ENGINEERING NEWS

Record

A JOURNAL OF CIVIL ENGINEERING AND CONSTRUCTION

VOLUME LXXII

JULY 1—DECEMBER 31, 1914

HILL PUBLISHING COMPANY
HILL BUILDING
10TH AVENUE AT 36TH STREET
NEW YORK

ENGINEERING NEWS

INDEX TO VOLUME LXXII, JULY 1—DECEMBER 31, 1914

Subdivided into GENERAL (including AUTHORS.) ENGINEERING LITERATURE and CONTRACT PRICES

INDEX

EXPLANATORY NOTE

This index follows, for the most part, the methods adopted, and more fully explained, with the index for Volume 71. An asterisk (*) indicates an illustrated article and (n), (ns) note, notes. Letters are not specified as such, nor are editorials usually. An editorial referring to an article may be indexed by appending the page number.

Following is a list of the pages included in the several numbers of this volume, by date;

July	2	pages	1-54
"	9	"	55-112
"	16	"	113-168
"	23	"	169-224
"	30	"	225-276
Aug.	6	"	277-330
"	13	"	331-376
"	20	"	377-424
"	27	"	425-472
Sept.	3	"	473-518
"	10	"	519-566
"	17	"	567-614
"	24	"	615-662
Oct.	1	"	663-710
"	8	"	711-758
"	15	"	759-806
"	22	"	807-854
"	29	"	855-902
Nov.	5	"	903-958
"	12	"	959-1002
"	19	"	1003-1050
"	26	"	1051-1098
Dec.	3	"	1099-1144
"	10	"	1145-1192
"	17	"	1193-1240
"	24	"	1241-1298
"	31	"	1299-1334

A

D

DAMS

DRAWING, DRAFTING

E

EARTHSLIDES

EARTHWORK

ENGINEERING LITERATURE (SUPPLEMENT)

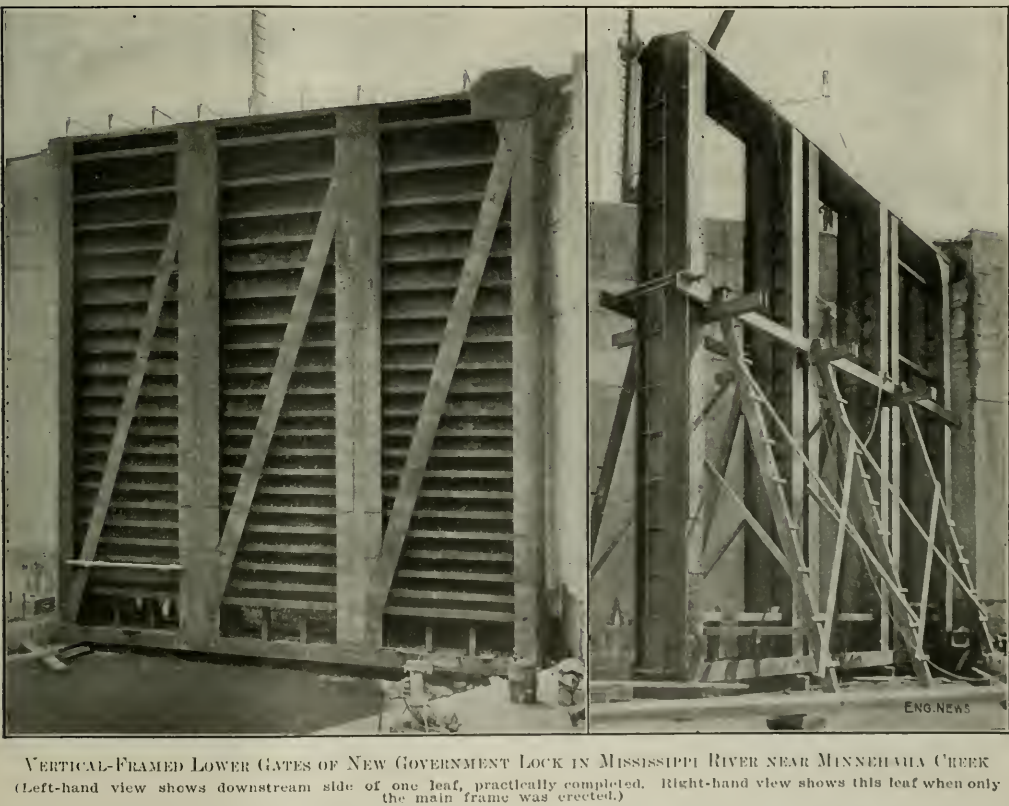
CONSTRUCTION NEWS (SUPPLEMENT) CONTRACT PRICES

Engineering News

VOLUME 72 JULY 2, 1914 NUMBER 1

Vertical-Framed Lock-Gates, St. Paul-Minneapolis Dam

A rarely used form of lock-gate has been adopted for the 31-ft.-lift lock of the new government dam across the Mississippi River at Minnehaha Park, between St. Paul and Minneapolis. The gates do not miter except at the extreme top, where thrust blocks are fitted to the meeting ends of the gates and to the hinge joints; the rest of the gate pressure, or two-thirds of the total, is carried lower gate-recess to lift wall near upper gate. Each leaf is 47 ft. 3 in. long by 49 ft. 3 in. high over all, which brings its top about 39 ft. above the probable low-water level in the lower reach, and about 2 ft. below the estimated extreme flood level of the pool above (when a 10-ft. depth of water flows over the dam). The two gates, designed for maximum stresses of 12,000 lb. per sq.in., weigh about 300 tons. They were built by the Independent Bridge Co., of Pittsburgh, Penn., and erected by the U. S. Engineer Office, St. Paul, which is constructing the



Vertical-Framed Lower Gates of New Government Lock in Mississippi River near Minnehaha Creek
(Left-hand view shows downstream side of one leaf, practically completed. Right-hand view shows this leaf when only the main frame was erected.)

by direct bearing of the gate leaves against the sill. Thus the body of the gate leaf must transfer the water pressure vertically to the sill girder at the bottom and the miter or arch girder at the top, instead of horizontally to hinge joint and miter joint. This gives the type its name—vertical-framed gate.

The lock is 80 ft. wide by 350 ft. long between gate quoins, or about 365 ft. long from the upper edge of dam and lock on force-account. The cost of material and erection of the gates was unusually low, on account of the simplicity of design and the low stresses resulting from the type of framing.

In this type of gate, only one-third the arch-thrust of the mitering type of gate has to be carried, since two-thirds the water pressure goes direct to the sill. As height and width of the gate are practically equal, the lengths of

main beams would be about the same whether vertical or horizontal. However, the arrangement of the beams is somewhat more economical in the vertical-framed type, as it is possible to use vertical main beams and horizontal secondary beams, arranged with sole regard to economy of metal. Further, the thrust being reduced by two-thirds, the abutment or quoin castings are reduced correspondingly, in weight and cost.

Two views herewith show the gates during erection. They are now completed except for the water-stop members at hinge and miter joints, and the operating mechanism. The plating of the gates is at mid-depth of the girders, the secondary framing beams being shallow enough to permit this. This arrangement was utilized to reduce the uplift when the lock is full, to an amount corresponding to half the ground-plan area of the gate, which is enough to nearly balance the weight of the steel.

Lieut.-Col. Charles L. Potter is in charge of the construction of the lock and dam. Geo. W. Freeman, Assistant Engineer, designed the structures and is carrying out the construction work as superintendent.

A Private River-Straightening Enterprise at Cleveland

One of the many windings of the Cuyahoga River at Cleveland, Ohio, is being straightened by a cutoff, but private enterprise is doing the work for its own interests, on the basis of plans worked out and approved by public authorities. Work was begun last season, and by the end of 1914 it is expected to be so far along that water will flow in the cutoff channel. Filling the old channel will probably require the 1915 season.

The sketch map, Fig. 1, shows the location of the work now in hand (hatched portion near southerly end), and several projects proposed (more or less definitely) for acquisition of the entire width of the bottoms by Cleveland capitalists forming the Cuyahoga Valley Realty Co., and the sale by them of the westerly half to the Otis Steel Co. The project for the cutoff was worked out by the City of Cleveland, however, through its River and Harbor Commission and the City Engineer's office (Robert Hoffmann, City Engineer; E. B. Thomas, Assistant Engineer in charge of river and harbor). The U. S. War Department gave its approval to the proposed work in January, 1913. The central part of the work is being

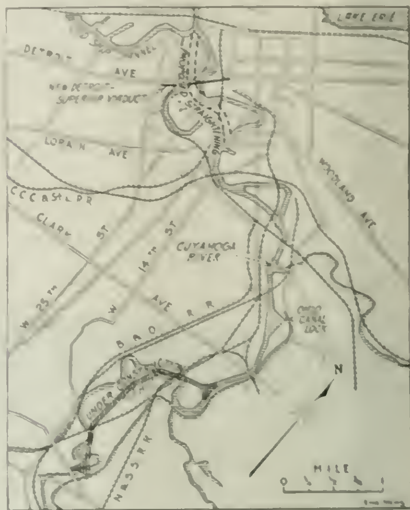


Fig. 1. Cuyahoga River, Cleveland, O., Showing Straightening Proposed and in Progress

Figs. 2-4. River-Straightening Work in Progress

(Fig. 2. Looking toward hill to be removed on line of new channel. Fig. 3. Steam shovel at work. Fig. 4. Fill made from steam-shovel excavation.)

the near future. A cutoff passing under the easterly part of the new Detroit-Superior viaduct was projected but has been abandoned; instead there may be cutoffs both upstream and downstream of the viaduct, leaving the present channel at the viaduct.

The valley of the Cuyahoga for three miles below the [illegible] viaduct forms a broad bottom over a mile wide. To the upper half of this stretch the present straightening enterprise is limited. It will divide the width of the valley into almost equal strips, and will give to the new plant of the Otis Steel Co., east of the new channel, an unbroken width of ground [illegible] fronting the full length along the new channel.

The construction of the cutoff came about through the done under direction of the Otis Steel Co., and is paid for by this company and the realty company. About one-third of the total length of the new channel, the upstream and downstream ends, will have to be constructed by the city (alone or in coöperation with private interests) on account of land-ownership difficulties and other reasons.

The location of the new channel cuts right across a hill rising some 100 ft. out of the bottom land. The first construction work was making the cut through this hill. This was steam-shovel work, the spoil, moved by cars, being used to fill low-lying ground nearby. The views, Figs. 2 to 4, show the shovel work in progress, and indicate the character of the valley generally.

Dredging was begun in a small way last season, but

primarily as regular work on the cutoff but for the purpose of obtaining sand, outside parties doing the dredging at their own cost. This was not carried very far, however, because of too much clay in the soil

Dredging by the contractor for the cutoff is to begin shortly, with equipment specially built for the job. Expectations are that it will progress fast enough to open the channel through the hill before 1915. The dredge is a suction dredge with electric-driven pumps, set in a light-draft hull, and supplied with power by pole-line. The American Shipbuilding Works, Cleveland, built the hull, and the Marion Steam Shovel Co. furnished and placed the machinery.

P. T. McCourt is contractor for the cutoff. The total cost of the work will be about $1,000,000.

A Safety Fire Escape*

The fire escape shown in the accompanying sketches has been installed in the printery of the Travelers' Insurance Co., at Hartford, Conn. Its distinguishing feature is a design whereby the lower flight is normally in a horizontal position well up from the ground, but is automatically swung to the ground by a person coming down the flight next above. The general outline is given in Fig. 1 and the details of the releasing mechanism in Fig. 2.

The projection at the free end of the stairway (Figs. 1-2) rests upon a lever, when the stairway is in the horizontal position (as shown by the dotted lines in Fig. 1), which lever is itself supported by a bracket and by bolts

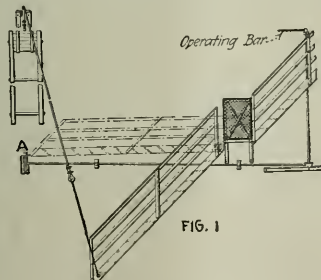


FIG. 1

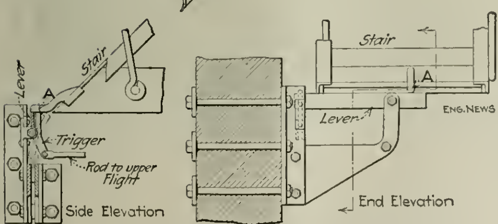


FIG. 2

FIG. 1. OPERATION OF THE SWINGING STAIRWAY
FIG. 2. DETAILS OF RELEASING MECHANISM

passing through the wall. Heavy plates are used between the nuts and the inside of the wall. A trigger fulcrumed to the bracket engages the lever and thus supports the stairway in the horizontal position. The lower end of the trigger is pivoted to a horizontal rod, which passes along the side of the wall through supports to a box, to which a vertical rod is connected, through a cam within the box. This vertical rod passes between the wall and the stairway to a point about half-way up the upper flight; the brackets are bolted to the wall to support this rod. The upper end of the rod is connected to the operating bar, which normally extends across the stairway.

In case of fire, a person coming down the stairway pushes against the operating bar and swings it against the wall. This causes the vertical rod to turn the cam in the box so that it pushes the horizontal rod and releases the lever by operating the trigger. The hinged stairway now being unsupported, tilts the lever and swings to the ground; the counterweight is purposely made too light to support the entire weight of the stairway. These operations take place before the person who moves these levers has reached the lower balcony; and upon reaching this balcony, therefore, he has a continuous solid stairway before him.

In moving from the horizontal to the inclined position, the stairway has a shearing action. The wire-mesh guard, shown in the upper diagram, is therefore provided to prevent accidents.

*Abstracted from the "Travelers Standard" for May.

An Engineering Competition for Students

A competition in the solution of engineering problems, open to students in technical colleges, has been recently completed by the Engineers Society of Western Pennsylvania, under the direction of its committee on Engineering Education. The results have been so satisfactory that a second competition will be arranged for 1914-15.

One problem was offered in each of the fields of civil, mechanical and electrical engineering. Copies were sent Oct. 15, to deans of engineering schools in which students wished to compete, four months actual work being allowed and a copy given to each competing student. An explicit statement of sources of information and procedure accompanied each. Contestants were third- or fourth-year men working alone or in pairs; solutions represented no assistance beyond the printed data and "such general discussion as was consistent with honorable competition." The prizes were a first, second and third "certificate of award" and "honorable mention," in each class. The judges were (I) Civil Engineering: Paul L. Wolfel, Chief Engineer, McClintic-Marshall Construction Co.; Richard Khuen, Jr., General Manager of Erection, American Bridge Co.; (II) Mechanical Engineering: O. P. Hood, Chief Mechanical Engineer, U. S. Bureau of Mines; F. C. Biggert, Jr., Chief Engineer, United Engineering & Foundry Co.; (III) Electrical Engineering: William Hoopes, Electrical Engineer, Aluminum Co., of America; W. Edgar Reed, Consulting Engineer.

The civil-engineering problem was the design of a country highway bridge—given survey notes, unit prices, etc. The mechanical-engineering task was the design of a grinding machine taking castings up to 12 in. wide. The problem in electrical engineering was to design a system by which 30,000-volt alternating current was transported and converted to 550-volt direct current.

Those receiving the first awards were: In civil engineering H. W. Terhune and R. W. Hill, Tufts College, Boston; in mechanical engineering, F. C. Eastman and A. D. Stewart; in electrical engineering J. R. Lambach, Georgian School of Technology.

Two Recent Water-Power Plant Accidents

Two accidents of rather unusual character have recently occurred at water-power plants located in the State of New York. In one the ashlar face of a 14-year old masonry dam slid off for the whole length of the dam under conditions not obviously abnormal; in the other a moderate flood was diverted, mainly by an incompleted culvert, in an undesigned direction with the result that about 700 ft. of new macadam roadway was destroyed by a serious washout that also undermined the foundations of 150 ft. of 7-ft. steel penstock.

Dam Face Failure

The dam affected is located at Hannawa Falls, St. Lawrence County, New York, and forms the storage reservoir for the Hannawa Falls Water Power Co. On the morning of Mar. 1, the Potsdam sandstone ashlar facing

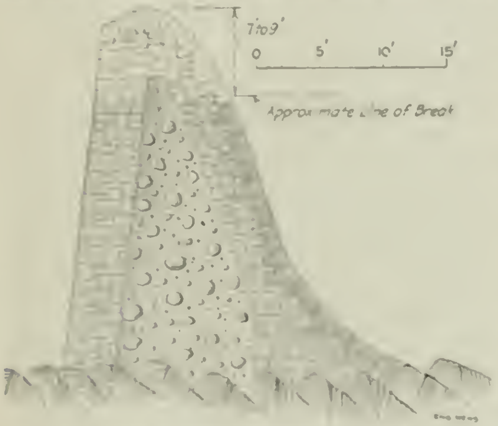


FIG. 1. CROSS-SECTION THROUGH HANNAWA FALLS DAM, SHOWING BREAK IN ASHLAR FACING

of the downstream side of the crest of the dam slid and broke off for a distance of about 7 to 9 ft. below the crest and throughout practically the entire length of the crest of the dam. This dam was constructed in 1900, having a cross-section as shown in Fig. 1,* the central core being concrete. The upstream rubble facing was injured to some extent but not to as great a depth as on the downstream side. The line of fracture occurred at the plane of contact between the cyclopean concrete core and the masonry facing. The concrete core remained intact.

The flow of the stream was relatively small at the time, being reported as follows at the nearest gaging station at Parishville: Feb. 27, 445 cu.ft. per sec.; Feb. 28, 417 cu.ft. per sec.; Mar. 1, 395 cu.ft. per sec.; Mar. 2, 373 cu.ft. per sec.

The drainage area at Parishville is 789 sq.mi. and that of Hannawa Falls about 1100 sq.mi. The dam formed a pond of about 200 acres area, which was covered with thick ice at the time of the accident, by the dam. Owing to the low stage of the stream, the water was quickly drawn down below the level of the injured portion of the dam.

Various theories have been offered to explain the injury to this dam; including, first, direct ice pressure against the ashlar coping above the level of the concrete; second, injury to or disintegration of the ashlar masonry by moisture and frost. Potsdam sandstone is a comparatively soft porous material. In view of the fluctuation in water-level in the pond and the manner of the dam failing without injury to the concrete core or upstream face comparable to the injury of the downstream face, it appears that no theory yet advanced is satisfactory.

Road and Penstock Washout

The washout described below occurred during the last part of April near another water-power plant in the northern part of the state. The plant in question has a solid masonry dam forming a pond which is crossed by a highway about 50 ft. above the dam. The highway, after crossing this bridge, turns away from the downstream face of the dam and runs along a sidehill, at the bottom of which is the gorge of the dammed stream. Between this gorge and the highway there was a 7-ft. steel penstock, built in a trench excavated in the loose sand and gravel which overlies the rock.

The results of the washout are shown in the view in Fig. 2, which is from a photograph taken looking along the sidehill toward the dam in the right background. The washout, alongside of the road and directly under the destroyed penstock, is in the center of the view and the highway is shown at the extreme upper left.

The flood was a sudden one, arising from the melting of the snow in the woods after a rapid rise in temperature. Although the flood was of unusual volume, the discharge over the dam did not reach the spillway capacity. The immediate cause of the washout was water following down the penstock trench to a gulley, where it accumulated and broke through the bank into the gorge below. The loose soft material—sand, gravel, and sawmill waste—was easily eroded, undermining the highway for about 700 ft. and the penstock for about 150 ft. The water which did the damage apparently came from two sources, partly from the pond above the dam and partly from hillside drainage from the slopes to the left of the dam looking upstream. This drainage came down the highway to a point where the macadam road turned to cross the bridge above the dam. Near this turn in the macadam road was a culvert intended to carry this hillside drainage into the river. Owing to the lateness of the season when the work was finished, no channel had been provided to take the discharge of this culvert after it crossed the highway, and the flow through the culvert entered directly into the penstock channel.

At the time the water in the pond reached a sufficiently high stage to flow over the highway, the water in the pond was rising very slowly and in fact did not rise to any appreciable height after the washout started. Damage from this source could apparently have been avoided by the simple expedient of throwing up a loose sand embankment 40 or 50 ft. long and not more than one foot high along the highway. However, the only persons present were the operatives of the power plant who, seeing the danger, devoted their entire attention to clearing the headgates. As a result, the water was diverted on

*Taken from a paper, "Water Power Development at Hannawa Falls," by W. G. Atwood, Trans. Am. Soc. C. E., Vol. 49, 1902.

of the penstock before any portion of the penstock was undermined.

The injured penstock was taken apart in sections; sent to the nearest boiler works, rolled into shape and is at this time being put back into position.

The drainage area above the dam is 110 sq.mi. There are numerous lakes and a broad flat valley with deep sand deposits which acts as a very extensive natural regulator, so that in spite of the precipitous rock slopes surrounding the basin, the runoff is very regular. The maximum discharge of the stream at the time of the accident is estimated to have been in the neighborhood of 1500 cu.ft. per sec. Judging by the reported conditions and from the cross-section of the channel where the water flowed over the highway, the quantity of water passing around the end of the dam apparently could not at any time have exceeded 100 cu.ft. per sec. Inasmuch as this channel was greatly increased in area by the washing out of a section of the highway, it appears probable that the quantity of water which flowed around the end of the dam did not at any time exceed 40 to 60 cu.ft. per sec. The fact that many thousand yards of earth were removed during the period of a few hours by this small quantity of water is due to the extremely loose character of the material excavated. The penstock was constructed in a trench excavated in the loose sand and gravel which overlies the rock. The work was completed late last fall and as excavated material had frozen the trench was not refilled.

Fig. 2. Washout of Highway and 7-Ft. Steel Penstock Due to Bypassed Overflow from a Dam and to Side-Hill Runoff

Cleaning and Repairing the Sudbury Masonry Aqueduct of the Metropolitan Water Works, Boston, Mass., is described in the recently issued annual report of the Metropolitan Water and Sewerage Board as follows:

Two gangs of men were employed one beginning at each end of the section to be cleaned and working toward each other. One gang used water and hand brooms in cleaning the sides and top of the aqueduct, a wagon with a tank body being used when cleaning the top. The second gang made use of a gasoline power sprayer, by which water under 200 lb. pressure was discharged against the interior surface of the aqueduct. This method proved more efficient, more economical and quicker than the hand method. The cleaning of the bottom was done with push brooms operated by hand. The ironwork of the gates and stop-plank grooves in the screen and terminal chambers was thoroughly scraped, dried by the use of torches, and painted with two coats of red lead and oil. When the aqueduct was first emptied it was found that water was flowing in through small crevices in the brick and concrete, the greater number of which were where the aqueduct is generally in tunnel. In this section 1400 leaks in the tunnel lining were repaired by driving the calking wedge lead, tea lead or lead wool into the joints. The cost of cleaning and repairing this section of the aqueduct was as follows:

	Labor	Materials	Total
Cleaning aqueduct	$270.05	$1.58	$274.63
Cleaning and painting ironwork	121.00	21.27	142.27
Repairing leaks in masonry. . . .	96.75	37.10	133.85
	$487.80	$62.96	$550.75

General Observations on Street Pavements of European Cities*

By Henry Welles Durham†

SYNOPSIS—In the summer of 1913 Mr. Durham was commissioned by the Mayor of New York City to attend the Third International Road Congress at London and to take several months to study European pavements, which from time to time had been compared with New York City pavements, to the disadvantage of the latter, by the popular press. In this article Mr. Durham summarizes European paving practice in such a way that municipal engineers may know just what foreign practice is and just what results have been attained.

Foundation

Up to the middle of the last century, the pavement consisting of stone blocks laid directly on the ground surface of the street was considered satisfactory in all European cities. At the present time, such a surface is used on a great part of the streets in every European city.

It was not until the year 1890, when was first commenced the placing of electric wires in underground conduits instead of on overhead poles, followed within a few years by the introduction of motor-driven vehicles in large numbers, that the necessity for a rigid foundation under a separate wearing surface for city streets assumed great importance.

At the present time, due to the great increase in weight of traffic on the streets of cities of the first class, and to the frequent necessity for opening them for the laying of various substructures required by conditions which have arisen within the past 25 years, there is universal agreement among those in control of city highways that concrete foundations are indispensable when constructing new pavements in important thoroughfares.

Such foundations are essential in almost all streets of American cities, which, in addition to having been disturbed for subsurface construction, are very largely on regraded ground; whereas many of the older cities of Europe have streets which have occupied their present position for hundreds of years; and where, as can be seen in Hamburg in the case of a street not subject to frequent opening, the stone block surface can be satisfactorily maintained on the original hard soil underlying it.

Fig. 1. Method of Construction, a 12-In. Concrete Foundation for Soft Wood Block; All Hand Mixing; Gracechurch St., London

Fig. 2. Finishing a Concrete Surface for Hard-Wood Blocks; Rotterdam

Subsurface conditions in London, on the other hand, due to the nature of the underlying material, are such as to justify the authorities there in demanding the heaviest foundations to be found anywhere, 12 in. being used in the central part of the city. But even in London there were found in the outlying residence districts a large proportion of satisfactorily surfaced streets without an artificial foundation.

Great differences exist as to the thickness of concrete foundation where used, and the proportioning of materials composing it. Concrete 4 in. thick is regarded as satisfactory in many places, even in such an important city as Brussels. Probably the standard thickness at the present time is from 6 to 8 in. The proportions in which foundation concrete is mixed vary greatly. For purposes of comparison, Table I shows some of the various proportions used abroad.

*Abstract of Chapter XII of the forthcoming report on "Street Paving and Maintenance in European Cities" to the Mayor of the City of New York.

†Chief Engineer, Bureau of Highways, Borough of Manhattan, New York City.

TABLE I

	Cement	Fine Aggregate	Coarse Aggregate	
London:				
City and Westminster	1	..	6	Thames ballast—unscreened river gravel
Lewisham	1	..	7	Thames ballast—unscreened river gravel
Battersea	1	3 sand	5	clean gravel
Liverpool	1	6 crushed slag	3	broken stone, 3-in. gage
Paris	1	3¾ sand	7½	stone or gravel
Berlin and Charlottenburg	1	..	8	fine gravel and sand
Hamburg	1	..	7	unscreened river gravel
Vienna	1	3 sand	5	gravel

The concrete is commonly laid between forms set transversely to the axis of the street at intervals of about 15 ft., materials being turned over on a mixing board between these forms directly into place. Final finish to the surface is then obtained by drawing a straight-edge across the width of the street, the concrete being mixed wet enough so that finer material flushes to the surface and produces a fairly smooth finish under the straight-edge.

Where this method is not followed, the forms are placed longitudinally and the finished surface obtained by drawing along on them a template formed to the proper transverse section.

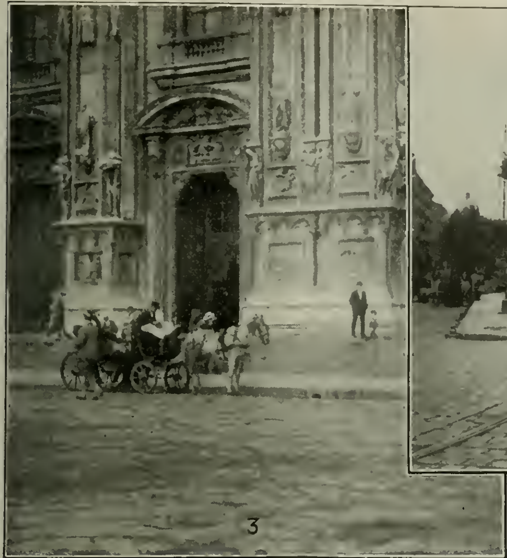


Fig. 3. Large 18x24-In. Stone Blocks in Front of Cathedral at Milan

Fig. 4. Large Stone Blocks, 8x10 In., Laid on Sand Foundation, Vienna

Fig. 5. Granite-Block Pavement, Liverpool

Typical Stone-Block Pavements in European Cities

The work of concrete mixing is done almost entirely by hand, although concrete-mixing machinery has been introduced in Germany to a small extent. The subfoundation is generally rough graded, with about the same accuracy prevalent in New York City, but it is more usual to finish the concrete surface smooth.

Where wood pavement is to be laid, particular attention is given to obtaining an accurate, smooth surface, and a certain amount of hand-smoothing is sometimes employed. It was noted in London and in other cities,

however, that by employing the method of accurately setting transverse strips to the surface grade on narrow widths of concrete, and then drawing a straight-edge or a screed along on these adjacent strips (between which the work of mixing and placing was carried on), that a sufficiently smooth finish was obtained with very little surfacing. For asphalt and granite pavement, it is not attempted to obtain such smooth results on the foundation surface; but usually a more accurate surface is obtained on all classes of work than in this country, though it is at the sacrifice of speed. The quality of the concrete is in no case inferior to that being produced at the present time in New York City; and frequently it is inferior.

Fig. 6. Liverpool Pavement of 4-In. Cubes

Fig. 7. Birmingham Alley Paved with Small Cubical Blocks on a 7-In. Slag-Cement Foundation; Pavement Less Than 2 Years Old

Fig. 8. Hamburg Pavement of Large Stone Blocks, of Remarkably Uniform Surface; Fairly Heavy Traffic

Typical Granite-Block Pavements in Europe

Stone Pavements

Perhaps the most frequently used block in Europe is the squared block having generally cubical dimensions, of the type known in this country as "Belgian" block. These blocks are usually laid without foundation, but their irregular shape permits of joints not exceeding 1 in. in width and a surface much smoother under wheel traffic than that of the old-style cobble.

Another variation, but of the same class, is the type of large slab block pavements employed in Italy and other of the more southern countries, composed of stones measuring from 18 to 24 in. on top, and having a 6-in. depth, laid with comparatively close-fitting joints. On a level street these pavements furnish fairly good foothold for horses, and still have a smooth surface under wheel traffic.

Variations from the cubical shape of the "Belgian" block were introduced in German and English cities approximating more nearly to the dimensions of our granite paving block of today, but having the same general quality and wide joints as the old "Belgian" block.

A great part of the stone-paved streets in the continental cities (constituting generally a majority of the total area of carriageways) is paved with one or another of the above types of block, either a granite or a material like trap, the latter called whin stone in Great Britain and porphyry in France and Germany. The granite, being a softer material and subject to more rapid wear, has not been so largely employed in the past, except on grades where its lack of extreme hardness makes it less slippery for horses' feet.

With the introduction of concrete foundations under stone pavements, came a reduction in the depth of blocks, and today where this foundation is used in France and Germany, the blocks have a depth of from 5 to 6 in., instead of 8 in. or more, as when laid without foundation.

In the German cities, two standard types of specifications are recognized for these two classes of pavement, and where concrete foundation is employed stones of smaller surface area and more closely dressed are used.

As characteristic of the extent to which concrete foundation is employed under stone pavements on the continent, however, reference may be made to the city of Paris, where only one-eleventh of the entire area of stone-block streets is so constructed. Liverpool has tried a great number of different types of block, both with and without concrete foundation, although for the past 25 years concrete foundations have been almost always used.

The fact that certain peculiarly shaped blocks are giving satisfaction in the streets of Liverpool does not indicate that this type of block is a standard nor one to be recommended for employment at the present time, because much difficulty is now experienced in obtaining any but the standard set from the Welsh and Scotch quarries which supply the English cities.

The best foreign practice is to lay stone pavement on a concrete foundation, as in this country, employing a cushion of sand or fine stone screening of 1 in. to 2 in. thickness, sometimes mixing in a small proportion of cement, in order to have subsequent rigidity in the cushion.

Joints are sometimes filled with gravel or fine crushed stone and then poured with tar or with a mixture of tar and sand; or, as is the practice in some cities, with a liquid cement grout. A combination of the two methods, using a mortar filled joint for half the depth with tar at the top, is sometimes used. For the large areas of stone pavements with no foundation, a great proportion has no filler in the joints other than fine gravel or sand.

On account of the lower rate of wages paid in Europe, it is possible to produce blocks more accurately dressed for the same amount of money than can be done in this country. Usually, a small amount of tool work can be done on the sides in order to permit the block to be laid with closer joints, but only in isolated instances where specially dressed blocks are employed are the joints less than ½ in. in width.

Fig. 9. Laying Replaned Old Hard-Wood Blocks on New Concrete Foundation, Birmingham

Fig. 10. Laying Rock Asphalt Pavement; Spreading Hot Asphalt Powder; Hand Ramming; Berlin

Fig. 11. Victoria Embankment, London; American Asphalt on Macadam Foundation; Granite Blocks on Tramway

There were nowhere found any road authorities who recommended small cube-block pavement (that is, blocks 2 in., 3 in., and 4 in. on the side) as a competitor or sub-

stitute for the large granite-block type of pavement on a concrete foundation. Where laid in England, the small cubes are used as an alternative to some type of bituminous concrete.

The small-cube pavement streets and roads in Germany are almost always a means of substituting a harder surface for ordinary water-bound macadam. The blocks are frequently laid with sanded joints as a carpet coat on the old macadam, and when laid on a concrete foundation with tar-filled joints, they are still employed only on streets of light traffic where bituminous concrete or a sheet-asphalt surface would otherwise be used.

The engineers in Birmingham and the Borough of Chelsea have found the small-cube pavement satisfactory; the engineer of Battersea does not think it adaptable for employment on a city street. The experimental lengths laid on the Sidcup Road running out of London, where the small cubes have been used in competition with various other types, are too new to allow the drawing of definite conclusions, but appear to have been satisfactory up to the present time. The Liverpool engineers do not consider the small-cube pavement suitable on any class of city street, and they regard the rectangular granite block as best for heavy traffic and the bituminous macadam the best for the light traffic residence streets.

FIG. 12. BRICK PAVEMENT NEAR DOCKS, AMSTERDAM

The advantages of the small-cube pavement for suburban roads are: Low cost of maintenance and absence from dust when constructed with tar-filled joints. The disadvantages appear to lie in its noisiness, the tendency of the blocks to wear round due to wide joints, and their liability to become displaced and cracked on account of their small size. Cases were observed where this type of road surface showed material wear both under high-speed pleasure automobile traffic and slow-moving steel-tired motor and horse-drawn heavy traffic.

There are a few instances abroad of small areas laid with specially dressed granite block at a cost much in excess of anything we have, and presenting a surface almost as smooth as asphalt. But even could such a pavement be laid economically in this country, it is doubtful whether it would be advisable, on account of its having a surface too smooth and slippery.

WOOD PAVEMENTS

There are two classes, soft pine and hardwood. The blocks have dimensions approximating those used in this country—a depth of from 3 to 5 in., a width of 3 to 4 in., and a length averaging between 6 and 10 in.

Australian hardwood has been very extensively laid, both in England and on the Continent. Wherever it has to carry heavy traffic it has proved unsatisfactory. The blocks have a tendency to wear round and become rough and uneven. Some attempts have been made to take up the blocks from streets where this has occurred, plane off about ½ in. from the heads and relay them. This has been done with some success in various cities, but it is at best a temporary expedient, and in no city of first importance is it regarded as desirable to lay hardwood blocks at the present time. The blocks are always laid directly on a smooth concrete surface, being previously hand-dipped in tar and the surface poured with the same material. Soft wood blocks, made of Norwegian, Swedish and French pine and similar material, somewhat softer than our long-leaf yellow pine but very much resembling it in appearance, are being used with great success at the present time.

In the construction of soft wood-block pavement, the concrete foundation is finished with a perfectly smooth surface to the proper crown of the street and the blocks, previously treated with from 4 to 12 lb. of creosote oil per cu.ft., are laid directly on this surface.

After the blocks are laid in place, and this is usually done with the joints a trifle less close than in the American practice, the surface is swept with tar, which has been hand poured, as a joint filler. When this has sufficiently hardened, the entire surface is gone over with a thin coating of liquid cement grout, presumably to reduce the amount of stickiness from the tar, and the street is finally spread with a layer of granite screenings or crushed gravel, which traffic soon rolls into the soft surface of the wood. This produces a gritty nonslippery surface, which permits this type of material to be laid on grades up to 5% with entire success, under horse-drawn traffic. When well done, a wood pavement presents undoubtedly the finest street surface in existence; when the contrary is the case, they are about as poor as any to be found.

ASPHALT

The asphalt pavements of European cities are largely constructed from the natural asphalt rock found in various parts of Italy and southern France. It consists of a limestone impregnated with bitumen, which is mined in rough fragments, and run through a crusher and mill, and after being reduced to a fine powder, is heated to a high temperature, producing a material similar in consistency to the artificial asphalt topping used in this country, but it is of a brown color. The heated material is taken to the streets in wagons, spread to a depth sufficient to give a final thickness of from 1½ to 2 in. on the concrete foundation, and, after a preliminary rolling with a hand roller, is given its final compression by hand-ramming. Where the rock contains a deficiency in the amount of bitumen necessary, the required addition is made.

The City of Paris prohibits the reuse of any of the old wearing surface removed from the street, but on new pavements in Berlin and Charlottenburg the contractor is permitted to employ this old material in the proportion of about one-third of the total quantity. The practice is to take the old wearing surface as it is brought in carts

to the plants, mixing it in alternate layers with the broken rock from the mines, the mixture then being run through the crusher.

Rock-asphalt pavement has been employed for a long time in the principal European cities, producing a surface very similar to asphalt pavements of American cities, but somewhat harder and possibly a trifle more slippery under cold-weather conditions. In extreme warm weather it is liable to the same tendency encountered in this country to soften and roll. It is successfully employed in London, Paris, and Berlin, on streets that would not be regarded as suitable for our type of asphalt. It is nowhere regarded as satisfactory on any grade.

Abroad, asphalt pavement is usually thought to be too high priced to employ in quiet light-traffic residence streets to the extent followed in New York City. All new districts in Berlin, however, are being developed by asphalt roadways, and Paris has made contracts for the repaving with asphalt of a large extent of the existing wood, stone block and macadam. Vienna is now undertaking an extensive repaving of its old stone-block streets mainly with asphalt.

There have been some attempts to introduce American asphalts in competition with the European. The Thames Embankment has a Trinidad asphalt surface on the old macadam foundation, which has given satisfaction. A few experimental lengths of American asphalt have been laid in Berlin, and a company now operating there is preparing to make contracts for the use of some of the asphalts from this country. In general, however, the foreign engineers are satisfied with their own type of material and are somewhat averse to trying experiments with another.

The point must be emphasized that many of the superior features in regard to foreign asphalt streets, as they strike the observer's eye, are directly attributable to the much better and more thorough street-cleaning system in operation; while the points of criticism based on the condition of certain American asphalt streets can also be attributed in many cases to the faulty foundation conditions, which have not prevailed abroad.

Summary

These three types of surface—rectangular stone block, wood block, and compressed rock asphalt—are the prevalent surfaces for modern city street construction in the great cities of Europe. A great variety of other types can be found in small amounts and generally used where traffic is light. These include various kinds of compressed asphalt block, usually a thin slab or plate laid on concrete foundation; concrete blocks cast in forms under pressure, usually large slabs and laid more often for sidewalks than for other purposes; slag blocks, which present a smooth surface when new but rapidly deteriorate even under light traffic conditions; and brick, both ordinary hard burned and vitrified. Hard-burned bricks dipped in tar have been used in Brussels on some of the parkways, and there are many miles of brick roads in Holland.

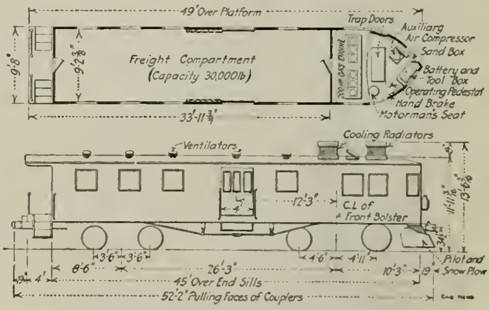
All classes of tar and bituminous macadam made under many processes, some of them patented and with various names, are being tried out and extensively used for suburban and country-road traffic, as in the United States. Tar macadam particularly is being largely introduced in the residence districts of European cities, under conditions similar to those where sheet asphalt on concrete is so often employed in the Borough of Manhattan, New York City.

After classifying all improved and modern pavements, it is found they are much in the minority as compared with those which may be termed ordinary or usual—large stone blocks on sand, or water-bound macadam.

A Self-Propelled Convertible Freight Car*

The Minneapolis & Northern Gasoline Motor Ry. has recently purchased a motor freight car to be used for freight and express service between Minneapolis and Anoka. It is a semiconvertible car which, during periods of heavy passenger traffic, can be used for transportation of passengers—removable seats and chairs being installed for that purpose.

The accompanying floor diagram and side elevation illustrate the general design of the car, from which it will be noted that the front end is wedge shaped and the rear end has a platform for passengers' ingress and egress. The now familiar depressed side-center entrance has not been used. The car structure consists of a metal underframe,



A Self-Propelled Convertible Freight Car

and continuous 2-in. grooved steel combination side posts and car lines extending from side sill to side sill with metal diagonal bracing. The outside and inside wall sheathing is of 1⅛-in. fir. The floor is of 1⅝-in. fir. The motor truck is forward. The air-brake system is arranged for "straight" operation on the motor car and "automatic" on trailers.

The main dimensions are:

Length over end sills	45 ft.
Length over platform	49 ft.
Length overall	52 ft. 8 in.
Width over side sills	9 ft. 8 in.
Width over sheathing	9 ft. 9⅝ in.
Width overall	10 ft. 4¾ in.
Width inside	9 ft. 2¾ in.
Length freight compartment	33 ft. 11¾ in.
Height, rail to roof	11 ft. 11 3/16 in.
Weight	56,000 lb.

An Appropriation of $100,000 for a Valuation of the property of the New York Telephone Co. by the Public Service Commission of the Second District (New York City) has been approved by Governor Glynn. The valuation will afford a basis for rate readjustment.

*From information furnished by the McKeon Motor Car Co., Omaha, Neb., builder of the car described.

Construction Difficulties with Stockton St. Tunnel, San Francisco

The chief engineering features of the Stockton St. tunnel in San Francisco were described in Engineering News, Feb. 12, 1914, p. 344. The contractors who are performing the work have encountered a serious problem in supporting the enormous weight of the shattered shales and schist traversed by the bore. Owing to the looseness of this material and to the necessary flatness of the arch, at certain locations a great proportion of the dead

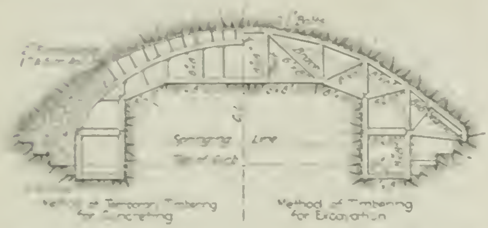


Fig. 1. Original Method of Timbering Stockton St. Tunnel, San Francisco

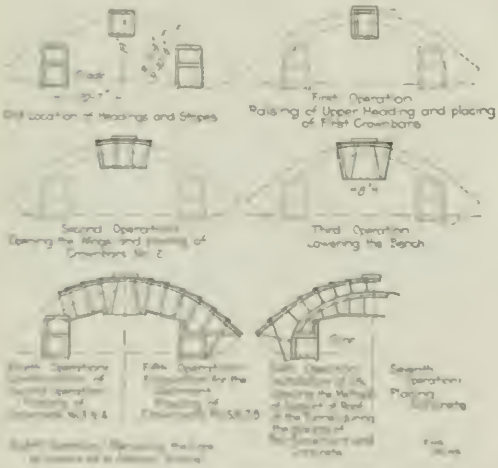


Fig. 2. Details of Progress of Later Method of Timbering Designed by L. F. [illegible]

weight of the material between the extrados and the ground surface must be supported by the falsework until the concrete lining is in place. The original plan of timbering is shown in Fig. 1. Near the portals this method was satisfactory, but when the central drifts had been advanced a distance of 130 ft. from the south portal a slide of loose, plastic material, which extended to the surface, temporarily blocked progress in the east drift.

After clearing the débris, instead of continuing to use the long [illegible] crown bars, the type of timbering illustrated in Fig. 2, proposed by L. F. [illegible], consulting engineer for the contractors, was adopted. This drawing shows each successive operation as followed in advancing the tunnel. So great was the stress to which the timbers were subjected that in one instance while performing the third operation the heavy longitudinal crown bars were crushed almost to failure. The hasty substitution of additional and larger timbers saved the section from failure.

A small portion of the tunnel is through sandstone, and in this formation the original concrete section was placed for the lining, wherever the formation was sufficiently solid to warrant its use. At other locations a modified and heavier section was substituted.

Fig. 3. View of Later Timbering

The present city engineer revised the plans and designed the thicker section. This resulted in an additional expenditure of $60,000 for 800 lin.ft. of tunnel lining. The new concrete lining is carrying the pressure successfully without any signs of settlement and makes this work monumental as the widest long span tunnel yet constructed.

New York City Ordinances for the Prevention of Sewer Explosions

The disastrous explosion at the Chelsea St. pumping station of the Metropolitan sewerage system in East Boston, Mass., June 1, again brings to the front the dangers resulting from gasoline and oils in sewers. With the universal use of gasoline motor vehicles, these explosions are increasing in frequency in every large city and must be stringently guarded against. Not only must laws be passed to prohibit the escape of gasoline and inflammable oils into sewers, but frequent investigations should be made of the sewer air in suspicious districts to make sure the law is being complied with.

New York City has had its share of explosions, but of late they have not been so frequent or so serious as they were a few years ago. The New York ordinances covering this point are given below:

EXTRACT FROM CODE OF ORDINANCES OF THE CITY OF NEW YORK

Section [illegible]. No connection with or opening into any sewer or drain in the City of New York, either public or private, shall be used for the conveyance or discharge, directly or indirectly, into said sewer or drain of any volatile inflammable liquid, gas or vapor, it being noted that a volatile inflammable liquid is any liquid that will emit an inflammable vapor at a temperature below 140° F.

Section 562. Every occupant of any premises which may be connected with a sewer or drain, public or private, who shall use or permit or allow to be used said sewer or drain for such purposes as hereinbefore specified in Section 1, and every owner of any premises who shall use, permit or allow the use of such sewer or drain for such purposes shall be deemed to have violated the provisions of this ordinance and be guilty of misdemeanor, and shall be punished upon conviction thereof by a fine of $50, or imprisonment for 30 days. (Ord. app. July 6, 1906).

EXTRACT FROM THE REGULATIONS OF THE MUNICIPAL EXPLOSIVES COMMISSION

Section 376. No garage permit authorizing the storage of volatile inflammable oil shall be issued for any premises which are not provided with an oil separator, trap or other similar apparatus attached to the house drain for the purpose of preventing volatile inflammable oils from flowing into the sewer; provided, however, that the Fire Commissioner may, upon the recommendation of the Municipal Explosives Commission, exempt from the requirements of this section a garage draining into a short sewer line.

Section 396. Each oil separator installed in a garage shall be connected to the house drain, and shall be so arranged as to separate all oils from the drainage of the garage.

A Continuous Reinforced-Concrete Girder Bridge for Interurban Cars

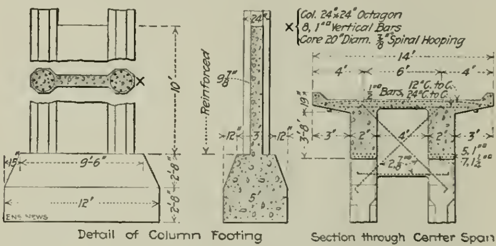
A reinforced-concrete girder bridge of simple details but effective design has recently been completed across White Rock Creek, about 6 miles outside of Dallas, Texas, for the Eastern Texas Traction Co., an interurban electric line to run between Dallas and Greenville. Fig. 1 shows the general details and Fig. 2 a view when it was nearly completed.

White Rock Creek has an intermittent flow; it is generally nearly dry, but at flood times reaches over a wide area of bottom lands. In addition, the railway crossing is within the back-water area of the White Rock Reservoir of the Dallas water-supply, so that ample provision had to be made for the water section. This consideration, together with the reduced cost due to simplicity of construction, led to the adoption of the girder bridge shown.

In brief, this bridge consists of three 50-ft. spans resting on two intermediate column bents and two twin-wall abutments. The roadway, for a single-track line, is a ballasted track laid on a solid concrete floor, continuous between abutments and forming a double T-beam with the girders, which in turn are monolithic with the bents and the abutments. There is no expansion joint in the structure, it being considered that it was strong enough to take all movement from end to end. The approaches are wooden trestles, with the end stringers resting on the abutments. The reinforcement of the superstructure is the normal rod system; the columns of the bents are reinforced by spirals.

Fig. 2. View of Bridge during Moderately High Water

The west abutment (right hand in Fig. 1) is founded on a satisfactory clay and the other abutment and piers on rock. Work was carried out by the company's forces, who, from inexperience in this type of work, had some trouble, but it is thought that for future similar bridges on the same line, better progress will be made. The bridge was designed by W. E. Beilharz, office engineer, under the direction of W. A. Obenchain, Chief Engineer of the company.



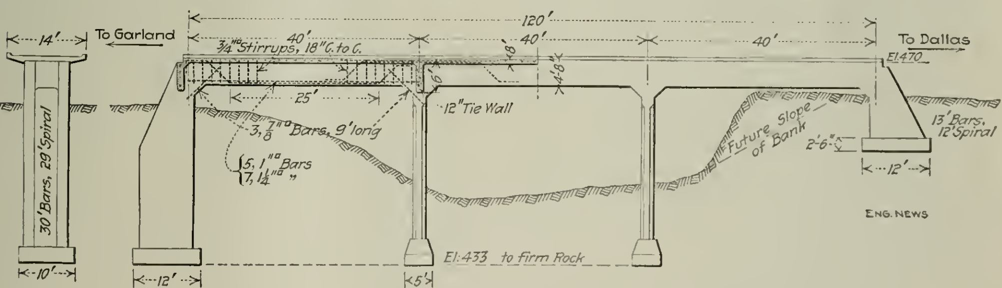


Fig. 1. Details of White Rock Creek Bridge, Eastern Texas Traction Co.

Road Improvement Work in Ohio during the present season will amount to about $15,000,000, according to a recent estimate of State Highway Commissioner James M. Marker. Of this sum $9,000,000 will be spent on contracts under the supervision of the State Highway Department and the remaining $6,000,000 directly by the counties and townships. About 320 miles of road are now being improved, 140 miles with macadam, and about 90 miles each with brick and concrete pavements. Since the organization of the State Highway Department in 1905 contracts have been let for the improvement of 67 miles of road. The only states which, it is claimed, surpass Ohio in the percentage of improved roads over all roads are Massachusetts, 19%, and Rhode Island, 49.1%, while Ohio has 34% of its highways improved.

Reducing the Per Capita Consumption of Water, Metropolitan District, Boston, Mass.*

The accompanying chart shows the remarkable results obtained by a systematic campaign to reduce the waste of city water in the Boston Metropolitan Water District. Of the 18 towns and cities using the water of the Metro-

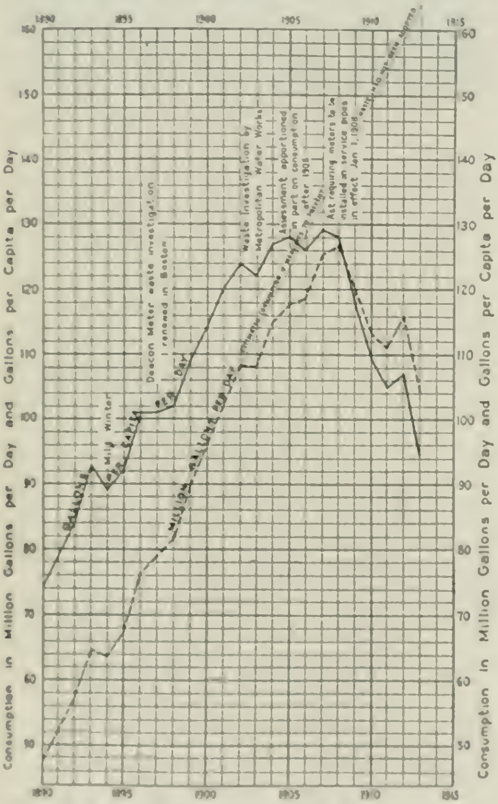


DIAGRAM SHOWING REDUCTION OF WATER CONSUMPTION IN THE METROPOLITAN WATER DISTRICT

politan Water District, has have practically all their services metered. Of the total of [illegible] services in [illegible] Dec. 31, 1913, [illegible] were metered. Had the per capita consumption continued at the rate at which it stood ten years ago, some [illegible] gal. per day more water would now be required and the Metropolitan Water Board would have spent and would be spending millions of dollars to develop new supplies.

Besides the service inspections, [illegible] every effort is made to detect and repair leaks in mains. To simplify this task there are now 77 Venturi meters connected with the works. Four of these are at the Wachusett Dam and are used in measuring water drawn from the Wachusett Reservoir. Two are located on the pipes leading from the Sudbury Dam and are used for measuring water drawn from the Sudbury Reservoir and delivered into the Weston Aqueduct. Sixty-five are on connections through which water is supplied to the different municipalities. There are also 3 Hersey disc meters, 1 Hersey torrent meter and 5 Hersey detector meters used in measuring small quantities which cannot be conveniently measured with meters of the Venturi type. The work of caring for these meters in the Metropolitan District has been done by two men, assisted at times by a third. The cost of the work connected with the reading, operating and maintaining of these meters has been $1,974.38.

*[illegible] Metropolitan Water and Sewerage Board, Boston, Mass.

Methods Used in Investigation of Explosive Gases and Oils in Sewers

By G. J. White*

City engineers are interested in the investigation of sewer explosions, yet perhaps but few of them have much knowledge of the methods used to determine whether the gas in a sewer is explosive or not, and if so, what makes it explosive. The purpose of this article is to give the average engineer, who is not a chemist, an outline of a method which may be used to determine if a sewer gas is explosive. A complete gas analysis is a long tedious process and if the gas is not explosive either alone or when mixed with air, the engineer has but little interest in it.

Gas Sampling

Gas-sampling pipettes (Fig. 1) of the mailing type (fitted in tin tubes or wooden boxes), may be purchased at a reasonable price and are convenient for handling. These should hold at least 300 c.c. to give a large sample to work on. An aspirator bottle (Fig. 2) holding a little more than the pipettes and a few feet of rubber tubing are necessary.

The pipettes should be filled with sewage which is saturated with the gas with which it is in contact. To do this fill the aspirator bottle with sewage, attach the rubber tube to the bottle and the lower nipple of the pipette; elevate the bottle above the pipette and open both cocks of the pipette, allowing the sewage to flow into the pipette by gravity. When the pipette is full, close both cocks, remove the rubber tube leading to the aspirator bottle and return the pipette to its case. As many pipettes as are necessary to secure the required number of samples may be thus prepared on the surface before entering the sewer.

The pipette is now taken into the sewer, to the point from which it is desired to secure a sample of the gas present, removed from its case and held in a vertical position with both cocks open. The sewage flowing out draws the gas in and when the sewage is all out, the pipette is full of gas. The stop cocks are now closed and the pipette returned to its case and the case marked for identification.

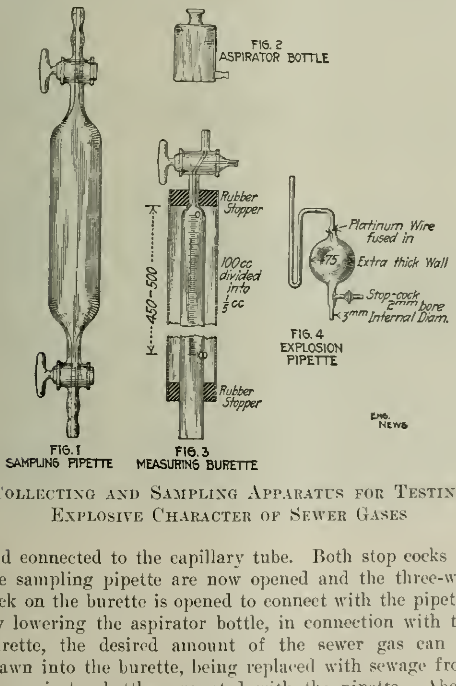
Examination in the Laboratory

For the examination in the laboratory, a water-jacketed [illegible] burette (Fig. 3) with a three-way cock

*[illegible] Department of Public Work, Detroit, Mich.

similar to a Hempel burette is necessary for the gas measurements. An explosion pipette (Fig. 4) connected up with two or three batteries and a good sparking coil is necessary for the explosion tests. The explosion pipette should be mounted in a wooden case with a sliding front of heavy plate glass in order that the operator may watch the explosion, yet be amply protected from harm in case of a too violent explosion.

The sampling pipette is removed from its case and mounted in a suitable holder in position to attach the capillary tube from the gas-measuring burette. The aspirator bottle is filled with sewage and placed on a shelf above the pipette, the end of the rubber tube being closed with a pinch cock. The rubber tube is now allowed to fill with water and slipped over the lower nipple of the pipette. The capillary connecting tube is attached to the burette with heavy rubber tubing and securely wired. The aspirator bottle connected with the gas-measuring burette is filled with sewage and the bottle raised, with the three-way cock open straight through, until water appears at the end of the capillary tube. The upper nipple of the pipette is now filled with sewage



Collecting and Sampling Apparatus for Testing Explosive Character of Sewer Gases

and connected to the capillary tube. Both stop cocks on the sampling pipette are now opened and the three-way cock on the burette is opened to connect with the pipette. By lowering the aspirator bottle, in connection with the burette, the desired amount of the sewer gas can be drawn into the burette, being replaced with sewage from the aspirator bottle connected with the pipette. About 25 c.c. of gas should be drawn over and allowed to stand three minutes (to allow water on the sides of the burette to run down), before measurement. In the meanwhile the cocks on the pipette are closed, the pipette removed from its holder, returned to the case and the explosion pipette connected to the capillary tube. The three-way cock is now turned to connect through from the explosion pipette to the air, the stop cock on the explosion pipette opened, the aspirator bottle filled with mercury raised to allow the explosion pipette to fill with mercury. A cushion (about ½ in.) of water should be carried on top of the mercury in the explosion pipette. When the explosion pipette is full and water appears at the three-way cock, the cock is turned to connect through from the burette to the explosion pipette, the mercury bottle lowered and the sample of gas drawn into the explosion pipette. When the gas is all over, the three-way cock is closed and a pinch clip is placed on the rubber tubing connecting the capillary tube to the explosion pipette—to protect the gas-measuring burette in case of a too violent explosion. The mercury bottle is now raised to the level of the mercury in the explosion pipette and the stop cock closed. The gas sample is now confined in the explosion pipette over mercury and at atmospheric pressure. The switch connected with the batteries is then closed for a moment, passing an electric spark through the gas. If the gas is explosive, the operator will see a flash of flame through the gas. If the gas is not explosive in its original condition, it may only need oxygen to make it explosive: so it is passed back to the gas-measuring burette, the capillary tube disconnected and equal parts of air drawn into the burette. After measurement the mixture is passed into the explosion pipette and a spark sent through it. Various mixtures of the gas and air, under various conditions of pressure may be passed into the explosion pipette and sparked. If it is found that the sewer gas cannot be exploded alone or when mixed with air, then measured amounts of city gas from a gas tap may be added to find the amount needed to make the sewer gas explosive.

If it is desired to measure the relative intensity of the explosion of various gas mixtures, a sensitive recording gas-pressure gage may be connected in series with the explosion pipette and the mercury bottle and the blow of the explosion thrown directly onto the recording chart. While this method will not give absolute measurements of the intensity of the explosions, it will give relative measurements which are of value.

If it is found that the sewer gas is not explosive alone or when mixed with air, the engineer is no longer interested in it. If it is found to be explosive, then the remainder of the sample in the sampling pipette should be sent to an experienced gas analyst for analysis to determine what makes it explosive.

Examination of Sewage for Oil

At least ten liter samples of the sewage should be obtained in bottles with a small neck. Two or three pounds of common salt (NaCl) are added to the sewage to make a fully saturated brine and the bottles are allowed to stand at least 24 hr. The salt increases the density of the solution and hastens and makes more complete the separation of the oil. After standing a sufficient length of time, the oil is siphoned off the top (preferably with a vacuum pump) into a distilling flask with a side-arm outlet. It is impossible to prevent some of the water coming over with the oil, so the flask is now connected with a Leibig condenser and the oil distilled off at 205° F. This will give a fairly good separation of the oil from the sewage and does not necessitate the distilling of the entire sample. If it is desired the oil may be redistilled and fractionated to determine the boiling point of the various fractions. A Westphal balance or hydrometer may be used to determine the specific gravity of the fractions for further identification.

Two Interesting Bridges on the El Paso & Southwestern Ry.

The bridges on the El Paso & Southwestern line between Fairbanks and Tucson, Ariz., include a riveted-truss bridge in which the trusses have no counters, and a plate-girder bridge with three-post towers which are triangular in plan. The other structures are mainly concrete arches and concrete slab-deck trestles. The bridges are designed for Cooper's E-55 loading. J. L. Campbell is engineer of the railway.

Bridge Trusses without Counters

Near Irene, Ariz., the line crosses the Southern Pacific Ry. and the cañon of Cienega Creek by a bridge having two riveted-truss deck spans of 168 ft., with a single 50-ft. plate-girder span (65 in. deep) at one end and two 75-ft. plate-girder spans (85 in. deep) at the other end. This bridge is shown in Figs. 1 and 2. The assumed dead-load for the truss spans is 2100 lb. for the trusses, 600 lb. for the floor and 500 lb. for the track, or 3200 lb. per lin.ft. of bridge; for the girder spans it is 1100 lb. and 800 lb. for steel and 500 lb. for track, making 1600 and 1300 lb. for the 75-ft. and 50-ft. spans, respectively.

The trusses are of the parallel-chord Pratt type, with vertical end posts. They are 23 ft. 9 in. deep, and have a panel length of 23 ft. 9 in., the length c. to c. of end pins being 166 ft. 3 in. The expansion bearings are on the middle pier and the fixed shoe bearings on the end piers. The trusses are spaced 15 ft. c. to c., and have plate-girder floorbeams riveted between the posts. The floorbeam at the outer end of each span is 60 in. deep, all the others are 46 in. deep. Upon the floorbeams are two lines of 38-in. plate-girder stringers 7 ft. 6 in. apart, which carry ties 10x10 in., 10 ft. long, boxed out $\frac{1}{2}$ in. over the flanges and carrying guard timbers 6x8 in., which are boxed out 1 in. over the ties. Each third tie is secured to the stringers by $\frac{3}{4}$-in. hook-bolts which pass through the guard timbers.

The top chords of the trusses are of trough section, with two 22-in. web plates (16 in. apart), four outside flange angles 4x4 in., and a top cover-plate 26x$\frac{5}{8}$ in., while double lacing is riveted across the lower flanges. The bottom chords are similar, but with double lacing top and bottom, and in the three middle panels the 22-in. web-plates are reinforced by outside 13-in. plates. The vertical end posts are of similar section to the top chord, with the addition of an interior transverse diaphragm or web-plate secured to the side plates by four angles. The

Fig. 1. Bridge with Riveted Truss Spans of 166 Ft. 3 In., across Cienega Creek; El Paso & Southwestern Ry.

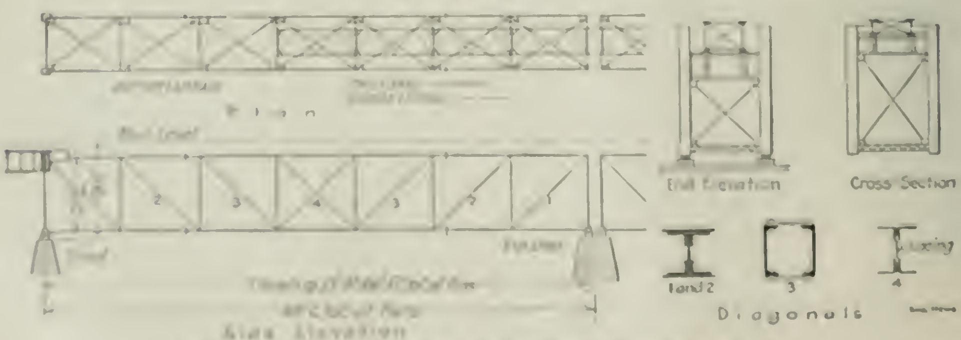


Fig. 2. Riveted Deck Truss Spans for Cienega Creek Bridge

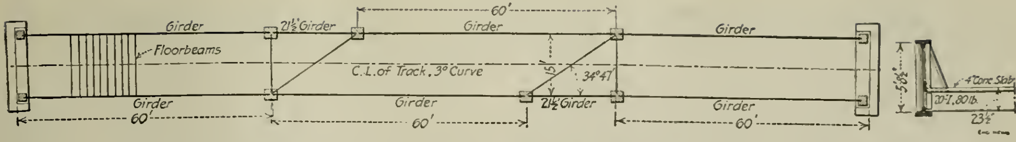


FIG. 3. THREE-SPAN PLATE-GIRDER BRIDGE WITH THREE-POST TOWERS; EL PASO & SOUTHWESTERN, RY.

shoe pins are 8 in. The intermediate posts are of box section, built up of plates and angles or of a pair of channels (with flanges inward).

The diagonals in the first two panels at each end are of H-section (three plates and four angles), while those of the next panels are composed of two 15-in. channels with flanges inward. In the middle panel, each diagonal is of four angles and transverse web lacing, with two connection plates 45 in. square at the intersection. All connection plates are large, to provide for ample riveting.

BRIDGE WITH THREE-POST TOWERS

At Mescal, Ariz., the line again crosses over the Southern Pacific Ry. It is carried by a through plate-girder bridge having three 60-ft. spans, and the angle of skew (34° 47′) led to the use of the three-post pier arrangement shown in Fig. 3. Each tower has one 21½-ft. girder to fill in between the two 60-ft. girders, and is braced on all three sides. A view of this bridge is shown in Fig. 4.

Each column is composed of a pair of 15-in. channels (with flanges inward), a diaphragm or web-plate 15x⅜ in., and four angles 5x3½ in., connecting the web to the channels. The open sides have no bracing or batten plates. The shoe rests on a concrete pedestal and the top has a ½-in. cap plate 25x25 in., secured to the column by four angles 4x6 in. The struts, braces and hangers are pairs of angles with lacing or batten plates over the flanges. The hangers are used only on the two longer sides of the tower.

The 60-ft. girders have ½-in. web-plates 68½ in. deep, four flange angles 8x8 in., and cover-plates 20x$\frac{9}{16}$ in. They were made in half lengths and spliced in the field. The 21½-ft. girders have the same web-plates, with flange angles 6x4 in., and no cover-plates. A solid floor is used, so that the ordinary ballasted track is carried across the bridge. The floor consists of 20-in. transverse I-beams resting on the inner flange angles and secured to the girders by angle connection plates. Over these beams is laid a 4-in. concrete deck, which is sloped up against the girder web on each side. This construction is shown in Fig. 3.

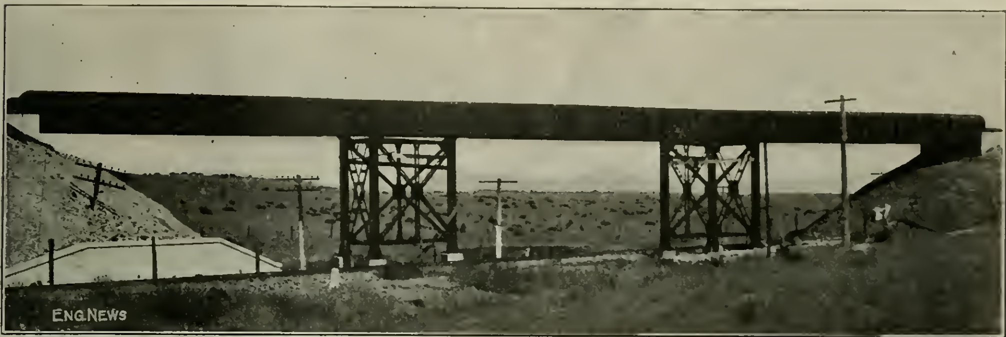


FIG. 4. PLATE-GIRDER BRIDGE WITH THREE-POST TOWERS

Dust on Underground Railways in Paris has been investigated owing to the condition of the air in the tunnels of the Metropolitan line being much worse than in those of the North-South line. It is found that the former contains 134 milligrams of dust per c.c. as against only 6 to 16 milligrams in the latter. The principal cause (on the Metropolitan) appears to be in the rails, which are of relatively soft steel, and in the braking, the brakeshoes being of cast iron. On the North-South line, the rails are of harder steel and the brakeshoes are faced with a tar-treated fabric, which reduces wear and noise. Another cause is in the car-floor construction, the cars of the former line being of wood with narrow wearing strips which make it difficult to clean the floor. On the latter line the floor is covered with a composition which gives a smooth and uniform surface that is readily cleaned with wet sawdust. Another proposed plan, as noted in "The Engineer" (London) is to cover the ballast with tiles at the stations, so that the track can be cleaned and the dust removed.

A Reinforced-Concrete Pier Damaged—What appears to be a serious imperfection in the concrete jetty erected by the Gladstone Harbor Board, Queensland, has been noted by E. A. E. Cullen, Engineer for Harbors and Rivers, who has recommended that the necessary repairs be undertaken forthwith. Mr. Cullen, who inspected the jetty, submitted a report as follows: "It is a matter of great disappointment to find that a reinforced-concrete wharf may require a periodic maintenance, as it was hoped that such would not be the case, except for surface wear and tear. What has occurred at Gladstone is that the concrete in the beams has not proved impervious to the water everywhere, and in consequence moisture has in places reached the steel reinforcing bars, causing corrosion. The expansion of the rust caused cracks in the concrete. Another factor which may have produced cracks, permitting moisture to enter, is the severe punishment the jetty receives at times from the impact of steamers. To repair the structure it will be necessary to cut away the damaged concrete, clean any rust off the bars, and restore with fresh mortar. It is very difficult to estimate the cost of such work. Probably it will not exceed £250. The structure was completed in 1908, and showed no visible deterioration until recently, save for a few rust spots in places where the steel had been insufficiently covered with mortar. These were cut out and restored in November, 1912."—"The Commonwealth Engineer," Melbourne, Australia.

A Novel Flexible Locomotive

SYNOPSIS—Several types of locomotives with flexible wheelbase have been designed for railways having numerous and sharp curves, and where the limiting conditions of power and axle load necessitate distributing the load over several axles and a considerable total length of wheelbase. The general principle of these is to mount the engine on groups of wheels, some or all of which are carried in swiveling trucks, while the wheels of each group are driven directly or by gearing. The accompanying article describes an English design of flexible locomotive which is in use on a number of railways, and which has the peculiar feature of carrying the boiler suspended between the trucks.

⁂

The Garratt type of flexible locomotive, now in use on some foreign railways, has the boiler mounted on a girder frame whose ends are pivoted upon two steam trucks, there being no wheels under the boiler. This is the distinctive feature which differentiates it from all other flexible locomotives (articulated or otherwise), as noted in a brief description in our issue of Apr. 13, 1911. Fig. 1 shows a freight locomotive of this type for the Tasmanian Government Railways. It will be seen that the engine consists of three separate and distinct units: the boiler with its girder frame, and the two steam trucks or driving trucks. The pivots or king-pins forming the attachments of the boiler frame to the trucks are near the inner ends of the trucks (or nearly over the inner driving axles), and the requisite weight on the forward part of each truck is supplied by a water tank.

In the Fairlie and Mallet engines the wheels are divided into two groups, each with its own cylinders, but all the wheels are placed beneath the boiler. The Fairlie engine has two swiveling trucks, while the Mallet engine has the rear group carried in rigid frames and the leading group carried in a swiveling truck having a pin-jointed connection at the rear end. In furnishing us with information as to the newer type of engine, the inventor calls attention to some points in comparing the Garratt type with the Fairlie and Mallet types, especially the greater possible sizes of boilers and wheels under like conditions of gage, and the relative stability of the three types.

In the Garratt type, as the wheels are not under the boiler, both they and the boiler may be of any size that will pass through the clearance limits. In the Mallet and Fairlie types the wheels are under the boiler, and therefore limit each other. Mr. Garratt thinks it would be difficult to build a high-speed engine on these designs, because, if the wheels are to be of suitable diameter for fast running, there would not be room for a large boiler and firebox of sufficient capacity. However, Mallet engines with 73-in. wheels and weighing 188 tons are in use in passenger service on the Atchison, Topeka & Santa Fe Ry. They are of the 4:4:0—0:6:2 type, and operate on grades of 1.75% with curves of 16°.

It is claimed that in the Garratt arrangement the trucks swing more freely and follow the curves with less resistance than in engines having the trucks under the boiler. As the boiler frame does not extend beyond the truck centers, when the engine is on a curve there are no overhanging ends of the frame of the boiler (tangential to the curve) to reduce the stability. With regard to stability, Fig. 3 shows three types of flexible engines on the same curve, the Mallet engine being shown

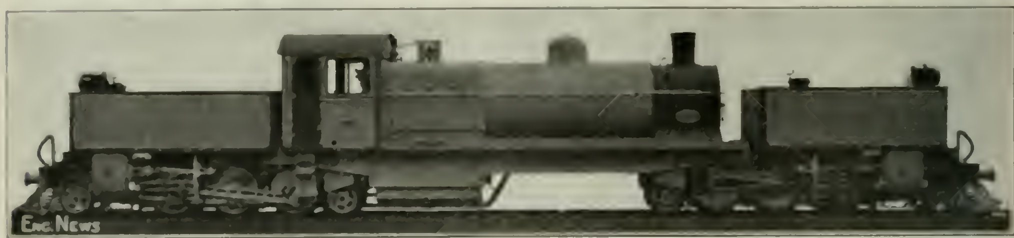


FIG. 1. FREIGHT LOCOMOTIVE OF THE GARRATT FLEXIBLE TYPE; TASMANIAN GOVERNMENT RAILWAYS

without its tender and the other two being tank or self-contained engines. The portions shaded black indicate weight displacement unfavorable to stability, and the cross-hatched portions indicate weight increasing the stability. It is noted that in the Garratt engine, the sharper the curve the greater the favorable displacement of weight, while in the Mallet and Fairlie types, the unfavorable condition increases as the curve becomes sharper.

Further, as the rear-wheel system of the Mallet type is rigid, the center line of the engine is tangential to the curve, as from the center of the rear-wheel system, thus throwing greater weight on the outer leading wheels, which at high speeds, may exceed the official fixed maximum weight. The engine described is the invention of

FIG. 2. STEAM TRUCK OF A PASSENGER LOCOMOTIVE OF THE GARRATT TYPE, TASMANIAN GOVERNMENT RAILWAYS

(Each truck has four cylinders.)

Herbert W. Garratt, 9 Ellerker Gardens, Richmond (Surrey), England, and is built by Beyer, Peacock & Co., locomotive builders, Gorton Foundry, Manchester, England. For information regarding it we are indebted to Mr. Garratt and the builders.

Garratt Locomotives for the Tasmanian Government Railways

A Garratt freight locomotive for the Tasmanian Government Railway is shown in Fig. 1, while Fig. 2 shows one of the steam trucks for a passenger engine for the same railways. In the former, each steam truck is of the 2:6:2 type, with six driving wheels, while in the latter each truck is of the 4:4:2 type, with four driving wheels. They are for service on the main lines (3-ft. 6-in. gage), where the maximum grades are 2.5% (up to 6½ miles long) with curves as sharp as 17°.

The passenger engine has four cylinders to each truck, 60-in. driving wheels with 6-ft. rigid wheelbase, and a maximum axle load of 12 tons. It is designed for a maximum speed of 55 mi.p.h., and to haul a train load of 200 tons at 30 mi.p.h. on the maximum grade with 17° reverse curves. The freight engine has two cylinders to each truck, 42-in. driving wheels with 8-ft. rigid wheelbase, and a maximum axle load of 9½ tons. Its tractive force, at 75% boiler pressure, is 28,284 lb. The boilers are alike and the parts of the two engines are made interchangeable as far as possible. The ordinary engines used in the same service are 4:4:0 passenger engines(which haul 100-ton trains), and 2:6:0 and 4:6:0 freight engines, all having tenders.

The absence of side tanks and of wheels beneath the boiler permitted the use of a barrel of large diameter and moderate length, with a wide and deep firebox of the Belpaire type. The grates are designed for burning the inferior native coal, but provision has been made for using oil fuel, in view of the development of oil wells in Tasmania. The boiler is of steel, with copper firebox, steel tubes and a 24-tube Schmidt superheater. The steam pipes have ball joints directly over the king-pin pivots. The exhaust from the two groups of cylinders is led to a double exhaust nozzle in the smokebox, having a central opening for the forward cylinders and an annular opening for the rear cylinders.

In the passenger engine, the driving and rear axles of each steam truck are equalized. The four cylinders drive the first driving axle (which is of nickel-chrome steel), the inside and outside cranks being placed at

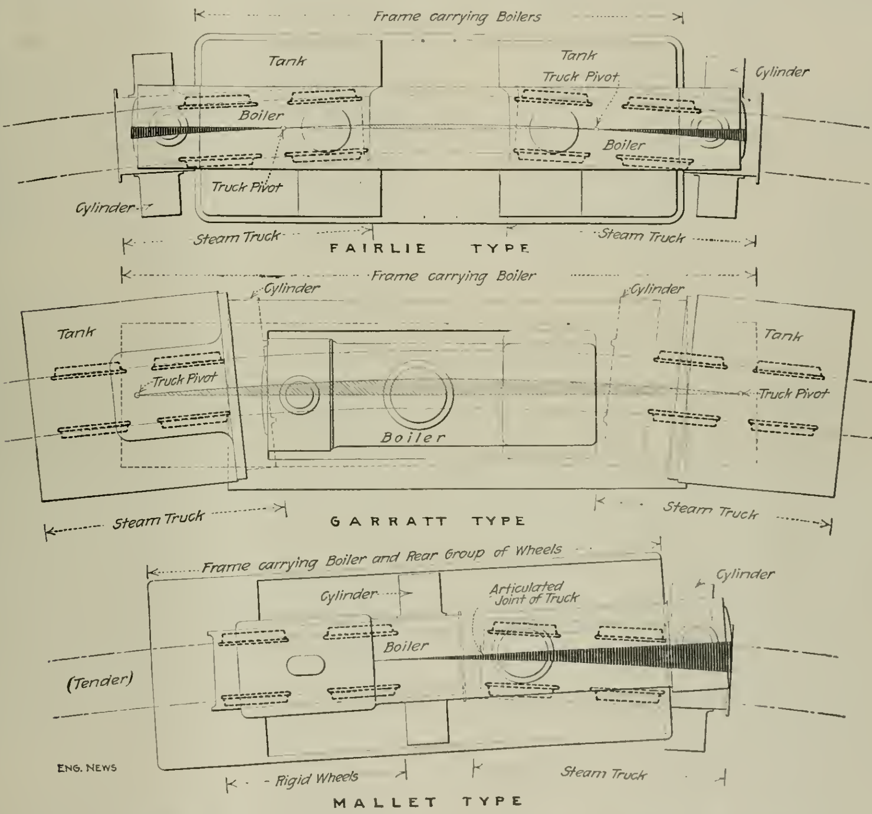


Fig. 3. Diagram Indicating Relative Stability of Flexible Locomotives on Curves

(Black areas indicate weight unfavorable to stability on curve. Shaded areas indicate weight favorable to stability on curve.)

DIMENSIONS OF GARRATT FLEXIBLE LOCOMOTIVES

	—Tasmanian Govt. Rys.— Passenger	Freight	W. Australian Govt. Rys.	Belgian Congo Ry.
Gage	42 in	42 in	42 in	30 in
Wheel plan (each truck)	4 4 2	2 6 2	2 6 0	0 6 0
Driving wheels	(8) 60 in	(12) 42 in	(12) 39 in	(12) 33¼ in
Outer truck wheels	(8) 28½ in	(4) 27 in	(4) 30 in	none
Inner truck wheels	(4) 34½ in	(4) 27 in	none	none
Wheelbase, driving	6 ft 0 in	8 ft [illegible] in	7 ft 6 in	7 ft 4 in
Wheelbase, each group	20 ft 9 in	17 ft 4 in	13 ft 9 in	7 ft 4 in
Wheelbase, total engine	61 ft 10 in	58 ft 8 in	47 ft 0 in	35 ft 0 in
Distance between centres	30 ft 6 in	29 ft 8 in	27 ft 0 in	
Weight (each group) drivers	24 tons	28 tons	25½ tons	
Weight, outer truck	15 tons	8 tons	7 tons	
Weight, inner truck	8 tons	9 tons		
Weight, total, each group	47 tons	45 tons	32½ tons	
Weight, total engine	94 tons	90 tons	65 tons	50 tons
Weight, total, empty	72 tons	67 tons	55½ tons	
Cylinders	(4) 12x20 in	(4) 15x22 in	(4) 12½x20 in	(4) 12½x14 in
Tract. power per lb. m. e. p. in cyls	192 lb	235 lb	160 lb	
		Both engines		
Boiler diameter		5 ft 3 in	5 ft	
Superheater		Schmidt	Schmidt	
Working steam pressure		160 lb	175 lb	200 lb
Firebox		78x62 in	57x56 in	
Firebox, depth		6 ft 3 in	5 ft 3 in	
Tubes, ordinary		No., 225, dia., 1¾ in	No., 288, dia., 1¾ in	No., 119, dia., 2¼ in
Tubes, superheater		No., 24, dia., 5¼ in		
Tubes, length		11 ft 3 in	9 ft 1 in	10 ft 8 in
Superheater steam pipes		dia., 1¼ in		
Heating surface, tubes		1750 sq ft	1233 sq ft	1097 sq ft
Heating surface, firebox		136 sq ft	107 sq ft	123 sq ft
Heating surface, total		1886 sq ft	1340 sq ft	1220 sq ft
Superheating surface		333 sq ft		
Grate area		34 sq ft	22½ sq ft	
Total capacity of tanks (2)		3000 gal	2000 gal.*	
Capacity of coal bunkers		4 tons	2 tons	

* 1220 gal. on front truck.

180°. The Walschaerts valve gear is used, with screw reversing gear. The inner carrying axle of each group has a lateral play of ¾ in. The water tanks are connected by equilibrium pipes, with flexible connections, and the coal bunkers have inclined bottoms so as to feed the coal to the deck by gravity. Steam and vacuum brakes are applied to all driving wheels, while the truck at the firebox end has also a hand-brake for the coupled wheels. A steam sanding apparatus is applied, and the engine has an electric headlight and a speed indicator.

In the freight engine, the front truck and first driving axle of each group are equalized, while the second and third (main) driving axles and inner carrying or pony-truck axle form a separate equalizing system. This engine has an acetylene gas headlight. A satisfactory distribution of weight is secured, so that even with both bunkers and tanks empty (which condition would not exist in service) there is ample weight on the pony truck axles. The general dimensions of these two engines are given in the accompanying table.

The first Garratt engines used on the Tasmanian lines were for the Northeast Dundas branch, of 2-ft. gage, having maximum grades of 4%, and sharpest curves of 99-ft. radius. Each engine had two four-wheel trucks (with the cylinders at the inner ends), and weighed 33 tons complete. The ordinary engines on this branch were tank engines of the [illegible] type.

THE GARRATT LOCOMOTIVE ON OTHER RAILWAYS

Six locomotives of this type were built in 1911 for the Western Australian Government Railways (3-ft. 6-in. gage), and they proved so satisfactory that six additional locomotives (equipped with superheaters) were ordered and were delivered in 1913. Each truck has a 2:6:0 wheel arrangement, with [illegible] for the boiler frame between the second and third driving axles. These engines were designed to [illegible] grades of [illegible] with curves of 17°, and the axle load was limited to 8 tons. The dimensions of the engines are given in the accompanying table.

In addition to the Tasmanian and Australian railways noted, locomotives of the Garratt type have been built for the Darjeeling-Himalayan Ry., in India; the Arakan Flotilla Co., of Burma; the San Paulo Ry. and Mogyana Ry., of Brazil, and the Belgian-Congo Ry., of Africa. The Darjeeling Ry. (24-in. gage) is noted for its steep grades and its extremely sinuous location, including several loops. The engines have two four-wheel trucks (0:4:0—0:4:0), with the cylinders at the outer ends; they weigh 28 tons, and can traverse reverse curves of 60-ft. radius. The Congo Ry. engine (30-in. gage) has six-wheel trucks (0:6:0—0:6:0), with cylinders at the extreme outer ends connected to the inner driving axles. Oil fuel is used, carried in a cylindrical tank on the forward truck. The engine was built by the Société de St. Léonard, at Liége, Belgium, and was shown at the international exhibition at Ghent in 1913.

Designs have been made for a large standard-gage engine of the 0:8:0—0:8:0 class, with eight driving axles.

A Special Rail Section for Curves

An interesting development in railway-track construction is a so-called "frictionless" rail designed to be used on the inside of curves. Its special feature is a very narrow head, and its purpose is to reduce the slip of the inside wheel, which takes place in compensating for the greater length of travel of the wheel on the outside rail. It is claimed that there is a diminution of friction and resultant wear to both the outer and inner (frictionless) rails and the wheel flanges; while the reduced friction gives a freer and smoother passage of the wheels, with a reduction in power required to handle a given tonnage. The rail is supplied by the Frictionless Rail Co., of Boston, Mass.

Other special rails for curves have been designed mainly to give additional metal available for wear. The Manning rail, tried some years ago on the Baltimore & Ohio R.R., had $\frac{3}{32}$ in. of additional metal on the inner side of the head and $\frac{3}{32}$ in. less on the outer side. The special 110-lb. rail of the Lehigh Valley R.R. (ENGINEERING NEWS, Oct. 24, 1912) has the head slightly wider and considerably deeper than that of the standard rail.

SOUTHERN PACIFIC RY.

The Southern Pacific Ry. has ordered 5000 tons of the frictionless rail, using a 90-lb. section as a companion to the standard 90-lb. A. R. A. (A) type section, and for information as to this we are indebted to John D. Isaacs, Consulting Engineer, Southern Pacific Co. The rail is laid on 9° and 10° curves on single track, carrying heavy traffic. The track has 18 ties 7x9 in. to a 33-ft. rail length, the ties having tieplates and being laid in a full bed of ballast. The rails are laid with suspended joints, 18 in. c. to c. of ties, and are spliced with [illegible] bars, having four bolts ([illegible] in. c. to c.) with heads alternately on the inside and outside of the rail. This is the standard joint construction.

The rail has not been in service for a sufficient time to enable a definite statement to be made as to its performance, but we are informed that so far the reports are satisfactory. The sections of the standard and frictionless rail are shown in Fig. 1, while Fig. 2 shows the

taper rail for connecting the two sections at the ends of the curves. The dimensions are shown in the accompanying table:

Boston Elevated Railway

On the Boston Elevated Ry., the frictionless rail has been laid on several curves, ranging from 9° to 57°, the length of rail used being from 116 to 482 ft. The rail weighs 79½ lb. per yd. and is used with the 85-lb. Am. Soc. C. E. section. Both are of openhearth steel, treated with ferro-titanium, with chemical composition as follows: carbon, 0.80 to 0.95%; phosphorus, under 0.04%; silicon, 0.10 to 0.20%; manganese, 0.65 to 0.90%; metallic titanium, 0.10%; sulphur, 0.03 to 0.05%. For information as to the service we are indebted to H. M. Stewart, Chief Engineer of Maintenance-of-Way.

On account of the short length of these curves it has not been possible to obtain accurate tests as to the increase or decrease in power consumption used by a train in going around the curves, but it is known that less power is required than when the curves were laid with the 85-lb. rail. In some instances where power was required to pass a curve laid with the 85-lb. rail, it is now possible to coast through the curve. It is not found that the narrow-headed rail decreases the braking power of the trains. Practically all of the special rail is on the elevated structure where it is considered necessary to use a heavy guard rail, rigidly attached to the inner rail of the curve. Therefore, the results on this road may not conform with those obtained on steam roads where guard rails are not used.

As an example of the experience with this rail, the curve at Causeway and Haverhill St. may be taken. This has a radius of 90 ft. on the center line, and about 297 ft. of the frictionless rail was laid on the inside of the curve in 1912. The conditions on this curve have been as follows:

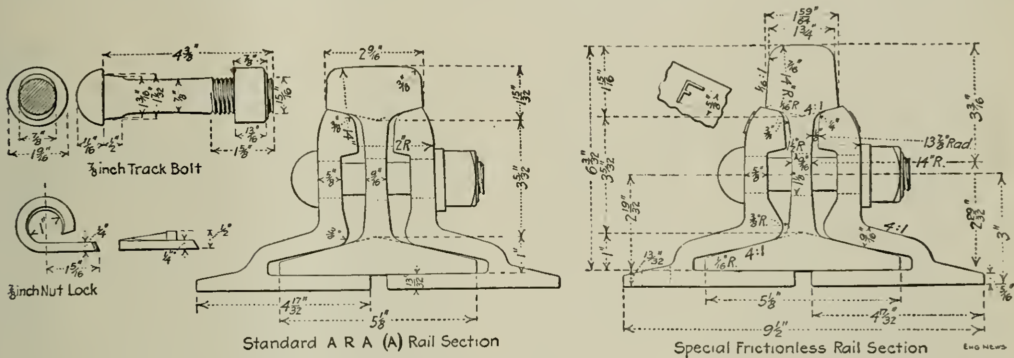


Fig. 1. Comparative Sections of the Standard 90-Lb. Rail and the Special "Frictionless" 90.29-Lb. Rail Used on the Inside of Sharp Curves; Southern Pacific Ry.

On the inside of the curve, the 85-lb. Am. Soc. C. E. rails of openhearth ferro-titanium steel were removed Nov. 16, 1912, after a life of 262 days, with a wear of 0.029 ft., being removed on account of corrugations. The 79-lb. "frictionless" rails of the same steel, laid on the above date, were examined on Aug. 26, 1913, after 283 days' service. The wear was 0.036 ft., while there was very little corrugation. The permissible amount of wear is 0.015 ft., and the life of this rail therefore was estimated at 351 days, or 35% more than the actual life of the former ordinary rails.

On the outside of the curve, the 85-lb. rail showed a wear of 0.039 ft. during the 262 days' life of the 85-lb. ordinary rail on the inside, while it was 0.040 ft. during the 283 days' service of the 79-lb. special rail.

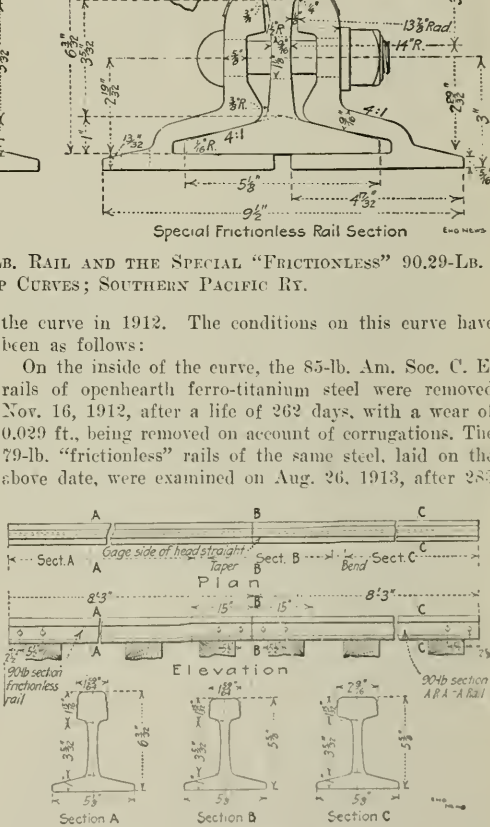


Fig. 2. Taper or Compromise Rail for Connecting the Ordinary and Special Rails at the Ends of Curves

STANDARD AND SPECIAL RAILS FOR CURVES: SOUTHERN PACIFIC RY.

Type of rail	A.R.A. (A)	Frictionless
Weight, per yd.	90 lb.	90 29 lb.
Height	5⅝ in.	6 3/32 in.
Width of base	5⅝ in.	5½ in.
Width of head, top		1¾ in.
Width of head, bottom	2 9/16 in.	1 59/64 in.
Side of head, slope	1/16 to 1	1/16 to 1
Depth of head	1 15/32 in.	1 13/16 in.
Depth of web	3 5/32 in.	3 5/32 in.
Depth of base	1 in.	1 in.
Thickness of web, middle	9/16 in.	9/16 in.
Thickness of flange, edge	11/32 in.	11/32 in.
Height to c. of bolt hole	2 19/32 in.	2 19/32 in.
Radius, top of head	14 in.	14 in.
Top corners of head	⅜ in.	7/16 in.
Bottom corners of head	1/16 in.	1/16 in.
Fillets	¼ in.	¼ in.
Corners of base	1/16 in.	1/16 in.
Sides of web	14 in.	14 in.
Edge of base	Vert	Vert.
Fishing angles	4:1	4:1
Area of head, frictionless, 3.229 sq.in.	36 2%	36 5%
Area of web, frictionless, 2.116 sq.in.	24 0%	23 9%
Area of base, frictionless, 3.507 sq.in.	39 8%	39 6%
Area, total	8.82 sq.in.	8.852 sq.in.
Moment of inertia	38.70	43 48
Section modulus, top	......	16.67
Section modulus, base	......	12 47
Height of neutral axis from cen. of bolt holes	0 05375 in. below	0.0145 in. above

The Wheeler Filter Bottom

By Robert Spurr Weston*

It has been clearly demonstrated by J. W. Ellms† at Cincinnati that the sand beds of mechanical filters can be most effectively cleaned by the application of wash-water at rates exceeding a vertical velocity, above the sand, of 8 mm. per second (18 in. per min.). Other engineers have confirmed the truth of Mr. Ellms' observations. Where lower velocities have been used, it has been necessary to agitate the sand during washing by means of revolving rakes, compressed air or other devices.

To make use of the higher velocities of wash-water, it has been the practice either to deepen the whole gravel layer of the filter or to hold in place the lower coarse layer (that immediately above the wash-water inlets) by means of suitable screens. When the bottoms of such filters consist of a series of troughs or inverted pyramids, the screens cover the depressions, but where a flat bottom is used special standards have to be provided. All of these arrangements are expensive and not in all cases satisfactory.

The disadvantages of existing arrangements led William Wheeler,‡ on June 29, 1907, to design an improved filter bottom. At that time his idea was to use it in connection with a filter plant in Kentucky. This work, however, was postponed and the device was not worked out until 1913, when the writer and his assistants experimented with it and later embodied it in the design of the filters at Belfast, Maine, recently put into operation.

Mr. Wheeler's original design (Fig. 1) consisted of a series of concrete inverted pyramids, spaced 1 ft. c. to c. At the bottom of each pyramid is a 0.75-in. tube which serves both as filter outlet and wash-water inlet. There is nothing particularly novel in the so called hopper bottom; it has been used in water filters for many years, notably at the plant of the Hackensack Water Co., at Milford, N. J.§

Hitherto all filter bottoms with depressions, pyramidal or prismoidal, have been provided with strainers of some sort and have been filled either with uniform or ununiform material placed at random—for example, shot, quartz, gravel, rods, etc. The Wheeler filter bottom obviates [illegible] the objections to previous designs and differs from them in that it substitutes for a wash-water distributing layer placed at random, an assembly of distributing elements in the form of true spheres of cement, earthenware or other suitable material. In other words, it substitutes for a random layer a system of spheres arranged according to definite mechanical principles. These make use of the adhesive force between the water on the one hand and the spheres and the slopes of the inverted pyramids on the other, effecting a nearly perfect distribution of wash-water, so that it leaves the tops of the pyramids with a nearly uniform vertical velocity. It does this without allowing any of the sand to work down into the voids between the spheres, and at the same time it renders available substantially the entire top of the depressions to collect and discharge the filtered water.

The ball nozzle is an example of the action of the sphere on the jets issuing from the bottom of each pyramid during washing. It is a well known fact that a solid sphere is the geometrical form having the greatest weight in proportion to its surface. Therefore, it presents a form which has the greatest weight with the least surface friction. The form and the surface of the spheres, therefore, makes them least liable to disturbance by the upward flowing stream of wash-water. In fact, they will not move with wash-water velocities of less than 25 mm. per sec. (5 ft. per min.) even when uncovered with gravel. This immobility of the spheres allows the use of very thin gravel layers to support the

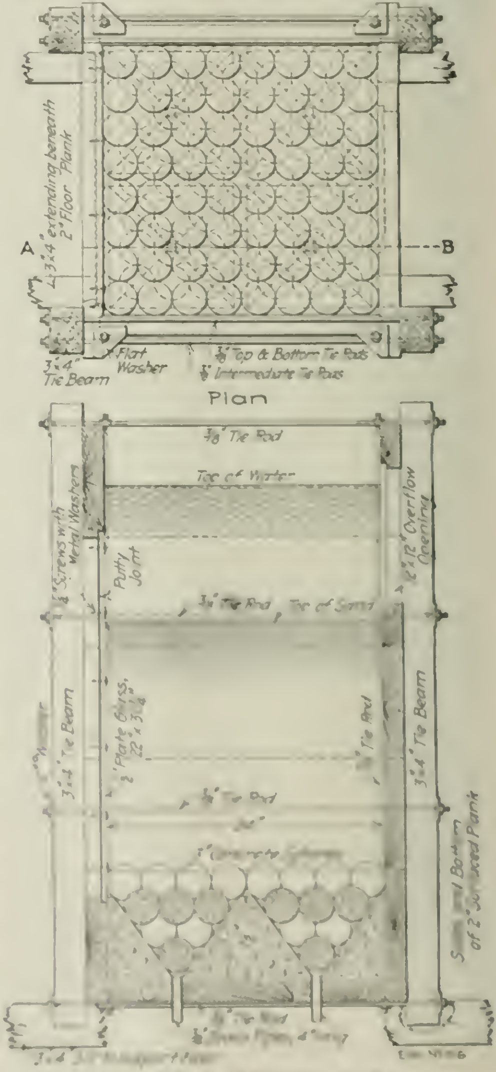


FIG. 1. WHEELER FILTER BOTTOM IN CONCRETE EXPERIMENTAL FILTER

*Consulting Sanitary Engineer, 14 Beacon St., Boston, Mass.
†Superintendent of Filtration, Cincinnati, Ohio.
‡Consulting Engineer, 14 Beacon St., Boston, Mass.
§"Engineering Record," Vol. 50, p. 672.

sand layer—thereby reducing the thickness of the underdrain system and the cost of construction.

Design of the Filter Bottom

Mr. Wheeler's original design was as follows: Directly over each wash-water inlet was placed a 3-in. sphere molded of Portland cement; over the first sphere were placed four others; over these four, nine; and over these nine, twelve more—making a system of 30 spheres arranged like an inverted pile of cannon balls.

Experiments showed that this first design was unnecessarily refined. Accordingly, the number of 3-in. balls was reduced from 30 to 5, and above these were placed nine glazed, earthenware marbles, eight of which had a diameter of 32 mm., and one (the center one) a diameter of 40 mm. Above this system of spheres were placed three layers of gravel. These layers may be surprisingly thin without allowing any of the sand to escape during filtering or any mixing of it with the gravel during washing. In the plants in practice a layer 6 in. in thickness has been used, but the writer feels reasonably sure that a 3-in. layer would satisfy all requirements, so good is the distribution of wash-water and the grading of the gravel layer. The inverted pyramids are truncated and their sides do not meet to form a sharp edge.

Experiments—Preliminary to designing the new filters for the Belfast (Maine) Water Co., Mr. Wheeler and the writer conducted a series of experiments at Concord, Mass., with a small observation filter.

Filter—The filter is practically that shown in Fig. 1. It had an area of cross-section of 4 sq.ft. and four 3/4-in. effluent tubes were connected by means of reducing fittings and 1½-in. pipes with an adapter, the latter connecting with the 2½-in. hose to the hydrant. With this arrangement it was possible to maintain a vertical velocity of 25.2 mm. per sec., equivalent to about 5 ft. per min.

Sand—Five different kinds of sand were used. Two, from Concord, Mass., were bank sands, and three were beach sands from the Massachusetts coast. The results of mechanical analyses of samples of these sands, taken after they had been in use, are shown in Table I.

TABLE I. MECHANICAL ANALYSES OF FILTER SANDS

Sand No	Kind	Lab. No.	10% finer than	60% finer than	Uniformity coefficient
1	Concord	348	0.49	0.94	1.92
2	Concord	355	0.33	0.47	1.42
3	Plum Island	363	0.53	0.79	1.49
4	Salisbury Beach	370	0.40	0.60	1.50
5	Ipswich	377	0.26	0.44	1.69

Gravels—Three grades of gravel were used to support the sand. This gravel was screened from Concord sand No. 1 and separated into three grades, first that passing a coarse screen having 1 in. square meshes and retained on one having 3/8-in. square meshes, second that passing through a screen having 3/8-in. square meshes and retained on one having 1/4-in square meshes, and third that passing through a screen having 1/4-in. square meshes and retained on one having 12 meshes per lin.in. Two of these gravels were subjected to mechanical analysis (see Table II).

TABLE II. MECHANICAL ANALYSES OF FILTER GRAVEL

Sample	Lab. No.	10% finer than	60% finer than	Uniformity coefficient
Medium	383	12.5	18.0	1.41
Fine	384	2.36	2.60	1.10

Cement Balls—The 3-in. cement balls used to fill the pyramids were made in the laboratory from neat Portland cement. Their specific gravity was 2.4.

Marbles—The marbles used to fill the interstices between the cement balls were ordinary German, blue agate marbles—that is, cheap glazed earthen ware. They averaged 1.2 in. in diameter, and had a specific gravity of 2.84.

Trials

Trial No. 1—The first trial was made with each pyramid filled with four layers of concrete balls, that is, 30 balls to a pyramid. The interstices between the balls at the surface were filled with 25 marbles.

Water was applied to this system of balls and marbles at the rate of 25 mm. per sec. without disturbing the position of the marbles.

Trial No. 2—In this trial the upper layer of balls was removed, leaving the first 14 balls in each pyramid arranged in three layers. These balls could not be displaced with the velocity available, and 16 marbles were placed in the interstices at the surface. Table III gives the results of observations at different velocities:

TABLE III. RESULTS OF TRIAL NO. 2 WITH THREE LAYERS OF BALLS, AND ONE LAYER OF MARBLES, AND WITH AND WITHOUT GRAVEL LAYERS

System	Vertical velocity mm. per sec.	Vertical velocity ft. per min.	Results
A—Balls and marbles only.	8.0	1.6	No movement
	20.0	4.0	No movement
	21.8	4.3	No movement
	22.6	4.4	Marbles revolve
	23.5	4.6	Marbles revolve
B—Like A with 2 in. of ⅜ to 1 in. gravel. Level of gravel was 1 in. above tops of balls.	12.7	2.5	No movement
	24.4	4.8	No movement
	24.6	4.8	No movement
C—Like A with 1 in. of ⅜ to 1 in. gravel, 1.5 of ¼ to ⅜ in. gravel.	24.6	4.8	No movement
D—Like A with 0.3 ft. of graded gravel.	20.0	4.0	No movement
	24.6	4.8	No movement

Trial No. 3—Trial No. 3 was similar to Trial No. 2, with the exception that fine gravel of two different thicknesses, namely 0.1 and 0.3 ft., was placed above the coarser graded gravel.

When the finer layer (*A*) was used, most of the movement took place around the periphery of the filter and at the corners of the pyramids. The lift or boiling in the center of each pyramid was less than around the periphery but was in spots, and always in the same spots. With velocities below 18 mm. per sec., equivalent to 3.5 ft. per min., the fine gravel was undisturbed. With higher velocities there was a slight movement.

With the thick layer of fine gravel, the surface was lifted at two spots from 0.2 to 0.3 ft. above its average elevation.

The results are summarized in Table IV (p. 24).

Trial No. 4—Trial No. 4 was made with two layers of balls and one layer of marbles; that is, four marbles and nine balls in each pyramid. In addition to the balls, gravel layers of various thicknesses were tried.

It will be noticed that when balls and marbles alone (*A*) were used, a velocity of 10.7 mm. per sec. caused the corner marbles to revolve slowly. When the velocity was increased to 16 mm. per sec., the side marbles revolved; the corner marbles were lifted one-half way to the top of the pyramid, while the center marble remained stationary. When the velocity was increased to 17.9 mm. per sec., a large percentage of the corner marbles was lifted nearly to the top of the pyramid and all of the marbles except the center ones were moved.

TABLE IV. RESULTS OF TRIAL NO. 3 WITH THREE LAYERS OF BALLS, ONE OF MARBLES AND VARIOUS GRAVEL LAYERS

System	Vertical velocity mm. per sec.	Vertical velocity ft. per min.	Results
A—With 0.3 ft. graded gravel and 0.1 ft. fine gravel	12.7	2.5	No movement
	16.9	3.3	No movement
	17.9	3.5	No movement
	20.3	4.0	Slight movement at edges
	21.8	4.3	Slight boiling
	22.0	4.3	Boils and expands 0.5 in.
	23.5	4.6	Boils and expands 0.5 in.
B—With 0.3 ft. graded gravel and 0.2 ft. fine gravel.	12.7	2.5	No movement
	17.9	3.5	Very slight boiling
	19.3	3.8	Very slight boiling
	20.3	4.0	Boiling around edges of pyramids. Whole surface boils, but the motion is greatest above the junctions of the pyramids.
	23.5	4.6	
	24.3	4.8	
	25.0	4.9	

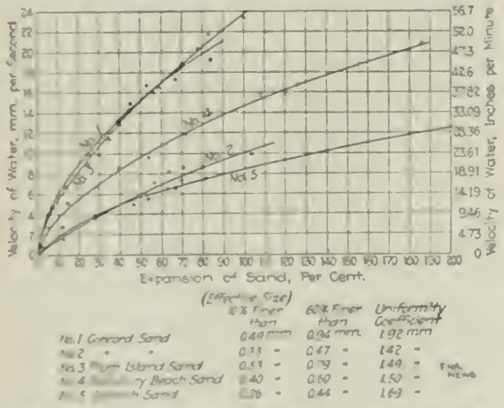


FIG. 2. RELATION BETWEEN UPWARD VELOCITY OF WASH WATER AND EXPANSION OF SAND IN MECHANICAL FILTERS

With the highest velocity, 25 mm. per sec., the action was similar to that observed at a lower velocity. A larger percentage of the particles, however, was lifted to the tops of the pyramids. With the velocities available none of the marbles could be washed from one pyramid into another. It is doubtful if this could be brought about even with a considerably higher velocity.

When coarse gravel was used (B and C) there was no lifting of the gravel, but only when fine gravel was used (D and E) was the gravel disturbed, in some cases being expanded by the action of the water according to the velocity.

The results of these experiments are shown in Table V.

Trial No. 5.—Trial No. 5 was made with the same arrangement of balls and marbles used in Trial No. 4. Above this was placed the following arrangement of gravel: 1.5 in. coarse gravel, ⅝ to 1 in.; 1.5 in. medium gravel, ¼ to ⅝ in.; 3 in. fine gravel, No. 13 mesh to ¼ in. Above the gravel was placed 12 in. of one of the various sands described above.

The action of the gravel and sand layers during Trial No. 5 was all that could be desired. In no case was the gravel disturbed and the sand was uniformly expanded.

Analyses of these various sands have showed how complete was the separation of the sands into sizes by the process of washing. They also indicated considerable va-

TABLE V. RESULTS OF TRIAL NO. 4 WITH TWO LAYERS OF BALLS, ONE LAYER OF MARBLES, AND VARIOUS GRAVEL LAYERS

System	Vertical velocity mm. per sec.	Vertical velocity ft. per min.	Results
A—Balls and marbles	13.7	2.5	Marbles revolved slowly
	16.0	3.2	Marbles moved (1)
	17.9	3.5	Marbles moved (2)
	25.0	4.9	Marbles moved (3)
B—Like A with 1 in. of ⅝ to 1 in. gravel.	13.4	2.6	No gravel lifted
	17.7	3.5	No gravel lifted
	21.8	4.3	No gravel lifted
	25.0	4.9	No gravel lifted
C—Like B with 1.5 in. of ⅝ to 1 in. gravel and 1.5 in. of ¼ to ⅝ in. gravel	16.6	3.3	No gravel lifted
D—Like C with 1 in. of No. 13 mesh to ¼ in. gravel.	13.1	2.6	No gravel lifted
	14.9	2.9	No gravel lifted
	17.5	3.4	Slight boiling
	21.8	4.3	Gravel expanded ¼ in.
	25.0	4.9	Gravel expanded ¼ in.
E—Like D with fine gravel layer increased to 3 in. in depth.	13.7	2.5	No gravel lifted
	16.0	3.2	No gravel lifted
	17.9	3.5	No gravel lifted
	20.3	4.0	Slight lifting of gravel more marked at periphery of filter
	21.8	4.3	
	25.4	5.0	Gravel boils gently

(1) Side marbles revolving, corner marbles lifted half way.
(2) Side and center marbles revolving, corner marbles lifted half way.
(3) Side marbles lifted half way, corner marbles lifted to top.

riation in uniformity. For example, the Concord sand to a degree dependent upon its size and the vertical velocity of the wash-water passing through it. It is believed that even a considerably thinner layer of fine gravel could be used in practice than the 3-in. layer used during the experiments, and with equally good results.

SORTING OF THE SAND PARTICLES BY WASHING—After the trials with each kind of sand had been made, samples were taken for mechanical analyses, from the surface of the sand layer and from various depths below its surface.

No. 1 varied in size between the surface and the bottom of the sand layer from 0.25 mm. to 0.84 mm. effective size, while the Ipswich sand varied only from 0.21 mm. to 0.31 mm.

The summarized analyses also showed how the effective size of the sands might be markedly altered by scraping the surface of the sand after washing. For example, by scraping 1 in. from Concord sand No. 1, after washing, the effective size could be increased from 0.25 to about 0.45 mm.

FIG. 3. PYRAMIDAL FILTER BOTTOM USED FOR THE MECHANICAL FILTER PLANT, BELFAST, ME.

EXPANSION OF SAND—Many data were obtained during these experiments which had reference to the sand and not to the filter bottom. Fig. 2, showing the relation between the upward velocity of the wash-water and the percentage expansion of the five sands as observed during

the experiments, is of interest in this connection.

To determine the degree of expansion the sand layer was measured before and after washing and the average elevation of the surface of the sand during washing was estimated as accurately as practicable.

It will be noted that the degree of expansion for any given velocity of water varies not only with the effective size of the sand but also with the shape and character of

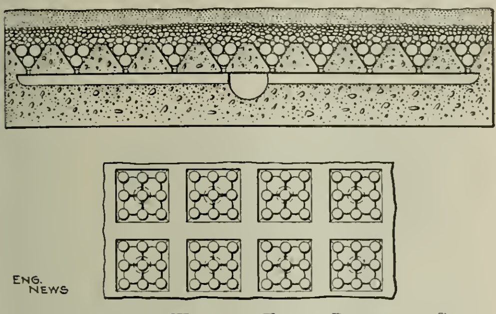


Fig. 4. Design of Wheeler Filter Bottom as Shown in Patent Application

the sand grains themselves. Consequently, two sands of different sizes and uniformity, like Nos. 1 and 3 and 2 and 5, respectively, show similar degrees of expansion with various velocities of wash-water. Still greater variations could be expected if the sand contained mica, limestone or other minerals varying in shape, specific gravity and structure.

The effective size of the sand, that is, its 10% size, is of especial value for determining the friction of the sand layer when water is being filtered through it. For estimating the friction during washing, the average size of the particles is of far greater importance. The value nearest the average size which is given by the ordinary sand analysis is the 60% size, that is, the size when 60% of the sand is finer than any given diameter.

The uniformity coefficient of the sand layer affects its hydraulic value and also the degree of expansion of the sand layer with varying velocities of wash-water (Fig. 2).

In addition to the above trials, the optimum velocity of wash-water for each of the five sands used was determined; also the percentage expansion of each sand when washed at the optimum velocity. Other experiments were also made but like the ones just mentioned they had no reference to the design of the filter bottom, although its precise action made the results of filter-sand experiments of greater value than usual.

Results in Practice

The filters at the Belfast Water Co., mentioned above, have been in operation a very short time. Nevertheless, there is no reason to believe but that they will continue to operate as efficiently in the future as they do at present. Since the Belfast filters (Fig. 3) were designed, Frank A. Barbour, of Boston, Mass., has embodied the Wheeler filter bottom in the design for the new water-purification plant for the city of Akron, Ohio, and negotiations are now in progress for its use in a still larger plant.

To protect the design (Fig. 4), patents were applied for on June 26, 1913.

The Gatun Hydro-Electric Plant, Panama Canal*

The following particulars of the hydro-electric plant at Gatun Dam are of interest on account of the part of this station in the general canal development and because of the various features themselves. The project for the use of electric energy in various services in connection with the operation of the Panama Canal has been noted from time to time in Engineering News as the plans developed (and were summarized in an article on the lock-control system, Dec. 25, 1914).

The Gatun Lake storage offers good opportunity to generate current for lighting the canal, for operating the gates and other locking machinery, for the towing locomotives, for coal-handling plants at both ends of the canal, for machine shops, water-works, dry docks, and possibly in the future for hauling trains on the Panama Railroad.

The Gatun plant has a present capacity of 6000 kw and this can be increased to 12,000 kw. if advisable, outlet pipes having been installed in the dam along with the original pipe lines. (To insure continuity of service in case of accident, a 4500-kw. steam-electric station at Miraflores, erected a few years ago to supply power for construction work, will be ready to pick up the load when necessary.)

Operating Head and Intake—The gross head available from Lake Gatun to mean-tide level of the Pacific Ocean varies from a maximum of 91 ft. in the extreme flood times to a minimum of 79 ft., to which level the lake may possibly drop toward the close of the dry season. The plant is designed consequently to develop full capacity under an effective head of 75 ft. For three or four months of every year there is absolutely no rainfall on the Isthmus; and during this period, it is desirable to conserve the water to as great an extent as possible. Maximum efficiency was therefore demanded for the apparatus of both the waterwheel and generator manufacturers. As shown in Fig. 1, in the masonry at one side of the Gatun dam spillway, are six 12-ft. passages protected with iron trash racks. Only three pipe lines have been put in with their headgates $10\frac{1}{2}$ ft. in diameter.

Each gate has two steel stems with bronze nuts in roller bearings; each pair of nuts is driven through bevel gears by a 15-hp. motor. Hand-operating mechanism is disconnected during power operation (two men are required to open).

The gates have an automatic control consisting of a limit switch geared to one of the gate stems and a float switch actuated by the water in the pipe. The gate-motor switch is closed at the power house, the gate being closed and the pipe line empty. When the gate has opened a distance which would fill the pipe line in about five minutes, the limit switch opens the circuit and stops the motor. When the pipe line is filled and the water rises in the 36-in. vent just below the gate, it actuates a float switch and again closes the motor circuit, thereby causing the gate to be opened fully, when the limit switch again operates to prevent over-travel. The gate is closed by reversing the main switch.

Pipe Lines—Each gate is bolted to a steel pipe line 10 ft. 6 in. in diameter with an average length of 420 ft.

*From information furnished by the General Electric Co., Schenectady, N. Y.

The pipes are of $\frac{5}{8}$-in. plate, courses 8 ft. long and three sheets around the circumference. Each course has a center ring of $\frac{3}{8}$x3-in. Z-bar. The pipes are covered with reinforced concrete as rust protection. They come down on a uniform slope and turn under the station with 90° bends of 30-ft. radius. Each pipe is arranged for Pitot-tube tests in service.

Each pipe has two 6-in. saddle-nozzle connections located 15° on each side of the vertical center line of pipe. From these connections there are two Pitot-tube guide supports placed across the pipe at right angles to each other. These are bolted in the pipes and, while intended to be permanent, can be removed readily if desired.

STATION BUILDING—The principal buildings are designed along simple lines in harmony with the unbroken surfaces of concrete of the adjacent engineering works. For the same reason they are devoid of all modeled ornament, the plain wall surfaces are relieved only by the base moldings, cornices and the architraves bounding the openings. This has the effect of enlarging the apparent size of the buildings, though they must appear dwarfed by proximity to large masses of concrete.

The station building is 61x137 ft. and 74 ft. high. There is a single room open to the roof, exposing the trusses upon which is laid the reinforced-concrete roof slab, which, in turn, receives the red Spanish tiles. The walls are of poured concrete, 30 in. thick to the level of the crane rails, near the cornice. The exterior overhang of the main roof is 13 ft. 2 in. and that of the monitor roof 4 ft. 8 in., the exceedingly large projections having been generally adopted for all the permanent buildings in the Canal Zone as a shelter from tropic rains, as well as from the heat of the sun.

Beyond the general use of tile for flooring, and an interior white enameled brick wainscot 14 ft. high, to relieve the coarseness of the walls, there is no difference in the finish of the concrete surfaces within and without. There are four principal interior elevations: (1) turbine pit with an area of [illegible] sq.ft., [illegible] ft. below the main floor and reached by [illegible] stairs [illegible] from the pit to store, compressor and pump rooms. The pit is lined with white enameled brick. Between pit and main floor levels are the following rooms—separate [illegible] for black and white employees; (2) the main floor, partitioned off to give two [illegible] passageway for [illegible] electrical equipment, etc., and the other as an uninterrupted passage along the line of turbines; (3) a mezzanine gallery reached by concrete stairways at the building ends; (4) a second gallery which with the mezzanine carries the switches, reactances, control boards, etc. These run the entire length of the building; in one corner are two superimposed galleries, one used as an office and the other as a machine shop.

TURBINES—The three 2000-kw. main generating units in the hydro-electric station are each driven by a special, 30-in., vertical, single-runner, Francis turbine. Each has a maximum capacity of 3000 hp. when operating under an effective head of 75 ft. and at a normal speed of 250 r.p.m. The center of the runners is 20 ft. above tail water.

Water is discharged through steel-lined ($1\frac{1}{4}$-in. plate)

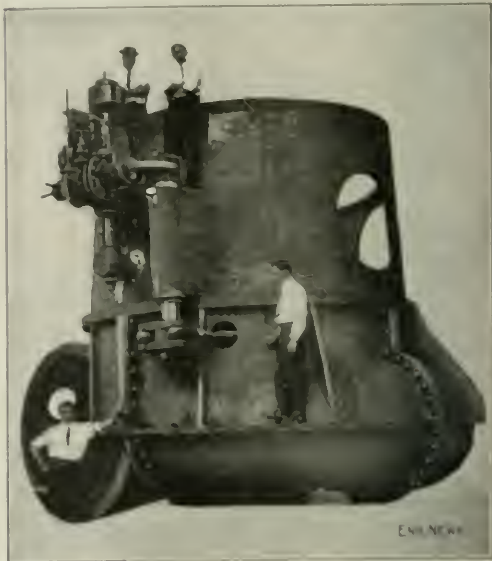


FIG. 2. SPIRAL CASING FOR FRANCIS TURBINE, DISTANCE RING AND GOVERNOR

FIG. 1. PANORAMIC VIEW OF HYDRO-ELECTRIC STATION WITH PENSTOCKS AND SPILLWAY FOR MAIN DAM; GATUN LAKE, PANAMA CANAL

concrete draft tubes, which are 71 in. in diameter at the discharge from the runners and increase to an elliptical section of 9 ft. by 17 ft. at horizontal outlets.

The spiral casings carry the generator frames through cast-iron distance rings (Fig. 2). A roller thrust-bearing on top of the generator frame carries the load of revolving parts (32 tons); at full capacity on upward thrust of 20,000 lb. relieves the bearing. Geared to the main shaft is a small oil pump for the thrust-bearing; the returning oil lubricates the lower guide.

The turbine runners (weight 7000 lb.) are of bronze, hand finished, bored taper and held on the shaft by bronze nuts. The wicket gates are steel castings, hand finished; the pivot stems rise through glands to levers. The levers are linked into the gate ring and the whole gear is outside the turbine casing except the gates proper. Oil-pressure governors are provided, geared to the main shaft. Small motors permit remote control of governor setting to vary speed for synchronizing.

Generators—The main generators are of a three-phase 25-cycle revolving-field type developing 2000 kw. at 0.8 power factor, 2200 volts and 250 r.p.m. They have 25% two-hour overload rating.

The exciter is mounted below the main generator but is readily accessible through large holes in the distance ring, a platform being provided inside the ring from which the exciter commutator and generator-collector rings may be reached. All windings were made moisture proof on account of extreme climatic conditions. Provision is made for securing the magnet frame of the exciter to the revolving element of the generator, so that the complete rotating element, together with the exciter frame, is raised at once in disassembling. In addition, there are two motor-driven exciters.

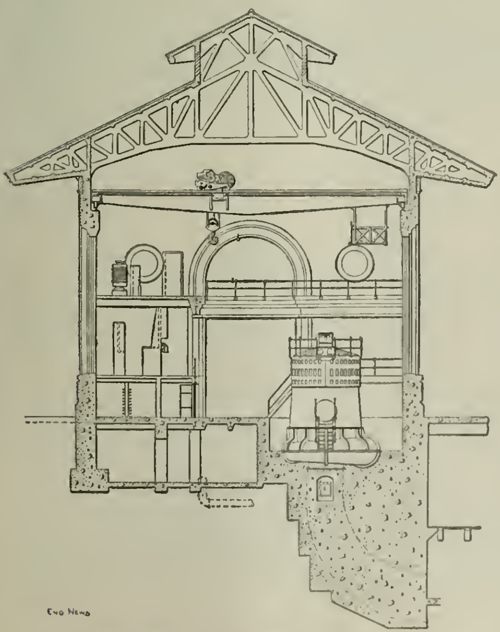


Fig. 3. Sectional Elevation of Gatun Station

The official tests showed generator efficiencies (at 0.8 power factor) of 95.1% at 2000 kw., 94.3% at 1500 kw., and 92.5% at 1000 kw.

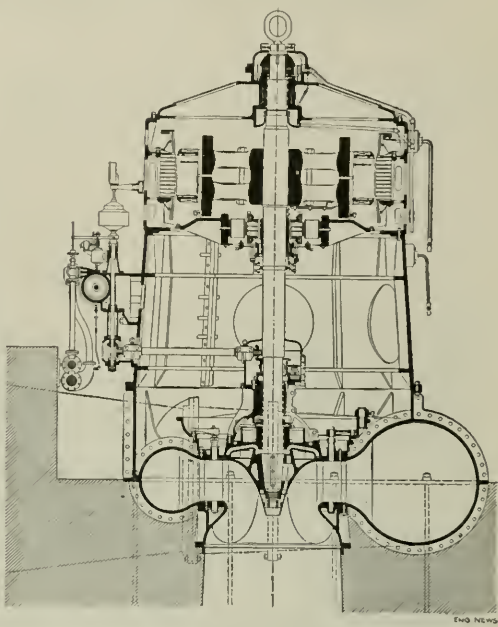


Fig. 4. Section through Turbine Generator and Exciter, Gatun Hydro-Electric Station

Switchboards—Current is transmitted at 44,000 volts, but the step-up transformers are not in the main stations. The connection schemes throughout follow a double-bus, double-switch scheme as being most flexible for uninterrupted operation during repairs. The main switchboard comprises a control bench and a vertical rear panel for relays, uniters, etc.; a second story houses the motor-operated rheostats.

The complete hydraulic equipment was designed and built by the Pelton Waterwheel Co., of San Francisco; the electrical apparatus was designed and built by the General Electric Co. All details of design and construction were subject to the requirements and approval of the engineers of the Isthmian Canal Commission.

Structural Steel Frames of very considerable size and complication of design are being used in Europe as hangars for large dirigible balloons. In "Le Genie Civil," May 23, 1914, there is an extended article describing some typical sheds in use in France and Germany. In general these sheds consist of a series of simple arch frames, similar in design to the usual armory roof in this country but of much lighter material because of the very light roofing. They are usually rectangular in plan, providing room for one airship with exit or entrance at either end, but some of the newer sheds are wide enough for two airships, side by side, and proposals have been made to build them in triangular or in starshape plan, so as to provide entrance in the direction best favored by the prevailing wind. To accomplish this latter end, at least one shed has been built, 413x85 ft. in plan, mounted on a turntable so that it may be turned to meet any wind condition.

The Design and Construction of Sanitary Sewers, Carlisle, Penn.

By C. A. Bryan*

SYNOPSIS—This article is published not because it describes anything novel but rather because it illustrates the opposition and delays encountered and the methods commonly followed establishing a sewerage system for a small town.

The borough of Carlisle, Penn., has a population of about 10,000, is of slow growth and is considered very conservative. That the majority of the younger generation realize the necessity of improvements is evident but their influence is far outweighed by the majority of their elders who are opposed to improvements of any nature.

Sewerage was agitated in Carlisle as far back as 1905, at which time Chauncey Ives, Chief Engineer for the Cumberland Valley R.R., was consulted and prepared an estimate of the cost of sewering the town. No further definite action was taken until 1907-08, when T. Chalkley Hatton, Consulting Engineer, of Wilmington, Del., was instructed to prepare plans and specifications covering the proposed work. Plans were submitted in 1908 and approved by the Borough Council and a special election authorized to determine by popular vote whether the system should be constructed. The proposition was defeated. At the expiration of two years, the time specified in the act of assembly regulating elections of this nature, a second election was held, and the sewerage system was authorized. Exceptions to the result of this election were taken, a bill in equity filed and an injunction restraining the borough from proceeding with the work was issued. The case was carried up to the Supreme Court of the State and was finally decided in favor of the borough. The work was therefore advertised in March, 1913, the contract signed and construction work started in April, continued through the summer, and the system finally finished during March, 1914.

Photographs, here reproduced as Figs. 1 to 4, were taken for the purpose of demonstrating the need for a sewerage system. These views were not taken to present the worst phase of the question, but to show that sewerage was unquestionably necessary.

Fig. 5 is a plan of the borough, showing the layout of the streets and the sewer lines. Elevations of the street surfaces and of the inverts of the sewers are given at all street intersections [but not all elevations are reproduced.—Ed.]. The town is divided into two natural drainage areas by the two principal streets, Hanover and High, as the ground falls to the east and west of Hanover St. and also to the north and south of High St.

After considerable study it was determined that the entire sewage of the town could be collected by two intercepting sewers, one to carry the sewage from the northern portion of the city and the other to carry that from the southern section, as shown by the map. For convenience in handling, the plan was then subdivided into five sections—each being entered by a main branch line which joined either one or the other of the two intercepting sewers.

From the company supplying the city with water, what information relative to the total water consumption of the city that they could furnish, was obtained. This information was at best very approximate inasmuch as the company had no accurate records. It was estimated that the average per capita consumption per day would amount to 100 gal., and the system was designed on this assumption.

The minimum velocity of flow of the sewage through the mains was fixed at 3 lin.ft. per sec., and the grades determined in accordance therewith. The topography was such that this velocity could be obtained without undue expense and in only a very few instances was it necessary to resort to the minimum velocity of flow.

It was assumed that the rate of increase in the population of Carlisle would be 500 per year (considerably greater than in the past), and it was also assumed that the system will serve 25,000 people, or more than double the present population of the borough. Allowance was made for an infiltration of ground water into the system amounting to 5000 gal. per mile of sewer per day.

The sizes of the various mains were then computed, profiles of each sewer were made, and an estimate of the cost of the lateral sewerage system computed.

In designing this system, careful attention was given to both the matter of cleaning out the mains and to their ventilation. The former was accomplished by placing the manholes at a distance of not over 250 ft. apart and the latter by providing eight holes, each 6x1 in. in size, in the center of the cast-iron manhole covers. To prevent dirt and other foreign matters from getting into the sewers through these holes galvanized-iron catch buckets were hung in each manhole frame just under the cover. At the dead ends of all sewers, flush tanks were placed and at each flush tank a lamp-hole was built, thus providing a method whereby the sewer barrel between the flush-tank and the next manhole downstream could be easily inspected. Each flush-tank was designed to discharge a flush of 190 gal. into the sewers. Miller siphons 5 in. in diameter were specified and it was decided that the tanks would operate twice in 24 hours when put into service.

The specifications also provided that previous to the final acceptance of the system by the engineer each section of sewer should be tested by the passage through it of a ball whose diameter was to be 2 in. less than that of the sewer itself. The testing of the entire system of lateral sewers was put under the supervision of one of the inspectors well qualified for the work and a resident of the city. The city is thereby assured that the sewers when taken over were practically clean.

In computing the cost of construction, it was quite necessary to obtain an approximate estimate of the amount of rock to be removed. This was accomplished by taking a boring at each street intersection and also at a point in the middle of each block. These elevations were then plotted upon the profiles and the quantity of rock estimated.

*Resident Engineer, Sewerage Commission, Carlisle, Penn.

It was estimated that the lateral system would cost $49,600 to construct.

Bids on this work were asked for in March, 1913, and the lowest bid for the construction of this portion of the system was submitted by the H. C. Brooks Co., Inc., of Martinsburg, W. Va., and the work was awarded to it. Construction work was started early in April and continued through the summer and up to February, 1914, when bad weather set in just after the last block of sewer had been laid. During construction nothing especially difficult was encountered, the contractor finding but little ground water to contend with, and fully 80% of the work was laid in dry trench. More rock was encountered than was estimated and as it was all limestone and very hard to remove, progress was slow. In most of the alleys in which sewers were built, progress was also slow because of the extreme narrowness of these alleys, a fact which made it difficult to take care of the materials excavated from the trench. This was especially true in those alleys in which the cut was deep.

In general, the earth excavated was of a clayey composition and the sides of the trenches did not require much shoring. In those ditches in clay, where the cut exceeded a depth of 9 ft., considerable difficulty was experienced. In one stretch where the ground appeared to be of a character similar to that encountered in the other portions of the town, it proved very treacherous and caused no end of trouble. The material seemed to pulverize upon exposure to the atmosphere and was constantly falling upon the workmen in a sort of fine shower, and it

Views Taken for Use in Campaign to Show the Need for Sewers in Carlisle, Penn.

(Fig. 1. Cesspool back of laundry. Fig. 2. Laundry wastes from overflowing cesspool. Fig. 3. A Main St. eyesore, but common to whole town. Fig. 4. Alley in east end of borough.)

was soon shown that the only way to prevent this was to sheet the ditch throughout.

The futility of attempting to execute work of this sort by using local labor was well illustrated at Carlisle. The contractor experimented with local labor for fully two months and was able to complete only about 1.5 miles of sewer in this time. Local labor was therefore discarded and foreign labor imported and retained on the work until it was completed.

The final estimate given the contractor shows that a total of 7.2 miles of 8- to 18-in. vitrified-pipe sewers have been constructed at a cost of $71,000, or $9,750 per mile of completed sewer. The increase of approximately $20,000 in excess of the estimated cost is due principally to the fact that the rock encountered exceeded by nearly 50% the quantity estimated. This unexpected increase in the rock excavation cannot be laid to the engineer, for his preliminary investigation was carried on much more carefully than was warranted by the amount paid him by the town for his services.

Fig. 3. Layout of Sewerage System of Carlisle, Penn.

(Only a few samples of the figures showing grade elevations are here reproduced.)

The cost of constructing this system of sewers will be borne by an assessment levied upon abutting property owners on the basis of $1.20 per front foot. In the case of corner lots where sewers have been constructed on two sides, the assessment on the street on which the property fronts will be the same as in any other case, while

for the computation of the assessment on the other frontage, distances up to 130 ft. will be divided by two and the quotient assessed on front footage at the rate adopted. In cases where the distance on the side exceeds 130 ft., 65 ft. will be deducted from the total side distance and the remainder assessed as front footage. A survey of the town showed that a total of 60,000 lin.ft. was assessable. The rate quoted above was determined on this basis.

This sewer system was designed by and installed under the supervision of T. Chalkley Hatton, now Chief Engineer of the Milwaukee Sewerage Commission, Milwaukee, Wis. The writer was the resident engineer in charge of the work.

In conclusion, the writer is of the opinion that the attitude of the citizens of Carlisle in regard to the construction of the sewer system is illustrative of a condition unfortunately only too prevalent throughout the country. Sewerage in any city of the size of Carlisle is a necessity beyond a reasonable doubt. The demands for it on the grounds of the public health are constantly growing stronger and stronger. Had the citizens of the borough of Carlisle realized the necessity of sewerage at the time when the proposition was first submitted to them every taxpayer would be unquestionably better off. The increase in the prices demanded for labor, materials and other commodities used in the construction of this system was so great during the years that this proposition lay dormant that it has increased the cost of the construction of the system by many thousands of dollars. In addition, the borough has been obliged to bear the expenses of a long drawn out lawsuit which failed to accomplish its purpose.

The experience of Carlisle should serve as a lesson for and be carefully studied by the authorities of those cities in which this matter is now being agitated.

Water-Works Plans of the Public-Utilities Commission of Denver

By A. Lincoln Fellows*

In the year 1910, the people of the city of Denver created a commission called the Public Utilities Commission, whose only powers, however, were to have charge and control of the operation of a water-works, to supply the city and county of Denver and its inhabitants with water for all uses and purposes, and to have control of such other public utilities as might be acquired by the city.†

†See "Eng. News," June 2, 1910, p. 659.

This Commission was specifically directed to offer to The Denver Union Water Co. the sum of $7,000,000 for its plant, and if this were not accepted, to proceed with the construction of a new plant. Naturally, as the valuation of the plant of the Denver Union Water Co., made about a year prior to that time, gave a value of $14,400,000 to the plant, the company refused to accept the offer and brought suit restraining the city from proceeding with the construction of a new plant. This case was finally settled by the United States Supreme Court, which rendered an opinion to the effect that the city had acted entirely within its rights, and that the Public Utilities Commission might proceed with the construction of a new plant, if it desired to do so, in accordance with the terms of the charter amendment, previously mentioned. This decision was handed down in July, 1913, and immediately thereafter the Commission appointed a committee of engineers to make an investigation as to the value of the plant of The Denver Union Water Co., and also make a preliminary estimate as to the cost of a new plant. This committee consisted of the engineering member of the Commission, A. Lincoln Fellows, and of Edmond C. VanDiest, of Colorado Springs, and Charles P. Allen, formerly Chief Engineer of The Denver Union Water Co.

The sum allotted and the time permitted for making the investigations were so limited, that surveys of a new plant were impossible, and only an incomplete report could be made. The committee reported in January, 1914, $10,045,000 as the physical value of the plant, including approximately $375,000 as development expenses. The committee did not place any value upon water rights claimed by the company, taking the position that this was a legal question, which could be determined only by the courts, and no allowance was made for going value other than the development expenses, this being considered also a question to be passed upon by the courts.

The Commission also gave a preliminary estimate of the cost of $12,750,000 for a new plant for the city, this estimate, however, as was stated in the report, being made without surveys, and with only the most incomplete information.

Soon after the completion of that report, at another election held in the city, a plan proposed by some of the business men of the city, which provided for arbitration as to the value of the Denver Union Water Co.'s plant, was rejected by the people by a very large majority. Immediately thereafter the Public Utilities Commission commenced further investigations for the acquisition of certain reservoir sites, and the preparation of plans for a new plant, this being the only course open to the Commission. It has, however, been hampered by another suit, seeking to enjoin the Commission from issuing bonds. The bill was, however, dismissed in the Federal District Court on June 10, 1914, and although an appeal was taken to the Court of Appeals, the Commission is proceeding to advertise the sale of the $8,000,000 of bonds which have been authorized by the people: bids to be opened July 20, 1914. The bonds are to be issued in blocks of $500,000 each, as money may be required.

The Commission plans the commencement of surveys and the preparation of plans as soon as money is available for its work. Certain tentative plans have already been drawn, which will be submitted to a consulting board to be selected at the proper time by the Commission, and the details will then be passed upon by the consulting board.

A number of plans have been presented to the Commission, as follows:

(1) The use of the water of the South Platte River, which is now used as the source of the water-supply for Denver by the Denver Union Water Co.

(2) Tunneling of the Continental Divide by means of a tunnel, approximately 4½ miles in length, and the diversion of the waters of Blue River from the Western to the Eastern Slope. The waters would then be turned

*President, the Public Utilities Commission of Denver; General Manager, the Field, Fellows & Hinderlider Engineering Co., Denver, Colo.

down the South Platte channel to be again taken out in accordance with the laws of the State of Colorado and used for supplying Denver with water.

(3) A similar plan might be adopted with reference to the waters of the Fraser River. An additional complication in this plan is the fact of the voting of $3,000,000 by the city of Denver for the construction of the so called Moffat Tunnel, which tunnel, while it is to be used for railroad purposes, is nevertheless, in theory at least, primarily for the purpose of bringing water from the western to the eastern slope for the use of the city of Denver.

(4) A similar plan with reference to the waters of Williams Fork, or a combination of Williams Fork and Fraser River.

Whatever course is adopted, large reservoirs must be constructed for the regulation of the supply to be used in the city. Fortunately, good reservoir sites are available and can be had for the purpose when required.

It is the Commission's intention to proceed as rapidly as possible with the preparations of the plans for the construction of a new plant, but as yet no details are ready to be given out. It is hoped that by the first of August parties can be sent into the field for the commencement of this work.

It will be of interest also to note in this connection that the City Council recently passed an ordinance, initiated by the people of the city, for the purpose of reducing the rates of the Denver Union Water Co. 20%. The company has brought suit to restrain the City Council from carrying out the provisions of the ordinance on the usual theory that it is confiscatory. A master has been appointed by Judge R. E. Lewis for the purpose of hearing the testimony, and the hearings are now going on. The company has engaged as its experts in the case Clarence Goldsmith, John R. Freeman, W. L. Holman, George G. Anderson, and Leonard Metcalf. The city will depend for its case largely upon cross-examination and the testimony of local men familiar with various details. The main questions at issue are:

(1) The value of the physical plant.

(2) The value of the water-rights claimed by the company.

(3) Going value.

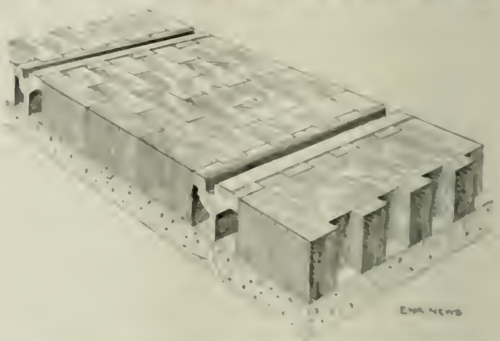
The company claims approximately $11,500,000 for the physical value; $3,[illegible] for value of water-rights, and $1,[illegible] for going value, a total of $17,000,000.

The city on the other hand contends that there should be included in the physical valuation only those parts of the plant actually useful at the present time in furnishing water to the city; that only such amounts should be paid for water as will compensate the company for the water-rights which it has purchased, and that these amounts should be included in the values given for the basis with water-rights; and that in a case, such as this, where there is no franchise and no expectation of granting a franchise, but where, on the other hand, the company is allowed to use the streets only by sufferance and until such time as a new plant shall be completed, no going value should be allowed.

In answer to this last contention the company contends that the fact that the construction of a new plant is threatened should entitle it to increased rates because of the ultimate abandonment of the plant to a condition of complete uselessness within a period variously estimated at from five to seven years. At the present writing the master has not definitely ruled regarding this point, but is admitting evidence upon practically all relevant points for later consideration.

A Street-Railway Rail for Block-Paved Streets

The accompanying view shows an indented rail which has been in service for eight years on one of the street railways of Paris, France. The rail was designed to provide a bond between the paving block and the street-car



A Special Rail to Prevent Excessive Wear between Track and Pavement

(From Le Génie Civil, Paris, France.)

rails so that the usual excess wear of the blocks immediately adjacent to the rail might be avoided.

The rail is of the usual tramway type, but is rolled with alternate notches into which the adjacent paving blocks fit. This bond acts to bridge the wearing action of wheels alongside of the rail and the device has been quite successful in retaining an even surface at the edge of the rail. The City Council is so satisfied with its performance in the one place where it has been laid that a much longer stretch is to be placed with a view to further experimentation.

The Fottinger Hydraulic Turbine Transmission for marine propulsion is being developed on a considerable scale in Germany. In the Fottinger system, high-speed steam turbines are directly connected to hydraulic turbines. The water delivered from the latter exerts its power to rotate a low-speed hydraulic turbine mounted on the propeller shaft. While there is in this system a continuous loss due to the friction of the water passing through the two hydraulic turbines, this is claimed to be more than offset by the ability to use a steam turbine of very high rotative speed and consequent compactness and efficiency and a propeller at the stern of the vessel of low rotative speed and corresponding high efficiency.

One of the vessels on which the system has been applied is the [illegible], a German [illegible] steamer of [illegible] tons. The vessel is equipped with a steam turbine developing [illegible] h.p. at [illegible] r.p.m. The low-speed hydraulic turbines which drive the propeller shaft run at [illegible] r.p.m. A second hydraulic turbine on the propeller shaft has its vanes reversed so that when the water is turned into it the propeller is rotated in the reverse direction. A simple valve controls the movement of the pressure water delivered from high-speed hydraulic turbine either to the ahead or astern low-speed turbine. The system therefore has the additional advantage of avoiding the use of reversing steam turbines which are a necessity on the ordinary steam-turbine driven vessel. It is stated that the system is to be applied to a transatlantic steamship and also to a German cruiser of [illegible] tons.

Editorials

The Salem Conflagration

The horse has been stolen from the stable at Salem and it does no good now to say that the stable door should have been and might have been locked. Salem's fire department and water-supply were both insufficient; on the other hand it is doubtful whether twice the fire-fighting equipment and a liberal water-supply would have availed to stop the progress of the flames, once well started. The fire hazard of Salem lay in the extensive frame construction in and surrounding high-value districts, and the narrow streets.

The local fire department was augmented by about 60 pieces of fire apparatus and 700 firemen from neighboring cities and towns; but this was too much of a tax on the water-supply, which was further reduced by leakage from broken supply pipes which could not be shut off. A number of buildings were dynamited, in the path of the original fire, but the wind carried burning embers over the waste and the flames advanced without check.

Warnings to Salem were not lacking. As far back as 1907, the National Board of Fire Underwriters made a report on fire risks in Salem. The following significant extracts are taken from the general summary of that report:

Water-Supply and Fire Department—Water supply from sources barely sufficient for present needs. Fire department weak in both apparatus and men.

Building Department—Laws old and poorly arranged. No mention of many fire-protective requirements and devices.

Explosives and Inflammables—Laws inadequate. Inspection not in hands of fire department.

Conflagration Hazard—Severe in and around the principal mercantile districts and the south mercantile and manufacturing district.

Salem has received a fearful blow, but with the energy and pluck characteristic of American cities which have been visited by a similar calamity, is already planning to rise from its ashes. With the erection of new buildings of more modern design and of materials more fire-resistive in the burned-over district the fire hazard of Salem will be less portentous.

Other cities where similar conflagration risks exist might well learn from Salem's disaster. Frame structures cannot, of course, be replaced in a day by steel and concrete and brick; but an inadequate water-supply and weak fire department ought not to be allowed to continue in any city, where such serious conflagration hazards exist.

Engineering Societies and the Public

There are two opposing views as to the functions of an engineering society. One view is that such a society should concern itself solely with the purposes for which such societies were originally organized, which may be defined as the social and professional advantage of its members. The other view holds that engineering societies should improve the opportunities for public leadership which are opening before them at the present time and should become working organizations rather than social clubs.

An excellent illustration of the sort of responsibility which is being laid upon engineering societies where they are willing to assume it is afforded by the laws regarding steam boilers. A half-dozen States have enacted laws fixing standard requirements which makers and users of boilers must observe, and also in some cases establishing examinations for those responsible for the care of steam boilers and their inspection. These legal requirements fixed by different States are so varying and in some instances conflicting that they are a serious burden to steam-boiler manufacturers and purchasers.

It is all very well to say, as many engineers do say, that the States should not pass legislation of this sort interfering with private industry and matters of a technical character. The fact to be faced is that such legislation had been enacted and much more of it is certain to come in the near future. It is said on good authority that the legislatures of some seven or eight states are practically certain to pass a steam-boiler law at the next session.

The American Society of Mechanical Engineers, fortunately, has had a committee at work on this matter for some time and it has already framed a preliminary report and will very likely have a complete report ready for the December meeting of the Society. That report is, we understand, likely to be accepted by the various legislatures as a guide in the framing of laws. Not only this, but other organizations and interests directly affected by such legislation are looking to the Mechanical Engineers to take the lead.

The reason for this is obvious. The public is deeply distrustful of business organizations. If the associated steam-boiler manufacturers should frame a law and offer it for passage by the States, charges would at once be circulated that they had so framed the law as best to protect their interests. The same sort of criticism might be brought against the steel makers, or the boiler-insurance interests. A professional society like the Mechanical Engineers, however, can come before the public and stand a much better chance of having its work accepted as authoritative and unprejudiced.

It may be said that the States should employ and pay engineers as expert advisers to do the technical work of drafting such laws; but suppose the several States did follow this course. What are the chances that the engineers whom a legislative committee might select for work of this sort would be such men as the profession would approve as well qualified to carry it out? Would not the inevitable result be the passage of different laws by different states embodying different and conflicting requirements, making ten times worse the confusion which already exists?

This is but an example of numerous cases where the public demand for legislation effecting Government control of industry can only be satisfied if the expert technical knowledge of the engineer is sought. And it is

vastly easier to shape legislation in the making—to aid in making a law effective and preventing it from being so framed as to work serious injustice—than it is to secure the repeal or amendment of a bad law after it has been placed on the statute book.

It deserves emphasis, too, that the engineering organization is as powerful in this matter, provided it will realize and use its influence, as the individual engineer is helpless. Organization in every branch of trade and industry and professional work are making their influence felt in these matters. The engineer must realize that his own organizations, formed originally for the purpose of mutual benefit and the advancement of the profession, must assume the responsibilities that properly belong to them in working out solutions for the serious social and industrial problems of the present day.

The Neglect of Brick Pavements

In the notable appeal for the substitution of brick pavements in place of bituminous macadam in State highway construction in New York, made by Gov. Glynn some months ago, our readers will remember that he based his chief argument on the small cost of maintenance of brick pavements, placing this maintenance cost at no more than $50 a mile per annum.

From recent inspection of a considerable mileage of brick-paved roads and streets in various parts of the Central West it appears to us that a very considerable percentage of the brick pavements recently laid are suffering deterioration because they apparently have had nothing at all expended on them for maintenance. On many miles of brick-paved roadways in Cuyahoga County, Ohio, which have been laid within a comparatively short time, and are good examples of first-class construction, the only defect noticeable is longitudinal cracks, extending usually along or near the center of the roadway. So long as these cracks remain merely open cracks, they do no injury to the road and apparently nobody pays any attention to them.

What happens, in no very long time, however, is that the calks of horseshoes and steel tires gradually chip away the sides of the crack, and what has been a crack becomes a groove. As soon as the groove becomes wide enough for a steel tire or a horseshoe calk to drop into it, the destructive effect is rapidly accelerated. One sees not a few places on these brick roads where depressions half an inch or more in depth, and six inches to a foot in width, have been hollowed out along the line of what were originally mere cracks in the pavement.

This is, in fact, exactly what would naturally be expected to happen, and what is bound to happen so long as the fallacy obtains that a brick pavement once well laid needs no repairs whatever. It is entirely true, we believe, that such a pavement needs a comparatively small amount expended on it to keep it in good repair, provided it has been originally constructed in a first-class manner, but that small amount it must have, even though it be as little as $50 per mile per year, or damage will be done compared with which the cost of repair would be a mere trifle.

It would be an exceedingly easy matter when these longitudinal cracks form in a brick pavement, to fill them flush with the surface, either with a cement grout of the consistency of cream or with a mixture of tar and sand in the same way that cracks in concrete roads are mended. From the practical point of view, the tar and sand is probably the best possible material to use. About the only objection that we know of is that it is more or less unsightly and brings the defect to notice just as it does when the same method of repair is applied to a concrete pavement. If cracks in concrete pavements could be filled with cement grout, so that the cracks would not be noticeable, instead of filling them with tar, which advertises the crack to everybody who passes over the road, the reputation of the concrete road would probably be a good deal higher, even, than it is.

City Governments and Electric Lighting Companies

Relations between cities and electric-lighting companies are to be considered at a national conference of city officials next autumn, a call for which has just been issued by Mayor Blankenburg, of Philadelphia, in cooperation with Mayor Mitchel, of New York, Mayor Harrison, of Chicago, Mayor Baker, of Cleveland, and Mayor Shroyer, of Dayton, Ohio.

In the call for this conference, which was sent out last week, it is stated that the city of Philadelphia is soon to appeal to the new Public Service Commission of Pennsylvania, for the adoption of a proper schedule of rates for the sale of electric light and power in Philadelphia. In preparing this case for presentation to the Commission, it has been found that in previous rate cases before Public Service Commissions of other States the side of the public has seldom been adequately represented, while the organization of public-utility companies has in its service the best informed and most able men to be found.

Mayor Blankenburg's letter continues as follows:

> If the cities do not join together for the presentation of their cases, as the public utility companies have done, the laws and precedents established by the Commissions stand in danger of being biased by the able arguments of the representatives of the corporations.
>
> The equipment required for an adequate presentation of the rights and interests of the people involves a degree and extent of technical knowledge and information which it is not practicable for any one city to obtain. It must be borne in mind that the utility companies constitute an offensive and defensive alliance probably stronger than any other interest in this country. Its weakest member is never without information and assistance of every kind. To meet this situation it has been suggested that there should be formed a bureau of public utility research, which shall equip itself to give to the cities the same able assistance which the public-utility companies' association gives to the public utility companies.

That there is need and opportunity for such an organization as Mayor Blankenburg suggests, would hardly be denied even by the officers of the public-service companies themselves, if they are candid.

So far as water-supply is concerned, there is fortunately no need for such an organization, as the proportion of water-works owned by municipalities is so large that a city desiring to present its side in a rate proceeding or a proceeding to acquire a privately owned works has no difficulty in securing able engineering and legal experts to present its side of the case.

An entirely different situation exists, however, with respect to electric lighting, gas supply and street railways. In this country, practically all the engineers in the gas business are in the employ of private companies and would run serious danger of blacklisting were they to en-

gage as experts on the public side in proceedings to lower gas rates or further municipal ownership of gas plants.

Almost the same situation exists in the distribution of electric current and it is a situation which from the nature of the case cannot permanently continue. It is everywhere recognized by candid and intelligent men, even among the officers of public-utility companies, that the growing public sentiment in favor of municipal ownership can only be counteracted by making public regulation of the utility companies a success. But public regulation can only be a success provided it is guided with the same high-class expert knowledge that is at the disposal of the utility companies themselves.

It is doubtful whether the officers of public-utility companies fully realize the extent to which they have failed to secure the backing of intelligent public opinion in the conduct of their business. We have passed through the stage of competition in the distribution of gas and electricity and the public accepts the fact that the business must be a monopoly; but being a monopoly, the principle of public control must be recognized to the fullest extent. There must be corresponding publicity in relation to corporate affairs. Sooner or later the companies must make public their actual cost sheets of generating and distributing electric current and manufacturing and distributing gas. The public is willing to pay the cost of what it purchases and a fair rate upon invested capital, but it is not willing to be unfairly taxed by reason of monopolistic control or to pay interest on dead capital.

A Searching Criticism of the River and Harbor Appropriation Bill

Senator Burton, of Ohio, is probably the best informed man in Congress on the government's work for the improvement of rivers and harbors. He served for many years while in the House as chairman of the Rivers and Harbors Committee. He was also chairman of the National Waterways Commission of 1909-10, which reviewed the whole subject of government expenditure for the improvement of navigation and laid down the policy which the government should follow to meet economic conditions of the present day.

Notwithstanding the publicity which was given to the report of that Commission and the general discussion which has taken place on the subject, river and harbor bills continue to be framed in the same old way. It is therefore refreshing to find a man of Senator Burton's ability and experience coming forward with a public criticism of the present pending river and harbor bill, which deserves to attract public attention.* Certainly it should receive the attention of engineers, for the subjects therein discussed are subjects on which the expert technical knowledge of the engineer is essential to sound reasoning.

And at the outset it may be well to lay down what is the point of view from which river and harbor appropriations should be considered. As a matter of fact, the strong influences at work for river and harbor appropriations are first of all the local interest which judges the efficiency of a Congressman by the extent to which he can draw upon the Federal treasury for funds to be spent within his district. Second comes the interest of those who wish appropriations made for rivers and harbors, ostensibly to improve navigation, but really for the benefit of lands subject to overflow, erosion, etc. In the third place come the interests which seek large river and harbor appropriation bills because of the opportunities for profitable contracts that may result. Finally comes the comparatively small minority which seeks Federal appropriations for the benefit of water transportation.

There can be no dissent, however, from the proposition that the last consideration is the only one that can in any way justify the use of the nation's funds, collected from the taxpayers, upon waterways for interstate commerce. Not a few of the Congressmen who join in the scramble to secure their proper share of the distribution from the river and harbor pork barrel frankly deplore the necessity which compels them to join in a riotous waste of the public funds for which no corresponding benefit is received.

The river and harbor appropriation bill, as reported by the House, carried total appropriations of $43,400,000, which have been increased by the Senate to $53,680,000. Of this amount about $10,350,000 is for beginning work on projects which are to be completed under the "continuing contract" system. This means that small sums have been appropriated to start works on projects for which much larger amounts must be appropriated in following years, or the entire work will be a total loss.

In the present year the amount necessary to be appropriated in the sundry civil appropriation bill on continuing contracts will be between seven and eight million dollars. On this basis, therefore, the entire amount to be spent by the government on river and harbor improvements during the fiscal year under the pending appropriation bill as reported in the Senate will be in round numbers $60,000,000.

Senator Burton, however, rightly says that it is not the amount of the appropriation, large though it is, but the methods by which the appropriations are made that most deserves public criticism. He declares that many of the appropriations are made for waterways which under present conditions cannot be profitably improved. And, further, that the bill contains large appropriations for local benefits which have little to do with navigation.

As our readers know, the idea has been spread abroad by energetic workers for river and harbor appropriations that the United States has neglected its water courses, and that this is the reason why the traffic upon them has declined and in many cases entirely disappeared. On this subject, certainly, Senator Burton, by reason of his long service on the Rivers and Harbors Committee of Congress, can speak with high authority. We quote from his report as follows:

> An erroneous impression prevails that the government of the United States has not been liberal in its appropriations for the improvement of rivers and inland waterways. This is altogether incorrect. More money has been expended for these purposes by this country than by any other of equal population or equal area.

As is well known, commerce on the Mississippi River has dwindled away until its commercial importance is today trifling. In 1880, the volume of traffic on the Mississippi River between St. Louis and Cairo was reported as 1,030,000 tons, and with a ruling depth of water of only 3½ to 4 ft. Since that time the government has

*Senator Burton has submitted a minority report on the River and Harbor appropriation bill, printed as Senate Doc. 522, 63d Congress, second session, Report 599, Part 2.

expended $15,574,000 to provide an 8-ft. depth of water over this section of the river, and such a channel has been available to traffic for years. The traffic on the river, however, has steadily decreased and was only 265,000 tons in 1912.

The money which Congress has appropriated to improve these [illegible] miles of the Mississippi River in the last 25 yr. has far exceeded the amount spent by Germany in the improvement of the River Rhine from the frontier of Holland to Strassburg, a distance of 355 miles. Yet this section of the Mississippi had only 265,000 tons of traffic in 1912, while the commerce on the Rhine was nearly 40,000,000 tons, or about 150 times as great. In addition to the amount above noted, there has been spent by the government on the lower Mississippi between Cairo and the head of the Passes since 1879 the sum of $78,-[illegible], notwithstanding which fact the traffic shows a steady decrease. It fell off one-half in the decade from 1901 to 1910.

It may be remarked in this connection that it is not always safe to take mere tonnage figures as a basis on which to estimate the importance of commerce on an inland stream. An analysis of the commercial statistics shows that in many cases the tonnage of traffic which is reported consists largely of sand, gravel and stone. In 191[illegible], more than a third of the Mississippi River commerce between Vicksburg and New Orleans consisted of these low-grade materials.

It should not be understood that Senator Burton in his report stands opposed to all appropriations for river and harbor improvement. On the contrary, he approves of the expenditure of public money upon those projects which can be shown to justify the expenditure upon them by the traffic which they bear. Many so called rivers included in the river and harbor appropriation bill are really arms of the sea. The money expended upon them to enable ocean vessels, larger or smaller in size, to navigate them and use them as harbors shows often very large returns in the way of benefits to commerce.

There is a general popular impression that the United States has been derelict in the improvement of its seaports. Regarding this, Senator Burton says:

> The United States has first-class harbors not only in much greater number than any other country of the world, but the distance between them is generally not so great as in the very densely populated countries of Europe. The Republic of France has but four of the first-class harbors, and Germany has but three. The harbors of the United States already improved, or on which improvements are well underway, surpass those of any other country.

It is with respect to the improvement of inland waterways that Senator Burton's chief criticism is directed. Prior to the advent of the railway as a freight carrier, the navigable rivers of the country rendered an important service in carrying long-distance traffic. Analysis of the present water-borne traffic proves that long-distance inland transportation by water has almost wholly disappeared. Where the rivers are still being used for freight it is almost wholly local.

Turning now to the record of actual results from the Government expenditures on inland waterways, Senator Burton instances the Red River below Fulton, Ark. For a distance of 175 miles on this river there was in 1912 a total traffic of 44,567 tons, of which 42,6[illegible] tons were saw logs. The United States has spent on the improvement of this stream $1,7[illegible], and the pending River and Harbor bill proposes to add $[illegible] to this sum. Senator Burton computes that, figuring interest at 4%, the cost to the Government for every ton of traffic carried on this stream last year would be $4.68. With the saw logs excluded (since they have been floated on the river without any improvement) the cost per ton, to the Government would be $90.56, and the cost per ton-mile, $1.53. The Red River, moreover, is not an isolated example of the waste of river and harbor appropriations by any means. The United States has spent on the Arkansas River $3,108,000, and the pending bill proposes to add $164,-000 more, yet the river carries a total traffic of only 71,516 tons in a year, of which 56,000 tons were saw logs. Going to the far West, on the Columbia River about Portland, the United States has spent about $9,000,000, and the total traffic on this stretch of the river is now only about 80,000 tons per annum.

There has been great agitation, in recent years, as many of our readers will recall, to secure the improvement of the Missouri River. Great things were promised by certain commercial associations as to a revival of boat traffic upon that stream, and the agitators were successful some years ago in inducing Congress to resume appropriations for its improvement.

Before the advent of the railway the Missouri was, indeed, an important avenue of traffic for the pioneers, but steamboat traffic on it disappeared years ago and in 1902 Congress decided that it was not worth while to expend further money on the stream. At that time the appropriations for it had amounted to $7,227,000. As a result of the agitation above referred to, the Government is now committed to a project to spend $20,000,000 more on the river between Kansas City and its mouth, of which $4,100,000 have already been appropriated. The traffic on the river in 1912 was 185,110 tons, of which sand and gravel hauled one mile made up 155,420 tons, leaving 29,690 tons for all other freight. The bulk of even this, however, was local traffic and the only long-distance traffic to be found in the record is 4174 tons of miscellaneous freight carried 330 mi., and 1404 tons of manufactured iron and steel products, carried 158 mi.

Senator Burton, however, suggests the real reason behind the agitation for the Missouri River improvement. From an official report filed in 1908 it appears that lands adjacent to the river, amounting to over half a million acres, would be benefited by the proposed improvement. Naturally the owners of this land desired to have it protected from erosion or overflow at the expense of the Federal Government.

The most signal instance of waste of public funds in river and harbor appropriations, however, is in connection with the improvement of rivers by slack water navigation. "It may be confidently asserted," says Senator Burton, "that the only waterways in the United States which can be profitably improved by the construction of locks and dams are the Monongahela, the Kanawha and the Ohio, which are improved by the Federal Government, and the Barge Canal connecting Lake Erie and the Hudson River, improved by the State of New York. It is possible also that the improvement of the Allegheny and the Black Warrior River in Alabama will prove desirable."

We should say that it is an open question whether the traffic on even these streams will in the end justify the expenditure which has been made upon their improve-

ment. Certainly at the present time, with the sole exception of the Monongahela, there has been no evidence of such a result.

As examples of waste of public funds in slack-water navigation, Senator Burton cites among others the famous Hennepin Canal, which connects the Illinois and Mississippi Rivers. Its advocates thirty years ago maintained that its construction would save the public $20,000,000 per annum in freight. Its construction dragged along over many years with the piecemeal appropriations which Senator Burton roundly condemns, and it was finally opened for traffic in 1908. Up to date the Government expenditures upon it have been in round numbers $8,740,000, and it carried last year only 11,962 tons of commercial freight. In the year 1909 the tonnage of material hauled for repairs and improvement of the canal itself was more than 22 times as great as the commercial freight handled over the canal.

Muscle Shoals Canal, on the Tennessee River, has cost the Government four and one-half million dollars and in 1912 the freight passing through the canal amounted to 5520 tons.

On the Big Sandy River, located on the boundary between Kentucky and West Virginia, the Government has expended about $2,000,000 in constructing locks and dams, and the total tonnage carried in 1912 was 500 tons. During this same period the railway operating in the Big Sandy valley handled 2,225,000 tons of freight.

These are extreme, but not isolated, examples of the practically total failure of the Government's expenditures in slack-water navigation projects to produce any benefit to commerce at all proportionate to the cost. Yet in the face of these well known facts, government appropriations for building locks and dams still continue. There might be the shadow of an excuse for them where such structures are built to complete a project already begun; but what possible excuse can there be for the Government to undertake new projects for improving inland rivers by a system of transportation which has been proved obsolete? The present river and harbor bill, however, contains appropriations to begin the construction of a complete system of locks and dams on the Brazos and Trinity rivers in Texas. Senator Burton sets the cost of the entire project at $10,000,000 for each of these rivers, and there is reason to believe that much larger sums would be required before the useless work could be carried to final completion.

Much more could be said to prove that of the sixty million dollars a year which the Government spends for navigation improvement, a large part is spent on works which afford no corresponding benefit to commerce; but the facts are already well known to many engineers. That the remedy for this wholesale waste does not lie in change of political parties is seen by the fact that the Democratic majority responsible for the present River and Harbor bill has pursued the same methods and gone merely a little farther than its Republican predecessors. It is seen also in the fact that some of the Progressive party leaders have been leaders also in the popular agitation in favor of waterway improvements.

How strongly the beneficiaries of the present River and Harbor system are intrenched is proved by the fact that with all the exposures of its iniquities by such men as Senator Burton and President Taft, and many years ago by President Cleveland, to say nothing of many others of prominence, the system still continues to draw money from the national treasury in a flood which increases year by year.

Sometime, perhaps some influential commercial or technical organization may be able to bring about a reform. Until that happens the nation will continue to calmly pour out millions a year into pools and ditches to perpetuate obsolete systems of transportation and benefit a traffic which has disappeared.

Letters to the Editor

Band vs. Spiral Hooping for Concrete Piles

Sir—Referring to the note on "Strength of Band and Spiral Hooping," in reinforced-concrete piles, in your issue of May 28, 1914, p. 1202, it seems possible that a more comparative test of the spiral and band reinforcing would have resulted from two test piles being driven under identical conditions, one reinforced spirally and the other reinforced with bands.

The effect of the band reinforcement probably was such that the two systems, being in conjunction, influenced detrimentally the weaker system. Although a great many experiments have been made to determine, if possible, the best method of pile and column reinforcement, no agreement has apparently been arrived at between the various authorities.

From his experience with reinforced-concrete piles the writer is inclined to think that the weakness of the spiral system lies in the fact that a rupture at any point must necessarily affect detrimentally the spiral binding for a considerable distance on either side of the break—this effect diminishing as the ratio of the distance from point of rupture. The whole of that portion of the pile contiguous to the rupture being no stronger in its resistance to crushing stress than if the pile were reinforced with longitudinal bars only. In other words, spiral reinforcement depends almost entirely for its effectiveness upon its continuity, whereas band reinforcement, being made up of a series of units, does not allow the compressive strength of the pile to be affected except locally by the breaking of a band.

Tests have shown that while spiral or band reinforcement increases the crushing strength of the column, the shortening due to deformation is very great at a comparatively early period of the load application—so much so that it would seem hardly good practice to base the safe strength directly on the breaking strength. This early deformation appears to be about equal to the maximum for plain concrete. Upon the increase of the load the

failure of the concrete is prevented by the hooped reinforcement, but the concrete continues to expand laterally; thus the elasticity of reinforced-concrete piles depends upon the strength and elasticity of the hooped reinforcement. It has been found that hooped reinforcement—while giving the necessary elasticity to columns or piles, and postponing failure beyond the time when the concrete shell outside the reinforcement has failed by cracking and peeling—does not increase the stiffness under comparatively low loads.

F. H. FRANKLAND.

Bridge Engineer, Highway Dept., Calcasieu Parish, Lake Charles, La., June 5, 1914.

Floods in Texas Since December, 1913

SIR—Since the disastrous floods of December, 1913 (described at length in my article in ENGINEERING NEWS, May 21, p. 1116), Texas has suffered another, but less severe loss by a series of heavy rains which began on Apr. 21 and continued at close intervals until June 1. The rainfall for May, 1914, averaged 7.68 in., which is 0.61 in. more than the average for June, 1899, which heretofore was the wettest month of record. Until the latter part of April the weather was about right for the farmer and prospects for bumper crops were excellent. A temporary let-up of precipitation occurred during the week ending May 11, which was promising at the time, but did not appear to help much. Heavy rains set in again on May 12 and after that date farm work came to a standstill.

The soil was too wet for cultivation and roads for the most part were impassable. In some parts land was badly washed, resulting in much loss of crops; in others, weeds and grass made rank growth and injured the crops, especially corn and cotton, and a large acreage will have to be replanted. Railways suffered from washouts and softened roadbeds.

All streams from the Rio Grande to the Sabine were more or less flooded, but the runoff was smaller than the amount of precipitation would indicate, and it is probable that the rank growth of weeds and grass prevented or at least retarded drainage into the main channels. There were strong fluctuations in the streams and at many stations flood stages were attained several times during the month. The stages were generally well below high-water mark, but there was much apprehension among the farmers of the lowlands.

The damage from the flood so far reported aggregates $1,750,000, and is likely to be much greater, as the returns are far from complete. Of this amount $405,000 was reported from the Trinity; $707,000 from the Brazos; $[illegible] from the Colorado and $[illegible] from the Guadalupe Valley; and the remaining $1[illegible] from other watersheds, and from a small per cent. of railway and telephone companies. There were 11 deaths by drowning in the swollen streams. Savings effected from warnings, so far as reported, amount to $[illegible]. Loss of live stock was small.

While pessimistic reports were received from many sections of the state during the rainy period, the outlook in the Panhandle and West Texas is promising. Ranges were reported never better; cattle fattening, and small grains in good condition; and now, that favorable weather has set in, the soil cultivated and much cotton and corn replanted, hopeful reports are coming in from nearly all sections.

So far as known the levees which were injured or destroyed by the December floods have not been rebuilt; but the matter is being agitated in the press, and the Reclamation Department of the state is receiving applications to furnish surveys and hydraulic information. Arthur A. Stiles, State Reclamation Engineer, in a letter to this office stated his belief that the tendency will be to give more careful attention to engineering details in rebuilding these levees than seems to have been exercised when they were first built.

B. BUNNEMEYER,
Section Director.

Local Office of U. S. Weather Bureau,
Houston, Tex., June 25, 1914.

A Mexican Engineer on International Relations

SIR—Owing to the irregular postal service, due to the situation prevailing in this country, it is only lately that I received ENGINEERING NEWS of Apr. 30. The interest which I always find in the editorials was considerably increased when I found that the title of one of them was "War with Mexico."

For many years I have constantly read ENGINEERING NEWS, as I consider it to be the first engineering publication in the United States and, most certainly, one of the best in the world. For this reason I esteem it as a safe guide in professional matters, as well as one of those old friends which we love because we know they are good. I fancy that I am intimately acquainted with its editors, although I have never seen them, and although they belong to another race, talk a different language, profess a different religion, have different habits, are inspired, perhaps, by different ideals and their hearts beat under different sentiments. At the same time, they are in communion with myself because of our common high regard for the engineering profession, and because of their strict proceedings and the nobility of their aims. We are all members of the great human family, and honest men of every nationality must stand together in defense of righteousness and truth. For all of these reasons I venture to write you to tell you the impressions made on my mind by that editorial entitled "War with Mexico."

I did not find—nor did I expect to find—a single word of sympathy for the people which struggles in such anguish for the solution of their tremendous political and social problems, nor did I find a single reproach to the American Government for its aggressive action toward a weakened people, action taken contrary to the promises of President Wilson before his arrival in power, which promises announced to the Latin-Americans the initiation of an era when the jingo would be suppressed and politics would be made subordinate to morals. But I certainly saw in the editorial "War with Mexico" the same intelligent viewpoint which has always inspired the editors of "ENGINEERING NEWS," the same sound basis in their arguments, the fair and judicial spirit which rules their discussion, and above all, the sense of honesty which characterizes the conduct of this journal.

I have always believed that the American engineers, considered as a body, represent the highest principles of probity and justice. George Washington and Abraham Lincoln devoted some of their activity to the noble profession of engineering. I have been personally acquainted with many engineers who are your fellow countrymen and I hold in high esteem their talents as engineers and their qualities as men. Some of the men who stand in the first rank of American engineers have lived in Mexico at some time and undoubtedly their hearts beat in sympathy with this hospitable land which tendered them every kind of favors and courtesies: A. M. Wellington, Captain Jas. B. Eads, E. L. Corthell, Howard and James Schuyler.

The high opinion I always held of the Yankee engineer has been strengthened by the wonderful address of Prof. George Fillmore Swain, Past-President of the Am. Soc. C. E., which was read at the 45th Annual Convention of the Society, held in Ottawa, Ontario, in the month of June, 1913. When a corporation has such eminent members as Prof. Swain, we can be sure it will always go forward in the right track.

As a general rule, the engineer (the genuine engineer, not the man who empirically carries on the profession), due to his knowledge of exact sciences, physical and natural, as well as to his intimate touch with nature, loves truth and justice and right, and hates deceit and hypocrisy. For this reason such a man everywhere stands above the common level. If in the United States, at some happy day in the future, engineers should rule over the political life of the nation, the Latin-American peoples could rest in tranquility. Such men would surely disclaim the infamous maxim of Bismarck: "Reason and Right stand on Strength." They would direct their activities through different channels as they would understand that justice and respect for another's rights are the firm foundation for the moral greatness of nations, the only one that can last through centuries.

Turning to another subject: Whenever, in any country, foreigners live and prosper during peaceful and orderly times and enjoy every kind of security for their honest industry they are bound to suffer the consequences of disturbances in connection with any struggle for the solution of the problems connected with the internal life of the nation and the settlement of the basis of civilization. According to the sound principles of international right and justice, a powerful government must not interfere with the internal differences of another country, nor even exact from it any claims for his citizens who have suffered damage, and this will assuredly happen when moral law rules in the world.

You know well how General Sherman's army devastated the country in his triumphal march throughout the Southern states, at the time of your Civil War. You know also that the Federal Government did not pay any claims on account of this damage either to Americans or to foreigners. When England exhibited its claims, the answer was the most round refusal.

At the moment I write these lines I do not know the result of the Niagara Falls Conference, but be it what it may, and whatever the destiny reserved to this country, weakened and impoverished by nearly four years of civil war, and held by an extraneous hand which hinders the solution of its difficult social problems, I will always keep in good remembrance the honesty and fairness of Engineering News, in reference to the possibility of a war with Mexico, virtues in harmony with the irreproachable conduct of that journal which has won its great reputation.

L. Perez Castro,
M. Am. Soc. C. E.

Box 1354, City of Mexico,
June 4, 1914.

Unit-Stresses for Steel Highway Bridges

Sir—Recently, while designing several highway bridges, the writer noticed that different specifications give widely varying results, although all are supposed to give a bridge of the same capacity.

One of the bridges has a span of 250 ft., 20-ft. clear roadway, brick pavement on a reinforced-concrete slab. The stresses in the bottom chord at the center of the span are dead-load 411,700 lb., live-load 153,000 lb. The net section required, etc., according to several specifications is shown by the accompanying table.

TABLE OF UNIT STRESSES FOR STEEL HIGHWAY BRIDGES

Specification	Tension Unit-stress live load	Tension Unit-stress dead load	Unit shearing stress shop rivets	Net area required	Number ⅞-in. shop rivets required in single shear	Impact
Cooper's Highway '09	12,500	25,000	10,000	28.7	94	No impact
Ketchum	16,000	16,000	12,000	37.9	84	$*I = \frac{S \times 150}{L+300}$
American Br. Co.	17,000	17,000	12,000	35.5	84	25% live-load
Osborn Eng'g Co.	22,000	22,000	10,000	27.6	101	$*I = \frac{S \times S}{S+D}$
C. C. Schneider	16,000	16,000	12,000	37.9	84	$*I = \frac{S \times 15}{L+300}$

*I = impact stress. S = liveload stress. D = deadload stress.
L = loaded length, ft.

It seems to the writer that this wide discrepancy should be eliminated and standard unit-stresses adopted. It also seems reasonable that where the dead-load is large in proportion to the live-load a higher unit-stress might safely be used than where the dead-load is comparatively small.

It would also seem reasonable to make little or no allowance for impact where you have a concrete-slab floor.

E. P. Knollman.

Columbus, Ohio, June 20, 1914.

A Highway Water Supply—A very unique feature relative to the Manila-North Road, unique when the highways of the world are considered, but not unique in the Philippine Islands, is the copious supply of excellent artesian water flowing at its side. The traveler will not find it necessary to trouble the housewife for a drink of water, nor the cantina nor the hotel, neither will he find it necessary to trespass upon private property to reach water. The Bureau of Public Works has drilled hundreds of these wells, and several of the provinces have purchased well-drilling machines in order to extend the well system more rapidly. Nearly every town has several of these wells and generally one may be observed at the roadside every few minutes as the traveler passes along. The water is pathogenically pure, clear, sparkling, cool and flowing, which conditions are a natural sequence after the waters have fallen upon the distant and forest-covered sierra, and have percolated for miles through the porous stratum to the perforation made by the bit of the well-drilling machine. Thus, it may be observed that ample facilities to obtain potable water exist for man and animal, and for motor cooling. Previously, it was stated that the artesian wells were not unique relative to this main trunk line. They are also being drilled by the side of the second- and third-class roads, not only in the plains region of central Luzon, but throughout the archipelago.—"Quarterly Bulletin," Bureau of Public Works, Philippine Islands, Apr. 1, 1914.

Timbering in Open Cut for Fourth Ave. Subway, Brooklyn

The collapse of the timbering in the excavation for the new Fourth Ave. subway between 76th and 77th Sts., Brooklyn, N. Y., at about 9 a.m. on June 23, dropped a 10-ton stiffleg derrick mounted with hoisting engine on an 8-wheeled truck to the bottom 30 ft. below. When completed, this section of the subway will be the 76th St. station; hence the cut is about 17 ft. wider than between stations. At this point the width is about 55 ft. and the depth to subgrade 30 ft.

The soil is mixed sand and clay and quite firm. The 8-in. timber sheet piling (not tongued and grooved) which retains it, is braced every 10 ft. by a bent built of four tiers of transverse braces, which extends entirely across the cut, butting against the wales of the sheet piling on each side. Between the several tiers at irregular intervals wood posts are set. Further stiffening against buckling is provided by two lines of 3x8-in. longitudinal bracing. The transverse braces and posts are, for the most part, 10x10-in. Fig. 1 shows the method of bracing the sheet piling.

A traveling derrick, located approximately as shown in Fig. 1, was working ahead, removing with a 1-cu.yd. dump bucket the lower 15 ft. of earth. The traveler was built of four longitudinal 12x12-in. stringers, mounted on 8 steel wheels, four per side, on a track of about 20-ft. gage. A number of wood beams placed at right angles to the stringers carried the flooring, upon which was mounted the derrick (in front) and a shanty containing the hoisting engine. The derrick had a 40-ft. boom.

Figs. 2 and 3 show conditions subsequent to the collapse. The mass of wreckage gives little indication as to the direct cause of the failure. Just prior to the acci-

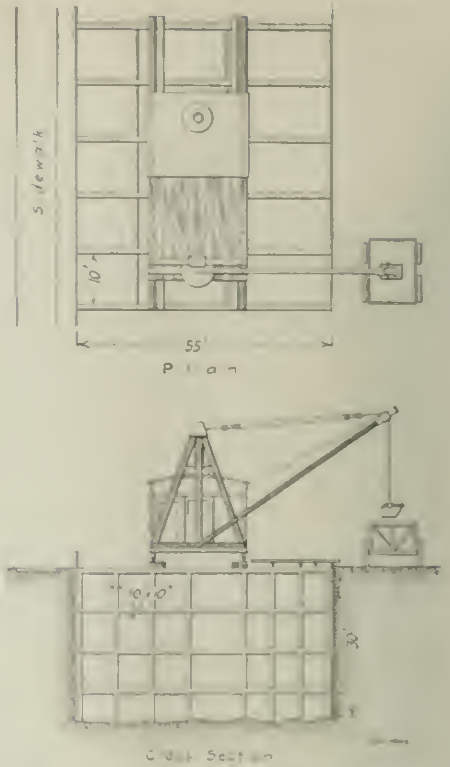


Fig. 1. General Scheme of Timbering and Position of Traveler at 76th St.

Fig. 2. View of the Break from the West

[illegible]

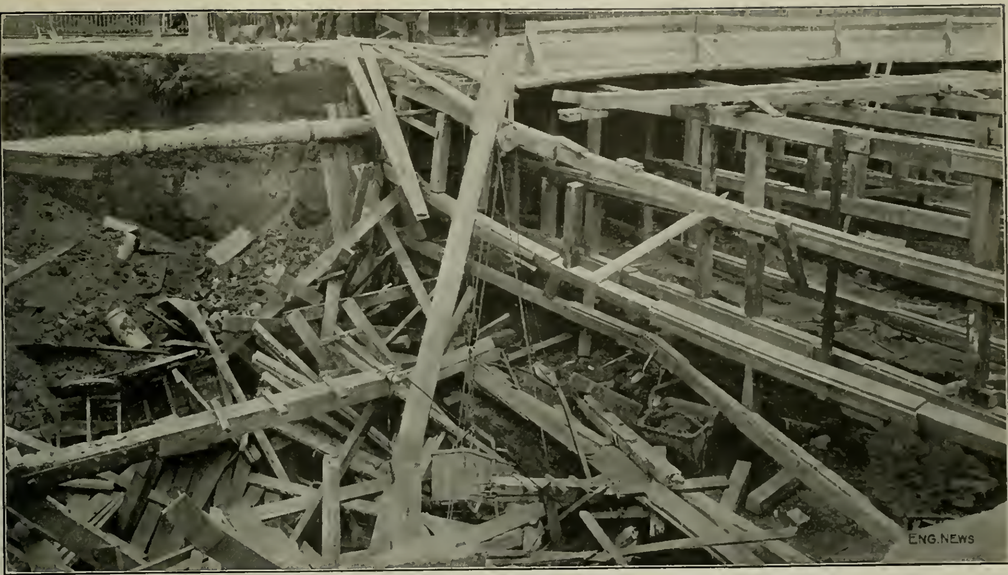


Fig. 3. The Wrecked Derrick and the Timbering at Upper Face of Break

Fig. 4. General Method of Bracing Sheet Piling in 15-Ft. Cut

dent the traveler had been moved forward about 20 ft. and was again operating. Three bents, together with the sheet piling on one side, collapsed. The fourth bent on the upper side of the break sagged, and several of the posts were displaced, as shown in Fig. 3.

It is possible that earth pressure caused one of the braces to knuckle, as the longitudinal bracing was flimsy. On the other hand, the timbering carried a live load in the form of a derrick; it is, therefore, possible that one of the bottom posts supporting the lowest brace in one of the bents collapsed, due to undermining, either from the digging operations or from ground water. There is no information that a moving bucket struck the timbering nor that the derrick itself failed.

At the time, 20 men were working down in the cut (12 muckers and a timbering gang of 8 men). One man was killed, another died a few days later, and five others were injured. A team and truck fell into the cut, killing one of the horses. Three 10-ft. lengths of a 16-in. water main were left entirely without support (Figs. 2 and 3): but the main did not break. The water, however, was ordered cut off, and there was no pressure from 9 a.m., until 5 p.m. In the meantime the main was stiffened by suspending from a steel I-beam.

Since the Collapse

A jinney-winch, to be caused by the steel erectors, was fortunately at hand and was pressed into service. It was installed just back of the collapsed portion of the timbering, and proceeded to retimber the break, working forward. On June 26, this work was nearly completed. To continue the mucking a new traveler has been erected of the same design as the old, but on the opposite side of the break. This was done so as not to interfere with the operations of the jinney-winch.

The new traveler was placed in service June 30. It moved backward on the timbering of the first cut, which is only 15 ft. deep. The transverse bracing here is of the same character as in the deeper cut, but there are only two cross braces per bent instead of four. The spacing between bents is still 10 ft.

This method of moving the traveler is not so satisfactory as was the old, where it moved on the final timbering; but the total duration of the work will be shorter than would be the case with the jinney-winch taken out of service and moved to the opposite side of the break. The new traveler could not be erected back of the winch,

because of the interference of a temporary highway bridge.

METHOD OF EXCAVATING AT 76TH ST.

The first cut, of 12 to 18 ft., was made with a steam shovel traveling on the ground. It was the original intention to make the second and final cut with a locomotive crane traveling on the bottom of the first cut. Failure to deliver the steelwork for the subway caused this plan to be abandoned; the locomotive crane merely removed

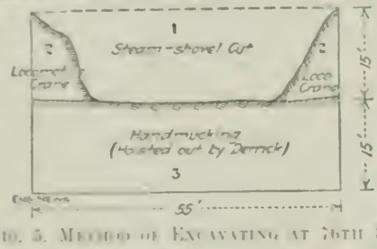


FIG. 5. METHOD OF EXCAVATING AT 76TH ST.

(The first cut was made with a steam shovel, side slopes removed by a locomotive crane traveling at 15-ft. sublevel. The next cut will be mucked by hand and earth removed by a derrick traveling on top of timbering.)

the side slopes left by the shovel. The cut was then timbered, and work transferred to other portions of the line. Had the work proceeded without interruption at this point, this section might have been completed several months earlier.

When it was decided to reopen operations here, the presence of the timbering made the employment of the locomotive crane impracticable. A traveling derrick was, therefore, erected on the timbering, and the work proceeded until the unfortunate accident described. The mucking was done by hand and the material hoisted by the derrick. Three buckets in rotation were employed. About [illegible] ft. of mucking remains to be done here. The derrick had been in use several weeks on this class of work.

The Degnon Contracting Co., New York City, was general contractor on this section. The subcontractor was Carpenter, [illegible], Inc., Roanoke, Va.

Annual Convention of the American Railway Master Mechanics' Association

The 47th annual meeting of this association was held at Atlantic City, N. J., June 15 to 17. Below is a brief account of the proceedings supplementing that given in the "Society Proceedings" column of last week's issue.

MECHANICAL STOKERS FOR LOCOMOTIVES—This subject is of growing importance with the increase in train loads and power of locomotives, and the committee's report showed that the mechanical stoker is no longer an experimental machine. At the present time there are about [illegible] stoker engines, [illegible], [illegible] Crawford stokers, and a few of half a dozen other designs. The average mileage per machine failure (exclusive of failures due to improper handling) has been about [illegible] miles on the Norfolk & Western R.R. and [illegible] miles on the Baltimore & Ohio R.R.

The mechanical stoker is not to be considered primarily as a coal-saving device, but rather as a power-increasing device, and the general consensus is that the stoker engines can haul heavier loads than hand-fired engines. Further, the stoker can work to full efficiency throughout the run, while a fireman's efficiency falls off as he becomes tired. But the stoker needs to be handled carefully to maintain the full efficiency and power of the engine and to avoid excessive coal consumption. The discussion strongly indorsed the position taken by the committee.

SUPERHEATER LOCOMOTIVES—The report dealt with the results of various changes in the form and dimensions of superheaters (Schmidt type) on the same engine, as shown by experiments on the locomotive-testing plant of the Pennsylvania R.R. It dealt also with the question of piston packing and rod packing that will resist the action of superheated steam. A paper by H. W. Coddington (independent of the report) described road tests on the Norfolk & Western R.R. with engines having Schmidt superheaters, but with and without firebrick arches. The former showed a saving of 5% in coal consumption.

FUEL ECONOMY—This report constituted a digest of replies to a list of questions. It advocated the purchase of coal by specification, the keeping of accurate coal-supply records, the use of good feed water (with treatment if necessary), the reduction of waste due to coal falling from tenders and cars, the keeping of engines in proper condition, and a full cooperation between enginemen and firemen and between these men and their superior offices. It suggested also that the use of pulverized coal may effect considerable economy.

In regard to good feed-water, the report stated that the saving due to reduction in scale and decreased boiler maintenance will pay for the cost of treating the water. The discussion tended to show that while scale is undesirable it has practically no effect upon fuel consumption. As to the selection of good coal, another view presented was that it is better to provide for the effective use of the poorer grades of coal.

SMOKE PREVENTION—Steam jets and blowers are used by a number of roads, and the former are considered to be very effective. One road uses a perforated ring blower around the top of the stack. The mechanical stoker and the brick arch tend to reduce smoke, but the effect of the superheater in this respect is varied. Only one road has introduced apparatus for dealing with the smoke at roundhouses, and this smoke-washing plant (on the L. S. & M. S. Ry., at Chicago) was described in ENGINEERING NEWS, May 15, 1913. The various devices used on the engines are efficient, but the men must be trained as to their proper use. The subject is of importance since so many municipalities are taking up the question of abating the smoke nuisance.

TRAIN RESISTANCE AND TONNAGE RATING—The committee recommended certain car-resistance diagrams and tables for use in computing the tonnage rating (a) for track having heavy rails and a high degree of maintenance, and (b) for lighter track with medium maintenance. The figures recommended in the report were objected to as being based on insufficient investigation, and the report was referred back to the committee for further consideration.

STEEL ALLOYS AND HEAT-TREATED STEEL—The committee stated its opinion that the manufacture of plain carbon and alloy steel to be quenched and tempered will eventually be developed to the point where such material can be used in designs involving much higher unit working stresses than are possible with untreated or an-

nealed plain carbon steel, with a consequent reduction in the weight of parts.

Locomotive Headlights—A voluminous report described a number of road and laboratory tests, and gave the rules of various railways and the requirements of various public authorities. The conclusions were as follows: (1) the headlight must have a beam candlepower not greater than 3000 cp. at 500 to 1000 ft. from the engine, in order to avoid such intensity as would interfere with signals (block, hand, etc.), and temporarily blind an engineman looking into it; (2) the headlight should have an apparent beam candlepower of not less than 450 to 500 cp. at 500 to 1000 ft. from the engine (and 30 to 350 cp. at distances of 50 to 400 ft. from the center line), in order to give sufficient illumination to show landmarks, crossing and other signs, and to enable the engineman to readily perform his duties at terminals, etc.

The discussion brought out the disadvantages and incidental dangers of high-power headlights. It was suggested that one reason why enginemen have advocated such lights is that they give a better side illumination, enabling signs, etc., along the right-of-way to be seen readily. This side illumination or lateral spread of the light is of more importance than a powerful beam of light directed straight ahead.

Other Reports and Papers—Other committee reports were as follows: (1) Rules for road and laboratory tests of locomotives; (2) Revision of standards and recommended practice; (3) standardization of tinware (oil cans, buckets, etc.); (4) train brake and signal instructions. The committees on boilers and safety appliances made no reports. There were also other papers as follows: "Flange and Screw Couplings for Injectors," by O. M. Foster (L. S. & M. S. Ry.); "Electric Motors in Railway Shops," by B. F. Kuhn (L. S. & M. S Ry.), and "The Minor Mechanical Organizations," by Angus Sinclair.

Annual Meeting of the Master Car Builders' Association

The 48th annual meeting of this association was held at Atlantic City, N. J., June 10 to 12.

In his presidential address, M. K. Barnum (B. & O. R.R.) referred to the necessity of equipping freight cars promptly with the safety appliances called for under the present laws. The building of wood passenger cars has practically ceased, and many roads are applying steel underframes and steel ends to the existing cars, while much work has been done in improving the older freight cars by applying steel underframes and ends and heavier draft gear. He advocated standard dimensions for 40-ft. and 50-ft. freight cars, but pointed out that when the American Railway Association some years ago adopted a standard 36-ft. box-car the traffic departments at once began to demand special sizes. At the present time very few of these "standard" cars are built.

Car Construction—The principal feature of interest in this report was its recommendation of a minimum cross-sectional area of 24 sq.in. for the steel center sills of new cars. H. H. Vaughan (Can. Pac. Ry.) opposed this as being too high, he having had satisfactory results in four years' service with a number of cars having only 20 in. of metal. Others thought four years too short a time, and reference was made to cars having 35 to 40 sq.in. in the sills. The matter will go to letter ballot.

The question of standard design of box-cars also produced decidedly opposite views, some considering that car design is at present in a state of evolution and that standardizing would be premature, while others thought it time to take the matter up, especially as it would be some years before any standard design could be submitted and adopted. The statement was made that the American Railway Association has been making an investigation as to interior dimensions of box-cars, with a view to adopting some standard, and will submit the matter to the Master Car Builders' Association.

Retirement of 20- and 25-Ton Cars—This committee recommended that cars of less than 30-ton capacity should not be accepted in interchange service after Oct. 1, 1916, and this will be submitted to letter ballot. There were the usual objections as to such a move, both by railway men and private-car owners, and it was pointed out that many 30-ton cars may be of weaker construction than the lighter cars. But the weight of opinion was to the effect that these latter cars are a source of expense, trouble and danger.

Tank Cars—There is some controversy as to the handling and testing of the older tanks, and the committee did not favor the unrestricted transfer of such tanks to new steel underframes, especially where inflammable liquids are to be carried. The owners of such tanks desire a lower pressure test than the 60-lb. standard for new tanks, and the committee suggested a 40-lb. pressure for tanks built before 1903, but prohibiting them from carrying inflammable liquids. A "collision test" indicated that a tank which will stand 20-lb. water pressure without leaking will withstand the shocks acquired in transportation when filled with a liquid of the same viscosity as water.

Car Wheels—The subject of the contour of chilled cast-iron wheels in relation to frog and guard-rail flangeways has been submitted to this association and the American Railway Engineering Association by the American Railway Association, but the committee reported that there is not yet sufficient information as to the latest design of wheel to warrant any recommendations. It was stated, however, that the U. S. Bureau of Standards is about to make an investigation as to the manufacture and design of wheels of this class.

Car Trucks—The committee had been instructed to submit limiting dimensions for cast-steel truck frames for 40-, 50- and 70-ton cars. As such frames are generally covered by patents it was considered impracticable to recommend definite designs, but limiting dimensions are necessary to provide for applying and interchanging the standard bolsters designed and submitted by the committee. The report will be sent to letter ballot but th section relating to truck springs will be referred to the committee on specifications and tests.

Brake-Shoes and Brake-Beams—The committee reported the conclusion of the extended series of tests on brake-shoes at Purdue University, bringing the earlier tests into relation with the more recent tests at high speeds and pressures. It reported also that greater attention should be given to the hanging of the brake-beams, as a very large proportion of the defective beams removed show that the trouble is due to improper hang-

ing. This statement was strongly indorsed in the discussion.

COUPLERS AND DRAFT EQUIPMENT—The committee reported satisfactory experience with the road-service tests of the new experimental couplers, which prove to be much stronger than the present types. After considering the various designs submitted by manufacturers as embodying the requirements agreed upon between the committee and manufacturers, two were selected for the final elimination trial in service. In the discussion it was pointed out that railway officials should understand that while the new couplers are larger, heavier and more costly, they are a necessity to meet present-day traffic conditions.

CAR-DUMPING MACHINES—The committee reported that as a result of its 1913 report on the damage to cars by these machines, the manufacturers are modifying the designs and have prepared plans for necessary changes in existing machines. Further, it appears that no new machines of the solid-floor type will be built, all being of the movable platen type.

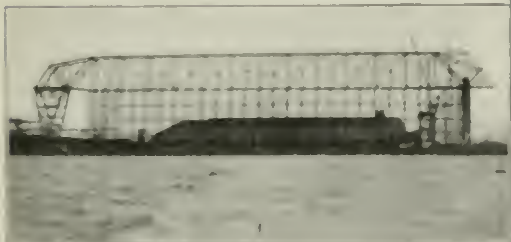
OTHER REPORTS—The reports of other committees were as follows: (1) Train brake and signal equipment; (2) safety appliances; (3) train lighting (design of axle-carrying pulleys); (4) rules for loading materials on cars (including brick, drain tile, etc.); (5) inspection of box-cars; (6) specifications and tests of materials; (7) standards and recommended practice; (8) rules of interchange; (9) prices of labor and material for car repairs.

The officers for the ensuing year were given in our issue of June 25, 1914.

Storm Damage to Steel Structures at Duluth

The accompanying views show a part of the damage done at the coal docks at Superior, Wis., during the tornado of May 25, 1914.

Figs. 1-3 are views taken at the Northwestern Fuel Co., Dock No. 1, located on Superior Bay. Here the largest coal-handling bridge in the world was blown down by the wind and the rig is a total loss. The span of the bridge was 552 ft. with a height from the floor to the top chords of about 140 ft. Fig. 1 shows the huge bridge standing before the storm. This view was taken in June, 1913, while the construction work was going on and when most of the falsework was in place. The bridge was designed and built by the Heyle-Patterson Co., who have already been awarded a contract for a duplicate machine to replace it. Fig. 2 shows the destruction at the shear end of the bridge and the manner in which the steamer "Wm. A. Rogers" was pinned under the apron. The operator of the bridge was just hoisting the bucket, which was located at the left of the view, out of the hold of the boat when the bridge started to move, and when it fell he was caught under the wreckage and almost fatally injured. Fig. 3 shows the manner in which the pier end of the bridge fell and gives a clear view of the way part of the trolley runway lies. The brakes, clamps and chocks held this end of the bridge, but under such an excessive strain the shear



FIGS. 1-3. NORTHWESTERN FUEL CO.'S DOCK NO. 1, SUPERIOR BAY, WIS.

(FIG. 1. [illegible]. FIGS. 2 AND 3. [illegible] BY TORNADO MAY 25, 1914.)

FIG. 4. WRECKAGE OF ISLAND CREEK COAL DOCK NO. 2, ST. LOUIS BAY, SUPERIOR, WIS.
FIG. 5. WRECK OF NORTHERN COAL & DOCK CO.'S COAL-HANDLING BRIDGE, NORTHWESTERN DOCK, SUPERIOR, WIS.

end moved for some distance before the whole structure overturned.

Fig. 4 shows wreckage at the Island Creek Coal Dock No. 2 on St. Louis Bay, Superior. The clamps and chocks in this case also could not hold the big bridge and it skidded for almost 25 ft. before going over. A duplicate of this bridge is to be built by the Brown Hoisting Machinery Co., of Cleveland, but none of the mechanism, etc., of the old rig can be used.

Fig. 5 is one taken of the wrecked bridge at the Northern Coal & Dock Co. dock, located almost next to the Northwestern Dock on Superior Bay. Here also the destruction is complete and it has been found impracticable to use either the steel or machinery in the reconstruction work.

The damage from the storm undoubtedly will run well over $500,000. The wind was from the southwest and although the Weather Bureau recorded a maximum velocity of 65 miles per hour, the extreme velocities must have been much greater than that in the storm path.

Progress on the Alaska Railway Surveys*

Eleven parties are now entering the field under the direction of the three commissioners, William C. Edes, Lieut. Frederick Mears and Thomas Riggs, Jr. It is planned to gather data over some 1100 miles of line during the summer season.

Six locating parties will make location surveys over the Seward-Fairbanks route via Susitna Valley and Broad Pass. A reconnaissance party will go over the route of the proposed Kuskowim extension via the Skwintna, while other parties will work in the vicinity of Knik and Turnagain Arms, Matanuska, Portage Bay and Seward.

The three locating parties between Broad Pass and Fairbanks will be under the direction of Mr. Riggs. Lieut. Mears will direct three parties in the Susitna Valley up to Broad Pass, and Mr. Edes will have charge of the parties adjacent to the coast. The headquarters will be at Ship Creek on Knik Arm and an office will be kept open at 1108 Alaska Bldg., Seattle, Wash.*

*From D. L. Reaburn, Locating Engineer, Skagway, Alaska.

*For further data on the Alaska Ry. routes the reader is referred to "Engineering News," Mar. 20, 1913, containing an abstract of the report of the Alaska Railroad Commission.

The Railway Mileage of the World was 670,000 in 1912, according to a recently published report of the Prussian Department of Public Works. The western hemisphere contains more than half of this mileage, the United States, with almost 245,000 miles of railways, has no rival, Germany is second with 38,000 miles. Belgium, the most densely populated nation, has the highest record in proportion to area—47 miles of railways to 100 sq.mi. of territory. Australia, with the thinnest population of civilized countries, has the record in proportion to population. The United States has 6.92 miles of railways per 100 sq.mi.; while Europe has 5.63 miles per 100 sq.mi. Railway systems of the five great geographical divisions, compare in miles of operated line as follows:

	1912	1911	Gain
Europe	212,427	210,131	2,296
North and South America	343,557	333,376	10,181
Asia	66,483	65,107	1,376
Africa	26,478	25,103	1,375
Australia	21,578	20,089	1,489
Total	670,523	653,806	16,717

Annual Meeting of the Society for the Promotion of Engineering Education

The 22nd annual meeting of the Society for the Promotion of Engineering Education was held at Princeton University, June 23-26. For many years this Society thought it necessary to hold its annual summer convention at the same place and at about the same time as some one of the national engineering societies, so that those of its members who desired to attend the national society convention might have a double inducement to attend. The experience at Princeton this year, however, proved that this society is entirely able to hold a successful convention by itself. Over 200 members were in attendance, and the regularity with which the daily sessions were attended and the active discussions which took place on most of the papers presented would have done credit to societies of much larger membership.

Most of the papers presented at the meeting, aside from the committee reports, had been printed in advance in the Society's journal, so that the time was spent in discussion and not in the reading of long papers. One or two excellent features in the conduct of the convention which we have never seen elsewhere are now followed by this Society and are well worthy of note by those interested in the successful conduct of engineering meetings. In giving out badges to those in attendance upon a convention it has become usual now to have the wearer's surname on the badge. We believe the American Society of Mechanical Engineers was the first society to start this custom a quarter of a century or more ago. The wearing of a surname printed in plain letters on a badge attached to the lapel of the coat has saved many thousand embarrassments without doubt to men who on recognizing a familiar face have searched their memories in vain for the name of the person recognized. The Engineering Education Society has now inaugurated an improvement on this excellent custom. The badges worn at the Princeton convention had marked upon them the wearer's initials as well as his surname, and also the name of the college with which he was connected or his place of residence. In practice this is found to add a great deal to the sociability of the members and to the facilities for making acquaintance. To read plain "Jones" on the lapel of a man's coat may not place him at all definitely, but to read "Ezekiel Jones, M.I.T." at once gives information on which to hang conversation and acquaintanceship.

Another feature that adds very much to the interest of the discussion is the following: A large blackboard is placed at the front in view of the audience. As soon as a member rises to take part in the discussion, the Secretary writes in large letters on the board the name of the member and also the institution with which he is connected. Among the features of the meeting were a series of papers on "Methods of Teaching Mathematics," which brought some striking differences of opinion, and reports of some recent experiments on the rating of engineering students according to their character and personal qualifications which have been made at the University of Cincinnati and at Purdue University.

Besides the technical program presented in the four days' session, various social events were arranged for the visitors' pleasure, including a reception by President and Mrs. Hibben, a lecture on the great meteor crater of Arizona, and the annual dinner of the Society on Thursday evening, at which the President, Dean Gardner C. Anthony, of Tufts College, delivered the annual address.

The following officers were elected for the ensuing year: President, Anson Marston, Dean of the Division of Engineering, Iowa State College, Ames, Iowa; Vice-Presidents, Henry H. Norris, *Electric Railway Journal*, New York, and C. Russ Richards, Acting Dean of the College of Engineering, University of Illinois, Urbana, Ill.; Secretary, F. L. Bishop, Dean of the School of Engineering, University of Pittsburgh, Pittsburgh, Penn.; Treasurer, William O. Wiley, John Wiley & Sons, New York; members of the council, R. H. Fernald, A. H. Fuller, A. M. Greene, Jr., E. V. Huntington, Vladimir Karapetoff, D. C. Miller, W. M. Riggs. The reports of the various officers showed that the society is in a flourishing condition; the individual membership is now nearly 1100 and the institutional membership about 50. The council recommended that the 1915 meeting be held in the Middle West.

Annual Convention of the American Institute of Electrical Engineers

The 31st Annual Convention of the American Institute of Electrical Engineers was held June 22 to June 26, at the Hotel Pontchartrain in Detroit. In the annual address by President C. O. Mailloux at the opening session, Mr. Mailloux congratulated the Institute on the extraordinary progress which had carried it, the youngest of the great National Engineering Societies, to a position where it could claim precedence not only in number of members and of local sections, but also in the importance of its technical work.

The field of electrical application is rapidly enlarging, and unless this enlargement should result in a loss of solidarity through the splitting off of societies of a too specialized character, the greatest work of the Institute is still before it.

President Mailloux then spoke at length upon the duties of the engineer to society. The engineer has been prone to regard his duties with too narrow a vision. Not enough emphasis has been placed upon the broader development which would fit the prospective engineer for the position he should hold in the public life.

In recent years no other profession has had so profound an influence upon the advancement of civilization as has that of the engineer, but he has been too busy with the details of his task to realize his mission or to impress it upon the public mind.

The public has long since come to demand the services of a jurist in important judicial positions and of a physician when questions of health and sanitation are under consideration. It is equally necessary that its engineering problems be solved by engineers. Now its engineering commissions are largely filled with lawyers, politicians and merchants. This situation must be changed. Every year, with the increasing complications of modern life, there is more and more need for the engineer at the helm.

Mr. Rushmore, of Schenectady, in discussion of the address, said that the engineer instead of being on the Public Service Commissions and in the responsible civic po-

sitions where he should be was now usually employed to serve and instruct the laymen Commissioners and public officials. The man who knows and is competent is too often under and dominated by the man who does not know and is incompetent.

The first technical paper of the session was upon Electric Heating as Applied to Marine Work. The authors were Lieutenant C. S. McDowell and D. M. Mahool, who have been conducting extensive tests upon this subject for the Navy at the Brooklyn Navy Yard. It was brought out in the paper and the discussion that for most cases the radiant heater depending upon the radiation from large lamps or red-hot wire was most satisfactory and efficient. and that for moderate temperatures and auxiliary heating, the cost of its operation was not prohibitive. However, as showing the impracticability of using electric heat for general use, it was shown that at five cents per kilowatt-hour the cost for heating a medium-sized house would be about $2000 per annum, using the data given in the paper. An interesting point also brought out in the discussion was that furnaces given a coat of whitewash would have a higher surface temperature but would radiate less heat than those unpainted.

Perhaps the most noteworthy development in the application of electricity which was described at the convention was that of the gyroscopic compass as described in the paper of H. C. Ford, of Brooklyn, N. Y. This application of the well known gyroscope has been developed by a pioneer electrical inventor and a charter member of the Institute, Elmer A. Sperry. The compass requires no corrections such as are necessary with the magnetic compass and it is absolutely permanent. Its use has become general in the navy and it is beginning to be adopted by the merchant marine. The successful use of large gyroscopes for stabilizing boats and preventing their rolling was also described and several other uses were touched upon.

The evening session on Tuesday was under the direction of the Industrial Power Committee and the Chairman. Rudolph Tschentscher, of the Illinois Steel Co., South Chicago, presided. Three papers were read, all relating more or less to the steel industry.

Direct-current motors for coal and ore bridges by R. H. McLain of the General Electric Co., Schenectady, gave valuable technical data with regard to the characteristics of motors for this use and their operation. Mr. McLain took up particularly the relative values of acceleration and running speed needed for various length and times of travel. The trolley accelerations vary from 1.5 to 2.5 ft. per sec. and car speeds run as high as 1500 ft. per min. Series motors with dynamic braking are used, though a weak shunt field may be added to accelerate the braking action. For hoisting, use is made under varying conditions of either series, compound or shunt-wound motors, the series being used for the lowest and the shunt for the highest speeds. On low-speed hoists, dynamic braking is used in lowering the empty bucket.

Transmission Lines

On Thursday morning a meeting was held under the direction of the Engineering Data Committee with P. H. Thomas, Consulting Engineer, of New York City, Chairman. "Data relating to high-tension transmission systems" was the subject of a subcommittee report which was prepared by Mr. Thomas. It is an analysis of the reports made by 25 power companies in reply to inquiries sent out to about one hundred companies operating at 25,000 volts or over. Those reporting included six companies working at 100,000 volts or over, 4 at about 85,000 volts, 10 at about 60,000 and 4 at 25,000 to 50,000 volts. One of those now rated at 85,000 is designed to eventually operate at 140,000.

A large collection of valuable technical data concerning the characteristics and operation of high-tension lines was given, largely in tabular form. Some points of general interest are the following: although one span on the lines of the Pacific Gas & Electric Co. is mentioned as of 4427 ft., the largest span described is 3200 ft. in the line of the Mississippi Power Co. and crosses the Missouri River. A steel core cable is used and the highest tower is 230 ft. The greatest total mileage is that of the Pacific Gas & Electric Co., California, with 1260 miles. Standard tower spans vary from 400 to 800 ft. Very little deterioration of any kind was reported, though it was brought out in the discussion that one Western company had just discovered bad pitting of the copper wires at certain points where in contact with the insulators. This line had been in use 11 yr., most of the time at 60,000 volts. Nearly all companies work on one of two lines on the same pole or tower while the other line is alive. Eleven companies use preservative treatment on their wooden poles at costs varying from 10c. to $1.50 each. The largest line-charging current reported is 250 amperes at 60,000 volts by the Pacific Gas & Electric Co. Nearly all companies have telephone lines on the same poles or towers as the power lines.

Power Plants

Wednesday afternoon the meeting was presided over by H. G. Stott, Chairman of the Prime Movers Committee and Superintendent of Motive Power of the Interborough Rapid Transit Co. The paper presented jointly by him and Messrs. W. S. Gorsuch and R. J. S. Pigott, both of the Interborough Company, was, on account of Mr. Stott's reputation as an authority, one of the most anticipated of the meeting. Its title was "The Present Status of Prime Movers."

Six subdivisions were given as follows: (1) Reciprocating steam engines; (2) steam turbines; (3) gas engines; (4) oil engines; (5) hydraulic turbines; (6) Finance and economics.

The reciprocating steam engine was disposed of in half a page as not to be considered except in very small sizes or under unusual conditions. Prime movers are to be compared as to (a) capacity, (b) efficiency, (c) weight and (d) price. Taking up first capacity and efficiency, the writers criticized the steam consumption per kilowatt-hour as being unsatisfactory when not accompanied with data as to steam and vacuum conditions. They advocate a wider use of the efficiency ratio (Rankine cycle), which is a measure of the excellence of design and which differs much less among modern turbines than the varying water rates would lead one to suppose. Curves showing the rate of steam consumption taken from actual turbines up to 30,000 kilowatts showed a minimum water rate about 12¼ lb. for a 60 cycle; 80% power factor; 175 lb. pressure; 100° F. superheat and 28.5-in. vacuum, which are taken as standard conditions. At 15,000 kw. the rate is only a small fraction of a pound higher, but below this size the rate goes up rather rapidly.

The best water rate should, for most purposes, occur at 75 to 85% of the maximum 24-hr. rating.

Curves showing Rankine-cycle efficiency ratios, with a maximum of 77% and thermal efficiency with a maximum of 20%, were given. These curves were nearly flat throughout the upper half. A similar curve for pounds per kilowatt brings the weight for 30,000 kw. down to 30 lb. per kilowatt as a minimum, and is a straight line to 15,000 kw., where the figure is 35 lb. per kilowatt. Again, the lowest cost per kilowatt ranges from about $6.60 at 15,000 kw., to $6.20, at 30,000 kw.

Taking up the gas engine, the statement is made, that over 75% of the gas-power machinery, is used with blast furnaces and natural gas. Blast-furnace engines have reached a capacity of 6000 b.hp. for a single unit of the twin-tandem type. The gas engine has an efficiency curve which rises continually to its maximum load, and thus has no inherent overload capacity. The gas engine has the advantage of fairly uniform thermal efficiency for all sizes, and this may be taken as 23.8% on a basis of kilowatt-hours at full-load rating (25.2% for brake horsepower). Guaranteed fuel consumption varies from 13,500 to 19,200 B.t.u. per kw.-hr., for producer gas, with a somewhat wider range for natural gas, and 15,000 B.t.u. for blast-furnace gas. In the matter of weight, the high temperatures and pressures involved, place the gas engine at a disadvantage when compared with steam engines. Weights are given up to 1500 kw., where the average weight per kilowatt is 740 lb., as against 58 lb. for a 3600-r.p.m. turbine. Moreover, the weight per kilowatt of the gas engine increases with size. On account of the great weights, the costs also, of gas engines are high. The curves given show an average cost for 1500 kw.-units as $71.60 per kilowatt.

There are approximately 300 installations of medium and heavy-duty oil engines in the United States, aggregating over 75,000 hp. The largest of these is 450 b.hp., although in Europe 2500-hp. Diesel engines have been built. For 19,000-B.t.u. oil, a curve is given, showing a full-load efficiency of 28.2%, on the basis of electrical output (auxiliaries not allowed for). For a 400-kw. vertical Diesel engine, the pounds per kilowatt are 750, and the curve is nearly horizontal, though it rises rapidly for the lower capacities. The cost per kilowatt, is given as $95, though the data for this figure are limited.

The best efficiencies now obtainable from hydraulic turbines are slightly over 90%. Much improvement has been made in the power per unit weight. Recent progress is toward the use of single-runner vertical-shaft turbines for low and medium heads. Weights and costs are not strictly comparable with steam and gas equipments, on account of the influence of difference of head in the case of water power.

Under the head of "Finance and Economics," a comparison is first made of different heat engines and curves are drawn, showing the comparative costs at different percentage loads of 750 kw.-units. From these curves, the following data may be derived:

Per cent. of load	Cost per kw.-hour, mills 25%	50%	100%
Steam turbines	6 3	4 3	3.2
Gas engines	9 5	5 2	3.2
Oil engines	12 0	7 0	5 0

A similar set of curves is given for the comparison of one 20,000-kw. turbine, ten 2000-kw. gas engines and forty 500-kw. oil enginets, the power in each case aggregating 20,000 kilowatts. This case is naturally still more favorable to the turbine. The cost figures at full load are: turbine, 2.1 mills; gas engine, 3.2 mills; and oil engine, 4.7 mills. In these figures, coal is taken at $3 per ton, for both turbine and gas engines, and oil is figured at four cents per gallon. Attention is called to the unsuitability of gas engines, hydraulic turbines or other apparatus with high-investment charge for carrying short-time-peak loads. The fact is also noted that the largest turbines have now surpassed the best gas engines in fuel economy at high-percentage loads. Emphasis is placed upon the reliability and low maintenance of the steam turbines, and upon their great space economy.

Cables

A paper on voltage testing of cables, by W. I. Middleton, of the Simplex Wire and Cable Co., of Cambridge, Mass., and C. L. Dawes, of Harvard University, was a highly technical discussion of the conditions met with in testing cables.

In discussing the paper, Mr. Stott stated that all the cables of the Interborough road were tested with 2½ times normal voltage at least once a year, and many of them oftener.

Edison Medal

On Thursday evening occurred the presentation of the Edison medal, always one of the most interesting events of the Institute meetings. Funds for this gold medal were provided by a number of Mr. Edison's friends on the occasion of his 57th birthday. This year, the fourth time that it has been awarded, it was given to Charles F. Brush, of Cleveland. Before making the presentation, President Mailloux sketched at some length the early history of electrical development, with which Mr. Brush was closely associated.

To show what an advance Mr. Brush had made in electric lighting Pres. Mailloux describes one of the earliest installations of arc lights where ten lights were arranged around Madison Square, each lamp being driven by a separate generator taking 2 or 3 horsepower each. It was such a condition as this, which impressed upon Mr. Brush the necessity of a better method for the operation of lamps and which led to the successful development of the series arc-lighting system. In 1881 there was exhibited at the International Exhibition at Paris, Brush apparatus built by the English Brush Company.

It was not until 1882 that the first constant potential Edison central station was built on Pearl St., New York, and already at that time hundreds of stations for the production of arc lighting were in operation all over the country. These were all very small, usually not over 15 or 20 lamps at the largest. A 50-hp. engine was a large one. The 150-hp. engine at the Pearl St. Station was mammoth. At that time, the rivalry between the Edison and the Brush system was most severe, and Pres. Mailloux called attention to the changed conditions which now after thirty years, bring it about that Mr. Brush is receiving the "Edison" medal.

Ultra-Violet Rays

On Friday morning a paper on the sterilization of water by ultra-violet rays of the mercury vapor quartz lamp, was given by Mr. von Recklinghausen, Director of the Westinghouse Cooper-Hewitt Co., Paris, France. It

is found that all the dangerous bacteria, and all their spores succumb to the ultra-violet light, if exposed to it strongly enough, for even a fraction of a second. To obtain the use of all the light, the lamp must be surrounded by the water, but it is found that if the water comes in contact with the tube of the lamp itself, the activity is greatly reduced. Also since glass is opaque to the ultra-violet rays, only quartz can be used between the tube and the water. Stirring up the water in its passage through the tank is necessary, to prevent the bacteria from hiding behind particles of the matter in the water and escaping. The largest plant now in use is at Luneville, France, and has ten lamp equipments. The water as fed to this outfit, has a germ content, sometimes as high as 1000 per c.c.; on leaving, the bacterial content is reduced down to from 0 to 10. There has been a great reduction in the typhoid-death rate in this place, the old rate ranging from 70 to 160, balanced against almost no deaths at all, at the present time. The energy consumption is very small; the largest lamp in use takes but 2½ amperes at 500 volts. From 50 to 130 kw.-hr. per million gallons is a liberal estimate of the power necessary. In answer to questions which came out in the discussion, Mr. von Recklinghausen estimated the cost at about 60c. per million gallons, including power at 1c. per kw.-hr. and lamp renewals at 30c. per million gallons. The water must not be too turbid, so that the light will be too soon absorbed by it. The Luneville plant has been in operation three years, and purifies 200,000 gallons per day.

The afternoon of Friday was devoted to a conference of the section delegates. There are at present 30 sections, and 48 University branches. The traveling expenses of the section delegates are paid, and nearly all the sections were represented at the meeting. Among other things, a resolution was passed, asking the Board of Directors of the Institute to define more exactly the relation of the section delegates to the affairs of the Institute.

The attendance was nearly 500, and the convention will long be remembered as a most successful one.

The Ficklen Patent on Steel Expansion Joints for Concrete Roads

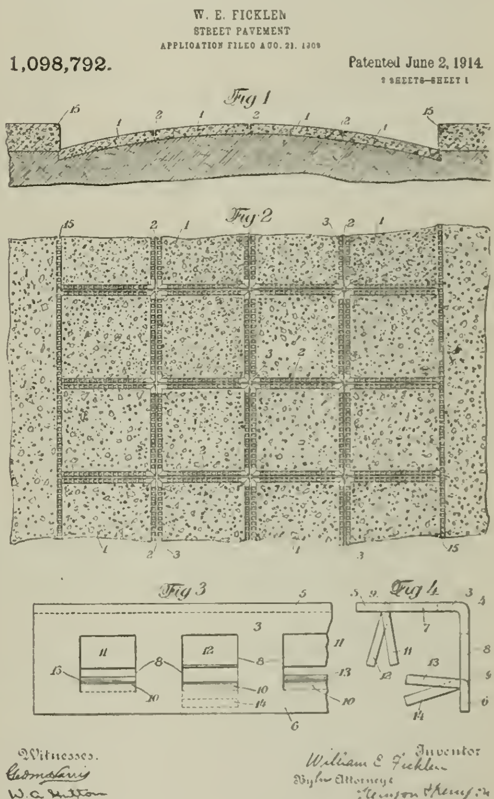
Letters have recently been sent out by the firm of Moore & Clark, Patent Attorneys, of 2 Rector St., New York City, addressed to various State Engineers and others demanding royalties on concrete pavements or roadways on account of a patent issued June 2, 1914, to Wm. Ficklen, of 2 Rector St., New York City. The letter states that "the patent broadly covers a concrete pavement supported on an earth bed and formed with expansion joints armored at their upper edges."

While the Ficklen patent was issued on June 2, the original application was filed Aug. 21, 1909. The attorneys claim that Ficklen's invention antedates the inventions of Baker, Kahn and others who have for some time been making and selling steel material for expansion joints in concrete roads, and that those who have purchased and used such joints, therefore, are subject to suit for the collection of royalties.

By the courtesy of the patentee and his attorneys, we have been permitted to examine the record of the case before the Patent Office. This record is extremely voluminous. During the five years since Ficklen filed his original application, his case has been in the hands of several different firms of patent solicitors, and the records show over forty different actions by the Patent Office before the case was finally allowed.

The patent undeniably contains broad and sweeping claims. They are typified by Claim 1, which is as follows:

1. A pavement comprising an earth roadbed, a crust supported directly on said roadbed and comprising a plurality of concrete sections of relatively large area separated from each other by expansion joints extending from the top of the pavement to the roadbed, and reinforcing means embedded in and carried by and continuing along the upper portions of the edges of the concrete sections at the joints which require reinforcement.



FACSIMILE OF MAIN PAGE OF ILLUSTRATIONS OF U. S. PATENT NO. 1,098,792

We reproduce herewith the first sheet of drawings of the Ficklen patent (which is No. 1,098,792). It will be noticed on this drawing that Ficklen originally contemplated dividing up a roadway into blocks about the size of ordinary sidewalk slabs. The words "relatively large area" did not appear in the broad claims filed with the original application, but were added in some of the numerous amendments. Possibly it was thought their addition would better sustain the claim that the construc-

[illegible] and described applied also to concrete roadways with transverse joints spaced 25 to 40 ft. apart.

Referring to Claim 4, its validity rests on the question whether Fischer was the first to combine, with the expansion joint (or dividing plane) of a section of concrete pavement, "reinforcing means embedded in the upper edges of the concrete section," and further whether such a combination constituted an original invention in view of the state of the art of reinforced-concrete construction in 1907.

The Patent Office examiner long opposed both of these contentions by the applicant's attorneys, and again and again rejected all the claims, citing numerous prior patents in support of their position. Not until very recently did the office finally recede from its position and grant the broad claims above referred to.

It is not, of course, our function to act as expert advisers to pass upon questions of the validity of patents. It is proper for us, however, to point out that in view of the long opposition of the Patent Office to the issuance of this patent, it is likely that the courts might take a similar view of it, should the threatened court proceedings for its infringement be carried into effect. Certainly the record of prior patents cited by the Patent Office, easily obtainable from the office files and very possibly prior use of steel reinforcement, not on the Patent Office records, should furnish plenty of ammunition for those who desire to fight such a suit rather than pay royalty.

Failure of Coffer-dam at Dam No. 1, Mississippi River St. Paul

Telegraphic reports from George W. Freeman, U. S. Assistant Engineer at St. Paul, state that on June 29 a portion of the mid-river coffer-dam used in building Dam No. 1 across the Mississippi River near St. Paul, Minn., was washed out under exceptionally high water for that time of the year.

Lock and Dam No. 1 are being built by the United States Government for combined power and navigation purposes. The work comprises the reconstruction of an old lock and the construction of a reinforced-concrete powerhouse and hollow reinforced-concrete dam across the river. The powerhouse and lock have been completed and a portion of the dam has been built within a coffer-dam. The river had then been turned through openings in the completed portions and the mid-river section of the dam was being built within another coffer-dam, comprising upper and lower barriers.

The flood crest is at last elevation [illegible] (Cairo datum), but this was designed for the high-water period, which ordinarily does not come at this time of the year. The coffer-dam had a top elevation of about 732. On June 4 the water rose to this elevation and flooded the dam. It [illegible] rising steadily until June 29, when an elevation of 734.4 was reached and water was flowing over the entire length of the coffer-dam. At 2:30 p.m., June 29, the [illegible] portion of coffer-dam between the [illegible] and the [illegible] failed, and in 15 minutes there was an 80-ft. gap. The lower barrier of the coffer-dam was washed away, but the [illegible] section of the upper barrier is intact. Three [illegible] of the partially completed reinforced-concrete dam (which was of a [illegible] cellular steel construction type) were undermined and are now in danger. These may be a total loss. There were several narrow escapes downstream from the dam, but no lives were lost.

Notes from Engineering Schools

University of Kansas—A correspondence course in water filtration and pumping will be given as state extension work. Prof. C. A. Haskins, as state sanitary engineer, found the men in charge of the water works of smaller cities inexperienced and without technical knowledge of the works.

Massachusetts Institute of Technology—Electrical engineering research has developed very rapidly during the past year and a noteworthy extension of the laboratory organization has recently been effected (aided by the cooperative agreement between Harvard University and the Institute of Technology whereby the two departments of electrical engineering were practically merged). There has been created a research committee to whom reports are made upon the progress of the various researches. The committee comprises (1) those members of the electrical engineering department staff who are supervising or actively engaged in research work, (2) those men who are personally carrying on research work in any branch of the department, and (3) those who have completed a recognized piece of research work during the preceding year. The research committee, as a whole, will meet once a month during the school term, such meetings being open to all members of the department staff. By this arrangement, the research activities of the department will be brought into close relation with the regular teaching work. Thus, any member of the staff, whether professor, instructor or assistant, who desires to carry out any original investigation may become identified with the research work through the research committee. Some of the special resources of the research laboratory which have not been designated for use in a particular investigation may be used in providing such a man with apparatus and other laboratory facilities. Even if a member of the department staff is not able to devote a considerable portion of his time to an experimental investigation, he will have the opportunity of offering suggestions upon the conduct of investigations which are being made by others.

The staff at present includes six research associates and assistants who give their whole time. This number will be increased to nine on July 1, 1914. In addition to the work of these men, who are appointed by the Institute, the theses of those students who are candidates for advanced degrees in electrical engineering have been carried on in the research laboratory during the past year. An amount of over $20,000 is available for salaries, supplies and other expenses in connection with the work of the research laboratory and library during the next year.

Massachusetts Institute of Technology—The Institute has accepted the recommendation of the Alumni Council in regard to the establishment of a new four-year undergraduate course—one in science, engineering

and business administration as outlined in ENGINEERING NEWS, Sept. 11, 1913, p. 578. This will be open in the regular program of the fall of 1914.

NEWS NOTES

A Private Water Tank Exploded during a fire in a residence in Walsenburg, Colo., on June 21. The tank was located in the attic.

An Earthquake in Southern Sumatra is reported to have caused widespread damage on June 26. Sumatra possesses a number of volcanoes. It is the largest island except Borneo of the Malay archipelago.

A Steamboat Damaged the Appoquinimink Bridge on her trip from Philadelphia, Penn., to Odessa, Del. The captain of the "Clio" is reported to have stated that he saw a white light on the bridge and supposed the draw span was open.

A Heavy Premature Quarry Blast, at the Melrose Granite Co.'s quarries, 3 mi. from St. Cloud, Minn., on June 23, killed one man and seriously injured three others. The four men were charging a "lift hole" 17 ft. in depth. The foreman was tamping the powder when the explosion occurred.

The S.S. "California" Went on the Rocks of Tory Island, Ireland, in a thick fog, on June 28. No lives were lost; the 1016 passengers of the "California" of the Anchor Line, bound for Glasgow, were landed at Londonderry on June 29. Two British destroyers early on June 29 stood by as long as needed.

A Lifeboat Broke Away from its Davits while loaded with passengers of the "Gothland," the Belgian steamship which was recently wrecked on the Scilly Islands, and fell 30 ft. into the sea. The bottom of the lifeboat was smashed, and all of the occupants were thrown into the water, but were rescued.

A House Slid Into an Adjoining Excavation for a moving-picture theatre in Brooklyn, N. Y., on June 23, seriously injuring two persons. While tearing down a cellar wall the adjoining house sagged, and the third floor and part of the second fell into the cellar. According to reports the house had not been shored.

A Steamer Was Wrecked on a Water-Works Intake Crib at the Chain of Rocks, St. Louis, Mo., on the night of June 24. It was claimed that rivermen were not notified of the construction of the crib, and further that the crib was equipped with lamps at the corners, only 4½ in. in diameter, visible only 200 yd. away. Divers found that the crib was uninjured, but that the "Majestic" had a hole in her hull, 30x3½ ft. It is probable that when the river lowers to a workable stage, the hole will be temporarily covered, the hull pumped out, and the vessel floated to Cairo for repairs.

Gas in a Deep Cesspool in East St. Louis on June 23, caused the death of the contractor who had built the cesspool, and of two other men. The contractor, discovering that a tool had been left at the bottom of the pit just completed in the rear of a grocery store, started down a ladder to recover it and was overcome by gases and fell into about 6 ft. of water. One after the other, two assistants who attempted to rescue him were overcome and fell. A fourth man was pulled back unconscious, before falling. The pit was 22 ft. deep by 18 ft. in circumference and connected to an old cesspool. It is supposed that the fumes came through the connecting pipe after the water in the old pit had run into the new. A lighted lantern is said to have been extinguished by the fumes.

The Salem Fire—At a little before 2 p.m., on June 25, a fire was discovered in a brick and wood factory building of the Korn Leather Co., in the leather and shoe district of Salem, Mass., which spread rapidly until an area of about 2 sq.mi. had been devastated. The damage is estimated at about $12,000,000. The original blaze moved eastward and westward with broadening front, before a brisk wind. First, a section of small frame residences and then the more important residential district in the western portion of Essex and Broad Sts., were destroyed.

Within an hour flying embers had started other blazes, in South Salem, and about 9 p.m., a third fire broke out, in North Salem, about 1½ mi. from the starting point of the original fire.

More than 1000 buildings, including a score of factories in the shoe and leather district, were destroyed and about 15,000 persons made homeless. The fire burned itself out on June 26. Seven persons are known to have died. Martial law was established at 9 p.m., June 25.

In addition to the Salem fire department, the neighboring cities and towns responded with fire apparatus and men; but the burning area was too great, the building construction too inflammable, and the water supply inadequate, to make resistance effective.

Structural conditions at Salem were as follows: Frame dwellings with out-buildings may be erected within the fire limits, but were restricted to 40 ft. in height and 2000 sq.ft. in area, if within 8 ft. of any other wood building. Frame tenements or lodging houses of over 30 ft. frontage must have a brick division wall. The height of frame tenements or lodging houses within the fire limits is restricted to 48 ft.

In the principal mercantile district about 75% of the construction is joisted brick, and the remainder frame. Heights vary from two to four stories.

The Pacific Great Eastern Ry. is rushing construction on its line between Vancouver and Fort George, B. C. The Squamish section is 93% completed, and track has been laid to within 20 mi. of the Pacific Coast terminal. Over 5500 men are now engaged on the construction work.

Brick Roads in Cuyahoga County, Ohio, will be increased 60 miles in length during the present season, according to the plans recently announced by the County Engineer. There are already about 400 miles of brick pavement in the county. A minimum width of 16 ft. has been adopted for the new roads. The present season's work will amount to about $900,000.

The Snake River Viaduct of the Oregon-Washington Ry. & Navigation Co., at Perry, Wash., is a steel structure 4500 ft. long, with its rail level 300 ft. above the water. The middle portion consists of five truss spans of 240 ft.; the remainder has 23 plate-girder spans of 60 ft. for the towers and 80 ft. for the intermediate spans. The bridge is expected to be completed this year.

Uniform Building Law for San Francisco Bay Cities—The mayor of Berkeley, Calif., has requested the coöperation of the executives of the cities surrounding San Francisco Bay in adopting a uniform building ordinance. At the present time there are many dissimilar clauses in the various ordinances, which prove a source of annoyance to engineers, architects and contractors whose practice is not confined to one city.

A Speed of 300 Miles an Hour has been claimed for a miniature electric railway system recently exhibited in England, and known as the Bachelet levitated flying train, the train being entirely unsupported during its travel. The inventor's modest claim has been easily outdone by another foreign inventor who claims that his system will give a speed of 500 miles per hour. The Bachelet inventor is pleasantly disposed of in the "Railway Engineer," of London, as follows:

> This interesting scientific toy is by no means new, as it was exhibited in the United States in 1912, but because the "experts" who write about such things in some of the daily and weekly papers had apparently never heard of it they thought they had seen a new wonder of the world, and became temporarily (we hope) demented, and gushed out the most dreadful nonsense about trains traveling at a speed of 300 miles an hour. The idea is that the car or container is raised off the track by magnetic repulsion and then sucked along by solenoids. The whole scheme, whether for parcels or passengers, is fantastic, and from a commercial and practical point is not worth a second thought.

Constructing a Filter Plant by Day Labor was one of the features of the new sewage-disposal plant at Aberdeen, S. D. (12,000 population), described by W. G. Potter in a paper read before the Western Society of Engineers. The plant includes a sedimentation tank, sludge filter, siphon chambers, sprinkling filter and final settling basin. The total cost will be about $130,000. Labor was paid 22¼c. per hour at first, but for most of the work the rate was 25c. per hour, and labor was very hard to get during the summer and fall seasons. Carpenters on form work were paid 35c. to 45c. per hour, and brick masons 70c. to 80c. per hour. The entire work except part of the excavation, part of the pipe hauling, and the construction of the pump-house superstructure, was done for the city commissioners by city forces, without contract, Mr. Potter being the designing and constructing engineer. He states that it is a good example of nonpolitical municipal work, and that politics was one of the incidental troubles that was entirely absent from this work.

The Plan to Sell the United States Battleships "Idaho" and "Mississippi," which was recently abandoned by the House and the Navy Department, was approved by the former body on June 23. The House reversed its former action and accepted in substance the Senate's amendment. The vote was 174 to 87, showing a remarkable change in sentiment. These

[illegible] to Greece for their value new, and the [illegible] in the purchase of a super-dreadnought.

Paving by Municipal Day Labor in Duluth, Minn., as noted in our issue of May 21, 1914, p. 1155, is proving very successful according to the Duluth Herald of June 15, which states:

[illegible] superintendent in charge of the paving of [illegible] St. between Fifteenth and Thirtieth Aves., is [illegible] a great deal of praise from merchants for the [illegible] which he is pushing the paving work. The business men say that not only is the city saving considerable money on the job by having the work done in this manner, but is also getting a better job done.

Highway Repair Work in Pennsylvania has received new [illegible] from a recent decision of the Dauphin County Court which releases $1,[illegible],[illegible], the accumulated money derived from automobile licenses, and places it at the disposal of the State Highway Department. Money for state road work has been scarce in Pennsylvania since the failure last fall of the proposed [illegible] bond issue to pass the referendum, and the highway engineering staff has been threatened with disintegration.

Coöperative Drainage Work is being carried out by the U. S. Department of Agriculture and the University of California. As a first experiment in the reclamation of land formerly highly productive under irrigation and covered with [illegible] vineyards, orchards and alfalfa, but now given up to alkaline barrens or Bermuda grass pasture, 160 acres of badly alkaline land at K[illegible] Park, near Fresno, will be [illegible]. This land belongs to the University of California. The field work for this investigation is in charge of Walter W. Weir, U. S. Drainage Engineer, Berkeley, Calif.

Motor Cars Have Displaced Steam Trains on the Central New York Southern Ry., a [illegible] line extending between [illegible] and Auburn, N. Y. The cars are of the gasoline type, [illegible] mounted on the [illegible] truck and driving the front axle direct for through [illegible] (or slow speed). They are [illegible] ft. long. The [illegible] end has a door for communication with trail cars. Other features are a [illegible] valve and whistle lever (pedal) at the rear [illegible] register which registers the mileage of each trip as well as the total mileage. They were built by the McKeen Motor Car Co., of Omaha, Neb.

The Coming Extension of Auto-bus Service is indicated by the fact that [illegible] applications for approval of auto-bus [illegible] were [illegible] for hearing before a member of the Public Service Commission, Second District, at Albany, N. Y., on June 24. The names of the applicants and the proposed routes were as follows: [illegible]

Cement Gun Operators Are Not Plasterers [illegible]

[illegible]

The Investigation of the "Empress of Ireland" Disaster [illegible]

afterward and the Court will have to sift out from the mass of conflicting testimony whose was the act that brought the two vessels into collision.

The very short time in which the "Empress of Ireland" remained afloat after her side had been pierced by the "Storstad's" bow is explained by the fact that the doors through the water-tight bulkheads were open when the collision occurred. There was no means by which they could all be closed simultaneously from the Captain's Bridge, and the steward whose duty it was to close the doors had no time to do so after the collision, although some doors were closed. There has been no thoroughly satisfactory explanation of the excessive list of the vessel as she sank. It is thought, however, that one of the boilers may have broken from the mountings by the collision and rolled to the side of the ship, and as the vessel listed more water would come in through open port holes.

A Neighborhood Center Planning Competition is to be held under the direction of the City Club of Chicago. The object is to show the desirability of and possibility of developing the city as a federation of neighborhoods, but not to the extent of isolation. While an enormous amount of trade is scattered through Chicago, local business suffers from the lack of district trading points and the local trading centers are not distributed according to any plan, but rather by [illegible] influences. This lack of definite arrangement applies also to such social institutions as schools, post offices, police and fire stations, playgrounds, libraries, social settlements, [illegible], etc. The city's population averages 12.2[illegible] per sq. mi., with 71,[illegible] and 3[illegible] as the maximum and minimum. For the residential area, the average is [illegible] and the maximum [illegible] per sq. mi. There are [illegible] of [illegible] to [illegible] in the outer sections, and about [illegible] of the whole area of the city is still vacant, while the residential districts represent about [illegible]. [illegible] competitors will reach their own conclusions as to what institutions to include in their plans, and the plans need not apply specially to Chicago. The preliminary competition will close Nov. 9, and a jury will select a number of the best plans, whose authors will enter a final competition closing Jan. 25. An exhibition of the plans will be held in February. Further information may be obtained from George E. Hooker, Civic Secretary, City Club, [illegible] Plymouth Court, Chicago.

Panama Canal Fender Chains. Three sections of fender chain, two of which were [illegible] ft. long, and one of which was [illegible] ft. long, all three making one complete chain [illegible] ft. in length, arrived on the Isthmus on June [illegible] on the steamship "[illegible]." [illegible] [illegible] Nos. [illegible] and [illegible] at Pedro Miguel Locks to protect the intermediate gate in the east [illegible]. With the delivery, [illegible] complete chains out of the [illegible] required have reached the Isthmus. [illegible]

[illegible]

New York Town Awarded Contract for Highway Construction. [illegible]

[illegible]

engineer's estimate had been kept at a particularly low figure so that it would not be likely that anyone would bid under the price bid by the town.

Section 131 provides that if such contract be awarded the board of supervisors or town board, such board shall by resolution designate some suitable person or persons to carry into effect on behalf of the town such contract and transact all business in respect thereto, as may be necessary. This action has been taken in the case of the Town of Mendon and bond has been given to the town guaranteeing the faithful performance of the contract. Under the provisions of the law, the board of supervisors and the town board will designate by resolution a banking corporation or a trust company wherein the moneys received on such contract will be deposited.

This system of building roads by the town has been tried in the past but has not been entirely successful; but it has never been demonstrated that the fault was with the system; on the contrary it was believed that it was entirely with the way the work was carried out.

Under a recent amendment of the Highway Law, any town can bid for a contract for state or county highway and if the contract is awarded, and it desires to do so, can make application to the Superintendent of Prisons for convict labor to work on the roads. In this case, the Town of Mendon is not going to do this but is going to do the work itself the same as any contractor would do.

PERSONALS

Mr. S. Hickson has been appointed Roadmaster of the Oregon-Washington R.R. & Navigation Co., at Colfax, Wash., succeeding Mr. T. Keaveny, resigned.

Mr. Charles J. Chenworth, Engineer of Roadway of the Atlantic Coast Line R.R., Savannah, Ga., has been appointed a member of the Board of Drainage Commissioners of Savannah.

Mr. C. M. Means, M. Am. Inst. E. E., Consulting Engineer, Randolph-Means Co., Pittsburgh, Penn., has been appointed Consulting Electrical Engineer of the United States Bureau of Mines.

Mr. N. P. Zech, recently in charge of statistics of the subsidiary companies of H. M. Byllesby & Co., Chicago, Ill., has been elected Comptroller of the Atlantic Gas & Electric Co., New York City.

Mr. Joseph S. Mallary has resigned as Fire Marshal of Philadelphia, Penn., to become Chief Engineer of the Merchant & Evans Co., of Philadelphia. He is succeeded as Fire Marshall by Mr. George W. Elliott, Deputy Fire Marshall.

Dr. Edgar Marburg, M. Am. Soc. C. E., Professor of civil engineering at the University of Pennsylvania, delivered the commencement address on June 11, and received the honorary degree of Doctor of Laws, at Franklin and Marshall College.

Prof. John H. Nelson, of the department of applied mechanics, Worcester Polytechnic Institute, has been granted six months' leave of absence, which he will spend as Associate Engineer-Physicist, United States Bureau of Standards, Washington, D. C.

Mr. George H. Wynn, of Canton, Ohio, has been appointed Resident Engineer in charge of construction of the new sewage-disposal plant at Canton. Mr. Wynn received the highest rating at the recent civil-service examinations. He was formerly with the engineering staffs of the American Bridge Co., Pittsburgh, Penn., and the Berger Co., of Canton.

Mr. William A. Williams, M. Am. Inst. M. E., recently Chief Geologist of the Associated Oil Co., San Francisco, Calif., has been appointed Chief Petroleum Engineer of the United States Bureau of Mines, San Francisco office. Mr. Williams is a graduate of Leland Stanford University, and has made a specialty of petroleum mining for the past 10 years.

Mr. J. H. Toupet has resigned as Chief Engineer of the National Fire Proofing Co., and has opened an office at 1428 Oliver Bldg., Pittsburgh, Penn., under the firm name of Toupet, Bell & Conley, Inc., Fireproofing Specialists and Contracting Engineers. Mr. Toupet is President, Mr. F. C. Bell, Treasurer and Mr. F. G. Conley, Secretary of the new firm.

Prof. R. L. Sackett, Assoc. M. Am. Soc. C. E., of Purdue University, Lafayette, Ind., has been appointed a member of a newly created State Highway Commission of Indiana. The other four commissioners appointed by the governor are Messrs. Thomas Taggart, of Indianapolis; W. H. O'Brien, of Lawrenceburg; Leonard B. Clore, of Laporte, and Addison C. Harris, of Indianapolis.

Mr. I. M. de Varona, M. Am. Soc. C. E., Chief Engineer of the Department of Water Supply, Gas and Elect 'city, New York City, has resigned. Mr. de Varona is 72 years old and has been in the city service for over 30 years. He will probably retire on a pension of half his salary of $10,000 per annum. Mr. de Varona graduated from Rensselaer Polytechnic Institute in 1863, and was first connected with the Brooklyn water-works as Assistant Engineer. Later he was Chief Engineer of the Brooklyn water-works.

Prof. Frederick G. Cottrell, M. Am. Inst. M. E., formerly of the University of California, Oakland, Calif., has been appointed Chief Chemist of the United States Bureau of Mines. Prof. Cottrell has been Chief Physical Chemist with the Bureau of Mines since 1911. He is a graduate of the Universities of California, Berlin and Leipsic, and is famous as the inventor of the process for electrical precipitation of suspended particles from smelter fumes, described in "Engineering News" of Oct. 26, 1911. In order to accept his position with the Bureau of Mines he gave to the Smithsonian Institution at Washington his patents on this and other valuable processes.

Mr. William McClellan, F. Am. Inst. E. E., Consulting Engineer, New York City, formerly Chief of the Division of Light, Heat and Power, Public Service Commission, Second District, New York, has been appointed "Confidental Engineer" in charge of the physical valuation and investigation of the New York Telephone Co. The chairman of the Public Service Commission is reported to have said that he would ask the commission to place all appointments to be made in connection with this work under the exempt class. Mr. McClellan was born in Philadelphia, Penn., in 1872, and graduated from the University of Pennsylvania in 1900. From 1905 to 1907 he was with Westinghouse, Church, Kerr & Co., New York City.

Dr. William David Coolidge, Assoc. Am. Inst. E. E., Assistant Director of the Research Laboratory, General Electric Co., Schenectady, N. Y., has been awarded the Rumford Medal of the American Academy of Arts and Sciences for his invention of ductile tungsten and its application in electric illumination. Dr. Coolidge was born in Hudson, Mass., and graduated at the Massachusetts Institute of Technology in 1896. He received his Doctor's degree at the University of Leipsic in 1899. Until 1905 he was a member of the faculty of the Institute. He was appointed Assistant Director of the Research Laboratory of the General Electric Co. in 1908. Some of the other recipients of the Rumford Medal have been Ericsson, Langley, Edison, Curtis and others.

Mr. W. Averill Harriman has been elected Vice-President of the Union Pacific Ry., to succeed Mr. W. V. S. Thorne, resigned. Mr. Harriman is 24 years old and has had no very extensive railway operating experience. He is, however, the son of the late Edward H. Harriman. Mr. Thorne is a graduate of Sheffield Scientific School, Yale University, and has been in railway work since January, 1886, when he joined the engineering staff of the St. Paul, Minneapolis & Manitoba Ry., on preliminary surveys and construction. He was subsequently promoted to be Superintendent of the Minnesota division of the Great Northern Ry., and was later an executive officer of other railways. He became connected with the Union Pacific Ry. in 1902 as Assistant to the President, E. H. Harriman, and has since been in charge of the purchasing department. Mr. Harriman is reported to have spent part of his summer vacations working as a chainman of a survey party, as a fireman on a locomotive and as a clerk in the freight department of the Union Pacific Ry.

OBITUARY

Russell S. Penniman, former General Manager of the West Coast Division of the E. I. du Pont de Nemours Powder Co., died June 18, at his home in San Francisco, Calif.

Newton Wilson, M. Am. Inst. M. E., of Beaumont, Tex., died in St. Louis, Mo., June 23. He was 56 years old and widely known throughout the Southwest and Mexico.

Edmund C. Limbach, M. Am. Inst. M. E., was accidentally killed in a mine at Oglesby, Calif., June 16. He was 42 years old and a graduate of the Colorado School of Mines, class of 1891.

Morgan Bransby Williams, M. Inst. C. E., in early life connected with the construction of some of the most important railways in England, died in London, June 22, aged 89 years. For the past 20 years he had been a banker of prominence. He was born in 1825. After a grammar-school education he started his career in mining engineering, but subsequently turned to civil engineering and railway construction. He was employed on the construction of the London & Northwestern Ry., the Caledonian Ry. and the London & Southwestern Ry. He then went to Italy, where he was Engineer of Construction on numerous railway lines, and later to Russia, where he was Chief Resident Engineer for the late Sir

[illegible] Hlwshlw. While in Russia he married the Baroness von Wulf, daughter of the Military Governor of St. Petersburg. For some time Mr. Williams was General Manager of the [illegible] & [illegible] Ry. in Russia, until it was purchased by the Russian Government. He then retired from engineering and railway work and made his home in South Wales.

Mrs. George Westinghouse died at her country residence, Erskine Park, Lenox, Mass., on June [illegible]. Mrs. Westinghouse had been in ill health since September, 1912, when she suffered partial paralysis. Since the death of Mr. Westinghouse, in March last, her condition has been serious. Mrs. Westinghouse was the daughter of Capt. Daniel Walker, of Roxbury, Delaware County, N. Y. She was married to Mr. Westinghouse in Brooklyn, N. Y., Aug. 8, 1867, when he was a young and comparatively unknown inventor. Mrs. Westinghouse was prominent in social matters and in charity work, and took a great interest in Mr. Westinghouse's engineering activities. When the American Society of Mechanical Engineers held its Washington meeting in May, 1898, Mrs. Westinghouse gave a special reception in her Washington residence to the Society, building a special pavilion on the lawn adjacent to the house in order to accommodate the large number of guests. In later years she had been present with Mr. Westinghouse at many of the Society's social affairs and had become well known to many of the members.

Benezette Williams, Consulting Engineer, of Chicago, died at Western Springs, Ill., June 22. His residence was at that place and he was about to start to attend the commencement exercises at the University of Michigan, where he was to receive an honorary degree of Master of Engineering. He fell dead in the railway station. He was born at West Liberty, Ohio, Nov. 9, 1844. He graduated from the University of Michigan in 1869, and the same year went to Chicago, where he entered the office of E. S. Chesbrough, civil engineer. Later he was in the office of the city engineer of Milwaukee, and then in railway service on the Milwaukee, Lake Shore & Western Ry. and Chicago, Burlington & Quincy R.R. In 1872 he became Assistant Engineer for Mr. Chesbrough, then City Engineer of Chicago; he worked in the sewer and water-works departments, was in charge of the construction of the [illegible] Ave. [illegible], and later became Superintendent of Sewers. He was City Engineer of Chicago from 1875 to 1879. He took a prominent part in the preliminary projects and the early construction of the Chicago drainage canal, and was Chief Engineer of the Sanitary District of Chicago (which is in charge of the canal) in 1892 and 1893. Afterward he took up private practice, maintaining an office in Chicago and making a specialty of municipal and sanitary engineering. He was a member of a commission appointed some years ago to report on an improved water-supply for St. Louis, Mo. He became a member of the Western Society of Engineers in 1872 and was president of the Society in 1880. He was married to Lydia J. Terrell at Cleveland, Ohio, in 1871, and had three sons and a daughter.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 30-July 3. Seventeenth annual meeting at Atlantic City, N. J. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Penn.

AMERICAN SOCIETY OF ENGINEERS, ARCHITECTS AND CONSTRUCTORS.
July [illegible]. Convention at [illegible] Beach, L. I. Secretary, T. [illegible], [illegible] St., New York City.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
July [illegible]. Semi-annual meeting at Cleveland, Ohio. Secy., J. J. [illegible], [illegible] St., New York City.

OHIO ELECTRIC LIGHT ASSOCIATION.
July [illegible]. Annual convention at Cedar Point, Ohio. Secy., [illegible], [illegible], Ohio.

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.
[illegible]. Annual meeting at New York City. Secy., E. H. [illegible], [illegible] Union Station, St. Louis, Mo.

AMERICAN PEAT SOCIETY.
[illegible]. Annual meeting at [illegible], [illegible]. Secy., Julius Bordollo, 17 Battery Place, New York City.

Inland Waterways Association—[illegible] to organize a section of the Inland Waterways Association in the Sacramento Valley, California.

Pittsburgh Chapter of the Illuminating Engineers' Society—At the annual meeting of the Chapter held at the [illegible] [illegible] [illegible] was elected Chairman and F. H. [illegible], Secretary.

Railway Signal Association—The next annual convention will be held Sept. 22-24, at Bluff Point, N. Y., with headquarters at the Hotel Champlain. The secretary is C. C. Rosenberg, Times Building, Bethlehem, Penn.

Illuminating Engineering Society—The eighth annual convention will be held Sept. 21-25 in Cleveland, Ohio. The assistant secretary is Joseph Langan, 29 West 39th St., New York City.

Fourth American Road Congress—The Congress under the auspices of the American Highway Association, and the American Automobile Association, will be held in Atlanta, Ga., Nov. 9-14. Inquiries should be addressed to Colorado Bldg., Washington, D. C.

Portland Association of Members of the American Society of Civil Engineers—At a regular meeting of the Association held in Portland on June 5, Frederick W. Mulkey, Chairman of the Commission of Public Docks, spoke on the Portland Harbor and Docks.

American Society of Agricultural Engineers—The next meeting of the Society, whose membership has grown 25% since Jan. 1, will be held in Chicago, Dec. 28-30. One of the items for discussion is whether to hold an extra meeting in San Francisco during the Panama-Pacific exposition. The secretary is F. M. White, Madison, Wis.

Southwestern Water-Works Association—At the annual convention held at Tulsa, Okla., June 15-17, the following officers were elected: President, H. L. McDuffie, Sherman, Okla.; Vice-Presidents, Jesse Shaw, Topeka, Kan., and W. H. Bruce, Fort Smith, Ark., R. E. McDonnell, Kansas City, Mo., L. H. Gray, Lufkin, Tex., and J. B. Hudgins, Roswell, N. M.; Secretary-Treasurer, E. L. Fulkerson, Waco, Tex. The 1915 convention will be held at Galveston, Tex.

National Association of Sheet-Metal Contractors—About 600 delegates attended the 10th annual convention of the Association, held in Cincinnati, Ohio, June 16-19. The next annual convention will be held in Denver, Colo. The officers elected for the ensuing year were: President, Paul F. Brandsted, Washington, D. C.; Vice-Presidents, Julius Gerock, St. Louis, Mo., K. I. Willis, Moline, Ill., and T. P. Walsh, of Youngstown, Ohio; Treasurer, W. A. Fingles, Baltimore, Md.; Secretary, Edwin L. Seabrook, Philadelphia, Penn.

Sixth International Congress of the Mining, Metallurgy, Engineering and Economic Geology—The Sixth Congress will be held in London, July 12-17, 1915, and will be divided into four sections: Mining, metallurgy, engineering and economic geology. Among the subjects to be treated in the engineering section are the following: Exhaust-steam turbines; gas motors and turbines; compressed-air locomotives in mines; economies of rock drilling; standards of comparison in the use of compressed air; utilization of low-grade fuel. Inquiries should be addressed to the Secretary of the International Congress, 28 Pretoria St., London, S. W.

The Pacific Northwest Society of Engineers—The 12th annual convention of the Society was held in Seattle June 19-20. President Joseph Jacobs, in his annual address, made a plea for the opening up of the arid and logged-off lands of the Pacific Northwest. In speaking of the opening of the Panama Canal, he said: "Of the 300,000 to 600,000 immigrants likely to come to the Pacific Coast, Washington will get at least 10,000, and if only five acres per capita were allowed, it would total 200,000 acres; figuring $50 per acre as cost of reclamation, the expenditure would be $10,000,000." In the afternoon session a paper was delivered by Floyd W. Allen, Deputy Engineer of King County, on "Highway Construction." In the evening the annual banquet was held at the Hotel Frye. Sterling B. Hill acted as toastmaster, and the principal address of the evening was delivered by D. C. Henny, Consulting Engineer of the United States Reclamation Service, who spoke on "Drainage Problems in the Yakima Valley."

New England Water Works Association—The June outing of the association, held in Worcester, Mass., June 24, was a very enjoyable affair. After the arrival of the main party from Boston at 9:15 a.m., automobiles and a special trolley car were taken to the town of Holden, where the new reservoirs of the Worcester water supply were inspected. At Pine Hill the city has begun the construction of a 68-ft. masonry dam on one of the most remarkable dam sites in the Eastern States. The valley is narrow, with a granite ridge running past with [illegible]. From Pine Hill the party proceeded to the Tatnuck Canoe Club House on an island in Lake Quinsigamond, where a lunch was served. Mayor Wright, of Worcester, was an invited guest. In the afternoon the party went to the northern outskirts of the city to witness the operation of a municipally owned Austin trenching machine. Afterward an inspection was made of the city water works shops and stable.

Engineering News

VOLUME 72 JULY 9, 1914 NUMBER 2

Making Three 24-in. Connection Cuts in a 60-in. Steel Water Main under Pressure, Pittsburgh, Penn.

By Chas. A. Finley*

It rarely happens that it becomes necessary to connect two 60-in. steel water mains, and at the same time keep the pressure in one of them. This was the problem encountered by the Bureau of Water of Pittsburgh, Penn., in March, 1914, and successfully solved by making three 24-in. cuts in the old main while under pressure and connecting as many branch pipes of that size with a three-way special provided at the end of the new main. The circumstances which led to this job and the details of design and execution are stated in the following text, which is supplemented by a plan and section and two halftone views of the connection.

Prior to the latter part of April of this year, the North Side of Pittsburgh (formerly Allegheny) had never enjoyed the advantages of filtered water. Up to that time it had been supplied with raw water by a 60-in. steel rising main from the Montrose Pumping Station, situated on the right bank of the Allegheny River, some miles above the city limits.

Going back a few years, it may be noted that after the consolidation of Allegheny with Pittsburgh, in 1907, measures were taken to remedy this condition. These measures necessitated the expenditure of $2,500,000, and embraced the erection of a new pumping station near the Pittsburgh Filtration Plant at Aspinwall, for supplying filtered water to Allegheny, the laying of some 1200 ft. of 60-in. riveted steel pipe connecting the Aspinwall Station with the 60-in. force main from Montrose at a point near the western confines of the Filtration Plant and, in an air line, 1050 ft. northwest of the Aspinwall pumping station, and the construction of a new storage reservoir.

Fig. 1. Making the Second 24-In. Cut in 60-In. Steel Water Main under Pressure, Pittsburgh, Penn., Looking North

(Three-way special in foreground; Smith tapping machine in right middle ground central connection already made, third connection, on left, not yet started.)

*Superintendent, Bureau of Water, Pittsburgh, Penn.

Owing to the available storage on the North Side being insufficient to permit throwing the Montrose force main out of service long enough to connect the two mains by a Y-branch, recourse was had to three 24-in. cuts in the Montrose main, all made under pressure and connected to the new Aspinwall main by means of a special three-way casting. (See the plan and section, Fig. 2, and the views, Figs. 1 and 3.) Each of the 60-in. mains is riveted steel, ½ in. thick.

Prior to the cuts being made the pipe was uncovered and inclosed in a reinforced-concrete vault, 11½x31½ ft. in plan. The roof and south wall were left off until after the pipe cuts were made. Concrete supporting piers and backing blocks at the point of each cut insured stability during the cutting operations.

The main was next encircled by three heavy cast-steel sleeves 4 ft. wide and 11 ft. 8 in. c. to c. Each sleeve was in two sections, provided with flanges held in place by twelve 1¾-in. nickel-steel bolts at each joint and made tight by means of lead gaskets ⅛ in. in thickness.

Owing to the flexibility of steel pipe and the possibility that the section in question might lend itself readily to distortion during calking some apprehension was entertained as to the possibility of obtaining satisfactory lead joints and in consequence special care was exercised to insure as equal a fit as possible between the pipe and the sleeves. The sleeves were poured solid throughout, [illegible] lb. of lead being required for each. All joints were painstakingly calked by experts, special attention being given to the area immediately surrounding the point of cut.

Flanged openings were provided on each sleeve to which were bolted 24-in. gate valves. Valves and openings were slightly in excess of 24 in. in order to allow for the cutting of a disk full 24 in. in diameter.

The valve being opened the cutter was inserted against the pipe and held in place by a cutting back, bolted to the valve through a stuffing-box from which the stem and gears protruded for operation. A 1½-in. drill preceded the main cutting tool a sufficient distance to penetrate the pipe before the 24-in. cutter was engaged, allowing the full pressure on the sleeve and gate and permitting of any additional calking found necessary before proceeding further. No particular difficulty was experienced in this respect, however, but had occasion demanded, the machine was equipped to tap and plug the 1½-in. hole, permitting the removal of the valve and sleeve without danger. Some minor leaks developed but were readily made tight and the cuts expeditiously completed.

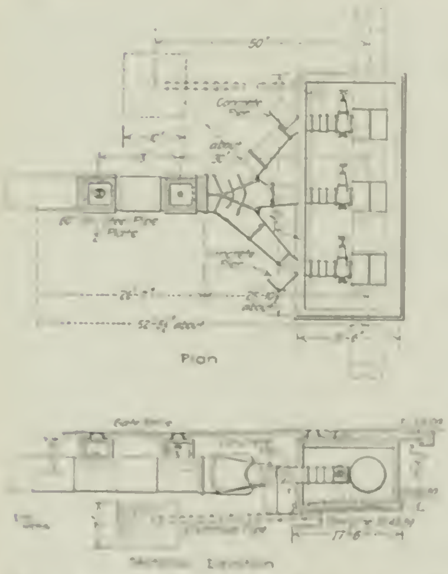


FIG. 2. PLAN AND SECTIONAL ELEVATION OF CONNECTION BETWEEN TWO 60-IN. STEEL WATER MAINS, PITTSBURGH, PENN.

FIG. 3. CONNECTING 60-IN. STEEL WATER MAINS AT PITTSBURGH, WITH MAIN UNDER PRESSURE; LOOKING SOUTHWEST

(Note flanged and bolted sleeves for use in tapping in the three 24-in. connections.)

The cutting machine was operated by hand. An average of five hours was required from the beginning to the completion of each cut, including the removal of the piece cut out.

The method employed to hold the cutting machine rigidly in place during the operation is shown by the views (Figs. 3 and 1), the extra heavy pipe being in compression and the rods passing through them in tension. After completion of the cuts and the installation of the 24-in. makeups, consisting of two flange and spigot pieces and a leaded sleeve between each valve and the three-way casting, these members were removed.

The cutting machine and castings were furnished and the cuts made by the A. P. Smith Manufacturing Co., of East Orange, N. J., under the direction of the Bureau of Water, Mechanical Division, of which C. O. Daugherty is Division Superintendent. F. W. Lyon, Division Engineer, was in immediate supervision of the work and T. R. Tarn, Division Engineer, was in charge of design.

Track Plans for Stations on Single-Track Railways

By G. P. De Wolf*

Among the important features in the design of the track layout at stations on single-track lines are the facilities for handling local freight traffic without obstructing through trains. In my 27 years of railway work (which have been pretty well distributed between construction and maintenance-of-way, with some experience in conducting transportation), I have given considerable study to conveniences for getting trains over the road, but it has been my observation that little attention has been given to this subject and that few roads appreciate the saving that can be made by a little care in the arrangement of tracks and conveniences at small stations.

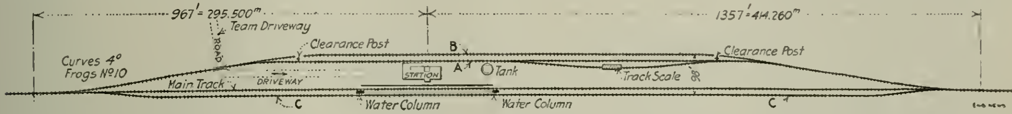
The item of overtime for train crews, together with additional fuel consumed and delay to equipment and freight, is a serious matter with single-track roads. Too much time is consumed by local freight trains at stations, and such a train occupying the main line at stations is frequently the cause of delay to through freight trains which otherwise would not stop, and through freights thus standing do not increase net earnings. The restarting of a train costs money and time, and when a train once stops, all the men have to get ready before it starts again; some crews are quick, while others are slow. The only way to get trains over the road is to keep them moving; main lines are built to run on, and (as far as practicable) should be used for no other purpose.

The accompanying plan represents the layout for local stations as adopted by the National Railways of Mexico, with the above object in view. It is designed with two main features: (1) to keep the main track clear of local freight trains while doing their work, in order to avoid delays to other trains; (2) to furnish a track to be used for local cars only, in order that they will be disturbed as little as possible and avoid interference with the work of shippers or consignees in loading or unloading these cars. Other features are arranged to conform with these two requirements.

Track *A* is the house track; *B* is the team track, and *C* is the passing track. The station has a combination freight and passenger building. At one end is the freight warehouse, with platform on two sides. The platforms are level with the floor of cars standing on the house track *A*; the height of floor of warehouse is just enough higher than edge of platform to give drainage. At the other end is the passenger waiting room, with the station agent and telegraph office between this room and the freight room.

For water stations, the tank is placed as shown, so that engines on track *A* can take water direct from the tank; water columns or engine standpipes are placed between the main track and the passing track *C*; and engines can take water from either track. These water columns are 50 meters (164.04 ft.) in each direction from the telegraph office. Passenger trains can take water while discharging and taking on passengers, express and mail. The scale track is put in only when needed. The freight warehouse is located at the end of station next to direction of business.

Track *A* is built in all cases; track *B*, where there are two freight trains daily in each direction, and track *C* where there are five freight trains daily in each direction. All cars left at station are placed on track *B*, leaving tracks *A* and *B* clear. The length of tracks *A* and *C* will be fixed to suit the traffic. The total length of layout as shown is 700 m. (2369 ft.) between main-line switches, but this is varied by the engineer according to the requirements of each station.



Standard Track Layout for Stations on Single-Track Lines, National Railways of Mexico

Local freight trains are required to head through track *A*, and not use the main track between the main-line switches, unless meeting another local freight. The train spots the local cars at warehouse; the conductor and swing brakeman handle local freight, while the head brakeman with the engine sets out and picks up cars to be left or taken. Generally both parties will finish about the same time, without having blocked the main line, except in entering and leaving the station.

*Chief Engineer of Construction, National Railways of Mexico, Mexico, D. F., Mexico.

The Standard Asphalt Pavement of Oakland, Calif., consists of a concrete foundation 6 in. deep, having a 1½-in. asphalt wearing surface laid on a 2-in. binder course of asphaltic concrete. This pavement will sustain the heaviest loads, even bridging over soft spots in the ground, can be torn up for pipes and replaced without damage, and its surface can be restored where worn at a minimum expense for patching. The only objection to this pavement is its slipperyness during a fog or light rain, but this difficulty has been largely eliminated throughout the hand-swept district by placing dry sand in suitable receptacles, to be applied by the street sweepers as needed.—Recent Report of the Commissioner of Public Works.

Investigation of a Break in a 36-In. Force Main, Toronto—Early last March a 36-in. force main connected with the water-works of Toronto, Ont., burst at Devonshire Place, near Bloor St. Apparently little damage was done except to the pipe and the street. We have received from R. C. Harris Commissioner of Works of Toronto, the following summary of results of investigation of the break:

Our investigations were carried out under these three main heads: (1) defective material; (2) water hammer, and (3) cooling strains.

Samples of iron from each of the broken pipes were analyzed, and its composition was found to be satisfactory. Bars cut from the broken pipes, and tested, gave good results. It would, therefore, appear that the breaks were not due to defective material.

Pressure-recording gages were placed at intervals along the mains, and vibration caused by the electric pumps was shown, but no abnormal pressure was registered, such as might cause the fracture of the pipe. Water hammer might have caused an excessive pressure, which would be transferred along the pipe so rapidly as not to be registered upon the gage, but since both of the breaks occurred during peak load intervals, and also as reliefs occur at two cross-connections, it is improbable that the breaks were caused by water hammer.

There remains the possibility that the breaks were due to cooling strain, and this assumption is strengthened by the fact that both breaks occurred in cold weather, and where the ground is somewhat easily penetrated by frost

Street Cleaning Methods and Costs at Washington, D. C.

By J. W. Paxton*

SYNOPSIS—In a paper† read before the Sanitary Engineering Section of the American Public Health Association at its Colorado Springs meeting, September, 1913, Mr. Paxton described how an efficient municipal day-labor organization had greatly reduced the cost of street cleaning as formerly done by contract in the city of Washington. Since then, he has received many inquiries as to the exact methods employed to attain these results. In this article are explained the cost-keeping methods for fieldwork, shopwork and stables. Many blank forms and cards are not reproduced, as these would probably vary according to the taste and experience of those who would be likely to make use of them, and because many changes in detail have been made since the system was established and many more are likely to be made before it is perfected. It should be remembered, too, as Mr. Paxton says, that the Washington system as a whole will probably fit no other street-cleaning department, the principles only are important.

One of the first attempts of the new municipal street-cleaning organization, under the Engineer Department, was to establish a cost-keeping system. As not much time was available for preliminary study, a rough system was started and enlarged upon from time to time. This period of development at an end, the other stage, that of [illegible], began.

As part of the preliminary study, reports and data from other cities were examined to see what had been done in street cleaning and cost keeping, but no system was found applicable to local conditions. Many valuable data were obtained, however, from the recent publications of well known cost-keeping and scientific-management experts.

The main appropriation of the Street Cleaning Division is for Dust Prevention, Cleaning and Snow Removal, which gives authority to hire laborers, mechanics, etc., but excludes foremen, clerks and superintendents, a separate appropriation, entitled Annual Salaries, being provided for these officials. The last appropriation, under the contract system, paid for inspection and superintendence, and except for minor changes was the same as the present [illegible].

Comparison of Day-Labor and Contract Costs—Neglecting for the present the items of interest and depreciation, which are thought to be high in contract work and, as will be shown later, are low or nonexistent when the work is done directly by the municipality, the contract price (see [illegible]) was composed of the contractor's expenses, the salaries of his supervisory force and his profit. The cost to the city was this price added to the expense of city supervision (inspection, measurement of work done and accounting), or:

(1) Cost to City = Contract price + City Supervision.

With municipal operation, charges corresponding to the contractor's direct expenses and his supervisory or overhead force must be incurred, but no profit need be figured, nor a second supervisory force maintained. Therefore, for municipal operation,

(2) Cost to City = Direct Expenses + Overhead Charges.

If we now suppose that an equal amount be expended under both systems, we have

(3) Contract Price + City Supervision = Direct Expenses + Overhead Charges.

Conditions in Washington, however, make this overhead charge under municipal operations equal to the city supervision expenses under contract. Canceling, then, these similar items, we have

(4) Contract Price = Direct Expenses.

Contract price, therefore, compared with the direct charges for labor, stable expense, supplies and repairs under municipal operation, gives the saving or additional cost to this city of the day-labor over the contract method of street cleaning.

Object of Cost-Keeping Methods—The object of the cost-keeping system being partly to obtain this comparison, the regular monthly cost sheets of the department include only the direct charges mentioned above. The main advantage of excluding all overhead expenses from these sheets is, however, the ease of comparison between similar gangs or classes of work as well as individual items. Overhead expense is added annually as a direct or *pro rata* charge, giving a second set of unit costs which can be used in comparison with unit costs in other cities where this item is included.

Depreciation and interest on investment, as charges against appropriations, are nonexistent. Extraordinary expenditures, such as the remodeling or the purchase of a stable, are provided for by special appropriations. Live stock is secured mainly from other departments, principally the fire and police. Transfers between departments of live stock and other equipment are made without charge. On the General Equipment Account, these transfers are recorded at the full purchase price, but no financial transaction is made. If any equipment or live stock is sold, the proceeds are returned to the United States Treasury and not credited to the appropriation available for current work. Very few sales of equipment take place for this reason; extensive repairs are made, practically offsetting all depreciation.

To admit of comparison, however, with contract costs or unit costs in other cities where it is desired to consider depreciation and interest, a theoretical charge at [illegible] of the total investment for interest and 1% of this total for [illegible] depreciation is made; 1% of the total investment being about [illegible] of the value of the live stock, giving a third set of unit costs.

As it is desirable for the cost keeping to check with the accounting, and it is necessary to conform to certain requirements of the auditing, purchasing and disbursing officers, which originated before this cost-keeping system

*Superintendent of Street Cleaning, Washington, D. C.
†Abstracted in "Engineering News," Oct. [illegible], 1913, p. [illegible].

was attempted, it is more complicated than a simple division of expenditures to obtain unit costs would be.

Expenditure Chart—Practically the first step was the development of a skeleton diagram showing from what appropriation and under what heads money was expended. The Expenditure Chart (Fig. 1) shows this diagram in its present state and gives the headings under which money is acquired and expended, and how these expenditures finally are included into the three sets of costs, which, when divided by quantities of work done, give the unit cost.

While a portion of the Annual Salaries and Contingent and Miscellaneous are joined up with the Streets appropriation, they reappear only as a Miscellaneous, and the line of this entry joins to Overhead and only enters the cleaning costs, such as Hand Patrol, Alley, etc., in the second set. Thus the first set of costs deals only with the Street appropriation.

Purchasing and Stores

All purchases must be made through the Purchasing Officer of the District of Columbia. The different departments notify him of their needs through requisitions, and he attends to the details of the purchase.

Supplies have been divided into two general classes, those purchased as needed on the open market, and certain standard articles contracted for annually, this latter class covering practically all articles regularly used.

Requisition Blanks—Under the cost system, material needed at the storeroom is requisitioned for on two forms, which are merely statements carrying a contract requisition number, the amount, article, item number, unit price, cost, contractor, directions for delivery, purpose; each requisition has an order number, is dated and signed by the foreman and approved by the Superintendent. These forms are purely local and are sent to the general street-cleaning office in duplicate, where, after approval by the Superintendent, the requisitions on the Purchasing Officer are made out. The form for noncontract purchases is printed on green paper, this distinction being advantageous as bids must be obtained, and considerably more time elapses between order and delivery, than is necessary with contract material.

Views in Storeroom, Municipal Street Cleaning Department, Washington, D. C.
[(1) View of general storeroom; (2) oil and paint room; (3) bolt rack in general storeroom; (4) lumber, iron and bulk storeroom.]

Upon receipt of the official order number from the Purchasing Officer, the local requisitions are given the same number, the duplicate is returned to the issuing storeroom, and the original is filed.

Material Received Slips—When material is received at the storeroom, a statement, giving order number, amount, unit price, date received and account charged to, is sent to the main office. This form is compared with the original requisition on file, for check on the delivery, and no voucher is approved until the requisition is satisfied.

Inventory Cards—Previous to July 1, 1911, stores were carried only for the hand patrol work, and repairs were made only on the few wagons used in that service. Consequently, for the new work, the storeroom and the

storeroom-accounting system became entirely inadequate. The first work in establishing the cost system was, therefore, in the storeroom. The floor space and shelving were more than doubled, a complete inventory was taken, the results being recorded on cards $7\frac{1}{4}$x$9\frac{1}{4}$ in., designed to fit a filing drawer $9\frac{1}{2}$ in. wide. One such card is made out for each kind of a supply in the storeroom, contract material being on yellow cards while noncon-

proper date in the Received column, and the On Hand column increased by the amount received.

Order Slips—Issues from the storeroom are made on a Storeroom Order Slip, showing to what the articles listed should be charged. This slip is also used for recording credits, the In column being for this purpose. After issuing or receiving supplies on the order slip, the articles listed are entered in the Issued or Received

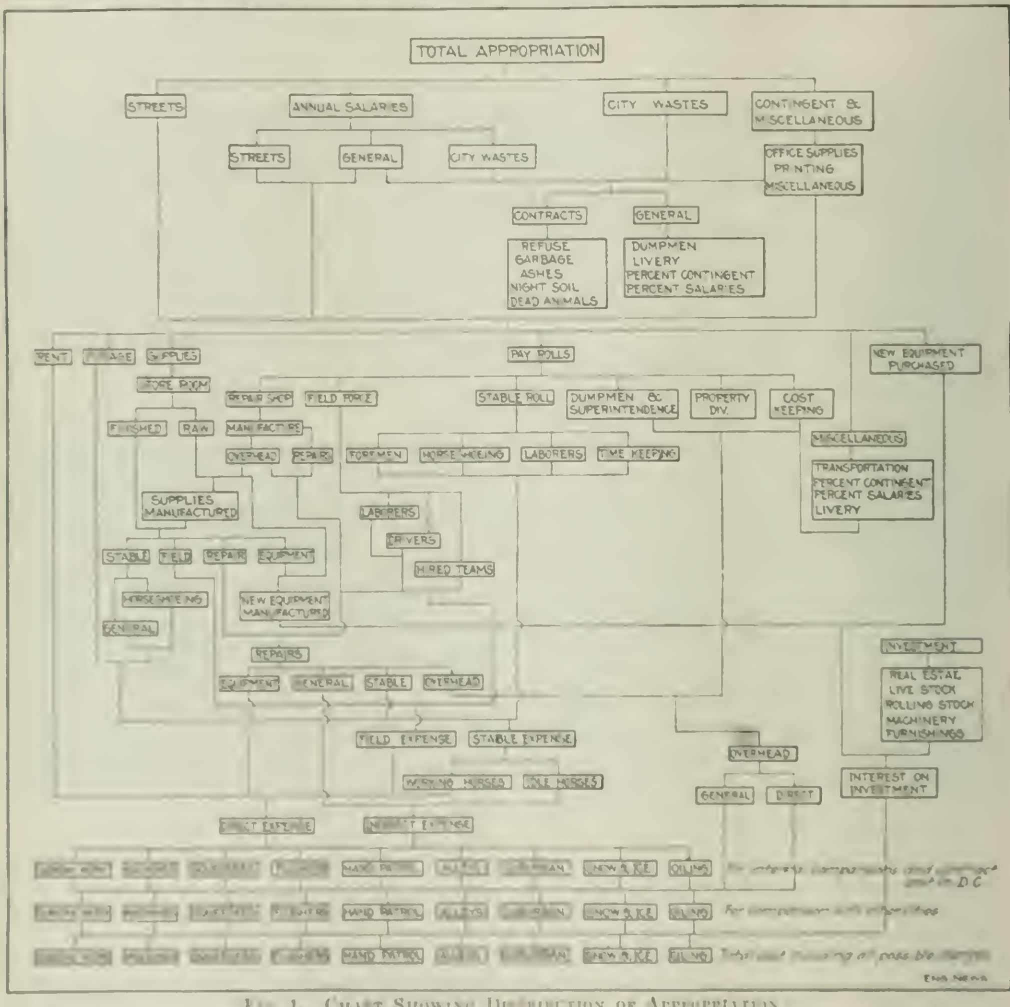


Fig. 1. Chart Showing Distribution of Appropriation

([illegible] such expenditures as are considered in obtaining [illegible])

[illegible] and manufactured material is recorded on [illegible] colored cards.

Requisitions are made up from the information given on the Stores Cards, and are recorded as to date and quantity under the heading "Material Ordered," the [illegible] order number being filled in upon the return of the duplicate requisition from the general office. [illegible] of material purchased, the order number and quantity are entered opposite the

[illegible] of the Stores Card, and the amounts are deducted or added to the quantity on hand.

Stock System—This Stores Card ledger consists of about 2000 cards and about half the time of one clerk is required to post entries, make out requisitions, etc. The value of stock averages about $20,000.

At first, inventories were taken every six months, but the error found was so small that, at present, material on hand is only counted when a new supply is ordered.

With each requisition is forwarded an account showing for each article the amount actually on hand and the amount called for on its Stores Card. This record is of value, not only as a check, but particularly as a guide to the Superintendent in going over the requisitions submitted for his approval.

Among the advantages of some such a stores system are a perpetual inventory of stock on hand, with all articles located, priced, and automatically replenished by maximum limits, which prevents overstocking, and by minimum limits, which prevents running short. Stock is issued only on written order, and all losses eliminated.

Time-Keeping

The appropriations for street cleaning divide the employees into two classes, those paid a yearly salary, the titles and amounts of which are specifically fixed; and those paid per diem.

The duties of the annual employees, which include all the foremen, clerks and higher officials, are not subject to sudden or frequent change, and so far as the cost-keeping is concerned, their time is added yearly as an overhead charge.

Semi-Monthly Time Reports—The time of all per diem employees is reported on the semi-monthly Time Report, consisting of a permanently bound page (*a*), printed and ruled with a column for name, rate of pay, and columns for each day, numbered above from 1 to 7 inclusive, and below from 16 to 22 inclusive, like the left-hand main sheet (*c*); a perforated transparent sheet (*b*), with heading, name and rate columns as on the left-hand page (*c*); the double-page main sheet (*c*), which is bound on a perforated stub; and a page (*d*), printed and ruled as the right-hand main page (*c*), which is a continuation of the left-hand side with the columns for days numbered to 15 and 23 to 31, and there are three extra columns for total hours and days and amount of pay due. Between (*a*) and (*b*) a double-faced carbon sheet is bound, duplicating any mark on the left page of (*c*) on both (*a*) and (*b*). For duplicating on (*d*), characters written on the right-hand page of (*c*), a single-faced carbon is bound between.

On the 13th and 28th of each month, the perforated, transparent sheet (*b*) is torn out and sent to the office, where it is used in entering names and rates on the payrolls, which are then forwarded to the Disbursing officer who transfers this information to the pay envelopes. At the end of the semi-monthly period, the main sheet (two facing pages) (*c*) is separated from its perforated stub. The removal of the carbon sheets leaves the foreman sheets (*a*) and (*b*), which are exact copies of each half of (*c*).

Upon receipt of the main sheet (*c*) in the office, the hours are added, reduced to working days of 8 hr. each. and the amounts due determined. These amounts are then entered on the payroll; and the timebook sheets (*c*), the original record, are bound and filed as the permanent office record. As indicated above, the foreman is also enabled to retain a carbon copy of the original record. This method of time-keeping, as compared with the old method, has eliminated several duplications with the consequent probability of mistakes. Disputes between foremen and office are avoided; clerical work in the field and office is saved and it is possible to pay off one day earlier.

Shop Methods and Accounts

The shops of the Street Cleaning Division comprise a wood-working shop, blacksmithy, paint shop, tin shop, harness and leather shop, broom-making shop, and a general repair shop. Modern power-driven tools, such as an engine lathe, boring machines, power hammer, band saw and planer have been installed, and all repair work is done at the department's shops. In addition, carts, wagons, etc., are built, and such supplies as hand- and machine-brooms, pan scrapers, waste-paper cans, etc., are manufactured.

The greater part of the repair work is on the rolling stock, which is numbered consecutively, carts being 1 to 50, wagons 50 to 75, etc. As the same equipment is always sent out to each gang, and the repairs to each piece of apparatus are recorded on separate cards, these numbers also serve the purpose of job numbers.

Jobs other than repairs to rolling stock are given a key letter and numbered consecutively; all jobs which, when finished, are turned in to the storeroom, have the letter "A" followed by a number, and ordinary jobs have "B," with a number.

Work Orders—The storeroom Order Slip, previously described, when filled out by the shop foreman, is also used as a work order. Each shop is provided with a small rack of four compartments for holding duplicates of these work orders, the first compartment for a job under way, the second for that to be next taken up, the third for future jobs, and the fourth for finished work. The original work orders are filed in a similar manner in the storeroom which is connected to the shop office.

Shop Methods—When a job is finished, the workman removes the slip from the first compartment of his rack, signs, dates and places it in the compartment for finished work. The slip in the second compartment is then moved to the first, the first of those in the third compartment moved into the second, and work commenced on the new job.

Slips are collected frequently from the Finished Work-boxes and turned into the storekeeper, who immediately rearranges his rack to correspond to those in the shops, calling in any material remaining from the old job and issuing that called for on the new order slip.

If additional material is found necessary as a job progresses, the storekeeper adds it to the slip in his rack. Each day the foreman looks over the active slips of this rack and sees that none but proper material and in proper amount has been issued.

After crediting any material remaining from a job, the original and duplicate order slips are fastened together, the material charged off the Stores Cards, and the slips are then sent to the main office for posting on the cost records.

Paint and Harness Shops—In the case of paint and harness shops, it has been found necessary to vary the normal shop procedure. It is impossible to issue and return leather and paint after each job without driving the system to extremes. Leather and paints are accordingly issued in small quantities, these being charged on an Order Slip as a supply to the shop. When turning in work orders, the amount and kind of paint, or leather,

used is estimated by the workman. In the main office, a perpetual inventory is kept, and checked at the end of each month, by an actual inventory of material on hand in the paint and harness shops.

General conditions are such that a bonus or even piecework system is impossible; but for manufactured articles, a standard has been set and a certain quantity and quality demanded.

Time Slips—The Time Slip records give the time of

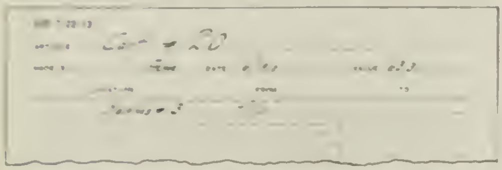


Fig. 2. Front Face of Equipment Card; Actual Size, $7\frac{3}{4}$x$4\frac{3}{4}$ In.

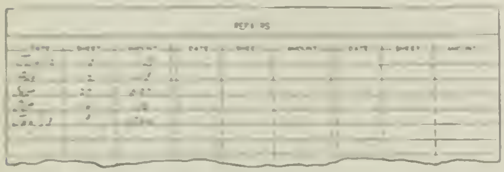


Fig. 3. Reverse Side of Equipment Card

the shop employees. Each man is listed on a separate slip headed with his name, number, and rate of pay per day. The slips are kept by the shop foreman, the job number being placed opposite the time of starting. At the close of the day, the time and amount chargeable to each job is calculated, and the total hours recorded are posted to the man's credit on the Semi-monthly Time Report, previously described.

When the Time Slips are received at the main office, the overhead charge on each job is determined and entered in red ink at the right of the Amount column. This overhead charge is the expense of per diem foremen, storekeepers, timekeepers, etc., at the repair shop and is charged as a percentage of the direct labor cost.

Repairs and Manufactures—As the work of the shops can be divided into two general classes—Repairs and Manufactures—two corresponding office records are compiled. The monthly Repair Sheet, with column headings, material, date, time, total charge to, is used for all repair work whether on rolling stock or "B" jobs; and the Manufactures Sheet, with column headings, date, material used, time, remarks, is used for new equipment or new improvements—all "A" jobs.

The Repair Sheets are made up from the Storeroom Order Slips and the Time Slips. For convenience, the Repair Sheets are grouped as far as possible, all cart repairs being placed on one sheet or set of sheets, wagon repairs on a second set, "B" jobs on a third, etc.

Equipment Records—Repairs charged on these sheets are transferred to Equipment Cards (Fig. 2), one such card being made out for every individual piece of apparatus owned by the department. The face of these cards record the manufacturer, date and value, as well as its present location, thus forming a convenient equipment account. The reverse side contains a record of the cost of repairs, the Repair Sheet numbers, locating the details of each job for reference. This record of repairs is valuable in comparing the relative efficiency of similar kinds of apparatus.

Record of Manufactures—The Manufactures Sheet is made up similar to the Repair Sheet, the quantity manufactured being credited on Storeroom Order Slips. At the end of each month, these sheets are totaled, incomplete jobs are transferred to the new sheets, and in the case of brooms or other supplies made up in quantities, an average cost is obtained for the month. This is again divided into the average unit cost of each component of the manufactured article, and the information is recorded on the Manufactures Index cards, 5x8 in., giving a comparative unit cost record, showing increases or reductions from previous months.

Materials Record—The Material Sheet gives a record of finished supplies received or returned by foremen, stable losses, etc., the information being obtained from Storeroom Order Slips. A check on the Material Sheet is obtained from the Foreman's Inventory, which is a printed list of all ordinary tools and supplies with column headings to be filled in, on hand, received, sent to storeroom, lost or stolen, remarks. The material on hand in the toolhouses or lockers is also given.

The Supply Summary, 5x8-in. card, collects and condenses the information of the Material Sheet and Fore-

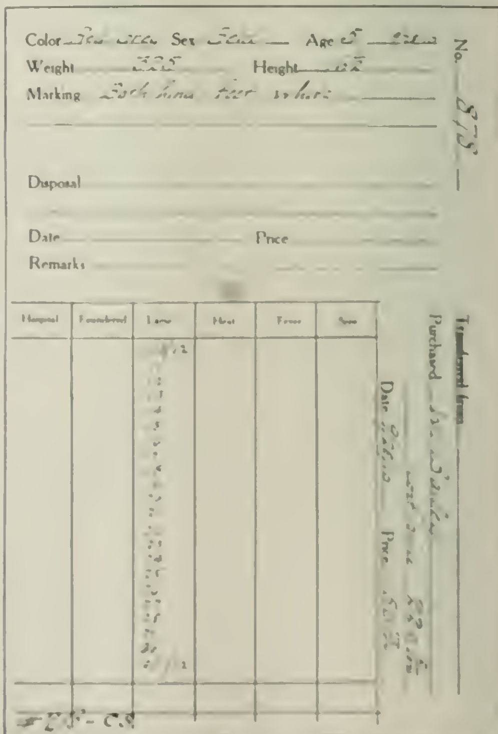


Fig. 4. Horse Identification Card; Actual Size, 6x4 In.

man's Inventory in an account which shows immediately any abnormal issues to the foremen or change in the stock carried in the toolhouses or lockers. It also gives a comparative record of supplies issued to or carried by different foremen.

Stables

Horses are obtained by purchase or through transfers from other departments. Every horse is given a description and a number by the district veterinarian. Upon entering the street-cleaning service, this information is recorded on a blue card (Fig. 4), 4x6 in. A disability record is posted from the daily reports of the stable foremen, which shows the assignments of the various horses and is useful in deciding when horses are not rendering efficient service. Upon condemnation, the data and method of final disposition are also entered.

A distribution of the number of horses for each division of the work, under normal conditions, is authorized by the Superintendent. This is entered on the same sheet as the Stable Profile, each time a change is made, in the form of a table, giving also an equipment and labor distribution.

Stable Profiles—The Stable Profiles (Fig. 5) show graphically, on standard profile paper, information obtained from daily reports of the stable foremen, such as the number of horses in the stables, sick, convalescent, available for work, and working. The line of normal distribution given in the tables is also plotted on the same scale. Three separate profiles are kept, one for each stable, and a combination one for the entire division.

Distribution of Stable Costs—For cost-keeping purposes, a monthly Horse Distribution Sheet is arranged from the normal distribution tables which accompany the Stable Profiles, and the daily Horse Distribution Report. If, on account of bad weather, Sundays, lack of drivers, etc., the regular quota of horses has not been worked, their expenses are still charged, as maintenance goes on just the same. In addition, any extra horses which have been used by any division of the work are charged directly. The total expense of the remaining extra horses is divided *pro rata* monthly. The monthly total of horse-days is divided into the total costs for forage, horse shoeing, etc., to obtain the cost per horse per day.

Supplies, other than forage, are issued on the regular Storeroom Order Slip, signed by the stable foreman. Forage is requisitioned for monthly on the contract requisition. Theoretically, this forage passes through the storeroom as though an ordinary supply. No rations are fixed, but each foreman is allowed to use his own judgment as to the needs of his stock unless the cost records and the condition of the animals indicate the advisability of a change. Comparisons between the two stables are made each month, and each foreman is furnished with the costs in his stable.

Forage Records—Forage is drawn out but once each day (there being less possibility of error with the fewer drafts) and later subdivided for each meal. A record of the quantity used is forwarded daily to the main office on Forage Slips, and entered on the Forage Account, which is a perpetual inventory. Forage received at the stable is weighed, and the result sent to the main office with an inventory of the amount on hand, which is compared with the Forage Account, corrections made, and the amount received added. This corrects a small error in weighing and any losses. The foreman is always notified of this error, and an investigation is made if the amount is too great.

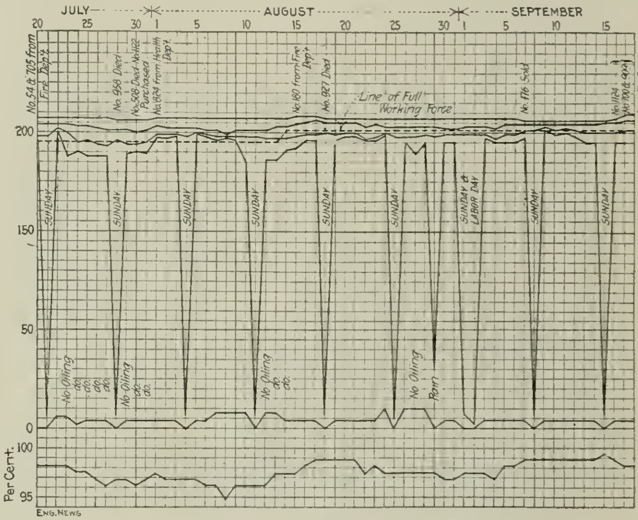


Fig. 5. Stable Profile

(Top curve shows total horses in department. Second shows number fit for work. Third shows second less those the stable boss considers in need of a rest. Fourth shows number working. Fifth shows number hired. Dotted line is line of full working force. Bottom curve shows efficiency of stable or percentage of horses fit for work to the total number.)

At the end of each month, this account is balanced and the cost of feeding determined. This information is transferred to the Forage Sheet, which gives a comparative statement of forage on hand, ordered and fed; the cost of feeding and the cost per horse per day for a 6-months' period.

Cost-Data Sheets

In compiling the data sent to the main office, Stable Expense is taken up first. The cost of the different gangs is materially affected by this expense. It is entirely independent of the efforts of the gang foreman, and unlike payrolls, continues whether work is done or not.

Stable-Expense Sheets—The Stable Expense Sheet gives the summation of data from the stable, storeroom and repair shop, reduced first to actual cost, per horse per day; and, second, to cost per working horse per day. The second is the first plus a *pro rata* charge for idle horses.

The actual cost per horse per day for forage, labor, shoeing, stable supplies and stable repairs is found by dividing the total costs of these items, obtained from the

Forage Account, the semimonthly Time Report, the Material Sheets and the Repair Sheets, by the total number of horse-days obtained from the Horse Distribution Sheet.

The cost of feeding idle stock must, of course, be borne by each gang in proportion to the number of horses charged to each. This necessitates a new figure for a cost per working horse per day. This is found by adding to the actual cost per horse per day the result of dividing the total idle-horse expense by the number of horse-days charged against all divisions of work as given on Horse Distribution Sheet.

The total cost of forage, labor, shoeing, etc., may be found either by multiplying the actual cost "per horse per day" by the total number of horse-days or by multiplying the cost "per working horse per day" by the number of working days.

SECTION COST SHEETS—On a printed Section Cost Sheet, all items of the expense previously obtained are assembled and arranged for each gang to indicate the total and unit costs of cleaning for each division of the work, as well as the unit cost of each item.

To obtain the item for Forage on this sheet, the number of horses charged to the gang on the Horse Distribution Sheet is multiplied by the average actual cost per horse per day for forage on the Stable Expense Sheet. In the same way, the items of Stable Labor, Horseshoeing, Stable Supplies, Stable Repairs, and those bracketed as Extra Horses, are obtained from the Horse Distribution Sheet and the Stable Expense Sheet.

The items for foremen, laborers and hired teams are obtained direct from the Semimonthly Time Report. The item for section supplies is obtained from the Material Sheets.

The items for section repairs and general repairs are obtained from the Repair Sheets. All rolling stock is permanently numbered and each gang assigned sufficient equipment for normal conditions. Repairs to this equipment are charged direct. Sufficient extra rolling stock is carried to replace any being repaired or to cover extraordinary demands. Repairs to such equipment are divided pro rata to the various gangs and charged as general.

WORK SUMMARY SHEETS—From a Work Summary Sheet, the actual number of [illegible] days worked, the calendar days worked and the area cleaned is obtained. Each item making up the total cost for the month is divided by the area cleaned, giving the detailed costs per thousand square yards, from which comparisons are made between the costs of different methods of work, one gang's work with another similarly engaged, and the same gang in previous months.

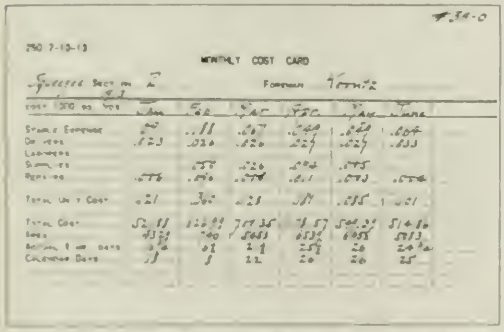


FIG. 6. MONTHLY COST CARD SENT EACH FOREMAN EVERY MONTH, GIVING COSTS FOR HIS GANG. ACTUAL SIZE, $7\frac{1}{4} \times 4\frac{3}{4}$ IN.

As this office study resulted in increased efficiency, an effort was made to secure the foremen's interest and coöperation by sending them each month on a Monthly Cost Card (Fig. 6), the principal features of the Section Cost Sheet, together with a letter indicating conclusions reached by office study, if important.

AUTOMOBILE COST SHEETS—The Automobile Sheet is a comparative record of automobile data. The item of supplies issued is from the Supply Sheets, the repairs from the Repair Sheets and the time from the Repair Shop Time Slips. Odometer readings are taken when tires are changed, and also at the end of each month, from which the mileage figures are computed.

SUMMARY SHEETS—A Summary Sheet assembles in convenient form, the information for all classes of work from the Section Cost Sheets and represents the total expenditures from the appropriation for street-cleaning work alone, the unit costs representing the first of the three totals referred to in the introduction.

Expenditures from the other appropriations are now brought in the account and the second and third set of unit costs previously referred to obtained. Direct charges are made wherever possible and other items divided *pro rata* according to their relation to the main charges. An annual Cost Sheet represents this account, the notes explaining the transactions. The figures for street cleaning have been obtained from the cost keeping, while those of the other appropriations have been taken from the accounting.

The error of the cost keeping, as shown on this sheet, amounts to about 1 in 1000. This account shows the excess of stock and equipment over that of the previous balance, the error, when the actual value of stock and equipment taken care of by the cost keeping is considered, amounts to only about 1 in 1900. This error is, however, positive and no doubt due to a considerable extent to the use of a slide-rule in working out cost data.

WORKING CHART—The Working Chart (Fig. 7) subdivides the Annual Cost Sheet into the cost-keeping records, which go into its make-up, forming a skeleton, not of expenditures, but of the cost-keeping system. This is emphasized in the original chart by printing secondary records in black, primary in red, office in brown, and those for which no special form has been provided—informal reports—in green.

The idea of this chart is purely a guide to the office, a record showing how the reports are being used and who is responsible for the making up of the different records. This feature of having, under each record, the name of the party responsible for its accuracy and upkeep has proved almost invaluable. Any question as to responsibility is immediately settled by referring to the chart and any change in form shows exactly what records must be altered to suit same.

CONCLUSIONS

That increased efficiency has resulted from the establishment of a cost system is plainly shown by the de-

creased unit costs in every class of work. No large outlay for equipment or labor was required and no changes in personnel were made in the development and application of the cost keeping.

At the present time, all the office force necessary to keep up the cost-keeping system is done by five men, the entire payroll amounting to less than $4000 per year. Previously, about $1500 per year was expended in keeping rcords now included in the cost system, such as statistics of quantities of work done, arrangement of schedules, etc. The printing is now done in the office and the labor employed included in the above figure.

The principal advantages of the cost system may be summarized as follows:

(1) Gives the detailed cost for each gang, for each class of work or for any particular feature thereof, in such form as to admit of direct analysis of any variation from previous costs or comparison between similar details of other work.

(2) In the same way, gives the result of any change in methods of working.

(3) Provides a means of determining the relative efficiency of foremen or laborers, a tangible record for educational purposes, giving in money the effect of any internal change in the make-up of a gang and means of competitive comparison between gangs.

(4) Gives records of intermediate costs, such as stable, repair-shop or office expense, in which the greatest possibility of saving lies, in terms which admit of comparison with other departments or firms, as well as inter-

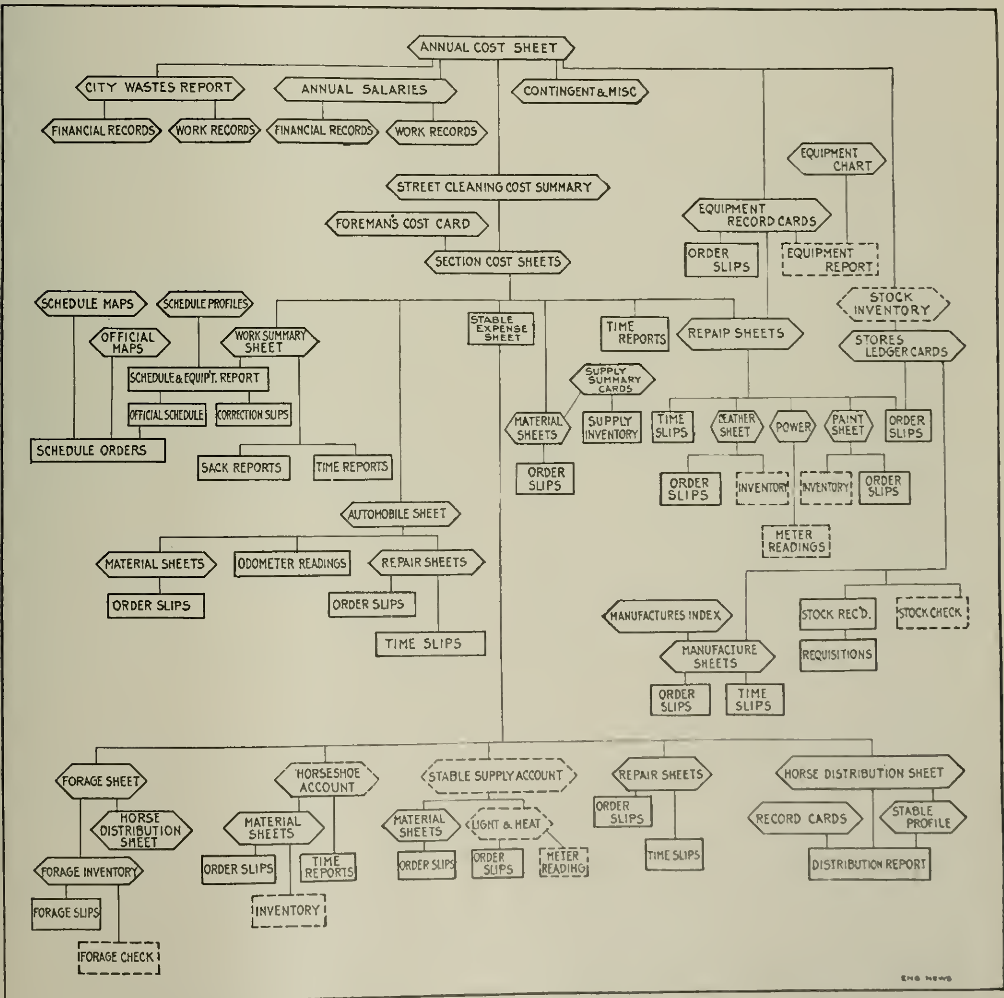


Fig. 7. Chart Showing the Different Records of the Cost-Keeping System and How Compiled to Make Up the Annual Cost Sheet

(Original records for which a regular form has been issued are shown in a solid rectangle. Informal original records are shown in a dotted rectangle; secondary records for which a regular form has been issued are shown in a diamond-shaped figure; while informal secondary records are shown dotted.)

and comparisons between two units, such as two stations of the same department.

(5) Gross repair costs, which in time, will admit of comparison as to relative efficiency of two similar pieces of apparatus of different manufacture, as well as a check on excessive repairs.

New applications are constantly coming up to keep the system alive. Often some new item will creep into a standard report, be investigated and result in a new train of thought and study, with increased efficiency and renewed interest, not only in the new feature but necessarily in the routine which is required to develop the working figures.

The Wisconsin State Building Code

By Sidney J. Williams*

Previous to 1913, Wisconsin state building regulations consisted of a few isolated statutes on fire escapes, exit doors, elevator shafts and scaffolds; a comprehensive tenement-house law, embracing both fire-protection and sanitation, for cities of the first class (i.e., Milwaukee); and a tenement-house law of limited scope for smaller cities. The fire-escape law, which was enforced by the Bureau of Labor (succeeded in 1911 by the Industrial Commission) gave insufficient protection when applied to some types of buildings, while in other cases it was so unreasonably rigorous that it could not be enforced.

In the prevention of industrial accidents, very good results had already been obtained under a statute which, instead of prescribing specific machine guards, etc., simply laid down the broad principle that all places of employment must be made reasonably safe, and empowered the Industrial Commission (subject to court review) to fix specific standards of reasonable safety. These standards or "general orders," being a creature of the Industrial Commission, could of course be altered, interpreted or suspended by the Commission at any time. As a result of this elasticity, and of the Commission's policy of having the actual detailed orders drafted by practical shop men and manufacturers, a great improvement in shop safety and sanitation was brought about without unnecessarily burdening the manufacturers or arousing their opposition.

The legislature of 1913 decided to apply this same method to the subject of building regulations. This was easily done by amending the statute mentioned in the preceding paragraph, to include public buildings as well as places of employment. The latter terms were so defined as to include practically all buildings except private residences; the term "safe" had already been defined to cover life, health and welfare. Specific statutes on fire escapes, etc., were repealed, with the single exception of the tenement-house law for Milwaukee, which had proved satisfactory. The way was then open for the Industrial Commission to formulate, adopt and enforce a comprehensive state building code on a much more elastic basis than is usually possible.

The Commission's broad power along these lines was subject to four limitations, which were really more beneficial than otherwise:

(1) The Commission's jurisdiction does not cover private residences.

(2) The code is confined to the protection of life and health. Ordinarily such protection must be sought by the same means, and with the same results, as the protection of property. There are some regulations, however, such as fire-limit restrictions and the limitation of the size of one-story buildings, which are a necessary precaution against a general conflagration, but are not necessary to the safety of the individual occupants. Such regulations cannot be included in the state code but must be covered by local ordinances.

(3) The code must be "reasonable." This statutory provision simply enforces, by the threat of court review, the policy which a wise commission would pursue in any case. It is the uniform policy of the Wisconsin commission to apply the criterion of reasonableness very strictly, not only to all its general orders, but also to the application of these orders to particular cases. The Industrial Commission will not order any safeguard on a machine or on a building, unless the resulting benefits will justify the expenditure. Under a rigid specific statute this policy would put the Commission in the undignified attitude (to say the least) of winking at a violation of law. Under the Wisconsin statute, as stated above, the Commission can legally follow the obviously businesslike policy of altering, interpreting or suspending its own rules if necessary in order to "make the punishment fit the crime."

(4) A very important practical limitation is that imposed both by the limited funds of the Commission and by its general policy, namely, that the code must be enforced largely by the cooperation of fire chiefs and other local officials. The statute requires all local officials to enforce the orders of the Industrial Commission; but efficient cooperation cannot be obtained with a club. The Commission has tried to insure such cooperation by sending copies of the tentative code to architects and fire chiefs throughout the state, for criticism, and by holding public hearings in several cities; and is prepared to make any reasonable modification in the code to meet local conditions. This may not make the Wisconsin code a technically perfect document, but the Industrial Commission feels that it is wiser to aim at 80 or 90% of the ideal and get it (or most of it) by peaceful methods as far as possible, rather than to ask for 100% and, by hard fighting, get perhaps 50.

This proposition, of the necessity of securing local cooperation, has an important corollary. The framers of the Wisconsin code believe that if the village (or small city) fire chief is to be expected to read, understand and sympathetically enforce the state code, it must be both easily intelligible and brief.

To make the code brief, only those points were covered which, under conditions actually existing or liable to exist in Wisconsin, constitute a real menace to life or health, and the emphasis is placed on the points which constitute the greatest actual menace. Readers of the code will thus find that fire-protection has received the most attention, sanitation the next, and structural design the least.

It is apparent from the foregoing considerations that the Wisconsin state code will not take the place of a local code in any city or village large enough to have fire limits.

*[illegible] Industrial Commission of Wisconsin, Madison, Wis.

Such a limitation of the scope of the state code is believed to be desirable. There is much truth in the common contention that differing local conditions require different treatment. Moreover, common sense and psychology agree that the best way to interest a man in anything is to give him something to do. The best way to secure the coöperation of local officials in enforcing a state building code, is to leave to them the task of working out local regulations to supplement the state code. The scope of such local regulations will depend on the size of the municipality; ranging from a simple fire-limit ordinance to an elaborate code which might include, among other things, detailed specifications on structural design and workmanship. In some particulars, e.g., the limitation of nonfireproof construction, the local code might well set a higher standard than was considered feasible for the state code. Even the smallest municipality will be encouraged to require building permits and will be assisted in working out a simple and economical system of building inspection. The Commission considered the advisability of requiring a state building permit, except in cities which require a city permit; but this was given up as being too obnoxious and irritating in localities where considerable missionary work is necessary to overcome the popular prejudice against any building restrictions at all.

The code was drafted by an advisory committee of architects, with the assistance of other architects and representatives of various interests. The Industrial Commission's building inspector, as secretary of the committee, handled the necessary correspondence and investigations, consulted with specialists on various subjects and drafted the various sections for discussion by the committee. Existing codes were consulted and used in varying degrees.

The code was first printed in tentative form and distributed for criticism. The discussions at the public meetings have brought out a number of suggestions; most of these deal with minor matters, and most of them will probably be accepted; none was really vital. No objection has been heard as to the general purpose and essential features of the code.

After all criticisms have been received, they will be considered by the building code committee, which will then make a final report to the Industrial Commission; the code will then be formally adopted by the Commission, probably about Aug. 1, and will become effective thirty days later.

Arrangement and Contents

The arrangement of the code was chosen with the object of making it as easily intelligible as possible. The first four "parts" apply to all classes of buildings; the last four take up the four classes into which all buildings covered by the code are divided, and give the requirements peculiar to each class.

Part I. Scope of the Code—This part briefly defines the application of the code to new buildings, alterations and changes of occupancy. The question of fire escapes and other fire-protection in existing buildings is not covered by the code but will be the subject of other "general orders" to be issued in the near future.

Part II. Definitions and Standards—Here are defined four types of construction—fireproof (wood floors and trim permitted), mill, ordinary (brick walls and wood-joist floors), and frame (including veneer). This part also contains specifications for standard fire escapes, inclosed fireproof stairways or "smokeproof towers," horizontal exits, etc.

Part III. General Requirements—In this part are included the usual limitations of height and area of buildings; minimum sizes of courts; construction, size, ventilation, etc., of toilet rooms; protection of boilers, furnaces, stoves, smokepipes, steam and hot-air pipes; and similar subjects. The most interesting section of this part, however, is one which provides that all buildings must be designed and supervised by competent persons. This provision has been criticized as being of no practical value, since there is no architects license law in Wisconsin, and since the Industrial Commission is hardly in a position to pass on the competency of all architects, engineers and builders in the state. It was felt, however, that a definite stand should be taken against the designing and construction of buildings by irresponsible parties, even though a complete enforcement of this regulation is impossible.

Part IV. Structural Design—This section gives permissible floor loads and unit stresses. Both are fairly conservative.

Part V. Factories, Offices and Mercantile Buildings—This is mainly devoted to the fire-protection of such structures, with an especially complete section on stairway requirements.

Part VI. Theaters and Assembly Halls—Existing theater ordinances offered plenty of material for this.

Part VII School Buildings, Libraries and Museums—Here again the fire escape and stairway requirements were the hardest problem, and are the parts to which most attention is desired.

Part VIII. Apartment Houses, Hotels and Places of Detention—This classification includes practically all buildings, except residences, in which persons sleep at night. The principal requirements are for fire-protection.

In the foregoing discussion, many features of the new Wisconsin code, relating to sanitation, ventilation, lighting, and other subjects, have not been mentioned at all for lack of space. The emphasis has been placed on fire-protection because that is actually the greatest problem which had to be met.

Experience will no doubt indicate the necessity of changes in and additions to the code, and may disprove some of the arguments developed in this article. When changes become necessary, they can be made without any legislative investigation or special machinery, thanks to the elastic basis which is the most important feature of the Wisconsin code.

A Reinforced-Concrete Pontoon, for a landing stage for ferry service, has recently been put into use in the Harbor of Sydney, Australia. The pontoon is 100 ft. long, 13 ft. wide at one end and 68 ft. at the other, 7 ft. 9 in. deep, with a 32-in. freeboard. The bottom is flat, and the sides and ends are sloped to an angle of 70°. Special attention was given to the design of the reinforcement, with a view to enable the construction to withstand the excessive strains likely to occur should vessels be berthing at each side of the pontoon at the same moment. In the construction of the top and bottom of the pontoon, allowance has been made for a live load of 150 tons, which will be distributed over the center length between the posts. The whole structure is divided into 48 water tight compartments by solid reinforced-concrete walls. It weighs about 650 tons. A view and a brief description appear in the "Commonwealth Engineer" for June, 1914.

A Box Type of Abutment for Subways at Memphis, Tenn.

By Paul D. Fuqua*

For some subways on grade-separation work, at Memphis, Tenn., a box type of combined abutment, curb pier and sidewalk span was adopted.†

The streets to be carried under the tracks were generally 60 ft. wide and the length of subways between right-of-way lines 100 ft. or over. As it was desired to reduce to a minimum the length of time during which trains would have to be operated over falsework and temporary tracks, it was decided to make the deck of slabs cast in a yard adjacent to the subway, these being set in place on the substructure after they had thoroughly seasoned. By adopting this method, it was possible to cast the slabs in advance and have them ready for use. The heaviest slab weighed about 40 tons and was easily handled by a 100-ton wrecking crane. Fig. 1 shows one of the large parapet slabs being placed in this way.

The city ordinance under which the work was carried out, provided that one line of supports be placed in the middle of the street and two at the curb lines. The designs for the first two subways to be constructed under this ordinance provided independent footings for the bents at the curb lines and for the abutments (which latter were of the counterfort type). With this type of construction (Fig. 1), it was necessary to cast each line of slabs in four sections, two of which covered the space between the curbs while the other two covered the sidewalks.

In the two following subways to be built, a box type of abutment was adopted, which combined in monolithic construction the three former subdivisions of curb bent, counterfort abutment and sidewalk slab. A typical design is shown in Fig. 2, and a section through the center line of one of the curb piers (which were spaced 8 ft. to 9 ft. apart) is shown in Fig. 3. Fig. 4 shows one of the subways under construction, and attention is called to the method of finishing the ends of the box-type abut-

*Assistant Engineer, Morgan Engineering Co., Dayton, Ohio.

†The subways are on a line of railway which extends along [illegible] Ave. toward the Memphis bridge. The two first subways with separate abutments and curb bents are at [illegible] Boulevard and Mississippi Boulevard. The two with box abutments are at South Third St. ([illegible] ft. long), and South Main St. ([illegible] ft. long), the length of the latter being due to a Y track connection to the new station of the Illinois Central R.R.

The right-of-way on Railroad Ave. is 100 ft. wide and the tracks were elevated in connection with the construction of the new union station, which was opened in 1913. This station is owned by the Memphis Union Station Co., of which W. F. [illegible] was Engineer of Construction, and he was also engineer for the Board of Control appointed by the four railways interested to represent them jointly in carrying out the track-elevation work and subway construction adjacent to the station. The box abutment design described in this article was designed by Mr. Fuqua while acting as Assistant Engineer under Mr. [illegible].—Ed. "Eng. News."

FIG. 1. CONCRETE SUBWAY WITH SLAB SPANS AT MEMPHIS, TENN.

(The wrecking crane is setting a parapet slab on one of the street spans. The sidewalk spans in this case are similar but smaller slabs.)

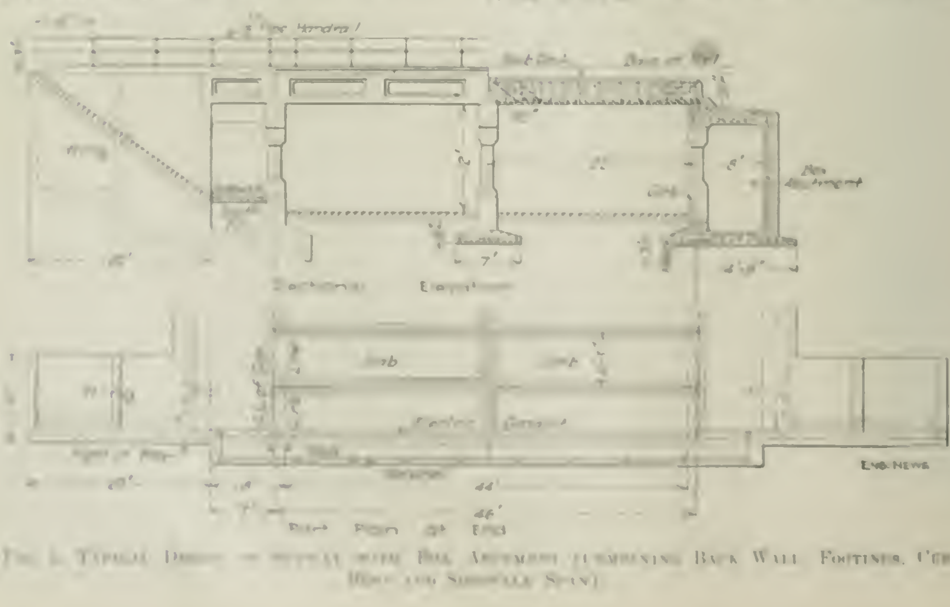


FIG. 2. TYPICAL DESIGN OF SUBWAY WITH BOX ABUTMENT (COMBINING BACK WALL, FOOTINGS, CURB BENT AND SIDEWALK SPAN)

ment. On the right side, the roof slab slopes up, and is paneled, which gives the bridge the appearance of having the slabs extend over the abutment. The falsework at this bridge was provided for four of the nine tracks which are normally operated over it.

In the comparative estimate made for constructing a subway 100 ft. long, and based on local prices for work,

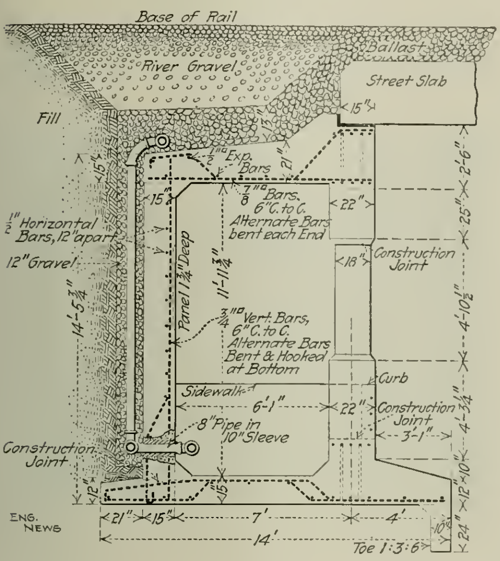


Fig. 3. Section of Box Abutment, with Drainage System

the saving in cost by adopting the box design in place of the design which provided independent curb bent, abutment and sidewalk slab, amounted to some \$1700. Among the items on which a saving was effected, may be mentioned the following:

1. The volume of excavation required was reduced by allowing the toe of excavation slope to be moved in from a point 7 ft. back from the face of abutment (with independent abutment) to a point 3 ft. back (with box-type abutment).

2. The volume of backfilling required after the abutment was finished was reduced by the amount of the excavation saved, some 6 cu.yd. per lin.ft. of subway.

3. A saving was effected in the cost of waterproofing the tops of the slabs by reducing the width to be waterproofed some 8 ft. over the sidewalks, on each side of the street. The cost of the waterproofing is usually 25c. to 30c. per sq.ft.

4. The cost of construction was reduced by an amount estimated at \$1 per cu.yd. of concrete on account of simpler form work, more massive construction, the fact that concrete could be placed and tamped more easily, and that the reinforcing steel could be bent and placed at less cost.

5. The yardage of concrete in the box-type abutment was about 1% less than in the construction which it replaced, although the sections were more liberally proportioned than in the design for the counterfort abutment. The latter provided shallower foundations, a face wall only 8 in. thick under panels, reinforced with only one set of reinforcing bars which were bent in at the counterforts and out in the slabs between them, to take care of both negative and positive bending moments.

6. A further saving was made in building the sidewalk slabs in place by eliminating the cost of setting them with the wrecking crane, which (under traffic) amounts to about \$1 per cu.yd. of concrete.

Among other comparative advantages which do not affect cost but which are highly to be desired may be noted the following:

1. A more impervious abutment wall is secured, on account of increased thickness and better tamped concrete. With the main reinforcing bars vertical, the stone in the concrete has much less tendency to "pocket" than when these bars are horizontal.

2. More impervious sidewalk slab construction is secured by building the slab in place, in that open joints at each end of the sidewalk slab, and between slabs at intervals of 6 ft. 3 in., are entirely eliminated.

3. There is better drainage, as indicated by Fig. 3. A pocket of gravel is provided over the sidewalk span, into which the water drains readily from the street spans. This water is carried off by a 6-in. vitrified-tile drain laid with open joints. Down pipes 20 ft. apart are laid in a 12-in. filling of gravel behind the abutment, each with an 8-in. pipe extending through a 10-in. sleeve in the wall, and an 8-in. vitrified drain at the back of the abutment.

4. There is an inherent advantage of monolithic construction over unit construction, in absorbing impact and vibration due to passing trains.

In the work described above, the superstructure was designed for a live-load equivalent to Cooper's E-55 load-

Fig. 4. Subway with Box Abutments Completed and Ready for the Slabs of the Street Spans

ing, with an addition of 50% of the live-load to cover impact. The substructure was designed to carry live-load plus dead-load with no allowance for impact. High-carbon deformed reinforcing bars were used. The percentage of reinforcement was arrived at by allowing a unit stress of 17,000 lb. per sq.in. tension in steel and 650 lb. per sq.in. compression in concrete.

The writer was employed on this work for 18 months as assistant engineer and made the design for the box type of abutment described.

The Ohio State Highway Department had already obtained over half a million dollars from automobile license receipts up to June 23 of the present year. The expenses of administration amount to less than \$100,000 a year, so that the Highway Department has already received five-sixths of the gross income from this source. Another \$100,000 is expected before the end of the year

Balcony Framing, McBride Theater, Victoria, B. C.

Some interesting balcony-framing features are found in the McBride Theater, recently built in Victoria, B. C., by the Victoria Opera House Company, Ltd. Following the general modern practice, the balcony is supported by a transverse truss, eliminating columns in the clear space of the auditorium below; radial cantilever girders resting on this truss and anchored to the back wall, support the balcony floor-beams. The radial girders are of unusually long overhang—up to 21 ft. at the maximum—and because of the mezzanine foyer below, they are of irregular shape.

The theater building is 90 ft. wide by 150 ft. long. The small-scale plan in the drawing herewith shows the arrangement of the balcony framing. The balcony-truss columns are set a short distance inside the side walls. The truss is 74 ft. 10 in. long c. to c. of end columns; its effective depth is about 8½ ft. There are seven radial girders of full length to back wall, and two auxiliary radials so located that they could not receive wall anchorage. The back end of each auxiliary radial is supported and anchored by a short loading girder in the plane of the floor-beams, while the middle of the radial is suspended from an 18-in. I-beam set just above the regular floor-beams and concealed under the second step of the balcony.

The end column just back of the boxes has the balcony fascia girder attached to it, but is stiffened in both directions, transversely by a beam connecting it with the wall column and longitudinally by a 15-in. floor-beam. The fascia girder is a light 18-in. plate-girder.

The Warren-system web of the balcony truss gives room for passing the radial girder between the chords, without interfering with the truss members. It is fastened by seat- and stay-gusset connections to the lower and upper chords. This position of the radial girder brings it considerably below the stepping of the balcony. In consequence, back of the balcony truss, where the mezzanine foyer required increased clearance, the line of the radial girder is offset upward, producing a reversed bend in the outline of the girder. The splices at the angles do not involve any particular complication.

The radial girders weigh about 6½ tons each. They were shipped and erected entire.

The balcony truss, whose makeup will be clear from the drawing, has its end panels sloped up, which gives it a sagging shape. Inclined passage-ways (in place of steps) from the street level to the balcony cross under the balcony truss at the ends at about the level of the bottom chord, and the headroom needed for these pas-

Fig. 2. Balcony Steelwork of McBride Theater, Victoria, B. C.

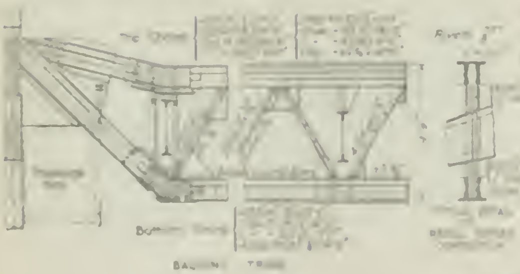


Fig. 1. Balcony Truss and Cantilever Girders of McBride Theater

sage-ways required the truss to be sloped up. Since the balcony floor is a curved surface, the clearance over the truss increases at the sides sufficiently to give ample room for the sloped panel.

The total weight of the balcony truss is 51 tons. The truss was assembled in the shop and all connection holes reamed to match, then knocked down, slipped in separate pieces, and erected in the field.

The roof and floors throughout the building are reinforced-concrete slabs with triangle-mesh reinforcing.

The McBride Theater cost $400,000. It is considered to be one of the finest buildings of its kind on the Pacific Coast. The steel framework has a total weight of 500 tons. The foundations are concrete piers through mud to bedrock, 20 to 50 ft. below sidewalk. They were constructed by sinking open cylinders and filling them with concrete after reaching rock.

Rochfort & Sankey, of Victoria, B. C., were architects for the theater, and H. W. Bittman, of Seattle, Wash., was structural engineer. Pinney & Mc Lellan were the general contractors, while E. E. Davis & Co. erected the steelwork.

Asphalt Paving Repairs in St. Paul, Minn., by Municipal Day Labor*

In 1912 the city of St. Paul, Minn., purchased a municipal asphalt plant at a cost of about $15,000. The plant consists of a Warren Bros. portable asphalt plant, one 8-ton asphalt steam roller, one scarifier, one Lutz surface heater, one fire wagon, one gyratory stone crusher, two portable melting kettles, six 2-cu.yd. steel-lined asphalt wagons, four ¾-cu.yd. concrete spreaders, one set of curb cutter's tools, nine asphalt rakes, testing scales, and the necessary small tools. The accompanying table gives an itemized cost of the plant.

	No.	Rate	Cost
Warren Bros., portable asphalt plant..	1	......	$4850
Steam roller, 8-ton....................	1	......	2250
Scarifier	1	......	365
Lutz surface heater....................	1	......	1800
Fire wagon.............................	1	......	112
Melting kettles........................	2	$425.00	850
Asphalt wagons, 2 cu.yd...............	6	171.50	1029
Concrete carts, ¾ cu.yd................	4	117.00	468
Koehring concrete mixer, No. 14.......	1	......	1950
Tandem steam roller, 8-ton............	1	......	2200
Koehring paver, No. 14................	1	......	1900
Chain belt paver, No. 15..............	1	......	1770
Chicago concrete mixer, No. 5.........	1	......	481
Tinius-Olson brick tester.............	1	......	475

The plant was put into operation Apr. 25, 1912, and during the season of 1912 was worked a total of 92 days. The amount of asphalt pavement turned out during the season was 19,428 sq.yd.; 15,040 sq.yd. of this was cut out work and 4388 sq.yd. burner work. Besides this, 5459 sq.yd. of asphalt pavement were put down for paving contractors in repairing pavements built under a guaranty; of this, 2363 sq.yd. was cut out work and 3095 sq.yd. burner work. The total cost was $6013, which was charged to and collected from the contractors.

All asphalt-paving repairs during the year 1913 were made by this municipal asphalt plant. The plant was put in operation March 30, and during the season worked 178 days. Asphalt paving to the amount of 44,191 sq.yd. was turned out; 43,296 sq.yd. of this was cut out work and 897 burner work. Asphalt repairs for contractors were made to the extent of 16,832 sq.yd., of which 16,039 sq.yd. was cut out work, and 793 sq.yd. was burner work.

*Data from recent report of Commissioner of Public Works.

The total cost was $21,613, which was collected from the company which had guaranteed the pavement.

For the City Ry. Co., 7370 sq.yd. of asphalt pavement were laid, and the cost, $11,031, collected from the company. For other public-service corporations, 1250 sq.yd. of asphalt pavement and 118 sq.yd. of concrete foundation were laid. This work cost $2340, which was collected from the various corporations.

About 246 sq.yd. of asphalt pavement was laid on bridges on which the city maintains the wearing surface; this cost $430, and was charged against the bridge building and repair fund at $1.75 per sq.yd. Small repairs were made for other city departments and charged against those departments at $1 per sq.yd. The repairs to asphalt pavements on which the guaranty period had expired and for which the city paid, amounted to 14,487 sq.yd. of cut out work. This repair work cost the city $18,490, an average of $1 per sq.yd.

The following shows cost and relative data regarding asphalt repairs for the year 1913:

Total area of pavements on which repairs were made in sq.yd..................................	222,327
Area or repairs in square yards................	18,733.18
Per cent. of area repaired.........................	8.42
Cost of repairs..	$18,921.34
Average cost per square yard of total area.....	0.085

Cuts in asphalt pavement made by the City Water Department, heating, lighting and telephone companies, sewer contractors and others, were repaired, at a cost of $2340, which was collected from the various companies.

Cost of Operation—The operating crew at the plant consisted of one foreman, one engineman, one tank man, four laborers, and a night watchman. Four teams were employed hauling asphalt from the plant to the work.

The street crew was made up of one foreman, one timekeeper, one roller man, two rakers, two tampers, one smoother and one cement man laying new pavement; and two shovelers, six scrapers and two teams removing and hauling old paving. The total expense was divided as follows:

Operation of plant, labor........................		$5,889.02
Fuel		1,024.47
Hauling material		1,559.18
Superintendence, livery, watchman, etc		3,164.21
Repairs and supplies.............................		1,658.05
Material		26,876.59
Street crew labor.................................		8,206.66
Hauling material to street.....................		5,068.40
Engineer and watchman.........................		1,391.65
Tools, repairs, etc................................		790.05
Total		$55,628.28
Total labor	$25,175.66	
Total material	30,452.62	
		55,628.28
Charged to outside parties	$34,194.23	
Charged to bridges................................	430.49	
Material on hand.................................	2 512.71	
		37,137.43
Total cost to city of work........................		$18,490.85

Municipal Motor Cars versus Horse Vehicles—The city of Fitzroy, Victoria, Australia, recently installed a motor truck instead of a horse-drawn vehicle for the collection of refuse. A recent report gives the comparative figures of the motor-truck and the horse-drawn truck operation as follows:

For the six months ending Mar. 31, the motor truck, working 110 days, had taken 995 loads (3483 tons). It had run 4923 miles at a cost for gasoline of 4.48c. per mile. The total cost of the service, including interest, depreciation, employment of extra carts when the motor was not running, etc., was $6340. For the corresponding six months of the year previous, the horse-drawn vehicles, eleven in number, which did the same amount of work as the one-motor truck, cost $5670, so the cost of the motor truck was $670 greater than the horse-drawn vehicles. The officials state that in their opinion the motor effected a greater saving than is shown by the figures. They say that the truck had not been used in the way for which it was intended, and has taken on more work than the vehicle it displaced.

The Throttle Dam, Raton, N. M.; an Earth Embankment for Sudden Flood Waters

The most irrigation projects' dependence in reservoirs is gradual throughout the entire wet season. For such conditions a definite percentage of the seasonal rainfall may be assumed as a reasonable basis for computing the amount of water available for storage. The Throttle Dam, on the ranch of Thompson and Malche about 15 miles southeast of Raton, N. M., was constructed to store the water of heavy freshets, where, owing to the nature of the catchment area, the total runoff occurs within a period of a few hours. Several prominent engineers reported unfavorably on the project, not daring to risk the construction of this type of dam at a site that was subject to freshets of over 15,000 sec.-ft. However, the embankment as built has stood without serious injury, despite the fact that twice during the course of construction, when the dam was two-thirds completed, flood waters poured over the crest and submerged practically the whole structure.

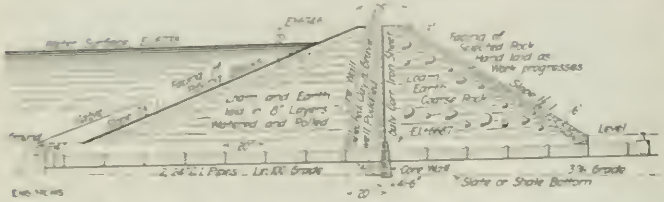


FIG. 1. DETAILS OF THROTTLE DAM NEAR RATON, N. M.

The purpose of this construction was to conserve water for irrigating portions of a 57,000-acre ranch where a prolonged dry period would mean the extermination of many head of cattle and stock. The reservoir has a capacity of 4000 acre-ft., which will be replenished twice during ordinary seasons. On the watershed above the dam site the average annual rainfall is 15 in. The catchment area is 58 sq.mi. It contains at the higher levels a large mesa which is so flat that in ordinary light rains there is practically no runoff from the cultivated lands thereon. The remainder consists of creek gorges. The rapidity of the runoff results partially from the steepness and bareness of the sides of these gorges, and partially from the fact that most of the rain storms are torrential. An investigation was made as to the feasibility of digging a diverting ditch $1\frac{1}{2}$ miles long to lead flood waters for irrigation, the attachment from about 30 sq.mi. of the upper drainage area, to a desirable reservoir site on an adjacent mesa outside the shed. This plan was abandoned because it would be impracticable to make the ditch sufficiently large to divert even a considerable fraction of the freshet runoff, and due to seepage and evaporation such a ditch would be almost dry except at times of heavy downpour. The estimated cost for a ditch of this character was $44,900.

DESIGN

The Throttle Dam (Fig. 1) is 1060 ft. in length along the top and 77 ft. in height from the lowest point in the foundation to the crest. A concrete core-wall 600 ft. in length, $1\frac{1}{2}$ ft. wide at the base and $2\frac{1}{2}$ ft. at the top extends from bedrock to a height of $17\frac{1}{2}$ ft. In front and above this is a puddle-wall of selected clay and gravel, of the dimensions shown on one of the drawings.

FIG. 2. VIEW LOOKING ALONG THROTTLE DAM DURING CONSTRUCTION

Fig. 3. Downstream Side of Throttle Dam, after Overtopping
(Only damage caused by flood was a small area old riprap washed out.)

This is completely faced on the downstream side with No. 12 gage galvanized corrugated ingot iron which extends from the concrete core-wall to the crest of the dam. The sheets composing this facing are 6 ft. long, have a side lap of 2½ in., a vertical lap of 4 in. and are riveted both ways with ⅜-in. rivets at 2¾-in. centers. The object of this sheeting is to prevent rodents from boring through the structure.

Upstream from the puddle wall the embankment consists of loam and earth thoroughly rolled and compacted, faced with basalt paving blocks having a uniform exposed surface, a minimum depth of 12 in. and a minimum weight of 50 lb. each. In the downstream portion, large rocks were compacted with the loam and earth and a rough rubble facing of rock 3 ft. thick at the crest and 6 ft. at the base was hand laid to a slope of 1½ to 1. Large trapezoidal spillways were provided on both ends of the dam, as shown in one of the drawings. Cutoff walls and aprons for the spillways were lined with concrete.

Intake Control

Water is drawn from the reservoir through two 24-in. cast-iron bell-and-spigot pipes, incased in concrete, carried from bedrock through the base of the dam, laid on a 1% slope. No gate tower was erected over the intakes but an auxiliary emergency device arranged by which the flow could be controlled from the crest of the dam. At the reservoir end of each 24-in. pipe a quarter-bend elbow is attached and turned upward so that the intake is horizontal. In the open ends of the elbows are fitted cast-iron valve caps which may be lifted to permit the inflow, by means of a plow-steel cable 1⅛ in. in diameter. This cable is led over 24-in. sheave wheels to a multiple-pulley windlass on the dam crest (Fig. 4). The amount of water drawn through the intakes is controlled by two 24-in. valves in an ice-proof shed located 141 ft. 7 in. downstream from the center line of the crest. This type of control is more economical than providing an intake tower within the reservoir, as very heavy construction would be necessary for such a tower to be able to resist the impact of large masses of floating ice, frequently 24 in. thick, common in that locality.

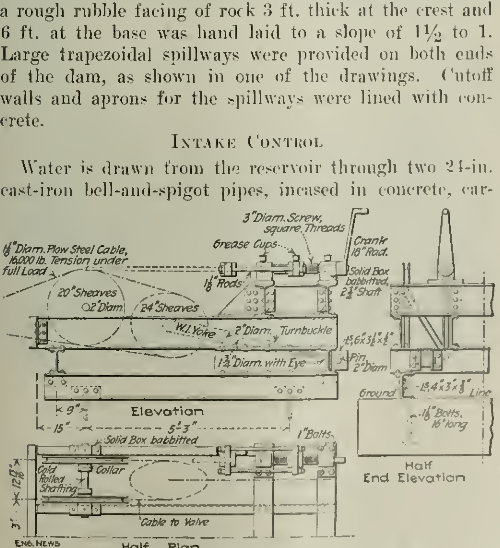


Fig. 4. Details of Sheave Control of Intake at Top of Dam

Construction

Earth and rock for the embankment were excavated from the adjacent hillsides with a steam shovel. This material was conveyed to the dam in 2-yd. dump wagons (Fig. 2). The earth was spread in 8-in. layers with wheel and Fresno scrapers and thoroughly wet by hosing. A four-horse roller weighing one ton per lineal foot of tread and consisting of a number of railroad car wheels, compacted this material.

Concrete for the core wall was mixed in a 1-yd. batch mixer. The proportions were 1 part cement, 2½ sand and 5 crushed rock. A special alkali-proof, slow-setting cement was first used, but although the proportions were accurately measured and care taken in mixing, it was discovered that after the concrete had been in place for five weeks it showed no signs of setting, and fell apart from its own weight when exposed to the action of seepage water. This defective concrete was removed, the cement condemned as unsatisfactory, and a standard portland cement substituted. No trouble was experienced with the latter brand. The reservoir has been filled to

the spillway level, and there is absolutely no leakage through the structure.

The cost of the dam and appurtenances was approximately $50,000. M. M. O'Shaughnessy, acting as Consulting Engineer, was in charge of the design and construction. The work was done by day labor under his direction. H. W. Blackburn was Resident Engineer.

A Machine for Laying Brick or Block Pavements

A machine has been designed and patented which will level, smooth and compact a sand or wet concrete base and lay automatically consecutive rows of brick or other kind of paving blocks, closing the joints, rolling the paved surface and leaving it ready for the joint-filling operation.

The machine travels on rails, laid carefully to a correct grade, on both sides of the strip to be paved. It is obviously intended only for straight stretches of uniform

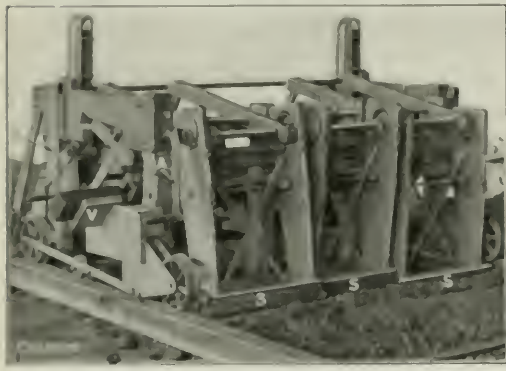


Fig. 1. Front View of Experimental Paving Machine Invented by William Bayley

Fig. 2. Side View of Bayley Paving Machine

kinds of paving. If the machine is motor-operated, the only manual labor necessary, other than that required of the operator, is the feeding of the blocks into V-shaped troughs on the sides of the machine.

The illustrations, Figs. 1, 2 and 3, show the front, side and rear, respectively, of an experimental machine built to lay a 6-ft. strip of paving. The front has three separately operated shovel edges S, which by means of cams and levers have a shoving and up-and-down motion which rolls the sand or wet concrete ahead of the machine and smooths and prepares the bed in advance of the bricks. The shovels can be detached from the links on the rocker and thrown over the shaft on top of the machine, so that any cleaning up can be done, as when commencing or stopping work. The V-shaped trough V (at the left on Fig. 1) is for feeding the blocks into the machine, which, in the case of this experimental one, is operated by turning the cranks A and B by hand.

Operation—To make clear the operation of the paving machine reference to Figs. 4, 5, 6 and 7 is essential. Fig. 4 shows the swivel arms 3 in normal position. The front shovel 4 is moving the loose sand or concrete ahead, and the back one 6 is acting as a tamper and smoother. The block box 1 is shown full with a row of blocks. The dotted line 7 is the path of the blocks 2, while in the act of being placed. The links 8 and 9 and the bent connection 10 swing from the block placer, being hung on shafts 11 and 12. They lift the block placer by means of contact with the stop angle 13, which extends across the machine. There are three sets of these links and connections on the machine.

When the block-placer descends to the position shown in Fig. 5, the fingers 14, which are attached to the hinged angle, or box end 15, come into contact with the shaft 17, which arrests the descent of 15, whereby the continued descent of 1 opens the rear end of the block-box and prepares a way for the blocks to pass out.

The box-front 15 is hinged at point 16. The box-frame 1 continues to descend and opens the block-box until the position shown in Fig. 6 is reached. The box 1 is now on the paving bed and has reached the end of its movement and has delivered the row of blocks on the paving bed, abutting those previously laid; except that the bottom plate 1 is still under the row.

Fig. 3. Rear View of Bayley Paving Machine

The bottom plate 1 is rigidly attached to the beams 37 as well as to the angle 18, which has an end extending out over the track at each side of the machine. These ends stop the movement of the beams 37 and the block box 1, as well as gage the position of the row of blocks from the tracks.

The links 8 and 9 and the arms 10 with the connection 10 continue to swing back away from the stop angle

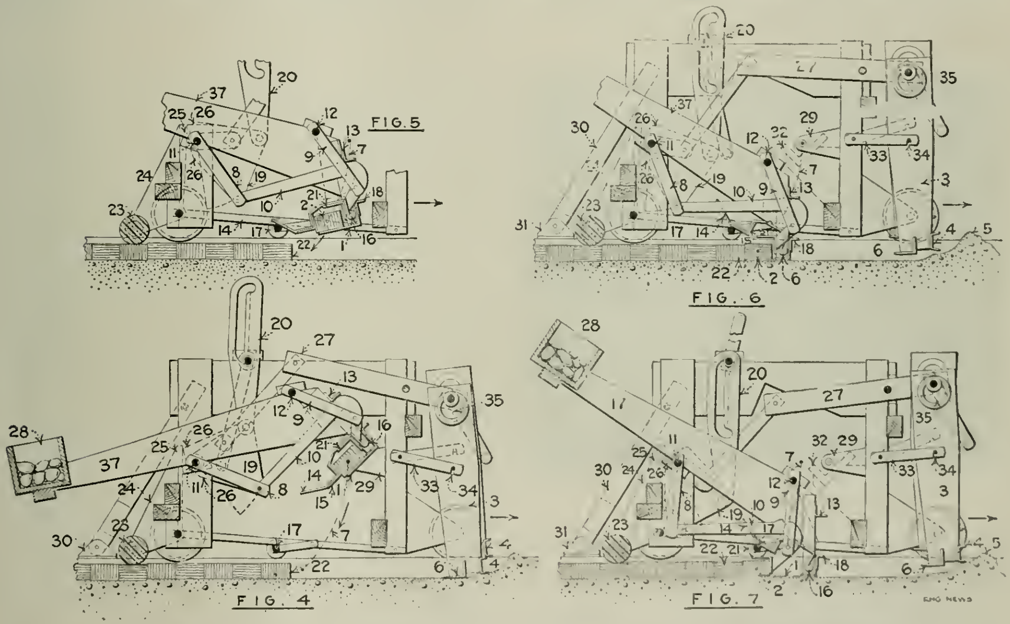
15, being propelled by the arms 19, which are on each side of the machine and are moved by the racks 20 until the end of the rack movement is reached, as shown in Fig. 7.

The angle 21, which extends across the machine and forms the front of the block-box, and is connected to the ends of connection 10, has pressed against the row of blocks 2 continually through this last movement, the whole machine is advanced by the pressure exerted against the shaft 11. Or in other words, the lower centers of links 8 and 9 and arms 19 remain stationary along the paving bed while the top centers, shafts 11 and 12 and the frame of the machine holding them, move forward.

This withdraws the plate 1 from under the row of blocks and passes the angle 15 over them. It will be seen that the row 2 has passed out of the machine, but by reason of the pressure exerted against it by the angle

In Fig. 6, the shovels 4 and 6 are being raised away from the paving-bed by the arms 27, until, as shown in Fig. 7, they have reached their greatest height. This raising movement prevents the shovels from being shoved into the mass of material in front of the machine and thus choked, but allows them to move this material forward gradually by taking off the top in small quantities, and gradually ramming down and finishing the bed. This is an important part of the working of the machine, for it is designed not only to make a good solid true bed, but to divide up the work of the machine so that when it is shoveling it is not placing blocks, and when placing blocks it is not shoveling.

In Figs. 4-7, the part 28 is a counterbalance box for the block placer; 29 is a stop for feeding the blocks into the machine. This experimental machine is fed from one side, but larger machines will be fed from both sides against an automatic adjusting stop in the center and by



Figs. 4-7. Showing Various Steps in Operation of Bayley Paving Machine

21 it is still clamped between angle 21 and the row of blocks 22 already laid. Hence, there is a clean, close joint between the rows 2 and 22, and row 2 is held suspended until the reverse action of the rack 20 takes all the parts back through the different positions shown by Figs. 4, 5 and 6.

As the machine is advanced, the roller 23 settles each row in turn, with all the pressure that is possible to put upon it. The roller 23 runs on its own wheel on the track. It is trailed from the rear axle of the machine by arms 24. These arms 24 have extensions 25, which come in contact with cams 26 at each end of the movement of the arms 19, of which the cams 26 are a part. Heavy contact at this point lifts the rear wheels from the track about 1/8 in. and thus throws all the weight of the rear of the machine on the roller and settles the blocks effectively.

two or more men. The part 30 is a pawl to resist backing and opposes the tendency of the shovel to back up the machine. The links 33 can be raised off of the pin 34 and turned up over the eccentric 35. When this is done, access is had to the paving-bed back of the blocks.

It is evident that the machine may be used for leveling cement or bituminous concrete as well as for laying blocks. To date, it has been used only for some factory floors, shown in the accompanying views, Figs. 8 to 10. It is claimed to be particularly adaptable to bedding brick or blocks directly in the soft concrete base, without the use of a sand cushion. In the views of the machine shown, it is being operated with asphalt blocks 5x12x3 in.

Two men working with this experimental machine laid 135 sq.yd. of brick pavement in a 9-hr. day, or at a labor cost of 3.67c. per sq.yd. With motive power, it is estimated that the cost would be about half. The

FIG. 8. ASPHALT-BLOCK FACTORY FLOOR LAID WITH BAYLEY PAVING MACHINE

FIG. 9. CONCRETE PAVEMENT LAID WITH BAYLEY PAVING MACHINE

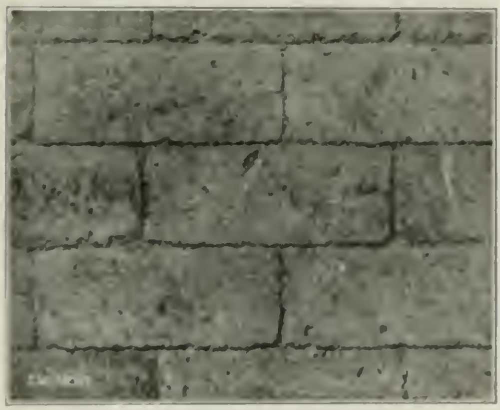


FIG. 10. ASPHALT-BLOCK PAVEMENT, SHOWING CLOSENESS OF JOINTS

speed at which the machine operated was limited by the speed with which the cement grout could be delivered in front of it. A larger machine would have an automatic block, or batch feeder, which would also economize time.

The apparatus described is known as the Bayley Paving Machine, invented and patented by William Bayley, President of the William Bayley Co., steelwork manufacturers, Springfield, Ohio.

Cement Joints for Sewer Pipe at Edmonton, Alta.

By J. M. Rose*

The difficulty of getting in Edmonton a sufficient number of skilled pipelayers and inspectors has led me to consider carefully possible methods of making cement joints in sewer pipe. It is a simple series of operations and, yet like many other simple things it is not always well done. Perhaps it is just because it is a commonly easy part of the work, that it is apt to be overlooked.

*Assistant City Engineer in Charge of Sewers, Edmonton, Alta.

Once a sewer is covered up, and the sewage entering it gets away freely, it is assumed that the sewer is in good working order, but that is not always so. The sewage may be getting out, or ground water may be getting in to an extent that seriously decreases the capacity of the sewer.

The common method of specifying sewer joints is to require a strand of oakum or hemp gasket all around the inner part of the joint and cement mortar to fill up the rest of the jointing space. The gasket prevents the mortar from entering the barrel of the sewer. In making a joint of this kind, the usual procedure is to dig a hole under the bell of the pipe last laid, insert the next pipe, calk the gasket all round the joint and complete the joint with cement mortar, using the hands to get it in under the pipe. From Ogden's "Sewer Construction," I take some directions typical of those which cover this method:

> All pipes and specials shall be laid to the grade given by the engineer . . . special care being taken that there is no sagging of the spigot end in the hub. . . . A narrow gasket of jute shall be provided by the contractor, to be well soaked in neat cement grout and introduced between the bell and spigot, and well and properly rammed. It shall in all cases be driven to the bottom of the hub to leave room for the mortar as specified. The space between the spigot and hub shall then be entirely filled with mortar thoroughly pressed in on the bottom sides and top and every precaution taken to secure a water-tight joint. The mortar shall be applied with a rubber mitten and rammed or compacted with a wooden calking tool. The joint shall be finished with a neat and generous bevel made with the mitten.

A careful and conscientious pipelayer can make an excellent joint in this way, but it is obvious, that, if he is at all slovenly, the lower half of the joint, which in a sewer is the vital part, is more likely to suffer. It is the most difficult part to get at, and the larger the pipe the greater is the difficulty. The danger is increased if the contractor is pressing the pipelayer to get along quickly and if the inspector is inclined to keep to the top of the trench. From that position he cannot see what the pipelayer is doing with his hands under the pipe. On a small job, where there is ample opportunity for careful inspection, and time is available, the method is not likely to be found unsatisfactory, but with thirty or forty miles of construction to cram into six months, I have found it apt to break down here and there.

If the pipelayer has any latitude at all, as often as

not he backslides and adopts another and easier method. Before laying any pipe, he places some mortar in the lower part of the bell of the pipe already laid, inserts the next pipe, and then finishes the upper part of the joint with oakum and cement, or with cement alone. Such a method leaves little chance of a leaky joint below the water run, but another danger is incurred. In the very act of inserting the pipe, the pipelayer is likely to squirt some of the mortar into the barrel of the sewer. This mortar, of course, can easily be removed with a scraper or a tight-fitting bag, but the pipelayer again may neglect to do this and the inspector may fail to detect it in one or two lengths.

I do not see how one can avoid running one or other of these two dangers. The engineer, who cannot always be on the job himself, can only choose the method that seems to him to offer the least chance of being carelessly carried out. The one method—calking oakum all round the joint before adding any mortar—involves the risk of a leaky joint, owing to the irksomeness of getting mortar into the bottom; the second method—placing mortar in the bell before introducing the next pipe—involves the risk of cement getting inside the sewer and forming a little ridge across the water run. In spite of this possibility, I have come to think this latter method the less dangerous. As a rule, not a great deal of cement does actually squirt through into the sewer, and the pipelayer has little temptation to omit cleaning out what does get in. Incidentally, I prefer the wooden scraper to the bag hauled through the sewer with a rope as pipelaying proceeds.

But many engineers who specify this method of first lining the bell with cement overlook an important point. Cement mortar alone in the bell will not support the spigot end of the next pipe. The spigot sinks down into even the stiffest mortar, and if the whole line is laid in this way you get a water run like the edge of a saw. Very little pressure is required to squeeze down the pipe into the bell. If the pipelayer steps on the pipe or if the backfilling is thrown on top of it while the mortar is green, it is enough to cause it to sag, even if the weight of the pipe itself does not carry it down. It is advisable, therefore, to lay a piece of hemp, about 6 in. long, on the lower part of the bell and then place the mortar on top of it. This may seem a clumsy proceeding but, if you try to introduce the hemp afterward, you will find you need to calk it away into the bell to raise the pipe, and in the larger diameters it is hard to raise the pipe in such a way at all. To raise the pipe with a chip of wood in the bell will not do as it lifts the spigot off the mortar, and any method of making the pipes concentric which depends on a finical trimming of the trench is not likely to be very successful. Hemp gasket is about the best and handiest material, but just before being used it should be dipped in neat cement grout.

In his "Engineering Work in Towns and Cities" (1908) Ernest McCullough quoted from Engineering News a specification which reads in this way:

Joints shall be made as follows: (1) Line with mortar the lower third of the entire circumference of the bell; (2) insert the pipe to be laid and a jute gasket freshly dipped in neat grout; (3) bring the pipe to grade and line, (4) calk the gasket tightly into the joint; (5) fill the joint with mortar mixed rather stiff, using a rubber mitten (6) tamp mortar into joint with an approved tool until it is solidly filled, (7) smooth on mortar, using a rubber mitten; (8) protect the cement (preferably with burlap) and all around the barrel of pipe with sand or similar material, tamping solid with an approved tool, (9) remove burlap and cover joint and pipe with fine material, (10) clean out and point joint on inside of pipe.

This is a better clause than is found in most specifications, though the manner of conducting operations (2) and (3) is not very clear. Mr. McCullough, in a note, states that he fails to see the necessity for specifying a gasket in sewer-pipe joints, except when the sewer is laid in water. But, as a few minutes' experimenting on the ground will show, it is difficult to get an even water run without the gasket in the bottom. The gasket in the top half of the joint is, of course, a safeguard against cement getting into the pipe. It may be argued that as we have to clean out any cement that gets in at the lower part of the joint, a little from the upper part will not materially add to the danger; but it is advisable to reduce the danger to a minimum.

The following is the specification we use at present in Edmonton:

The ordinary joint shall be made in the following manner:

(a) Lay along the lower quarter of the bell and just at the entrance a piece of Russian hemp or other approved material freshly dipped in neat cement grout. This hemp is to keep the pipe to be laid next from sinking into the mortar in the bell and must therefore be thick enough to keep the pipes concentric.

(b) Line the lower third of the bell with stiff mortar, covering completely the strand of hemp.

(c) Insert the pipe to be laid, pushing it home until it is hard against the inner end of the bell. Great care must be taken to see that the spigot end of the pipe rests on top of the hemp and does not catch it and jam it back into the bell.

(d) Calk into that part of the bell not already filled with mortar a strand of gasket freshly dipped in neat cement grout. This gasket after calking must not take up more than one-quarter of the space available in the bell for the whole joint.

(e) Fill the joint all the way around with stiff mortar, using a rubber mitten, and finish off the outside of the joint both top and bottom with a neat bevel. But no joint is to be completed in this manner until at least two joints have been calked in advance with the gasket as described in paragraph (d).

(f) Clean all cement from the inside of pipe up to 15 in. diameter by using a wooden scraper made in the form of a semicircle. Pipes over 15 in. and less than 22 in. diameter to have the lower half of the joints pointed on the inside. Pipes 22 in. diameter and over to have the joint pointed all the way around on the inside.

The method so specified is no doubt open to criticism but it is an attempt to work out a method which, taking full account of human nature and the actual conditions of pipelaying, should reduce the danger of leaky joints to a minimum. The trouble is not that a contractor may be dishonest. A good joint can be made about as easily and cheaply as a bad one. The trouble is simply that the pipelayer may find it awkward to make the bottom of the joint carefully and it is important to have a standard method that insures easy inspection and leaves as little room as possible for careless workmanship. There is nothing in the method suggested which a contractor could consider a hardship. It is easier than the method of calking a gasket all the way round before adding the cement, and it takes the same material. The latter method is almost sure to lead to leaky joints, if inspection relaxes for even a short time, or if the work is at all hurried.

It might after all be argued that the method I have recommended needs rigid inspection just as much as the other. It does need careful inspection, but this much at least can be said for it that once a pipelayer becomes accustomed to it there is little or no temptation to depart from it even if the inspector's back is turned.

Field and Office

Trenching a City Street for a 15-ft. Sewer

A very large trunk sewer in the Borough of Brooklyn, New York City, is being constructed, through some of the older sections of the city, with so little interference to street traffic that quite a thorough search of the locality has to be made to find the places where work is under way. Although the trench occupies nearly the full width

Fig. 1. Traveling Steam-Hammer Piledriver

of the street and is about 30 ft. deep in some places, the work is so expeditiously handled that less than a block is open at any one time. Within that distance, the excavating is made, the 15-ft. diameter reinforced-concrete arch sewer is built, and the backfill made simultaneously.

Driving the Sheeting—The timber sheeting is driven on both sides of the trench at the same time by two steam-hammer piledrivers, taking steam from a portable 30-hp. boiler and is taken through pipe and flexible hose connections. The piledrivers are mounted on travelers (Fig. 1) which run on light rails parallel to the trench.

Over the trench, on the top braces of the sheeting, are laid the rails which carry the light-steel trestle (Fig. 2) of the sewer-trenching machine; each post of the trestle is mounted on a wheel, which enables the whole outfit to be moved forward. The diagonal timber braces were added to the trestle framework by the contractor to give additional rigidity.

Trenching Machine—The illustration (Fig. 3) shows a Potter sewer-trenching machine (described in Engineering News, Apr. 28, 1898), which has been used considerably throughout the Middle West, but is little known to many Eastern contractors. This machine consists of a hoist traveler carried on the light-steel trestle shown in Fig. 2.

The traveler with loaded buckets is moved rapidly to the rear by a cable which starts from the upper drum of a 7x10-in. hoisting engine (in the shack at the left), passes along the trestle over the traveler, around a tail-block pulley or sheave at the far end of the trestle, and returns to the traveler, where it passes around a bull wheel, to which it is attached. Another cable starts from the lower drum of the hoisting engine and goes directly to an eye or ring on the front of the traveler. This cable holds the traveler stationary while the buckets are raised and lowered, and pulls it forward after the loaded buckets have been dumped. The buckets are raised and lowered by the main cable winding and unwinding on the bull wheel.

The traveler is moved by the engineman in the shack on signals from a man on the traveler. The buckets are cylindrical in shape, and hold 1 cu.yd. They are managed by the man on the traveler.

Excavation—The excavation is chiefly in sand. The earth is excavated by hand and raised in the buckets, 12 of which are constantly in use; two buckets at a time are run back on the traveler and dumped into one of two hand-pushed 2-cu.yd. tip cars, running on a narrow-gage track laid on the planks over trench bracing of the completed sewer and backfill. The cars are handled and dumped by two men. There is very little loose earth to be taken care of, for after the material from the first cutting is taken away the material from the remaining excavation is dumped directly into the backfill as fast as it is excavated.

The excavation amounts to about 30 cu.yd. per lin.ft. of trench, and the machine handles about 250 cu.yd. per [illegible] 8 hr., or makes a progress of 8 ft. of sewer per day, with a force of about 60 men.

Concreting—Following the piledrivers, on the left-hand side of the street is a steam-engine-operated 17-cu. ft. concrete mixer (Fig. 1) which dumps directly into a chute leading to the forms for the arch sewer. Steam is furnished by the same portable boiler which supplies the piledrivers. About 30 laborers are engaged in the concrete work and two masons on the brick invert. The

Fig. 2. Traveling Steel Trestle for Trenching Machine

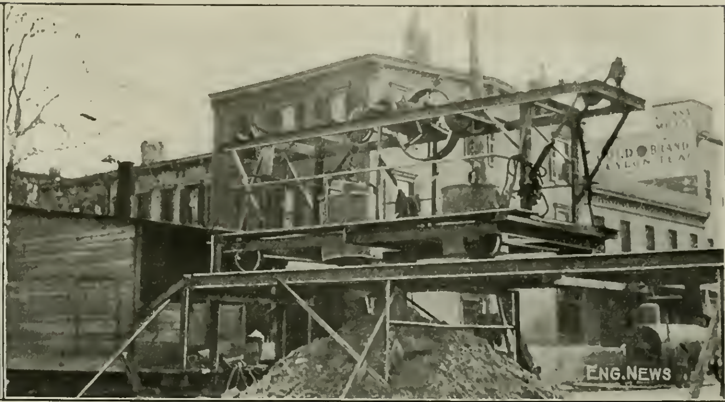


Fig. 3. Potter Sewer-Trenching Machine, Tompkins Ave. Sewer, Brooklyn, N. Y.

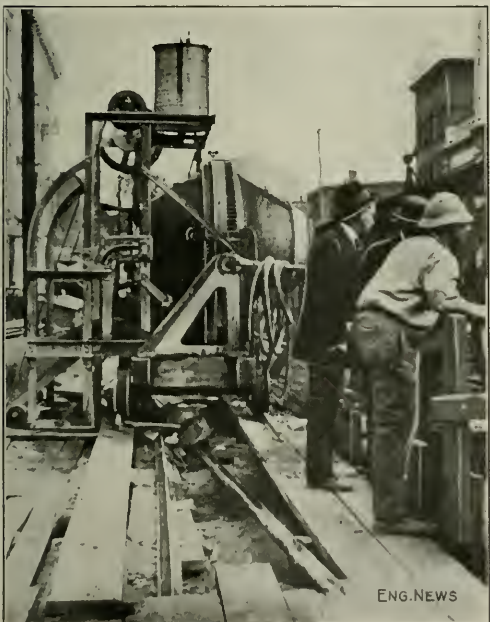


Fig. 4. Traveling Concrete Mixer, Tompkins Ave. Sewer

concrete work is, of course, so gaged as to keep pace with the excavation, and *vice versa*.

As soon as the concrete is sufficiently set, the backfill is continued over it. The bracing and sheeting remain in, and the street surface restored to use. About 100 men form the whole force engaged.

The contractor, John J. Creem Co., of Brooklyn, N. Y., has three such outfits on the same sewer contract, working independently on different sections of the work, which is under the supervision of E. J. Fort, Chief Engineer of the Bureau of Sewers, of Brooklyn.

The Removal of the Old Jackson St. Bridge at Chicago

The superstructure of the old Jackson St. bridge over the Chicago River at Chicago was removed in very short time, in May last, by cutting it apart with blowpipes and swinging the several parts onto barges by means of a derrick boat with 60-ft. steel boom.

The old bridge (built in 1888) had a three-truss swing span (with through trusses) 280 ft. long and 58 ft. wide, the east arm of which spanned the navigable channel of the river. The west arm spanned team driveways and freight tracks, beneath which was a bypass to give the necessary flow capacity to the river. The removal of this bypass, to make room for the new bridge, was described in our issue of Aug. 28, 1913, this bridge being built to give a greater width of channel, as required by the U. S. Government.

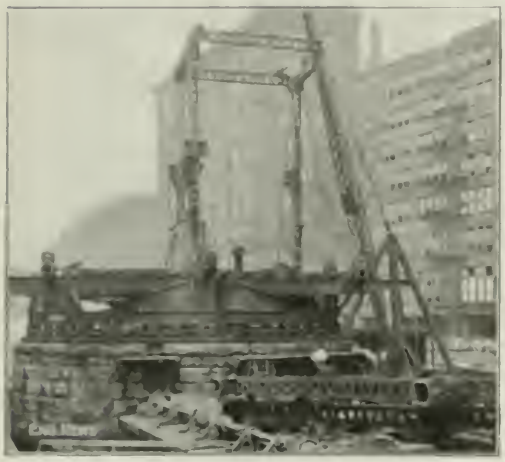
The new west abutment is close to the west side of the old center pier, and work has been commenced on the foundation for this. The coffer-dam has a single row of steel sheet piling, with heavy timber bracing. The weight of the adjacent pier and swing span, and that of the west retaining wall of the bypass, made it impossible to maintain this coffer-dam water-tight when excavating within it, particularly for the open wells which are to be sunk to rock for cylinder piers supporting the abutment. Therefore, it was considered better to remove the old bridge at once rather than to reinforce the coffer-dam at considerable expense.

Careful investigation showed that two high brick buildings on the east side of the river at Jackson St., built on pile foundations, must be placed on piers resting on the bedrock before it would be safe to put in the east abutment. The delay on the contract due to the construction of these piers under the buildings threw the removal of the old superstructure of the bridge into the season of navigation, while according to the contract and the arrangements originally planned, this span was to be removed in the winter time.

The cutting was to have been done with the Great Lakes Dredge & Dock Co.'s floating electric welding plant, which is provided with electric arcs for cutting a

well as welding, but at times the bridge superstructure had to be taken down (May, 1914), this plant could not be spared from its regular repair work on the fleet of dredges, tugs, etc., in the Chicago harbor. So it was decided to do the cutting with blowpipes, as it was important to avoid all possible delays to navigation at this season of the year on the busy Chicago River. The current at the bridge channel is about three miles per hour.

The bridge (weighing about 800 tons) was swung to the open position, and the floating turn up. The stringers were first cut away with the blowpipes, after which the floorbeams were cut loose in the same way. As the floorbeams were removed, the chords and diagonals were cut near the panel points, and the several sections swung onto barges by the derrick boat. Work was done from both ends so as to keep the remaining part of the structure in balance, as no falsework was used, and it was



REMOVAL OF THE JACKSON ST. BRIDGE AT CHICAGO, BY CUTTING THE MEMBERS APART WITH BLOWPIPES

necessary to maintain a nice poise as the truss action of the remaining members was much impaired.

The accompanying cut shows one of the top-chord sections of the center panel of a side truss being held by the derrick boom while a man is cutting it loose at the farther end with a blowpipe. The view shows also the severed portions of the three bottom chords, with one of the plate-girder floorbeams resting on the turntable. The small cabin in line with the center truss is the operator's house, the bridge having been operated by electricity.

The girders and members were cut mainly to 18-ft. lengths for removal, and will be cut with blowpipes to 3-ft. lengths for charging in furnaces as scrap. The thickness of the members cut varied from $\frac{3}{4}$ in. to 3 in., and where parts overlapped the thickness was as much as 6 in. Different types of blowpipes were used (the Oxweld, the Davis-Bournonville, the Engineering Sales Co. and the American Boiler Welding Co.), but most of the work was done with those of the Oxweld Acetylene Co. Not more than five operators were engaged in cutting with blowpipes at one time. The entire work occupied 15 days, including the removal of the turntable, leaving the masonry piers bare. It is believed that the acetylene torch or burner has some advantages over the electric arc in cutting steelwork, in that it cuts a narrower groove and is more easily manipulated than the latter.

In regard to removal by other methods it is stated that it would have taken at least four weeks to cut off rivet heads, drive out rivets, and chip or cut the members into the necessary lengths. In this case also there would have been required a greater amount of equipment in the way of air compressors, air hammers and chisels, and other tools, and probably falsework, together with more laborers and operators, while there would have been a greater amount of work in handling the parts by the derrick boat. The method employed effected a great saving of time and the delays to navigation were reduced to a minimum, this being an important item.

The new bridge will be a double-leaf trunnion bascule structure of the Strauss type, with deck trusses, having a span of 202 ft. $3\frac{1}{4}$ in. c. to c. of trunnions and 182 ft. c. to c. of front bearings, while the clear width of channel will be 168 ft. The bridge will have a 37-ft. roadway and two 13-ft. sidewalks. The substructure will include two masonry abutments, each supported on four concrete piers sunk to rock at a depth of 90 ft. below datum. The contract for the superstructure was let to the Strobel Steel Construction Co., and the contract for the substructure was let to the Great Lakes Dredge & Dock Co., both of Chicago. The substructure contract included the removal of the old superstructure (as described above) and the old substructure.

Some Neglected Points in the Theory and Adjustment of the Wye-Level

By J. A. Kitts*

Although the wye-level was invented 174 years ago (by Jonathan Sissons, of London), the writer does not believe that this instrument is generally understood, particularly in the method of use, by young engineers.

Two general methods of setting up a wye-level are used, one consisting of bringing the bubble to the center of the tube, and the other of bringing the vertical axis into a vertical position. The writer believes this latter method to be the proper one, and adjustments to suit this method are outlined herein. The former method is the more common practice; there seems to have been little said or written about the latter method, and it is the first impulse of the novice with spirit-level instruments to center the bubble, little understanding why he does so.

This practice of keeping the bubble in the center of the tube leads to error, as in the best of instruments the grinding or calibration of the bubble tube is such that the bubble centers differently for different temperatures; and the relation between the line of sight and the bubble position is therefore not amenable to fine adjustment.

The levelman centering the bubble for every observation at a different angle has no way of detecting the change of the relation between the tangential axis of the bubble tube and the line of sight, until the instrument is very badly out of adjustment. Unless he has time to

*Isthmian Canal [illegible], Panama.

check the adjustment often, here is another source of error. On the other hand, if the levelman levels so that his vertical axis is kept vertical, he becomes thoroughly acquainted with his instrument, knows where his bubble centers for varying lengths of the bubble due to atmospheric changes, and thus has an index to any changes in his instrument.

The wye-level was designed with the object of utilizing the principle of reversion to adjust the line of sight perpendicular to the vertical axis, and, by keeping the vertical axis vertical, maintaining the line of sight in a horizontal plane. In a completely adjusted wye-level the line of sight is necessarily perpendicular to the vertical axis of the instrument, and for successful operation the vertical axis should be kept vertical (operation 2, as given below), and it is not essential that the bubble rest in the center of the tube.

Keeping the vertical axis vertical is easily accomplished by use of the leveling screws in bringing the bubble into a position where it will remain for any angle of the telescope about the vertical axis. This does not depend upon the bubble axis being adjusted parallel to the line of sight but does depend upon the spindle and bearing fitting properly and not being worn elliptical in section. This provides an index to a defect in the spindle.

The line of sight can be adjusted perpendicular to the vertical axis (operation *3ab*) with fine accuracy depending upon the telescope collars being true circles of the same diameter. This is an index to a defect in the collars; (*3a*) and (1) cannot be accomplished if the collars are not of the same size and circular.

In a theoretically perfect wye-level the following specifications obtain:

(*a*) The object and eye glasses are perpendicular to the optical axis.

(*b*) The optical axis coincides with the axis of rotation in the wyes.

(*c*) The line of sight coincides with the axis of rotation.

(*d*) The line of sight is parallel to the tangential axis of the bubble tube.

(*e*) The collars resting in the wyes are true circles of equal diameter and concentric with the line of sight.

(*f*) The wyes fit either collar in exactly the same manner.

(*g*) The bubble moves over equal spaces for equal displacements of the telescope in vertical arc.

(*h*) The bubble expands or contracts equally from the center in both directions in changes of temperature.

(*i*) The vertical axis is perpendicular to the line of sight, or horizontal axis of the telescope.

The maker of the better class of instruments meets these specifications with a fine degree of precision, excepting in simple bubble tubes, specification (*h*), and, as been pointed out, this is not essential if the proper method of leveling the instrument is used.

Items (*d*) and (*i*) often require readjustment in the field, and the following procedure is suggested:

Wye-Level Adjustments and Use

(1) Make line of sight coincide with axis of telescope collars:

Clean collars and wyes. Level sight at point and clamp vertical axis. Revolve telescope 180° in wyes. Note vertical and horizontal displacement from the point. This is twice the error. Adjust cross-hairs and repeat until they remain on the point through 360°. Clamp telescope in normal position, unclamp vertical axis, and see that point follows horizontal hair when turning instrument about vertical axis.

(2) Make the vertical axis vertical:

Level over both screws, bringing the bubble to the center. Note end of bubble nearest the eyepiece. Rotate instrument 180° about the vertical axis and again note eyepiece end of bubble. Correct one-half the interval over both pairs of screws. The bubble will then remain in the same position for any angle of the telescope about the vertical axis and the vertical axis is then vertical.

(3) Make horizontal axis of telescope perpendicular to vertical axis:

(*a*) Keep vertical axis vertical by (2), having clips loose. Reverse telescope in wyes and again note end of bubble toward eyepiece. Adjust wyes to correct one-half the interval. The bubble then assumes a new position for (2).

(*b*) Check this adjustment by sighting on distant point, reversing telescope in wyes and again sighting on the point, keeping vertical axis vertical by (2). Adjust wyes for one-half the interval between sights.

(4) Bring bubble to center of tube:

(*a*) Make vertical axis vertical by (2). (*b*) Adjust bubble tube until bubble comes to center. Repeat *a* and *b* until bubble remains in center through 360° about the vertical axis.

(5) Bring bubble axis into vertical plane through axis of telescope: Level by (2) observing that bubble tube hangs in normal position under the telescope. Rotate the telescope slightly in the wyes, noting position of bubble for swings to right and left. If the bubble runs toward the eyepiece when swung to the right the end of the bubble tube toward the eyepiece is too much to the right, or *vice versa.*

(6) Repeat and check all adjustments as any one adjustment may affect another. However, this method of adjustment makes each adjustment as nearly independent as possible.

(7) In using level, level by (2) as calibration of bubble tube is usually such that bubble center is different for varying temperatures. The vertical axis should be kept vertical, as the line of sight is adjusted perpendicular to the vertical axis thus obviating releveling when taking observations at various angles, and thereby effecting an economy of time and labor.

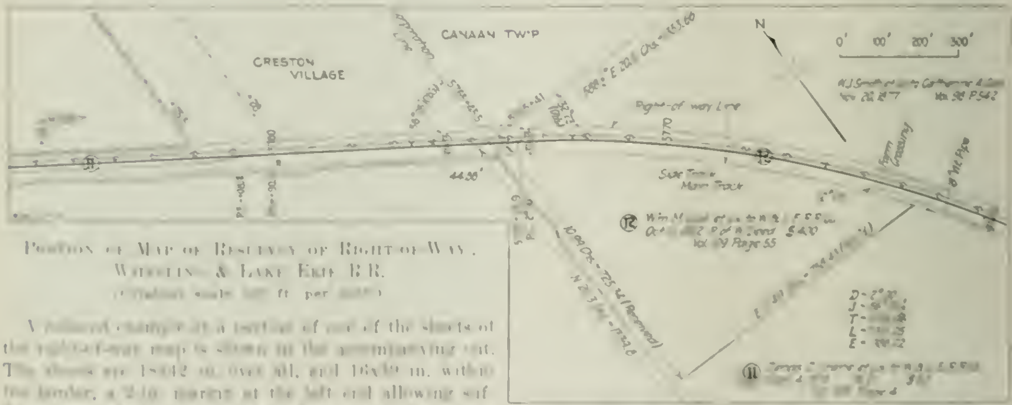
(8) Make line of sight coincide with optical axis: This adjustment is seldom necessary. If a distant object appears to shift position with reference to the aperture when revolving the telescope in the wyes, center the eyepiece until no movement is observed.

Making Permanent Record Maps Instead of Field Notes—To bring the records of street subsurface structures uptodate, one man experienced in field surveys and drafting work was assigned from each highway district office in Philadelphia, Penn., in 1913. The use of field books was discontinued. The note-books were replaced by 8½x11-in. sketch cards. These cards are used in the field for the plotting of the subsurface structures, etc., and are then forwarded to the office where they are properly colored and inked in by the drafting force, thus making these cards the office record, which does away with the work formerly involved in plotting the field notes from the book to the office card record.—From 1913 Report of the Philadelphia Bureau of Highways.

Resurvey of Right-of-Way: Wheeling & Lake Erie R.R.

A class of work which has been undertaken by several railways in recent years is that of resurveying and marking the right-of-way and other land owned, in order to have exact location and record of such property. The importance of such work is readily appreciated when it is realized that original records are often incomplete or faulty. As property both in the cities and along the railways increases in value it is increasingly necessary for the railways to define and assert their ownership by setting fences and monuments and recording all deeds and other transactions as to real estate.

Work of this kind has been carried out on the Wheeling & Lake Erie R.R., under the direction of W. L. Rohbock, Chief Engineer. The work of making the surveys and preparing the right-of-way maps covered a period of about five years for the entire system, involving about [illegible] miles of main line and branches. The cost of this, including all survey work and drafting, was about $60 per mile.



Portion of Map of Resurvey of Right-of-Way, Wheeling & Lake Erie R.R.
(Original scale [illegible] ft. per inch.)

A reduced example of a portion of one of the sheets of the right-of-way map is shown in the accompanying cut. The sheets are 18x42 in. over all, and 16x40 in. within the border, a 2-in. margin at the left end allowing sufficient room for binding. These plans are all made on a scale of 1 in. to 100 ft., except that the extra sheets showing the right-of-way through thickly settled cities or villages are on a scale of 1 in. to 50 ft.

On the drawings, the original center line as relocated by surveys is shown in a full red line, and the main track, where not coincident with this center line, is shown in black. Where the track is on or near the center line, only the rail line is shown. All company additions, private tracks, street lines and outlines of allotments are shown in full black lines. Switch lines and figures representing the [illegible] (as taken from recorded maps) are shown in blue. Measured distances and figures representing [illegible] dimensions given in deeds, etc., are shown in black. The outline of the railway company's property is shown by broken lines (dash and double dot); fences are shown by broken lines, with [illegible].

Figures enclosed in circles designate the various parcels of land referred to in the property title notes on each sheet. Monument figures are shown in red. Points where iron rod monuments are set are shown by red spots. Different tints indicate ownership as follows: (1) land acquired by deed, right-of-way contract or agreement; (2) land acquired by condemnation or act of public official; (3) land acquired by lease; (4) land held in trust by agents or trust company; (5) land sold, or leased indefinitely. The explanation of this coloring scheme is shown on each sheet.

On account of the stationing on the road starting from the west end (at Toledo) and running toward the east, the maps are all made to read from left to right. Reference to this stationing is made along the right-of-way, being shown in white paint at intervals in conspicuous places such as telegraph poles, station buildings, etc., where the stationing may be easily picked up should it become necessary to tie into it when making additional surveys.

The original center line of the right-of-way is shown in all instances and where it does not coincide with the center line of the present track both the original center line and the track center line are shown. The fences along the right-of-way are not shown except where they do not coincide with the established right-of-way lines. Right-of-way posts are set at places where fences would not be desirable. These posts are 6 ft. long and project 3 ft. above the ground, the portion projecting out of the ground being turned to a diameter of about 6 in. The post is painted white and the lettering runs perpendicularly, showing it to be a right-of-way post of the W. & L. E. R.R.

One of the handy features of these maps lies in the references given to the original purchase of right-of-way. These are numbered consecutively through the different counties, the right-of-way lands being divided into the several different counties along the line. The references show the date of the original purchase, the name of the original owner, price paid for the right of way and general conditions of the purchase. On sheets involving considerable detail as to streets and other data, where these references cannot be shown, the number of the reference is simply shown on the parcel and a separate sheet is made up giving the details as above described. Examples of these references on the maps are as follows:

8. W. & L. E. R.R. Co. to N. Y. P. & O. R.R. Co. Apr. [illegible], 1886. Lease. [illegible] Lease for term of 99 years and renewable forever on similar terms without further [illegible]. To be used for railway purposes only. W. & L. E. R.R. Co. to defend the N. Y. P. & O. R.R.

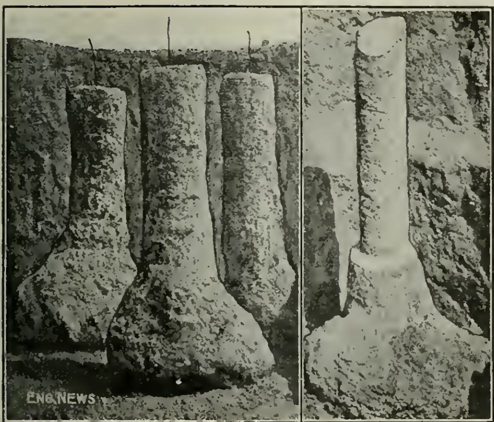
Co. in the enjoyment and peaceable possession of the premises. Part shaded in (green)covered by this lease.

10. A. L. Miner to W. & L. E. R.R. Co. Mar. 3, 1874. Right-of-way contract and $300 in company stock. Lease. Record, Vol. 1, page 577-8. A. L. Miner agrees to convey land if railway is built not later than two years from this date. Also railway company to have enough land in addition to the 66-ft. strip named to maintain proper slopes, and after location of said road the railway company may cut down trees that are liable to interfere.

12. Wm. M. Cook et ux. to W. & L. E. R.R. Co., Oct. 11, 1882. Right-of-way deed. $400. Vol. 109, page 55.

Concrete Piles with Bulbous Ends Formed by Explosive

The formation of enlarged or bulbous ends for concrete piles cast in place, in order to serve as footings and give increased bearing, has been employed in a number of cases, and a process of forming the cavity for the bulbous end by means of explosives has been invented in



Concrete Piles with Enlarged Bases Formed by Exploding Charges at the Bottom of the Holes

Europe, which is known as the Wilhelmi system. A wooden pile inclosed in a 16 or 20-in. steel tube is first driven, and is then withdrawn, leaving the tube in place. The explosive charge is then lowered in a shell or casing so made that the force of the explosion will be directed mainly in a lateral direction. The hole is then partly filled with concrete and the tube drawn up about 1 ft., after which the charge is fired and the wet concrete settles into the cavity thus formed. Fresh concrete is at once deposited until the hole is filled, the tube being drawn up at the same time.

This process has been used for supporting the pivot of a locomotive turntable at Havre, France, the foundation being a circular block of reinforced-concrete 15 in. diameter and 16 in. thick, supported by a single central pile 16 in. diameter. The point of the wood pile penetrated to a depth of 22½ ft. and the bottom of the steel tube to 21½ ft. A charge of about 1 lb. of explosive was placed and the hole filled for about 16 ft. with concrete, which dropped nearly 13 ft. after the explosion. As the additional concrete was filled in and the tube withdrawn, the concrete was tamped with a 220-lb. ram, spreading it into the compressible earth. The enlarged head was loaded with 40 tons of rails which remained in place for three weeks without causing settlement.

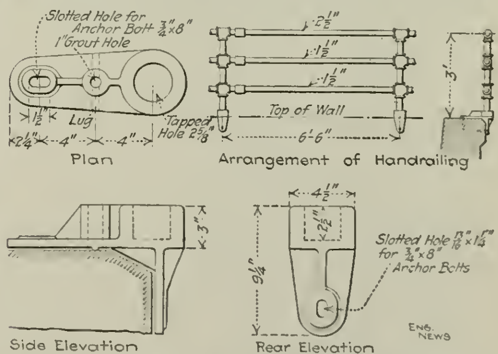
It is stated that in soft or loose soil the practice is to sink several piles close together. The French patents are owned by Camus, Besse & Drieux, of Havre, France. Our information is taken from an article in the June number of "The Railway Engineer," of London, from which also the accompanying illustration is taken. The same (or a similar) system, but under a different name, was noted in our issue of Aug. 21, 1913.

Hand-Railing for Bridges and Retaining-Walls

Where hand-railings are placed on railway bridges and retaining-walls it is desirable to place them near the outer edge of the bridge or wall, in order to give as much clearance as possible between cars and the railings. In some cases the railings are inclined outward to enable a man to lean back out of the way of a passing train.

On concrete walls and parapets it is very general practice to set the posts or standards of the railing at approximately the center line, but in the track-elevation work at Memphis, Tenn., the railings are placed along the outer edges of the retaining-walls and the shallow curb or parapet walls of the bridges. This is done by means of angle-shaped sockets fitted to the edges of the wall, as shown in the accompanying cut. This cut represents the railing on the South Front St. subway of the Illinois Central R.R.; in some other cases the posts or standards are 6 ft. apart.

The socket has a threaded hole for the pipe standard, a grouting hole, and two holes for anchor bolts, while a rib across the bottom leaves a ¼-in. grouting space between the casting and the masonry. The top of the railing is lined up to a straight line by rocking the castings on these lugs and tightening and loosening the bolts as



Hand Railing Set on Edge of Retaining-Walls on Track Elevation Work at Memphis, Tenn.

required. When the railing is in line, the castings are grouted to a permanent bearing. The anchor bolts are leaded in place.

A Gyroscopic Monotrack Automobile has recently been demonstrated in London. This car has two wheels placed centrally in line in the chassis, while in the center of the chassis, below the seat, is the gyroscope, which is electrically driven. The speed of the gyroscope is 1200 r.p.m.

An Ash Wagon with Electric Hoist

For removing ashes from isolated power plants the Union Electric Light & Power Co., of St. Louis, Mo., operates ash wagons equipped with electric hoists to raise the ash buckets through manholes in the sidewalks. During the winter about six teams are in service, each hauling five loads daily. One of these wagons is shown in the accompanying cut.

Ash Wagon with Electric Hoist

The hoisting apparatus consists of a ½-hp. motor driving a small drum. The motor runs continuously and is connected to the drum by a loose belt, there being a belt tightener which is operated by hand when it is desired to hoist the bucket. Power is obtained through an extension cord connected to a lamp socket in the buildings. The motor, starting box, drum and belt tightener are all assembled on an iron bedplate supported by four spiral springs, and located at the rear of the wagon, as shown. There is also a davit fastened to the side of the wagon, with a pulley extending over the sidewalk to drop the bucket through the hole to the basement.

One man on the wagon operates the hoist and handles the bucket, another man being below for loading the buckets. A light wire rope is used for hoisting. The buckets are small, being only about 16-in. diameter, this being necessary on account of the small holes in the sidewalk. For information as to these wagons we are indebted to John Hunter, Chief Engineer of Power Plants of the above company.

Organization for Surfacing Track*

Prior to a job of surfacing track the first thing to consider is the widening of banks where the subgrade is too narrow to hold the ballast. The widening can be done to advantage with material excavated in widening cuts. The next thing is to decide on the uniform raise to be given the track, and the raise to be made in sags (if any). This being settled, the engineer should mark the grade stakes (in vertical figures) near the top to show the raise in inches. The figures should be on both sides (and not on the face), so that the conductor of a gravel train from either direction can see the figures. The station number can be marked on the back of the stake. This arrangement will assist the roadmaster and work-train conductor in getting the material distributed properly.

When track is to be raised more than 12 in., one short lift should be taken care of first, and the track given one lift with the first lot of ballast to make room for sufficient material to finish surfacing on the second lift. Doing this work first avoids the necessity of hauling gravel over track where the surfacing crew is at work. The unloading and distributing of gravel should be under the personal direction of the roadmaster or an experienced foreman, and not left entirely to the work-train conductor. In this way the work can be supervised and markers set up to indicate where additional material is to be deposited by the next train.

I recommend the following organization for surfacing gangs varying from 50 to 100 men: One foreman, two assistant foremen and one timekeeper. One assistant foreman to do the raising, and the other to do the lining or to herd the men who are doing the tamping, as the work may require. The crew should be provided with six track jacks, two level boards, and two spot boards. One man should have charge of setting up the spot boards. A sufficient number of men should be kept ahead to dig jack holes, which should always be dug level so as to guard against throwing the track out of line.

When raising track with 100 men, four jacks should be used (two on each side), and both sides raised at the same time. No men should be allowed to work ahead of the man who is sighting the track, so as not to interfere with his work in sighting the spot boards.

Wherever there are grades, the work should progress against the grade if possible. This will assist materially in holding the steel from running down grade. The foreman should see that the assistant foreman doing the raising makes a good run-off at the close of each day, so that it will not be necessary for trains to reduce speed at night. For eight gangs of tampers, two on each side and four in the center, the foreman should pick out eight of his best men and make these the leaders. Two tampers on each side and four in the center should go ahead, and tamp one tie and skip three ties and so on all day. The second and third gangs will tamp the next ties, and the fourth gang tamps the fourth tie, thus finishing the tamping in full. The center tampers do the same as the outside tampers, thus finishing up as they move along in organized form. The number of gangs may be reduced to three or increased to five, according to requirements.

*Condensed from an article on the "Track Foreman" [illegible] of the Roadmasters' and Maintenance of Way Association, by [illegible], Division Roadmaster, Minneapolis, St. Paul & Sault Ste. Marie Ry., Minneapolis, Minn.

Instruction Diagram for Trackmen on a Chinese Railway

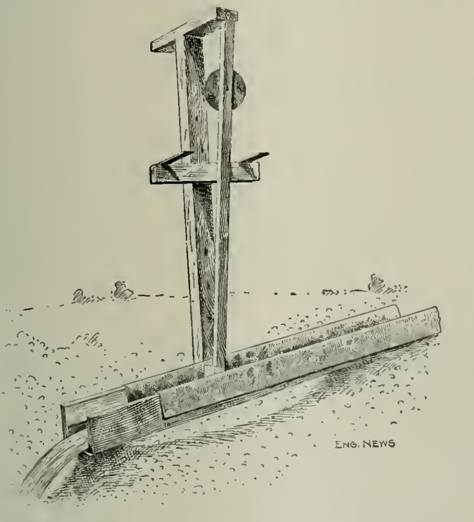
An example of the instruction diagrams issued to Chinese section foremen on the Shanghai & Nanking Ry. is shown in the accompanying cut. It indicates that in handling material on a push car there must be a

red flag on the car, while other red flags are to be carried at a distance of 15 rail lengths in advance and in rear of the car. The foreman must stay near the car. Any infringement of the regulations "will be met by severe punishment." The cut is reproduced from an article in *The Engineer*, of London, May 22.

The railway is 193 miles long, with a 10-mile branch to Woosung, and is double-track for 54 miles. The track is laid with 36-ft. 85-lb. T-rails of the British standard section; the ties are of jarrah wood, 10x5 in., 9 ft. long, with 14 ties to a 36-ft. rail length. The line is well ballasted throughout. There is one tunnel 1320 ft. long built for a double line 28 ft. 3 in. wide at spring of arch and 27 ft. 3 in. at rail level, the height being 21 ft. 3 in. from rail to soffit. The line was opened in 1908. A. C. Clear is Resident Engineer.

A Field-made Pendulum to Indicate Pump Discharge

The accompanying illustration is from a photograph taken on one of the contracts of the Passaic Valley Sewer near Newark, N. J. It shows how a light 1x2-in. stick suspended from a frame as a pendulum, with its lower



Field-Made Pendulum to Indicate Pump Discharge

end in the flume of a pump discharge, indicates by its oscillation how the pump is working.

A steam vacuum pump is used to keep the water out of the excavation, discharging through about 150 ft. of rough wooden flume. About 30 ft. from the end a gallows-frame of 2x6-in. and 2x4-in. timber, about 6 ft. high, is erected at one side of the flume. From the head of this frame, hanging by a screw-eye over a nail, is a 1x2-in. stick about 6 ft. long. At the bottom of the stick a piece of rubber belting is nailed to form a paddle and to offer a larger surface to the stream of water. A round sheet of tin, about 8 in. in diameter and cut out of the top of a tin can, is nailed to the stick to form a target, and a little horizontal piece is attached to the standard about halfway up to form a guide so that the pendulum will not swing too far out of line.

The surge of the stream not only keeps the pendulum at an angle but continually agitates it through an arc of 10 deg. or 15 deg. By glancing at the indicator, the foreman, several hundred feet away, can always tell approximately how the pump is operating.

Instructions to Civil Engineers of the Southern Pacific Co.

For the benefit of the hundreds of young men just starting their careers as railway civil engineers, and for other engineers who wish to have a little insight into the duties of railway field engineers, we reprint the newly revised instructions of William Hood, Chief Engineer of the Southern Pacific Co., to chiefs of party and transitmen:

INSTRUCTIONS TO ENGINEERS IN CHARGE OF FIELD PARTIES

(1) All pay-rolls and vouchers are to be made out on the first day of each month, on the blanks furnished for that purpose, and forwarded to the Chief Engineer.

Give the Christian name and initial letter of a middle name on payment roll and voucher.

Itemize all vouchers, giving the date and place of disbursement; and when possible to do so, take receipt for all disbursements.

Time will be computed by calendar months and fractions of the same. A contribution of 50c. per month for hospital department will be collected by deduction on pay-roll from all officers and employees of the company, with the exception of Chinese, and those specially excluded from benefits. This contribution will be due on entering the company's service, and thereafter will be due for and apply to each month, or part of a month, while in the service.

(2) No time will be allowed men absent on private business. No time will be allowed any of the party, excepting those placed on duty by the chief of party until the work for which they were engaged shall commence; nor will any time be allowed after the evening of the last day's work, excepting to those detailed as teamsters, cooks, or for other duty by the chief of party or his agent. Give to men discharged a certificate of the time and amount due them.

(3) All men will be returned free to the place at which they were engaged for any particular survey—excepting by agreement to the contrary—unless discharged for disobedience or incompetency, or leaving without the full consent of the chief of party, in which case traveling expenses will not be allowed. Ten days' notice will be required from all employees, in order to leave the service in good standing, unless the requirement be waived by the engineer in charge.

In case of sickness of any member of party entitled to hospital treatment, the chief of party must give a hospital certificate.

(4) Books, stationery, instruments and other property of the company are to be kept in good order; the chief of the party will be charged for the same, and he must return them in like order in which they were received, or satisfactorily account for their damage or loss.

(5) All requisitions must be sent to the Chief Engineer by letter and the telegraph is not to be used for that purpose, unless writing would occasion delay or loss.

(6) Note on first page of every field book a full description of the particular route, line and work to which the notes relate, and enter date of each day's work in the proper place.

(7) Note name and address in each transit book of all members of the party; and in the level book, name and address of leveler and rodman.

(8) A journal must be kept, fully describing each day's work, and noting all information of interest, and how it was derived.

(9) Monthly reports must be sent to the Chief Engineer on the first day of each month, giving the lengths and descriptions of the various lines run and all work done, with such other information as may come within the knowledge of the engineer in charge, of which the Chief Engineer should be informed.

INSTRUCTIONS TO TRANSITMEN

(1) See that transit plummet and line are well protected from air currents, while being adjusted to the angle point.

(2) No instrument station must be in such a position as to prevent the line of sights for backsights or foresights striking within 2 in. or less of the point of the rod.

(3) Double-center all instrument points, checking each sight back, after setting the point on foresight.

(4) No sights are allowed longer than 1000 ft. on tangents, or 800 ft., or 45° deflection, on curves.

(5) On taper curves, the B.C. or E.C. and C.C.'s of main curve must be put in from each other by one deflection and long chord, and not through the intermediate compound curve points.

(6) [illegible] all angles [illegible] bearings of all courses and take [illegible] at least once in ten miles [illegible], [illegible] country, and once in 25 to [illegible] [illegible].

(7) A [illegible] of [illegible] notes will be made out each evening on a tracing sheet, showing true (or assumed) bearings, and magnetic bearings for use in mapping and for ready detection of errors [illegible].

(8) All lines in [illegible] country will be run with a [illegible]-ft. chain. In open country a 100-ft. chain may be used on the tangents, and a [illegible]-ft. chain on all curves.

(9) On location lines small pegs must be driven to the ground surface at each chain length as well as the usual [illegible]. On [illegible] lines stakes only need be used, except at instrument points.

(10) Stakes must be well driven and fit to stand several years.

(11) Chainmen will use hand levels to determine the difference of height of the ends of the chain, and will use [illegible] on all rough ground. Chain must be stretched out [illegible] in line on rough ground, before measuring the short [illegible] distances, so as to use all parts of the chain instead of using one part repeatedly.

(12) All instrument stations put in at other points than at end of full chain must be measured in with steel tape and checked by chain. Where an instrument station is set at other point than at end of full chain the next full chain station must be [illegible] from the last one back of the instrument and not from the instrument point.

(13) Chain must be tested once a day at least.

(14) All transit books must be paged and fully indexed.

WILLIAM HOOD,
Chief Engineer.

A Hand-Power Piledriver

The piledriver shown in the accompanying sketch is one built by the Chicago Tunnel Co. It was used at work at 12th St. and Wabash Ave., Chicago, to drive 4-in. pipe down 45 ft. to meet the section of the tunnel in service under 12th St. While this driver was designed to drive pipe, there is no reason why it should not operate successfully on light sheet piling.

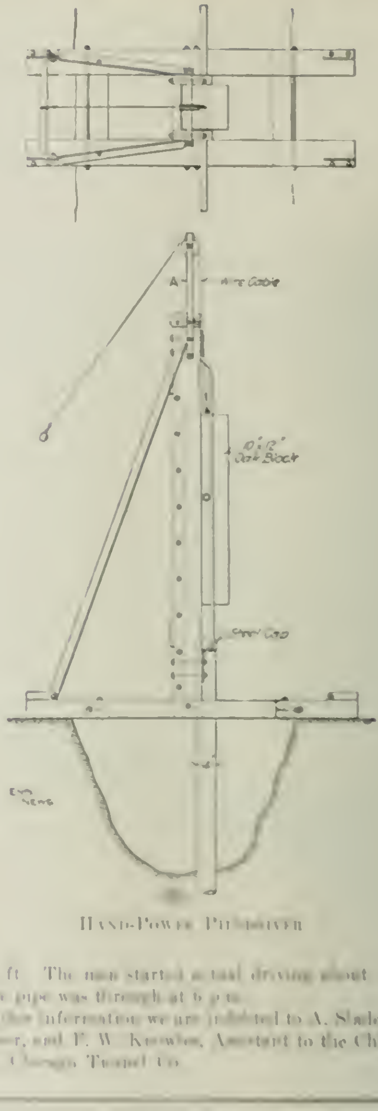
The driver itself consists essentially of a channel lead A, built by bolting two 2x6-in. sticks to each edge of a 2x12. This lead, about 6 ft. high, is supported vertically on a pair of heavy horizontal skids, approximately 4x6 in., and is braced back on to the horizontal skids by a pair of steel angles. The actual driving is effected by a 10x12-in. oak block, 12 in. long, sliding in the lead.

The driver is operated by four men; two stand behind the driver and with a pick handle looped into a cable, raise the block; the other two, standing each side of the block, working with a piece of pipe put through a hole in the block, bring the block down on the pipe being driven. The [illegible] effort of each pair causes the rig to deliver about [illegible] blows per minute.

To keep the block from going outward, a pair of guides are fastened to the face of the lead. The pipe-handle slides inside the guides.

On the work in question, 4-in. pipe was being driven [illegible] ft. [illegible]. A [illegible] cap screwed into the end of the pipe took the impact of the blows. Short sections, [illegible] ft. long, and [illegible] blocks were used to get the pipe down. [illegible] of driving is shown by the fact that on this work [illegible] ft. of [illegible] pipe was driven down so as to [illegible] a [illegible]-in. opening [illegible] in the roof of the tunnel.

The daily cost of operating on this particular job, comprising the team of four men at $[illegible] each and one foreman at $[illegible], working 10 hr. Only one day was needed to get the pipe down. This included taking up a [illegible] [illegible] over an area of about [illegible] ft., and excavating a hole about [illegible] ft. deep, with an average cross-section of [illegible] ft. The men started actual driving about 11 a.m. and the pipe was through at [illegible] p.m.



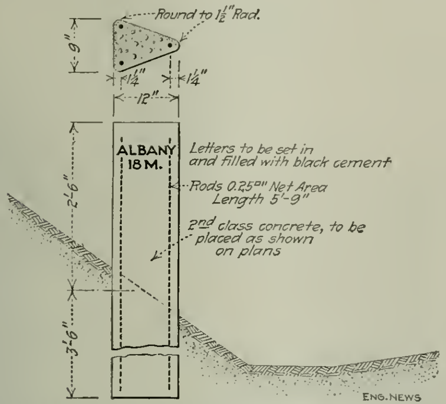
HAND-POWER PILEDRIVER

For this information we are indebted to A. Slade, Chief Engineer, and F. W. Knowles, Assistant to the Chief Engineer, Chicago Tunnel Co.

NOTES

Calculation of End Areas for Earthwork—[illegible] [illegible] calls our attention to the fact that substantially the same method of computing end areas as that described by W. L. Webb in our issue of June 11, p. [illegible] was proposed by him in "Engineering News," [illegible]. [illegible] we find this to be so, but Mr. Webb has described the process in more detail, and shows how the method may be applied to end three-section [illegible]. Originality for methods of earthwork calculation is a difficult claim to prove, as any one may determine for himself if he will look through the files of "Engineering News" for the past 10 or 15 years. For no matter how much original research one puts into this subject the subject itself has been explored so thoroughly that there is hardly a possibility of finding a single [illegible] of [illegible] growth in the whole field.

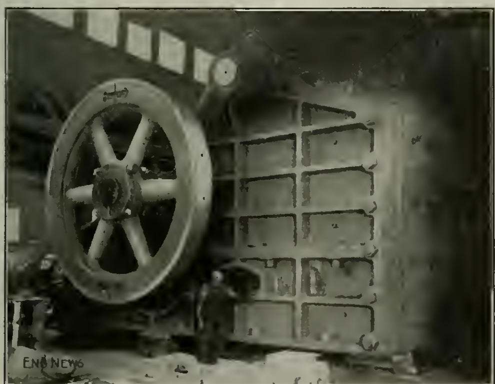
Reinforced-Concrete Mile Post—The accompanying illustration shows the standard reinforced-concrete mile post adopted by the New York State Highway Department. Each post contains about 1½ cu.ft. of concrete, so taking the cost of concrete at $10 per cu.yd. we have $0.55 per post, as an approximate estimate of the cost, exclusive of the rods and of the inscription.



STANDARD CONCRETE MILE POST, NEW YORK STATE HIGHWAYS

Very Large Rock Crusher—The accompanying view shows an all-steel frame jaw rock crusher with a 60x84-in. opening for breaking up rock to be used in the manufacture of asbestos.

The side plates are of rib design and were cast in two parts. The end plates are one piece. The crusher will be 19 ft. 7½ in. long, 11 ft. high and 18 ft. 1½ in. wide, and will weigh 500,000 lb. The machine is made of cast steel throughout, with manganese-steel crushing plates, check plates and toggle seats. A better idea of the size of some of the working parts can be obtained perhaps from their dimensions, notably those of the shafts. The main shaft is 23 in. in diameter, and the swing-jaw shaft 19 in.



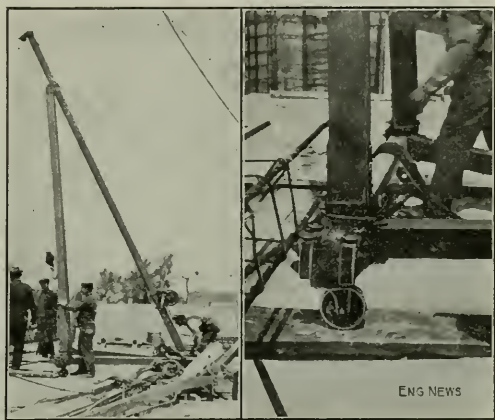
A 60x84-IN., ALL-STEEL FRAME JAW ROCK CRUSHER

What was primarily here desired was ample size of opening, in order to permit a reduction in quarrying expense. The size of the feed opening is 60x84 in., and under working conditions the crusher will deliver a 10-in. product. As an indication of its capacity, when crushing down to 14 in., it will crush approximately 1000 tons per hour. When crushing to 10 in., its capacity with asbestos rock is expected to be 3000 tons per 8-hr. day.

This crusher was built by the Traylor Engineering & Manufacturing Co., Allentown, Penn., for the Asbestos, Que., plant of the H. W. Johns-Manville Co., and cost about $25,000.

A Portable Cantilever A Frame Derrick—Handling construction units in concrete work is an interesting problem. Reinforcing rods are fabricated into bulky units, more or less rigid (usually less), and these frames have to be placed in the form; the "how" is often hard to find, at least with due regard to low cost.

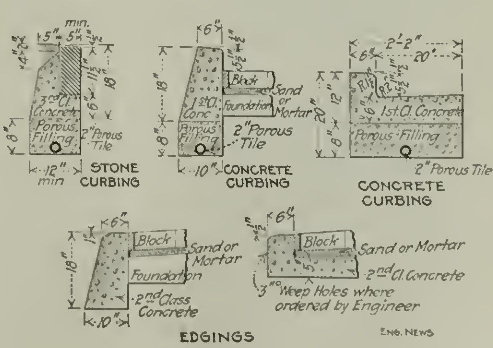
On work for the Excelsior Motor Co., Wells Brothers, Chicago contractors, built a cantilever tripod derrick rolling on heavy truck-casters and equipped with a hand winch. The frame was made of 6x6 timbers. The base is an equilateral triangle some 8 ft. on a side. The head block is about 20 ft. above the floor level. This derrick, set on plank runs laid on the floor forms, was used for elevating and placing fabricated frames of steel reinforcement in the heavy wall panels. Two views are shown herewith.



A PORTABLE CANTILEVER A-FRAME DERRICK

In Unloading Stone from Cars for the sewage filter at Aberdeen, S. D., the work was done mainly by rigging up a block and tackle so that a drag scraper could be pulled lengthwise of the car. The scraper dumped at the end over a trap into small dump cars below, on a 24-in. gage track. About 175 carloads of crushed stone were required to make the filter bed, and the above arrangement reduced the cost of unloading and making stone into position by about 50% as compared with unloading by hand. This statement is made in a paper by W. G. Potter in a paper on this sewage disposal plant, read recently before the Western Society of Engineers.

Curbings and Edgings, New York State Highways—The accompanying illustrations are self-explanatory. They represent the latest practice of the New York State Highway Department. Curbings are placed on roads through villages, where the street is bordered with sidewalks. The edgings are necessary on brick or block-paved roads.



First Aid for Derailed Dump Cars—In handling heavy excavation work with steam shovel and dump cars, the impact of the [illegible] if it hits the dump car off center is very apt to throw it off the track. To keep the work going properly, it is of [illegible] to keep cars on the track. On one of the contracts on the Sag [illegible] near Blue Island, Ill., where a [illegible] steam shovel is loading into 7 cu.yd. end dump cars which are pulled up an incline, the car tender keeps a short piece of cable ready to [illegible] at the loading point. At the first [illegible] when the car goes off the track, the tender jumps forward with the cable, gives it a sling around the front axle and a loop over the teeth of the dipper. A little signalling, [illegible] "wig-wagging," some nice handling of the heavy boom and dipper, and the car is easily and quickly put back on the track. The contractors on the work where this kink was noted are Byrne Bros., Chicago.

ratio between the strengths of the materials, that is, $\frac{s}{c} = \frac{16,000}{650} = 1:24.66$. Connect the ends of the lines as shown. Then the vertical distance from the top to the intersection of the lines is the depth to the neutral axis of the beam, in per cent. of d, the depth to the center of the steel.

LOOPING OF CABLE OVER DIPPER TEETH TO RESTORE DERAILED CAR

A STEAM-SHOVEL DIPPER BOOM FOR AIDING DERAILED DUMP CARS

A Spring-Roll Covering for a Drawing Table—The accompanying sketch shows the method employed for covering the drawing tables in the office of the Reinforced Concrete Co., St. Louis, Mo. Using a spring curtain roller is not especially novel; on the other hand, it is not universally in use in drafting rooms, although apparently the best method known. The novel feature of the present sketch is that the roll is mounted on a hinged board which can be swung back under the table and out of the way. Ordinary screen-door spring hinges are used. The bar in the end of the [illegible] [illegible] which holds the covering smooth and close against the drawing board, is usually of ½-in. round steel.

ARRANGEMENT OF SPRING ROLLER AND COVERING FOR COVERING DRAWING TABLES

A Graphical Determination of the Neutral Axis [illegible]

[illegible]

To find the percentage of steel: At b, Fig. 2, the shaded triangle is the total compression in the concrete, according to the straight-line formula. The maximum stress f_c is at the top and the area of the triangle $= \frac{f_c}{2} \times k$. The unit resisting moment $R_c = \frac{f_c}{2} \times k \times j$, in which j is the moment arm and is equal to $d - \frac{k}{3}$.

Then $R_c = \frac{f_c k j}{2} = 325 \times 0.38 \times 0.873 = 108$ (slide-rule used).

The steel ratio $p = \frac{R_c}{j f_s} = \frac{108}{0.873 \times 16,000} = 0.0077$

FIG. 1 FIG. 2

[illegible]

Editorials

Many strange tales have come out of East Aurora, New York—the home of Elbert Hubbard. Not the least strange and weird—to an engineer at least—is the following from the *Buffalo Express*:

East Aurora, June 23.—The problem of a sinking bridge is again before the village officers. Early this spring a new wooden bridge was built across a pond on the Gurdle Road, which leads directly through the quicksand beds in the northern section of the village. The new bridge has followed the trail of its predecessors, and is fast sinking into the pit that has already swallowed up 28 or 30 bridges in the last 50 years.

The sinking pond has a unique history. Originally, there was only a country sluice, with a four- or five-plank bridge to span it. Gradually it has increased in width, until now it takes nearly 300 ft. of planks to cross the black hole. The underlying formation is quicksand and the bridges slowly sink from sight. The new bridge, built less than three months ago, has been condemned by the highway commissioner, and the state department has been asked for a remedy to put a stop to the wholesale devouring of a bridge or two each season.

It seems to us that East Aurora displayed remarkable sagacity in turning to the State Department for advice. The recent experience of that department with treacherous quicksands should certainly have enriched it with a fund of experience to draw upon.

Engineers have some experience in dealing with ordinary quicksand, but a quicksand of such specific gravity that wooden structures and planks sink into it instead of floating on its surface is too diabolical and unprecedented for engineers to tackle. They will much prefer to have the experimenting on such quicksands done by diplomats. They may possibly be light enough to float.

Preventing Conflagrations by Rebuilding Congested Districts

The recent great fire in Salem teaches anew the same lesson which was taught by the conflagrations in Chelsea, in Baltimore and in half a dozen other cities during the past dozen years, to say nothing of the great Chicago fire. The lesson is that a large area of buildings of inflammable construction, closely huddled together, is a danger to other and more valuable sections of a city.

In certain foreign cities, the municipality itself has been empowered to tear down and rebuild whole areas, compensating the owners of private property for the damages; but we recall no case in which an American city has undertaken a similar sweeping reformation. In Cleveland, Ohio, however, through the fortunate circumstance of a railway condemning a considerable area for terminals, the city's most congested tenement district is to be partially abolished. The Cleveland & Youngstown Ry. Co., a new interurban line, has recently acquired property for terminals in this district and is tearing down over 130 buildings occupied by some 3000 persons.

When municipal authorities awake to the importance of city planning, such condemnation of districts which constitute a fire hazard to the rest of the city may become common. Under present laws, however, it would be exceedingly difficult for an American city to undertake such an enterprise.

The Approach Facilities of Large Railway Stations

A feature of railway station design which seems rarely to be given the attention its importance demands is that of the approach facilities for passengers. The track layout, the trainshed plan and the conveniences inside the station building are carefully studied. The architects lavish artistic ability on the ornamentation of the structure but the arrangement of street approaches with a view to the comfort and safety of arriving and departing passengers appears to be very largely neglected. A recent controversy between municipal and railway authorities over the plans for a new station was based largely upon complaint as to the inadequate and inconvenient passenger approaches provided by the plans.

Because of this usual neglect, especial interest attaches to the excellent solution of the problem at the Pittsburgh passenger terminal of the Pittsburgh & Lake Erie R.R., illustrated in this issue. Here a passenger arriving or departing is under cover all the way from the train to the street car, nor does he have to cross a street crowded with traffic in order to take a car going in the direction he desires. The way in which this is done is simple enough—merely roofing over a short section of the street, and making a subway beneath it; but it is none the less deserving of careful study. In this case the tracks are below the street level, but where they are elevated the street shelter may form a bridge connection with the train floor of the station.

It will be evident that in order to carry out this desirable improvement, coöperation between the railway, the city authorities and the street railway company was necessary. This coöperation ought in theory to be easily obtained. In practice it appears to be very difficult.

We have in mind one of the most costly and well planned suburban railway terminals in this country, completed only a year ago. It would have been perfectly easy to have arranged sidings at the station where street cars could have received the passengers delivered by incoming trains. Special cars for this purpose have long been required. The city authorities, however, would not permit street-car tracks to cross a sidewalk, hence one may see daily the entire traffic on the city's main street blockaded while a crowd of passengers are boarding the cars.

At many stations in this country the passenger who takes a cab or omnibus is well provided for and protected from the weather; but similar protection for the street-car passengers, many times as numerous as those who take cabs, is very seldom provided.

Nor is the covered cab stand always to be found. At how many stations may be seen cabs standing at the curb

with passengers landing on an open sidewalk and standing in the rain, snow, or wind while they pay the drivers and collect their baggage? At one several-million-dollar station may be seen thrifty porters who have equipped themselves with umbrellas to meet these conditions and to encourage the grateful tip.

Many railway stations in this country are placed as close as possible to the street, but in foreign cities it is very general practice to put a large court or open space between the street and the station, even when (as in London or Paris) the land thus occupied is of high value. This is due in part, no doubt, to the much larger proportion of cab traffic, which could not well be accommodated at the curb without interfering with the stream of street traffic. At the station entrance, therefore, the railway company may build such covers and shelters as it desires, without interference by municipal authorities. In many cases, also, the vehicles may drive into or through the train-shed. One objection to this has been the consequent dirt and smell, but with the reduction in horse-drawn vehicles and the increase in motor vehicles this objection is becoming of less weight.

Where a passenger must walk all the way across a broad plaza to reach a street car, the distance of the station from the street is an objection. The proper method in such cases is to locate loops or sidings for the street cars close to the station where they can take on passengers without stopping traffic on the main street.

Ocean Traffic and Municipal Prosperity

A great deal has been said and written in the last dozen years concerning the great effect which the opening of the Panama Canal is expected to have on the growth of various cities, particularly in the South. Most extravagant expectations are entertained as to the stimulus to trade and traffic which will result from the opening of the canal and the impetus to the growth of various commercial cities and seaports which will result. The fact is, however, that even if the canal should carry as great a volume of traffic from the very start as its most sanguine promoters have claimed, there is little reason to believe that it will have any noticeable effect on the growth in wealth or population of any city or seaport either on the Atlantic, Pacific or Gulf coasts.

The idea that the opening of the Panama Canal will greatly develop the commerce and wealth and population of various seacoast cities is really part and parcel of the widespread fallacy that commerce is the great influence which upbuilds cities. We refer to commerce, of course, in the limited sense of transportation, and in the broader sense in which the term includes all industry. It is not strange that this fallacy should be widespread, especially in commercial circles, but engineers who study causes and effects should have a juster view of the situation.

The reason why this fallacy is so widespread is because up to comparatively recent times it was indeed commerce which determined the growth of cities. It is a most interesting chapter in history that traces the rise and fall of famous cities in Europe by the growth and decay of their commerce. It was her facilities for water-borne commerce that made the greatness of Venice; it was their commerce that built up the cities of Holland and in a more recent era the seaports of Great Britain. In our own country down to the middle of the 19th century there were many cities which grew large and wealthy solely by their commerce. Such New England cities as Portland and Salem and New Bedford and New London owed their early prosperity solely to the shipping which sought their harbors. But the revolutionary changes which have taken place in transportation have absolutely altered the influence of commerce upon city growth.

A remarkable illustration of this economic fact is furnished by the city of Galveston. As most of our readers will recall, the United States government some twenty years or more ago ordered a commission of engineers to report as to what port on the Gulf of Mexico could best be improved to serve as a shipping point for the products of the Southwest, so that they could reach deep-water transportation there at less cost than that involved in carrying them a long distance to ports on the Atlantic coast. This commission reported in favor of Galveston as the port to be improved; and the government has since expended large amounts to give Galveston a safe and commodious harbor suitable for deep-draft vessels.

As a result of this improvement, in connection with the development of the Southwest and the increased production of goods seeking a market from that section, the commerce of Galveston has grown by leaps and bounds and its foreign trade is now larger than that of any seaport of the United States, excepting only the port of New York. In the fiscal year of 1913 the total trade of Galveston amounted to $240,000,000, whereas previous to the improvement of the harbor its commerce was comparatively trifling.

If the commonly held ideas as to the effect of commerce on city growth and development were correct, then manifestly Galveston ought to have doubled, or trebled or quadrupled in population in the third of a century which has elapsed since the census of 1880, at which date trade through the port of Galveston was comparatively trifling. Instead of this being the case, however, the growth of Galveston has been extremely small. It had in round numbers 22,000 population in 1880, and in 1910, although the second city in the country in its volume of foreign trade, its total population was only 37,000. Better proof that a great volume of commerce may have little or no effect upon a city's growth in population could hardly be asked for.

When one contrasts the difference between old-time methods of transportation and those in force at the present day, it is not difficult to see why commerce has so little effect upon a city's growth. In the days when wooden sailing ships came up to the wharves of Salem, bringing their cargo of tea and silks from China, there were great profits in the shipping business. These old sailing vessels remained a long time in port and required extensive refitting in sails and rigging and food supplies after every voyage. A whole list of industries prospered at each port upon the ships that brought and took cargo from there. The buying and selling in connection with the goods brought and taken by the ships, moreover, were generally carried on at the port itself, and the opportunities for profit brought a large influx of people to push their fortunes.

All these things have been revolutionized by modern machinery and modern commercial methods. Nowadays, a million dollars' worth of goods may pass through a sea-

port with very trifling toll paid to residents of the port, even in the employment of labor. A thousand bales of cotton, for example, may be bought by a firm in Houston or Fort Worth or New Orleans, or New York City. The cotton is shipped from some interior point to Galveston. The cars containing it run alongside a steamer which may be owned in Holland or Liverpool or Stockholm, a gang of colored stevedores transfers the cotton from the cars to the hold of the vessel and she steams away to her destination. The only toll which any resident of Galveston has obtained from this commerce was the wages paid to the stevedores.

In the handling of grain, the case is even more striking, for the carloads of grain discharge directly into the boot of an elevator and without the intervention of human muscle the grain is stowed in the ship's hold.

Another apt illustration may be found in the transfer between railway cars and lake steamers at the principal lake ports. Buffalo owed its early importance to its position as the western terminal of the Erie Canal and the eastern terminal of the Lake transportation lines. As recently as 20 years ago, the transfer from the vessel to the railway car gave employment to an army of shovelers in handling grain and ore and coal. But modern machinery has now dispensed with the shovelers. Today on some of the great ore docks on Lake Erie an operating force of only three men can move the entire cargo from a big lake ore steamer and place it in railway cars ready for shipment within half a dozen hours.

The same thing is illustrated at the head of Lake Superior where the ports of Duluth and Superior handle a traffic whose tonnage exceeds that of any other port in the world. This vast traffic is handled and transferred with only very trifling tribute to the two cities.

The city of New York 15 or 20 years ago was greatly exercised because its export traffic in grain was slipping away from it. The cost of handling grain through its crowded harbor, with the necessary expenses of lighterage, etc., was such that grain dealers began to send their shipments by preference through such ports as Baltimore, New Orleans, Galveston and Montreal, where the cars could be discharged directly into the ship alongside. It was agitation over this situation that led the State of New York to undertake the $100,000,000 barge canal from Albany to Buffalo so that New York's commercial supremacy should be maintained.

The theory of those whose influence brought about the undertaking of the New York Barge Canal enterprise was that New York City owed its growth and prosperity chiefly to its location at the terminus of the water route from Buffalo to tidewater by way of the Erie Canal. They held that unless the importance of this water route could be maintained by rebuilding the Erie Canal to make the new Barge Canal, New York would decline in population, prosperity and wealth compared with rival Atlantic seaports.

It is interesting now to recall some of the lugubrious prophecies concerning the decay of New York's commerce that were current fifteen years or more ago. The prophecies have indeed proved true in this respect, that the export grain traffic which formerly flowed through New York has been almost wholly diverted to other ports; but the prophesied effect upon the city's growth and prosperity is nowhere to be seen. Grass does not grow in New York's streets; and the chief problem of the city is not how to secure additional population, but how to provide transportation facilities for the vast numbers which every decade adds to its population. Traffic by Erie Canal boats has ceased to have any commercial significance whatever; the new Barge Canal is not completed, and no one in commercial circles betrays any particular interest as to when it will be completed.

In business circles it has now come to be recognized that with railway rates under public control, it is to the advantage of shippers and the public to have as much freight as possible handled by the railways, so that they can afford to handle it at the lowest rate, instead of trying to hamstring them by taking away a part of the traffic and carrying it at public expense on the water route. Enormous as is the volume of New York's commerce, it is after all only a trifling proportion of its enormous population that depends upon that commerce for a living. It is manufacturing industries, and not transportation, that engages the great bulk of its people.

Two other Atlantic Coast cities which have been recently greatly concerned over their commercial facilities are Philadelphia and Boston. Apparently, some of the Philadelphia commercial organizations believe that the future prosperity of the city depends upon the increase of its foreign trade. The absurdity of this is manifest enough when one compares Philadelphia, with its million and a half of population, and Galveston with its 30,000. Were Philadelphia to succeed in increasing its volume of foreign traffic so as to displace Galveston as the second city in the country in volume of foreign trade, it is probable that the resulting increase in its population would be too small for anyone to discern. Here again it is Philadelphia's great manufacturing establishments and not the vessels which enter and leave its harbor, that determine its prosperity.

We are, of course, by no means unmindful in this discussion, of the importance of proper transportation facilities to a city, and especially to a manufacturing city; but good railway facilities, enabling a manufacturer to place his product directly upon a car at the gate of his works, are many times as important to a city's welfare as are its facilities for water transportation, even though the city be located on the seacoast.

Further than this, it is important to bear in mind that improved transportation or transfer facilities at a seaport, are chiefly of benefit, not to the seaport itself, but to all the country which sends and receives products through that port. The cheap route from the Southwest to Europe through the port of Galveston, made possible by the millions expended by the Government in the improvement of Galveston Harbor, has benefited the producers of half a dozen Southwestern States vastly more than it has the City of Galveston itself. Improved facilities for ocean shipment at Boston benefit the State of Massachussetts, and all of New England and other sections which send commerce to that port, far more than they benefit Boston itself.

That the statements made above are well grounded, there is plenty of evidence, in addition to what we have cited above, to prove. These statements have a direct bearing upon the present tendency in numerous cities toward municipal extravagance in connection with transportation facilities. Suppose the City of Galveston 20 years ago had decided that it would itself undertake, at its own

expense, to carry out the work of harbor improvement, and the building of wharves, piers, etc. It can easily be imagined that in the days when the Southern real-estate boom was at its height twenty years or more ago, enthusiasts might have declared that by such a municipal expenditure that city might at no distant day become the second in the country in volume of its foreign trade. It would have been assumed as a matter of course that on reaching that proud position it would have experienced an enormous increase in population and in wealth. It is quite within the possibilities that had not a great calamity overwhelmed Galveston it might have embarked on some such financial venture, just as much larger cities on the Pacific and Atlantic and Gulf coasts are today embarking on large enterprises for the development of terminals for water-borne traffic.

We would not be understood by any means as wholly condemning such enterprises. We have indeed recognized the importance to a city and to its tributary territory of proper facilities for the conduct of land and water transportation. The point we would emphasize is that when a city undertakes such an enterprise it should do it on the same basis as a private investor; that is to say, it should plan to receive a liberal income on its investment from the rental of the privileges which it provides. It should not be deceived by the specious claim that the city can afford to provide such privileges at the expense of the taxpayers because of the indirect benefit that will accrue.

How widespread is the belief in these indirect benefits may be seen in New York City, where there is constant pressure upon the city authorities to reduce the rentals of docks owned by the city, below what will return to the city a fair income on their cost, on the plea that the city must do it because of the indirect benefit it receives on account of the commerce so provided. As we have remarked above, fallacies of this sort are widely held by prominent men engaged in mercantile and manufacturing pursuits and by those who direct influential commercial organizations. It is the business of engineers, however, who carefully study questions of this sort, to hold correct views upon them, and be able to advise the public against unwise and unsafe expenditures.

Letters to the Editor

Longitudinal Expansion Joints in Brick Pavements

Sir—O. M. Severson, in a letter printed in ENGINEERING NEWS, of June 4, raises the question of the necessity for longitudinal expansion joints alongside the curb of brick pavements. He rightly dismisses transverse joints as useless. He might have gone further and said that transverse joints are a positive detriment to a pavement.

I cannot, however, subscribe to Mr. Severson's contention that the only use of a longitudinal expansion joint "of any value is to protect a flimsy curb." "A light curb," says Mr. Severson, "set only in a sandbed, may need the joint, but if the curb is properly built so as to be permanent, it will withstand the pushing due to the expansion of the pavement."

If the steadiness of the curb were the only question involved, no issue would be raised. But, while I do not write in a controversial spirit and have no intention of entering into a controversy, I desire to point to a few facts which Mr. Severson seems to have overlooked, and which, if duly considered, might modify his conclusions.

A curb that could be depended upon to withstand the extreme push of an expanding grouted-brick pavement could surely be built, but probably such a curb would add materially to the cost of construction. Allowing that an ordinary curb needs protection, a longitudinal expansion joint meets the conditions at a minimum cost without impairing the structural integrity of the pavement itself. Therefore the joint is justified by economical considerations.

Possibly I do not define the term "flimsy curb" exactly as Mr. Severson means it to be understood. It seems hardly probable that he [illegible] the standardized stone curb, and I have seen a curb of that kind, a curb having a 4-in. dressed top, and set in 2 ft. of concrete, sheared off at the top and the concrete base heaved by the thrust of expansion in a pavement having transverse expansion joints but no expansion joints alongside the curbs.

This object lesson teaches the possibility, rather than the probability, of a well built standard curb failing to perform its duty; but the lesson has a value—it proves that in order to be absolutely sure that a curb will not yield to the thrust of expansion under any circumstances, it is necessary either to increase the strength of the curb, or buttress it with a sidewalk, or put in a longitudinal expansion joint. The problem of handling expansion is not merely a question of the stability of the curb.

If expansion cannot find relief at the curb, it must be equalized by compression or the pavement will bulge. If we take up the expansion by means of a longitudinal joint, we keep the brick in contact with the sand cushion beneath, thereby preventing the rumbling noise so often heard and usually caused either by the lifting of the pavement or by the settling of the foundation.

The theoretical adequacy of compression to offset expansion is tenable, if at all, only in the case of a pavement lying perfectly flat and level. This type of pavement is never constructed. A crown is necessary for drainage, although the crown should be no higher than is absolutely necessary for drainage. We have in the crown a very different problem from that presented by a flat pavement.

Highway engineers know that a grout bond which fills only the upper interstitial space between bricks, leaving the lower space vacant, acts as a wedge against the bottom or haunch of the joint. This wedge intensifies the upward trend of the applied force, causing the crown of the pavement to strain.

If the thrust of expansion exceeds the ultimate strength of the curb to resist tearing, something must yield—

if not the curb, the pavement. If the thrust of expansion is greater than the resistance, plus the compressibility of the crowned pavement, the pavement will buckle. With only a curved pavement to relieve expansion, compensatory compression is practically a negligible quantity. Thus we have the basic theory of the necessity for an expansion joint along the curb, and generally speaking, engineers are agreed that the theory is sound.

I beg leave also to except to Mr. Severson's statement in substance, that concrete pavements and brick pavements are on a parity in respect of expansion and contraction, although I surmise he did not mean exactly that.

Both materials expand and contract, but not equally, and some authorities claim that both do not expand from the same cause. After expansion or contraction, brick resumes a normal state. Concrete acts differently. Brick is a finished product. After it is laid it undergoes no seasoning process that might cause changes in its density, molecular structure, chemical elements or proportions.

Concrete, being spread while very wet, is expanded by its excess of moisture content. A large percentage of the original moisture content is lost by evaporation during the process of hardening. What concrete gains in density through hardening, it loses in volume, and this shrinkage involves a pulling away of the mass from some original point of contact, or a fracture at some place in the mass. The point of cleavage may be at the curb, but usually longitudinal cracks appear either along the median line of the crown of the pavement or on either side of it, or both, and often it happens that radial cracks appear.

It is well to bear in mind that whether concrete be expanded by heat or by moisture, it never expands after hardening to the extent that wet concrete contracts in hardening. We have, therefore, in a concrete pavement, an initial contraction which never is completely overcome by subsequent expansion; for the reason that the moisture content of the concrete, when it is mixed, is never as great afterward.

The necessity for spreading concrete while it is wet and plastic explains the fact that a concrete pavement cannot be patched satisfactorily. A defective brick can be replaced by a good one; but a wet patch placed in hardened concrete shrinks in drying and pulls away from the adjacent pavement, leaving an interspace between patch and pavement which entirely surrounds the patch.

The crack may not define itself at once, but the line of cleavage is established at the outset of the hardening process, so that the appearance of the fracture is only a question of a short time. Even in the matter of cracks, a wide difference between brick and concrete exists.

A crack in a brick pavement is unsightly and undesirable, but it is not necessarily immediately harmful. Brick pavements often give excellent service for many years after cracks have appeared. Brick does not disintegrate, it wears away by abrasion. But when concrete cracks or pits, it begins immediately to ravel and the progress of disintegration goes on so rapidly that the pavement usually goes to the bad within a comparatively short time.

F. A. Churchill,
Dunn Wire-Cut-Lug Brick Co.

Conneaut, Ohio, June 23, 1914.

A Warning to Railway Construction Engineers Working for English Companies

Sir—Recently a limited liability company organized under the laws of England to engage in railway construction in South America went into voluntary liquidation in England. About 30 engineers, who were employed in South America, were sent home and discharged. All of them were under three-year contracts and had completed about half of their time. A clause in their contracts stated that in case they were discharged the company would pay them six months salary. After reaching England, these men went to the Receivers of the company to get their pay and were informed that the company would only pay £50 to each man.

I am informed that according to English law when a company goes into voluntary liquidation, the salaries have preference up to £50 provided the arrears do not date more than four months back; but any salary accruing after date of the company going into liquidation and all expenses due to the employee and any balance of arrears over the £50 becomes an ordinary debt and is second to the bondholders' claims. The average engineer seems to be under the impression that salaries and wages are preferred claims, but it seems they are not in this case, according to English law.

The Chairman of the Board of Directors of the construction company is also the Chairman of the Board of Directors of the bank which owns all of the bonds.

All of the engineers have claims running from £150 to £1000 each and apparently they will only receive £50 apiece. These men are all capable and honest and the officials who were in charge of the work are also good men; but the bankers and lawyers of the company will find all of their doings looked upon with suspicion in the future.

It would be wise for men who have employment contracts under English law to insist on having their salaries paid at the end of every month.

M. E. B.

Rio Janeiro, Brazil,
June 4, 1914.

NOTES AND QUERIES

A correspondent asks if there is any record of cooling ponds built of reinforced concrete. We have no knowledge of such construction and would be glad to hear from any one who has. Useful information would be in regard to any concrete tank containing water of a temperature of say 200° F., with an outside temperature of 0° F.

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The Liberalizing Tendencies of Good Roads Enthusiasm is illustrated by two news items of June 19; one is from Cañon City, Colo., stating that the bankers and business men of that municipality "realizing that brawn and muscle are essential to the construction of public highways, have not only subscribed liberally of money, but have gone out with pick and shovel and worked 10 hours a day to improve the roads"; the other item is from Jefferson City, Mo., and states that 40 convicts have been selected for experimental work on the public roads of Missouri. Convict labor is now authorized in practically all the states except Connecticut, Massachusetts, Rhode Island and Minnesota; yet in spite of this road work appears to be looked upon as a fashionable recreation by eminent citizens in many parts of the country.

The Recent Street Subsidences in Paris, France

Following a very severe rainstorm on June 15 the sewers and streets in the city of Paris, France, were flooded to such an extent that severe subsidences took place in three different locations near the center of the city and a number of minor depressions occurred all over the city area. At last accounts about 14 deaths were caused by the accident and it is thought that a number of others may have occurred, the bodies having been washed through the sewers to the Seine and not yet discovered. The cable reports which came first from Paris did not particularize the cause of the trouble, but recent advices seem to show that the subsidences were due primarily to the overflow of flooded sewers into subway excavation.

The city of Paris is now constructing by contract under municipal engineering direction a number of new rapid-transit subways. Owing to the very great complication of underground structures, both of a public-service nature and old building foundations, it has been considered impossible to drive these tunnels by the shield method. At the same time it appears that the Paris engineers are not acquainted with the cut-and-cover method now being so successfully employed in the construction of the New York subways, because it is stated that they cannot allow the stoppage to traffic incident to the open-cut subway construction method. There remains, therefore, only the timbering tunneling method.

The subways now under construction in and around the Place de L'Opera are being driven by the ordinary timbering method; that is, a center heading is first driven and arched up, side excavation being carried out by fan-shaped timbering on either side. Just at present a large part of the subway has the center arch in place, the masonry being supported at its haunches on the as yet unexcavated earth. Above the tunnel arches the sewers and water mains of the city are allowed to remain in their normal position not many feet away from the crown of the subway arch.

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Fig. 1. Cave-In in the Rue de la Boetie, Paris, Caused by Sewer Overflow into Subway Workings

(Copyright by International News Co.)

Fig. 2. Cave-In adjacent Place St. Augustin

The rain of June 15 was very sudden, so sudden that it was not possible for the city authorities to control the internal valves by which the excess rainfall flow is diverted from the sewers to the river. Consequently, the sewers soon became full and in places under pressure. It seems that they either began to leak or in places actually broke, allowing the full flood of the excess flow to be diverted onto the subway top where in three places, as noted above, the sides of the arch were undermined and the arch dropped, carrying with it the superposed earth, wire conduits, water and sewer pipes and street paving.

The accompanying views show two of the three large subsidences. Fig. 1 is on the Rue de la Boetie. At this

point it will be seen that the subsidence approached dangerously near the foundation of the adjoining building. Fig. 2 is in the Place St. Augustin. Here in the foreground is a large opening about 50 ft. long, 40 ft. wide and 33 ft. deep, roofed over by the wood-block paving shown. It was in this hole that a taxicab with a driver and woman passenger disappeared, and the man and woman were both drowned.

Report of the Board of Engineers on Flood Control in Los Angeles County, Calif.

In February of the present year the city and county of Los Angeles were visited by an exceedingly heavy rainfall which resulted in a record-breaking flood throughout the entire district. Engineering News in many numbers throughout the first half of this year reported various details of the damage done by the flood water. On Apr. 3, 1914, a committee was appointed to investigate the causes of the flood and to report upon a system of flood control which might be adopted. This committee consisted of H. Hawgood, Chairman, Chas. T. Leeds, J. B. Lippincott, Frank H. Olmstead and James W. Reagan. The provisional report of the Board of Engineers who constitute this committee was made on June 3, 1914. Below is given a brief abstract of the recommendations.

Flood Damage

The committee first sought to compile a record of the flood damage and sent out a number of blanks from which estimates of damages have been made. The data returned to the Board up to June were as follows: Land overflowed, 11,763 acres land totally ruined, 1904 acres land partially ruined, 1081 acres. The estimated amount of losses in ranch and horticulture property is $2,626,845, which includes only about 60% of the loss of the county outside the city of Los Angeles, so that a total ranch or farm loss in the county would be about $4,476,000, to which should be added the losses of the private corporations operating in the county and county highway losses of $2,725,000. Besides this a loss of say $500,000 occurring in the city of Los Angeles may be added, making a total physical loss in the county of $7,601,000.

This amount is only for property or physical loss. In only a few instances were the losses incurred by way of depreciation in value of property included in the estimate. The committee finds that the sum of the depreciated losses and loss due to suspension of business fight total about $2,500,000, making the approximate cost of the floods of February about $10,000,000.

Past Floods

It appears that there had been some heavy floods in the district in 1825, 1833, 1862, 1867, 1884, 1886 and 1889, the flood of 1889 being the heaviest, with perhaps the exception of that of 1862. Since 1889 there have been serious floods in 1891, 1906, 1911 and 1914. This covers a period of 90 years. The mean interval between destructive floods has been about eight years, the maximum interval twenty-nine years, and the minimum three years. Considering the expectancy of floods, it is to be noted that in five years, 1884 to 1889, there were three destructive floods, two of which, notably 1884 and 1889, being among the highest on record.

Recommendations

The Board's recommendations are as follows:

The methods available for flood control are broadly separable into two general classes, opposite in their action: first, those which accelerate the discharge of the main streams, such as the improvement and straightening of channels; second, those which retard and regulate the flow of the feeders into the main stream, such as dams, the spreading of water, the planting and preservation of trees, and especially of low growing brush and willows.

The methods that the Board is able at this time from the data before it to recommend are as follows:

The waterways should be of a type having a channel of moderate width and depth for low-water flow, with levees of such height and set out at such distances apart as would provide an adequate flood channel. The dimensions of the channel should be varied from place to place according to the hydraulic requirements. Protection can be effectually given the levees by revetments and by spur dikes of piles and wire netting. The well-known protection of fascines and mattresses of willow cannot be adopted except in a few places for the compelling reason that the country does not as yet afford a sufficient wealth of willows to supply the necessary material.

The top of the levees throughout their length should be prepared with particular regard to their use by heavy motor trucks. These roadways would be of great value for maintenance service and are in fact a necessity. In making the roadway, oil would be used. The Board is investigating the value of extending the oil into the water face of the levee to furnish resistance to erosion of the light soil, of which many of the levees must necessarily be built.

While flood control by levees in this and foreign countries has been marked by numerous failures and it is impossible to forsee conditions and meet every future contingency, it is a noticeable fact that these failures have been almost universally due either to undue encroachments on the river channel or to insufficient design, inspection and maintenance.

The spreading of flood waters over the gravel deposits and miles of cañons is in general advocated by this Board, it is believed it will indirectly repay in most cases the cost of work from increased irrigation and water-supply alone.

The Board is of the opinion that it may prove a very important factor in avoiding flood damage to construct, according to the Swiss practice, a series of low and inexpensive dams in the upper tributaries of the various watersheds. The effect of this is to change the naturally continuous slope of the stream bed to a succession of steps similar to the drops inserted in irrigation channels to reduce velocity. This method opens the way to vary the time and rate of the maximum flood discharge of the numerous feeders so that the waters from the upper watersheds shall not arrive at the cañon narrows at the same time as the water from the lower side cañon.

There then follows in the report detailed recommendations as to the treatment of the particular rivers which were flooded in the recent floods. The report concludes with the following general recommendation:

The Board recommends that only substantial construction be employed and whatever can be done to commence the work of flood control, even if it be at first only work on the smaller streams and the cleaning of obstructions to the larger, be put in hand with all possible speed. Surveys should be made to define the rights of way for the official channels and to base detail estimates of construction costs upon. All work, irrespective of size, should be approved and supervised by a control board or authority appointed by the county in order that they may be harmonized into one general plan by which means alone can success be achieved. No flood or storm water control, construction, or structure over official waterways should be permitted that is not in accordance with the adopted general plan and approved by this adequate authority.

The Board considers that the construction of the works noted in its report, together with a 25% overhead allowance and including $1,400,000 item for harbor work on six miles of Los Angeles River (which may be considered particularly a federal and state concern and which possibly would be undertaken by the state or the Federal government) would cost about $9,400,000.

A Pittsburgh Railway Station

By G. P. Forsberg*

SYNOPSIS—The most striking feature of the station entrance is the exceptional protection from the weather for those passing to and from the street cars at the station. There is the very unusual arrangement of a shelter roof over the street and sidewalks, with stairways and a subway under the street. The station has forced-draft ventilation, with the air washed and heated, or cooled to suit temperature conditions.

The Pittsburgh & Lake Erie R.R. terminal station and general office building at Pittsburgh, erected in 1900, is located on Smithfield St. at the south end of the bridge over the Monongahela River.

The facilities for caring for passengers arriving at and departing from the station have been enlarged at an expenditure of approximately $12,000, adding the feature of making it possible to pass under cover from train to street car or other conveyance. The general arrangement is shown in Fig. 1, and also by the plan, Fig. 2. The station has both stub and through tracks, and the level of the general waiting room and the concourse and platforms is 12 ft. below the street level. The plan, Fig. 2, represents two levels, but the notes and description will make its meaning clear.

Passengers arriving by train pass from the train shed into the concourse. From this they may pass through the waiting room to reach automobile, cab, street car or sidewalk, or they may go by a more direct route to these same points, under the protection of a covered way outside of the station building but at the platform level, as shown.

The large majority of passengers do not pass through the waiting room, but use the covered way. From the end of this, the passengers may use the stairway to the street or pass through the subway to the east side of the street. The latter is the proper route for passengers taking northbound cars, as its use protects them from crossing at grade a street thickly congested by street-car and vehicle traffic. A "cornerman" is on duty at this crossing for the protection of pedestrians who fail (through chance or otherwise) to use the subway and cross the street and tracks at grade. A suitable booth with glass sides is provided for the "cornerman's" protection in severe weather.

FIG. 1. STREET SHELTER AND COVERED WAY AT THE ENTRANCE OF THE PITTSBURGH & LAKE ERIE R.R. TERMINAL STATION, PITTSBURGH, PA.

The stand for taxicabs, automobiles and cabs, is directly under the Smithfield St. approach to the station, and passengers may reach this stand under cover. Signs are clearly displayed directing the route to be traveled at all points where there is a divergence of routes, so there need be no doubt or misunderstanding in the minds of strangers as to which route they should take.

Passengers arriving at the station to leave by train are afforded similar protection. If they arrive by street car, they alight under the protection of a roof 45 ft.

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wide, spanning the entire width of Smithfield St. (Figs. 1 and 3). These passengers should use the stairway on the east side of the street, leading down to the subway. From the west end of the subway they may go through the station, if they desire to purchase tickets, check baggage, etc., or, if all this has been arranged, they may go by the more direct covered way to the concourse.

Pedestrians from the north and parties alighting from the street cars who desire to reach the station by crossing Smithfield St. at grade (a bad practice) may either use the covered stairway that leads to the covered way to

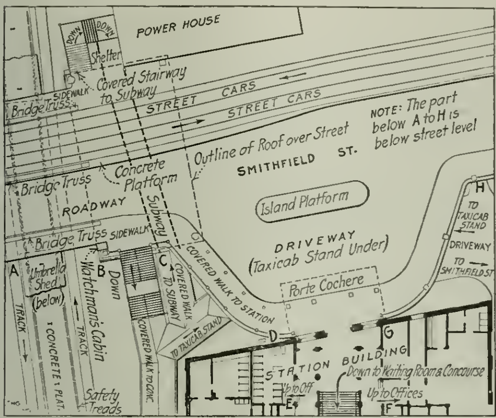


Fig. 2. Plan of Street Shelter, Covered Way and Subway for Passengers; Pittsburgh & Lake Erie R.R. Terminal Station, Pittsburgh, Pa.

the concourse or if they desire to pass through the station they have a covered walk, at the street level, that leads to the main entrance. They may then go down the stairway to the general waiting room, or take elevators to the offices above. Passengers arriving by public or private conveyance alight in the cab stand and reach the concourse by either of the two routes previously described for travel between the trainshed and cab stand, or alight under the protection of a porte-cochere at the Smithfield St. entrance to the station.

Fig. 3 shows an elevation and sections of the shelter spanning Smithfield St., the covered way leading to the station entrance, and the stairway to the platform and subways. Fig. 4 is a cross-section of the subway under Smithfield St., and Fig. 5 is a view of the station end of the subway. This subway is constructed of reinforced concrete, lined inside with white ceramic tile, with a dark

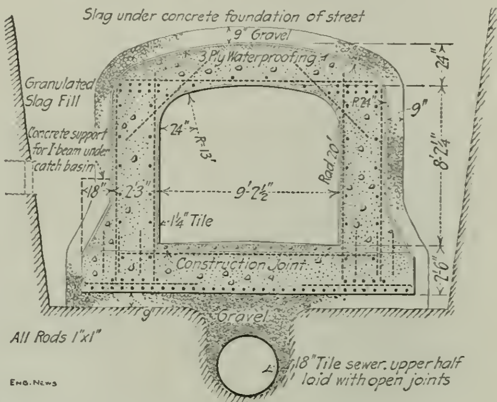


Fig. 4. Cross-Section of Passenger Subway

ceramic-tile base, and granolithic-concrete floor. It is well lighted by electric lights. The heavy reinforcing and the spread of the footings was made necessary on account of the unstable foundation upon which the subway is constructed. Up to the present time, a little more than two years since the construction of the subway, no perceptible settlement has taken place nor have any cracks developed.

Other Facilities

Drinking Water—The sanitary drinking fountains, and the old-type drinking fountains from which water may be drawn for filling individual cups, are supplied with distilled drinking water, cooled by ammonia coils to 45° F. The water is kept in constant circulation by a small pump and returns through a pressure valve to a cedar storage tank so that a person does not have to allow the water to run, but may drink at once. The passenger coaches of all trains leaving Pittsburgh are stocked with distilled drinking water.

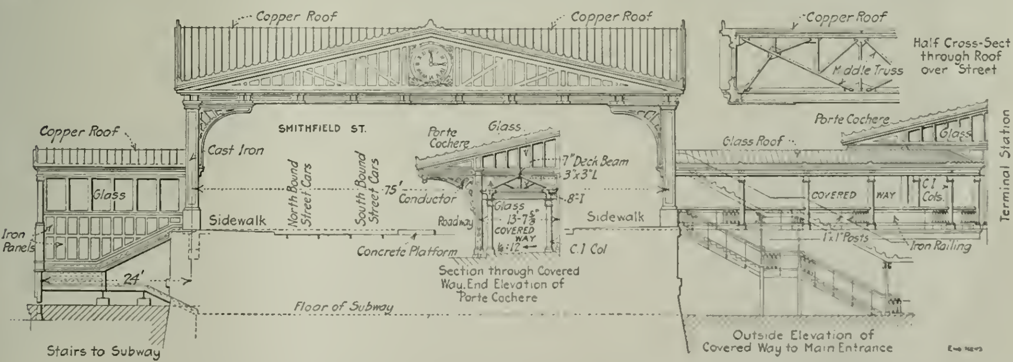


Fig. 3. Sectional Elevation of Facilities at Entrance to Passenger Station

VENTILATION—The ventilating system of the entire building, from which the passengers receive especial benefit in the waiting rooms, is by means of a forced system of circulation. The air is freed from practically all extraneous matter by a washing process and is heated to the desired temperature in winter and cooled in summer. It is then discharged into the rooms approximately at the floor level. At the ceiling are outlets of the same area, which (also by means of forced circulation) draw the air from the rooms at a slightly less rate than it is being delivered. This keeps a slight excess pressure in the rooms, which tends to prevent dust or dirt from the outside getting through any cracks or openings that might exist around the window frames or through exterior doors when open.

This fresh air is delivered and exhausted in such quantities as to change the air in the rooms every 15 min. The window sashes are built in, one sash in each opening being hung on hinges in order that the janitors may get outside to wash them. These windows are kept locked, the janitors having the keys.

GATEWAY RAILING—Fig. 6 shows a detail of the railings at the approach to the ticket gates between the concourse and train shed. This design differs from the ordinary practice in that the top or guard rail is not supported directly on the uprights. The arrangement permits a passenger to walk through the gate rails with a suitcase or valise, without the customary annoyance of striking his burden against the upright supports. At the same time it preserves a distance between the guard rails which insures only one person, at a time, passing through the gate.

FIG. 5. COVERED WAY AND STREET SUBWAY; PITTSBURGH & LAKE ERIE R.R. TERMINAL, PITTSBURGH, PA.

FIG. 6. ARRANGEMENT OF RAILINGS AT ENTRANCE TO TRAIN PLATFORMS, ALLOWING SPACE TO CARRY HAND BAGGAGE

PLATFORMS—The concrete platforms in the trainshed are $12\frac{1}{4}$ in. above the top of the rail, which makes the distance from the platform to the first step of the coach vary (for different classes of equipment) between nothing and $8\frac{1}{2}$ in. This easy rise avoids the necessity of stools being used to assist passengers in boarding or alighting from a train. In the platforms protected by the umbrella shed, safety treads are built in the concrete at the edge of the platform (Fig. 2) in the location that a person would step in alighting from a train.

The terminal station building and facilities were designed in the office of the Chief Engineer, Pittsburgh, Penn.; J. A. Atwood, Chief Engineer, and A. B. Rayner, Assistant Chief Engineer.

Petroleum Production in the United States in 1912 and 1913 was 222,935,044 bbl. and 248,446,230 bbl., respectively. The average value per barrel in each year was [illegible] and [illegible], according to the United States Geological Survey. These figures show that while the gain in output was less than [illegible], the gain in value was almost [illegible]. The output in 1913 was greater than in the previous year by more than [illegible]. Every state except Colorado showed an increase in the value of the oil. The greatest producing districts were as follows in the order named: California, Mid-Continent, Illinois, Appalachian, Gulf, Lima and Indiana, Colorado and Wyoming.

Annual Meeting of the American Society for Testing Materials

The 1914 meeting of the American Society for Testing Materials, held last week (June 30 to July 3) at Atlantic City, was fully as active as its predecessors, which means that it was the busiest engineering meeting of the year. It was distinctly marked by a drifting-apart of committee work and independent papers, evidenced by the fact that few of the papers related closely to subjects of specifications or other committee work. Part of this phenomenon is chargeable to the large amount of subcommittee work which the main committees now carry on. Thus the committee on Preservative Coatings for Iron and Steel has half a dozen or more subcommittees studying various phases of oil analysis, etc., and their results are incorporated in the committee report as small-print appendices, whereas formerly such auxiliary work might have furnished material for independent papers.

This, however, is part of a larger change in the society, which represents an important evolutionary stage.

Great Growth of Committees

The committees of the society are becoming so large as to constitute independent societies, so to say. One of them has 108 members, another 67 members, and several others have over 30 members each. They have their own officers, their own meetings, their own income (contributions solicited from manufacturers), and—as an innovation of the past year—their own constitutions or regulations.

But the most prominent mark of the commanding status of the committees is found in the fact that they have become self-perpetuating. So far as the society membership at large is concerned, the committees are virtually immortal. They control their own membership, and they can be discharged only at their own motion or with their consent, except "for cause," in which case the Executive Committee acts as judge and executioner. At least this is what appears from a new set of Regulations Governing Technical Committees, which are now in force, by virtue of having been promulgated by a special committee.

Another change just made is also a reflection of the magnitude and importance of the committee work. The terms of the officers of the committeees are now limited to two years, just as in the case of the society itself. This arrangement by itself suggests the permanent nature of the committees.

Power of the Membership to Be Limited?

Related to the preceding is a suggestion which Prof. Edgar Marburg (Univ. of Pennsylvania) made in a paper entitled "A Critical Review of the Procedure Governing the Adoption of Standards." He suggests that it is meaningless and undesirable to have the whole society vote on the adoption or rejection of specifications, standard methods, and the like. Committees made up of experts draw up such recommended standards, and the general membership of the society is probably incompetent to pass judgment on the specialized matters presented.

Prof. Marburg did not suggest an alternative; or rather he suggested several, in the form of queries—his paper was largely an assemblage of queries. But any alternative to the present method of taking a vote of the whole society, by letter ballot, on the adoption or revision of specifications, must be a move toward limiting the powers of the members.

The discussion which followed the reading of the paper made it clear that some members would object to a course of this kind. Sharply diverging opinions were expressed. Thus, R. W. Hunt (Chicago) called the letter ballot farcical, and claimed that all doubts or objections to a specification should be fought out on the floor of the society's meeting at the time the committee presents its report. On the other hand, Prof. A. N. Talbot (Univ. of Illinois) favored retention of the letter ballot, and boldly asserted that not all knowledge on a given subject is tied up in the committee which deals with that subject.

No action was taken in the matter, as no specific proposal had been advanced by the author.

Specifications for Engineering Methods

A radical innovation in the society's work presented itself during the meeting in the shape of a specification which, instead of defining a material, prescribed certain methods of engineering construction. So unobtrusively did this make its appearance that no word of comment was uttered, and with smooth dispatch the meeting adopted it for submission to letter ballot, which usually is equivalent to final adoption (no letter ballot having resulted in rejection, in the society's history).

The committee on Drain Tile reported (1) a set of methods for strength tests of drain tile; (2) a specification for quality of drain tile (strength only), and (3) a set of rules entitled "Proposed Recommended Practice in *Design and Construction* of Tile Drains." The latter contained very detailed prescriptions for bedding, backfilling and tamping; and, further, *a table of earth pressure on pipes* in trenches of various widths and depths, for sand and clay. Instructions for using the table, and factors of safety to be employed in designing tile drains, were also given.

Overnight consideration of this proposal resulted in a qualified reconsideration of the approval given these specifications the previous day. A resolution was passed which (1) directs the executive committee to consider the departure from prior policy involved in the formulation of rules on engineering design and construction, and (2) directs the executive committee and the drain-tile committee jointly to consider this question in its aplication to the present case. However, as no formal vote was taken to rescind the meeting's approval, the drain-tile specification will presumably go out to letter ballot in the usual way.

The most important or interesting of the committee reports are summarized below. Elsewhere we give some notes on new data or other useful information contained in the papers presented at the meeting.

Steel Committee

The formidable Steel Committee (108 members, 15 subcommittees) reported a large batch of revisions of existing specifications, and some new specifications. Of the 30 standard specifications previously worked out by the committee, only 11 remained unchanged. All the recommended changes and new specifications were accepted by the meeting and passed to letter ballot of the society. The most important changes are as follows:

Steel Rails

In the face of requests made on behalf of the American Railway Engineering Association to take no action on rail specifications now, the committee revamped its rail specifications thoroughly. It substituted a single specification for the two separate ones dealing with open-hearth rails and bessemer rails; increased the carbon (to a maximum of 0.62-0.75%, for openhearth rails over 85 lb. per yd.); extended the range of sizes down to 50 lb. per yd. and up to 120 lb. per yd.; adopted a ductility measurement in the drop test; abandoned a fixed ingot-discard; and fixed the standard rail length at 33 ft.

Bridge and Structural Steel

While still maintaining the distinction between bridge steel and building steel, the committee made some important changes. Among them are the following:

In *bridge steel*. Strength of rivet steel reduced 2000 lb., to 46,000-56,000 lb. per sq.in., and sulphur raised half a point, to 0.045%; a bend test for eye-bars added; tension tests from angles abandoned.

In *Nickel steel*. Sulphur raised one point, to 0.05%; tension tests of angles abandoned.

In *Building Steel*. Strength of rivet steel reduced 2000 lb., to 46,000-56,000 lb. per sq.in.

A new specification for *Structural Steel for Cars* was drawn up. It calls for metal of 50,000 to 65,000 tensile strength, in plates and shapes over ⅛ in. thick. Parallel with it is the revision of the specification for *Structural Steel for Locomotives*.

Reinforcing Steel

In concrete-reinforcing steel rolled from billets, an intermediate grade was added, between the structural and hard grades. This grade is to have 40,000 lb. yield-point and 70,000-85,000 ultimate tensile strength.

Ductility and Ultimate Strength

In all the above, as well as in other specifications under charge of the steel committee, the elongation requirement will hereafter be made inversely proportional to the ultimate strength, i.e., per cent. elongation equals the quotient of a constant divided by ultimate strength. This calculation, evidently, takes account of the fact that, with the same original material, slight variations of physical condition will shift the strength and the ductility in opposite directions.

A particular application of this calculation led to a warm fight. The specification for *tempered axles* was revised in consultation with a committee of the American Electric Railway Engineering Association. That committee demanded, for electric-motor axles, a high ductility of fixed amount for all tensile strengths within the allowed range. The steel committee declined this demand and stuck to the inverse-ultimate rule. The fight was brought into the meeting, W. V. Johnson appearing for the A. E. R. E. A. committee. The society finally supported its steel committee, and passed the specification to letter ballot.

All other specifications for railway forgings were also revised, and the revisions accepted by the meeting. A proposed standard method for chemical analysis of plain carbon steel was also accepted by the meeting.

C. D. Young (Pennsylvania R.R., Altoona, Penn.) is chairman of the committee.

Wrought Iron

Staybolt iron still occupies the wrought-iron committee (chairman, S. V. Hunnings, Schenectady, N. Y.); a minor change in the existing standard specifications was recommended, and was accepted by the meeting. Vibratory tests of staybolt iron cannot be included in the specifications, the committee reports, because the various testing machines do not agree.

Chain iron will be studied during the coming year. The subject of pipe threads will also be considered.

Cement: The Autoclave Test

The savage fight waged over the autoclave test at the 1913 meeting of the society resulted in the cement committee's finally entering upon consideration of this form of test. Preliminary arrangements have been made for a systematic trial of the test, in which 16 laboratories will assist. Of these 16, no less than 11 were already engaged in making such tests when the committee inquired about the matter.

The Force patent of Feb. 3, 1914, covering the autoclave method of testing cement, is a confusing element in the situation.

The International Association for Testing Materials has, during the past year, reorganized its committee on Accelerated Tests of Constancy of Volume of Cements. R. L. Humphrey (Philadelphia) is the new chairman of this committee. The autoclave test may receive consideration also by this committee.

Two other subjects will be dealt with by the American Society's cement committee during the coming year: the Chapman method of determining consistency, and a standard screen scale.

Lime

Two sets of specifications for lime, covering respectively quicklime and hydrated lime, were prepared by the lime committee for submission to the meeting. At the eleventh hour, however, the committee changed its mind, revised the specifications, and presented them only as tentative, not for present adoption.

These specifications give a classification of limes, limit the carbon-dioxide content, limit the coarse material, and, for hydrated lime, specify a soundness test. Strength requirements are not feasible, and other requirements which would define the product precisely are apparently not possible at the present time.

Drain Tile and Sewer Pipe

Two separate committees are handling specifications for drain tile and sewer pipe respectively. The latter has not yet drawn up a specification, but the drain tile committee (chairman, Prof. A. Marston, Iowa) reported a group of three specifications on methods of test, quality of tile, and proper design and construction of tile drains.

Novel features of these specifications are:

Three methods of making a crushing test of drain tile are described and permitted on equal terms; the results are declared to have certain specified ratios. The strength as given by the sand-bedding method is made the standard of reference, but the assumption is made that this method produces the same bending moment in every case.

Three qualities of drain tile are recognized. Of these, the highest grade must be vitrified salt-glazed clay tile or thoroughly seasoned concrete tile, but the other two

grades may be of any material. The grades are distinguished according to crushing strength, tables of strengths for various sizes being given for each grade.

The specification for design and construction of tile drains has already been mentioned. A factor of safety of 1½ is prescribed for ordinary tile-laying. A table of loads on pipe in trenches, as determined by tests, gives loads for depths of trench up to infinity, and widths up to 5 ft.

These specifications received no discussion at the meeting, but were passed to letter-ballot. A special resolution was passed at a later meeting (as previously noted), calling for consideration of the policy of adopting engineering rules.

The work of this committee is remarkable also for having included a very great amount of experimental work. Full reports of the experiments were published as Bulletin 34 of the Iowa State College of Agriculture & Mechanic Arts, quite recently.

The Sewer Pipe Committee (Chairman, R. Hering, New York) also proposes to draw up a specification for laying pipe, as part of its final report. A memorandum on this subject, and a glossary of technical terms, have been prepared, and were presented at the meeting as tentative.

Road Material, Brick, Cement and Waterproofing Committees Conflict

A set of proposed test methods for specific gravity and absorption of rock, and methods of mechanical analysis of broken stone, gravel, and sand were prepared by the Committee on Standard Tests for Road Materials. But the concrete committee protested that it should have a voice in formulating such methods, and the result was that the proposed methods were referred back, for conference of all interested committees. Definitions for certain terms relating to bituminous materials were also proposed, but here the waterproofing committee protested, and similar action was taken as in the other case.

This led to heated discussion when the brick committee presented a report of progress. The committee on road materials, which had just been treated as noted, made the claim that it should have a voice in considering paving brick. But Prof. A. H. Blanchard's vehement argument to this effect was ineffective, as the meeting voted against the claim.

Paint

The report of the paint committee (Preservative Coatings for Structural Materials) took the shape of a 125-page book. The committee has 67 members and 12 subcommitttees, and carries on a number of elaborate investigations. Detailed reports on laboratory studies of paint materials filled most of the book. Their subjects are: Tests of Chinese wood oil, 22 pages; Tests of linseed oil; Methods of analysis of white pigments and red lead, 20 pages; Turpentine, 28 pages; Other Thinners, 4 pages; Shellac, 7 pages.

Tentative specifications for turpentine, covering some of the properties of turpentine, were presented, but not for present adoption. Several other properties cannot be specified until additional test results are obtained.

A series of definitions of technical terms relating to paint was criticized by C. D. Rinald (Philadelphia), and finally was referred back to the committee for reconsideration.

The Havre de Grace Bridge Paint Test

Eight years ago the committee painted the Havre de Grace bridge, Pennsylvania R.R., with 19 paints. Now many parts of the bridge need repainting and the test is declared ended. On a rating of 10 = perfect, the inspection of the bridge May 1, 1914, showed 9 paints to be in condition meriting a rating of 5.0 or over. The two highest ratings are 8.1 and 7.2. The committee resolved not to make public any information as to the origin of the various paints.

Other Exposure Tests of Paints

The steel-plate panel tests with ocean-side exposure, at Atlantic City, started six years ago by the Paint Manufacturers' Association, has also come to a final end. The last inspection was May 2, 1914. The paint committee of the American Society for Testing Materials has coöperated in these tests. It reported the 1914 ratings of the panels that still survived, but for some unaccountable reason it did not offer a word of comment or conclusion.

White paints are being tested on a test fence in Washington, D. C. This test was started in 1912. Results (for 15 mo.) will be reported in our next issue.

New and Revised Specifications

Besides those noted above, three other new specifications were presented and were accepted by the meeting: Cold-drawn bessemer automatic-screw stock, which describes a dead soft steel of 0.08 to 0.16% carbon; recommended practice for the annealing of carbon-steel castings; hardened steel objects.

The following specifications were revised, more or less extensively: Standard magnetic tests of iron and steel; manganese-bronze ingots for sand castings; spelter; locomotive cylinders.

The committee on Methods of Testing reported a large series of recommended revisions in its specifications. Many of them were based on the use of three-point extensometers, which the meeting was not willing to accept as standard. All the recommendations were finally referred back.

Lubricants were also a subject of contention. Provisional tests for lubricants were presented for adoption. The Saybolt viscosimeter was made standard, though a minority of the committee demanded that the Engler viscosimeter be admitted as alternate. The split on this point resulted in the specification being referred back to the committee for reconsideration.

Progress Reports of Committees

Fireproofing materials are being studied, but further progress waits for extended tests which are to be made this year. One line of study will be materials suitable for furnishing short-time protection to columns and girders of buildings, at less cost than complete fireproofing.

The committee on rubber products has ceased work on air-brake hose but continues work on pneumatic-tool hose. Specifications are being drawn for cold-water hose, low-voltage insulated wire, packing, gaskets, pump-valves and steam hose.

Copper trolley-wire specifications form a subject of nonagreement between the society's committee and a committee of the American Electric Railway Engineering Association. It is proposed to collect data on trolley-wire service which may settle the differences.

The next year committee is working on revision of the malleable castings specifications, as the change in the business due to steel castings taking up the field of heavy castings is making better specifications necessary.

Brick is still in a tentative stage. The provisional specifications presented a year ago are not recommended for adoption, but elaborate tests on relation between strength and absorption, etc., will be made; 24 laboratories will coöperate in the work.

An elaborate progress report was presented by the committee on Sampling and Analysis of Coal. This is the result of joint work with the American Chemical Society, and is the second preliminary report on the work.

The Committee on Specifications for Timber proposes to undertake some work during the coming year.

The address of the retiring president, Arthur N. Talbot, was on the subject "The Relation between Research and the Activities of the Society." It was in part an earnest reminder of the fact that to make specifications and to formulate testing standards requires thorough knowledge of materials and their properties, and that to secure such knowledge calls for much and thorough experimental research. Obviously the society should stimulate research.

Possibly some day there may need to be a general research committee of the society to coördinate work and to stimulate opportunities. * * * Research requires patience, diligence and skill as well as knowledge and opportunity, from outlining the problem and separating the essentials from the non-essentials to analyzing the data and drawing conclusions. See that men of ability and training are selected for such work. Express appreciation of the results obtained and encourage extension of the work. For one function of the society is to widen our knowledge of materials.

In reviewing the available agencies of research the speaker attributed special importance to coöperative studies by committees of the society (and other societies) and laboratories of producers, consumers, independent and schools. One of the instances he cited is of particular interest, on the one hand because it involves exceptional difficulties, and on the other hand because the research will be largely Prof. Talbot's own work. This is the study of stresses in railway track, from roadbed up to rail, which has recently been put under way by the American Railway Engineering Association and the American Society of Civil Engineers.

New Officers

The terms of the principal officers expiring this year, A. W. Gibbs (Pennsylvania R.R.) was elected president, A. A. Stevenson, Vice-President, and Edgar Marburg re-elected secretary and treasurer. The new members of the executive committee are, Robert Job, F. W. Kelley, A. Marston, and S. S. Voorhees.

A group of amendments to the constitution, providing for selection of a nominating committee by the membership, was approved by the meeting and passed to letter ballot.

Useful New Facts About Materials

News and Results Abstracted from Papers Read Before the American Society for Testing Materials

How Strong Is Steel under Repeated Stress?

Steel bridges, axles, springs, shafts, and a great variety of other structures and parts are called upon to endure many-times-repeated stresses. Their safety depends on the ability of the metal to endure stress-repetitions or stress-reversals, rather than on strength under static load. Soft and ductile steel is safe in this respect, as past experiments have shown quite conclusively. But metal which has been partly hardened by cold working may be less safe, inasmuch as it is employed under stresses higher than soft metal could carry, although we do not know that it has greater endurance under repeated stress.

This is one and the most important of the queries propounded by Prof. H. M. Howe (Columbia University, New York) in a paper "Are the Effects of Simple Overstrain Monotropic?" The paper considers whether steel is hardened (its yield point raised) in all directions when it is cold worked in only a single direction. Some tests made at Columbia on the broken halves of a tensile test piece showed practically equal [illegible] hardness in all directions. But in connection with this narrower subject the author deals with many related questions, among them the above-noted question as to strength under repeated and reversed stress.

Experimental work on this important detail, however, seems to be little more than begun. A few quotations from the paper are:

There is much evidence to show that reversing overstrain instead of adding to the [illegible] elevation of the elastic limit and tensile strength caused by prior overstrain, as simple overstrain does, for example in wiredrawing and cold-rolling, has the opposite result of effacing the effects of such overstrain. If this is true, then it follows that any rise of the tensile strength and elastic limit caused by prior overstrain is fictitious as regards the endurance of stress reversals, and that the effective fatigue strength is that which existed before such prior overstrain, and hence that to which the metal would return on removing that overstrain by annealing at [illegible].

This hypothesis [illegible] would imply that cold-rolled shafting, cold-drawn wire and like materials have no greater endurance than the same materials when annealed.

If it is true that stress reversals efface the elevation of the elastic limit due to prior overstrain, but elevate that caused by cold-rolling or [illegible], then it seems to follow that [illegible] specifications for objects which in use are subjected to vibratory stress reversals should [illegible] such elevation.

[illegible]

Internal Fissures in Steel Caused by Defective Manufacture

A large locomotive driving axle broke while in the lathe, before it had been in service. Examination by Robert Job (Montreal, Que.) showed a large transverse fissure 8 in. in diameter, at the point of fracture, which left only a narrow ring of solid metal around the periphery. There were also some longitudinal cracks. The

steel contained 0.48% carbon, low phosphorus and sulphur, and was not segregated, nor did it contain excessive slag. Microscopic examination showed evidence of uneven heating, and overheating on one side. The case proves that an internal transverse fissure may be produced in metal at the mill and as a result of severe stresses induced by defective mill practice.

Prof. H. M. Howe suggested that such cracks probably result often from charging a cold ingot into a hot furnace. Snapping sounds are given out by such a piece as it heats up, suggesting that the cold interior is torn apart as the outside heats up.

An Accelerated Endurance Test for Metal Coatings

The protective value of galvanizing and other metal coatings has hitherto been largely subject to guess. Exposure tests are likely to vary in their conditions so greatly as to vitiate comparisons; the fact that they require a very long time before any results whatever are obtainable makes them inapplicable as routine acceptance tests. No accelerated test of general applicability had been devised. Now, however, a very promising test has been developed in the laboratory of the General Electric Co., and the company's testing engineer, J. A. Capp, described it under the title "A Rational Test for Metallic Protective Coatings."

The test consists in exposure of the test articles to a saturated salty atmosphere. An atomized spray of water saturated with common salt is projected into the chamber containing the articles. Rust appears very quickly, in times ranging from an hour or two to several weeks. This length of time is taken as measure of the protection afforded by the coating. The rusting usually is practically uniform over the whole surface of the article; when certain parts of the surface (as the edges of screw-threads on a threaded article) show rust much earlier than other parts, the coating is evidently thin or weak at these points.

The spray test (without salt) was first used as an accelerated test of insulations. In applying it as a rusting test to galvanized or sherardized articles, the simple water spray was too slow; by adding salt, much more rapid action was obtained. In this form it has been in regular use for several years past in the laboratory above mentioned.

When the coating is relatively thin and poor, rust may develop in from 2 or 3 hr. to 24 hr., or longer. A better coat will last two or three days, but a well applied coat of requisite thickness will last at least a week. If no rusting is developed in two weeks' time, it may safely be assumed that the life of the coating will be practically indefinite. These figures are based on experience with both sherardized and galvanized types of coating.

The standardization and adoption of such a test is likely to have a considerable effect in promoting the intelligent selection and use of metallic coatings.

Paint on Cement or Concrete Surfaces

H. A. Gardner (Washington, D. C.) adds materially to the few existing data on painting concrete. A two-year test of 35 different paint mixtures applied (3 coats) to separate panels of a cement-stucco test fence in Washington shows that good oil paints give very satisfactory service on cement surfaces, while water paints and varnish or other resinous paints do not. A priming coat of 25% zinc-sulphate solution was applied to the panels, to neutralize any free lime, but this is held to be unnecessary if the surface is dry when painted and will not be exposed to the weather. The oil paint is not attacked by the dry cement, and holds both texture and color. Boiled linseed oil, mixtures of raw and boiled oil, and mixtures with Chinese wood oil, gave equally satisfactory results. Such simple paint coatings were also found to be excellent for concrete floors, being durable, wear-resisting, and dust-preventive.

The Strength of Slag Concrete

Although much concrete made with blast-furnace slag as aggregate is in service (and has been in service for years), there are still many who doubt the strength and the permanence of such concrete. As to strength, new data have been provided by W. A. Aiken (Philadelphia). He started an extensive series of tests a year ago, making 500 six-in. cubes of 1 : 2 : 4 cement-gravel-slag mixture. The sand "was not what could be considered first-class material." Of the total number, 400 have already been tested; the other 100 are to be tested at future periods. The average crushing strengths obtained were, in pounds per sq. in.:

SLAG CONCRETE. AVERAGE WEIGHT 140.8 LB. PER CU.FT.

Age	28 d.	3 mo.	6 mo.	9 mo.	1 yr.
Crushing strength.....	1561	1952	2589	2841	2797

The author interprets these figures as follows:

The main point is whether the compressive-strength values herein developed are sufficiently great to warrant the employment of slag as aggregate, in competition with broken stone and gravel. We think the findings are in favor of this, since our experience has been that the crushing strength of broken-stone or gravel concrete, made up under ordinary field conditions, will not average over 1500 lb. per sq.in. at the age of 30 days.

Slag varies widely, both physically and chemically. That firm slag will make a strong concrete has never been much in doubt. Naturally, the discussion of the paper dealt with the permanence of slag concrete rather than its strength, although Mr. Aiken gave no data on permanence. Opposing opinions were expressed. R. L. Humphrey (Philadelphia) mentioned having examined many cases of disintegrated concrete made with blast-furnace slag. He claims that slag if suitable is excellent for concrete, while if unsuitable it is the worst material that can be used.

Expansion and Contraction of Concrete with Wetting and Drying

Experiments by Prof. A. H. White (Univ. of Michigan) reported three years ago showed that concrete expands by wetting and contracts by drying, in amount sufficient to affect structures quite seriously. Continuation of these experiments has shown that these volume changes do not decrease or stop with age. Further, bars cut from sidewalks after 20 yr. service also show these phenomena, and retain them even after baking at 600° F.

Progressive expansion or contraction may also occur. A bar of neat cement could by successive bakings be made to contract as much as 1.6%. Bars of 1 : 3 sand mortar could, by successive bakings and boilings, be made to elongate 0.75%. Bars cut from sidewalks taken up after 20 yr. service were made to elongate 0.175% by successive immersions in water at room temperature; it

would take 200° F. temperature rise to produce an equal heat-expansion.

Full data on these tests are given in Prof. White's recent paper "Volume Changes in Portland Cement and Concrete." The author suggests that the observed phenomena represent serious causes of destruction of concrete in service. But on this point the concrete men disagree with him heartily. They have asserted that his test conditions are artificial. The permanence of concrete pavements and sidewalks is claimed to be a sufficient answer to his allegations.

Additional Results Obtained with Autoclave Test for Cement

H. J. Force (D., L. & W. R.R., Scranton, Penn.) reported new figures on the relation of tensile strength, compressive strength, and air and water storage, to aging of cement-mortar testpieces. Tensile tests of 1:3 briquettes, tested up to 1 yr., do not show very marked influence of the ability of the cement to pass the autoclave test. But in the compression tests up to 1 yr., the cements which failed to pass the autoclave test were much lower than those which passed the test.

Briquettes stored in water for varying periods up to 2 mo., then tested by autoclave and broken in tension, showed that "seasoning" was frequently not obtained by the water storage. Many of the 2 mo. briquettes failed in the autoclave test, but cement which passed the test in 24-hr. briquettes did not fail in the test at subsequent periods.

Briquettes stored in air for 18 mo. were in some cases not "seasoned" with respect to the autoclave. But those which passed the autoclave test at 24 hr., and gave high tensile strength, also gave high strength after passing the autoclave at the age of 18 mo.

Test for Concrete Aggregate

C. M. Chapman (Westinghouse, Church, Kerr & Co., New York) has tried the following test of the value of broken stone, etc., for use as aggregate in concrete. A skeleton testpiece of the stone to be tested is formed by filling the stone into a mold and then filling the interstices with a standardized grout; then this skeleton testpiece is crushed at 14 or 28 days. The compressive strength so found is taken as a measure of the value of the stone.

In actual manipulation, the stone after first being soaked in water, is mixed with the 1:1 standard grout, the surplus grout drained off through a $\frac{1}{4}$-in. sieve; the stone so coated with grout is then put in the mold and shaken and rodded down, and the rest of the grout poured in to fill all voids. A 6-in. cylinder 6 in. high is one of the shapes tried.

[Other abstracts will follow in next week's issue.]

Test for Fireproofing—A test structure for conducting tests of fireproofing and fire-resistive coverings for structural members is being erected at the Underwriters' Laboratories, Chicago, the Western [illegible] Fire Insurance Companies cooperating in the enterprise. The test structure, it is claimed, will be the most [illegible] of the kind ever built. Temperatures will be measured with great accuracy. Many kinds of tests can be made. The Bureau of Standards may assist in conducting the tests.

A New City Charter for St. Louis

The city of St. Louis, on June 30, by a vote of 46,839 to 44,158 adopted the new charter prepared by the Board of Freeholders. The Board of Freeholders consisted of six lawyers, six business men and one engineer, Edward Flad, M. Am. Soc. C. E., for several years Water Commissioner of St. Louis.

The new charter provides for a single legislative body, a Board of Aldermen, consisting of 28 members. The Mayor is the chief executive and responsible officer, and appoints the administrative heads of all the departments. His salary is $10,000 per annum. He and all other elective officers are subject to recall. There are also the usual provisions for initiative and referendum. No recall petition can be filed within six months after an election.

Of the most interest to engineers is the Board of Public Service, which is appointed by the Mayor. This board is composed of a President and four Directors: the Director of Public Utilities, the Director of Streets and Sewers, the Director of Public Welfare and the Director of Public Safety, each the head of a Department of the same designation. The salary of each member of the board is $8000 per annum. According to Section 2, Article XIII,

> The President of the Board and the Directors of Public Utilities and of Streets and Sewers shall be engineers of technical training, of at least ten years experience and qualified to design as well as to direct engineering work.

The President of the Board has charge of any public works undertaken by the city which are not assigned to special departments. The Department of Public Utilities, which includes water-supply and city lighting, has general supervision over maintenance, equipment, operation and service. Under the new charter the city may buy and operate any kind of a public service. The water-supply is a subdivision under a Water Commissioner. The work of the Department of Streets and Sewers includes garbage and refuse collection and disposal, bridges, wharves and levees. The Department of Public Welfare includes parks, hospitals and penal institutions, including a division under the Health Commissioner. The Department of Public Safety includes police and fire-protection, weights and measures, and building inspection.

All subordinate employees are examined and selected by an Efficiency Board consisting of three members appointed by the Mayor. The Board may call on other persons to frame questions and conduct examinations or tests. Any appointing officer may suspend or discharge or reduce in rank any employee under him. So far it is merely a civil service board, but in addition to these powers it is also to investigate and keep a record of the efficiency of officers and employees in the classified civil service, and requires reports relative to employee's efficiency from appointing officers.

The purchases for all city departments are made through a Supply Division of the Department of Finance, which is distinct from the other city departments and is under the general supervision of a Comptroller elected by popular vote. The subordinate officers of the Department of Finance, the Assessor, Collector, Treasurer, and Supply Commissioner, are appointed by the Mayor. The Supply Division does not have jurisdiction over the purchase of material for public works and improvements.

The Largest Pumping Plant in the World: a Great Humphrey Engine Pumping Plant for Land Drainage in Egypt

The Egyptian government has just awarded to the Humphrey Pump Co., Ltd., of London, a contract for ten Humphrey direct-acting explosion pumps with a combined capacity of a billion Imperial gallons per 24 hours for use in drainage of the Nile Delta at Mex, Egypt. This will be, we believe, in volume of water handled, the largest pumping station in the world, if not at first then certainly when it reaches its ultimate size, as provision is to be made in the construction for the addition of eight more pumping units, giving it a total possible output of 1,800,000,000 gal. per 24 hours. In making comparisons, of course, it must be remembered that these are Imperial and not United States gallons.

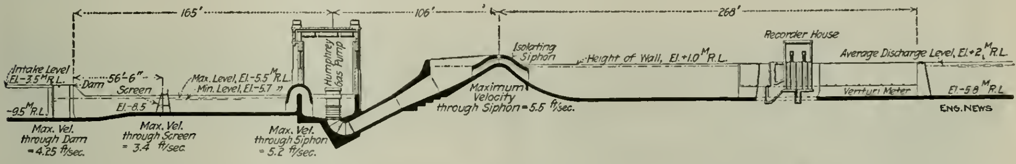
The only pumping installation we can recall which might possibly compare in volume of water handled with this great Egyptian plant is some of the screw propeller pumps, built to force a current of water through a tunnel for flushing out river channels, such as the well known plant at Milwaukee. These screw-propeller pumps operate, however, under a very small head, whereas the Humphrey pumps at the Mex station will lift the water 19 to 20 ft. According to the information furnished to us, the purpose of this great pumping plant is to furnish drainage for a considerable part of the Nile Delta. The drainage from a large area of irrigated land flows into Lake Mareotis, beside which the station is to be built. The pumps will lower the level of this lake 7 ft. and will then maintain it at this lower level. Each pumping unit is to be designed for an output of 68,750 Imp. gal. per minute normal rating (100,000,000 gal. per 24 hr.), with an overload capacity of 75,625 Imp. gal. The pumps will be supplied with producer gas made in Dowson producers from anthracite coal. The contract awarded includes besides the pumps the necessary screens, sluice gates, etc., the gas producer plant, auxiliary gas engines and electric generators for power and lighting, and Venturi meters for recording the flow in the conduits. The accompanying cut gives a profile and cross-section of the new pumping station as now designed.

The great size of the pumps may be judged from the fact that each unit is to be capable of delivering more than double the amount delivered by each large Humphrey pump unit installed at the Metropolitan Water Board's Pumping Station at Chingford, which have an output of 40,000,000 gal. per day each.

The maximum internal diameter of the combustion chamber will be 8 ft. 8 in. and its height about 11 ft. The water valve box will be 8 ft. 8 in. diameter and 7 ft. high, and will be fitted with 100 valves of the hinge type specially designed to enable any valve to close upon an obstruction, such as a piece of wood, without throwing undue strain on the hinges. The design is such that on the next stroke, when the obstruction has been removed by the rush of water, the valve will automatically readjust its position and close fairly upon its seat. This type of valve has proved itself thoroughly satisfactory under test.

All the main castings will be of steel, and will be carried upon a cast-steel bend which connects to the playpipe. This bend will be in two parts, making up the 118.5° required to connect with the inclined playpipe.

At Chingford, the bend has an angle of 90° and connected to a horizontal playpipe, which in turn connected through a second 90° bend to a vertical conical water tower. At Mex, however, there will be only one bend, and the playpipe is sloped upward so as to deliver the water at the required elevation in the discharge basin. In order to reduce the velocity of the water at the exit, the playpipe ends with a long conical portion giving a 12-ft. diameter outlet. Not only does a sloping playpipe eliminate one of the bends and give rise to a simpler construction, but it has the additional advantage that the vertical components of the forces due to momentum of the moving masses of water in the combustion-chamber portion and playpipe portion, respectively, are balanced.



LONGITUDINAL SECTION THROUGH CONDUITS OF HUMPHREY GAS PUMPING STATION TO BE BUILT AT MEX, EGYPT

The pumps will be started by forcing into the combustion chamber a mixture of gas and air which is exploded by means of the usual sparking plug and switch so as to give rise to the first oscillation, after which the working becomes automatic. Compressors capable of rapidly charging the pumps for this purpose and having separate cylinders for air and gas are included in the contract.

Five of the pumps will be made by Wm. Beardmore & Co., Ltd., of Glasgow, and five by the Tecnomasio Italiano Brown Boveri at Milan.

The anthracite gas plant will be capable of gasifying 44 tons per day. There will be nine producers, one of which will be a spare.

There will be two Venturi meters supplied by George Kent, Ltd., each arranged to measure the water delivered from one or more pumps up to a total of five. These meters will be of square section and 12x12 ft. in the throat. The meters are guaranteed to be accurate within $1\frac{1}{4}$%. Except that the throat diameters will be lined with gun-metal to insure smooth and accurate stream lines they will be mostly constructed of $\frac{3}{4}$-in. steel plates bolted to rolled-steel joists and jointed with lead strips. The meters will be partly supported in the natural rock as excavated and partly by concrete walls.

The whole of the work will be carried out under the

supervision of Harper Bros. & Company, Consulting Engineers to the Egyptian Government.

We are indebted for the above information to the owners of the American rights to the Humphrey patents, the Humphrey Gas Pump Co., Syracuse, N. Y.

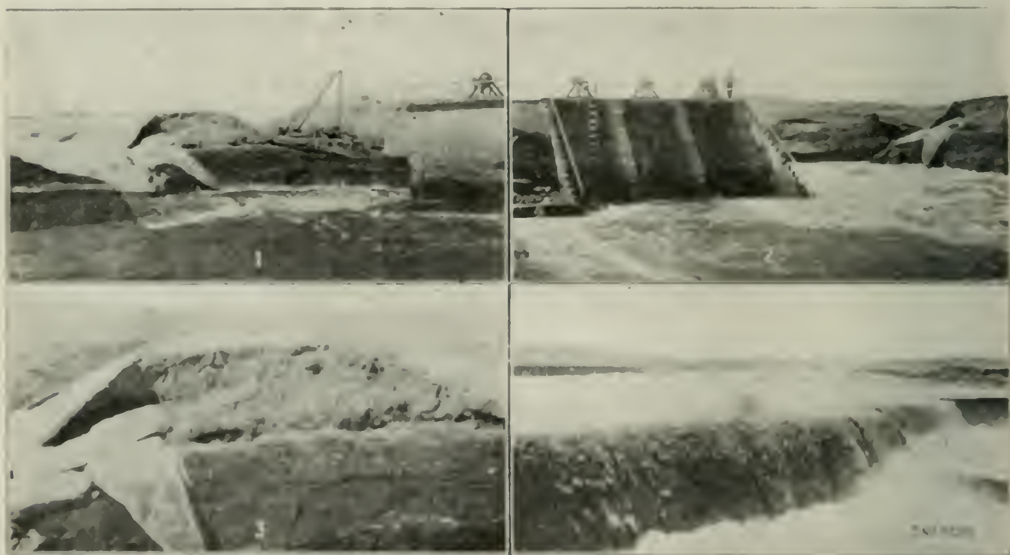
Reservoir Embankment Failure; Turlock Irrigation District, California

(CONTRIBUTED)

The break in the embankment of Davis reservoir, Turlock Irrigation District in Stanislaws County, Calif., was an accident of no little engineering interest so that available details should be put on record. The immediate damage to the irrigation works is comparatively small (possibly $50,000) but the loss to the community from crops ruined by the deprivation of water, may amount to a million dollars or more, if water is not quickly restored. However, a large force of teams was put at work immediately to construct a new canal [illegible] and the District officials hope to resume irrigation service in about 20 days.

CANAL AND RESERVOIR—The main canal of the Turlock Irrigation District heads on the Tuolumne River at the La Grange Dam about [illegible] miles east of Modesto. From the intake the canal runs generally west for 10 miles and empties into Davis reservoir. This latter has what is locally termed a "[illegible]," covering [illegible] acres, and having a maximum depth of 40 ft. and a capacity of [illegible] acre-ft. It is formed of a series of earth dams with concrete facing built last winter. The natural formation at the [illegible] grounds is 30 to 40 ft. of fine sandy soil, and sand of various degrees of fineness which in places is cemented so as to form a hardpan. The outlet structure is located in a deep cut made through this latter material. In placing the outlet, which consists of three radial gates, a cut was made considerably wider than the structure itself and the backfill was dumped in wet and, some claim, not puddled. A 6- to 8-in. concrete face was placed on the face of the fill and extended into the bottom hardpan several feet. This facing connected with the gate structure but the sides of that structure were made smooth without any cutoff walls or wings.

Water was first turned into the reservoir early in April before the reservoir structures were complete, and on June 27, the gage registered 38 ft.—nearly the full capacity. Soon after the reservoir was finished a number of water users protested against the acceptance of the work by the District, claiming that the filling had not been properly puddled and that the packing was cracking. There was reported a small leakage around the outlet structure. Some repairs were made but the leakage continued.



FIGS. 1 TO 4. VIEWS OF DAVIS RESERVOIR EMBANKMENT FAILURE

[illegible]

THE FAILURE—At 2 a.m., June 27, the night watchman at the reservoir discovered that water was pouring through a hole on the right side of the gate structure, was rapidly tearing away the fill on that side and was cutting into the original hardpan sides. At 9 a.m., this gap had widened to 60 or 70 ft., and it is estimated that water was pouring through at the rate of 18,000 cu.ft. per sec. The water was carried by the canal a short distance and then broke its banks and overflowed into the Tuolumne River, finally cutting a deep, wide channel to the river, and washing out, beyond repair, about a mile of the canal. At this time (June 28) water is still flowing out and it will probably take several days to

FIG. 5. MAP OF TURLOCK DISTRICT

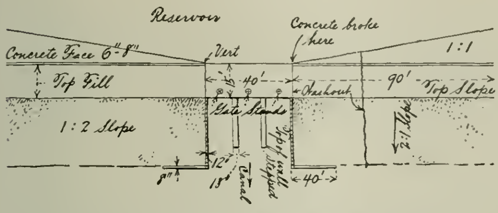


FIG. 6. SKETCH OF GATE STAND AND EMBANKMENTS AT BREAK (DIMENSIONS APPROXIMATE)

empty the reservoir. Figs. 1-4 show photographs taken on the morning of the 28th, when there was some 15,000 acre-ft. in the reservoir and about 10,000 sec.-ft. flowing out the break. Fig. 5 is a map of the district and Fig. 6 is a sketch, hastily drawn, of the gate and embankments.

CAUSE OF THE FAILURE

The cause of the break may be attributed to any one of several conditions which were found to exist.

(1) There was no provision for any cutoff wall on the side of the gate structure except the thin concrete facing. The structure presented a perfectly smooth surface and the new fill and small holes through the facing next to the wall would have led to an easy discharge path along this wall.

(2) The partly washed-out fill on the left side of the structure showed that it was composed of boulders, lumps of rock and hardpan and a fine sandy soil. Although it is claimed that this was puddled in place, some persons who witnessed the construction declare that the material was merely dumped from cars into a pool of water that was maintained in the center of the fill. The present exposed fill shows that the mass was not thoroughly compacted and not of very well selected material.

(3) The concrete facing on the fill is said to have extended 2 to 3 ft. into the hardpan on the bottom. When water was first placed in the reservoir and before it had attained any considerable head against this facing, leakage developed, which was apparently from under the fill. It is the opinion of some who watched the construction of the fill that this leakage was the cause of the failure.

✕

A Proposed Deferrization and Demanganization Plant for the Lowell, Mass., Water-Supply

A novel water-purification plant for the removal of both iron and manganese from well water has been recommended to the city of Lowell, Mass., by F. A. Barbour, Consulting Engineer, Boston, Mass. The plans have been approved by the State Board of Health, and it is expected that bids for construction will soon be invited. The works have been designed for a nominal daily capacity of 10,000,000 gal., or a net average daily capacity of 7,500,000 to 8,500,000 gal. They include six coke prefilters, 10 ft. in depth and with a total area of 0.4 acre, to be operated as contact beds; a 500,000-gal. settling basin, in two units; 6 sand filters with a total area of one acre; and a 1,000,000-gal. filtered-water reservoir.

The nominal daily capacity of 10,000,000 gal. is based on a 75,000,000-gal. rate through the prefilter and a 10,000,000-gal. rate through the sand filter. The net rate mentioned allows for cleaning and for a possible lower rate of prefiltration. The estimated cost of the purification plant, low-lift pump to serve it and pipe connections is $180,000; to which $30,000 should be added for an extension of the well system to insure a supply equal to the capacity of the proposed purification works. The average cost of iron-and-manganese removal under these plans for the next 25 years is $7.65 per 1,000,000 gal., including interest, depreciation and operating charges.

Before deciding on the system of water treatment recommended, a long series of experiments was made on the removal of iron and manganese from the well water, and also another set of experiments on the decarbonation of water from another group of wells, the excessive carbon dioxide in which has given rise to lead poisoning and the consequent use of the wells only in times of high consumption. The design of the deferrization and demanganization plant was based on the experiments just mentioned. The decarbonation tests showed that the carbon dioxide could be removed by fine-spray aëration, in case it becomes desirable to use regularly the water.

In addition to the experiments with the well water, estimates were made of the cost of obtaining supplies from the Merrimac River, filtered, and from the Metropolitan water-works at the Wachusett Dam. The latter was found to be prohibitive in cost. A filtered supply from the Merrimac would cost about $250,000 for construction and $10.27 per 1,000,000 gal., including operating and capital charges. This is $2.62 more than the cost of iron-and-manganese removal, but the cost of maintaining the well system is estimated at $1.40 per 1,000,000 gal., which makes the filtered Merrimac supply less expensive by $1.78. Mr. Barbour considered this possible saving in cost more than offset by "the greater safety of the ground water, the lesser color, the lower temperature in summer, and the popular prejudice against the use of a polluted river water, however well purified."

TABLE SHOWING ANALYSES OF WATER SUPPLY OF LOWELL, MASS., FROM 1896 TO 1913.

Period	Color	Total solids	Ammonia Free	Ammonia Albuminoid	Chlorine	Nitrates	Nitrites	Oxygen consumed	Hardness	Iron
1896-00	15	44.2	0.087	0.032	2.7	0.261	0.001	0.7	17.6	0.322
1901-05	11	44.2	0.040	0.035	2.5	0.157	0.001	0.8	17.0	0.341
1906-10	25	42.7	0.131	0.048	2.8	0.098	0.001	1.1	18.5	0.770
1911-13	36	61.8	0.067	0.067	3.8	0.117	0.001	...	28.0	1.468

Deferrization and Demanganization Experiments

In 1893, Lowell put down a gang of driven wells in the valley of River Meadow Brook, known as the Cook Wells, and in 1894 put down another gang, a mile farther upstream, called the Hydraulic Wells. Together these wells yield about 5,000,000 gal. per day. The State Board of Health having concluded that these wells would not yield more than half the amount of water needed by the city, a contract was let in July, 1895, for driven wells, two miles above the Pawtucket Dam, between the Merrimac River and the Boulevard—hence the name, Boulevard Wells. A total of 160 wells yielded about 4,000,000 gal. a day. In 1899, the Cook supply was condemned because of lead poisoning through the action of carbonic acid on lead pipes. In 1900 and 1901, there were added to the Boulevard system 177 wells, making 341 in all. In 1911, there were added 118 wells, bringing the total up to 459. In 1902 and 1903, the Cook wells were not used, but since then they have been used for short periods each year, to the extent of 3.2% of the total consumption in 1904 and 28% in 1913.

With the increased draft on the Boulevard wells the water has become turbid and colored, due to increasing amounts of iron and manganese—although it does not appear that manganese determinations were made until recently.

The five-year averages of chemical analyses (in table on page 107) of the Boulevard well water, made by the State Board of Health, are of interest as showing (particularly by iron and ammonia) the effect of "overworking the soil" from which the water is drawn (quantities in parts per 1,000,000):

It will be noted that although the last period is for three years, only the iron and other mineral contents showed a greater increase than in the five-year periods. It may be added that analyses made from August, 1913, to April, 1914, showed weekly averages ranging from 1.[illegible] to [illegible] of iron and 1.7 to 3.55 of manganese (p.p.m.). Mr. Barbour states that with 1.6 parts of iron and 3.2[illegible] of manganese, 19[illegible] lb. of these two metals were being pumped into the water mains.

The 118 wells added in 1911 made "a temporary improvement in the quality of the supply, but within a few months, metal contents again increased to a point which rendered the supply disagreeable and altogether unsuitable for domestic service."

Experiments on this water were conducted with as much regularity as pumping conditions warranted from September, 1909, to April, 1914. Water was pumped to an overflow tank, passed through an orifice to a prefilter and then to a sand filter provided with a rate controller. The desired rate of filtration was maintained by meters and daily calibrations.

A series of [illegible] experiments is outlined and summarized in the report. We give here only the summary and conclusions, as follows:

[illegible]

[illegible]

[illegible] quent filtration through sand at a rate of 10,000,000 gal. per acre daily.

On these conclusions, plans of a purification plant have been prepared, based on the use of coke prefilters 10 ft. deep, an intermediate sedimentation basin of 1 hr. capacity, and sand filters 3 ft. deep. The depths of both filters are greater than in the experimental apparatus, and the addition of the intermediate sedimentation basin will serve to reduce the work to be done by the sand filter. It is believed the experiments were sufficiently prolonged, and on such a scale as to permit safe conclusions to be drawn, and that there can be no doubt that the plant designed will successfully remove the iron and manganese and render the Boulevard supply entirely satisfactory.

Estimated Cost of Deferrization and Demanganization

An outline of the proposed plant and costs of construction and operation have already been given. The prefilters would be above ground, and apparently without a roof. The inner walls of the prefilter would be carried up and a roof thrown across to house the operating gallery. In front of this a headhouse and laboratory would be built from which the main operations of the whole plant would be controlled. Still farther to the front, the settling basins would be located, with the sand filters on either hand and the filtered-water reservoir in front. The settling basins, sand filters and filtered-water reservoir would all be underground, built of concrete, with groined arches.

Some of the unit construction costs are as follows: Earth excavation and embankment, 70c. per cu.yd.; concrete masonry, $9.50 per cu.yd.; steel reinforcement, 4c. per lb.; coke, $2.50 and gravel and sand each $2.25 per cu.yd. The recording apparatus complete is estimated to cost $3500.

The cost of treated water per 1,000,000 gal. has already been given as $7.65, as an average for the next 25 years. This is based on the following detailed estimate for a daily rate of 5,800,000 gal. in 1915 and 8,400,000 in 1940.

	1915	1940
Fixed charges at 6%	$1[illegible]	$1[illegible]0
Fuel, low-lift pumping	[illegible]	6,1[illegible]
Oil, waste, etc.	3[illegible]	4[illegible]5
Scraping, washing and replacing sand	2[illegible]	4[illegible]
Three filter attendants	[illegible]	3,0[illegible]
Superintendence, laboratory maintenance	1,5[illegible]	1,[illegible]
Total cost per annum	$1[illegible]3[illegible]5	$2[illegible]71[illegible]
Cost per 1,000,000 gal.	[illegible].60	[illegible]
Cost without fixed charges per 1,000,000 gal.	3.51	3.2[illegible]

The present Holly pumps would lift the well water to the coke prefilters and two new steam-turbine-driven centrifugal pumps, located in a small extension to the present pumping station, would lift water from the filtered-water reservoir into the force main leading to the West St. pumping station.

James H. Carmichael is Commissioner of Water and Fire Protection of the City of Lowell, and Robert H. Thomas is Superintendent of Water Works.

Proposed California Law to Regulate Expert Testimony

Oscar C. Mueller, attorney, of Los Angeles, Calif., in collaboration with others, has drawn a proposed code to regulate the testimony of experts in trial cases, which has been approved by various professional organizations and will be presented to the next legislature by Mr. Mueller,

who is chairman of the committee on amendment of laws of the Los Angeles Bar Association. The following is the text of the proposed law:

Whenever it shall be made to appear to any court or judge thereof, either before or during the trial of any action or proceeding, civil or criminal, pending before such court, that expert evidence is, or will be required by the court or any party to such action or proceeding, such court or judge may, on motion of any party, or on motion of such court or judge, appoint one or more experts to investigate and testify at the trial of such action or proceeding relative to the matter or matters as to which such expert evidence is, or will be, required, and such court or judge may fix the compensation of such expert or experts for such services if any, as such expert or experts may have rendered, in addition to his or their services as a witness or witnesses, at such amount or amounts as to the court or judge may seem reasonable.

In all criminal action and proceedings, such compensation so fixed shall be a charge against the county in which such action or proceeding is pending and shall be paid out of the treasury of such county on order of the court or judge. In all civil actions and proceedings such compensation shall, in the first instance, be apportioned and charged to the several parties in such proportion as the court or judge may determine and may thereafter be taxed and allowed in like manner as other costs.

Nothing contained in this section shall be deemed or constructed so as to prevent any party to any action or proceeding from producing other expert evidence as to such matter or matters; but where other expert witnesses are called by a party to an action or proceeding they shall be entitled to the ordinary witness fees only and such witness fees shall be taxed and allowed in like manner as other witness fees.

Any expert so appointed by the court may be called and examined as a witness by any party to such an action or proceeding or by the court itself and, when called and examined by the court, may be cross-examined by the several parties to the action or proceeding in such order as the court may direct. When such witness is called and examined by the court, the several parties shall have the same right to object to the questions asked and the evidence adduced as though such witness were called and examined by an adverse party. Whenever the expert or experts so appointed are called to testify, the court may, in its discretion, advise the jury, if there be one, that such expert or experts had been appointed by the court to make the necessary examination and testify as expert witnesses. The court or judge may, at any time before the trial or during the trial, limit the number of expert witnesses to be called by any party.

NEWS NOTES

A Cave-in in a 6-ft. Trench in Los Angeles, on June 23, severely injured a workman caught in the trench.

A Dynamite Explosion on a Government Dredge at Smithsonia, Ala., on the Tennessee River, on June 26, killed seven men.

A Boardwalk Collapsed dropping 50 persons into the river at Stag Island, on July 1. No one was injured. The walk led over water to a dock.

An 80,000-lb. Blast was shot at Colton, Calif., on July 4, according to press dispatches. The blast was for the purpose of getting out limestone for cement.

A Ship's Gangplank Broke in Charlestown, Mass., on June 30 and fell upon the crowd of people below, killing one man and injuring four others just before the White Star Liner "Cimric" sailed for Liverpool.

Broken Tackle dropped 40 tons of steel turbine casing to the deck of the new Argentine battleship "Rivadivia" at the docks of the Fore River Shipbuilding Co., Quincy, Mass., on June 29, according to press dispatches.

A Canadian Pacific Steamer Grounded on the rocks at Bad Neighbor Island, near Cove Island, on the night of July 1, in a fog. Sister ships speedily reached the "Assiniboia," 5000-ton flagship of the railway fleet, and commanded by Commodore McConnel. Early on July 3 her cargo was taken off by lighters and the steamer floated. She proceeded under her own steam to Port McNicoll.

A Large Flywheel Burst, shutting down for 24 hr. the plant of the Union Brewery, St. Louis, Mo., at 1.25 a.m., on June 29, with damage amounting to about $50,000. A segment of the 24-ft. 8-ton flywheel shot through the 4-in. concrete ceiling, breaking the ammonia pipes in the condensing room above. At the same time, steam pipes were broken, shutting down the plant. It is said that the speed of the wheel increased from 40 r.p.m., normal speed, to several times this speed before bursting.

A Loose Rock in a Deep Shaft of Section 3, Bayonne, N. J., of the Passaic Valley sewer, now under construction, fell to the bottom, killing five of a gang of thirteen muckers, at 9 p.m., July 3. The shaft was at one end of the siphon under Newark Bay; the other end is in Newark. The inside diameter of the shaft after the 18-in. concrete lining has been placed is to be 12 ft. It will be 250 ft. deep, and had been sunk to a depth of 230 ft. at the time of the accident. The shaft was through firm rock and was not timbered. The main piece which fell weighed about 5 tons, and dropped from a point in the wall about 75 ft. above the bottom. There was no blasting going on at the time and no other shock is reported. The fall was probably caused by intersecting seams in the rock. According to the New York & New Jersey Constructing Co., New York City, the shaft is inspected or scaled for loose rock every day, and had been thus inspected by the foreman one hour before the slippage. The large size of the loose section probably accounted for its not being discovered.

A Gas Explosion in the New Water-Works Intake Tunnel, Milwaukee, Wis., injured 21 workmen of a gang of 30, at 7.30 a.m., Monday, June 29. No work had been done in the tunnel on the previous day, which accounted for the large accumulation of gas. The explosion was probably caused by a lighted match or a spark struck by a drill. The tunnel was not damaged.

The tunnel, described in "Eng. News," July 24, 1913, p. 155, and June 18, 1914, p. 1334, is of brick lined with concrete and has a diameter of 12 ft. It will extend into Lake Michigan a distance of 4000 ft. to a crib from which four lines of 6-ft. cast-iron water mains will extend to a point 2500 ft. out in the lake where the water is 60 ft. deep. Work is going forward rapidly. The tunnel is divided into compartments and it was in the farthest out of these, 2050 ft. from the shore shaft, that the explosion occurred. The work is not done under compressed air, although an emergency air-lock has been provided. The crib was to have been sunk in place June 29.

The City-Manager Plan for Seattle, Wash., was defeated by a heavy majority at a popular election held on June 30.

The Proposed Naval Dry Dock at Norfolk, Va., which was in the preliminary Naval Bill before this Congress, has been rejected in the final bill. Provision was made in the bill for the rental from the Union Iron Works of a new dry dock to be built at San Francisco and to be capable of taking care of any boat which can pass the Panama Canal.

Pavement Construction by Municipal Day Labor has been decided upon in Kalamazoo, Mich. The city council has decided to purchase a complete plant for building concrete and brick pavements. It is expected to construct about $20,000 worth of concrete pavements and a $10,000 reinforced-concrete bridge by municipal labor during the present season.

A Municipal Paving Plant is soon to be put in operation by the Canadian city of Edmonton, Alta. It is planned to lay about 100,000 sq.yd. of asphalt and concrete pavements during the present season by municipal day labor. The plant will be operated in competition with contractors. The entire paving program for the present season involves an expenditure of $1,500,000.

Petty Grafting in the Public Works Department of Detroit, Mich., has been unearthed by the new Commissioner of Public Works, George H. Fenkell, M. Am. Soc. C. E., and 25 teamsters have been discharged. These teamsters are alleged to have pocketed thousands of dollars from the sale of old wood paving blocks, which were the property of the city. The blocks were sold for fire wood.

A Comprehensive Sewerage Scheme for North Toronto, Ont., has been recommended by the Commissioner of Public Works. R. C. Harris, of Toronto, of which North Toronto has become a part. The approximate cost of the proposed combined system is $4,114,256, including many miles of large trunk sewers and a sewage-disposal plant. The estimated cost of a sep-

ar[illegible] system of sanitary and storm water sewers for the [illegible] was [illegible].

Railway Terminals in Foreign Cities are to be investigated by the new Railway Terminals Commission, of Chicago, which [illegible] is composed of representatives of the city and of [illegible] organizations. The party is expected to include some of the engineers who are members of [illegible] whose work is related to the problem of [illegible] the railway terminals and facilities. The party will sail from New York on July 11 and is expected to return in September.

Concrete Road Construction in the United States, according to the "Bulletin on Concrete Roads" published by the Universal Portland Cement Co., has increased from 364,000 sq.yd. [illegible] to 19,[illegible] sq.yd. which will be laid during the season of 1914. This area to be laid in 1914 is nearly double that laid in 1913, and over ten times the yardage laid in 1911. The yardage for 1914, above noted, which doubtless includes city streets as well as country roads paved with concrete, would be equivalent, if laid in one stretch, to a roadway 12 ft. wide and 2740 miles long.

Instruction in Public Health, Sanitary Science and Preventive Medicine. A committee to study and to report to the university authorities what courses in these subjects should be given in the College of Physicians and Surgeons and in other departments of Columbia University has been appointed by President Butler. Among other members the committee embraces E. R. A. Seligman, Professor of Political Economy, Chairman of the Committee; D. D. Jackson, Assistant Professor of Civil Engineering; Dr. Hans Zinsser, Professor of Bacteriology; and Dr. Walter Bensel, formerly Sanitary Superintendent of the New York City Health Department; Robert E. Chaddock, Associate Professor of Statistics.

Sanitary Protection of the Water-Supply of Interstate Vessels.—The U. S. Treasury Department has amended the interstate quarantine regulations administered by the Public Health Service by adding the following paragraph governing the water supply of ships:

No person undertaking to furnish water for drinking or cooking purposes to any vessel in any harbor of the United States, intending to clear for some port within some other state or territory of the United States or the District of Columbia, shall furnish for such purpose water taken from the waters of any harbor, or from any other place where it has been or may have been contaminated by sewer discharges. Any person violating this regulation will be liable to a penalty of not more than $[illegible] or imprisonment for not more than one year, or both, at the discretion of the United States District Court.

The Purchase of the Property of the Spring Valley Water Co. of San Francisco, may be effected by agreement with the company instead of by condemnation. A valuation of the plant has been completed by M. M. O'Shaughnessy, City Engineer, who states that [illegible] of the property as the city needs for water-supply purposes is worth $[illegible]. It is [illegible] that the officials of the city and the company will agree to submit the question of purchase at this figure to popular vote. If approved by the people, the condemnation proceedings entered upon some time ago will, of course, become unnecessary. We understand that a number of [illegible] engineers have been at work for both sides in preparation for the condemnation proceedings.

A World's Concreting Record. What is believed to be a world's record in mixing and placing concrete for [illegible] of [illegible] was [illegible] on the [illegible] Dam [illegible]. The record is as follows:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

A $200 Prize for the Best Thesis on House Plumbing [illegible] has been offered to the students of the Harvard University and the Massachusetts Institute of Technology. [illegible]

[illegible] must be handed in on or before May 1, 1915. These must be typewritten and three copies furnished. Awards will be made by a committee appointed by Prof. Whipple and Gifford LeClear, Lecturer on the Mechanical Portions of Buildings in the Harvard Department of Architecture. In making the award special consideration will be given to theses based on original investigations.

Sub-Basement Stores or Salesrooms, made practicable by the deep foundations of some of the large store buildings in Chicago, are prohibited by city ordinance as being dangerous (in case of fire) and unsanitary. The ordinance limits the depth to 2[illegible] ft. below the street grade, but one new store building has a sub-basement 40 ft. below the street. The Health Department brought suit against the owners, and after a municipal court judge had decided against the city, the case was appealed to the Illinois Supreme Court, which has rendered a decision upholding the ordinance. It was argued that a fire in a crowded store two floors below the street would be extremely dangerous, while investigation has shown that it is practically impossible to secure adequate ventilation at such depths and in floors occupied by crowds of people. Such floors are liable to be damp, and the employees would have to work continuously under conditions of artificial light and ventilation.

The Eruption of Lassen Peak, Calif., began, May 30 at 5.30 p.m. with an outburst of steam, which, according to Forest Supervisor W. J. Rushing, continued about 10 min., forming a crater in the snow-covered summit above 25x40 ft. and covering the snow for a distance of 300 ft. with dark, wet dust. Geologist J. S. Diller, in a report to the United States Geological Survey, stated that on the following day, at 8 a.m., another eruption occurred, followed on June 8 by a third and heavier one lasting 30 min. In all there were 11 eruptions to June 21. The most violent was at 9 a.m., June 14, which was visible from the Sacramento Valley, nearly 40 mi. away. The eruptions are usually preceded by a complete cessation of escaping steam. By June 20 the crater was 100x100 ft. by about 100 ft. deep. The ejected dust appears to be disintegrated or pulverized dacite and is produced by the pulverizing action of the explosive gases on the rocks through which they escape, and is not the result of the explosive expansion of gases in a liquid lava.

The Relative Importance of Different Seaports of the United States is shown by the statistics in the annual report on Commerce and Navigation for 1913, just issued by the Department of Commerce. The total foreign trade of the United States, including both imports and exports, now amounts to four and one-quarter billion dollars in round numbers, of which about two billion dollars were handled through the port of New York. The second seaport of the United States, however, is now Galveston, through which $[illegible] worth of goods passed last year. New Orleans comes third with $[illegible] worth; Boston fourth with $216,[illegible]; Philadelphia fifth with $17[illegible]; Baltimore sixth with $1[illegible]; San Francisco seventh with $[illegible]; Puget Sound ports eighth $[illegible]; [illegible] Detroit tenth, $[illegible]. In the total foreign trade amounting to $4,2[illegible] last year, the exports exceeded the imports by $[illegible]. The value of manufactured goods exported was more than six times as great as the imports of manufactured goods.

The Salem Conflagration caused the largest loss ever experienced by the Massachusetts Mutual Insurance Companies of New England. The Naumkeag cotton mills, which were in the area swept by the conflagration, were wholly destroyed with a loss of about $[illegible]. Although the area [illegible] was closely covered with dwellings and various business buildings, about one-third of the value destroyed was contained in this one factory plant. [illegible]

PERSONALS

Mr. Merritt Haviland Smith, M. Am. Soc. C. E., recently Deputy Chief Engineer of the Board of Water Supply, City of New York, has been appointed Chief Engineer of the Department of Water Supply, Gas and Electricity, to succeed Mr. I. M. de Varona, M. Am. Soc. C. E., resigned as noted in our issue of last week. Mr. Smith was born in New York City in 1862 and graduated in civil engineering at the Pennsylvania Military college in 1880. For three years he was in the engineering department of the Pittsburgh & Western R.R. on survey and construction work. In 1884 he first became connected with the public works of New York City as a chief-of-party on surveys for the New Croton Aqueduct. Later he served as Assistant Engineer under the

Merritt H. Smith

Resident Engineer in charge of maintenance, repairs and operation of the Old Croton Aqueduct. During 1890 and 1891 he was engaged in engineering work in Florida. Mr. Smith returned to New York City in 1892 as Assistant Engineer of the Finance Department of the City, and the following year he was appointed Engineer on Repairing and Principal Assistant Engineer of the Department. During the Spanish-American War he received nine months' leave of absence from his city office, and during this period he served as Captain and Major of the First United States Volunteer Engineers in the Porto Rico campaign. He was appointed Department Engineer, Board of Water Supply, City of New York in 1906, and had charge of the Southern Aqueduct Department. Subsequently he was promoted to be Deputy Chief Engineer.

Mr. W. C. Lyon has resigned as Chief Inspector of the Rockford, Ill., city water department and will move with his family to Florida.

Mr. Frank Ernst has resigned as Sewer Commissioner of Moundsville, W. Va., to accept a position with the engineering department of the Wabash R.R.

Mr. J. R. Kearney, former Superintendent of Transportation of the Baltimore & Ohio R. R., has been promoted to be General Superintendent of Transportation.

Mr. Alan P. Wilson has been appointed Western Sales Manager of the Blaw Steel Construction Co., of Pittsburgh, Penn., with headquarters in the Peoples Gas Bldg., Chicago, Ill.

Mr. Thomas E. Murray, F. Am. Inst. E. E., Vice-President of the New York Edison Co., New York City, has been elected a member of the Board of Trustees of the Emigrant Industrial Savings Bank, New York.

Mr. E. W. Bemis has been appointed by Mayor Harrison, of Chicago, to succeed Mr. George Weston, M. Am. Soc. C. E., as the city's representative on the Board of Supervising Engineers which is in charge of the local traction affairs.

Mr. E. M. Scofield, M. Am. Soc. C. E., President of the Scofield Engineering Co., Philadelphia, Penn., has been appointed Vice-President of the Texas Southern Electric Co., owning and operating public utilities in Southern Texas.

Mr. George A. Greenslade has resigned as General Superintendent in charge of terracing operations on the east bank of Culebra Cut, Panama Canal, and is now in New Orleans, La. He expects to return to the Canal Zone to engage in private business.

Mr. James E. Taussig, recently Superintendent of Transportation of the Texas & Pacific Ry., Dallas, Tex., has been promoted to be General Superintendent to succeed Mr. J. W. Everman, resigned, as noted eleswhere in these columns. Mr. Taussig's former position as Superintendent of Transportation has been abolished.

Prof. R. J. Potts, head of the department of highway engineering at the Agricultural and Mechanical College of Texas, has resigned, effective Aug. 1. Prof. Potts has formed a partnership with Messrs. Charles E. Moore, of Waco, Tex., and W. Fred Smith, of Dallas, Tex., under the firm name of the Potts-Moore Gravel Co., with offices at Waco.

Mr. Charles H. Motsett, former Superintendent of the New York division of the New York, New Haven & Hartford R.R., is now Superintendent of the Panama R.R., with headquarters at Colon, Panama. Before going to the New York, New Haven & Hartford R. R. in 1908 most of his experience was with the Chicago, Rock Island & Pacific Ry.

Mr. W. W. Follett, M. Am. Soc. C. E., for the past 12 years Consulting Engineer of the International Boundary Commission, United States and Mexico, has resigned. His present address in 414 El Paso and Southwestern Bldg., El Paso, Tex. Mr. Follett received the honorary degree of Master of Engineering at the recent commencement of the University of Michigan.

Mr. Chas. E. Weidman, former Chief of the Division of Fire Protection of the Panama Canal Zone, has left the Isthmus for his former home in Lincoln, Neb., where he was Chief of the city fire department before going to Panama in 1905. Since Apr. 15 of the present year, the Division of Fire Protection, Panama Canal Zone, has been merged with that of Police and Prisons.

Mr. L. H. Shoemaker, M. Am. Soc. C. E., recently Engineer in charge of design, American Bridge Co., Pittsburgh, Penn., has been appointed Division Engineer of the Pittsburgh division of the company, succeeding Mr. Richard Khuen, Jr., M. Am. Soc. C. E., transferred to the erecting department. Mr. Shoemaker graduated from the University of Michigan in 1897. He joined the staff of the American Bridge Co. in 1901 as an Estimating Engineer.

Mr. H. G. Hamett has been appointed Chairman and Mr. William Hutton, Jr., Secretary of a Harbor Commission, recently appointed by the Mayor of the City of Troy, N. Y. The Commission contemplates the development of the harbor, the construction of warehouses, concrete bulkheads, slips and piers; all made necessary to care for the expected increase in traffic when the New York State Barge Canal is completed. It is expected that a Consulting Engineer and a Traffic Manager will be appointed to act with the Commission.

Mr. John W. Everman, formerly General Superintendent of the Texas & Pacific Ry., Dallas, Tex., has been promoted to be Vice-President and General Manager of the St. Louis & Southwestern Ry. of Texas, with headquarters at Tyler, Tex., succeeding Mr. W. N. Neff, resigned. Mr. Everman is a native of Philadelphia, Penn., where he graduated from the public high school in 1876. For two years he was engaged in mining work in Venezuela. In 1879 he entered the service of the Pennsylvania R.R. The following year he joined the operating staff of the Texas & Pacific Ry.

Lieut. George R. Goethals, Corps of Engineers, U. S. A., who has been in charge of the building of the Panama Canal Fortifications, under the immediate supervision of his father, Col. Geo. W. Goethals, Chief Engineer of the Panama Canal, has completed his work on the Isthmus and has been detailed to the Military Academy at West Point as Instructor. The fortifications have been constructed with the utmost secrecy, and probably no engineers but Col. Goethals and his son are familiar with all the works. The forts on the Atlantic side have batteries of 14-in. guns, 12-in. mortars and 6-in. guns, while those on the Pacific side have in addition one 16-in. gun, according to press dispatches.

Messrs. Frederic H. Fay, Chas. M. Spofford, M.'s Am. Soc. C. E., and Sturgis H. Thorndike announce the formation of the firm of Fay, Spofford & Thorndike, Consulting Engineers, [illegible] Boylston St., Boston, Mass. Mr. Fay has been Division Engineer of the Department of Public Works of Boston for several years past and has had charge of the design, construction and maintenance of all city bridges and the operation of the city ferries. Prof. Spofford is Hayward Professor of civil engineering at the Massachusetts Institute of Technology, and he will continue in this capacity, devoting only a portion of his time to the new firm. Mr. Thorndike until recently was Designing Engineer of the Department of Public Works of Boston under Mr. Fay. The new firm will specialize in the design of structures in steel and masonry, including superstructure and foundation, and river and harbor work.

Mr. I. M. de Varona, M. Am. Soc. C. E., whose resignation as Chief Engineer of the Department of Water Supply, Gas and Electricity was noted in our personal columns of last week, has been connected with the Greater New York water-works for nearly 32 years. His first work was in Brooklyn in 1882, when he was placed in entire charge of the surveys for the extension of the works from Rockville Center to Massapequa, the purchase of the property, the preparation of plans and specifications, and later the construction of the water-works with the exception of the Millburn reservoir. In 1894 he was appointed Engineer of Water Supply of the City of Brooklyn, and as such he was in charge of the collection, extension, distribution and pumping systems. For eight years following Mr. de Verona was actively interested in developing the driven well system, which is the chief source of the Brooklyn water supply. This work was continued until the total underground supply was increased from 17 millions to 130 million gallons daily. In 1897 he established the Prospect laboratory for the study of the prevention of water pollution, one of the pioneer plants of its kind. In 1902 he was promoted to be Chief Engineer in charge of the entire water-works system of Brooklyn, and in this capacity entirely remodeled the distribution system of Brooklyn, thereby adding greatly to the effectiveness of the fire protection of the city. Mr. de Varona planned and constructed the first infiltration gallery system for collecting the subsurface water on Long Island in 1903. He designed the high-pressure auxiliary fire protection system of Brooklyn in 1904, and subsequently, in 1905, when similar systems were planned for the other boroughs of Greater New York, Mr. de Varona was appointed Chief Engineer of Water Supply of the Boroughs of Manhattan, the Bronx, Queens and Richmond, continuing in charge at Brooklyn as Acting Chief Engineer. In 1910 the operation of the water-works of all the boroughs was consolidated into the Department of Water Supply, Gas and Electricity, and Mr. de Varona was appointed Chief Engineer. Some of his most notable work here has been in water waste prevention. It is estimated that the systematic campaign conducted under his direction has saved the city nearly 100 millions of gallons per day out of a total of 500 millions per day. The cost of operating the system has been reduced $1,000,000 per annum. The more important works recently prepared have been the plan of the utilization of the Catskill supply to [illegible] the boroughs, the design of the connections between the Catskill and existing systems in the Boroughs of Manhattan, The Bronx and Brooklyn, the by-passing of the Central Park reservoirs, the tunnel under the Harlem River, so as to make an additional connection between the Bronx and Manhattan, the study of the [illegible] of the Croton [illegible] to provide adequate [illegible] in Manhattan and The Bronx, a tabulated statement of the present and prospective [illegible] of the water supply system of Greater New York, referred to the period between 1913 and [illegible], the present worth of the whole water-supply system of Greater New York, and the study of the reorganization of the Bureau of Water Supply on a functional basis. Mr. de Varona has also been consulted on water works problems by numerous [illegible].

OBITUARY

[illegible]

[illegible]

[illegible] June 28, aged 29 years. He was the son of George N. Orcutt, Assistant to the President of the Erie R.R.

George T. McLaughlin, a contractor, of Pittsburgh, Penn., was drowned in the Allegheny River, near Hulton, on June 28. He was swimming near his summer home.

Alexander Stewart, General Superintendent of Motive Power and Equipment of the Southern Ry., Washington, D. C., died June 28, in Paris, France. He was 46 years old. He was born in Fort Wayne, Ind., and began his railway experience as a machinist's apprentice on the Union Pacific R.R. He was promoted in the service of the Union Pacific to be Master Mechanic at Cheyenne, Wyo. In 1903 he left the West to enter the employ of the Southern Ry. as Division Master Mechanic at Knoxville, Tenn. He was successively promoted to the highest office in the mechanical department within three years. He was a delegate to the International Railway Congress at Berne, Switzerland, in 1910, and was prominent in the railway mechanical associations.

ENGINEERING SOCIETIES

COMING MEETINGS

OHIO ELECTRIC LIGHT ASSOCIATION.
July 16-19. Annual convention at Cedar Point, Ohio. Secy., D. L. Gasgill, Greenville, Ohio.

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.
Aug. 20-21. Annual meeting in New York City. Secy., E. H. Harman, Room 101, Union Station, St. Louis, Mo.

AMERICAN PEAT SOCIETY.
Aug. 20-22. Annual meeting at Duluth, Minn. Secy., Julius Bordollo, 17 Battery Place, New York City.

AMERICAN BOILER MANUFACTURERS' ASSOCIATION.
Sept. 1-4. Annual convention in New York City. Secy., J. D. Farasey, E. 37th St., and Erie Ry., Cleveland, Ohio.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 7-10. Annual meeting in New York City. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

NATIONAL ASSOCIATION OF PORT AUTHORITIES.
Sept. 8-10. Annual convention in Baltimore, Md. Secy., Wm. Joshua Barney, 29 Broadway, New York City.

ROADMASTERS AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.
Sept. 8-11. Annual meeting at Chicago, Ill. Secy., L. C. Ryan, Sterling, Ill.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.
Sept. 8-11. Annual convention in Nashville, Tenn. Secy., A. P. Dane, Reading, Mass.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 9-11. Annual convention in Boston, Mass. Secy., Willard Kent, Narragansett Pier, R. I.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Sept. 15-18. Convention in Atlantic City, N. J. Secy., Clayton W. Pike, Electrical Bureau, Philadelphia, Penn.

ILLUMINATING ENGINEERING SOCIETY.
Sept. 21-25. Annual convention in Cleveland, Ohio. Secy., Joseph D. Israel, 29 W. 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Sept. 22-24. Annual convention in Bluff Point, N. Y. Secy., C. C. Rosenberg, Times Building, Bethlehem, Penn.

Ohio Electric Light Association—The 2[illegible]th annual convention of the Ohio Electric Light Association will be held at Cedar Point, Ohio, July 21-24. The Secretary is D. L. Gaskill, Greenville, Ohio.

Roadmasters and Maintenance of Way Association of America—The association will hold its annual meeting in Chicago, Sept. 8-11 at the Auditorium Hotel. The Secretary is L. C. Ryan, Sterling, Ill.

American Mine Safety Association—The next annual meeting of the association will be held in New York City, Sept. 7-10 at the Waldorf Astoria. The annual field meet will take place at Terre Haute, Ind., Sept. [illegible]. R. Dawson Hall of "Coal Age," [illegible] Pearl Street, New York City, will be in charge of the local management of the New York meeting. The Secretary is H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

Canadian Electrical Association—The 24th annual meeting of the Association was [illegible] at the Ritz-Carlton Hotel, Montreal, Que., on June [illegible]. The following officers were elected for the ensuing year: President, Col. D. R. [illegible] Secretary-Treasurer of the Ottawa Electric Co.; Vice-Presidents, [illegible] of Toronto, R. M. Wilson, of Montreal, and Willis McLachlan, Toronto; Secretary, Allan [illegible], Toronto.

The index for Vol. 71, January-June, 1914, will be mailed all subscribers to ENGINEERING NEWS in the issue of July 16.

Engineering News

VOLUME 72 JULY 16, 1914 NUMBER 3

The 174th Street Arch under the Grand Boulevard and Concourse, Borough of The Bronx, New York City

By Jacob M. Friedland.*

The Grand Boulevard and Concourse is a parkway 182 ft. wide, extending from the southern end of Franz Sigel Park, at East 151st St., New York City, north to Mosholu Parkway, near Van Cortland Park. It is laid out on the crest of a practically unbroken ridge which separates the Jerome Ave. valley from the Webster Ave. valley.

The law which authorizes the Concourse provides for the construction of not more than fifteen "Transverse Roads" under it. These enable the crosstown trolley cars to cross the Concourse without endangering the fast north and south automobile traffic, and at the same time they eliminate some very steep grades for the general east and west traffic. In the typical Transverse Road, of which seven have been constructed so far, the inclined approaches to the Concourse are 35 ft. wide, and the transverse road has a 36-ft. roadway and two 4.5 sidewalks. A single row of columns in the center of the roadway carries a line of girders, which girders and the sidewalls, in turn, support transverse 24-in. I-beams with concrete jack-arches which carry the roadway above them.

The 174th St. Transverse Road differs entirely from the typical road described above. The Concourse at this point is so high above the adjacent streets that the inclined approaches were omitted. The road, therefore, simply permits 174th St. to run into Featherbed Lane, which leads, by way of Aqueduct Ave., to the Washington Bridge over the Harlem River. The underlying material being a compact limestone, it was decided to build a masonry (concrete) arch, which was more economical than a steel structure, and permitted a street 80 ft. wide without obstructions in the roadway.

Among the noteworthy peculiarities of this arch may be mentioned (1) the sharp skew; (2) the deep fill over the arch; (3) the design of the spandrel walls; and (4) the architectural treatment of the faces of the arch and of the spandrel walls.

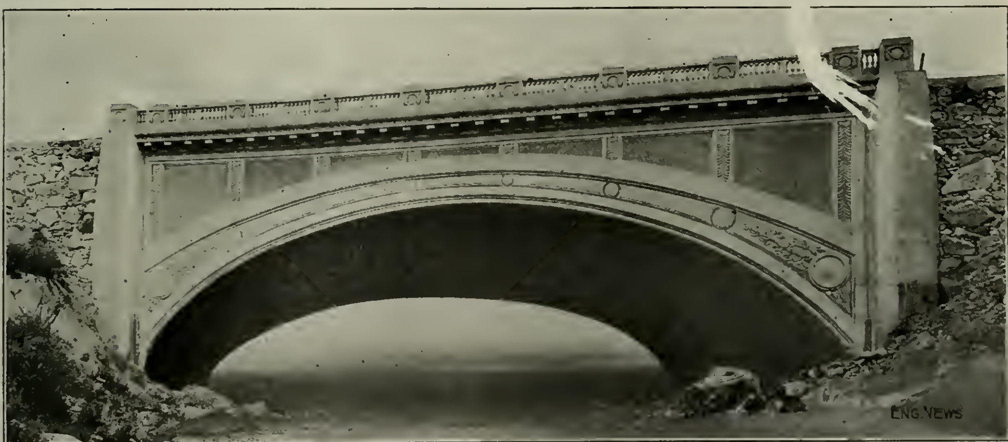


Fig. 1. Concrete Skew Arch Carrying the Grand Concourse over 174th St., Borough of the Bronx, New York City

Sharp Skew—The east face makes an angle of about 52.5° with the axis of 174th St. (instead of 90°), and the west face makes an angle of about 58.5° with it: so that while 174th St. is only 80 ft. wide, the span, measured along the east face, is 100.93 ft. (See Fig. 2.) The arch barrel, with a length of over 221 ft. along the center line of 174th St., is divided by expansion joints into six sections of 36.84 ft. each, in order to make sure that the arch would have an effective span of about 100 ft. Without these joints the arch would probably have acted as an arch with a span of 80 ft., while near the faces there would be overhanging ends in which the stresses are practically incomputable, and which would have been endangered by the extra weight of the spandrel walls and by the outward thrust at their foot.

Deep Fill—In order to pass the sewers on the Con-

*664 E. 170th St., New York City.

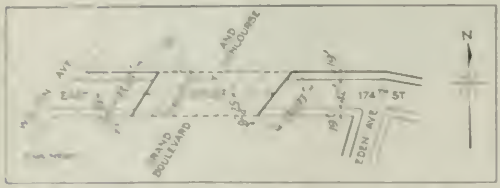


FIG. 2. PLAN OF 174TH ST. CROSSING OF THE GRAND BOULEVARD, THE BRONX, NEW YORK

enough for the extra load due to the spandrel walls, the balustrade, and the earth thrust.

SPANDREL WALLS—A spandrel wall acting as a retaining wall of the gravity type, or of the usual plain or buttressed reinforced types, with heel weighted down by earth backing, was not considered safe here. The intensity and the uncertain nature of the stresses near the faces, the downward slope of the top of the arch toward the face on account of the skew, and the fact that high compressive stresses, added to the outward thrust, might

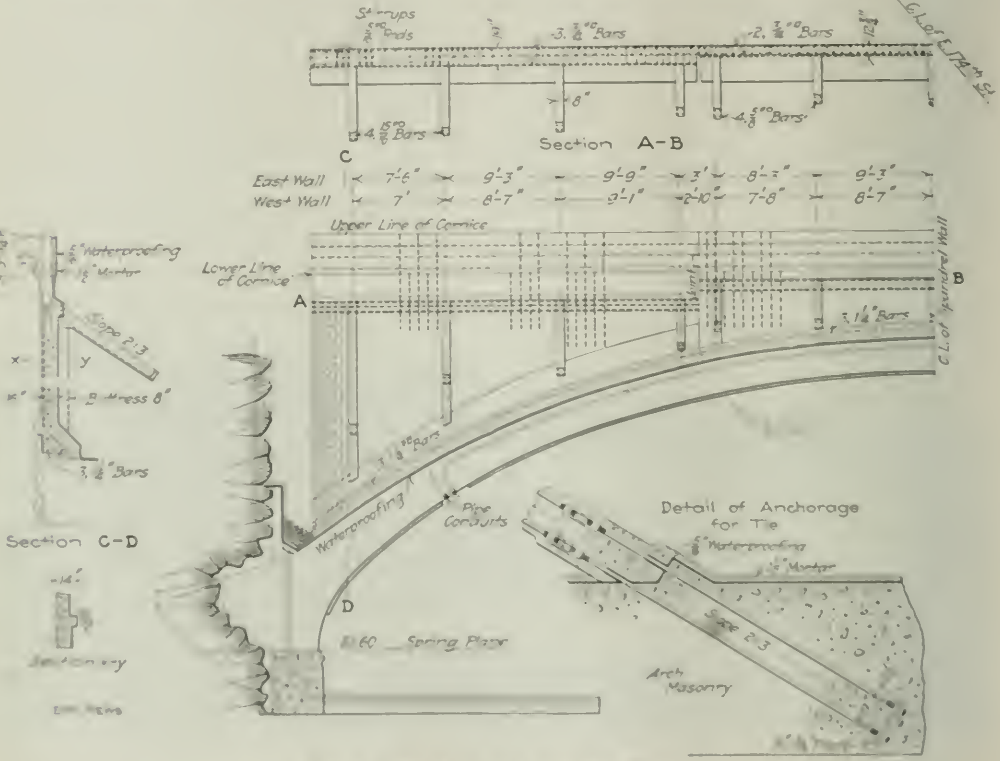


FIG. 3. DETAILS OF THE SPANDREL WALL

hauled across the arch, the fill over the crown had to be 9.5 ft. deep. While the heavy fill simplified the computations by reducing the disturbing effect of the live-load unit stresses on the dead-load unit stresses, it required an arch with big dimensions, and with correspondingly high retaining walls over them.

Excepting 9 ft. from either face, the arch is of plain masonry of a 1:2:5 mixture, in which the native stone was used. It has a span of 160 ft. and a rise of 22.1 ft. The crown is 5.67 ft. thick and the spring 8 ft., requiring 8 in. of extra thickness on the soffit to produce the parallel effect. Contraction and expansion effects based on a drop in temperature of 60° F. produce extreme fiber stresses of 240 lb. per sq.in. compression, and negligible tension at the critical point. For 9 ft. from either face, the arch is made 6 in. thicker and is reinforced with twisted I-bars, square bars to make it strong

cause the architectural features of the face to spall off. All these considerations made it desirable to obviate high toe stresses under the wall, as well as outward thrusts on the face of the arch. Computations also showed that shrinkage and arch deflection would cause the wall to crack unless expansion joints were provided, both in the wall and between the wall and the arch extrados.

Fig. 3 shows the wall that satisfies the requirements. Below the cornice the wall is a reinforced-concrete slab from 10 to 16 in. thick, with vertical reinforcement. Nearly the entire earth pressure against it is transmitted to the horizontal beam, placed at a height slightly above the resultant of the earth pressure, so as to leave a very small outward thrust at the base. The horizontal beams in turn react against the inclined ties which are anchored back into the arch far enough from the face, or into bulge-pads. These ties are in planes perpendicular to the face,

FIGS. 4-5. VIEWS SHOWING THE SPANDREL WALL DETAIL DURING AND AFTER CONSTRUCTION

and not parallel to 174th St., and for this reason some of them do not strike the arch barrel at all.

The vertical component of the stress in the inclined

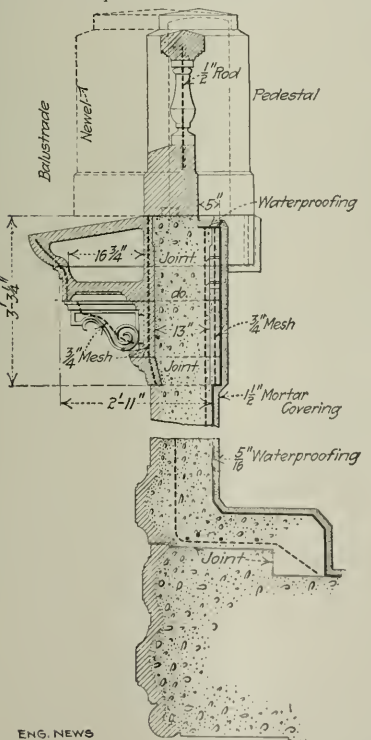


FIG. 6. DETAILS OF CORNICE, 174TH ST. ARCH, NEW YORK CITY

ties is taken up at the wall by concrete posts cast integral with the wall slab, and is distributed evenly over the 2-ft. width of face arch, which is thickened and specially reinforced to carry the additional load.

On top of the wall slab, and forming an integral part of the wall, rests the cornice, which is 3 ft. 3¼ in. high. (Fig. 6.) It consists of four courses of cast concrete blocks having cellular spaces directly over the wall slab. running clear through the four courses, and permitting the reinforcing bars from the slab beneath to pass through to the uppermost block. The cellular spaces were filled with concrete to key the whole firmly together. Enough reinforcement was provided to make the whole act as a reinforced-concrete beam, resisting the moment

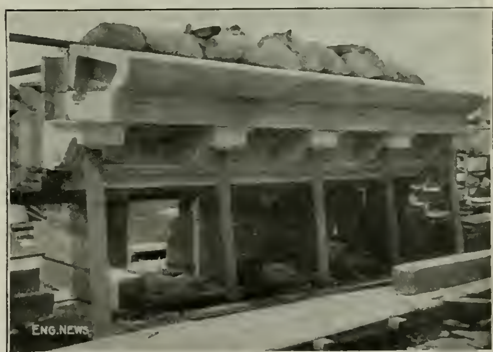


FIG. 7. CORNICE BLOCKS IN PLACE

due to the earth pressure behind, and to the overhang on the face.

ARCHITECTURAL TREATMENT—As shown by Fig. 1, the architectural treatment is elaborate. The balustrade and the cornice consist of cast concrete elements (Figs. 6-7), the balustrades having no less than eight different elements, and the cornice not less than five, not counting right- and left-hand elements and special blocks near the ends. The oblong foliated panels on the wall and the panels carrying the branches and the large end medallions are inset, and were anchored with dowels after the rest of the work had been completed and the face forms removed.

None of the face fillets corresponds to a line of the arch behind it, nor do the long foliated panels coincide

with the location of the ties which hold the wall. Yet so skillfully has the work been carried out that the free joint which separates the wall from the arch cannot be detected, while only parts of the vertical joints in the wall can be seen where they are not concealed by the foliated panels. The latter joints are carried clear through the cornice and balustrade.

Fig. 8 shows the arch centering. The specifications required it to be so smooth and rigid as not to leave any marks either of the wood, or of deflection or irregularity, on the completed arch. The centering was used three times, being lowered, shifted and wedged up twice.

To get the correct position of the many fillets, tablets, etc., on the face, the whole face was carefully plotted on stretched paper to a scale of 1 in. = 1 ft., and the coördinates of the several fillets and tablets scaled and reduced to a table of elevations. These were afterwards marked on the face forms, and the strips and tablet molds fastened to the backing board in accordance with these marks.

The fact that the face concrete, from 2 to 3 in. thick, is different from the backing concrete, and the thinness of the entire wall made it necessary to carry up the rear

FIG. 8. CENTERING FOR SKEW ARCH, 174TH ST. AND GRAND CONCOURSE, NEW YORK CITY

forms just ahead of the concreting, so that, while the rear boards were being nailed on, the face concrete having the consistency of stiff mortar was deposited with shovels against the face forms, and right behind it was dumped the wet concrete. Considering the complications the results are remarkably satisfactory, and, unlike other works of the same nature, the actual face looks even better than the "picture."

SPECIFICATIONS—The following are abstracts from the specifications:

[illegible]

[illegible]

[illegible]

[illegible]

ment mortar similar in color to the face concrete, calked hard and neatly finished with flat-faced calking chisel.

Panel ornamentation of the arch faces, and the foliated panel ornaments of the spandrel walls shall be cast separately, to fit recesses left for them in the concrete. Each piece shall be anchored with at least three anchors made either of aluminum, or of steel, hot galvanized all over. No part of these ornaments shall be thinner than 2 in. unless so shown on the detail drawings.

PERSONNEL—The arch was designed in the Bureau of Design of the Borough President's office, Borough of The Bronx, Richard H. Gillespie, Chief Engineer, and Charles Gartensteig, Engineer of Design. F. F. McDowell was Assistant Engineer in charge of construction. Handy Bros. were the contractors, and the concrete work was carried out by the Londino Construction Co., as subcontractors, to whom most of the credit is due for the success of the work.

※

Scoop Car for Handling Railway Slides

A special car has been designed for clearing railway track of material brought down by landslides or by the caving of a tunnel roof. In such cases the use of a steam shovel may be impracticable, due to the difficulty or impossibility of getting cars within its reach to receive the material excavated, while in many cases the slide may contain large masses of rock difficult to handle. The scoop car is forced ahead into the material till the scoop is full, and the car is then hauled rapidly to some convenient point for dumping. These cars are in use on the Norfolk & Western R.R. and a few other roads, and one of them is shown in the accompanying cuts.

The car is 40 ft. long over the end sills, or 51 ft. 8 in. over all; it is equipped with a 20-ton crane mounted over the center of the front truck, and having a fixed reach of 12 ft. A double-drum hoisting engine with cylinders $8\frac{1}{4}$x10 in. operates the 1-in. hoisting cable and the $\frac{3}{4}$-in. swinging cable, the latter passing around a bull-ring at the foot of the mast. There is a vertical boiler 8x$4\frac{1}{2}$ ft., with the necessary coal space and water tanks. To the hoisting block is attached a swing beam having a chain at each end. The scoop is about 12 ft. long, 7 ft. 8 in. wide and 3 ft. 4 in. deep inside, with a nominal capacity of 10 cu.yd., and it is fitted with heavy teeth on the edge. The car and its machinery weigh about 90,500 lb., which the scoop increases by 16,000 lb.

When excavating, the front of the scoop is attached to the chain hooks and its rear end is held by a pin and backed against a heavy bumper in front of the car, the bumper being supported by inclined braces from the sills. When the scoop is loaded, its front end is raised clear, and the car is run out. At the dumping point, the scoop is lowered upon the rails, with a timber or metal block under one side (as in Fig. 2). The chains are then detached from the end and hitched to lugs on the bottom of one side, so that the scoop can be tilted and emptied, as in Fig. 1.

The use of this car is said to result in considerable saving of time and expense by reason of its being able to handle quantities of loose rocks much too large to be removed by hand. The following example of the work done is from a report by H. C. Weller, Superintendent of the General Western Division of the N. & W. R.R.

We have had occasion to use the scoop car for the purpose

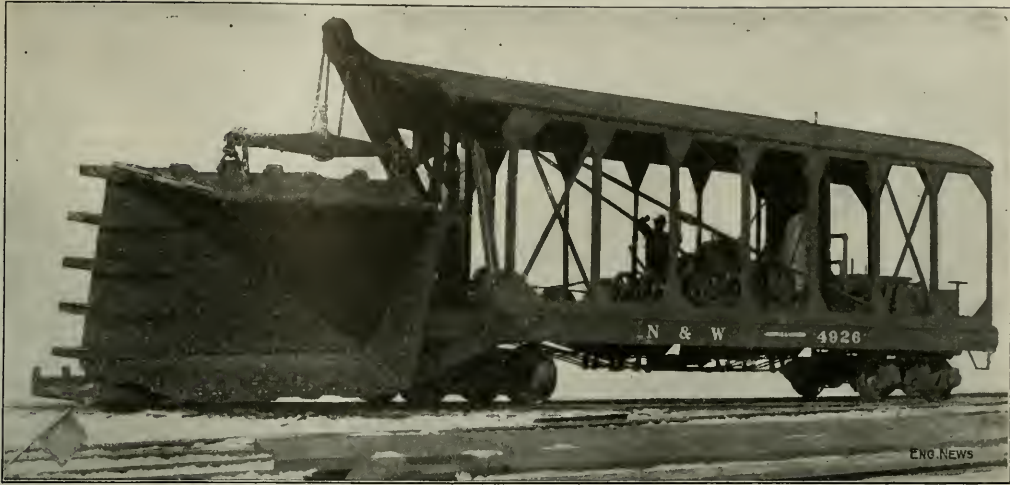


Fig. 1. Scoop Car for Clearing Slides; Norfolk & Western R.R.

(The 10-yd. scoop is shown in the dumped position.)

of moving slides on new westbound main track east of Sycamore. We had a slide at that point approximately 110 ft. in length and 5 ft. deep, or a total of approximately 800 cu.yd. of material to move. It required 10 hr. with the scoop car to move this and convey it from 100 to 150 ft. from the point of the slide. Our labor cost for handling the above quantity of material, which consisted of dirt and rock, amounted to $182, including work-train cost, etc., which is 22.7c. per cu.yd. On occasions when it has been necessary to use the scoop car for handling slides it has proved very satisfactory.

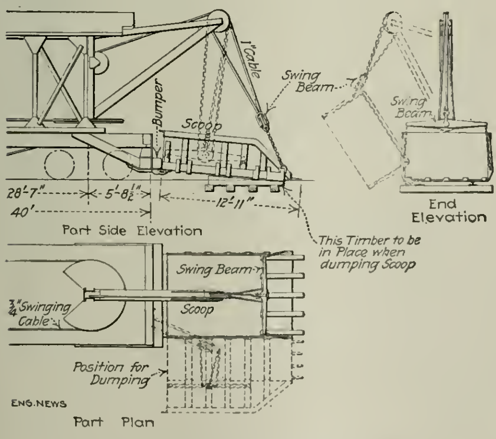


Fig. 2. Front End of Scoop Car, Showing Attachments When Excavating and Dumping

This scoop car has been designed and patented by L. E. Johnson, President of the Norfolk & Western R.R., at Roanoke, Va., and we are indebted to him for photographs and other information.

Preventing Escape of Natural Gas While Drilling for gas or oil is a subject given considerable study by the United States Bureau of Mines, and the result published in Technical Paper 68, dated 1914. Practically all wells are drilled under contract. The contracts are usually lax, to allow for the variable conditions. Drilling contractors are apt to be inclined to disregard the interests of the owner, and to devote their energy to "making hole," i.e., to drilling to a maximum depth in the shortest time and with the least cost. The suspension of work to examine the tightness of casing, or to case off water or gas, is not viewed favorably by the contractor.

The investigation of the Bureau was conducted in the Cushing field, in Creek County, Oklahoma. The method of drilling here is similar to that employed in all Eastern and Northern oilfields, and is called the "dry-hole" method of cable-tool drilling, as the hole is drilled with practically all water cased out. Only enough water is used to keep the drillings slushed out, so that the drill bit strikes the rock at the bottom and the bailer can pick up the drillings and clean the hole. In the Cushing field, the main producing sand, both of oil and gas, is the "Wheeler sand," at 2200 ft. below the surface. The average time required to drill a well to this sand is about 50 days. The hole is usually started 18 in. in diameter; 16-in. casing is set to a depth of 20 to 60 ft., from which point the hole is carried down with a diameter of 16 in. to a depth of 500 to 600 ft., where 12½-in. casing is set. It is necessary to set 10-in. casing at about 800 ft., and 8-in. casing at a depth of about 1200 ft. From 1200 ft. is is usually possible to drill open holes to the top of the Wheeler sand, when 6⅝-in. casing is placed. With this method, the gas waste runs into millions of cu.ft. per day. To give instances, on Apr. 10, 1913, a well was drilled into the Wheeler sand and allowed to go wild for four days, i.e., the drillers left the well without sealing it. The gas wasted daily through an 8-in. open hole was 37,000,000 cu.ft. Its roar could be heard two miles away. This well was shut off on Apr. 17, after some 250,000,000 cu.ft. of gas had been wasted. Nearby, at about the same time, gas was struck at about 520 ft. in a 10-in. hole, and 30,000,000 cu.ft. of gas escaped daily for several days. Other instances are cited, the gas waste in several days. Other instances are cited, the gas waste in some reaching 40,000,000 cu.ft. per day.

The method for conserving gas recommended by the Bureau of Mines is known as the mud-laden fluid method. For purposes of demonstration, a well which had been drilled to a depth of 2140 ft., was filled with mud-laden water and allowed to stand thus for three days, when drilling was resumed. Gas which had been escaping from the well before the introduction of the fluid mud was successfully excluded from the bore-hole. Demonstrations show that the precautions necessary to prevent gas leakage are as follows: (1) Seal gas-bearing stratum as it is encountered, by drilling with the holes full of mud-laden fluid; (2) Set each string of casing with a secure and watertight base, using a long shoe or packer to insure tightness; (3) when casing through a gas-bearing stratum, keep the space between the casing and wall full of mud fluid; (4) place a gate valve on top of the inner string of casing before drilling into any gas-bearing stratum.

A Low-Head Water-Power Plant

SYNOPSIS—At the Coon Rapids hydro-electric plant on the Mississippi River, six miles above Minneapolis, 15,000 hp. will be developed with only 17½-ft. head. The dam is supported on piles with steel sheet-pile cut-off walls beneath. The water level is regulated by large Tainter gates on the dam crest. Vertical turbines are used of 2100 hp., carried on roller bearings at the top of the shaft. Steel-framed forms were used for the dam.

The hydro-electric power plant now under construction on the Mississippi River, at Coon Rapids, six miles north of the city limits of Minneapolis, is of interest on account of the low head to be developed and also on account of the manner in which the power is to be used. The average head is about 17½ ft., and with full flow there will be a development of 15,000 hp. (seven units). There is no storage capacity, however, and at low stages of the river, the flow will be sufficient to develop only about 4400 hp.

Ordinarily, this great variation in power capacity would not be satisfactory for an independent plant, but this plant will be an auxiliary to the larger hydro-electric plant (of 25,000 hp.) at Taylor's Falls, on the St. Croix River, which is owned by the same interests and which supplies current for lighting, traction and general power purposes in both Minneapolis and St. Paul. At present a steam plant of 10,000 hp. is held in reserve at Minneapolis with this station, to take care of peak loads. The Coon Rapids plant will provide for these loads and will enable the steam plant to be shut down, and kept as a reserve for use only when the river is low or in case of any failure at the water-power plant.

In December, 1911, Congress granted the Great Northern Development Co. permission to build a dam at the Coon Creek Rapids to develop water power under a normal head of 16 ft., and the general plans were approved by the War Department in November, 1911. Nothing was accomplished in regard to financing the project, however, and only enough construction work was done to comply with the requirements of the franchise.

In December, 1912, the franchise and property were transferred to R. J. Graf, as trustee, pending the organization of the Northern Mississippi River Power Co., which was completed in March, 1913. Revised plans were approved by the War Department in December, 1912. The franchise required the dam to be completed by Jan. 12, 1914, so that prompt action was necessary. As soon as the property was in the hands of the trustee, a survey party was organized to check the land lines and the flow line of the reservoir, and a superintendent was appointed to organize a construction force and establish a camp. The dam was completed early in January, 1914, and probably the first generator units will be in operation by September.

The general character of the plant is shown by the plan, Fig. 1. There is an island in the river at the site of the dam, and as the left channel is narrower and deeper than the others it was decided to place the power house across this channel, and to build a spillway dam across the wider and shallower channel, the water level being regulated by a row of Tainter gates along the top of the dam, raising the normal water level 7½ ft. above the spillway level. This arrangement is similar to that at the Keokuk Dam, but in the latter case vertically sliding gates are used. The spillway has a discharge capacity of 80,000 cu.ft. per sec.

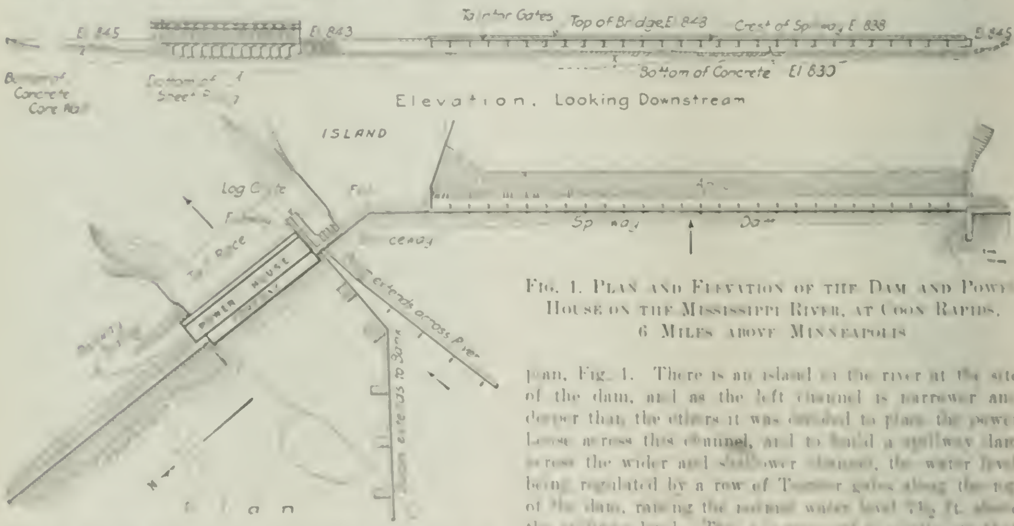


FIG. 1. PLAN AND ELEVATION OF THE DAM AND POWER HOUSE ON THE MISSISSIPPI RIVER, AT COON RAPIDS, 6 MILES ABOVE MINNEAPOLIS

A concrete retaining-dam extends beyond the head of the island from the end of the spillway dam, and between this and the power house are located a fishway, a log chute and four sluice gates. An earth embankment extends from the power house to the high ground on the north bank.

With this arrangement of the power house and spillway, no flood water will be passed through the tail race, and the effective head will be reduced during flood stages only by the backwater from the foot of the island. The spillway dam has a length of about 1000 ft., the retaining dam at the head of the island, 170 ft., the sluices, log chute and fishway, 62 ft., the power house, 255 ft., and the embankment 675 ft., making a total length of 2070 ft.

The entire plant was designed by H. M. Byllesby & Co., consulting engineers, of Chicago. Otto E. Osthoff, Chief Engineer, and W. R. Thompson, Manager of En-

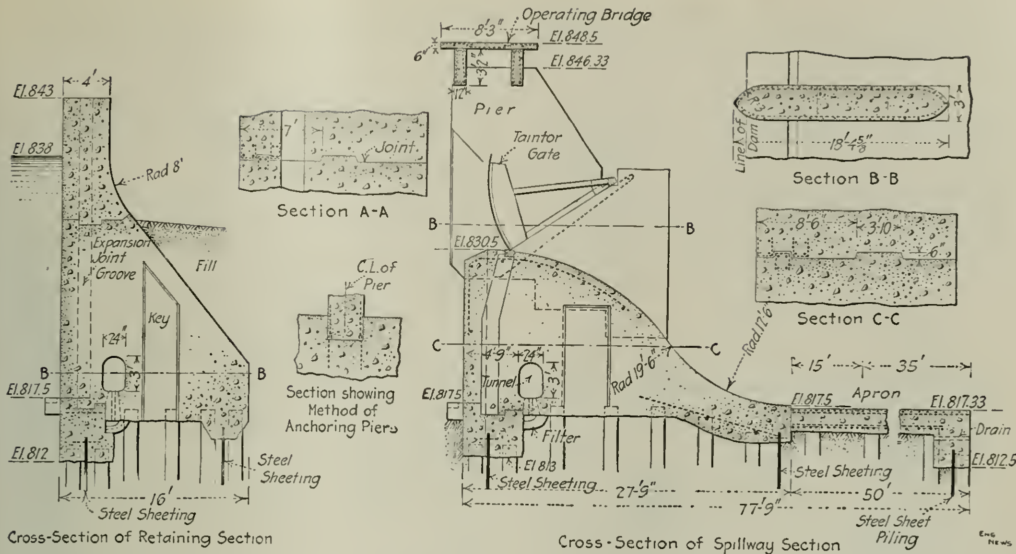
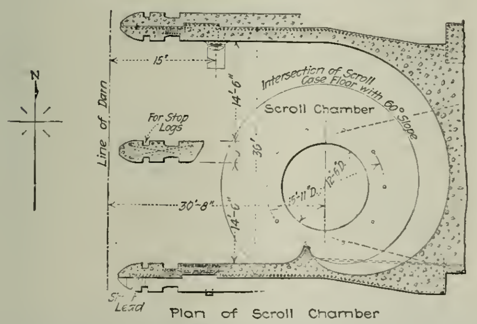


FIG. 2. CROSS-SECTIONS OF DAM, SHOWING THE SPILLWAY SECTION AND RETAINING SECTION



gineering and Construction. It was built by this company's construction force. The design and construction were under the direction of J. W. Link, Hydraulic Engineer; W. T. Walker was Superintendent of Construction, and W. B. Saunders, Resident Engineer.

SPILLWAY DAM

The main dam is built on a deep bed of glacial drift. The Great Northern Development Co. in its preliminary work had made a line of wash borings across the river, approximately on the line of the dam, and other borings above and below the line. These indicated that rock was at too great a depth (not less than 150 ft.) to be reached by the foundations. The Byllesby Co. had additional

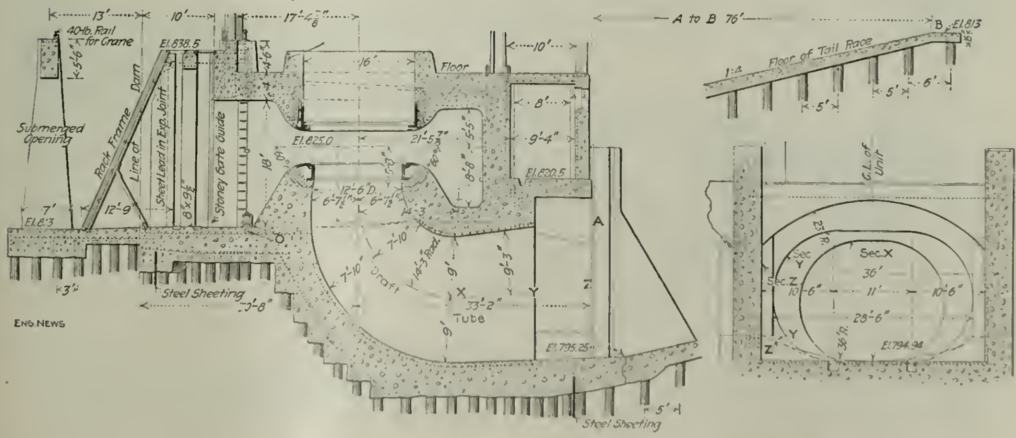


FIG. 3. SECTION THROUGH LOWER PART OF POWER HOUSE; SHOWING THE INTAKE, SCROLL CHAMBER AND DRAFT TUBE OF ONE UNIT

[illegible] borings made by driving 1-in. pipe, the pipe being pulled up after each penetration of about 2 ft. to 3 ft. and the enclosed material removed and preserved. This

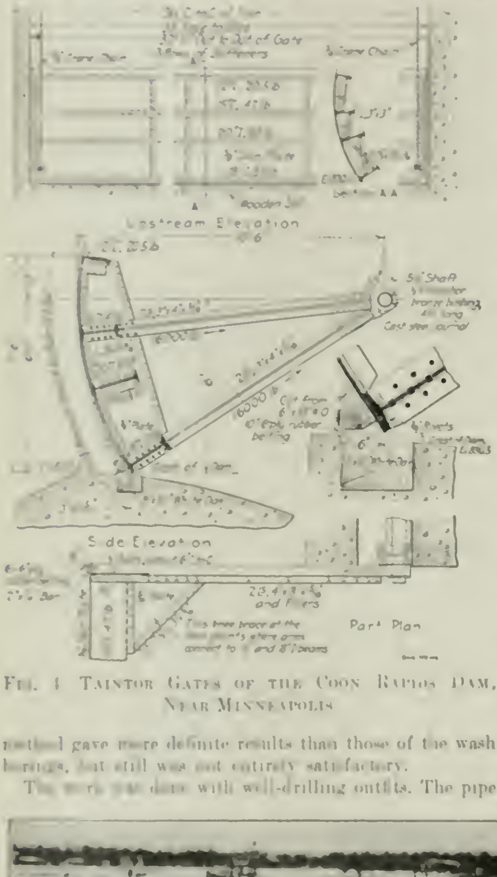


FIG. 1. TAINTOR GATES OF THE COON RAPIDS DAM, NEAR MINNEAPOLIS

method gave more definite results than those of the wash borings, but still was not entirely satisfactory.

The work was done with well-drilling outfits. The pipe drill was fitted with a collar near the upper end to receive the blow from the hammer, the latter having a hole through the center so as to slide on the pipe. The hammer rope passed over a sheave on top of the leads or tower and down to a niggerhead or drum on the engine. The drill runner alternately slackened and tightened the rope on the drum to give the required raising and dropping of the hammer.

The spillway dam is of the section shown in Fig. 2, with a base width of 27 ft. 9 in. and a height of about 12 ft. to the spillway crest. Within it is formed a drainage conduit, with openings in the bottom to a gravel-filled trench or filter, so that any water working beneath the heel can escape without causing upward pressure on the base of the dam. Below the dam is a reinforced-concrete apron 50 ft. wide to prevent scour at the toe.

Along the dam are piers 3 ft. thick, and 36 ft. apart, carrying two lines of reinforced-concrete girders with a deck 8 ft. 3 in. wide, upon which are mounted the hoists for operating the Taintor gates. The boxes for the shafts of these gates are carried in the rear end of the piers. The section of the retaining dam between the power house and the spillway dam, across the head of the island, is also shown in Fig. 2.

The dam is carried on foundation piles, driven to varying depths, and until the penetration indicated a safe bearing value of ten tons per pile. To provide a cutoff against flow of water beneath the dam, there are two lines of steel sheet piling, driven to penetrate at least 5 ft. into material which, from the borings, was assumed to be impervious and which varied in depth below the river bed from about 2 ft. at the south end of the dam to about 25 ft. at other points. A third row is carried under the toe of the apron but this is only 8 ft. deep, being intended to prevent scour beneath the apron by back-wash. For about 200 ft. at the south end where compact material rises to the surface, a trench was cut in this and a concrete cutoff wall built. The power house also has pile foundations, driven to refusal in the com-

FIG. 2. THE SPILLWAY SECTION OF THE COON RAPIDS DAM OF THE MISSISSIPPI RIVER ABOVE MINNEAPOLIS

[illegible] Taintor gates above the crest, the gates being operated from the concrete deck [illegible]. View looking north from the [illegible] side. The power house is at the farther end [illegible]

pact material, while lines of steel sheeting form the cutoff.

Power House

Fig. 3 is a section through the lower portion of the power house. In the forebay is the wall of the intake, with submerged openings to the screen chamber, which contains the inclined trash racks and has grooves for Stoney gates to close the inlets to the turbines when necessary. The gates will be operated from a hoist on a gantry crane spanning the chamber, one end of the crane-girder having wheels riding on an elevated runway along the wall of the power house, while the other end rests on a leg with wheels riding on a rail laid along the forebay wall.

From the inlet the water enters the scroll chamber, and after passing through the turbine is discharged through the draft-tube, which enlarges from a circular opening 12 ft. 6 in. diameter beneath the turbine to an oval opening 32x23 ft. in the rear wall. This discharges the water into the tail race, which has an inclined floor of concrete on a slope of 1 on 4, rising from elev. 795 (the bottom of the discharge opening) to elev. 813, which is the level of the river bed.

There will be seven vertical-shaft turbines of 2100 hp. each, five of which are to be installed at present. The shafts are suspended from roller bearings above the generators.

Gates

The 28 Taintor gates along the top of the spillway dam are 32 ft. 11 in. long on the face and 7 ft. 6 in. high, with a face radius of 10 ft. 6 in., as shown in Fig. 4. Heavy vertical girders are connected by I-beams to which the faceplates are riveted, and the construction is sufficiently stiff to enable cross-bracing to be eliminated. Each gate weighs about 6½ tons, and is operated by a pair of chains passing over drums mounted on the concrete deck or bridge and arranged for either hand or motor operation. Fig. 5 shows the completed spillway with dam gates in place.

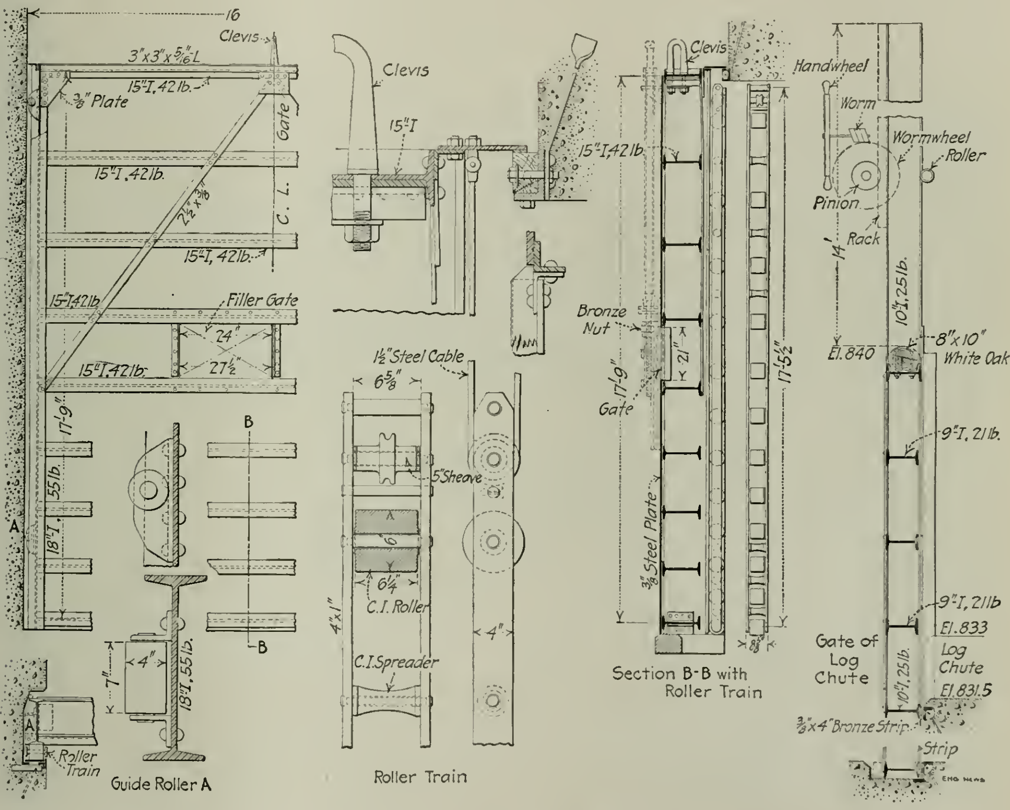


FIG. 6. STONEY GATES FOR THE POWER HOUSE INTAKES, AND GATE FOR THE LOG CHUTE; COON RAPIDS DAM

When closed, the edge of the gate rests on an oak sill on the crest of the dam, and as such sills invariably warp to some extent, a water-tight joint is made by a doubled strip of rubber belting, which is attached to a timber on the face of the gate and projects below it so as to lie against the beveled corner of the sill. The ½-in. clearance at each end of the gate is also sealed with a rubber strip riding against the face of the pier, as shown.

The Stoney gates for the intakes have a framing of 18 in. vertical and 15 in. horizontal I-beams, with ⅜-in. steel plating on the upstream side, Fig. 6. At each

end is a train of rollers riding against a guide in the groove in the masonry. These gates are 15 ft. 2 in. wide (for 14½-ft. openings) and 17 ft. 9 in. high, weighing about 8 tons each. In the center of each is a filler gate 18x21 in., having threaded lugs engaging with vertical operating screws. On the top of each gate is a clevis loop, for the hook of the operating gantry crane.

The four sluice gates are 6 ft. 5½ in. wide and 11 ft. 9 in. high, weighing about 1½ tons each. Each is built of two 8-in. vertical I-beams, with horizontal I-beams between them and with plating on the upstream face. The gate has contact plates of bronze sliding against cast-iron guides in the masonry and has a vertical stem with threaded upper end passing through a revolving nut driven by a hand-operated bevel gear. Fig. 7 shows a section through the sluices. The Stoney gates and sluice-gates close against wood sills when lowered. The sluice gate for the log chute is of similar construction, 10 ft. wide and 9 ft. high, but moves downward instead of upward in opening. It is operated by a rack and pinion at each end, the shaft being driven by a worm gear and hand wheel.

Auxiliary Works

The log chute is 10 ft. wide and the fishway is of the type prescribed by the U. S. Fish Commission. The embankment formed at the north end of the power house has a concrete core wall, with a line of steel sheet piling beneath it. The slope of the embankment on the water side is paved with sacks of concrete laid on 6 in. of broken stone or gravel, as shown in Fig. 7.

There is a considerable amount of logging on the river, and special means are taken to keep the logs away from the forebay and spillway and to guide them to the log chute for passing the dam. Along the north shore and extending across the forebay is a heavy timber boom attached to cribs and forming one side of the approach to the chute. Another floating boom extends from the opposite side of the chute on a diagonal line across the river. The sections of this boom are anchored by chains to pairs of piles having the heads cut off below the water line.

Construction

The Great Northern Ry. and Northern Pacific Ry. are about a mile from the site, and within about half a mile are a public highway and the Minnesota & Northern Ry. This latter is an interurban line to Anoka, operated by gasoline motor cars and freight locomotives.* This line was used for bringing in materials, a spur being built which will be retained permanently. As the construction of the spur was delayed by very cold weather, large quantities of lumber, building materials, and pipe for the water and sewerage systems of the construction camp were hauled by teams and motor trucks from Minneapolis, a distance of 10 or 12 miles. The snow was not deep, and had packed so hard that the roads were good and heavy loads were handled without difficulty.

CAMP—The camp was located on high sandy ground and in a grove of oak trees at the north side of the river. It accommodated a force of about 800 men, besides many women and children. There were about 13 cottages for the accommodation of as many families, besides stores, etc. These were laid out on streets, and provided with water, sewerage (outdoor closets) and electric light. They were frame structures, covered with heavy roofing paper, and were well separated so as to reduce the fire risk. During severe winter weather the bunk houses were heated by hot air furnaces. Other buildings had stoves.

All were temporary buildings, with the exception of the store, the hospital, the superintendent's office, and the bunk houses for the engineers and foremen. A school was provided for the children, and this was used also for moving-picture shows and other entertainments. The water (for domestic and fire purposes) was obtained from an artesian well. The sewage was delivered to an Imhoff tank and the effluent treated by the hypochlorite process.

The spur track from the interurban railway divided into two lines, one being a permanent line which enters

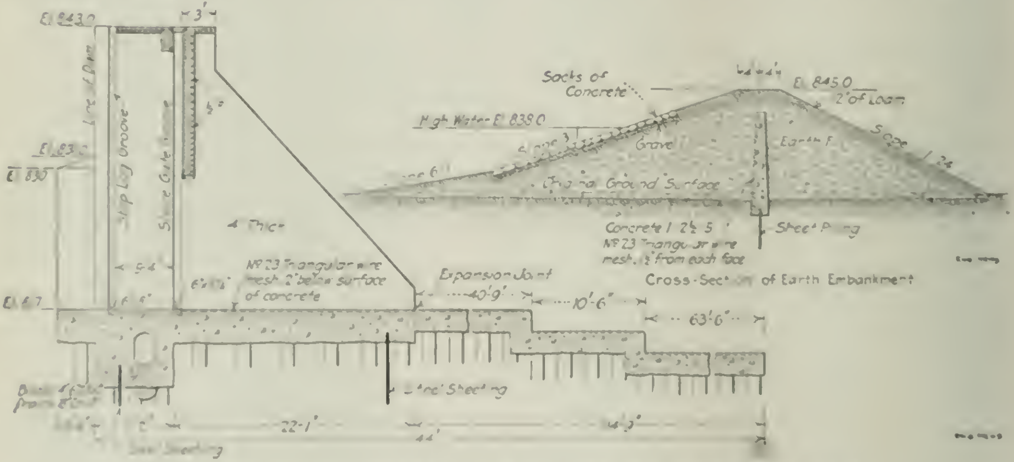


FIG. 7. CROSS-SECTION THROUGH SLUICES AND THROUGH EARTH EMBANKMENT

*"Engineering News," Oct. 16, 1913.

the power house and will serve for handling machinery, etc. The other was a temporary line at a higher elevation and extending on a trestle over the sand and stone bins of the concrete plant, so that these materials could be dumped directly into the bins. From these, it was raised by dump cars on a cable incline for delivery to the mixers. The two 1½-yd. mixers (driven by electric motors) discharged the concrete into 1-yd. dump cars on a narrow-gage track carried across the river on a trestle inside the coffer-dam.

Fig. 8 shows the trestle and construction track, with two inclined chutes for connecting the draft tubes. At the right is the higher trestle for the material track. the light locomotives and concrete cars, and the tracks were connected at frequent intervals by crossovers to facilitate operations. The plant was capable of mixing and placing 1000 cu.yd. of concrete per 24 hr. if necessary. The best records were 516 yd. in a 10-hr. shift, 1006 yd. in 20 working hours, and 72 yd. in one hour.

The concrete was discharged from the two 1½-yd. mixers into steel dump cars of 1-yd. capacity. These were hauled by light locomotives on the construction trestle inside the coffer-dam, the cars being dumped sideways at inclined chutes, as shown in Figs. 9 and 10. These chutes generally delivered the concrete into place, but for the apron of the spillway they delivered it into hoppers

FIG. 8. CONCRETING THE DRAFT TUBES OF THE POWER HOUSE AT THE COON RAPIDS DAM

(The concrete cars are run out on the longer trestle and dumped at hoppers on the inclined chutes. The shorter and higher trestle carries the material track, and has the storage bins beneath it. The draft tubes are 12½ ft. diameter at the upper end and 32x23 ft. at the outlet.)

Fig. 9 shows the work in the first portion of the coffer-dam. Two of the sections of the dam are completed and stripped, and a third is being concreted. The apron also is shown. The grooves in the upper face of the dam are for the piers. The trestle is at the right (upstream side).

This trestle carried three tracks. On the side next to the dam was a standard-gage track on which ran a locomotive crane (Fig. 8) for handling the form work, depositing concrete, setting Taintor gates, etc. Between the rails was laid a third rail to form a track of 3-ft. gage, and another track of 3-ft. gage was laid on the upstream side of the trestle. On these two tracks operated for supplying wheeled carts of 6½ cu.ft. capacity. The trestle track was a little above the level of the top of the dam, and for the upper part of the work the concrete was delivered in dump buckets (on flat cars) which were hoisted by a locomotive crane and dumped into the forms. This crane was used also to handle the forms and other material.

The concrete was mixed 1:2:4 for reinforced work, 1:3:5 for mass work, and 1:2:4 for the floor. All reinforcement was of square twisted bars. A good grade of sand was found adjacent to the work. The stone was crusher-run limestone, hauled from Minneapolis.

The cement store had a capacity of about 7000 barrels. The receiving track was on the outside, and the track for taking cement to the mixers on the inside but at the opposite side of the house, thus facilitating the taking of the cement from the storage space in the order in which it was received.

All the machines in the carpenter shop and blacksmith

Fig. 9. First Portion of Spillway Dam Completed Within the Coffer-Dam

(The construction track and concreting track are on the trestle at the right. The tunnel in the dam is a relief conduit, with overhead drains through the floor to permit the escape of any water under the dam.)

shop, as well as all pumps, etc., were driven by electric motors. As the current generated at this plant is to be sold in Minneapolis, the transmission line was built first (with one circuit of copper cable), in order to get current from the Minneapolis plant for use at the camp and on the construction work.

The construction of the dam was done in two sections, inclosed within timber coffer-dams, consisting of a row of piles 8 ft. apart with waling timbers and a single line of triple-lap sheeting. A bank of earth was deposited against the outside of the sheeting to make it waterproof. For the power-house work, in the deeper channel of the river, the coffer-dam was of stone-filled cribs, held in place by piles.

The deep excavations for the draft tubes extended some 25 ft. below the bed of the river. For the first four tubes the excavation was carried on while the sheeting was being driven and braced, and then the foundation piles were driven. The vibration due to the pile driving, however, caused such pressure and movement of the material that the bracing was distorted and broken and it was difficult to hold the sheeting in place. In fact, it became necessary to replace some of the 12x12-in. timbers with pairs of 15-in. I-beams.

As a result of this experience, for the other three draft tubes the steel sheeting was first driven, and then the foundation piles, these piles being put down to the required elevation by means of followers. When all this was completed, the space to be excavated was inclosed by wood sheeting driven to the full depth, and the bracing was placed as the excavation progressed.

Forms with steel ribs were used for the whole of the dam and Fig. 11 shows the design of these forms, which were in lengths of 54 ft. 8 in. The lagging was of wood, 4 in. thick, held to the ribs by light clamps as shown at X in Fig. 11. To resist the upward pressure of the concrete deposited beneath the lagging, the forms were anchored by rods secured to the foundation piles. The upright posts of the forms were seated in pockets in a concrete shelf along the face of the toe-wall. The piers were built after the dam proper. Fig. 10 shows the forms in place and concrete being deposited.

Four 54-ft. openings in the spillway dam were left to provide ample waterway while the work was being done in the coffer-dam at the power house. These were floored

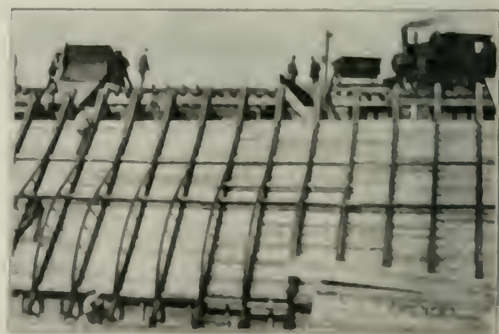


Fig. 10. Concreting the Spillway Section of the Coon Rapids Dam

(The steel ribs of the forms are anchored to the foundation piles to resist the pressure of the concrete, which is [illegible] [illegible] place through the [illegible].)

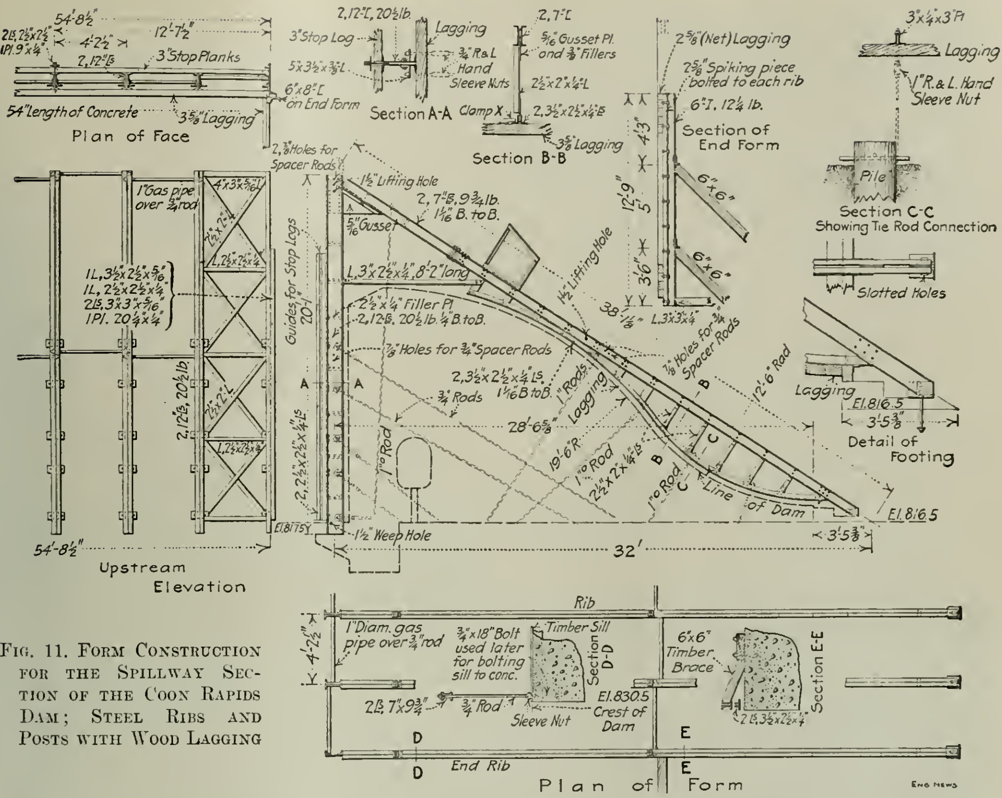


FIG. 11. FORM CONSTRUCTION FOR THE SPILLWAY SECTION OF THE COON RAPIDS DAM; STEEL RIBS AND POSTS WITH WOOD LAGGING

with planking, temporarily, and were finally closed, with the steel forms serving as coffer-dams.

The forms for the scroll cases and draft tubes (Fig. 8) were made in sections, and were collapsible. In this way they were readily assembled and removed.

Sweeping over Macadam and Gravel Roads as a Maintenance Measure

In an article on road maintenance in the *Quarterly Bulletin* of the Philippine Bureau of Public Works, for April, 1914, J. L. Harrison gives some valuable information on road-maintenance problems in the tropics. The following paragraphs advocating the regular sweeping of macadam and gravel roads are particularly interesting, since few states in this country have as thorough or as efficient a maintenance organization and methods as the Philippine Bureau of Public Works.

Mr. Harrison writes: All roads should be swept frequently. This is not because their appearance is thereby improved, though it is undoubtedly true that the neat appearance of a clean right-of-way is very pleasing to the eye; but because of distinct benefits that accrue to the highway itself. All sorts of litter accumulate on an unswept road. That which is not removed either grinds to dust under the wheels of passing vehicles and in this form is mixed with the stone dust and prevents it from properly performing its functions, or washes into the ditches where it causes serious annoyance by collecting about obstructions and causing overflows.

The regular sweeping of a macadam or gravel road also aids in preventing rutting. Many animals instinctively follow paths or trails. Those used in domestic service show very marked tendencies in this direction. If a little fine loose gravel is present, the sweeping of a highway will obliterate wheel tracks. With these out of sight draft animals will make no effort to keep on any particular part of the road surface and a more equal use of the whole of the metalled section will result.

The more evenly wear is distributed the longer a road will last. It may, therefore, be advisable to sweep a road quite often simply to obliterate the wheel tracks. The necessity or advisability of such action will depend on the amount of traffic and the kind of material used for metalling. Roads built of hard rock are less affected by traffic and less aided by this treatment than are roads built of softer stones. Gravel roads seem to be helped more than macadam roads.

Of course, the better the binding qualities of the metalling the more advantage there is to be gained by frequent sweeping for, in the wet season, if the binding quality of the metalling is good, much of the material swept onto the road may bind in and, in that case, not only is rutting prevented but the deficiencies caused by a season's wear may be largely corrected.

Failure of Mixing Flumes for Water-Softening and Filtration Plant, Dallas, Tex.

By N. Werenskiold*

Early in December, 1913, an attempt was made to put the new softening and filtration plant at Dallas, Tex., in operation. Water was turned through the treating and mixing channels leading to the sedimentation basin (Fig. 1), as apparently intended by the plans. Within 27 hr. about 200 ft. out of a little more than 600 ft. of the two basins. The soil when dry has considerable bearing power and cohesion; when saturated with water, as the water side of reservoir embankments will be, it will merely stand on a slope of 2 to 1. It absorbs water readily and holds it well.

Under the engineer's plans, the west basin is to be used for sedimentation, the east basin for filtered water. The raw water was to enter Channel *A* (see large section, Fig. 1) near the division embankment and there be treated with limewater, then to flow to the far end and around the light division wall into Channel *B* and back toward the division embankment. The coagulant was to

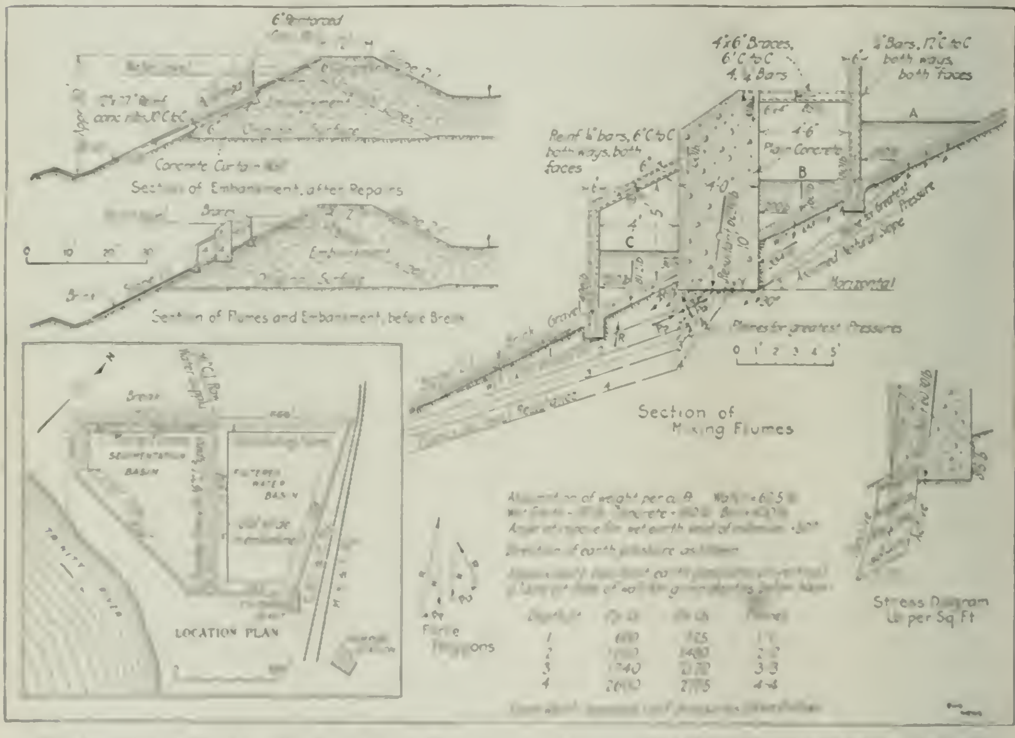


Fig. 1. Mixing Flumes for Filtration Plant, Dallas, Tex., with Sections and Diagrams Showing Cause of Failure and with Location Plan

the flume failed (see Fig. 2). According to the best information obtainable the slope below the flume bulged out and part of the embankment with the heavy walls of the flume slid gradually down, making a rumbling noise and producing fissures felt some distance off. The heavy wall was built on the water slope of a reservoir embankment constructed about 25 years ago.

The two old settling basins (see plan, Fig. 1), each of a capacity of about 65,000,000 gal., were built in and of the alluvial soil in the Trinity River bottom. Their water slopes were protected against wash and wave action by a paving pavement of common brick, made out of the bottom soil, and no other and resting on a little gravel, plastered with cement mortar. Some old pipes in the dividing embankment make it possible to connect be added at the far end. By means of gates the treated water could then be turned either into Flume *C* and flow about 800 ft. through it to the inlet pipe to the sedimentation basin, or it could be turned into a 36-in. cast-iron bypass pipe, resting on top of the decanting or outlet flume, and carried to the small reaction tank of the filter plant. A bypass to avoid both flumes and sedimentation basin had also been provided.

Under the conditions of the filling a lineal foot of the flume and walls would be subject to the approximate forces shown on the section (Fig. 1). The vertical plane of the face of the heavy wall extended below the base may be considered as the back of a retaining wall, which, to prevent the soil from coming out from under the heavy wall, must offer a greater resistance against sliding on the plane of least resistance than the maximum pressure exerted on its back by the earth under the heavy wall.

*City Engineer, Dallas, Tex.

Under assumptions more favorable to the design than any responsible designer would be likely to make, the active and passive earth pressures on the vertical plane have been determined graphically by trials, for different depths, the average unit pressures derived therefrom and shown on a diagram (Fig. 1). The results indicate failure to be reasonably certain.

As a practical demonstration of the need and usefulness of simple theoretical investigations, where precedent, experience or instinct furnish no guide, the design has been a decided success. That only about one-third of the flume failed in one slip may be attributed to varying conditions of the embankment, which had not as yet been saturated by seepage through pavement and construction joints. The embankment could not be expected to support the heavy wall, if there was no water in the channels, after it had been saturated. With water in the basin and corresponding pressures on the slope, the passive pressures would have been far greater; but wave actions might have a disturbing effect.

These extracts were sent to us by Mr. Werenskiold, with the statement that they were taken from the Dallas *Morning News* of Dec. 13, 1913.—EDITOR.]

On Dec. 1, at 1:09 p.m., Mr. Morey, in the presence of the representative of the American Water Softener Co., turned the water into the west basin, through the mixing channel, at the rate of 11,000,000 gal. per day. The water continued to flow into the basin at that rate all that night and until 10:10 a.m. the next day, at which time the accident occurred. There was but one eye-witness to the accident, although Mr. Morey was on the wall ten minutes before the break occurred, and saw then no sign of weakness. When the break occurred a considerable length of the wall seemed to have been undermined at the same instant, the first thing noticed having been the bulging of the slope pavement in a line about 7 ft. below the lower channel; this was followed by the immediate discharge, below the foundation of the wall, of water and mud behind the three parallel walls and the falling flat on its north face of 150 ft. of the collapsed section.

As above stated, the water was brought into the basin through the mixing channel, which was not the proper procedure as, with the basin empty, this would bring pressure on the walls which they were not intended to bear. The basin should have been filled up to nearly the full operating depth through the bypass pipes before permitting the water to flow through the mixing channels, the walls of which were intended merely to divert the course of the water slowly back and forth across the end of the basin to allow it to mix for half an hour with the added chemicals before entering the basin.

FIG. 2. VIEWS OF MIXING FLUME, DALLAS FILTRATION PLANT, LOOKING WEST FROM DIVISION EMBANKMENT
(1) Original flume, immediately after failure. (2) Upper channel (see sections, Fig. 1) reconstructed along length of broken portion.)

In making the repairs the Channels *B* and *C* (see large section, Fig. 1) were bulkheaded off at the break and shortened about 300 ft. The Channel *A* was maintained by supporting the light wall on buttresses and ribs, 10 ft. c. to c., reinforced and provided with curtain walls, as shown by one of the small sections (Fig. 1) and the photograph (Fig. 2). During the latter part of April, the sedimentation basin was partly filled from and through the filtered-water basin by pumping raw water through same, and also through the east end of Flume *C*, which has been converted into a bypass to avoid the use of the other channels in filling. The plant is now (May 11, 1914) reported to have been in successful operation for a few days without any new accidents having been made public. When the water in the sedimentation basin is drawn down some distance below the flume, as it is likely to be sooner or later from some cause, more of the original flume can be expected to take a very natural course down the slope.

CONSULTING ENGINEER'S REPORT ON THE FAILURE

[We reprint herewith extracts from a report on the failure by James H. Fuertes, of New York City, Consulting Engineer on the Dallas water-purification plant.

By filling the basin through the mixing channel the water got through cracks in the old slope pavement and, working down through the gravel under the pavement, brought up against the heavy wall, and backing up, caused excessive pressures.

Had the basin been filled through the bypass there would have been no pressure against the wall when the water was admitted through the mixing channels, and had the backfilling behind the big wall been rammed in, watertight, and the slope paving over this filling been promptly replaced, as directed, the wall would not have failed under the pressures actually exerted, as is shown by the fact that more than two-thirds of the wall still stands intact, and undisturbed even by the violent strains therein caused by the failure of part of it, and that the part that failed is the part from behind which the replacement of the paving was longest delayed.

The portion of the wall that failed is about 200 ft. long, the undermining of this portion displacing and damaging the adjoining sections for a short distance on each side. The failure of the wall destroyed the old slope paving for a corresponding length and for from half to two-thirds the full depth of the slope. The fallen sections of the wall lie nearly flat on this slope, at the middle of the break, and range from this position to a standing position at the two ends of the break; all three diverting walls were destroyed for the width of the break.

There appears to be no further tendency for the walls to slide or move, either as to the uninjured parts, or as to the

poses which fell, and I believe it would be unwise to disturb the fallen pieces on account of the treacherous nature of the soil and its liability to cave, settle and slide when saturated with water and disturbed. I would also hesitate to restore the original slope to this embankment, fearing the reproduction of the conditions that gave so much trouble in the repair of the broken cross-wall.

After stating that it was possible but not advisable to put the filtration plant in operation regardless of the break, although the softening process could not be used until the west basin was made available, Mr. Fuertes discussed repairs to the break in the mixing flume as follows:

It will not be advisable, as above stated, to attempt to replace the slope paving at the break, on the original lines. A treatment similar to that adopted for the old broken cross-wall [not here described.—Ed.] will be required, though it will be less extensive as the caving is much less pronounced and the soil firmer. It will not be feasible, except at considerable cost, to replace all the broken cross-walls, on account of the difficulty of getting proper foundations, but the portions now standing can be utilized by building bulkheads up the slope, each side of the break, and properly connecting the channels across the break in a manner that I will show in drawings which I will prepare after the surveys now in progress are completed. I have made a number of studies for different plans for accomplishing the desired results, and the approximate estimates of cost indicate that an expense in the neighborhood of $5000 will be involved in making the repairs.

We are informed by Mr. Fuertes, under date of June 23, 1914, that the repairs to the flume were carried out in accordance with the general plan outlined in the paragraph last quoted and that the plant has been in operation six weeks. Mr. Fuertes also states that some of the discussions of the break have been "based on the erroneous assumption that the wall which failed was intended to act as a dam or retaining-wall."

Experiments with Screw Spikes and Auxiliary Rail Fastenings; Pennsylvania Lines

Some extensive tests have been made on the Pennsylvania Lines to determine the efficiency of screw spikes as rail fastenings, and to determine also the value of some supplementary devices which are employed in Europe to increase the holding power of screw spikes in the ties. The results were far from satisfactory, although the screw spike has been generally considered as a very efficient rail fastening. Two supplementary fastenings were used: (1) the Thiollier lining,* which is a steel-spring spiral screwed into a thread in the spike hole, in order to compress the wood on which the thread of the screw spike must bear; (2) the Lakhovsky lining, which is a split sleeve inserted in the bored hole and forming a threaded socket for the spike, the sleeve being spread outward against the wood as the spike is screwed home. These linings are shown in the accompanying cut.

The tests were undertaken by W. C. Cushing, Chief Engineer of Maintenance of Way, Pennsylvania Lines (Southwest System) and were in charge of R. D. McKeen and W. H. Wiggins. A resume of the tests and their results has been published in Bulletin No. 165 of the American Railway Engineering Association, and we give herewith a brief summary of the reports. The introductory statement by Mr. Cushing is as follows:

The experiments described were undertaken by the writer to determine if it would be possible to find auxiliary rail fastenings which would serve so as to obtain the full life of a preserved wood tie. It seemed quite doubtful whether the fastenings heretofore proposed would last sufficiently long for the purpose, and suspicions against the screw spike were aroused by the fact that in Europe it was necessary to invent various methods of repairs, such as the wooden screw plug,* the Collet wooden screw trenail, the Thiollier helical lining and the Lakhovsky cast-steel lining.

The methods used in placing these screw spikes were those in common use in France, and the screw spikes used were obtained from France. The trial shows that the screw spikes were too small, the method of placing (without shoulder support for the head) defective, and the problem of rust is still so serious that such kinds of fastenings are rendered ineffective in altogether too short a time.

As a result of these tests, more elaborate tests have been inaugurated on the Pennsylvania R.R. and the Pennsylvania Lines, which are under the charge of a joint committee. The screw spike used is much larger and is the result of study made by the writer. Some of the same difficulties are arising in the new tests, which clearly show that a screw spike is not a successful device for securing rails to wooden ties, unless a successful method of repairs from time to time can be devised, which will enable one to "cure" the screw spike when it becomes loose, which it does inevitably in the course of time in many instances, under heavy traffic and severe conditions.

Indeed, it may be found ultimately that the practice of the Great Western Ry., of England, in using bolts clear through the ties, may be the most successful plan.

A condensation and some direct quotations from the two reports follow:

Ties and Fastenings†

The French screw-spike (Eastern Ry.) used in the test is $5\frac{1}{2}$ in. long under the head, $\frac{1}{2}$ in. diameter at the root of the thread, increased to $\frac{11}{16}$ in. at the shank to insure tightening in the last turn of the spike. The pitch is two threads per inch. The head has a square top tapering from $\frac{3}{4}$ in. to $\frac{5}{8}$ in. for engaging the socket wrench, but this should be made without a taper, as it causes the wrench to lift when the screw is being seated. There were 18,000 of these spikes and the spiral linings. The tie-plates were of the flat-bottom type, 6x9 in., $\frac{11}{16}$ in. thick.

Quoting now from the report:

On hewed ties, the rail seats were adzed by hand, a template being used to insure accuracy. Holes were then bored through the tie with ordinary auger and proper spacing template. The boring may be done by hand or power. In this case a portable air-compressing plant (made for use in bridge riveting) was used, with a wood-boring air motor.

It is necessary to bore the holes entirely through the ties, as the thread-cutting tool could not otherwise be used, due to the accumulation of shavings from it in the bottom of the hole. The holes were then tapped with a special thread-cutting tool furnished by Thiollier. The diameter of the tool at the root of the thread is the same as the diameter of the hole. This operation may be performed by hand, or with a boring machine. In this experiment a compressed-air plant and a heavy air motor were used.

The screw spikes were run down three-fourths of their length with an air-motor wrench and tightened by means of a socket wrench about [illegible] in. long, equipped with an ordinary brace-wheel at the upper end. Two men were required for operating each wrench.

The helical lining is then screwed in the hole by means of a driving mandrel on which the lining is placed, the lining being turned into the tie. Great difficulty was experienced in placing the linings by hand. When the lining was partly in place the friction between it and the wood became so great as to straighten out the bend which engages the mandrel, permitting the latter to turn in the lining. In this event, it became necessary to remove the lining from the hole and replace the bend at the lower end, or replace the lining itself with a new one.

The insertion of the lining was accomplished with difficulty and many were broken during this operation or in replacing the bend so that it might again be driven into the tie. Various attempts were made to overcome this difficulty. Both

*"Engineering News," June 11 and Aug. 13, 1908.

*"Engineering News," Oct. 15, 1914.

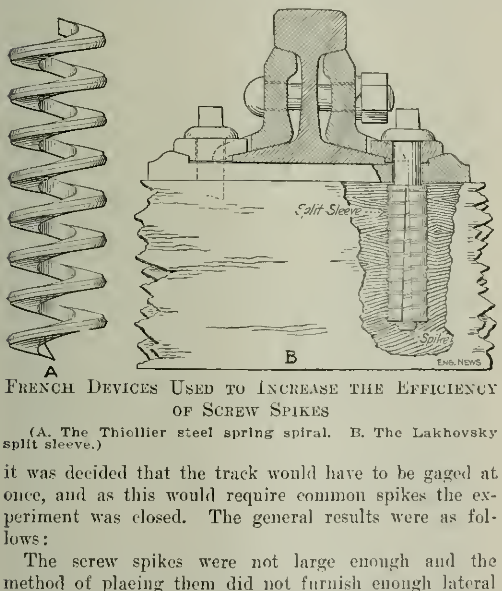
†From the report of W. H. Wiggins, Division Engineer, Pennsylvania Lines, Pittsburgh Division.

the diameter of the hole and the size of the thread were increased, within limits, without much success. A slight increase in the size of the hole, or of the thread-cutting tool, resulted in the lining being too loose and coming out with the screw spike when there was occasion to remove it. A new design of driving tool was finally devised with a shoulder to engage the upper end of the lining, in addition to the one at the lower end. This tool pushed, as well as pulled, the lining into place. Some improvemnt was effected by the use of this tool, but the difficulty was not entirely overcome. It wohld be necessary to use special machinery for executing work of this character.

The cost per tie was \$1.78 with common spikes and \$2.16 with screw spikes and spiral linings. The cost includes the creosoted tie, spikes, tie-plates, linings, adzing, unloading and piling ties, placing ties and surfacing track.

Results of Tests*

The screw spikes and Thiollier helical linings for the spike holes were installed during June to November, 1907, in ties of Kentucky short-leaf pine and red oak, treated with 2½ gal. of creosote per tie (0.33 gal. per cu. ft.). After an inspection of the track in February, 1913,



French Devices Used to Increase the Efficiency of Screw Spikes

(A. The Thiollier steel spring spiral. B. The Lakhovsky split sleeve.)

it was decided that the track would have to be gaged at once, and as this would require common spikes the experiment was closed. The general results were as follows:

The screw spikes were not large enough and the method of placing them did not furnish enough lateral resistance to prevent the widening of the gage. The tie-plates were almost entirely destroyed by rust and many of the screw spikes and Thiollier linings were corroded badly, so that their holding power was destroyed. This condition is supposed to be aggravated by brine dripping from refrigeration cars, as this traffic is heavy.

The holding power of screw spikes is greater than that of the hook spikes commonly used, but the forces tending to loosen them are very great, unless the surface of the track is kept in a high state of perfection. The spikes in loose ties are apt to be quickly loosened by having the threads in the wood destroyed. The above defects having developed in 5½ years, it appears that the fastenings must be adapted for repair work or the full life of creosoted ties cannot be obtained.

There were more loose screws where the tie-plates were used, owing to the corrosion of the plates. The condition of the intermediate screws and tie-plates was very bad, many of the plates having rusted almost entirely away, largely due to the action of the brine from refrigerator cars. The screws in some cases were almost destroyed, their threads having been eaten away, permitting the screws to be lifted out of the ties. Many screws were worn under the head and bent. The bending could be overcome by designing a tie-plate that would support the head of the screw and assist in resisting the lateral thrust of the rail. The tie-plates had all cut into the ties about ¼ in., as had the rails on the ties without plates. Some ties were crushing under the plates. The joint screws and plates were in good condition, but some screws could be raised an inch, due to the tie decaying around the lining.

It is impossible to extract the Thiollier linings or to introduce new spikes with good results. Therefore, the Lakhovsky linings were introduced at the joints, in new holes, to compare them with the other lining. At the time of inspection the joint screws which were installed in 1910 with Lakhovsky linings, clips and larger tie-plates, were giving satisfactory service. They were not bent and all were in good condition with the exception of a few of the linings being loose. At a great many of the joints, the rail, tie and tie-plates seemed to be held firmly to each other, and the entire joint moved up and down under traffic. The joints were all in fairly good line and surface, and this type of fastening seemed to give much better service than the smaller intermediate screws.

CONCLUSIONS: 1. Screw spikes offer a greater resistance to extraction, and will remain tight for a longer period than common spikes if the track is well maintained.

2. By greater holding resistance they tend to reduce creeping of rail and also to prevent the slewing of the ties, but this action is not complete.

3. The screw spikes do not cause the ties to split, as do the common spikes, on account of boring the holes in advance.

4. The cost of maintenance of track for screw spikes is from two to four times as great as for common spikes.

5. Screw spikes cost from two to three times as much to apply as common spikes, and first cost is considerably greater.

6. When screw spikes break, it is impossible to extract the stump from the hole, and when tie-plates are used, it is either impossible or very costly to exchange the tie-plates, so as to allow the proper number of spikes to be used. This might be a very serious matter when the spikes are cut off by a derailment.

7. It is impossible to gage the track which is laid with screw spikes or to straighten rail which is canting on curves, when placed in accordance with the plan used for this experiment.

8. It is impossible to remove screw spikes which have rusted, in order to replace them with new ones.

9. Tie-plates with bosses supporting the heads of the spikes and screws with heads beveled to fit the rail would decrease the lateral thrust and would offer a greater resistance to the rail creeping.

10. Larger tie-plates are required, as those which were used cut into the ties badly.

11. It would seem desirable to fasten the tie-plates to the tie with screw or common spikes so that the sawing action of the plate, under traffic, would be eliminated and reduce the cutting of the plate into the tie. The plate must be held firmly to the tie.

12. Heavier screws are needed, and two screws per rail on the inside should be used on curves to prevent canting and assist in maintaining the gage.

13. The screws should be applied by some mechanical device, so that each screw would bear equally against the rail. By applying screws by hand, equal bearing is not obtained.

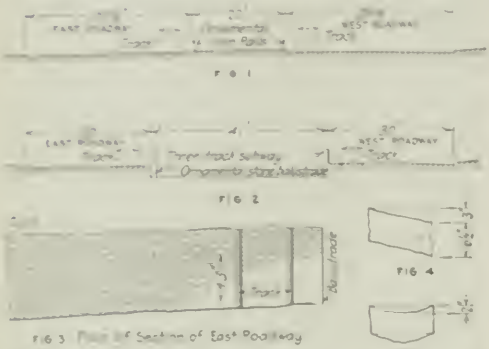
14. Some method should be devised to overcome the effect of the brine from refrigerator cars on track fastenings. The failure of these fastenings was due largely to the corrosion of tie-plates and screws.

*From the report of R. D. McKeon, Assistant Division Engineer, Vandalia R.R.

Remarkable Instance of the Creeping of Asphalt-Block Pavements

By J. H. Gandolfo*

The following description of a creeping pavement that has recently come under the writer's notice, illustrates one of the most advanced cases of such an occurrence of which he has ever heard. The conditions tending to produce the creeping are, however, probably more severe than those ordinarily found on the average city highway.



Plan and Cross-Sections of Upper Broadway, New York City, Showing Creeping of Asphalt-Block Pavement

Upper Broadway, in New York City, is a wide thoroughfare, with two sidewalks, two roadways, and a grass plot in the center, as shown in cross-section in Fig. 1. This avenue runs approximately north and south, the east roadway being used exclusively for northbound traffic and the west roadway for southbound traffic. Along each side of the grass plot is a trolley track (underground conduit system).

The Broadway branch of the subway passes under the avenue, and between 121st Street and 122nd Street the trolley tracks diverge, narrowing the roadways to 30 ft. wide, in order to provide room for the three tracks of the subway, which comes out at 122nd Street in open cut, preparatory to crossing Manhattan Valley on a steel viaduct. The cross-section of Broadway at this point is shown in Fig. 2.

Beginning at 116th Street and extending north to Manhattan Street (125th Street), a distance of [illegible], Broadway is on a down grade of from 1% to [illegible]. The street is paved with sheet asphalt from 116th Street to the south side of 118th Street; but from here on to Manhattan Street the pavement is asphalt blocks. These blocks are [illegible] (5x12-in. surface exposed), on ½-in. cement mortar on a concrete base [illegible] in. thick. This pavement was laid in [illegible].

In addition to the ordinary street traffic of a large city, upper Broadway is subject to a very heavy automobile traffic, as this street is the main artery from the west side of the city leading to the bridge across the Harlem Ship Canal at Spuyten Duyvil. This is the only bridge for vehicles across the river and canal on this side of the city, leading directly north.

Under this heavy traffic, the blocks of the east roadway (the down grade) have at various points moved bodily from their original positions, until the lines of blocks have assumed positions as shown in Fig. 3. There does not seem to be any regularity in this movement, some sections of the avenue being apparently free from any considerable movement, while other sections exhibit a large displacement. This displacement seems to have reached a maximum just north of 122nd Street, where the pavement is now in poor condition. Here the movement of the blocks has reached the astonishing amount of over 4 ft., as shown in Fig. 3.

Creeping of Asphalt-Block Pavement; Patch of New Blocks, Ocean Ave., Brooklyn

The following comparison will give an idea of the singular variation in this movement, the reason for which the writer is at a loss to understand:

118th St. to 120th St., 2 ft.
120th St. to 121st St., very little movement.
121st St. to 122nd St., from 1 ft. 9 in. to 2 ft. 2 in.
Just north of 122nd St., 4 ft. 3 in. (the maximum).
122nd St. to 123rd St., badly creeping, but difficult to follow the lines of the blocks in order to measure the displacement.
123rd St. to 124th St., 1 ft. 10 in. to 2 ft. 2 in.

*[illegible], New York City.

124th St. to 125th St., fairly regular except just north of 124th St., where there is a displacement of 2 ft. 6 in.
125th St. to 126th St., here the roadway widens again, the car tracks being carried in under the viaduct. From here on to Manhattan St. there is very little displacement.

The strain of this movement on individual blocks has been such as to cause them to assume various shapes and dimensions, two maximum cases of deformation being illustrated by Figs. 4 and 5. From these it will be noted that whereas the blocks were originally 5 in. wide, some are now 6½ in. wide, and have been bent and twisted 2 and 3 in. from their original rectangular shape. Of course, it is to be remembered that all these figures are taken from surface measurements, and the blocks are perhaps not so badly distorted deeper down.

Owing to the creeping of the surface of the blocks over the joints between them, combined with the oil drippings from automobiles, the joints are practically obliterated over large areas of the pavement, and it is therefore impossible to follow the lines of the blocks at all on these areas. Indeed, it takes close scrutiny at places to tell the surface from that of the ordinary sheet asphalt.

In making necessary repairs, the blocks have been cut out in the worn portions, and new blocks, 5x2½x12 in., put in place in regular rows perpendicular to the curb, no attempt being made to follow the reversed curve assumed by the old blocks.

There is no way of telling, at present, whether there has been any movement of the concrete base, but it is the writer's opinion that there has not been any very serious displacement. Apparently all the movement has taken place between the blocks and the concrete base; the cause, of course, being the very heavy traffic on a down grade and all in one direction.

On the west roadway, where the traffic is uphill, there has been some little movement at some points, but it is of small amount and very irregular. The general tendency, however, seems to be a movement *up hill,* on this side of the avenue.

Creeping of Asphalt-Block Pavement on Ocean Ave., Brooklyn, N. Y.

Some of our readers will recall a letter published in our columns of Dec. 25, 1913, p. 1315, calling attention to the creeping of the asphalt-block pavement on Ocean Ave., Brooklyn, N. Y., in much the same manner as the pavement described above by Mr. Gandolfo and to a maximum displacement of 4 ft. 6 in. The blocks on Ocean Ave. are 5x2¼x10 in., laid in the same manner as on Broadway. Here also the same reversed curve was noticeable although this avenue is not divided by car tracks.

The accompanying illustration shows a patch of new blocks, placed recently on Ocean Ave. The pavement was put down in the summer of 1910, and is apparently being repaired under the guarantee clause of the contract. In some cases the old blocks are being cut out so as to make a regular-shaped patch, but in many instances the patching is like that shown in the illustration.

This method of failure seems to be common on all the heavily traveled streets in the city which are paved with asphalt blocks. A portion of Flatbush Ave. on a considerable grade shows the same tendency of the blocks to creep or flow *up hill,* as noted by Mr. Gandolfo on Broadway. The cause is the same in all instances—the heavy motor-vehicle traffic always in one direction.

The chart and photograph are particularly interesting as illustrating graphically the strains every pavement surface is subject to. Probably all bituminous surfaces flow or creep in exactly the same manner, but owing to the absence of joints the movement is not so easily detected.

It has been suggested that regularly spaced ribs in the concrete foundation would help to eliminate this trouble. These ribs might be 10 in. wide, perhaps, and come to 1 in. of the surface of the pavement. Over the ribs, special blocks 1 in. thick could be laid, so that the asphalt surface of the pavement would be unbroken.

Slate Beds and other Features of the Devizes Sewage Works

About nine years ago, W. J. Dibdin, of London, England, included slate-contact beds as a part of sewage-treatment works for the small town of Devizes. The following description of the works as they now stand is slightly condensed from notes by Alan J. King, in the *Journal* of the Institution of Municipal and County Engineers (London) for April, 1914.

The plant consists of a total of 18 beds, 8 coarse (2 of these being for storm water), and 10 fine. The coarse beds are 68 ft. long by 48 ft. broad, and are filled with layers of slate about 1 in. apart to a depth of about 4 ft. The storm-water beds are similar, only bigger, being 80 ft. long by 68 ft. broad. These are used when the sewage to be dealt with is more than can be treated by the first six coarse beds, which only happens during very wet weather, and the effluent, after having been through these beds, is allowed to run away without further treatment.

The fine beds are the same size as the coarse beds, and are filled for a depth of about 4 ft. with coke breeze, which has been previously passed through a screen. These beds require renewing about every five years, but the slate beds being once well laid will, with a little attention, last indefinitely. There are also two grit-settling tanks which belonged to a former system, and are now used for allowing the grit to settle after a heavy storm.

The sewage is a dense domestic one about 210,000 [U. S.] gal. per 24 hr., and has the storm water included with it.

Except after heavy rain, when the grit chambers are first brought into use, the sewage is run straight on to the primary slate beds, consecutively, each one taking about 2½ hr. to fill. After standing for about 3 hr., it is run in the same way on to the secondary coke breeze beds and allowed to stand the same time. Then it finally finds its way by a channel over the land immediately below the sewage farm and eventually into a brook.

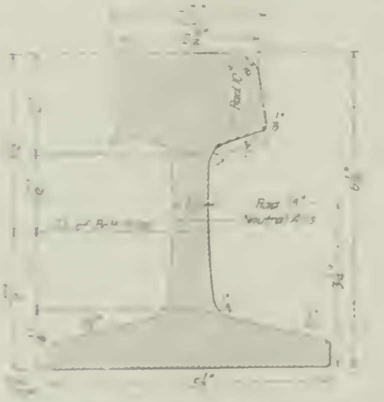
By the time the effluent has come from the fine beds it is very good, so that when not wanted on the land, it is allowed to run straight away into the brook without causing any ill effects.

The whole plant employs 3 men (2 by day, and one for night duty), and the cost is under $1000 per annum. All this amount is practically for wages, and the cost appears to much advantage when compared with the system of pressing the sludge with lime, which was formerly used, and which besides resulting in a large amount of sludge, caused an annual expenditure of nearly $3500.

New 120-lb. Rail Section; Pennsylvania R.R.

The 100-lb. rail, of different sections, has for some years been the maximum size of rail for steam railway track, but the possible necessity and economy of using heavier rails on lines carrying heavy traffic has been suggested from time to time, and the Pennsylvania R.R. has now decided upon trials of a 120-lb. rail. This rail is of an experimental character, and the section is shown in the accompanying cut, while its dimensions are given in tabular form.

In general, the new rail resembles the heavy-base rail (type B) of the American Railway Association sections, but with some important modifications. The proportions of this 120-lb. rail are 41, 22 and 37% for the head, web and base, as compared with 40.2, 19.2 and 40.6% for the 100-lb. A. R. A. (B) rail. The sides of the head have an unusually steep slope (8° as against 3°), while the top of the head has the short radius of 10 in. (as against 12 in.), and corner radii of $\frac{1}{8}$ in. (as against $\frac{5}{16}$ in.). The fishing angles are 18° for the head and 14° for the base, while in most rail sections the angles are uniform and those of the A. R. A. sections are 13°. The height is $6\frac{1}{2}$ in. as against 6 in., but the width of base is the same, since the use of tieplates obviates any necessity of increasing the bearing surface of the rail.



EXPERIMENTAL RAIL OF 120 LB. PER YD., PENNSYLVANIA R.R.

The nearest approach to this new section is the 110-lb. rail of the Lehigh Valley R.R., described in Engineering News, Oct. 24, 1912, and designed for use where heavy grades and sharp curves cause severe conditions of wear. In this case, the height remained 6 in., the same as the A. R. A. (A) section, forming the standard rail, but metal was added to the web and head. This 110-lb. rail (like the new P. R.R. rail) has a 10-in. top radius, instead of the 12-in. of the A. R. A. (A) section. The sides of the head have a slope of 1° (instead of 3°), while the Pennsylvania rail reverts to what has long been an obsolete practice in giving a much greater flare to the head.

This practice was introduced originally on the Lehigh Valley R.R. in fact, some 76-lb. rail of 1881 had a flare of 10°, as against 8° in the new Pennsylvania rail.

120-LB. RAIL, PENNSYLVANIA R.R.

Weight per yard	120 lb.
Height	$6\frac{1}{2}$ in.
Width of base	$5\frac{1}{2}$ in.
Width of head, top	$2\frac{11}{16}$ in.
Width of head, base	$2\frac{31}{32}$ in.
Side of head, slope	8°
Depth of head	2 in.
Depth of web	$1\frac{11}{16}$ in.
Depth of base	$1\frac{3}{16}$ in.
Thickness of web, middle	$\frac{11}{16}$ in.
Height to center of bolt holes	$2\frac{11}{16}$ in.
Radius, top of head	10 in.
Radius, top corners of head	$\frac{1}{8}$ in.
Radius, bottom corners	$\frac{1}{16}$ in.
Radius, fillets	$\frac{1}{2}$ in.
Radius, corners of base	$\frac{1}{16}$ in.
Radius, sides of web	18 in.
Edge of base	Vertical
Fishing angles, top	18°
Fishing angles, bottom	14°
Area of head (41%)	4.84 sq. in.
Area of web (22%)	2.60 sq. in.
Area of base (37%)	4.38 sq. in.
Area, total (100%)	11.82 sq. in.
Moment of inertia	59.20
Section modulus, top	17.77
Section modulus, base	20.00
Neutral axis above center of bolt holes	$\frac{1}{8}$ in.
Ratio of perimeter to area, head	1.13
Ratio of perimeter to area, web	2.88
Ratio of perimeter to area, base	2.77
Ratio of perimeter to area, total	2.12

The flare in the Lehigh Valley rails was reduced to 5° in 1891, and since then it has been limited to 3° to 5° in most rail sections. Presumably the present revival of the flaring head is due in part to considerations of flange wear on curves.

An article describing several so called "frictionless" rails for use on the inside of curves appeared in ENGINEERING NEWS, July 2, 1914, p. 20.

Fire Hazard from Refuse Incinerating Plants, Galveston, Tex.

A brief report on fire dangers from city and private refuse-burning plants at Galveston, Tex., was recently made by the Committee on Fire Prevention of the National Board of Fire Underwriters (135 William St., New York City) following a recent visit by Mr. Goldsmith, one of the committee's engineers. The committee's remarks on the city's plant are substantially as follows:

The city garbage incinerating plant consists of a two-story iron-clad frame building with open first story, adjoining a concrete furnace with concrete stack. Combustion is assisted by oil burners. The chimney is equipped with a spark arrester. The plant has proved to be not well designed to eliminate the fire hazard.

The nearest exposure is a cotton platform 200 ft. to the east, where several minor fires, caused presumably by sparks from the incinerator, have been put out with a bucket of water by the watchmen. These fires were probably due to the poor condition of the spark arrester, the screen of which is rapidly deteriorated by the fumes. It is reported that the clinker is not always wet down by the attendant when it is drawn from the furnace, and this is likewise a possible source of fires.

After commenting on a number of private incinerators, which are of local interest only, the report concludes:

The city is considering the construction of a modern incinerating plant about 300 ft. from pier sheds.

It is believed, from knowledge gained by the inspection of a newly erected plant in Atlanta, Ga., and of the conditions under which other modern plants are operated, that a properly designed and constructed plant which gives complete combustion and provides for safe disposal of the clinker, will introduce no hazard at the proposed location.

The operation of a number of scattered plants should be discontinued, and all burning of refuse confined to a single plant at which the hazards are more carefully safeguarded than it has been in the past; the high winds coupled with large cotton storages in the open render such processes exceptionally hazardous when carelessly handled.

Remarkable Day-Labor Municipal Construction in Minneapolis

By E. M. Richter*

Minneapolis, the first important city in the United States to depart from the contract system on public work, has ordered this year more than $3,500,000 of municipal construction under the day-labor plan, carried out by the city engineering department. Many other cities have adopted the day-labor plan more or less extensively, but none has developed it to the same degree as Minneapolis.

More important items on the 1914 schedule are enumerated in the following tabulation. This does not include the ward street work and sprinkling, in which the day-labor plan also obtains, and many other minor items; the total goes well past the $3,500,000 mark. Further, it does not include betterments in the parks, libraries, hospitals, etc. The latter works are under boards or commissions, independent of the city council under which the engineering department operates. In the boards the contract system is chiefly employed, despite the success claimed for the day-labor plan by its friends.

MINNEAPOLIS PUBLIC WORK TO BE DONE BY DAY LABOR IN 1914

Concrete bridges	$865,000
Paving	750,000
Sewers	680,000
Filtration plant enlargement	200,000
Water-works distribution system	225,000
Sidewalks	150,000
Good roads (special fund)	100,000
Curb and gutter work	100,000
Bassett's Creek improvement	75,000
River harbor wall	65,000
Total	$3,210,000

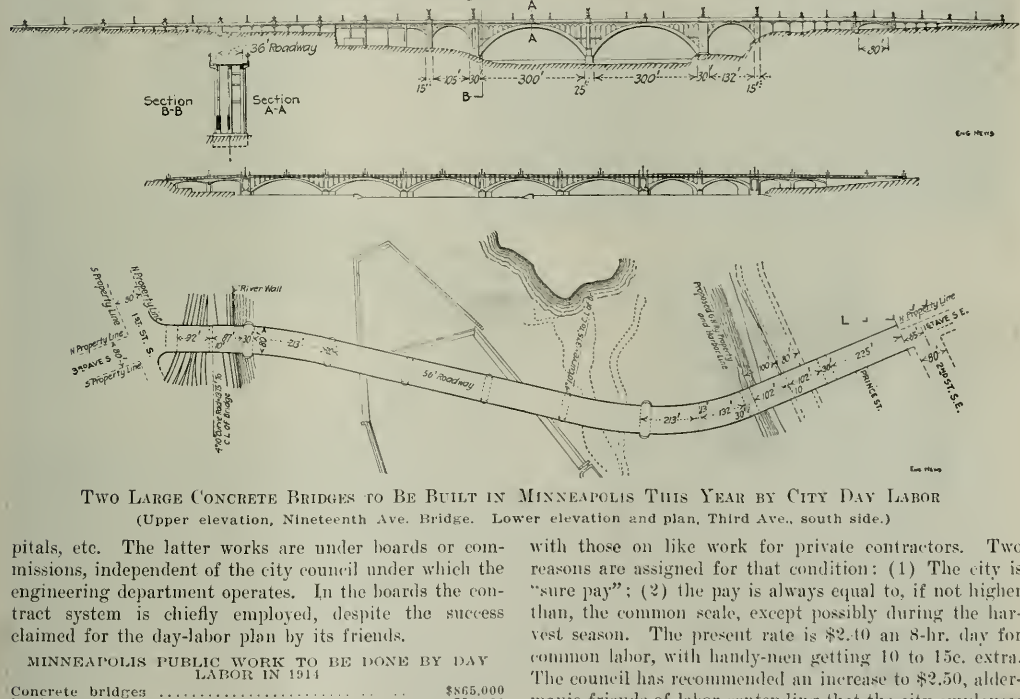
(Minor items add several hundred thousand dollars.)

It is a noteworthy fact that, although permits for private buildings† so far issued in 1914 show a gain of 100% over the same period in 1913, yet the city will be its own largest builder this year. Practically all of this city work has already been put under way and two-thirds of it will be completed by the end of the season. It is carried on under the personal supervision of the city engineer, Frederick W. Cappelen. Nearly 5000 laborers, besides many skilled mechanics, foremen, engineering assistants, etc., are engaged in the work.

Labor Handling

Minneapolis' day-labor work is governed entirely by the municipal civil-service system, inaugurated last July (1913). Common laborers are examined chiefly for physical fitness. Preference is given first to men who have been employed in the same class of work for years by the city, then to American-born men of families—homeowners—over alien labor.

City crews on paving, sewer, water and like construction experience remarkably few changes in comparison with those on like work for private contractors. Two reasons are assigned for that condition: (1) The city is "sure pay"; (2) the pay is always equal to, if not higher than, the common scale, except possibly during the harvest season. The present rate is $2.40 an 8-hr. day for common labor, with handy-men getting 10 to 15c. extra. The council has recommended an increase to $2.50, aldermanic friends of labor contending that the city employees give better service than those of private contractors, even if they are somewhat higher paid; the subject is waiting confirmation by the civil-service commission. Teamsters are receiving $1.75 minimum and $5 maximum.



Two Large Concrete Bridges to Be Built in Minneapolis This Year by City Day Labor
(Upper elevation, Nineteenth Ave. Bridge. Lower elevation and plan, Third Ave., south side.)

Two Large Concrete Bridges

Topping the list of day-labor work is the item of $865,000 for two new ornamental concrete bridges to span the Mississippi River. One is in the heart of the city, at Third Ave. South. The other is at Nineteenth Ave., about a mile below. The former is to have five 213-ft. spans and several shorter spans; the other, two spans of 300 ft. each. The cost estimates, which are thought to be conservative, are $500,000 for the bridge on Third

*Of editorial staff of the "Minneapolis Journal," Minneapolis, Minn.

†Includes a 21-story building already under way, a 27-story building which will be more than half finished by Nov. 1, and numerous other important structures. However, the increase in the permit value is not chargeable to a few unusually large buildings, for the increase in number of permits corresponds to the increase in value.

[illegible]

[illegible]

Ave. (just two blocks from the new postoffice and adjacent to the famous St. Anthony Falls and the great flour-milling district for which Minneapolis is known the world over) and $418,000 for the structure on Nineteenth Ave. Mr. Cappelen and Assistant Bridge Engineer K. Oustad believe, however, that approximately $50,000 may be saved on the construction cost of the latter bridge by using the form material and other equipment used on the Third Ave. bridge.

Sketches of the two bridges are given in the drawing on p. 133.

It may not be amiss to add that the care and maintenance of all the river bridges in Minneapolis are in the hands of the city engineering department.

Paving

Several hundred thousand yards of paving are being laid this year. Creosoted blocks of long-leaf Southern pine are used for the great part of the city paving. The material is popular because there has been practically no difficulty from oozing creosote, buckling and other troubles complained of in some other cities.

A portable asphalt plant, costing about $25,000 equipped, is being operated by the city this year for the first time. It was delivered last fall and used for a small amount of experimental work, which is influencing its use this year. The asphalt crew is putting down principally asphaltic concrete, in most cases as resurfacing on worn brick and granite-block pavement. Orders for this work followed recommendations of Mr. Cappelen that it is both economical and satisfactory.

The general street work is supervised by Assistant City Engineer Ellis R. Dutton, who pays particular attention to paving operations, and is assisted by Street Engineer Benjamin Durham, in charge of grading and other dirt work.

In addition to the large amount of new paving and the ward funds for street work, a special fund of $100,000, proceeds of a "good roads" tax, general in the city, is being used for the improvement of the arterial streets. The ward work, although largely delegated to the street commissioner in each of the thirteen districts, is superintended by Walter Walsh of the city engineer's office.

Sewer Construction

New sewer construction, third in importance on the list, embraces plans for some 20 mi. of sewers, extensions and enlargements of the system, estimated at $680,000, all of which will be completed before snow flies, according to City Sewer Engineer Carl J. L. Ilstrup. It includes the digging of sewer tunnels in the sandrock 80 ft. below the surface through the business district, to relieve overtaxed systems in the district and to provide for business buildings with sub-basements extending below the level of the original sewers. The biggest single sewer project under way is the 10-ft. trunk on Thirty-eighth Street, which is being extended across the southern section of the city from the river at the east limits to the lakes district on the west border, a distance of nearly five miles.

Increased Water Supply

Improvements in the water-works department for 1914 may reach $500,000. Enlargement of the new mechanical filter plant on Columbia Heights just over the north boundary of the city, now in its second year of operation, will increase the capacity from 48,000,000 gal. to about 64,000,000 daily. An additional coagulation basin has just been put into commission to increase the efficiency of the plant, and four additional filter beds (making a total of 16) will be finished about midsummer. William N. Jones, formerly connected with the engineering corps of the Cincinnati filtration plant, in charge of construction here, believes the enlarged plant will be in working order before Sept. 1.

Eighteen miles of water laterals are being laid, under supervision of J. H. McConnell. Demands for extensions were so heavy that the council committee on water-works was forced to limit orders to graded streets, but all these are now to be supplied.

A 50-in. steel main from the filtration plant to the southeastern section of the city, designed to improve pressure conditions in that district, is being laid. The appropriation for it is $45,000.

The water-works extensions are under the supervision of J. Arthur Jensen. The filtration plant is under the superintendency of Lewis I. Birdsall, formerly engaged in a like capacity at Rock Island, Ill.

Valuation and Study of Water Department—With Mr. Birdsall's assistance, City Engineer Cappelen has recently completed a survey of the city water department. A feature of his report is a recommendation that a lime process be adopted to reduce the alkalinity of the city water-supply. The suggestion was approved and the process is to be inaugurated when the plant enlargements are completed.

Street Widening

One of the important items of projected city work is the widening of Seventh St. North, a distance of three blocks in the heart of the business district, and its extension thence in a straight line for about ten blocks through a well built-up residence district. The estimated cost is $567,000. Work will start late this fall or early in the spring, proceedings having already been finally confirmed by the city council.

Bassett's Creek Covering

Bassett's Creek, a stream crossing the northern part of the city, has a history of periodical destructive floods, dating back before the incorporation of Minneapolis. The creek has been a frequent cause of complaint, both for its floods and (in recent years) for its unsanitary condition, produced by rubbish dumps and the like along its banks. The city engineering department is now developing plans to convert the stream into a concrete-enveloped sewer. An appropriation for the construction has been made by the council.

Municipal Harbor Sea-Wall

Finishing the list of regular work committed to the Minneapolis engineering department for execution under the day-labor plan is the item of $65,000 for the erection of a sea-wall, as the first step toward the establishment of municipal steamboat terminals on the river. Minneapolis will be at the head of navigation on the river when the government dam just below the city is completed. The wall is to be started shortly and is likely to be completed this season. Then will follow the building of wharves and warehouses with hoists to elevate the cargoes up the

[illegible] to the level of the proposal municipal belt line to connect with railroads.

Other Work

Additions are being made to the city garbage crematory. A [illegible]-ft. stack is being erected, and preheaters and a forced-draft system are being installed. The incinerators generate steam from which is produced electric current. The station lights and heats the city tuberculosis hospital and workhouse nearby, and operates 200 street arc lights in the surrounding parts of the city.

Day-labor construction is also being used in the erection of warehouses* for the sewer and water departments, at a cost of $25,000. Water-towers have been built for improving the pressure on two elevated areas.

Nor is the story all told. In embryo are projects for a number of municipal ice-houses, a municipal street-railway $1\frac{1}{2}$ mi. long to connect the privately owned city trolley system with the filtration plant, acquisition by the city of the gas plant, and many minor things.

Public Utility Planning by the City Engineer's Office

The last legislature of Minnesota gave the city's engineering and construction organization a noteworthy endorsement by passing an act which authorizes the city to acquire and maintain a union steam-railway passenger terminal. Similarly extensive powers are vested in the city for the purpose of grade-crossing elimination, for which the city may make complete plans.

Union Station Planning

Efforts in the past to secure a union station in Minneapolis by private action had failed. The legislative authorization to the city therefore opens a way to providing a necessary improvement not otherwise obtainable.

The Great Northern Ry. has just erected a $2,000,000 passenger station, opened for traffic early this year. The station of the Chicago, Milwaukee & St. Paul Ry., four blocks distant, serves several other lines; the Minneapolis & St. Louis and Soo lines maintain separate passenger stations.

The legislative act empowers the city to acquire by condemnation necessary ground for trackage. Proceedings have been commenced to obtain title to a strip about [illegible] blocks long and two blocks wide along the river, in the heart of the city, part of which strip is now utilized for tracks into the Great Northern station. Sketches are being drawn in Mr. [illegible]'s office for the station and the entrance trackage. The main feature of the plan is simply to add to the new Hill station an additional wing which will more than double the capacity of the present structure, and to double the station trackage. The city engineer will soon make a tour of Eastern cities to inspect new passenger terminals, prior to the final design.

The most difficult part of the commission was to arrange for all the railways' trackage for both passenger and freight through the district affected. In handling this problem, the aim was to give every railway that enters the city more advantageous facilities than it now enjoys.

Grade-Crossing Elimination

[illegible] several important grade-crossing eliminations are either under way or projected. Detailed plans for all the separate projects under the general movement have been prepared by the city engineer's department, and in most instances two sets, respectively, for track elevation and for depression. In carrying these projects into effect the procedure will be to order separations by ordinance embodying the city engineer's plans and specifications. The cost of the separations must be borne by the railways, even to damages to abutting property, according to the city's contention.

Depression of the H. & D. tracks of the C. M. & St. L. Ry. across the southern section of the city, embracing the construction of a large number of concrete bridges to carry streets over the railway, is well advanced. This is done under plans made by the railway company. For future work, however, the city will make plans. The city is about to bring an action to enforce depression of the main-line tracks of the C. M. & St. P. between Sixth Ave. S. and Thirty-second St. Depression of the Northern Pacific tracks or their removal from their present location in southeast Minneapolis has just been ordered. Proposals covering other lines in the city are pending.

Municipal Water-Power

Plans are being made for a water-power plant and auxiliary steam equipment to produce electrical energy at the new government dam (nearing completion) in the Mississippi River just below the city. A public corporation, organized and operating under special legislative authority, is confident that the Federal War Department will lease to it the dam power rights for the benefit of the University of Minnesota and the cities of St. Paul and Minneapolis. Negotiations with the Federal officials are under way.

Financing the Elwell Law

Funds are now available for practically all the various undertakings listed in the table given at the beginning of this article. The money comes from sales of bonds, levies of special assessments, and the sale of special certificates of indebtedness under the so called Elwell law.

The Elwell law, embodying a plan entirely new in Minnesota, is designed to aid cities in a stage of rapid development to secure public improvements on a provision for extending assessments in twenty annual installments. It can be made to cover the cost of complete improvements on a street, from condemnation of the land, through grading, laying of water mains, sewer, sidewalk, curb and gutter to paving, or any part of the list as the city council may elect. It provides also for payment from general funds of any part up to 33⅓%, and assessment of the remaining expense to the benefiting—not necessarily abutting—property. The validity of the act has been upheld by the state supreme court and many projects are being carried out according to its provisions.

Highway Work in West Virginia—According to recent estimates about $[illegible] is available for highway improvement work in West Virginia during the present season. Of this nearly $[illegible] is to be raised by the sale of county bonds, while the remainder is raised by taxation. The Chief Engineer of the State Highway Department is A. D. [illegible], and Prof. [illegible] Davis of the University of West Virginia, was recently appointed Bridge Engineer. The state [illegible] in the form of [illegible] labor, to be employed under the supervision and in accordance with [illegible] and specifications of the state road bureau.

*[illegible]

San Francisco's Sewer System

By H. W. Shimer and A. J. Cleary*

Previous to 1900, the sewers of San Francisco were extremely discreditable to a city of its size and prominence. As a general rule, they had been laid haphazard as necessity arose, with complete disregard for every engineering principle of design and construction. No attempt had been made to build any one conduit as an integral part of a logical system, nor did the volume of sewage to be disposed of seem to be regarded as an important factor in determining the size. To run the line down hill and reach the bay as soon as possible, apparently was the only method followed. In September, 1899, the Board of Supervisors appointed a commission to investigate, design and report upon a suitable sewer system, and estimate its probable cost. This commission was composed of C. E. Grunsky, Marsden Manson and C. S. Tilton, with Rudolph Hering as Consulting Engineer. The present system, begun in 1904, follows very closely the recommendations of this commission.

Factors for Design

In calculating the requisite size of storm sewers the rainfall rate adopted was 0.598 in. for a continuous storm of one hour duration, while for a period of concentration of 5 min. a maximum rate of 2.16 in. per hr. was presupposed. For intermediate periods the rates were determined empirically.

For a population of 20 per acre a runoff of 30% was assumed, while for districts having 100 residents per acre the runoff was taken as 75%, with an almost uniform increase between these limits. The time element also entered into the calculations, the period necessary for runoff from the most remote portions of the district to reach the conduit and the cumulative quantities that would pass controlling points under the most critical conditions being computed.

At convenient points all water due to storms that exceed 1/4-in. rainfall in 24 hr. is allowed to spill over long overflow weirs and directed through conduits to tidewater. The amount retained in the intercepting sewer is composed of storm water not in excess of the above specified amount, ground-water infiltration, and domestic sewage. Various allowances were made for ground-water infiltration, depending on locality and on the material of which the sewer is built. Usually 0.002 sec.-ft. per acre was assumed. The domestic sewage flow was computed on the basis of an average water consumption of

Fig. 1. Relief Map of Main Sewer System, San Francisco, Calif.

*Assistant City Engineers, City Hall, San Francisco, Calif.

70 gal. per person per 24 hr. This gives an average rate of flow of 0.109 cu.ft. per sec. per 1000 inhabitants. Assuming the maximum flow for short periods to be 50% in excess of the average, the rate for domestic sewage flow is taken at 0.163 cu.ft. per sec. per 1000 inhabitants.

Topographical Features

San Francisco is located at the northern extremity of a peninsula 35 miles in length. The city terminates on the west at the shore of the Pacific Ocean, and on the north and east it is bounded by San Francisco Bay. A spur of the Coast Range divides the area into two main drainage districts, one sloping toward the ocean on the west, the other toward the bay on the east. Many portions of the city being exceedingly hilly both these drainage areas are in turn subdivided. Previous to 1906 there were over 125 sewer outlets along the bay shore. By the recently constructed system the number discharging house sewage will ultimately be reduced to five, with provision for storm-relief outfalls as indicated on Fig. 1.

In determining points of outlet those locations were chosen at which, by reason of strong tidal currents, the maximum dilution of sewage would be obtained. Float observations were made near all of the points in question at flow, ebb and intermediate stages of the tide. It was proven that at the locations selected, when the outfall was extended far out into the bay, no offensive material would be washed back on the land.

As a general rule, the elevation of street surfaces along the water front is city base. Extreme high tide is 1 ft. below city base. Such a height occurs only at a rare combination of wind and flood. Ordinary extreme high tide is 3 ft. below city base and the intercepting sewers are designed to retain their flow without spilling over the weirs of relief outlets at this tidal elevation. Extreme low water is about 12 ft. below city base and inverts of outfall sewers at the bulkhead line are usually from 11 to 13 ft. below city base. As yet, no special devices have been installed at the outfalls, as none have been found necessary.

The ordinary tidal prism of the San Francisco Bay is [illegible] cu.ft., while the maximum flow from the tributary rivers in 6 hours (the duration of an average tidal outflow) is [illegible] cu.ft. This gives a maximum total flow through the Golden Gate of [illegible] cu.ft. in 6 hours. The ultimate maximum sewage flow from the municipal area of San Francisco is estimated at about 215 sec.-ft., which will be reached in 50 years.

Western Drainage Area

Along the ocean beach the breakers are always high and form at a considerable distance from shore. To construct an outfall beyond their influence would be impracticable, so the entire flow of the western drainage area is carried to the northern end of the peninsula through the Sunset District sewer. Storm water will be discharged near Mile Rock and in dry weather house sewage will be pumped from the main intercepting sewer to the Fort Point outfall, where it will empty at ebb tide far out in the channel. The lower portion of the storm sewer will be in tunnel for 1450 ft. Due to protracted litigation before a right-of-way for the outfall could be secured the upper sections were completed first. Work on the tunnel is now being rushed to completion.

For approximately a mile in the higher levels the course of the Sunset District Sewer lies within the drainage area of Lake Merced, whence San Francisco derives a portion of its domestic water-supply. The quality of the water from this source is by no means of the best and to guard against further pollution 24-in. cast-iron pipe with well calked lead joints was used for the sewer within the watershed.

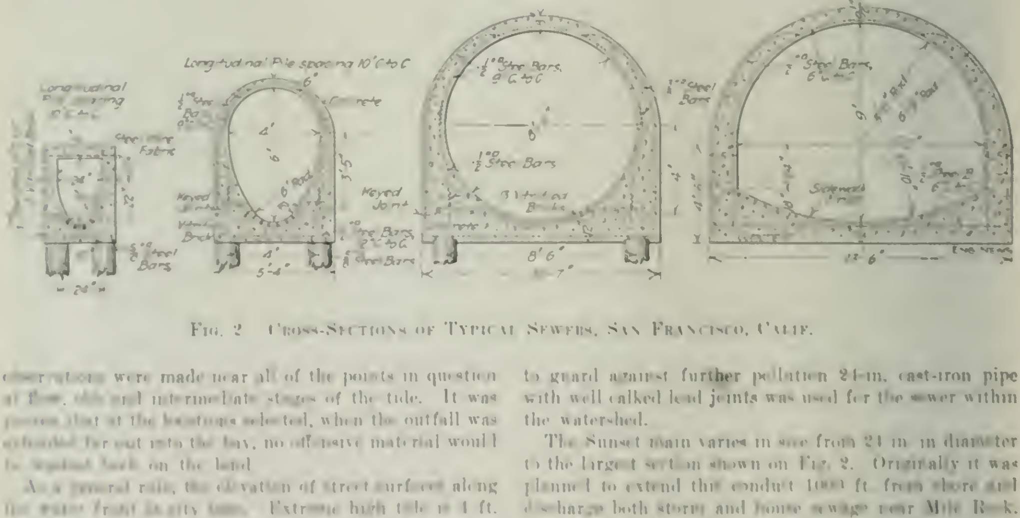


Fig. 2. Cross-Sections of Typical Sewers, San Francisco, Calif.

The Sunset main varies in size from 24 in. in diameter to the largest section shown on Fig. 2. Originally it was planned to extend this conduit 1000 ft. from shore and discharge both storm and house sewage near Mile Rock. From the results of float observations taken near Mile Rock, it is evident that at flow tide the currents would carry suspended matter in an eddy toward the shore and into the harbor, while at ebb tide all of the sewage would be carried out to sea. Only one float out of the entire number dropped at ebb tide was washed back on the beach, but even after this demonstration the precaution was taken of diverting house sewage from this locality.

Eastern Drainage Area

In the low level districts of the Eastern drainage area a separate system for house sewage was installed. Due to the necessity of providing drainage facilities for deep basements and a flow free from tidal influence, it was essential that sanitary sewers should be laid at considerable depths, the sewage directed by gravity to locations of minimum elevation and then raised by pumps into the

large high-level intercepting storm or combined sewers. Sanitary sewers were of salt-glazed, vitrified iron-stone pipe, and varied in dimensions from 8 to 20 in. In soft ground a pile foundation was provided and the pipe surrounded by reinforced concrete.

By far the greater portion of the city is provided with the combined system. Combined sewers constructed since 1906 are all of reinforced concrete, with a pile foundation wherever necessary to prevent settlement. The smallest size is a 2x3-ft. structure with egg-shaped invert and flat top, as shown in Fig. 2. The inverts of all concrete sewers were lined with vitrified brick in order to prevent scouring action.

In the eastern drainage area the largest combined sewer is the North Point main, which discharges into the bay opposite the foot of Sansome St. A district of nearly 12,000 acres, in which are the homes of over 80% of the population, is served by this sewer. Into it will also discharge three of the pumps by which the contents of the separate system are raised. When completed the North Point main will be approximately six miles in length. When flowing quarter full over four miles will be of sufficient sectional area to admit of inspectors traversing it in a steam launch.

Fig. 3. Equalizing Chamber in Triple-Compartment Storm Sewer

Besides the North Point main, the topography of the eastern drainage area rendered necessary two additional intercepting sewers. One drains the southern portion of the city and discharges at Hunter's Point; the second traverses the Panama Pacific Exposition grounds at the northern end of the city.

Both design and construction are now under the direction of M. M. O'Shaughnessy, City Engineer.

Wood Preservatives Used in 1913 by 93 wood-preserving plants, amounted to the following quantities: Over 108,000,000 gal. of creosote oil, 26,000,000 lb. dry zinc chloride, and nearly 4,000,000 gal. of other liquid preservatives. Over 153,000,000 cu.ft. of timber were treated by these plants, or about 23% more than in 1912. These are the figures given by the American Wood Preservers' Association in coöperation with the Forest Service of the Department of Agriculture, Washington, D. C. The report goes on to say that while in Great Britain and most of the European countries, practically all railway ties and telephone or telegraph poles receive preservative treatment, in the United States less than 30% of the 135,000,000 cross-ties annually consumed are treated, and that the proper treatment of an annual consumption of 4,000,000 poles may be said to have scarcely commenced.

Specification for a Non-Patented Bituminous-Macadam Pavement; Connecticut Highway Commission

The following specifications, drawn by Charles J. Bennett, State Highway Commissioner, of Connecticut, have resulted in a satisfactory bituminous macadam, or as some insist, a bituminous-concrete pavement. Being cold rolled, no elaborate apparatus is required for its construction and some of the work done under these specifications has been done by the state's own day-labor repair gangs:

QUALITY OF STONE

Unless otherwise specified, trap rock will be required. Only broken stone accepted by the Division Engineer will be allowed in the work. If trap rock is not required, the stone must be of a hard and compact texture and of a uniform grain. No disintegrated or rotten stone will be allowed. All stone shall be thoroughly clean before crushing and must be well screened, and free from injurious matter of every nature.

FIRST COURSE

SIZE—The broken stone for the first course shall be as nearly cubical as possible and shall consist of ¾-in. and ½-in. stone evenly mixed at the quarry or the run of the crushed up to ¾-in. stone without the dust.

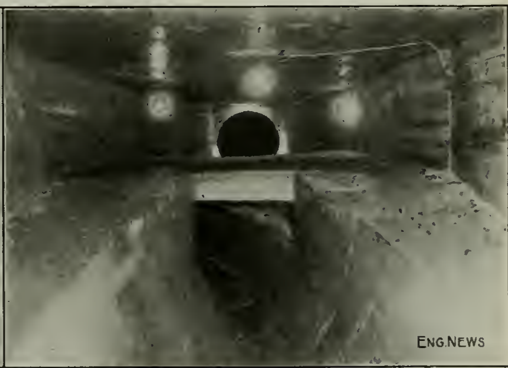


Fig. 4. Overflow Structure for Diverting Storm Water

BINDER—Texaco Macadam Binder or No. 161 Road Asphalt heated to a temperature of 300° F. shall be mixed with the stone using about 6½% of material by weight. The mixing may be done with a machine or by hand so long as properly proportioned and thoroughly mixed. This asphalt or binder shall be equal to sample submitted and shall be satisfactory in every respect to the State Highway Commissioner.

DEPTH—After the subgrade and roadbed have been made as specified a sufficient amount of this thoroughly incorporated aggregate shall be evenly spread thereon so that this course shall measure 2 in. in depth after rolling has been completed.

The stone shall be in a bone-dry condition, either naturally or having been dried out by the use of suitable heaters, if the weather is cold or moist and the stone damp. Under no circumstances, however, shall the stone be so hot as to cause the bitumen to fail to adhere to it in a coat of satisfactory thickness.

ROLLER—After the mixture has been spread for the first course, sufficient to roll down to 2 in. it shall be allowed to set for a period of at least two hours, and then a roller shall be run over the stone a sufficient number of times to form a firm and smooth surface of the proper cross-section. The wheels of the roller shall be oiled to prevent picking up the mixture in rolling. Should any unevenness or depressions appear during or after the rolling of this course, stone and bitumen shall be added to remove such uneveness or depressions.

SEAL COAT

ASPHALTIC BINDER—Immediately after the rolling of the first course a coating of Macadam binder shall be applied under pressure to the surface in the amount of ¾ gal. per sq.yd. so as to completely fill all interstices and voids with the hot asphalt. The temperature at which this asphalt is applied shall be about 1100° F. This macadam binder shall be equal to sample submitted and shall be satisfactory in every respect to the State Highway Commissioner.

SCREENINGS—Immediately after it has been spread, clean dry screenings, free from dust and sand shall be uniformly scattered over the surface and then rolled until the screenings are thoroughly embedded in the macadam binder of the seal coat.

ROLLING—The rolling shall be continued until the surface presents a smooth and finished appearance to the approval of the Division Engineer. Upon completion the road shall stand at least 12 hours before being opened for traffic.

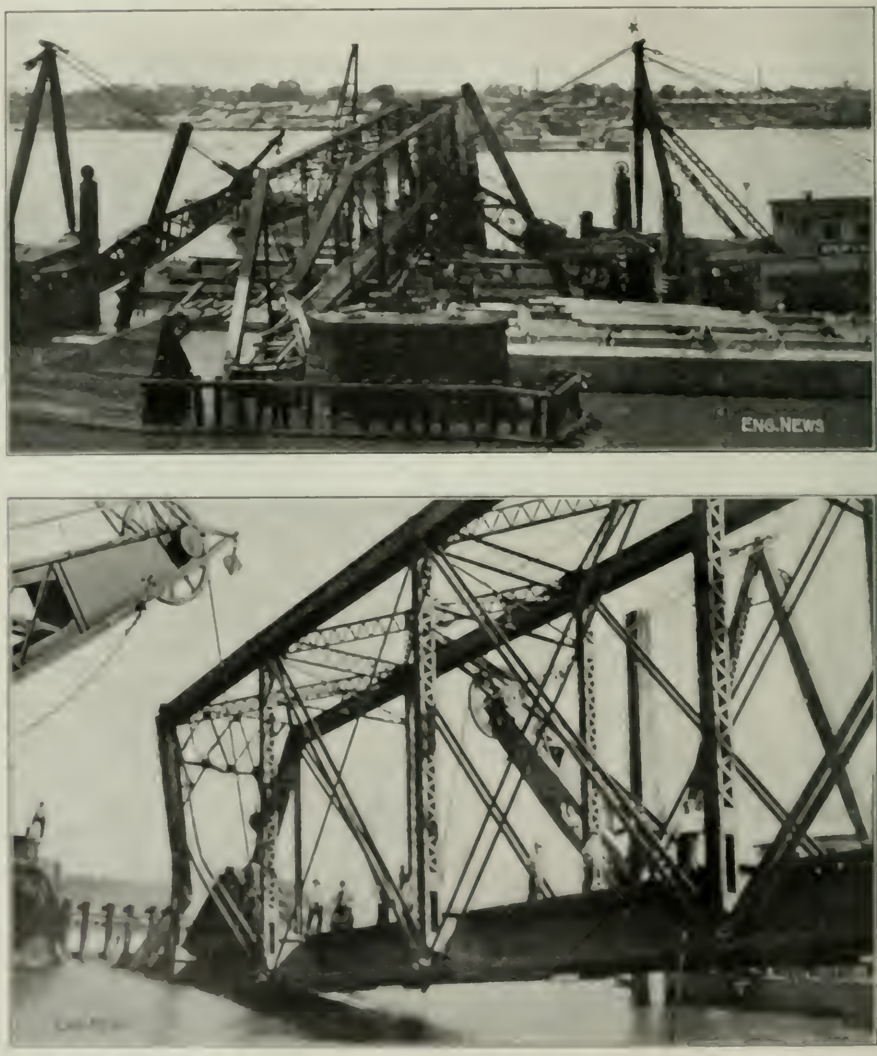
Raising and Repairing the Wrecked W. & L. E. R. R. Bridge over the Maumee River at Toledo, Ohio

By Edward U. Smith*

The wreck of one span of the Wheeling & Lake Erie R.R. bridge 2-A, over the Maumee River, at Toledo, Ohio, was noted in Engineering News, June 25, 1914. The span was 177 ft. instead of 150 ft. as stated.

It might be well to state that this particular span has

*Assistant Engineer in Charge of Bridges, Wheeling & Lake Erie R.R., Cleveland, Ohio.



Figs. 1-2. The Wrecked Span Being Raised by Two Great Lakes Dipper Dredges of 25-Tons Lifting Capacity Each

(Note the [illegible])

some back history, before describing the present accident and necessary repair work.

Prior History of the Bridge

Prior to the year 1896, this span was a wood-and-iron combination truss. It failed in 1895 while a heavy crane was crossing it, the crane and span both going into the river. A new steel span was built in 1896, designed for Cooper's E-35 loading and fabricated by the Toledo Bridge Works.

Pending the erection of the new steel span, piling was driven and frame bents set on top in order to carry traffic. On account of insufficient longitudinal bracing, these bents fell while a train was passing over, and several hopper cars were thrown into the river. The falsework was rebuilt with piling, omitting the frame bents.

In the year 1903, a boat failed to find the opening of the draw and hit this span, pushing it bodily into the river. On examination, the steel was found so badly damaged that it was necessary to build an entire new span. The new span, which was the one recently wrecked, was designed for Cooper's E-50 loading. It was fabricated by The American Bridge Co. and erected in 1904.

The Latest Accident

The wreck of June 11, 1914, was a remarkable accident, in that very little damage was done to the colliding barge and comparatively little to the bridge, considering the fact that it was torn loose from the pier at its fixed end and this end fell on to old piling which surrounds the pier and had been cut off below the water line. These old piles prevented the span from going to the bottom. It did settle about 14 ft. under the water. The other end, which was the expansion end, remained on the pier and was thrust against the next span with such force that it tore its anchor bolts loose and damaged the stone masonry to such an extent that the top of the pier will have to be rebuilt. The steel in this span was not damaged.

Raising the Wrecked Span Back to Place

With the aid of two Great Lakes Dredge and Dock Co.'s dipper dredges, having a hoisting capacity of 95 tons each, we experienced considerable difficulty in getting the span loose from among the piles. Once it was started, however, it was an easy matter to raise the span up far enough to get two water-ballasted scows under it. As the span was raised, the scows were pulled over as close as possible to the pier and timber cribbing was placed under the span as the dredges raised it. A final raising, of a foot or so, required to bring the span to the proper elevation, was accomplished by pumping water out of the scows.

After the span was up to grade, a line was run to the scow from the dredge, and the span was swung into its true alignment, by towing the scows downstream. The expansion end, which had remained on the pier, was fastened back to the second span beyond by two 1½-in. wire cables, with ship-wrenches inserted to take up the slack as the span was raised. This precaution was taken to prevent the span from moving forward off the pier while being raised.

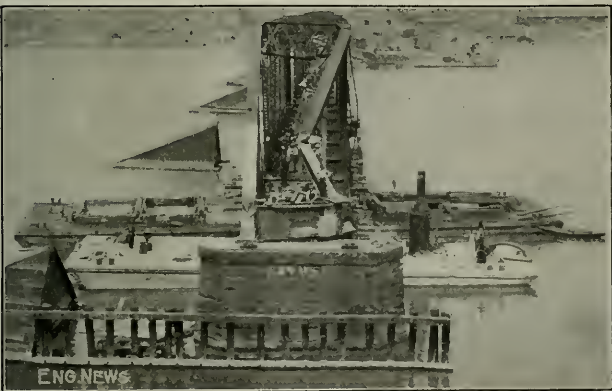


Fig. 3. Span Back in Place

Fig. 4. Supported on Pile Bents and Broken End-Post Removed

Restoring Traffic over the Wrecked Bridge

The damage to the span was found to be as follows, as will be seen in the pictures. The bow of the barge struck the end post and bottom chord, buckling them. This caused the portal, portal brackets and end floor-beam to buckle. The pin plates at the hip were sheared, allowing the end-post joint to open. The rest of the damage was caused by the impact with the piling.

The parts to be renewed were one end post, portal, portal brackets, two bottom chords for the first panel, one end floor-beam, one hanger, and two end stringers.

Restoring Traffic

To support the span and traffic while the new parts are being fabricated (by the American Bridge Co.), it was necessary to drive several pile bents. Using 55- and 60-ft. piles, single bents consisting of eight piles each, were driven, as nearly as possible under the first four panel-points of the wrecked span and the first two panel-points of the span next to the wrecked one. Single bents of eight piles each were driven on both sides of the damaged pier. One 24-in. 120-lb. Bethlehem girder I-beam

was placed under the posts, and one under each stringer of the second, third and fourth panels of the wrecked span, oak wedges being used to obtain a full bearing of the floor-beams on the I-beams. The end panel of this span, from which the damaged stringers were removed, is being carried on eight 9x18-in. yellow-pine stringers. The second and third floor-beams of the other span were simply blocked up on the pile bents.

In order to temporarily support the ends of the two spans over the damaged pier and to provide for the repair of the pier without further interruption of traffic, four 24-in. 83-lb. Bethlehem I-beams, 24 ft. long, were placed on the two eight-pile bents, immediately under each shoe. These 8 I-beams will be left in position and four 24-in. I-beams 8 ft. long, placed longitudinally, with a transverse grillage of 60-lb. rails, on the pier under each shoe to make up the depth of 52¾ in., the depth to which the top of the pier was removed. The pier will be capped with concrete and the ends of the 24-ft. I-beams will be cut off with an acetylene torch.

The wreck of this bridge occurred about 8:30 a.m., June 14, and the bridge was reopened to traffic on June 27. The new steel members have been fabricated and are now being placed in position without interrupting traffic.

The raising of this span was done under the personal supervision of W. L. Bolbock, Chief Engineer of the Wheeling & Lake Erie R.R.

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A Large National Water-Works System for Cities and Towns in Southern Italy

By John C. Trautwine, Jr.*

To supply water for domestic consumption and public purposes to 4,000,000 people living in cities and towns in an arid section of 5000 sq.mi. in southeastern Italy, the Italian government, through a franchise contractor, is carrying water through the Appenines from western Italy by means of a long aqueduct and a network of cast-iron pipe, the whole of the conduits totaling about 1900 miles. Hydro-electric-power and water-power plants developed by the fall of water through the aqueduct, together with Diesel oil engines where aqueduct power is not available, will pump a large part of the water to cities and towns 300 to 700 ft. above the main conduits. The use of some 800 Venturi meters, a universal consumer's meter system, and the purchase of a large quantity of American pipe [illegible] in the interest of the works, which, with the reasons for their construction, are here briefly described.

Along the Eastern or Adriatic coast of southern Italy stretches a district, about 300 miles long, from northwest to southeast, and of a nearly uniform breadth of about 40 miles (see map). This district (once the Duchy of Apulia, or Puglia) comprises the three provinces of Foggia, Bari and Lecce. Its population is about 3,000,000.

The district is of a cavernous limestone formation, with very little ground cover, and is practically without fresh ground water. Wells yield only brackish water, and the few and small streams are generally dry in summer. The country is therefore dependent upon rain water, caught in cisterns. In 1908, from March to October, no rain fell, and the Government, during more than two months, was forced to send fresh water, for the relief of the 3,000,000 inhabitants, by railway and in war vessels.

In October, 1906, the Italian government began the construction of a gigantic water-supply system for the permanent relief of the people of Puglia. Eastward from Naples lies the watershed, an elevated district of dolomitic limestone, underlaid with clay, with an area of some 600 sq.mi., and with elevations of from 4000 to 6000 ft. above sea level. The rain falling upon this district finds outlet at only three points. One of these is the Serino source of the Naples water-supply; a second is being developed for the supply of Salerno, 30 miles east of Naples; and the third is the source of the River Sele, which is being used for the supply under consideration.

The Sele issues from the southeastern side of the district, in a spring, at Caposele, having an elevation, above sea, of about 700 ft., and flows into the Tyrrhenian Sea about 20 miles south of Salerno. The flow here is about 115,000,000 gal. per day, and is exceedingly constant; a little greater than normal in summer (when most needed), owing to melting snow. In the near neighborhood are three smaller springs, to be utilized eventually. They will increase the supply to about 150,000,000 gal.

Map Showing Location of the Puglia Water-Supply District, Italy

(Water naturally flowing westward into the Tyrrhenian Sea will be diverted from the headwaters of the River Sele, and carried eastward, by tunnel through the Appenines to the arid district of Puglia, on the Adriatic Sea.)

daily; for which quantity the works are designed. The water issues from this spring at a temperature of 48° F., and in order to maintain this low temperature, all pipes and conduits are required to be laid not less than 3 m. (say 10 ft.) below the surface; all reservoirs have a cover of the same depth; and any conduits, which, for any reason, cannot be given the prescribed 3-m. cover, are protected by air jackets about 8 in. wide.

The water of the entire district is of exceptional purity; so that no filtration, or other purifying process, is required. The Sele supply, moreover, is carefully protected against accidental or malicious defilement. The water furnished to Naples (notwithstanding its limestone source) is entirely soft, while the Sele supply is a trifle hard.

The natural basin, which forms the Sele spring, has been filled with loose broken stone, and roofed over, with the specified cover of 3 m., of reinforced concrete and earth.

*Consulting Engineer, [illegible], Philadelphia, Penn.

Here begins the aqueduct, which has here an ovoidal section of about 72 sq.ft., and a downgrade of 1 : 4000, which, with a few exceptions, is maintained throughout the entire length, between those points where water-power is utilized, as described below. The object of using the flat slope of 1 : 4000, is mainly to conserve the head for power purposes, at the expense of a larger cross-section than would have been sufficient with a steeper fall and higher velocities. The aqueduct will run nearly full. Except in the siphons, it is nowhere under pressure.

From the source, at Caposele, the aqueduct extends northeastwardly, passing to the south of Rionero and Venosa. West of Venosa branches off the line extending northward to S. Severo (the northern end of the system) and supplying Foggia, the northwesternmost of the three provinces constituting Puglia. Southeastwardly, the distribution extends to Cape S. Maria di Leuca, at the extreme end of the supply district.

The passage of the Appenines is effected by means of a series of tunnels, covered conduits, aqueduct bridges and inverted siphons.

Of the total length, 60 miles are in tunnel. Six of the tunnels have an aggregate length of 36 mi.; and, of these, one is 12 mi. long, or as long as the Simplon tunnel. The small section of these tunnels, and their down grade, of course added to the difficulty of their construction.

Some of the tunneling work has been of exceptional difficulty. In the first tunnel driven (over 9 mi. in length), the contractors encountered a plastic black clay, which swelled greatly when moistened. In the headings, close timbering, of 14-in. round logs, was bent inward, and the ends of the posts were driven bodily into the caps and sills, indicating a pressure far in excess of that due to the greatest height above the work, and suggesting an internal force due to the expansion of the material, caused by moisture. In this material, 1 to 3 ft. per day was the maximum rate of advance.

The last piece of tunneling, that at Croce del Monaco, has just been finished, after being greatly delayed by quicksands.

The siphons are of brazed steel pipes, in pairs, and in general with leaded bell-and-spigot joints, and incased in concrete.

The profile of the conduit consists of slopes, generally of 1 : 4000 (as already mentioned) separated by steeper slopes, from which water power is derived. The power is utilized, mostly by means of electrical transmission, in pumping from the conduit to the several towns, most of which are situated upon elevated sites, from 200 to 700 ft. above conduit level. In some cases turbines are directly connected with the pumps. Where water-power is not available, Diesel motors are used. All pumping stations are in duplicate, as a precaution against accident.

In the three provinces to be supplied, there are at present no villages, and even the farming population resides in the towns and cities; the farm workers walking (often many miles) to and from their work. This results from malaria, which infests the low lands, driving the inhabitants to the towns upon the hills; and from the fact that, formerly, the district was subject to incursions from warlike neighbors, who crossed the narrow seas which separate this part of Italy from its surroundings.

It is, however, provided, by law, that water is to be furnished, from the works described, to any who may wish to settle in its neighborhood, and it is believed that this, together with changed political conditions, and the general sanitation of the low lands, will conduce to the establishment of villages and small towns, and the creation of a rural population.

Construction

The work is being constructed by the Societá anonima Italiana Concessionaria dell' Acquedotto Pugliese-Genova (President, Senatore Giovanni Bombrini) under contract with the Italian government, the terms of which are fixed by a special law. Under this contract, the company receives 124,000,000 lire ($24,800,000), which will be largely exceeded by the cost of the work; but the company is given also the entire earnings of the works for a period of 90 years from their construction.

Not less than 400 Venturi meters are to be installed on the work, for the large-scale measurement of the water.

By the terms of its contract, the company is bound to supply each town with public fountains, in number proportional to the number of inhabitants. All other water, for both public and private use, is to be sold by meter, at sliding-scale prices, fixed by law.

With 3,000,000 population, and an eventual supply of 150,000,000 gal. per day, the per capita daily consumption will be 50 gal.

The cities of Puglia are as yet without sewerage systems. With the construction of sewers, the consumption of water may be expected to exceed the capacity of the works here described.

The company is required to furnish water only for domestic and public consumption (the latter only for public buildings, schools, etc., not for boiler use or for irrigation). The company has the privilege of furnishing water for other uses; but this is not contemplated for the near future. A project for irrigation, using another source, is now under study by the Italian government.

For each town, the company is required to construct a covered reservoir, holding not less than two days' supply.

The water is to be pumped to the elevated towns, from the aqueduct, through cast-iron pipes, with bell-and-spigot lead joints, requiring a total of about 120,000 tons of pipe. American industry is reaping some benefit from this work, the water company having contracted with R. D. Wood & Co., of Philadelphia, for the supply of about one-third of the cast-iron pipe required.

On an average, about 10,000 men have been employed upon this work for eight years.

The total length of conduits and piping will be about 3000 kilometers, or 1900 miles.

For the data here given I am indebted to Sig. Carlo di Chiusano, engineer to the contracting company, which he served chiefly in connection with its tunneling work. Sig. di Chiusano is now in America, looking after the execution of his company's pipe contracts.

A Pavement Problem in Reading, Penn., has grown out of an old court decision that the city authorities cannot assess abutting property owners for the cost of repaving macadamized streets with uptodate pavements. The streets being held to be already paved must be improved at the expense of the city as a whole. Of its 80 miles of paved streets Reading has about 60 miles surfaced with macadam, so the problem is a large one, and it has recently been studied by the Bureau of Municipal Research of New York City.

Tar-Formation Temperatures for American Coals

One of the troublesome points in the better utilization of miscellaneous American coals is the formation of tars; therefore, a recent investigation, which gives information on (1) the temperature limits of tar formation; (2) the temperatures of maximum evolution, and (3) the relative quantities evolved from various coals, is of wide interest and importance. This study was made by O. C. Berry while Assistant in Steam Engineering at the University of Wisconsin (and is being continued at Purdue University where he is Instructor in Mechanical Engineering). The following brief report is based on a detailed statement forming Bulletin No. 635, University of Wisconsin (Engineering Series, Vol. 7, No. 7).

When bituminous coal is fired in a boiler furnace, the volatile constituents are driven off at a comparatively low temperature and appear above the fuel bed. If the air supply, over grates, is insufficient or cold or if the volatile matter is chilled by cool parts of the boiler, carbon is deposited as soot or floats out as more or less dense smoke. The practical problem is to cause the volatile gases, carbon monoxide and tar vapors to mix with high-temperature air; a better knowledge of the temperatures at which tars distill and the rates at various temperatures then is of material aid in designing furnaces and grates and facilities for the best firing of the coal.

In coke manufacture, with the rise of byproduct processes, this same information is of service. Perhaps the most important field for its application, however, is in bituminous gas-producer work; tar vapors are particularly troublesome here, for if carried over to the gas engines, they clog up the pipes and valves. Complete separation of tar is difficult and more or less expensive. Attempts have been made to burn the tar and to "crack" it into permanent gases.

Tar formation temperatures have to be considered in such efforts—as for instance if air is introduced to unite with the tar at the last point where it is evolved in the fuel column, this point is determined by the temperature. In the scheme of drawing tar vapors off the top of the fuel column, introducing them under the grates and drawing tar-free gas off at the center height, such knowledge as mentioned is essential in securing good gas without excessive heat losses.

In the studies undertaken, furnace conditions were simulated but with such apparatus as afforded good control. It was desired (1) to heat the coal slowly and at a uniform rate; (2) to conduct the heat to the center of the coal body by good conductors; (3) to know the coal temperature at all times; (4) to sweep out the evolved gases as rapidly as formed; (5) to cool down the gases and continuously test for tar; (6) to prevent low-temperature deposition in the pipes and later high-temperature redistillation.

The furnace was a special resistance-coil design. The coal was held in a cartridge, $2\frac{1}{2}$ in. in diameter with small inlet and discharge pipes for blowing inert gas through, and with a thermometer well. To transmit the heat to the interior, perforated iron disks were packed with the coal $\frac{1}{4}$ in. apart. The sweeping-out gas was air with the oxygen burned out, furnished under pressure and at full furnace temperature. To test for tar a small stream of the gases direct from the cartridge was chilled and caused to impinge at high velocity on a paper ribbon. If there is any trace of tar it is deposited on the paper; Not quite all the tar evolved is secured owing to the rebound of the smallest and lightest of the tar particles; however, the deposit probably is nearly proportional to the entire tar content. To prevent redistillation, the pipe leading out of the cartridge was changed every 5 to 10 min., there being plenty of duplicates.

A study of the tests and results leads to several generalizations:

(1) Tars begin to distill from any grade of bituminous coal or lignite at some 300° C.

(2) Maximum evolution is between 375° and 475° C.

(3) Tars have been all evolved on reaching a temperature of 550° C. usually, though 600° is obtained for a few coals.

(4) Formation *temperatures* are not dependent on the geological age of a coal, amount of volatile matter, or carbon-hydrogen ratio in the class tested; tars may appear or disappear at approximately the above temperatures with any grade of American bituminous coals.

(5) No relation is evident between evolved tar and amount of volatile matter in the coal.

(6) A distinct relation is seen between *amounts* of tar evolved and the carbon-hydrogen ratio. Maximum amounts of thick tar came from coals with this ratio ranging from 13.5 to 18; knowing the carbon-hydrogen ratio of two coals and the tar evolution of one, the yield can be predicted with considerable accuracy for the other.

(7) The volatile matter of Western coals contains fixed gases and watery vapors of low calorific value—shown by small amounts of tar deposited but low-heating value of coal.

The specific data for 11 typical coals is given in the accompanying table.

TAR-FORMATION TEMPERATURES OF AMERICAN COALS

Coal	Geological age	Carbon-hydrogen ratio	Volatile matter per cent	Tar starts deg. C	Temp. max tar deposit deg. C	Tar ceases deg. C	Per cent of sample deposited on paper	Per cent of volatile matter deposited as tar	Heating value B.t.u. per lb.
[illegible]	Carboniferous	[illegible]	[illegible]	[illegible]	[illegible]	600	0.177	[illegible]	[illegible]
[illegible]	Carboniferous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Carboniferous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
[illegible]	Carboniferous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Carboniferous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Carboniferous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Carboniferous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
[illegible]	Cretaceous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.102	[illegible]
[illegible]	Carboniferous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
New Mexico No. 2	Cretaceous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.294	[illegible]	[illegible]
Colorado No. 1	Cretaceous	[illegible]	[illegible]	[illegible]	[illegible]	613	0.180	0.373	[illegible]

*[illegible]

Editorials

A Mileage Charge to Owners of Motor Omnibuses to Pay for Road Repairs

The injury done to road surfaces by heavy motor trucks and motor omnibuses is beginning to be talked about by engineers in this country. It has hardly come as yet to the notice of the taxpayers, who pay the money to maintain the roads, a possible reason for which is that in a large proportion of the States the roads are not maintained in the proper sense of the word. and are allowed to be practically destroyed after construction before anything is done about it.

In England, however, the problem of making the owner of the motor vehicle pay for the damage he does to the roads he uses is already a question of practical politics. The London *Surveyor* states that on July 1, the Local Legislation Committee of Parliament considered the question of the contributions owners of motor busses should make to pay for road maintenance. The City of Sheffield desired authority to run motor omnibuses outside the city limits into adjacent counties. The county authorities opposed the granting of the privilege unless the City of Sheffield would pay enough for road maintenance to cover the resulting wear and tear. The Committee finally granted permission to operate four of the seven routes desired, on condition that the City of Sheffield would pay the counties ¾c. per car mile for all mileage traveled by its motor omnibuses within the county limits, this rate of payment to be subject to revision every three years.

The Chairman of the Committee also announced that a general act would probably be brought forward in Parliament, fixing a rule to apply to the whole country, as to the amount to be paid toward road maintenance by operators of heavy motor vehicles. It should be remembered in this connection that Great Britain already assesses a heavy license tax on all motor vehicles, graded according to the weight and power of the vehicle, the proceeds of which are devoted to road construction and maintenance under the National Road Board. The proposed special charge to users of heavy motor trucks and motor omnibuses is in addition, therefore, to the heavy tax already laid. The almost universal testimony of English road engineers is that this additional tax is a necessity to fairly repay the added cost of road maintenance due to these heavy high-speed vehicles.

Reducing Casualties on Construction Work

New York's new Employer's Liability Law, which went into effect on July 1, should bring about a reduction in the number of men injured on construction jobs. This result will not be realized at once. Employers must first appreciate the full measure of the added responsibility. On the first day of the new law, on a large building contract in New York City, one man was killed and three others injured by falling material. There have been other casualties on this same job from this same cause.

The dropping of objects constitutes one of the greatest hazards of building construction. This hazard increases with the area and distribution of the work; it is obvious that the dangers from this source are greater, for instance, at the Equitable Building, the largest office building in the world in point of floor area, than on some 20-story loft building or apartment house uptown, all other factors equal.

Other factors contributing toward the construction hazard are: the number of floors upon which work is in progress simultaneously; character of the work; speed of its prosecution; skill and intelligence of the workmen, and the vigilance and efficiency of the man in charge. The last two factors are especially important; mechanical safeguards can prevent but a small proportion of accidents where reckless methods are permitted. Coöperation between employer and employee, foremen and men, is absolutely necessary if the irreducible minimum of accidents is to be attained and maintained.

Careless handling of materials and defective plant equipment are going to cost employers a lot of money under the new law; and the sooner this is appreciated, the better for all concerned. Most failures of handling equipment can be traced directly to lax plant inspection

On a big construction contract where the responsibilities of the superintendent are too great and too pressing to permit him to personally acquaint himself with the condition of scaffolds and other falsework, derrick guys and cables, loads on tools, and methods of hoisting and piling material, it would be economy to place a competent man in charge of these details. Saving one man from death or serious injury might pay the salary of such a "Safety Man" for a year or for several years. When subforemen are held accountable for accidents, the result is usually divided responsibility. The duties of subforemen frequently overlap, when, of course, "nobody is to blame."

It must be frankly accepted that the most efficient method of prosecuting work is not always the safest. For instance, blasting can be carried on with comparative safety, but the work does not progress fast enough; it costs too much. In blasting for the foundation of a well known metropolitan skyscraper in a thickly populated district, a rock as big as a man's head was thrown two blocks, dropping into a large railway terminal. This was not "safety first."

There are conditions which demand speed even at the cost of inconvenience to the public; prohibitive financial loss to the contractor, etc. In such cases, the work should be pushed with the greatest speed commensurate with reasonable safety and with the maximum safety possible with that rate of prosecution.

Temporary coverings, floors, or "butterflies" of wood or corrugated metal should be built where practicable in new buildings to prevent tools, brick, tile and other small objects from falling through open space and striking men

working below. This sort of protection is required over sidewalks in most large cities. If the idea were followed up inside the buildings, fewer broken heads would be recorded. Such protection is especially desirable on wrecking operations.

The use of chains is diminishing and wire cables are being substituted where possible. Careful inspection often fails to discover worn links, but broken strands are readily detected. Mechanical safety devices in the form of safety grips on derrick or crane hooks, covered gears and boxed-in conveyors and hoists, etc., should be insisted upon.

The best way to stop abuses, nuisances, incompetent or slipshod methods, is to give them publicity. If all the accidents which occur in the building construction of a large city were recorded and published, safer methods would be used. From analysis of such statistics, causes of accidents would be revealed and met where possible with remedies. Contractors, who have to bear the expense of accidents occurring on construction work, would undoubtedly be glad to accept authoritative and practical recommendations for better practice.

Who Owns the Pennsylvania Railroad?

There is a widespread popular impression that the great railway and industrial corporations of the country, with their many millions of dollars of capital, are owned by a few wealthy individuals, and that legislative attacks upon them tending to destroy the value of their property will injure nobody except people who have already more money than is good for them. Nothing could be further from the truth.

We had occasion not long ago to carefully examine the list of stockholders of one of the great manufacturing combinations, a concern which is undoubtedly a "trust" in the popular acceptation of that term, and which has some $50,000,000 in common and preferred stock outstanding. It was little short of amazing to find how widely distributed was the stock of this company and what a large proportion of it was in small holdings, owned by persons scattered all over the United States. No single stockholder, as we recall, held over half a million dollars' worth of the stock and there were very few who held over $100,000. There was an enormous number of small stockholders with lots of five, ten, twenty or thirty shares.

We have not the accurate figures at hand as to the actual distribution of the stock in that trust, but we are able to give figures for the distribution in a far larger corporation, the Pennsylvania Railroad Company. According to figures just made public, the stock of the Pennsylvania R.R. Co. is now held by 90,844 people, of whom 44,[illegible] are women. The tendency toward a wider distribution of stock is shown by the fact that the number of stockholders increased over 8000 in the past year, and the average number of shares per stockholder dropped from 116 shares to 111 shares. The women stockholders hold, on the average, 64 shares apiece. As the Pennsylvania R.R. stock has a par value of $50, this means that the average Pennsylvania stockholder owns $5550 worth of stock, and the average woman stockholder holding Pennsylvania R.R. shares owns $3200 worth of stock, par value.

One occasionally hears the claim made that the Pennsylvania R.R. is owned by foreigners. While it is true that there are many stockholders of the Pennsylvania and other large investment corporations resident in foreign countries, the great bulk of the stock is held in the United States. According to a summary made on May 31, a third of the Pennsylvania R.R. stockholders, or 30,163, live in Pennsylvania; half as many more, or 15,350, in New York; 16,536 in New England, and 11,803 in foreign countries.

But in answering the question, who owns the Pennsylvania R.R., we cannot consider its 90,000 stockholders alone. Suppose the influences which are seeking to destroy all property values, and especially those held by corporations shall be finally successsful, so that a great corporation like the Pennsylvania R.R. will be compelled to steadily increase its expenses by paying higher wages to labor, etc., while at the same time its earnings steadily decrease until it can only pay its operating expenses, leaving nothing for dividends to stockholders or interest on its bonds.

It would not be merely the 90,000 stockholders of Pennsylvania R.R. stock scattered all over the country who would suffer loss as the result of such a campaign. The number of people who would lose by such a calamity would be numbered in the millions. They would include beside the 90,000 holders of Pennsylvania R.R. stock, the many thousands of holders of stock in other corporations which are affiliated with the Pennsylvania R.R. system and operated in connection with it.

But the stockholders after all are few in number compared with those who have an interest in the bonds issued by the company. The various bond issues of the Pennsylvania and its affiliated companies amounting to something like $300,000,000 are very largely held by savings banks and life-insurance companies, scattered all over the country. These bonds represent the accumulated savings of millions of men and women, working for wages, who have laboriously saved their earnings to provide for illness or old age. A campaign to annihilate property values could not be carried very far before a host of savings banks and life-insurance companies would have to suspend payments. Then would follow the appointment of receivers and in too many cases the dissipation of the remaining assets among a horde of hungry lawyers and political sharks.

The wide distribution of ownership in the Pennsylvania Railroad typifies the ownership of every other great railway and industrial corporation and is of interest also in connection with the current discussion respecting government ownership of railways.

The underlying idea in a large part of the agitation for government ownership is that the railways are now owned by a few individuals of enormous wealth, who are rapidly growing richer from the dividends and interest payments, whereas if the railways were taken over by the government, the government itself would hold all the stocks and bonds and would receive all the profits. But as the above discussion shows, the railways of the country are owned not by a few thousand wealthy individuals, but by millions of people who work for their living. The government could not and will not, until the forces of anarchy are triumphant, destroy the property belonging to all

these people and forcibly take it away from them. If we are to have government ownership of railways, it can only come about by the government buying the railways from the stock- and bondholders and paying for them in promises; or, in other words, government bonds. This would simply mean that the millions of people who now hold railway stocks and bonds would hold government bonds instead, and the government itself would be obliged to pay the interest on these bonds or go bankrupt, whether the railways earned profits enough to pay the interest or not.

If anyone believes that under government ownership the railways would be more efficiently and economically and honestly managed than they are now by their present officers under the supervision of State and Federal authorities—if anyone really believes this proposition, we suggest a careful study of our recent editorial wherein we reviewed what the government actually does in spending money on river and harbor improvements.

Until the United States government is administered with enough wisdom to stop spending many millions of dollars a year on works for inland navigation which are of no possible benefit to anybody, it would be the height of foolishness to place upon Congress the additional responsibility of directing the operation of the country's railways.

Laying Sewer Pipe with Water-Tight Joints

In our last week's issue we published a very interesting and carefully prepared article by J. M. Begg, Assistant City Engineer of Edmonton, Alberta, describing the methods which have been adopted in his practice in laying cement sewer-pipe joints so as to produce a water-tight line.

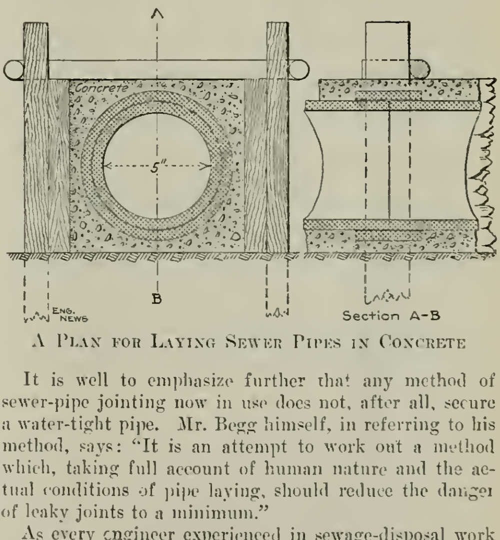
We wish to call special attention to Mr. Begg's paper in connection with the editorial suggestion on p. 1138 of our issue of May 21, in which we proposed to substitute in place of the present difficult and uncertain method of attempting to fill the joints of vitrified pipe with cement paste, the plan of surrounding the whole pipe with concrete. We discussed briefly the possibilities of this plan in the editorial referred to, but we wish to recur to it again and study its advantages farther, in connection with the statements made by Mr. Begg.

In laying sewer pipe by the suggested plan, when the bottom of the trench is finished to grade, two lines of boards would be set up on the bottom of the trench, the width between them being two or three inches greater than the diameter of the vitrified pipe to be laid, and held in position by stakes and clamps. Next, concrete would be deposited between these boards to a depth of two or three inches, and then the pipe would be laid and slightly bedded in the concrete. Next, concrete would be filled in on both sides and on top of the pipe, flush with the top of the boards, and slightly tamped or smoothed off to make the whole solid. When the concrete had set, the boards would be removed, ready for use on the next job.

The accompanying sketch shows sections of such a concrete-embedded pipe. In a sewer lateral of 5-in. outside diameter, embedded in a 7-in. square line of concrete, the cross-section of the concrete would be in the neighborhood of 30 sq.in., at which rate a cubic yard of concrete would be sufficient for nearly 135 lin.ft. of pipe. Assuming a cost of $5.50 for the concrete, which should be made, of course, with fine stone or gravel aggregate, the total cost would amount to only about 4c. per lin.ft. of pipe laid.

It should be worth very much more than this sum in any sewerage system to thoroughly secure the laterals throughout the system from the infiltration of ground water, to say nothing of eliminating the annoyance often caused by the penetration of tree roots into the sewers through defective joints. The cost of the concrete, however, would be largely offset by the saving of the expense of making and inspecting the sewer-pipe joints in the ordinary manner, as described in Mr. Begg's article.

As some of our readers may recall, R. H. Peck, of Palmerton, Penn., in ENGINEERING NEWS of June 4, declared that his trouble in getting water-tight joints in sewer work was so great that a rule had been established under which this work was done throughout the entire city by one experienced and reliable foreman. The difficulties presented when such an indispensable man takes a vacation, has a period of illness, or goes on a strike, are obvious.



A PLAN FOR LAYING SEWER PIPES IN CONCRETE

It is well to emphasize further that any method of sewer-pipe jointing now in use does not, after all, secure a water-tight pipe. Mr. Begg himself, in referring to his method, says: "It is an attempt to work out a method which, taking full account of human nature and the actual conditions of pipe laying, should reduce the danger of leaky joints to a minimum."

As every engineer experienced in sewage-disposal work is aware, tests of sewerage systems laid according to the specifications of the best engineers, and in the most thorough and conscientious manner, have shown that notwithstanding all the care taken, ground water to the amount of many thousands of gallons daily percolates into the pipes.

Nor is this the only difficulty experienced from the present methods of making sewer-pipe joints. As Mr. Begg points out, a very little carelessness on the part of the workmen will produce joints of an uneven thickness, pipes with an uneven grade, and projections of cement inside the pipe which, if they do not cause clogging, form little dams in which standing sewage collects, increasing the septic action, and the bad odors in the pipes.

All these difficulties should be obviated by the plan we have here suggested, of bedding the pipes in solid concrete. While the cement mortar in the concrete would

work into the joints to some extent, sufficiently to hold the pipes solidly and firmly in place, it would hardly creep so far as to enter the pipe itself. If it were found with very wet concrete that any trouble of this sort was experienced, it would be an easy matter to pull a bar through the pipe before the cement set, as is often done to avoid trouble with cement joints laid in the ordinary way.

As we pointed out in our recent editorial, the possible usefulness of the suggestion we have made is not limited to the sewer laterals only 4 to 6 in. in diameter on private property. It would be equally advantageous to apply the same system to the laying of street sewers up to a diameter of at least 12 ins. While the amount of concrete required would be considerably larger, it would still be a very small percentage of the total cost involved; and besides the water-tightness secured thereby, the protection of the sewer from injury by workmen engaged in other street excavations is an advantage of no small importance.

Still further, if engineers in considerable numbers were to adopt this method of laying sewer pipe in sizes up to say 12 ins. in diameter, it would doubtless lead to a reduction in the cost of the pipe, which would at least partially offset the cost of the concrete in which it was laid. It is probable that straight lengths of sewer pipe without the bell and with plain collars to cover the joints in place of the bell, could be manufactured at a materially lower cost than the present form of pipe. Such straight pipes could be piled and transported with much less loss by breakage. It is the projecting bells in a pile of sewer pipes that generally suffer when breakage occurs.

Such straight lengths of pipe, laid with collars, would eliminate any possible question as to the water-tightness of the construction described. It will be admitted, doubtless, that any water which enters a line of glazed sewer pipe must enter through the joints. In order to enter the joints of a concrete-embedded pipe it must percolate through a considerable thickness of concrete, and with closely fitting collars instead of bells for the joints, the cross-sections of concrete through which percolation could occur would be so exceedingly small as to eliminate almost the last possibility of leakage.

We trust that some of our readers engaged in this field of work will try out the system above suggested and report results.

Letters to the Editor

Narrow Tires as Road Destroyers.

Sir—Some years ago you said that I exaggerated greatly the effect of bad wheels—narrow tires—on macadam roads. Did you notice that a year or two ago the Massachusetts Highway Commission confirmed me? At least I understand that the Commission has reported that it is heavy loads on narrow tires that cause damage, not motor vehicles.

Of course the Commission should have known what a road—what a wheel—is without being shown, but after all their moral error is in not seeing that *light* loads on narrow tires are cutting out their general problem for them.

I believe that if you had properly reported this discovery, Governor Glynn of New York State might not have fallen into (or might have fallen out of) the error of saying recently that, in Massachusetts, experiments showed that the automobile is the worst vehicle for wear on roads!

I do not think so much of your claims to be the [illegible]

We are trying to build good roads for bad wheels! How [illegible] Missouri experiment station trials. Collecting and averaging the trials in Bulletin No. 39, I found these remarkable results:

[illegible]

1½-in. tires on earth roads, average lb. pull per ton, 86 = 141%.

1½-in. tires on macadam roads, average lb. pull per ton, 71 = 116%.

6-in. tires on macadam roads, average lb. pull per ton, 55 = 90%.

Just think of our fool investment in rolling stock which constantly produces in roads and vehicles, and requires from horses, 41% excess pull per ton on earth roads and 30% extra on macadam and gravel roads. I can't see why you keep mum so absolutely as to what great things good wheels would do. If a hint to the wise is sufficient, this should be ample for you, but, alas, there is none wise as to roads!

J. M. HEISKELL.

1107 S. Cooper St., Memphis, Tenn.,
June 29, 1914.

The Proportional-Flow Weir Devised in 1896

Sir—Herewith I hand you a copy of Vol. 1, No. 1, of the *Transactions of the Nebraska Engineering Society*, published in 1897. On p. 74 you will find an article by me entitled "A New Form of Weir Notch." I am unable to see that the article entitled "A Proportional-Flow Weir," appearing on p. 1300 of ENGINEERING NEWS of June 25, 1914, goes beyond this.

The same problem was worked out independently at a later date by Prof. Clarence T. Johnston, of the University of Michigan, who at that time was assistant chief of the Irrigation Investigations of the United States Department of Agriculture, and at a still later date by Prof.

Joseph Le Conte, of the University of California. Professor Le Conte has further pointed out, in correspondence addressed to me, that by expanding in series the form to be integrated in deriving an expression for the discharge, it is seen that a weir notch may easily be devised to give a discharge proportional to any desired power of the head on the crest.

In addition to the uses indicated in my article, the weir has been employed to a limited extent to measure the flow in small farm laterals used for irrigation, the weir being set in a diaphragm which has a sharp edge on the bottom and sides, so that it may be set down at any place in such a lateral where the banks are high enough to prevent overflow from the water backing up above the weir. I believe some use has been made of it in the laboratories of the University of Illinois.

O. V. P. Stout.

University of Nebraska, Lincoln, Neb.,
June 28, 1914.

[The weir form of Prof. Stout was exactly the same as that shown by Prof. Rettger, being of such outline that the breadth of the notch at any point is inversely proportional to the square root of the height above the crest. The formula is demonstrated, viz., discharge is directly proportional to depth of flow over crest. Prof. Rettger's method of correcting the weir form for varying coefficient of discharge is an addition to the subject, apparently.

Prof. Stout pointed out the disadvantages of this weir: its limited capacity, and the greater loss of head than in other forms of weir. At capacities over about 2 cu.ft. per sec., he says, the weir becomes ungainly.

The weir was used to measure water pumped by windmills at the farm of the Nebraska Agricultural Experiment Station. Prof. Stout believed it to be applicable to a variety of water measurements in agricultural, industrial and domestic use.

The value of the proportional-flow weir—or weir-notch—has not been recognized sufficiently, it would seem. That the Stout notch found use only locally and then was forgotten is surprising. However, similar notches are used in chemical-feeding devices in water purification.—Editor.]

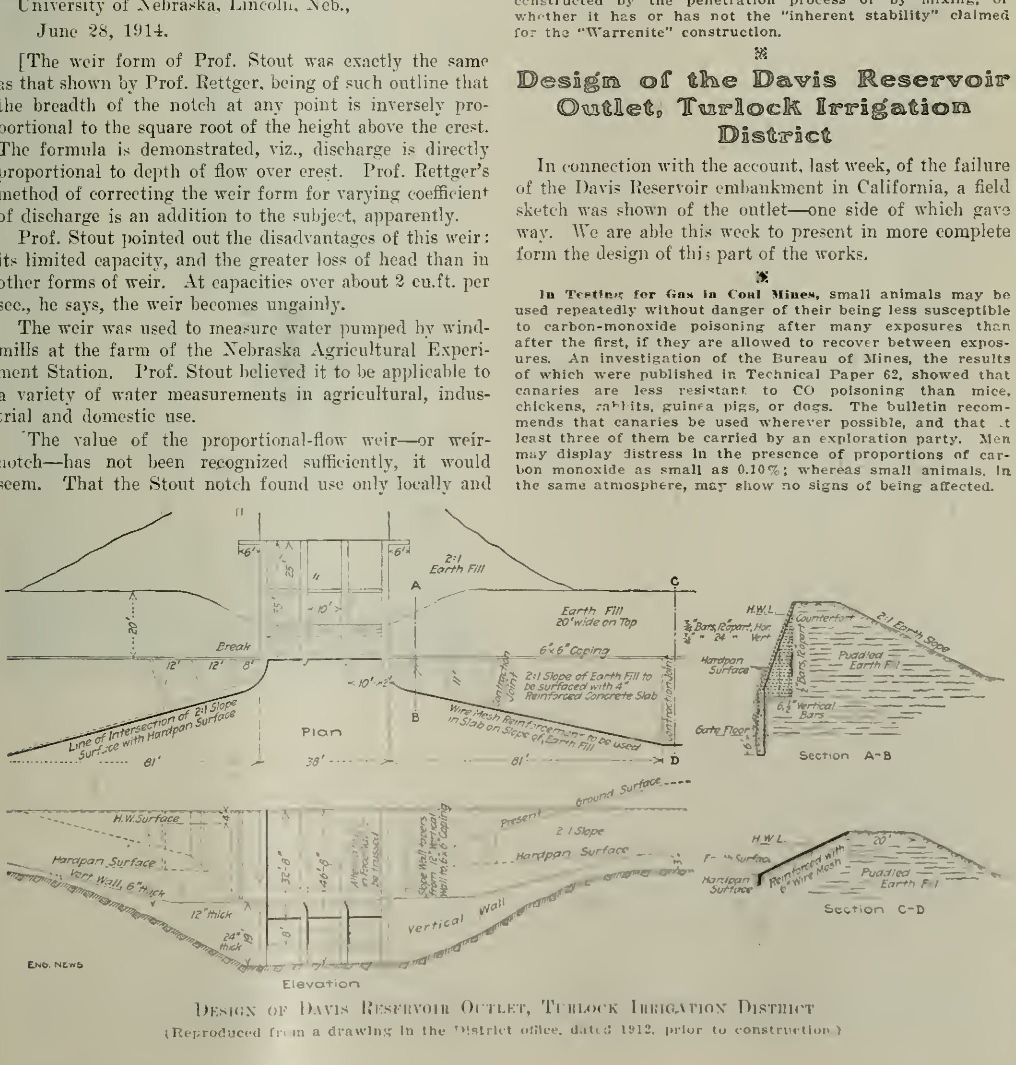
NOTES AND QUERIES

What Is a Bituminous Macadam Pavement?—George C. Warren, President of Warren Brothers Co., Boston, Mass., objects to calling some of the roads illustrated on pages 1342-1344 of our issue of June 18, bituminous macadam. He recognizes the illustrations as those of roads constructed by the "Warrenite" process, which he says is a bituminous concrete, quoting as authority the definitions recommended by the committee on bituminous paving nomenclature of the American Society of Municipal Improvements, and adopted by the society in 1911. That was three years ago, but to establish a change in language is extremely difficult, and we believe it is still common to call any road in which broken-stone aggregate is held together by a bituminous binder a bituminous macadam, irrespective of whether the road was constructed by the penetration process or by mixing, or whether it has or has not the "inherent stability" claimed for the "Warrenite" construction.

Design of the Davis Reservoir Outlet, Turlock Irrigation District

In connection with the account, last week, of the failure of the Davis Reservoir embankment in California, a field sketch was shown of the outlet—one side of which gave way. We are able this week to present in more complete form the design of this part of the works.

In Testing for Gas in Coal Mines, small animals may be used repeatedly without danger of their being less susceptible to carbon-monoxide poisoning after many exposures than after the first, if they are allowed to recover between exposures. An investigation of the Bureau of Mines, the results of which were published in Technical Paper 62, showed that canaries are less resistant to CO poisoning than mice, chickens, rabbits, guinea pigs, or dogs. The bulletin recommends that canaries be used wherever possible, and that at least three of them be carried by an exploration party. Men may display distress in the presence of proportions of carbon monoxide as small as 0.10%; whereas small animals, in the same atmosphere, may show no signs of being affected.



Design of Davis Reservoir Outlet, Turlock Irrigation District
(Reproduced from a drawing in the District office, dated 1912, prior to construction.)

The Largest Elevated Steel Tank

By R. W. Becker*

The surge tank just completed at Altmar, N. Y., for the hydro-electric power plant of the Salmon River Power Co., is the largest known structure of its kind, having a total capacity of 1,500,000 gal. This is a hemispherical-bottom tank with a cylindrical portion, 50 ft. in diameter and 80 ft. high. It is supported by ten steel columns raising the top of the tank 185 ft. above the top of the foundation. These columns are braced by two sets of struts forming the equal tower panels each about 31 ft. long.

This surge tank, located on the top of a hill, is connected to the lower end of a pipe line conveying water from the dam to the penstocks. The pipe line is 9500 ft. long, being 11 ft. in diameter at the dam and terminating in a 12-ft. distributer pipe. Four penstocks 8 ft. in diameter lead from the distributer pipe to the power plant below. The entire plant is designed to generate 40,000 hp.

A 12-ft. tee in the distributor pipe connects to the 12-ft. riser pipe of the surge tank. This riser terminates in an expansion joint below the tank so that about four feet of the pipe are carried directly by the tank bottom. To this latter piece of pipe the inner 10-ft. riser pipe is connected by twelve vertical I-beams. This is 100 ft. long and is carried entirely by the tank bottom. The only point of bracing is at the top where the riser flares out to a diameter of 15 ft. The lower end has a diameter of 10 ft. 8 in., thus affording an annular opening 8 in. wide between the two riser pipes.

This feature of the construction makes the surge tank a "differential regulator" and the twelve spaces into which the annular opening is divided by the I-beam connections are called "differential ports." The principal function of these ports is to retard the flow from the main tank to the turbines when the load on the plant is suddenly increased, so as not to apply the full accelerating head to the pipe suddenly; another function being to check the rise in pressure more gradually than would be the case without such ports, when load is thrown off. This is the invention of Raymond D. Johnson[1] of Niagara Falls, N. Y. On account of the economy of the "differential regulator," its extensive use in hydro-electric power installations is expected in the future.

The water, surging up and down, causes a difference in the water levels of the tank and the riser pipe which at times is very considerable. When the water rushes out, the difference in the water levels causes an external pressure on the inner riser pipe tending to collapse it. The [illegible] plate of this riser was reinforced by an angle [illegible] every 3 ft. 6 in., riveted on the inside so as safely to withstand an external head of 65 ft. of water.

The sudden exit of water also causes a partial vacuum which affects the tank and protective ceiling. This external pressure was assumed not to exceed 100 lb. per sq.ft. Vacuum holes in the ceiling were designed to minimize the external pressure. The assumed loading necessitated the reinforcement of seven of the 8-ft. tank rings with a pair of $5 \times 3\frac{1}{2} \times \frac{7}{16}$-in. angles on each. All this is shown in Fig. 3.

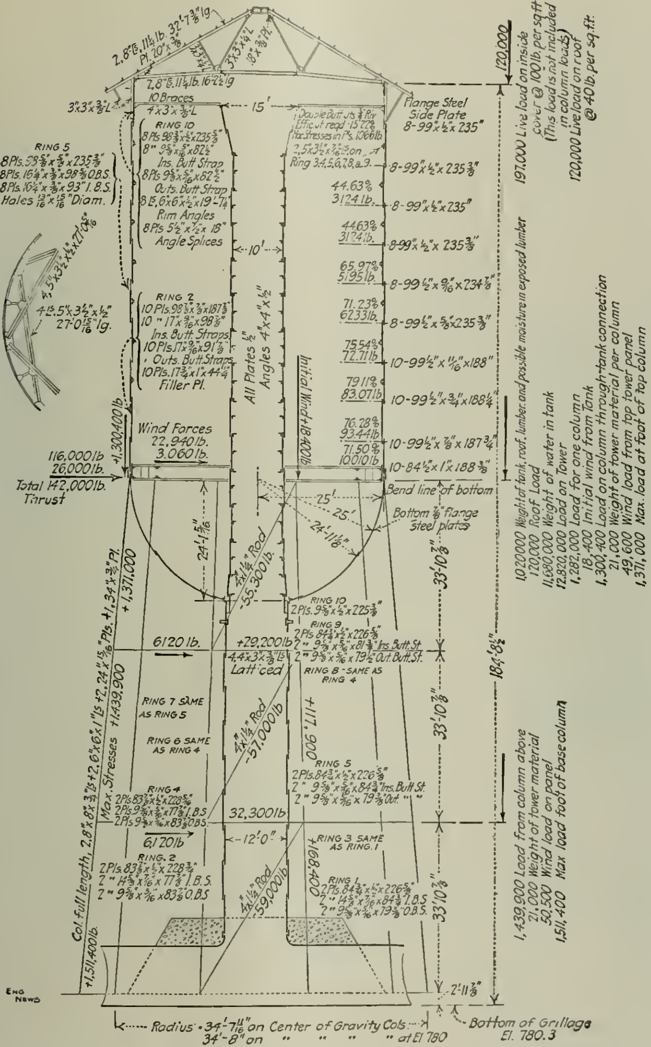
The entire tank and riser are inclosed by double cypress sheathing attached to 3x12-in. pine studding so as to form a 12-in. air space. The lower sheathing incloses a stairway to the bottom of the tank from which level an inclosed steel ladder leads to the top and inside of the tank. Hot air will be circulated within the inclosure from heaters at the foot of the lower riser pipe when temperature conditions require it. The entire tank inclosure is carried by the steel work.

Fig. 1. The 1,500,000-Gal. Surge Tank at Altmar, N. Y., Nearing Completion

The wood ceiling is carried on the lower chords of the ten main and ten half-roof trusses. The trusses are also designed to carry a live load of 40 lb. per sq.ft. and a suitable wind load. An asbestos covering on double sheathing and wood purlins is used. The roof projects 6 ft. over the tank, the trusses being stiffened by 20 brackets. These brackets extend down the full height of the top ring, thus reinforcing the latter under the heavy roof loads. The top of the tank is reinforced by a 6x6x

*[illegible]

[1]The "differential regulator" is fully explained in a paper [illegible]. It is entitled "The Surge Tank in Water Power Plants."



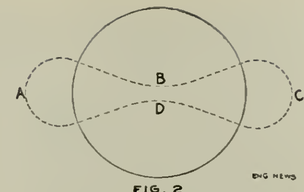


FIG. 2

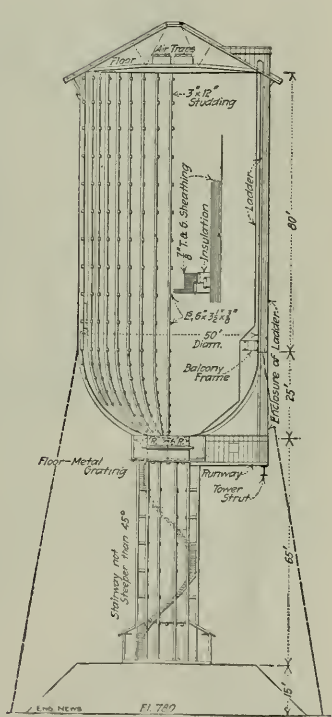


FIG. 3. DIAGRAMMATIC ELEVATION OF ALTMAR SURGE TANK, WITH STRESSES, ETC.

FIG. 4. PROTECTIVE COVERING FOR STEEL TANK AND UPTAKE

½-in. angle to take the horizontal thrust of the roof trusses, and to hold the tank in a circular form. The tank is also stiffened by the ten braces holding the inner riser pipe in alignment. No plates less than ½ in. thick were used in the tank and riser pipes. All plates were of openhearth flange steel and all steel was rigidly inspected at the mill. The specifications for the shop fabrication were in accordance with the best practice in bridge construction.

On account of the limited space of this article a discussion of all the original features of this design is not given, a few are mentioned briefly. The method of determining the stresses involved due to the external forces assumed on the main tank and riser pipes is entirely original. External hydrostatic or similar forces on a perfect cylindrical form can produce only a pure compressive stress in the shell just as the internal hydrostatic forces can produce only pure tension. The only difference between the two loadings is that while the internal one tends to correct any deviation of the cylinder from a perfect circular section, the external one tends to increase the deformation and consequently tends to increase the stresses.

From observation, we notice that when a pipe fails by collapsing due to an internal negative pressure, two diametrically opposite sides try to meet while the other

Fig. 5. Altmar Tank in Second Stage of Erection

two sides increase the distance between them as far as possible. The usual tendency is for not more than two sides of a pipe to move inward. There are, therefore, four points of metal, *A*, *B*, *C*, *D* (Fig. 4), which when considered very small, show no relative movement with the adjacent metal. All molecules of metal between these points, however, changed their positions with reference to adjacent molecules in their movement from the original cylindrical portion of the tank sufficient to show no perfect circular section. It, therefore, follows that the collapse is due entirely to the inability of the metal between the points noted, safely to carry the imposed stresses. As before stated, the stresses are purely compressive. The metal between *A* and *B* must, therefore, have failed as a column whose length is the distance from *A* to *B* measured on the center line of the plate. The distances between the four points are approximately equal, their inequality being due only to variations in the rigidity of the plate. Therefore, to design a cylindrical shell for external hydrostatic pressure, we need only consider one-fourth of the circumference of the plate as the column length. The stress in this column is computed the same as for the internal pressure, and is equal to the head times the radius in inches. When the slenderness ratio is large, Euler's formula for long columns should be used.

If the section of plate required for the computed stress is very thick, it is preferable to use a lighter plate with some reinforcement at regular intervals. The column then consists of a width of plate equal to the distance between reinforcements, with the reinforcing section at the center of the plate. The reinforcement used on the tank and standpipe can be checked by this method.

The principal stresses in the tank bottom are due to (1) the head of the water in the tank; (2) the weight of the 10-ft. riser pipe; and (3) the 12-ft. opening for the riser connection. The thickness of plate used is sufficient to take all these stresses without following the custom of concentrating metal around the opening. The local concentration of metal in any stressed spherical shell is an objectionable feature. The stresses due to the opening are a maximum at the bottom and gradually diminish until they vanish at the top of the bowl.

Only one thickness of plate is used which would indicate an unnecessary thickness of plate at the top if the method of support is not considered. As the tank is supported at ten individual points, a concentration of stress results at these points, which fact is ignored by most designers. The magnitude of the increased stresses at the supports varies in different designs with the actual

Fig. 6. Foundations for Altmar Surge Tank

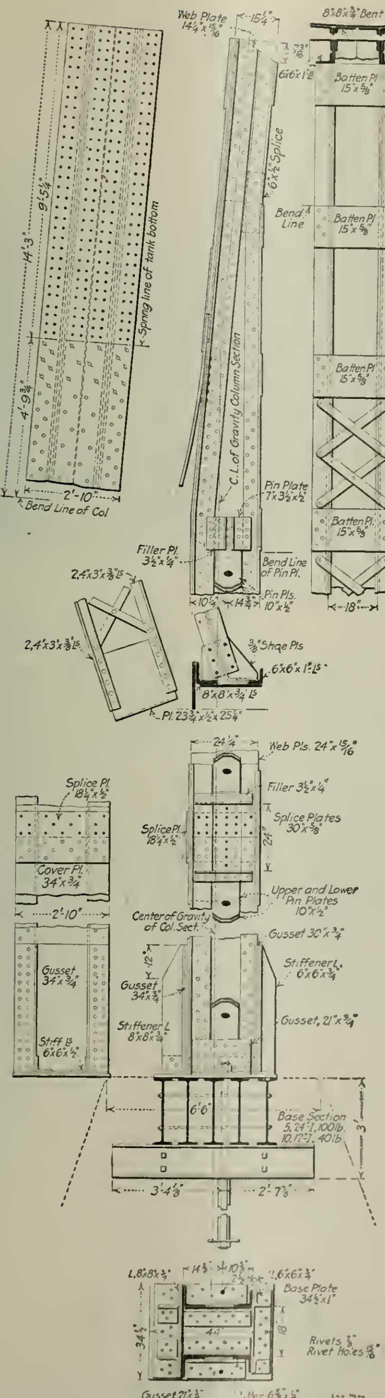


FIG. 7. COLUMN FOR STEEL TOWER

elongation of the material in the span between posts. To obtain a uniform stress in the bowl between supports, it would be necessary to use a thickness of steel in the ceptible elongation under full loads.

There must also be a circular reinforcement in a horizontal plane at the top of the bowl sufficient to permit of no inward deflection between these supports. As such requirements are not practical, it is advisable to ascertain the additional stresses caused due to the elongation of the tank plates used. The bottom plates should be thick enough to take these additional stresses and come within the allowable unit stresses, and the riveting on the horizontal seam should correspond. On the usual sizes of

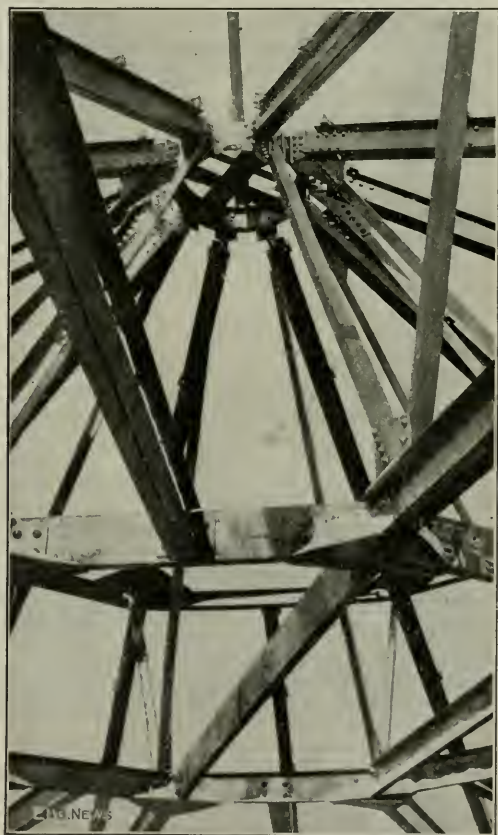


FIG. 8. ROOF FRAMEWORK FROM INTERIOR

tanks, these stresses are important only when large spans are used between supports. The bottom as here designed reduces bending stresses in the lower part of the tank cylinder to a minimum. Most designers are content to have the factor of safety take care of these stresses in the lower rings. Tank bottoms which are comparatively flat spherical segments or shallow elliptical bottoms depend almost entirely on the cylindrical shell to carry the transmitted shears to the posts.

The horizontal thrust of the columns at the top is carried by an interior truss work which also stiffens the

lows between posts. Further stiffening is accomplished by the two horizontal belt straps. On account of the importance of this structure a factor of safety of not less than five was used throughout.

Each of the ten columns is anchored by means of two 2½-in. bolts. They rest on a double tier of steel-grillage beams which are set at an angle to take the load of the columns correctly. The beams rest on concrete piers which are connected at the bottom by a heavily reinforced-concrete slab connecting them in a circle.

The tower, first ring, bowl and part of riser pipe were erected by means of a special steel derrick consisting of a 110-ft. mast, a 125-ft. boom and having a 20-ft. bullwheel. The upper 10 ft. of riser pipe was then completed and two 40-ft. swinging booms attached near its top from which the tank and roof trusses were erected (Fig. 5). All rivets were driven by pneumatic hammers and the work was closely inspected in the field as well as in the shop. The few leaks which were found after testing were quickly stopped. The tank was tested during very cold weather in order to rush its completion. To keep ice from forming on the water, a 2-in. steam pipe was run over the top of the tank and by the use of three swivel joints, was supported on floats which held the steam nozzle a few inches below the water surface.

This structure was designed by the writer for the Kennicott Co., of Chicago Heights, Ill., who fabricated and erected it. The work was directly in charge of the general superintendent, Chas. F. O'Connell. The Eric Construction Co. are the general contractors for the hydro-electric power plant. R. D. Johnson, their hydraulic engineer, made the complete specifications. The work was passed upon in detail by V. G. Converse, Chief Engineer of the Salmon River Power Co.

A Real Fireproof Building

The June 25 fire at Salem, Mass., produced one very striking example of the fire-resisting qualities of a well built concrete building with the openings thoroughly protected by wire-glass and by fusible-link shutters. The large plant of the Naumkeag Steam Cotton Co. was located at the extreme eastern end of the burned area and was almost the last place the fire reached. Like everything else in the path of the fire, all of the buildings were destroyed, with the exception of a reinforced-concrete storehouse and an old gasometer, which had also been used as a cotton storehouse.

The reinforced-concrete warehouse, built about eight or nine years ago, is 60x100 ft. in plan and four stories high. It is of reinforced concrete throughout, with straight column-and-girder construction, having plain slabs reinforced with expanded metal spanning the girders and with girders strung between the columns. The roof was covered with tar and gravel. The outside walls are provided with small windows, glazed with wire-glass set in iron frames and protected on the inside by hinged, metal-covered shutters, ordinarily held open by chains with fusible links at the outer ends. The building was designed and built by the Eastern Expanded Metal Co.

The warehouse is bounded on two sides by streets, while a third side faces a wide alley, so that only one side, where buildings stood within 6 ft., was subjected to the fiercest flames. The difference in the intensity of the heat to which opposite sides of the storehouse was exposed, is shown by the fact that, while on one side the rain-water conductors and the zinc flashing at the edge of the roof were melted down, on the opposite side, which faces a 40-ft. street, a wooden beam, bolted to the wall of the building to carry insulators for electric wires, was not even charred. The buildings on the opposite side of the street were, however, burned, and the heat on that side, as well as on the others, was sufficient to melt the fusible links holding the window shutters so that all of them were closed automatically.

That the temperature inside the building did not become excessively high is shown by the fact that the fusible heads of the sprinkler system, set to melt at 160° F., did not open in a single instance. Neither was the white paint, with which the interior walls are covered, blistered, and practically no damage was done to the $30,000 worth of finished goods which the storehouse contained.

The outside walls of the building appear to be absolutely unhurt. Most of the wire-glass in the windows is badly cracked, but no other damage is apparent and one would not guess that the structure had been in the midst of a conflagration except for the surroundings. The building cost about $25,000 to build, including the elevator and electric work. This is about 12c. a cu.ft. of volume above the street level.

The Manufacturers' Mutual Fire Insurance Co., of Providence, R. I., of which John R. Freeman, M. Am. Soc. C. E., is president, which had to pay about $800,000 for the losses in the Naumkeag company, has issued statement of the conditions around that plant. From that report we give below some extracts.

The loss is by far the greatest single loss that has ever occurred in the seventy-nine years' experience of the Factory Mutual System. The loss next in importance to this was that of the Warren Manufacturing Co. about nineteen years ago, in which the mutuals lost less than one-fourth part of the present amount. The present loss involves one of the largest payments (if not the largest) ever made to a single corporation for a fire loss. It is of interest to note that although more than 250 acres closely covered with dwellings, etc., was burned over, about one-fourth of the whole value burned was in this one factory yard.

The loss was in every way a legitimate one, and the exposure could not have been fairly called bad enough to forbid taking the risk. The risk bordered Salem Harbor and was divided into six principal buildings separated by reasonably broad open spaces. The flames that swept were driven toward these from a burning area extending over a mile back and a third of a mile in width and across these mills along their exposed front of about a quarter of a mile in length with a heat that no ordinary construction could withstand. Moreover, this was almost at the end of the conflagration, the city water pressure had been rendered practically useless by fire drafts and broken pipes, and no public fire apparatus and no public firemen put in an appearance at the mill or rendered the slightest assistance. A few men of the factory organization worked valiantly and worked to the limit, the mill's own big fire pumps fed from the harbor, and when these men were finally driven away they left the pumps running at full speed and a full head of steam on the boilers. They had to escape with two of the factory mutual engineers who were on the ground helping the men, by a boat, the mill being then all on fire, entirely surrounded by flames on the land side. Along the front after the fire had reached the mill it was impossible to hold hose lines in the smoke and heat, and more sprinklers were opened by heat than the pumps could supply. A radical substitution of new machinery for old throughout most departments had just been completed and last year they had [illegible] their fire protection appliances at an expense of about ten thousand dollars.

No more complete burning of everything combustible has ever been witnessed, with the exception of two storehouses—one a low circular structure, without windows (formerly a gasometer) used for the storage of cotton, the other a new four story concrete storehouse for finished goods, which had

FIG. 1. A REINFORCED-CONCRETE SURVIVOR OF THE SALEM FIRE. STOREHOUSE OF THE NAUMKEAG STEAM COTTON CO.

FIGS. 2-3. CONDITION OF THE REMAINDER OF THE NAUMKEAG PLANT AFTER THE FIRE

small wire-glass windows in iron frames, reinforced on the inside by tin-clad shutters dropped by automatic fusible links. This building, although surrounded on all sides by a sea of flames, came through the fire practically uninjured, except for the cracking and melting of the wire-glass in a few of the windows and a little smoke damage.

This concrete storehouse is a most instructive object lesson as to the feasibility of building storehouses at moderate cost that will withstand the fiercest conflagrations, and is well worth a visit by anyone about to build a storehouse.

⁂

The Cost of City Government in 195 American cities having 30,000 population and over is reviewed by the Census Bureau in a bulletin shortly to be issued. The statistics give the total cost of carrying on the general government, police and fire departments and all other protections to person and property, conservation of health, sanitation and street cleaning, care of highways, charities, hospitals and correction and conduct of education and recreation. Expenses in connection with public service enterprises, such as municipal waterworks, etc., are not included. The average annual per capita payment for the 125 cities is $17.34. The expense is higher, however, in the larger cities. In the cities of group 1, having a population in excess of 500,000, the average per capita cost is $21.24. In this group Boston has the largest ratio of expense, the amount being $28.06, and Baltimore has the lowest, the amount there being $15.14. In the group of cities having 300,000 to 500,000 population the average per capita expense is $20. In this group Washington is the most expensive city, the per capita cost being $25.43, and New Orleans the lowest, with $12.79. In the cities with 100,000 to 300,000 population the average per capita cost drops to $14.22, in the cities with a population of 50,000 to 100,000 the cost is $12.06 per capita, and in the cities of 30,000 to 50,000 population the cost is $11.69 per capita. As would be expected, however, there is great variation in the cost of city government in the different cities. In Mt. Vernon, N. Y., for example, the per capita cost is $27.53, and in Charlotte, N. C., it is only $6.44. The statistics also show a large and steady increase in the payment per capita on account of police, fire and education. The per capita expenses for education increased from $3.61 in 1902 to $5.02 in 1912.

The Newly Created State Department of Health of Massachusetts

The Massachusetts State Board of Health was legislated out of office on July 7. In its place, there was created a State Department of Health consisting of a single commissioner as executive officer and a council of health. The council will be made up of the commissioner and six other members. It will make rules and regulations, and perform other functions, not clearly defined, but will have no administrative or executive functions. The act substantially in full is as follows:

AN ACT

To create a State Department of Health and to amend the Public Health Laws.

There is hereby created a state department of health which shall exercise all the powers and perform the duties now conferred and imposed by law upon the state board of health. The state department of health shall consist of a commissioner of health and a public health council. There shall also be directors of divisions, district health officers and other employees as hereinafter provided.

The commissioner of health shall be appointed by the governor, with the advice and consent of the council, and he shall be a physician skilled in sanitary science and experienced in public health administration. The term of office of the commissioner of health shall be five years. He shall receive an annual salary of $7500, and shall devote his entire time to his official duties. The commissioner of health shall be the administrative head of the state department of health. His powers and duties shall be to administer the laws relative to health and sanitation and the regulations of the department, to prepare rules and regulations for the consideration of the public health council, to appoint and remove, with the approval of the public health council, directors of divisions, district health officers, inspectors and other necessary employees and fix their compensation, subject to the approval of the governor and council, within the limitations of appropriations therefor. Directors of divisions and district health officers shall be exempt from civil service regulations. The commissioner of health shall submit annually to the public health council a report containing recommendations in regard to health legislation, and shall perform all executive duties now required by law of the state board of health and other duties incident to his position as chief executive officer. He may direct any executive officer or employee of the state department of health to assist in the study, suppression or prevention of disease in any part of the commonwealth.

The public health council shall consist of the commissioner of health and six members hereinafter called the appointive members, at least three of whom shall be physicians, all to be appointed by the governor, with the advice and consent of the council. [illegible] The terms of office of the said members [illegible] shall be three years. Vacancies shall be filled by appointment of the governor, with the advice and consent of the council for the unexpired term. The public health council shall meet at least once in each month and at such other times as they shall determine by their rules, or upon the request of any four members, or upon request of the commissioner of health. The appointive members shall receive [illegible] a day while in conference and their necessary traveling expenses while in the performance of their official duties. It shall be the duty of the public health council to make and promulgate rules and regulations, to take evidence in appeals [illegible] required by law, to hold hearings, to submit annually to the general court, through the governor, a report including recommendations as to needed health legislation, and to discharge other duties required by law, but it shall have no administrative or executive functions.

There shall be in the state department of health such divisions as the commissioner of health may, with the approval of the public health council, from time to time determine. The commissioner of health shall appoint and may remove, with the approval of the public health council, a director to take charge of each division and shall prescribe the duties of each division. The compensation of directors of divisions shall be fixed by the commissioner of health within the limits of appropriations therefor, and subject to the approval of the governor and council.

The commissioner of health, with the approval of the public health council, shall from time to time divide the state into [illegible] health districts and shall appoint and may remove a district health officer for each district, with the approval of the public health council, at a compensation, subject to the approval of the governor and council, not exceeding $[illegible] a year. The district health officers shall not engage in any other occupation and shall give their entire time to the performance of their duties. The commissioner of health may, from time to time, order two or more of said district health officers to work in one district in order to study, suppress or prevent disease. Each district health officer shall have all the powers and perform the duties now provided by law for inspectors of health and further shall, under the direction of the commissioner of health, perform such duties as may be prescribed by, and shall act as the representative of the commissioner of health and under his directors shall secure the enforcement within his district of the public health laws and regulations. Said district health officers shall be graduates of an incorporated medical school admitted to practice in the Commonwealth, or shall have had at least five years' experience in public health duties and sanitary science.

. . . Present employees shall be continued in office until their successors are appointed and qualified, or until removed by the commissioner, provided, however, that no employee shall be removed who was appointed or is now employed under the provisions of the civil service laws and regulations, other than for cause, except division heads and district health officers, who shall be appointed as hereinbefore provided.

As the original bill was promoted by the Governor, it is assumed that he will sign it. The bill will then go into effect on Aug. 6, 1914.

Denver Municipal Bonds for Moffat Tunnel Declared Unconstitutional

The Colorado Supreme Court has denied the right of the City of Denver to issue bonds for driving a tunnel through the Continental Divide to be used by the Denver & Salt Lake R.R. and for the transportation of water and electric current (as described in ENGINEERING NEWS, Jan. 29, 1914). The city was given the right to proceed with this work and a commission was created by a constitutional amendment adopted May 20, 1913. After the issuance of the Tunnel Commission's report, the bonds were approved by the voters of the city on Feb. 17, 1914 (as noted in ENGINEERING NEWS, Mar. 5, 1914, page 541).

The court declared the tunnel contract unconstitutional and characterized it as a deliberate attempt to evade the constitution, coming within the fundamental inhibition against the use of municipal funds for the credit or benefit of private corporations. The counsel for the Tunnel Commission argued that there were four reservations taking the matter out of constitution limitations. The court overruled each of these, holding (1) that the city had made no provision to pay for the construction of conduits through the tunnel, that it had secured no right to use water from the western slope, and that it had not declared its intention of acquiring such right; (2) that the same facts held as to the use of the tunnel for the conveyance of electricity; (3) that, in regard to the city's reservation of right to mineral discovered in driving the tunnel, the city has no right to levy tax for the purpose of locating mineral claims; (4) that, in regard to the use of the tunnel by more than one railroad, no showing was made that any other road desired to use the tunnel.

The court concludes that these provisions in the contract were inserted in an effort to evade constitutional prohibition.

Notice has been given by the Tunnel Commission and City Attorney that an attempt will be made to recall the

decision under an amendment adopted in 1913, which permits a judical decision involving constitutional questions to be reviewed and recalled by a vote of the section of the state interested. In spite of this, it is reported that there seems no certainty of such an effort being supported by the Denver vote, and it is possible that the Supreme Court would step in again and deny the right of one part of the state to change a constitutional provision applying to the whole state.

Therefore, at the present moment, early completion of the project seems to hinge on the willingness of the railroad company to complete the construction of the tunnel without the city's coöperation.

The Strength of Lime Mortar*

The scanty data on strength of lime mortar are much amplified by test results of W. E. Emley and S. E. Young, presented in a paper under the above title. By mixing in the mortar a 1% solution of "Wool Blue R," the setting of the mortar can be observed in broken specimens; the dye colors the calcium carbonate blue, but leaves the hydrate colorless. In the broken specimens, a blue exterior shell was seen, showing the penetration of the atmospheric carbon dioxide, which converted the lime hydrate into hard carbonate.

A set of compressive and tensile tests made on various commercial limes in 1:3 mortar at 6 mo. age, in 2-in. cubes and standard briquettes, gave results tabulated below. The important feature is the higher strength of the dolomitic limes, shown near the bottom (low CaO content). The high-calcium mortars crush at 100 lb. per sq.in., while the dolomitic limes crush at 300 lb. per sq.in.

The high-calcium limes acquired strength somewhat earlier than the dolomitic limes, but at 1 mo. age the latter were 50% stronger in compression and continued to gain strength faster than the high-calcium limes.

Since lime mortar hardens from the surface inward, large cubes show lower strength than small cubes. At 3 mo., 6-in. cubes were only 1/3 to 1/4 as strong as 1-in. or 2-in. cubes. Prisms of equal cross-section, with different ratios of exposed surface to volume, showed much greater strength.

The strength of mortar increases with the fineness of the sand. Both high-calcium and dolomitic limes showed 2½ times as great a crushing strength with sand of 60 to 80 mesh fineness as with sand of 10 to 20 mesh. Excessive water weakens the mortar, but below a certain minimum of water, varying from 15% to 35% for the various lime-sand mixtures tried, there is a very great drop in strength.

Adding lime to portland-cement mortars, both neat and 1:3, did not weaken the mortar appreciably at ages up to 1 yr., provided the amount of lime did not exceed one-third the amount of cement. This applies to both compressive and tensile strength, and either air or water storage.

TABLE I. COMPRESSIVE AND TENSILE STRENGTHS OF LIME MORTARS

(Mixture 1 part lime to 3 parts river sand. Age 6 months).

Quicklime			Hydrated Lime		
CaO, per cent.	Compressive strength, lb. per sq.in. (av. of 10)	Tensile strength, lb. per sq.in. (av. of 5)	$Ca(OH)_2$, per cent.	Compressive strength, lb. per sq.in. (av. of 10)	Tensile strength, lb. per sq.in. (av. of 5)
98.41	72	28	92 98	61	21
98.13	90	43	91.77	80	31
98.13	48	28	88 78	153	46
97.78	104	30	88 42	128	48
97.65	98	40	87 78	95	19
96.22	118	29	82 46	188	47
95.81	156	36	74 38	130	28
95.38	73	21	61.44	148	22
95.01	129	33	57 27	222	29
94.64	156	45	54.05	165	37
94.09	85	25	52.19	259	67
93 84	147	63			
92 56	154	31			
92.45	156	36			
92 23	92	36			
89.29	144	40			
86.23	126	40			
84.51	119	43			
84.41	113	..			
60.87	186	44			
60.40	280	63			
58.10	313	50			
56.95	391	84			
56.93	319	41			
56.33	315	59			
55 98	363	93			
55 06	303	71			

*Abstract of paper presented before the American Society for Testing Materials, Atlantic City, June 29-July 3.

NEWS NOTES

A Wood Highway Bridge Collapsed under the load of a moving automobile near Dale, Mich., on June 30. The automobile came down a steep hill and onto the structure, through which it fell to a shallow stream 30 ft. below.

The Steamship "Invermore" Went Ashore near Brig Harbor, on the Labrador coast, on July 10. The "Invermore" is owned by the Reid Newfoundland Ry. Co. and carries passengers, mail and freight. She is a single-screw steamship, 250 ft. long, 30-ft. beam, built in 1881, and is commanded by Captain J. Kanel.

A Large Flywheel Burst in a cooperage factory of New York City, on July 6. Five minutes after the shop machinery was started the flywheel, 5 ft. 6 in. in diameter, burst. Many of the smaller machines were wrecked; but due to the early hour few men were at their places and only two were injured. A 300-lb. piece of the wheel was hurled through a window and through the wall of an adjacent tenement house.

A Sandy Hook Pilot Boat Was Sunk at the entrance of the Ambrose Channel, New York, recently by the United Fruit steamship "Manchioneal," outward bound in a fog. The crew of the pilot boat (the "New Jersey") was taken off by vessels in the vicinity. The "Manchioneal," of 1600 tons, continued on her voyage to Jamaica. The "New Jersey" was a 248-ton wooden vessel, 144 ft. long.

The First State-Aid Roads to be built under the new Illinois law in Logan County are to be of concrete, 10 ft. wide, with 8-ft. strips of waterbound macadam on the sides.

Work Begun on Hetch Hetchy Road—City Engineer M. M. O'Shaughnessy of San Francisco recently visited the Hetch Hetchy Valley personally to supervise the beginning of the first construction road to the dam site. Work was started on a road 8½ miles in length. It will first be used as a wagon road, but later railroad tracks will be laid upon it.

City Waste Collection and Disposal in Chicago is to be investigated by a special engineering commission, with a view to working out a system to be adopted by the city. The council has made an appropriation of $35,000 for the work and the necessary experimental plant and equipment. This is the result of the report of a former commission, which report has been given in abstract in our columns.

The Longest Tunnel in America—The Mount Shasta Power Corporation is pushing construction on a seven-mile tunnel to carry water from the Pitt River, in Shasta County, Calif., to the forebay of its projected power house. The tunnel so constructed is to be 7 ft. wide and 9 ft. high. Later it will be enlarged to a width of 16 ft. and a height of 19 ft. Crews are working at both ends, the aggregate length of the two sections now being a little over a mile. The entire length will be completed as a 7x9-ft. section before the bore is enlarged.

Systematic Sale of Inferior Cement Discovered in San Francisco—The Commissioners of the Board of Public Works of San Francisco have discovered that deteriorated cement is being disposed of in large quantities throughout that city. The yards of a prominent firm of contractors were inspected and sacks of the spoiled product found in abundance. The Commissioners have received reports that certain building foundations are crumbling away, which leads to the belief that a ring of dishonest dealers are systematically marketing a very inferior mixture

The City of Long Beach, Calif., is held responsible for the condition of its municipal pier, which collapsed on May 24, 1913 (see Eng. News, June 19, 1913, p. 1255), killing 11 persons and injuring some 2[illegible] more. In a test case brought before the Superior Court of the state, damages to the extent of $[illegible] were awarded to a man for the death of his wife in the accident. If the precedent holds, the city will be mulcted of several million dollars. It will be remembered that the pier in question was a timber structure of strikingly weak design and in a poor state of maintenance.

Federal Aid to Good Road Construction was provided for to the amount of $2[illegible] in the Shackelford bill passed by the House of Representatives some months ago. The bill has since been in the hands of the Senate Committee on Post Offices and Post Roads, of which Senator Bankhead, of Alabama, is chairman. A letter of Senator Bankhead's dated July 3, says:

The committee is diligently at work perfecting the bill and I have no doubt that in a few days a report will be made. The bill will probably be along the line of the discussions at the meeting of the United States Good Roads Association at St. Louis last November.

A District Water Supply Project for Cohoes, Waterford, Watervliet, Green Island, N. Y., and adjacent territory has been launched by the State Conservation Commission. This is the so-called Charlton project to use the waters of Aplaus Kill, Saratoga County, some 25 miles northwest of Albany. A dam would be constructed to create a 3000-million-gal. storage reservoir. The population of the proposed union district is 51,[illegible], with a present consumption of 6,300,000 gal. per day; provision is planned for 15,000,000 gal.

This scheme conflicts with the plans of the city of Watervliet to take a supply from the Normanskill at French's Mills, using waterpower to pump through the supply line. Watervliet has secured enabling legislation, but has yet to secure the approval of the Conservation Commission.

The Height of Buildings in Chicago is limited by ordinance to 2[illegible] ft. A special permit was asked recently for a hotel building 26[illegible] ft. high, on Michigan Ave. When this was refused, an ordinance was introduced to permit the construction of 26[illegible]-ft. buildings along Michigan Ave. where it fronts upon Grant Park and the lake. Fortunately this was rejected by the council, and it was shown very clearly that one cause of the great and increasing traffic congestion of Chicago is due to the tendency to confine the business district to a limited area by the construction of "skyscraper" buildings. The pressure for space is so great that office and mercantile buildings are now being built outside of the old central district and the Chicago, Burlington & Quincy R.R. has even put its new office building on the west side of the Chicago River.

The Right of the Illinois Highway Commission to Make Contracts for Material for road construction has been upheld by the state courts in a decision handed down the last week in June. To prevent skimping of cement and other material the Highway Commission has decided to purchase the materials and furnish them to contractors who are awarded construction contracts. According to press dispatches from [illegible], Ill., July 1, the suit involved was filed at Sycamore, [illegible] County, where attorneys representing certain taxpayers sought to enjoin the State Highway Commission from purchasing cement and other materials. The attorneys, who [illegible] were employed by a cement company which failed to get a contract from the commission, contended that [illegible] the new road law did not authorize the commission [illegible] to purchase materials that [illegible] cannot [illegible] make such purchases.

The Glasgow Dock Fire—It now appears that the [illegible] [illegible]

Interference with the U. S. Geological Survey [illegible] surveys and other work of the U. S. Geological Survey." Its provisions include the following: (1) the appointment of the annual appropriation for topographic surveys and water resources investigations among the several States on the basis of area and population; (2) the distribution of the field work within each State upon the recommendation of the majority of the congressional delegation; (3) the determination of the technical details of the topographic and hydraulic surveys by the Secretary of the Interior upon the advice and recommendation of the majority of the Congressional delegation from each State.

The scale for maps would be decided by each State, so that there would be no uniformity, and the general control of the work would be political (and of the pork-barrel variety) instead of scientific. The Western Society of Engineers and the Illinois Society of Engineers and Surveyors have sent protests to Congress against the passage of the bill. They refer to the high quality of the work of the U. S. Geological Survey, and the resolution of protest adopted by the first-named Society states that this bill is fundamentally wrong in that it substitutes the judgment of a majority of the Congressional delegation for that of the Director of the Geological Survey on matters which are purely technical.

An $85,000 Error in a $322,000 Bid for a bridge contract came very near proving disastrous to a firm of contractors, which was awarded a contract for the construction of the Central bridge at Lawrence, Mass. Shortly after the bids were tabulated, the contractor informed the bridge commissioners that he had made a mistake in his calculations aggregating about $85,000, the accepted bid being about $322,000. The next lowest bid was something like $101,000 higher than the one for which the contract was awarded. Subsequently, questions were raised as to the appropriation of the money for the construction of the bridge and the commissioners were given to understand that owing to certain legal questions the contractor would not undertake the contract. Legal proceedings were begun by him to prevent the bridge commissioners from enforcing the contract. Subsequently, however, an arrangement was made between the commissioners and the contractor whereby the foundation and excavation work to spring lines, including what is called in the contract "Class C concrete," should be done as force account work, namely, the total cost including labor and materials and use of plant as agreed upon by the consulting engineer and the contractor, plus 10%. R. H. Davis, Consulting Engineer, advised the commissioners to make the above change in the contract. It is estimated that the additional expense to the city will not exceed $1[illegible] over the bid submitted by the contractor. On the above basis a contract has been signed, a bond has been furnished and the construction of the bridge begun. [Information from John J. Donavan, Chairman of Lawrence Bridge Commission.]

The Ohio Conservancy Act is still awaiting a final interpretation by the courts of the state. The present status of the act is reported by the Dayton Citizens' Relief Commission to be as follows:

On June 3 the Court of Appeals rendered a decision upholding the constitutionality of the Conservancy Act of Ohio in all major points. The laws of Ohio provide that an appeal may be taken on error from a decision of the Court of Appeals within 70 days after the decision is rendered. In making its decision the Court of Appeals granted to the contestants a stay in its mandate to the Court of Common Pleas, or Conservancy Court, ordering the petition for the forming of the Miami conservancy district to be heard at once. This stay was granted until July [illegible] in order that the contestants might have time to decide whether they would take the case to the Supreme Court of the state on error before the Conservancy Court made any preparation to begin its hearing upon the original petition.

The mandate of the Court of Appeals ordering the case back to the Conservancy Court was filed July 1. On July [illegible] attorneys for the contestants announced, after consultation, that they would take an appeal to the Supreme Court on error. They further [illegible] that they desired to print the [illegible] [illegible] would require they said about three weeks. As the [illegible] period from the date of the Appellate Court's decision gives them until August 12 it is not likely that formal action in the appeal will be taken until the latter date. It is believed that once the case is brought before the state Supreme Court there will be little delay in [illegible] hearing, as the Ohio Conservancy Act was passed as an emergency measure and specifically provides that it shall be given precedence.

The "Storstad" Was Blamed for the loss of the "Empress of Ireland" by the Commission of Inquiry headed by Lord Mersey in its report [illegible] at Quebec, Que., on July 11. The "Empress of Ireland" of the Canadian Pacific [illegible] was rammed by the collier "Storstad" in the St. Lawrence River

on May 29 and sank near Father's Point with a loss of 1014 lives. Third Officer Tuftenes of the collier is held directly responsible, in the following words:

We regret to have to impute blame to any one in connection with this lamentable disaster, and we should not do so if we felt that any reasonable alternative was left to us. We can, however, come to no other conclusion than that Mr. Tutenes was wrong and negligent in altering his course in the fog, as he undoubtedly did, and that he was wrong and negligent in keeping the navigation of the vessel in his own hands, and in failing to call the captain when he saw the fog coming on.

The second important finding was that the disaster was not due in any way to any special characteristics of the St. Lawrence River. "It was a disaster which might have occurred in the Thames, in the Clyde, in the Mersey, or elsewhere, in similar circumstances."

The following is quoted from the report:

After carefully weighing the evidence we have come to the conclusion that Mr. Tuftenes was mistaken if he supposed that there was any intention on the part of the "Empress of Ireland" to pass port to port, or that she, by her lights, manifested the intention of doing so; but it appears to us to be a mistake which would have been of no consequence if both ships had subsequently kept their courses.

Shortly after the ships came into the position of green to green, as claimed by Capt. Kendall, or red to red, as claimed by Mr. Tuftenes, the fog shut them out from each other, and it is while they were both enveloped in this fog that the course of one or the other was changed, and the collision brought about. From the evidence adduced on behalf of both vessels it is plain that before the fog, and when they last saw each other, there was no risk of collision, if each kept her course.

It is admitted that those on board the "Storstad" did that which in ordinary circumstances would change her course, and they did it in the fog shortly before the accident. They ported and they hard-a-ported the "Storstad's" helm. Assuming that she answered to this hard-a-ported helm, the effect would be to bring her head around to starboard in the direction of the "Empress of Ireland," and if she continued in the direction of the "Empress of Ireland" under this helm the effect would be to bring her into collision with the "Empress of Ireland."

It may be asked what induced the men in charge of the "Storstad" (Mr. Tuftenes and Mr. Saxe) to port and to hard-a-port the helm. The explanation is fairly plain. They believed, wrongly as it turned out, that the "Empress of Ireland" was passing their ship red to red. They wanted, as Mr. Turtenes said to Mr. Haight when he gave his first version of the story, "to make sure of ample room," and they ported in order to secure it. Unfortunately the "Empress of Ireland" was passing green to green, and so far from the porting securing more ample room, it brought the vessels into closer proximity, and then into collision.

The Commission of Inquiry is composed of Lord Mersey, formerly presiding justice of the British Admiralty Court; Sir Adolphe Routhier, of Quebec; and Chief Justice McLeod, of New Brunswick.

PERSONALS

Mr. F. C. Baluss has been appointed Engineer of Bridges and Buildings of the Duluth, Missabe & Northern R.R., with headquarters at Duluth, Minn.

Mr. Harry J. Marks, M. Am. Soc. M. E., Manager of the New York City office of the American Engine & Electric Co., has been promoted to be Sales Manager of the company.

Mr. J. N. Olson, Jun. Am. Soc. C. E., formerly Office Engineer of the J. C. Field Engineering Co., Denison, Tex., has been appointed Assistant City Engineer of Denison

Prof. H. C. Ramsower, of the college of agriculture of the Ohio State University, has been appointed the head of the new department of agricultural engineering of the college.

Mr. W. C. Barrett, formerly Special Road Engineer, Grant District, Jacksonburg, W. Va., has been appointed Division Engineer of the Lehigh Valley R.R., with office at Sayre, Penn.

Mr. R. F. Kelker, Jr., recently Assistant Engineer, Division of Valuation, Interstate Commerce Commission, has been appointed Traction Expert of the Bureau of Public Service of Chicago, Ill.

Mr. A. B. Copley, Division Superintendent of the Chicago, Rock Island & Pacific Ry., at Little Rock, Ark., has been promoted to be Assistant General Manager, with headquarters at El Reno, Okla.

Mr. W. A. Whitney, former Division Superintendent of the Southern Pacific Ry. at Sacramento, Calif., has been appointed General Superintendent of the Oregon Short Line R.R., with office at Pocatello, Idaho.

Mr. Hans August Evald Conrad von Schon, M. Am. Soc. C. E., has resigned as Consulting Engineer in charge of construction of the new water-works of the village of Highland Park, a suburb of Detroit, Mich.

Mr. Charles F. Brush, M. Am. Inst. E. E., of Cleveland, Ohio, has been awarded the Edison Medal of the American Institute of Electrical Engineers for his inventions and developments in electric arc lighting.

Mr. M. J. Butler, M. Am. Soc. C. E., of Montreal, Que., has been appointed a valuation expert to examine into the physical aspects of the Montreal Water & Power Co., to succeed Mr. Ernest Belanger, M. Can. Soc. C. E.

Mr. Lincoln Breedlove, of Martinsville, Ind., a recent graduate of the University of Illinois, has been appointed Supervisor of and Lecturer in mechanical enginering courses at Roberts University, Constantinople, Turkey.

Mr. E. L. Adams, recently Assistant Signal Engineer of the Lake Shore & Michigan Southern Ry., has been appointed Senior Signal Engineer of the Division of Valuation, Interstate Commerce Commission, at Chattanooga, Tenn.

Mr. E. C. Noble, of Houston, Tex., has been elected President of the Altus, Lubbock, Roswell & El Paso R.R., a new railway which has 60 miles of road in operation and 86 miles of roadbed graded through the Panhandle of Texas.

Mr. George Weston, recently removed by Mayor Harrison of Chicago, Ill., from his position as the city's representative on the Board of Supervising Engineers (in charge of traction work), retains his position as Chief Engineer of the Board.

Dr. Robert H. Whitten has resigned as Librarian-Statistician of the Public Service Commission, First District, New York State, to become Secretary of the committee on city plan of the Board of Estimate and Apportionment of New York City.

Mr. I. M. de Varona, M. Am. Soc. C. E., whose resignation as Chief Engineer of the Department of Water Supply, Gas & Electricity of the City of New York was noted in our issue of July 9, has been granted a pension of $3500 per annum, or 35% of his former salary.

Mr. J. W. Mulhern, former Superintendent of the Pere Marquette R.R., at Grand Rapids, Mich., has been appointed Superintendent of the Northern division of the Chicago Great Western R.R., with headquarters at St. Paul, Minn., succeeding Mr. W. B. Causey, resigned.

Mr. Carl Rankine has been appointed Locating Engineer of the San Francisco municipal railway to be built from the San Joaquin Valley to the Hetch Hetchy damsite. Mr. Rankine has had several years' experience in location surveys for the Southern Pacific Co in California, Oregon and Arizona.

Mr. T. H. Sears, Division Superintendent of the Atchison, Topeka & Sante Fé Ry., at Marceline, Mo., has been promoted to be General Superintendent with headquarters at Armarillo, Tex. He is succeeded as Division Superintendent at Marceline by Mr. R. H. Allison, former Trainmaster at Emporia, Kan.

Maj. R. W. Leonard, M. Can. Soc. C. E., has resigned as Chairman of the Canadian Transcontinental Railway Commission in order to devote his whole time to private business. The duties of the commission are to be taken over by the Commissioner of Railways, under whose supervision the construction work now under way will be completed.

Mr. Otto Holstein, formerly Superintendent of Transportation of the Guayaquil & Quito Ry. in Ecuador, has been appointed Superintendent of Transportation of the San Antonio, Fredericksburg & Northern R.R., with headquarters at Fredericksburg, Tex. Mr. Holstein was formerly in charge of operation of the Central Ry. of Peru.

Mr. John J. Brown, President of the village of White Plains, N. Y., has been appointed Manager of the recently completed Bronx Valley Trunk Sewer, at a salary of $2500 per annum. The sewer has been completed, but is not in operation because the city of Yonkers, N. Y., has obtained an injunction against the building of a disposal works within that city.

Mr. Alexander Johnson, Assoc. M. Am. Soc. C. E., has resigned as Chief Engineer of the Department of Bridges, New York City. Mr. Johnson has not been in good health for some time. He is a graduate of Sheffield Scientific School, Yale University, and has been connected with the New York City Bridge Department for 18 years. He is succeded by Mr. Austin Lord Bowman, M. Am. Soc. C. E., as noted elsewhere.

Mr. Albert J. Stone, General Manager of the Erie R.R., at New York City, has been elected Vice-President in charge of operation, with headquarters at New York. Mr. Stone entered the service of New York, Lake Erie & Western R.R. in 1888 as a messenger. With the exception of two years, 1903 to 1905, when he was General Superintendent of the Delaware & Hudson R.R., Mr. Stone has been continuously in the employment of the Erie R.R.

Mr. R[illegible] W[illegible], formerly Chemist and Engineer of Tests of the M[illegible] R.R., has leased the railway company's laboratory, which was used for testing materials during the construction of the Detroit River tunnel, new Union Station and subsequent improvements at Detroit. The laboratory will now be conducted under the name of the [illegible] Testing Laboratory, and will be used by Mr. Perry for the general practice of chemical, inspecting and testing business.

Mr. Daniel F. Fulton, for the past six years Assistant City Engineer of Yonkers, N. Y., has been appointed City Engineer, succeeding the late Samuel L. Cooper, M. Am. Soc. C. E., who died a year ago. Mr. Fulton is a graduate in civil engineering of Cornell University, class of 19[illegible], and was first employed as Assistant to the late George W. Rafter, M. Am. Soc. C. E., Consulting Engineer, of Rochester, N. Y. Later he was with the Buffalo, Rochester & Pittsburgh R.R. In 1[illegible] Mr. Fulton was appointed Assistant Engineer in the New York State Engineers' Department. From 1906 to 1908 he was in charge of Residency No. 1 on the Champlain Canal.

Mr. James H. Hustis, President of the New York, New Haven & Hartford R.R., will resign, it is reported, Aug. 15, to become President of the Boston & Maine R.R., which is to be entirely separated from the New Haven system. He succeeds Mr. Morris McDonald, who returns to his former office as President of the Maine Central R.R. Until his election as President of the New York, New Haven & Hartford R.R., Mr. Hustis was Vice-President and operating head of the Boston & Albany R.R., so that there is probably no railway man in the country more familiar with New England conditions, although few of Mr. Hustis' contemporaries are likely to envy him on account of his new office. According to the recently enacted law of Massachusetts the New Haven system must sell its holdings of Boston & Maine R.R. stock within three years, the State of Massachusetts reserving the right to buy during or after that time.

Mr. Austin Lord Bowman, M. Am. Soc. C. E., Consulting Engineer, New York City, has been appointed Chief Engineer of the Bridge Department of the City of New York, succeeding Mr. Alexander Johnson, Assoc. M. Am. Soc. C. E., resigned. Mr. Bowman is a graduate of Yale University, class of 1883. Following his college course he began engineering work and in 188[illegible] was employed in the city engineering department of St. Paul, Minn. Later he was with the engineering departments of Minnesota & Northwestern R.R. and the Chicago, St. Paul & Kansas City R.R. Mr. Bowman returned East in 1887 to join the engineering staff of the Kings County Elevated R.R. in Brooklyn, N. Y. From 1887 to 1890 he was with the Norfolk & Western Ry., and from 1890 to 1895 he was Engineer and Superintendent of Construction for the American Bridge & Iron Co. of Roanoke, Va. In 1897 he opened an office in New York City as Consulting Engineer. From 1901 to 1907 he was Consulting Engineer of the Central R.R. of New Jersey, and since 1907 Consulting Engineer of the New York City Department of Bridges.

OBITUARY

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[illegible]

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[illegible]

... St. Louis Ry., died at Hot Springs, Va., July 11. He was born in Harrison, Maine, in 1842, and when 28 years old was made President of the Indianapolis, Cincinnati & Lafayette R.R.; later he was Receiver for the same railway. He was President of the reorganized company, and again Receiver for it, when it failed a second time in 1876. He was subsequently President of the reorganized and consolidated railways which became the Cleveland, Cincinnati, Chicago & St. Louis Ry. From 1888 to 1900 Mr. Ingalls was also President of the Chesapeake & Ohio Ry.

ENGINEERING SOCIETIES

COMING MEETINGS

OHIO ELECTRIC LIGHT ASSOCIATION.
July 16-19. Annual convention at Cedar Point, Ohio. Secy., D. L. Gaskill, Greenville, Ohio.

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.
Aug. 20-21. Annual meeting in New York City. Secy., F. H. Harman, Room 101, Union Station, St. Louis, Mo.

AMERICAN PEAT SOCIETY.
Aug. 20-22. Annual meeting at Duluth, Minn. Secy., Julius Bordollo, 17 Battery Place, New York City.

AMERICAN BOILER MANUFACTURERS' ASSOCIATION.
Sept. 1-4. Annual convention in New York City. Secy., J. D. Farasey, E. 37th St. and Erie Ry., Cleveland, Ohio.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 7-10. Annual meeting in New York City. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

NATIONAL ASSOCIATION OF PORT AUTHORITIES.
Sept. 8-10. Annual convention in Baltimore, Md. Secy., Wm. Joshua Barney, 29 Broadway, New York City.

ROADMASTERS AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.
Sept. 8-11. Annual meeting at Chicago, Ill. Secy., L. C. Ryan, Sterling, Ill.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.
Sept. 8-11. Annual convention in Nashville, Tenn. Secy., A. P. Dane, Reading, Mass.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 9-11. Annual convention in Boston, Mass. Secy., Willard Kent, Narragansett Pier, R. I.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Sept. 15-18. Convention in Atlantic City, N. J. Secy., Clayton W. Pike, Electrical Bureau, Philadelphia, Penn.

ILLUMINATING ENGINEERING SOCIETY.
Sept. 21-2[illegible]. Annual convention in Cleveland, Ohio. Secy., Joseph D. Israel, 29 W. 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Sept. 22-24. Annual convention in Bluff Point, N. Y. Secy., C. C. Rosenberg, Times Building, Bethlehem, Penn.

Atlantic Deeper Waterways Association—The eighth annual meeting of the Association will be held in New York City, Sept. 9-12. After the first day's session an inspection of New York harbor and of the New York and New Jersey waterways will be made. For the remainder of the convention the delegates will be housed aboard the Hudson River boats, on which the remaining sessions will be conducted. Representative J. Hampton Moore is President of the Association.

American Peat Society—The eighth annual meeting will be held Aug. 20-22 at the Commercial Club, Duluth, Minn. There will be an excursion to two peat bog districts some [illegible] miles north of the city, in one of which large drainage ditches are being cut to prepare the land for agricultural use. The papers will cover the cultivation and drainage of peat lands and the commercial uses of peat. Some of the papers are as follows: "The Peat Gas Producer," F. [illegible], Ottawa, Can.; "The Possibilities of Peat in [illegible]," Prof. [illegible], University of Minnesota; "Converting Peat into Fuel," Charles A. Davis, U. S. Bureau of Mines; "Peat Briquettes," [illegible]; "Briquettes from Peat and [illegible]," Robert [illegible], [illegible], Calif.; "The [illegible] Machine," [illegible]; "[illegible] of Machinery to Peat Deposits," L. A. [illegible]; "[illegible] a Peat Bog for Fuel Making," [illegible]; "Peat Lands in Minnesota and Wisconsin," Prof. J. T. Stewart, University of Minnesota; "The Peat Situation in Minnesota," [illegible]; "[illegible] of Peat in America," [illegible], New York.

Other papers will deal with the peat industry in England, Ireland and Russia. An exhibit of peat, peat products, cultivating machinery, etc., photographs of works, and other matters pertaining to peat development will be displayed at the rooms of the Commercial Club, Aug. 19-Aug. 22. Further information may be had from Julius Bordollo, Secretary, American Peat Society, 17 Battery Place, New York, N. Y.

Engineering Literature

CONTENTS

CORRESPONDENCE

A Book Purchaser on Title-Page Dates

Sir—In your issues of Dec. 18, 1913, Jan. 15, Feb. 12, and Mar. 19, 1914, you comment upon "Title-Page Dates," particularly upon the misrepresentation involved in a change of title-page date when there is substantially no change in the text.

May I call your attention to a flagrant case of such misrepresentation? I refer to "Electric Power Conductors," by Del Mar, "Second Edition Revised." I ordered this book, misled by the advertisement, thinking it to be a new edition, but in ordering it I warned the company supplying it that I should return it if it were not really a second edition, stating that I had frequently been swindled by fake second editions.

My attention was first attracted by the preface to the "second edition," signed by the author, reading as follows:

> The specifications for rubber insulation are radically different from those of the first edition and represent the results of a great deal of investigation and research. Other changes of more or less importance will be found on nearly ten (10) per cent. of the pages of the book.

This led me to inspect the book with some care. The first inspection revealed no changes other than those in the specifications for rubber insulation, but a further examination made with considerable care brought to light the following changes:

On pp. 13, 46, 49, 101, 124, 302 and 307, the addition of a footnote on each.

Pages 82, 83 and 251, rewritten in part.

Page 294, formulas changed.

Pages 317, 318 and 319 rewritten.

While I am not prepared to say that this covers absolutely every trifling change in the book, yet I believe it does substantially. You will note that there are practically no changes in the book save those referring to the changes in the "Rubber Specifications," which are included in pp. 189-92 and pp. 317-19.

Under these circumstances, it is difficult to see what justification there is either for the preface to the "second edition" or the change in the title page and the caption "second edition revised." The book is not a second edition; it is a first edition with very slight revisions and it is a gross misrepresentation to pretend that it is anything else.

I have frequently in the past been deluded into buying valueless technical books by practices of this kind, and I think it time that a strong protest be made against this sort of thing.

Cary T. Hutchinson.

60 Wall St., New York City,
June 19, 1914.

A Handbook of Fan Engineering

Sir—The writer is much disappointed with the review (Engineering News, June 18, 1914), which you have given to the "Fan Engineering Hand Book," published by the concern with which he is associated. He feels that your remarks convey a wrong impression to the reader and, inasmuch as the company is selling the book at $3 per copy, he cannot but feel that there will be confusion created in the minds of those of your readers who may see the advertisements of this work.

The writer must take exception to your statement that it is partly fundamental theory, partly a statement of common practice and much from the company's files, not because these items are not included, but because your comment implies there is nothing else to the work. There is included in this book much that is new to the fan engineer and it is information which is not limited in application to one concern's apparatus. Therefore it is left that the claim is substantiated for the book as a decided step forward and to be recognized as a true text or reference book on the subject.

H. C. Rice.

Buffalo Forge Co., Buffalo, N. Y., July 7, 1914.

A puzzling bit of railway English is circulating at the rate of some hundreds of miles a day on a railway south of Mason and Dixon's line. It reads:

> Passengers are respectfully requested to keep their feet off the seats.
> Conductors are instructed not to permit this.

Notwithstanding this sign, the seats did not look footworn nor the passengers nor conductor careworn.

REVIEWS AND NOTES

Irrigation in Egypt

Reviewed by F. H. Newell*

EGYPTIAN IRRIGATION. By Sir W. Willcocks, Formerly Adviser to the Ministry of Public Works, Constantinople, Managing Director of the Daira Sanieh Company, and Director-General of Reservoir Studies, Egypt; and J. I. Craig, Director, Computation Office, Director Meteorological Services, Egyptian Survey Department, now Controller, Department of General Statistics; with an Introduction by Sir Hanbury Brown, formerly Inspector General of Irrigation, Egypt. Two volumes. Third edition. London: E. & F. N. Spon, Ltd. New York: Spon & Chamberlain. Cloth; 7x10 in.; pp. xxxiv + 881; 188 illustrations and 51 folding plates. 15, net, per set.

American engineers, particularly those having to do with water-supply, irrigation or drainage, will find much of interest in the recent, the third, edition of "Egyptian Irrigation" prepared by Sir William Willcocks and J. I. Craig. This interest is aroused both by the similar and by the contrasting conditions between those in Egypt and in the United States.

Under the head of similar conditions which afford lessons of direct application are the problems of storage of flood waters, of disposing of silt, of guarding against excessive use of water and consequently of alkaline conditions, of the necessity of fertilization, not merely for immediate increase of crop production but also as saving waste of water, and in pumping water both as a supplemental supply and as the only source of irrigation water.

The contrasting conditions which are also valuable, though of less direct application, are the regularity of flow of the river, the unity of the problem—as the water is derived from the one drainage area—the method of application of the water in great basins, the labor conditions, the character of land ownership, and the financing of the works and recovery of the cost by taxation.

The book itself, of two volumes, aggregating nearly 900 pages, with plates and illustrations, is largely a compilation of official reports. While this form of presentation has its advantages in showing the development of ideas and in affording opportunity of reference to these early reports, yet to a stranger it has the great disadvantages of repetition, of unnecessary elaboration, and of more or less confusing arrangement. The man who thoroughly understands the subject can readily add to his knowledge through such profusion of detail and by occasional divergence of view expressed, but to a busy engineer the task of digging out some of the larger elementary facts is discouraging. The value of the book could be greatly increased to the engineering profession in general if brief elementary explanations were given as to the local customs and terms, also by having simple conversion tables showing the relation between the units of quantity, area and values, with those habitually employed in other countries, notably in the United States.

Surmounting these barriers to easy progress, however, the irrigation engineer finds much "pay-dirt" scattered through the book. It begins with a general description of Egypt and the Nile, then takes up the basin irrigation which has been practiced for thousands of years, followed by more modern perennial irrigation which has become possible through the building of barrages, or as we term them diversion dams. Next comes the important subject of drainage and land reclamation, together with the engineering details of the barrages, storage reservoirs, flood protection and agricultural conditions. One of the most striking of these is a statement repeated from an early report, "The Nile in 1904," as follows:

> It would be a healthful innovation, indeed, if the provision of suitable manures were to be considered as an essential part of a project for providing perennial irrigation. The day is not far distant, I believe, when governments which provide irrigation works will also provide manures, and sell the water and the manures together, one being as essential as the other. I know well, from observation, that a well manured field needs only half the water that a poorly manured field does, and in years of drought and scarcity manures almost take the place of irrigation. Why should there not be a manure rate as well as a water rate? Here in Egypt, the numerous ruins of old-world cities have hitherto provided manure for a great part of the perennially irrigated lands, but these are being fast worked out and other sources must be sought for. Farmyard manure will never suffice for the intense cultivation in this country.

Compared with conditions in the United States, irrigation in Egypt appears to be a relatively simple problem, although one of great magnitude. To the outsider it appears at first glance that all that is needed is ample money to build a few big storage dams and to divert the water into large canals from which it could be distributed over millions of acres. Going deeper into the matter, however, it seems that this broad requirement is complicated by a number of conditions, not at first apparent even to the men who have been on the ground. The fundamental difficulty encountered throughout the world is that whenever an ample supply of cheap water is provided by storage the lands are over-irrigated quickly and a large part of them ruined by excessive application of water. In the United States this danger is being met by delivering water for irrigation on a measured basis; that is to say, by selling the water or charging the cost of delivery on the basis of so much per acre-foot. In this, the ordinary commercial rules are followed, as in the sale and delivery of coal or any other commodity. Through the *pocket nerve* it is thus possible to secure economy of water and save good land from destruction, even where every other argument fails.

In storing and diverting the water of the Nile there have arisen not only the evils of swamping the lands and of accumulating salts or "alkali" on the surfaces, but also the deprivation of much of the land of the rich red water renowned throughout all time for its fertilizing qualities. It is not enough merely to obtain water for the land; to secure the highest results the water must carry and leave on the fields the red mud which comes mainly from the Blue Nile and other tributaries rising in the mountains of Abyssinia. These floods of red water occur with marvelous regularity and have been the cause of the agricultural success in the Nile Valley for upward of 7000 years. The time of occurrence of the red water is relatively short; throughout the rest of the year the water, though valuable, does not bring with it the elements of fertility comparable with those of the red-water period.

It is obvious that this rich, red water cannot be held in storage but at the time of occurrence must be passed on directly to the fields and the distribution system so arranged that not only will ample water come to the fields but there must be provision for rapid escape of much of the water after it has deposited the red mud on the fields. This is a condition, emphasized by the present book, which has not been fully appreciated even by some of the

*Director, United States Reclamation Service, Washington, D. C.

administrative officers who have had responsible charge of the planning and operation of the works. They have either overlooked or minimized the value of this red water or have not provided ample capacity for bringing it to the fields or for carrying the water away after it has deposited its burden.

The problem of the most complete use of the Nile is further complicated by certain peculiar topographic conditions which are not usually appreciated. The problem is not a simple one of storing all the water possible in large reservoirs near the headwaters and letting it down when needed. The best reservoir sites do not occur where the water can be stored to best advantage. This is almost invariably the case in every country. In addition, is the peculiar topographic condition that down along the lower course of the river shortly before it branches at the delta, there is in the desert to the west of the river a series of deep depressions the bottoms of some of which are below sea level. In this respect the contour of the country is somewhat similar to that of the Salton Sea area in Imperial County, southern California, west of and above the delta of the Colorado River.

It is possible to divert the floods of the Nile, as in the case of the Colorado River, to these basins in the west. This is by no means a modern discovery. The conditions were not only known to the ancients but the early Egyptian engineers and rulers actually built works for diverting the high Nile floods into these basins, thus protecting the lower lands from inundation. These works were of such magnitude that it has long been a question as to whether the remains now existing were actually built by the hand of man. They rival the building of the pyramids and far surpass these in grasp of engineering laws and in value to the country.

The ancient rulers not only diverted the extraordinary floods for purposes of preventing inundation but by filling one of these basins to the level of high Nile were able to draw back into the lower river a certain amount of water when the floods subsided. In this respect they had certain advantages over the modern plans which contemplate using one of these basins for escape or relief to the extraordinary floods but which on account of the topography cannot return the water to the river at low stages as was formerly done. The basin which was then used and which could deliver back to the river some of the stored water, is now being cultivated to an extent that it is not practicable to utilize it again for water storage.

Passing from these larger engineering conceptions, the book deals with many important administrative problems, notably with reference to control of the use of water to prevent deterioration of the land. In this respect, the Egyptian government is autocratic and can and must enforce the regulations devised by its experienced advisors. It need not await the slow education of the great body of water users before adopting those practices which experience has shown are necessary for the general prosperity. The book emphasizes the well known saying that "the Egyptian question is the irrigation question; without irrigation there can be no Egyptian people; certainly no civilization in Egypt."

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Bulletins on the Results of Spirit Leveling in Kansas, Washington and Oregon, from 1896 to 1913, inclusive, have been published recently by the U. S. Geological Survey, Washington, D. C.

THE MUNICIPAL YEAR BOOK OF THE UNITED KINGDOM for 1914—Founder and Director, Robert Donald. Editor, Albert E. Cave. London: The Municipal Journal, Ltd., Sardinia House, Sardinia St., W. C. Cloth; 6x9 in.; pp. 1193. 15 Shillings, net.

A vast amount of information regarding the municipalities and municipal activities of England, Wales, Scotland and Ireland is given in this thick volume. Besides lists of council members, "chief officers" and a variety of descriptive, historical and general information under each place listed, there are given many facts and figures regarding water-works, gas works, electricity supply, tramways, refuse and sewage disposal, housing, town planning, baths and wash houses local taxation, financial transactions of municipalities for 1912-13, and other subjects. This plan is convenient when looking for information on a single topic, as water-supply, but it scatters the information for a given city all through the book. However, such a storehouse of municipal data is a boon, however arranged, and this volume is systematically arranged and well indexed. Services rendered by private companies are not even mentioned.

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The 1913 American Year Book

THE AMERICAN YEAR BOOK: A Record of Events and Progress, 1913—Edited by Francis G. Wickware, under Direction of a Supervising Board Representing National Learned Societies. New York and London: D. Appleton & Co. Cloth; 5x8 in.; pp. xx + 892. $3.

An incorporated Supervisory Board of 39 members, representing officially or unofficially 39 learned societies, has directed 128 contributors in the preparation of this, the fourth, issue of "The American Year Book." The large mass of information given is classified and subclassified under 35 departments.

The departments of most direct interest to the readers of this journal are: Municipal Government; Public Resources and Public Works; Public Services; the Mineral Industries; Trade, Transportation and Communication; Engineering, Mathematics and Astronomy; and Chemis- and Physics. In addition, history, government, foreign affairs, population and a variety of other large subjects are treated.

In such a reference annual as this, of course, the information given in any one department is not designed for specialists in that field, but rather for those in other fields and for laymen. From this viewpoint the 35 pages devoted to Engineering and the 8 pages given to Civil Engineering may perhaps be considered sufficient, at least in relation to the 860 pages which comprise the book. It should be noted, however, that many of the subtopics treated under Engineering appear in one to three or four departments—partly as additional information and partly as repetition.

Where space limitations compel such light touching on the high peaks as is noticeable in this volume the departmental repetition seems questionable. As an example of questionable repetition the proposed Hetch Hetchy or Tuolumne River water-supply for San Francisco may be cited. This has a short paragraph under Legislation (p. 27), nearly a page under Public Resources and Public Lands (p. 270), a paragraph under Public Services (p. 304), and another paragraph under Water-Supply (p. 581). Altogether, Hetch Hetchy gets considerably more than a page in these four places. Some of the information under Civil Engineering is both duplicated and seemingly contradicted under Public Services, in the references to the killing of the New York

water-filtration project, and a resume of water disinfection by chlorination appears under both Civil Engineering and Sanitary Chemistry, with somewhat misleading statements in each place. The blemishes cited are minor ones and might not deserve mention if they did not occur in duplicated matter.

The mystery surrounding the non-representation of the American Society of Civil Engineers on the Supervisory Board still remains unexplained. It is all the more noticeable when one finds four or five other national engineering societies and the American Institute of Architects represented.

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Tests of Bond between Concrete and Steel

TESTS OF BOND BETWEEN CONCRETE AND STEEL—By Duff A. Abrams. Bulletin 71, Engineering Experiment Station, University of Illinois, Urbana, Ill. Paper 6x9 in.; pp. 238; illustrated. $1.

The nature and extent of the bond between reinforcing and concrete in reinforced-concrete beams has been the subject of experimental investigation ever since reinforced concrete has come into very extensive use, and a number of series of such experiments have been reported in serial publications and in laboratory bulletins. The bulletin before us, however, is by far the most elaborate of any such publications we have seen, and the tests on which the bulletin is based seem to be more extensive than any hitherto made. The bulletin is by D. Abrams, Associate in Theoretical and Applied Mechanics of the Engineering Experiment Station at the University of Illinois, and the tests on which the bulletin was based were made in the Laboratory of Applied Mechanics of the University of Illinois between 1909 and 1912, under the direction of Prof. A. N. Talbot. The experiments were made on straight pull-out specimens and on beams of various design and dimension, with different types and sizes of reinforcement.

The report of the tests is very much too long to abstract here, and the results obtained are equally extensive. In fact, the author requires 101 paragraphs to summarize the results as analyzed by him. We give below, however, the various headings under which the investigations were made, so that the reader may get some idea of the extent of the investigation.

Under the pull-out tests the subheads are: The effect of variations in the dimensions of pull-out specimens, the effect of shape and section and condition of surface of bar, effect of condition of storage, bond tests with deformed bars, effect of age and mix, effect of anchoring ends of bars, and miscellaneous tests.

Under reinforced-concrete beam tests, each of the three years' tests are taken up separately, under such headings as bond with plain round bars, bond with deformed bars, comparison of bond resistance in beams and in pull-out tests, effect of vertical stirrups on bond resistance, effect of depth of concrete below the reinforcement, effect of span lengths, effect of length of overhang and ends of beams, theory of reinforcement, effect of repeated and sustained load on beams, slip of reinforcing bar at [illegible] [illegible] in beams, distribution of bond and tensile stress along the bar, relation of slip of bar to diagonal tension cracks, influence of slip of bar upon beam deflection, critical bond stresses, and working stresses for bonds.

Enough has been given, we are sure, to indicate to the reader how valuable a contribution to the theory of reinforced-concrete design Mr. Abrams and his associates have made.

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Coast Sand Dunes

COAST SAND DUNES, SAND SPITS AND SAND WASTES—By Gerald O. Case, Consulting Engineer for Coast Works. London: St. Bride's Press, Ltd. Cloth; 5x8 in.; pp. 162; 43 illustrations. 5 shillings, net.

A large part of the shores of the oceans and large lakes of the world, is lined with sand, which, under natural conditions, is a moving body, subject to the forces of wind and wave, and often a serious danger to inshore life and structures. In the older countries of the world considerable effort has been made to fix this sand and to prevent its movement in so far as possible. This has been done by the construction of groins extending out into the water and by the planting of various local trees and bushes on the foreshore itself. Some of this work has been done in the United States and in England, but most of it in Continental Europe.

So far as we know, there has been very little published in the English language which would help an engineer in preparing the design for such protective works. Mr. Case has, therefore, in the little book which is before us, filled a gap in English technical literature.

The book is exceedingly well written, and should be quite interesting to any engineer, even though he has not in prospect the construction of shore-protection work. It describes in some detail the nature of sand dunes and formations throughout the world, explains the movement and the forces behind the movement of the sand, and outlines somewhat extensively the damage which can be done by the sand movement. The latter part of the book is devoted to the various methods of protection which have been utilized in different specific cases. While quite a good deal of the book is devoted to the groin construction, far more is concerned with the planting of trees and bushes.

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THE PANAMA CANAL—By Frederic J. Haskin, author of "The American Government," etc. Garden City and New York: Doubleday, Page & Co. Cloth; 5x8 in.; pp. x + 386; illustrated. $1.35, net.

This is one of the many popular books on the Panama Canal which has appeared recently. The author is a well known newspaper correspondent and is able to write in a very entertaining manner. The book is based on facts taken from the official Panama Canal *Record* and illustrated by reproductions of official photographs, and therefore, so far as engineering data go, is accurate; indeed, the chapters on engineering features have Col. Goethals' endorsement.

It is a book intended for laymen and not for engineers, and is written in the breezy newspaper style of superlatives, with which all are familiar. It is unfortunate for the fame of other continents that the same public [illegible] [illegible] cannot be presented for great engineering projects [illegible].

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CHEMISTRY IN AMERICA: Chapters From the History of the Science in the United States—By Edgar F. Smith, [illegible] Professor of Chemistry, University of Pennsylvania. New York and London: D. Appleton & Co. Cloth; 5x8 in.; pp. viii + 356; illustrated. $[illegible], net.

Before the author became Provost of the University of Pennsylvania, he was in great demand for remarks on

the development of chemistry and for lectures in the classroom and out of it. Much more from the original sources of Prof. Smith's various addresses have been presented in this printed form than could be given in the limits of any set of lectures. He quotes some papers left by a few men of investigative nature in colonial days and outlines the activities of the Philadelphia Chemical Society (1792). Certain eminent pioneers are the subject of biographical sketches—informally and with regard to their works rather than their lives. Among these, memoirs of James Woodhouse, Thomas Cooper, John Maclean, Robert Hare and Benjamin Silliman, occupy considerable space and a score of others are crowded into smaller compass.

Thought and Method in Administration

Reviewed by Edwin R. Douglas*

BUSINESS ADMINISTRATION; Its Models in War, Statecraft and Science—By Edw. D. Jones. New York: The Engineering Magazine Co. [Works Management Library.] Cloth; 5x8 in.; pp. vii+275. $2, net.

The argument for this book is given in its first chapter. Considering briefly the industrial history of the United States during the times of the pioneers and of the development of mechanism, the author passes to the present beginning of the age of administration. Regarding this he comments substantially as follows:

The executives who first took advantage of conditions were self-made men, captains of industry. Their era has been marked by a lack of clear distinction between the process of amassing a fortune and the requirements of administration.

There is now being introduced into industry the judgment of the action itself, regardless of the personal reward which may have been received. "Scientific Management," which took its rise as a philosophy of the shop, has culminated in a group of principles constituting an earnest of a forthcoming science of administration. There is being created a central strategic position to be occupied by the professional administrator.

A new and larger conception of industrial leadership is called for. Society is no longer satisfied to trust, for its administrators, to processes of "learning through experience." What is wanted is a body of principles of industrial action.

The remainder of the book is devoted to a study of those general principles of administration revealed in military and political history, science and diplomacy. The records are full of achievements in these fields and to them we are confined, for the Captains of Industry have been too much occupied to formulate and record the principles by which they acted.

Under the headings, "The Administrator as General—as Scientist—as Diplomat," these three branches of human effort are studied in turn, historically and analytically. The principles discovered are, by analogy, applied to business administration. As stated, they range from Decision, Initiative, Preliminary Planning, through Economy of Means, Openmindedness, Fertility of New Viewpoint, to Courtesy, Compromise, Just Proportion; about two dozen altogether.

Opinions may differ as to a list like this, particularly as a statement of principles; there will be little question as to the unity of the underlying principles in all forms of administrative effort. A chief merit of the book is in bringing this fact prominently to the mind, and in emphasizing the importance, to the coming Business Administrator, to his business, and to society, which he will serve, of a broad foundation in generalship, scientific method and diplomacy. The book is an exposition of Thought and Method in administration.

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REGULATION OF PUBLIC SERVICE COMPANIES IN GREAT BRITAIN, With Supplemental Chapters on the Boston Sliding Scale and Toronto Auction Sale and Maximum Dividend Plans—By Robert H. Whitten, Librarian-Statistician, Public Service Commission for the First District, State of New York (154 Nassau St., New York City). [Reprint of Appendix G, Annual Report of the Commission for 1913.] Paper; 6x9 in.; pp. 231.

Mr. Whitten recently completed for the National Civic Federation a six-months' study of the regulation exercised in Great Britain over public utilities. The material gathered forms the basis of a lengthy dissertation, a readable "story" virtually, which the Public Service Commission for the First District of New York (with which Mr. Whitten was connected) has printed as an appendix to its 1913 report.

While the report is a study of regulation as a whole—as affecting organization, rights, capitalization, vested interests, voting powers, operation, accounting, dividends, etc.—the greatest interest centers on some aspects of British regulation greatly at variance with our own practice—lack of general regulatory acts and the number of special bills, sale of new stock by auction and tender, retrogressive scales of voting power, outside audits, dividing scales to govern rates and dividends. A large part of the volume is taken up with the last topic. British acts embodying it are reprinted and such information as is available on the practical operation. With this is also a review of the arguments on both sides of the water as to the proportion of division of excess profits.

MODERN CITIES; Progress of the Awakening for Their Betterment Here and in Europe—By Horatio M. Pollock and William S. Morgan. New York and London: Funk & Wagnalls Co. Cloth, 5x8 in.; pp. x+418; illustrated. $1.50, net.

The authors have brought together in a series of chapters on such topics as city planning, city streets, art in cities, parks, harbors, government and education a considerable amount of readable information relating to what they term "social progress and civic betterment" and "the best modern features and ideals of American life." Frequent reference to conditions and achievements in foreign cities are based largely on an extensive European tour made in 1910. The book contains some useful facts and statistics but these appear to have been chosen to enforce the argument for municipal betterment rather than to be of direct practical use in bringing it about—which is not a fault in a book which is primarily inspirational in character.

A report on the "Fourth General Adjustment of the Precise Level Net in the United States and the Resulting Standard Elevations," by William Bowie, Inspector of Geodetic Work and Chief of the Computing Division, and H. G. Avers, Computer, U. S. Coast and Geodetic Survey, has just been issued. This is the authority on precise spirit leveling and should be included in the library of every engineer interested in this branch of engineering. Besides a description of the instruments, methods of fieldwork, computation, etc., the report contains

a revised list of precise-level benchmarks, with their descriptions and adjusted elevations, all through the United States. The advantages of tying local survey nets into the national precise-level net is not fully appreciated by many engineers and surveyors; yet it is the only way in which a city datum may be settled once and for all.

A Public-Health Compendium

PREVENTIVE MEDICINE AND HYGIENE—By Milton J. Rosenau, Professor of Preventive Medicine and Hygiene, Harvard University; formerly Director of the Hygienic Laboratory, U. S. Public Health Service. New York and London: D. Appleton & Co. Cloth; 6x9 in.; pp. xxviii + 1074; 177 text illustrations. $6.

The modern spirit of health-protective work is reflected in both the title of this admirable book and in the order of presentation of its two grand divisions. That is to say, the author first takes up the prevention of specific diseases, particularly those which are communicable. This done he considers environment in relation to health and disease. The author presents his vast mass of information in the illuminating and discriminating light of long and varied experience in the Federal health service, both field and laboratory, and in the university classroom. The facts so compiled and presented, the author states, "have been collected for the convenience of the student of medicine and the physician, as well as those engaged in sanitary engineering or public-health work."

That the task which the author set for himself was a large one, demanding unflagging industry and keen judgment through many months is evident from the program just outlined and still more evident from the book itself. The latter part of the foregoing statement will be better appreciated after giving a brief summary of the contents of the volume.

First of all, the various communicable diseases are considered separately, grouped according to modes of transference from person to person, as by alvine discharges, nose and mouth discharges and insects. Besides modes of transmission, resistance, immunity, prevention and general considerations are all taken up for the more important diseases.

Following the section on communicable diseases, which fills 396 pages, 121 pages are devoted to immunity, heredity and eugenics; 111 to foods, including milk and its sanitary control; 48 to air, which embraces sewer air and ventilation and heating; 27 pages to soil and its relation to disease; 117 to water, including conservation, sources, analysis, purification and relation to disease; 26 to a rational treatment of sewage disposal and 4 to refuse disposal, both by Prof. Geo. C. Whipple; 35 to the very important subject of vital statistics, by Dr. Cressy L. Wilbur; 78 to industrial hygiene and diseases of occupation; [illegible] to schools; and, finally, the book closes fittingly with [illegible] pages on [illegible].

The very fact that Dr. Rosenau's book is the most recent comprehensive survey of the whole field of public health goes far toward placing it ahead of anything else on the subject in the English language. Add to this that the plan of the book is better suited than the older ones to the needs of the day, and that the plan has been well executed, and the leading position of the book is assured.

Although the statements in the foregoing paragraph are made unqualifiedly—in fact, with pleasure—we cannot refrain from suggesting that a smaller book might be more serviceable and that this and other huge treatises on public health might be made shorter by one or both of two methods: (1) By not repeating so much already in print in a score or several score books, and (2) by not trying to make one and the same volume serve the physician and the engineer. We are well aware that the classroom lecturer and the textbook writer must repeat many oft-told tales and that there is a considerable demand for what may be termed the single encyclopedic volume. If the engineer and doctor, in embryo or in practice, are to be served by a single book, would it not be better to treat each branch of the subject with relative brevity, dealing chiefly with principles and referring to existing works for most of the detail?

As an illustration of the briefer treatment, Prof. Whipple's four pages on refuse disposal may be cited. In those pages he tells all that most doctors need to be told on this subject and enough to serve many engineering students. The engineer who wants much more information might better go to some of the books cited at the end of the chapter—although the most recent book is omitted; an unfortunate omission, because it is a British book and the British lead the world in refuse destructors.

Another pertinent question is whether in this or any other book of as wide a range, collaboration should not be practised to a larger extent than was done in the present case, thus lessening the time required to prepare the book and making it more uptodate when published, besides lessening the volume of matter that is sheer compilation and giving more from the pens of specialists in the subjects treated.

Such questions as we have raised are not designed to belittle the value of Dr. Rosenau's monumental work. If he set himself a higher task than some may think to have been necessary, no one can deny that he planned and executed it most admirably and that he deserves high credit both for the magnitude and character of his accomplishment.

HEAT—Prepared in the Extension Division of the University of Wisconsin by E. M. Shealy, Assistant Professor of Steam Engineering, University of Wisconsin. (Engineering Education Series.) New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. vi + 262; 119 text illustrations. $2, net.

In connection with the extension teaching of the University of Wisconsin, a series of elementary texts of unique merit is being built up, and this addition to the list maintains the degree of excellence attained by earlier volumes. Prof. Shealy has given here an exposition of heat phenomena and their common application, for men in mechanical pursuits but of limited education in physics particularly. Such a treatise should also be of service to a great many engineers who years ago have forgotten the details of the physics of energy reactions, on account of their mental preoccupation in construction.

The first part covers temperature effects and measurements. A following chapter distinguishes between force and work and describes an elementary steam engine. Then energy and power are differentiated. From here on, heat phenomena are directly involved—generation, transference, development of pressure in gases, effect of compression and expansion, properties of vapors. This completes what might be called Part One, though there is no such formal division. From here on, machinery and commercial processes are described. The steam engine is described in further detail; air compressors and explosion engines are briefly passed over. Chapters on modern refrigeration and house heating close the work.

British Utility Management

THE MANAGEMENT OF PUBLIC ELECTRIC SUPPLY UNDERTAKINGS—By A. Hugh Seabrook, General Manager, St. Marylebone Electric Supply; formerly Engineer and Manager, and subsequently Consulting Engineer, West Ham Electric Supply. London: "The Electrical Times," Ltd. Cloth; 6x10 in.; pp. 192. 7½ shillings, net.

Mr. Seabrook is a British utility engineer and his dissertations in this volume were intended for British managers, who labor under conditions quite different from our own. But what is said of English utilities as they are and as they might better be, is, nevertheless, of interest to American managers. Moreover, not all conditions are so unique in the British Isles that we cannot profitably study the utilities there.

The book is based on lectures to technical students but it is of greatest interest to men active in the industry. The earlier parts of the book are very general—Chapter I pleads for better public relations and Chapters II and III discuss the burning questions of industrial employment. After about a fifth of the book is passed through for such matters, the writer confines himself more to the electricity-supply field.

First, the advantages of electric service are pointed out alluringly "to emphasize the importance of good and efficient management." The author argues that the best service comes from private companies under municipal regulation.

The organization of an undertaking with a plant of about 20,000 kw. capacity is described—embodying the author's ideas of a general manager and chief engineer (one person) under a "board of management" and over a secretary-accountant, generating engineer, mains engineer and sales manager, each with a complete staff. Yet in discussing organization, the author seems to admit that these four colleague deputies must be a wholly sympathetic quartette filled with the spirit of coöperation or else the big boss of all must never fall ill or go away. The scheme will be criticized on both sides of the pond by those who have achieved success with say two deputies and an automatic succession down the line to the mantle of authority in the absence or illness of those higher up.

The main office for this undertaking is described in detail—if this were more than a dream, employment with this concern would be most alluring. It is on the main street; there are revolving doors and a "smartly uniformed commissionaire" selected for marvelous politeness and intelligence. There is a "spacious waiting room comfortably but not luxuriously furnished"; a few daily newspapers and reference books are to be seen there, and, in the background, catalogs and advertising literature. There are consultation rooms and show rooms—and everything worked by electricity. All this for the 20,000-kw. concern!

The ideal General Manager is described as a man of most wonderful make-up—naturally humane, patient, tactful, polite, forceful, inspiring, fair, receptive, well educated, quick of perception and decision and, last but not least, thoroughly trained in engineering and versed in law and finance. We are warned that unless the man is both a commercialist and an engineer he will fail. We wonder what salary would attract such an intellectual giant to the 20,000-kw. company.

Some 40% of the volume following, sets forth in much detail the organization and working of the four deputies' departments. Here is a fine place for some of our organization and efficiency experts to seek work if British plants really are run this way; for instance weekly statements of detailed costs (of dubious utility) are compiled and there is a monthly analysis of connections and disconnections even down to every fan, cooker and curling iron. There are some technical matters of peculiarity, like the preference for "drawn in" underground mains (even though there may be frequent customer connections), single-conductor in place of concentric-conductor cables, and elevated connection posts wherever possible. Yet most of the discussions awaken an approving response.

The last forty pages are devoted to rates (or, as our cousins more properly call them, "tariffs"). No one will dispute the author's proposition that the object of a tariff system is (1) to secure an income to cover operating and fixed charges and profit; (2) to encourage increased use of electricity for all purposes and by all persons; (3) to avoid discriminations. There is one stated prime object, however, which may or may not be accepted, depending on its interpretation—this is the securing of a "proportional amount of profit from each class of consumer" (though not from each ultimate customer). The author's basis for his tariffs is not cost plus reasonable profit or fair return on fair value but is instead "the value of the service to the consumer which is settled by the price of competitors" (meaning gas or oil, etc.). Fundamentally then the author cannot be in harmony with American rates. This conflict does not extend to the superstructure of rates, as when it is stated: (1) "in calculating charges for a class of new business it is permissible to ignore much of the existing expenditure" with benefit to the original customers due to general decrease in cost of production with the great volume of new business and use of more modern machinery; (2) "it is not necessary that each section of the business should contribute the whole of its share of fixed charges."

The author has a high opinion of the two-part scheme of charging (*a*—a service charge per kilowatt of maximum demand; *b*—an energy charge per kilowatt-hour used) and he has an unique contempt for a single-part scheme. This distrust will not be shared in this country where, by classification of customers and experience with various maximum demands, it has been possible to draw up very simple rate schedules apparently on a one-part scheme but really securing the fair allocation of costs upon a two- or three-part basis.

The author's scrutiny of rate situations has not reached its ultimate stage since he seems to hold that any other utility, like water-supply, must, for equity, make use of a "readiness-to-serve" charge by which fixed charges are distributed according to participation in peak of demand. He neglects the effect of easy storage for such utilities, like water-works, as handle a product and have their investment fixed by total quantity supplied rather than by maximum demand.

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A comparison of the union scale of wages and hours of labor prevailing in various cities on May 15, 1912 and 1913, is given in "Wages and Hours of Labor Series," No. 7, recently issued by the U. S. Bureau of Labor Statistics, Washington, D. C. The figures are given not only by trades, but also by classes of workmen under each trade.

ENGINEERING MANUAL OF THE AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION, Covering Its Standards, Recommendations and Miscellaneous Methods and Practices. New York City: Office of the Secretary, [illegible] Loose-leaf form, [illegible] cloth [illegible]

This manual of the American Electric Railway Association is a compilation of [illegible] standards and recommendations regarding materials and methods. [illegible] the whole electric railway field is covered—buildings and structures, power-distribution lines, poles, rolling stock, signals, track and way, etc. There are 82 sections with [illegible] illustrations; "standards" are on [illegible] paper and "recommended practices" are on white. A loose-leaf binding has been used in hope that members may keep the manual up to date.

REINFORCED CONCRETE RAILWAY STRUCTURES—By J. D. W. Ball, Assoc. M. Inst. C. E. New York: D. Van Nostrand Co. [The Glasgow Text Books. Edited by G. [illegible]] Cloth, 6x9 in.; pp. xiv + [illegible], 127 illustrations. [illegible] net.

This is a British book on which has been placed an American title page. The subject matter is purely British, and applies only in a limited extent to American practice. The author has simplified the formulas for the design of reinforced-concrete members considerably, which is a refreshing novelty in books on reinforced concrete. He evidently recognizes that the peculiarities of construction are so great that extreme refinements in design are not desirable.

Following the usual theoretical chapters, the discussions are on floors, buildings, foundations, retaining-walls, bridges, arch bridges, sleepers (i.e., ties), and fence posts. The chapter on ties is very complete, more nearly so than in any American book.

NEW PUBLICATIONS

(So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by enclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.)

ACOUSTICS OF AUDITORIUMS—By F. R. Watson. Urbana, Ill.: Engineering Experiment Station, University of Illinois. Bulletin [illegible] Paper, 6x9 in.; pp. [illegible], illustrated. [illegible]

AUSTRALIAN COMMONWEALTH STATISTICS—Issued by [illegible] Knibbs, Commonwealth Statistician. Melbourne, Australia. [illegible] Paper, [illegible]
Transport and Communication, 1903 to 1912. Pp. [illegible] [illegible] 1901 to 1913. Pp. [illegible]

[illegible]—[illegible]

[illegible] PRACTICE IN THE UNITED STATES—[illegible] Washington, D. C.: Bureau of Mines. [illegible] Paper, [illegible]; pp. [illegible], illustrated.

[illegible] REAGENTS: Their Purity and Tests [illegible] [illegible] Henry [illegible] New York: D. Van Nostrand Co. [illegible] $1 net.

[illegible]

THE CITY MANAGER PLAN OF MUNICIPAL GOVERNMENT—[illegible] "The American City" [illegible] New York [illegible] Paper, [illegible]

[illegible]—By T. L. Walker, Professor of Mineralogy and Petrography, University of Toronto. New York and London: McGraw-Hill Book Co., Inc. Cloth, 6x9 in.; pp. xiv + [illegible], 133 illustrations. $2, net.

DESIGN AND CONSTRUCTION IN WOOD—By William Noyes, Assistant Professor of Industrial Arts, Teachers College, Columbia University. Peoria, Ill.: The Manual Arts Press. Cloth, 6x9 in.; pp. 1[illegible], [illegible] illustrations. $1.[illegible]

Designed to teach boys something about common woods, and particularly how to use carpenters' tools by giving illustrated directions for making a variety of simple objects. Although useful for self-instruction, the book would be of most service under some guidance by an instructor.

FIELD MANUAL FOR PLANE SURVEYING AND RAILROAD CURVES—By R. C. Yeoman, Dean of Engineering, Professor of Civil Engineering, Valparaiso University, City Engineer of Valparaiso, and E. A. Tucker, Instructor in Surveying, Assistant in Civil Engineering, Valparaiso University, Valparaiso. Valparaiso, Ind.: M. E. Bogarte Book Co. Cloth, [illegible] in. [illegible]

FUEL ECONOMY AND CO_2 RECORDERS: A Practical Manual Dealing Chiefly with the Heat Losses in Boilers and the Principle, Operation and Care of CO_2 Recorders—By A. R. Maujer and Charles H. Bromley, of the Editorial Staff of "Power." [Engineers' Study Course from "Power."] Cloth, 6x9 in.; pp. x + 1[illegible], 2[illegible] illustrations. $1.50, net.

A GLOSSARY OF ROAD TERMS—By H. Percy Boulnois, M. Inst. C. E., Borough Engineer of Portsmouth, City Engineer of Liverpool, Deputy Chief Engineering Inspector of the Local Government Board. London: St. Bride's Press, Ltd. Cloth, [illegible] in.; pp. 71. [illegible] shillings, net.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS—Proceedings of 29th Annual Meeting, Peoria, Ill., Jan. 28-30, 1914. Wheaton, Ill.: E. E. R. Tratman, Secretary. Paper, 6x9 in.; pp. 1[illegible], illustrated. [illegible]

INVESTIGATIONS ON DRAIN TILE—Report of the Investigations of Committee C-6 on Standard Tests and Specifications for Drain Tile, of the American Society for Testing Materials. Published by authorization of the Society as Bulletin 36, Engineering Experiment Station, Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa. Paper, 6x9 in.; pp. 11[illegible], illustrated.

MADRAS PRESIDENCY PUBLIC WORKS DEPARTMENT—Administration Report for 1912-1913. Part II, Irrigation. Madras, India: The Department. Cardboard, [illegible]x13 in.; pp. 271, illustrated.

MAIN DRAINAGE AND SEWAGE DISPOSAL WORKS PROPOSED FOR NEW YORK CITY—Report of the Metropolitan Sewerage Commission of New York, 17 Battery Place, New York City, April 30, 1914. Cloth, 9x12 in.; pp. 762, illustrated.

MATHEMATICS FOR THE PRACTICAL ENGINEER: A Mathematical Manual for the Power Plant Engineer. Contains Simplified Lessons for Home-Study in Fractions, Ratio and Proportion, Percentage, Involution and Evolution, Square Root, Cube Root, Formulas, Logarithms, Mensuration and Plane Trigonometry—By Charles H. Bromley and Henry R. Cobleigh, of the Editorial Staff of "Power." [Engineers' Study Course from "Power."] New York and London: McGraw-Hill Book Co., Inc. Cloth, 6x9 in.; pp. x + 2[illegible], [illegible] text figures. $[illegible] net.

MECHANICAL MOVEMENTS, POWERS AND DEVICES: A Treatise Describing Mechanical Movements and Operative Machinery and the Mechanical Arts, Being Practically a Mechanical Dictionary, Commencing with a Rudimentary Description of the Early Known Mechanical Powers and Defining the Various Motions, Appliances and Inventions Used in the Mechanical Arts to the Present Time, Including a Chapter on Straight Line Movements—By Gardner D. Hiscox, Author of "Gas, Gasoline and Oil Engines," "Compressed Air," etc. 14th Edition, enlarged. New York: The Norman W. Henley Publishing Co. Cloth, 6x9 in.; pp. 409, 16[illegible] text illustrations. $[illegible]

NEW JERSEY BOARD OF PUBLIC UTILITY COMMISSIONERS (Trenton, N. J.)—Abstracts of Reports Made by Public Utilities for the Year 191[illegible]. Cloth, 6x9 in.; pp. 3[illegible]

NEW JERSEY STATE BOARD OF HEALTH (Trenton, N. J.)—[illegible] Annual Report, and Report of the Bureau of Vital Statistics. Cardboard, 6x9 in.; pp. [illegible], illustrated.

PRACTICAL SANITATION: A Handbook for Health Officers and Practitioners of Medicine—By Fletcher Gardner, Captain Medical Corps, Indiana National Guard, First Lieutenant Medical Reserve Corps, United States Army, Health Commissioner of Monroe Co., Ind., and James [illegible] Simonds, Professor of Preventive Medicine and Bacteriology, Medical Department, University of Texas, lately Superintendent Indiana State Laboratory of Hygiene. St. Louis, Mo.: C. V. Mosby Company. Cloth, 6x9 in.; pp. [illegible], [illegible] illustrations. $[illegible]

THE ROYAL NAVY: Its Influence in English History and in the Growth of Empire—By John Leyland. New York: G. P. Putnam's Sons. Cambridge, England: University Press. Cloth, [illegible] in.; pp. [illegible], net.

SANITARY PLUMBING [illegible] Clarksburg, W. Va.—Copies sent free on application to [illegible] Highland, Secretary and General Superintendent, Water-Works and Sewerage Board, Clarksburg, W. Va. Paper, 6x9 in.; pp. [illegible], illustrated.

Besides giving what appears to be a carefully prepared plumbing code, this [illegible] contains a brief description and a number of illustrations of the Clarksburg sewer and water purification plants, some useful information for water users and some local [illegible] matter.

SHOP LIGHTING: A Handbook for Superintendents and Contractors. Madison, Wis.: Industrial Commission of Wisconsin. [illegible] J. Watrous. Paper, 6x9 in.; pp. [illegible], illustrated.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1911. Part III, Ohio River Basin—By A. H. Horton, W. E. Hall and H. J. Jackson. Washington, D. C.: U. S. Geological Survey. Water-Supply Paper [illegible]. Paper, 6x9 in.; pp. 11[illegible], illustrated.

Engineering News

VOLUME 72 JULY 23, 1914 NUMBER 4

Large Masonry Arches on a Swiss Mountain Railway

By J. C. Van Langendonck*

In Engineering News, Dec. 25, 1913, p. 1294, there appeared a brief article describing the Swiss railway now under construction from Chur to Arosa and illustrating two of the large concrete arches now under construction. The accompanying cuts show some further views of these handsome bridges and illustrate particularly well the types of falsework used in continental practice.

The meter-gage Chur-Arosa adhesion railway is a branch of the Swiss Federal Railway System. The line, which will be opened for the summer season of 1915, has a length of about 10 mi. It starts at Chur (altitude 1913 ft.), the capital of the Grison Canton, and follows the carriage road along the River Plessur, as far as Sassal, and then ascends along the right side or sunny aspect of the Schanfigg Valley as far as Langwies, where it crosses over the left side of the valley and reaches the terminal station Arosa at an altitude of 5729 ft.

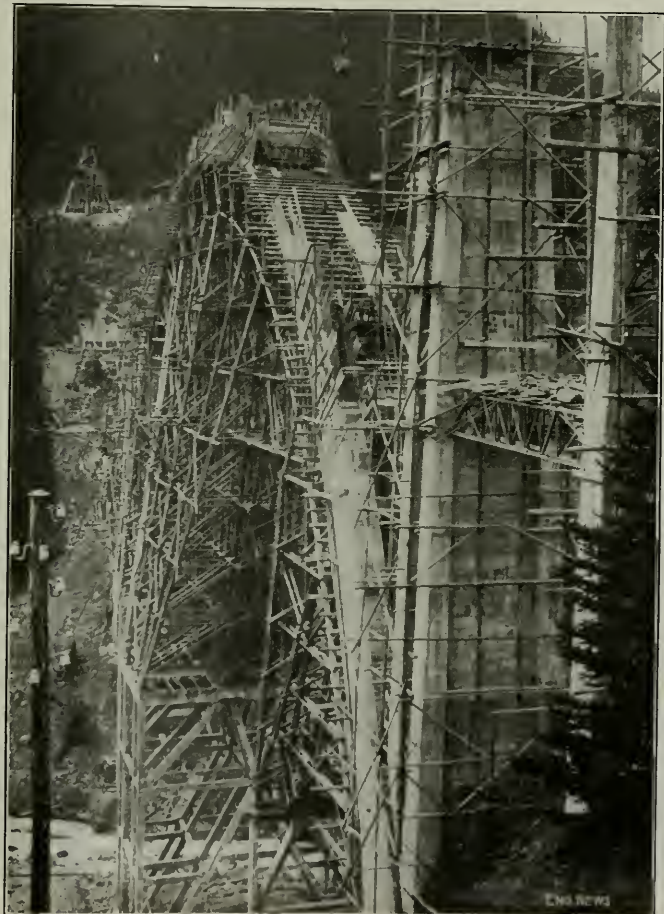

Fig. 1. Centering in Place under the Langwies Arch, Chur-Arosa Ry., Switzerland

The lower portion of the Schanfigg Valley is a wild ravine, and in the upper portion its right slope is furrowed by many deep gorges as far as Langwies, but thence to Arosa fewer constructional difficulties were met. Although the River Plessur is only crossed once—at Langwies—yet there are between Chur and Arosa 27 bridges of stone, three of iron, and two of concrete, as well as 19 tunnels with a total length of 7800 ft.

In the construction of the tunnels, the geological anticipations proved to be correct in every instance, with the exception of the 960-ft. Arosa tunnel, in which clayey moraine-stone and weathered serpentine were met with instead of the gneiss rock which was expected. These much-dreaded moraine formations proved in the wet summer of 1913 to be quite serviceable working ground on which safer foundations were obtainable than, for example, could be got on the detritus declivity below the village of Maladers.

The view on this page shows the famous Langwies Viaduct under construction. As described in Engineering News, Mar. 19, 1914, p. 608, the main arch of this bridge (the second longest masonry arch in the world) has a clear span of 315 ft., and a rise of 140 ft. The viaduct itself is 960

*50 Chaussée de Tervueren, Etterbeek-Brussels, Belgium.

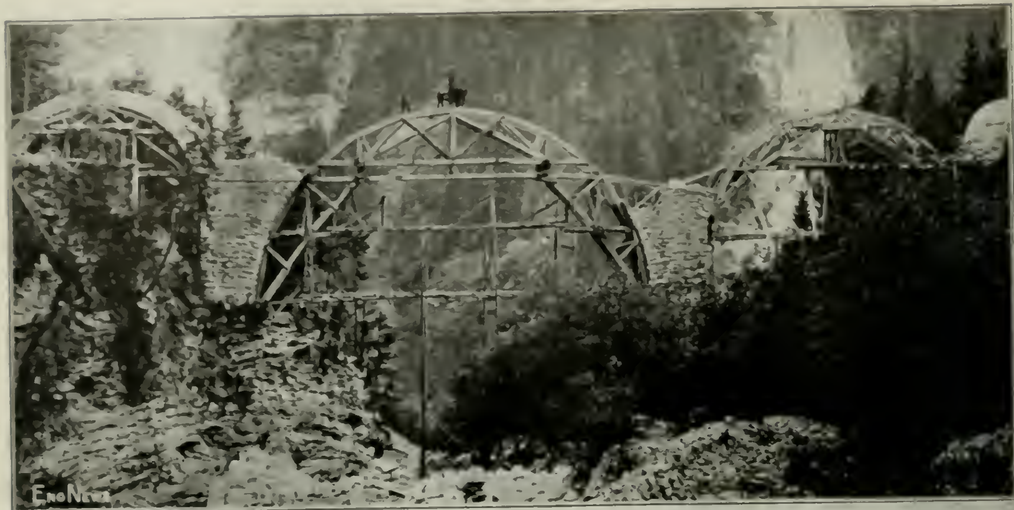

Fig. 2. The Calfreisen Viaduct under Construction, Chur-Arosa Ry., Switzerland
Fig. 3. Building the Castiel Viaduct, Chur-Arosa Ry., Switzerland

ft. long and has a grade elevation of 207 ft. above the valley. The view gives an idea of the very careful construction of the centering for the principal arch, which after laying the green concrete, scarcely showed 0.4 in. deflection.

Another imposing engineering construction on the line is the Calfreisen Viaduct, the centering and piers for which are shown in Fig. 2. Here the two central arches, which have respectively a span of 92 ft. and 60 ft., are built of concrete blocks, while the four lateral arches (40 and

20 ft.) are of tamped concrete. The piers of the principal arch rest on rock, and on account of the scarcity of building stone have a core of tamped concrete cased with quarry stone. In Fig. 3 is illustrated the most imposing stone bridge of the line; it has three arches of 84-ft. span each. The main pier of this Castiel Viaduct has a height of 180 ft. and starts in the middle of the valley.

Superiority of the V-Shaped Flume in Logging*

Of the two types of logging flumes in general use in the United States, the V-shaped has proved more satisfactory, both from cost to construct and efficiency of operation. The square or rectangular flume is the older, and is still used extensively where economy of water is a secondary consideration. Furthermore, owing to its construction, there is a greater chance for leakage in the square type.

It stands to reason that the flume requiring the least amount of material for construction, the least amount of repairs, and in which logs are least liable to jam, is the best flume for general use. Up to the present time, this description fits the V-shaped flume; but it is not unlikely that the portable metal flume already in use on hydroelectric and irrigation projects will eventually supersede the timber flume.

Design and Construction of the V-Shaped Flume

Degree of Angle—Angles of from 70 to 110° have been tried; but the consensus of opinion favors 90°. Future data and references in this article relate to straight right-angle flumes.

Flume or "Boxes"—Construction methods are dependent upon the kind of material to be handled. The sections of the flume or the "boxes" vary in length from 6 to 20 ft. Sometimes only one thickness of board is used, but more often two thicknesses are employed, with joints broken or staggered. The details of the box construction is largely a matter of individual opinion. The aim almost always is to keep down leakage.

A triangular section of wood sawed to fit snugly into the bottom of the V on the inside is sometimes employed for purposes of reducing the amount of water necessary and strengthening the flume itself. The value of this measure is, however, disputed on the ground of too great cost.

Size of Flume—Material to be handled is a prime factor in determining size. For railway crossties, cants, poles, cordwood, etc., a 30-in. (inside width of one side on slant) flume is usually satisfactory wherever there is sufficient water to fill the flume two-thirds full. For the handling of long timbers or "brailed" (clamped) sawed lumber, the size of the V should be from 40 to 60 in., according to the volume of water available and the size of the material to be handled.

Grade—The grade of a flume is a matter to be carefully considered from the standpoint of subsequent operation. An abrupt descent results in rapid wear of the lining, with consequent increase in the maintenance cost and a tendency toward jamming. In the other direction, 1% is held to be the smallest grade for successful operation; 2 to 5% is better. Flumes have been operated for short distances on a 30% grade, but this is undesirable. The most satisfactory is 2 to 10%, and wherever possible below 15%.

Maintaining a steady or even grade necessitates the use of more or less trestling. In order to know just what length of timber should be cut for the bents, it is necessary that a careful survey should have been made. This matter of a careful survey is of importance in more ways than one.

Curves—For obvious reasons a sharp curve is inadvisable. It throws the weight of the material and water to the outside of the curve, with a tendency toward jamming. The degree of curvature should be kept as low as practicable and should rarely be permitted to exceed 20°. Shorter "boxes" and the closer spacing of supporting bents are very necessary in sharp curves.

Cost of Construction—The cost of constructing flumes is, of course, a variable. Rough lumber suitable for construction can ordinarily be cut and fitted at from $7.50 to $10 per M. The cost of construction of the Bear Cañon flume in Montana, a 26-in. V, 10 mi. long, was approximately $2000 per mi. Lumber cost $8.50 per M. to manufacture and fit and about 100,00 ft. b.m. were required per mile. Labor cost $800 per mi., and $350 per mi. was expended for surveying, nails, steel, etc. This flume, however, was constructed a number of years ago, when the cost of material and labor was less than at the present time.

Probably one of the best examples of modern V-shaped log-flume construction is a flume recently constructed on Rochat Creek, near St. Joe, Idaho. This flume, which is unusually large, and strongly constructed for handling large, heavy logs and long timbers, is said to have cost approximately $8000 per mi. for the 5 mi. of its length. This figure includes the cost of constructing a wagon road and of a telephone-line equipment, which latter is a valuable adjunct to flume operation.

*From Bulletin No. 87 of the United States Department of Agriculture; "Flumes and Fluming," by Eugene S. Bruce, expert lumberman. The article discusses the use of flumes in lumbering operations, and tells how to build them, with much valuable data as to the weight of water in different size flumes, velocity of water for different grades in different size flumes, and the amount of material required for their construction.

The Weathering of Coal in the Pittsburgh coal bed where it outcrops on a hillside near Bruceton, Penn., was carefully investigated by the U. S. Bureau of Mines, and the results publisched in a recent bulletin. The data are applicable as a basis for approximate estimates of the alteration of the same bed in other mines similarly situated. It was demonstrated that indications of weathering such as yellowish coatings of iron hydrate or a dull appearance of the surfaces, do not always signify a material change of the chemical composition or heating value of the coal itself. Chemical analyses show that changes in composition have occurred in the coal for a distance of 50 ft. from the outcrop, and that the composition and the heating value of the unweathered coal, computed on the moisture and ash free basis, are fairly constant. An extensive collection of analyses shows that there has been a considerable alteration of the coal substance in the first 40 ft. from the outcrop, decreasing inward. Between 40 and 75 ft., the alternation was slight, and beyond 75 ft. was not perceptible. The alteration manifests itself in a decrease of calorific value (16.3% at 5 ft., 6.6% at 20 ft.), and an increase of oxygen (amounting to 10% at 5 ft.), with a corresponding decrease of carbon and hydrogen. Beyond the zone of weathering (75 ft.), the variation in the largely adventitious constituents, moisture and ash, is not to be regarded as having a relation to the outcrop. The percentage of sulphur in the weathered part of the bed is less than half that of the fresh coal.

Because of the prevailing prejudice against coal having a rusty appearance, and the popular belief that its evaporative power is less than that of fresh looking coal from the same mine, a series of evaporative tests were run on two samples. The results were practically identical.

Building a Granite Shaft 300 Ft. High: The Perry Memorial

An interesting piece of high-class masonry construction is being carried out by contractors J. C. Robinson & Son at Put-in-Bay, Ohio. They are building there the Perry Memorial, a granite monument in the form of a Doric column 300 ft. high, which is to commemorate Commodore Perry's naval victory on Lake Erie in the War of 1812. Work was begun late in 1912, and will be completed this fall. At present the structure has progressed to a height of about 225 ft.

The shaft of the great column is 45 ft. in diameter at the base and 35½ ft. at the throat, just under a square cap 47½ ft. on a side. Its height from top of concrete base to top of cap is 300 ft., but an attic 17 ft. high and a huge bronze lantern 18 ft. high make the total height 335 ft. above base, or about 360 ft. above bottom of foundation. The taper of the shaft is not straight but has the classical entasis, the curve of the side swelling about 4 in. out from the chord. The Doric fluting is a striking feature of the shaft; there are twenty flutes,

FIG. 1. DESIGN FOR PERRY MEMORIAL MONUMENT
(From the architect's preliminary drawing.)

meeting in sharp arrises, from base to echinus just below the cap.

The exterior of the shaft is of Milford (Mass.) granite, backed with concrete to a circular well 27½ ft. in diameter extending the full height of the monument above a ground-floor rotunda. The wall thickness of the shaft thus ranges from a trifle less than 9 ft. to 4 ft., including the granite exterior (18 in. to 30 in.) and a 4-in. brick lining of the well. The lower story is a rotunda, about 77 ft. high, and a trifle less in diameter than the well above; it is roofed with a flat elliptical dome of Bedford (Ind.) limestone backed with concrete. The interior of the rotunda is lined with limestone in decorative panels. Two spiral stairways are formed in the wall around the rotunda, leading to a reinforced concrete floor a few feet above the domed ceiling.

From this floor, a central elevator hoistway 7 ft. square, and a reinforced-concrete staircase surrounding it, extend to the top of the monument. The reinforced-concrete flights are supported by four continuous concrete columns set in a square of about 13 ft., and resting on reinforced-concrete girders between floor and dome. The columns are octagonal, 16 in. on a side, reinforced with eight [illegible]-in. longitudinal rods. There are no floors above the foot of the elevator, the well being open all the way to the top.

An interesting structural feature is the square cap of the shaft which is a reinforced-concrete slab resting on top of the circular shaft. This cap slab has deep reinforced-concrete girders around its outer edge, which form the parapet of a walk way around the attic. The granite facing of the shaft continues along the under side of the cap and the outside of the parapet; the stones here are cut with heavy longitudinal dovetailed keys projecting from their back faces, which will bond into the concrete and so carry the stones. It will be necessary to set this stonework complete (on falsework) before casting the reinforced-concrete slab and girders. The overhang of the cap being about 10 ft. on the diagonals of the square, and the stones of the underside being radial, without transverse joints, large weights will have to be handled and substantial falsework provided for suspending the stonework until the concrete is in and has taken its set.

THE FOUNDATION

The monument is located on a narrow neck of land about midlength of Put-in-Bay Island, where the distance from water to water is less than 500 ft. This neck was a marsh, with rock 10 to 15 ft. below water. Fig. 2 suggests the nature of the site. Both the monument itself and the extensive concrete esplanade which later is to be built around it must be carried to rock foundation.

The monument foundation is ring-shaped. It was constructed between walls of sheet piling driven to rock—except when boulders stopped the sheeting, as the subsequent excavation disclosed. Inflow of water and soft ground, and the necessary removal of boulders, caused much trouble and delay, and the continuous high level of the lake in the spring of 1913 did not improve matters. When rock was finally reached and cleaned off and a little stepping done, the concrete placing was a simple matter, and the ring was soon built up to grade, about 10 ft. above ground. Toward the end of June, 1913, the base was ready for the shaft to be begun. Setting the first ring of stone was hurried, and the formal cornerstone-laying occurred on July 4. Fig. 2 shows the condition of the work a few days earlier.

BUILDING THE SHAFT

The granite facing is laid out in 3½ ft. courses (3 ft. 9 in. near the base). It is set two courses at a time, and the concrete backing for these is then placed before more stone is set. Flat anchor-straps hooked into holes in the beds of the stones tie them back into the concrete, though the grip of the concrete also binds them in efficiently.

Setting the stone is the main operation. The courses of stone are all different (on account of the batter) but have the same bond, as sketched in Fig. 3. By shifting the ring shown in Fig. 3 one flute either way, the bond of the next course is represented, but the next course is deeper, header and stretcher courses alternating. There are only three patterns of block per course, making up a width equal to two flutes, so that there are 30 stones per course. The cutting is all done at the quarry. Joints are cut true for a width of at least 4 in., back of which they recede.

In setting the stone, the sharp arrises between flutes must be plumbed perfectly, and the batter must be set true. For the latter, a cleat or block of proper thickness, nailed to the edge of the plumb-level near one end, enables the batter to be obtained by direct plumbing. The

cleat must be changed at each change of batter (usually every three courses).

Each stone is set with its face true to the stone below at the bed joint, and every two courses the diameter is checked up. Any variation from correct dimensions is noted, and made up in setting the next course.

As a stone is hoisted to place it is lowered onto its mortar bed by the derrick, set true and plumb, while the derrick still holds the strain, and then wedged in position by wooden wedges. After slacking off the derrick, mortar is packed into the back of the bed joint to fill, while the builds are just closed with mortar, leaving the further filling for the concrete.

The back of each stone is painted with R. I. W. to prevent staining. The granite (also of limestone facing in the rotunda) is laid in mortar of white Medusa portland, made near-by in Sandusky. The face joints will be pointed with the same mortar after completion of the masonry.

Concreting back of the facing is done against segmental inner forms. A central concrete hoist dumps its bucket automatically into a hopper bracketed to one side of the hoist tower near its top (several feet above the highest level of wall to be built with that setting of the tower), and from here the concrete is distributed to the wall forms by chutes. The forms are strutted to the tower (sometimes clear across to the opposite wall), and the bond straps of the granite stones are wired inward to the forms.

In a few cases, the pressure of the liquid concrete placed behind the granite pushed out a facing stone. These accidents prove that thorough tying is important.

The concreting is done in heights of but two courses for the reason that the third or header course would create a difficult pocket to fill solid. However, the matter of pressure of concrete would probably also be troublesome at depths greater than two courses or 7 ft.

Handling Material

The lower part of the shaft was set by a yard derrick close by. This is a derrick with 65-ft. wooden mast and 90-ft. steel three-section extension boom, which normally handles the stone in storage around the base of the shaft and serves the concrete mixer plant alongside. Above the reach of this derrick, all work was done from the inside.

The weights of single blocks in the lower section ran up to as much as 5 tons; generally in the shaft the weights were around 2 to 2½ tons, but in the cap some 4- to 4½-ton blocks will have to be handled.

Two stone-setting derricks are stepped at diagonally opposite corners of a timber tower which is built up in the center of the well, around the permanent elevator framing, and this framing is used as the equivalent of derrick masts. Within the elevator frame a self-dumping concrete hoist operates, to a height which may be as much as 70 ft. above the wall when extended for a fresh raise. Only the concrete is taken up in this hoist; stone is hoisted outside by the two stone-setting derricks.

The construction of the derrick tower is sketched in Fig. 9. The steps for the booms are bracketed just above a square ring of 4x14 timbers clamped around the elevator angles. This ring is carried by eight 12x12-in. raking struts set on jack-screws in notches cored in the concrete about 30 ft. below the boom steps. The struts are in the planes of the sides of the elevator frame.

The topping-lift block is hitched to a forged ring fastened to the corner of the elevator frame about 25 ft. above the boom step. Back of this ring are attached two 1-in. wire-rope guys extending about 60 ft. down to an anchorage in the concrete wall of the shaft. There are two guys at each corner of the tower, eight in all; the guys on each face of the tower are crossed, as shown in the sketch, so that in ground plan they are in planes nearly parallel to the diagonals of the tower. The mast stress of the derrick goes down the single 6x6x½-in. elevator angle. Timber strutting and bracing are clamped to the sides of the elevator frame above the boom seat to stiffen the mast angles and form a full-braced tower up to the level of the concrete hoist sheaves. Below the boom seats no bracing is used. There are no permanent diag-

Fig. 2. Setting Stones for First Ring, June, 1913

Fig. 3. Tower 90 Ft. in Height, January, 1914

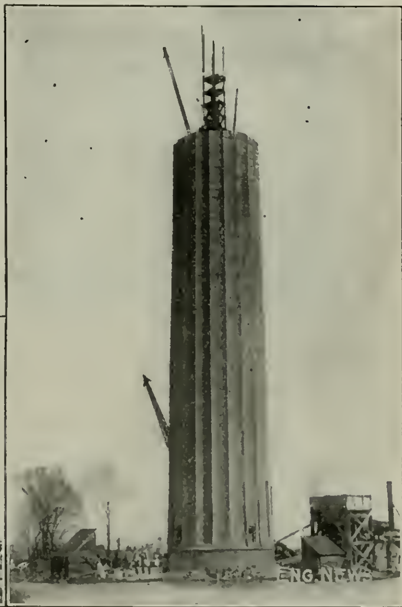

Fig. 4. Tower 185 Ft. High, April, 1914

Figs. 2-4. Three Stages of Progress on the Perry Memorial

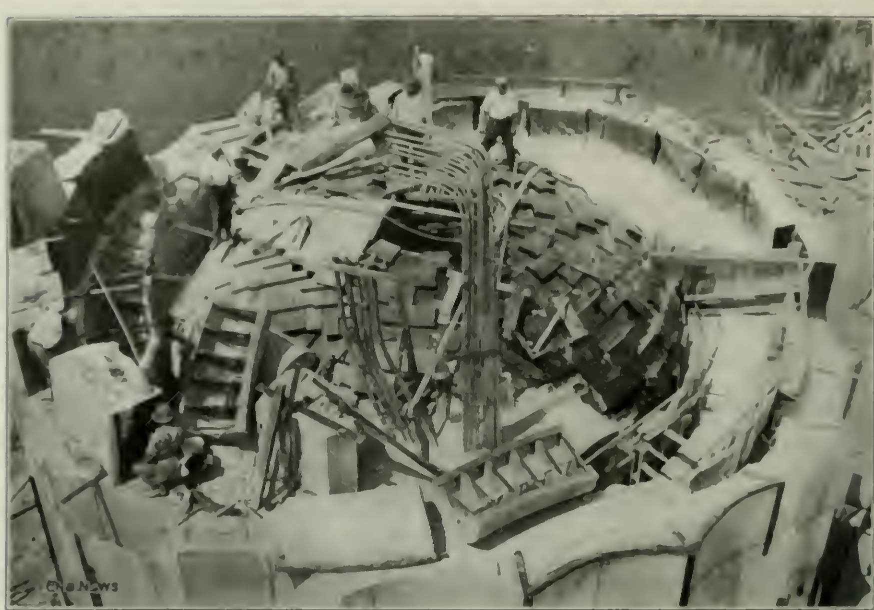

Fig. 5. Elliptical Vaulted Dome of Rotunda in Lower Story of Tower. View of Stone Vaulting before Concreting

onals in the elevator framing, the reinforced-concrete staircase being relied upon to hold it laterally.

In making a new setting of the derricks, the legs for the boom seats are set on top of the finished concrete wall, notches having been cored out here. Anchor stirrups of 1-in. square iron, concreted in two courses (7 ft.) lower down, give points of attachment for the mast guys which run up to the tower. This allows of setting and rigging the two booms complete. As the concrete hoist inside the elevator framing goes above the level of the mast-top, no horizontal diagonals can be put in to secure the square framing against distortion in a diagonal direction.

The load and boom lines are run down the boom to sheaves at the step, and continue down alongside the elevator angles to the floor above the rotunda. Here they

Fig. 6. Construction of Spiral Stairway

Fig. 7. Spiral Stairway after Removal of Forms
(Concrete has been [illegible] for [illegible] with glazed tile lining.)

are turned by two sheaves to pass down just inside the hoistway to the ground, and run out through holes in the foundation wall to the engine house.

One setting of the derricks is counted on for a raise of about 60 ft. of shaft wall. Fig. 9 sketches the extreme positions. With so great a raise, the upper courses of stone interfere with the boom in position for hoisting from the ground, and a gap must be left here, the remaining stones hoisted and set around temporarily inside, and then the gap closed with the boom topped in.

The concrete bins and mixer, alongside the shaft, are supplied by the yard derrick. Concrete is discharged by a chute into the basement of the shaft, whence it goes up by the concrete hoist.

Special Work in the Rotunda

The rotunda involved special work, on account of the limestone side facing, the two spiral stairways in the wall, the dome, and four deep reinforced-concrete girders over the dome which carry the staircase columns above.

The views Fig. 2 and 5 represent the wall construction of the rotunda and the dome work respectively. The

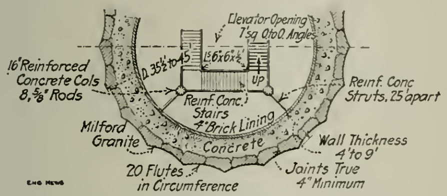

Fig. 8. Sketch of Part Cross-Section of Shaft of Perry Memorial

walls were concreted (in several stages) after setting both granite and limestone and building the forms for the spiral stairways between. The thin stonework of the dome was laid on centering and keyed up, and then backed with concrete; the view indicates the header and stretcher arrangement of the blocks.

Work Inside the Shaft

The brick lining of the shaft, kept far below the wall work, is laid from a ringshaped safety scaffold hung from cross-timbers above. A little lime is mixed with the portland cement in the mortar for the brickwork. Wire loops formed into the concrete wall hold the lining. The brick is buff Kittanning face-brick, practically vitrified, and highly nonabsorptive.

The stairs and their supporting columns are built in stages of about 25 ft., the height of a full turn of four flights. The column reinforcement and the electric-wire conduit inside of it being set, the form is placed and plumbed, and the column then cast to the bottom of the next stair-landing. The depth of column joined to the landing is later cast with the landing, and at the same time a radial strut is cast which here extends from the column out to the wall, bonding into a recess molded in the wall concrete.

The stairs comprise reinforced-concrete stringers on either side, reinforced with rods, and continuous tread and riser construction reinforced with expanded metal. The latter is received in widths just equal to the stair width, and already bent to the required stepped shape in the shop. The sheets drop into place and merely need a few blocks to hold them off the bottom form. Several flights are usually cast at once.

The only standing staging used in the shaft is that required for the column and stairwork. Ladders on side platforms resting on beams thrown across the shaft have

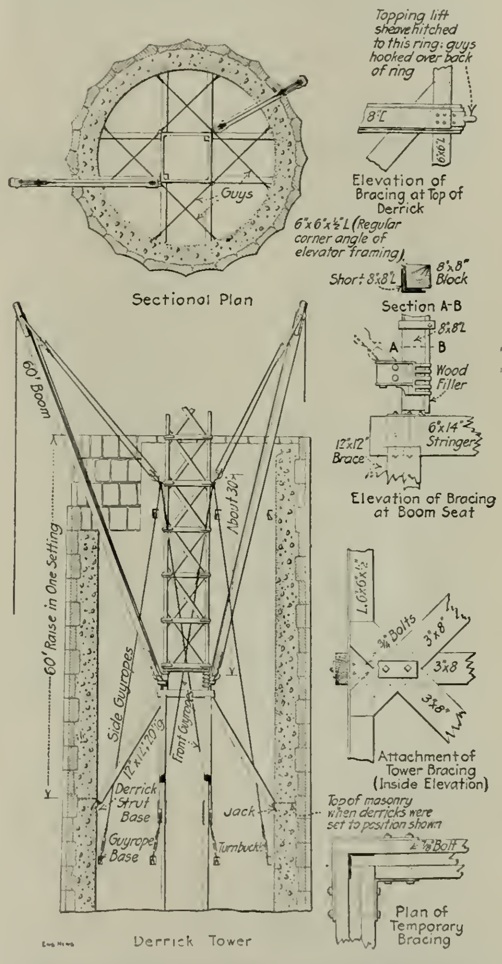

Fig. 9. Erecting Derrick for Perry Memorial

been used for the men up to now, but a temporary passenger hoist is now being installed.

Finish

On completion of the structure, the exterior will have to be cleaned off and pointed up; the sandblast may be used for cleaning. The inside brickwork will also require cleaning of cement stains, etc. The concrete column and stairwork is being rubbed with carborundum brick, holes and voids being first filled with cement.

Reinforced-Concrete Esplanade

The monument itself is to be surrounded by a concrete plaza or esplanade extending from water to water (460

ft.) and about 700 ft. long, in cross shape, covering an area of close to 5 acres. As it is some 10 ft. above present ground level, it is designed as slab-and-beam construction of reinforced concrete resting on piers and walls carried down to rock. The money required for this work is not yet at hand, and the monument will probably stand without the esplanade for a time. The floor of the esplanade will be 4 in. above the base of the granite.

The Perry Memorial Association is building the monument, with subscriptions collected for the purpose; Geo. C. Worthington, Cleveland, Ohio, is President General. Freedlander & Seymour, of New York City, are the architects, and Major Cassius M. Gillette was Consulting Engineer in the earlier stages of the enterprise. Boller, Hodge & Baird designed the structural parts. C. E. Sadler is Engineer of Construction supervising the work. The contract work is in personal charge of B. H. Robinson

Pavement Foundations for Heavy Traffic

By Daniel B. Goodsell*

SYNOPSIS—The author gives the results of an investigation of English experience with portland cement pavement foundations under particularly heavy traffic, especially of motor vehicles. English engineers seem to have come to a conclusion that 6 in. is not a sufficient thickness of concrete to meet present and forthcoming traffic conditions. Concrete foundations for asphalt and wood-block pavements may soon have to be increased from the now almost universal 6-in. depth to 9 or even 12 in. to safely care for the enormous loads put upon them by heavy motor trucks and omnibuses.

The writer has recently had occasion to make inquiry as to whether damage has been done to concrete foundations of city pavements by motor vehicles, and if so the nature and extent of such damage, together with the weight of traffic causing it. The intention was to determine if the present concrete foundations were sufficient and to determine whether occasion exists for increasing the thickness to accommodate the rapidly increasing weight of vehicles.

In order to present an idea of the stresses which may be produced by heavy vehicle units or groups of units, the accompanying Table I, based on observed weights and tire widths, is presented for consideration. It is believed that the weights represent average conditions for trucks in the Borough of Manhattan, New York City. The maximum weights on the axles or tires are not given, and, of course, would be considerably above the average weights shown, which are, in the absence of data, assumed to be evenly distributed on the four wheels.

A coal firm in the borough, in its busy season, has 150 trucks at work, 9 of which weighing 6 tons each carry loads of 10 tons, 11 weighing $3\frac{1}{2}$ tons each carry 6 tons and 50 weighing $2\frac{1}{2}$ tons each carry 7 tons. Loads of from 10 to 15 tons are common.

A search was made of the proceedings of various engineering societies, of periodicals, etc., for expressions of opinion or statement of facts concerning the subject. What was found is here presented. London is apparently the only city where the damage alluded to has occurred, and, although communication was had with a number of officials in the larger cities in the United States, no information was elicited; and it is hoped that some facts may be brought out by this paper.

TABLE I. SHOWING WEIGHTS PER INCH RUN ON TIRES OF FOUR-WHEELED TRUCKS

Trucks	No. of [illegible]	Average tire widths [illegible]	Average [illegible] lb. per [illegible]	Maximum [illegible]	Minimum [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*[illegible]

TABLE II. SHOWING WEIGHTS OF SOME HEAVY TRUCKS AND LOADS

[illegible]	[illegible]	Width of tires, in inches			[illegible]	Weight of [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*[illegible]

*[illegible], New York City.

Extracts from Printed Reports and Papers

DAMAGE TO ROADS, MIDDLESEX, ENGLAND—As to 6 in. of concrete being insufficient on roads, experience bears out that opinion. On the Green Lanes, Wood Green, after six months' motor traffic the wood paving was found to be not only corrugated, but in blisters and depressions and it was necessary to reconstruct the road.

When the wood blocks were removed it was found that the 6-in. concrete foundation underneath was so absolutely fractured that there was not a square yard of sound concrete left. The whole of the material was fractured and damaged to such an extent that it not only had to be excavated but relaid 12 in. in thickness for the wood blocks, which already showed signs of fracture. Cement grouting is never used in connection with wood paving here; a bituminous filler has been found more satisfactory.—H. T. Wakelam, County Engineer of Middlesex, in the "Surveyor," [illegible]

EXPERIENCE IN SHEFFIELD, ENGLAND—[illegible] foundation of cement concrete 6 in. thick, in the proportion of 6 or 8 to 1 [illegible] wood paving [illegible]

[illegible]

The Metropolitan Committee on the Materials and Means of Paving the Streets of London received a number of replies in response to an inquiry whether motor

traffic has had the effect of increasing the cost of paving and maintenance. In most cases the answer is in the affirmative. Many surveyors report that they are finding it necessary to increase the depth of the concrete foundations. In Bermondsey, for instance, while concrete 6 in. deep was formerly sufficient, the depth is now being made 9 in. or even 12 in. In Hackney foundations which were sufficient a few years ago are now found quite inadequate, and in new work the concrete is being made 50% thicker.

The City Surveyor of Hampstead considers that the life of wood paving has undoubtedly been reduced by one or two years, and that it has become necessary to increase the thickness of the concrete foundations from 6 in. to 9 in. In Holborn, concrete foundations 12 in. thick, are being laid in places where a thickness of 6 in. was sufficient ten years ago. In Paddington, concrete from 10 to 13 in. thick is being used on wood-paved carriage ways where the thickness was originally about 7 in. In Westminister the specifications now used when new foundations have to be laid provide for 1 in. of "floating" and 8 in. of concrete foundation instead of 6 in.

FOUNDATIONS OF ASPHALT PAVEMENTS—The thickness of hydraulic concrete necessary will vary under different circumstances. It has usually been 6 in. for sheet-asphalt pavements, carrying the heaviest traffic. At times the thickness is reduced to 4 in. on residence streets. Such a thickness will not be found sufficient to carry the travel which is promised in the future either on such streets or on some of our country highways.

With the advent of the motor truck, the traction engine and the motor omnibus, English engineers have arrived at the conclusion that not less than 9 in. of concrete will be required to furnish a satisfactory support. Such a thickness will be eventually demanded in the United States because in the area included in a radius of 30 miles or more about our own large cities motor trucking is common, with loadings amounting frequently to 10 tons.—"Asphalt Construction," by Clifford Richardson.

EXPERIENCE IN WIMBLETON, ENGLAND—The damaging effect of this latter form of traffic (motor busses), so far as we can see at present, has resulted in the destruction of portland-cement concrete 6 in. thick, where placed beneath wood paving and asphalt.

The author has only found one exception in the London district, viz., that of George St. and High St., Richmond, which carries no fewer than 1155 omnibuses per day of 16 hours, and 1878 on Sundays, equivalent to 55,212 tons per week, on a carriageway 25 ft. in width. The carriageway is paved with 5-in. creosoted deal blocks, laid on a 6-in. portland-cement concrete.

The only reason the author can give for the paving withstanding such a heavy traffic is that it is on a gravel subsoil. In other districts the thickness of the concrete has been increased to 9 in., and where trenches are subsequently made 12 in. is laid as a rule beneath the blocks used in repairing the surface.—Charles Hamlet Cooper, Borough Engineer of Wimbleton, in the "Surveyor," Oct. 10, 1913.

DISCUSSION—In my view, the breaking up of concrete foundations was not caused so much by ordinary motor vehicles as by those over 3½ tons in weight, shod with steel tires, one class of these being allowed to travel at eight miles and the other at five miles an hour. The passage of such vehicles [probably means traction engines with trailers] had the effect of hammering on the road, which did more damage than the twin-tired or any other rubber-tired vehicles (busses or autos)—E. Van Putten, Borough Engineer of Lewisham, London.

REVIEW OF ENGLISH EXPERIENCE—The cost of paved roads was reported to have increased in areas in which the strengthening of foundations had not proceeded very far, but elsewhere this traffic (heavy motor traffic) has not increased the cost of maintenance.

Reports of increased cost of maintenance are usually accompanied by the statement that deeper foundations will be provided in the future. Taking into consideration the increase in the passenger mileage and ton mileage of traffic, the cost of reconstruction and the cost of maintenance, there does not seem to be any cause for alarm as regards the paving of the main routes in the London area.

It is not really necessary, however, to make these foundations of tough concrete throughout, since the greater depth very much reduces the tension on the underside when the foundation acts as a beam or slab, and very greatly increases the area of road bed over which a wheel load is distributed. As a beam a 10-in. slab has 2½ times the strength of a 6-in. slab, and a relatively poor concrete for the lower 4 or 5 in. would in most cases be of ample strength.—Editorial in the "Surveyor," Jan. 30, 1914.

EXPERIENCE IN BELFAST, IRELAND—The concrete bed should be from 6 in. to 9 in. in depth, and vary acording to the subsoil; and having regard to the development of heavy self-propelled traffic, the author is inclined to advise that in no case should the concrete be less than 9 in. deep. —Hector F. Guillan, Superintendent, Works Department, Belfast, in the "Surveyor," July 25, 1913.

CONSENSUS OF ENGLISH RECOMMENDATIONS—The importance of the concrete foundation cannot be over-rated. The foundation should be at least 6 in. in thickness, composed of 1 part of portland cement to 6 of proper aggregate, upon which should be laid a "floating" not less than 1 in. in thickness of 1 part of cement to 2 or 3 of fine granite, slag, or sand, brought up to a perfectly smooth face.—Joint Report of English Engineers, International Road Congress, 1913.

RESULTS OF INQUIRY OF METROPOLITAN PAVING COMMITTEE OF LONDON—Effect of motor traffic on cost of paving and maintaining roads. (Replies by Borough Engineers to queries on above.)

St. Marylebone—The council has increased the depth of concrete foundations for wood paving in the more important thoroughfares from 6 in. to 8 in. and 10 in.

St. Pancras—Many wood-paved streets in this borough have either already been injured or shortly will be by this traffic breaking up concrete foundations insufficient to carry the traffic. The St. Pancras Borough Council have recently had to reconstruct the concrete foundation of Seymour St. when repaving it.

The original concrete foundation was about 6 in. thick, and for many years it proved sufficient to carry the very heavy ordinary traffic of the street, but as soon as two services of motor busses began running, the surface in many places showed indications of subsidence, and on examination the concrete was found to be completely broken up, and it was found necessary at the time of repaving the street to form a new concrete foundation 12 in. thick.

In Great College St. there is a daily and very frequent traffic of a motor steam-wagon, and the condition of the granite pavement in this case indicates the destruction of the foundation.—Tenth Annual Report of Metropolitan Paving Committee, 1911-12.

Experience in the City of Westminster, England—The City Council last year approved an alteration in their specifications for paving work to provide for the laying of 8 in. of concrete foundation and 1 in. of "floating" instead of 6 in. of concrete, and 1 in. of "floating" formerly specified—this, of course, only to apply in cases where new concrete foundation is laid.

Summary

In review, regarding the sufficiency of the present concrete foundations for heavy automobile traffic, a difference of opinion has developed, some authorities stating that a thickness of 6 in., which is now used, is sufficient; and others, notably Clifford Richardson, expressing the opposite view. The writer has been able to collect very few data about the sufficiency of the present concrete foundations in the United States. There does not seem to be enough experience with the destructive action of heavy trucks to warrant a decisive opinion.

There is a very strong consensus of opinion among the English engineers that both foundation and wearing surfaces should be absolutely stable in character; that both the concrete foundation and the asphalt macadam wearing surface or asphalt wearing surface should be so constructed that the aggregate will not move under traffic. Any movement or displacement of the stones in the surface mixtures by the rolling action of heavy traffic

is said to rapidly lead to disintegration of the surface and foundation.

A comparison of the concrete foundations of London, Liverpool and Paris with those of the Borough of Manhattan is difficult to make by reason of the fact that the mixtures used abroad are more lean than those used in this borough. A 1:2½:6 or even a 1:3:8 mixture is common, particularly in Paris. Gravel concrete is very common in both London and Paris.

An inspection of the concrete foundation of the former pavement of Fifth Ave., Manhattan, which had been down for nearly 15 years, except where removed for openings or other purposes, disclosed the fact that there were many wide cracks and deep depressions due to the subsidence of the soil beneath, which in turn was due to shrinkage of fill; and that the bad condition of the foundation was due almost entirely to such cause, and not to wear.

With such a rapidly growing borough as Manhattan, heavy and dense traffic conditions are likely to continue and no doubt will be such as to warrant an increased thickness of the pavement foundations. If this borough had as thoroughly consolidated subgrade conditions as London, it is doubtful whether there would be need of increase in the thickness of present foundations, in view of the fact that the concrete is much richer, stronger and of a better mixture than that used in either Liverpool, London or Paris.

In the writer's opinion, the concrete foundations for all the different kinds of pavement should be made smooth by "floating" the surface, thereby adding to the strength and accurate contour of the surface, which is desirable for all the different kinds of pavement. This "floating" would require a departure in the treatment of wearing surfaces which would tend to improve them.

Useful New Facts About Materials

News and Results Abstracted from Papers Read before the American Society for Testing Materials

Permeability of Paints: A New Research Test

Prof. A. M. Muckenfuss (New Orleans, La.) has experimented with a new kind of test for paints, designed to show how rapidly water-vapor can pass through a paint film. It is as follows:

The paint is spread on a support of hardened paper, wire cloth, or cement, and this is laid (with gasket) over a pan of water and under a mercury-sealed cover which incloses a weighed dish of calcium chloride. The weight gained by the calcium chloride in 24 hr. is the measure of permeability.

The results obtained with this test so far are a stimulus to further experiments. By applying the test after exposing the paint film to the atmosphere, the effect of weathering was studied somewhat. Artificial weathering was tried, by subjecting the film to regular alternations of warmth and cold, moisture and drying, electric illumination and darkness, etc.; accelerated "weathering" of films were found to result.

Strength of Glue

O. Linder and E. C. Frost report the results of various tests of ordinary glue. They find that in judging of glues the following qualities should be regarded: viscosity of the melted solution, strength of the cold jelly (judged by the fingers), odor, reaction, grease content, liability to foaming, ash, moisture, appearance.

The adhesive strength of 35 samples was tested by gluing a [illegible] block between two [illegible] pieces, pressing together under 100 lb. pressure for 12 hr., and, after another 12 hr., pushing the middle block from between the other two in a testing machine. Reducing the results to lb. per sq.in., by dividing by 4, the results showed strengths from 1100 to 1950 lb. per sq.in. for 1 part dry glue to 3 parts water, and 60 to 70% of this for a 1:5 glue.

Prolonged heating lowers the strength. Glue solutions kept heated to 150° F. for 20 hr. showed a loss of 30% to 45% in strength, when tested as above.

New Testing Appliances

A hydraulic compression machine of 125 tons capacity, with width of 10 in. between posts, was designed by W. H. Weston and built for W. O. Lichtner, for testing concrete. It can test an 8-in. square prism to 3900 lb. per sq.in., and an 8-in. cylinder to 5000 lb. per sq.in. Two gages, 10 tons and 125 tons capacity, are attached. The total cost of the machine was $550. Its outside dimensions are 20x32 in. by 60 in. high, and its weight 3000 lb. ("A Simple Compression Machine for Testing Structural Materials," W. O. Lichtner).

Extensometers and compressometers taking measurements on three gage lines, 120° apart, have been used at the University of California. A. C. Alvarez designed them. The measuring is done by roller dials. ("An Improved Type of Axial Strainometer," A. C. Alvarez.)

The American Locomotive Co. has developed a vibratory testing machine claimed to be more accurate and more adaptable than prior machines for vibratory tests. Tension tests, as well as oscillatory tests and rotating vibratory tests under longitudinal tension can be made with full assurance that the grip on the ends will remain firm. A tension up to 40,000 lb. can be applied to the specimen, and a bar of hard steel 1¼ in. in diameter can be tested in the vibratory test. The axis of the machine is horizontal. The machine was built by Tinius Olsen & Co., Philadelphia, to designs of C. L. Heisler. ("A New Vibratory Testing Machine and Results obtained by its Use," S. V. Hunnings.)

A centrifugal sandblast machine for testing brick, etc., by sand abrasion, was built recently at the Municipal Testing Laboratory, St. Louis, Mo., by Mont Schuyler. The vertical shaft of an electric motor, passing up through a fixed horizontal bedplate, carries two oppositely directed tubular horizontal arms. Above these arms the shaft is hollow and at the top it has a feeding funnel, for feeding sand down through the shaft to the arms, whence it is thrown out by the centrifugal force through

the tubular arms. Test specimens may be set on the bedplate in a circle, the tubular arms just clearing the inside of the circle; a sheet-iron cover incloses the working area, the funnel projecting out at the top.

With a given sand, fed in at a given rate, uniform abrasion results are obtained. Different sands give different rates of abrasion, probably due to influence of size of grain. If the machine is standardized in its details and manner of use, it may prove to be a valuable testing device for clay products. In the case of brick, experiments showed a hyperbolic (decreasing) relation between strength and abrasion loss, and a roughly parabolic (increasing) relation between absorption and abrasion, which indicates that the test has practical value. Possibly this form of test may make the rattler test for paving brick unnecessary; it has great advantages in rapidity, definiteness and noiselessness, over the rattler test. ("A Machine for Testing Clay Products," Mont Schuyler.)

Drill-testing to determine the best speed, etc., may be done on a new machine built by Tinius Olsen & Co., Philadelphia. The feed pressure and the cutting torque at various speeds are measured. Drills $\frac{1}{4}$ to 1 in. diameter can be tested at speeds of 50 to 1000 r.p.m., the low speds taking care of taps and dies. Torque is measured by a pendulum weight as in the Thurston torsion-testing machine. An autographic record of torque is made on a rotating drum. ("An Efficiency Testing Machine for Testing Drills, Taps and Dies," T. Y. Olsen.)

To measure the "friction" of rubber hose or belting, i.e., the resistance of the several plies against unwinding or stripping, J. M. Bierer has made an autographic machine which pulls two grips apart at the standard rate of 1 in. per min., and registers the pull on a steam-indicator cylinder. ("An Autographic Friction Testing Machine for Mechanical Rubber Goods," J. M. Bierer.)

The difficulties and uncertainties of present ways of measuring the viscosity of liquids led Prof. A. E. Flowers to suggest a new type. If a liquid is placed in a tube, the tube inclined a little from the horizontal, and a heavy sphere somewhat smaller than the bore of the tube is allowed to roll down in the tube, the velocity of the ball will depend on the viscosity of the liquid. Thorough review of the subject of viscosity brought Prof. Flowers to the conclusion that an instrument using this principle will be accurate and very adaptable, and subject to only slight corrections for different specific gravities of liquid. A small sample suffices for the test. Tests could be made at high temperatures or under pressure, just as easily as under normal conditions. The ball diameter should be one-half to three-quarters of the bore. ("Viscosity Measurement and a New Viscosimeter," Alan E. Flowers.)

Permanent Magnetism

The amount of permanent magnetism which hard steel will retain, and the tenacity with which it retains it, are profoundly affected by the heat treatment of the steel, as well as by its chemical composition. But different steels are affected differently by heat treatment. Some have their best permanent-magnet quality in the oil-hardened condition, while others (0.60% carbon steel and 5% tungsten steel) are best when water-hardened. Thus, the "magnetic hardness" does not vary in the same way as physical hardness. Drawing the temper, however, reduces both hardness and magnetic permanence. In some steels, pieces of small section have greater permanence than larger pieces, while other steels have the opposite characteristic. These facts are some of the results obtained by J. A. Mathews (Halcomb Steel Co., Syracuse, N. Y.) in a very extensive series of magnetic tests on alloy steels. While these tests are perhaps the most elaborate study ever made of permanent-magnet quality of steels, their chief result up to the present is that no uniformity of behavior is found among different steels, and that no laws or theories covering the phenomena can be deduced before a great amount of further experimenting has been done.

Mathews found the best index of permanent-magnet quality to be the ratio between residual magnetism and coercive force (the reverse magnetizing force required to wipe out the residual magnetism). He proposes this ratio as a new magnetic unit. ("Magnetic Habits of Alloy Steels," J. A. Mathews.)

Hardness Tests of Metals

Tests of various metals for Brinell hardness and scleroscope hardness, made at Watertown Arsenal, have been plotted to show what relation exists between the two kinds of hardness. A straight-line relation was found, but different metals lie on different straight lines (all passing through the origin). Carbon steel, nickel steel and chrome-nickel steel fall on the same line, for which the Brinell number is 6.67 times the Shore scleroscope number. Bronze, cast iron and aluminum have lower ratios of Brinell to Shore number, but the tests do not show clearly what these ratios are; that for cast iron is about 5.3. ("Hardness Tests, Relation between Brinell Ball-test and Scleroscope Readings," J. J. Thomas.)

A Simple Deflection Formula for Reinforced-Concrete Beams

The deflection of a beam may be expressed by the area of its M/EI diagram, and this in turn is, for any given method of support and loading, proportional to the maximum moment. From these facts may be derived the following simple formula for deflection of a reinforced-concrete beam:

$$f = k \frac{l^2}{d} (e_c + e_s)$$

in which

f = deflection;
k = a constant;
l = length of beam;
d = depth of beam, to center of steel;
e_c = unit-deformation in extreme fiber of concrete;
e_s = unit-deformation in extreme fiber of steel.

The constant k, in simply-supported beams, has the following values: For uniform loading, $k = 0.1041$; for center loading, $k = 0.0833$; for third-point loading, $k = 0.1065$. In fixed-end beams the values are: For uniform loading, $k = 0.0313$; for center loading, $k = 0.0416$; for third-point loading, $k = 0.0347$.

The formula has been checked by the results of numerous tests of reinforced-concrete beams. ("Relation be-

tween Deformation and Deflection in Reinforced-Concrete Beams." G. A. Maney.)

Fictitious Yield-Point Obtained for Reinforcing Bars by Testing Turned Sections

In testing deformed bars used for concrete reinforcement, it is permissible (according to most specifications) to make the test on a piece turned down to cylindrical shape. At the St. Louis municipal testing laboratory, it has been found that such tests show a higher yield-point than the true one. The error may be as much as 10%. Not only deformed bars, but also plain bars, showed this liability of error. It is due to the nonuniformity of a rolled bar, the interior being of more fibrous structure than the exterior, as photomicrographs revealed. ("The Use of Turned Sections in Tension Tests of Reinforcing Bars." E. P. Withrow and L. C. Niedner.)

Water Purification Plant, Belfast, Maine

By Robert Spurr Weston*

The works of the Belfast Water Co. have recently been improved by building an additional impounding reservoir on Little River and a 1,000,000-gal. water-purification plant consisting of a coagulating basin, two 500,000-gal. mechanical filter units with Wheeler filter bottoms, a filtered-water basin and a wash-water tank. The filter plant was put in service in January, 1914, and is now supplying about 400,000 gal. a day.

Although the object of this article is to describe the purification plant, a few words may be said regarding Belfast itself, the water-works as a whole and the new dam.

The city of Belfast is situated on the westerly shore of Penobscot Bay, between the cities of Bangor and Rockland. It is the seat of Waldo County and is the market town for a locality devoted to dairying and fishing. There are also shoe, clothing, leatherboard and woodenware factories, besides a shipyard. During recent years, the beauties of the bay and its shores have attracted an increasing number of summer residents.

Dam and Water-Works—The original water-works were designed and built, in 1887, by the firm of Wheeler & Parks, of Boston. They consisted of an impounding reservoir with granite masonry dam and pumps operated by both steam and hydraulic power, discharging through about two miles of 10-in. mains to city and standpipe—against a head of 250 ft.

The dam and pumping station are located on Little River, 1.9 miles south from the center of the town. The storage has been only sufficient to drive pumps by water power for three or four months out of each year. So, during 1913, the storage has been increased by building another dam about three-quarters of a mile up the stream.

This dam was built of concrete masonry. Its crest is 220 ft. long and 30 ft. above the bed of the stream; the spillway is 90 ft. wide. The end portions of the dam are straight with the central or spillway section arched. The dam is 13 ft. thick at the bottom and 4 ft. 3 in. at the flow line of the reservoir. It contains very little reinforcement. It was designed by William Wheeler, Supervising Engineer for the Company, and built by the M. W. Allen Construction Company of Walpole, Mass., under the supervision of G. A. Sampson of the writer's office. It required about 200 cu.yd. of earth and 50 cu.yd. of rock excavation; and contained about 700 cu.yd. of concrete, besides gates, pipes and appurtenances. The total cost, exclusive of engineering, was about $8500.

The water supplied directly from the reservoir to the town, while safe to drink, was objectionable on account of its high color and, at times, its pronounced odor and

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Fig. 1. Dam, Pumping Station and Purification Plant of Belfast Water Co.

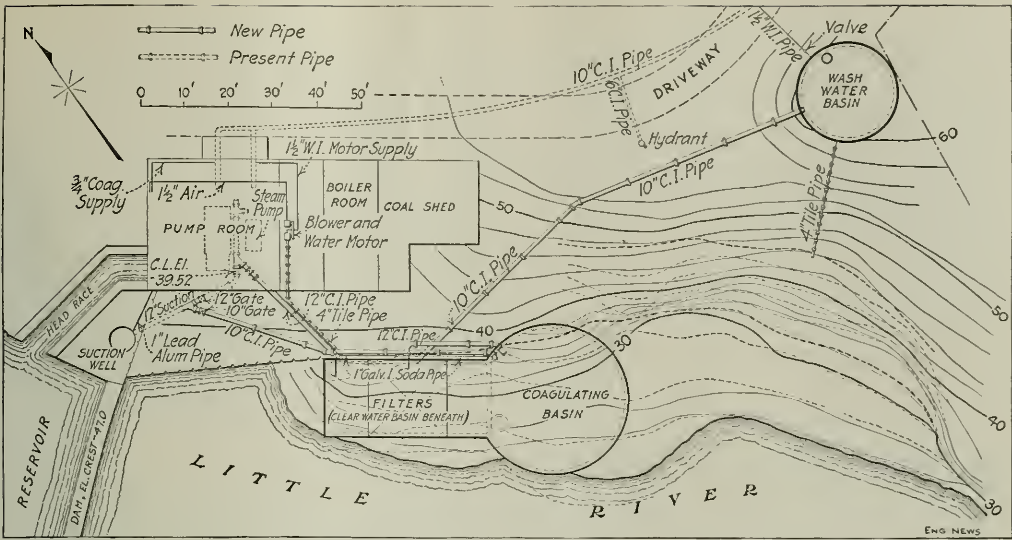


FIG. 2. LAYOUT OF BELFAST WATER-PURIFICATION PLANT

turbidity. The character of the water is illustrated by the following typical results of analysis:

Source of sample	Reservoir
Date of collection	June 17, 1912
Odor, cold—20° C.	1—vegetable
Odor, hot—90° C.	4—vegetable
Turbidity—silica standard	15
Color—platinum standard	70
Oxygen consumed	6.82
Nitrogen as: Free ammonia	0.022
Albuminoid ammonia—total	0.124
Suspended	.....
Dissolved	.....
Nitrites	0.000
Nitrates	0.06
Chlorine	2.16
Alkalinity	10.0
Hardness by soap method	20.8
Iron, Fe.	0.45
Residue on evaporation: total	41
Bacteria per c.c.—20° C.	145
Bacteria per c.c.—37.5° C.	62
Bacillus coli	Negative
B. coli—presumptive test	Negative

WATER-PURIFICATION PLANT

In addition to the increased storage, which will improve the water, the company has built a water-purification plant, of 1,000,000 gal. daily capacity, consisting of coagulating basin, two 500,000-gal. filter units with Wheeler filter bottoms, filtered-water basin and wash-water tank.

The plant was designed by the writer and built by John W. Gulliver of Portland, Me.; it cost $16,000, including engineering and changes in the pumping station. John M. Cashman was Resident Engineer for both dam and water-purification plant.

The water requires treatment with sulphate of alumina, and, at times of low alkalinity, with soda, followed by storage in a coagulating basin for at least two hours and filtration through mechanical filters. At this writing, less than twenty parts of sulphate of alumina and 5 parts of soda per million are required.

The plant is located on the bank of the tidal estuary near the pumping station, as shown by the view, Fig. 1, and the plan, Fig. 2. The filters and adjoining coagulating basin are in the form of a circle intersecting a rectangle. Beneath the filters, and supporting them, is a filtered-water basin. Both pump well and coagulating basin rest directly upon and conform to the sloping rock on the bank of the estuary.

The reservoir water is supplied to the coagulating basin by gravity, through a 10-in. pipe terminating in a float valve within the basin. Sulphate of alumina is added to the water as it leaves the reservoir, and soda either as the water enters or leaves the coagulating basin.

COAGULANT SOLUTION TANKS

The devices for applying coagulant consist of four solution tanks and two feed boxes, all of reinforced concrete, and two porcelain sinks connected with the two feed pipes, all as shown by Fig. 3. The sulphate of alumina tanks are each 3.25 x 5 ft. x 5 ft. deep.; the soda tanks are half as large. In the corner of each tank is a solution box with perforated bottom and removable screen. Each tank is provided with air pipes for stirring the solution, the air being supplied by a No. 00 Sturtevant pressure blower driven by a 6-in. Pelton wheel. The waste from the wheel discharges back into the filtered water basin.

The solutions discharge from the tanks into feed boxes provided with ball cocks and glass or brass plates, with 20 orifices drilled in each plate, similar to the devices used at Steelton, Penn., and elsewhere. All working parts coming in contact with sulphate of alumina were made to resist corrosion. The screens and air pipes are of hard rubber, the piping is of phosphor bronze, the ball and orifice plate are of glass and the tanks themselves have been given three coats of a solution of white Japan-wax in turpentine. Brass and galvanized iron were used in contact with the soda solution.

The solutions fed through the orifices fall into the two porcelain sinks connected with their respective feed pipes.

COAGULATING BASIN—This (Fig. 4) is built of reinforced concrete with a concrete and earth cover. It is

of irregular shape and has a capacity equivalent to two hours' flow. The treated water enters through the float valve near the bottom and flows over a funnel-shaped outlet into the 10-in. effluent pipe. The bottom of the coagulating basin slopes to a 10-in. drain; a concrete overflow weir is also provided.

FILTERS AND WHEELER FILTER BOTTOM—The filters (Fig. 5) consist of two 500,000-gal. units, each having an area of 192 sq.ft. The filter sand was obtained from Old Orchard Beach, Maine, and has an effective size of 0.41 mm. and a uniformity coefficient of 1.58. The sand layer is 2.5 ft. deep and rests upon a graded gravel layer, 6 in. thick, supported by the Wheeler filter bottom.

The three gravel layers are of the following sizes and thicknesses:

Layer	Thickness in.	Size
Top	3.0	No. 4 to No. 12 mesh
Middle	1.5	0.5-in. to No. 4 mesh
Bottom	1.5	0.75-in. to 0.5-in. mesh

These very thin layers of gravel were made possible by the Wheeler filter bottom* upon which the gravel rested. This device was invented by William Wheeler† to overcome some of the disadvantages of those filter bottoms which are provided with inverted pyramids or troughs, either filled with a very thick layer of gravel or having the lower layer of gravel held in place by screens.

The Wheeler filter bottom consists of a series of inverted pyramids, spaced 1 ft. c. to c. and containing four 3-in. spheres molded from neat cement. These spheres, arranged according to a definite mathematical principle, take the place of the usual random arrangement of gravel or other supporting and wash-water distributing media.

Above the 3-in. balls and around the sides of each pyramid were placed eight glazed earthenware marbles, each 1.25 in. in diameter, and over the larger central space hand-picked beach pebbles of a diameter of about 1.5 in. The 0.75-in. outlets discharge into channels in the concrete, communicating with the 6-in. effluent pipe.

The filter piping is contained within the pipe gallery between the filters. The effluent pipes discharge into the filtered-water basin through Venturi meters and controllers, the recording devices for which are located on the operating platform above. The effluent valve is provided with a hydraulic piston actuated automatically by

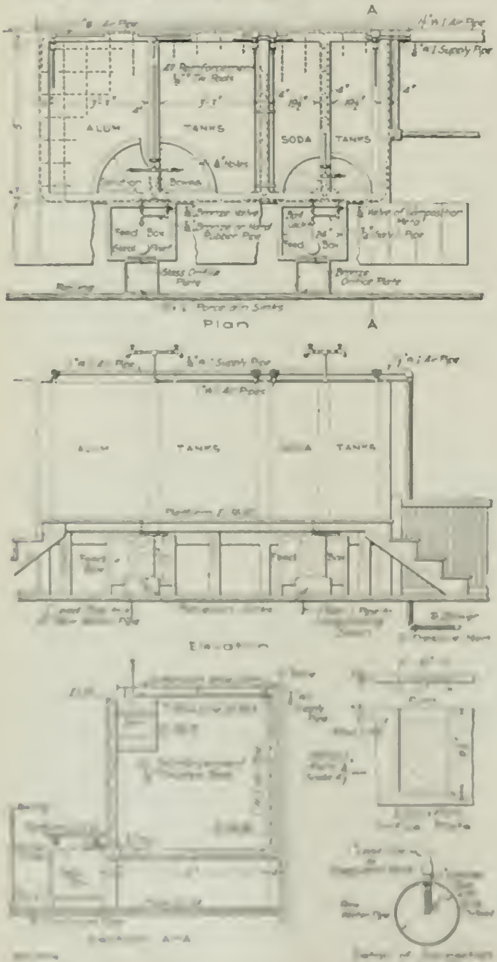


FIG. 3. DETAILS OF COAGULANT SOLUTION TANKS

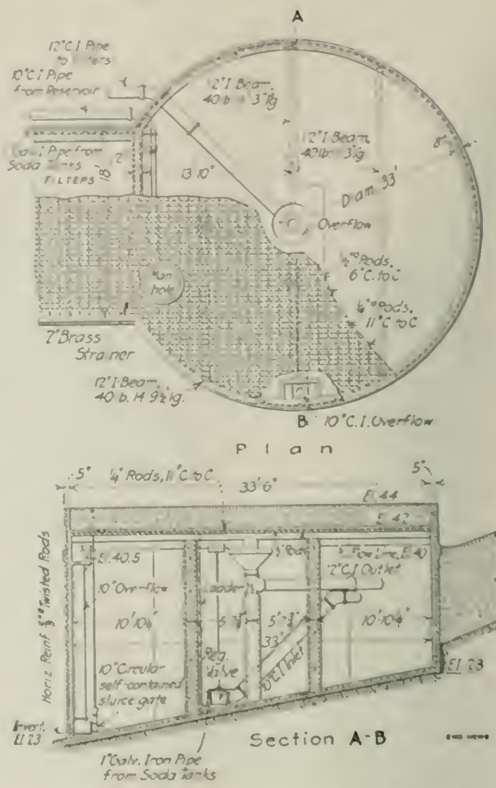


FIG. 4. COAGULATION BASIN, BELFAST FILTERS

*"Engineering News," July 2, 1914.

†Consulting Engineer, 14 Beacon St., Boston.

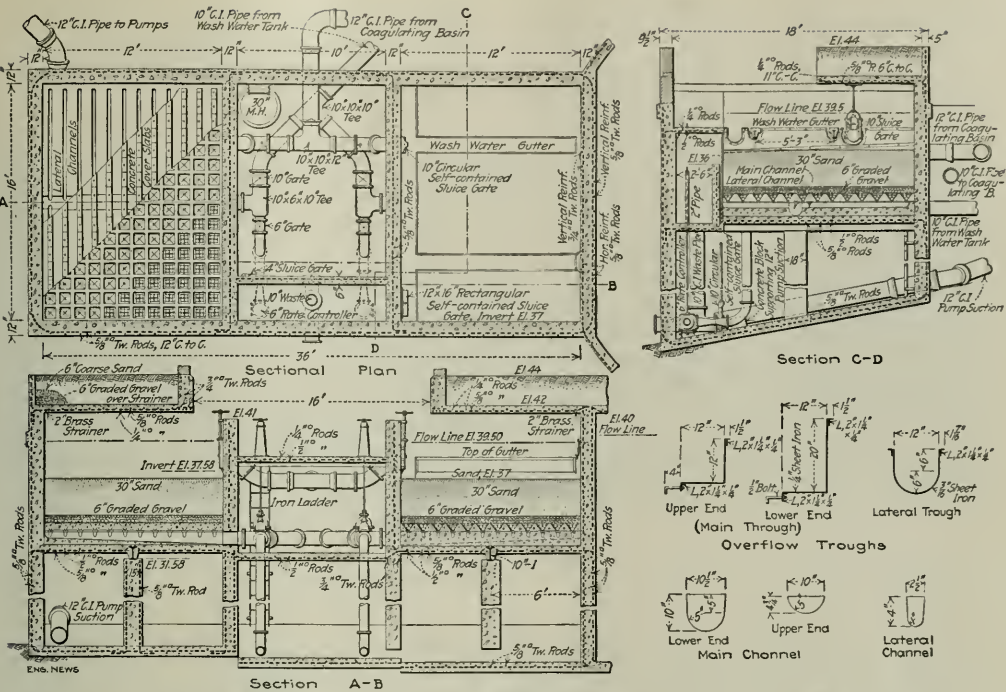


FIG. 5. MECHANICAL FILTERS WITH WHEELER FILTER BOTTOM, BELFAST, ME.

the Venturi devices. The filters are designed to operate without using negative heads.

The wash-water gutters (Fig. 5) are of the usual type. The 8-in. influent gates and the 12x16-in. waste gates communicate with these gutters. The waste gates discharge into a concrete compartment at the end of the pipe gallery. This compartment is connected with a 10-in. waste pipe passing through the pump well, discharging into the estuary; it also serves as an overflow for the filtered-water basin. At the bottom of the filtered-water basin a 10-in. drain connects with the waste pipe.

The 12-in. pump suction connects directly with the filtered-water basin.

The wash-water tank is located on the hill above the filters. It is built of reinforced concrete and is 20 ft. in diameter by 20 ft. deep, with 8-in. walls and a 4-in. cover. The tank is supplied with water from the high-service and a 10-in. wash-water main with 8-in. branches leads to the filters. The tank is provided with a float valve on the inlet and a 4-in. overflow.

Statistics of United States Railways in 1913

The Interstate Commerce Commission has issued an advance abstract of the official statistics of steam railways in the United States for the fiscal year ending June, 1913. This year witnessed by far the greatest volume of passenger and freight traffic that has ever been carried on American railways. The business of the year ending June 30, 1914, has shown a large falling off, as is generally known.

The density of traffic in 1913 is perhaps best shown by the figures for passenger and freight mileage per mile of road. In 1913, 143,067 passengers were carried one mile per mile of road, against 140,393 in 1912. In 1913, 1,245,158 tons of freight were carried one mile per mile of road, as against 1,110,811 tons in the preceding year. A general review of the financial results of operations is of interest, in view of current discussions of the relations of the railways and the public. We omit the details and give the figures in round millions, for the sake of easy comprehension.

In 1913, the railways covered by these statistics (including all roads earning over $100,000 in the year, an aggregate of 244,400 miles of road operated) had total earnings from operation of 3125 million dollars. Of this amount, there was paid out in operating expenses, 2169 million, leaving them 955 million as net earnings. Out of these net earnings the railways had to pay 122 million in taxes, leaving them a net income from operations of 835 million. The railway companies also received from investments in stock of other companies, leased roads, etc., 283 million. They had to pay out in rentals on leased roads, etc., and in interest to holders of bonds and other debts, 630 million, leaving them a net corporate income of 488 million. The money was used first to pay 242 million in dividends to the stockholders who owned this 244,000 miles of railway; $48,000,000 was spent on additions and betterments to the railway property, $50,000,000 on miscellaneous appropriations, and a balance of $184,000,000 was placed to the credit of profit and loss. It will be seen from the above figures that of every dollar which the railways receive in payment for freight and

passenger transportation they paid out 60c. in operating expenses, 4c. in taxes, and 8c. in dividends to stockholders.

The total capitalization of the railways is, in round numbers, 17,800 million dollars. About a third of the outstanding railway stock received no dividends and about 10% of the railway bonds received no interest. The average receipts per passenger per mile in 1913 were 2.08c., and the average receipts per ton-mile were 0.729c. The average passenger train earned $1.35 per mile run; the average freight train, $3.24 per mile run. The average freight train carried 445.25 tons of freight. In 1912, the average was 440.26 tons. Of the total railway earnings, about three dollars came from freight traffic to every dollar from passenger traffic. The total number of employees in the railway service was 1,815,239. The total amount of wages and salaries paid to railway employees was 10,373 million dollars. Thus for every dollar paid out by the railways in operating expenses, 63c. was paid directly to railway employees in salaries or wages.

A Visit to the Lassen Volcano*

By W. H. Wright†

An eruption on Lassen Peak, California, occurring at 10 a.m. Sunday, June 14, had just ceased when I arrived at Prattville, Cal., on the way to Drake's Springs. The mud-cloud still hung over the mountain. A resident of Prattville stated that this had been the largest of all eruptions and earnestly sought to dissuade me from going up to what he seemed to consider certain death.

I visited the peak with two companions on June 16, [illegible] Harry Kaul, who had spent the winter at Drake's Springs as caretaker. Kaul stated that on Thursday night, May 28, he heard a rumbling like that of thunder. Upon going out of doors he found the stars shining brightly. Also that on Friday afternoon, at 2:30, a slight earthquake caused the poorly fastened roof of the barn to slide to the ground. This shock was felt in Westwood, 29 miles, and Susanville, 51 miles, distant. At this time Kaul was probably the nearest to the mountain of any person in that region. On Saturday, May 30, the first eruption occurred, although a stage driver reports seeing a vapor rising from the mountain on Friday. Two days after the eruption, Kaul accompanied a party to the peak. The crater or fissure was then about half its present size, but general conditions were the same. There was not so much debris scattered about, and a small pool occupied a depression in the old crater. Since that time numerous eruptions have taken place, and have all been of the same character. Tin cans left by the party on Kaul's first visit to the peak were picked up by our party. They were badly mashed and dented by falling stones.

Tuesday morning, June 16, our party left Drake's Springs for the summit of Lassen Peak. The trail leads through a magnificent growth of timber. Above 6000 ft. altitude the traveling was done over hard snow, which as we neared the top became very deep. It easily supported the horses and made the ascent much easier than at other seasons. Even close to the peak only a slight amount of dust covered the snow. In Fig. 2 the shadowy area covering the top of the mountain is dust-covered snow and plainly marks the distance any great amount of dust fell. The lighter-colored portions of this area are bare rock covered with cement-colored dust; the dust upon the snow, being wet, is dark colored.

At 12:30 the ridge at the top was gained and our first view of the crater obtained. The party then descended the slope into the cup-shaped depression that marks the site of the ancient crater. The new crater has broken out on the northwest side of this, and seemingly has

Fig. 1. The Eruption of Mt. Lassen

([illegible] June 14, 1914)

*Published by permission of the "Engineering and Mining Journal."

†Mining Engineer, [illegible] Bldg., San Francisco.

been formed by steam escaping under high pressure from a fissure which lies along the main axis of the oval-shaped pit. Fig. 3 shows this fissure distinctly. The steam forced its way through the fissure and formed a narrow crater, the sides of which had begun to cave, rapidly widening it.

tain and about a thousand feet from the crater, had its roof perforated in many places by falling rock. The largest hole was 12 in. in diameter and clean-cut.

At the edge of the crater, débris from the different explosions lay on the snow to a depth of three or four feet. This gradually diminished to a depth of 6 in. at the

Fig. 2. Lassen Peak from 8600-Ft. Elevation
(The dark shading shows where the ash fell on snow; the lighter, ash on shale.)

Fig. 3. The Crater
(Track of guide who paced length of crater, at right.)

These pictures were taken at great risk. Aside from the danger of an outbreak of the crater, the danger from the caving sides was great. In order to get good views of the pit it was necessary to go close to the edge. Huge cracks extended back 25 and 30 ft. Every few minutes great masses would fall from the sides. A short time after one of the pictures was obtained, the place from which it was taken suddenly fell into the hole, sending up a cloud of dust and making a spectacular display, which, unfortunately, was over too soon to be photographed, as the party was busily engaged in eating lunch.

The volume of escaping steam varies from moment to moment. In appearance and odor the steam resembles that escaping from the boiling springs which occur along the valley leading up to the peak. That the vapor is steam is evidenced by the fact that it condenses and disappears after rising into the air for a short distance. The hole is about 100 ft. in width and 500 ft. in length. Large quantities of huge rocks have been thrown out. The one in the foreground weighed at least two tons. The deep snow, on the north slope of the south side of the old crater, which was covered with dust, sand and rocks, contained several hundred holes which had been caused by falling rocks. These must have been hot, as they were deep in the snow, which is as hard as ice; also, the sides of the holes are perfectly smooth, and there are many large stones lying on top of the snow beside these holes. Of course, it is possible that the unburied ones did not fall from as great a height as those that are buried. A stone lying 1000 ft. from the crater measured 30x54 in. As it was deeply buried, the thickness could not be measured.

Small heaps of crumbled rock lying on the snow showed that some of the stones crumbled upon being suddenly cooled by it. The lookout station of the forest service, situated on the highest pinnacle of the mountop of the ridge surrounding the cup of the crater. Upon the snow were stones of various sizes. Next is a deposit of coarse sand, upon which is a layer of very fine dust that closely resembles portland cement. There was no lava or cinders. The only indications of heat were the hot stones and steam. The mountain is composed of dacite, which has the appearance of gray granite. If one could collect the débris from a blast in this rock, he would have exactly the same material that has been cast up by the present eruptions.

The edges of the fissure are covered with a yellow deposit that appears to be sulphur. This could not be verified, as it was impossible to reach the fissure. The presence of sulphur is not unexpected, as deposits of sulphur are found at many of the hot springs in this locality. An odor of sulphur was noticed in the dust, but it was so faint that it could not be determined whether it was the hydride or dioxide.

The evidences on the ground bear out the belief that the material thrown out by the outbursts consisted of débris from the walls of the ancient crater broken and forced from the fissure by steam under great pressure. Much of this material fell directly back into the new crater or caved from the side, closing the vent and making other explosions necessary to clear the outlet of the debris.

Lassen Peak is 10,437 ft. high and is the southern terminus of the Cascade range. Like many other mountains in this range, it was thought to be an extinct crater. In the Lassen lava field, which lies to the northeast and north of Lassen Peak, is situated Cinder Cone, the latest active volcano in the United States. History does not record this last eruption, which appears to have occurred in the neighborhood of 200 years ago. This eruption was so quiet that it would not have attracted attention in a sparsely settled country.

Experiments on the Decarbonation of Water to Prevent Lead Poisoning at Lowell, Mass.

About a dozen years ago the city of Lowell, Mass., virtually abandoned a driven-well water-supply of from 2,500,000 to 4,000,000 gal. daily capacity because the excessive amount of carbonic acid in the water corroded lead service pipes and caused lead poisoning among water consumers. Recent experiments* have shown that this water can be decarbonated and rendered noncorrosive by aeration. Although it is not proposed to make the water usable by this means at present, the experiments are worth recording here briefly, as well as the sort of aerating plant which they indicated would best serve the purpose.

Two methods of decarbonation were available: (1) neutralization of the carbonic acid by lime or soda and (2) removal by iron. The latter proved to be preferable since lime treatment increased the hardness and aeration did not.

Observations were made to show the effect of untreated and treated water on three 50-ft. coils of lead pipe: one pipe for untreated water; one for water treated with lime and one for aerated water. Samples were taken after the water had stood in or been passing through the pipe for 4 hr. and for 15 hr.

LIME-TREATMENT—The apparatus for applying lime is described as follows:

The apparatus for the addition of lime consisted of a funnel-shaped saturator 24 in. high and 16 in. in diameter at the top. The lime was slaked in a small receptacle at the side of the saturator and introduced as milk of lime by a pipe which led to the bottom of the funnel. Water was introduced from a perforated nozzle into a pipe which extended vertically through the center of the funnel to the bottom, the supply of water then rising slowly through the milk of lime and overflowing at the top from a circular weir. The capacity of the saturator was such that when treating 5000 gal. per day of water with 1 grain of lime per gal., the time of passage of the lime water through the saturator was about one hour.

The lime water varied in strength more or less but on the average contained 1120 p.p.m. of calcium oxide, or 65.5 grains per gal. of this oxide, these figures being based on determinations of the caustic alkalinity of the lime water as it issued from the saturator.

The flow of lime water was maintained at as nearly a constant quantity as possible, and the amount of raw water was varied when it became necessary to change the quantity of lime added per gallon. The lime water was applied to the raw water without exposing the latter to the air, duplicating, as far as possible, the conditions under which if this method of removing carbonic acid were adopted the lime water would be discharged into the suction pipe of the pumps.

AERATION APPARATUS—This was very simple, comprising 1/8- to 1/4-in. diameter nozzles, throwing a very fine spray, furnished by the Spray Engineering Co., Boston. Nozzle pressures were obtained by a gage, or, in the case of very light pressures, by a manometer tube.

CHARACTER OF THE RAW WATER—Analyses of the raw water made in September and October, 1911, showed the following averages, expressed in parts per million: Alkalinity, [illegible]; total hardness, [illegible]; [illegible], [illegible]; iron, [illegible]; carbonic acid, [illegible]. For the same period the dissolved oxygen, in percentage of saturation, was [illegible].

RESULTS OF LIME TREATMENT—The standard of results with either method of treatment was taken as a maximum lead content of 0.5. Untreated water standing 4 hr. in the lead pipe took up an average of 0.5 p.p.m. and standing for 15 hr., 6.7 p.p.m., or from 10 to 13 times the safe limit.

It had been hoped that a fraction of a grain of lime per gallon would make the supply safe, but it was found that with approximately 1 grain per gal. (100% of lime available) the water still took up 1.5 grains of lead per gal. after 4 hr. and 3.1 after 15 hr., or 3 and six times the safe limit. With 1 3/4 grains of lime per gal., the carbonic acid was practically neutralized and the lead content of the water after standing in the lead pipe either 4 or 15 hr. was approximately 0.5 grain per gal. It was finally concluded that 1.5 grains of lime per gal. would render the water safe, since the 15-hr. test was probably more severe than conditions in practice. Even this result was disappointing, for 1.5 grains per gal. of lime would add 45.6 p.p.m. of hardness. This would increase the total hardness by 80%, bringing it up to about 100 p.p.m., "an amount too great to be satisfactory to consumers accustomed to soft New England waters." Table I gives analyses of untreated water after standing four hours in lead pipe.

TABLE I. RELATION BETWEEN CARBONIC-ACID AND LEAD CONTENT OF UNTREATED AND LIME-TREATED WATER AFTER REMAINING IN PIPE FOUR HOURS

	Untreated water		Lime-treated water			
	Carbonic acid	Lead taken up	Lime added		Carbonic acid	Lead taken up
Date	p.p.m.	p.p.m.	p.p.m.	gr. gal.	p.p.m.	p.p.m.
Sept. 2-4	37.5	5.000	16.9	0.93	16.0	2.0[illegible]
9-11	40.5	5.200	18.5	1.[illegible]	19.0	1.[illegible]
17-19	38.0	5.200	16.7	0.98	16.0	2.2[illegible]
23-24	35.5	3.000	16.8	0.98	14.5	1.314
27	..	2.800	17.2	1.00	..	0.914
Oct. 2-3	31.5	4.000	17.4	1.02	9.0	1.[illegible]
7	37.5	3.600	17.7	1.04	13.0	1.630
10	45.0	5.2[illegible]	38.0	2.22	1.8	1.4[illegible]
17-19	41.5	6.[illegible]	35.6	2.08	0.0	0.4[illegible]
22-23	38.0	4.[illegible]	25.9	1.51	6.0	0.714
27-28	42.3	5.2[illegible]	26.1	1.53	0.0	0.257
Nov. 5	39.0	7.000	29.7	1.73	0.0	0.2[illegible]
6-7	41.5	5.[illegible]	29.1	1.71	1.8	0.[illegible]
12	36.0	4.6[illegible]	29.5	1.73	0.0	0.[illegible]
13	37.5	5.[illegible]	25.5	1.49	0.0	0.8[illegible]

p.p.m. = parts per million

RESULTS WITH AERATION—Dismissing lime treatment as "undesirable and uneconomical," the report next discusses the results with aeration. These indicate that aeration by fine-spray nozzles "is very effective in the removal of carbonic acid, although the time during which the spray is in the air is short." The tests also indicated that with a 5-lb. nozzle pressure "the carbonic acid can be reduced from 45 p.p.m. in the raw water to about 3.3 p.p.m. in the aerated water, and that with this reduction, the effect of the water on lead pipes is so far lessened as to render the supply safe."

Table II gives analyses of aerated water which had stood 4 hr. and 15 hr. in lead pipe.

TABLE II. RELATION BETWEEN CARBONIC ACID AND LEAD CONTENT IN AERATED WATER AFTER REMAINING IN PIPE FOR 4- AND 15-HOUR PERIODS

	4-hour sample		15-hour sample	
Date	Carbonic acid	Lead taken up	Carbonic acid	Lead taken up
Sept. 9-11	[illegible]	0.114	2.5	0.571
17-19	[illegible]	[illegible]	2.[illegible]	0.5[illegible]
23-24	[illegible]	[illegible]	2.5	0.[illegible]
Oct. 2-3	[illegible]	[illegible]	2.[illegible]	0.457
7	[illegible]	[illegible]	4.5	1.1[illegible]
17-19	[illegible]	[illegible]	2.5	0.4[illegible]
[illegible]	14.[illegible]	[illegible]	13.[illegible]	0.7[illegible]
[illegible]	1[illegible]	[illegible]	16.0	0.[illegible]
[illegible]	3.[illegible]	[illegible]		
Nov. 6-8	1[illegible]	[illegible]	4.5	0.[illegible]
13	[illegible]	[illegible]	17.5	1.1[illegible]
13	3.[illegible]	[illegible]		

All in parts per million.

*This article is based on a report on "Improvement of the Water Supply of the City of Lowell, Mass.," made in June, 1914, by [illegible], Consulting Engineer, Boston, Mass. [illegible] is Commissioner of Water [illegible] and [illegible] is Superintendent of Water Works, Lowell, Mass.

The report sums up the decarbonation studies and gives an estimate for an aërating plant as follows:

The removal of carbonic acid by aëration has a great advantage over the lime treatment in that it does not increase the hardness, and further, as indicated by the tests, aëration is more effective than the lime treatment in reducing the corrosive action when an equal amount of carbonic acid is left in the treated water. This result is not what might be expected, because by aëration the dissolved oxygen, which has generally been considered a contributary factor in corrosion, is increased, but the experiments clearly indicate that, with an equal content of carbonic acid, the aërated water takes up less lead than the lime-treated water.

An aërating plant, if constructed, would include a pipe system into which the necessary number of nozzles would be tapped, a concrete pool, and below the pool, a small storage basin with a capacity of perhaps one hour's run of the pumps. The water, as drawn from the wells, would be forced through the aërator, and after falling into the storage well, would be repumped into the distribution system.

It is estimated that the first cost of an aërator, storage well and new steam turbine centrifugal pumping unit of 4,000,000 gal. daily capacity will be approximately $25,000. Assuming that the installation of the aërator will involve an additional lift of 30 ft., the cost of aërating the water will not exceed $225 per 1,000,000 gal., including interest, depreciation and the cost of extra pumping necessitated by aëration. This cost is less than the cost to consumers for additional soap, which would necessarily be used if the carbonic acid were neutralized by lime treatment, and it therefore follows that aëration is the more economical method.

Water from the Cook wells, as this group of wells is called, could be used for summer-peak consumption to supplement the Boulevard-well supply, which Lowell now proposes to treat by (1) coke prefilter operated as a contact bed; (2) sedimentation; and (3) sand filtration for iron- and manganese-removal, as outlined in our issue of July 9, 1914.

Oscillating Signals for Grade Crossings

The demand for greater protection to road traffic at railway grade crossings has led to the designs of signals with special features to compel attention. Such signals are specially desirable where there is much automobile traffic, as the cars approach at high speed and a sign or gate (or even a flag) may not be very conspicuous, while the noise of the engine may prevent the driver from hearing the sound of a train, whistle or ordinary crossing bell.

A crossing signal of this kind which was developed in California and has been applied extensively on steam and electric roads, combines sound, movement and light as means of attracting the attention of highway traffic when a train is approaching the crossing. The accompanying cut shows two of these signals installed recently at the 7th Ave. crossing of the Chicago Great Western Ry., at Maywood, Ill. The steel post is surmounted by a fixed bell of the locomotive type and carries a bracket arm from which is hung a 2-ft. disk having a pendulum movement imparted by mechanism contained in the box at the end of the fixed arm. The disk is swung through an arc of about 3 ft. in length, and makes 40 to 60 strokes per minute.

The disk is hollow, made of two conical plates, enameled red on the outside and white inside (as a reflector), and having a red signal lens in the center of each side. The disk is lettered on each side "Danger, Stop," the former word being in white, while the latter is formed in 6-in. letters of white glass "jewels." In the hollow disk are placed two incandescent lamps (so that if one burns out the light feature of the signal will still be operative); These illuminate the red lens and the word "stop." With the brilliant lights, the swing of the disk, and the sound of the bell, the signal is made very conspicuous, and attracts attention at a considerable distance.

The disk-swinging mechanism and the lights are operated from the electric-light mains, while the bell is operated from a local battery. The bell mechanism and the lights are operated (independently) from the track-control instrument, which is placed 2000 to 3000 ft. from the crossing and is operated by the train. Thus a defect in any one of the three means of warning does not affect the others. The signal can be operated on alternating or direct current and on voltages of 8 to 12 or as high as 110 to 550 volts. The disk mechanism may be operated from storage batteries, lighting circuits or trolley circuit. On steam railways, the rails for the desired distance are charged with current from a battery, the train completing the circuit and operating a relay which connects the motor with the power circuit. On electric railways, the connection to the motor may be made through

Grade-Crossing Signal with an Illuminated Swinging Disk and a Locomotive Bell

a contactor on the trolley-wire or third rail, and operated by the car, while a second contactor serves to break the connection.

The signal was designed to serve as an automatic flagman. In the original form the mechanism and a gong were mounted on top of the post, with the disk on a rod extending vertically above it. But by putting the disk on a bracket at the side, it is made more conspicuous to drivers in the street or road. About 1700 of these signals are in use. The signal has been developed in its present form by the Railroad Supply Co., of Chicago.

Two other forms of swinging or "wig-wag" crossing signals are in use, but to a more limited extent. One of these has a pendulum disk (with central lens and inclosed lamp) hung from an arm of the post, while the post also carries a loud gong or bell. This is a specialty of the Bryant Zinc Co., of Chicago. In the third signal, the post is surmounted by a swinging bell, the shaft of which carries two small red swinging blades; these have a limited travel and are for the day indication only. At night, a lamp mounted in a hood above the bell gives a flashing red light while the bell is ringing, and there may be a crossarm with "Danger" in flashing red letters. This signal, which is made by the Hoeschen Mfg. Co., of Omaha, Neb., has no battery. It has metallic circuits to

magnetic generators placed at the desired distance and operated by the deflection of the rails under passing wheels. The signals may have an electric lamp or a long-burning oil lamp for use on steam railways.

The Houston Ship Channel

By Charles Crotty*

The Houston Ship Channel is the name of the improvement now under way to provide a ship channel to connect the City of Houston, Texas, with the Gulf of Mexico, and to provide a new port for the handling of the growing commerce of the Southwest.

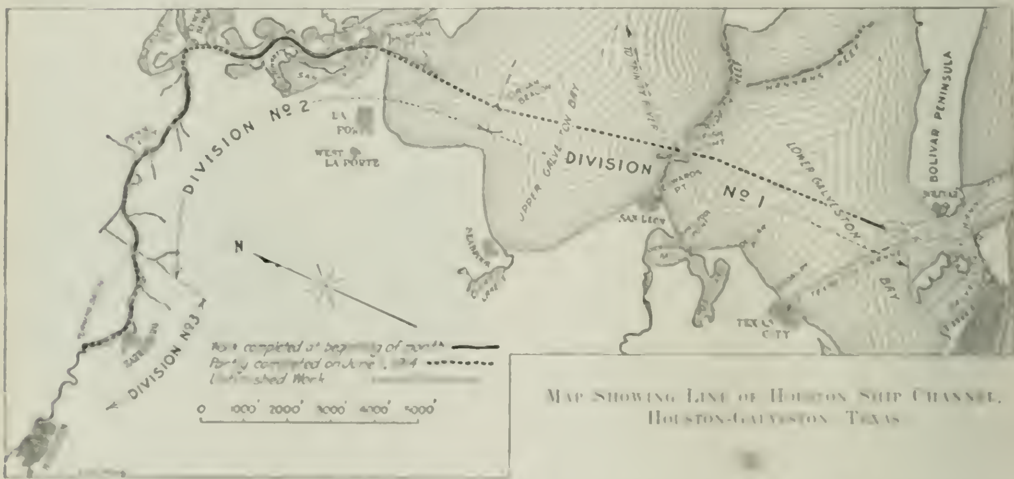
The channel extends from Galveston Harbor opposite the inner end of the jetties and upper end of Bolivar Roads, in a northwesterly direction across lower and upper Galveston Bay, San Jacinto Bay and River; entering Buffalo Bayou at Lynchburg, thence up Buffalo Bayou, past the historic San Jacinto Battlefield, to the foot of Long Beach, about two miles above Harrisburg, ending in a turning basin which is about seven miles below Houston's business center by water and about 4½ miles in a straight line. The total length is 50 miles, of which 25 miles is in Galveston Bay.

In their natural condition prior to improvement, these waterways had a depth of about 9 ft. in the lower and about 7 ft. in the upper Galveston Bay, 10 to 20 ft. in the San Jacinto Bay and River, with low marshy banks and a width of 300 to 800 ft. and 10 to 15 ft. in Buffalo Bayou, with gradually rising banks from 6 to 40 ft. at the turning basin and widths of 200 to 500 ft. The material consists of mud, sand and clay, with some shell through Galveston Bay, sand and clay of varying colors and hardness through the river and bayou.

For convenience and division of contracts the waterway has been divided into three general divisions, No. 1 extending from Bolivar Roads to Morgan Point, about 20 miles long and 2½ miles from upper end of bay at Morgan Point; No. 2 extends to the mouth of Vince's Bayou, and is about 25 miles long, and No. 3 thence to turning basin 5 miles, though what is usually known as the Houston division from turning basin to foot of Main St., Houston, a distance of 7 miles is really a part of Division 3.

The earlier projects for the improvement of this natural waterway, which were adopted in 1871 to 1892, provided for a channel 100 ft. wide and 12 ft. deep, dredging being carried on for a number of years in removing shoals to attain this depth, which was sufficient for the character of vessels then navigating these waters. The Morgan Line began operating steamships and sailing vessels between New York and Houston as early as Apr. 21, 1876, when the "Clinton" passed up the channel and docked at the wharves at Clinton, a few miles below Houston where a branch line of the Texas & New Orleans R.R. connected with the city and other railway lines.

Considerable traffic was carried on for many years, until the increased size and draft of the vessels outgrew the development of the channel and they were forced to seek ports with deeper water.



Map Showing Line of Houston Ship Channel, Houston-Galveston, Texas

The existing project, as adopted in 1899, and modified in 1905, provided for the completion of the ship channel to a depth of 25 ft. and width of 150 ft. across Galveston Bay, with slopes of 1 vertical to 3 horizontal, and width of 100 ft. in river and bayou, with slopes of 1 vertical to 2 horizontal, and a turning basin 600 ft. in diameter on the bottom.

As a part of this project the channel was dredged in 1903-05 to a depth of 18½ ft. under contract with the Bowers Southern Dredging Co., of Galveston, Tex., at the rate of 8.8c. per cu.yd. in Galveston Bay and 11c. per cu. yd. in river and bayou. This depth was obtained as far as Harrisburg.

In 1906, contract was entered into with the Atlantic, Gulf & Pacific Co. for the dredging of Division 3 above Harrisburg and the excavation of the turning basin, at the rate of 19.9c. per cu.yd. Under the various small appropriations from year to year, this work, and the removal of several sharp bends by contract and Government dredges, the entire channel was completed to a depth of

*U. S. Superintendent in charge of field work and supervising dredging operations, Houston Ship Channel, La Porte, Texas.

18½ ft., though the shoaling in Galveston Bay of several feet prevented its use by deep-draft vessels.

In view of the fact that previous appropriations had not been in sufficient amount to insure the completion of the channel to its full depth of 25 ft., its entire length, at one time and make it available for practical use, the citizens of Harris County, through their Deep Water Committee, proposed to the Rivers and Harbors Committee in Congress that they would be willing to contribute one-half of the funds required to complete the work if Congress would make a large enough appropriation and enter into contract for the prompt completion of the project.

Acting on this proposition, Congress, in June, 1910, appropriated $300,000 and authorized contracts for $2,500,000 provided that Houston interests would contribute one-half of the cost of the work, or $1,250,000, and provided that any contract entered into must specifically provide for the completion of the project.

The Harris County Houston Ship Channel Navigation District was then created, taking in the entire county, bonds were voted and sold, the money being turned over to the United States early in 1912.

Under this authorization contract was entered into on June 19, 1912, with L. T. Gaylord, representing the Atlantic, Gulf & Pacific Co., of New York, for the dredging of all three divisions, and providing that on completion of the work the contractor should turn over to the United States a channel the full depth of 25 ft. from end to end, and width of 150 ft. in Galveston Bay and 100 ft. in river and bayou, the slopes to be as steep as the material would stand with payment to be made for excavation within 1 on 3 in bay and 1 on 2 in river and bayou. This placed the responsibility of maintenance until completion of contract upon the contractor, and insured the obtaining of a finished channel its full length at one time.

The contract rates are 6.95c. per cu.yd. in Div. 1, based on estimated quantities of 10,538,000 cu.yd.; 14.9c. per cu.yd. in Div. 2, based on 6,100,000 cu.yd., and 18c. for Div. 3, based on 4,025,000 cu.yd.

Work was started June 15, 1912, with one dredge, a second was added Aug. 4, the third Aug. 31, the fourth Nov. 17 and the fifth on Dec. 28, 1912. The fleet was kept on Divisions 2 and 3 until they were practically completed, Division 1 across the bay being left until last. To June 1, 1914, these five dredges have excavated a total of 20,027,418 cu.yd. of material from within the prescribed cross-section, and a gross total of 28,788,596 cu.yd., including overdepth, outside of slope lines, etc., beside the removal of silt and shoals over about 17 miles of Division 2 in final clean-up of which no accurate record has been kept.

The first cut was completed June 15 and all the fleet massed on the clean-up work, which it is expected will be finished about Aug. 1, 1914, and the channel opened up for navigation about a year and a half in advance of the time allowed under the contract.

The plant engaged on the work is of the most modern and efficient type of hydraulic suction pipe-line dredges, and consists of the following: "Geo. W. Catt," steel hull, 27-in. suction, 24-in. discharge; "Texas," "Washington" and "Pensacola," with wooden hulls, 22-in. suction and 20-in. discharge pipes, belonging to the Atlantic, Gulf & Pacific Co.; and the "Galveston," wooden hull, 22-in. suction, 20-in. discharge, and the "Houston," a new wooden hull, steam turbine, electrically driven pump and cutter engine, 24-in. pump and 22-in. discharge pipe, belonging to the North American Dredging Co., of Galveston, Tex.

The largest output for any single month was made by the "Texas," which excavated 1,261,646 cu.yd. of mud, shell and sand, completing a channel 150 ft. wide and 9100 ft. long, pumping through about 1200 ft. of pipe line working in Galveston Bay. The dredge "Houston," equipped for high speed and lifts, handled 222,861 cu.yd. through a pipe line 3800 ft. long and with a lift of 36 ft. while working in the turning basin. A large part of this material was hard red clay, the rest mud and sandy loam.

For the maintenance of the channel after the completion of this contract, two large hydraulic suction-pipe-line dredges are being built under contract with the Bowers Southern Dredging Co., of Galveston, Texas, at a cost of $320,000 for the two. The steel pontoons, pipe lines and other equipment will probably bring the cost up to about $400,000, of which one-half is contributed by the Navigation District.

The completion of this channel will allow vessels to reach a harbor 50 miles closer to the point of production of the greater part of our commodities, and to form connection with the seventeen railways centering at Houston, will provide for the expansion of the growing business of the Southwest and create a great inland, fresh-water harbor, develop industries along its route by furnishing cheaper transportation for raw and finished products, and with pipe-line connection to the fuel-oil fields of Texas and Oklahoma, the opening of the new iron-ore fields of northeast Texas, the early completion of the Intra-Coastal Canal enabling coal barges to be brought from the fields of Alabama, and along the Ohio River, it is expected that a new era of business development in manufactures will take place.

Cotton is still the greatest single item of export and about 400,000 bales have been handled over this channel each year by barges, while about 5,000,000 bales per year have passed through Houston to be loaded on vessels at Galveston and Texas City. It is expected that Houston, with the many compresses and warehouses of the most modern fireproof type that are now built along the channel and between the turning basin and the city, will be able to load a great deal of this commodity into vessels in her own harbor.

The recently created Harbor Board of Houston is now working up plans for the construction of the latest type of wharves, warehouses and freight-handling machinery, to be erected in units as the needs of commerce justify, beginning at the turning basin, and working down the channel. As the waterway connects with other streams and lakes there is available for improvements about 75 miles of water front, with close rail connection, and with its ultimate enlargement as the business grows and the Western country becomes more thickly settled and productive the possibilities for the future as a port are unlimited. Of course, Houston expects to reap a considerable share of the trade developed for this section of the country by the opening of the Panama Canal.

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Street Pavement Work in Zanesville, Ohio, will amount to nearly $200,000 for the period since the great flood of 1913, according to statistics recently published in the local newspapers. About $50,000 is being spent on the sewerage system.

Putting 13-In. Pins in Place of 10-In. Pins, Williamsburg Bridge

By D. E. Hovey*

In the May 14, 1914, issue of Engineering News, reference was made to "the sensational performance of taking out a 10-in. bridge pin and putting a 13-in. pin in its place" on the Williamsburg Bridge, and a brief outline of the general method adopted was given. The writer believes that a further account of this unusual piece of work will be of interest to engineers.

The Problem

The Williamsburg suspension bridge, crossing the East River at New York, is so designed that the portions of the main cables extending from the tops of the towers back to the anchorages carry no load from the land spans. These spans are supported by steel towers. Fig. 1 shows the general arrangement. The stiffening trusses of the main span are continuous between the towers and are supported on rocking links at the towers; the trusses continue landward of the rocker supports for a distance of $20\frac{1}{2}$ ft., or one panel, as cantilevers. In the original construction, these cantilevers consisted of a single triangle at each end of each truss, L-29 L-30 U-30, in Fig. 2, carrying the land span at L-29 by a 10-in. pin.

On account of this unusual construction, all motions of the center of the main span up or down, due to contraction, expansion, or live-load variations, cause points L-29 to move down or up. Also, contraction or expansion of the stiffening trusses causes points L-29 to move horizontally toward or from the towers (the stiffening trusses being free to move on account of their rocker support); such horizontal motions are communicated to the land spans at both ends of the bridge, and cause tension or compression across the points L-29. These stresses are further increased by horizontal or wind stresses, since the main lower chords are also the wind chords.

The general strengthening of the bridge for subway trains, recently completed, required various additional members and connections. Those at panel-point 29 are shown in Fig. 2. The original cantilever has been strengthened by the addition of triangle U-29 L-30 U-30. A portion of the load from the land span has been permanently transferred to the new triangle by means of a new transverse lattice truss attached to the land span at point U-29 and resting on adjustable wedge bearings on the new cantilever triangles at U-29. This construction is shown by Fig. 2.

It was also necessary to replace the old 10-in. pins at L-29 by new pins 13 in. in diameter. To do this, the old 10-in. pin-holes must be enlarged to 13 in. in diameter, with all connecting main members in position. On account of the difficulty of removing the chips produced by the boring operation by any other method, it was decided to remove the old 10-in. pins and enlarge the holes by open boring and the use of a boring head fed along a boring bar, if a safe method of procedure could be developed.

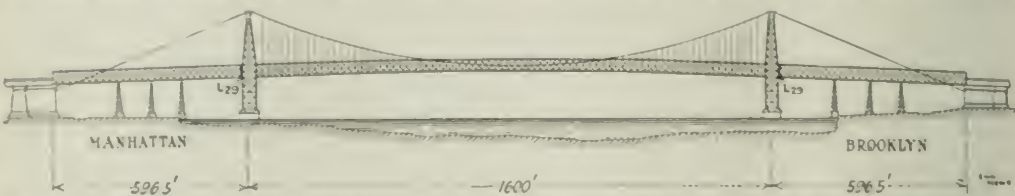


Fig. 1. The Williamsburg Bridge as Strengthened by Additional Towers in Shore Spans

*Assistant Chief Engineer, American Bridge Co., 30 Church St., New York.

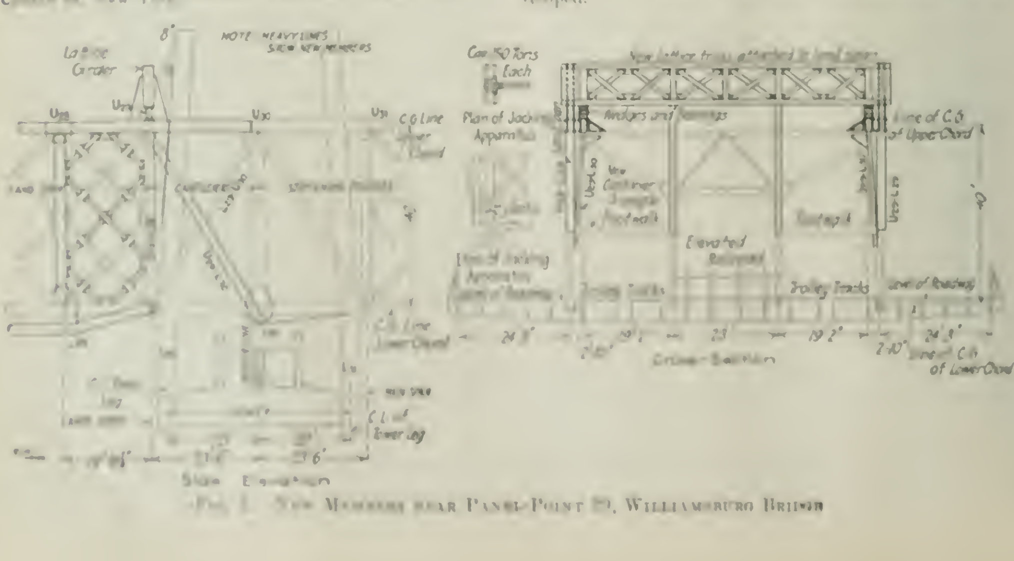


Fig. 2. New Members near Panel-Point 29, Williamsburg Bridge

To relieve the 10-in. pins of vertical load, the new wedge bearings at U-29 could be temporarily replaced by hydraulic jacks and blocking, by which means the load of the connecting spans could be temporarily transferred from the old cantilever triangle L-29 L-30, U-30, to the new triangle U-29 L-30 U-30, in Fig. 2. Longitudinal movements at L-29 could be temporarily suppressed or at least reduced, by stopping trolley and vehicular traffic during the early morning hours of certain nights. As the bridge is a very important traffic link, it was imperative to make the stoppage of traffic as brief as possible. This demanded the development of a device to enlarge the holes quickly, and effective guarding against all unnecessary delays during the boring operation.

Locking Joint L-29

It was obvious that the boring, with the old pins removed, would not be successful unless the connecting members were held in fixed relative positions during the entire operation of removing the old pin, enlarging the holes and driving the new pins. It was also necessary to arrange for connecting the new wind chords L-28 L-29 on the new pins, and further to provide for stresses at the joint due to temperature changes and lateral wind pressure.

The lower chords were prevented from moving toward each other by driving wedges in the clearance spaces between them. They were held from moving apart by two tie-rods $3\frac{1}{2}$ in. in diameter, fitted to temporary brackets on their bottom flanges. The three intersecting members of the land span were already connected by heavy gussets inside of the posts L-29 U-30. But the members L-29 L-30 and L-29 U-30 of the old cantilever were connected only by the pin; therefore, triangular brackets were provided to attach these members rigidly together and to stop relative angular motion. It was then only necessary to furnish heavy struts to join the land span to the cantilever in order to stop all relative motions at this joint. To prevent the thrust of the boring head from pushing the members together, transversely with the trusses, small wedges were driven in the clearance spaces between them. The design of these devices for locking joint L-29 against all motions is shown in Fig. 3.

To further guard against any possible motions at L-29, the upper chords of the land span and the stiffening truss cantilever were locked by struts and tie-rods, as also shown in Fig. 3.

All of these temporary parts to lock the joint against motions were carefully fitted up on the bridge in advance and adjusted loosely so as not to interfere with the normal movements of the bridge until everything was ready for the removal of the old pins.

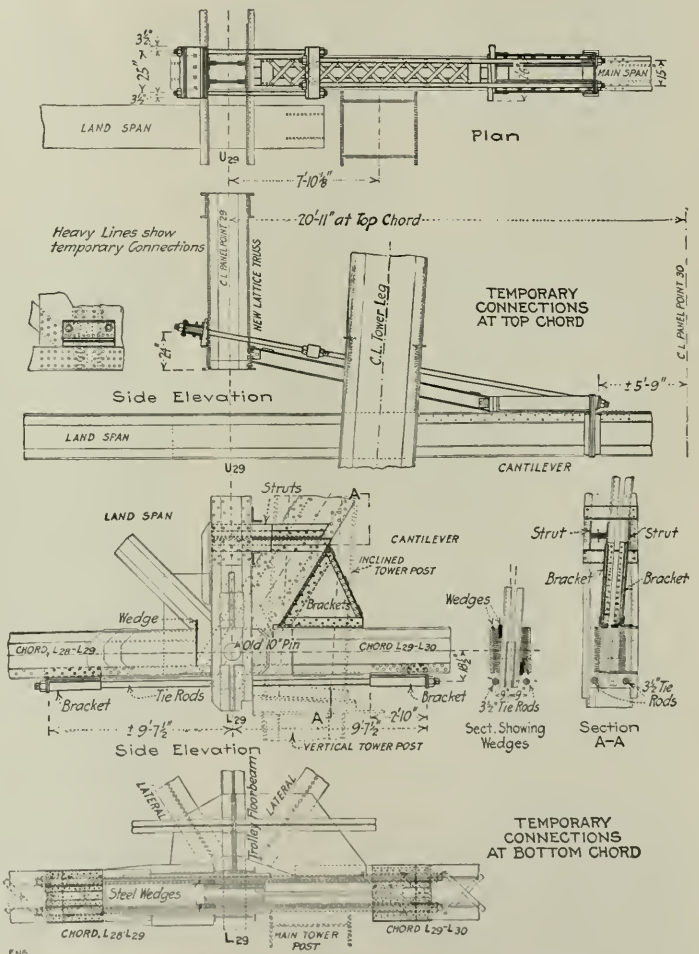


Fig. 3. Temporary Connections to Hold Joint L29 Rigid While Boring Out the Pin-Hole

It was found that the old pins could not be backed out, as they had been driven very tight and some corrosion had occurred, thoroughly cementing them into the ends of the holes. The pins were therefore collapsed by boring axial holes along the horizontal diameter and chipping away the walls between the holes. The half pins were then loosened and wedged back in their original positions, so that when all was ready they could be quickly removed.

Boring Machine

The design of the boring machine for enlarging the holes presented an unusual problem. Pins L-29 are very near the main tower legs, and the clearance was so limited that the machine had to be placed on the landward side of the hole. This meant inverting the machine from right handed to left handed when changing from south truss to north truss or vice versa. It was vital that the machine should be so made that it could be attached to the bridge and carefully aligned in advance, and clearance provided so that the old pin could be taken out, the boring bar put in and removed, and the new pin driven without disturbing the main frame and the alignment of the machine. It must be as compact as possible to avoid having to cut a large hole in the roadway floor. As the amount of steel to be bored out was about 1300 cu.in., ample strength, stiffness and power were necessary. The removal of 1300 cu.in. in one hour (over 6 lb. per min.) runs in a groove milled in the bar, and is driven by gears in the feed head O. The fixed pinion P is boxed in the plate R, which is attached to the fixed boring-bar box K by studs S. The shaft carrying pinion P is fitted with a handle which was locked to the plate R, thus providing automatic feed of the screw due to rotation of the boring-bar. To stop the feed, this handle could be unlocked, allowing gear P to rotate, thus stopping the action of the feed train.

In ordinary practice, the tool head is fed along the bar toward the feed mechanism. Clearances prevented this being done, and to keep the feed-screw in tension, it was necessary to provide a thrust bearing at the extreme outboard end of the bar. This thrust bearing is of bronze, with 12 collar bearings, each lubricated by means of a central oilhole in the boring bar, with branches to each collar, and supplied from a grease cup in the end of the bar.

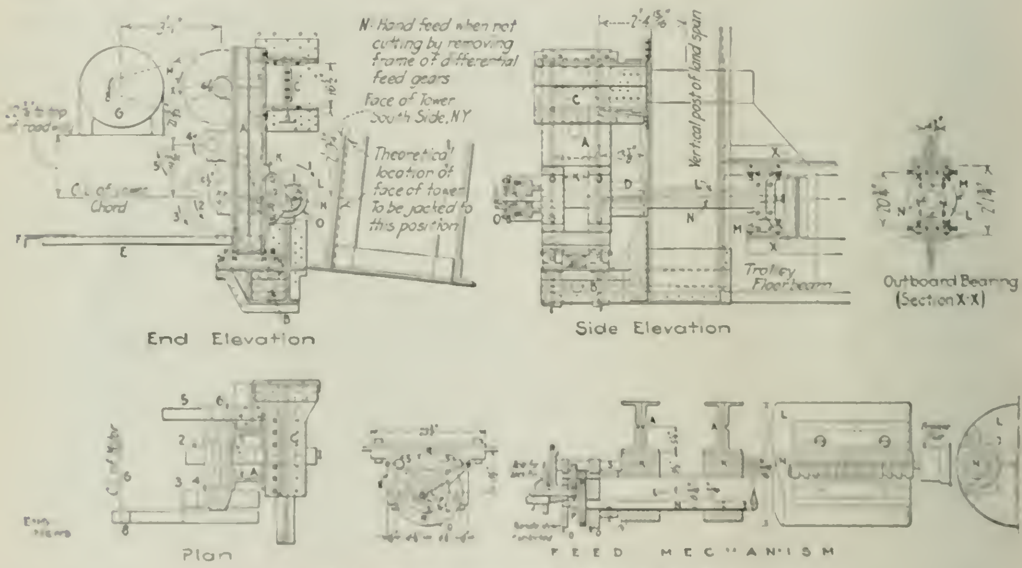


FIG. 4. SPECIAL PIN-HOLE BORING MACHINE

in the form of spiral chips, required ample space for their successful removal.

To provide for convenient attachment to the bridge superstructure and for assembling alternately right and left, the frame of the machine (Fig. 4) is a structural-steel post A. This was attached to the bridge by steel brackets B, C and D and braced by the strut E, bolted to a bracket bolted to lower chord L-28 L-29. On the back of the frame is a gear train, 2, 3, 4, 5, 6 and 7, driven by a [illegible]-hp. motor G, by a [illegible] Morse chain H, engaging sprockets 7 and 8. The front of the frame is left clear for the boxes K and [illegible] of the boring bar I. To the stringer floor-beam was clamped an outboard bearing M, one-half of which could be removed for inserting and removing the boring-bar without disturbing the alignment of the bearing.

The boring bar is $6\frac{1}{2}$ in. in diameter, and 7 ft. 11 in. long as assembled. A feed screw N, $1\frac{3}{4}$ in. in diameter, The boring head carries seven self-hardening, high-speed steel tools. Six of these were so set that each made a circular cut $\frac{1}{4}$ in. wide. The tool taking the cut from 10 in. to $10\frac{1}{2}$-in. diameter was set in advance of the next from the center and so on for the six. The seventh tool took a light finishing cut. The assembled boring-bar as it was handled in and out of the hole is shown by photograph, Fig. 5.

The Boring Operation

All preliminary operations having been completed in advance, on the night set for removing the various pins a force of picked men, each carefully instructed in his duties and working from a carefully prepared schedule of operations, was assembled on the bridge and at the time fixed to begin work all trolley and vehicular traffic was stopped and the work begun. At each of the four points the work was completed well within the time allowed.

Fig. 5. Boring Bar

The following gives the record for each point:

Point	Date 1914	Traffic stopped	Traffic resumed a.m.	Total time hr.	Total time min.	Time first cut min.	Av. hp.	Steel removed, lb., per min.
Manhattan south......	Apr. 12	1.00 a.m.	5.50	4	50	60	26.9	6 15
Manhattan north......	Apr. 26	25th; 12.20 p.m.	3.45	3	25	58	22.6	6.35
Brooklyn south......	May 16	15th; 12.25 p.m.	3.30	3	5	57	22.5	6.46
Brooklyn north......	May 29	28th; 12.15 p.m.	3.30	3	15	58	21.4	6 35

The boring machine assembled on the bridge is shown by the flashlight photograph, Fig. 6, in which the boring bead is seen just entering the vertical post.

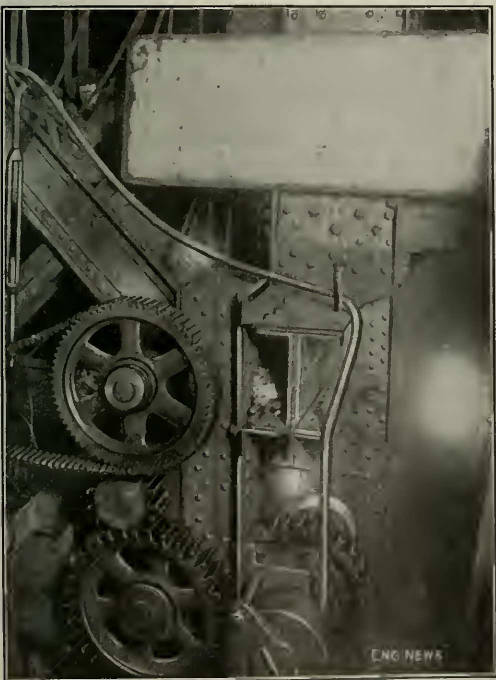


Fig. 6. Boring Machine

This work was done by the Snare & Triest Co., of New York, under a contract for strengthening the end spans of the Williamsburg Bridge, and under the direction of the Department of Bridges of the City of New York.

The devices for locking joint L-29 against motion, and the boring machine, were designed by the writer, who was retained by the Contractors as Consulting Engineer.

The boring head was developed by Martin Joachimson, Assistant Engineer of the Bridge Department, in consultation with the writer.

The Old Wooden Bridge

[The excellent parody on Longfellow's "Evangeline," printed below, we take from the June "Bulletin" of the Iowa State Highway Commission, which credits it to the Manchester (Iowa) "Mirror," where it was printed anonymously. Such bridges as are well described in the verses exist, however, in hundreds of country towns beside Manchester.

It is fair to say, however, that while there are many such rotten and rickety wooden structures which ought to be replaced in the interest of safety, there are still localities where the wooden truss bridge is probably the best structure that can be built; and many old wooden bridges, properly protected from the weather, have had a useful life longer than that of many steel bridges.]

This is the structure primeval; the tottering beams and the timbers,
Patched up with boards and with fragments, old, frail and fearful to look at,
Stand like ruins of Rome, with memories sad and prophetic;
Stand like a pile of junk that no one will take for the hauling.
Loud from the rickety boards, the ancient nails all together,
Shriek, and in accents disconsolate, answer the curse of the traveler.

This is the structure primeval; but where are the hands that in old times
Wielded the hammer and saw, and fashioned its lines full of beauty?
Where are the boys of the village that leaped from the rail in bravado?
Where are the maidens of those times, who made sand cakes in its shadow?
Gone to their final home, but the bridge in rotting decadence,
Marks for all who can see, the date when our city was founded.

Dear to the hearts of the Council is this relic received from the ancients;
Precious is each piece of punk secured by rust to the ruin;
Ten-penny nails in rich measure adorn every spot that will hold them;
Boards of all kinds, wire and rocks give grace in fullest profusion.
Think not that money is lacking to furnish a structure more modern—
Money is raised every year, and spent where the aldermen wish to;
Near to their hearts and their homes have they laid out their lines of improvement,
Trim and neat is our city, wherever the "drag" has been working.
No, this bridge is preserved, a dangerous trap for the user,
Likely to cost many times the price of a new and secure one,
A monument, always to stand, to the wisdom and pride of our Council,
Showing the different styles of nailing supports to a ruin,
Showing to all the world the power that lies in the Council.

Field and Office

A Drafting-Room Innovation: Drawing with Steel Point on Coated Paper

A proposal to revolutionize drafting-room practice is just being put forward in practical working form. Drawing paper and tracing cloth, pencil, pen and ink are to be abolished. In their place is to come a dark-coated fabric and a steel scriber; to make a drawing, use the scriber as a pencil and scribe the drawing on the coated fabric, producing white (and *translucent*) lines on the dark (and opaque) fabric. Blueprints are made direct from the finished drawing.

Charles H. Little, of Cleveland, Ohio, worked out the new appliances, in pursuit of the idea that double work—drawing and tracing—is superfluous and ought to be abolished. He says that very many trials and experiments were required to find the right base (paper or fabric), the right coating, and the right scriber. Now that the work has reached the point of practical success, Mr. Little's company, the Universal Drafting Machine Co., Cleveland, is putting the fabric and scribers on the market. The fabric is called Unidraft Fabric, possibly in reference to the elimination of double work.

The Fabric—The surface of the coated fabric is resistant enough that it does not become scratched in working on it and handling it; yet it takes the scriber marks easily, with just enough resistance to permit of varying the width of line by controlling the scriber pressure. Figs. 5 and 6 show lines of different strengths. The surface is dull, and does not reflect a glare into the eyes. Also, the color (dark brown) gives it one great advantage over paper and tracing cloth: the eye is rested where it looks at the general surface, and only the narrow width of the scribed lines is seen. This not only is restful to the eye in a general way, but it makes it very easy for the draftsman's eye and mind to follow the drawing, for the same reason that a lantern at night strikes the eye much more quickly and surely than does a black object in daytime. The fabric is claimed to eliminate the eyestrain question (always important with draftsmen), and that the unsolved problem of satisfactory drafting-room lighting ceases to exist.

A cloth base for the coating is preferred to a paper base, although the latter was tried out extensively in the course of the development work. The durability due to the cloth base, and the freedom from soiling due to the dark, nonabsorbent surface, are distinct advantages where a drawing is worked on for a length of time.

The Scribers—Various forms of scribers have been tried. The one shown (magnified three or four times) in Fig. 1 is the preferred form, being most widely adaptable. It is held with the triangular side leading, the beveled face standing about vertical (hardly inclined forward, as in Figs. [illegible] and [illegible]); the trick of using it is learned easily, as we have had occasion to prove.

Circles are drawn just as easily as straight lines, scriber points being inserted in compasses and bow instruments. Fig. 2 illustrates the work of drawing circles with bow compasses. Here also the width of line is controlled by pressure variation, same point being used throughout.

The scriber shown answers all requirements as to drawing lines. It is also satisfactory for lettering, but in this part of the work individual preferences and habits of the hand are a consideration. A scriber of cross-shaped section, ground off on a bevel like the one shown, is also an efficient tool in lettering. The important fact as to lettering is that a little practice enables one to letter just as rapidly and neatly with the scriber as with the pen.

By eliminating ink, the work of drawing on this fabric is clean, quick work; the draftsman does not wait for ink to dry, or run the risk of making a smear. This fact alone means great saving of time, enough to make up for any other differences of facility between scriber and pen.

Erasures—To erase lines or marks from the fabric, it is only necessary to draw or mark over them with pen and ink. The white under-coating takes the ink; the black or dark-blue coloring of the ink is hardly distinguishable against the brown, in looking at the surface, while for blueprinting purposes the erasure is completely effective.

Another line or mark can be made over the erasure, by again using the scriber, which cuts away the ink, together with some of the under-coating.

The erasure process is much quicker and easier than erasures on tracing cloth, and in certain cases may be quicker and more convenient than erasing pencil marks or lines. Thus, taking out part of a line in a crowded part of a drawing is easy with the fabric, while in pencil work it will require redrawing some lines erased unintentionally. Converting a full line into dashed or dotted is also very easy in the case of the fabric.

The facility of erasure is apt to be an important question with those who are accustomed to making drawings by the trial-and-erasure process. For work of this kind, the applicability of the fabric is rather limited. Its primary field is that class of work in which the arrangement and layout of the drawing is well fixed in advance, as in detail work, shop drawings, etc. Especially where the edges of the rules bear scales, as in the drafting machine, there is a constant guide to the line work which is of value in the most efficient use of this fabric.

Blueprinting—The fabric prints practically as fast as tracing cloth. The prints are clear and sharp, being quite as contrasty as ordinary blueprints. Being made from a white-on-black drawing, they show blue lines on a clear white ground. It is possible to make good white-on-blue prints from the first prints.

Cost—The Unidraft Fabric costs "from 25 to 30% more than the combined cost of the drawing paper and the tracing cloth which it replaces." The makers intend to put it out regularly in sheets, on the idea that rolls are wasteful.

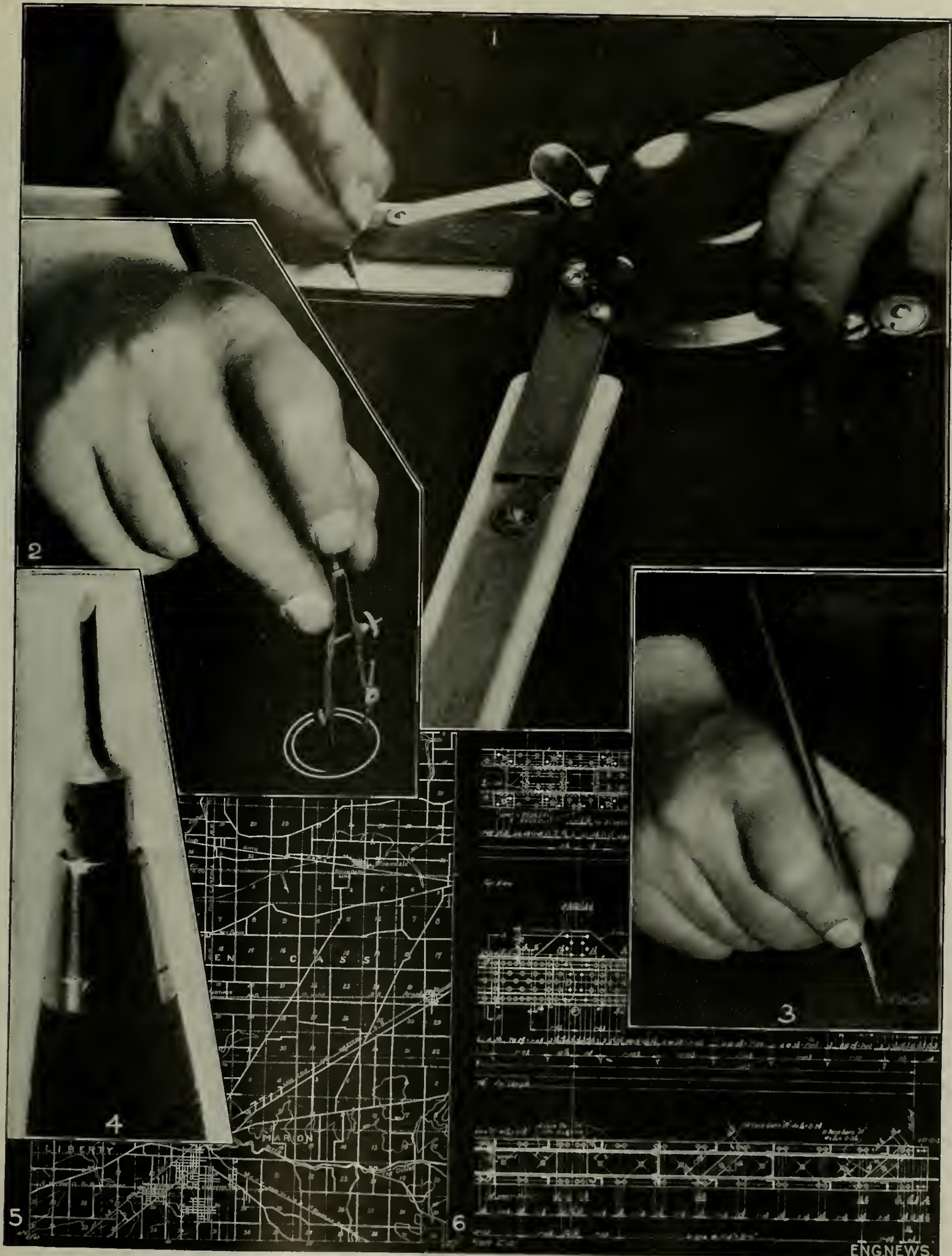


Fig. 1. Working on Unidraft Fabric with the drafting machine. Fig. 2. Scriber point in bow compasses for circle work. Fig. 3. Lettering; with a little practice the lettering becomes as perfect as ink or pencil lettering, and it is fully as rapid. Fig. 4. Scriber point for line work, magnified several times. Fig. 5. Part of a map drawn on the fabric, showing fine contours and heavier road lines, irregular lines, etc. Fig. 6. Part of a structural-steel drawing, with close line work of fine and heavy width, crowded lettering, and small bow-compass work. (Figs. 5 and 6 are reproduced direct from photographs of finished drawings on the fabric.)

THE NEW FABRIC AND SCRIBER FOR MAKING SINGLE-PROCESS DRAWINGS

A Very Large Block and Hook

Readers of current engineering literature have probably noted the gradual growth in six-sheave blocks during the past four years. The one here shown differs from that described in ENGINEERING NEWS of Jan. 5, 1911, in having ¾-in. instead of ½-in. plates. The block and hook illustrated are to be used on a 50-ton Mitchell derrick car manufactured by the American Equipment Co., for bridge erection.

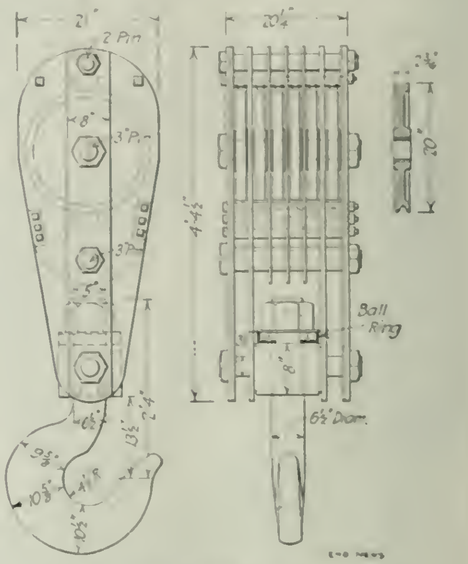
BIG SWIVEL HOOK FOR 50-TON PATTERSON BLOCK

The total weight of the block is 2500 lb. Its tail bolt is 2 in. in diameter; the sheave pin is 3 in. in diameter with a ½-in. dog to prevent turning. There are four heavy cast-iron separators between the ¾-in. plates. There are six sheaves, 20 in. in diameter, for ⅞-in. wire cables. The block is fitted with a ball-bearing hook, forged from an 8x8-in. forging billet, flattened to 10⅝x6½ in. The hook, with supporting beam, weighs 1040 lb.

The block was designed and built by the W. W. Patterson Co., Pittsburgh, Penn., for the Illinois Central R.R. It was delivered 23 days after the placing of the order.

Trench Backfilling Machine

A backfilling machine for trench and other work is now being introduced, which travels at the side of the trench and scoops in the dirt from the dump pile left by the excavator. It has a 10-hp. hoisting engine and vertical



DETAILS OF LARGE HOOK BLOCK

boiler mounted on a steel frame carried by wide-tired traction wheels and propelled by its own power. It is about 10x10 ft. over the wheels.

Across the front of the machine extends a horizontal frame 16 to 40 ft. long, according to requirements, along which travels a carriage to which is attached a scraper plate. The carriage has wheels riding upon the frame

TRENCH-BACKFILLING MACHINE

(The scraper or bucket is attached to a carriage traveling on the horizontal frame and operated by a cable.)

and bearing against it laterally, the wheels having deep flanges so as to resist the vertical and horizontal thrust of the scraper. To the carriage are attached the ends of a wire cable which leads over horizontal sheaves at the ends of the frame, and then back over other guide sheaves on the front of the main frame, and thence to the engine drum. The scraper is L-shaped in plan, 24 in. wide and 36 in. high, and the carriage forms a back plate 36 in. long. It has an adjustable bottom plate or apron.

In operation, the machine travels near the side of the trench, and the scraper runs to and fro, scraping material from the dump pile into the trench. At each end of its travel the scraper strikes an adjustable trip, thus automatically reversing the engine. It makes 10 to 15 strokes per minute. The distance from the center of the trench to the center of the machine is equal to half the length of the long frame which carries the scraper. The machine has backfilled about 300 yd. in a single day, when working against a clay spoilbank that had stood for four or five months during the winter and had become hardened.

The machine is the invention of F. L. Monahan, of Joliet, Ill. It is intended particularly for use in connection with his trenching machine, and is a development of his earlier backfiller, in which a scraper was hauled by a cable from an engine on the opposite side of the trench, the scraper being run back by men handling and guiding it. This was described in our columns some time ago. The new machine is being built by William Heggie, of Joliet, Ill.

Cleaning Old Paving Brick by Compressed-Air Hammers

By Charles S. Butts*

The construction of the Rocky Branch joint district sewer at St. Louis, Mo.,† involved the disturbance of a considerable extent of paved street. The work is 5724 ft. long (on Blair, Palm and Glasgow Aves.) and was done by the James Black Masonry & Contracting Co., at a price of about $500,000.

Of the total length, 4600 ft. was in streets having brick paving grouted with cement, the paved width being 17 to 30 ft., and the total paved area being about 10,000 sq.yd., with about 530,000 brick. The specifications require the contractor to repave the streets and leave them in as good a condition as before the construction of the sewer.

The question was (and always has been) whether it pays to clean vitrified paving brick (cement grouted) for use in repaving streets. In cleaning them by hand a man can clean about 300 a day. And at $4.50 per 1000 (which was paid for this method of cleaning) he would only make $1.35 per day. In order to make it any inducement to clean them by hand about $9 per 1000 would have to be paid. The contractor finding this method not only slow but also unsatisfactory, abandoned the hand-cleaning method and adopted the following machine method which has proved very satisfactory.

An old vacuum-cleaning wagon was obtained and set up in a convenient location at the pile of brick to be cleaned and used as an air compressor. A ½-in. supply pipe was run to a cleaning board, and to it were connected ¼-in. hose, to each of which was attached a 6½-lb. stonemason's vibrating air hammer. The hammers had 1-in. chisel points for cleaning the portland-cement grout from the brick. A bench was built and about 70 bricks placed on it with the side upward. One side and one end were cleaned first; then they were turned and other side and other end were cleaned. As there was no cement on top or bottom it required only one turn to complete the cleaning. The capacity of this particular machine is three hammers, and, as the following table shows, the more hammers operated, the cheaper the brick can be cleaned.

	1 hammer	2 hammers	3 hammers
No. brick cleaned per day	1200	2400	3600
Cleaning brick, $2 per 1000	$2.40	$4.80	$7.20
Turning brick, $1 per 1000	1.20	2.40	3.60
Gasoline for machine	1.40	1.40	1.40
Cost	$5.00	$8.60	$12.20
5% for care of tools, etc.	0.25	0.43	0.61
Total cost	$5.25	$9.03	$12.81
Cost per 1000 brick	.4.375	$3.762	$3.3558

The difference in cost per 1000 is due to the gasoline used, it costing $1.40 per day to run the machine whether one, two or three hammers are used. To the above costs per thousand for cleaning must be added about $2 for hauling to the pile and back on the street, which would make the cost (using the two-hammer price) $5.76 per 1000. This against $16 per 1000 for new brick makes a saving of $10.24 per 1000 for the small-size brick (2¾x4x8¼ in.). The large paving brick now in use (3¼x8½x4⅛ in.) would cost about $4.50 per 1000 to clean, plus $2 for hauling, making $6.50 per 1000 against $22 for new brick, a saving of $15.50 per 1000.

Cleaning Cement Grout from Paving Brick with Pneumatic Chisels at St. Louis, Mo.

*First Assistant Engineer, Sewer Department, St. Louis, Mo. (In charge of the construction of the Rocky Branch joint district sewer).

†"Engineering News," Apr. 16, 1914

An Editor's Apology—The Secretary of the Oklahoma Society of Engineers prefaces Vol. 1 of the Society's "Transactions" with the following note:

Able contributors will be abashed to learn that their remarks have been garbled beyond recognition or omitted entirely. Many papers are missing and requests for brief synopses have generally brought no replies.

If the transactions are not worth perusing it must be the fault of the Society for entrusting the work to

THE SECRETARY.

Rapid Excavation, Foundation of Citizens' National Bank, Los Angeles

The work of clearing up the site of the future 12-story Citizen's National Bank Building, at the northwest corner of Fifth & Spring St., Los Angeles, Calif., began on Apr. 28, but difficulty in acquiring certain buildings on the site prevented excavating going forward until June 8.

The lot fronts $115\frac{1}{2}$ ft. on Spring St. and is 155 ft. deep. There will be eight cantilever footings, each containing 2600 cu.ft. of concrete and 4 tons of steel reinforcement, with bottom of cantilever 40 ft. below the sidewalk. Forty piers with pedestals are to be placed, averaging 20 cu.yd. of concrete and 1500 lb. of steel each. A sub-basement with floor 30 ft. below the sidewalk occupies an L-shaped portion of the lot adjoining the north and west property lines. The remaining portion of the building will have a basement with floor 13 ft. below sidewalk.

When once started, the excavating was pushed rapidly, and was completed in about one month.

Excavation was started by a steel stiff-leg derrick, of 70-ft. boom, using buckets of 2-cu.yd. capacity, shown in Fig. 2. The deep excavation necessitated a comparatively long boom, but made its operation difficult on account of the limited space. The buckets were loaded by hand, lifted by the derrick and dumped into a 30-cu.yd. bunker placed 12 ft. above the sidewalk at Spring St. The earth was removed from the bunker by motor trucks, which carried it about two miles, requiring 30 minutes for the round trip. The derrick could take out 500 cu.yd. in 24 hr.

Old brick walls abutting the site were shored and underpinned. At the left of Fig. 1 is shown a two-story brick wall, which extends about 8 ft. below the sidewalk. This wall was carried down in some places to a depth of 40 ft. The underpinning required the use of 300,000 bricks.

Fig. 3 shows the retaining-wall necessitated by an alley on the west. This retaining-wall was of reinforced concrete, 40 ft. high, 3 ft. thick, with a reinforced footing 8 ft. wide. The wall was heavily shored during construction.

All the buildings on the site had been removed by June

Fig. 1. Site Shortly after Start of Work

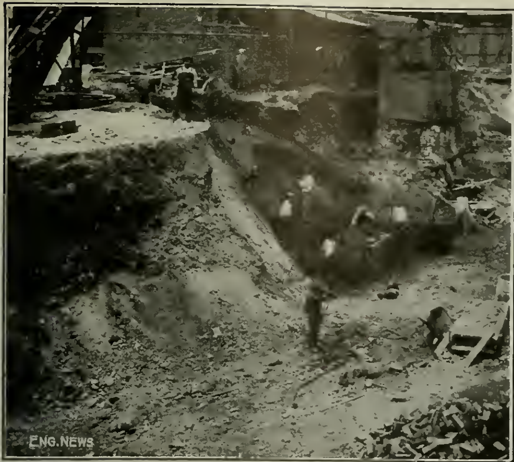


Fig. 2. Shoveling Into Derrick Buckets

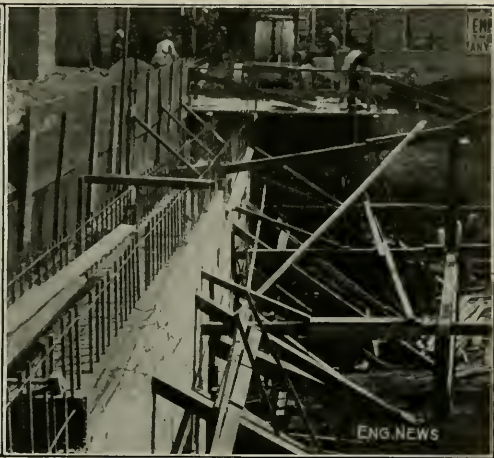


Fig. 3. Concrete Retaining-Wall with Timber Shoring

12, when teams were put to work on the shallow portion. The derrick continued in service until the night of June 14, when a cable broke. As the deep excavation was practically completed at this time, the derrick was removed and the work finished by teams. A wagon of 1½-cu.yd. capacity was loaded in 8 min. by 21 shovelers (mostly Mexicans), and hauled to the street in 2 min., with the assistance of two snatch teams. The work was scheduled for completion July 1, and will actually be completed shortly afterward. Extension of time was necessary and allowed, on account of delays caused by conditions beyond the control of the contractor.

Fig. 4. Excavating with Teams on Shallow Portion

The excavation amounted to 15,000 cu.yd.; while 3000 cu.yd. of concrete and 70 tons of steel reinforcement were placed. Fig. 4 shows progress on the foundation and excavation up to June 29, and the firm character of the soil.

The work has been pushed night and day, and according to the engineer would have been completed two weeks earlier had the lot been clear of buildings at the start. After all the leases were purchased, the last three buildings were wrecked in 24 hr.

The excavating was done by the Sound Construction & Engineering Co., Seattle, Wash., whose engineer in charge is J. T. Walsh.

Sub-Irrigation and Drainage for Golf Greens

To keep the golf greens of the parks in good condition during the summer, the Park Department of St. Louis has constructed them with a sub-irrigation system, supplemented with a drainage system for the removal of excess water.

Along one end of the green is laid a 1-in. iron header

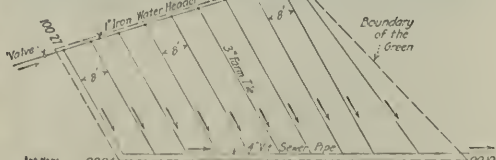


Fig. 1. Plan of Golf Green, with Sub-Irrigation and Drainage System; Park Department, St. Louis, Mo.

pipe, with 4-in. branches of $^3/_8$-in. brass pipe inserted at intervals of 8 ft. Each branch ends in an elbow, turned downward, and enters the upper end of a line of 3-in. farm drain tile laid with open joints and having a slope of about 0.5%. These lines of tile connect with a 4-in. vitrified sewer pipe laid along the opposite side of the green, this pipe extending to a sewer connection. The 3-in. tiles are laid in a 5-in. bed of sand above, which is 12 in. of soil, and the grass roots run down to the bed of damp sand and get an ample supply of moisture.

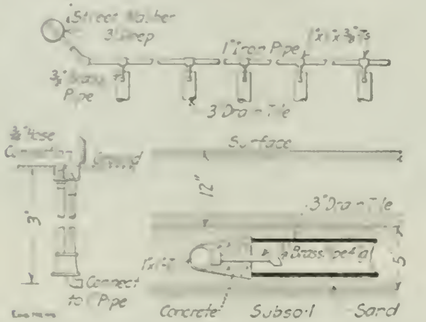


FIG. 2. DETAILS OF SUB-IRRIGATION FOR GOLF GREENS

The water is supplied by a 1-in. pipe laid 3 ft. deep and connecting with a McNamara street washer which serves as a valve box. From the top of the riser pipe of the street washer a $^3/_4$-in. hose connection is made to the

FIG. 3. PREPARING THE SAND BED OF THE IRRIGATION SYSTEM FOR GOLF GREENS

(The [illegible] pipe has a short branch into each line of tile, the tile drains being bedded in sand and the whole covered with 12 in. of earth)

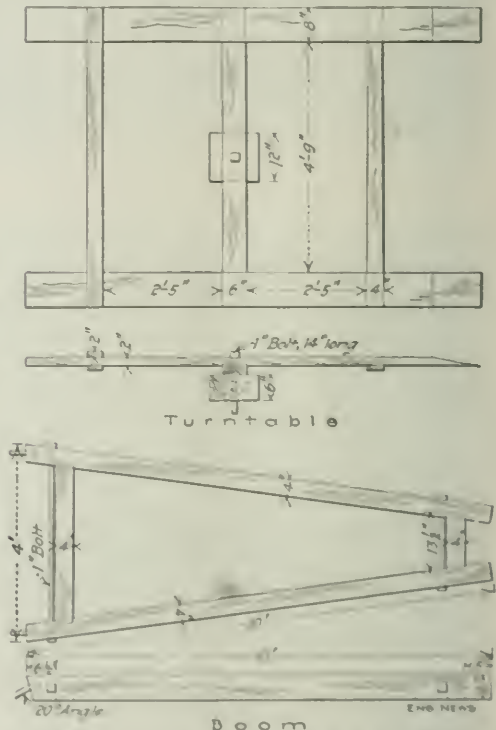
hose header of the irrigation piping. The irrigation is done at night usually.

A number of greens have been equipped with this system. It was designed by [illegible], Superintendent of Construction of the Park Department, and the work has been done by the park forces under his direction.

A Bridge Repair Derrick

A truck derrick for bridge repair and maintenance designed by H. Walker, master carpenter of the Cincinnati, Lebanon & Northern Ry., is illustrated by the accompanying drawings. The derrick consists of a truck carrying a platform upon which is a small windlass and boom, with blocks and tackle. Its object is to facilitate the handling and renewal of stringers, and other heavy timbers in the maintenance of wooden bridges.

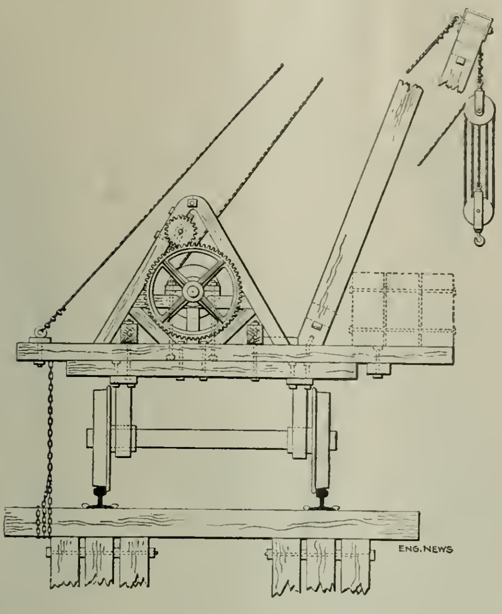
Edmund Feldman, 3591 Wilson Ave., Cincinnati, Ohio, who sends us this information, states that with this tool four men can handle and replace a 16-ft., 3-ply chord



DETAILS OF BOOM AND TURNTABLE OF THE TRUCK DERRICK

in a half-hour. To perform this operation, the wood guard rail above the chord is first removed and the bolts connecting the chord to the corbels are taken out. The track rail is then jacked up about 6 in., carrying the ties with it, which gives free access to the stringers. The truck derrick is run over the bridge to about the center of the stringers to be removed, and chained down to prevent tipping during lifting. A chain is placed around the chord which is then hoisted and placed on the truck in the location provided for that purpose. The truck is then unchained and pushed off the bridge where the stringers are unloaded. The new chord is then picked up by means of the derrick, pushed onto the bridge, and lowered into position. The bolts and guard rail are then

replaced. A turntable is provided so that the truck can be used on the other side of the bridge without dismantling the derrick.



Elevation of a Truck Derrick for Bridge Repair

The derrick was built by Mr. Walker for his particular needs and is not manufactured commercially.

Expensive Repairs to an 8-In. Water Main, 40 Ft. under Water*

About two years ago, an 8-in. cast-iron water main was laid across Galveston Channel, from a connection with the city water mains of Galveston, Tex., to the Government Immigration Station, on the north side of the channel, 1400 ft. distant. The submarine portion of the main was laid in a trench 40 to 100 ft. wide, dredged to a depth of 41 ft. across the entire width of channel, which was then 30 ft. and less in depth. The main was constructed with flexible joints of the ordinary ball-and-socket type, which allows deviation from a straight line of about 12°. Ordinary lead calking was used with yarn packing.

Soon after the pipe line was completed and water turned into the main, leaks began to develop, due partly to the method of laying and to the uneven character of the bottom, which caused such a deflection at each joint that the lead calking squeezed out. Other damage was done to the pipe line by a ship's anchor before the pipe laying had been completed. Efforts made to recalk the leaky joints by the aid of a diver were unsuccessful, because the pipe was found deflected to such an extent that there was no room for calking on two sides of the joint.

*Abstract of article in "Professional Memoirs," Corps of Engineers and Engineer Department at Large, July-August, 1914, pp. 553-559, by N. T. Blackburn, Junior Engineer, Galveston, Tex.

Box Forms for Inclosing Leaky Joints

The method adopted for repairing the leaks was as follows: A wooden box form was placed around each joint, and this form filled with neat portland-cement grout. Each form was supported on three 3-in. pipes, 14 ft. long, driven through holes in the box forms into the underlying clay, so as to form a pile foundation and prevent settlement at the joint.

The box form is shown in detail in the accompanying sketches, Figs. 1, 2 and 3. The box was hinged along one horizontal top edge and opened diagonally. In the top is a 4-in. hole with a pipe flange for connecting a 4-in. pipe extending to the top of the water, as shown in Fig. 3, through which the grout was poured into the box from a barge above.

A chain, fastened to one side of the lower half of the box, helped to close it and held it closed; one link was looped over a hook attached to the upper half of the box, and the hook was screwed up until the form closed tight. On opposite sides of the box, where the water pipe passed through, square holes 18x18 in. were left in order that the box form would close, no matter if the adjoining pipes were at their greatest possible angle, either vertical or horizontal.

Movable diaphragms, each consisting of two pieces, 2x12 in. by 3 ft., with holes cut in the form of an 8-in. semicircle to take one-half the pipe, closed around the pipe, tightly covering it and at the same time entirely closing the 18-in. holes. These false ends or diaphragms were outside of the form and were held in position by iron straps, under which they could move freely against the side of the form.

Three holes, large enough to take a 3-in. pipe, were bored through the top and bottom of the form for the piling. After the pipe piles were driven down through the form flush with its top, ½-in. iron plates were laid over the tops of the piles and bolted to the form, to carry its weight until the cement grout had set around the piles.

Construction Methods

Most of the filling over the water pipe was removed by a 20-in. suction dredge, but for fear of disturbing the pipe, work with the dredge was not carried within 4 ft. of the top of the pipe. The rest of the fill was removed by an 8-in. sand pump, mounted on one of the barges. After dredging, the water was cut off from the main, and air pressure was put on, and the leaks were thus located by air bubbles coming to the surface of the water.

All leaks of any consequence were marked by dropping a weight into the hole blown through the mud over a leak by the escaping air, and carrying a line ashore from the weight. It was not safe to use buoys for marking the leaks, as a buoy was liable to be carried away by ships. All leaks had to be located and marked before repairs were commenced.

After the box form was placed the air pressure had to be taken off the line and kept off until the cement grout in the box form was thoroughly set.

The construction plant consisted of two barges, one carrying a derrick, and the other an 8-in. belt-driven sand pump. The barges were anchored over the leak, and the overlying sand and mud covering was first pumped away. Then to the flange coupling on the box form was connected a 15 ft. length of 4-in. pipe. Three rope lines were fastened to the front of the lower jaw

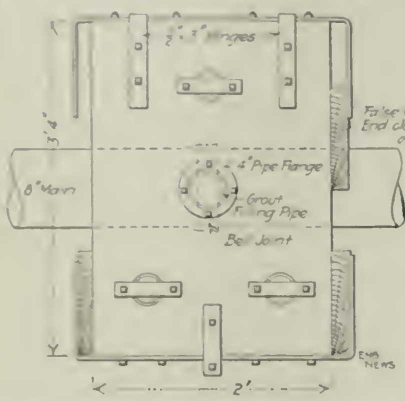


FIG. 1. PLAN OF BOX FORM FOR REPAIRING LEAKY JOINTS

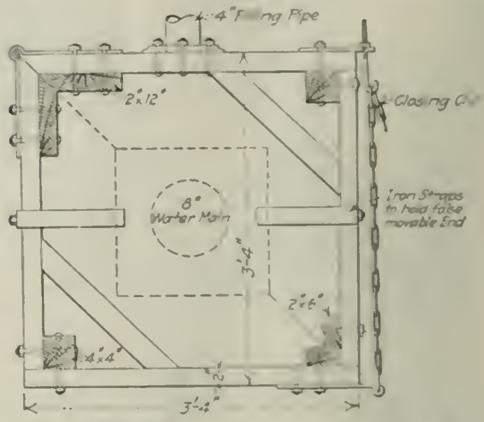


FIG. 2. END ELEVATION THROUGH BOX FORM

of the form, one to the end of the closing chain, and one near each side.

The driver took all three lines down around under the pipe and back up on the barge, where a man was stationed at each line. As the form was lowered away by the derrick with a line from the 4-in. pipe, the men took in on the other three lines. The form was thus guided into place under the pipe. Lowering on the upper half the form closed the box in position.

The piles were then driven flush with the top and the iron straps bolted over them. A water jet was inserted in the box form through the 18-in. square openings, and any mud in the box was driven out and the pipe joint thoroughly washed clean. A piece of raveled, loose rope yarn was tied securely around the leak to keep the cement from entering the pipe joint. The plank diaphragms were then driven into place around the pipe, and the form was ready for the grout.

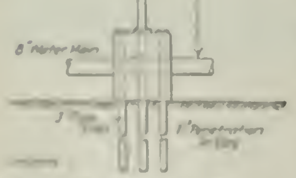


FIG. 3. BOX FORM IN PLACE FOR GROUTING

The grout was mixed with salt water to a consistency that would just pour through the funnel into the 4-in. pipe leading down to the form. It was found necessary to pour it slowly in order to give the grout time to settle. Displaced water went out of the form through the holes around the piling in the top of the form. When the form was filled, the nuts on the bolts in the flange union fastened to the form were taken off and the 4-in. filling pipe removed; and the job was completed. To save time, on the last joint repaired, grout was lowered to the diver in buckets and poured into the form by him.

Where the soft mud and silt was so bad that it could not be kept out of the form, a 4-in. centrifugal pump with a flexible suction end was to clean out the box, after it was in place and closed. The mud was pumped out through the grout filling hole, while a jet alongside stirred it up.

When repairs were completed, the grout was allowed to set a week. About 40 lb. air pressure was then put on the main and kept on for over an hour. During this time only a single air bubble could be seen, and the water meter on the main showed the leaks had been stopped.

Four leaks were repaired and the entire work was executed in about four weeks, including the time of assembling plant, dredging, building box forms, etc. By actual time a box form was lowered and fastened around the pipe in 45 min. To close the end diaphragms of the box form required 50 min. To drive the piles required from 1 to $1\frac{1}{2}$ hr. To mix the grout and fill the form required 1 hr. and 15 min. A good deal of credit was due the diver for the rapidity with which the form was placed. The diver worked without a suit, but simply had a diving helmet over his head. With the proper plant after the water main was cleared, one leak a day could be repaired.

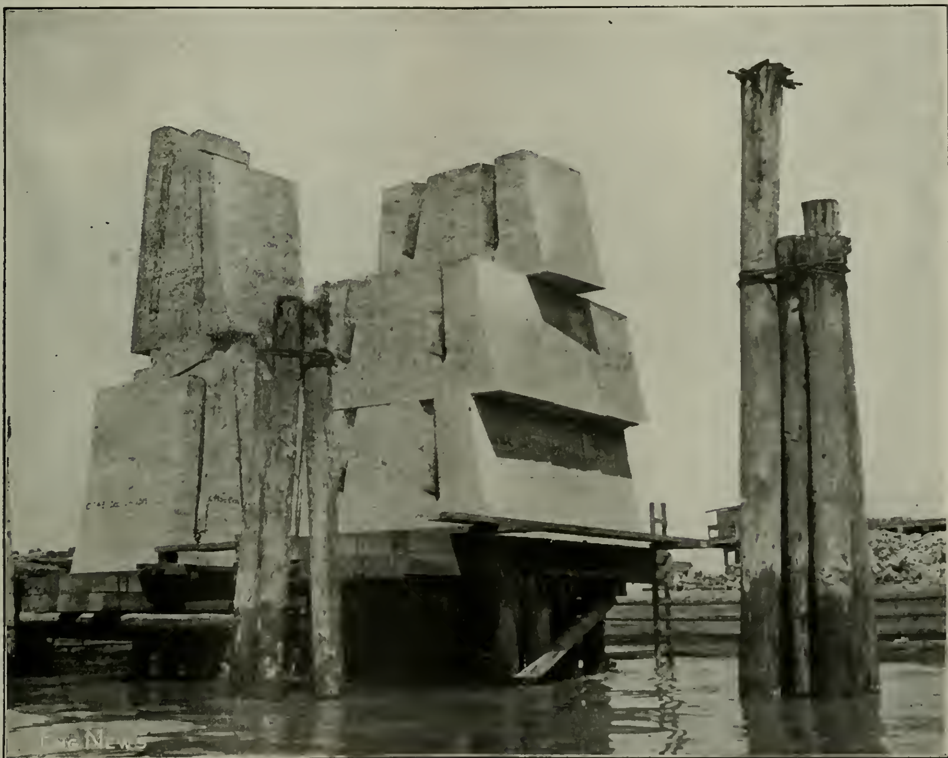
COST DATA

The total cost of repair work, for closing the four leaks, was $2,000. The work was done by the United States Engineer Department, under the direction of Lieut.-Col. C. S. Riche, Corps of Engineers, and the plan of closing leaks was devised, designed and superintended by O. R. Scott, U. S. Inspector. The force consisted of one foreman, one hoisting engineer, six laborers and one driver.

NOTES

A Remarkable Pile Test—The accompanying view shows a test of a group of piles under a load of 220 tons now being carried on by the Department of Docks & Ferries of New York City, under the direction of Chief Engineer Chas. W. Staniford, in the construction of the 46th St. pier of the North River, in the Borough of Manhattan, a description of which appears on p. 212 of this issue. A portion of the pier is to be built in deep water on timber pile footings, which on account of the heavy slit and mud bottom have to be nearly 90 ft. in length. The design calls for carrying the pier proper on 10-ft. spaced piles, but the shed and upper works are to be carried on 20-ft. spacings of columns, footing on pile clusters. This wide spacing requires that each cluster shall have a loading of about 220 tons. The test shown herewith is the second one of two which have been carried on by the department to determine the bearing power of the long pile clusters driven in deep water and very soft mud bottom.

The concrete blocks which are used to load the cluster are the regular quay-wall blocks used by the Department of Docks and Ferries in the construction of the bulkhead walls around New York City. They were floated up to the site and loaded on the structure with the department's 100-ton barge crane. They are to be used in the permanent wall somewhere, when the experiment is finished.



A Remarkable Pile Test

Each cluster consisted of a square of 16 piles, in the first test the piles being driven on about 2-ft. 6-in. centers, and in the second on about 3-ft. 6-in. centers. Each pile is of Eastern pine and is between 85 and 90 ft. long. In the first test, every other pile was lagged on the sides with a double lagging of four 5x6-in. timbers for a distance of 30 ft. up from the bottom of the pile. These four timbers are spaced around the four quarters of the pile circumference and are bolted through, two and two. In the second test every pile in the cluster was lagged.

A marked and continuous settlement was noted in the original test, which has been in progress about seven months, but in the second test, which has been in progress about four months, satisfactory results have so far been obtained under the loading of about 220 tons. It will be some time before the full details of the test are available.

Repairing a Dredge Hull Below the Water Line by Use of an Ice Coffer-dam—The United States dredge "Warroad" was repaired at Kenora, Ont. (Lake of Woods), in 1912 as follows: When the ice had formed about the dredge to a depth of 18 in. a trench was made 20 ft. long, 3 ft. wide and 12 in. deep alongside the dredge. Thereafter each day, when the thermometer had been below zero the night before, 1 in. of ice was cut out of the bottom of the excavation. Days when the thermometer was not higher than +15° F. during the entire day, there were taken out 1½ in. After each day's work a small hole was bored to a depth of 5 in. and dry wooden plugs kept near to plug the holes in case the bit broke through, but it never did. The rate of cutting and the means of insuring a thickness of 5 in. in the bottom of the trench were determined by the custodian of the dredge, as he had no instructions except to get down to the leak. It is probable that he might have gone down somewhat more rapidly, but he was present every day in care of the dredge and there was no occasion to hurry. Parties harvesting ice at that time found that their ponds, left open at night, were frozen about 2 in. during the coldest nights. During the operation, the maximum daily temperatures ranged from +30° to —15° and the minimum from +6° to —47°. Only once was the minimum above zero, and the maximum was below zero for five consecutive days. On Feb. 24—in exactly 30 days—there was a trench 20 ft. long, 3 ft. wide, and 34 in. deep, with 6 in. of ice in the bottom. The thickness of ice in the vicinity was 24 in. So we had gone down 10 in. below the bottom of normal ice; we still had 6 in. under us; and had uncovered the leak 34 in. below water line. The repairs amounted to nothing more than cleaning out a small split

in a plank and caulking it. [Lieut.-Col. Chas. L. Potter, Corps of Engineers, U. S. A., in "An Ice Coffer-dam," Professional Memoirs, Corps of Engineers, U. S. A., May-June, 1914, p. 149.]

Computation of Lot Lines on Curved Streets—A. M. Haynes, of 314 So. Washington St., Denver, Colo., is worried lest the method of computing lot lines described by P. H. Skinner in "Engineering News" of June 25, p. 1241, will mislead surveyors. He writes to Mr. Skinner as follows:

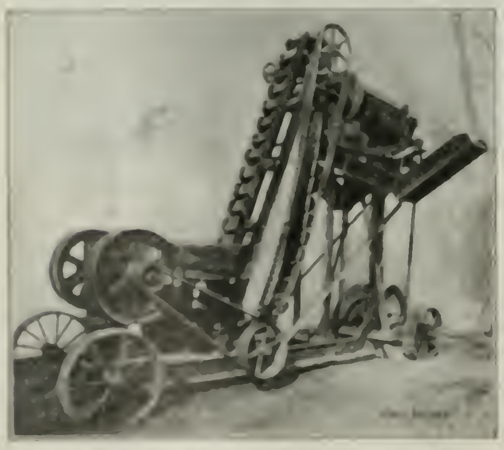
I have been to much trouble making tables for the work you describe. It is the same method as invented by Shunk and copied by many authors in the past 30 years. I made a new definition for Degree of Curve and made the work exact. I find the degree of your curve is 11 175°. Your x is half the long chord, and y is R — versed sin of double your angle A. My tables give exactly the same figures that you have for frontage, and I do not bother with the old-fashioned Sin, Cos, etc. Should you not send this to the "Engineering News" to repair damages? A lot of poor transmitmen will lose their jobs trying to follow you.

To this letter Mr. Skinner replies as follows:

To cover the remote possibility that others may have fallen into the same misapprehension that has brought forth the letter from Mr. Haynes, it may be said that the method of computing curves, described in "Engineering News" of June 25, is intended for use only where logs or a calculating machine are available. Such an arrangement of work has been found to shorten the computations greatly in the office, but no claims are made for it as a field method.

A Wagon-Loading Machine for dry brick clay is employed by the Hydraulic-Press Brick Co., of St. Louis, Mo., in gathering the clay for its plant. Special plows hauled by traction engines turn up the top of the field to a depth of $1\frac{1}{2}$ in., the teeth of the plow being so set that each turns up a strip about $4\times1\frac{1}{2}$ in. This strip curls over and breaks into pieces 4 to 8 in. long as it falls from the plow. The entire field is plowed in this way and left to dry for 12 to 24 hours, according to the weather. The wagon loader has a four-wheeled wagon bed, surmounted by an enclosed vertical frame or tower within which works a vertical bucket conveyor having long buckets. The lower end of the conveyor comes close to the ground and just in front of it is an apron which gathers up the clay so that it is within reach of the buckets. At the top, the buckets dump their contents into an inclined chute projecting from the side of the tower and discharging the clay into wagons which are driven alongside the machine as it travels across the field. The elevating conveyor is driven by a sprocket chain from one of the rear wheels, and the machine is hauled by a team of six mules. The plows and wagon loaders are of the company's design and are built in its own shops.

A Dinkey Stone-Crushing and Screening Outfit is illustrated herewith. The whole plant mounted on a four-wheel steel truck weighs only about four tons and can be moved from place to place by a pair of horses. The outfit includes a Fort Wayne No. F 2 jaw crusher, which has provision on for three different targets, for crushing coarse, medium and fine; a belt-driven steel chain bucket conveyor, a revolving cylindrical screen, with dust jackets if desired, and a dumping or loading chute. The jaw opening for coarse and medium crushing is 8x12 in. and for fine crushing 5x12 in. The elevator is 12 ft. 6 in. long. The revolving screen is about 3 ft. long and 2 ft. 6 in. in diameter. The mounting is a steel



A Small Portable Crushing and Screening Plant

frame of I-beam construction with heavy steel wheels and axles. The wheels have broad tires, and the hubs are provided with lubricating cups. Motive power for operating the crusher, elevator and screen may be furnished by an 8-hp. gasoline engine, which, however, is not part of the outfit as shown. The speed of the eccentric shaft is designed to be 285 r.p.m. and the belt drive should be 16 to 18 ft. long. The outfit described is made by the Good Roads Machinery Co., Kennett Square, Penn.

Nailed Wedge-Shoes for Shores in Floor Centering—Placing concrete centering accurately and economically is an engineering problem. Floor centering, when ready for concrete, should be level, and the accompanying illustration shows how Wells Bros., Chicago contractors, start to get level points before placing shores for floor centering.

On the finished concrete surface of the floor over which they are working, and which is brought to a true surface with the top finished, 1-in. boards are laid, on which are

Setting Wedge-Shoes for Floor Centering to a Uniform Elevation with Level and Rod

placed wedges, cut from ordinary 2x4-in. stuff, to serve as shoes for the vertical shores.

To establish levels for each panel a handy man goes ahead with wedges, and at four well distributed points for each panel he nails in place the bottom half of a pair of ordinary 2x4 wedges, fastening it firmly to the 1-in. sills. A wye level is set up at a convenient point on the floor, and a definite uniform elevation is established by adjusting the pairs of wedges to a known level established by the instrument. Then the top half of the wedge is nailed in place, determining accurately at 4 points in each panel a standard elevation.

New Types of Automatic Water-Stage Registers have been put on the market by W. & L. E. Gurley, Troy, N. Y. These include an entirely new device which makes a printed record of the water height at intervals of 15 or 30 min. This register is built and installed like the regulation gage-curve recording registers, but instead of a pen point moving over a wide roll of paper, a narrow ribbon of paper passes continuously under a time stamp. The type wheels for printing the height records are moved automatically by the rise and fall of the copper float in the gage well. The motive power for operating the register is a weight-driven clock, the weight of which descends at the rate of $1\frac{1}{2}$ in. in 24 hr. The ribbon record is $1\frac{1}{4}$ in. wide, and the record for 24 hr. is 96 impressions within a space of 2 ft. The range of the machine is 16.66 ft.

The same manufacturers have also improved their standard graphic registers so that they will make two and seven-day records, of the curve kind.

Editorials

Lessons from the Lowell Experiments on Well-Water Treatment

The experiments on driven-well waters at Lowell, Mass., described in our issue of July 9 and in our present issue, are encouraging not only for Lowell but for other cities as well. At the same time they illustrate anew the difficulties that may be encountered with well waters, even where such supplies do not seriously diminish in quantity as well as in quality after a few years' use. They also show how each well water may be a law to itself as regards needed methods of treatment.

Twenty years ago Lowell began to secure a water-supply from driven wells. The water from the first wells sunk appeared at first to be satisfactory in quality, but not being sufficient in quantity, more wells were sunk at a different site. After a few years' use, it was shown that an excessive amount of carbonic acid in the water from the first wells attacked lead service pipes and caused lead poisoning throughout the city. The other wells were therefore added to and the first wells abandoned, except for summer-peak use. Although several extensions to the new well system were made, the water from it gave more and more trouble from turbidity and color. This was at first attributed wholly to iron in the water, but it has been shown recently that the trouble was due to manganese as well as iron.

Hygienically, the Lowell well water was excellent, as indicated by the typhoid record. It was therefore decided to find out whether the iron and manganese could be removed from the one well system and the carbonic acid from the other.

The experiments emphasize afresh that each well water is a law unto itself when it comes to removing or neutralizing unsatisfactory mineral contents, and that a testing or experimental plant, in the hands of trained men, is often needed to find the law and the best means of applying it in daily practice.

So far as iron is concerned, some of the many conditions governing its removal are thus stated in F. A. Barbour's report on his recent Lowell studies:

> Iron, which is found in the form of ferrous hydrate, can be readily oxidized, and if there are no interfering substances, such as manganese, carbon dioxide, or organic matter, which hold the iron in semisolution, or in a colloidal condition, it can be precipitated and removed by aëration and sand filters. In some waters, however, excessive aëration is possible, and a retention of a certain portion of the carbon dioxide is necessary to prevent the organic matter from interfering with the precipitation of the iron. Also, it has been found that manganese interferes, and the removal of the last traces of iron, if the necessary conditions are not provided for the coincident removal of the manganese is impossible. It therefore follows that, while the deferrization of some waters involves simple aëration and sand filtration, others require more highly developed preliminary treatment by passage through coarse filters, operating either as tricklers or contact beds.

Apropos of the last clause of the last sentence, it may be noted that coke prefilters at Lowell, it was found, should be operated as contact beds rather than as trickling filters for the removal of iron and manganese.

The diversity of well waters from sources near together is illustrated by Lowell experiences. One series of wells yields water high in iron and manganese and another gives a water low in iron but with so much carbonic acid that the water attacks metal service pipes. Close by the group of wells last mentioned, with low iron content, is a third group, for some time unused, with an iron content so high as to promise trouble with the increase of iron that so often follows use.

Considering now the removal of carbonic acid from the Lowell wells, it is worthy of note that before the experiments were begun, it was supposed that a fraction of a grain of lime per gallon of water would decarbonate this water. Instead, it was found that 1½ grains per gal. would be required, which would have added an intolerable hardness to the water. Fortunately, the experiments showed, the carbonic acid can be easily removed from this water by aëration by means of fine-spray nozzles under light pressure.

As we said at the start, the Lowell experiments are encouraging to all who have certain ground-water problems to solve. But it must not be overlooked, as we have tried to make clear, that each ground water is so much a law unto itself as to make it unwise to adopt any special mode of treatment until local experiments, or at least expert advice based on laboratory tests, indicate that the proposed treatment will successfully and most economically meet the conditions of that particular water.

Legislating the Massachusetts State Board of Health out of Office

Whether considered as a sacrifice to politics or to progress, the abolition of the time-honored and justly renowned State Board of Health of Massachusetts will come as a shock to sanitarians and public-health workers the world over. We sincerely hope that the State Department of Health which takes the place of the Board will make as enviable a record for itself and do as much for public health and sanitary progress within and outside of Massachusetts as did the State Board of Health.

Unfortunately, the new Department starts with a handicap—or a bunch of handicaps. First of all, the Governor and his political associates are under suspicion of having successfully promoted a reorganization of the health administration of the State in the name of governmental progress but with political expediency as the real object. This suspicion may be lived down by a judicious series of appointments to the positions of Commissioner of Health, Public Health Councillors, Directors of Divisions and District Health Officers. But even if this suspicion be lived down instead of being justified by the building up of a part of a state political machine, the fact will remain that the new Department of Health of Massachusetts will be of a mongrel administrative type.

The Commissioner of Health, nominally the chief exe-

[illegible] health officer of Massachusetts, is really under the control of the Governor and Council of the State on the one hand, since they confirm all appointments made by the Commissioner, while on the other hand, he is dependent on the Public Health Council (1) for the approval of the appointment of directors of divisions and of district health officers before these appointments go to the Governor and Council (a sort of State Cabinet) for confirmation; and (2) is also dependent upon the Public Health Council for the enactment of department rules and regulations. In addition, the Public Health Council acts as a Board of Appeal, presumably from orders issued by the Commissioner, although that is not clear. The Commissioner reports to the Public Health Council and the latter to the Legislature, through the Council.

Instead of an out-and-out single-headed Department of Health, Massachusetts will have a combination of the commissioner and the board plan, with neither supreme, and with Commissioner, Public Health Council, Directors of Divisions and the eight (geographical) District Health Officers all creatures of the Governor.

To make matters worse, the members of the Public Health Council are to be paid $10 a day and traveling expenses, which is just enough to attract place-seekers but too little to compensate men of training and ability, who would rather serve gratuitously than be paid inadequately for their time.

The long and short of the matter is that what was heralded at the outset as a radical reorganization of the state health service of Massachusetts, with a single independent Commissioner, quick and powerful in action, turns out to be little but the substitution of a Council for a Board and a Commissioner for a secretary, with neither in supreme command, and with a nebulous area of duties, powers and relationships in place of sharply delimited fields of responsibility and power.

Whether the old board plan or the newer single-commissioner plan is the best for Massachusetts or for any other State, we are not discussing. That a jumble of the two should be avoided seems to need no argument.

We are not so rash as to say that even under the abortive act which goes into effect on Aug. 7 (see our issue of July 16), men of training, ability and devotion cannot sustain the high standards of the Massachusetts State Board of Health which so many of us have long admired and rejoiced to honor. Men like Mills and Walcott, Woodruff and Harrington, Stearns and Noyes, Drown and Sedgwick, Hazen and Fuller, to name only some of the former members, secretaries, engineers, chemists and biologists who have helped make the Board known the world over, would rise above any petty obstacles incident to a badly muddled piece of legislation. But, and there's the rub, they would not stoop to become parties to the political expediencies which the present act seems on its face to have been drafted or influenced to serve.

If the new appointments are not already made before these words are printed, a few weeks at most will serve to show in large measure how far the Governor of Massachusetts, in advocating a reorganization of the State health service, was actuated by a desire to give the State what he conceived to be a more efficient health administration and how far his ruling motive was to build up a more efficient political machine. If, as we hope, the health service is the thing at heart able men can doubtless be found to carry on the work so well performed in the past and the next legislature can perhaps be induced to remedy the obvious defects in the new health act, as well as the weaknesses which a few months will bring into prominence.

A National Water Law

The need of national legislation on the matter of river regulation and control is agreed upon by everyone familiar with the facts. That, however, is about the only point on which agreement exists. One group is concentrating all its energies to have a national law passed that will facilitate the development of unused water powers by private enterprise. Another group is concentrating all its influence to secure the enactment of legislation under which the federal treasury can be tapped to aid in the construction of levees for the Mississippi and its tributaries. Still another group is infatuated with the idea that the Newlands bill, with its fantastic plan for concentrating all authority over the uses of water for every purpose throughout the length and breadth of the United States in a federal bureau at Washington, is the way to salvation and is working diligently for the success of that scheme.

It may be freely admitted that many of the advocates of the Newlands scheme are actuated by high ideals; but as we showed in an analysis of the Newlands bill in these columns a year or so ago, the Newlands bill as a measure of practical government administration is far too vast and unwieldy and complicated to possibly be successful.

The trouble with all these schemes heretofore presented is that they have been drafted to serve some particular interest and generally with entire ignorance of the other interests involved. Under these circumstances, the work of the special committee of the American Society of Civil Engineers appointed to prepare a national water law with special reference to the Federal control of interstate waters is particularly timely. This committee has just sent out a circular letter of inquiry asking for information where controversies exist over the use of interstate waters, and its aim evidently is to obtain first of all a large amount of facts on which to base its general conclusions. Any engineer desiring to aid the committee in this work by giving information as to controversies in which the control of interstate waters is involved can doubtless obtain copies of the circular letter of inquiry by addressing the Chairman of the Committee, Frederick H. Newell, Chief of the U. S. Reclamation Service, Washington, D. C.

Cellular Sheet-Pile Coffer-Dams; The Maine Coffer-Dam and Its Lessons

The very remarkable coffer-dam now under construction at the foot of 46th St. on the North River at New York City and described in detail elsewhere in this issue is worth the closest attention of the constructing engineer, especially the man engaged in any kind of marine construction. So far as we know, it is to be under a greater head, when completely unwatered, than any other coffer-dam ever successfully completed and at the same time its extreme length increases considerably the liability of localized failure.

A study of its design inevitably calls to mind the famous coffer-dam around the wreck of the "Maine" in Havana harbor, so that a brief history of the behavior of that dam and a comparison of it and the North River dam should be in order.

It will be remembered that the "Maine" coffer-dam was designed to be a series of circular cells, each 50 ft. in diameter, tangentially interlocked to form a closed ellipse about 400 ft. in its major and 170 ft. in its minor axis, with each cell made up of interlocking steel sheet piles and filled to the top with mud taken from the harbor. It was sunk in a depth of 35 ft. of water, with a mud bottom about 120 ft. above rock. The piles were 70 ft. in length, made up of two spliced sections to each unit, and they penetrated about 10 ft. of a dense mud or clay stratum. While precedents for such a design under such adverse conditions of head and material were entirely lacking when the "Maine" coffer-dam was planned by the U. S. Army Engineers, it was the hope that the individual cylinders would act as rigid columns and, while it was not counted upon, that there would be a certain amount of rigidity given the whole structure by the elliptical shape, in other words that some arch action from cylinder to cylinder would take place.

How far these original hopes were realized is shown in the final report of the "Maine" Board, which was published as a government document early this year. From that report, which is incidentally a most valuable engineering treatise, it will be learned that the cylinders were anything but rigid, that they commenced to bulge and distort and even to break under the fill of hydraulically placed mud from the harbor, that the linear distortion of the coffer-dam itself under the low heads of the early unwatering became so great as to require what ENGINEERING NEWS predicted would be necessary, viz., the dumping of riprap against the inside of the coffer-dam and further to require the shifting of the fill inside the cylinders so as to form in effect a continuation of the riprap slope from the inside bottom of the dam up through the cylinder. Finally, before the dam could be completely unwatered, a number of heavy braces had to be set between the cylinders and the wreckage of the "Maine" and one continuous brace had to be placed across the dam.

This final structure was successful in its purpose; the "Maine" was examined, dissected, floated and removed to the ocean bottom outside the harbor, without damage to life, limb or property and the site was restored to the condition it was in before that fateful February of 1898. But instead of an originally estimated $300,000, the total expenditure for the work was $785,774.83 and the final coffer-dam was far different from the original project.

This pioneer work done at Havana served admirably to instruct the engineers of the New York dock department in the things to avoid in the North River coffer-dam. In two respects, the conditions at the two sites were quite similar. Both dams had to be footed in a mud bottom so far above the bedrock as to forbid reaching it with the piles, and both were to hold back very high heads of water, that at Havana averaging 40 ft., with pockets inside the dam reaching 50 ft. below the water level while it is expected the average excavation in the North River will be 44 ft. below low water with the inner toe of the dam about 20 ft. lower. Here the similarity ends, for the Havana dam was a comparatively small closed curve while that at New York is a very long nearly straight line, precluding the possibility of cross-bracing. The similarity is sufficient, however, to make the lesson of the earlier dam useful in the building of the later, particularly in regard to the assumption of rigidity in the filled cells.

In their report, the Army Engineers state that in their opinion the rigidity of the cylinders, and therefore the correctness of the original design, would have been assured had the filling of the cells been made with some solid, dry clay instead of the harbor mud, heavy with water because of its placing by a suction dredge. However, the New York dock engineers apparently are not entirely convinced of the truth of this conclusion, for they have designed a dam, which, while it possesses a family resemblance to its predecessor in Cuba, is in realty a radically different structure, only remotely depending on the cylinder rigidity. It is in effect, a dam of riprap which in turn is retained by a series of mud-filled sheet-pile cells. The inherent rigidity of the cells is assumed to be sufficient only to uphold the cells themselves and to withstand the limited pressure of the riprap backing, which is offset somewhat by the outshore mud backing.

Manifestly, the final expensive efforts to maintain the Havana cylinders as rigid columns will not trouble the New York engineers, but on the other hand, they will be put to an equally serious concern in preserving the balance of load against the cellular core during the progressive removal and placing of the mud and stone fills on either side of the dam. So far the only trouble experienced has been in severe straining, and in two cases rupture of the pile interlock due to the excessive pressure of the interior fill; but when unwatering commences, or even before that when the side loads are placed, the behavior of the dam will be of the greatest interest. Holding back 50 ft. of water across a 800-ft. opening and with a mud fill as a base, is a colossal engineering feat.

The Interstate Commerce Commission's Indictment of the New Haven Railroad Administration

The scathing report of the Interstate Commerce Commission on the financial mismanagement of the New York, New Haven & Hartford R.R., made public last week, is a document whose importance can hardly be overestimated. To a considerable extent, the facts which are set forth by the Commission in its arraignment of the New Haven directors have been known for some time by the well posted in financial circles. The Commission's report, however, now collects all this information and presents it in a most forceful manner, the whole constituting probably the most damning indictment of railway mismanagement on a large scale that has ever been made in this country.

The most important feature of the New Haven wreck is not merely the vast amounts of money which have disappeared like dew before the sun. It is the character of the men and the firms and the companies which were concerned in and were responsible for the wreck. It is well known, of course, that the history of American railroading is full of instances of crooked financing. Since the

very early days of the railway era, there have been railway promoters and railway wreckers, whose methods of doing business have been on a par with those of the green-goods vender, the confidence man, and the vender of wild-cat mine prospects. There always have been pirates on the financial seas; and when they came into control of a property, wise investors knew that it was time to sell out.

But what had the old, conservative New York, New Haven & Hartford R.R. Co. to do with business methods of such a sort? Year after year, and decade after decade, the company went on its way, paying its regular 10% dividends and investing large amounts in excess of these dividends in the improvement of its property. All through New England, stock of the New York, New Haven & Hartford had a reputation equal to that of first-class state or municipal bonds. Men and women invested their money in New Haven stock and thought it was as safe as the savings bank. The directors and officers of the company were largely New England men of good reputation for honesty and conservatism. The great banking firms identified with the property had a reputation for turning everything they touched into gold which even King Midas might have envied. Is it any wonder that when, following the advent of Mr. Mellen to the presidency, the company embarked on a policy of expansion and filled the newspapers with glowing accounts of its great plans for development and extension, New England investors were ready to pour out millions to buy additional New Haven stock and bonds as fast as they were offered.

There seems to be, even now, a considerable degree of misunderstanding as to the real crime of which those who have controlled the New Haven R.R. Co. have been guilty. It is not the traveling and shipping public that has suffered materially. The New Haven R.R. system has on the whole rendered good service and its rates have been on the whole reasonable. The crime committed has been against the owners of the property, those who purchased in good faith its stock and its bonds and to whom the directors were responsible as trustees.

The Interstate Commerce Commission estimates that the losses to the New Haven stockholders through the dissipation of the company's assets during the past ten years amount to $60,000,000 to $90,000,000. The proceeds of the stock and bonds which have been issued by the New Haven Co. during the last ten years have been used to buy properties at prices far in excess of their true value. Over $30,000,000 was invested in the Westchester enterprise. More than this amount was expended in buying street lighting and electric-railway properties in Connecticut and much more in the street railway properties in Rhode Island. Many millions have been lost in the foolish attempt to control the Boston & Maine Co.

The only defense made for these purchases, and in fact the only possible defense, is that those who were responsible for them honestly believed that it was for the interest of the company to purchase these properties at the prices paid in view of their future value to the company. It requires a large amount of credulity for one to believe this defense. The financial history of the properties acquired and the way they were acquired, the enormous sums paid to go-betweens, the great amount paid for "convincing" public opinion, for manipulation of state legislatures—all of these and many other things covered in the report of the Commission and the knowledge of the circumstances and conditions under which the New Haven wrecking operations were carried on, all point to the inevitable conclusion that those of the New Haven directorate who were responsible for these huge exploits in high finance were not by any means ignoramuses, but were in fact the hard-headed, shrewd bankers and lawyers and financiers that they were held to be by general reputation.

That somebody profited, and profited enormously, by those exploits in high finance is beyond dispute. The $60,000,000 to $90,000,000 which have been lost by investors in New Haven securities have not been destroyed; they have simply been transferred to the pocket of someone else. It is possible that the courts may be able to unravel some of the financial tangles and compel restitution of some small part of the losses the New Haven stockholders have sustained; but it is at best only a possibility. The statute of limitations and the work of the shrewd lawyers who covered up the processes of high finance, combine to effectually hamper any effort to compel restitution.

It is important that the situation should be clearly understood, however, since there appears to be an attempt to shift the blame from the shoulders of those responsible. It is claimed, for example, that it was State and Federal interference with railway operations in New England that caused the losses of the New Haven stockholders.

For a direct and complete answer to this statement, one has only to take the gross and net earnings of the New Haven Ry. system itself at the present time. In the 11 months ending May 31, 1914, the New York, New Haven & Hartford R.R. Co. earned $60,927,000 gross and $13,291,000 net. These figures put out by the company itself, show conclusively that the railway still earns enormous profits. It is the other enterprises which the New Haven directors foolishly and wickedly loaded upon the railway company, whose deficits and fixed charges absorb the profits that the railway company earns.

It is claimed, however, by those who would defend the New Haven management, that during all the time that the New Haven has been carrying on these exploits in high finance the Federal and State governments have had full authority to control operations; and that if these things were contrary to law and against public policy, the government should have stopped them.

This is indeed pleading the baby act with a vengeance. As well might the burglar arraigned before the court say that he was not responsible for the theft he had committed since the city police department and the private watchman of the bank maintained an organization to prevent such depredation! It seems well nigh incredible that men with a fair degree of intelligence should put forth such a plea and expect it to be accepted at face value.

Another aspect of the New Haven matter on which altogether too much emphasis is laid is the idea that the chief offense of the directors was in attempting to create a monopoly in New England transportation. It is even on the program that a Federal suit is to be brought against the company under the Sherman law.

But as a matter of fact, there has been, for nearly two decades, no important amount of competition in New England. The old New England Ry., the only competing railway line between New York and Boston, was absorbed by the New Haven Co. before Mr. Mellen's day.

The much-discussed absorption of the Boston & Maine system by the New Haven Co. did not have, to any important extent, the elimination of competition as its object, for at very few points do the two systems compete with each other.

It was indeed a foolish piece of business for the New Haven to purchase control of the Boston & Maine at the price which was paid; but so far as the traveling and shipping public in Boston & Maine territory is concerned, the only question is whether the old or the new management gives more efficient and economical service.

Even the purchase of the Connecticut and Rhode Island trolley lines cannot be considered to have been in any large degree for the purpose of creating monopoly, although when originally built, these lines did take over traffic which had previously been carried on local steam-railway trains. But the field of the electric-trolley railway and of the steam railway is now well established; each handles the traffic to which it is best suited, and no steam-railway manager with any claims to good judgment would dream of purchasing trolley lines simply to stop their competing with his steam-railway trains.

There is, of course, no doubt that the managers of the New Haven system did attempt to create a monopoly of all rail and water transportation in New England and to a large degree succeeded; but the absolute power of State and Federal commissions to control both rates and service rendered made it impossible for any such combination to reap monopolistic profits. The existence and operation of this power of government control during the years while the New Haven monopoly was in process of creation were perfectly well known to Mr. Mellen and his associates. They knew perfectly well that any attempt to advance rates because of the absence of competition would meet defeat. They knew perfectly well that however much they might perfect their monopoly, the rates they could charge and the service they would be obliged to render would be under public control—a control which has grown and is bound to grow more strict and certain with each succeeding year.

The most important results of the New Haven episode is likely to be its effect on public opinion. It has done more to injure railway credit and make it difficult to sell railway bonds and stocks, both here and abroad, than any similar event in the railway financial world for 25 years. It is today, without doubt, having a powerful influence at Washington upon the appeal for permission to increase freight rates, upon the current acute controversy between the Western railways and their engineers and firemen over a radical increase in wages, upon pending legislation in Congress to establish public control of railway security issues. Those who argue against the increase in freight rates say, "of what avail to give these companies larger revenue when it only gives their banker directors a larger surplus fund to play with in Wall Street. Railway employees, when told that the railway companies cannot afford to grant the increase in wages asked, listen with incredulity and declare that when railways can invest millions of money in all sorts of outside enterprises, they must have money enough to pay higher wages. In the debate upon Federal control of stock and bond issues, it is argued that the officers charged with such control would be governed by political influence and even if honest would be ignorant of the details of corporation finance. Those who favor such control, however, answer this argument by merely pointing to that tangled web of iniquity woven by the New Haven management and say, "could anything be worse than that?"

Still further, no one who keeps in touch with the state of public opinion can doubt that the New Haven wreck has made converts by thousands and hundreds of thousands to the government ownership of railways. That clause which the Massachusetts legislature insisted should be tacked on to every certificate of Boston & Maine stocks taken over by the New Haven, that the State of Massachusetts can at any time purchase the stock at an appraised valuation, is merely a straw showing which way the wind is blowing.

There is at least one constructive and useful suggestion which ought to result from the New Haven wreck, and that is the necessity of a sweeping reform in the method of control of our great public corporations.

In the New Haven wreck, public attention is fixed upon the directors and all the talk is of suits against them to compel restriction. In Washington nowadays the tendency is to treat every director of a great corporation as a man under suspicion. The statesmen (or alleged statesmen) at the Capital are busying themselves with the framing of laws to prohibit interlocking directorates and to find out how to prevent this or that or the other class of men from being elected as directors of the public-service corporations. Not a word is heard as to the solution of the most difficult problem, that of finding men of requisite ability and trustworthiness who are willing to serve as directors of our great corporations and assume the responsibility that should rightly be theirs.

In this very case of the New Haven Company, probably not one in ten of its Board of Directors really knew enough about the affairs of the corporation to fully realize what was going on. Practically all of the directors had their own business and personal affairs to attend to. Membership on the Board of Directors required them to attend, if convenient, a directors' meeting possibly once a fortnight or once a month, at which they voted on such affairs as the three or four leaders in the directorate chose to lay before them.

Such a system of control might perhaps pass muster with the men and the methods of 25 years ago; but it is an absolute failure under the conditions existing today. The board of directors of a great railway or industrial corporation should be made up of men willing and able to devote enough time to the work so that they can fully inform themselves on all the large questions of policy which the board of directors alone should decide. Such directors should be paid enough to command the services of the ablest men, who will regard the office as a public trust instead of considering, as has been too often the case in the past, that membership in a directorate, since it brought no direct compensation of consequence, justified one in making such profits as opportunity permitted from private operations made possible by the knowledge he gained as a director.

With a board of directors paid to devote time to their work, it would be possible to hold them to strict personal and financial responsibility for their acts. If such responsibility is enforced under the present system, however, it simply means that we must be content with a set of men for directors of our public corporations who will be financially irresponsible, since no others could afford to accept such positions.

Letters to the Editor

The Earnings of Technical Graduates

Sir—Under the caption "The Potential Value of Our Engineering Graduates," ENGINEERING NEWS of June 25, prints an extract from the address of Prof. Harold B. Smith, at Clarkson College of Technology, Potsdam, N. Y., in which the Professor says, "the technically trained graduate of our engineering colleges earns annually, on an average, at least $3000."

The average annual earnings of technical graduates who are employed in the bridge and structural engineering departments of the various railroads, bridge and structural shops, engineers and architects are less than one-half of $3000. Further, it is generally understood that those engaged in the bridge and structural line receive a somewhat higher wage than those in the other engineering branches.

Prof. Smith may, by some sort of legerdemain, satisfy his own mind that his is not a gratuitous assertion, but this Clarkson Class of embryo engineers, who received this last injection of university optimism, "bunk," will soon learn their *actual* value as money-getters, and it will be a sad awakening.

HARRY J. BUCH.

14 E. Kinney St., Newark, N. J., June 28, 1914.

A Defense of the Pittsburgh Flood Commission

Sir—In the *Proceedings* of the Engineers' Society of Western Pennsylvania, Vol. 30, No. 2, Mar. 11, 1914, the paper read by Sir William Willcocks on "How the Ancients Would Have Controlled the Mississippi and Its Tributaries," contains certain references to the report of the Flood Commission of Pittsburgh, Penn.

The privilege of an engineer to discuss the work and opinions of his professional brethren is well known and this may even become a duty, if differing profoundly upon important public policies, affecting the safety, health and general welfare of the people. There is, however, a duty, fully as grave and customarily imposed, and that is that one shall completely inform himself before criticising the position and statements of others. This is particularly true and the duty is all the more important when the critic occupies a world-wide position of renown and international standing in the profession.

As to this address delivered at the invitation of the Engineers' Society, certain statements appear to attack the methods and findings of the engineering work of the Pittsburgh Flood Commission, the members of the Engineering Committee believe it a duty to the profession, as well as to their associates on the Commission, to answer the exceptional criticisms contained therein. The remarks of the author evidently were not based upon an accurate reading of the Flood Commission report. Had he carefully read and considered such report or obtained correct information thereto, it is believed that his views upon the matter of flood control, as applied to our local rivers, would have been materially modified.

(1) The author undertakes to impress his readers that his opinions were based upon personal observations and at the same time to lodge a charge of incomplete investigation against those who have been responsible for the Flood Commission Report. For instance, he says on p. 128:

> I never saw such bad looking stuff for reservoirs, and I found that no one had bored down one foot to see.

As a matter of fact, the author never visited a single reservoir site and fails to show the source of information, hearsay or otherwise, upon which he was relying for his extravagant statements. Upon the other hand, members of the Engineering Committee of the Pittsburgh Flood Commission visited the site of each proposed dam and satisfied themselves fully as to the presence of natural rock formation.

(2) Again on p. 128, the author says:

> And your condition is such that if you had a high flood and a reservoir with 150 ft. head on the hills above you, and it happened to breach and come on top of the flood, all of the disasters you know of today would be but child's play. And if you had two in the same valley and the upper one burst and came down on the lower one, and the two came together, you might open the early chapters of Genesis and begin reading about Noah's flood to comfort you.

The purpose of the author's pleading is not clear. If he is adverse to dams of 150 ft. or more in height, because these are dangerous, we respectfully call attention to the fact that the highest dam proposed by the Commission is 113 ft. in height and the average of the seventeen dams proposed is 93 ft. However, we further note that there are several dams in this country of more than 200 ft. in height. Height simply requires adequate design and strength.

(3) Upon p. 127 of the paper, the following statement occurs:

> This horizontal sandstone you have here and shale in alternating strata is considered the worst foundation for reservoirs of anything in the world. More accidents to big reservoirs have happened on it than any other. If the strata are inclined at a steep angle and you build your dam on it, it rests on the hard particles and the weak strata are more or less ignored.

As the author very shrewdly abstains from giving definite information as to who holds these absurd opinions as to our local geological conditions and as we are addressing those who have knowledge of these matters, comment is unnecessary.

(4) Upon p. 128, the author states:

> In your book you show that you spent money on many things, but not one penny to show what your foundations are, and all the rest of it is worth nothing until you are sure of your foundations. You ought to spend some money for drills and take two of the nearest sites and expose the foundation and see if you can build a dam there. If you find real good foundation your difficulties will be at an end.

Engineers of ability and experience engaged upon a preliminary study and general design, judge by the surrounding outcropping rock, which indicates geological

conditions. Thus the feasibility of location is determined and customary allowance made in estimates of costs for depths of foundations. Later drillings will determine actual design and depth.

Without undertaking to give detail answer to this criticism and show how the money was spent, all of which is stated in the report thus mentioned, the engineers of the Flood Commission, after personal inspection of the sites, considered that it was unnecessary to spend any money for borings for the purpose of their preliminary report. But it goes without saying that before actual sites would be determined and building begun, such borings would, of course, be made by those responsible for the design and construction.

(5) Upon p. 127, it is further stated:

In a recent book which you have written on this reservoir question I see that the quantity of water you consider necessary to impound in these reservoirs seems to be in excess of what you need. In all the calculations it has been assumed that when the river rises, its discharge increases up to its maximum stage. . . . As in all these estimates, you have allowed for an increasing discharge and not reduced by half for the falling gage, a much smaller quantity of water than you have assumed would, I think, suffice to shelter you from these hours of high flood which produce all the worry.

This appears to be a criticism of the use, by the Flood Commission Engineers in their report, of a greater factor of safety than the author thinks necessary. It may be stated that the hydraulic measurements, upon which the quantities were determined, were based upon the careful methods of the United States Geological Survey and of the Pennsylvania Water Supply Commission and many of the stations were operated in coöperation. Full and complete allowances were made in the rating curves, notwithstanding the above quoted comment, for the fact that river velocities are not the same upon rising and falling stages. This statement can be verified by reference to the rating diagrams in the report.

(6) The weakness of the author's paper and of the apparent criticisms of the Flood Commission's report are due to two facts: The opinions expressed in the report were based upon five years' study by engineers who possessed full knowledge of local circumstances and who therefore do know, whereas the remarks of the author emanated from a necessary cursory and hasty examination of the subject and conditions.

(7) The Engineers of the Pittsburgh Flood Commission have the highest appreciation of the professional and ethical responsibility of opinions upon such a question as flood control and regret that so eminent an engineer should undertake to speak to the world upon such an important subject without fully informing himself as to the data from which he draws his conclusions.

Geo. I. Davison,	M. Am. Soc. C. E., Past-President Eng. Soc. of Western Pennsylvania.
Paul Didier,	M. Am. Soc. C. E.
George M. Lehman,	M. Am. Soc. C. E.
Julian Kennedy,	Past-President, Eng. Soc. of Western Pennsylvania.
Morris Knowles	M. Am. Soc. C. E.
E. K. Morse	M. Am. Soc. C. E., Past-President, Eng. Soc. of Western Pennsylvania.
Emil Swensson,	M. Am. Soc. C. E., Past-President, Eng. Soc. of Western Pennsylvania.
W. G. Wilkins,	M. Am. Soc. C. E., Past-President, Eng. Soc. of Western Pennsylvania

MEMBERS ENGINEERING COMMITTEE,
PITTSBURGH FLOOD COMMISSION.

Pittsburgh, Penn., July 17, 1914.

Brick-Pavement Repairs

Sir—I have read with much interest your editorial comments in ENGINEERING NEWS, July 2, 1914, on "The Neglect of Brick Pavements," and I fully agree that from whatever cause a repair is needed in any kind of a road, including a brick road, it should have immediate and prompt attention. But I must take exception to one or two statements made in the editorial, also to the form of remedy suggested.

First, your statement:

On many miles of brick paved roadways in Cuyahoga County, Ohio, which have been laid within a comparatively short time and are good examples of first-class construction, the only defect noticed is longitudinal cracks extending along or near the center of the roadway.

The objection to this statement lies in the fact that they "are good examples of *first-class construction.*"

Many of your readers will recollect the paper read before the American Highway Association in Detroit last October by James M. McCleary, a Cuyahoga County road engineer, whose connection with the building of these roads covers a period of 20 years.* Mr. McCleary not only confessed errors in construction and the slowness with which mistakes were corrected, but pointed out in detail many of the mistakes, one admitted defect particularly being a lack of drainage.

Even where some effort at drainage was made, a confession followed that the very methods employed in drainage were such as would be expected to bring about the moist condition underneath the pavement and develop the cracks from the effects of low temperature of which you speak. So these cracks are not in roads which are good examples of *first-class construction.*

Quite the contrary is found in the fact that there are perhaps an equal number of miles of brick roads and streets in Cuyahoga County, which approach examples of *first-class construction.* In these, no cracks whatever appear, a condition that may be expected to obtain in cases of properly constructed brick streets, where the danger of cracking is intelligently and scientifically provided for.

Strictly speaking, it may be a fallacy that a brick pavement when once well laid, needs no repairs whatever. While I do not want to be in a class that would take such an extreme position, still the public should know the truth; which is, that if a brick pavement is properly constructed, the repairs are merely a negligible consideration and do not amount to even as much as Governor Glynn declares, to wit: $50 per mile per annum. This is not an extravagant statement to make in view of the fact that a great many miles of brick streets and roads have been built and are in constant use with much more than an average traffic, and have not needed a dollar for repairs, and will probably not need any repairs for many years to come.

I think your suggestion as to the manner and method of repair where these repairs are needed is unfortunate. In the judgment of the writer, the only practical and economical way to repair a brick road is to restore the pavement to a condition in accord with the original construction both as to manner and method. This is not quite so easily done as in the way suggested.

WILL P. BLAIR.

Sec'y, National Paving Brick Manufacturers' Association.

Cleveland, Ohio, July 11, 1914.

*For abstract of Mr. McCleary's paper see "Engineering News," Oct. 16, 1913, pp. 749, 750.—Ed.

The Coffer-Dam for the 46th St. Pier, North River, New York City

The deepest and one of the largest coffer-dams ever built is now under construction on the North River at the foot of West 46th St., Borough of Manhattan, New York City, to be used in laying bare the site of the shore end of a new 1000-ft. pier being built there by the City of New York. The coffer-dam is made up of continuous cells of steel sheet piling and is similar in construction to the dam used in the construction of Black Rock harbor in Buffalo, and somewhat similar to the famous coffer-dam, which inclosed the ruins of the "Maine" when the wreck of that vessel was raised some years ago. Profiting by the experience gained in these two dams, however, the engineers are backing the sheet-pile cells with a very heavy filling of riprap, so that in effect the pockets of steel sheet piling form the seal of the coffer-dam, and are held in place by the riprap fill.

Design of the Pier

The increasing demands of the extraordinarily large vessels now berthing in the North River has led the City of New York to the construction of 1000-ft. piers in the North River and the location selected is the Manhattan side of the river north of 42nd St. The first construction in this new location was authorized for the foot of 46th St. about a year ago. It was intended at that time to build a 1000-ft. pier directly at the foot of 46th St. with berths on either side and to defer the construction of a half pier at 44th St., providing an additional berth to the north, until property rights could be acquired later. However, within the past few months the city has acquired full rights at 44th St., so that the work now under construction comprises a pier 150 ft. wide and 1000 ft. long, at the foot of 46th St. with berth to the north and to the south 1000 ft. long, and a half pier on the northerly side of 44th St. 1000 ft. long with a 1000-ft. berth to the north.

The coffer-dam, which is to inclose the shore end of this area, extends then from 47th St. to 44th St. The whole contract comprises the placing of about 3500 tons of steel in the coffer-dam, 99,000 cu.yd. of riprap in the embankment, the removal of 76,000 cu.yd. of rock and the placing of 14,000 cu.yd. of concrete masonry. The whole basin created by the coffer-dam will cover an area

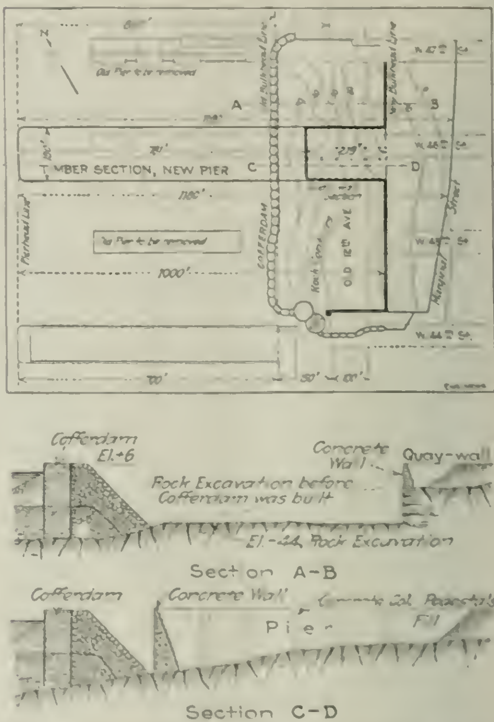


Fig. 1. Plan and Sections of New Pier at Foot of W. 46th St., North River, New York City. Showing Location of Coffer-Dam

Fig. 2. View of [illegible], Foot of W. 46th St., July, 1914, Showing Coffer-Dam Partly Completed and Shore Excavation Made

of about 800 ft. in length and 300 ft. in width, requiring about 55,000,000 gal. of unwatering. The greatest head on the coffer-dam will be over 65 ft.

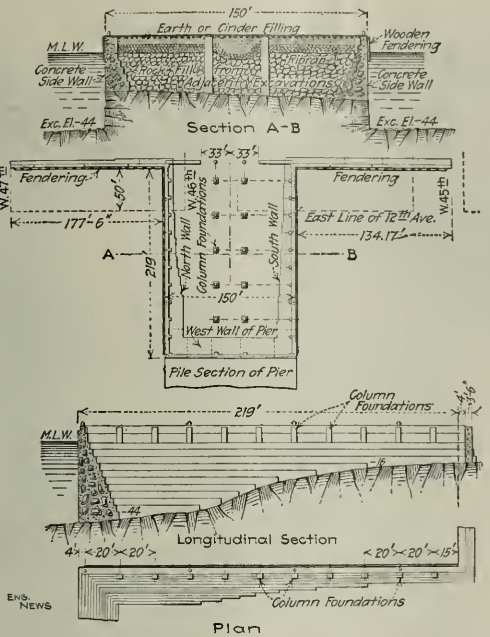
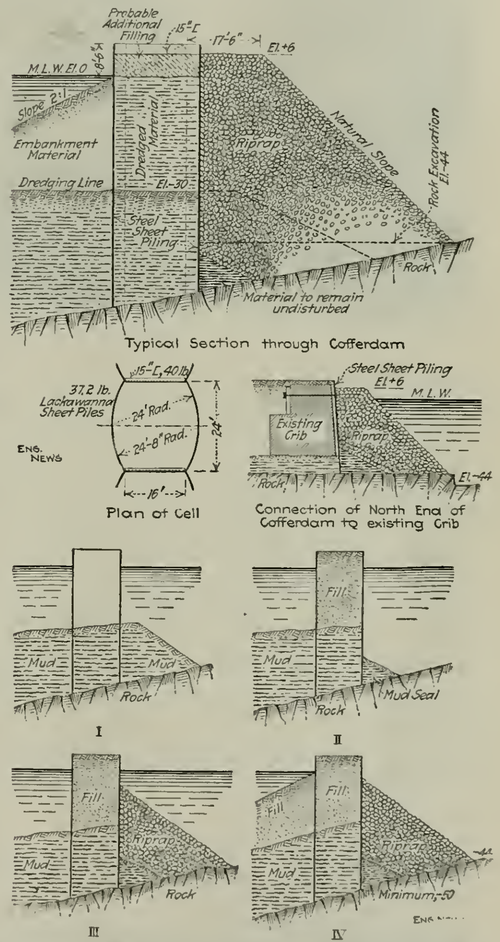


Fig. 3. Details of Quaywall and Fill Construction of 46th St. Pier

The pier-head line in the North River at this location is 700 ft. riverward from the old bulkhead line, so to provide a 1000-ft. dock it is necessary to extend the bulkhead line inshore some 300 ft. Borings and soundings at the site showed the following conditions: Along the new bulkhead line rock was found at an average depth of about 20 ft. below mean low water. Running outshore at a distance of about 220 ft. rock was found at a depth of about 44 to 50 ft. below water. From this point outshore the rock slopes off at a uniform grade, at the pier-head line rock was found at a depth of about 150 ft. below mean low water with an overlying layer of soft mud. The ships for which the new docks are designed require nearly 40 ft. of water, and it was felt that excavations should be carried to at least a depth of 44 ft. below low water to insure safety in berthing in extreme low tide. It, therefore, was necessary to excavate at the shore end of the berth a ledge of rock running from 20 ft. in depth near the bulkhead line to zero about 250 ft. from that line.

At the same time the nearness of the rock to the surface near the shore line made exceptionally desirable the construction at that end of the pier of a filled-in quaywall rather than the ordinary pile-pier construction common to New York harbor. For these reasons it was decided to build the pier 1000 ft. long with a shore end of 219 ft. of gravity section concrete wall filled behind with riprap and earth and with the outshore 781 ft. of ordinary timber-pile construction. On p. 194 of this issue is a note, with a view, describing the test piles driven in preparation for this outshore section.

For the construction of the shore section, underwater excavation of the rock was considered, but because it was very necessary that the rock bottom as excavated should



(Note that the outshore fill shown in stage IV is deposited in part in stage III. See text.)

Fig. 4. Details of Coffer-Dam for 46th St. Pier and Diagram, Showing Successive Stages of Construction

be comparatively smooth and well below the bottoms of the vessels entering the berth and furthermore because in the estimate it proved more economical, it was decided to inclose the entire shore area with a coffer-dam, to unwater the area and to excavate the dock areas by rock excavation in the open, leaving the rock under the quaywall and pier section at its natural elevation and leaving, furthermore, a sheer wall at the quaywall, so that there would be presented a smooth, vertical wall from the river bottom at the dock to the top of the pier. (See Fig. 3 for details of the pier design.)

Fig. 5. View of Coffer-Dam under Construction

The coffer-dam to be built had to be driven in 20 to 30 ft. of water with an underlying mud to the rock surface, which required a total length of piles making up the coffer-dam of some 70 ft. This extreme depth, together with the very heavy head that the dam would have to carry, required an exceptional type of dam and the engineers decided to utilize the cellular sheet-pile method noted above. In the Black Rock harbor coffer-dam, at Buffalo, and particularly in the coffer-dam of the "Maine," which was considerably deeper than the Buffalo dam and therefore more nearly resembled the problem in the North River, a first attempt was made to insure stability of the dam by filling the cells with the mud or silt excavated from behind the dam. In the "Maine" this proved quite unsuccessful and it was necessary to fill in behind the dam with riprap. In the North River dam, therefore, it was decided to forestall any future movement of the dam by providing at the beginning a heavy fill of riprap against the inside of the sheet-pile fill.

Design of Coffer-Dam

The dam used (Fig. 4) consists of a corewall formed of cellular pockets of interlocking sheet piles, each pocket being about 16 ft. in width and 24 ft. in length with an embankment of riprap on the shore side with a width of $17\frac{1}{2}$ ft. and an elevation 6 ft. above mean low water, with a natural slope of 1 on 1 and with an embankment of earth along the outshore, or water face up to mean low water.

The cells are made up of the Lackawanna sheet piles of the 37.2-lb. sections, capable of safely resisting a jaw tension of 9500 lb. per lin.in. Each cell consists of two slightly rounded outer walls with joining transverse straight walls, which are additionally braced by a heavy channel crossing the wall and bolted to each separate sheet pile (Fig. 6). This cross channel was devised to give additional stability during the construction of the pockets. The ends of the coffer-dam are joined at the north end to an existing crib by framing one of the sheet piles of the last cell into a straight single line of sheet piles, which in turn are tied back with tie rods to the interior of the crib work (Fig. 7). At the south end the shore end runs up to above water with a single line of sheet piles. The connection of one cell to another is made with a three-way special sheet pile, designed for this purpose. One may be noted in Fig. 7.

As is shown in Fig. 1, two of the cells are circular in plan and of much larger size than the standard; this is imposed by the necessity of clearing the corner of the existing pier at the foot of 11th St.

The progressive steps in building the dam are shown on the diagram on Fig. 4. The first step in the construction was to destroy the inshore portions of the old existing pier, then to dredge to rock within the area included between the new bulkhead line and a point about 240 ft. west of it. This included both under-water dredging and the excavation of a previous shore section. The coffer-dam cells were then driven across the opening just riverward of the dredged section, so that the piles were driven through an overlying 20 ft. or more of mud and silt. These conditions are shown under step I, in Fig. 4.

Step II was to tub out the mud lying on the shore side of the coffer-dam and into the cell of the dam, leaving a seal of the mud at the inner toe of the dam. Step III is to place the fill of mud up against the river side of the

Fig. 6. A Brace in the Transverse Wall between Two Cells of Coffer-Dam

coffer-dam and to dump the riprap against the shore side of the dam, and step IV will be to pump out the dam. Examination of the diagram showing these steps will show that at various times during the process the dam would be in rather precarious state of equilibrium if the processes indicated on the steps were continued entirely across the dam. For instance, in step III, if the riprap were placed entirely before the fill was placed on the river side of the dam, as the diagram shows in step III, there would be a pronounced tendency to turn over toward the river.

In order to avoid such possibility the filling and excavating on either side of the coffer-dam are now being carried out with extreme caution in alternate sections along the dam, so that no great length of the dam is subjected to excessive pressures from either side at any one time.

Fig. 7. North End of Coffer-Dam, Showing Connection to Existing Crib

The present state of the dam is shown in the large view in Fig. 2. A considerable portion of the cells has been driven and the dredges are working, filling the cells and the dam. The fills inside the cells cannot be completely made with the tubbed-out material inside the dam and the fills in upper part of the cells are to be made by wagons from shore, driven out over the coffer-dam on plank laid across the top of the cells.

Some little trouble has been experienced in driving the closure piles of each cell and in two cases at least the driving has put such a strain upon the pile as to cause them to break. Fig. 6 shows a break of such a nature in one of the cross walls between two adjoining cells.

Personnel

The pier has been designed and is being constructed by the Department of Docks and Ferries of the City of New York, R. A. C. Smith, Commissioner of Docks and Ferries, and C. W. Staniford, Chief Engineer of the Department.

Holbrook, Cabot & Rollins, of Boston and New York, hold the contract for the work which has been described.

Standards of Water Purification and Sewage Treatment

The following standards of water purification are a result of a conference of eminent sanitary engineers, held at the request of the International Joint Commission, to aid the Commission in its investigation of the pollution of the Great Lakes. The engineers asked to participate were George W. Fuller, George C. Whipple and Earle B. Phelps for the United States and F. A. Dallyn, W. S. Lea and Theo. J. Lafreniere for Canada. These engineers were submitted a list of questions on which a general discussion took place. As a result, a resumé was drawn up and signed by all of the engineers except Mr. Dallyn, who objected to several points and asked for the elimination of paragraphs 5, 7 and 11. The other members could not consent to this, so Mr. Dallyn's name was left off the statement, which follows:

1. Speaking generally, water supplies taken from streams and lakes which receive the drainage of agricultural and grazing lands, rural communities, and unsewered towns are unsafe for use without purification, but are safe for use if purified.

2. Water supplies taken from streams and lakes into which the sewage of cities and towns is directly discharged are safe for use after purification, provided that the load upon the purifying mechanism is not too great and that a sufficient factor of safety is maintained, and, further, provided that the plant is properly operated.

3. As, in general, the boundary waters in their natural state are relatively clear and contain but little organic matter the best index of pollution now available for the purpose of ascertaining whether a water-purification plant is overloaded is the number of B. coli per 100 c.c. of water expressed as an annual average and determined from a considerable number of confirmatory tests regularly made throughout the year.

4. While present information does not permit a definite limit of safe loading of a water-purification plant to be established, it is our judgment that this limit is exceeded if the annual average number of B. coli in the water delivered to the plant is higher than about 500 per 100 c.c., or if in 0.1 c.c. samples of the water B. coli is found 50% of the time. With such a limit the number of B. coli would be less than the figure given during a part of the year and would be exceeded during some periods.

5. In waterways where some pollution is inevitable and where the ratio of the volume of water to the volume of sewage is so large that no local nuisance can result, it is our judgment that the method of sewage disposal by dilution represents a natural resource and that the utilization of this resource is justifiable for economic reasons, provided that an unreasonable burden or responsibility is not placed upon any water-purification plant and that no menace to the public health is occasioned thereby.

6. While realizing that in certain cases the discharge of crude sewage into the boundary waters may be without danger, it is our judgment that effective sanitary administration requires the adoption of the general policy that no untreated sewage from cities or towns shall be discharged into the boundary waters.

7. The nature of the sewage treatment required should vary according to the local conditions, each community being permitted to take advantage of its situation with respect to local conditions and its remoteness from other communities, with the intent that the cost of sewage treatment may be kept reasonably low.

8. In general, the simplest allowable method of sewage treatment, such as would be suitable for small communities remote from other communities, should be the removal of the larger suspended solids by screening through a ¼-in. mesh or by sedimentation.

9. In general, no more elaborate method of sewage treatment should be required than the removal of the suspended solids by fine screening or by sedimentation, or both, followed by chemical disinfection or sterilization of the clarified sewage. Except in the case of some of the smaller streams on the boundary, it is our judgment that such oxidizing processes as intermittent sand filtration, and treatment by sprinkling filters, contact beds, and the like, are unnecessary, inasmuch as ample dilution in the lakes and large streams will provide sufficient oxygen for the ultimate destruction of the organic matter.

10. Disinfection or sterilization of the sewage of a community should be required wherever there is danger of the boundary waters being so polluted that the load on any water-purification plant becomes greater than the limit above mentioned.

11. It is our opinion that, in general, protection of public water supplies is more economically secured by water purification at the intake than by sewage purification at the sewer outlet, but that under some conditions both water purification and sewage treatment may be necessary.

12. The bacteriological tests which have been made in large numbers under the direction of the International Joint Commission indicate that in some places the pollution of the boundary waters is such as to be a general menace to the public health should the water be used without purification as sources of public water supply, or should they be used for drinking purposes by persons traveling in boats.

13. It is our judgment that the drinking water used on vessels traversing boundary waters should not be taken indiscriminately from the waters traversed unless subjected to adequate purification but should be obtained preferably from safe sources of supply at the terminals.

14. While recognizing that the direct discharge of fecal matter from boats into the boundary waters may often be without danger, yet in the interest of effective sanitary administration it is our judgment that the indiscriminate discharge of unsterilized fecal matter from vessels into the boundary waters should not be permitted.

A Combination Brick and Asphalt Pavement.—Sheet asphalt for the middle portion of the street and brick pavement on the sides and gutters is suggested by the City Engineer of [illegible], as a solution of that city's paving problems. It is claimed that this type of pavement has proved successful in other cities.

A Relic of Some of New York City's Early Water-Works

The accompanying views show the demolition of a cast-iron storage tank of the Manhattan Co., built about 1800, at the corner of Reade and Centre Sts., New York City, as a part of the water-works which supplied the lower part of the city from about 1799 until the introduction of Croton water in 1842.

Walled in by an old building, this interesting relic has existed for over 100 years, forgotten by practically every-one but the owner of the property, the Manhattan Co., which, due to one of those curious legal fictions, must maintain the semblance of a water-works plant in order to keep its charter; and this charter of the Manhattan Co. is a valuable document, since, under a "joker" clause, it has built up one of the greatest banking institutions in the city. The water-works company will continue by a similar fiction of maintaining a 25-ft. diameter well, which is under the tank and its masonry substructure.

FIG. 1. DEMOLISHING OLD CAST IRON WATER TANK OF THE MANHATTAN CO., NEW YORK CITY

THE EARLIEST CITY WATER WORKS.—New York City had a water works system as early as 1774, when Christopher Colles built a reservoir on Broadway near the present Leonard and Franklin Sts., together with a pumping plant operated by two Newcomen's atmospheric steam engines, and water mains in many of the downtown streets, of pipes made of bored logs. These were in use in 1776.

but the War of the Revolution and accompanying troubles put an end to the water-works company.

History of the Manhattan Company—From then until the Manhattan Co. began operations in 1799, the city had no public water-supply. This granting of a charter to the Manhattan Co. was a historic event, and thereon hangs a tale, which is related in a booklet published by the Manhattan Co., as follows:

Fig. 2. Cast-Iron Floor Plates of Old Tank

Corporate banking in New York began with the organization of the Bank of New York by Alexander Hamilton in 1784, which received its charter in 1792. For 15 years this bank, together with the New York branch of the first Bank of the United States were the only banks doing business in either the city or state of New York. With Hamilton and the Federalists in control of the legislature, new bank charters were unobtainable. This monopoly of banking facilities in the city and state was of great strategic value to the political party in control, and naturally aroused jealousy and resentment among the members of the opposition, whose leader was Aaron Burr.

In 1798 New York City suffered from a severe yellow fever epidemic, which was attributed to an inadequate and inferior water supply. Upon the assembling of the legislature in 1799, an association of individuals, among whom Aaron Burr was the moving spirit, applied for a charter for the purpose of "supplying the city of New York with pure and wholesome water." With a capital of $2,000,000 the project was an ambitious one for those days, and, as there was considerable uncertainty about the probable cost of the water-works system, a clause was inserted in the charter permitting the company to employ all surplus capital in the purchase of public or other stock, or in other monied transactions or operations, not inconsistent with the constitution and laws of New York or of the United States.

A great effort was made to defeat the charter on account of this clause granting the company banking privileges. But the necessity for a proper water-works system, which could be secured only by the organization of a responsible company with large capital, carried it through the legislature, and it received the governor's signature.

The first meeting of the directors was held on Apr. 11, 1799. Dan Ludlow was chosen president, and the following minute was made:

The principal object of this incorporation being to obtain a supply of pure and wholesome water for the city of New York.

Resolved, That Samuel Osgood, John B. Coles and John Stevens be a committee to report with all convenient speed the best means to be pursued to obtain such supply.

On May 6, 1799, the water committee was empowered to contract for as many pine logs as they might think necessary for pipes, and also for boring the same.

A number of wells were sunk, reservoirs and tanks built, and the distributing system extended generally through the city south of city hall.

About 1836 the system was extended north along Broadway as far as Bleecker St., and at that time the company had about 25 miles of mains and supplied 2000 houses.

A 40x20-Ft. Cast-Iron Tank—Of the reservoirs operated by the Manhattan Co., the cylindrical cast-iron tank at Reade and Centre Sts. has been apparently the sole survivor. This tank was an interesting example of early 19th century water-works engineering. It was about 40 ft. in diameter, built of cast-iron segments about $2\frac{1}{2}$ ft. wide by $4\frac{1}{2}$ ft. high and fully $\frac{5}{8}$ in. thick. The plates were bolted to one another through outside flanges on all four sides of the plates and each plate had a transverse rib in the middle. The inside of the tank presented a smooth surface. The joints between the plates were evidently filled with an iron cement, apparently salamoniac and iron filings. The tank was about 20 ft. high. The cast-iron plates were imported from England.

As one of the views shows, there was about 4 ft. of water in the bottom of the tank; from all appearances, there had been water there from time immemorial. When the water was removed, there was a black, slimy, greasy sediment 4 or 5 in. deep, of about the consistency of axle-grease, which gave eloquent evidence of the character of the water that has filled the tank during recent years, at least. The bottom plates, after this deposit had been removed, showed almost no corrosion. According to con-

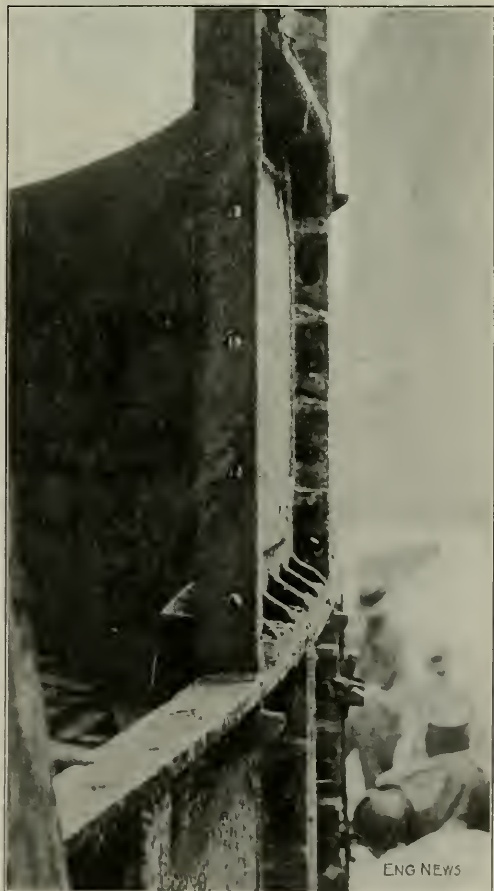


Fig. 3. Near View of Cast-Iron Plates

temporary reports the water was always notoriously bad.

All the sole plates are still good sound iron; few had apparently lost more than one-quarter of their original thickness, although, in removing the plates, rust scale on the exterior of the tank fell off in sheets several feet square. It is, of course, impossible to tell whether the interior was ever painted or coated in any way, but evidently the best protection of all had been the scale itself, and the good quality of the iron.

FIG. 1. A PRIMITIVE GATE-VALVE; DUG UP IN PARK ROW, NEW YORK CITY, IN 1900

The masonry substructure is of curious construction. It is formed of a central pier with radial arches of brick masonry extending to an outside row of piers. The inlet and outflow pipes were cast or wrought iron; and the valve on the outflow pipe was of a gate-valve design, with a rising stem screw.

Proposed Improvements in Municipal Street Cleaning; New York City

In a recent report on a proposed model street-cleaning district in the Borough of Manhattan, New York City, J. T. Fetherston, Commissioner of Street Cleaning, points out the possibility of introducing many improvements and economies. The system now in use in New York City is practically the same as that installed by Col. G. E. Waring over 17 yr. ago.

The main feature of the new plan, which is novel only in its adaptation to municipal conditions, replaces horse-drawn vehicles with power-driven motor tractors, each fitted with three types of trailers; one for street flushing or sweeping, one for refuse collection, and the third for plowing, sweeping and hauling snow. The remainder of the equipment will consist of standard types of covered receptacles for holding garbage or ashes, and a transfer station or dump provided with power-operated devices for handling refuse.

TRACTOR-TRAILER OUTFITS—For the proposed model district, 12 tractors of the nominal 5-ton type, with 36 trailers, will be required. These will be equivalent to 36 single trucks and constitute the main feature in the new scheme. No other city has taken up the tractor-trailer system, but it is successfully employed by private companies. Its adoption for municipal street cleaning, Mr. Fetherston believes, will solve the problem of decreasing the fixed charges by extending the functions of the trailers and the hours of work of the tractors.

Each tractor, as already noted, will be provided with three types of trailers. For collecting refuse, a trailer body fitted with removable compartments to hold at least 10 cu.yd. of refuse will be provided and so designed that material from the standard cans will be transferred to an appropriate compartment without creating dust or nuisance. All classes of refuse will be collected at one time, and not more than one collection trip per day will be made through any street. This will result in all cans being removed from sidewalks and areas except at the removal period, which can be closely timed for every street.

For cleaning streets, a trailer containing a water tank holding about 1500 gal. with sprinkling, flushing and revolving-broom attachments will be furnished, and for snow work a plow and revolving broom, following street-railway practice, is contemplated. Manufacturers of auto trucks have been consulted as to cost and feasibility of the combination tractor-trailer system and have decided the apparatus to be both practical and economical.

DUMP AND TRANSFER STATION—The transfer station or dump will consist of a closed shed on a pier following the general type of shed built along the waterfront, using structural-steel members covered with galvanized-iron sheathing. An electrically operated telpher system will unload refuse containers from vehicles and transfer the material to scows moored alongside the dock. Until the existing contracts for final disposition expire on Jan. 1, 1917, it will be necessary to use the present scows, but later they will be fitted with steel compartments or containers to hold refuse, instead of piling it loosely on the deck to be scattered on the water by the wind while in transport. On account of the picking contract now in force, it will be necessary to construct a temporary rubbish incinerator on the pier, but on the expiration of this agreement (Jan. 1, 1917) all trimming and picking will be eliminated at the transfer station.

The transfer station will become the headquarters for the district and will be provided with an office, employees' dressing rooms, lockers, shower baths and all suitable appurtenances for the work. Temporary storage of refuse pending the arrival or shifting of scows will be provided by means of 24 steel receiving tanks each of 20 cu.yd. capacity. In operation, such a transfer station will eliminate present nuisances at the waterfront dumps.

ESTIMATED COST—The model district proposed contains a population of 130,000, an area of 900 acres, has 50 miles of streets and 807,555 sq.yd. of pavement. The district includes wholesale and retail business, residences, tenements, manufacturing plants, apartment houses, pub-

lic institutions—in fact is thoroughly representative of city conditions. The accompanying Table I shows the estimated cost of the plant described for this district.

TABLE I—COST OF TRACTOR-TRAILER PLANT

Equipment	Total Investment
Shed at dock, 12,500 sq.ft. @ $1.35	$16,875
Telpher track, 1500 lin.ft. @ $5	7,500
Telpher switches, 8 @ $200	1,600
3 telphers complete, $5000	15,000
Temporary rubbish incinerator and belt	10,000
Plumbing and heating	3,000
Electrical work	3,000
Office and equipment	1,000
24 steel receiving tanks (8x8x10) @ $300	7,200
12 tractors and trailers complete @ $10,000	120,000
26,000 special refuse receptacles @ $1.25	32,500
3 auto runabouts	1,800
Engineering—Design and tests	21,500
Contingencies	12,025
Total	$253,000
Annual interest @ 4½%	$11,385

The accompanying Table II gives the estimated cost of operation of the tractor-trailer plant and equipment, which represents an estimated saving of $54,312 over the present methods.

TABLE II—ESTIMATED ANNUAL COST OF OPERATION, MAINTENANCE AND FIXED CHARGES, TRACTOR-TRAILER METHOD

Item	Street Cleaning	Refuse Collection	Snow Work	Totals
Operation and Maintenance	$186,300	$77,412	$15,688	$279,400
Interest	2,365	5,081	1,059	8,505
Depreciation	998	15,643	439	17,080
Totals	$189,663	$98,136	$17,186	$304,985

Municipal Ownership and the Commissioner of Utilities at Port Arthur, Ont.

It is doubtful wheter any other city this side of the Atlantic has gone farther in municipal ownership than Port Arthur, Ont. It owns and operates a street-railway system, electric lights, power service, telephones and water-works. In addition to its extensive ownership of public utilities it adopted what is virtually the city-manager plan about three years ago, or before the plan was more than launched in the United States.

The City Council of Port Arthur appointed J. J. Hackney Commissioner of Utilities in August, 1911. Mr. Hackney has direct control of the eight following city departments: Street Railway; Electric Light; Power; Telephone; Water-Works; Collection; Purchasing; Street Lighting. Besides, he has a general supervision of the Fire and other Departments of the city.

Mr. Hackney informs us that besides making all purchases, all bills are approved by him before being passed by the City Council. He also states that he reports to the Council and that the relations between him and the Council "have been very, very agreeable," with "an entire absence of friction."

The tax rate of Port Arthur for 1914 is 20.5 mills on the dollar, including the school tax. Mr. Hackney states that this is about the lowest rate in Canada for the current year and says considerable credit therefor "is due to the surpluses from the utilities."

The financial results of municipal ownership at Port Arthur are thus summarized by Mr. Hackney:

The following are the gross gains of the Utilities Department for 1913, showing the percentages on the capital invested. This would be the amount that in the case of private companies would be available for dividends. Of course, in Canadian municipal corporations we issue debentures for our capital construction, and take care of interest and sinking fund thereon.

ELECTRICAL DEPARTMENT

Gross revenue	$174,733	
Operating expenses	66,869	
Gross gain		$107,864

TELEPHONE DEPARTMENT

Gross revenue	$46,097	
Operating expenses	26,573	
Gross gain		$1,728

WATER-WORKS DEPARTMENT

Gross revenue	$51,465	
Operating expenses	23,833	
Gross gain		$27,631

STREET RAILWAY DEPARTMENT

Gross revenue	$288,724	
Operating expenses	$190,956	
Gross gain		$97,768

If we take the utilities individually, the gross revenue would show a good return on the amount invested, with the exception of the water-works, as follows: Street railway, 10½%; electrical, 16%; telephone, 6½%; water-works, 1¼%.

The water-works department is under heavy expenditure just now for a new pump-house, intake and force mains, from which there will be no revenue until next year, when this department will show up to much better advantage.

That the consumer's rates at Port Arthur compare favorably with those in other cities, Mr. Hackney thinks is borne out by the following:

STREET RAILWAY DEPARTMENT—Tickets, 8 for 25c. and 6 for 25c.

ELECTRICAL DEPARTMENT—Domestic: 4c. per 100 ft. area charge plus 2½c. per kw.-hr., less 10 per cent. Commercial: 6c. for the first hour's daily use of installed cacity, 2½c. for all above, less 10 per cent. Power: Unrestricted power, $25 per hp. per annum for 24-hr. power, $20 per hp. per annum for 10-hr. power.

Metered power—A. C. service charge of $1 per hp. per month, and a consumption charge of

1.3c. per kw.hr. for the first 50 hr. monthly use of maximum demand.
0.9c. per kw.hr. for all additional consumption up to the second 50 hr. monthly use, and
0.1c. per kw.hr. for all remaining consumption.

Metered power—D. C. service charge of $1 per hp. per month, and a consumption charge of

1.5c. per kw.hr. for the first 50 hr. monthly use of maximum demand.
1.0c. per kw.hr. for all additional consumption up to the second 50 hr. monthly use, and
0.15c. per kw.hr. for all remaining consumption.

TELEPHONE DEPARTMENT—Residence party line, $12 per yr.; residence single line, $15 per yr.; commercial, $30 per yr.

WATER DEPARTMENT—10c. per 100 cu.ft. for the first 1000 cu.ft., and then 7c. per 100 ft. for all above, plus meter rent.

The Production of Sand and Gravel in the United States in 1812, reported to the U. S. Geological Survey by Ralph W. Stone, was 68,318,877 short tons, valued at $23,081,555, as compared with 66,846,959 tons in 1911, a net increase of 1,471,918 tons. Sand for building purposes constitutes about ⅓ of the total production. In 1912, 23,632,157 tons of building sand were produced, valued at $7,904,321, as compared with 24,-614,342 tons, valued at $7,719,286 in 1911, a decrease in production of 1,082,185 tons, and an increase in value of $185,035. The average value of building sand per ton increased from 31c. in 1911 to 33½c. in 1912. Mr. Stone attributes this condition to the higher wages paid to laborers.

The tonnage of gravel produced exceeds that of sand. In 1911 nearly 30,000,000 tons of gravel for concrete paving, filter beds, roofing, road-making, railway ballast, etc., was produced, as against about 26,600,000 tons in 1911. The increase in average cost per ton of gravel was from 25c. to 26c. Mr. Stone says that although wages paid to laborers have probably increased and tended to raise the cost of gravel he believes that the introduction of machinery during 1912 tended to reduce the average cost per ton.

The heaviest building-sand producer in 1912 was New York, which produced 4,126,271 tons. Next in order, all exceeding 1,000,000-tons production, were the following states: Illinois, Missouri, Pennsylvania, Ohio, Indiana, New Jersey and Iowa. The greatest gravel-producing state in 1912 was Illnois with 3,481,638 tons. Next in order, all exceeding 2,000,000 tons capacity, were Ohio, Indiana and New York.

Street Damage from a Sewer Collapse, Newark*

By Edward S. Rankin†

Shortly after midnight on July 7, during a heavy downpour of rain, a section of the sewer on Bank St., Newark, N. J., between High and Plane Sts., about 20 ft. in length, collapsed, completely blocking the flow and forcing up the water through a manhole, to the surface of the street.

The street has a steep grade, approximately 7%, and was paved less than a year ago with grouted granite on a concrete base. The sewer, built of brick in 1871, parallels the surface at a depth of about 13 ft. It is egg-shaped, 3x4.5 ft., and was constructed in a rock cut. Apparently, no care had been taken to properly fill the voids between the rock and the masonry. The sewer theoretically is large enough to care for the storm water tributary to it during the heaviest rainfalls and no complaints have ever

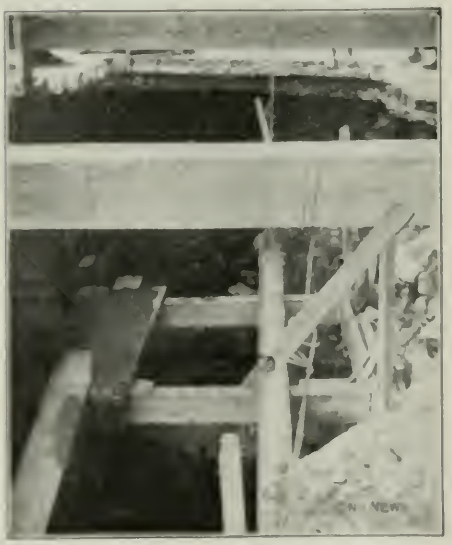


Fig. 1. Large Hole in Bank St. at Point of Sewer Collapse

(The brick sewer is 13 ft. below street level. The cast-iron water main shown was not disturbed.)

been received of flooding in this section, although much heavier rainfalls have been experienced.

The rising water somehow found its way between the concrete foundation of the pavement and the granite blocks, and the latter being absolutely watertight were lifted bodily from the foundation by the head of water caused by the steep grade of the street. The pavement for a distance of 300 ft. is more or less raised and buckled and in three places, about equal distances apart, badly arched. The upper and middle breaks take the form of transverse arches with a span of about 15 ft., and a rise of 18 in. At the lowest break, a section of the pavement about 3x8 ft. was lifted completely from its bed and thrown several feet from its original position.

While the breaking of the sewer was undoubtedly the primary cause of the trouble, it is impossible to determine

Fig. 2. Bulged Granite-Block Pavement

(Pavement was laid by the Hildreth Granite Co. in July, 1913. The 5-in. blocks were laid on a 1½-in. sand bedding on a 6-in. concrete bed of 1:3:6 mixture, which rested on rolled earth. The blocks were grouted with a 1:1 mixture. When the blocks were laid they were first flushed with very wet grout, then grout of creamy consistency was worked in between the joints. The whole was allowed to set for seven days and kept wet meanwhile.)

positively how this break could have damaged the pavement to such an extent. It seems probable, however, that the water escaped through loosely laid brick at the top of the manhole immediately below the cast-iron head, as a number of brick were found to be washed out at this point. The entire pavement for a distance of 300 ft. will probably have to be relaid, although it is believed that most of the concrete foundation will be found intact.

*[illegible] Hildreth Granite Co., [illegible] Broadway, New York City, who laid the pavement on Bank St., Newark.

†[illegible] Department of Sewers and Drainage, Newark, N. J.

The Report of the Commission of Inquiry on the "Empress of Ireland" Disaster

We briefly summarized in our last week's issue that part of the report of the "Empress of Ireland" Commission which dealt with the placing of the blame for the collision between the "Empress of Ireland" and the "Storstad." A part of the report which is of greater engineering interest deals with the question why the "Empress of Ireland" sank in so short a time after receiving the fatal wound.

The "Empress of Ireland" was a comparatively new vessel. She was built in 1906 to class 100 A1 at Lloyds. She had four complete steel decks running from stem to stern: the shelter deck, upper deck, main deck and lower deck. The upper deck was at its lowest point 21 ft. above the water line.

There were ten transverse water-tight bulkheads terminating in each case at the upper deck. These bulkheads were built in accordance with the recommendation of the British Board of Trade Bulkhead Committee of 1891. They were designed in accordance with recommendations of that committee so that any two adjacent compartments might be flooded without sinking the ship below the margin of safety line drawn below the upper deck. Twenty-four water-tight doors in these transverse bulkheads were of the horizontal sliding type, opened and closed by hand. All these doors appear to have been open at the time of the collision and the board concluded after hearing the evidence that nearly all the water-tight doors

on the starboard side between the main and upper decks remained open after the collision. A large proportion of the porthole openings in the side of the ship were also open when the collision occurred.

The stem of the "Storstad" penetrated the side of the "Empress of Ireland" some 21 ft., making a hole about 46 ft. in height, about 25 ft. of which was below water. The width of the hole it is impossible to ascertain, as there may have been some longitudinal ripping action as well as the direct contact. The commission concludes, however, that when the bow of the "Storstad" was withdrawn from the side of the "Empress," an area of no less than 350 sq.ft. was opened for the access of water to the hull.

The collision occurred in the immediate vicinity of the water-tight bulkhead between the two boiler rooms; hence these compartments with a combined length of 175 ft. were at once placed in communication with the sea. With both these compartments flooded the vessel would be sunk practically 9 ft. and if she remained on an even keel without listing, this would take the main deck 4 ft. below water amidships. She would still have had a metacentric height of just over 2 ft., however, and would have continued to float upright had the water-tight doors in the bulkhead above the main deck on either side of the flooded compartments been closed. With the water-tight doors open, however, water from the flooded compartments immediately entered the compartments adjoining. The reason for the great listing of the vessel was that the flooded boiler rooms were divided longitudinally by a coal bunker, steam-pipe passages, etc., which, while not by any means water-tight, considerably delayed the flow of the water from the starboard side to the port side. The commission concludes that the ship probably listed some 15 to 20°; and deep in the water as she was from the flooded boiler compartments, this would cause the water to pour in all along the starboard side of the vessel at the open port holes.

Conclusions

At the close of its report, the commission makes the following suggestions:

1. In order to prevent, if possible, disasters such as that into which we have been inquiring, we think that in foggy weather it would be desirable to close all watertight doors and port holes below the top of the watertight bulkheads, and to keep them closed until the fog has completely cleared. We think, also, that wherever practicable all watertight doors and portholes below the above level should be closed at sunset and kept closed until sunrise.

Precautions of the kind suggested would have the effect of securing the floatability of the ship in accordance with the intentions of the designer, whereas neglect of such precautions may lead to the foundering of a vessel which would otherwise have remained afloat.

2. The rapidity with which the vessel foundered after the collision made the life saving appliances on board of little use. Most, if not all, of the passengers were in bed when the vessel was struck, and there was an interval of only about fifteen minutes between the collision and the foundering. The list which the vessel took to starboard was so sudden and so great that the lifeboats on the port side were rendered useless almost at once. Some of them were indeed worse than useless, for they broke adrift and injured people as they clattered down the sloping deck. Of those on the starboard side, six only were launched, although the best was done in the short time available to get them into the water. These circumstances lead us to suggest that it might be desirable to consider whether rafts could not be placed in such a position on the upper deck that they would float automatically on the water as the ship sank. Such rafts would doubtless have to be attached to the deck in such a way as to prevent them from getting adrift in bad weather; but the attachments might be of a simple kind which could be loosened in a very short time.

NEWS NOTES

The Boiler of a Steam-Shovel Engine exploded at Wrenshall, Minn., on July 16, killing one man.

The Walls of a Frame Church Collapsed near Mount Vernon, Ark., on July 6. There was no one in the building at the time.

The Steamship "Mendoza" Went Ashore in a fog off Mogotes Point on the Argentine coast, on July 11. The "Mendoza" is a vessel of 2856 tons, belonging to the Hamburg-South American Steamship Co. She was built in 1894.

A Traction Engine Went Off a Dock at Glenwood, L. I., on July 18, when the engineer lost control. The engine was used in transporting sand to Roslyn. A derrick at a sand bank on the opposite shore lifted the engine from the channel without difficulty.

A Sewer Cave-In Laid to Rats—A 4-ft. brick sewer on Liberty St., between Broad and Nassau St., New York City, collapsed on July 20, shortly after 5 p.m. The cause of the collapse is said to have been the water rats gnawing at the mortar between the bricks.

A Cloudburst in Raleigh, N. C., caused considerable damage on July 14. The Carolina Power & Light Co.'s plant was shut down, and the basements of printeries were flooded to a maximum depth of 6 ft. The rainfall is reported at 3.4 in. in one hour, the heaviest in Raleigh in 26 years.

A Cave-In in the Balkan Mine at the Alpha location, near Iron River, Mich., on July 15, caused by quicksand, killed seven miners. The miners were drilling into a roof when the drill hit quicksand. The gang, about 30 in number, rushed toward the mouth of the tunnel. The mine was filled by the sand.

A Railway Collision between an electric excursion train and a Virginian Ry. freight train at a grade crossing near Norfolk, Va., on July 17, killed six persons. Press dispatches state that the crossing gates were down, and that the electric train crashed through these gates before striking the freight.

A Cloudburst in Bull Run, Penn., on July 15, moved 20 houses from their foundations, sweeping several into the Susquehanna River. A mill and a cigar factory were destroyed, as were the roads in the vicinity of the town. Bridges were washed away, and it is said that the fields were under 10 ft. of water.

A Suspension Bridge Over the Merrimac River Was Blown Over in a severe electric storm which swept a portion of the Merrimac Valley on July 12. The bridge was located at Tyngs Island. It was built by the Vesper Country Club six years ago, and cost $5000. It failed by breaking in two. The abutments on each side are intact.

A Street Car Fell Off a Viaduct at Superior, Minn., on July 9. According to press dispatches, the car was coming down the slope of the east portion of the viaduct when it jumped the track, crashed through the rail and dropped near the railway tracks underneath. The speed was moderate and the brakes set when the derailment occurred. There were no fatalities.

A Building Wall Collapsed in Northampton, Mass., on July 18, severely injuring one person. The damaged building is known as Union Block, and fronts upon Main St. The building houses several stores and lodge rooms. There were more than 100 people inside at the time, but the sound of cracking timbers gave sufficient warning for most of them to escape without injury.

A Heavy Rainstorm in Philadelphia on the afternoon of July 15, tore holes in pavements, flooded cellars, and interrupted street-car traffic. On Thompson St. a sewer caved in. A deep cut on the Philadelphia & Reading Ry. between Pennsdale and Roxborough was filled with 4 ft. of soft sand and debris. The official rainfall figure was 0.61 in. in 15 minutes, but in Manayunk, where the greatest flood damage is reported measurements taken by Supt. Winfield Gulle of the Manayunk Canal are said to show a precipitation of 2 in. in 20 minutes.

A Severe Wind Storm, with rain and hail, struck Henderson, Ky., on July 16, about 5:30 p.m. Several buildings were wrecked, roofs blown off, trees blown down, and much miscellaneous damage done. The municipal electric light plant was struck by lightning, while the rear end of the building was

[illegible] had the roof blown off. The street and inter-[illegible] lines were put out of service for some hours, due to [illegible] damage to the overhead [illegible] was [illegible] as a result of crossed wires. [illegible] in a residence which was crushed [illegible] being blown over upon it.

Municipal Docks at Trenton, N. J., are to be started with the construction of the new pier on the Delaware River at the foot of Federal St., the plans and specifications for which have just been approved by the city authorities. It is to be [illegible] ft. long and will cost about $70,000.

Engineering Activity on the West Coast—More than 2000 applications have been received by the City Engineer of San Francisco, Calif., for employment on the engineering staff [illegible] Hetch Hetchy municipal water supply project. ["Western Engineering," July, 1914.]

Tunnels Named for Engineers are to be a feature of the [illegible] cut-off line which the Baltimore & Ohio R.R. is [illegible] between Orleans and Little Cacapon, W. Va., 11 miles. The four tunnels will be named for four of the road's chief engineers as follows: James L. Randolph (1863-1883), J. M. Graham (1883-1904), D. D. Carothers (1904-1911), and Francis Lee Stuart (1911 to the present time). The new line shortens the distance by six miles and extends the four-track system east of Cumberland.

Commercial Attaches May Be Appointed for the principal United States legations in foreign countries, according to [illegible] of the Department of Commerce. It is proposed to have connected with each important legation a man of good business experience who will be competent to give advice in all cases in which matters come up affecting his country's commercial relations, and who will be able to make himself generally useful in promoting the commercial interest of the United States in the country to which he is accredited.

Concrete Road Construction Statistics—According to statistics gathered by the California State Highway Commission three times as much concrete was laid on roads and streets in California during 1913 as in any other state. The [illegible] laid last year was 1,766,000 sq.yd. in California, while the country's total was [illegible] sq.yd. Ohio was second with 6[illegible] sq.yd. The total amount of concrete roads and streets laid up to Jan. 1, 1914, in the United States amounted to [illegible] sq.yd., of which California is credited with 1,-[illegible] sq.yd. New York leads in present construction work with a total of 2,402,798 sq.yd.

A New German Canal from Berlin to Stettin, on the North Sea, was officially opened on June 17, and has been named the Hohenzollern Canal. The length of the canal from Berlin to its junction with the Oder River is about 60 mi. The canal is shallow, the vessels plying upon it having a draught of only [illegible] ft., but by using a length of 214 ft. and a width of [illegible] ft. a cargo of 6[illegible] tons can be carried. The cost of the canal has been about $1[illegible], and it is estimated that for several years there will be a deficit in its operating expenses of about $1[illegible] per annum. This will [illegible] the national treasury, however, but will [illegible] by the cities of Berlin, Charlottenburg and Stettin.

A 16-in. Gun, constructed at Watervliet Arsenal, was recently shipped to the Panama Canal fortifications, after tests at the Sandy Hook proving ground. The gun is [illegible] ft. long, weighs [illegible] tons and fires a projectile about 6 ft. long. The [illegible] weighs a ton, and is [illegible] ft. of [illegible] men are required to [illegible] the powder charge. The gun has a maximum range of about 22 miles. [illegible] the shell is revolving about its axis at about [illegible]. The [illegible] is [illegible] per sq.in. The [illegible] is [illegible] ft. per second [illegible]. The carriage for this gun is now [illegible] at the Watertown, Mass., arsenal, and will [illegible] until next spring.

First Decision under New York's New Liability Law—The [illegible] Commission in its first [illegible] [illegible] the Commission. This [illegible] on July 1 [illegible].

Awards Have Been Made in the Competition of the Barber Asphalt Paving Co. [illegible] in "Engineering News," Mar. 12, 1914, p. 586), for papers from engineering students on the subject of asphaltic materials for highway construction. The following students were awarded prizes of $100 each: Frederick O. X. McLoughlin, Columbia University; Harry Schindler, Cornell University; R. J. Fletcher, University of Georgia; John W. Hill, University of Illinois; Robert S. Johnson, Iowa State College; M. V. Holmes, University of Kansas; F. P. Gilbert, Massachusetts Institute of Technology; Harold J. LaLonde, University of Michigan; Benjamin Wilk, University of Minnesota; Alvin C. Smith, University of Nebraska; O. H. Gossweln, Purdue University; Alfred A. Berkowitz, Sheffield Scientific School; W. J. Campbell, Syracuse University.

The Power Plant, Substation and Transmission Line of the Truckee-Carson irrigation project will be leased by the U. S. Reclamation Service for ten years to the Canyon Power Co., of Oakland, Calif. This is subject to power sales already made. The bid of the Canyon Power Co. is at the rate of ¼c. per kw.-hr. for the excess power during the summer months (April to September, inclusive), and at the rate of [illegible] from October to March, inclusive. There is to be a minimum payment of $1200 per month during the summer months. The net income to be expected is approximately $14,000 per annum as a minimum, with a possible maximum of approximately $30,000 per annum; the more probable figures are about $20,000 per annum. A stipulation will be inserted in the contract for the protection of small consumers by limiting the price to be charged.

The Compensation of Railway Labor in the United States and in England was compared in an interesting statement issued by the Bureau of Railway News and Statistics. According to the British Board of Trade, there were 643,1[illegible] wage earners employed on the railways of Great Britain on Dec. 31, 1912. Of these 594,088 were classed as adults, and 49,047 as boys (i.e. under 18 years of age). The total is 44,365 more than in 1910, but only 21,791 over the number reported in 1907. The salaried staff is not included in the figures. In the United States, in 1913, the total was 1,714,6[illegible], also exclusive of officers. The compensation of British railway employees between 1901 and 1912, from available figures, increased from $146,0[illegible] to approximately $17[illegible]—about 19%. The number of workers, however, increased only 11%. During the same period, compensation of American railway employees, exclusive of officers, increased from $588,000,000 to $1,22[illegible], or [illegible]%, against an increase of 61.5% in the number of workers. The average pay of [illegible] railway employees in 19[illegible] was about $255 per year, and in 1912 $271. American employees in 1901 received $[illegible] each, and in 1912, $716 each.

The Morris Dam of the Waterbury, Conn., Water-Works, described in detail in "Engineering News," Mar. 2[illegible], 1911, is now complete with all its appurtenances. There is a 9[illegible]-ft. earth dam with a concrete core-wall, one of the largest structures of the kind in the Eastern States. The quantities in the completed dam are as follows: 46,[illegible] cu.yd. earth excavation, 96[illegible] cu.yd. rock excavation, 53[illegible] cu.yd. rolled embankment, 1[illegible],206 cu.yd. [illegible], 3[illegible] cu.yd. [illegible] masonry, [illegible] cu.yd. concrete [illegible], [illegible] cu.yd. rubble masonry, 369 sq.yd. granolithic finish, 11,[illegible] sq.yd. paving (including brook channel), 171 cu.yd. riprap, [illegible] cu.yd. broken stone, 362 lin.ft. 12-in. vitrified tile pipe, [illegible] lin.ft. 8-in. vitrified tile pipe, [illegible], [illegible] (temporary dam), 4[illegible] sq.ft. steel sheet piling, [illegible] lb. steel reinforcement, 51,[illegible] bbl. cement, 1 drain gate house, 1 service gate house.

Special care was taken with foundations. [illegible] the entire length of the dam, which is 11[illegible] ft. over all, masonry was started in the bottom of the trenches [illegible] the surface had been cleaned and washed with water [illegible] portions of loose rock or dirt removed. In the construction of the earthwork remarkably good material was available. All masonry is of concrete. The cement was at all times satisfactory. [illegible] quarry just west of the dam and was found of good quality except for the presence of a [illegible] amount of [illegible]. Concrete mixtures were [illegible] from 1:3:6 to 1:2:4 [illegible] used in construction of [illegible] which form the exposed surfaces of all walls [illegible] of the walls [illegible]. R. A. Cairns is City Engineer of Waterbury, from whose [illegible] the data quoted were taken.

No Proposals For Bonds, to be issued by the city and county of Denver to the amount of $[illegible] for construction

of new municipal water-works (as outlined in "Engineering News," July 2, 1914) were received by the Public Utilities Commission on July 20 when bids were to have been opened. The failure to receive bids is construed by the Utilities Commission as due to the opposition of bond houses, owing to the fact that $12,000,000 in bonds of the Denver Union Water Co. are now outstanding and no provision was made for their redemption in bonds of this issue (rather than as being reflection on the credit of the city). It is reported that a number of bond houses have signified their desire to purchase the bonds, provided the bonds of the water company are taken care of. Several informal offers of reservoirs, reservoir sites, irrigation works, and even covering the construction of a new plant in return for bonds have been received but have not been acted upon.

The Cucaracha Slide on the Panama Canal appears about to finally yield to the continued assaults upon it. Ever since water was admitted to the cut, dredges have been at work at the toe of the slide, endeavoring to excavate the earth and rock as fast as it flows in. As is generally known, this slide consists of a huge blanket of clay, covering originally some 47 acres, which is gradually moving down the hillside on the sloping bed rock like a huge glacier. The surface of the slide from the top to the bottom has the appearance of a series of waves, caused by the formation of the underlying rock over which the slide is moving. As much of the rock is soft and the pressure of the earth is great, a considerable amount of the rock has broken off and added its volume to the slide. For a considerable time, a navigable channel has been maintained past the slide, and there is now depth and width sufficient for ships to pass with a draught of 25 ft. The ladder dredge "Corozal" is now at work deepening this channel to the full depth. The movement of the slide has lessened of late. On July 20, 4800 lb. of 60% dynamite carried on the drill barge "Teredo" prematurely exploded, killing five men and injuring 18. Eight drill holes in the slide had just been charged when the explosion occurred.

A Report on the Panama Canal, both comprehensive and concise, will be a part of the proceedings of the International Engineering Congress to be held at the Panama-Pacific International Exposition, San Francisco, Calif., Sept. 20-25, 1915. Col. Goethals is chairman of the Congress and is to open the discussion on the Canal, which will be divided into the following heads:

(1) Col. Goethals' general report, (2) Dry excavation of the Panama canal by Col. Goethals, (3) Dredging the canal; (4) Terminal works, dry docks and wharves of the canal; (5) Meteorology and hydrology of the zone; (8) Designs of locks, dams and regulating works; (9) Methods of construction of same on the Atlantic side; (10) Same on the Pacific side; (11) Designs of locks walls and valves; (12) Spillways; (13) Gates of the canal; (14) Electrical and mechanical installation; (15) Emergency dams above locks; (16) Municipal engineering and domestic water supply in the zone; (17) Reconstruction of the Panama railroad; (18) Aids to navigation of the canal; (19) Geology of the canal zone; (20) The working force of the canal;(21) Sanitation in the zone; (22) Purchase of supplies for the canal.

Following Colonel Goethals' personal reports, each of these topics will be treated by the heads of departments or other attaches who were responsible for that part of the canal construction.

PERSONALS

Mr. George F. Baker, formerly with the Morgan Engineering Co., of Memphis, Tenn., has been appointed Assistant City Engineer of Dayton, Ohio.

Dr. Charles W. Berry, a physician of Brooklyn, N. Y., has been appointed Sanitary Supervisor of the New York State Department of Health, at a salary of $4000 per annum.

Mr. J. W. Carnes, recently Trainmaster of the Trinity & Brazos Valley Ry., at Teague, Tex., has been promoted to be Assistant General Superintendent, with headquarters at Teague.

Mr. F. K. Zook, former Engineer of Maintenance-of-way of the Northwestern Pacific R.R., has been promoted to be Chief Engineer of Maintenance and Structural Engineer of the railway.

Mr. Ross S. Marshall, formerly Superintendent of the Minneapolis & St. Louis R.R., at Oskaloosa, Wis., has been appointed Division Superintendent of the Seaboard Air Line Ry., at Richmond, Va.

Mr. H. B. Grimshaw, former Superintendent of the Seaboard Air Line Ry., at Americus, Ga., has been appointed General Manager of the Macon, Dublin & Savannah R.R., with offices at Macon, Ga.

Mr. William Bacon Gray, Assoc. M. Am. Soc. C. E., formerly General Superintendent of S. Pearson & Son, Inc., has opened an office for the general practice of civil engineering at 2 Rector St., New York City.

Mr. Samuel Wilson has resigned his position with the American City Bureau, New York City, and has been elected Secretary of the Chamber of Commerce of Johnstown, Penn., at a salary of $3600 per annum.

Mr. R. C. Watts, formerly in the employ of the New York, Chicago & St. Louis R.R., on grade elimination work in Cleveland, Ohio, has accepted a position in charge of equipment of the State Highway Department at Columbus, Ohio.

Mr. J. S. Calhoun, Jr., recently Sub-Inspector, Department of Public Works, Charleston, S. C., Navy Yard, has been appointed Superintendent of J. F. Jenkins & Co., of Osceola, Fla., contractors for the United States Post Office at La Fayette, La.

Mr. P. C. McArdle, Assistant State Highway Engineer of Illinois, has been appointed Acting Chief State Highway Engineer, to succeed Mr. A. N. Johnson, M. Am. Soc. C. E., resigned, as noted in our issue of June 25, to become connected with the Bureau of Municipal Research, New York City.

Mr. Frederick O. Ball, M. Am. Soc. M. E., has resigned as General Manager of the American Engine & Electric Co. (formerly the American Engine Co.), of Bound Brook, N. J., to engage in the manufacture of carbureters with his father, Mr. Frank H. Ball, M. Am. Soc. M. E., under the firm name of Ball & Ball, Detroit, Mich.

Mr. D. Howard Martin, M. Am. Soc. C. E., recently Division Engineer of the Pittsburgh & Shawmut R.R., Brookville, Penn., has been appointed Chief Engineer of James H. Corbett & Sons, Kittanning, Penn., contractors for Section 5 of the new Welland Ship Canal, with headquarters at Allanburg, Ont. The company is also engaged on railway construction contracts in the United States and Canada.

Mr. J. W. Williams, former Assistant Chief Engineer of the Northwestern Pacific R.R., has been appointed Chief Engineer of Construction to succeed Mr. William C. Edes, M. Am. Soc. C. E., now a member of the Alaska Engineering Commission. Mr. Williams is a native of Milan, Ohio, and has been in railway engineering work since 1901, when he was employed on the Santa Fé Central Ry. as chainman, levelman and transitman. He has been Assistant Chief Engineer of the Northwestern Pacific since 1907.

Mr. J. R. Bibbins, associated with Mr. Bion J. Arnold, M. Am. Soc. C. E., Consulting Engineer, Chicago, has been engaged by the law department of the city of Pittsburgh, Penn., in an advisory capacity in connection with the improvement of local transportation facilities. An attempt will be made, in coöperation with the street-railway company, for an operative service standard, for scientific rerouting in the terminal district and for progressive rehabilitation of the property. Mr. Bibbins was Resident Engineer for Mr. Arnold on the investigation of transit problems in Providence and San Francisco.

Mr. Joseph Bucklin Bishop, Secretary of the Isthmian Canal Commission since September, 1905, has resigned, as his work at Panama has been completed. Mr. Bishop founded and edited the "Canal Record," and is well known to many engineer visitors to the Canal Zone. Previous to entering the Canal Service he was for 35 years engaged in newspaper work in New York City, chiefly as an editorial writer with the "Tribune" and the "Evening Post." Mr. Bishop has entered a contract with Charles Scribner's Sons, publishers, New York City, for literary work in connection with their magazine and publication department.

Mr. Etienne Pelland, former Engineer in charge of the sewer department of Montreal, Que., has been arrested on charges of alleged graft in connection with the construction of the Notre Dame de Grace sewer. According to the Montreal "Gazette,"

> It is alleged that during the period between January and April, 1911, with intent to defraud the city of Montreal by false pretences, Mr. Pelland illegally, unlawfully and fraudulently procured, and caused to be procured at various times, various sums of money, in all amounting to about $75,000, to various persons, by making false reports and causing to be made false plans and profiles of a sewer to falsely and fraudulently represent rock at certain elevations.

Mr. George M. Lehman, M. Am. Soc. C. E., Engineer in Charge of the Pittsburgh Flood Commission work, Pittsburgh, Penn., has been appointed Chief Engineer of the Lake Erie & Ohio Canal Board, recently appointed by Gov. Tener,

of Pennsylvania. The members of the Board are: President, Mr. William A. Magee, former Mayor of Pittsburgh; Col. Thomas W. Symons, Corps of Engineers, U. S. A., retired; Mr. Tom P. Smith, of Lock No. 4, Washington County, Penn.; Messrs. James A. Chambers and A. S. McSwigan, of Pittsburgh, Penn. Offices have been opened in the Farmers Bank Bldg., Pittsburgh, and the fieldwork of surveying has been begun.

Messrs. George T. Seabury and Albert A. Northrop, M's Am. Soc. C. E., announce the formation of the firm of Seabury & Northrop, Inc., Consulting and Construction Engineers, 101 Park Ave., New York City. Mr. Seabury is a graduate of the Massachusetts Institute of Technology, class of 1902, and received his early engineering experience with the contracting firms of J. C. Rodgers and John F. O'Rourke. For the past eight years he has been connected with the Board of Water Supply of the City of New York, engaged upon the preliminary investigations of the Olive Bridge dam, later as one of the two personal Assistants to the Chief Engineer, and for the last four years as Assistant to the Division Engineer, in charge of constructing the Kensico dam and that portion of the Catskill aqueduct, including the complicated Control Works at the Kensico reservoir. Mr. Northrop is a graduate of New York University, class of 1900, and his early experience was in railroad construction and maintenance. He was in direct charge of the construction of the Olive Bridge dam of the Ashokan reservoir for the Board of Water Supply, and for the last four years has been associated with Mr. John R. Freeman, M. Am. Soc. C. E., Consulting Engineer, of Providence, R. I. For Mr. Freeman, he has had charge of the construction of the Holter dam across the Missouri, in Montana, of estimates and reports upon the various hydro-electric developments, and was Auditing Engineer on the construction of the hydraulic features of the Mississippi River Power Co., at Keokuk, Iowa. The new firm will specialize in the investigation of hydroelectric developments and the supervision of general construction.

Mr. Alfred Douglas Flinn, M. Am. Soc. C. E., Department Engineer of the Board of Water Supply of the City of New York, has been promoted to be Deputy Chief Engineer, succeeding Mr. Merritt H. Smith, M. Am. Soc. C. E., resigned, to become Chief Engineer of the Department of Water Supply, Gas and Electricity, as noted in our personal columns of July 9. Mr. Flinn was born in Pennsylvania in 1869 and graduated in civil engineering at the Worcester Polytechnic Institute in 1893. From 1893 to 1895 he was connected with the distribution department of the Boston, Mass., waterworks, under Mr. Dexter Brackett, M. Am. Soc. C. E., Chief Engineer. From August, 1895, until October, 1902, Mr. Flinn was with the Metropolitan Water Commission of Boston, first as a transitman and Assistant Engineer on surveys, and later on design and construction of various parts of the Metropolitan water-works. From 1902 to 1904 he was Managing Editor of the "Engineering Record." Mr. Flinn first became connected with the New York City water-works in August, 1904, as General Inspector of the Croton Aqueduct Commission. On the establishment of the Board of Water Supply's engineering department in 1905, to make and carry out plans for the Catskill water supply, Mr. Flinn was appointed Department Engineer in charge of the headquarters department, where he had supervision of the preparation of all important designs, the preparation of contracts and specifications, the inspection of materials, researches and investigations, annual and other reports, organization and general executive matters relating to the engineering bureau. The appointment is effective Aug. 1 and carries a salary of [illegible] per annum.

OBITUARY

[illegible], former Minister of Railways and Canals of Canada, died July 9 at his home in [illegible], N. B.

[illegible], a civil engineer employed by the sewer department of Toronto, Ont., was asphyxiated by illuminating gas while making survey measurements in the [illegible] St. sewer tunnel, Toronto, July 7.

[illegible], for many years Professor of [illegible] at the Brooklyn Polytechnic Institute, died July [illegible], at his home in Brooklyn, N. Y. He was born in 18[illegible]; he retired from the faculty of the Institute in 18[illegible].

[illegible], for many years Chief Engineer of the [illegible] Coal [illegible] Co., died July [illegible], at the home of his son, George [illegible], a contractor of Brooklyn, N. Y. The elder Mr. [illegible] was born in England [illegible] years ago.

Samuel F. Prince, Jr., formerly Superintendent of motive power and rolling equipment of the Philadelphia & Reading Ry., died in New York City, July 13. He resigned from the railway company in 19[illegible]4 to accept a position with the Niles-Bement-Pond Co., New York City. He was 62 years old.

Kurt W. Peuckert, of the firm of Peuckert & Wunder, Architects and Engineers, Philadelphia, Penn., died July 11, at his home at Sharon Hill, Penn. He was born in Germany 68 years ago, and came to this country at an early age. He was a member of the Franklin Institute and many fraternal societies. He is survived by a widow and one daughter.

Dr. William Bleecker Potter, M. Am. Inst. M. E., Mining Engineer and Metallurgist, founder and Manager of the St. Louis Sampling & Testing Works, St. Louis, Mo., died July 14, aged 68 years. He was a son of Bishop Horatio Potter and a nephew of the late Bishop Henry C. Potter, of New York City. He was born at Schenectady, N. Y., in 1846, and graduated from Columbia University in 1866. In 1869 he received the degree of Mining Engineer at Columbia. For a few years he was Assistant in geology at Columbia, and then was Professor of mining and metallurgy at Washington University, St. Louis, Mo., until 1893, when he founded the St. Louis Sampling & Testing Works.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.
Aug. 20-21. Annual meeting in New York City. Secy., E. H. Harman, Room 101, Union Station, St. Louis, Mo.

AMERICAN PEAT SOCIETY.
Aug. 20-22. Annual meeting at Duluth, Minn. Secy., Julius Bordollo, 17 Battery Place, New York City.

AMERICAN BOILER MANUFACTURERS' ASSOCIATION.
Sept. 1-4. Annual convention in New York City. Secy., J. D. Farasey, E. 37th St., and Erie Ry., Cleveland, Ohio.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 7-10. Annual meeting in New York City. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

NATIONAL ASSOCIATION OF PORT AUTHORITIES.
Sept. 8-10. Annual convention in Baltimore, Md. Secy., Wm. Joshua Barney, 29 Broadway, New York City.

ROADMASTERS AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.
Sept. 8-11. Annual meeting at Chicago, Ill. Secy., L. C. Ryan, Sterling, Ill.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.
Sept. 8-11. Annual convention in Nashville, Tenn. Secy., A. P. Dane, Reading, Mass.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 9-11. Annual convention in Boston, Mass. Secy., Willard Kent, Narragansett Pier, R. I.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Sept. 15-18. Convention in Atlantic City, N. J. Secy., Clayton W. Pike, Electrical Bureau, Philadelphia, Penn.

ILLUMINATING ENGINEERING SOCIETY.
Sept. 21-2[illegible]. Annual convention in Cleveland, Ohio. Secy., Joseph D. Israel, 29 W. 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Sept. [illegible]-24. Annual convention in Bluff Point, N. Y. Secy., C. C. Rosenberg, Times Building, Bethlehem, Penn.

American Society of Agricultural Engineers.—The committee on farm structures of the American Society of Agricultural Engineers, the chairman of which is E. S. Fowler, Security Bank Bldg., Minneapolis, Minn., is making a study of the most economical and convenient designs for farm buildings, etc. The results of the study will be reported at the next convention of the Society, to be held in Chicago, next December.

American Boiler Manufacturers' Association.—The 26th annual convention will be held in New York City, Sept. 1-4, with headquarters at the Waldorf Astoria Hotel. All boiler, tank, and stack manufacturers and fabricators of steel plates, also manufacturers of materials and supplies used by boiler manufacturers are invited to attend this convention. Among the important subjects to be discussed is that of uniform boiler specifications. The secretary is F. B. Slocum, West and Calyer Sts., Brooklyn, N. Y.

International Street Railway and Light Railway Congress.—The next meeting will be held at Budapest, Austro-Hungary, Sept. [illegible] to 1[illegible], instead of in August as previously announced. In addition to entertainments during the period of the Congress there will be two alternative excursions of three days each. One of these is north to Tatra in the Carpathian mountains, the other is south to Arad and Baziás, and thence by steamer down the Danube to [illegible]. The Secretary of the Congress is H. [illegible]amp, 21 Rue d'Arlon, Brussels.

Engineering News

VOLUME 72 JULY 30, 1914 NUMBER 5

Framework of the Equitable Building

Steel erection recently began on what will be the largest office-building in existence, the Equitable Building, New York City, on the site of the burned office-building of the Equitable Life Assurance Society.* The large size is the product of an unusual area of ground plan and an unusual (but not unprecedented) height. But it must be remembered that the very tall buildings, as the Singer, Metropolitan, Central Union, L. C. Smith, and Woolworth, are tower buildings, the main buildings being of moderate height and only a narrow section or tower extending up beyond this. The Equitable, on the other hand, represents a reversion to the normal type of building, the ground-plan area being carried up undiminished to the top. In part this may be due to the fact that it occupies an entire block (Broadway to Nassau St., Pine St. to Cedar St.) over which the old Equitable Building spread in its heterogeneous growth.

*For notes on the fire of Jan. 9, 1912, and the old building, see "Engineering News," Jan. 18, 1912, p. 123, and Nov. 28, 1912, p. 986.

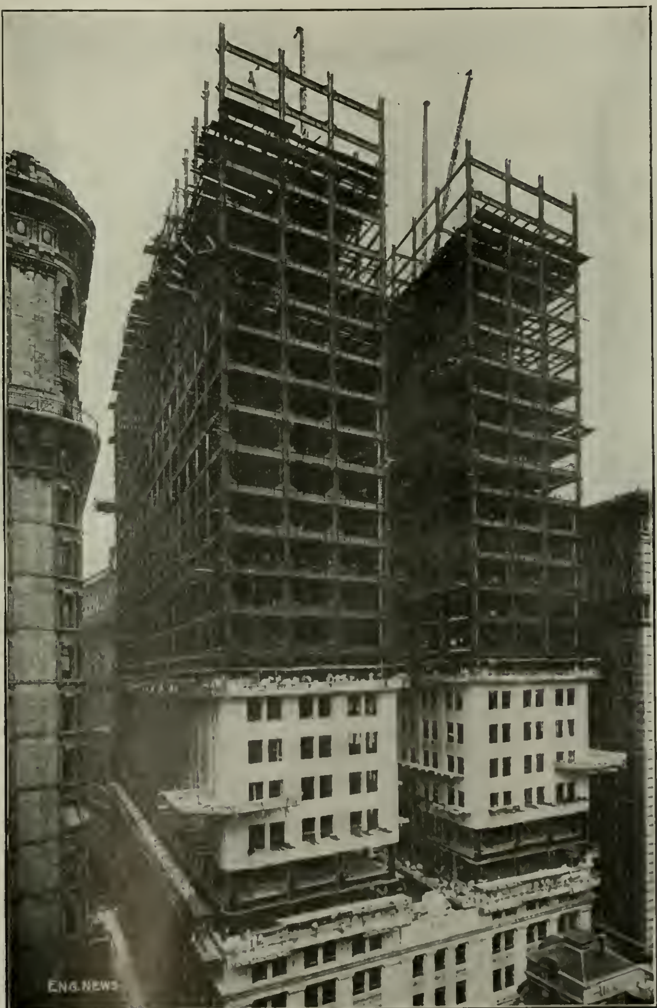


Fig. 1. The Equitable Building on July 16, 1914

Structurally the building is of remarkably regular design. All its columns run through from footing to roof, and there are no trusses or similar complications—an unusual condition in so large a building. The frame is composed essentially of columns, beams and wind-bracing.

The bank vaults in the basement, as well as engines and boilers, etc., are carried on their own foundations, independent of the steelwork, thus eliminating the weight of framing which would have been required to support them.

The Equitable has three stories below ground and 36 main stories above, but these contain two intermediate floors (3 to 4, 34 to 35), making 41 tiers of beams, inclusive of the roof. The building is about 542 ft. high from Broadway sidewalk to coping; measured from the level of the normal foundation grillages, it is about 600 ft. high.

The area of the block occupied by the building is slightly more than an acre, being 159 ft. in width average and 308 ft. in length average (the outline of the block has no right angles and no parallel lines). Thus the total floor space is nearly 40 acres.

Great Weight of Framework

While ordinary office-building floor loads are figured on in the design of the building, the mere size of the structure makes the weight of the framework run to unprecedented figures. The following little tabulation is instructive:

WEIGHT OF STEEL FRAMEWORK IN SOME LARGE BUILDINGS

Equitable Building, New York	32,000
[illegible], Philadelphia	28,000
Woolworth, New York	26,000
Hudson Terminal, New York	20,000
Continental National Bank, Chicago	16,000

There are several buildings in the neighborhood of 20,000 tons of steel. It is seen that the Equitable Building is from 1[illegible] to 14% in excess of what has heretofore been attained in office-building construction, in point of size as gaged by weight of frame.

and this section is developed to areas of over 390 sq.in., about twice as great an area as ever before used with this form of column.

General Arrangement

The floor plan (see windbracing sheet) shows that the building is arranged in H-form, courts being cut in at the middle of the Nassau St. and Broadway fronts, each 35 ft. wide and about 77 ft. deep; these courts, however, exist only above the sixth floor. The floor area within outer walls is 45,000 sq.ft. per floor below the sixth, and 40,000 sq.ft. above.

The elevators are in six banks of eight each, in the center of the building, extending to the following floors, respectively: 13th, 21st, 28th, 33rd, 36th and 38th. In

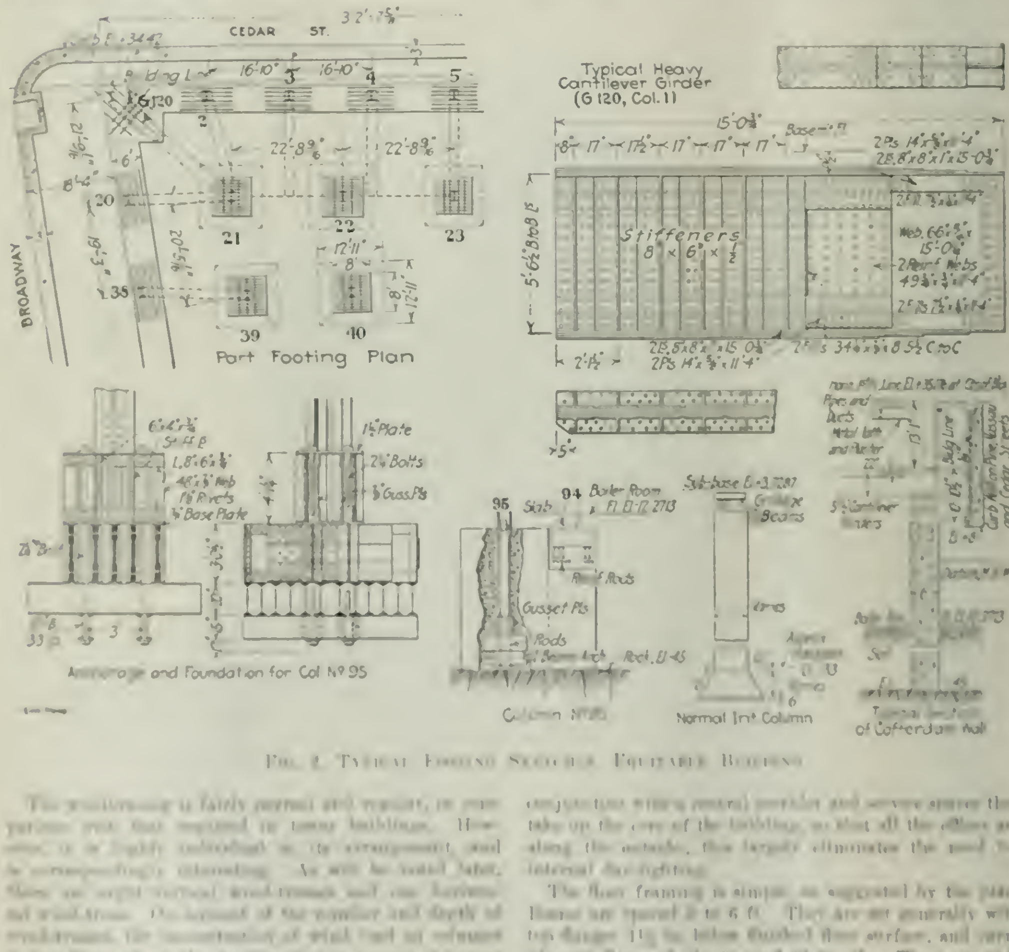


Fig. 2. Typical Footing Sketches, Equitable Building

The windbracing is fairly normal and regular, in comparison with that required in many buildings. However, it is highly individual in its arrangement, and is correspondingly interesting. As will be noted later, there are eight vertical wind-frames and one horizontal wind-truss. On account of the number and depth of windframes, the concentration of wind load on columns is less than where the windbracing is [illegible] concentrated. Therefore, while the Equitable has some remarkably heavy column sections, none of these are [illegible]. [illegible] however, is [illegible] for [illegible] heavy construction; a simple I-section is used.

[illegible] with a central corridor and service spaces that take up the core of the building, so that all the offices are along the outside, this largely eliminates the need for interior daylighting.

The floor framing is simple, as suggested by the plan. Beams are spaced 5 to 6 ft. They are set generally with top flange 1½ in. below finished floor surface, and carry tile-arch floors of 12, 14 and 16 in. tile. These are end-construction flat arches, with [illegible] —the latter an unusual feature.

The wall architecture is also sufficiently regular to make the connections of the steelwork at the walls rela-

tively simple. A few spandrel sections are illustrated in Fig. 5.

Foundations

In the original design, most of the piers for the interior columns were to be carried only to the hardpan overlying the rock (as shown in Fig. 2). Before the piers were built, however, it was decided to carry them down to rock. All these piers were built in open pits.

The entire exterior line of columns is carried on *pneumatic caissons* sunk to rock, and these caissons are arranged to form a tight coffer-dam wall, retaining the surrounding earth and excluding water. The steelwork of basement and sub-basement floors braces this coffer-dam wall.

Four of the interior column piers are specially heavy, and contain steel anchorages. These are the main piers of the principal central windbracing system (systems *C*, windbracing sheet), being cols. 44, 47, 92 and 95. A general sketch of one of these piers is given in Fig. 2. Alongside is a sketch of one of the normal interior foundations.

The section through the coffer-dam wall and curb retaining wall in Fig. 2 illustrates the foundation arrangements at the street line.

In connection with the foundations it is to be noted that the present practice of the Building Department in New York City prohibits foundations extending beyond the building line into the clearway of the public streets. This means that the outer edges of the grillage footings must be inside the building line and the center of the footing therefore some distance back of the building line. As the column ordinarily will not be so far back of the building line, cantilever footings must be used in order to center the load on the grillage. Thus the entire outer ring of column bays in the building contains cantilever footing girders. At the corners of the building the cantilever girders of the corner column and the two adjoining wall columns were carried back to the same interior column for anchorage. This results in a three-forked girder arrangement at the corners, as shown by sketch in Fig. 2.

At the four main columns of the central windbracing system, the wind stress exceeds the dead-load at top of concrete pier, giving an uplift on the windward side. For this reason the column base is anchored and a special connection of base to column provided to transmit the tension; and the splices in the lower section are proportioned to transmit the tension.

The concrete caps of all foundation piers, under the column-footing grillage, are reinforced by two layers of steel rods in the concrete, although the grillage beams cover the entire area of the pier.

The I-Shaped Columns

Strict uniformity was maintained in the column design, all sections adhering to a set of three types, namely:

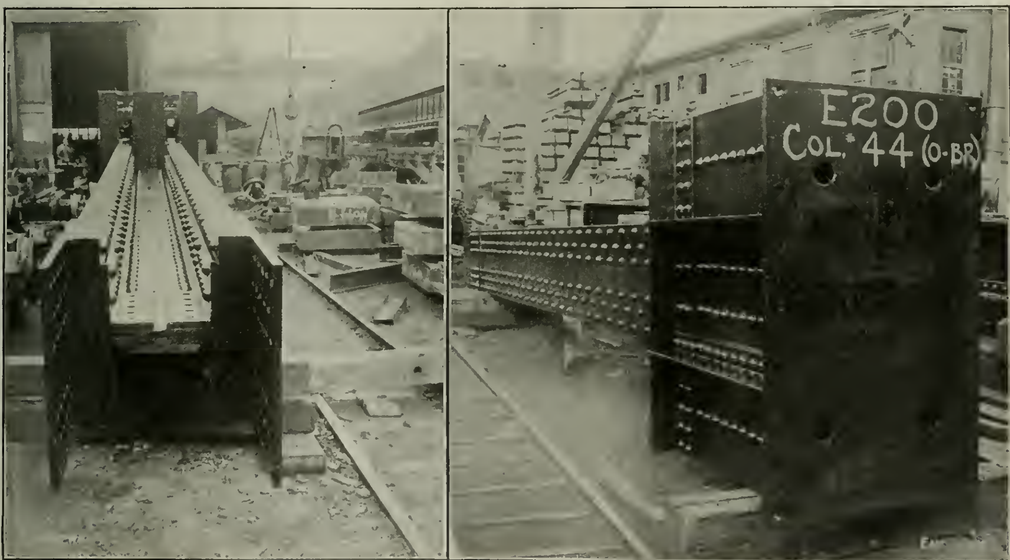


FIG. 3. AN ANCHOR COLUMN OF THE EQUITABLE BUILDING, IN THE PENCOYD SHOP YARD

(American Bridge Co.)

Simple I-section, consisting of four angles and web: I-section with covers; and I-section with covers and web reinforcing. However, there were three fixed depths of web (13, 14 and 17 in.), and three widths of cover-plate (18, 20 and 24 in.), so that 13 separate series of column sections resulted. The following remarks on the several classes begin with the lightest (upper stories) and go downward:

SIMPLE I-SECTION—Classes A, B and C, of web depth 13 in., 14 in. and 17 in., respectively. Range of make-up, from four angles 5x3x⅜-in. with ⅜-in web, to four angles 8x8x$\frac{15}{16}$ in., with $\frac{13}{16}$-in. web. Range of area, 17 to 72 sq.in.

I-SECTION WITH 18-IN. COVERS—Classes D, E and F. Body, four angles 8x6 or 8x8x⅞, with ⅞-in. web; cover-plate thickness per flange, from [illegible] in. to 2 in. Range of area, 69 to 139 sq.in.

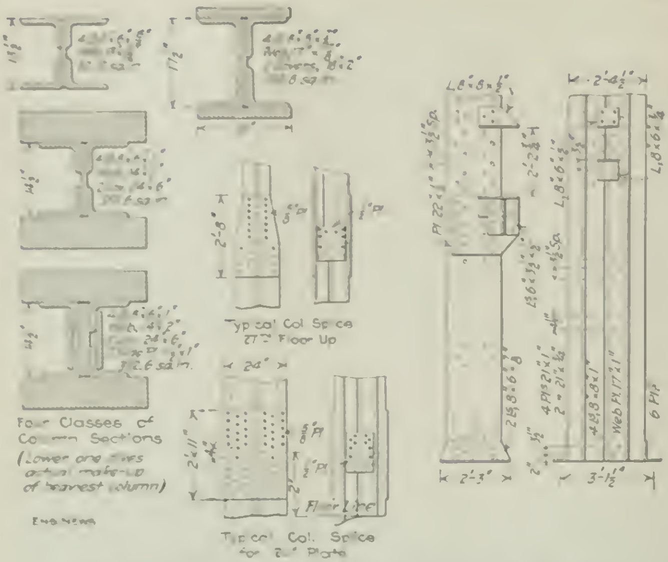


FIG. 4. TYPES OF COLUMN SECTION, EQUITABLE BUILDING

I-SECTION WITH 24-IN. COVERS—Classes J and K (14- and 17-in. web). Body, four angles 8x8x1 in., with 1-in. web, cover-plate thickness per flange, 2½ in. to 6 in. Range of area, [illegible] sq.in. to 356 sq.in.

I-SECTION WITH SIDE PLATES—Class M (14-in. web). Body, [illegible] web 14x1 in. to 14x2 in.; two side plates, [illegible]x1 in.; cover-plates per flange, 24x6 in. Range of area 373 to [illegible] sq.in.

The thicknesses of cover-plates, etc., refer in all cases to total thickness specified. It was left to the contractor to decide upon the number of the plates with which to form this thickness. For the thick covers, 1-in. plates were generally used, partly because more readily obtainable in long lengths, and of more assured quality, than thicker plates.

Four sizes of rivets were used in the columns, as well as elsewhere in the work: ¾-in. rivets for grips of less than 2 in.; ⅞-in. for grips from 2 in. up to 4 in.; 1-in. rivets for grips of 4 in. to 6 in.; and 1⅛-in. rivets for grips of 6 in. and over.

A set of type sections of columns and an actual cross-section of the maximum column are given in Fig. 4.

The column of greatest sectional area, [illegible] sq.in., has a length of 11 ft. [illegible] in., and weighs [illegible] tons. Its maximum load is [illegible] tons. Another column weighs more, however, on account of its greater length ([illegible] ft. [illegible] in.). Its weight is [illegible] tons. The longest column section, 47 ft. long, weighs [illegible] tons. The character of the detailing and riveting is shown in Fig. 4 by a copy of the shop drawing for one of the heavy columns, and in Fig. [illegible] a view of one of the [illegible] column sections.

[illegible] are interposed between column and grillage.

WINDBRACING

The end areas being small and the resisting sides (east and west) being very long, no special provision is made for windbracing on the long north and south fronts of the building. All spandrel girders on these two sides, however, have top and bottom connections as well as web connections to the columns, and therefore offer ample resistance to pressure in a longitudinal direction.

In the shorter or transverse (north and south) direction, where the total width of the building is about half the length and where the width of the wings alongside the courts is about one-sixth the length, there are no less than eight planes of windbracing (see plan on windbracing sheet). Each plane was designed to support the building halfway to the adjoining plane of bracing on either side.

The planes of bracing are as follows: One each in the Broadway and Nassau St. fronts; one each in the back walls of the courts (systems *A* and *A*[1]); and four lines between the A-systems, namely systems *B*, *C*, *C*[1] and *B*[1]. The front and A-systems extend the full width of the building, except that the former are divided by the courts which extend above the sixth floor. The B- and C-systems, however, are confined to the three center panels of the width, where they do not infringe on office space. Therefore the windbracing problem in the middle part of the building was just as serious as in a very much narrower building of the same height.

Further, the B- and C-systems are not entirely equivalent, for the C-systems, forming the central bracing, extend to the 32nd floor, while the B-systems go up only to the 23rd floor. Above the 23rd floor the C-system must carry the entire building between back walls of courts, a length of about 150 ft. At the 23rd floor, therefore, where the B-systems start and the A-systems broaden from the width of the wings to the full width of the building, a horizontal truss is formed in the floor, tying together systems *B* and *C*. At this level the wind shear of the C-systems is assumed to divide equally between the B's and the C's, but, of course, the accumulated column wind stress in the C-systems remains there.

The front wall system and A-system of wind bracing are made up almost exclusively of girders and gussets or knee-braces. The four interior B and C windbracing systems have girder bracing in the center panel, the outside panels having diagonal bracing. Girders with gussets are used in the middle panel for the reason that this panel must be left unobstructed for corridors (wind-

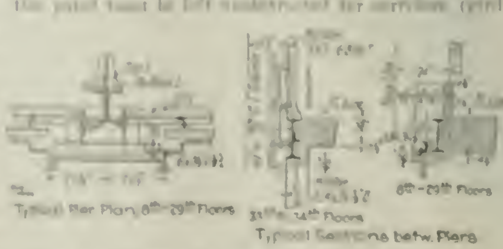


FIG. 5. TYPICAL SPANDREL SECTIONS, EQUITABLE BUILDING

ers and gussets are also used in some special cases in the side panels of the B-system). Up to the 13th floor, double girders and gussets are used, for the reason that with single-girder construction the girders would have been so deep as to infringe on the headroom of the corridors. Single girders and gussets are used from the 14th floor upward.

In the upper floors the diagonal bracing of the B- and C-systems is in panels two stories high. In the three lower stories the diagonal system is one story high, with intermediate horizontal struts run from the point of intersection of the bracing to the point of counterflection of the columns next to the corridors.

The two main fronts, on Broadway and Nassau St., have large entrances two stories high. The high unsupported lengths of the columns at these points are reinforced by auxiliary columns, with diagonal windbracing between the two.

Except in the 23rd floor, no interior horizontal floor bracing is used, the floor construction itself being relied upon to transfer by shear in each floor the wind pressure from panel to panel and finally to the exterior or interior vertical windbracing systems.

Typical details of the windbracing are shown on the windbracing sheet. The proportioning of the diagonals will be obvious. The knee-braced wind girders range generally from 24- to 42-in. depth, with webs generally from $\frac{5}{16}$ to ½ in. thick though some are as thick as $\frac{11}{16}$ in. The flange angles are 6x3½ in. or 6x6 in., in thickness from ⅜ in. to ⅞ in. These ranges of dimensions may be taken as increasing quite regularly from the 32nd floor to the bottom, the lowest values applying to the upper five or six stories of windbracing.

Design of Windbracing

The wind pressure was assumed at 30 lb. per sq.ft. over the entire surface of the building from sidewalk to coping, in accordance with the New York building code. The method of analysis of wind stresses is substantially the same as has been followed in a considerable number of large buildings.

The fundamental assumptions were: (1) Points of contraflexure of columns and girders are at mid-span and mid-height, respectively; and (2) column reactions vary as the distance from the neutral axis of the group. The principle of the method, strictly, requires that the column reactions should be proportional to the products of sectional area and distance from neutral axis. But for simplicity it was assumed that all columns are of equal area; that is, the wind reaction attributed to a particular column of a bent depended only on its distance from the neutral axis of the bent and not upon its area as compared with the areas of other column sections in the bent.

The vertical shears in the panels of a bent for a given story accumulate toward the neutral axis. These shears represent the increment of the column reactions of that story; hence the vertical shear in the center panel is equal to all the column reaction increments on one side of the neutral axis.

The horizontal shears in the columns of a bent increase toward the neutral axis, and represent the forces required to balance the action of the vertical shears in the panels acting on any one joint.

To facilitate calculations in a system of more than three columns, the effective depth is first established. This effective depth is equal to the distance between resultants, which are located at the center of gravity of the column reactions on each side of the neutral axis of the system. The value of these resultants is 100%, while the percentage value of any one column varies according to its distance from the neutral axis.

This cantilever method was adopted some years ago by the engineering department of Graham, Burnham & Co., in charge of J. G. Giaver. It is now used in figuring wind stress in all tall buildings designed by this firm. In the earlier period of high-building construction, the engineers commonly considered only horizontal shears produced by the wind pressure.

Detail Procedure—The procedure in applying this method was as follows: Taking a given plane of windbracing, for instance, one side of the Broadway front, the effective depth of this "wind-truss" was computed, i.e., the distance from center line of bent to the line at which the aggregate actual tensions and compressions in the columns would give the same resisting moment. In this case, the bent being 62.6 ft. wide, the effective depth was found to be 52.4 ft. Denoting by 100% the chord stress, which would result in each of the two chords of a truss of this effective depth, the percentages of wind reaction in the several columns of the actual bent were found. These percentages, being constant at all floors, hold good for the entire bent, so long as its dimensions did not change.

Second, the wind shear generated at each floor level of the bent was computed, and by the successive addition of these shear increments, the total wind shear in each story was found. These shears, multiplied by the distance center to center of successive stories, gave the overturning moments in the several stories, which must be resisted by the column stresses. Dividing this moment by the effective depth of wind truss (as previously found) yielded the 100% chord-stress figure, which, upon multiplication by the percentages belonging to the different columns of the bent, yielded directly the column wind reactions.

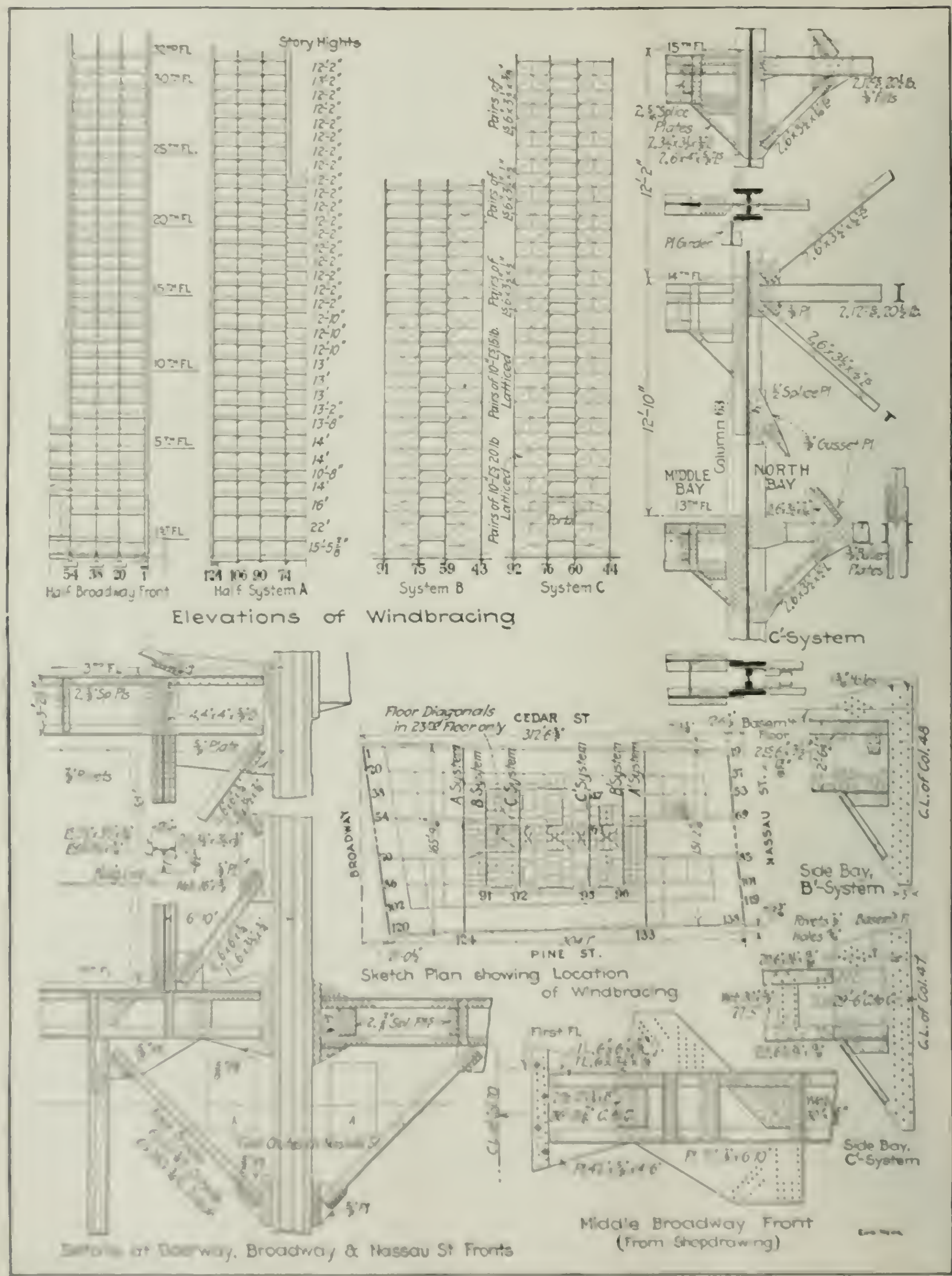
The distances between column stresses in successive stories gave the girder shears directly, and from the girder shears, by taking moments around the complete joint, the column shears were obtained.

The computation, according to the procedure outlined, proved to be well suited to convenient tabular work. In this entire analysis *the knee-braced bays were treated as though equivalent to the bays with diagonals.*

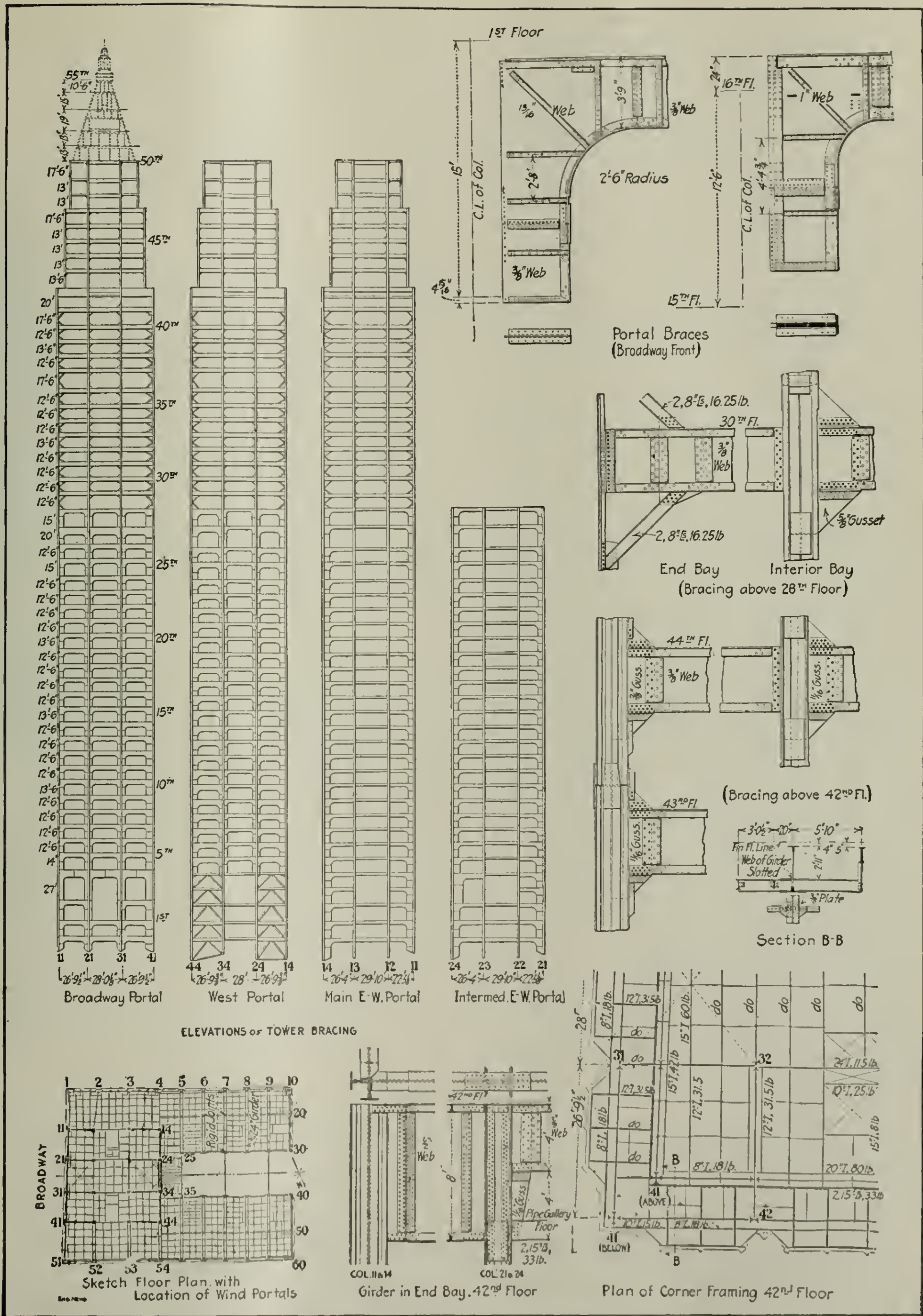
Designers and Builders

The Equitable Building was designed by E. R. Graham, architect, Chicago (Joachim G. Giaver, structural engineer). The Thompson-Starrett Co. (George Simpson, Chief Engineer), of New York, is general contractor for the building. The subcontract for furnishing the steel was let to the American Bridge Co., while the Thompson-Starrett Co. itself is erecting the steel (see Engineering News, Apr. 23, 1914).

The following article, on the windbracing of the Woolworth Building, facilitates direct comparison of the structural parts of the largest and the highest office buildings in the world. On pages 230 and 231 are given comparative windbracing drawings.



WINDBRACING OF THE EQUITABLE BUILDING



WINDBRACING OF THE WOOLWORTH BUILDING

(Plan and tower elevations are to same scale as on Equitable sheet).

Frame and Windbracing of Woolworth Building

The Woolworth Building, 233 Broadway, New York City, completed during the past year, is the tallest office building in the world, and the most prominent example of the tower type. Its general outlines are familiar but the character of the windbracing has received little attention. We outline it in the following, for comparison with the preceding account of the Equitable Building windbracing.

The Woolworth Building is 55 stories high and extends 7[illegible] ft. (base of flagpole) above curb. The main portion, however, is only 30 stories high, the upper half of the height consisting of a tower about 85 ft. square. From the windbracing standpoint the building is all tower, since the parts of the building outside of the tower are left entirely free of windbracing, the rearward wings excepted.

Great interest attaches to the bracing because of the thoroughgoing use of the portal system of bracing. This system has not been used extensively in windbraced buildings before this, whereas in the Woolworth Building it constitutes the principal or sole element of lateral strength of the building in the lower 27 stories. The upper portion of the building, involving lighter wind moments, is taken care of principally by girder-and-knee-brace stiffening.

The rear wings are braced independently of the forward half, which centers about the tower. The bracing of the wings is of the type first applied by S. C. Weiskopf in the Trinity Building, New York City, and subsequently adopted in a number of other structures* and today perhaps the most popular type, i.e., double-girder rigid-joint bracing without kneebraces. In this system, the regular floor girders are pairs of channels or I-beams (here, a pair of 24-in. plate girders) straddling the columns, and either the girders or splice-plates at their ends are riveted to the side faces of the columns, the shear moment of the rivet group being made sufficient to resist the girder wind-moment. The connection is developed wholly within the depth of the girder.

The two wings are made to act together by struts spanning the light-court. There are two struts at every fifth floor (see ground plan on inset sheet). No portal-girder action is counted on in these struts.

The arrangement of the tower bracing is shown by a series of elevations and a small-scale plan, on the full-page windbracing sheet herewith. (Both plan and elevations are to the same scale as those of the Equitable Building, on the page opposite.) The detail construction is typically represented by several larger-scale sketches.

Design of Wind Bracing

The basis for the calculation of wind stresses was a wind load of [illegible] lb. per sq.ft., which corresponds to the New York Building Code requirement of 30 lb. wind with [illegible]% stress increase.

The *column stresses* caused by wind were assumed to be proportional to the distances of the several columns from the center of gravity of the bent or plane of bracing to which the columns belong. The *column shears* were assumed to be equal, in any particular story of the bent. The *column contraflexure* was taken at midheight of the story. On the basis of these assumptions, the girder shears in the several bays of a story necessarily came out unequal, and the girder contraflexure was found to be not at the middle point of the bay (except in the central bay of the bent). The designers state that this method of calculation was used because it gives stresses slightly higher than those based on the assumption of unequal column shears (girder contraflexure at middle of bay).

In applying the method to the east-west planes of bracing in the tower, the easterly pair and westerly pair of portals were considered independent, joined simply by struts in the middle bay; in other words, the east-west bracing was regarded as consisting of eight independent two-column bents. This, of course, applies only below the 28th floor, as above this level the two intermediate planes of bracing are omitted, and the entire east-west tower bracing is in the northerly and southerly walls of the tower.

In constructing the portal bracing, the upper or horizontal part of the portal was built as a separate erection piece, in the shape of a girder. The vertical portions also were built as separate pieces, field-connected by vertical joints to the columns and by horizontal joints to the upper part of the portal. The columns in most cases were constructed with projecting web or flange plates, as gusset-strips for attaching the portal.

Columns

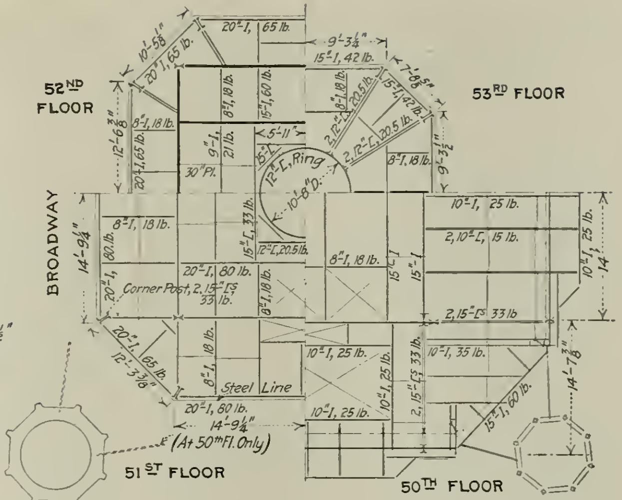
The building is notable for its heavy column sections. In fact, the heaviest columns far exceed any previously used in buildings. The maximum column has a cross-section of 700 sq.in. It is made of three webs, 21 in. deep, aggregating $12\frac{1}{4}$ in. in thickness; eight flange angles 6x6x$\frac{7}{8}$ in.; eight middle angles, 6x4x$\frac{7}{8}$ in., and two $43\frac{1}{2}$-in. cover-plates each of total thickness $3\frac{1}{2}$ in. In each cover-plate, one of the component plates is extended out $3\frac{1}{2}$ in. as a connection for the portal bracing. Similarly, a longitudinal connection plate 7x1 in. is riveted at right angles to the middle of one of the flange-plate faces by means of two 5x3x$\frac{1}{2}$-in. angles, as a connection for the other plane of portal bracing reaching this column. This column carries a maximum total load of about 4740 tons, of which 1300 tons is wind load.

The same type of column was generally used in the lower portion of the building; that is, three built up webs and two cover-plates, forming a two-cell box column. All columns are made in two-story lengths.

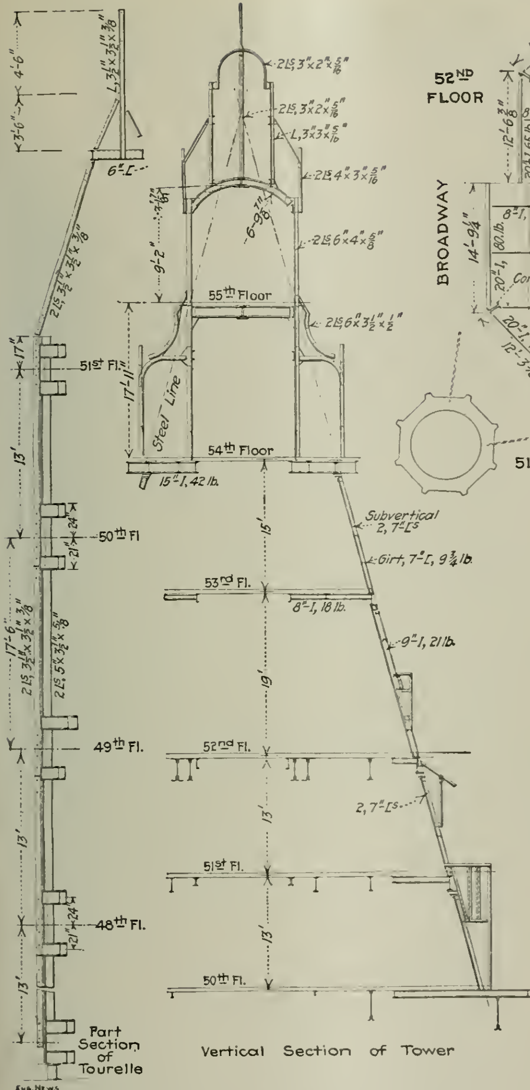
Special Framing

The architectural development of the Woolworth tower called for setting back the wall line several feet at the 42d and 47th floor levels. At each of these points, the wall columns above do not have direct column support below, but must be carried by girders. This arrangement is typically represented on the windbracing sheet by a diagram of the girder-and-beam framing in one corner of the 42nd floor. Adjoining it is an elevation sketch of one of the heaviest of these girders, namely, that in the Broadway front, an 8-ft. plate-girder which supports the end of another girder on which the 42nd-story corner column is carried.

*[illegible]



TOWER FLOOR PLAN



TOWER FRAMING, WOOLWORTH BUILDING

Where the columns are thus offset, the transfer of wind shear in the outer faces of the tower must be made by way of the floor. The middle bay of the floor on each side of the tower has horizontal diagonals; for the rest the strength of the floor is counted on.

Corner turrets occur on the terraces where the walls are offset; those in the 42nd story are low, while those rising from the 47th floor are about 75 ft. high. Both have steel frame, supported upon and anchored to the floor steelwork. A vertical section through the larger turret is shown herewith. The northeasterly turret at this level is not steel-frame filigree work, but is a hollow brick shaft, which in external appearance is made as near like the other three turrets as possible. It is the chimney.

The tower framing is indicated by the composite plan and the vertical section herewith. The taper of the tower naturally changes the floor framing continuously, beginning at the 50th floor.

The steel framework of the Woolworth Building weighs 24,100 tons, which cost 1¼ million dollars. The building was designed by Cass Gilbert, architect, and built by the Thompson-Starrett Co., New York City. The steelwork was designed by the Gunvald Aus Co. and fabricated by the American Bridge Co.

The substructure, built by the Foundation Co. after the design of the Gunvald Aus Co., consists of concrete piers sunk by the pneumatic process to rock about 100 ft. below curb. The principal complication in the foundation work arose from the fact that the entire plan of the building was changed after the foundations were already started. The original plan was to build on the northerly (Park Place) side of the lot only, an area 102 ft. wide on Broadway by 197 ft. deep on Park Place, and contracts were let for the building designed to cover this site. Subsequently, the south half of the block, the Barclay St. corner, was bought and the building redesigned to cover the entire block of the Broadway front, with the tower in the center of this front. As the heavy columns, namely, those of the tower, were thus changed in location, the caissons had to be rearranged, and in some cases, where the proper arrangement was no longer possible, a combination of two caissons had to be used in place of one large caisson, and the columns supported by heavy triple girders spanning the two caissons.

The Total Value of the Mica produced in the United States in 1913 was $436,060. The production came from 11 states—North Carolina, New Hampshire, Idaho, New Mexico, South Dakota, South Carolina, Alabama, Virginia, Pennsylvania, Colorado, and New York, named in the order of the value of their output. The value of the production of mica in 1913 exceeded by $104,164 that of 1912, and was the largest ever reported.

Government Aid to Irrigation in the United States and in Australia

By Elwood Mead*

SYNOPSIS—In continuation of the discussion of "What Is the Matter with Irrigation," begun in the editorial columns of our issue of June 12, 1913, the author first pictures conditions in the United States which make farm ownership by the actual cultivators of the soil difficult in both unirrigated and irrigated areas, and particularly in the latter. The argument for State aid to irrigation farmers in the United States is supported by the practice and results in Australia, notably in the State of Victoria.

"The Answer to What Is the Matter with Irrigation?" contributed by E. P. Osgood to Engineering News, of Feb. 19, 1914, deals with obstacles to rural development in America that are encountered outside of irrigation areas.

Every increase in the price of land limits the numbers of those able to buy it. Farming land in some of the Western States now sells for five times as much as it did 10 years ago. Farms can be purchased within 30 miles of London at lower prices per acre, with less interest and better terms of payment, than is needed to buy farm land in parts of the Middle West. The result is that farm buying, in these localities, is now largely restricted to men with accumulated capital, while nonresident ownership and tenant farming are rapidly extending.

These are not desirable conditions, but if they are to be improved, it would seem that this country should bring into operation some of the agencies that are proving so effective in Europe, for enabling poor men to own the land they cultivate. The use of the credit and direction of the government in the buying and subdivision of land, the loaning of money to buy and improve farms on long-time payments, at less than half the rate of interest paid by farmers in Western America, are aids to the extension of agriculture and improvement of rural life now employed by nearly every civilized country excepting the United States, and they are as much needed in this country as in Ireland, if the United States is to continue to be a land of opportunity for farmers without capital.

The systems that restrict farm buying in the fertile East are delaying development in the irrigated West. The opportunities to build small, simple ditches and fill them from the mountain streams, without storage, are all absorbed. Large and costly canals, with reservoirs, to supplement the summer flow of streams, must now be built if irrigation is to extend. These mean costlier water-rights and larger annual operating charges, which must be paid in money instead of labor, as was formerly possible.

So long as there was public land to be had for the filing fee, and the cost of water-rights did not exceed $15 an acre, it was not difficult for a settler to bring enough land under cultivation to provide a living for his family and earn money to meet the payments on water-rights by working at intervals for others. Under these conditions it did not mean disaster if the improvements of the homestead was slow, as was almost invariably the case. But when larger canals had to be built and more difficult engineering obstacles overcome, and water-rights began to cost from $40 to $50 an acre, it was necessary, in order to meet the payments on these water-rights, for the settler to bring the whole of his land promptly under cultivation. To do this, he must expend about $30 an acre on clearing, grading and seeding, and about $40 an acre for a house, farm buildings and fences. He begins his attempt, therefore, saddled with a debt of about $100 an acre, and if the money for these improvements has to be borrowed in the West, it can only be obtained on comparatively short time and at a rate of interest much higher than that prevailing in many other countries with less available capital. It is no longer possible, therefore, for settlers, without capital, to support their families and meet the required payments, and it is not surprising that fully 80% of those who do attempt this, fail.

The obstacles to irrigation settlement, described in Mr. Osgood's article, are becoming more serious each year, and the prospects of failure to settlers, with small capital, are so great and the hardships involved so severe, that the continuance of settlement of unimproved irrigation areas, without state aid, cannot longer be honestly encouraged.

To leave unchanged conditions which restrict settlement under government projects to men with from $4000 to $6000 capital would defeat one of the most worthy objects of the Reclamation Act. Men with this amount of money do not need to go West and help subdue the desert and the number who do this would be so small as to delay for years the full use of existing canals. What is needed is a carefully thought-out scheme of National or State aid, which will carry the settler through the years when the outlays for improvements are large and the returns from cultivation small.

The best place to inaugurate such a system would be under the National Reclamation works. The nation could use its savings' bank deposits for this purpose and thereby secure larger interest than is now paid by the banks, and largely increase the income from its canals. Such action, while an innovation in this country, is a common feature of irrigation development elsewhere. In the Australian States, where there are still large areas of public land which are practically free, the settlers are given financial aid to carry them over the lean years when they are improving their farms. Owing to the similarity of conditions there and in Western America, it is believed that the methods these States have adopted can be successfully employed here.

Such aid is a feature of irrigation settlement in every Australian State, as it is recognized that the outlay needed to bring unimproved irrigable land under cultivation is larger than is needed under rainfall. The most extensive application of this idea is found in the State of Victoria, where large areas have been purchased, subdi-

*University of California, Berkeley, Calif.; lately Chairman of the State Rivers and Water Supply Commission, Victoria, Australia; formerly Chief of Irrigation Investigations, U. S. Department of Agriculture, and before that, State Engineer of Wyoming.

vided and settled by men with too little capital to attempt to secure a home unaided. Under its scheme, men have succeeded who had not a dollar to start with and settlers with less than $1000 are more numerous than those with more than this sum, although oversea settlers with less than $1500 are not encouraged.

Knowing that these settlers must be helped and could not afford to lose time nor to make mistakes, the state worked out a plan for their management, as complete in its details as that of a corporate, private enterprise. In order to lessen their living expenses while securing a farm, the settlers are lodged in a state-managed rooming house where meals cost only 12c. and room and bed 20c. a day. They are shown the land available, by a responsible state officer, with no expenses for conveyances outside reduced railway fares. When the farm is selected, the state, if requested, builds a house for the settler, he having the choice of 14 different designs. When the settler selects his type of house, he pays a deposit, varying with the cost, and has twenty years in which to complete the payments. Some of these houses are built before the settler arrives. Where they are erected after the settler arrives, the state provides portable houses and tents to shelter the family, for a nominal weekly rental, so that in either case he goes to work at once. The state also grades and seeds one-fourth of each settler's holding. If desired, the settler pays only one-fifth the cost of this grading at once and has ten years in which to pay the remainder. At first all the grading work was done by the state, but now private contractors are doing much of the grading, but the state still pays four-fifths of the cost wherever it approves the contracts and accepts the completed work.

As a result of this assistance, many of the settlers who have gone into dairying have been getting cream checks which more than meet all living expenses in less than thirty days after selecting their farms. Even with this aid few settlers are able to bring the whole of their land into cultivation the first year. It usually requires two or three years to get the entire farm fenced, ditched, graded and seeded. During this development period the settler has a large outlay and less than full income and he would not be able to improve his land promptly unless further aid was extended. This is done by the state loaning the settler money on his improvements. Ditches, fences, grading of land, erection of buildings and the planting of orchards and vineyards are improvements entitling the settler to loans. The state values these improvements and lends up to 60% of the valuation. Sometimes this loan is given in cash and sometimes as credit against payments for land and water. At first, the state gave no aid in equipping farms. Now, it provides some costly implements which are loaned to settlers for a small charge. It keeps pure bred bulls in the dairy districts for the use of settlers and where the settler is known to be competent and reliable, it furnishes both horses and cows, the settler paying a deposit or giving additional security.

The extension of this aid would be hazardous if it was not accompanied by the oversight of settlers by capable, practical men. A scheme having so many generous features is certain to attract a considerable number who are indolent or impractical, and who seem to believe that the world owes them a living—or, in the language of Victoria, that it is the business of the state to spoon-feed them. Such settlers have to be promptly eliminated, and the Victorian Act provides for this.

There are other settlers whose lack of experience would result in costly mistakes if left to work out their own salvation. To guide and encourage the industrious beginner and weed out the failures, the state locates in each settlement an officer known as an inspector, who makes frequent visits to each farm, observes the progress made in improvements and cultivation and reports thereon to the commission in charge of the work. It is these reports which determine quite largely the extent of the financial aid which will be given a settler. If two-thirds of the farm is not brought under cultivation by the end of the second year further financial aid will be refused unless exceptional conditions cause the delay. At first, settlers are inclined to object to this oversight, as they regard it as interference with their private affairs, but it does not take them long to realize the value of being able to obtain competent advice free.

A good inspector soon brings his settlers to act together for their own good and for the reputation of the district. The emulation between settlements works wonders in hastening the cultivation of all the land.

The state retains the ownership and management of canals. During the first year, settlers are only required to pay for the water they use. After that they pay for the water allotted to their land, which rarely exceeds the water used. The price of the water is fixed so as to provide 4% interest on the cost of the works besides expenses of operation and maintenance. It is believed that this plan could be adopted with advantage in America on the Reclamation Service projects. If the ownership and management were retained by the government for 25 years and settlers required to pay only operating expenses and 4% interest on the cost, it would greatly reduce the earlier payments, and relieve settlers from the responsibility of management until they had gained experience.

In Victoria, settlers are given 31½ years in which to pay for their land, with interest at 4½%. The farms vary in size from two-acre blocks intended for farm laborers, up to holdings having a value of $12.500. The average-sized fruit farm at present is about 30 acres, and the dairy farm from 40 to 50 acres, experience having shown that these areas are all that the farmer and his family can properly cultivate unless considerable hired labor is used.

In equipping and improving these farms the state invests much more money than the settler, and it has to do this if the chance for a living is to be open to men of less than $1000 capital. The intention is to provide homes for farm laborers without capital and to enable farmers with a capital of $1000 to secure farms of 40 acres or less.

The following table will show the amount of money invested by the settler and by the state in a dairy farm of 40 acres, costing $60 an acre.

		Paid by settler	Paid by state	Period of deferred payments	Interest rate
Land	$2400	$144	$2256	31½ yr.	4½%
House	1200	150	1050	20 yr.	5%
Grading and seeding 15 acres	325	65	260	10 yr.	5%
2 horses	250	50	200	5 yr.	5%
20 cows	800	160	640	3 yr.	5%
	$4975	$569	$4406		

This does not take into account the expenditure for milking shed, outbuildings and fencing, but 60% of the latter outlay can be returned to the settler as a loan as soon as the improvements are completed, and this will pay for the material needed. One great merit of this plan

is the way it protects the settler from using up his capital for living expenses. One with $2000 who has to build his own house and grade and seed his land consumes about half his capital in living before he gets any return from cultivation, but with the house built and the alfalfa or other fodder crop sown before hand, the capital all goes into development.

In addition to the outlays mentioned, the settler must buy furniture for his house and harness for his team. He must have a wagon or cart, a cream separator and cans, a plow, a harrow, a mower and rake. He cannot buy these things and pay his deposits unless he has a cash capital of $1000 but the number who have $1000 is many times the number who have $5000 and under this scheme the capital needed is reduced with the acres taken.

Providing ready-made farms for settlers has brought about a larger extension in the irrigated area in the last four years than was obtained in the 25 previous years in which settlers were left to work out their own salvation, unaided. It has so increased the revenue from canals and the payments by settlers have been so satisfactory that the state is now considering a large extension of the irrigated areas and opening up for settlement areas of less than 20 acres, on still more liberal terms of payment.

The opportunities for extending such aid in America are greater than in Australia. Money can be obtained here at a lower rate of interest. In America there is a greater number of home seekers and settlers and they do not have to be brought half way around the world, as is the case in Australia. We also have more skilled irrigators, whose services could be obtained for purposes of instruction. The need is so great and the chances of success so encouraging that it is hoped state aid in creating ready-made farms will be tried on at least on project.

The Early History of Bituminous Street Pavements

Although the best known textbooks on pavements invariably state that asphalt or bitumen has been known and used for many ages—that bituminous cement was used for the walls of ancient Babylon—these same books are invariably hazy on the first use of asphalt during modern times for street paving.

The brief article in our issue of Apr. 30, 1914, p. 945, describing an experimental pavement on Oxford St., London, England, in 1839, gives a bit of the earliest history of bituminous pavements in England. Since that article was published we have found among the "Papers on Practical Engineering published by the Engineer Department for Use of Officers of the Corps of Engineers" an excellent monograph on "Bitumen," written by Lieut. H. Wager Halleck in 1841, and in view of the recent history of bituminous pavement and the patent fights over methods of construction we deem the following facts compiled by Lieut. Halleck worthy of the attention of present-day pavement experts.

Regarding the early use of native bitumen he writes:

For 25 to 30 years (written in 1841) mineral tar, in combination with sand and calcareous matter, has been used in Bordeaux and its vicinity for roads, pavements, floors and the roofing of houses. It was first used, with stone only, in the repair of roads near Bayonne, and being found to answer the purpose, it came afterward to be employed by builders in its combined form, [illegible] and many houses in Bordeaux are now roofed with it.

Regarding the use of bitumen on macadam roads, Lieut. Halleck described the now so called penetration method as follows:

The soil is first removed to a depth of about 5 in., according to the thickness to be given to the road covering, and the earth well rammed. to make it still more firm, small broken stones, about 1 cu.in. in size, may be driven in. A layer, about 4 in. thick of broken stone from ¾ to 1 in. in diameter is spread over and smoothed off so as to give the surface a slight curvature. Over this is poured a very hot and liquid mixture, of one-third coal tar, one-third pulverized asphaltic stone (of an inferior quality) and one-third fine sand. A sufficient quantity should be put on to penetrate all the crevasses of the stone and form a solid mass. After this has become cold, a layer of good bituminous mastic about 1 in. thick, is applied, and, while still hot, is covered with a layer of broken stones about 1½ in. in diameter, placed close together, but without touching, and pressed into the mastic by an iron roller. The thickness of this covering may be varied, according to the wear and tear it will have to resist.

The first bituminous pavement laid down in Paris, it seems, was a genuine asphaltic block pavement, in many respects very similar to those now in use. On this subject, Lieut. Halleck quotes M. Partiot, Chief Engineer of Roads and Bridges of France in the "Annales des Pontes et Chaussées," for March and April, 1838:

The first bituminous pavement in Paris was at the entrance of the Place de La Concorde. The pieces of stone (that is, artificial stone or compressed asphalt blocks) are

PLACE DE LA CONCORDE; SITE OF THE FIRST ASPHALT PAVEMENT IN PARIS

(From a photograph taken in the summer of 1913 by H. W. Durham, Chief Engineer of the Bureau of Highways, Borough of Manhattan, New York City. Now paved with wood block on a concrete foundation.)

there arranged like mosaic work, with their smoothest side uppermost, and then connected together by a very adhesive bituminous mastic. They form a continuous and solid mass.

This experiment has not been completely successful, for the road which has been in use since [illegible] 3, 1837, is already (March, 1838) worn away in many places, but this is the result of defects in the execution of the work. The contractor erroneously considered that his bituminous mastic was capable of resisting the direct action of the wheels and horses' feet. This mastic, which attaches itself very strongly to the stones, should be used only for cementing them together, so as to form one solid block, but it should not be visible, the stone alone being seen upon the surface. The stones of this pavement were not placed near enough together, and the interstices were filled with bituminous mastic, which is not capable of resisting friction, so that the joints are open, and the surface of the road, although at first smooth, has already become rough and uneven.

These defects might have been avoided if the following precautions had been taken. The fragments of quartz should have been placed as close together as possible, and the intervals between filled with small chippings of stone, which the larger masses would have sufficiently protected; these artificial paving stones should have been placed diagonally, in order that the direction of the joints should not have been lengthwise of the road. Moreover the width of the joints

should have been only 0.3 to 0.4 in. instead of 1½ to 1¾ in., as they really are. . . .

So far as ease of traveling or cheapness of draft are concerned, the bituminous pavement will always, without doubt, be preferable to the ordinary paved or broken stone roads. [These pavements cost about $2.53 per sq.yd.]

Lieut. Halleck describes further on in his monograph the construction and use of asphalt blocks, as follows:

Pavements have been made in Paris of fragments of quartz cemented together with bituminous mastic, and shaped by running them into molds. These blocks, properly prepared beforehand, are laid upon a bed of sand, and the joints, which are about 0.4 in. wide, filled with mastic [patented binder].

It appears from the foregoing that asphaltic pavements were laid in Paris in 1837; and from that time forward there was a gradual development, the heavy rolled compressed sheet asphalt, like pavement in use there today, which is, in most instances, a natural rock asphalt, was developed about 20 years later. But is also appears that asphalt had been used on roads in Bordeaux at least a quarter of a century before being tried in Paris. This is probably the earliest use during modern times of asphalt for road purposes. It is known to have been used in ancient times for mosanic pavements in buildings, halls and court yards, but so far as known it was never used on ancient roads subjected to wheeled-vehicle traffic.

Col. J. W. Howard, Consulting Engineer, New York City, in a lecture before the graduate students in highway engineering at Columbia University, on Jan. 24, 1914, gives the following information on the early use of asphalt:

In 1712, D'Eyrinys discovered, and in 1721 published, a description of the rock asphalt at Val-de-Travers, Neufchatel County, Switzerland, and several uses for this material. D'Eyrinys, in 1735, opened the bituminous limestone deposits at Lobsann (Germany), which deposit has been worked ever since. About 1797, the deposit at Seyssel, France, was opened, and then, like the others, was used for making asphalt mastic by extracting the bitumen from some of the rock and enriching the powdered fresh rock with it.

In 1802, Count de Sassenay took charge and reformed the methods, very much improving them, getting his supplies from the Swiss and French deposits mentioned. Rock asphalt-mastic was soon used for floors, sidewalks, public squares, bridges, and then streets. It was in Lyons, France, about 1834, that in mastic form, it succeeded fairly well for street paving. In the same year it entered Paris and rapidly became almost universally used for sidewalks.

Meriam began about that time to observe that lumps of the broken and powdered bituminous limestone, dropping from wagons near the quarries, were crushed and coalesced under wheel traffic into a firm, continuous sheet on the roads. It was then that the noted engineer, Leon Malo, of France, entered the industry and devoted his life to it. He is known throughout the world as the father of the asphalt industry.

Delano, of England, colabored with Malo in France, and introduced sheet-asphalt pavements, made of European rock asphalt, and asphaltic-mastic sidewalks, floors, etc., into England and the cities of almost all nations.

In 1854 Malo, after some experiments, laid the first successful sheet-asphalt pavement. It was made with compressed natural rock asphalt. He demonstrated the necessity of a firm concrete foundation. The wearing-surface layer was made by crushing, powdering, and then heating the bituminous limestone and spreading and compressing it in place on the street. This first street was Rue Bergere, Paris, which, from the first, was successful, and by proper maintenance it has been kept thus paved in constant good order for 60 years to date.

The success of compressed, rock-asphalt pavement in Paris since 1854, has attracted the attention of all important cities. London, England, began its use by paving Threadneedle St., in 1869, and has steadily extended its use to many other streets of that city. Geneva and Berlin began in 1871, and all the principal cities of Europe soon followed.

Its extensive use in America was prevented, first, because of the heavy freight charges from Europe, and secondly, because of the invention by DeSmedt of the American form of sheet-asphalt pavement. He laid his first piece on William St., Newark, N. J., in 1871, then in other cities, and in 1876 on a portion of Pennsylvania Ave., Washington, D. C., where his artificial composition of sand, limestone powder, and asphalt cement proved successful.*

Suggestions as to the Maintenance of Driven Wells, at Lowell, Mass.

Although in some parts of the country, driven wells are commonly used for public water-supplies, they are usually confined to relatively small cities. One of the larger cities with a driven-well supply is Lowell, Mass. In reporting on the possible treatment of the Lowell water for the removal of iron and manganese, F. A. Barbour, Consulting Engineer, Boston, Mass., made some suggestions regarding the maintenance and operation of the Lowell wells that may be of service to those in charge of driven wells elsewhere.

After speaking of the desirability of distributing the draft of water uniformly over the whole field, Mr. Barbour says:

To do this, it will be necessary to keep the well strainers in better condition than in the past—first, by washing down all wells, instead of driving, and second, by using an all brass well strainer section, instead of the iron and brass section now employed, in which the electrolytic action between the two metals contributes to the clogging of the strainer.

The present Boulevard system comprises some 450 wells, connected to a number of suction lines, which converge with the main pipe leading to the air chamber at the station. The several lines of wells vary considerably in age, and in the condition of the strainers, and thus it is that, under the vacuum maintained at the station, the new wells, or those last cleaned, have furnished the greater part of the water, and the quantity drawn from these new wells has been so large that the clogging of the strainers by silt is accelerated, and the quality of the supply rapidly depreciated by overworking the adjacent ground. The obvious remedy is to maintain the well strainers in reasonably uniform condition, and by partial closing of the gates to different degrees on the several suction lines, to so balance the water drawn from different parts of the well field that the water table will be more uniformly depressed—a larger area of subsurface sand being thus made effective in the filtration of river water, and the average rate of filtration by this increase in effective area being inversely reduced.

As already stated, in the past the greater part of the water has been drawn at high rates from a rather limited area, which shifts in location as the wells are cleaned, or new wells are driven. It is now proposed that when new wells are driven, the draft from these wells shall be limited to the quantity which they can reasonably continue to supply without too rapid clogging of the strainers or overworking of the adjacent soils; that the quantity drawn from each section of the field shall be determined by pitometer gagings, and that these gagings, together with observations of the elevation of the water table in test wells, shall be made the basis of a system of control such that the total area of the well field will be more uniformly worked.

It is necessary to recognize that the continued maintenance of a driven-well system requires thorough development of the wells when driven, the use of material in the well points which will not corrode, and a control of the draft from the different sections of the field which will, as far as possible, not overwork the soil in any one section to the detriment of the quality of the water. By the methods proposed, and which can be carried out under the supervision of the operator in charge of the purification plant, it is believed that a greater quantity of better water than has been obtained in the past can be drawn from the territory in which wells are already driven, and that the continuous increase in the amount of iron and manganese, which has been in evidence in the past, will be checked.

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*Authors or authorities on bituminous limestone and its uses. Busch, about 1802, d'Aoust (1834), Purivs (1836), Itier (1839), Millet (1840), Huguenet (1847), Daubree (1850), Hessell & Kopp (1855), Benoit (1860), Homberg (1865), Leon Malo (1866), and his subsequent publications, Delano (1871 to 1893), Jeep (1867), Meyn (1872), Coignet (1875), Kayser (1879), Woas (1880), Zetter (1880), Ducker (1881), Wein (1881), Dietrich (1882), Schubarth (1883), Narcy (1889), Baumeister (1890), Lonholdt (1891), Jaccard (1895), Haft (1897), Loewe (1906), Boorman (1908), Danby (1913).

Reconstruction of a Jersey City Railway Passenger Terminal

SYNOPSIS—Reconstruction of a railway and ferry terminal handling about 50,000 passengers per day. Existing buildings and ferry slips were either replaced or remodeled and the whole terminal enlarged. High trainshed was replaced by a large shed of the low type. The site is made ground of depth up to 110 ft.

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The complete reconstruction of the Jersey City passenger terminal of the Central Railroad of New Jersey, in progress since 1911, is being rapidly brought to conclusion. In addition to the passenger service of the New Jersey Central, the New York passenger traffic of the Philadelphia & Reading Ry., the Baltimore & Ohio R.R., and the Lehigh Valley R.R. is handled through this terminal. The Lehigh Valley was taken on in 1913, during the heaviest construction. About 50,000 passengers are handled per day and most of the business is short-haul commutation business.

While the work was in progress about 185 trains per day were handled in each direction, on the two main-line tracks and the two tracks of the Newark branch—four passenger tracks in all. The passenger-coach yards, the locomotive terminal, the U. S. Express Co. offices, the Pullman yard and service buildings were on the north side of the main line.

The work comprised the following elements, proceeding east from the river bank: Erection of a new two-story double-deck ferry house with [illegible] rearrangement of the old station buildings; building a three-story steel, brick and concrete building, [illegible], for handling express business, offices, records, etc.; the erection of a service building for power purposes, e.g., heating, cleaning service, water and compressed air; rebuilding two small piers in the North River; demolition of the old style steel trainshed and erection of a low shed covering a much larger area. Fig. 1 shows the extent and scheme of this work. The table gives dates and rate of progress on the several elements.

A general idea of the size of the work may be had from the following figures: the ground area occupied by the station and ferryhouse is 2.31 acres; by the train concourse, 0.52 acre; by the new trainshed, 7.18 acres.

Double-Deck Ferryhouse and Slips

An old one-story wood structure was torn down in May, 1912; and in June, 1914, a new and modern steel-frame two-story building with reinforced-concrete floors, terra-cotta block partitions, a concrete roof covered with tar and slag, and an ornamental copper front, was erected. In addition to the ferryhouse, four slips with pile racks were constructed. With this work commenced the active construction on the passenger-handling section of the enterprise, through all of which traffic was not interrupted. To maintain normal service two temporary slips, one on each side of the existing four, were built and the two northern slips abandoned, leaving four still in operation. The buildings between these two northern slips were then torn down, part of the ferry concourse was closed, and the foundation work on the northern half commenced.

When the northern new slip had been rebuilt and placed in service, old No. 3 slip was taken out of service, and when the ferry bridge of new No. 4 was put in service old No. 3 slip was demolished, as was also the southern half of the old ferryhouse. The foundations for the southern half were placed in a manner similar to that employed on the northern half. All the foundation work was completed in December, 1913.

The ferry bridges are of the wooden bowstring truss

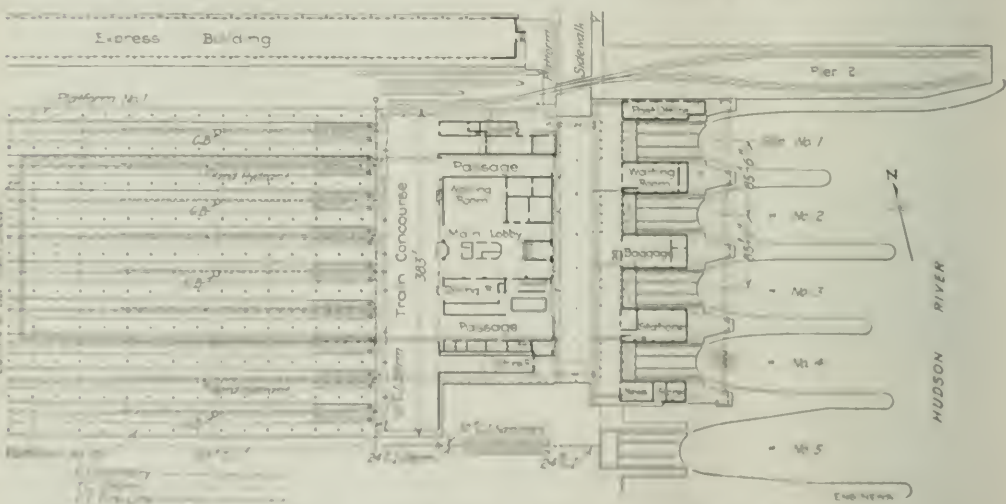


Fig. 1. General Layout of Ferry House, New Station and Trainshed

FIGS. 2-3. OLD AND NEW FERRY HOUSES AND SLIPS

OLD CONSTRUCTION NEW CONSTRUCTION

type, 79 ft. long, with one end supported on a rocker beam. The off-shore end is raised and lowered by electric-driven machinery, supported on steelwork entirely separate from the building. The raising and lowering of the bridges to fit varying conditions of tide and boat-loading is accomplished at a speed of about 6 ft. per minute.

The ferryhouse is fireproof throughout and rests on about 5000 piles 60 to 80 ft. in length with a butt diameter of about 14 in., driven through soft mud to rock. The building contains 1500 tons of structural steel, 7000 cu.yd. of concrete, and 1,800,000 ft. b.m. of lumber in the foundation under water and in the ferry racks.

The contractor's plant for the foundation work consisted of two floating piledrivers and two floating derricks. The land piles (west of the bulkhead) were driven by a standard land piledriver equipped with a 1½-ton drop hammer.

Gravel, sand, etc., for the substructure were delivered on scows from which they were lifted by a floating derrick to a large concrete mixer. This mixer was situated on a fixed platform supported by piling, about 20 ft. east of the bulkhead. From the mixer it was lifted in a steel tower about 60 ft. high to chutes suspended by wire cables. These chutes were shifted as desired, during the work. Materials for the superstructure were delivered by cars to a mixer located on land, from which the concrete was conveyed by wheelbarrows to a hoist and lifted to the upper floor and roof.

During the latter part of 1912 and the first part of 1913 when the foundations were under way, the work was pushed hard; as many as 400 men per day were at work, representing weekly payroll of approximately $9000. This work was prosecuted in two shifts of 8 hr. each.

The steelwork was furnished by the American Bridge Co. G. B. Spearin, of New York City, placed the substructure and erected the steel for the new ferryhouse. The superstructure was erected by C. T. Wills, Inc., of New York.

REARRANGING OLD STATION BUILDING

The old station was a three-story brick building on pile foundations. It was constructed about 1888, and not

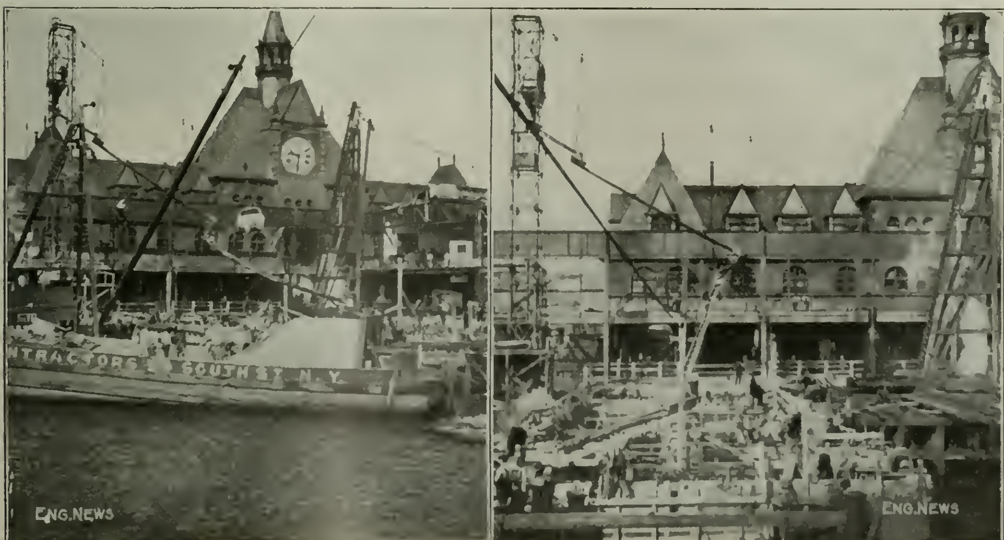


FIG. 4. CONTRACTOR'S PLANT ON FERRY HOUSE CONSTRUCTION

will suffice for present needs. It was found, however, that the same outside walls could be used, only a rearrangement of the first floor interior was necessary. Part of this floor was formerly used for conductors' and brake-

Fig. 5. A Completed Slip and a Portion of New Ferry House

mens' layover rooms, stores and records, ticket offices, baggage, mail rooms and other various uses. This floor was completely remodeled and given over entirely to passenger business. The upper two floors were left practically unchanged.

A small interior structure, 16x20x10 ft. high, was constructed in the center of the old waiting room to be used for ticket offices, information bureau, telegraph office and parcel room. The first floor of the station building is divided into three general bays, the central portion (formerly the waiting room) is now called the main lobby. The entire south wing is given over to restaurant, café and grill room. A tiled floor, tile wainscoting and plaster side walls and ceiling replace the old wood floor, wainscoting and ceiling. The rearranged north wing is given over entirely to waiting rooms, smoking room and toilets. The main waiting-room has a terrazzo floor laid on concrete arches, with green-tile wainscoting and plaster walls and ceiling. It is lighted by a large leaded-glass skylight in the roof as well as by large windows opening on the train concourse and main lobby.

A feature of the station improvement is the wide central stairway in front of the ticket offices leading from the main lobby to the upper deck of the ferry concourse. The main lobby was given a new red-tile floor laid on the steel and concrete base of the old floor; and the whole inside of the station was cleaned, repainted and refitted.

Another important feature is the addition of two inclines, one on each side of the station building, leading from the train concourse to the upper-deck ferry concourse. They slope 1 in 10, and have cement floors with carborundum finish to prevent slipping. They were thrown open to passenger traffic April last.

North of the old depot was constructed a new two-story building containing the station master's office, the trainmen's layover room and a substation for light and power.

Service Building

The service building contains the heating plant, consisting of six 250-hp. boilers for station and yard heating; a fire pump of 90,000 gal.-per-hr. capacity; vacuum cleaning machines for cleaning the station and the cars in the yard; and a 2500-cu ft.-per-minute air compressor for train charging for airbrakes and for train-signal operation in the terminal.

Construction of Two Piers

The work of rebuilding two railway piers just north of the ferry slip has not yet been commenced. Pier No. 2 is intended for the railway-mail service, which has greatly increased during the past two years on account of the addition of the parcel post. Here also will be delivered westbound mail from incoming steamships, thus saving several hours on this class of matter. Pier No. 1 is used for the emigrant service, and will continue to handle this travel after remodeling.

Low Trainshed

The outline of the old trainshed is superimposed on Fig. 1, which shows the new layout. The old structure was 512x216 ft. in plan, with a three-truss roof 142 ft. 7 in. in span, trusses spaced 32 ft., 70 ft. high from top of rail to peak. There was also a small lean-to 36 ft. 6 in. wide on each side. Within this shed were 12 tracks of 90 cars capacity. The old shed was built in 1888 and re-

Fig. 6. New Trainshed and Station, from the West

(The [illegible] building on the left is the [illegible] building. The sky-line of New York City is in the distance.)

quired for its maintenance a permanent gang of painters on account of the corrosion due to locomotive gases.

In July, 1912, the work of replacing this old shed with a shed of the Bush type was started. The new structure covers an area of 817x383 ft. and has 20 platform tracks with a capacity for 225 cars. The roof is supported on round cast-iron columns spaced 27 ft. c. to c. along the platforms. There is an 11-ft. cantilevered roof on each side. The distances from top of rail to top of platform and from top of rail to underside of smoke duct are 6 in. and 16 ft. 3 in., respectively.

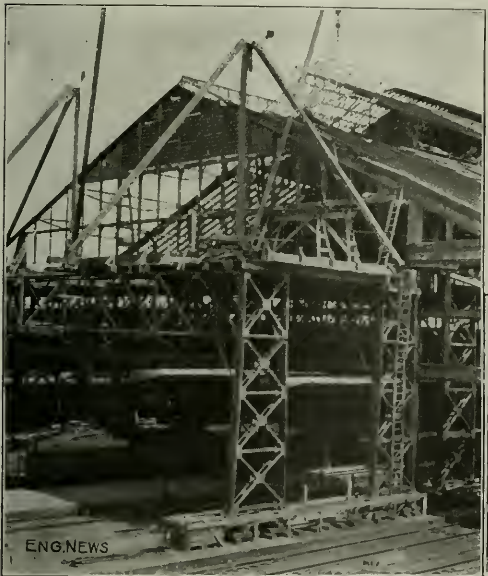
Drainage is furnished by wrought-iron pipe leaders carried inside the supporting columns. These leaders run to a terra-cotta drainage system, situated between alternate pairs of tracks. This system discharges into a 3-ft. trunk sewer, south of the station and is carried thence to the North River.

The reinforced-concrete platforms and concourse are carried on reinforced-concrete girders, supported on concrete piers which rest on wood piles below groundwater level. About 4000 piles were used in the foundations of the shed and concourse. These piles are from 50 to 110 ft. long, the longer ones being spliced. The splice is made by means of 24-in. steel dowel-pins 1 in. in diameter or by an iron collar 12 in. in diameter and 24 in. long, of ½-in. metal, for reinforcing the joints between pile and follower. The tracks themselves are carried on the natural surface, which is all filled ground, the fill having been made some years ago when the old trainshed was built.

During the progress of the work the pier excavations were kept dry by means of hand pumps and portable gasoline-driven pumps. Most of the excavation was done by hand, but later in the job a locomotive crane with an orange-peel bucket was used.

Piledriving was commenced on the south side of the old trainshed in July, 1912; and shortly afterward on the north side. Early in 1913 platforms 10, 9, 8, 1 and part of 2 with shed roofs 1, 8 and 9 were completed. The new tracks covered by these roofs were completed and connected with the interlocking system in March, 1913. These tracks were located just north and south of the old trainshed, traffic inside the shed therefore not being interrupted as yet.

On Apr. 8, 1913, the removal of the old shed was commenced, the large central portion being taken down first,



Figs. 7 and 8. Traveler Starting Removal of Old Trainshed

(The traveler was built of three standard 8-track steel signal bridges, mounted on a timber frame on wheels, and covered with a continuous platform. The first bridge carried the blocking; on the second were two derricks; the third carried the boilers and hoisting engines for operating the derricks.)

Between tracks in the shed are steel intertrack fences, and the platforms are blocked off at the train concourse by a sliding-panel fence. At the rear of each track and facing the station are Hutchinson train indicators, which display on large banners the departing time and station stops of the trains.

Between the shed and the station is a concourse, 58 ft. 6 in. wide, running the whole width of the train shed. This is a striking feature of the whole construction. It is separate from the station building and is constructed of heavy steel-arched girders resting on steel columns, supported by piles. Along the center of the roof runs a self-ventilating skylight 19 ft. 6 in. wide. The face of the structure above the trainshed roof is fitted with side lights in movable steel sash. The ends of the concourse are inclosed in glass; the lighting and ventilating arrangements are very liberal.

then the southern leanto. Meanwhile work was started on platform 7.

The work was pushed from south to north. New platforms were put in service as old platforms were discontinued. The work was carried on in pairs, i.e., when a new shed covering two tracks had been finished, the tracks were put in service and two old ones were taken out. When the work was started, 14 tracks were in service. It is worthy of note that thereafter, 16 tracks were always in service and on Saturdays and holidays, from 17 to 19 tracks could be used.

Getting material to and from the site without delaying the 370 trains per day and the many drill movements between the locomotive terminal and the trainshed, was no small problem. Work was carried in two shifts of 8 hr. each; the number of men at work reaching 450, involving a payroll of about $10,000 per week.

The plant used on this work consisted of two standard piledrivers, one with a 1½-ton drop hammer, the other with a 3-ton steam hammer. The rate of driving averaged about 10 piles for each piledriver per 8-hr. shift; being largely affected by the large area and the small concentration of work in progress within this area, due to its dependence upon traffic conditions.

Concrete was mixed by two mixers located on flat-cars. For the piers, girders and platforms, the concrete was chuted in place. The concrete for the roof was delivered from the mixer through a short chute to the bucket of a wooden hoisting tower situated on an adjacent flat-car. From this tower, concrete was distributed by means of three chutes fastened together and supported by two derrick booms projecting from the tower. This rigging was very flexible and could be quickly moved from point to point.

The steelwork and cast-iron columns for the shed framing were delivered to the job on cars and lifted directly into place by a small locomotive crane, having a 36-ft. boom. The steel for the large concourse was placed by a larger crane having a 70-ft. boom. The latter work required great care on account of the surrounding passenger traffic. This crane handled steel members weighing as high as 13 tons, from very awkward positions.

The construction of the trainshed, train concourse and platforms involved the driving of 4000 piles, the placing of 23,000 cu.yd. of reinforced concrete; 30,000 cu.yd. of excavation; 6000 lin.ft. of terra-cotta drain, and about 2700 tons of structural steel.

The general contractor was R. P. & J. H. Staats, of New York.

Method of Removing Old Trainshed

The 14 steel-roof arches of the old trainshed carried a slate roof laid on wood purlins and roofboards, and a large central skylight and ventilator. In taking down the steel, the skylight, ventilator, slate and roofboards were removed first and lowered by hand to cars on either side. To take down the heavier members, a traveler was erected, consisting of three 8-track, steel signal bridges with steel bents supported on a timber frame mounted on six wheels, three per side, running on one rail on each side, laid on two of the old concrete platforms. Opposite wheels were 108 ft. apart, and the clearance between the shed roof and the top of the traveler was 24 ft.

The traveler was erected just west of the old station on a Sunday morning without interference to traffic. Two locomotive cranes placed the leg frames while the signal bridges were being lifted one at a time from flat-cars by a wrecking crane and swung at right angles across the tracks. The two locomotive cranes hooked on to a signal bridge, one at each end, and lifted it to position, where it was bolted to its legs. After the three bridges were placed they were joined together and a light, timber platform laid over them.

Fig. 9. General View of New Trainshed Construction, Looking West

([illegible] completed sheds with tracks in operation; roof 4 under construction, showing [illegible] tower on flat car, and the [illegible] mixer under roof 5 for concrete platform slabs; pile drivers working on platform at right of picture; trenching for drainage mains between tracks; temporary wooden butterflies over tracks in operation, at extreme right.)

FIG. 10. INTERIOR OF NEW TRAINSHED

FIG. 11. INTERIOR OF TRAIN CONCOURSE

The first section of the platform carried the blocking; on the second section were two derricks for lowering the steel; while on the third were the boilers and hoisting engines for operating the derricks.

In operation, the traveler moved eastward. The forward bridge was run under a truss to be removed; the wood roof beams, steel purlins and the steelwork of the monitor were lowered to cars underneath. The truss was then blocked up and cut into section by the oxyhydrogen flame. About 870 tons of old steel were removed. After removing the main shed, the steelwork of the north leanto and later the south leanto was removed by a locomotive crane.

The traveler was erected Sunday, Apr. 13, 1913, started removing material Apr. 20, and was dismantled on Sunday, May 21. This work was accomplished without delay or accident. Trains were run under the traveler which spanned six tracks, and on both sides of the traveler. Two tracks were used for loading the steel removed. Canvasses were hung to protect passengers from falling rivet heads, small pieces of steel and dirt; and as the work

GENERAL ORDER AND PROGRESS OF WORK

Element	Start	Finish	Time in Months
Express building	May, 1911	Dec., 1912	19
Ferryhouse, 4 slips, etc.....	May, 1912	June, 1914	25
Rearrangement of passenger station	July, 1912	June, 1914	23
Service building	July, 1912	Dec., 1912	5
Train sheds	July, 1912	Feb., 1914*	19

*Six bays or twelve-track width of the shed not to be entirely completed until new interlocking tower is in service, probably early in 1915.

progressed, wood butterfly sheds were erected on three platforms to protect passengers from the weather.

Greater difficulty was experienced in dismantling the traveler than in its erection, on account of the wood butterfly sheds put up in the meantime. The same general method and plant, however, were employed. The bridges were unbolted, one at a time. Locomotive cranes then hooked on to each end and moved westward under their own power, carrying a bridge with them above the butterflies. At a point west of the butterflies the bridge was lowered to the ground. An erecting crane then swung it around and onto a car. Meanwhile, the locomotive cranes had returned for another bridge.

The operations of assembling and dismantling the traveler required but about four hours each. This removal work was done by Terry & Tench, of New York.

CENTRAL RAILROAD COMPANY ORGANIZATION

Reconstruction work was accomplished under the supervision of the Engineering Department of the Central Railroad of New Jersey: J. O. Osgood, Chief Engineer; A. E. Owen, Principal Assi tant Engineer; J. J. Yates, Bridge Engineer; A. M. Zabriskie and H. E. Van Ness, Assistant Engineers of Design; and C. M. Titworth, Assistant Engineer in Charge of Construction.

Government Forest Reservations in the Eastern Appalachians now amount to 1,104,000 acres, for which $5,556,000 have been paid. Of the land purchased up to date, about 133,000 acres is in the White Mountain area in New Hampshire and the balance is in various parts of of the Southern Appalachians, from Virginia to Georgia. About $2,000,000 of the original appropriation remains available for additional purchases during 1915.

The Effective Width of Reinforced-Concrete Slabs Supporting Concentrated Loads

By C. R. Young*

The frequency with which reinforced-concrete slabs are subjected to concentrated loading is sufficient to warrant careful determination of the lateral distribution of the loads. Practically all loads on highway-bridge floors are of this class, and although the floors of buildings are usually designed for uniform loads, the actual loads are applied over a relatively small area of the floor surface.

Nevertheless, uncertainty and considerable divergence of opinion still exists among engineers concerning the proper methods of proportioning slabs thus loaded. The method adopted is usually based on a more or less rational guess at the probable lateral distribution of the load and then an inch or so is added to the calculated thickness "to be on the safe side and to allow for wear." Building codes and general specifications for the structural work of buildings are practically silent on the matter and few highway-bridge specifications make any mention of it. The engineer is thus left largely to his own judgment in making loading assumptions that not only greatly affect the proportions of the slabs themselves but have an important effect on the weight and cost of the structure as a whole.

The only safe bases upon which to found any rules indicating the lateral distribution of concentrated loads must be experimental. For this reason, the results of such tests as appear to have any bearing on the matter will be briefly reviewed, and from them general distribution rules will be established, giving the effective width in accordance with the experimental evidence available at the present time.

In June, 1913, A. T. Goldbeck, Testing Engineer of the United States Office of Public Roads, presented a paper to the American Society for Testing Materials setting forth the results of a series of tests of reinforced-concrete slabs subjected to concentrated loading. These slabs varied from 4 to 7 in. in total thickness and, with the exception of one 6 ft. wide and 14 ft. long, were all 7 ft. wide by 9 ft. long. Loads were applied centrally over a bearing area 6 in. in diameter in case of the latter slabs and by means of one-half of a vitrified paving block for the 6x14-ft. slab. Careful observations made up to the point of failure indicated that at a distance of as much as 1½ ft. on each side of the central load, the slab carried considerable resisting moment, even in cases where no transverse reinforcement was provided. While hesitating to draw conclusions from what seemed to him insufficient data for generalization, Mr. Goldbeck stated that "in slabs of the kind tested and from 5 to 6 ft. in span the concentrated central load might be safely considered as carried by a width of slab equal to not more than 0.8 of the span length and the moment might be regarded as uniformly distributed over this 'effective width.'"

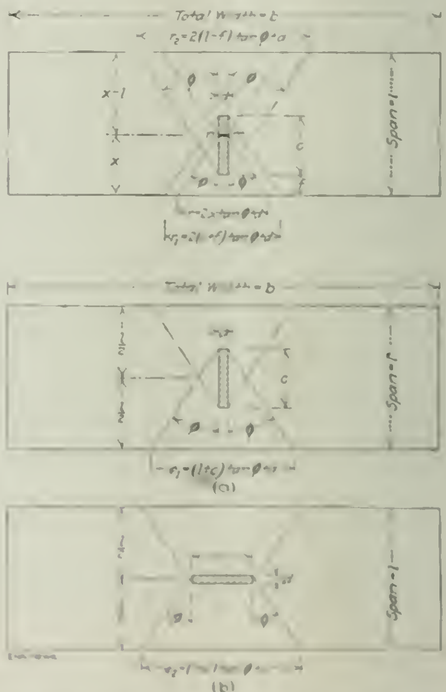
W. A. Slater, Test Assistant of the Engineering Experiment Station of the University of Illinois, in discussing Mr. Goldbeck's paper, cited a related series of tests being carried on at the University of Illinois. The tests then completed were made on (a), a large number of beams having a span of 4 ft. and widths varying from one-half the span up to twice the span; (b), one beam having a span of 10 ft. and a width half as great, and (c), two beams having a span of 30 in. and a width of 3.2 times as great. The loads were applied at the one-third points of the span.

On the basis of the latter tests and of those reported by Mr. Goldbeck, Mr. Slater recommended that where the total width is greater than twice the span, the effective width e be assumed as

$$e = \tfrac{4}{3}x + d$$

Where x = the distance from the edge of the concentrated load nearest the support considered to that support;

d = width, at right angles to the span over which the load is applied.



FIGS. 1-3. DIAGRAMS SHOWING POSITION OF CONCENTRATED LOADS ON SLABS

For slabs having widths less than twice the span, reductions in the effective width are recommended by Mr. Slater in accordance with a curve plotted from the results of the tests made at the University of Illinois. It was pointed out that, so far as tests had indicated, the effective width was but little influenced by the depth of the slab or by the percentage of longitudinal reinforcement. The introduction of transverse reinforcement would, no doubt, increase the effective width but this matter had not been investigated.

A striking conclusion arising from these results is that [illegible] the effective width for point loading is a constant

*Assistant Professor of Structural Engineering in the University of Toronto, Toronto, Can.

proportion of the span, the depth of slab required to support a concentrated load would be approximately the same for all spans.

Confirmation of these conclusions with respect to the width of slab over which a concentrated load is distributed is afforded by analysis of another series of tests undertaken for quite a different purpose. In his "Discussion of the Basis of Design for Reinforced-Concrete Floor Slabs," in the *Proceedings* of the National Association of Cement users for 1911, A. R. Lord draws attention to a number of tests made at the University of Illinois in order to throw light on the lateral distribution of stress in wide beams. This is an important consideration in the design of girderless floors, since it is desirable to know whether only those rods of a belt which pass over the column capital may be taken into account in figuring the resistance to negative bending moments, or whether some or all of the remaining rods of the belt may be included. The beams tested were 3 ft. wide, 4 ft. 10 in. long and 3 in. deep to the reinforcement. They were loaded across their full width at the ends and were supported at the third points, in some cases for their full width, in others for one-half of their width, and in still others for one-fifth of their width. The beams supported for half their width carried, taking the average result, the same load as those supported for their full width. Those supported for one-fifth of their width, and without transverse reinforcement, carried 14.4% less load than those supported for their full width, but for two other beams supported in the same way and provided with 0.4% of transverse reinforcement, the falling off in the load carried was only 3%.

If, now, the wide beams thus tested be considered *upside down*, they would become simple beams of approximately 4 ft. 8 in. in span loaded at the third points with loads bearing, in some cases, on only one-fifth of the width of the beam, in other words, with concentrated loads. From the loads actually carried, it is evident that the moment arising from such concentrations was distributed fairly well over the width of 36 in., even in the case of those beams without transverse reinforcement, and with surprising uniformity for those transversely reinforced. It follows that what has been called above the "effective width of the slab" would, on the basis of the tests just cited, be about 31 in., or 0.55 of the span of the slab. According to the rules given by Mr. Slater, the effective width would be about 25.5 in. or 0.46 of the span of the slab.

Further light is thrown on the subject of the lateral stiffness of slabs by a study of the Tests of Reinforced Concrete Footings conducted by Prof. Arthur N. Talbot at the University of Illinois Engineering Experiment Station and reported in Bulletin No. 67 of that institution. For a series of column footings 5 ft. square supporting a central pier 12 in. square it was observed that "about three-fourths of the steel is effective in resisting the calculated bending moment, or rather the stress in the highest stressed bars is the same as if three-fourths of the steel bars, equally stressed, made up the resisting steel." According to this, the effective width of the footing slab would be 45 in. or 0.75 of a hypothetical span equal in length to the side of the footing. Applying Mr. Slater's rules to this case the effective width would be 40.3 in., or 0.67 of the span.

A series of tests which may be expected to solve many problems connected with this matter was commenced by Prof. C. T. Morris of the Ohio State University in 1911, but no report has been issued further than a statement by Prof. Morris that the results conformed in general with those reported by Mr. Goldbeck.

With the object of affording some guidance to designers in estimating the effective width of slabs supporting concentrated loads, the writer submits below an analysis of the problem and working formulas derived therefrom based upon the experimental results already described.

Let a concentrated load, bearing on an area of length c and width d be applied in any general position to a slab having a total width b not less than twice the span length l, as shown in Fig. 1. If any small element of this load, as mn, distant x from the nearer support, be considered, it is directly evident from the experimental investigations cited above, that such part of it as is delivered to the nearer support may be regarded as wholly transferred to that support within lines drawn through the end points of the element making angles ϕ with the direction of the span of the slab, the tangent of which angle is between 0.67 and 0.80. For brevity, the angle between these two bounding lines, that is 2ϕ, may be called the "effective angle." The reaction at the near support may thus be regarded as uniformly distributed over a width of $r = 2x \tan \phi + d$, or if $\tan \phi$ be assumed as 0.67, a conservative value in the light of experimental results, this width becomes $1.33\, x + d$.

Although there is no direct experimental evidence that the effective angle to the farther support is the same as to the nearer, careful consideration of the matter leads to the conclusion that it is. If the farther support were moved in so that the element of load, mn, became central, the effective angles to the two supports would be equal. There would then be applied to the shifted support along a length that may be called the effective reaction-width of the reduced span a uniformly distributed reaction which, when the first support was replaced in its original position, would become a concentrated load on the original span. The virtual load would be delivered to the support nearest to it, but farthest from the original eccentric element of load mn within the same effective angle as would apply to the nearer support in any case. It thus appears that the effective angles from any element of loading to the two supports are equal.

When the selected element of loading is not at the center of the span and the reactions at the two supports are thus not distributed over the same effective widths, the question arises as to what should be the effective width of the slab for the calculation of resisting moment. It is probable that the average of the two reaction-widths would be the correct width to assume for this purpose, and in the absence of direct experimental evidence on the matter, this assumption is recommended.

Considering as a whole the concentrated load shown in Fig. 1, it follows that the part of it delivered to either support may be regarded as wholly transferred to that support within lines drawn through the remotest corners of the loaded area and making angles with the direction of the span of the slab equal to ϕ, one-half of the effective angle. If f be the distance of that edge of the loaded area nearest a support, from the support, the effective reaction-width, r_1 for the nearest support would be

$$r_1 = 2\,(c + f)\,\tan \phi + d$$

and for the farther support it would be,

$$r_2 = 2(l - p)\tan\phi + d$$

As in the case of an element of loading, the effective width of the slab for the computation of moment of resistance may be taken as the average of the reaction widths r_1 and r_2.

When the concentrated load is a moving one, the critical position will be at the center of the span. The effective reaction widths are then equal to each other and the effective width of the slab for the computation of moment of resistance is equal to either.

Since loads arising from wheels or rollers are often applied over considerably elongated areas, the orientation of the load on the span is an important consideration. For such loads, the distance d is always small—in theory only the width of a line—but the distance c may, for rollers, be as much as 48 in., and is commonly from 12 to 20 in.

The two extreme arrangements of the load, indicated in Fig. 2, will be compared. In Fig. 2 (a), the axis of the machine or vehicle is at right angles to the direction of the span of the slab, while in Fig. 2 (b), it is parallel to this direction. For the usual system of floor construction in a bridge, with the slabs supported on longitudinal stringers, the axis of the machine for the case shown in Fig. 2 (a) would be parallel to the axis of the bridge and for the case indicated in Fig. 2 (b), transverse to it. The latter is a contingency that must be considered in wide bridges. When the load is placed as shown in Fig. 2 (a), it follows from what has already been said that the effective width of the slab e_1 is given by the expression

$$e_1 = (l + c)\tan\phi + d$$

and when the arrangement is that of Fig. 2(b), the effective width is

$$e_2 = (l + d)\tan\phi + c$$

Since c is ordinarily very much greater than d, e_2 is greater than e_1 and the location and orientation of a wheel load most seriously stressing a slab is as shown in Fig. 2(a) and *not* as shown in Fig. 2(b).

For bearing areas differing in shape from those shown in Figs. 1 and 2, equivalent rectangles may be substituted.

When the length b of the slab is less than twice the span length l, it becomes necessary to make some reduction in the effective width. Reference has already been made to the reductions recommended by Mr. Slater. Upon comparing the effective widths indicated by the tests of wide cantilever beams resting on narrow supports, reported by Mr. Lord, with the effective widths estimated by Mr. Slater's rules, it has been shown that the latter give results well on the safe side. The application of these rules to concrete footings also gives results on the side of safety. The writer would therefore suggest that until further experimental evidence is available the values of the e/l to be used in any calculation of effective widths be assumed substantially in accordance with those given by Mr. Slater's graph, or as follows:

$\frac{b}{l}$	
[illegible]	[illegible]

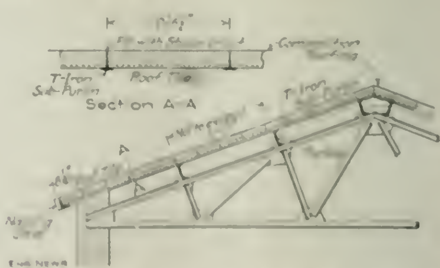
Although no experimental investigation of the relative distributing effects of various types of slab reinforcement has been made, it is probable that a form involving diagonal strands or rods is most efficient. Maximum stiffness along lines radiating from the load within the effective angle and the provision of a large number of strands directly under the load would thus be secured. Upon these considerations the delivery of the load to the supports over a considerable effective width largely depends.

The effect of a gravel cushion or other wearing surface in distributing concentrated loads over bridge floors has not been considered, as this is a matter not entering into the present discussion. Having found the area of the slab to which the load is applied by this surfacing, the problem is of precisely the same kind as arises when loads are applied directly to the slab. The only difference is that the bearing area of the concentrated load is increased with the use of a wearing surface and consequently the effective width of the slab also becomes greater.

Gypsum Slabs for Roof Construction

Rectangular gypsum slabs supported between inverted T-shaped steel sections and covered with a tar felt and gravel offer a light, insulated fireproof roof construction which has been developed by the U. S. Gypsum Co., Chicago, and used in their plant recently finished at Oakfield, N. Y. The accompanying figure shows the details of the construction.

The gypsum slab used in the "pyrobar" tile, made by this company, produced solid, without the cylindrical longitudinal openings, and reinforced, near the surface with a light wire mesh. The tile is 3x12x30 in., and weighs 13 lb. per sq. ft.



Typical Roofing Detail Showing Reinforced Gypsum Tile Laid between T-Section Subpurlins

Steel subpurlins of inverted T-section, $2\frac{1}{2}$x$2\frac{1}{2}$ in., are used, placed 2 ft. $6\frac{1}{2}$ in. c. to c. On the lower flanges of these purlins the tile are laid, starting at the lower section of the roof and fitting the slabs snugly together. The joint between the ends of adjacent tile and over the stem of the T, are filled with a plaster grout, which binds the tile together and makes a smooth upper surface ready for the application of a tar, felt and gravel roof, laid according to standard practice. The composition roof is laid directly on the gypsum tile.

Gypsum tile can be cut and fitted easily, and can be placed in between the steel purlins, using common labor practically altogether. The tile are laid directly on the purlins, and the work requires no scaffolding or false-

work. Forty tile cover one square (100 sq.ft.) of roof. The manufacturers state that such a roof will carry a safe load of 150 lb. per sq.ft., an ultimate load of 600 lb. per sq.ft.

Dump Cars for Transporting Garbage By Rail

At some cities where garbage-disposal plants are located at a distance from the city, the material is transported by rail, and a special type of dump car has been devised for this service.

One of these cars, as used at Cleveland, Ohio, is shown in Figs. 1 and 2. It is of steel construction, the underframe having two fish-belly plate-girder sills 24 in. deep at the middle. At each end are standards carrying a horizontal transverse perforated plate, the holes in which engage with studs on a cast-steel rocker on the end of the car body. The body is semi-cylindrical, made thoroughly water tight, and braced by three cross partitions which are perforated to allow liquids to find the same level throughout the car. It is supported on the end rockers and on three intermediate trains of rolls. It is provided with double covers, hinged at the middle and clamped to the top flange angle of the body when closed.

The body is held in position by side chains having the lower end attached to the sills and the upper end to a

FIG. 1. DUMP CAR FOR TRANSPORTING GARBAGE AT CLEVELAND, OHIO

(Orenstein-Arthur Koppel Co., Koppel, Penn., builders.)

shelf angle on the body. These are fastened with a shackle which can be disengaged readily. To dump and right the car, a crane or air hoist is used, its hook engaging a loop on the side of the body. Very little power is required, owing to the way in which the body is supported. The car is washed out with a hose when dumped, so as to remove any material adhering to it.

The cars are built with a capacity of 1450 and 1800 cu. ft., or 40 and 50 tons. The 40-ton cars are 37 ft. 4 in. long over the end sills, 30 ft. long inside, 10 ft. 1 in. wide over all, and 10 ft. 10 in. high. They have arch-bar trucks, and are built and equipped to conform to M. C. B. standards and the requirements of the Interstate Commerce Commission. The cars are built by the Orenstein-Arthur Koppel Co., of Koppel, Penn., and we are indebted to the company for drawings and information.

In regard to the garbage transportation service by rail, the city of Cleveland, Ohio, operates 14 cars in connection with its municipal garbage-disposal plant, two of which are of 50 tons capacity. Mr. Hobbs, City Commissioner, informs us that the haul is seven miles, over the Baltimore & Ohio R.R., which furnishes the locomotive for the work. The city pays the railway 15c. per ton for the haul, and in 1913 the service averaged 170 tons per day. The Public Service Department considers this the cheapest and most satisfactory method the city has been able to find for the removal of garbage to the disposal plant.

We are informed that the Standard Reduction &

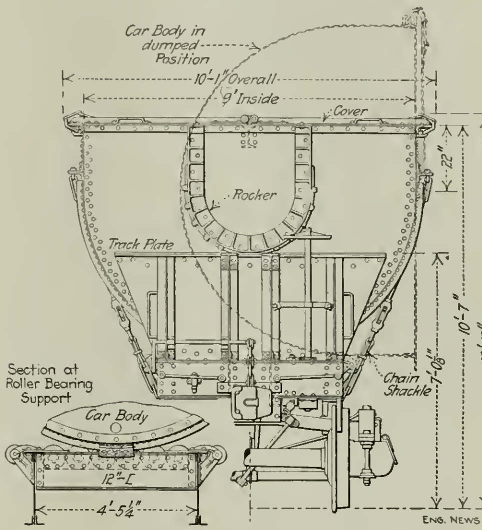


FIG. 2. DETAILS OF DUMP CAR FOR GARBAGE

Chemical Co., of St. Louis, has 18 of the cars in service; the city of Columbus, Ohio, has six, and the Garbage Reduction Co., of Toledo, has six. At Toledo, cars for this purpose were purchased by a former city administration to be used in connection with hauling garbage from a loading station centrally located. We are advised by Mr. McKechnie, Chief Engineer of the Department of Public Service, that on account of objections from property owners the loading station was never built and the cars were sold.

At Columbus, O., the garbage is collected in rear-dump wagons and hauled to a loading station, located in the central part of the city, where the wagons dump direct into the special garbage cars. The city has been operating four 40-ton dump cars and has purchased an additional 50-ton car, all of the type described above. The cost of these cars was approximately $1900 each. The garbage reduction plant is located about 3¼ miles south of the loading station. The cars are hauled two miles of this distance over the municipal railway track (built originally to serve the sewage disposal plant) and the remainder of this distance over the tracks of the Hocking Valley Ry. The railway delivers the loaded cars to the reduction plant and returns the empty cars to the loading station between 9:00 p.m. and 12:00 p.m. each day for a flat rate of $15 per trip, regardless of the number of cars handled. The above charge amounted to 25c. per ton of garbage hauled during 1912 and 21c. per ton during 1913.

The practice has been to load two cars each day. During the summer, however, the garbage averages nearly 90 tons per day and has reached a maximum of 130 tons,

so that the cars were becoming badly overloaded. The Department of Public Service now plans to use three 40-ton cars one day and a 50-ton and 40-ton car the next day. During the winter months, when the garbage amounts to about 55 tons daily, there is occasionally a day when no garbage is shipped. The average for the year 1913 was 72 tons daily. We are informed by John C. Prom, Assistant Engineer of the Department of Public Service, that the cars have proved quite satisfactory and the arrangement is much more economical than delivering the garbage all the way by teams.

Hauling City Waste on Street Railways at Chicago

The use of dump cars on electric street-car lines for hauling street sweepings and miscellaneous waste (but not garbage) is practiced in Chicago under the direction of the Bureau of Streets (Department of Public Works). This service was instituted in February, 1911, the refuse being hauled to abandoned clay pits in the northwestern part of the city. The loading station consists of an elevated platform at 15th Place and Loomis St., with an incline at each end, so that the wagons can be driven upon it and dump their loads into the cars, which stand on tracks on both sides of the platform.

The initial equipment consisted of six wooden dump cars and a motor dump car, each with a capacity of 36 yd. Six steel dump cars and an air-dump motor car have since been added to the equipment. The steel dump cars are constructed with three V-shaped buckets having a capacity of 10-yd. each, and a canvas cover is fitted over each car when loaded.

A train consists of three cars, including the motor dump car. The city of Chicago pays the railway company $25 per day for each motor and $6 per day for each trailer used, the motor being owned by the railway company and the trailers by the city. It is the intention to establish another loading station of this kind on Goose Island in the near future, and 12 additional steel dump cars have been ordered. For information as to the above we are indebted to Walter G. Leininger, Superintendent of Streets, Chicago.

A Spring Guard-Rail for Frogs

The frog guard-rail is a troublesome feature in track maintenance, owing to the severe service imposed upon it in holding (or forcing) wheels into proper line as they pass the frog. If the guard-rail is not secured to the track rail it will be forced away from its proper position by the continuous pressure and blows of the wheels, the flangeway being widened and the guard-rail rendered practically inoperative. If the guard-rail is bolted rigidly to the track rail, as is now general practice, the blows against it tend to pull the track out of line, and often result in the stretching and breaking of the attachments, besides causing severe wear on the frog point.

To meet these conditions a spring-cushioned attachment has been devised, using springs which are stiff enough to hold the guard-rail in place under normal conditions but which will yield slightly under heavy blows. The bolt is set at an angle instead of horizontally, so that the shock is taken directly at the head of the guard rail and transmitted to the base of the track rail. A lateral blow on the guard-rail will result in a partial upward reaction on the track rail, and this will be resisted by the weight on the wheel which delivers the blow.

The construction is shown in Fig. 1, and Fig. 2 shows a 15-ft. guard held by four of the spring-bolt attachments. The bolt *A* is long enough to carry the spring *B*, which is set up to the desired tension by the nut and bearing plate. The head of the bolt fits into a grooved block *C*, on the guard-rail, and the spring bears upon block *D*, which has a bearing against the head, web and base of the track rail. There is the usual spacing block *E*, between the rails, bored to fit the bolt.

Fig. 1. A Frog Guard Rail with Spring Attachments

We are informed, however, that the device does not meet with the approval of the railway engineers. They consider that it is wrong in principle, in that the guard-rail yields when it is needed to protect the frog point, and that a guard-rail should be held rigidly in its normal relation to the track rail. For this reason the one or two guard-rails which are in use have the spring action restrained by bolts.

This cushioned guard-rail is the invention of E. J. Shoffner, of Roanoke, Va., and has been in use at some turnouts on the Norfolk & Western R.R. for over five years. The maintenance work has been very little, none of the bolts show any stretching, and there has been but

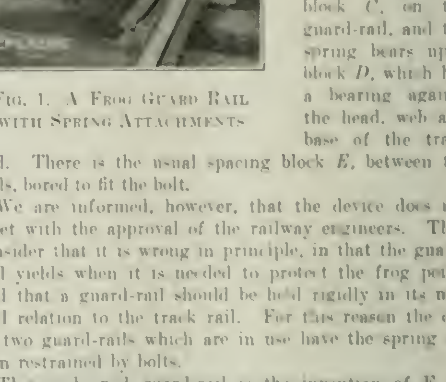


Fig. 2. A 15-Ft. Guard Rail with Four Spring Attachments

slight wear of either the guard rail or the frog point. We are informed, however, that the device does not meet with the approval of the railway engineers. They consider that it is wrong in principle in that the guard rail yields when it is needed to protect the frog point, and that a guard rail should be held rigidly in its normal relation to the track rail. For this reason the few spring guard-rails which are in use have the spring action restrained by bolts. In this connection mention may be made of

the Conley frog, in which the wheel is guided by the frog itself, dispensing with the ordinary guard-rails which guide the wheel through the medium of the axle and opposite wheel.

The spring guard-rail described above is manufactured by the Virginia Railway Supply Co., 500 Dickson Building, Norfolk, Va., and the company reports trial orders from other railways.

An Electric Air-Hammer Drill

The accompanying figures show the latest design of a type of electric drill that has been under commercial development, with considerable field service, for several years. The fundamental principle involved in the mechanism has been used in a line of electric coal-punching machines, though the idea of applying it generally antedates the application to coal mining. It was planned to make the development first for coal machinery, then for rock drills and finally for riveters, pile drivers, etc.

Electricity is used as the motive power but the blow is delivered to the drill steel by an air-actuated hammer descending on a dolly pin. The motor compresses the air in the drill cylinder and this is immediately expanded, in delivering the drilling blows, so that there is little dissipation of the heat necessarily developed in compression.

The mechanical action is seen in Fig. 1; on the forward stroke of the motor-driven compressing piston, air is admitted by an inlet valve on the compression space and follows the piston. On the return stroke this air is trapped and compressed. At the same time, atmospheric pressure below the hammer piston causes this to follow the compressing piston. When the latter on its up stroke uncovers the lower row of ports the compressed air escapes between the two pistons and in expanding causes the hammer to deliver its blow. At the end of the stroke of the hammer piston, a small port is uncovered and a small amount of air allowed to escape at slightly above atmospheric pressure, so as to prevent accumulating large air pressures between pistons.

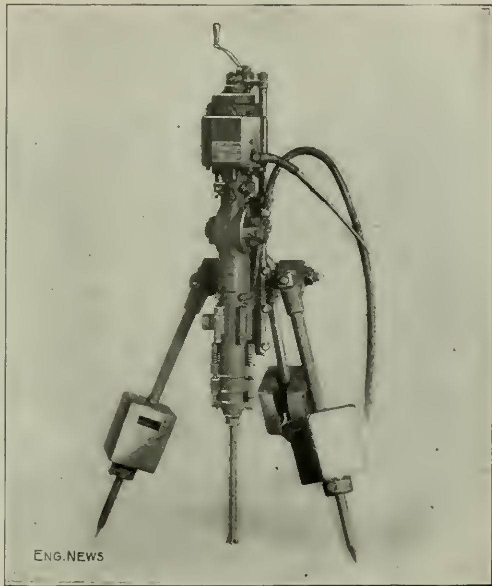


Fig. 2. Electric Air-Hammer Drill and Tripod Mounting

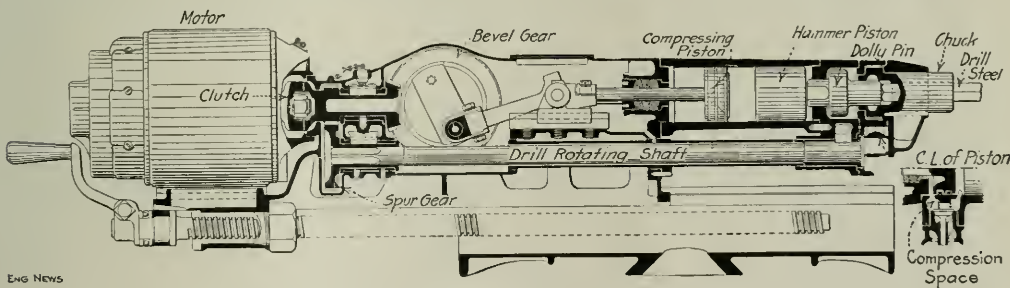


Fig. 1. Section through Electric Air-Hammer Drill

The design shown is fitted for the use of hollow drill steels and wash water continuously supplied. Water may be delivered from pressure lines if desired, but there is a small pump on the main-gear spindle and the discharge is piped to the drill-chuck chamber. The steel is rotated a fraction of a revolution after each blow, the chuck having a ratchet-and-pawl connection to a small crank arm on a long shaft running back to the motor gear, where it connects with the latter by spur pinion and gear.

Engine-indicator cards taken on these pieces of apparatus have shown an expansion curve lying close to the theoretical adiabatic line and indicating small heat losses. A maximum air compression of some 60 lb. per sq.in. is reached and, of course, heat is generated by this action the same as in any compressing machine. But the heat is absorbed by the immediate expansion and the only noticeable temperature is that of the cylinder walls resulting from absorption. This in no case exceeds 150° F. This latest type (3-in. cylinder and 3-in. stroke) is driven by a $2\frac{1}{2}$-hp. motor (direct- or alternating-current as desired) and this is claimed to draw only from $\frac{1}{5}$ to $\frac{1}{10}$ the amount of energy required for a distinct supply of compressed air to an air drill.

This machine is built by the Pneumatic Machine Co., Syracuse, N. Y., under the designs of Alexander Palmros, Chief Engineer.

FIG. 1. THE ELABORATE PILE FOUNDATIONS FOR THE BUILDINGS O

Soft-Ground Foundations, Panama-Pacific International Exposition

PENETRATION AND LOAD TESTS OF PILES

By L. F. Leurey*

SYNOPSIS—Heavy buildings to be erected on soft sand and mud—hydraulic-dredge fill. Continued subsidence of fill. Results of auger borings. Penetration and load tests of piles. Pile foundations adopted for a large part of the building area. Over 600,000 lin.ft. of pile driven at cost of 24½c. in place, 14c. delivered. This article is intended to supplement and elaborate on the articles on the Exposition by A. H. Markwart, Assistant Director of Works, ENGINEERING NEWS, Nov. 6, and Nov. 27, '13.

The site on which the Main Exhibit Palaces of the Exposition are located was originally a tidal flat of San Francisco Bay, with occasional deeper [illegible] that had been dredged out for wharves and anchorage for vessels. About twenty years ago, private interests received a grant of these tidal lands and built the rock sea wall which [illegible] the shore line on the map herewith. A large sand hill that overlay the site of the [illegible] was graded and the excavated material deposited over a large portion of the submerged area but the work was not carried to completion, and an area of water about [illegible] acres in extent remained to be filled by the Exposition.

The condition of the site when the Exposition took over the ground is shown approximately by the dotted [illegible] shown in Fig. 3A. [illegible] of this section was submerged, the average high-tide level being about Elev. [illegible] ft. and extreme high tide reaching Elev. [illegible], referred to San Francisco datum as zero. The average elevation of the submerged section of the site was about [illegible].

HYDRAULIC FILL; SUBSIDENCE*

The exposition company pumped 1,300,000 cu.yd. of fill into the submerged area. This brought the surface to Elev. —2.75 approximately. The fill material averages from 60% to 70% of sand, the remainder being mud and silt. Due to the superior weight and density of this material, it crushed its way 2 to 5 ft. into the soft ooze of the old bottom, to such extent that where the original soundings showed Elev. —15, the actual bottom of the dredger fill is nearer Elev. —20.

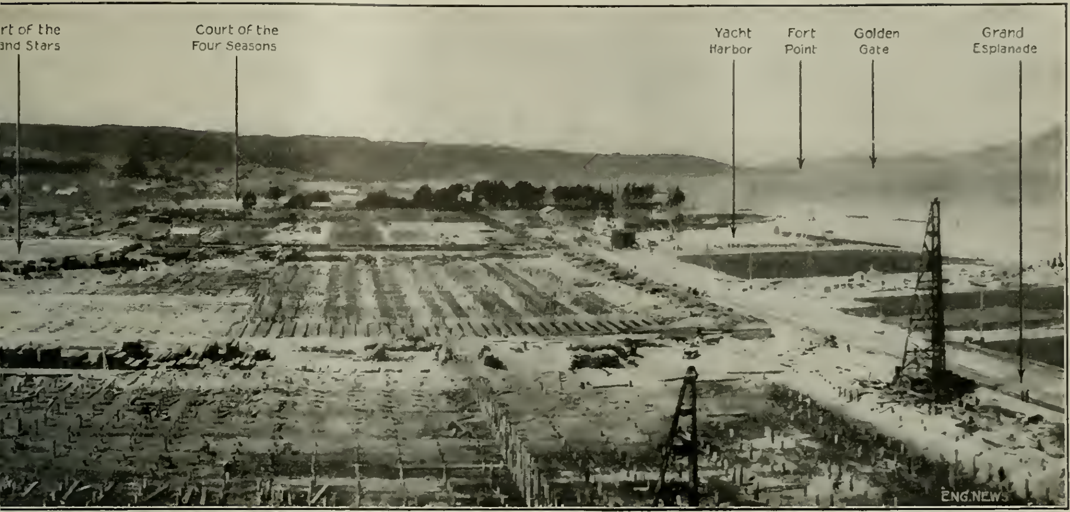
Due to the varied lines of flow of the dredger fill and its varying character, numerous "kolnays" or watery pockets were found in the fill. These kolnays often had skins of tight sand overlying them, but on driving in a long stake or pile their presence would be indicated by a geyser of water coming up around the pile and by the corklike action of the pile in floating up when relieved of the weight of the hammer.

*GENERAL CONTROL OF SETTLEMENT OF SITE—A. H. Markwart, Assistant Director of Works, states as follows concerning the settlement of the fill on the exposition site: [illegible]

[illegible]

[illegible]

*[illegible]



THE PANAMA-PACIFIC INTERNATIONAL EXPOSITION, SAN FRANCISCO

Shortly after the fill had been pumped in, settlement stakes were driven at various points within the filled area and levels taken at regular intervals. A typical curve of settlement is shown in Fig. 2. It will be noted that the initial settlement was rapid; this was, of course, expected. But it was not expected that the settlement shown by the latter part of curve would be so uniform and continuous.

Test Borings

After the fill had taken its initial rapid settlement, borings were made at the corners of all buildings of the main group. It was found that the soil was yellow beach sand overlying soft clay, or else blue dredger sand overlying blue mud and clay. Under the sites not occupied by the dredger fill, the clay is of a soft puttylike consistency and in some cases is mixed with sand; at the bottom of the clay stratum is a layer of 1 to 5 ft. of hard green sand and clay, and then yellow hardpan. Underneath the dredger sand, the same type of clay is found, but mixed with blue mud and water, and the same layer of green sand and clay and hardpan is encountered except along the north building line fronting the Bay: here the hardpan pitched below the limit of the boring tools, but was estimated from driven piles to be about 120 ft. below the surface.

The upper yellow-sand layer extends down from surface to a minimum of —18 and a maximum depth of —30. It is a clean, coarse, yellow or gray sand of uniform character. The dredger sand is much finer and more compact, and contains about 30% of silt, but due to its fineness and liquid character it has a powerful suction action on any material driven into it.

Some of the boring results are charted in Fig. 3. The locations of all borings are platted on the map in the same figure.

Pile Penetration and Loading Tests

The approximate character and stratification of the soil and the depth of hardpan being thus determined, it was decided to drive a number of test piles of various lengths to see what the supporting power of the ground was at different depths, because it was at once apparent that if every pile were driven to hardpan the cost would run into a very large amount of money.

The test-pile locations were selected as far as possible

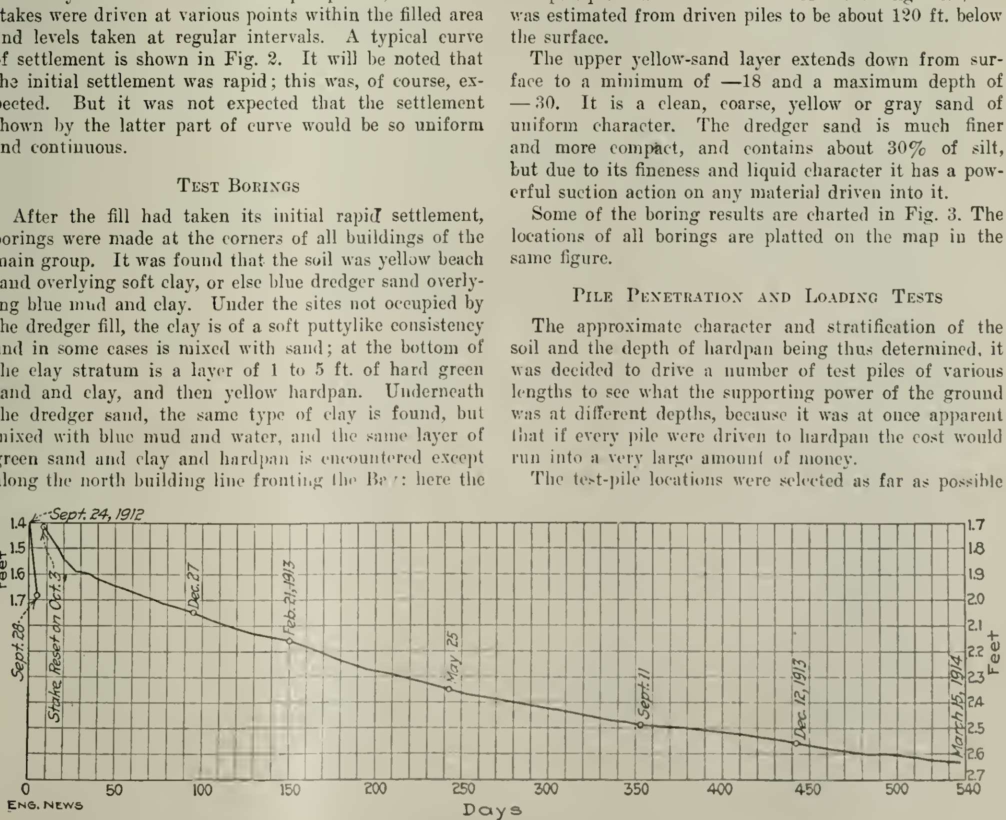


FIG. 2. SETTLEMENT DIAGRAM FOR STAKE 13

with a view to obtaining data primarily for the building itself and also for value of comparison with adjacent or similar areas in other parts of the grounds. The piles wherever possible were of the minimum size, so as to get the least favorable condition. They were loaded by means of timber sand-boxes (Fig. 5) to an ultimate load at least 50% in excess of what they were expected to carry. The loads were applied gradually, in batches, and no pile was loaded further while it was in the process of settling; the aim was to get the settlement of the pile at each stage of loading.

In driving the test piles, a 2700-lb. drop hammer was used, and the fall of the hammer was maintained at 10 ft. Records were kept of the number of blows required to drive a pile for each foot of its length underground; the results are given in Fig. 6.

THE DREDGER-FILLED AREA

The buildings roughly divide themselves into two groups. The first, consisting of the Varied Industries, Manufactures, Mines and Transportation Buildings, is in the area of the new dredger fill. The second consists of the Liberal Arts, Education and Food Products Buildings, which will rest on older fill or on ground which was unsubmerged at the time the Exposition took over the land. The Machinery and Agricultural Buildings are partly within and partly without the area of the new dredger fill. The Fine Arts Building, due to its concentrated loadings and the shallow depth of hardpan under it, was not considered in the pile tests, it being apparent that the proper course was to drive piles to a hard foundation.

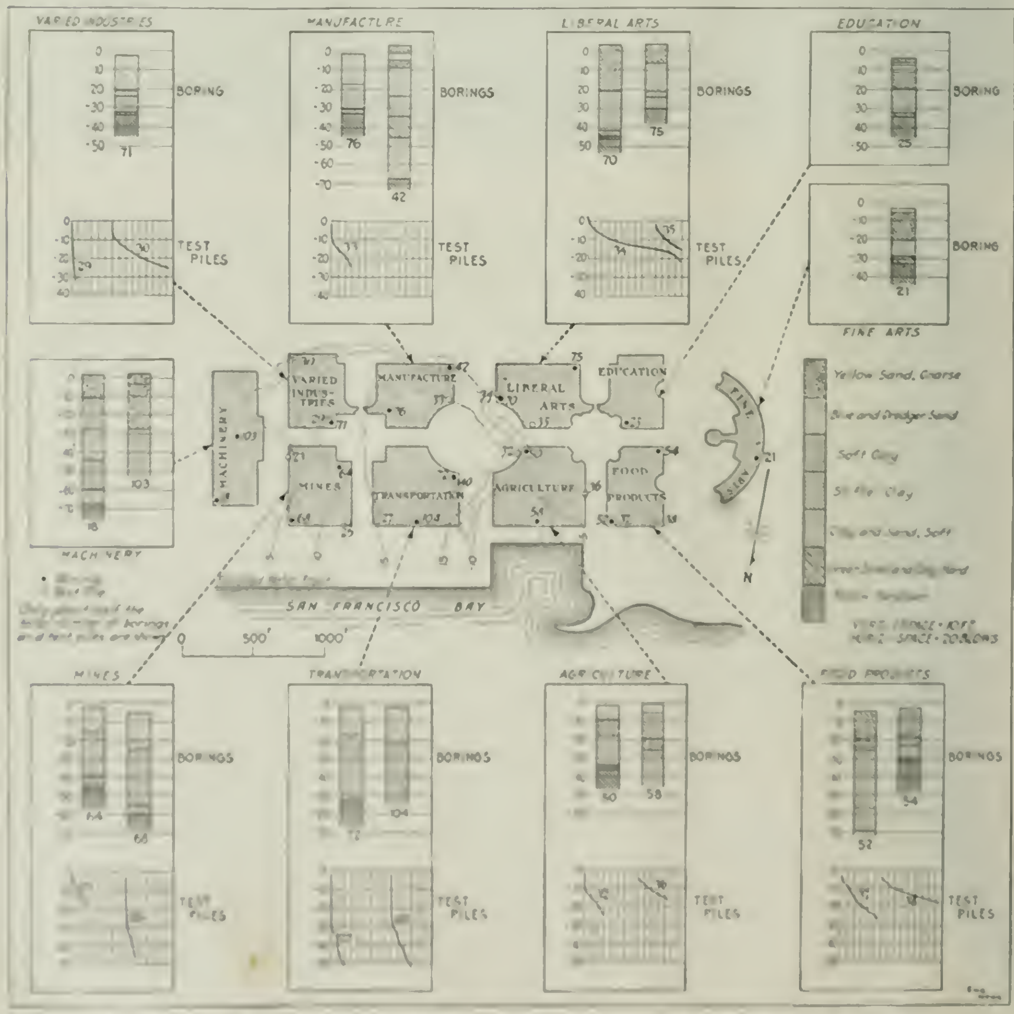


FIG. 6. TYPICAL TEST BORINGS AND TEST PILES, PANAMA-PACIFIC EXPOSITION GROUNDS

(... showing areas finally decided upon. Contours below site datum; M. H. W. is about —6.5 ft.)

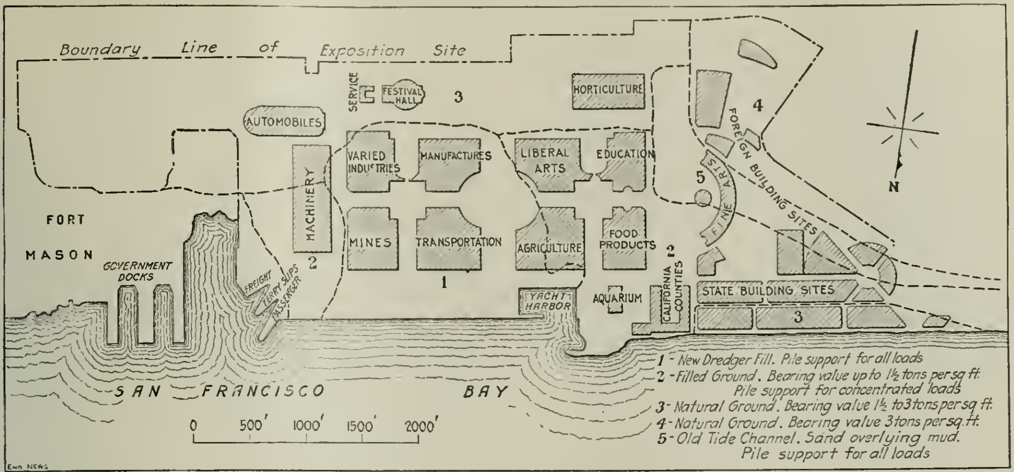


Fig. 4. Zones of Foundation Types, Panama-Pacific Exposition

It soon became apparent from settlement stakes and pile tests that the new dredger fill not only was non-supporting in character but was in addition *acting as a positive load on piles* driven into it or through it. After observing piles of various lengths and under various load conditions, it was deduced that, roughly, as much pile was required below the fill as there was driven through the body of the fill, to break the suction grip of the dredger sand. The question then arose how much piling was required below the fill to support the service load on each pile. Piles 45 ft. to 50 ft. below the surface seemed able to break the grip of the fill, but settled under the positive test load that was imposed on the pile.

Parallel tests were carried on by means of loaded platforms to get the supporting power of the dredger sand, and it averaged about 400 lb. per sq.ft. Of course, that figure represented the supporting capacity of the dredger sand relative to its own surface, since the whole fill was settling.

Decision of Board on the Transportation Building

At this juncture, the necessity arose for a definite decision as to the type of foundation to be adopted for the Transportation Building. Due to the very large amount of money involved and the necessity of feeling sure of the results to be obtained, an advisory group of consulting engineers: J. D. Galloway, C. E. Grunsky, C. Derleth, Jr., and C. B. Wing, was called in.

After studying very carefully the collected test data and witnessing the driving of four groups of piles in actual position on the building site, the board arrived at the same conclusion that the Exposition engineers had already tentatively formed, namely: That it would be unwise to attempt to carry the pile load on skin friction; and that it would be necessary to drive to a penetration of about 1 in. per blow of a No. 1 Vulcan steam hammer or its equivalent, obtaining this penetration in the hard skin of sand and clay that overlies the hardpan.

The driving of the four groups of long piles as recommended and witnessed by the consulting engineers showed that a penetration of less than ½ in. per blow could be reached with piles varying in length from 35 ft. to 75 ft., and that the intermediate ground offered practically no resistance to the penetration of the pile (in fact the weight of the hammer put all of these piles down for 35 ft. under the surface). To further confirm the latter opinion, Test Pile 28, at the southeast corner of the Transportation Building, on being loaded from 12 to 16 tons settled over 5 in. and continued to settle under a 20-ton loading until it pulled up on the hard green sand and clay—it had been originally driven to within 18 in. of this surface. It will be readily noted by referring to the penetration record, Fig. A, that this pile encountered practically no resistance to driving.

It was suggested at first to separate the floors from the building and carry them on platform foundations, but when it was considered that the relative value of the dredger fill for supporting loads was only 400 lb. per sq.ft., and that in addition some device had to be provided against the absolute settlement of the whole fill, it was finally decided to carry floors, tracks, walls and columns all on piling. The loathness of the engineers to accept what seemed inevitable, that is, long piles on this building, is explained by the fact that about 4500 piles, totaling 280,000 ft. below cutoff, were required for this building alone—for only ten months service.

The decision finally arrived at on the Transportation Building, substantiated by the tests made on the other sites within the area of the dredger fill, forced the conclusion that the same character of foundation must be obtained on these sites, and it was so decided to drive piling on the Manufactures, Varied Industries, Mines and on the affected portions of the Agriculture and Machinery Buildings into the hard, green sand and clay medium overlying the hardpan.

Eight months after driving the settlement stakes, the dredger sand was still continuing to settle at a uniform rate, amounting to an average of 1 in. per month. In places where there is a superposed fill, such as the 4-ft. fill for the Court of Honor, this rate has been increased to as much as 2½ in. per month for the first month after this fill was placed.

THE AREA OF ORIGINAL GROUND

For the building sites not affected by the recent dredger fill, comparative tests showed that it was at least as good (if not better) to rest the pile within the top layer of sand as to drive it through only a few feet.

As the result of all pile tests, it was determined to make the maximum service load of all piles 20 tons, and to determine the bearing power of short piles in the local sand formation. Six test piles were placed in the Education Building 14 ft. to 31 ft. below cutoff. All of these piles stood a load of 25 tons without settlement. The shortest pile of all, 14 ft. in the ground, was loaded to 20 tons without settlement. Seven other tests with short piles were conducted in ground of similar character (34 and 35 in Liberal Arts, 37 and 38 in Food Products, 41 and 42 in Machinery, and 36 in Agricultural Building), all of which confirmed the tests on the Education Building, namely: that short piles driven into and stopped within the sand layer of the old fill had ample factor of safety for carrying loads not exceeding 20 tons per pile.

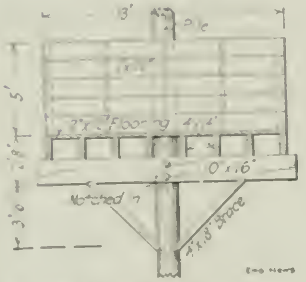


FIG. 5. SANDBOX USED IN PILE LOADING TESTS

The question might naturally be brought up that if the sand were capable of supporting short piles, it would also be capable of supporting spread footings. Spread footings were in fact considered, assigning to the sand a supporting value of 2000 lb. safe, which figure was determined from loaded-platform tests made on the site. Short piles, however, figured out cheaper, and possessed other advantages (simplicity of footing design, adaptability to all characters and elevations of surface), which finally led to the adoption of this type. It was thought also that pile footings in the territory of old or new fill would offer a better resistance in case of possible earthquake, as experience in the past indicates that structures were most affected when resting on filled ground by means of spread or raft footings.

The greatest observed settlement on any of these piles within the sand layer and loaded to 20 tons was $\frac{3}{4}$ in. It was consequently decided that piles should be driven into, but not through, the sand layer, for the Education, Food Products, Liberal Arts and such portions of the Machinery and Agricultural Buildings as were of similar character, for the support of concentrated loads. The decision to follow this procedure instead of driving through the substratum of soft clay resulted in the saving of a great many feet of pile.

FOUNDATION ZONES

After a general study of the pile tests, platform tests and borings coordinated with the information derived from studying the history of the site, the Zone Map, Fig. 4, was outlined. The zone areas thus established can naturally only furnish information of approximate character, this information being substantiated by local tests at all important building sites.

In this manner, it was decided to rest the Automobile Building on spread footings, 3 tons per sq.ft. safe.

The Festival Hall and Horticultural Building Sites were assigned a value of $2\frac{1}{2}$ tons per sq.ft., but it was decided to support the main dome of the Horticultural Building on piling.

The ground within the Concessions District has a high supporting value, and consequently requires no piling for the support of building structures. The States and Foreign Building Sites have a high average supporting value, but some piling is required in Zone 5.

The cost of the tests was very low, when compared to the total cost of foundation piling (see Tables I and II).

TABLE I. QUANTITIES AND COSTS OF FOUNDATION PILES, PANAMA-PACIFIC INTERNATIONAL EXPOSITION

Buildings	No. of piles driven	Lin. ft. piling driven	Lin. ft. piling cut-off	Piling below cut-off	Percentage of waste	Average length of pile below cut-off	Approx. cost per lin. ft. of pile below cut-off
Machinery	1,577	47,573	2,487	45,086	5.2	28.6	27c
Education	634	11,[illegible]	1,[illegible]	[illegible]	11.9	15.7	40
Manufactures	1,591	62,292	5,4[illegible]	[illegible]	8.7	35.7	25
Agriculture	1,374	59,710	[illegible]	[illegible]	3.8	41.8	23½
Food Products	665	12,015	2,388	9,627	19.9	14.5	40
Liberal Arts	751	10,980	1,241	9,747	11.4	13	40
Transportation	4,541	298,671	11,849	286,815	4.0	63.2	23
Fine Arts	1,051	31,111	4,173	[illegible]	13.4	25.6	2[illegible]
Varied Industries	1,444	52,467	2,756	49,611	5.2	34.3	22
Mines	2,026	98,463	4,600	[illegible]	[illegible]	[illegible]	22
Total	17,[illegible]			[illegible]		41.2	24½

Note—All piles were driven with No. 1 Vulcan Steam Hammers.

Weight of moving element approximately, lb.	[illegible]
Fall of hammer element approximately, ft.	[illegible]
Average cost of Douglas fir piles delivered at site, per lin. ft.	[illegible]
Approximate cost of erecting and dismantling per driver	[illegible]

TABLE II. UNIT-COSTS OF TESTS

(Total cost, including material, labor and engineering.)

Loading piles by means of 30-ton sandboxes, as shown in sketch, per test	$[illegible]
Loading platforms with sand load, per test	15
Hand borings with auger and 1-in. casing, holes 15 to 65 ft. deep in sand and clay, per lin. ft.	[illegible]

The results obtained were not only valuable in giving the engineers assurance in the use of short piling, but also reduced contractors' prices by furnishing them with accurate information, thus eliminating unnecessary waste.

✻

Grasses for Holding Earth Banks in Place—In maintaining earth fills or on the sides of cuts, hardy well rooted low growing grasses offer probably the best protection against erosion. In a recent issue of the "Service Bulletin" published monthly by the Iowa State Highway Commission, Ames, Ia., Prof. L. H. Pammel states that of the grasses developing a good system of root the following are the best: Hungarian brome grass (Bromus inermis), hairy brome grass (Bromus marginatus), Canadian blue grass (Poa compressa), blue grass (Poa pratensis), fescue grass (Festuca pratensis), western wheat grass (Agropyron Smithii). Quack grass produces good roots but its use is not to be recommended because it spreads freely to the fields.

One difficulty with the Hungarian brome grass is that it is not so good on the south or sunny slope of the hills because the hot rays of the sun interfere with the germination and growth of the grass. On the sunny slope western wheat grass or Canadian blue grass can well be used.

Planting on cut sides is another problem, and experience seems to indicate that some of the legumes will succeed better than the grasses, as it is always difficult to get the grasses to start. Sweet clover or creeping honeysuckle is very good for the sides of cuts.

Experiments have shown that all the vegetation of this type is easily killed by cultivation and that there is little fear of its spreading to the fields.

Tests of the Resistance to Corrosion of Various Brands of Iron and Steel

The Water Service Committee of the American Railway Engineering Association has been engaged for two years past on a series of tests to determine the relative resistance to corrosion of various samples of iron and steel. The results of these tests are of especial interest in view of the widely published claims concerning the resistance to corrosion of certain brands of iron and steel of special chemical composition.

The tests have been carried on under direction of J. L. Campbell, Engineer of Maintenance-of-Way, of the El Paso & Southwestern Ry., who is Vice-Chairman of the Water Service Committee. A report of these tests was presented at the annual meeting of the American Railway Engineering Association in March, and was briefly summarized in our report of that meeting. Since that time, the tests have been continued so that the results are now available from a twelve-month exposure of the various samples. These results, as will be seen by reference to the tables, indicate that corrosion proceeds at a substantially uniform rate on all kinds of rolled iron and steel, no matter what its chemical composition. We print the report below, as follows:

The resistance to corrosion of iron and steel plates has been the subject of considerable study and discussion by the Water Service Committee for several years with the view to determining the most suitable and most lasting material for steel water tanks. Following is a report prepared by J. L. Campbell, Vice-Chairman of the Water Service Committee, on a series of tests of various metals conducted by him, outlining their relative resistance to corrosive influences:

In the tests beginning May 1, 1913, seven samples of iron and steel were selected, as follows:

No. 1, Charcoal iron.

No. 2, Openhearth steel.

No. 3, Openhearth steel containing 0.40 per cent. of copper.

No. 4, Openhearth steel containing 1.00 per cent. of copper.

No. 5, Ingot iron.

No. 6, same as No. 3, except as to preliminary surface preparation as hereinafter described.

No. 7, same as No. 4, except as to preliminary surface preparation as hereinafter described.

Each sample contained four pieces. The samples were each ⅛ in. thick, 2 in. wide and 2 to 3 in. long.

In the following analysis, the figures in the first column are as given by the manufacturers, and in the second column, as given by S. W. Parr, Professor of Applied Chemistry, under the direction of A. N. Talbot, Professor of Civil Engineering, University of Illinois.

No. 1, Charcoal iron.

	Chemical Analysis by: Makers	Parr
		Per cent.
Carbon		0.041
Manganese		0.205
Phosphorus	No	0.049
Sulphur	analysis	0.033
Copper		0.00
Silicon		0.033

No. 2, Openhearth steel manufactured by the Carnegie Steel Co.

	Per cent.	Per cent.
Carbon	0.15	0.144
Manganese	.037	0.394
Phosphorus	0.037	0.038
Sulphur	0.037	0.039
Copper	Trace	0.00
Silicon	0.00	0.036

No. 3, Openhearth steel manufactured by the Carnegie Steel Co.

Carbon	0.12	0.141
Manganese	0.38	0.418
Phosphorus	0.020	0.037
Sulphur	0.032	0.028
Copper	0.40	0.43
Silicon	0.00	0.021

No. 4, Openhearth steel manufactured by the Carnegie Steel Co.

Carbon	0.15	0.139
Manganese	0.45	0.492
Phosphorus	0.023	0.038
Sulphur	0.033	0.034
Copper	1.00	0.98
Silicon	0.00	0.033

No. 5, Ingot iron manufactured by the American Rolling Mill Co.

Carbon	0.012	0.030
Manganese	0.025	0.180
Phosphorus	0.006	0.017
Sulphur	0.028	0.056
Copper	0.042	0.00
Oxygen	0.035	0.00
Nitrogen	0.004	0.00
Silicon	Trace	0.014

No. 6, Quality, manufacture and analysis the same as No. 3.

No. 7, Quality, manufacture and analysis the same as No. 4.

Five corrosive mediums were selected as follows:

No. 1, Clean sand.

No. 2, Clay soil, to which 5% of salt by weight was added.

No. 3, A mixture of equal parts of white and black alkali soils.

No. 4, Bituminous coal cinders.

No. 5, Cooling water in the overflow tank from the furnace water jackets of the Copper Queen Consolidated Mining Co., Douglas, Ariz.

Analyses of these corrosive mediums are as follows:

No. 1 Sand.

	Per cent.
Silica	82.31
Oxide of aluminum	9.44
Oxide of iron	2.98
Calcium oxide	1.86
Magnesium oxide	0.45
Oxides of sodium and potassium	3.18
Oxide of manganese	Trace
	100.22

No. 2, Clay soil plus 5 per cent. salt.

	Per cent.
Water	5.89
Silica	54.31
Oxide of aluminum	14.33
Oxide of iron	3.71
Calcium oxide	5.10
Magnesium oxide	2.15
Oxides of sodium and potassium	10.17
Oxide of manganese	0.11
Sulphuric acid, combined	0.95
Chlorine, combined	2.83
Carbonic acid, combined	2.05
Phosphoric acid, combined	0.16
	101.79

No. 3, White and black alkali soil.

	Per cent.
Water	5.10
Silica	48.46
Oxide of aluminum	8.76
Oxide of iron	2.00
Calcium oxide	9.45
Magnesium oxide	1.37
Oxides of sodium and potassium	11.10
Oxide of manganese	0.04
Sulphuric acid, combined	9.64
Chlorine, combined	3.64
Carbonic acid, combined	2.26
Phosphoric acid, combined	0.06
	101.88

No. 4, Cinders.

	Per cent.
Volatile matter	5.44
Fixed combustion carbon	24.60
Silica	41.06
Oxide of aluminum	21.76
Oxide of iron	1.54
Calcium oxide	1.60
Magnesium oxide	0.42
Oxides of sodium and potassium	1.22
Oxide of manganese	0.02
Sulphuric acid, combined	0.50
Chlorine, combined	Trace
Phosphoric acid, combined	0.07
	101.23

No. 5, Water in settling tank.

	Per cent.
Alkalinity in $CaCO_3$ parts in 100,000	21.00
Hardness in grains per U. S. gallon	3.50
Total solids	57.88
Silica	1.17
Iron oxide and alumina	0.47
Calcium carbonate	0.40
Magnesium carbonate	0.42
Sodium carbonate	14.00
Sodium sulphate	16.80
Sodium chloride	25.20

The sand, clay soil, alkali soil and the cinders were placed in aluminum pans, each pan being 4 in. deep, 11 in. wide and 16. in. long in the clear. The pans are numbered 1, 2, 3 and 4 and the settling tank at Douglas, No. 5, corresponding to the numbers designating the corrosive mediums contained by the pans. These pans are kept on the balcony of one of the south windows of the seventh floor of the office building of the El Paso & Southwestern R.R. Co., El Paso, Tex. They are exposed to sunlight and air, and the materials in them are periodically saturated with water, thereby being alternately wet

and comparatively dry, simulating in a general way service conditions of iron and steel buried in the ground with a light covering.

In each pan, one piece of each sample of iron and steel, No. 1 to No. 7, inclusive, is placed, with the exception of pan No. 5 at Douglas, in which samples Nos. 6 and 7 were not placed. The pieces are buried in the corrosive medium by forcing them down edgeways to the middle of the depth of the pan, the pieces standing side by side about two inches apart. As this places one piece of each sample of iron or steel in each pan, it makes the corrosive test strictly comparable throughout for all the corrosive mediums.

Each piece of each sample of iron or steel was prepared for beginning the test by carefully filing off all surface oxidation until only clean bright metal showed over all surfaces of the pieces, including the edges, with the exception of samples Nos. 6 and 7. The original surfaces of samples Nos. 3, 4, 6 and 7, containing copper, were covered with a distinct copper-colored oxidation. The oxidation was left on Nos. 6 and 7 to determine its effect in resisting corrosion as compared with samples Nos. 3 and 4, from which the surface oxidation was completely removed before beginning the tests.

After being prepared as above, each piece of each sample was weighed on a metric scale measuring to one centigram. All pieces of all samples were then immediately immersed in the corrosive mediums as described. At the beginning of the test it was decided to clean and weigh the samples at the end of each three months' period, and the loss in weight in grams per square inch of exposed surface was chosen as the unit for corrosive comparison.

It has been found that the corroded samples may be thoroughly cleaned of the corrosive action, leaving the clean metal, by immersing the samples in a 10% solution of ammonium citrate, and this method of cleaning has been adopted. In this connection, and at the first cleaning, a clean piece of [illegible] iron was also immersed in the solution in order to determine if the latter itself would produce any loss of weight in the metal. Subsequent weighing of this control piece shows that there is no such loss, and the ammonium citrate appears to be a satisfactory medium for cleaning.

In the following tables, the corrosion is measured in loss of weight in grams per square inch of exposed surface and edges, as follows:

PAN NO. 1. CLEAN SAND

Sample No.		Loss in grams per sq. in. of exposed surfaces and edges: In 3 mo.	In 6 mo.	In 9 mo.	In 12 mo.
1	Charcoal iron	0.41	0.86	1.35	1.73
2	Carnegie plain O. H. steel	0.42	0.86	1.21	1.56
3	Carnegie 0.4% copper O. H. steel	0.45	0.87	1.24	1.66
4	Carnegie 1.0% copper O. H. steel	0.45	0.86	1.2[illegible]	1.61
5	Ingot iron	0.43	0.87	1.[illegible]3	1.61
6	Same as No. 3 not filed	0.44	0.8[illegible]	1.[illegible]8	1.61
7	Same as No. 4 not filed	0.31	[illegible]4	1.21	1.58

Tests begun May 1, 1913, in office of Supt. M. of W., E. P. & S. W. R.R. Co.

PAN NO. 2. CLAY SOIL, 1% SALT BY WEIGHT

Sample No.		Loss in grams per sq. in. of exposed surfaces and edges: In 3 mo.	In 6 mo.	In 9 mo.	In 12 mo.
1	Charcoal iron	0.11	0.31	0.71	0.8[illegible]
2	Carnegie plain O. H. steel	[illegible]14	0.31	[illegible]	0.72
3	Carnegie 0.4% copper O. H. steel	[illegible]	[illegible]44	[illegible]71	0.85
4	Carnegie 1.0% copper O. H. steel	[illegible]14	[illegible]	0.60	0.84
5	Ingot iron	0.18	[illegible]41	0.6[illegible]	0.8[illegible]
6	Same as No. 3 not filed	[illegible]13	[illegible]35	0.56	0.86
7	Same as No. 4 not filed	[illegible]14	[illegible]35	0.57	0.85

Tests begun May 1, 1913, in office of Supt. M. of W., E. P. & S. W. R.R. Co.

PAN NO. 3. WHITE AND BLACK ALKALI SOILS

Sample No.		Loss in grams per sq. in. of exposed surfaces and edges: In 3 mo.	In 6 mo.	In 9 mo.	In 12 mo.
1	Charcoal iron	[illegible]	[illegible]	[illegible]	[illegible]
2	Carnegie plain O. H. steel	[illegible]	[illegible]	[illegible]	[illegible]
3	Carnegie 0.4% copper O. H. steel	[illegible]	[illegible]	0.1[illegible]	[illegible]
4	Carnegie 1.0% copper O. H. steel	[illegible]	[illegible]	[illegible]	[illegible]
5	Ingot iron	[illegible]	[illegible]	[illegible]	[illegible]
6	Same as No. 3 not filed	[illegible]	[illegible]	[illegible]	[illegible]
7	Same as No. 4 not filed	[illegible]	[illegible]	[illegible]	[illegible]

Tests begun May 1, 1913, in office of Supt. M. of W., E. P. & S. W. R.R. Co.

PAN NO. 4. CINDERS

Sample No.		Loss in grams per sq. in. of exposed surfaces and edges: In 3 mo.	In 6 mo.	In 9 mo.	In 12 mo.
1	Charcoal iron	[illegible]	[illegible]	[illegible]	[illegible]
2	Carnegie plain O. H. steel	[illegible]	[illegible]	[illegible]	[illegible]
3	Carnegie 0.4% copper O. H. steel	[illegible]	[illegible]	[illegible]	[illegible]
4	Carnegie 1.0% copper O. H. steel	[illegible]	[illegible]	[illegible]	[illegible]
5	Ingot iron	[illegible]	[illegible]	[illegible]	[illegible]
6	Same as No. 3 not filed	[illegible]	[illegible]	[illegible]	[illegible]
7	Same as No. 4 not filed	[illegible]	[illegible]	[illegible]	[illegible]

Tests begun May 1, 1913, in office of Supt. M. of W., E. P. & S. W. R.R. Co.

PAN NO. 5. WATER IN OVERFLOW TANK FROM WATER JACKETS

Sample No.		Loss in grams per sq. in. of exposed surfaces and edges: In 3 mo.	In 6 mo.	In 9 mo.	In 12 mo.
1	Charcoal iron	1.68	2.188	2.83	3.13
2	Carnegie plain O. H. steel	1.62	2.172	2.76	3.04
3	Carnegie 0.4% copper O. H. steel	1.82	2.310	3.16	3.32
4	Carnegie 1.0% copper O. H. steel	1.77	2.275	3.02	3.28
5	Ingot iron	1.39	1.880	2.65	2.93
6	Same as No. 3 not filed				
7	Same as No. 4 not filed				

Your attention is directed to results on samples Nos. 6 and 7 in pans Nos. 1 to 4, inclusive, from which it appears that the copper oxidation on the surface, as compared with the identical samples Nos. 3 and 4 but with the oxidation removed from the latter, protected samples Nos. 6 and 7 for three months, but this protection appears to have disappeared at the end of six months.

Perhaps the most significant figures are those showing the relative corrosion of samples Nos. 2, 3 and 4 as they are of the same grade of steel, made by the same manufacturer and are presumably identical in quality, the difference in copper content excepted. In regard to the addition of the copper, we quote from the letter of the manufacturer, as follows:

> In regard to the addition of copper, would say that the heats are made up as far as possible with copper scrap and any deficiency in the copper content is made up by adding the requisite amount of metallic copper to the bath in the open-hearth furnace about fifteen minutes or half an hour before tapping. The copper, therefore, has ample opportunity to become evenly distributed in the steel, particularly by the mixing action which takes place when the steel runs from the surface into the ladle.

It will be observed that the corrosion of the ingot iron is substantially the same as the other samples except in pan No. 5, containing the water from the overflow tank of the furnace water jackets at Douglas, Ariz. Of this water, Mr. Stuart W. French, General Manager, Copper Queen Consolidated Mining Company, says: "We have found that the water is extremely corrosive in our water jackets up to a temperature of say, 150° F. Above that temperature it seems to have little action. It is good water for our boilers, but in all cold-water pipes and water jackets where the water is more or less cool, pitting action is very strong."

The analysis of this water is given above. The steel water jackets of the furnaces mentioned require frequent renewal on account of the corrosion specified by Mr. French. It was for this reason that this water was also selected as one of the corrosive mediums in this test. The corrosive action of this water appears to be somewhat similar to that of an acid, and it will be observed that, while the corrosion of the ingot iron in the other corrosive mediums is not materially different from the other samples, it shows considerably less corrosion in the water, which conforms with its known ability to resist the sulphuric acid test.

The corrosion of all samples in the clean sand is greater than in the clay and alkali soils. Rather the reverse would be expected, especially in the alkali soil. This may be partially due to the fact that, while the sand is porous and allows a comparatively free circulation of air, the clay and alkali soils are very close-grained and practically exclude the air.

Tar Treatment of Macadam Roads in Lytham, England—Tar painting has been carried out in Lytham for the past nine years, this town being probably the first in the North of England to adopt it. Some [illegible] of the road along the sea front, which was an ordinary macadam road, were tried experimentally, half with limestone and half with granite chippings. The portion laid with limestone was for a time almost as dusty as ordinary macadam, but the granite being a harder material than the limestone, was practically lifeless when put [illegible] [illegible] but granite has since been used for tar-painted roads. When tar painting a new road an ordinary [illegible] tar boiler is used, which is [illegible] into a sprinkler with one [illegible] perforated to form a spray, but for repairs a small [illegible]-gal. boiler fitted with a pump and movable spray is chiefly used. A distilled tar is used for all [illegible] work, and for tar painting 1 part distilled tar to 1 [illegible] of crude tar. The tar macadam is better if it can be "[illegible]" for some time before laying, but in [illegible] [illegible] in handling [illegible] tar is put on the roads the same day that it is [illegible]. The tar-macadam used is composed of stone from [illegible] in. down to [illegible] in. and this macadam has been used long before a [illegible] [illegible] [illegible] [illegible] this method. [A. J. [illegible], Surveyor of Lytham, in the "[illegible] Journal," July 1.]

Editorials

The studies and experiments on which the design of the Panama-Pacific foundations was based, are probably as extensive a set of soil and pile tests as has ever been made. They testify to the prudence and skill of the engineers in charge of the exposition. Sound construction and maximum economy were secured. Erecting the great Exposition buildings on the yielding surface of a new sand-and-mud fill was in every respect a formidable task.

These tests are among the landmarks of a new spirit in foundation work. The future is to be a time when tests—both experimental tests and proof tests—will be the regular thing in foundation practice. The most advanced engineers have already come to this point. To guess at the bearing power of soil, or to "determine" the capacity of a pile by a mathematical formula, is a crude way to reach safe and economical results.

An Ancient Error

Heavy indeed are the responsibilities of a technical editor! A correspondent this week calls our attention to an error in a formula published in our issue of Nov. 17, 1892—22 yr. ago! The formula was the famous ENGINEERING NEWS piledriving formula, originally developed by the late A. M. Wellington in ENGINEERING NEWS, of Dec. 29, 1888. Discussing a formula for piles driven with steam hammers in the later issue referred to, Mr. Wellington gave the formula as

$$L = \frac{2\,WH}{s + 0.1}$$

and wrote:

> The same results will be reached if we retain the formula of par. 8, but let h = the total fall in feet in 10 blows, and S = the total set in inches in 10 blows.

Unfortunately, Mr. Wellington's handwriting was not of the plainest. His "S" looked more like a figure 5 than an S and the compositor set it up as 5. The error was undiscovered by the proofreaders and thus was handed down to posterity.

Fortunately, the remainder of the article made the error so obvious that probably none of the many engineers who have studied that editorial discussion have been seriously misled by the error. It is, however, an excellent illustration of the extent of the long continuing responsibility that the error of an editor, or even of a compositor, may make trouble long after those originally responsible for the error have passed away.

Signs to Mark Street-Car Stopping Points

In these times, when the managers of public-utility companies realize as never before the importance of cultivating the good will of their patrons, it seems worth while to again call attention to the system in use in German cities of plainly marking the places where street railway cars stop.

In American cities, it is customary for street railway cars to stop at or near every street corner to take on or leave passengers, but it is a constant bone of contention as to whether the stop should be on the near side or the far side of the street, and whether directly at the street crossing or beyond it, and how far beyond it.

Not only does the practice as to near-side or far-side stop vary in different cities, but it varies in the same city at different crossings. Furthermore, every little while a new city government or new management of the railway company upsets established customs and habits and changes the stop from the near side to the far side, or *vice versa*. The net result is that it is always a matter of doubt where a street car is going to stop. There are short streets and alleys in most of the older cities where a car may stop and may not.

Now when a man or woman stands on the street corner, often after having waited some time, makes frantic signals to a street-railway car to stop and then sees the car speed past, the motorman and conductor either paying no attention whatever or waving with a more or less derisive gesture at the other corner or some other place—when an incident of this sort occurs (and it probably occurs several million times every year in American cities) the would-be passenger, unless he is a person of most unusual good nature, is filled with indignation. In most cases he is ready to curse the street-railway company and all its works and workmen. What is particularly aggravating is that every such occurrence is supposed to testify to the ignorance or stupidity of the would-be passenger and he resents this as injustice. Henceforth he has it in for the street-railway company whenever he can get back at it with a vote at the polls or in the jury box. The chances are that he will vent a part of his disgust and irritation upon the motormen and conductors thereby adding a quite unnecessary increment to their contempt for the traveling public.

It would be easy to eliminate all this waste of human energy in useless anger and friction by adopting the simple plan common in every German city of having plain, neat, metal signs placed along the streets locating the points at which street-railway cars stop.

It would of course be impossible in old world cities, with their heterogeneous street arrangements to stop street cars at every crossing. Nor is there anything unreasonable in requiring a street-car passenger to walk three or four hundred feet along the street to a stopping point. He will be more than compensated by the greater rapidity of his journey once he is on the car. American street cars, in fact, stop too frequently for either the public convenience or the company's profit. With stopping points 800 ft. apart, the maximum distance a passenger has to walk along the street to a station is only 400 ft., and the maximum number of car stops per mile is only 6½.

Increasing the average speed of a street car increases its daily mileage and earnings. This is only one of the many directions in which American street-railway managers might profitably study foreign practice.

Questionable Taste in Publicity

From a recent trade publication we clip the following paragraph:

> McLean County, Ill., had a unique celebration on Good Roads Day, Apr. 15, 1914. It was a mock burial of inferior culvert materials.
>
> A concrete monument typifying the material and permanence of the concrete culvert, which will be used in future work, now stands above three graves in which were buried three old sections of culvert types which are no longer considered serviceable.
>
> While the mock burial was only a bit of fun indulged in by the County Highway men, yet it had a real meaning for the taxpayers. It meant that no more of their funds are to be expended in such a way as to require constantly recurring repair charges.

This "bit of fun" is similar to that indulged in by a prominent cement company at the last Cement Show, where one booth was given over to the funeral trappings of many satin-lined and glass-topped "coffins" in which were displayed cement sacks ruined, or to continue the morbid metaphor, "killed" by various forms of bad practice.

It seems to us that it takes a most peculiar sort of mind to see anything funny in death and particularly in the depressing accompaniments of modern burial.

Cleveland's New Municipal Electric Plant: Selling Electricity at a Three-Cent Maximum Rate

Cleveland has become famous as the only city in the country where a three-cent street-railway fare prevails. It is shortly to become equally noted as the only city in the United States—or anywhere else for that matter as far as we are aware—where a municipal electric plant furnishes electric current at a *maximum* rate of 3c. per kw.-hr.

Ever since the beginning of the electric-lighting industry, the rate of 10c. a kw.-hr. for current has had something of the dignity and standing that the five-cent fare has had in street-car service. While a higher rate has prevailed and still prevails in many places, there are very few places where a lower rate has been put in force.

In the early years of electric lighting, it is probable that a good share of the companies lost money at the 10-cent rate. The equipment was inefficient and the load factor was very low, when almost the sole use of the current was for lighting. Further, the amount of current used for lighting was very small compared with what present customs require.

In the last dozen years, however, great changes have come in the electric-lighting industry. We need not here take up these further than to say that their net result has been to cut down very greatly the cost of generating and distributing electric current when it is done on a very large scale. Of equal or greater importance than the reduction in the cost of making and distributing current has been the growth in the market for it, and especially in the demand for current for operating motors and heating appliances, which are in use during hours of the day when the station would otherwise be run on very light load.

These changes have been recognized by the electric-lighting companies and they have in almost all cases put in force heavy reductions in rates to *large* consumers of electric current. A sliding scale for the sale of current prevails almost everywhere; but the old price of 10c. is the base price in most general use and is the rate which the individual householder is obliged to pay for his electric light.

Now comes the City of Cleveland with the proposal not only to sell the individual householder electric current at 3c., but to make sweeping reductions from this base rate to the larger consumers, so that manufacturers and others who wish very large quantities of current for motor service can buy it as low as 1c. per kw.-hr.

No wonder that Cleveland and its city government are being cursed throughout the electric-lighting industry! For if Cleveland shall succeed in demonstrating that the city itself can make and sell electric current at such a low rate, it will give an enormous boom to municipal ownership of electric-lighting plants. Besides this, the success of such a demonstration would inevitably compel a reduction in rates for electric current sold by the companies not only in Cleveland but the country over. And it will have to be a sweeping reduction.

The question whether the Cleveland municipal electric plant can sell current at the proposed rates and make a fair profit, therefore, is not a merely local matter, of interest to Cleveland only. It is of interest to cities and city officers the country over and to engineers who have to do with municipal work and with electric lighting and power development.

Of course the final answer to this question must be given by the test of experience. Cleveland's new municipal electric station has just begun operation and six months or a year hence figures for its operating expenses will be available. A year or two years or even longer, however, will probably pass before the station load will be fully enough developed to enable high economy to be realized, and for the full realization of the changes to grow out of the Cleveland experiment because of the increased use of electric current, resulting from the low prices, one must wait probably years longer.

But without waiting for the final test of experience, it is of interest at this time, to ascertain the reasons why the Cleveland city officials in charge of the new municipal plant believe that they can carry out their great experiment with financial success.

It will, of course, be agreed by all that a municipal electric plant—or any other municipal enterprise for that matter—should be run on a business basis. That is, it should pay its way and pay the whole of its way, and not be a burden on the taxpayers. Rates for electric current should be such as will pay not only all the expenses of operating and maintaining the plant, but a sufficient sum in addition to cover the interest on its cost and an annual allowance for depreciation which will cover wear and tear and all other conditions, and when the plant is finally worn out or obsolete should be sufficient to replace it or to pay off the bonds issued for its construction.

If any municipal enterprise falls short of this, the deficiency must in the end be made good at the expense of the taxpayers.

It should be understood in the first place that the municipal electric-lighting business is not a wholly new experiment for the city of Cleveland. The city in fact fell heir to two complete municipal electric-lighting plants when

it absorbed two smaller municipalities a few years ago, the outlying suburbs known as Brooklyn and Collinwood. The Collinwood plant may be dismissed without further mention, as it is of very small size, so small that its operating cost per unit of power output is very high. The Brooklyn plant, however, has been in operation for a dozen years. Begun in a modest way in 1902 from the proceeds of a bond issue of $30,000, it has been added to year by year until its book value at the present time, including, of course, both the station and the distribution system, is $435,000 in round figures.

This book value has been reached by the rather uncertain process of adding to the original cost of the plant the sums spent on its enlargement and extension and deducting about 20% for depreciation. We are, however, informed that if the whole plant were appraised on the basis of what it would cost to replace it, including land, buildings, machinery, distribution system and all, the result would probably equal the book value above quoted.

Further than this, if the Brooklyn plant were appraised on the basis of its earning power—a basis so generally favored by the electric-lighting companies for their own plants—the fairness of the book value of $435,000 above quoted would be sustained.

The Brooklyn plant in 1913 sold current of a total value of $185,698. Its total operating and maintenance expenses were $116,719, leaving net earnings of $68,979.

THE NEW MUNICIPAL ELECTRIC STATION OF CLEVELAND, OHIO

It will be seen that these net earnings were equivalent to nearly 16% upon the book value above quoted of $435,000.

This Brooklyn plant, it should be especially noted, did this business and made this handsome profit at rates which, though not so low as those soon to be put in force by the new Cleveland plant, are phenomenally low compared with those usually charged by electric-lighting companies. *The average rate for all current sold by the Brooklyn plant last year was only 3.28 cents.*

The Brooklyn generating plant, however, is to be discontinued when the new municipal plant is in operation, for the cost of generating current will be so much lower there that it will no longer be profitable to operate the Brooklyn plant.

The abandonment of the Brooklyn plant is not expected to involve any considerable loss, for the distribution network and substations will be used as before, part of the machinery will be transferred to the new municipal station and the real estate will be salable.

And now let us take up the question, what will it cost Cleveland to generate and distribute current from the new municipal plant?

It will be admitted in the first place, of course, that the cost of current at the station busbars can be predicted in advance very closely. It is well known that electric central stations of large size using moderate-cost coal are today generally running at a total operating cost of less than ½c. per kw.-hr. of current output and often considerably below this figure.

The new Cleveland municipal electric plant is to begin operations with three turbine-generator units, each of 7500-kw. capacity. An additional unit from the Brooklyn station increases the total station capacity to 25,000-kw. It receives a supply of condensing water from one of the city pumping stations close by. Its machinery equipment represents the latest practice in steam boilers, turbines, electrical equipment and auxiliaries.

A full description of the equipment of this new station, which comprises many novel features in steam-power plant practice, is to be given at the December meeting of the American Society of Mechanical Engineers by Frederick W. Ballard, Commissioner of the Cleveland Municipal lighting department and engineer in charge of construction of the new plant. A detailed description of the plant is withheld until that time.

We can testify, however, that the station design and equipment is such that its operating cost should be at least as low as that of other first-class central stations. Large boilers, automatic stokers and cheap coal supply are among the important factors in keeping down the cost. It will certainly be on the safe side to assume that the total cost of current at the station busbars when the station is fairly loaded, including all outlay for operation and maintenance will not exceed 4 mills per kw.-hr.*

How much should be added to this for fixed charges (interest and depreciation) on the station cost? Here again we can figure very closely.

Interest on the city bonds issued to build the plant may be taken at 4½%. A 5½% depreciation charge or sinking-fund charge (it makes no difference which it is called) will certainly be ample to replace the plant well before it becomes worn out or obsolete, as it would be sufficient to pay off the principal in about 14 years.

Assuming the total cost of the power plant including land and building at $50 per kw. of capacity (which is close to the actual figures) we have annual fixed charges

*A valuable and authoritative statement on the cost of power development with present economical machinery is given by Mr. H. E. Longwell, Consulting Engineer of the Westinghouse Machine Co., in a paper published in the "Journal of the American Society of Mechanical Engineers" for July. We quote the paragraph as follows:

"As regards the cost of power: If one is satisfied with investment charges of 10½% per annum, if he can buy really good coal at not to exceed $3 per ton, if he is a capable manager and a careful operator, and reasonably economical, he ought, with a plant of 6000- to 9000-kw. capacity size, to be able to produce a kw.-hr. at the switchboard with substantially 100% load factor, for around 1.3 mills."

The new Cleveland municipal plant will obtain its coal at a cost of less than $2 per ton, and its capacity is 25,000 kw. Both these factors will operate to reduce its operating expenses below the figure set by Mr. Longwell. On the other hand, of course, the plant does not operate with a load factor of 100%.

Since Mr. Longwell includes the fixed charges in his final figure of 4.3 mills it is evident that our estimate of 4 mills as the operating cost of the Cleveland plant with its advantage of cheap coal and large size units is too high.

per kw. of capacity = 10% of \$50 = \$5. Let us further assume a load factor of $33\frac{1}{3}$%, giving an annual output per kw. of capacity of $\frac{365 \times 24}{3} = 2920$ hr.. Then \$5 divided by 2920 = about 1.6 mills.

Adding these fixed charges to the station-operating costs, we have a total cost of 5.6 mills for current at the station busbars.

And now what will it cost to distribute this current to the customers? Here we are on more difficult ground. The electric-lighting companies admit that the current which they sell the customer for 10c. costs them less than half a cent to produce in their stations; but they claim that the cost of distribution and sale is such that the 10-cent rate leaves them no more than a fair profit. But where are the actual figures of distribution cost to back up this assertion? Such figures appear to be jealously guarded.

Fortunately, Cleveland has experience enough of its own to serve as some guide in estimating these costs, for its Brooklyn municipal plant has now been in service for a dozen years.

As we have already noted, this Brooklyn plant, small in size and inefficient compared with present-day practice, nevertheless actually sold current to its customers last year at an average price of only 3.28c. per kw.-hr. and at this low rate earned a profit of 16% upon its book value.

Analyzing the operating expenses of the Brooklyn plant last year, we find that the total operating cost of both generation and distribution for the Brooklyn plant last year was 1.49c. per kw.-hr. and of this the station cost was 0.79c., leaving 0.52c. as the cost of distribution alone. This, however, was for current generated. The loss in distribution increases this to about 0.67 per kw.-hr. actually sold.

Now, it will certainly be agreed that a plant several times the size of the Broklyn plant can reduce the cost of distribution considerably below the figure quoted above. Let us be on the safe side, however, and assume that it will cost substantially the same or in round numbers 0.[illegible] per kw.-hr.

Next, what should be estimated for fixed charges on the distribution plant? The book value of the distribution plant in connection with the Brooklyn system is in the neighborhood of \$100 per kw. of station capacity. Probably a considerably higher figure should be assumed for the cost of a new distribution system, as a large part of it will have to be underground. On the other hand, while the amount of capital required for an underground system is much greater than for overhead wires, the percentage of cost required to cover maintenance and depreciation is much less. To be on the safe side, however, we will assume for the distribution system to be installed for the new Cleveland municipal plant an average cost of \$150 per kw. of capacity. Assuming the same interest and depreciation rate (10%) and load factor ($33\frac{1}{3}$%) that we assumed to find the fixed charges on the power station, we have \$15 ÷ 2920 = 5.13 mills.

Summarizing now the several items, we have the following as the total cost per kw.-hr. of output:

	Cents
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
	1.[illegible]

This is the figure for current at the station busbars. If we assume a 20% loss in the distribution system, then the cost of current at the consumer's meter will be 1.96c.

Low though this figure may seem to be, we believe it is conservative and further that there is reason to believe the actual cost may be reduced below even this figure. The load factor, for example, may be 40% or more instead of the $33\frac{1}{3}$% we have assumed, and this seems especially likely with the low rates made for large amounts of current for factory use.

It may seem on the face of the figures that the low rates of 1c. to 2c. per kw.-hr. for current to large users would result in a loss; but the cost to be figured against such consumers is chiefly the station-operating cost, since these customers use current at a time when the station and distribution system would otherwise be idle. The cost of distribution to such consumers also is generally very small.

Of course, only the test of final experience will determine what will be the average price received for the current sold, and, of course, this average price must be in excess of the 1.96c. found above for the average cost of current delivered to make the new municipal plant a financial success.

We may test the accuracy of these estimates also by comparison with the actual results in the Brooklyn plant. In this plant last year the entire operating cost of generating and distributing current was 2.06c. per kw.-hr. sold, and the allowance for interest and depreciation raised the total cost to 2.59c. If a 2500-kw. plant of out-of-date design can do this, it seems not unreasonable to expect that a 25,000-kw. plant operating with the high efficiency now obtainable will reduce this cost to 1.96c. The saving in station cost alone which will certainly be effected (the Brooklyn station cost last year was 0.97c. per kw.-hr. at the station busbars) would alone be nearly sufficient to reduce the cost as much as the estimate above given.

And if the Cleveland plant can deliver current to the consumer's meter at a total cost, including ample allowance for interest and depreciation, of 1.96c.; the prospects of the success of Cleveland's great experiment certainly seem favorable. The announced rate for the sale of current from the new station is 3c. per kw.-hr. Reductions from this are made only to consumers having connections of more than 10-kw. capacity. The flat 3c. rate will apply therefore to practically all private residences and all small stores and shops as well. The consumers who will benefit by the sliding scale and purchase current at less than a 3c. rate are nearly all of them purchasers for power rather than for light.

It must be remembered, of course, that before the cost can be reduced to this figure, the station must secure a load substantially equal to its capacity and with sufficient power customers to raise the load factor to substantially the figure of $33\frac{1}{3}$% assumed above.

The flat rate of 3c. per kw.-hr. will certainly be attractive to all those using current for residence lighting, but the users of current for power already have very low rates from the Cleveland Electric Co., and this part of the business will have to be fought for. The crucial question for the Cleveland plant will be whether its reductions from its maximum rate to power users will so cut down

the average return that it will fall below the average cost of production and distribution. The managers of the Municipal plant have certainly showed shrewd business ability in so simplifying their rate schedule that the average consumer can understand it and know in advance the price he will have to pay. This feature alone will help to bring them customers.

It is said by the critics that Cleveland's municipal electric plant is a shrewd political move of Mayor Baker. To cut the cost of electric current to thousands of householders is an achievement which will surely add greatly to the popularity of the administration. We believe the managers of private companies selling electric current will do well to study the Cleveland situation and take a leaf from Mayor Baker's policy. The friendship and good will of the thousands of small consumers who purchase current is something which the private companies need to cultivate. At the present time the average householder feels that he is being made to pay three or four times as much for the current as is paid by the large manufacturers and department stores, simply because he is helpless, whereas the large user will put in his own electric plant unless the central station gives him a low price.

A cut in the price of current to the householder may serve to stop agitation for municipal ownership before it begins, and the price reduction will be to a large extent made good to the company in the stimulus given to a larger use of electric light and especially of electric heating appliances.

Doubtless the figures we have presented above will be criticized. The financial interests at stake are so large that this is to be expected. But in order that such criticism shall be valid, it should be not merely general but should show wherein and by how much the assumptions on which the above figures rest are in error. If facts and figures exist which would modify the above calculation, by all means let them be brought forward; and if 1.96c. is too low or perchance too high for the cost of current from Cleveland's new municipal plant, let it be demonstrated how the estimate can be made more accurate.

It may be said, for example, that a municipal plant will be free from the city, state and federal taxation which is laid upon a private company and that due allowance should be made for this in computing the operating cost of a municipal plant. Such a criticism is entirely valid. We have not included it in the above figures for lack of data as to the proper amount to allow.

It may be said also that the low figures of cost which we have computed above will not be attained until customers are obtained sufficient to give the station an economic load. While the low rates offered are sure to attract all the customers that can be carried, some time will be necessary, of course, to extend the distribution system and reach them.

Of course, the new municipal electric plant can only serve a small part of Cleveland's great area and 700,000 population. The Cleveland Electric Illuminating Co., with its 100,000-hp. station, and its distribution system covering nearly the entire city is doubtless in the field to stay. For a good while to come it will probably prefer to relinquish customers to its municipal competitor rather than lower all its rates to the level set by the latter. It has, however, already met the situation in part by a large reduction in its rate, which it is claimed to be equivalent to a reduction of $800,000 per year in the payments for electric current in Cleveland.

Admittedly, the situation of the companies operating electric stations when faced with such business-like municipal competition as Cleveland has undertaken is a difficult one. Besides the burden of taxation which we have referred to, the companies in most instances have put far more money into their plants than would be required to replace them with plants as good or better at the present day and their interest charges on capital are 2 to 3% higher than a city has to pay.

In the long run, however, replacement value and not the amount of money invested in the past must be the measure of safe capitalization. The rule which applies under free competition must be made to apply to public utilities also. If the price of the machinery equipment for an electric station is cut in two, then the capital ought to be reduced in proportion, even though the old steam engines and slow-speed generators and small-capacity boilers may have actually cost all they are capitalized for. If alternating-current distribution makes an old direct-current system obsolete, then its cost should be written off to profit and loss. Any concern which carries dead capital on its books at its original cost, or at any more than its true present value, is in a weak position whenever a strong new competitor appears.

It is this situation, in fact, which gives the greatest excuse for municipal ownership and operation of certain public utilities at the present time.

The general principle is unquestionably sound that all publi utilities should be monopolies. Competition has been tried in water-supply, gas supply, street railways, telephones, and electric-lighting plants and has been proven in the long run to be a public injury instead of a public benefit. Economists and engineers are generally agreed that regulation of public utilities by public authorities rather than competition is the way out.

But it is not to be expected that a State public-utilities commission will compel a company to reduce its rates below the point necessary to yield a fair return on money actually invested; nor would the courts be likely to support such a forced reduction. If, however, a city like Cleveland can supply its citizens with electric current produced at lowest cost from an up to date plant there is no need of interference by commissions or courts.

And in conclusion, we should not by any means be understood as claiming that what Cleveland is doing in this field can be done by any other city anywhere. For one thing, Cleveland's advantages of cheap coal and abundant condensing water are great aids in reducing cost; but what is far more important is the success the city has attained in having its municipal enterprises carried out with a very fair degree of efficiency and honesty.

There will doubtless be other cities to follow Cleveland's lead in this experiment; but unless they are able to secure honest and efficient administration by competent engineers, and that not merely as a spasmodic effort at municipal house cleaning but as a permanent condition of city government—unless a city is able to fulfil this condition, experiments in municipal electric lighting will be apt to prove disastrous to the taxpayers.

Were it not for prevailing conditions in municipal government throughout the country, the electric-lighting companies would doubtless be even more concerned than they are over Cleveland's municipal electric plant.

Letters to the Editor

The SO_3 Content of Portland Cement

Sir—Prof. A. Baykoff, President of the Commission of the International Association for Testing Materials for the Study of the Influence of the Amount of SO_3 in Portland Cement, has communicated with the undersigned, who represent the American Society for Testing Materials on the Commission, in a letter which reads in part as follows:

As has been indicated in the report of the Association of German Portland Cement Manufacturers, various countries decide the question of the maximum amount of SO_3 in portland cement in a different way. Some make no difference between portland cement for fresh water and for sea water, others prescribe different limits according as the cement is to be used in fresh water or sea water.

Based upon these views, the VI Congress of the International Association for Testing Materials in New York adopted the following resolution:

> The Congress recommends generally that the conditions for accepting portland cement for all uses be fixed uniformly at a maximum amount of SO_3, that is to say, at 2.5%.

Thus the question proposed for the consideration of our Commission divides itself into two, which can be formulated as follows:

(1) Is it necessary to fix two different normals for the maximum admissible amount of SO_3 in portland cement according as the cement is designed for use in fresh water or in sea water?

(2) What should be the admissible maximum amount of SO_3 in portland cement under conditions conforming to the decision of the first question? Will it be necessary to use one or two normal figures?

As the solution of these questions can only be made after a sufficient quantity of exact data are available, it seems to me to be necessary, first of all, to collect a sufficient number of such data. With this object and independent of the researches which produce them or which are going to produce them, it will be useful to collect and discuss the greatest possible number of researches and the work devoted to the question of the influence of SO_3 on portland cement.

It seems to us that this matter should be put before the producers and users of portland cement in the United States so that such proposals in regard to the work to be done, and any data that may be available may be sent us for transmission to the President of the Commission. With this object in view, we are asking you to bring it to the attention of such persons through the columns of your journal. Communications are requested from all who are interested in the matter.

JOHN B. LOBER,
CLIFFORD RICHARDSON.

Woolworth Bldg., New York City, July 21, 1914.

Air-Valves and the Collapse of the Antelope Valley Siphon

Sir—In the excellent article on "Air Valves on Water-Supply Mains," by Clemens Herschel, in your issue of June 11, the writer notes the statement that the two ends of the Antelope Valley Siphon on the Los Angeles Aqueduct, which collapsed Feb. 18-20, 1914, were open. [See Eng. News, May 14, 1914, for account of collapse.—Ed.] The fact is that this siphon did not have its ends open, but continued at each end into a closed gravity conduit, formed by excavation into the ground, having sides and bottom lined with cement concrete and the top covered with a reinforced-concrete slab.

It is therefore impossible to conclude that the Antelope Valley siphon collapsed from negative water pressure, and not from the effect of a partial vacuum.

The writer has frequently observed phenomena of negative presure in water pipes, as stated by Mr. Herschel, and, under certain conditions, where the factor of safety is low, as in this case of the Antelope Valley siphon, distortion of the pipe shell might occur from such negative pressure. It is extremely doubtful, however, if not entirely impossible, for one to account for such a complete collapse as that occurring on the Antelope Valley siphon without the formation of a decided vacuum inside of the pipe.

That the middle portion of the pipe remained in shape is not a satisfactory explanation in this case, because air would rush in through the lower end of the pipe, where the rapid efflux lowered the water, so it did not occupy the entire cross-section in the pipe.

F. C. FINKLE.

I. W. Hellman Bldg., Los Angeles, Calif., June 17, 1914.

Sir—The article in your issue of June 11, 1914, "Air Valves on Water-Supply Mains," by Clemens Herschel, in its reference to the Antelope Valley Siphon, Los Angeles Aqueduct, brings out a very interesting point: that of "negative pressure while the pipe was still full of water."

The ordinary gage used on pipe lines does not show the true internal pressure tending to distend the pipe, but a pressure which is lower by 14.7 lb., due to the fact that the gage is itself subject to an external pressure to that extent. The true zero internal pressure is 14.7 lb. below the zero of the gage, and in changing from a high pressure to the true zero the conditions, when passing the zero of the gage, will be the same as at any other point in the range of movement. Assuming an air-tight pipe, the action will be the same below the zero of the gage as above it. There will be no parting of the water column, or pipe walls and water, until the true zero is reached. It is assumed in this discussion that the water is free of air and other substances tending to change its condition.

The fact that the pipe becomes subject to a collapsing pressure at a certain point in this pressure drop is due to the counterbalancing of the pressures at this point, and has no other relation to the change within. It is therefore clear that, in the absence of air in the pipe, it is possible to have negative gage pressure to an extent of atmospheric pressure, 14.7 lb. per sq.in., without a parting of the water column, or a separation of the pipe walls and the water.

To what extent a pipe will permit a lower pressure within than without will depend upon its resistance to collapse. Should it be unable to withstand an excess ex-

ternal pressure of 14.7 lb., it will be necessary to prevent the internal pressure dropping to the true zero. The surest way to do this is to provide for the admission of air to partly counteract the external pressure, and *to do this wherever the internal pressure tends to go below the zero of the gage.*

It is, on first consideration, astonishing to find what a slight change in flow conditions is required to produce these low pressures. To illustrate, consider a pipe line on an incline of the same grade throughout, filled with water and having a nozzle at the lower end. Let the pipe be 5 ft. in diameter, $\frac{1}{4}$ in. thick and under a head of 200 ft. at the lower end. Let the nozzle be of such size that it will produce a flow of 5 ft. per sec. in the pipe.

Reference to the formulas in the article, "The Calculation of Water-Hammer Pressures," in Engineering News, Dec. 4, 1913, will show that in such a pipe a ram pressure of 34 lb. follows a check in flow of 1 ft. per sec. It is equally true that a sudden increase in flow is accompanied by a fall in pressure of 34 lb. This depends upon the same law which controls the ram, and is nothing more or less than the action of gravity upon a compressible fluid in an elastic pipe. These effects have been too thoroughly demonstrated by theory and experiment to be open to doubt.

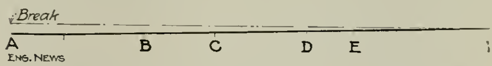
Suppose the nozzle to blow off, leaving a full pipe opening, and consider what will take place. Instantly the pressure of 87 lb. at the end of the pipe disappears, releasing the compressed water and permitting the pipe to contract, which two effects produce an additional flow of 2.54 ft. per sec. The pressure at the pipe end has fallen to atmospheric, which means that there is still an internal pressure of 14.7 lb. at that point. A wave of pressure drop, amounting to 87 lb., starts to pass up the pipe with a velocity of 2540 ft. per sec., but at a distance depending upon the inclination, a point is reached where 87 subtracted from the previously existing pressure reduces the internal pressure to the true zero. At this point, located about 34 ft. higher than the end, the water and pipe walls lose their power to furnish the required flow, and separation of the pipe walls and water takes place. It is seen that the pipe is subject to a superior external pressure varying from zero at the end to 14.7 lb. at the point mentioned.

Should the pipe be not sufficiently rigid to withstand this external pressure it will collapse and thus furnish the required flow with a less pressure drop. It is clear that the admission of air would produce the same result, in this respect, as the collapse, inasmuch as it would permit a partial evacuation of this part of the pipe to supply the required amount of water. Should no air be admitted and the pipe be strong enough to preserve its shape, a parting of the water from the pipe walls would result at the point where the true zero pressure was obtained, but not otherwise. The low-pressure wave will pass up the pipe, collapsing those portions of the line not sufficiently rigid to withstand it.

In this case an additional flow of 2.54 ft. per sec. (about 50%), brought about in the manner described, is sufficient to cause damage to a weak pipe line not provided with air valves in the proper place to care for such an emergency. This effect commences instantaneously and proceeds up the line with a velocity of 2540 ft. per sec. until the true internal pressure drops enough to permit the collapsing of the pipe by the external pressure or until the true zero is reached and separation takes place. In a uniform pipe this would probably take place between the upper wall and the water and not in the water itself. In lines consisting of pipes of varying size and thickness the conditions become very complicated, but, as a rule, it is possible to follow the effects until a collapsing pressure is found.

The point to be clearly understood is that the damage is done before any effect is felt at the upper end, and that prevention is to be found in the provision of adequate air valves along the line, even where the pipe will resist collapse. With the admission of sufficient air the pipe will flow partly full and the water will travel at a velocity dependent upon inclination and friction.

Referring to the Antelope Valley inverted siphon, the accompanying illustration shows the down-flow leg to the break and the table gives certain data pertaining thereto. Some of the figures are approximate only as they were scaled from a published diagram of small size. All pipe is 10 ft. in diameter.



Down-Flow Leg of Antelope Valley Siphon

Section	Length of pipe, ft.	Thickness of pipe, in.	Velocity of wave, ft. per sec.	Pressure change for 1 ft., lb.	Time of wave, sec.	Pressure at upper end, lb.
A B	2350	$\frac{3}{8}$	2300	31	1.02	78
B C	1415	$\frac{5}{16}$	2150	29	0.66	65
C D	1805	$\frac{1}{4}$	1965	26.5	0.92	39
D E	891	$\frac{1}{4}$	1965	26.5	0.45	33
E F	2736	9	2970	40	0.92	0

With such a break at the low point that free flow was permitted, the pressure at the end fell instantaneously to atmospheric, leaving an internal pressure of 14.7 lb., with no tendency to collapse. As the pressure fall was 87 lb. and 31 are required to give an additional flow of 1 ft. per sec., there was instantaneously added to the existing velocity a flow of 2.8 ft. per sec., calling for 220 cu.ft. per sec. This quantity would be provided by the pipe above the break to the limit of its capacity, which would be reached when the true internal pressure reached zero. As the pressure at *B* was 78 lb. per sq.in., there would have been, on the above assumption of free flow, a collapsing pressure of 9 lb. At *B*, where the wall thickness changes to $\frac{5}{16}$ in. and where a pressure fall of 29 lb. will increase the flow 1 ft. per sec., the required fall will be 81 lb., indicating a vacuum of 3 lb. In the $\frac{3}{8}$-in. pipe the true internal pressure will be 5.7 lb. and in the $\frac{5}{16}$-in., 11.7 lb. There would be an equalization of these pressures, raising the former and lowering the latter.

According to a table recently published by Enger and Seely, the $\frac{3}{8}$-in. pipe would partly collapse under such conditions, and the fact that it did not would indicate either that it was well supported, or, what is more likely, that there was not an entirely free flow permitted. To what extent the above conditions prevailed it is impossible to say, but it is evident that dangerously low pressures were promptly reached, and that had the lower sections been of sufficient strength to resist them, the usual lighter upper sections would have been damaged.

It is probable that the collapse started at the lower end and was completed during the rapid passage of the first wave of subnormal pressure; that air was supplied wher

the water reached the top, and that thereafter the pipe can partly fall until it was emptied.

In this particular case, judging from the published accounts, there was absolutely no reason to anticipate such extraordinary flood conditions, and therefore no reason to provide for them. Economy limits the engineer to reasonable safety provisions, and loss from unusual manifestations of nature must be accepted as part of the penalty we pay for living. Such a risk should be insurable for the same reason that we provide against fire loss and life hazard.

As the upper ends of this pipe were open to the air and as there were no summits along the line, it is evident that the dependence which has been placed on air valves, located at the summits, is not sufficient protection against damage following extensive rupture at any point on the line. *The entire line must be provided, at intervals, with valves of sufficient size to admit enough air to prevent the collapsing pressure reaching the limit fixed by the rigidity of the pipe,* and this air must be admitted during the time required for the passage of the wave of subnormal pressure from the break to the top.

S. L. BERRY.

417 Rialto Bldg., San Francisco, Calif.,
June 21, 1914.

[It seems to us that emphasis should be placed on a sentence in the last paragraph of the above letter which we have taken the liberty of italicizing. We do not believe that any computation can determine fully the particular points at which "negative pressure," which is really only another name for partial vacuum, may be developed under certain circumstances.

For example, a long level section of pipe may be flowing full at high velocity under considerable pressure. If a break occurs on this section, the pressure will be at once relieved, and at some point beyond the break, the water will flow backward toward the break while the water beyond this point will continue flowing, impelled by the inertia of the whole moving column of water in the pipe below.—ED.]

Making Cement Joints in Sewer Pipe

Sir: An interesting article, "Cement Joints for Sewer Pipe at Edmonton," appeared in your issue of July 9. The relative merits of certain details of procedure, under different specifications for pipe laying are discussed, and those which the author, J. M. Bogg, has found the most satisfactory are incorporated in his quotation from the Edmonton specifications.

I have had some experience with cement mortar joints made in three different ways: (1) where a gasket was not used; (2) where a gasket was inserted against the shoulder of the bell in the usual way; (3) where the gasket in the finished joint was at the entrance to the bell all the way round, calked flush with, or a little inside the outside edge of the bell. In all cases, the bottom third of the bell was lined with mortar before inserting the pipe. When no gasket was used, pipe 15 in. and over was centered by two small wooden chips. These chips were also used with the gasket in laying the larger sizes, 18 in. and over. Ordinarily, no difficulty was experienced in centering the 8-in. and 10-in. pipe without chips, whether a gasket was used or not. In every case the joints were pointed from the inside for all pipe 15 in. and over. In methods (1) and (2) the joints were protected with a burlap or cheesecloth band for pipe 18 in. and over.

So far as my experience goes, I am of the opinion (1) that the lower part of the bell should be filled before the spigot of the succeeding pipe is entered, and with more mortar than is needed in that part of the joint; for safety the mortar should appear on the inside; (2) that it is important to use a gasket, not only to assist in centering the pipe, but I believe that the clogging, or silting up of a gasket calked tightly into the bell, is a considerable factor in preventing leakage in either direction through the joint, where the cement mortar itself is defective; (3) that while no doubt it can be dispensed with, it is safer to use chips to prevent the larger pipes settling at the spigot end; (4) that while it is proper to give the joint a finished appearance by a moderate bevel, the so called generous bevel is, if anything, worse than useless with the larger sizes, as it tends to sag away from the sides of the pipe; (5) that with the larger sizes, the joint should be supported by a strap of burlap, etc., unless a gasket is inserted at the face of the bell after the joint has been filled up the sides and over the crown.

Moreover, the third method of joint making has appeared to insure the tightest work so far as I have seen it used. This joint is made by lining the bottom third of the bell in the usual way, covering the gasket which is placed along the outside edge of the bell. The gasket is long enough to encircle the pipe, and the two end sections are brought out of the bell after passing clear of the mortar in the bottom. The spigot end of the pipe is then entered with its crown guided against the bell, worked down to center at both ends and bedded. After the joint has been completely filled with mortar, the free end sections of the gasket are calked into the bell working from the bottom toward the crown. The gasket is driven flush with, or a little within, the face of the bell, the bevel applied, the joint pointed on the inside where accessible, and the surplus mortar cleaned out. There is not very much mortar driven through, particularly with the smaller pipe.

This feature of the mortar forcing through is occasionally objectionable in a way that is hard to avoid. The 12-in. pipe and under cannot be pointed from the inside, and if as sometimes happens, the plane of the spigot end is not perpendicular to the axis of the pipe, there may be a considerable space at the crown of the joint between the spigot end and the shoulder of the bell; and the mortar filling this space sometimes drops to the invert after the pipe laying has proceeded some distance in advance.

When laying 12-in. pipe, this feature has to be watched; it rarely happens with 8-in. pipe, or with the larger sizes where the joints have been pointed from the inside. With the joint made in this way the mortar is firmly held in the bell, and even if the bevel does sag, it cannot carry the mortar out of the bell with it.

I have not found the chips objectionable in the way Mr. Bogg suggests; perhaps more mortar was placed in the bottom of the bell; at any rate the chips did not keep the pipe off the mortar; they were practically buried in it near its upper edges. The chips were placed in this position, so that they could be easily moved a little higher, or lower, when [illegible] required; moreover, with the

chips in this position, any inequalities in either the pipe or the chips do not raise or lower the spigot end so much as if the chips were placed lower down, opposite a diameter approaching the vertical. However, there is no doubt that with the chips omitted, the gasket will generally be fitted tighter in the bottom, and that is a desirable feature.

The consistency of the mortar is an important matter, and not at all easily controlled. The tendency is to have the mortar too soft, as it is easier for the pipe layer to handle. Unless quite stiff initially, the mortar which has been hurriedly mixed, becomes sloppy on further handling, and cannot be easily compacted or retained in the bell. The man who mixes the mortar often has too many other things to look after. The mortar should be mixed in very small batches, and kept thoroughly stirred some time before being used. This permits the mixture to absorb more water, and the proper consistency can be better gaged by the mortar man as further handling does not affect it; moreover, the mortar appears to be tougher, and works smoother.

Mr. Begg has adopted a good specification at Edmonton. Clause (e) which specifies that no joint is to be completed until at least two joints have been bedded and graded in advance is to be particularly recommended. In reading his well presented article, I had hoped to find the detailed description of the work extended to include the method or the procedure followed in bedding the pipe. It is in connection with this, that the most serious difficulties arise in laying sewer pipe. It requires considerable skill and patience to bed a pipe firmly, and at the same time have it lying true to grade and alignment. It is true, that once the pipe is in the right position, it can be held and supported by tamping proper filling around it with a thin-bladed tool. In this operation lies the greatest risk of lifting the spigot end slightly from the mortar in the bottom of the bell.

It has been the writer's practice to defer tamping immediately around the joint until after the mortar has set up; but in bright, hot weather, at least, the joints were covered with loose earth. Before back-filling the trench the following day, some of this filling was removed, before the tamping was completed. Possibly this was not a good system; care certainly had to be taken to maintain the compacted filling at the same level on both sides of the pipe, so as to avoid jarring it slightly off the line; it is surprising how easily this can be done with even a very light tamping iron.

W. S. Lea.

New Birks Bldg., Montreal, Can., July 19, 1914.

Sir—The editorial in the July 16 issue of Engineering News, relating to sewer-pipe joints, has been read with much interest by me as also the preceding week's article by Mr. Begg.

I am strongly in favor of incasing small-sized sewer mains and laterals in concrete as suggested by you, not only on account of its protection against seepage but also on account of safeguarding the pipes against almost certain breakage caused by workmen driving a pick though the pipe when a new ditch happens to cross the line of the old sewer. A covering of concrete is an immediate and positive warning of an existing sewer pipe and the workmen will naturally stop and find out what it is before digging it out.

My reason for answering this editorial is that I strongly object to the method suggested of covering the pipe with concrete as per the sketch on p. 147 of your issue of July 16, without at the same time calking the joint with jute and filling with cement which should be tied up tightly with a strip of muslin. The sewers under discussion would in general be from six to ten feet below ground and especially after a rain of any duration would be under from two to five feet of ground-water head and the covering of concrete could not possibly keep out the water. It is generally agreed that it is easy to keep water in concrete but a problem to keep it out.

It would seem, however, that the combination of all the methods suggested to date would make a good general working method of laying sewer pipes and insuring the maximum efficiency of the joints; namely, according to the size of the city, have one man definitely charged with the responsibility of having water-tight joints in his section, lay all pipes according to the very clear specifications suggested by Mr. Begg and finally to incase all mains and laterals up to perhaps 15 in. in concrete for protection from seepage and from tree roots.

Russell H. Peck, C. E.,
Engineer Palmerton Disposal Co.

Palmerton, Penn., July 19, 1914.

A Warning to Railway Construction Engineers in Pennsylvania

Sir—Referring to the letter of M. E. R. in the July 9, 1914, issue of Engineering News, relative to a warning to railway construction engineers working for English companies, which concludes with "It would be wise for men who have employment contracts under English law to insist on having their salaries paid at the end of the month," M. E. R. does not have to go to England for this kind of law. Certain employees of insolvent companies will find that the State of Pennsylvania has a similar law.

Some years ago, the undersigned was chief engineer of a Pennsylvania state railroad which failed and went into the hands of the sheriff for adjudication. Upon trying to collect his claim he found that the only preferred creditors were clerks, miners, mechanics and laborers; so although he had "labored" hard during his engagement, he had to be satisfied with a very small percentage of his claim. Under this law there is even a distinction between a clerk and a bookkeeper.

So long as engineering societies are nothing but literary clubs, no redress need to be looked for.

Civil Engineer.

Buffalo, N. Y., July 10, 1914.

Portland Cement Manufacture in the Philippines is one of the possibilities of the future. The "Philippine Journal of Science" for February contains an article by Augustus T. West and Alvin J. Cox describing tests of raw materials available in the Philippines for portland-cement manufacture which showed excellent results. All the cement now used in the Philippines is imported. The consumption in the fiscal year 1913 was just short of 400,000 bbl. Cement from the United States is imported into the Philippines free of duty but the transportation cost is so great that American cements do not compete in the Philippine market. The selling price of cement in the Philippines on large contracts is stated to have varied from \$2.18 in 1907 to \$3.34 in 1912.

Sewer Explosions and their Prevention*

By Leonard Metcalf and Harrison P. Eddy†

SYNOPSIS—This article, composed of extracts from a forthcoming book on "Modern Sewerage Practice," gives in detail the precautions to be observed by sewer workers to avoid the danger of explosions. The nature of sewer explosions is gone into and the Washington City ordinance for preventing explosive mixtures in sewers are quoted. Dangers of asphyxiation are also described and precautionary measures outlined.

When a sewer is to be entered, or a lighted lamp or candle is to be lowered into it, great care should be exercised to avoid danger of explosion. Men accustomed to this work will quickly perceive the presence of illuminating gas or gasoline vapor, by the odor. This is the safest method of testing the air, but the observer should be careful to note whether the air is entering or emerging from the manhole, otherwise he is likely to mistake the absence of odor for the absence of gas in the sewer. If it is necessary to enter the manhole to determine the presence of gas, this should be done without a light, unless it be an electric lamp, and the man entering should wear a life belt with a line leading to his helpers at the top of the manhole. Although seldom done, it is always wise to open several manholes in the sewer to be entered some little time before the entrance is to be made, in order to provide a change of air within the sewer.

An inspection in, or very close to a manhole, should never be attempted by one man alone; the inspector should have at least one helper both for his protection and that of the public, and usually more than one. The helper should remain standing at the top of the manhole to warn approaching persons of the opening. Where the inspector is to go from manhole to manhole through the sewer a second helper should precede him to the manhole below that at which he enters. When the inspector has reached the second manhole, the second helper signals the first one at the first manhole, who replaces the lid and passes on to the third manhole, awaiting the arrival of the inspector at that point. Three men constitute the minimum safe size of gang for such inspection, and preferably two men should go together through the sewer.

Danger of Explosions

Many explosions have occurred in sewers due to explosive mixtures of illuminating gas, gasoline vapor and possibly other gases. Illuminating gas leaking from a defective gas main may find its way through the ground and into a sewer in sufficient quantity to cause an explosive mixture. Most superintendents of sewers have had experiences of this kind, although relatively few instances have resulted in explosions. It is not always easy to find the source of such gas, as it may travel a considerable distance from the point where it enters the sewer to the place where it is detected.

During recent years, trouble has frequently resulted from the discharge of gasoline into sewers, largely from automobile garages. Gasoline vapor is considerably heavier than air and therefore is not always readily distinguished by its odor when the observation is made from the top of the manhole. This new source of danger has necessitated ordinances preventing the discharge of gasoline into sewers and approving lighting appliances for the use of inspectors and laborers while working within the sewers.

An explosive mixture may result from the decomposition of the organic matter in the deposits. By such decomposition, marsh gas, or methane, may be produced in considerable quantities, and if there is not an adequate circulation of air to provide ventilation, it is conceivable that the proportion of this gas to the oxygen in the air in the sewer may be sufficient to provide an explosive mixture.

On Nov. 25, 1913, what was probably the most disastrous sewer explosion on record up to that time occurred in Pittsburgh, Penn. A detailed account of this accident was printed in Engineering News, Jan. 1, 1914. A series of spectacular explosions occurred in sewers in New York City, on Oct. 7, 1909, which was described by A. A. Breneman in Engineering News, Dec. 2, 1909, p. 608. The conclusion seemed to be that these explosions were due to gasoline vapor.

H. J. Kellogg, Assistant City Engineer, New Haven, Conn., carried on investigations for about a year to determine causes of, and to find means for preventing, explosions in sewers. He reported some of the results of these investigations in a paper read before the Connecticut Society of Civil Engineers, Feb. 10, 1914, from which the following notes and comments are taken:

> In 1886 there was an explosion in a New Haven sewer 60 in. in diameter. The arch was thrown completely off for about 100 ft. No one knows what combustible wrought the destruction, nor how it was ignited. No one was injured. . . . About 1891 a 3-ft. circular brick sewer was being flushed by four men when an explosion occurred. The men escaped with difficulty, two of them being disabled for six months or more. The cause of the explosion appears to have been illuminating gas ignited by candles which the men carried. . . . In 1913 a 12-ft. egg-shaped New Haven brick sewer was being cleaned when an explosion occurred, burning the men about their hands and faces. The cause of this explosion does not appear to have been definitely determined, although a slight odor of gasoline was noticed before the men entered the sewer. If gasoline was the cause of the explosion, it probably came from a manufacturing plant, the drain from which entered the sewer close to the point at which the explosion occurred. Very small quantities of gasoline are used at this plant.

At Philadelphia, an explosion in which several men were injured was attributed to gasoline vapor. Mr. Kellogg quoted from a letter from George S. Webster, Chief Engineer, Bureau of Surveys, as follows:

> A disastrous result was noticed upon opening a sewer manhole, and a blazing paper thrown in resulted in a column of flame about 40 ft. in height, due to gasoline from a nearby factory.

*Abstracted by the kind permission of the authors and publishers from a forthcoming book on "Modern Sewerage Practice," by Leonard Metcalf and Harrison P. Eddy. McGraw-Hill Book Co., publishers. The extract is from Chapter IX, "Operation and Maintenance of Sewerage Systems."

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Two men were killed in a Philadelphia sewer explosion about 1912. The cause is said to have been illuminating gas from a leaky main which ran parallel to the sewer. At a later date a man was burned by an explosion resulting from gasoline discharged from a dry-cleaning shop.

Explosions in sewers were reported from Providence, R. I., Buffalo, N. Y., Washington, D. C., Fall River, Mass., Detroit, Mich., Brooklyn, N. Y., Cleveland Ohio, Worcester, Mass., St. Paul, Minn., Kansas City, Mo., Duluth, Minn., Los Angeles, Calif., Savannah, Ga., Baltimore, Md., Hartford, Conn., New Haven, Conn., Pittsburgh, Penn., San Francisco, Calif., Louisville, Ky., and Charlestown, S. C. The cause of explosion in a majority of these places was reported as illuminating gas.

George H. Norton, Deputy Engineer Commissioner, Buffalo, N. Y., described a new gas found in sewers as follows:

It may be interesting to know that for three years past, at periods following thawing weather, after frost and heavy snow, we have had serious complaint from gas odor in some of our sewers. This has been traced and found to be due to the use by the railroads of what is called a hydro-carbon oil, which is used by them to prevent freezing of their switches and interlocking plants in their passenger station yards, and at other congested points. An examination was made by the city chemist, and he reported that at low temperatures this oil will crystallize, that such crystals are soluble in water, and for this reason he thinks that the odor or gases have passed the ordinary vent sewer trap. The gases arising from this oil are apparently highly explosive and would readily be the cause of a serious explosion. This oil is a byproduct from the Pintsch gas used for car lighting.

Roscoe M. Clark, City Engineer of Hartford, Conn., gave the following information:

I have no recollection of any explosions in the sewers previous to 1913. In 1913 we had two serious explosions in the Park River intercepter. The first, occurring in January, lifted one manhole head and threw several covers in the air, and also shattered windows in adjoining houses. The second occurred in May, when the East Side Pumping Station and its connection with the Park River intercepting sewer were in the process of construction. The most damage was done to the station and adjoining houses. Both of the explosions took place in the vicinity of the works of the Hartford City Gas Light Co. Suits brought by property owners and the contractor for the pumping station are now pending in court.

Robert Adamson, Fire Commissioner of the Borough of Manhattan, New York City, reported that there were eleven sewer explosions between June 5, 1912, and the date of Mr. Kellogg's inquiry, probably about a year later. He stated that the probable causes of explosions in New York are gasoline, illuminating gas, and calcium carbide. He stated further that prior to the regulation requiring the installation of oil separators in garages, the majority of sewer explosions was limited to what is known as the "garage zone." Since their installation, the number of explosions has been greatly reduced. The following quotation is from Mr. Adamson's letter:

The illuminating gas enters the sewer from ruptured, corroded or broken gas mains, or from leaky joints, and when mixed in the proper proportions with air forms an explosive mixture. Calcium carbide, which is used in garages for generating lights, may be thrown into the sewer, and when in contact with water generates acetylene gas, which is an intense explosive and is further auto-combustible, so that in many instances it may be lighted by its own heat generated in evolving the acetylene.

The vapors of gasoline and illuminating gas require an open flame to ignite them, but whether this occurs in sewers it is impossible to tell. In vaults and in conduits the igniting spark is furnished in a number of cases by electrical apparatus, such as switchboards, sump pumps, short-circuiting, etc.

Some relation exists between sewer explosions and flooding of the sewers, and further, when the sewers become tide-bound these explosions are more frequent, such as following an unusual shower of heavy rain or a fall of snow or thawing of ice. This causes a condensation of the gases within the sewer.

There are no causualties on record resulting from these explosions, but considerable damage to property often occurs.

In relation to places where oil is stored, the oil separator is the only method at present under the regulations of preventing volatile inflammable oil from discharging into the sewer.

Mr. Kellogg stated:

That one volume of gasoline oil produces 141 equal volumes of gas or vapor, as figured by the city's chemist, who gave as the computed best mixture for complete combustion: 1 part of gas to 62½ parts of air. In gas engines, especially in automobile driving, an excess of air is said to give better practical results. The following figures lead up to a knowledge of the amount of gas likely to be in a sewer from a given amount of oil: 1 gal. gasoline gives 141 gal. of gas; 141 gal. gas equals about 18.8 cu.ft. of gas; 18.8 cu.ft. of gas with 1175 cu.ft. of air gives the best explosive mixture.

There is a broad variation in the proportions of this gas and air that will form combustible mixtures. Now, allowing 8 cu.ft. as the available space for 1 lin.ft. of a 42-in. sewer, in New Haven, 1 gal. of gasoline could have furnished a prime mixture for about 150 lin. ft. of that sewer. A leaner but still dangerous mixture might more than double the danger zone. Although the rate of flow in the sewer, the time it would take to vaporize the oil, the draft in the sewer and perhaps other factors complicate the problem, the above figures show that a comparatively small quantity of gasoline is capable of making trouble.

Mr. Kellogg also stated that about one part of illuminating gas to about seven parts of air is computed to be the best mixture for complete explosive combustion.

The following ordinance from Washington, D. C., appears to provide as ample protection as is possible by law:

Sec. 18. No persons shall make or maintain any connection with any public sewer or appurtenance thereof whereby there may be conveyed into the same any hot, suffocating, corrosive, inflammable or explosive liquid, gas, vapor, substance or material of any kind; and no persons shall cause to enter or flow into any public sewer or appurtenance thereof any hot, corrosive, suffocating, inflammable or explosive liquid, gas, vapor, substance or material of any kind; provided, that the provision of this paragraph shall not apply to water from ordinary hot-water boilers of residences.

On Jan. 3, 1912, the Municipal Explosives Commission of New York adopted a code of regulations, some of which bear directly upon the admission of inflammable oils to the public sewers.*

The "Paragon" gasoline and oil separator is an apparatus which has been put upon the market by the Ansonia Manufacturing Co., of New York, to meet the regulations of the New York City ordinances. In it, by taking advantage of the difference in specific gravity, the oil and gasoline are allowed to overflow into an oil chamber while the water passes through the trap and out into the sewer. From time to time, as oil and gasoline accumulate in the chamber, they are drawn off or pumped out.

The occasional presence of illuminating gas in sewers has been a matter of common knowledge for a great many years. It does not seem that there is at present any tendency toward an increase of this sort of trouble, and so far as the authors know, there is no means of preventing its occasional occurrence. It is usually discovered and reported before an explosion occurs. When reported, every effort should be made to immediately ventilate the sewer in which it is found and to locate the leaks in the main which is permitting the gas to escape.

* Printed in "Engineering News," July 2, 1914, p. 12.

The trouble arising from gasoline vapor in sewers appears to have increased greatly in the last few years with the increased number of gasoline engines and automobiles in use. Something toward decreasing the danger can be accomplished by means of oil-separating traps thoroughly well ventilated to prevent the escape of gasoline into sewers. This does not seem to have met with general application, however, and great care should be exercised by those entering sewers to avoid danger of explosions. One of the best means of accomplishing this is to prevent open flames in sewers by using the electric lantern.

An instructive discussion by D. B. Rushmore, of safety lamps and a new electric light for miners, appears in ENGINEERING NEWS, Aug. 15, 1912. The electric lamp, made by the General Electric Co., is a combination of the hand lantern and headlight, consisting of a miniature tungsten-lamp unit operated from a light storage-battery. The battery has a capacity of 5 amp.-hr., and is of sufficient size to operate a lamp from 12 to 14 hr.

When used as a headlight, the lamp is fastened to the miner's cap and connected by a flexible chord to the battery, which is flat, $6\frac{1}{2}$x$1\frac{5}{8}$x$1\frac{1}{8}$ in., weighing 3 lb. and is carried on a belt. When used as a hand lantern, the lamp socket is removed from the cap receptacle and inserted into the receptacle on the side of the battery, simply taking the place of the cable attaching plug.

OTHER SEWER DANGERS

Even though the danger of explosion is avoided, in exceptional cases gases may be present in sufficient quantities and of the proper kind to endanger the lives of the men working in the sewer. Illuminating gas, while most common, may usually be detected by its odor. If, however, there are some gas-works wastes in the sewage which impart odor to the air and yet are not dangerous, the men may gradually come upon a quantity of illuminating gas without noticing the difference in odor, and be overcome.

There is also danger from marsh gas formed in decomposing deposits and liberated in large quantities when these deposits are disturbed, as by being shoveled or walked upon. Hydrogen sulphide may also be formed under similar conditions, especially where the sewage contains sulphates, as from very hard water or sea water. An illustration of such conditions is furnished at the end of the Los Angeles, Calif., outfall.

Another illustration is afforded by the death of three experienced sewer workmen at New Bedford, Mass., on Apr. 10, 1914. A section of an intercepting sewer had been closed by a bulkhead in order that the portion below the bulkhead might be put in use while that above was being completed. The men entered the sewer at a manhole 400 ft. above the bulkhead. They adopted none of the precautions advised in this chapter. About 8 hr. later, their bodies were found by a searching party under conditions which indicated that they had probably worked their way well down toward the bulkhead, when they discovered the presence of gas. One of them escaped to within 100 ft. of the manhole and then fell over with his face in a little trickle of water on the invert, in which he was probably drowned. The others did not get nearer than 300 ft. to the manhole; their bodies were found against the wall of the sewer, the arm of one through that of the other in a way indicating that he was helping the latter when both collapsed.

The only practicable way in which to avoid danger of being overcome by such gases as may be found in sewers under exceptional circumstances appears to be to provide liberal ventilation before entering and while working in them. Care should also be exercised to provide young and vigorous men for such work, to see that there are sufficient men in the party to provide necessary assistance in case of need, and to require that life belts be used, when the men are in particular danger. For emergencies, the breathing apparatus used in mine-rescue work and for entering burning buildings may prove useful. Such apparatus is described in Miners' Circular 4, U. S. Bureau of Mines.

Effect of High-Pressure Steam Mains under Streets

Damage to streets, sewers and paving by the presence of high-pressure steam mains in the street having been proved by an extensive investigation, the Public Service Commission for the First District, New York, on July 23, ordered the New York Steam Co. to remove and replace its 58,986 ft. of steam mains of the brick-trench type with mains of the modern tile construction shown on the accompanying drawing, or by some other type equally good, to be approved by the Commission, within five years, at the rate of not less than 12,000 ft. per year, beginning Sept. 1, 1914.

The New York Steam Co. was formed back in 1880. It is said to be the only concern of its kind operating high-pressure steam lines for heating and power. Three steam-boiler plants are operated. One, known as station B, built about 1885, in the lower part of the city, has a rated boiler capacity of 15,800 hp. The second, station A, built in 1897, with a rated capacity of 11,700 hp., is at the foot of 59th., East River. The third is at about the same location and is called station J Addition. It was built in 1908 and has a rated capacity of 1800 hp.

Station B supplies steam at 95 lb. boiler pressure with 30 lb. pressure at the extreme end of the mains. The steam from this plant is used about equally for heat and power. The other two plants serve the uptown district with steam at 55 lb. boiler pressure with 10-lb. pressure at the end of the mains. The steam is used almost exclusively for heating. The temperature of the steam in the mains is over 300° F. In addition to these stations, the company owns three ice plants with a combined daily capacity of 195 tons. The total value of the property of the company is estimated at $7,168,000.

The chief engineer of the company stated that the cost of relaying a 10-in. (the average size) main was about $18 per foot, and that this cost was greater than that of laying new mains because of the necessity of maintaining service and of removing the old pipe. In the uptown district there were 685 customers, 173 of which were supplied through meters, the others were served at flat rates. In the downtown district, there were 456 customers, all supplied through steam meters. It was stated that the maximum price charged for steam is $2 per thousand pounds. The minimum rate is 45c.

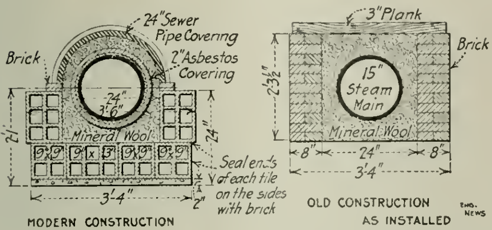
CONDITION AND EFFECT OF STEAM MAINS

The investigation revealed that it was a common occurrence to find the earth, for some feet outside the brick

walls of the steam mains, filled with steam which escaped when the earth was disturbed, and that the temperature of this earth ranged from 85 to 193° F. even in winter. One effect of these mains was to burn the leather washers in the water hydrants, and water discharged from some high-pressure hydrants was hot enough to give off steam. The unsatisfactory condition of the wood-block pavement in certain streets and their excessive cost of maintenance, can be attributed largely to the effect of the steam mains.

At street intersections, the waterproofing of the subway on lower Broadway was damaged by heat from the mains; the asphalt had practically disappeared, and the fabric was dried up and cracked. This effect is most important, because much of the new subway now under construction on lower Broadway is below high-water level, and waterproofing will, therefore, be necessary. This new line will encounter many steam mains between Chambers St. and Park Place, and elsewhere.

As for the effect of the steam mains on pavements, it was observed that on damp days such pavements were



PRESENT MAIN CONSTRUCTION OF N. Y. STEAM CO. AND NEW TYPE WHICH WILL REPLACE IT

dry, and the manholes in the street emitted steam, and that a light fall of snow would melt quickly.

In a certain sewer manhole back of Trinity Church, the temperature was 132° F., and in the sewer nearby was 180°. This temperature prevented men from working in the manholes. Another effect of this high temperature in sewer manholes was bad odors which issued from them. It was stated to be the consensus of opinion in the Department of Public Works, New York City, that the steam will loosen the cement in the joints of the sewer brickwall. In another manhole a 3-in. drip-pipe was discovered protruding through the wall and discharging into the sewer, steam at 210° F.

In the manholes of electric-cable subways, the temperature from the steam mains reached as high as 180° The effect of this temperature is not only to prohibit men from working in the manholes, but also to prevent the cables from working to full capacity.

It was stated that 60% of the steam pipes had screw flanges, which frequently leaked at the threaded connections. The chief engineer of the company said that welded flanges came in use on the system in 1901; and that about half of the mains in both districts had welded flanges and were laid in drained trenches. The number of feet of mains of modern tile construction in the downtown district is 3796, and in the uptown district 10,751, a total of 14,517 out of 73,553 ft., or less than 20%. The chief engineer of the company claimed that no leakage troubles were experienced where the trenches were drained and welded flanges used. His explanation of certain steam leaks which were proved to exist was that the trenches were not drained there, and that, although the pipes had welded flanges, they were the first of that kind so fitted, and that the flanges were made of wrought iron and had "porosity in them." The steam company claimed that much of the damage caused by leaks and radiation was because other subsurface structures have been located too close to the steam mains.

The report goes on to say that:

subsurface structures in many streets of New York are numerous, and space is limited. Each must be so constructed as not to injure the others, and that the record shows that no injury would have been caused had the steam mains been properly constructed. The steam company also says that much of the trouble is caused by leaks from water mains and house service piping, which is notoriously bad. But water pipes cannot be dispensed with, and the business of the steam company must adjust itself to conditions as they exist.

Mr. Goodrich [Consulting Engineer to the President of the Borough of Manhattan] testified that at Detroit, Mich., steam mains are placed in a tunnel which is from 15 to 35 ft. below the surface of the street, and that it would be feasible to construct such tunnels in New York.

The recent inquiry has been limited to the question of improvement in the distribution system of the steam company. No investigation has yet been made of the generating plants, or of other methods employed by the company in the conduct of its business.

New Locomotives for the Pennsylvania R.R. have been designed specially for use on the main line between Pittsburgh and Altoona, the purpose of the freight engines being to reduce double-heading to a minimum and to avoid breaking up trains at these points owing to the severe grades on this division. The clearance limits are restricted, and the weight per driving axle is limited to 65,000 lb. (with a 5% margin for scale variation), and the dynamic effect of the unbalanced reciprocating parts at 70 m.p.h. is limited to 30% of the weight on drivers. It was necessary to increase the power without exceeding the present clearances and to make the moving parts as light as possible while maintaining ample strength.

The running gear has been lightened by the use of heat-treated steel for driving axles, crankpins, piston rods, and connecting side rods, while the axle, pins and piston rods are hollow. The engines have the Walschaerts valve-gear, Schmidt superheaters, firebrick arches and screw reversing gear. The cabs are of steel, and much shorter than the ordinary design, this being made practicable by the use of the power reversing gear. The boilers and tenders are the same for both classes, and the boilers have the Belpaire firebox, 80x126 in.

The freight engines are of the 2: 8: 2 class, superseding a 2: 8: 0 class having cylinders 25x28 in. and a driving-wheel load of 220,000 lb., as against 27x30 in. and 262,000 lb. in the new engines. The tractive power is 57,850 lb., and 46,290 lb for the new and old engines respectively. The passenger engines are of the 4: 6: 2 class, taking the place of a 4: 4: 2 class having cylinders 23½x26 in. and a driving wheel load of 133,100 lb., as against 27x28 in. and 200,000 lb. for the new engines. The tractive power is 41,845 lb. for the new and 29,427 lb. for the old engines. The leading dimensions of the new engines are as follows

	Freight	Passenger
Class	2: 8: 2	4: 6: 2
Weight, total	330,000 lb.	305,000 lb
Weight on driver	262,000 lb.	200,000 lb
Wheelbase, driving	17 ft. ½ in	13 ft. 10 in
Wheelbase, engine	36 ft. 4½ in.	36 ft. 2 in.
Wheelbase, engine and tender	72 ft. 3 in	71 ft. 10 in
Cylinders (2)	27x30 in.	27x28 in.
Driving wheels	5 ft. 2 in.	6 ft. 8 in.
Boiler diameter	6 ft. 6¼ in.	6 ft. 6¼ in
Working pressure	205 lb	205 lb
Tubes length	19 ft	19 ft
Heating surface tubes	3747 sq.ft	3747 sq ft
Heating surface, total	4036 sq.ft	4036 sq ft
Superheating surface	1151 sq ft	1151 sq ft
Grate area	70 sq ft	70 sq ft
Rail to center of boiler	9 ft. 9 in.	10 ft. 1 in.
Water in tender	7000 gal	7000 gal
Coal in tender	25,000 lb	26,000 lb.

The Ohio River Bridge at Metropolis; Record-Breaking Simple-Truss Span

One of the most important of the many large bridges now projected and under construction is the new Ohio River bridge at Metropolis, Ill., the work for which has just been commenced and which will form part of a new railway route from northern and central points to the Gulf. The bridge will be a double-track structure, designed for unusually heavy loading and having a truss channel span 722 ft. 11 in. long between centers of piers. This span, being some 50 ft. longer than the main truss spans of the Municipal Bridge at St. Louis, will be by a large margin the longest simple span ever built.

The Metropolis Bridge will be built and owned jointly by the Chicago, Burlington & Quincy R.R. and the Nashville, Chattanooga & St. Louis R.R., and will form part of a new line between Metropolis, Ill., and Paducah, Ky., a distance of 15 miles. It is the development of a project initiated about 2½ years ago to establish a new and direct railway route between Chicago and Gulf ports (Engineering News, March 21 and May 2, 1912). This project was for a double-track bridge near Paducah to be built jointly by four roads (the Chicago, Burlington & Quincy, the Chicago & Eastern Illinois, the Illinois Central and the Louisville & Nashville). The bridge with its railway connections was to form the main part of a line between lines north of the Ohio and the New Orleans, Mobile & Chicago Ry., a new line owned by the 'Frisco and Louisville & Nashville railways. Financial and other troubles broke up the original project, but it is now to be carried out on practically identical lines.

The bridge proper will have a channel span of 723 ft., four truss spans of about 550 ft., with a 300-ft. shore span at the north end and a 250-ft. shore span at the south. This last is a deck span, while all the others are through spans with pin-connected trusses of the Petit type. The trusses of the through spans are spaced 37, 35 and 32 ft. c. to c. for the 720-ft., 551 ft. and 300-ft. spans respectively, while the maximum truss depths are respectively 110 ft., 82 ft. and 58 ft.

The north approach is a steel viaduct about 1600 ft. long, having 30-ft. tower spans and 75- to 90-ft. intermediate spans; at one point (where the line crosses a railway) the spans are carried by masonry piers instead of the steel towers. The south approach is similar, with alternating 30-ft. and 75-ft. spans, but having a length of only 600 ft. These approaches will have a concrete deck for ballasted track. The total length of bridge and approaches is about 5700 ft. The bridge is practically level, with ascending approach grades of 0.2% at the north and 0.3% at the south. The clear headway above high-water level is 53 ft., or 112 ft. at low water.

The foundations for the seven river piers will be sunk through a firm sand and gravel formation, pneumatic caissons being used; the maximum depth below low-water level is about 78 ft. The pedestals of the viaduct approaches will be supported on pile foundations, which will be built by the railway company.

A special feature of the bridge is the very heavy live-load assumed in the design, this being (for each track) two engines of Cooper's E-90 loading followed by a train load of 7500 lb. per lin.ft. This was adopted in view of the increasing weight of locomotives and trains, and to maintain uniform unit-stresses under these future heavy loads.

THE OHIO RIVER BRIDGE AT METROPOLIS.
(C. H. Cartlidge, Chief Engineer; Ralph

The bridge will be built by the Paducah & Illinois R.R. Co., a subsidiary of the Chicago, Burlington & Quincy R.R., and the Nashville, Chattanooga & St. Louis R.R. The Chief Engineer is C. H. Cartlidge (Bridge Engineer of the C., B. & Q. R.R.), and Ralph Modjeski is Consulting Engineer. The total cost will be about $3,500,000 for the bridge and approaches. The contract for the seven river piers was awarded in June to the Union Bridge & Construction Co., of Kansas City, Mo. Bids for the superstructure (the seven truss spans only) were received July 20, and the contract probably will be awarded in a few weeks. The bridge is to be completed in 1916.

Graphite Treatment for Boiler Scale

By L. W. Brooks*

Much has been heard in the last two years of the use of graphite in removing scale and sediment from steam boilers, and the writer has felt that this treatment should be of great interest to readers of Engineering News, comprising as they do a large number of water works engineers and general contractors.

Many believe the scheme to be a new one but really it dates back 25 years. Active interest in preventing boiler scale continues for two reasons: (1) reduction of efficiency—a deposit of scale 1/16 in. thick increases the fuel burned by 5 to 15%; (2) decrease in safety of operation—for scale is so poor a conductor that the boiler metal may be overheated.

In most plants the firemen have their own favorite methods of attacking the scale problem. Some are partly

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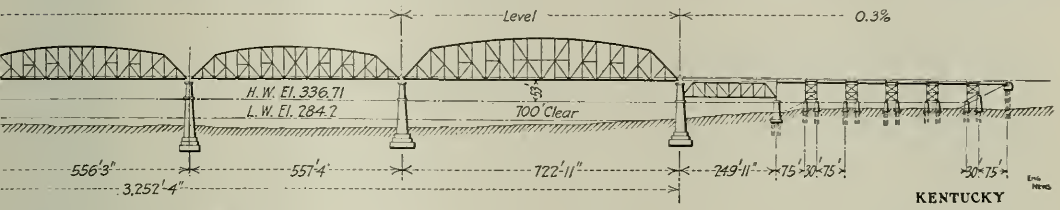
successful and others are useless if not actually harmful. In any case their success or failure is largely a matter of chance. A hit-or-miss attack is fairly certain to miss. Of the ordinary preventives, preheating the feed water, filtration, use of kerosene, introduction of zinc into the boilers, and chemical treatment of the water either inside or outside the boiler are the most common. Most such remedies are only a partial success for they do not remove all the scale, while some of the inside chemical treatments really do more harm than good.

The writer would not intimate that a chemical compound cannot be satisfactory. For instance if a water, known to contain a reasonably constant proportion of sulphate of lime, were treated with the proper amount



Ill.; Paducah & Illinois R.R.
Modjeski, Consulting Engineer.)

of carbonate of soda, no hard scale would be produced. Grains of carbonate of lime would fall down but would adhere to the plates and could, therefore, be blown out or gathered into sediment collectors. Chemicals would be in better repute if they were used more intelligently but unfortunately they are seldom compounded with reference to all the local conditions. The damage done to boilers by unsuitable compounds is enormous.

In contrast to such doubtful remedies the graphite treatment is conspicuous. The principle upon which it works is rather unique. It does not prevent the formation and precipitation of solid matter but it coats the interior of the boiler below the water line with a slippery veneer to which the scale cannot adhere firmly. Particles of graphite also settle on the bits of scale as they form and make the deposit soft or crumbly. As a result boilers can be cleaned with remarkable ease. Men who have cleaned boilers with hammer and chisel, or turbine cleaner, appreciate the difference. The writer has in mind one case where formerly five men required three days to clean the 580 caps of certain water-tube boilers. Since using graphite three men clean them in one day. Instances of this kind are common.

Graphite has no chemical action whatever. One would hardly believe it possible that graphite can remove old scale that the so called compounds have failed to loosen. The theory of its action is interesting. From the inside of the boiler, scale is seen to be full of fine checks or cracks, appearing somewhat like alligator skin. Contractions and expansions of the shell and tubes loosen the small sections at the edges. Graphite being swirled around in the water finds its way into the cracks and gradually gets under the edges of the sections of scale, thereby preventing the edges from sticking to the metal again. Continual expansion and contraction, with graphite filling the cracks, loosen the sections still more; graphite creeps in farther until eventually whole sections of scale are separated from the metal and they fall to the bottom of the shell (in return tubular boilers) or may be easily rapped loose. The writer knows where scale has been thus removed from water-tube boilers in which it had accumulated so thick that there was only a small hole left through the center of the tubes. To be sure, it took considerable time. The particular plant in which this was done is one of the thousands in which compounds have been used for years but have failed to prevent scale.

Graphite will not cause pitting or corrosion, is an excellent conductor of heat, prolongs the life of gaskets, packings and valve seats at least ten times their usual life, and in no way affects the quality of the steam. This latter virtue is welcome in plants that require clean steam—such as canneries, laundries, ice plants, and sugar refineries.

In beginning a graphite treatment it should not be expected to bring down the scale overnight or even in a week. It is reasonable to wait from three to ten weeks, according to the thickness and hardness of the scale, before appreciable results may be expected. Boilers operated continuously yield to the treatment more slowly than those in which the fires are banked overnight because of great dependence upon repeated expansion and contraction of the metal to crack the scale. Ordinarily the new scale deposits as sludge or in small lumps that may be removed each day by blowing-off. A really clean boiler is almost unknown unless graphite is used. In certain exceptional cases where the water contains unusually large amounts of solids it may be advisable to use a carefully selected chemical in conjunction with graphite so as to be doubly sure of getting rid of the deposit.

The method of introducing the graphite into the boilers is essentially the same as in feeding compounds. It is introduced into the feed-water line, preferably on the suction side of the feed pump, whence the water carries it to the boilers. The advantage of placing the graphite in the suction line is that it then lubricates the pump valves and packing. The graphite is equally efficacious in lubricating any hot-water meters and in loosening the scale in feed-water heaters, though such benefits are incidental. Anyone can rig up a home-made device for feeding graphite into the pump suction. The apparatus can be made to inject a whole day's supply at one time or may be regulated to give down its charge of graphite slowly throughout the day. The latter method is the best for obvious reasons. If boilers are in a battery, care should be taken that each boiler receives its share of graphite.

The amount of graphite required depends upon the character of the water. Ordinarily from a pint to a quart per day of twelve hours is sufficient for a boiler of

up to 250-hp. capacity. Larger boilers need proportionately more. The daily amount may be decreased as soon as the old scale has been brought down. In certain boilers the feed water first enters a mud pan or drum, the purpose of which is to separate from the water as much of the suspended solids as is possible. Naturally the mud drum will collect much of the graphite and prevent it from entering the boiler. As a result the regular prescribed dose of graphite will not be sufficient where the above condition exists, because only part of the graphite is really utilized in the boiler proper. It therefore becomes necessary to feed the graphite slowly throughout the day and to use more than is ordinarily required; otherwise the effect of the graphite on the scale will be of little value.

In comparison with "compounds," boiler graphite costs no more and usually costs less. The expense is overshadowed by the savings from improved steaming conditions. It is rare that graphite will not increase the steaming capacity of boilers at least 25%.

Careful consideration should be given to the grade of graphite best adapted to boiler use. Graphite as found the world over is divided into two general classes: (1) flake or crystalline, and (2) amorphous or powdered. Amorphous graphite is valuable for certain purposes, such as foundry facings or stove polish, where its properties of balling up or sticking together are not objectionable. It is a fact, however, that this form due to the physical characteristics of the particles, to a certain extent forms a mud in the boiler and settles on the plates and tubes. On the other hand, experience has shown that the finely pulverized, thin flake variety will be distributed evenly on the surfaces of the shells and tubes and become more permanently attached to the metal than the amorphous. Both amorphous and flake graphite are employed, but investigation shows that those who manufacture and sell both grades, recommend the finely pulverized flake material in preference to the amorphous, although the margin of profit is approximately the same on both.

A Test Case on the New York Labor Law

The constitutionality of the New York labor law, enacted eight years ago, is to be tested by carrying a case to the Court of Appeals.

The law provides that any public contract shall be void and the contractor shall not be entitled to receive any money thereon, if he [illegible] or permits a laborer, mechanic or workman, in his employ to work more than 8 hours in any one calendar day, except in case of "extraordinary emergency caused by fire, flood or danger to life or property"; if he pays less than the prevailing rate of wages for such trade or occupation in the "locality" where the public work is being performed or erected; or if he employs persons who are not citizens of the United States, native or naturalized. The law vests no discretion in public officers and is mandatory in its penalty of forfeiture of contract for violation of its provisions [illegible].

These drastic provisions of the law have prevented [illegible] financial obligations [illegible]. The General Contractors' Association has therefore arranged to have test suits brought on three small contracts in Bronx Borough, New York City, where deliberate violations of the law were made to furnish groundwork for the suits.

Mr. Charles R. Crane, Secretary of the General Contractors' Association, has submitted the following statement respecting the evils growing out of the law, as it now stands:

The courts and public officials have adopted a very liberal policy in construing the law in such cases of alleged violation as have come before them. In the eight years that the law has been in operation but one contract has been forfeited for violation of the labor law, and in that instance the contractor's claim for damages was settled out of court by the municipality affected by payment of a substantial sum.

Repeated efforts on the part of the State Labor Department to secure convictions, after finding what appeared to be substantial evidence of violations of the law, have failed. The contractor has always been able either to prove that an "extraordinary emergency" existed, or by a "preponderance of evidence" to establish that the complainants were mistaken.

These complaints have been mostly on overtime charges, and many peculiar situations arise which emphasize the defect in the law with regard to the eight-hour provision. It forbids the employer, under heavy penalty, to permit or require an employee to work overtime, but an employee may violate the provision with impunity. It is no uncommon occurrence on large contracts for workmen to make extra time by working in two shifts without the knowledge of the employer. These men are identified by numbers, or brass checks, and it is a simple matter for a laborer to leave his gang a few minutes before quitting time and apply for work at another gang starting on the next shift at a point some distance from his first place of work. With another timekeeper and foreman, it is almost impossible to prevent this, and the explanation of the two checks at the pay window is that one is for a "friend who couldn't come."

Needless to say, no contractor wants a laborer to work sixteen hours at a stretch; he wouldn't permit it, and he certainly wouldn't require it. The laborer wants the money, and he knows he is violating the law, but the only punishment that can be inflicted on him is discharge. In such instances the contractor would not be held responsible and would be in no danger of losing his contract, but the operation of the law is such that he could be put to great inconvenience if the discharged workman filed a complaint that he had worked overtime.

This complaint would serve to stop all payments on the contract until an investigation of the charge had been completed. The contractor would have to employ counsel to conduct his defence, and as the minimum time in which these proceedings can be concluded is about six weeks, in many cases he would have to borrow money to continue his work to replace his withheld payments. His only redress, on being absolved of the charge, is recovery of interest on his payments for the period of their retention.

The provision that no money shall be paid out on a contract pending the investigation of a complaint is a most serious menace to contractors. It is cheaper to buy [illegible] to submit to blackmail even when innocent of violations than to stand the expense and delay of the investigation. The opportunity to embarrass a contractor is too easy to be overlooked by one having a grudge. Unprincipled competitors have been known to file [illegible] complaints which are just as effective in tying up payments as bona fide affidavits. Affidavits have been filed by discharged workmen, to be withdrawn later if their demands are granted. The special Supreme Court grand jury in New York County which investigated the contract situation on the Catskill Aqueduct and other [illegible] admitted as one of its [illegible]:

"That the provisions of the Labor Law, as now administered with respect to public work, are used [illegible] themselves to a use by the [illegible] for the purpose of [illegible] from contractors [illegible] such public works."

[illegible] that section of the Labor Law [illegible] requiring that the prevailing rate of wages shall be paid in the "locality" where the work is done. Not only is it difficult at times to determine what the prevailing rate is, but the determination of "locality" is open to argument. The [illegible] of the state [illegible] a [illegible] "locality" [illegible] of a city. [illegible] in New York City, the rate [illegible] by labor unions is not

uniform throughout for the same class of work. The highest rates prevail on Manhattan Island.

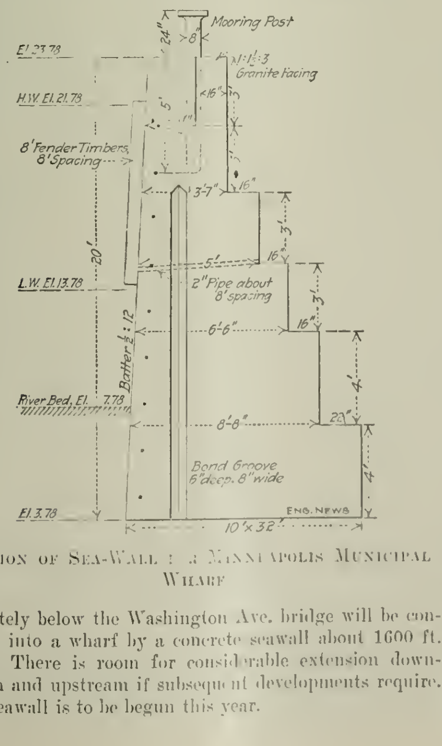
There is rarely a week that one or more complaints alleging that contractors are not paying the prevailing rate are not filed in the Finance Department, and only those persons who are familiar with the construction work now going on in this city can have any idea of the number of cases that are compromised under threat of complaint.

The test case involving the employment of alien laborers is highly important. It is true that this part of the law is honored more in the breach than in the observance, but it offers an opportunity as a "trouble maker" and has been brought up usually during ante-election campaigns to embarrass public officials who are candidates for office. While this law has been declared unconstitutional on two different occasions in this state, these opinions were rendered in trial courts and resulted in the acquittal of the contractor, thus rendering an appeal by the state impossible. The question therefore has not been passed upon by the highest courts, and the law remains on the statute books, fully operative whenever anyone sees fit to call it in use.

The officers of the General Contractors Association are: Franklin Remington, president of the Foundation Co., president; Edward S. Skillin, of Snare & Triest Co., first vice-president; Daniel A. Garber, president of the North Eastern Construction Co., second vice-president; William P. Schmuck, secretary of Degnon Contracting Co., treasurer; C. A. Crane, secretary.

Municipal Harbor Construction in Minneapolis

Improvement of the Mississippi River by a high-lift lock and dam half way between St. Paul and Minneapolis by the Federal government will shortly bring a navigation depth of 7 ft. up to Minneapolis where there has heretofore been only 2 ft. of depth. To develop all the navigation possibilities of this improvement the city of Minneapolis has designed and will shortly start building a municipal wharf. The right bank of the Mississippi im-



Section of Sea-Wall for Minneapolis Municipal Wharf

mediately below the Washington Ave. bridge will be converted into a wharf by a concrete seawall about 1600 ft. long. There is room for considerable extension downstream and upstream if subsequent developments require. The seawall is to be begun this year.

The river-gorge bluff is fairly close to the bank of the river along most of the length of the seawall, swinging back somewhat at the upper end in the vicinity of the bridge. Along the shore line, however, rock lies close below river bottom. The river bottom as it will be improved by dredging is at Elev. 7.78; rock is struck near this level all along the site of the wall, as test-pits have shown. A height of wall of 20 ft. from foundation to top is counted on as being adequate for all parts of the length. At one point a small run has cut a groove in the rock about 10 ft. below its general level, and this may require slightly deeper foundations.

The wall designed for this work, as shown in the drawing herewith, is a solid concrete gravity wall, with 10-ft. base for the 20-ft. height. It is to be constructed in lengths of 32 ft., separated by contraction joints. The wall will be backfilled level with its top.

The alignment of the wharfage involves a slight angle, about 1000 ft. from the upper end, the lower 600-ft. section swinging outward so as to form a hollow angle with the upper end. This is not likely to have any bearing on the use of the wharf however.

The city engineer plans to erect back of the seawall a warehouse 150 ft. wide, set back from the dock front sufficiently to give room for crane tracks and loading platform. No specific design for this part of the enterprise has been made.

The use of the wharf will require a certain amount of dredging in the river channel abreast of the dock. It is expected that the United States government will do this dredging outside of a line 10 ft. from the face of the seawall, to form a turning basin at the head of navigation.

The plans for the harbor development were worked out by the city engineer's department of the city of Minneapolis, F. W. Cappelen, City Engineer. An appropriation of $75,000 has been made by the city council, and work will start shortly. As in practically all other city work in Minneapolis this year, the day-labor plan of doing the work under direct charge of the city engineer's office will be followed.

NEWS NOTES

A 15-Ft. Sewer Trench Caved In when its shoring failed, in Montreal, Que., on July 20, killing one man and injuring another.

A Lifeboat Fell from Its Davits during a boat drill on the White Star steamship "Baltic," at Liverpool, on July 25, killing one man and injuring nine others. The boat fell 40 ft.

The Sunken "Empress of Ireland" has changed her position under the action of strong current, so that her masts are only about 35 ft. below the surface of the St. Lawrence River. Orders were given on July 24 to remove the masts with dynamite.

Burned Ties Wrecked the St. Louis, Iron Mountain & Southern R.R. mail train, one mile south of Diehlstadt, Mo., on July 21. Section men had been burning rubbish on the right of way and the fire had spread to the ties. Six ties were burned from under the rails at the point of the wreck, and a broken rail resulted when the train hit this point. More than 20 persons were injured.

A Broken Railway-Car Truck caused the wreck of a freight train on the East Penn R.R., at Macungie, Penn., on July 22, according to press dispatches. Twenty cars were involved in the derailment of the train, which consisted of 20 steel gondolas. The crippled car was the eleventh back of the locomotive, which went on with the front of the train. None of the train crew was hurt. A runaround was constructed.

A Broken Gas Main filled a manhole connected to a sewer, with [illegible] gas and caused the death of one person, recently, in Toronto, Ont. A main was broken by settling of the earth when the [illegible] was filled in. The gas passed from the manhole into the sewer. An engineer in the employ of the city was asphyxiated in the new sewer on Argyle St. from this cause. The contractor doing the work stated that the men knew of the presence of the gas four days before the death, and that the gas company had repaired the break a week before the death. Examination of the [illegible] indicated that death resulted from poisoning by carbon monoxide gas, which gas was present in the sewer in the proportion of eight parts in 1000.

Falling Structural Steel, which was being hoisted by a [illegible] to the 18th story of a new building being erected in Philadelphia by the F[illegible] Co. of Pennsylvania, blocked traffic for a half-hour by breaking a number of electric wires. The four steel members, weighing about a ton each and about [illegible] ft. in length, were suspended above the street when the [illegible] slipped. The beams struck the street, end on, ramming [illegible] a foot deep in the wood-block pavement. They rebounded in the air, falling against the trolley wires, which they bore down with them upon the track. Press reports state that [illegible] fastenings caused the accident. Just as the workmen were about to guide the four pieces into place one got loose, the others shot after it through the gap left in the [illegible].

High Wind Blew Down a 150-Ton Gantry Crane at the Marion power station of the Public Service Electric Co. of New Jersey on July 23. The crane which was parallel to the station, was blown along its track for a distance of about [illegible] ft., falling over on a yard locomotive. The span of the crane was 150 ft. and the length of the wheelbase 25 ft. Eight wheels on one side were locked by brakes. When the storm broke, the crane was standing at the western end of the [illegible] on a [illegible] dock on the Hackensack River. The wind started the crane, which acquired a high rate of speed along the level track, falling at the opposite end of the track. The tracks upon which the locomotive was standing were pushed about two feet into the ground. The damage is estimated at $50,000.

The crane had been in service 10 years. It handled coal from barges to storage piles and from the piles to the hoppers in the buildings.

Nearly a Half-Million Pounds of Dynamite Exploded—The [illegible] Powder & Dynamite Magazine maintained under the direction of the Depot Quartermaster at Mt. Hope, near the Gatun-Colon wagon road, about five miles from Colon, C. Z., was destroyed by an explosion at 9.[illegible] a.m. [illegible]. According to the "Canal Record," the magazine contained [illegible] lb. of dynamite and 15,3[illegible] lb. of Trojan powder. The [illegible] watchman was found dead about 72 paces from the magazine. The family of the night watchman, consisting of himself, wife and seven children, who lived in a small house about [illegible] yd. south of the magazine, escaped with slight injuries. The wall of the [illegible] house, about 180 ft. distant, was [illegible], allowing part of the roof to collapse. The shock from the explosion was felt in Mt. Hope, Colon and [illegible] and caused some damage in the way of broken glass, [illegible] life within a radius of several hundred yards of the explosion was destroyed.

The greater part of the powder and dynamite in the magazine was received [illegible] on May [illegible] since which time it has been inspected at required intervals and [illegible] The explosion is thought to have been due to spontaneous combustion.

The magazine was built into a hillside [illegible] at the back and sides it was surrounded by earth. The walls were constructed of hollow concrete blocks [illegible] ft. thick [illegible] the roof was of concrete reinforced with [illegible]. The building was [illegible] ft. [illegible] and [illegible] ft. high [illegible].

Two Steamers and One Large Sailing Vessel Went Ashore [illegible]

Other dispatches received at Halifax stated that the Austrian steamer "Irene" was ashore at Woody point, Pauline, and that the American schooner "Clarence C. Venner" crashed on the southwest ledges off Cape Sable. The crew was saved. The "Clarence C. Venner" was bound for Halifax from New York with 1300 tons of anthracite.

On July 19 the Italian bark "King Malcolm," bound from Portland, Me., to Richibucto, N. B., in ballast, was lost about seven miles from Yarmouth, N. S.

On July 18, the 3-masted schooner "Jennie A. Pickles," of Annapolis Royal, N. S., went ashore in a thick fog at Chance Harbor, in the Bay of Fundy. She was on her way from Bermuda to St. Johns, N. B., with a cargo of molasses.

June Floods Destroy Hundreds of Iowa Highway Bridges—May and June floods cost Iowa, it is estimated, $200,000 or more in damaged and destroyed bridges. What they cost in washed out grades and minor damage to highways, there is no possible way at the present time to even approximately guess. The estimate on bridge damage and loss is made by the field engineers of the State Highway Commission, who have been called to many counties by reason of the emergency work. The failures were due chiefly to two reasons, foundations insufficient and not properly placed reinforcing. In some cases of failure, the concrete material was of the best, but lack both of sufficient and properly placed reinforcing developed weaknesses that under ordinary circumstances would never have been detected. The washing out of creek and ditch bottoms, in some cases 9 or 10 ft. deep, disclosed many cases of the most woeful disregard of all engineering practices in the building of foundations. Concrete bridges were disclosed that had been resting on a thin film of black muck overlying quicksand. Many bridges went out for the simple reason that the wing walls were not securely tied by reinforcing to the abutment. This, with lack of depth in the foundation, allowed the flood water to sweep away the foundation of the wing wall, the lack of reinforcing allowed the wing to break from the abutment and topple, and with the fill melted away, the wrecking of the bridge was easy. Every concrete bridge wrecked had been built by bridge contractors on their own plans without other than their own inspection or by day labor by the counties themselves, sometimes on no plans at all. There is no record so far of a properly designed and constructed concrete bridge being destroyed.—[July "Service Bulletin" of the Iowa Highway Commission.]

Explorations for Two Dam Sites are being carried on by the Aluminum Company of America on the Little Tennessee River, near the Tennessee-North Carolina boundary. One of the proposed sites is just above [illegible], Tenn., and the other is nine miles above at the mouth of the Cheowah River, in North Carolina. The river runs through a deep gorge in both places. It is planned to develop [illegible] hp. to be transmitted to a reduction plant at Maryville.

Highway Work in Pennsylvania has begun in earnest. The release of the funds derived from the taxation and registration of automobiles, as noted in these columns of July 2, p. 52, amounts to about $1,[illegible], which can now be drawn upon by the State Highway Commissioner. According to newspaper reports no attempt will be made at new construction until repair and maintenance work has been accomplished. It is said between [illegible] and [illegible] men are already at work on the roads of the state.

Mesquite Wood Blocks have become so scarce that the city of San Antonio, Tex., has abandoned the plan of paving [illegible] sq. yd. of streets with this wood. The contract was let in April for over [illegible] sq. yd. of mesquite block paving, but the contractor has been unable to furnish the blocks. Mesquite is a very hard, tough, dense wood, almost indestructible, and has been used for the sills of adobe houses in the southwest for very many years. In many respects it makes an ideal material for paving.

Repetition of the Pittsburgh Sewer Explosion of Nov. [illegible], 1913 (see our [illegible], Jan. [illegible], 1914, p. [illegible]) occurred on Tuesday morning, July [illegible], 1914. It was a very small explosion compared with the [illegible] violent and extensive [illegible] of last November. The [illegible] St. [illegible] sewer near its outfall end was the seat of the explosion. The Lower [illegible] Mill of the Carnegie Steel Co. was slightly damaged. Repair and reconstruction work on the sewer has been going on [illegible] for the past seven months, the explosion of last November having destroyed a length of one mile of the sewer. This reconstruction is practically completed, some [illegible] had just left the sewer at the point of the accident when the explosion occurred.

A New Railway Bridge Over the Ohio at Scioteville is to be built by the Chesapeake & [illegible] Northern Ry. Co., a subsidiary company of the Chesapeake & Ohio Ry. The former company has asked permission of the War Department to erect a

bridge across the Ohio River a few hundred feet above the mouth of the Little Scioto River, at Sciotoville, Scioto County, Ohio. The bridge is to consist of two 750-ft. cantilever spans, with a south approach of 14 and a north approach of 11 deck plate-girder spans of 80 ft. each. Bids on the bridge have been called for.

The Road Congress at San Francisco—A general road congress, to be held at San Francisco during 1915, conducted jointly by the American Highway Association and the American Road Builders Association is being planned for. The plan was approved at a special meeting of the directors of the American Road Builders Association on July 17. The management of the joint meeting would be in the hands of a committee of five made up of two members from each association and a fifth member to be selected by these four. The meeting will probably be held immediately following the International Engineering Congress.

Six Large Contracts on the New York Rapid Transit system's extensions have recently been executed by the Public Service Commission. The aggregate amount of the six contracts is over $21,000,000. Two of these contracts were for the construction of the two East River tunnels, contract for which has been let to the Flinn-O'Rourke Co., an organization made up of the firms of Booth & Flinn, and the O'Rourke Engineering & Construction Co. A part of the Eastern Parkway subway in Brooklyn was awarded to the Cranford Co., the Canal St. subway in Manhattan to the Underpinning & Foundation Co., part of the Lexington Ave. subway in Manhattan to the Rapid Transit Subway Construction Co., and the Broadway subway from 26th to 38th St., to the United States Realty & Improvement Co.

The Record for Placing Concrete Masonry in Kensico Dam in the month of May, 1914, noted in "Engineering News," June 4, 1914, p. 1276, was surpassed in the month of June. The record is as follows:

Number of working days (8 hr.)	26½ days
Total masonry placed in dam, all kinds	76,970 cu.yd.
Average amount of masonry per day	2,905 "
Best day's work	3,314 "

Three gravity mixers, each taking 8-bag batches (nominal 2-yd mixers), were used for making the concrete. The average daily output per mixer, with no deductions for delays, was 669.7 cu.yd., or 83.7 cu.yd. per hour measured in place. Three-quarters of all concrete was mixed by two mixers located on the downstream side of the dam. The average daily output of each of these two mixers, with no deductions for delays, was 783.3 cu.yd., or 97.9 cu.yd. per hour, measured in place. The best day's output of one mixer was 1142.8 cu. yd., or 142.8 cu.yd. per hour, measured in place.

A Deep Water Diving Suit was tested in Long Island Sound off Stamford, Conn., on July 26, in a depth of 212 ft., which is probably a record for deep sea diving. The suit is in effect a metal casing, looking curiously like a suit of Chinese armor and jointed at the elbow, knee, hip and shoulder to allow movement of the diver. One arm is provided with a searchlight and the other with a grappling hook. The casing completely envelopes the diver and is of sufficient strength to resist pressures at least as great as that experienced in the test. According to the owner's reports, "no attempt is made to make the suit airtight, so that all of the water that works in through the joints is kept out by an automatic pump." Air for the diver is supplied through a pipe to the helmet, which pipe also contains a telephone wire.

The diver making the record was Arthur Gentsch, a well known deep-sea diver. The demonstration was under the direction of the Submarine Diving and Recovering Co.

An Electricity Rate of 18c. per kw.-hr. was recently protested to the Massachusetts Board of Gas and Electric Light Commissioners by the city of Northampton. An order of the Board governing the rates of the company in question, the Northampton Electric Light Co., has just been published. The company charged 18c. per kw.-hr. gross, for commercial supply, with a discount of 4c. for prompt payment, for the first 15 kw.-hr. For all in excess of 15 kw.-hr., the price was 11c. with 1c. discount for prompt payment. Net prices for power ranged from 6.7 to 3.0 per kw.-hr.; there were various special-service rates also. The prices for street lighting were $90 per year for all-night arcs, and $70 for midnight arcs with $5.56 extra per lamp for early morning operation. Several hundred 50-watt tungsten street lamps were used at $28 and $19 (all night and midnight). By special arrangement 12 street arches, carrying 208 50-watt tungstens were charged at $1200.

The company made a general reduction to 12c. maximum net commercial rate, $85 and $71 for arcs, and $21 and $18 for the 50-watt tungstens. The city asked for a general rate of 7c. per kw.-hr. for lighting, 5c. for street lighting and 2c. for power.

The Board reported that since 1888 (when the company began to report to the Board) the concern had failed to pay dividends in but two years. In only seven of the remaining had less than 6% been paid. In 1902, it began paying 8%, and in 1906, 10%. The annual dividends in the last five years had averaged over 20% and a surplus above interest, expenses and dividends of over $19,000 per year had been secured. The book value of plant and assets was $294,295, against which there were $206,878 in stocks, bonds and debts.

The Board fixed a rate of 9c. per kw.-hr. maximum net general rate; for arc lamps, $82 and $68; for tungsten street lamps, $17 and $13.50. The Board refused to touch other rates, holding that they were made from motives of expediency to obtain competitive business which could not otherwise be secured.

PERSONALS

Mr. F. L. Beal has been appointed Valuation Engineer of the Louisiana & Arkansas Ry., with offices at Stamps, Ark., under the direction of the General Manager.

Mr. W. A. Ebbert, formerly with the Pekin Wagon Co., Pekin, Ill., is now in charge of the dump wagon department of the Kentucky Wagon Manufacturing Co., Louisville, Ky.

Mr. Fitz J. Lewis, M. Am. Soc. M. E., Supervisor of the Pacific locks, Panama Canal, resigned, effective July 14, and sailed for New York July 16. He entered the Canal Service on Apr. 11, 1906, as a machinist in the shops of the Mechanical Division at Empire.

Mr. S. N. Mills, former Chief Clerk of the Block Signal and Train Control Board, Interstate Commerce Commission, has been appointed Inspector, and has been assigned to the work of investigating and testing signal and train control systems and other safety devices.

Mr. John L. Mohun, formerly with the mechanical department of the Pennsylvania R.R., is now Assistant to the Consulting Engineer of the Union Pacific R.R., the Oregon Short Line R.R. and the Oregon-Washington R.R. & Navigation Co., with headquarters at New York City.

Col. Henry G. Prout, M. Am. Soc. C. E., has resigned as President of the Union Switch & Signal Co., of Pittsburgh, Penn., to which office he was elected in April, 1914. A sketch of Col. Prout's career as a soldier, engineer, editor and business man appeared in these columns of Apr. 2.

Mr. E. L. Powers, Editor and owner of "Good Roads," New York City, and Secretary of the American Road Builders Association, was quite seriously injured in an automobile accident near Jamestown, N. Y., July 23. It is stated that he is now recovering and is resting comfortably in a Buffalo, N. Y., hospital.

Maj. G. A. Young, Corps of Engineers, U. S. A., has been appointed Professor of practical military engineering at the United States Military Academy at West Point, according to act of Congress, Apr. 15, 1914, which makes the head of that department at the Academy, hitherto known as Instructor, a Professor with the rank of Lieutenant-Colonel, U. S. A.

Mr. Charles D. Pollock, M. Am. Soc. C. E., has resigned as Chief Engineer of Highways, San Antonio, Tex., and has opened an office at 21 Park Row, New York City, as Consulting Engineer, specializing in paving. Before going to San Antonio, Mr. Pollock was Chief Engineer of Paving of Havana, Cuba. Previous to that he was with the Bureau of Highways of the Borough of Manhattan, New York City.

Mr. Henry R. Towne, Past-President, Am. Soc. M. E., President of the Yale & Towne Manufacturing Co., New York City, has been elected a Class B Director of the Federal Reserve Bank of New York, as a representative of commercial interests. The Class A Directors must be bankers. Mr. Towne has long been active in the affairs of the New York Merchants' Association and was President of that organization from 1908 until June, 1913.

Mr. Harold A. Petterson, Assoc. M. Am. Soc., C. E., Civil and Hydraulic Engineer, San Francisco, Calif., formerly Field Superintendent for the Union Oil Co. of California, left San Francisco, Calif., July 11, for China, where he has been appointed Professor of structural and hydraulic engineering at the University of Pei Yang at Tien Tsin. Mr. Petterson is a graduate of the University of California and was connected with the engineering staff of the Los Angeles aqueduct.

Mr. J. B. Lippincott, M. Am. Soc. C. E., of Los Angeles, Calif., has been selected by the Public Utilities Commission, of Denver, Colo., as its Consulting Engineer in connection with the proposed plan of constructing a new water-supply system for the city and county of Denver. Mr. Lippincott

[illegible] Chief Assistant Engineer throughout the construction of the Los Angeles [illegible]. The problem of providing a complete [illegible] system for Denver is very similar to the Los Angeles problem. Mr. Lippincott will undertake the preliminary [illegible] at [illegible].

[illegible] Cram, F. Am. Inst. Arch., of Boston, Mass., has been appointed Senior Professor of architecture at the Massachusetts Institute of Technology, succeeding Mr. [illegible] Knox Taylor, F. Am. Inst. Arch., resigned. Mr. Cram will continue in active practice and will devote only a part of his time to the Institute. Prof. William H. Lawrence, a graduate of the Institute and for many years Professor of [illegible], has been appointed Chairman of the Department of [illegible] and will be responsible for the administrative routine.

Mr. Max W. [illegible], formerly a Reclamation Service Engineer, of Hanford, Calif., has been appointed as one of the Assessors to determine the values of land along the Sacramento and San Joaquin Rivers, California, which will be taxable under the new "Flood Control" Bill. About 2,000,000 acres of river land, located in 14 counties, fall within the scope of the contemplated assessment. The project has already been approved by California, and the rivers and harbors bill, now pending in the national congress, if passed, will donate [illegible] to this undertaking.

The permanent staff for the operation and maintenance of the Panama Canal, which is soon to be opened for commercial traffic, is as follows:

Col. H. F. Hodges, M. Am. Soc. C. E., Corps of Engineers, U. S. A., is Engineer of Maintenance; A. H. Nichols, Office Engineer; Capt. W. H. Rose, Assoc. M. Am. Soc. C. E., Corps of Engineers, U. S. A., Electrical Engineer, Electrical Division, Balboa; [illegible] M. Wells, M. Am. Soc. C. E., Resident Engineer, Division of Municipal Engineering, Gatun; H. H. [illegible], M. Am. Soc. C. E., Civil Engineer, U. S. N., is Engineer of Terminal Construction, Culebra; F. H. Cooke, Assoc. M. Am. Soc. C. E., Civil Engineer, U. S. N., Designing Engineer; T. [illegible], M. Am. Soc. C. E., Engineer of Docks, [illegible]; J. A. Walker, Superintendent, Balboa; W. G. [illegible], Superintendent, [illegible]; [illegible] is Resident Engineer, Division of Dredging, Balboa; D. C. Nutting, Jr., Constructor, U. S. N., is Superintendent, Mechanical Division, Balboa; Capt. Hugh [illegible], U. S. N., is Superintendent of Transportation, Division of Canal Transportation; [illegible] D. E. Dismukes, U. S. N., [illegible] of the Port, [illegible]; Lieut.-Com. H. V. [illegible], U. S. N., Captain of the Port, Balboa; W. F. [illegible], Assistant Engineer, Lighthouse Construction, [illegible]; First-Lieut. A. H. Acher, U. S. A., is Assistant Engineer, Division of Fortifications, Culebra.

Mr. [illegible], M. Am. Soc. C. E., has resigned as Electrical and Mechanical Engineer, Panama Canal, and has returned with his family to the United States. He entered the Canal Service as Electrical and Mechanical Engineer on [illegible] 1906. During his period of service, he has been [illegible] with the [illegible] under the direction of Col. H. F. Hodges, formerly Assistant Chief Engineer, and since Apr. 1, Engineer of Maintenance, of the machinery and electrical equipment for the operation of the canal locks, spillways, and power plants, including the [illegible] station at Gatun, the substations at [illegible], Miraflores, and Balboa, and [illegible] transmission line. [illegible]

[illegible]

City. He was given a farewell reception by the Tivoli Club on Saturday evening, July 11, and by the University Club, on Wednesday evening, July 15. [From the "Canal Record," July 1[illegible].]

OBITUARY

William Yearlen, a young civil and mining engineer of Boulder, Colo., was drowned while swimming in a reservoir near Boulder, on July 10. He was formerly in mining work in Mexico. He was 26 years old.

W. S. Hecker, former Assistant to the President of the Norfolk & Western Ry., and for many years General Superintendent of the Western division of the railway, died July 19 at his home in Bluefield, S. C.

Marc Spencer, a young civil engineering graduate of the University of North Carolina, was killed July 21, by a fall while employed on construction work for the Southern Aluminum Co., at Salisbury, N. C. He was [illegible] years old.

Horace Crosby, M. Am. Soc. C. E., of New Rochelle, N. Y., died July 21. He was one of the founders of the city's public library and was at one time President of the Board of Education. He was one of the oldest members of the American Society of Civil Engineers, having been elected in 18[illegible].

David O. Fowler, President of the Uvalde Asphalt Paving Co., New York City, died at his summer home in Lawrence, Long Island, N. Y., July 2[illegible], aged [illegible] years. He was a great grandson of Admiral Comte de Grasse, the French naval ally of Washington in the Yorktown campaign which ended the Revolutionary War.

Horace H. Moses, an old-time civil engineer and in the early 80's Superintendent of Sewers of Boston, Mass., died at his home in Roxbury, Mass., July 21. He was born at Exeter, N. H., in 1831. In 18[illegible] he went to Boston and entered the office of a civil engineer. During his later life he devoted much time to landscape architecture.

William Perry, a [illegible] engineer whose experience dated back to the earliest days of American railroading, died July 23, at his home in Rochester, N. Y. He was born in Wales in 1821 and emigrated to America with his parents in 1828, when he was 7 years old. The family settled in [illegible], N. Y., where young Perry attended school until he was [illegible] years old, when he went to Rochester and entered the employ of the Auburn & Rochester R.R., [illegible] the New York Central & Hudson River R.R. He continued in active service from 18[illegible] until 18[illegible].

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.
Aug. [illegible]. Annual meeting in New York City. [illegible] H. [illegible], [illegible] Union Station, St. Louis, Mo.

AMERICAN PEAT SOCIETY.
Aug. [illegible]. Annual meeting at [illegible]. Secy., Julius [illegible], 17 [illegible], New York City.

AMERICAN BOILER MANUFACTURERS' ASSOCIATION.
Sept. [illegible]. Annual convention in New York City. Secy., J. D. Farasey, [illegible], Cleveland, Ohio.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. [illegible]. Annual meeting in New York City. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

NATIONAL ASSOCIATION OF PORT AUTHORITIES.
[illegible]

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.
Sept. [illegible]. Annual meeting at Chicago, Ill. Secy., [illegible] Ryan, Sterling, Ill.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.
[illegible]

NEW ENGLAND WATER WORKS ASSOCIATION.
[illegible]

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
[illegible]

ILLUMINATING ENGINEERING SOCIETY.
[illegible] New York City.

RAILWAY SIGNAL ASSOCIATION.
[illegible] N. Y. [illegible] C. C. Rosenberg, [illegible], Penn.

Engineering News

VOLUME 72 AUGUST 6, 1914 NUMBER 6

The Savannah River Levee, Augusta, Ga.

By Nisbet Wingfield*

SYNOPSIS—An eleven-mile earth levee, with reinforced-concrete bulk-head gates and retaining wall is being built by the city of Augusta from a point just above the city to and for three miles through the city and to a point eight miles below the city where it meets a bluff. Before describing the levee the causes which demand its construction are given.

※

The Savannah River heads in the Blue Ridge Mountains between Tennessee and North Carolina and flows southeasterly to the Atlantic Ocean. Located 202 miles from Savannah, or 220 miles from the mouth of the river, is the city of Augusta. From the head waters to Augusta, the river and its tributaries flow through a mountainous country, the highest point being 1600 ft. above sea level and the elevation at Augusta being 105 ft. Augusta is at the foot of the hills or "fall line" and from this point to the ocean the river flows through the coastal plane.

The total drainage area above Augusta is 7295 sq.mi., the rainfall from which quickly finds its way to the main stream. The extreme low flow of the river, at Augusta, during a record of 10 years, is 2300 cu.ft. per sec.; the ordinary low flow is 5000 sec.-ft. In times of greatest flood the river has a volume at Augusta of 300,000 sec.-ft. When these floods come, the water is kept within or near the river bank, on account of the high hills on each side, until it reaches the city of Augusta, which is located at the foot of the hills on the plane on the Georgia side of the river. On the South Carolina side, the foothills continue for some miles below the city, but on the Georgia side they stop abruptly at the upper limits of the city and there is no high ground until a point eleven miles further down is reached. This makes a gap through which the flood waters pour after the river reaches the stage of 34 ft., and the flow is directly through the business and manufacturing section; the flow passing to the low ground south of the city. On these occasions the entire business district and many miles of residence streets are under water, the depth of the overflow varying from 3 to 15 ft., according to locality. The loss of life and property at times have been tremendous. As the water flows in along the entire river front of the city, which is three miles, and also backs in from below the city, the only feasible method of protection was by a levee to be started at the high ground just above Augusta and continue down the river a distance of 11 mi. to a natural bluff on the river bank.

The city owns a water-power development which fur-

Fig. 1. Reinforced-Concrete Bulkhead and Gates at Hawks Gully, Augusta Levee

(Height, 49 ft. above foundations. There are 10 openings, each 5x15 ft. high in the clear. View taken on land side.)

*Chief Engineer River and Canal Commission, Augusta, Ga.

FIG. 2. REINFORCED-CONCRETE BULKHEAD, WATER-CONTROL

FIG. 3. LOCATION OF LEVEE FOR THE PROTECTION OF AUGUSTA, GA.

nishes all mills in the city with water power. This development was made 35 yr. ago before the hydro-electric method was thought of. There is a diverting dam (see map, Fig. 3) across the river seven miles above the city and a canal 150 ft. wide leads from this into and through the corporate limits of the city. The levee starts at the bank of this canal just above the city. At this point, emergency gates (Fig. 2) will be put in the canal to cut off the flood water from that direction if the river should back into the canal, as it has done during periods of high water. From this point the levee will go downstream, following closely the river bank, going between the mills and various other industries along the river bank and the river proper.

The ground on which the levee is being built was occupied by the railroad terminals, numerous mills and factories and a number of residences, all of which were bought by the city and moved to new locations.

As already stated, the maximum flood passing Augusta has been 350,000 sec.-ft. We have had four floods almost identical as to volume, but the record of rainfall over the watershed indicates that each of the several floods came from heavy precipitation on only a portion of the watershed and in no instance from the same area.

In determining the height of the levee, we provided for heavy rainfall over the entire watershed, which would bring the discharge at Augusta up to 400,000 sec.-ft. and the entire structure is designed to safely withstand this amount of flood.

The general construction of the levee is an earth fill sloped 3 to 1 on the river side and 2 to 1 on the land side, except at certain points where there was not sufficient space between the mills and the river. At these points reinforced-concrete retaining walls have been built

GATES AND LOCK IN AUGUSTA POWER CANAL AT HEAD OF LEVEE

on the land side and regular earth slopes carried out on the river side. The height of the embankment varies from a maximum of 46 ft. to a minimum of 10 ft. After passing through the city limits the levee will run eight miles downstream. The location is through hay farms, cotton fields and swamps.

At points where streams are crossed there have been constructed reinforced-concrete bulkheads with steel gates

FIG. 1. SIBLEY MILL BULKHEAD AND GATES

(Of reinforced concrete, 59 ft. high above foundations. The openings are 8x20 ft in the clear. View taken from river side.)

[illegible] views, Figs. [illegible] and [illegible]). All bulkhead foundations were [illegible] to solid [illegible].

At the [illegible] bridges crossing the Savannah River, additional spans have been constructed on the Georgia side of the river [illegible] on top of the levee. Proper approaches have been constructed by raising the roadway. At the point where the Southern Railroad is crossed, a gate will be put in with an elevation 6 ft. above the track. The C. & W. C. R.R., two miles below the city, will be raised to meet the level of levee.

The fill through the city will require [illegible] cu.yd. of earth, all of which is being hauled in by train from a borrow pit outside the city limits. From the eastern city limits to Butler's Creek, the fill will be made of earth borrowed along the line of the fill and the construction will be with scrapers. The slope along the city front is being paved with stone. That portion of the levee outside the city limits will be planted in Bermuda grass.

The pavement which is now being constructed is 18 in. thick, there being placed first a layer of crushed granite 6 in. thick, on top of which are laid stone slabs 12 in. thick, making a total of 18 in. This pavement was started at the bottom of the river at the toe of the natural bank, where a trench running parallel to the bank has been dredged 10 ft. wide to rock bottom. In this has been dumped heavy stone weighing from [illegible] to [illegible] lb., the same being brought up to an elevation that will intersect with the bank slope. From the shore side of this trench rock, the pavement is started and carried on over the entire bank and berm, without a break, to the crown of the levee.

The concrete retaining-wall at the Riverside Mills, [illegible] ft. in height, is carried on piles. Beneath this wall, sheet piling has been driven 27 ft., or practically to a level with the bottom of the river, in order to cut off a strata of running sand. This covers a space [illegible] ft. in length.

The sanitary and drainage systems of Augusta have heretofore all entered the river at various points along the [illegible] river front. We have 12 of these outfalls. To take care of the drainage during periods of high water without the necessity of constructing gates, it was determined to construct a new outlet emptying into the river eight miles below the city, at which point the flood level is not sufficient to back the water into the city. To accomplish this a drainage ditch 30 ft. wide and of varying depth has been constructed from the city to the river eight miles below. A large intercepting sewer is being constructed which will take all of the water passing out of the 12 outfalls and deliver it to this drainage ditch beyond the southern limits of the city. This will eliminate all openings through the levee, except at the large bulkheads at Sibley Mill, King Mill, Hawks Gully and the Southern Railroad. This sewer is being constructed of reinforced concrete, because at times there will be back pressure.

The total cost of the work, including right-of-way and paving the bank on the river side, will be approximately $2,500,000. The work has been divided into different contracts, varying in amounts from $50,000 to $[illegible],000, so that firms of moderate means can bid. In this way we are saving at least 10% of the estimated cost. Five contractors have completed jobs aggregating $[illegible], and other contracts are being let from time to time. A considerable part of the contract work was done by A. J. Twiggs & Son, of Augusta. Everything is going with a rush and we hope to have the city protected from all but highest floods by Jan. 1, 1915, and fully protected from all floods by Jan. 1, 1916.

Approximately $1,000,000 has been spent on the levee so far and recently the city voted $750,000 additional. The work is being done under a special board, called the River and Canal Commission. The writer is Chief Engineer and J. F. Parker is Principal Assistant Engineer of the work. The plans for the bulkhead were made by Charles A. Maxwell, of Augusta.

Fig. 5. Reinforced-Concrete Retaining Wall at Riverside Mills
(The wall is [illegible] ft. high and is supported on pile foundations.)

A Vibration Measuring Instrument, known as the [illegible] Vibrometer, was described in the London "Engineer" of [illegible]. The purpose of the instrument is to measure vibrations in rapidly moving machinery such as turbines or electric generators. The principle of the instrument is the tuning of a metallic reed until its response to the vibration which is to be measured. This does away with the necessity of obtaining some fixed stationary point [illegible] the machine to be measured.

Water-Level of the Great Salt Lake

By J. Cecil Alter*

The maximum stage of the Great Salt Lake, Utah, was reached June 10 to 15, 1914. It exceeded the crest stage of 1913 by 6 in. Last year the highest stage occurred during the latter part of May, and in 1912, during the last week in June, which is the average time for the high water to occur. The lake is averaging higher now than at any time since the middle eighties, long before the Saltair Beach bathing pavilion, near Salt Lake City, was built, and which stands now about 1200 ft. out in the lake in five or six feet of water.

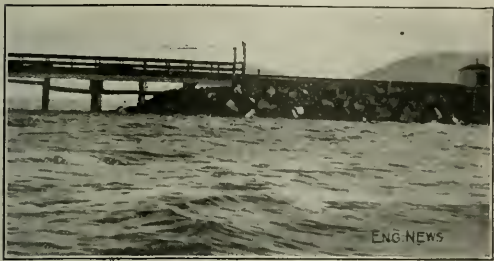


Fig. 1. East End of 11-Mi. Trestle of Southern Pacific Ry.

The oscillation of the lake, annually, amounts to about 1½ ft., though yearly oscillations have been as great as 3.6 ft.—from November, 1906, to July, 1907—and oscillations as small as one foot have been noted within the 11-yr. period of careful observations.

Beginning in June, the stream flow into the lake is being more and more utilized for irrigation purposes, and the stream supply from mountain snow is being more and more depleted, so that the amount of water flowing into the lake diminishes very greatly, besides this being the period of least rainfall over the Great Basin region. The loss of water from the lake by evaporation is greatest beginning in June, because of the increased heat, the greater number of hours of sunshine per day, and the increased velocities of the wind blowing over the lake.

These influences cause the lake to fall until the early half of January, each year, at which time the average wind velocities have lessened greatly, and other evaporation factors have become greatly lessened. This period of falling water usually covers about seven months. The rise takes place usually in a little more than five months. The greatest amount of precipitation over the Great Salt Lake watershed occurs in the spring; and with the melting snows and consequent rising streams, of March, April and May, the lake makes rapid rise to its crest stage.

The Engineering Department of the Oregon Short Line R.R. has kept a record of the semimonthly gage readings of the lake at Midlake station on the Southern Pacific Co.'s trestle, and at Saltair Beach, and of the rainfall over the contributory watersheds, together with the stream discharges into the lake, and the amount of snow accumulating and remaining in the mountains, as determined from Weather Bureau reports and bulletins.

The railway companies crossing the lake, both in the middle and at the southern extremity, are very much interested in the lake fluctuations because of the millions of dollars' worth of grade, trestle, track and improvements in the lake, for, not only do they wish to know where the water line will be on the grades and trestles, but stormy weather is much more to be feared when the lake is high than when low, as the wave action is much more serious, and wind tides are more disastrous.

About 16 mi. of the Great Salt Lake cutoff of the Southern Pacific Ry., between Lucin and Ogden, Utah, is over dry lake bed; 11 mi. is wood trestle across Great Salt Lake (Figs. 1 and 2). The first piles for the construction reached the lake in July, 1902. The rate of progress reached as high as 1140 ft. of trestle per day. Work was carried on from both ends and the juncture was effected Nov. 13, 1903. The construction of the Great Salt Lake cutoff is described in full in Engineering News, Feb. 27, 1902, p. 175 and Nov. 27, 1902, p. 442.

The resort companies in times past have found it necessary to rebuild or remove many expensive bathing houses and piers because of the changes in level.

The salt harvesters are also interested because their dirt dikes along the shore, inclosing the evaporating ponds, are sometimes endangered in high-water times, when strong wind tides are produced in wind storms of long duration.

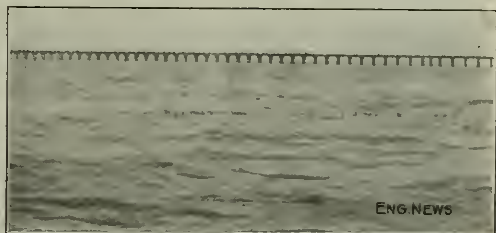


Fig. 2. Portion of the 11-Mi. Trestle

They are also interested in the probable depth of the water because the density of the brine has varied from about 25% to 20% solids, during the past 11 yr. The salt contents of the lake remains about the same, though it is diluted in time of high water, requiring the pumping of more water into the ponds, and longer waiting for it to evaporate, to obtain the same amount of salt.

*United States Weather Bureau, 1103 Boston Building, Salt Lake City, Utah.

Ohio Highway Facts—Ohio has (approximately) 83,700 miles of public roads outside of municipalities; 28,413 miles are improved. Of 11,000 miles of streets within the limits of the various municipalities, 6360 miles are improved. Some 573 miles of road improvement have been contracted for from the organization of the State Highway Department, in 1905, to November, 1913; 373 miles were contracted for during the last three years—up to and including Nov. 15, 1913; 103.7 miles of additional improvement have been contracted for from Nov. 13, 1913, up to the present time. Petitions had been filed for 7047 miles of improvement up to Jan. 1, 1914. The State Highway Department expects to improve approximately 500 miles of roads before the close of 1914. More than 55,260 miles remain unimproved. Ohio ranks third among the states in the percentage of public roads improved. Concrete roads have been built in 29 of the 88 counties of Ohio. Brick roads have been built in 39 counties. Cuyahoga County has the greatest mileage of brick roads (172.9). Huron County has the greatest mileage of concrete roads (16.0).—[From the June "Ohio State Highway Department Monthly."]

Washington Street-Cleaning Field Methods

By J. W. Paxton*

SYNOPSIS—This article is a continuation of the preceding one by Mr. Paxton in Engineering News *of July 9, 1914, p. 58, which described the cost-keeping methods. The following article describes in detail the field methods—the hand patrol; the machine-broom work; squeegee washing; flushing; suburban street cleaning and alley cleaning. Snow removal is briefly described. The stables and supply and repair divisions are included.*

The territory taken care of by the Washington Street Cleaning Division includes all of the streets in the city, certain suburban sections with gravel, macadam or unpaved streets and an extensive alley system.

The city is divided into two sections with approximately the same amount of cleaning in each. Almost in the center of one of these sections is a stable, the main storeroom, and repair shop; a second stable, auxiliary storeroom, and repair shop, are nearly in the center of the other section.

To meet the different conditions and requirements, cleaning is of several classes, such as Hand Patrol, Machine-Broom Cleaning, Alley Cleaning, Suburban Cleaning, Flushing, Squeegeeing, Oiling and Snow and Ice Work.

Hand Patrol

The hand-patrol area consists, at the present time, of approximately 3,[illegible] sq.yd., or about [illegible]% of the total paved area of the city. It includes practically the entire business section and considerable residential territory adjacent thereto.

Sections—This area is divided into five sections of from approximately [illegible] sq.yd. to [illegible] sq.yd. Each section is under a foreman with a force ranging from 32 men and 2 wagons to 57 men and 3 wagons, the total force employed being 221 men and 13 wagons. The average area per man is about 13,000 sq.yd., which is somewhat larger than reported for other cities, probably due to the frequent washing given the streets, to the fact that Washington has very little commercial traffic, and that men are employed strictly on merit. Each gang may cover its territory several times during the day, but the area is only credited once for a full day's work; one-half for one-half day's work, etc. At the end of the month, the total area credited is divided into the total cost charged, for each gang, giving the unit cost.

Subsections—Each foreman divides his large section into subsections to be worked by one, two, or five men. The area per man is dependent on the amount and character of traffic, the presence of car tracks, the sanding of car tracks, kind and condition of pavements, grade, surrounding population, [illegible] of unpaved streets, and the force available.

The one-man section is generally located in the suburbs where little dirt accumulates, and a large territory may be covered; the man sweeps, pans and sacks the dirt as he goes along. The two-man section is standard; the more active man uses a pan-scraper, broom or hand machine and deposits the dirt in the gutters; his partner with a bag carrier, collects the material so deposited, and sweeps the gutters clean.

The five-man section is used on broad, heavily traveled streets, where the area is large in proportion to the gutter length. The method here employed is similar to that on the two-man section, two men with bag carriers collecting the dirt deposited in the gutters by the other three.

Section Maps—The original development of the subsection is left to the foremen. The limits of each subsection and the number of men employed are reported to the office where the areas of each subsection and the areas per man are computed. This information, together with

Fig. 1. Hand Patrol Gang at Work, Showing the Pan Scraper, Hand Machine, and Bag Carrier Used in Washington; the Wagon Is Collecting the Filled Sacks

*Superintendent of Street Cleaning, Washington, D. C.

the amount of dirt collected per man, is plotted on a map, which is studied and rearranged in the effort to obtain a uniform task for each man.

RELATION BETWEEN AREA AND DIRT COLLECTED—The relation between area and dirt collected is theoretically an inverse ratio; other things being equal, that subsection showing the greatest area per man should accumulate the least dirt per 1000 sq.yd., while the minimum area per man should show a maximum of dirt collected per 1000 sq.yd. Frequent conferences between the office force and foremen are held to make and receive suggestions as to the best size of subsections.

The area of the subsections established, ranges from 6000 sq.yd. in the market section to 52,000 sq.yd. in the lightly traveled residential sections. The amount of dirt removed per day per bag carrier runs as high as 200 sacks during leaf season, and again as low as 8 or 9. The average per bag carrier per day lies between 10 and 20, each sack holding about 2 cu.ft.

HAND PATROL VS. MACHINE WORK—Experiments have been made as to the relative cost of machine work and hand patrol. It was found, in most cases, that the streets were kept in better condition, when the same amount was expended on hand patrol as on cleaning by machine brooms every other day.

In hand-patrol work, where the traffic conditions are variable, the distribution of the men can be increased or diminished accordingly. The greatest attention is given to the portions of the streets which need it the most, and the attention is continuous, the streets being just as clean at one time as at another.

With machine-broom sweeping, however, the entire section and every portion of each street must receive the same amount of sweeping. The streets present a good appearance immediately after the passing of the brooms, but become more unsightly than in hand-patrol work before the next cleaning, as the interval is much longer.

The machine broom raises so much dust that heavy sprinkling is required; the fine dust mixes with the water into mud, which is smeared on the street by the broom, and on drying, turns back to dust. The brooms only sweep the coarser particles and many of these are thrown over the broom by centrifugal force, back to the pavement again.

The policy of the division has therefore been to curtail the machine-broom area, whenever possible, in favor of the white wing work, supplemented, as funds are available, by washing in the more important and heavily traveled portions of the city.

SMALL POWER-OPERATED BROOMS—In hand-patrol work, a large proportion of the energy and time is consumed in traveling from one dirty portion of a street to another, particularly after the streets have been cleaned in the morning, or on streets where the traffic is light.

In an effort to increase the efficiency of this work, experiments have been tried with a light motor-driven tricycle, operated by one man. The broom is rotated by the engine, when lowered to the pavement, so as to brush the dirt into a pan receptacle; but it is disconnected, when raised, for traveling. A scraper in front of the broom loosens dirt which is stuck to the pavement.

This machine deposits the dirt in the gutters, and white wings equipped with bag carriers collect it as well as clean the gutters. The machine is still in the experimental stage, but the results obtained have been very encouraging. It may be possible eventually, by the use of a conveyor, to lift the dirt into bags or cans carried on the machine, doing away with hand-patrol work entirely.

SUPERVISION OF HAND-PATROL WORK—Motorcycles have been used to reduce the overhead expense of the hand-patrol work; three of the foremen supplied with these machines, take the places of four using bicycles, and they supervise a somewhat larger area. It is expected that another rearrangement of the white-wing area will shortly be made and the supervisory force reduced to four men, each equipped with a motorcycle, where six men with bicycles were formerly required. The foremen are very well satisfied with the machines, each making an average of from 50 to 80 miles per day.

HAND-PATROL EQUIPMENT—The equipment used on hand-patrol work consists of bag carriers, hand machines, pan scrapers, bamboo push brooms, sacks, shovels, sprinkling cans, etc. The dirt collected is placed in sacks which are collected in wagons manufactured by the Department. The question of building underground pits to hold the accumulation of street sweepings is being considered, but the initial cost would be so large that money is not available at the present time for this purpose.

The hand machine consists of a revolving bass broom mounted on wheels between two metal boxes, its action being exactly similar to that of a carpet sweeper. It is especially useful for removing fine dust on smooth pavements, but pan scrapers are found to be more generally useful.

MACHINE-BROOM CLEANING

The machine-broom area consists of approximately 2,000,000 sq.yd. or 43% of the paved area of the city; this territory is almost entirely residential. Some of the streets with heavy traffic are cleaned daily, others with very light traffic are cleaned three times in two weeks, while the majority are cleaned every other day.

The force employed in this work consists of two gangs of one sprinkler, three machines and four carts, and one gang of two sprinklers, six machines and seven carts, sufficient broom men being provided to pile the dirt swept to the gutters by the machines, the number of broom men depending on the general conditions of the territory under attention.

SUPERVISION OF MACHINE WORK—The supervisory force maintained for this division of the work consists of four foremen; one with a buggy for each three-machine gang, and two—one with buggy and one with motorcycle—for the six-machine gang.

Previously, four gangs of three machines were used, but it was found that while the machines were being closely observed, the cart men were practically left to themselves, it being impossible to follow both the machines and carts and make the necessary trips to the dumps. Two of these gangs were, therefore, combined, the machines being put in charge of a foreman with a buggy, while the carts worked under the direction of a second foreman with a motorcycle. This arrangement has not materially increased the yardage cleaned, but the foreman with the motorcycle has been able to give such attention to the carts that his force has been reduced from eight to seven.

METHODS OF OPERATION—The ratio of one sprinkler with three machines was found by experiment with odometers in connection with the cost keeping to be the most

Fig. 2. Machine-Broom Street Cleaning Gang; Washington, D. C.

efficient for local conditions. Under the contract system the organization of the gangs varied from one sprinkler with three or four machines to two sprinklers with five machines. These different combinations were tried out and it was found that higher unit costs were obtained with the one-three than with the one-four combination; but in the latter case the distance traveled by the sprinkler horses, in order to keep up with the machine, was prohibitive. The one-three combination gave a uniform distance of about 25 miles per day, for both machines and sprinkler, while the two-five combination favored the sprinkler as to distance traveled and gave still higher unit costs.

The mode of operation followed is for the sprinkler to precede the machine some little distance, the valves being stopped so that only enough water escapes to lay the dust and at the same time not cause mud. The machines follow each other, overlapping slightly, each street being swept from the center toward the curb.

It takes about two full working days for each gang to sweep their section. Sweeping must be done continuously from the time of leaving the stable until the return and in order to do this one side of the running street is swept going out, leaving the other side to be swept coming in. After reaching the territory, the order of sweeping is arranged as seems best in the judgment of the foreman at the time. An effort is made, however, to reduce the amount of turning to a minimum and always to sweep toward the dumps.

Each machine averages about 85,000 sq.yd. per day, the records, however, show spurts as high as 100,000 sq.yd. It should be noted that this class of work is harder than any other on live stock, although the draft is light, possibly due to the fact that the animals have no breathing spells or variation in work.

In leaf season, no additional machine work is required. The carts, however, have a much greater bulk to handle although the additional weight is very little. To care for this, all machine carts are provided with side and end boards of light weight, which fit on the flareboards, increasing the capacity of the cart about 2½ cu.yd. After leaf season, these tops are removed and stored for the next year.

Squeegee Washing

The area covered by the squeegees comprises about 1,766,000 sq.yd. of the smoothly paved streets in the white-wing section, being about 61% of the total white-wing area. The force employed on this work consists of three gangs, each under a foreman, and composed of one

Fig. 3. Squeegee Street-Cleaning Gang; Washington, D. C.

sprinkler and three machines, the territory being covered about twice per week. During the winter months, this force is decreased to two gangs of one sprinkler and three machines each, the interval between washings being correspondingly increased.

METHOD OF USING SQUEEGEES—The ratio of the number of machines to a sprinkler has been worked out in a manner analogous to that described under machine-broom cleaning, this combination proving the most economical. When filled, each squeegee carries as much water as an ordinary sprinkler, the broom must be dragged along the pavement and also revolved in the opposite direction to this motion; so it has been found advantageous to use three horses with each squeegee in the battery which works in a hilly section of the city.

Squeegeeing about twice per week almost entirely eliminates a fine scum which becomes plastered to the pavements, particularly sheet asphalt, which is not apparent when the pavements are dry but rises up in a thin sheet of mud when moist, making the pavements very slippery. This and fine dust cannot be removed by the hand cleaners.

Washington having a comparatively high-pressure water system, the machines used are of the hydraulic compressed-air type, and on the streets which are dirtiest will clean approximately their own width. Each filling is sufficient for a swath of about 500 ft. in length.

METHODS OF OPERATING FLUSHING MACHINES—The flushing machines are operated like the squeegees, each machine taking up the wave from the one in front and forcing it 7 or 8 ft. further toward the curb. Operated in this way, they are very efficient, but the cost of cleaning is about three times as much as squeegee work, so flushers are only used on streets unsuitable for squeegees.

It has been observed, in some other cities, that streets are said to have been flushed if one trip through has been made with a single flusher, and from the low cost of flushing reported from other cities, it is assumed that this is the method there pursued. Experiments here, indicate that this amounts to little more than sprinkling, although the pressure developed from the hydrant is always at least 45 lb. per sq.in.

Flushing being resorted to only on other than good sheet-asphalt streets, the territory is necessarily scattered

FIG. 4. FLUSHING GANG; WASHINGTON, D. C., STREET CLEANING DEPARTMENT

The sprinkler with the valves wide open precedes the squeegees at some little distance, the object being to thoroughly saturate this scum and soften the dry material on the street for removal by the squeegees. The machines follow each other as closely as possible, each machine receiving the dirt mixed with the water from the machine in front, and carrying it the width of the broom toward the curb.

The dirt deposited in the gutters is collected by the white wings, the cost of the collection being charged to that class of work, squeegeeing being considered an adjunct to the hand-patrol system and the charge for removal made on the theory that, were no washing done, this accumulation would have to be removed by the hand-patrol force.

FLUSHING

The flushing area comprises all worn and block pavements in the white-wing section, the entire territory totaling approximately 300,000 sq.yd. or 11% of the total white-wing area, each street being flushed about twice weekly by a gang of one foreman and three machines, three horses being used in each.

and it is impossible to arrange running streets or eliminate dead travel as is the case with other machine apparatus. The daily task performed only amounts to about 30,000 sq.yd. per machine.

CLEANING AND OILING SUBURBAN STREETS

The suburban territory consists of approximately 1,500,000 sq.yd. of water-bound macadam or unpaved streets. The object of this work is to keep the gutters clean, remove all trash, ravelings and weeds. Two gangs, each having a foreman with bicycle, ten men and four carts are employed.

DUST LAYING—In the fall of 1911, experiments in dust laying were tried on certain suburban streets, with calcium chloride and emulsified oil, instead of sprinkling with water, resulting in the decision to use only emulsified oil in the future.

In the spring of 1912, practically all of the suburban streets were thoroughly cleaned and swept with a sweeping machine, without sprinkling, before an application of oil was made. From then on applications of a mixture of about 1 gal. of oil to 6 or 7 gal. of water, spread in the proportion of approximately $^1/_7$ gal. of the mix-

yard to 1 sq.yd., were made about once every ten days or two weeks, the streets being cleaned with hand brooms previous to each application.

By this method, the dust nuisance was almost entirely eliminated. Less money was spent for sprinkling and oiling than for sprinkling alone during the previous year. Less suburban street cleaning was necessary, on account of there being less dirt and dust to be removed, and the general appearance of the streets was very much improved.

By the oiling method only enough equipment is required to cover the entire territory about once every ten days or two weeks, while by the sprinkling method it was necessary to carry enough equipment in wet weather to cover the entire territory two or three times a day in dry weather.

Only applications of light or emulsified oil will probably be made in the future, as dust laying and not road maintenance is the object in view, and where heavy oil is used in the city, many complaints are received on account of its being tracked into the houses.

Alley Cleaning

The alley system of Washington comprises approximately 1000 alleys, the majority being wide and well paved, the area amounting to about 1,000,000 sq.yd. The cleaning is done by three gangs, each under a foreman with a bicycle; two consisting of a sprinkler, one-horse sweeping-machine broom, three carts and six laborers; the other being a small hand gang of one sprinkler, three carts and four laborers, cleaning mostly narrow and very dirty alleys.

One-Horse Machine Brooms—After the contract system was abolished (previous to which all alleys were cleaned by hand), it was found by experiment, that many alleys could be most economically cleaned by one-horse sweeping machines. A chart of the daily yardage cleaned by two of the gangs, for six months after taking over the contract work, was plotted and studied. The foremen were then called to the office and this chart explained and suggestions invited.

As a result of this conference, entirely new schedules were issued in which the alleys were arranged in an approximate circle. These schedules were put in operation and an immediate increase in area cleaned resulted. Later squares containing alleys were classified as follows: those in which the alleys were paved and could be swept entirely by machines, by machines with one hand shaft, by machines with two or more hand shafts, or by hand; and those in which the alleys were partly paved or unpaved.

Classification Map—On a map of the city, all squares corresponding to the first classification were colored in red, to the second, in green, and so on, using a different color for each classification. Two alley schedules to be cleaned by machines, were then traced out, containing, as far as possible, all the squares in the first three classifications, and another schedule to be cleaned by hand, containing the balance of the squares.

An attempt was made, in each case, to arrange the squares in such order as to minimize the distance from the outlet of the alley in one square to the entrance to the alley in the next. Of course, where hand alleys were isolated and surrounded by machine alleys, they were absorbed in the machine schedule, and machine alleys were, in many cases, included in the hand schedule. The lines on the map representing the movements of the alley gangs have the appearance of a maze but every line has received careful study.

Fig. 5. Suburban Street-Cleaning Gang; Washington, D. C.; for Cleaning Macadam and Unpaved Streets

Snow and Ice Work

While Washington is subject to frequent snow storms, very few of them are severe. The climate is such that during the greater part of the winter, the snow disappears within a few days. The streets are wide and the traffic is not often interfered with. No effort is, therefore, made to remove snow except from a few street and railway intersections, and the principal transfer points. The street

railway companies bear a large proportion of this expense.

In case of a snow fall of 2 in. or over, snow plows are sent out early in the morning to open up sidewalks throughout practically the entire white wing and machine-broom area. Later in the day, the gutters are all opened by gutter plows in practically the same territory. Crosswalks and gutters are kept clear, openings made from the crown of the streets to the gutters, and the snow is sometimes transferred to the sunny sides of the streets. The idea is to assist the snow as much as possible to melt, and run off immediately to the sewers, before the water has time to freeze.

Stables

The two stables are both new; they are fireproof even to the extent of having iron stall partitions, rolling steel doors at the larger openings, and sprinkler systems in the feed rooms. They are designed for plenty of light and air; nearly all the horses have windows above their heads. There are electric lights throughout. Both stables are plentifully supplied with washing arrangements, all equipment being washed every night.

Only a sufficient force is employed at each stable to clean the building, to feed, water, and shoe the horses, and to watch at night. The horses and harness are taken care of by the drivers.

Duties of Drivers—All drivers must be familiar with the city and trained to their work. Some must use considerable intelligence in routing their machines, and others must load their own carts and wagons. Practically, they must serve two masters, the foreman on the streets and the stable boss in the stables.

Theoretically, however, when the driver satisfies one and not the other, and the case comes to the superintendent, the driver is considered to be under the orders of the stable boss, the team and driver going to the foreman as if it were rented from the stable boss, the foreman returning the whole outfit to the stable and requesting another until satisfied. This is on the principle that the stable boss cannot be made responsible for the horses unless he controls the drivers.

Some diplomacy and good feeling on the part of both foremen and stable bosses is necessary, but very little trouble has been experienced so far, and it seems to be the only solution to a problem which promised to be difficult.

Repairs and Supplies

The foreman of repairs is responsible for the condition of all property, such as buildings, cleaning machines, wagons, carts, harness, etc. The foreman of repairs orders or manufactures all supplies and equipment; and he must correctly anticipate the needs of the division. His work is rarely stationary, for it requires inspection of scattered equipment, the supervision of odd jobs here and there, and experimenting with and perfecting apparatus.

The foreman of repairs is, therefore, furnished with an automobile or hurry-up wagon, arranged as a light motor truck, to carry tools and light supplies. He has under him a shop foreman, who has charge of and remains constantly at the repair shop, a material clerk who attends to the ordering of supplies, and a storekeeper who takes charge of the supplies when received, and distributes them.

Fig. 6. Alley Cleaning Gang; Washington, D. C., Has Approximately 1000 Alleys

Statistics of Steel Production in the United States during 1913 are summarized in Special Statistical Bulletin No. 5, issued by the American Iron & Steel Institute, which succeeds to the work so long carried on by the late James M. Swank. Steel production in the United States in 1913 exceeded all previous records, being 31,300,874 tons. The production was, however, only 50,000 tons greater than in the year 1912. Almost exactly half this steel was produced in Pennsylvania. Ohio came next with 6,700,000 tons; Indiana and Illinois combined produced nearly 5,00,000 tons. The open hearth process of steel production now far exceeds the bessemer in volume of output. Last year the bessemer steel produced amounted to 9,545,000 tons, while the open hearth steel amounted to 21,600,000. The maximum bessemer steel production was reached in 1906, when 12,275,000 tons were produced. This compares with 11,000,000 tons of open hearth steel in the same year. Since then open hearth production has been increasing at a rapid rate, while bessemer has fallen off. The production of crucible steel amounted to 121,000 tons, while 34,000 tons were made in the electric furnace. The alloy steels produced amounted to 714,000 tons. The business of steel founding has had a large development. Over 1,000,000 tons of steel castings were produced last year, which compares with 132,000 tons of steel castings in 1898. Nearly all the open hearth steel made is now made in basic furnaces. Only 1,255,000 tons of open hearth steel were made in acid furnaces. The total number of works manufacturing steel from raw materials is 304, located in 30 different states of the Union and in the District of Columbia and Panama.

A Concrete-Incased Steel Viaduct at Chicago

SYNOPSIS—This article describes the decorative treatment of a plate-girder bridge over a boulevard and park-way, in order to secure an attractive appearance. The exterior girders and columns are covered with concrete, with effective results.

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The track-elevation work of the Baltimore & Ohio R. R., at the western section of Chicago, crosses Independence Boulevard, which is a broad thoroughfare connecting two parks and is under the jurisdiction of the West Chicago Park Commission. The boulevard is 250 ft. wide between street lines, and has two 32 ft. driveways separated by 151 ft. of parkway. The railway structure is a plate-girder viaduct, but the park commission required that it should be made of pleasing appearance, subject to its approval, and to meet this requirement the railway company adopted the plan of masking the outside girders and columns with concrete, giving the appearance of a masonry structure. The result has been very satisfactory, as may be seen from the view of the work in Fig. 1.

The park commission requires the railway to conform to the following conditions: (1) to maintain the concrete work in good condition; (2) to paint the exposed steelwork an approved light color, and repaint it when required; (3) to construct a tight floor which will prevent water, dirt and oil from dropping through.

The roadways are depressed 2 ft. at the viaduct, and the change from normal grade to the inclined approach at each end of the depression is made by a vertical curve connecting with the grades at points 80 ft. on either side of the center line. The paving is of asphalt on a 6-in. concrete base. The curbs are of granite, 6 in. thick and 2 ft. deep, except that where the cap is more than 1 ft. above the gutter the curb is 2½ ft. deep, 6 in. thick at the top and 12 in. at the bottom. The parkway beneath the bridge is covered with 6 in. of crushed limestone, bonded with screenings, and the sidewalks under the bridge extend to the curbs, the grass parking being omitted. The concrete sidewalks, curbing, paving, electric conduit and sewer work were done by the railway company in accordance with the specifications of the park commission.

The structural design was prepared under the direction of F. L. Stuart, Chief Engineer, and W. S. Bouton, Bridge Engineer, of the Baltimore & Ohio R.R. The design of the concrete covering was prepared by F. E. Lockwood, architect, of Chicago. The steel erection and concrete work were done by the railway company, being in charge of L. G. Curtis, District Engineer. The design and construction were under the general supervision of A. C. Schrader, Chief Engineer of the West Chicago Park Commission.

Steel Structure

The viaduct is a four-track structure with nine spans. There are two driveway spans 35 ft. c. to c. of columns, separated by five spans of about 25 ft. 7 in., while the two end spans are 30 ft. at the west end and 21 ft. at the east end. The headway is 13 ft. at the roadways (which are depressed 2 ft. at the crossing), 8½ ft. at the center to 11 ft. at the sides of the central parkway, and 10 to 11 ft. at the sidewalks (there being a slope of 1 ft. from the abutment to the curb.)

Fig. 1. Concrete-Incased Plate Girder Viaduct across Independence Boulevard, Chicago, Baltimore & Ohio R.R.

Each of the eight bents has five columns, connected at their upper ends by latticed struts, as shown in Fig. 2. In six of the bents each column is composed of a pair of 15-in. channels (with the flanges outward) and a 12-in. web-plate attached to the backs of the channels by four angles 4×3½ in. The third bent from each end, however, carries an expansion point, the structure being thus divided into three sections. In these two bents, each column is composed of two parallel 15-in. web-plates, with four flanges 1/2 in. on each side, and with diagonal lacing bars over the outer angles.

The bents carry five lines of 41½-in. plate girders, the girder depth being the same throughout and extra strength in the longer spans being secured by heavier

webs and flange angles. The webs of the outer girders have holes for short rods to bond with the concrete covering. The floor system consists of transverse 15-in. I-beams 21 in. c. to c., these being placed just above the bottom chords and secured to the girder webs by angle connection-plates. At the middle and end of each span are triangular brackets or gusset plates riveted to the girders and to the top of the floor-beams.

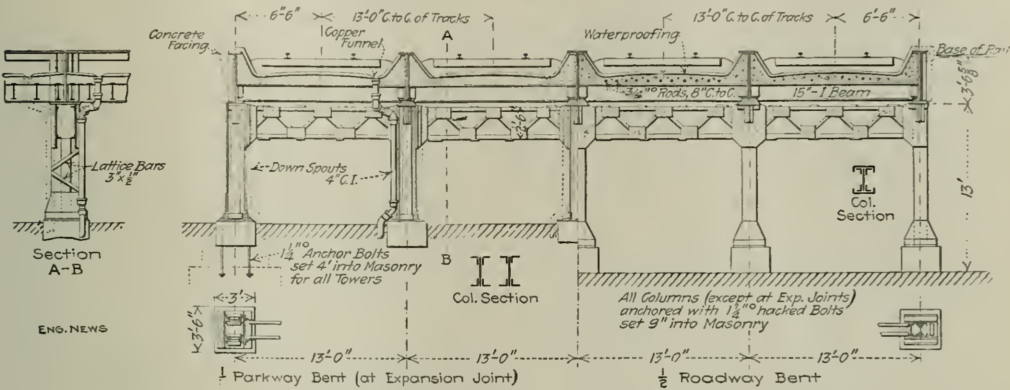


FIG. 2. CROSS-SECTION OF FOUR-TRACK VIADUCT AT CHICAGO; BALTIMORE & OHIO R.R.

CONCRETE DECK—Upon the steel floor framing is a reinforced-concrete deck or slab, the concrete being carried up against the girders so as to form a trough for each track. This deck is of 1 : 2 : 4 concrete, reinforced with 3/4-in. transverse bars spaced 8 in. c. to c. It is 8 in. thick at the middle and 7 in. at the sides, and drains longitudinally to 4-in. downspouts at the third bent from each end. On the concrete is a waterproofing course consisting of three layers of burlap mopped with hot asphalt, and this is protected by a 3-in. layer of concrete composed of cement and limestone screenings (1 : 2½). A bed of stone ballast is laid, with ordinary track construction, the ballast being about 6 in. deep under the ties, so that the base of rail is about 12 in. below the top of the concrete facing on the girders.

ABUTMENTS—The abutments are made with vertical instead of battered faces and without the usual coping at the bridge-seat, in order to conform to the architectural treatment of the concrete facing of the bridge. They are of 1 : 3 : 5 concrete, except that a 1 : 2 : 4 mixture is employed for the bridge seats.

CONCRETE FACING

In the architectural design, the columns and girders on each side of the structure are incased or masked with concrete as noted above. The two roadway spans are made distinctive by heavy columns or piers, by arched lines for the span, and by a simple decorative treatment at the piers and center of span. The bottom of the arch has a fillet of 2-ft. radius at each end, and its center has a rise of 15 in. above the fillets. The top of the arch has a deep coping with a central medallion, these parts projecting about 4 in. from the face, so as to produce an effective appearance due to light and shadow. The concrete columns or piers of these spans project about 16 in. beyond the face of the arch, with sloping buttresses projecting about 3 ft. beyond the main portion. These buttressed columns are carried up higher than the top of the arch, and are finished with concrete medallions projecting 3 in. from the face.

The main portions of the columns are reinforced with 3/4-in. vertical round rods at the corners, wrapped with wire netting. The buttresses are reinforced with 3/4-in rods at the corners, parallel with the slope of the face, and tied into the column with 3/8-in. stirrups. The steel girders are wrapped with wire netting of No. 23 gage, triangular mesh, to hold the concrete and prevent expansion and contraction cracks. Parts of this work are shown in Fig. 3.

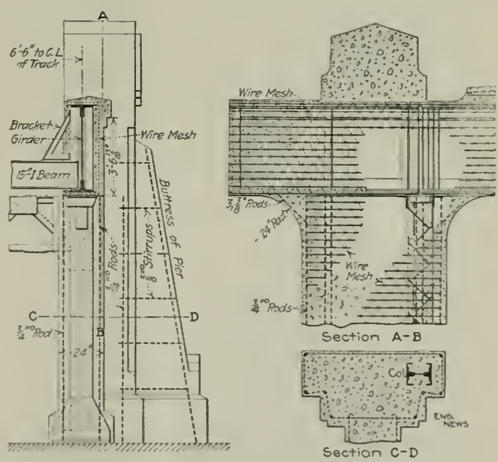


FIG. 3. CONCRETE CASING FOR GIRDERS AND COLUMNS OF THE 32-FT. ROADWAY SPANS OF THE VIADUCT OVER INDEPENDENCE BOULEVARD, CHICAGO

The shorter spans have 2-ft. fillets at the junction with columns and a very small rise (about 3 in.) above this. The coping for these spans is the same as for the longer spans, but is carried level across the bridge. The concrete casing of the steel columns is 2 ft. square and unornamented. At the corners are vertical 3/4-in. rods, with

[illegible] wrapped around them, and the fillets are also reinforced with bars placed at 45°. The corners and edges of all parts of the concrete work have a $\frac{3}{4}$-in. bevel.

The concrete used in the columns and arches was a 1:2 mixture of cement and crushed limestone (from $\frac{1}{2}$ in. to dust), no sand being used. Special care was taken to see that all concrete was of the same proportions and consistency, so as to maintain a uniform color throughout. The forms were of dressed lumber. The forms for the concrete covering of the girders were partly hung from the steelwork of the bridge and partly supported from the ground by struts and braces.

The concrete for all columns was placed before any concreting was done on the arches. The larger columns were poured to the top in one operation, a ledge being left at the junction with the arch fillet. The smaller columns were poured to the bottom of the fillets of the [illegible] arches or girders. The roadway arches were poured separately, as were the sidewalk spans and the [illegible] spans next to the roadway. The intermediate section of three spans was poured at one time, with an expansion joint at each end, where the expansion joints in the steelwork occur. The concrete was spouted directly into the forms from a mixer mounted on a flat car on the railway. No special facing was used in placing the concrete, a good surface being obtained by thoroughly spading the concrete next to the forms. The use of a small size of aggregate gave a fine texture for the surface, very little difficulty being experienced with pockets or hollows in face.

After the forms were removed and the concrete had seasoned and dried out for a few days, the lips and ridges due to the forms were chipped or filed off with a chisel, coarse file or rasp. The surface was then wetted and rubbed with a coarse carborundum brick until the surface was fairly smooth, a very thin wash of cement and sand being then applied and left to dry. The final rubbing was done with a fine carborundum brick until all the cement wash had disappeared and the surface was smooth and even. All concrete was treated in this manner, including the faces of the abutments. This treatment gives a [illegible] white surface of very light color.

The decorative treatment in this case is based upon [illegible] parts in bold relief, to give a pleasing appearance due to the light and shadow effect. With this is combined [illegible] of the surfaces. In another [illegible] bridge in Chicago with somewhat similar concrete [illegible] the surface is [illegible] [illegible] but the results were not very satisfactory. We pointed out at the time (ENGINEERING NEWS, Sept. [illegible], [illegible]) that better results might be expected by relieving the flat surfaces by outline and shadow rather than by the use of color, and this view is supported by the appearance of the bridge described above.

[illegible] The same [illegible] work of the Baltimore & Ohio R.R. [illegible] and the bridges are [illegible] with concrete in the way described above, but with less elaborate design. The girders [illegible] concrete girders with [illegible] on the faces and a [illegible] coping. The columns are not [illegible]. These bridges have [illegible] of the columns and, with transverse [illegible] the columns carrying longitudinal I-beams which support the [illegible] deck.

Spheroidal Gas-Holder Tanks

By PAUL SEUROT*

[Author's Note—This article refers to an illustrated note "Spheroidal-Tank Gas-Holders, a Modern German Type," published in ENGINEERING NEWS, of June 25, 1914, p. 1418. The remarks on design given by the author are based on notes compiled some years ago from the reports of "La Societe Technique du Gaz en France," 37 Congres, June 1910.]

The usual formula giving the thickness e of the plating of a gas-holder tank is:

$$e = \frac{HD}{2KS}$$

in which H is the height of the tank, D its diameter, K the ratio of the strength of a riveted section to the strength of the solid section, S the unit-stress.

The intention of the designers of the spheroidal tank, the Maschinenfabrik Augsburg-Nurnberg, is to replace the straight vertical wall of the tank, subject to unequal stresses and necessarily very thick, by a curved and flexible wall stressed equally at all points. This curve follows exactly the natural curvature of a drop of water or of a thin rubber-silk bag filled with water, suspended by a string and resting on a flat unyielding base (see Fig. 1 and Fig. 2); this bag and its contents then take such a shape or position of equilibrium that there is no shear in the shell at any point, the stress being purely tensile.

As pointed out in the article in ENGINEERING NEWS, above referred to, the tank cannot be a closed figure and the meridian tension must be counteracted by vertical struts. This is shown in Fig. 3. The

FIG 1

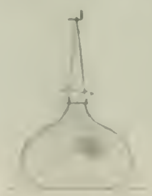


FIG 2

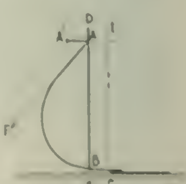


FIG 3

resultant force at A is tangential and acts along line AF. This force is resisted by a [illegible] horizontal built beam AA', and by the vertical struts DAB, which are connected together by X-braces.

The vertical struts are carried on foundation blocks K through the tank plating. The cylindrical volume of water within surface H is supported directly by the bottom plating and foundation. The volume comprised between H' and the shell produces a downward pressure which is carried through K onto the foundations.

To draw the curve of the shell, let us assume the problem solved and let AB, Fig. 3, represent the curve which is supposed to resist equal tensile stresses at all points; let us take a [illegible] metal [illegible] on the circumference of the spheroid, and let us divide the curve into a certain number of equal parts; in the present example, there are 15 divisions, 1.10 m. long each. At the center of gravity of each of these divisions, and normally, let us draw the water pressure, calculated for each point by multiplying the area of the section (its width by its length) by the

*[illegible] Engineer, Jacobs & Davies, Inc., Montreal, Que.

height of its center of gravity below the top surface. Drawing these forces one after the other, parallel to their direction and proportionately to their value, we get a polygon of forces, Fig. 4, whose closing line RR' is parallel to, and (measured by scale) equal to, the resultant RR' of the several pressures. The lines RO and $R'O$ parallel to the two reactions at the end of the curve give the value of the tensile stresses on the base-plating and at point A.

If we join the intersection of these reactions, in Fig. 4, to the several points of the polygon, we obtain the value and direction of the resultants of all the tensile stresses at each point in the shell. All these resultants must be equal, since the curve is supposed to be such that all the tensile stresses are alike. Therefore, *these lines must be the radii of a circle whose center is the intersection of the reactions,* and passing through the several points of the polygon. In other words, we should be able to inscribe the force polygon within this circle.

If now we draw the equilibrium polygon by laying, at each point of the curve, lines parallel to the rays of the force diagram, the sides of the equilibrium polygon will be tangent to the curve of the shell, and if we started at the lowest point the last side should pass at the top through point A.

In practice, the lower and higher points being given, it is customary to draw a trial curve, applying the hydrostatic pressures at each division. The force diagram corresponding to these pressures being drawn, it should be possible to inscribe it in a circumference if the original curve was correct. A few trials may be necessary to obtain the proper curve.

The weight of a tank designed along these lines will be about two-thirds of the weight of a vertical-side tank for the same unit-stress.

For instance, for a tank 13m. high and 65m. in diameter, with a unit-stress of 10 kg. per sq.mm., the thickness of the lower plating should be, in a cylindrical tank,

$$e = \frac{65 \times 13}{2 \times 10} = 12\ mm.$$

The thickness at the top would be from 6 to 7 mm. In a spheroidal tank, the thickness e would be constant and equal to:

$$e = \frac{62{,}100\ kg.}{950 \times 10} = 6.5\ mm.$$

In practice, a uniform thickness of 8 mm. would probably be adopted.

The above conditions obtain when the tank is full. When the tank is being filled, the tensile stresses induced in the wall are not equal. In order to avoid any deformation of the shell during the filling operation, the shell is connected to the vertical uprights by means of latticed girders (Fig. 6). The rivets connecting the latter to the shell cease to be under any stress when the tank is full, at which time the latticed girders could be left out altogether.

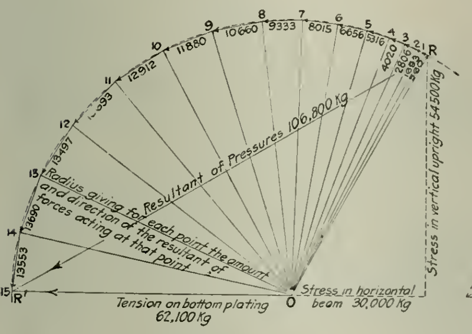


FIG. 4

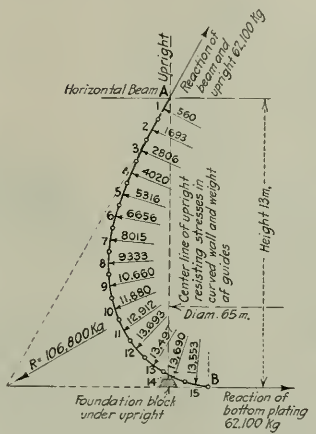


FIG. 5

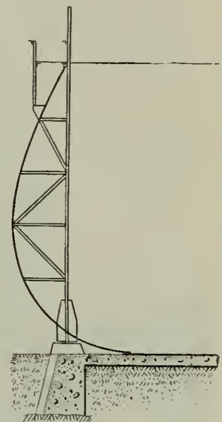


FIG. 6

In the case taken here as an example, the water pressures have been determined as follows:

No. of points	Development of skin, m.	Length of skin, m.	Area, sq.m.	Head, m.	Pressure, kg.
1	1.020	1.100	1.122	0.500	560
2	1.040	do	1.144	1.480	1,693
3	1.050	do	1.155	2.430	2,806
..	.....	.....	.....	.....	.....
..	.....	.....	.....	.....	.....
14	0.980	do	1.078	12.700	13,690
15	0.950	do	1.045	12.970	13,553

The Cable Lift Drawbridge of the Pennsylvania Lines over the south branch of the Chicago River is now nearly completed. It is a double-track bridge crossing the river on a skew of about 45° and having a through-truss lift span 272 ft. 10 in. long. The span weighs about 1500 tons, including machinery, etc., and this weight is carried by 64 steel cables 2¼ in. in diameter. There are 16 cables at each corner, pasing ove. 15-ft. sheaves at the top of the towers, and the 32 cables at each end are attached to a huge steel and concrete counterweight moving in guides on the rear side of the tower. The two towers are 195 ft. high to the centers of the cable sheaves, and are 53½x29½ ft. in plan. The towers were erected first, and then the span was erected in its upper portion on the cantilever system, with a fan-shaped falsework tower at each end, as in the Calumet River bridge for the same railway, described in our issue of Sept. 11, 1913.

When this bridge is completed, the old swing span adjacent to it will be removed, and a second lift bridge erected alongside the first one, thus giving the railway a four-track line into the city. The bridge was designed by Waddell & Harrington, of Kansas City, Mo., and built by the Pennsylvania Steel Co., of Steelton, Pa The design and construction were under the direction of J. C Bland, Engineer of Bridges, Pennsylvania Lines.

The Concrete Mixing Plant for Elephant Butte Dam

By L. J. Charles*

GENERAL FEATURES—The concrete mixing plant for the construction work of the Elephant Butte Dam on the Rio Grande Project of the Reclamation Service in New Mexico, is of interest, in addition to its size, because of the mechanical means developed to proportion the materials and with a minimum amount of labor.

This machinery is designed for this particular plant, of course, and would not be applicable where the output

Fig. 1. The Concrete Mixing Plant at Elephant Butte Dam

was to be small or the latter setting temporary. The conditions here, however, where the output will reach 600,000 cu.yd. or more from one fixed setting justified careful study of the design, in order to eliminate as much hand labor as possible, and this same point has been kept in mind also in the power house, sand-washing plant and other places.

Fig. 2 shows in plan the general arrangement with respect to cableways, railroad, sand-washing plant, etc. Fig. 3 shows the mixing plant and elevating facilities from the roadway. The position of the mixing plant in respect to the dam may be gathered by noting the axis of the dam in Fig. 2.

*Assistant Engineer, U. S. Reclamation Service, Elephant Butte, N. M.

The mixing-plant foundation is at Elev. 4376 and the crest of the dam will be at Elev. 4414. The "A" cableway is about over the center of the proposed roadway on top of the completed dam, which will strike the natural surface close to the sand hopper shown. The mixing plant, etc., are upstream from the dam.

In the mixing plant the three 80-ft. mixers are handled by two laborers and a plant foreman in general charge. This force can work the plant to capacity with a uniformly good output, the proportions of which are definitely known and which can be varied only by deliberate settings of the measures. The number of batches from each machine is automatically registered on tallying machines, and the combination of the number of batches and the known cubic contents of the measures gives all the data required for accurate determination of the quantity of materials used for cost-keeping purposes.

The laborer's duties consist of throwing a four-way cock through 90° to dump the mixer, and back through 90° to dump the batch and refill the measures. The plant foreman sees that materials are properly distributed, that concrete is delivered to the proper cableways, and looks after the operation of the plant in general.

PLANT DETAILS—Fig. 4 gives a general plan of the mixing-plant construction. The building is 54x40 ft. in plan, 74 ft. high, and arranged in five stories, the fifth

of which contains the screening machinery and head shafts of the various elevators.

The fourth story, comprising the bins, is 25 ft. high between floors, and is divided, the 40-ft. way, by two par-

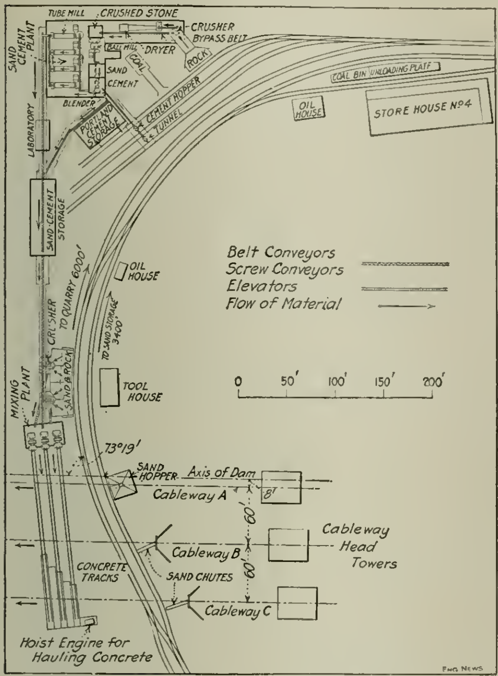


Fig. 2. Plan of Elephant Butte Mixing, Sand-Cement and Storage Plants

titions, making three compartments. The back compartment is 11½ ft. wide, with a capacity of 420 cu.yd. of rock over ½-in. diameter; the center, 7 ft. wide, holds 256 cu.yd. of sand ½-in. and smaller; and the front, 4 ft. wide, holds 103 cu.yd. of cement. The sand and rock bins are flat-bottomed. The cement bins are hopper bottomed, metal-lined, and deliver through 12x12-in. metal chutes through the vertical wall of the sand bin, and by a 15° elbow through the sand-bin floor to the cement measures.

The third floor of the building is the operating floor, containing the controlling devices for the gates, the measuring devices, which are suspended from the ceiling, the mixer-motor controllers, and the batch-tallying devices.

The second-floor houses, the three 80-cu.ft. mixers, which are arranged side by side, and dump into hoppers over the cement tracks on the ground floor. The cement tracks run approximately at right angles to the three cableways (which parallel the axis of the dam), and extend under each cableway so that material from any mixer may be delivered to any cableway independently.

Each mixer in the plant is an independent unit, having its own measuring hoppers, arranged in tandem for water, cement, sand and rock, and its individual cement bin, but draws rock and sand from a common bin through its own chutes. The mixing units are numbered from the main railroad track outward (see Fig. 2). Nos. 1 and 2 are arranged for 1 : 9 mix, and No. 3 for 1 : 6 mix. The proportions are determined by volumes.

The maximum practicable charge for one batch to an 80-cu.ft. mixer has been found to be 75 cu.ft. of loose, dry material, but for various reasons this has been reduced to a little over 66 cu.ft. The proportions for the 1 : 9 mix (adjusted by Fuller's method) are 1 : 2.9 : 6.1, requiring 7.5 cu.ft. of sand cement, 18.87 cu.ft. of sand, and 39.8 cu.ft. of rock. Weight of the batch is approximately 6600 lb.

The 1 : 6 mix is proportional as 1 : 1.8 : 4.2, and a batch consists of 10.7 cu.ft. of sand cement, 16.75 cu.ft. of sand, and 39.1 cu.ft. of rock. Both batches give a resultant of about 1.63 cu.yd. of mixed concrete. These proportions are adjusted from time to time as the material varies.

It is not planned to operate more than two mixing units at one time, but since each batch weighs over three tons, and each mixer can turn out 30 batches an hour easily, at least 180 tons of material must be handled per hour, and accurately measured as used.

Figs. 5 and 6 show the details of the sand and rock measures used on all three units. Measures similar to these have been used for sand and rock on the Pathfinder dam in Wyoming, and the Strawberry Valley project in Utah—although in both cases they were much smaller and were manually operated. These measures for the 1 : 9 mix can be adjusted by the telescoping attachment in the case of the rock between limits of 41.08 and 53.65 cu.ft. and in the case of the sand between 18.33 and 23.68 cu.ft. The No. 3 sand hopper is reduced by an internal bushing, and its capacity can be varied between 16.18 and 21.53 cu.ft.

Fig. 7 shows the design for the cement measures as originally installed. The knife edges of the segmental gates, upon which their tightness depends, were quickly

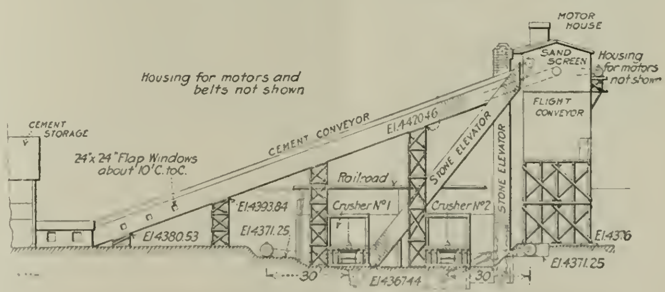


Fig. 3. General Elevation of Mixing, Crushing and Elevating Plants

ruined by catching fragments of hard material (broken pebbles, etc.) between the gate and the chute. Cement under the 28-ft. head acts in some respects like water, but has all the bad arching tendencies of sand when the flow is once arrested. Under the head mentioned a leak of knife-edge or pin-hole size will quickly waste a large

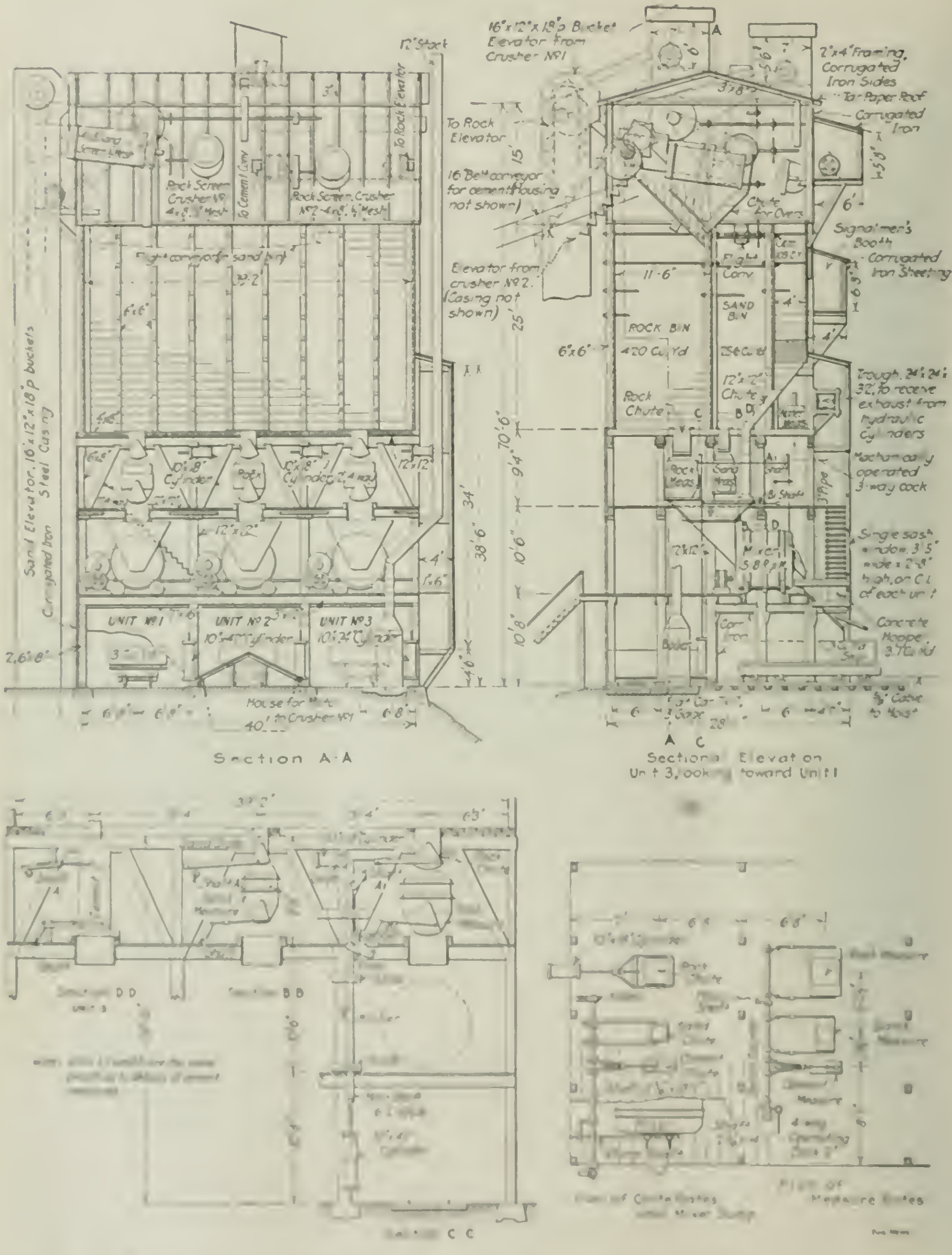


FIG. [illegible]. ARRANGEMENT OF MACHINERY IN MIXING PLANT, ELEPHANT BUTTE DAM

amount of material. The arching action has been overcome by introducing a jet of compressed air at the junction of the bin with the 12x12-in. chute (see Fig. 4). The introduction of air is controlled by a whistle valve, which is opened for an instant by the operator if an arch has formed.

Attempts were made to improve the segmental gates by hinging them eccentrically, and by replacing them with slide gates operating through the sides of the measures. It was found impracticable to pack the slide-gate slots so that they did not leak externally, without lifting them from their seats and causing internal leaks.

The original measures were finally discarded; Figs. 8 and 9 show the design of those now in use. The gates are slide gates operating over ports in the gate seats and sliding entirely within the measure. The inclined gate in Fig. 8 has been milled out ¼ in. deep, except for an inch lap around the seat, so that the gate becomes self-cleaning, and the gate guides have been removed as unnecessary. Before the gate was milled it showed a tendency to ride over the cement left on the seat, gradually developing leaks. Ample armholes have been introduced to aid in removing pebbles, etc., which are caught at the acute angle. The 2x4-in. openings covered by loose canvas diaphragms, are indicators to show when the measures are full. The 1¼-in. pipe is a vent for the relief of air compressed in the measures by the falling cement.

In the design of the operating mechanism there was the choice of water, compressed air, and electricity as motive power. Water was decided upon as the easiest controlled, slowest and steadiest in operation, while the exhaust could be used in the mix, thus getting work out of the water that would otherwise be wasted.

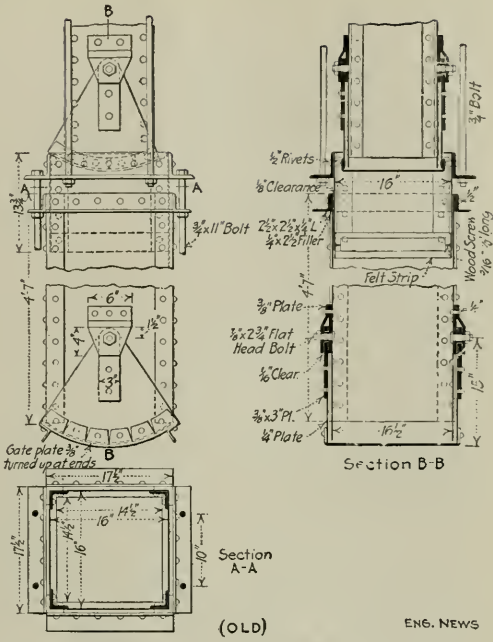
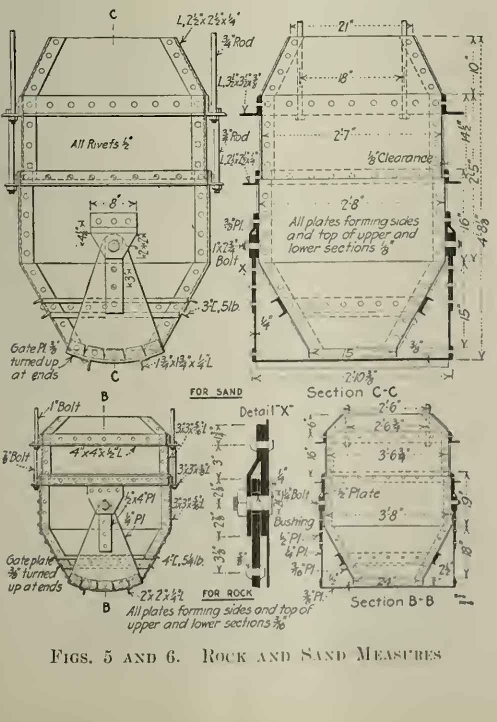


Fig. 7. Old Cement Measure



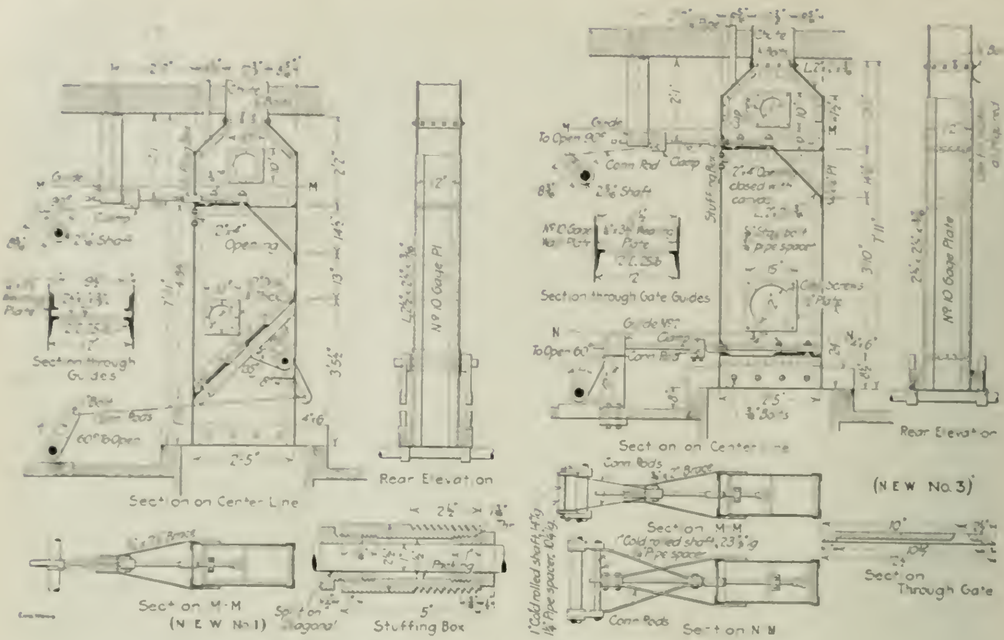
Figs. 5 and 6. Rock and Sand Measures

No data could be found upon which to base the cylinder sizes for the installation, and the following assumptions were made in the design: efficiency of the apparatus, 30%; power required to move a segmental gate, equal to the coefficient of friction of rock on steel times the weight of a column of rock 27 ft. high, and of a cross-sectional area equal to that of the opening to be cut off. The wedging of rock in the gate was allowed for by clearance of the gate below the chute. As the worst case would be that of the rock-chute gate, which if blocked would lock the entire mechanism, this was designed with a separate cylinder of its own, 10 in. in diameter, and 18-in. stroke. All the other chute and mixer gates, also the measured water dump and mixer dump, are operated by one cylinder of 42-in. stroke, 10 in. diameter. Separate cylinders for each set of gates were considered at one time, but the lack of data upon which to proportion their sizes and the difficulties of interlocking their movements led to the two-cylinder plan.

In the design of future plants, it would be advisable to make the diameter of the auxiliary cylinder larger than that of the main cylinder, as it is necessary that the rock-chute gate be closed before the main cylinder begins to open the measure gates to avoid bypassing. This difficulty occurs with this plant at times, but is obviated by throttling the flow of water to the main cylinder, so that the main piston rod moves slower than the auxiliary one. An increase in the size of the rock-chute cylinder, however, would be more logical and a better solution.

The static head of water available for power varies between 128 and 151 ft., according to the level of the water in the main-plant supply tank from which it is drawn. With heads greater than these, provision for the relief of water-hammer should be made.

Fig. 4 shows the operating-mechanism layout as in-



FIGS. 8 AND 9. NEW CEMENT MEASURES, ELEPHANT BUTTE PLANT

stalled. The piston rod of the 42-in. cylinder is extended through two floors by means of a channel extension which carries lugs to engage "kickers" on the various shafts to be operated, which are in turn connected to the various gates by crank arms and connecting-rods.

The "kickers" are built up of plates slotted out to engage the lugs on the plunger. Each kicker has an angle-iron wing upon which the plunger lug slides after the movement of the kicker is complete, thus introducing a time element between the closing of one set of gates and the opening of another.

Fig. 4 shows the mechanism at the mid-stroke point of the piston, with the A_1 kicker ready to engage on the up-stroke, and the B kicker half rotated. The B kicker operates all the measure gates, the [illegible] chute gates, the mixer [illegible], and the water measure three-way valve. The operation of the rock-chute gate cylinder is controlled by the G kicker, which rotates a three-way valve.

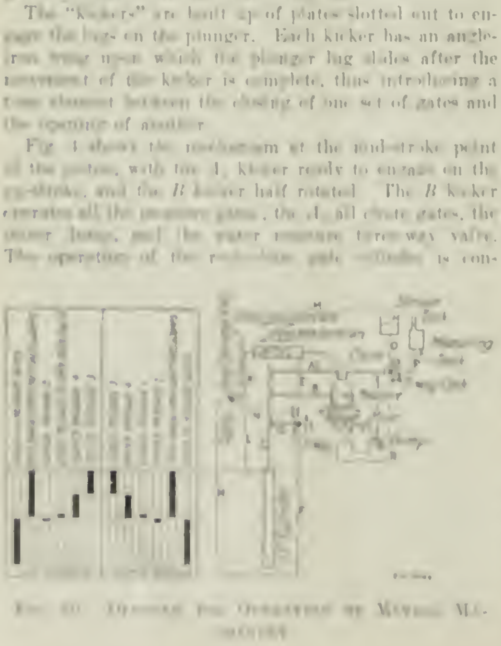


FIG. 10. DIAGRAM FOR OPERATION OF MIXING MACHINES

Fig. 10 shows diagrammatically the operation of the mechanism. Starting with the piston of the 42-in. cylinder at rest at the bottom of its stroke, and a charge in the mixer being mixed, the measure gates are open and the measures empty. The operator throws the handle of the four-way valve 90°, admitting water from the main supply through the pipe H to the bottom of the 42-in. cylinder, and through F as far as the three-way valve, which is closed. The plunger C begins to rise, the cylinder exhausting through L, the four-way valve and M to the storage tank. A plunger pin on C starts rotating the B shaft by means of its kicker, and closes the measure gates. This closure is completed just before the half stroke, and a second pin engages the G kicker, closes Passage 2, through which the forward end of the 18-in. cylinder exhausted during the cycle previous, and opens Passage 1, allowing water from the main supply to pass through F to the forward end of the 18-in. cylinder. This rotation of G is completed just over the half stroke, when a third pin engages the A_1 kicker and starts opening the sand and cement chute gates as the small cylinder opens the rock-chute gate. The small cylinder on this stroke exhausts through K, the four-way and M to the storage tank.

The A_1 shaft as it rotates dumps the mixer and rotates the three-way valve, closes Passage 4, through which the measuring tank had delivered its measured charge of water to the mixer through pipes P and R. The closure of this passage is completed at the three-quarters point of the upstroke, and the opening of Passage 3 begins, which admits water from the storage tank to fill the measuring tank through pipes O and P. The time required to [illegible] the latter is the longest period in the cycle, and

depends, of course, on the consistency of the batch. The water levels in both tanks equalize. The details of the adjustment device in the measuring tank, and also the piping layout, are shown by Fig. 11.

Referring again to Fig. 10, the upward travel of the plunger C having been completed, the piston of the 42-in. cylinder comes to rest against the cylinder head. The mixer is dumped, and the measures are all filling. As soon as this is completed, which takes only an instant, the operator throws the four-way back 90° to its original position. This admits water through L to the large cylinder, which exhausts through H and M to the storage, and through K to the short cylinder, which exhausts through E, F, H and M to the storage.

The falling plunger C begins to revolve the A_1 shaft, whose kicker is engaged closing the sand and cement-chute gates, also the mixer dump, and the piston of the 18-in. cylinder moves to the right to close the rock-chute gates. The rotation of A_1 closes Passage 3, which is completed on the half stroke, dumping the water charge to the mixer. Just before the half stroke G is engaged, closing Passage 1, opening Passage 2, and changing the path of the exhaust of the 18-in. cylinder from E, F, H, four-way, M, to E, N, M, direct to the storage tank. (This is done to close Passage 1 which controls the opening of the rock-chute gate on the upstroke.) The closure of the chute gates and mixer dump by the revolution of A_1 is completed on the half stroke down, and kicker B is engaged opening the measure gates and dumping the contents of the measures into the mixer, which operation is completed by the time the piston strikes the lower head of the cylinder.

It will be noted that the water charge starts to the mixer on the quarter stroke down, when the mixer dump is only half closed, but the slow opening of Passage 4 retards the flow, and no water reaches the mixer until the dump is well raised. The water is in the mixer about three revolutions of the mixer before the aggregate arrives, forming a cushion for the impact of the 3-ton charge, and saves wear and breakage of the mixer vanes. It also washes the mixer, removes the cement left by the previous charge, and prevents any gumming up of the mixer with partially moistened cement. The mechanism can be stopped at any point of the stroke, and locked there, by turning the four-way valve to the neutral point. The exhaust water all goes to the storage tank, and finally into the concrete. The storage is fitted with a float-valve supply and overflow, but as a general thing these do not come into use.

The plant was completed and concreting started on the dam in June, 1913, and has continued without delay. One cableway only has been available, and one mixing unit has been operated at about two-thirds capacity. On account of the excavation for foundations being carried on for a new section of the dam while concreting of the present block is in progress and because of the incomplete development of the quarries, it will be several months before the full capacity of the mixing plant can be realized. Judging from the work already done the output and efficiency of the plant will be fully up to expectations.

Personnel

Under the writer's supervision the preliminary plans, and many of the details of the operating machinery were prepared by Assistant Engineer Chas. A. Bissell, while Assistant Engineer Julian Hinds completed the detailing, and designed all the changes mentioned. The machine work and installation was done by Government forces, under W. C. Beatty, Master Mechanic. The Elephant Butte Dam is being constructed under the general supervision of L. C. Hill, Consulting Engineer, with E. H. Baldwin, Construction Engineer, in direct charge.

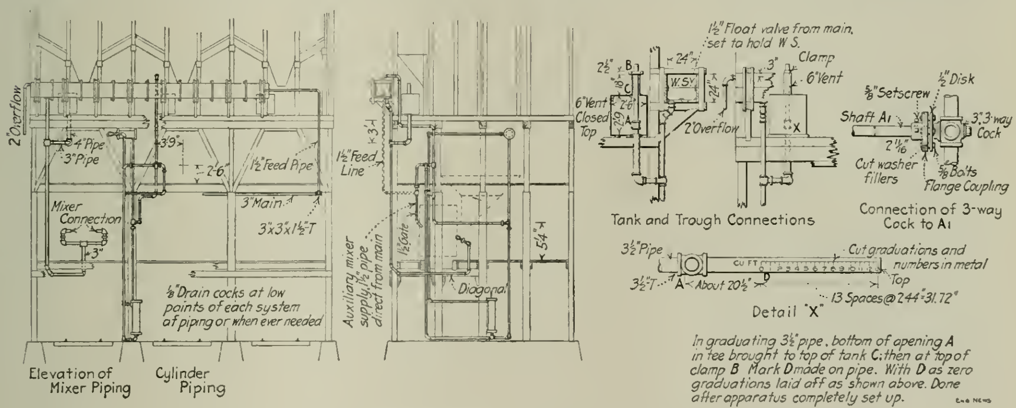


Fig. 11. Piping Arrangement, Elephant Butte Mixing Plant

Some Lessons from the Flood Failures of California Highway Bridges—The lesson taught by the failure of several long span steel bridges during the recent floods in some parts of California was a very valuable one to the counties. Many of the bridge failures were due to faulty pile foundations and consequent settling of piers; others were due to improperly designed abutments; but the principal and most important lesson taught was the urgent necessity for proper protection of the river banks to prevent continued erosion. On every river in Division No. 5 the erosion of the banks from the 1911 floods is the one big problem, and this problem should be solved before the acceptance of bridges menaced by this danger, for it may easily happen that a 700-ft. bridge accepted today may be an isolated structure tomorrow, and the expense of all the additional spans necessary to bridge this gap made by the flood waters would have to be borne by the state. [Walter C. Honer, Division Engineer, California Highway Commission, in [illegible] July "California Highway Bulletin."]

Lining Long and Deeply Overlaid Tunnels

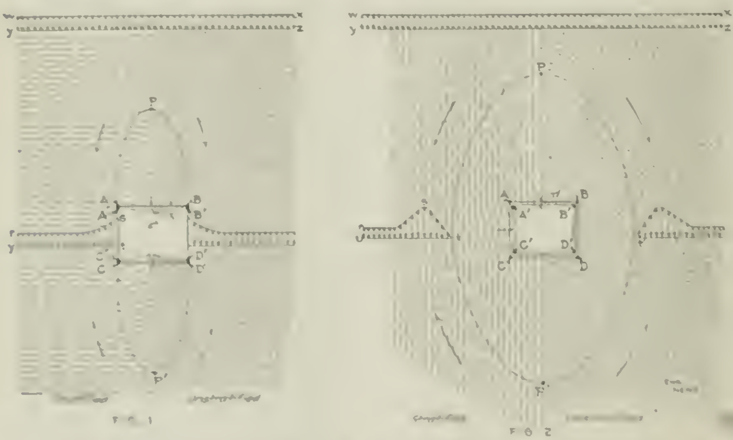
By Eugene Lauchli*

Only a few years ago, it was generally admitted that the form and thickness to give to tunnel linings was a mere matter of judgment; they were therefore proportioned according to the judgment of the engineer or designer, thus resulting very often in a waste of material, or in partial failures. The numerous observations made in tunnels, mines, shafts, bins, silos, together with laboratory experiments on the behavior of materials under compression, bending, etc., have resulted in throwing much light on this complex subject, and have shown that the designing of the lining of deeply overlaid tunnels, or of any tunnel, should be carefully considered.

Ground Pressure

It has been observed that in moderately overlaid tunnels, signs of pressure or deformation occurred first in the roof, in deeply overlaid tunnels in the sidewalls first, and then in the roof and floor. However, such phenomena have sometimes occurred in a reversed order, due to the peculiar stratification or formation of the ground, and also the crushing strength of the materials under consideration. In plastic soft materials deformation would appear under the form of crushing or bending of the tunnel roof, floor or sidewalls, while in hard and brittle materials flaking or shelling of the rock would take place.

It has also been observed that when a cave is produced in an earth or rock tunnel, or when a sand or salt bin, or a silo filled with grain would be emptied from the bottom, the void resulting from the caving, or from the material extracted, would take a vaulted shape, resembling that of a parabola. The height of the vaulted space was found independent of the depth or weight of the overlying material, but, on the other hand, was dependent on the width of the excavation and of the cohesion of the material under consideration.



Figs. 1 and 2. Diagrams Showing Pressure of Overlay in Deep Tunnels

(Fig. 1, In hard penetrating material. Fig. 2, In yielding material.)

The intensity and distribution of the ground pressure may be analyzed as follows: Let $ABCD$ (Fig. 1) represent the section of a deeply overlaid tunnel, and let $wxyz$ be the weight of the overlying mass, acting say at roof elevation of the bore. The material penetrated is assumed to be hard and solid, stratified horizontally to the left and unstratified to the right. It is evident that the load acting on the roof of the tunnel has to be transmitted to the floor, through the sidewalls AC and BD. If these are strong enough to resist the additional load, or reaction of the roof load, the stress thus borne can be illustrated by the diagram $stru$, the stress reaching its maximum value at the sidewalls, and decreasing in intensity at a distance away from same, down to a point where ru has a value equal to wy.

Under repeated blasting, and if the strength of the material penetrated is such as to allow a vertical movement of the roof and floor, the roof line AB will move down to $A'B'$, and as action and reaction are equal, the same process will be undergone by the floor line CD, to a less extent, however, as the pressure is somewhat counteracted by the weight of the material underlying the floor. A vertical movement having taken place, it is obvious that voids have been created between adjacent imaginary layers of rock above or below the roof and floor lines, and unless due provision is made to prevent further movement of the strata, the bore is liable to fill up, in the course of years, if not immediately. If, on the other hand, adequate timbering or lining is provided, further movements of the ground will be checked, and equilibrium will take place as the voids caused by the initial movement will fill up, due to successive settlements or swelling of the overlying material.

Under normal conditions, the disturbed zone will be confined within an area limited by a parabola, and the load carried by the roof of the tunnel will be that due to the weight of the materials confined within $A'PB'$.

Now let $ABCD$ (Fig. 2) represent the section of a tunnel driven through yielding material, stratified vertically to the left, and unstratified to the right. On account of the low crushing strength of the rock penetrated, and the inability of the sidewalls AC and BD to transmit to the floor the reaction of the roof load, vertical movements of the roof and floor, and horizontal movements of the sidewalls are bound to take place. The zone of disturbance will thus be spread over a large area surrounding the tunnel, and the stresses in the sidewall AC for instance, can be illustrated by the diagram [illegible]. It is evident that the load area of the parabola [illegible] has assumed different po-

*[illegible] Engineer, New York.

sitions, according to the inclination of the strata; but whatever position the axis may assume, the load to be carried by the tunnel lining, in deeply overlaid tunnels will always be a small fraction of the overlying depth.

The load acting on the roof and floor of a tunnel driven through hard and solid material will therefore be limited by the line $A'PB'$ and $C'P'D'$ (Fig. 1). The location of P above the tunnel roof will depend on the width of the bore as well as on the cohesion of the overlying material.

The load acting on the roof, floor and sidewalls of a tunnel driven through yielding materials will be limited by the line $tPt'P'$ (Fig. 2); the ground beyond these lines is supposed to have no action on the tunnel lining or timbering, provided unusual conditions such as geological faults, action of air or water on the rock, etc., will not cause large masses of ground to be set in motion, thereby causing unsymmetrical or excessive pressure.

According to the geological formation and stratification of a site considered, the following cases of loading are encountered most usually in deeply overlaid tunnels.

Case I (Fig. 3). The pressure acts vertically: there is no sign of pressure on the sidewalls. The lining should therefore be designed to carry the weight of the parabola

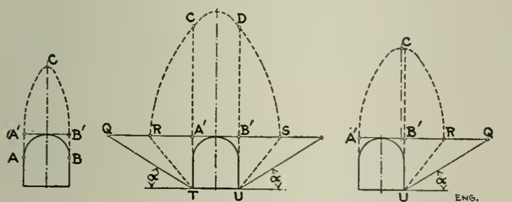


FIG. 3 FIG. 4 FIG. 5

FIGS. 3 TO 5. TYPES OF PRESSURE CONDITIONS ABOVE DEEP TUNNELS

ACB; for all practical purposes the points A and B are assumed to be in $A'$and B', located at crown arch elevation.

Case II (Fig. 4). The pressure acts vertically on the arch; signs of weakness are noticeable in the sidewalls. The arch is to be designed to carry the weight $A'CDB'$. If α represents the angle of repose of the material, it can be assumed for all practical purposes that the intersection of the line of rupture TK, with a horizontal line passing through the crown of the tunnel arch, is located at a point half-way between QA', or at R. Therefore, the sidewall $A'T$ is to resist the pressure due to the weight of the triangle $RA'T$, carrying the additional load RCA'.

Case III. (Fig. 5). The pressure is unsymmetrical to the center line of the tunnel, such a condition being caused either by the inclination of the strata or the yielding of the materials on the right-hand side of the tunnel. In this case, the arch should be designed to resist the stresses caused by the weight of $A'CB$; and the sidewalls are to resist the pressure caused by the weight of $B'RU$, supporting the additional load $B'CR$.

FORMULAS FOR GROUND PRESSURE—Several formulas that serve the purpose of determining the height of the parabola that represents the overlying weight acting on tunnel linings have been devised, but as it is beyond the scope of this paper to present and discuss all of these, the Kommerell formula only, together with a table giving results for different kinds and conditions of materials is

TABLE I. COEFFICIENTS IN FORMULA $H = \frac{100\,d}{C}$

Material	C
Pine sand, dry	1
Sand, gravel	1.5
Earth, loam, etc.	2 to 4
Marl	4 to 5
Shale	6 to 7
Harder rocks	8 to 15

TABLE II. VALUES OF H IN FORMULA $H = \frac{100\,d}{C}$

	Value of C.										
	1	1.5	2	4	5	6	7	8	10	12	15
d.	H	H	H	H	H	H	H	H	H	H	H
0.2	20	13	10	5	4	3.3	2.8	2.5	2	1.6	1.3
0.4	40	23	20	10	8	6.7	5.7	5	4	3.3	2.7
0.6	60	40	30	15	12	10	8 6	7.5	6	5	4
0.8	80	53	40	20	16	13	11	10	8	7	5
1.0	100	67	50	25	20	17	14	12	10	8	7
1 2	120	80	60	30	24	20	17	15	12	10	8
1.4	140	93	70	35	28	23	20	17	14	12	9
1.6	160	107	80	40	32	27	23	20	16	13	11
1 8	180	120	90	45	36	30	26	22	18	15	12
2.0	200	133	100	50	40	33	28	25	20	17	13
2.2	220	146	110	55	44	37	31	27	22	18	15
2 4	240	160	120	60	48	40	34	30	24	20	16
2.6	260	173	130	65	52	43	37	32	26	22	17
2 8	280	186	140	70	56	47	40	35	28	23	19
3.0	300	200	150	75	60	50	43	37	30	25	20

given here. The Kommerell formula is based on the deflection of the roof of a bore, or tunnel, and, as for the same kind of material, the deflection due to bending, increases with the width of the bore, the height of the parabola becomes a function of the tunnel width and of the kind and cohesion of the overlying material.

Let d (Figs. 1 and 2) represent the deflection observed in a tunnel roof; let C have the value given in Table I, and H be the height of an ellipse substituted with sufficient accuracy for all practical purposes to the parabola above the tunnel roof; then $H = \frac{100\,d}{C}$, the value of d and H being expressed in feet.

Table II indicates that, in a tunnel driven through sand, and with a roof deflection or settlement of 2 ft., H is equal to about 133 ft. If the material penetrated is shale, H will have an average value of 33 ft. In a deeply overlaid tunnel, C will have usually a value of 6 or more, for in such tunnels, rock only is usually encountered. However, judgment is to be exercised in selecting the proper value for C, as a roof deflection of say, 2 ft., may give H a value of 33 or 13 ft. ft. according to whether the rock penetrated is soft sandstone or limestone, or harder rocks such as granite, gneiss, etc.

TUNNEL SECTION

Having determined approximately the weight acting on a tunnel lining, the next step is to select the type of cross-section best suitable to resist the stresses borne by same. Theoretically, there is but one tunnel section that is most economical, corresponding to a given condition of loading; in actual practice, however, it would be unpractical to change the tunnel section very often; furthermore, certain clearance lines for the rolling stock and for other purposes have to be strictly observed; it is also desirable that the masonry forms and tunnel centers be made as uniform as possible. For the above reasons, it is usually the practice to design a few types of lining sections, the strength of which is determined *a priori*, adapting same, where found necessary, to conditions of loading.

In deep tunnels, and in tunnels subjected to ground pressure, it is desirable to make the roof of the bore as narrow as possible, thus making itself sustainable. In order to minimize the thickness of the arch, the thrust at the crown is reduced, by making the ratio of the arch

same in the span as small as conditions of clearance will permit. The type of arch answering best the above requirements is that nearing the parabola; but, for reasons of construction, the arch is usually made up of segments of circles. Straight lines are avoided altogether, and provision is made for future insertion of an invert, when deemed advisable.

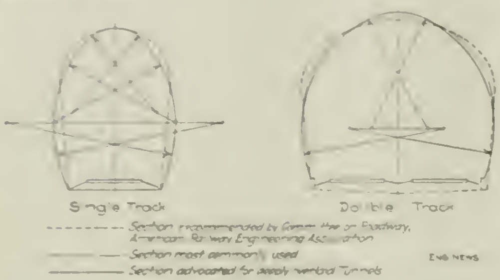


FIG. 6. TUNNEL SECTIONS FOR SINGLE AND DOUBLE TRACK

Fig. 6 shows the section recommended by the Committee on Roadway of the American Railway Engineering Association for single-track and double-track tunnels, together with that section mostly used and that section advocated by the writer for deeply overlaid tunnels. The area of the last named section is somewhat larger than the section recommended by the committee.

LINING MATERIALS

Opinions as to the kind and quality of materials best suitable to line deep tunnels, all aim toward the same results, i.e., toward material that will reach its maximum ultimate strength soon after being used, and that possesses high compressive strength, together with great resistance against action of water, heat, frost and gases from locomotives. The question of strength is obvious, for the thicker the lining, the wider the bore, and the greater the amount of excavation and masonry.

On account of the small compressive strength of brickwork, the use, in recent practice in deep tunnel work, of brick lining has been closely limited. In general, local conditions decide whether rubble or concrete masonry, or artificial masonry blocks are to be used. Rubble masonry, besides having a relatively low compressive strength, possesses the same disadvantages as concrete, i.e., the maximum strength is reached only long after being laid; and in wet sections, or in heavy pressure zones, both of these materials have proved to be rather unsatisfactory. In dry sections, and where the lining answers merely the purpose of preventing falls of rock, concrete can often be found cheaper than stone masonry.

Concrete and artificial masonry blocks are coming more and more into favor, and in general have given much satisfaction, both during and after construction. Such blocks possess the advantage of being manufactured at leisure and when used have already reached a high compressive strength. They can be placed more rapidly than dressed stone or brick masonry, and as the compressive strength of artificial or concrete blocks is more uniform than stone or brickwork, a smaller factor of safety can be used. Plain concrete blocks have been used in connection with the lining of several tunnels, and generally have given much satisfaction. Concrete blocks having an ultimate strength of 1200 to 2000 lb. per sq.in. were used extensively in lining the first bore of the Simplon tunnel. Similar blocks possessing an ultimate strength of 2500 lb. per sq.in. were used in lining the Loetschberg tunnel. The lining of the 26,683-ft. Hauenstein double-track tunnel and part of the second bore of the Simplon tunnel will consist of artificial masonry blocks possessing, when placed, 70% of a guaranteed ultimate compressive strength of 2844 lb. per sq.in. These same blocks when tested were found to have an ultimate strength of 4000 to 5000 lb. per sq.in.

Concrete blocks of the interlocking type are being used extensively in connection with the lining of the Mount Royal tunnel at Montreal and the method of erecting these blocks will undoubtedly make their use very popular in deep tunnels where a strong lining is often required soon after the excavation has been completed.

A New Portable Asphalt Mixing Plant; Catskill Water Supply Roads

A portable asphalt-mixing plant, shown in the accompanying illustration, Fig. 1, has been in use for the past two months on one of the roads built around the Ashokan reservoir by the Continental Public Works Co. for the Board of Water Supply of the City of New York. The apparatus was made by the F. D. Cummer & Son Co., Cleveland, Ohio, and consists of three units, which may be separated and loaded on flat cars in a few hours. According to W. B. Spencer, President of the Continental Public Works Co., the plant has averaged approximately 1060 sq.yd. of 2-in. bituminous top mixture per day, and has proved efficient and economical.

ASPHALT-MIXING PLANT

FIRST UNIT—The first unit consists of a drum sand dryer, having a rated capacity of 8 tons per hr., but with a tested capacity of 11 tons, with sand carrying 7% moisture and heated to 450° F., a two-shaft batch mixer of 5 cu.ft. capacity; a sand-bin of $5\frac{1}{2}$ tons capacity, with a rotary screen so arranged that sheet asphalt, asphalt binder, or asphaltic concrete may be mixed without changing the arrangement of the units; a sand measuring box on a beam scale, so arranged that each aggregate may be weighed separately or in combination, and an asphalt bucket on a double-beam scale. The whole unit is mounted on an all-steel truck (Fig. 2) with 30x12-in. front wheels and 36x12-in. rear wheels. Power is transmitted by one main shaft $2\frac{15}{16}$ in. in diameter and one main belt drive from the engine. The drum and mixer are directly connected to the main shaft.

SECOND UNIT—The second unit is the power unit, consisting of a 30-hp. locomotive type of portable boiler with a 25-hp. horizontal engine mounted on top, made by the Erie Engine Works, Erie, Penn.

THIRD UNIT—A 10-ton portable asphalt melting kettle constitutes a third unit. This unit is also mounted on an all-steel truck with steel wheels. Kettles are also made in 7-ton sizes.

The whole plant is modeled after the larger railway

FIG. 1. PORTABLE ASPHALT MIXING PLANT; ASHOKAN RESERVOIR ROADS, NEW YORK

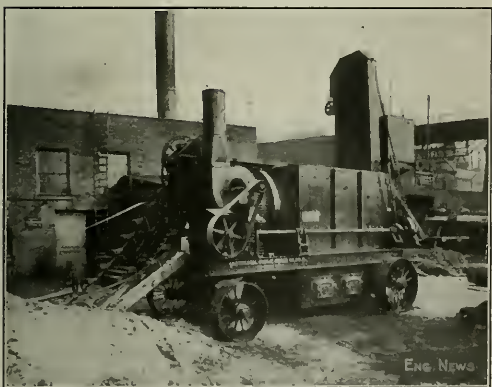


FIG. 2. MIXER UNIT, CUMMER PORTABLE ASPHALT MIXING PLANT

car mixing plant, which has been made by the same company for several years. The car plant has a capacity of 2000 sq.yd. of 2-in. bituminous top mixture per day, or about double the capacity of the portable plant.

The portable plant is designed to be hauled along the road as the work progresses. All the construction work that is necessary is to jack up the wheels of the mixer about 2 ft. to permit a wagon to be backed under it to receive the load. In Fig. 1 two standard kettle units are shown, one 10- and one 5-ton, but the trucks have been removed.

METHODS OF CONSTRUCTION; ASHOKAN ROADS

The Board of Water Supply specifications call for a pavement made of a 2-in. bituminous wearing course of 1½-in. stone with a seal coat of asphaltic cement and stone chips (stone passing ½-in. screen and retained on dust jackets), laid on a 6-in. bottom course of rolled crushed stone. The broken stone for the bituminous wearing course is heated to between 225° to 300° F.

The asphalt cement is required to be heated separately from 275° to 350° F. The mixture used contains 5 to 7½% bitumen by weight. The mixture is delivered on the road at a temperature of not less than 150° F. As soon as the wearing course is completed and rolled and the surface is clean and dry, the seal coat of hot asphalt cement is spread with squeegees or other suitable methods, at a temperature of not less than 275° F., or more than 350° F. The rate of application is between ½ and ¾ gal. per sq.yd. On this is immediately spread a uniform layer of dry stone chips, and the pavement is rerolled.

Steel Ties on Swiss Railways represent 65% of the mileage of the government railways. They are of rolled steel, of inverted trough section, with ends bent over and closed, and the ties are bent longitudinally so that the rail seats have an inclination of 1 in 20. The weight of the tie is about 160 lb. The rails are secured by clamps, and no tie-plates are used. At the rail joints, wide double-trough ties under the joint are now being used, instead of two closely spaced shoulder ties. these joint ties weigh about 276 lb. The above information is given in a recent consular report.

Rolling Asphalt Surfaces to Avoid Depressions—An English engineer, C. H. Cooper, Engineer and Surveyor of Wimbledon, has applied for a patent on a method of preventing depressions in rolling asphalt pavements, which he describes in a letter to the "Surveyor" of July 10, as follows:

In rolling asphalt it is necessary to bring the roller to a standstill for the purpose of reversing. In so doing the front rolls become stationary on the hottest, and certainly on that portion of the asphalt which can least resist their weight; the consequence is that depressions are formed in the asphalt, which should have a perfectly even surface so as to avoid the corrugations found in most pavements. In order to distribute the weight of the front rolls, and so avoid the formation of depressions, I place a sheet of iron on the asphalt—on this sheet the front rolls rest when the roller is brought to a standstill.

Field and Office

Moving Loaded Electric-Light Poles

By C. E. Drayer*

When a portion of St. Clair Ave., Cleveland, is repaved this year, both curbs will be moved back 2½ ft. between East 23rd St., and East 55th St., so that the width of pavement will be 60 ft. and uniform with that east of East 55th St. The plan to move the curbs required the Cleveland Electric Illuminating Co. to move back a line

Electric Truck in Cleveland Fitted for Moving Poles

of heavy poles a like amount. On the average, the poles are 70 ft. long, and carry four crossarms and about two dozen wires.

From East 23rd to East 40th St., the poles were moved back by hand by jacking them along cross timbers. But between East 40th and East 55th St., a 12-in. gas main, some 4 ft. in the ground, was against the poles in the [illegible]. To get the base to the new position, it was necessary to raise the poles vertically some 5 ft.

A 3½-ton electric truck, equipped with a 3-hp. motor and winch for pulling cables through underground conduits, was rigged up with derrick and backstays shown by accompanying figure. Four [illegible] channels with I-beams [illegible] along the center, were made fast to the tail of the truck at one end and bolted together at the top.

In operation, the truck backed up to the pole with the rear wheels as far from the face of the curb as the pole was to be moved back. A clamp to which the tackle was fastened was placed about the pole near the surface of the ground and a jack placed beneath the bed of the truck at the back end. When all was ready, the driver raised the pole by the motor and winch, and backed up the truck until the rear wheels struck the curb. The pole was steadied, against falling at right angles to the street, by a pike pole above and a piece of steel stuck into the pole below and fastened to the truck bed. The jack under the end of the truck was allowed to topple over during the backing movement.

*[illegible] East [illegible] St., Cleveland, Ohio.

Co-operation on Construction Work between Engineers and Contractors

By J. C. Lathrop*

During the construction of a new boiler house for the Consolidated Gas, Electric Light & Power Co., Baltimore, and after the steel frame was erected, a 3-ton jib crane so arranged that it would swing over the B. & O. siding adjacent to this plant and deliver material to the main boiler-room floor 20 ft. above this track was a decided help to all contractors, as well as to the company.

As the columns adjacent to this siding are designed to support a very large load in the future but are now carrying practically nothing, it was safe to attach the crane to one of these columns, in the manner shown on the accompanying photograph. A certain amount of the temporary covering for this side of the building was omitted until the completion of the building.

Jib Crane Put Up for a Company Job, and Later Used by Various Contractors to the Advantage of All Concerned

This crane was installed by the company for the use of the company's men while unloading parts of six Tucker stokers. There were but nine carloads of this material and it was not thought necessary to buy an elec-

*Consulting Engineer, Consolidated Gas, Electric Light & Power Co., Baltimore, Md.

FOUNDATION WORK IN THE LINCOLN MEMORIAL

tric-driven chain block for this work. A chain hoist was used for the heavier pieces and the light material was raised with a block and tackle. If the amount of work which this crane was called upon to perform had been anticipated in the beginning, it would have been a decidedly good investment to have purchased an electric chain hoist.

In addition to the stoker parts above mentioned, the contractor for the boilers used this crane in raising a large amount of minor material, the heavier parts of the boilers having been raised earlier by means of a derrick which the steel contractor had on the work. The contractor for the piping used the crane for raising all piping which went above the main boiler-room floor. The photograph shows this contractor raising a large section of 36-in. atmospheric exhaust pipe. As this work was done on the basis of cost plus a percentage, any saving was directly advantageous to the company.

The contractor for the boiler breeching unloaded all material and placed it upon the main boiler-room floor with the crane.

Numerous miscellaneous items which were to be erected in the boiler room above the main floor, such as coal chutes, minor beams, walkways, coal scales, etc., were unloaded from the cars and placed on the floor by the crane.

The above experience would indicate that better cooperation between the owners and the numerous contractors employed on a job of this magnitude would lead to better returns, for the following reasons:

First, if the owner or his engineer when asking for proposals would state what tools and facilities of that nature would be provided by the owner, it should lead to a considerable reduction in the prices quoted.

Second, the relation of the various contractors could be better controlled by the engineer in charge.

Third, a progress schedule prepared by the engineer could be held to much more closely than is usually the case, for it could be understood in the beginning that if the contractor or manufacturer was not ready to use the facilities provided by the owner at the time specified in the contract, he should forfeit the right to their use. He could then use them at night or at the discretion of the engineer. Doubtless, many unforeseen obstacles would prevent the exact working out of such a schedule and the control of these tools would necessarily be left more or less to the engineer in charge.

Sinking Cylinder Piers for the Lincoln Memorial

The accompanying view is from a recent photograph of the foundation work for the Lincoln Memorial on the banks of the Potomac River, at Washington, D. C. As described in our issue of May 7, 1914, p. 1010, this memorial to Abraham Lincoln is to be in the form of a Grecian temple and the superstructure is to be carried through the medium of a concrete substructure and a number of reinforced-concrete piers reaching down to bedrock some 40 to 50 ft. below the present surface. These piers are being sunk by the cylinder-pier method; that is, by excavating inside a weighted steel cylinder and adding upper sections to the cylinder as it sinks under the weight. After the cylinders reach rock they are filled with concrete reinforced with vertical twisted steel rods held in place by a spiral of steel.

In the view, a number of the footings may be noted. At the far left a reinforcing unit is just being dropped into an already sunk cylinder and just to the right of the spiral is shown the loading of another cylinder. In the foreground, the reinforced-concrete caps of the cylinders which have reached bottom are shown.

The work is being carried on by the Lincoln Memorial Commission with the engineering part under the direction of Col. W. W. Harts, U. S. Army. M. F. Comer & Co., Toledo, Ohio, are contractors for the substructure.

A Simple Instrument for Measuring the Deflection of Bridges and Structures, which has been quite extensively used in Europe, but until now has not been put on the American market, is called the deflectometer. This instrument consists merely of a revolving dial, about 5 in. in diameter, a pointer, a central pulley geared to the axis of the dial, and an idler pulley, which may or may not be used. There are two ways of using the instrument, either placing it on the structure, the deflections of which are to be measured, or on an adjacent rigid support. A steel tape or belt passes over one or both pulleys, and it is the movement of this tape which is magnified on the dial scale. When the instrument is placed on the structure one end of the tape is fastened rigidly below, to a buried weight or other anchor. The other end of the tape, after passing over the pulley, is attached to a weight, which is free to rise and fall. If the instrument is on a separate rigid support, the end of the tape is attached to the deflecting structure by a clamp, instead of being anchored. All movements of the tape are transmitted to a circular motion of the dial, a pin projection on which moves the pointer to ther scale reading. The pointer remains at the scale reading after the dial moves back, as it, of course, does when the load is taken off the structure. The instrument can measure the movement, vertical or horizontal, of any structure or part of a structure to 0.01 mm. The deflectometer is the invention of Wilhelm Fentzloff, Frankfort-on-Main, Germany, and is being introduced in this country by F. J. Bernard, 70 Murray St., New York City.

Rapid Rechaining for Railway Appraisal

A part of the work of valuing the railways of the United States now in progress under direction of the Interstate Commerce Commission consists in accurately measuring the length of all the railways in the United States. As the length of sidings and spur tracks as well as main tracks has to be measured, this means the measurement of lines over 350,000 miles in length.

The first tentative draft of the instructions for roadway and track field parties, issued by the Commission Apr. 23, specified that the measurement shall be done carefully and accurately with a steel tape measuring continuously along one of the nearest rails. This measurement is to be transferred to the base line, which on single-track road is central between the rails and on double-track roads is located midway between the two main tracks.

If measuring the length of the lines were all that was necessary for the valuation work, this length could be ascertained at a small fraction of the cost involved in the chaining by designing a simple odometer, merely an alloy wheel flanged to run on the rail and drawn along the track by a velocipede car or section motor car. With accurate calibration of the instrument and care in accelerating and stopping the machine, results of very high accuracy could doubtless be attained.

The survey parties, however, are required to mark all 100-ft. stations on the web or base of the rail, and the survey notes have to locate by stations and pluses all culverts, trestles, bridges, intersections of state, county, township and other lines, etc. The chaining is therefore necessary anyway. The odometer measurement, above suggested, however, might serve as a valuable check against errors of magnitude in the chaining.

A Temporary Sand-Bag Dam

In the improvement of the new Beargrass Creek channel (for an open storm-water channel) at Louisville, Ky., a sand-bag dam was built at the junction of the South Fork and Middle Fork for the purpose of diverting the flow of the creek to an intercepting sewer during construction work below this point.

The dam as first built is shown in Fig. 1, and was intended to be strong enough to stand during the lighter storms only, and to fail in storms severe enough to cause [illegible] endangering property above. During the construction work, the dam was washed out six times.

The width of the creek at the site of the dam was about 40 ft., but the dam was extended at the top to a length of about 60 ft. It had a height of about 6 ft. For the first construction, the dam had two rows of [illegible] piling driven against horizontal timbers into the bed of the creek to prevent underflow. The two rows of sheeting (which show in the view) were placed 5 ft. apart and the space between them was filled with sand bags. The sacks used for the dam were of about 2 cu.ft. capacity, but were filled [illegible], being sandy clay found near the work.

In order to obtain a dam of greater stability, some modifications were adopted upon its reconstruction. The most substantial type of dam was built of a trapezoidal section, and the sand-bags were protected by inclined timber aprons spiked to a heavy timber framework and secured at the bottom to sills set in the bed of the creek. The downstream face or apron was inclined at a slope of 1½ vertical to 1 horizontal; the upstream face was somewhat steeper. The completed dam as built in this way is shown in Fig. 2. For information we are indebted to J. H. Kimball, consulting engineer, Louisville Trust Bldg., Louisville, Ky.

Fig. 1. First Construction of Temporary Sand-Bag Dam on Beargrass Creek at Louisville, Ky.

Fig. 2. Reconstruction of Temporary Sand-Bag Dam, with Plank Covering

Shoring Difficulties in St. Louis Sewer Construction

By [illegible]*

The Apr. 16 issue of Engineering News contained an article describing very fully the reconstructed Rocky Branch Sewer in St. Louis, Mo. Not the least of the difficulties in carrying on this work was in connection with the shoring of the trench by means of sheet piling. Both sides of the streets through which the sewer passes are built up with residences and stores, and in many places

*Consulting Engineer, [illegible], New York City.

the material excavated was of loose nature, such as wet and dry sand, as well as quicksand.

The work is near completion on the round, 14-ft. brick sewer. Steel sheet-piling is driven to a depth of 40 ft. or more by means of extension pieces; steam piledrivers on derricks having 50-ft. booms, are employed. Excavation is accomplished by a steam crane with bucket. As the earth is removed, the sheet-piling is strongly braced lengthwise and crosswise by heavy timbers.

After excavating nearly to quicksand, special precautions are necessary, not only to protect adjacent property but also to make further operations possible. Bulkheads of plank piling are built across the trench every 20 ft. or so. These are 24 ft. high and are driven about 9 ft. below subgrade. The bulkhead, 8 in. thick, is composed of bolted tongue-and-groove piles. The details of the shoring are well illustrated in Fig. 1. With such an arrangement, it is comparatively simple to keep the trench dry and proceed with the work of laying the sewer.

As the completed masonry nears one of these bulkheads, it is not feasible to pull the plank piling until the fill has been at least partly completed, as the heavy cross timbers are partly braced by the piling and must be left to support the steel piling at the sides. The expedient adopted as most practical was to cut off the bulkhead piling slightly below grade and also just below the lower wale, which allows sufficient clearance for the masonry work.

The first attempt was to cut off these piles with an ax, but this method was found to be extremely slow and difficult. Large wood chisels fitted to special pneumatic hammers were next tried but without satisfactory results. Circular saws were also considered, but were discarded as being unsafe. Then a 1¾-in. wood-boring auger, operated by a No. 13 size "Little David" compressed-air drill motor, was tried and found to be a very practical means for cutting these thick planks. This motor requires about 30 cu.ft. of free air per minute, which was furnished by a Westinghouse air-brake pump. About seven holes of this size are required to sever a pile and the time consumed in boring each of these 8-in. holes is from 20 to 25 sec. Two or three are required to cut across the pile, so that the entire time consumed in making both cuts across the trench figures ordinarily, between 1½ and 2 hr. The cutting is often in awkward locations and sometimes the tool has to be operated under water.

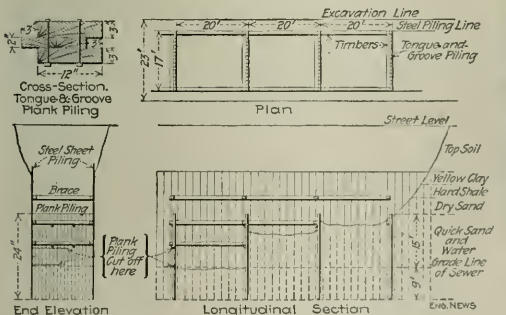


FIG. 1. SHORING AND BULKHEADS IN ST. LOUIS SEWER TRENCHES

Similar methods were employed on another part of the sewer which has been completed. There the sewer is rectangular in section to save headroom. On that section about 15 ft. of the lower part of the excavation was quicksand. Side piling, composed of 6x12-in. by 20-ft. planks, was driven down 6 ft. below subgrade and served not only as a bracing for the excavation, but also as the outside form for the concrete.

After the concrete had set, these piles had to be removed or cut off just below the street grade. As they were embedded quite deeply and were needed to prevent settlement of the adjacent ground, it was impractical to remove them, and the city permitted the contractor to leave them after cutting off the upper ends. There were about 1500 of these piles and a pneumatic wood auger was employed, as previously explained, for cutting off the piles about 10 in. below the pavement. It required from 16 to 20 sec. to bore each 6-in. hole, making the time for boring 7 holes, to cut one pile, 1¾ to 2½ min.

FIG. 2. CUTTING OFF THE TIMBER BULKHEAD PILING

(Shows the upper cut, just below the lower wale. The lower cut is hidden by the material on the floor. A small section of the sheet piling is shown at the extreme right.)

The above described work was done by the James Black Masonry & Contracting Co., of St. Louis. The writer is indebted to G. W. Winslow, of St. Louis, for most of the data contained herein, as well as the view.

A Reversible Section Liner—The "Sphinx" section liner, made by F. Weber & Co., Philadelphia, Penn., is now made in a reversible type, that is, the spacing apparatus made be made to operate either from right to left or from left to right. The 7-in. beveled arm may be set at any angle. The reversible section liner costs $1.75, or 25c. more than the single-action kind.

A Record of 65 Years' Progress in City Surveying: St. Paul, Minn.*

In 1849 when the village of St. Paul was incorporated, property ownership was based on claim lines. In 1853 the United States completed the subdivision of the territory now covered by the city, and since that time subdivision lines have been based on these township and section lines, excepting where claim lines existed.

Between the years 1885 and 1890, all of the section lines within the city limits were rerun with transit and steel tape, and all section and quarter-section corners were marked with granite monuments. At the same time all streets were resurveyed and monumented, so that a complete survey of the then existing, laid-out portion of the city's entire area was made and mapped on a scale of 100 ft. = 1 in.

All existing platting was shown on these maps with record distances, and also the resurveyed distances with monuments. These maps were called Standard maps and were made on mounted eggshell, each map covering one mile east and west and one-half mile north and south. There is a total of 118 of these maps. They were public records and were used continually by outside surveyors, real-estate men, etc., as well as by employees of the City Engineer's office.

FIG. 1. STANDARD GRANITE MONUMENT FOR STREET LINES, ST. PAUL, MINN.

As these maps became badly worn an attempt was made in 1902 and 1903 to trace them, but it was found impractical as so many of the lines had been obliterated by use and, furthermore, a great many errors had been made in the tracing and in the original platting. It was then decided to redraw them from the original notes on heavy, detail paper, trace these drawings and blueprint them; the blueprints were to be used by the public and the original drawings to be preserved.

MONUMENTS—Prior to 1901 all additions to the city were marked with wooden hubs, but since that date all block corners in new additions have been marked with iron pipe, in accordance with a state law. The additions have been laid out with reference to the section lines, and setting these pipes became the center lines of the previous street system, except where claim lines existed. As streets were improved these iron pipes were replaced by standard granite monuments (Fig. 1), either at the location of the iron or at the street intersection; now 90% of the streets are sufficiently well monumented to make the running out of a street line a simple matter. Fig. 2 shows method of locating and referencing monuments.

*From annual report of the [illegible] of Public Works [illegible], St. Paul, Minn.

As additions or rearrangements are platted and recorded in the Registry of Deeds office they are put on the Standard maps and after streets are improved they are monumented and the monuments are also shown on the Standard maps.

For a great many years a monument atlas was kept up, and it was necessary to refer to this atlas when monuments in any particular locality were required. Monuments were numbered and the number referred to the page of the monument record book on which were given the notes and ties required.

This monument record, for some reason, fell into disuse and it has also been found that the records on the Standard maps for the last few years are not complete. To remedy this a card-index monument record has been started with the intention of bringing up to date all records of monuments in the city. These cards are indexed under the street name. There are three or more intersections to each card and the cards are numbered and run consecutively on each street from the center of the city outward. These cards are also used for records of roadway widths.

The monuments themselves received no better care than the records. A great many of them were taken out or disturbed during construction work, such as grading streets, putting in sewers, and then not replaced. Some of the monuments were taken out by contractors under instructions from the street engineer because it could not be avoided, but the department was lax in not having them replaced as soon as the construction work was completed.

Specifications in all contracts for city work have the following clause:

> The contractor shall not disturb any monuments or stakes found on the line of the improvement until ordered by the engineer and shall reset any monument as directed by the engineer. A penalty of $25 may be imposed for each monument disturbed without orders and the amount deducted from the estimate.

ADDITION PLATS—All plats of additions or rearrangements of the existing platting must be submitted to the County Plat Commission for approval. This commission has jurisdiction over the arrangement of streets and alleys, their width, and their connection with existing streets and alleys, the placing of monuments, the corrections of the survey and the placing of all data on the plat necessary to retrace it in part or in whole on the ground.

FIG. 2. METHOD OF SETTING AND REFERENCING STREET MONUMENTS, ST. PAUL, MINN.

When surveys are necessary to check the accuracy of the work they are made by the City Engineer upon request of the Plat Commission when within the city limits

and by the County Surveyor when outside the city limits and within the county.

The Commission also sees to the compliance with the law regarding size of plats, quality of paper, character of drawing, form of affidavit, descriptions, dedications and acknowledgments. It is also the business of the Commission to see that a copy of the plat is made and filed in the City Engineer's office before the original is placed on record.

Hydrographic Surveying with a Four-Man Party

By B. L. Rees*

Some time ago, while the writer was in charge of some harbor work in the South for a private concern, it became necessary to take a series of off-shore soundings, where the method of locating soundings from two transit stations on shore was the only one applicable. The available party consisted of only one assistant engineer, a transitman, a laborer for a boatman, and the writer as the second transitman.

The results were very satisfactory, and the work was done rapidly. A party of four is believed to be the smallest possible for such work, and as some of the methods and equipment employed were unique but practical, a detailed description of both is here given.

Special Sounding Line—The usual cotton-cord sounding line was not used because of its variable length. A brass "jack" chain was substituted. The links of this chain are in the form of a figure 8 with one half of the link bent at right angles to the other. This type of chain does not kink readily and is easily handled, while it has the advantage of constant length, thus avoiding a variable correction.

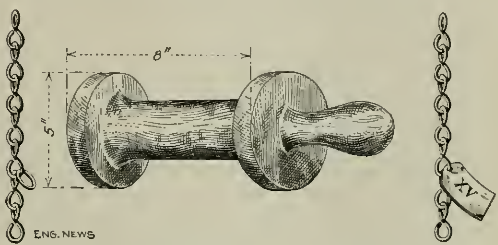
A good-sized chain for sounding purposes will run from 5 to 8 ft. to 1 lb. The foot marks were galvanized-iron rings about ½ in. in diameter, although brass is preferable when brass rings can be obtained. The 5-ft. marks were small strips of rawhide into which Roman numerals were burned with an iron. Circular brass tags about ⅝ in. diameter are preferable when obtainable. The chain was not used for casting, but the writer can see no objection to the use of such a sounding line when casting is necessary.

Tide Gage—The tidal range averaged about 8 ft. A tide gage was set where it could be readily observed by one of the instrumentmen while the soundings were being taken, although the work was generally done about slack low water.

Sounding Boat and Crew—An ordinary flat-bottom row boat, locally called a "bateau," with a single oarsman, was used. The leadsman did his own recording on manila cards 6x10 in., made fast by thumb tacks to the bottom of a shallow box which rested on the stern seat in front of him, while he was sounding. These cards were properly ruled and the lines numbered consecutively. As soon as the leadsman had completed his work, his records of soundings, necessarily wet and soiled, were immediately transferred to one of the transit books, checked, and the cards destroyed.

Whistle Signals—Next to the sounding chain, the most important item of the leadsman's equipment was a standard police whistle. With this whistle held in his mouth, he blew a signal whenever a sounding was taken. This "whistle method" replaced the usual method of timing soundings. The writer believes this whistle method has many obvious advantages over the time method, particularly since soundings can then be taken when possible—a very decided advantage in rough or flowing water. Where the leadsman is so far from the instruments that such a whistle is impractical, the body of water will necessarily be of a size requiring a power-boat and a flag or other flash signal will answer the same purpose. An extra or fifth man might be required in such a case.

Field Methods—The leadsman stood in the stern of the "bateau" facing back and had the box of record cards



Chain and Reel Used in Four-Man Sounding

before him on the seat. When ready to take a sounding, he suspended the lead-chain over the side of the boat toward the instrumentmen. Both instruments were then sighted to the chain at the water surface, and the alidades turned to follow the chain as the leadsman moved it slowly around and off the stern.

As the lead touched bottom, the leadsman blew the whistle and both instrument alidades were stopped at that position. He blew once for each sounding except the fifth, when two blasts were given; and in this manner the three men had a check, which was signaled back to the leadsman in the boat by the instrumentmen using the regular arm signals.

While the leadsman was recording his soundings and moving to another position, the instrumentmen read and recorded the horizontal angles and observed the tide gage.

The advantages of this method were: the leadsman gave the signal promptly and avoided the delay of telling a second man to signal; he took the soundings to the best advantage without regard to any time interval, working slower when required and making up for it when possible; an extra man in the boat as recorder and for signaling was eliminated and the instrumentmen did not have to read watches and record sounding time. There was no difficulty in taking soundings at the rate of two to the minute, at times; yet at other times, there were delays of several minutes.

Transit Stations—Two transits were used in the regular way at established stations. They were properly oriented and with the upper motion clamped only sufficiently to hold any set position, the instrumentman followed the suspended sounding chain until the leadsman by blowing his whistle gave notice of a sounding, when the alidades were stopped and the horizontal angles read and recorded.

*Assistant Engineer, Public Service Commission, 1138 Whitehall Bldg., New York City.

Each [illegible] had the regulation transit fieldbook, with lines numbered consecutively to check with the leadsman's signal at each fifth sounding. One of the [illegible] was ruled to show, in addition, the tide-gage reading, which was recorded for a change of a tenth. In addition to these columns, for horizontal angles and gage readings, columns were prepared for recording the soundings transferred from the leadsman's cards, and another for those soundings when reduced to mean low-water datum.

Illinois Road Cross-Sections

Standard cross-sections of Illinois state-aid roads are divided into two general types: those for the single-track roads, and those for double-track roads, with intermediate forms as noted below.

Where it is decided that the traffic will be accommodated by a single-track road, the paved portion is 10 ft. wide, if constructed of concrete or brick. This width is sufficient for a single line of vehicles and will also permit two vehicles to pass with only two wheels of one of the vehicles off the paved portion of the road, the other having all four wheels on the paved road. A modification of this section, offering a somewhat greater convenience than the single-track road alone, are the sections which provide in addition to the 10-ft. paved portion of concrete or brick, 4-ft. macadam shoulders on either side. It is anticipated, however, that this section in first construction will be used only on those roads where it may seem that double-track roads should be provided but, owing to the limited funds that may be at hand, together with a doubt that might exist as to the necessity for the double-track road, it is decided not to build an 18-ft. double-track road. Usually the macadam shoulders will not be provided in first construction, as they may be placed fully as cheaply after the road is built and when the traffic needs demonstrate the necessity for them.

As all the principal roads now carry a considerable proportion of motor traffic, and moreover as this proportion of motor traffic is fast increasing, it is necessary to take this fact into consideration in the proper design of the road. Experience has proved that to provide safely for two lines of mixed traffic, 18 ft. is the minimum width. It is apparent, therefore, that any width between 10 ft. and 18 ft. is uneconomical, because the traffic either requires the double-track road and therefore the road is too narrow for the traffic, or the traffic does not require a double-track road, in which case it is wider than is necessary.

The single-track roads for macadam construction, which will be used to some extent on the lower traveled roads in the south portion of the state, provide 12 ft. for a single-track road. The reason for a 12-ft. macadam rather than a 10-ft. is that the traffic on the 12-ft. road will tend to spread itself somewhat more evenly over the surface of the road and [illegible] and [illegible] the wear [illegible] as would be the case if a narrower road were built. With the paved brick or concrete surface, which will resist the wear, it is not so important that the traffic spread over the road as in the case of a macadam surface. [A. N. Johnson, formerly Chief Engineer, Illinois Highway Commission, in the [illegible] Bulletin of the Highway Department.]

Permanent Survey Monument for Southern Louisiana Reclamation Projects

A concrete survey monument, which has been used with success for marking important property corners in marshland in southern Louisiana, is illustrated in the accompanying sketch. It is built of cement mortar in a form made of common 5-in. iron stove-pipe. The sand and cement are mixed dry, two parts sand and one part portland cement, packed in cement sacks, each sack holding 0.75 cu.ft., and carried into the field. Two sacks are required to make one monument.

Concrete Monument Designed by Arthur M. Shaw, New Orleans, La.

Two lengths of stove-pipe are placed in the hole. The mortar is mixed moderately thick; in marshy ground a rammer is used to crowd out a small amount of mortar at the bottom to form a spread base. After the hole is backfilled with carefully tamped earth, the remaining mortar is deposited around the top of the monument as shown. A [illegible]-in. bronze bolt is pushed into the soft mortar flush with the top of the monument. The pipe is left in the ground.

The advantages of this type of survey marker are permanence, easy construction by ordinary laborers, easy transportation of materials, readiness with which the materials may be secured and their cheapness; the pipe forms are the cheapest grade of black iron stove-pipe, which comes "nested" in convenient shape.

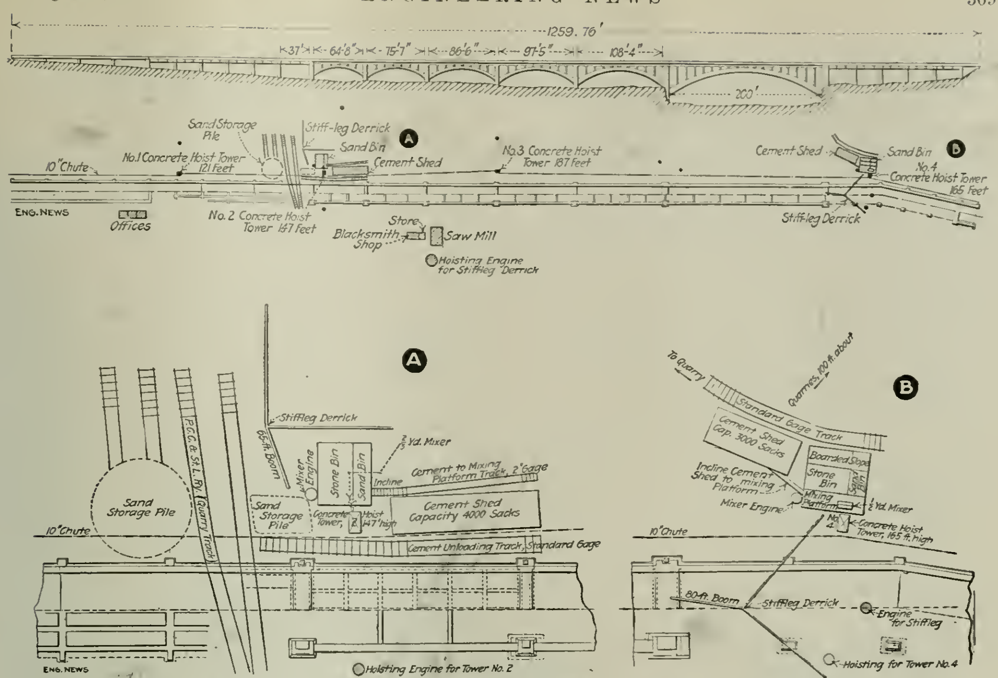
Iron pipes have been extensively used for markers of similar kind, but even galvanized iron rusts very rapidly, the destruction being most pronounced at the ground surface. Black iron pipe could not be depended upon in such locations to last more than two or three years. The monument shown was devised by Arthur M. Shaw, [illegible] Hennen Bldg., New Orleans, La.

Construction-Plant Layout for a 1200-Ft. Concrete Arch Bridge

By J. P. Kaufman*

A concrete bridge, known as the Williams Bridge, is now under construction over the Scioto River in Franklin County, Ohio. The bridge is located at Marble Cliff, several miles northwest of Columbus, and is to replace an old wooden structure carried out by the flood of March 1913. The new bridge has a total length of 1,[illegible] ft. 3 in. and is [illegible] ft. wide over all, with a [illegible]-ft. roadway and two

*Resident Engineer, [illegible], Columbus, Ohio.



Layout of Construction Plant, William's Bridge, Columbus, Ohio

2-ft. sidewalks. It has six arches of the ribbed type with varying spans, the main arch over the river having a clear span of 195 ft. At either end of the arch spans are several girder spans, and retaining-wall abutments. The concrete, exclusive of the railings, totals 4750 cu.yd.

At the present time most of the construction equipment has been installed. The east retaining-wall, east girder spans, and some of the arch piers, have been poured, and work is progressing westward. The drawing herewith shows the layout of the plant.

The main concrete-mixing plant is on the east side of the river near Pier 6. Here a stiff-leg derrick with 65-ft. boom is installed, commanding the quarry tracks, on which the materials are delivered. It operates a clamshell bucket with which the sand and stone are unloaded from cars and delivered to hopper-bottom storage bins, discharging by gravity to a measuring bin above a ¾-yd. Cube mixer. Incoming cement is unloaded from cars onto small push cars which deliver the cement to a shed, having a capacity of 4000 sacks. Cement from the shed is loaded into a car, pulled up an inclined track by means of a hoist on the mixer, and dumped onto the platform.

Concrete is elevated in Tower 2 (147 ft. high), and is delivered through chutes to a bucket in Tower 1 (121 ft. high), or to one in Tower 3 (187 ft. high), or direct to the bridge. At Towers 1 and 3, the concrete is again elevated and delivered through chutes to the various parts of the bridge.

This east-side mixing plant is to supply all the concrete required for that part of the bridge east of a point 20 ft. west of Pier 11.

There is an auxiliary concrete-mixing plant now being installed on the west side of the river. Here crushed limestone will be delivered in small side-dump cars directly from the quarries, which are in the immediate vicinity. The stone and sand will be dumped into bins discharging by gravity to a measuring hopper above a ½-yd. Ransome mixer. The cement will be unloaded into a shed having a capacity of 3000 sacks and, as needed, will be delivered by gravity to the mixing platform. The concrete is elevated in Tower 4 (165 ft. high) and chuted.

The chutes, hoppers, etc., are standard Insley equipment. Steel cables ⅞ in. in diameter are stretched over the tops of the towers to deadmen. From the cables, 10-in. chutes, inclined 30° with the horizontal, are hung on ¾-in. manila rope suspenders. Tower 3, which is a typical one, is 3½x6 ft. in plan and has four 6x6-in. posts braced with 2x10-in. transverse and 2x6-in. diagonal planks, all connections being bolted. Each tower has four sets of four guys.

Water is pumped from the river to a tank located on a large pile of quarry waste and is distributed by gravity.

The 225 tons of reinforcing steel are bent by hand on the job.

The arch piers are being constructed in open sheeted excavations which are carried to bedrock. The maximum depth of excavation is about 35 ft. The excavating for all the arch piers except 11 and 12 is being done by means of a stiff-leg derrick, with 40-ft. boom and ¾-yd. buckets. Derricks with 80-ft. booms are installed near Piers 11 and 12 and will be used to remove the sandstone abutments and pier of the old bridge, to excavate, and to drive the piling for the centering of the main arch.

The contractor for the bridge is D. W. McGrath; E. C. Miller is contractor's superintendent. John Peake is County Surveyor, Walter Braun is County Bridge Engineer, W. J. Watson & Co. are the consulting engineers, and the writer is Resident Engineer.

Load-Tests on Concrete Piles, North Side Point Bridge Approach, Pittsburgh

An acceptance load test of the concrete piles used for the foundation of the piers of the approaches to the North Side Point Bridge, Pittsburgh, Penn., was made on one pile in each of the eight pier bases. The tests were made under the specifications of the Director of Public Works of the city of Pittsburgh by the Raymond Concrete Pile Co., whose familiar cast-in-place concrete piles were used on the work.

The approach piers are founded in a sedimentary deposit of sand and loam, overlying a gravel bottom, into which it is quite difficult to drive or sink piles. Consequently the piles were short, the piles varying in length from 13 to 23 ft. and averaging about 17 ft. They were uniformly 8 in. in diameter at the point and increased in diameter toward the top at a rate of 0.4 in. per foot of length. The specifications under which these tests were made are as follows:

TIME OF TESTING.—[illegible]

[illegible]

base will be selected by the director for testing. In case any or all the piles tested fail to fulfill the requirements hereinafter specified the contractor shall, if ordered by the director, make tests of other piles in the groups in which the tests have failed without additional compensation. All piles for testing shall be selected by the director.

ADDITIONAL PILES.—In cases where the tests of a group shall fail to meet the hereinafter specified requirements, the entire group in which said test piles are located shall be considered the same as the test pile and their safe carrying capacity shall be considered one-half the load of said test pile when it gave a settlement of ¾ in. and the contractor shall drive such additional piles and at such locations and depths as ordered by the director.

Additional piles made necessary due to failure of test piles to sustain the specified test shall be driven where directed by the director and to penetration of surrounding piles at the expense of the contractor.

PREPARATION OF PILES FOR TEST.—The piles selected to be tested shall have placed in their top a suitable steel dowel or plug, securely grouted in place, with its top round, and the test loads shall be so placed that a level rod can be set on the plug at any or all times.

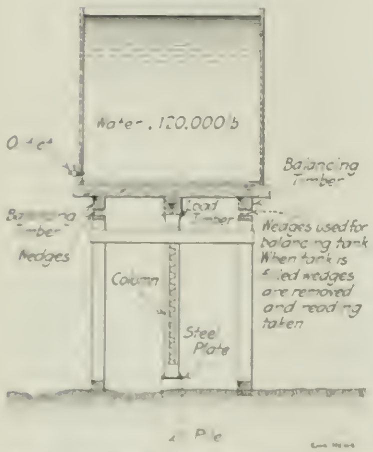


FIG. 1. METHOD OF SUPPORTING 60-TON LOAD ON TEST PILE

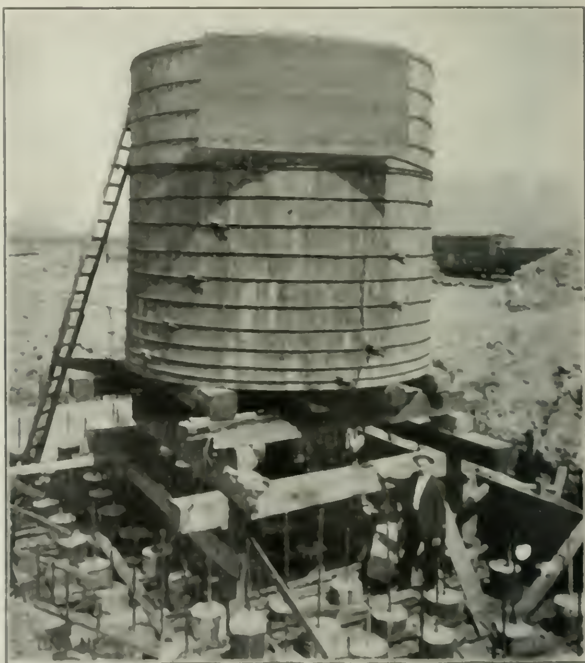


FIG. 2. ONE OF THE PILES UNDER TEST

Upon the pile shall be placed a suitable platform properly balanced so that the test load acts vertically on the pile.

LOADING.—Upon this platform there shall be placed a load of 60 tons, which shall remain undisturbed for 48 hours; the load shall then be increased to 90 tons and allowed to remain undisturbed for 48 hours. The load shall then be removed.

READINGS.—The following readings shall be taken: First, before any load or platform is placed upon the piles; second, immediately after the 60-ton load has been placed upon the pile; third, 48 hours after the 60-ton load was placed upon the pile; fourth, when the 90-ton load has been placed upon the pile; fifth, after the 90-ton load has been placed on the pile

TABLE OF RESULTS OF PILE TESTS, NORTH SIDE POINT BRIDGE, PITTSBURGH

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

sixth, immediately after the 60-ton load has been placed on the pile; seventh, 36 hours after the 60-ton load was placed on the pile; eighth, when the load on the pile has been reduced to 30 tons; and ninth, immediately after the entire load and platform have been removed from the pile.

ALLOWED SETTLEMENT—The pile, to be acceptable, must not show a settlement exceeding ¼ in. between the first and third readings, or a settlement exceeding ⅜ in. between the first and seventh readings, or a variation between the first and ninth readings exceeding $\frac{5}{16}$ in.

BEARING POWER—The bearing power of each group of piles will be determined by the director from all available data for each particular group and will be based on one-half the load which causes a settlement of ⅜ in.

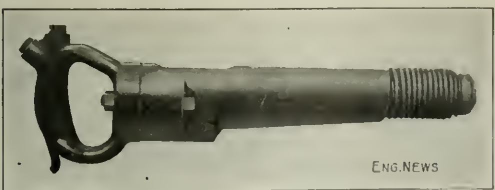
The accompanying diagram, Fig. 1, shows the testing rig. First, a circular steel plate was grouted on to the head of the pile under test and on this was placed a latticed steel column, 13 ft. long, which carried balanced on its top the loading timber on which rested the tank framework. As shown in the view, Fig. 2, side posts were also placed which carried the tank framework, through the medium of wedges, until a balance was attained. When the wedges were struck the tank, carrying the desired load of water, rested on the pile under test. Settlements were read upon a level rod set upon a reinforcing bar which protruded up from the pile through a hole in the plate cap provided for that purpose.

The results of the tests are given in the accompanying table.

The tests were under the direction of N. S. Sprague, Superintendent, Bureau of Engineering, City of Pittsburgh, and under supervision of W. F. Hall, District Manager of the Raymond Concrete Pile Co., for the Pittsburgh District.

NOTES

A Simple Riveting-Set Retainer for preventing accidents consequent to the ejection of the rivet set from the nozzle has been developed by the Ingersoll-Rand Co., 11 Broadway, New York City, for its line of "Little David" pneumatic riveting hammers. The retainer is a steel spiral spring, one end of which fits over a projection on the hammer nozzle; the other end is wound to a smaller diameter, so that the rivet set when for ⅞-in. rivets or smaller can be formed with a shoulder and slipped into the retainer. The larger sizes of riveting sets are formed with a coarse thread and screwed into place. It is claimed that the riveting sets cannot be driven out of the nozzle even when the hammer is run free under 90-lb. pressure per sq.in.



In the Graphical Determination of the Neutral Axis in a reinforced-concrete beam, discussed by Ernest McCullough, in "Engineering News," July 9, 1914, p. 88, a correspondent notes that the method fixes $\frac{k}{1-k} = \frac{n+1}{m+1}$ instead of $\frac{k}{1-k} = \frac{n}{m}$, which is the correct ratio according to the accepted theory. Mr. McCullough explains this discrepancy as follows:

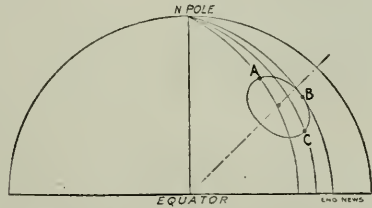
I have been teaching evening students for several years, draftsmen in the offices of architects, engineers and contractors whose mathematical attainments are very limited. With the great amount of free literature floating about it is useless to tell such men not to design, because they will attempt it anyhow. The thing to do is to give them instruction. I found it difficult by using the ordinary mathematical expressions to get into their heads the idea of how two differing ratios, the ratio of deformation and the ratio between stresses, fixed the location of the neutral axis. One evening I drew the two lines on the squared blackboard and the results were so nearly exact that I investigated the matter and found, naturally, that the relations were true. But in handling the students it was still difficult to make many understand where the ratio 1 : 15 and 1 : 24.66 came in without extending the ratio to the left of the line one division. With it in that shape their understanding of the matter seemed complete. The results were as close as ordinary accuracy in design requires, so I have held to this graphical representation in teaching and after the students grasped it showed them the relations actually existing and showed also that by omitting the division to the left of the line the mathematical expression and the graphical representation agreed.

A Problem in Astronomy—A correspondent in Philadelphia, Penn., proposes the following problem, which he has met with in his work, for any of our readers who wish to exercise their ingenuity in spherical trigonometry and astronomy, or solid analytical geometry:

Having given three points, all located in any one quadrant, upon the surface of a sphere, to find the center of the circle passing through the three points.

In the figure, Point A is Lat. 40°-00′ N.
Long. 82°-00′ W.
Point B is Lat. 38°-00′ N.
Long. 82°-00′ W.
Point C is Lat. 39°-00′ N.
Long. 80°-00′ W.

Required to find by a short formula, the latitude and longitude of the point x, the center of the circle, drawn on the surface of the globe, and passing through the points A, B and C.



A Hand Concrete Mixer was used in the construction of the new combined concrete and timber snowsheds of the Great Northern Ry., described in our issue of June 4. While ½-yd. power mixers were used for the heavy work of the retaining walls or back walls, the hand mixer was used extensively in making the concrete for the pedestals which support the timber posts for the roof. This arrangement worked out very conveniently, as the pedestals usually could not be built when the backwall was being built, while the amount of concrete in each was so small and the work so scattered that the concreting could be done in this way more economically than with a power mixer. The machine was built by the T. L. Smith Co., of Milwaukee, Wis., and had a 36-in. drum of about 2½ cu.ft. capacity, 32 in. long, on each end of which was an internal gear meshing with a pinion driven by a crank handle. The charging and dumping were done through openings extending across the drum, and the concrete was dumped directly into the forms, the machine being carried by a pair of 30-in. wheels so that it was easily shifted from place to place.

Designing Shallow Girders for Limited Deflection—R. C. Davis, Chicago, suggests a simple and convenient method for designing shallow girders under the rather common condition that the deflection of such a girder must not exceed the deflection of a girder of particular ratio of depth to span. Many railway specifications for steel bridges contain a clause such as the following:

Plate-girders and rolled beams used as girders shall preferably have a depth of one-twelfth of the span. If shallower girders or beams are used, the section shall be increased so that the maximum deflection will not be greater than if the above limiting ratio had not been exceeded.

In designing a shallow girder under this clause, it is customary to design first a girder having a depth of one-twelfth of the span, determine its moment of inertia, and then design the shallow girder for the same moment of inertia, which will make its deflection the same. Instead of making this double calculation, proceed as follows:

Having given the maximum allowable fiber stress, say 16,000 lb. per sq.in., design the shallow beam or girder in the usual manner, but with a fiber stress reduced in the same proportion as the depth of beam is less than the deeper girder whose deflection is taken as standard. For instance, in a span of 24 ft., if the normal limit is a depth of one-twelfth the span, or 24 in., but local conditions require a girder of 20-in. depth, then design the 20-in. beam for a fiber stress of $\frac{20}{24} \times 16{,}000$ or 13,300 lb. per sq.in. The 20-in. beam

[illegible] in this way will have the same deflection as the [illegible] beam designed for [illegible] lb. per sq.ft. Thus the value of $\frac{I}{c}$ will be $\frac{33}{24}$ of that which would be used for a 24-in. [illegible] and since the [illegible] is [illegible] $\frac{33}{24}$ the value of [illegible] for the [illegible] the values of I of the two beams will be [illegible], and thus [illegible] equal deflections.

An Improvised Gravel and Broken-Stone Spreader—A simple [illegible] designed by a motor truck mechanic [illegible] shop, eliminated the labor of [illegible] on the construction of a gravel road in [illegible], Tex. The device is nothing but two simple [illegible] which hold the tailboard of the truck partly open at the bottom, which it [illegible] hinged at the top. The catch has three adjustments for regulating the quantity of stone

Peerless Motor Truck Equipped with Gravel Dumping and Spreading Device

or gravel dumped. It was found by a few experiments that if the power dumping [illegible] was tripped in the usual way, and the truck thrown into the first speed ahead, the material was dumped and at the same time spread evenly to a depth of 6, 8 or 12 in., as the circumstances required. Two Peerless motor trucks were used to haul the gravel, which at first was dumped in piles in the middle of the road. The [illegible] of this simple device saves the labor of three or four [illegible].

Success of a Municipal Ditching Machine—The city of Worcester, Mass., does practically all its public work by municipal day labor and does the work efficiently. The accompanying views shows a municipally owned Austin trenching machine at work. The machine was purchased by and is part of the equipment of the city Water Department, of which George W. Batchelder, Water Commissioner, is in charge. The work on which the machine is employed is a 3-ft. sewer trench 12 ft. deep in a very hard hardpan containing numerous small boulders. The ditch was excavated by the Water Department for the Sewer Department at the rate of 39.2c. per cu.yd., based on a charge of $25 per day. The actual cost of operating the ditcher is stated by Mr. Batchelder to be very close to $15 per day. On a water-pipe laying job a trench was dug 6 ft. wide and 6 ft. deep, through various kinds of material, mostly gravel, in an actual operating time of 123 hours [illegible]35 ft., or nearly a mile of trench, was excavated. The trenching machine was recently inspected on the work illustrated by members of the New England Water Works Association, who expressed much satisfaction with its ease of operation and efficiency. Perhaps there is not better proof of Worcester's honest and progressive municipal day-labor administration than the fact that no protests have been received against the introduction of a machine which disposes with the services of several extra laborers.

Ground-Glass Drawing Boards—A sketching board for use in the drafting room in laying out sketches, details and illustrating portions of drawings for detailers, salesmen and customers, is one of the handiest things that a well equipped drafting room can have. Similar in use to the old-fashioned slate, the ground-glass drawing board painted black on one side, serves this purpose admirably.

A fine, evenly ground surface should be used to work on and the reverse side of the glass should be given two or three coats of smooth, black paint. The edges of the glass board should be squared to allow the use of a T-square and triangles. Small slate pencils are best for sketching and should be kept sharp by means of the ordinary sandpaper pad. Erasing is easily accomplished by means of a damp sponge or soft cloth, thus eliminating the dust and dirt incident to art gum or other erasers.

Such a board is especially useful when laying out preliminary sketches which mean constant changing and redrawing. The great saving in drawing and sketching paper is quite obvious. Glass boards up to 2 or 3 ft. square need not be mounted and can be used on any table with the ordinary precautions against breakage. Boards larger than this size should be mounted in a frame and adequately supported in a permanent location. [Frank H. Jones, 95 Partridge Ave., Winter Hill, Mass.]

Stiffleg Derricks are not now in favor with contractors on bridge and steel erection work, according to an erecting engineer. They may be used as yard derricks to unload the steel, but they are too cumbersome for erection, especially on bridge work. They may be used, however, when built as portable machines or "mule" travelers, mounted on trucks or flat cars, particularly for the erection of long steel-frame sheds or buildings at industrial plants. The use of stiffleg derricks at the plant of the Lima Locomotive Co. was described in our issue of May 7. For high steel office and warehouse buildings the preference is for guyed derricks.

Austin Trenching Machine Owned and Operated by the City of Worcester, Mass.

Editorials

On account of the European War and its consequent effect on American markets, the regular "market prices" supplement to ENGINEERING NEWS, which usually appears in the first issue of each month, has been postponed.

Federal Aid to Road Construction Unlikely

According to a recent Washington dispatch, the Senate Committee on Post Offices and Post Roads, of which Senator Bankhead of Alabama is Chairman, has agreed to report favorably the Federal aid scheme of Ex-Senator Jonathan Bourne, Jr., of Oregon.

Mr. Bourne's scheme was explained and criticised in our issue of May 22, 1913. In general his proposition was to lend the credit of the Federal government to such of the States as desire to borrow money for road construction, the total amount of Federal aid being limited to half a billion dollars. The National government would issue 3% bonds for this amount and would take 4% State bonds for the money it advanced, the difference of 1% forming a sinking fund for the payment of the bonds at maturity.

The chief objection to the Bourne scheme is the objection which attaches to all schemes for building roads with borrowed money; to wit, that the roads to be built will be worn out and gone long before the bonds issued to build them fall due. If the life of bonds issued to pay for road construction or paving were limited to the life of the roads built from the proceeds of the bonds, the objections would be much less serious. But almost invariably states and counties and cities which are building roads and paving streets with borrowed money raise the money by bond issues running twenty-five to fifty years. Part of the colossal debt under which New York City staggers is made up of bonds issued to pave streets on which the pavement already has been renewed two or three times since the bonds were first issued. The present generation of taxpayers is already loaded down with burdens from which they receive no corresponding benefit; they ought not, therefore, to lay increased burdens on the generation which is to follow. For the Federal government to encourage the several States to continue such financial folly would be a crime.

It may be shrewdly suspected that the reason why the Senate Committee has reported this bill of Senator Bourne's is because of its disinclination to report favorably the almost equally foolish House bill for Federal aid to roads, passed some three months ago.

There is considerable reason to believe that both the Senate bill and the House bill were intended rather for political effect than as measures intended for enactment into law, and that neither House or Senate seriously intends to enact any Federal aid to Highways law at this session.

The Water Supply of the Panama Canal

It requires no long memory to recall the dire predictions made only a very few years ago of disaster to the Panama Canal enterprise because, among other things, there was not water supply enough to provide for the traffic. These prophecies of evil were not confined to irresponsible writers for the newspapers. Some learned engineers wrestled with columns of figures and attempted to show that by allowing enough evaporation from the surface of Gatun Lake during the dry season, the level of that body of water would be reduced so low before the end of the season that the traffic would be interfered with.

It is of interest for this reason to compare with these prophecies the results of actual experience. Traffic is not yet passing through the canal, it is true, but during the recent dry season the surfaces of Gatun and Miraflores Lakes have been held at substantially the level they will be when the canal is open. Accurate records of the outflow from Gatun Lake, therefore, enable a close estimate to be made as to what amount of water will actually be available for purposes of lockage.

The *Canal Record* of July 8 summarizes the results of measurements of evaporation and outflow, and the conclusion may be summarized in a single sentence, which we quote as follows:

> The record of the season of 1912, in which the runoff from Gatun Lake watershed was the smallest observed during the past twenty-two years, demonstrates its capacity for all the traffic that can be brought through the canal.

Stating the figures in more detail, the assumption is made that Gatun Lake was at an elevation of 87 ft. above sea level at the beginning of the dry season on Dec. 1, that the hydro-electric plant at the Gatun spillway was continuously operated, and that 48 lockages a day were made. Under these conditions the surface of the lake would be reduced 7½ ft. to 79.5, on May 7, at the close of the dry season. At this elevation the depth of water through Culebra Cut is 39 ft., which is ample for navigation. This average of 48 lockages a day may be compared with the average number of lockages through the Soo Canal on the American side, which was 41.7 per day during the navigation season of 1912. During the eight months of navigation, the Soo Canal in that year passed 14,916 vessels, while the Suez Canal in the same year passed only 5373 vessels. According to these figures, therefore, there is water enough at Panama to handle probably three times as much traffic as now passes via Suez.

The Pittsburgh Sewer Explosion Repeated

A mile length of large trunk sewer blew up in Pittsburgh eight months ago, and since that time a couple of hundred thousand dollars have been spent in rebuilding the wrecked sewer. With this rebuilding work nearly

completed, on July 28 another explosion occurred in the same sewer. Fortunately this time the sewer was not wrecked, yet the explosion deserves to be classed among the violent sewer explosions on record.

Both last November's explosion and the explosion of July 28 appear to have been due to the same cause, namely, gasoline in the sewer. Because the first explosion destroyed such a large part of the sewer there was little chance to determine the cause with any great certainty. Whether for this reason, or not, the city authorities appear to have been a little reluctant about proceeding at once to take stringent measures against the discharge of inflammable wastes into their sewers. Now, after the second explosion, prompt action will undoubtedly be taken and the public will support the authorities in any necessary measures.

The following brief statement of facts of the second explosion is of interest:

The explosion occurred at 9:10 a.m. July 28. Gasoline odor was detected the day before. A quarter-hour before the explosion ten or twelve men working inside of the sewer on repairs were ordered out as the gasoline fumes became so strong that they could not remain inside. As electric lights were used in the sewer work, it is not clear how the gas became ignited.

The explosion was not serious. Damage was confined principally to breaking of glass in the adjoining mill of the Carnegie Steel Co. The explosion apparently did not extend beyond the length of sewer between the Allegheny Valley R.R. tracks and the sewer outlet. The explosion traveled through the pipe gallery of the steel company opening into the sewer and blew up plates in the mill, also damaging the roof, etc. A few men in the mill were injured by falling glass. The explosion made a loud report, not a muffled one, as in the former case. Working shafts and manholes were open, which probably reduced its force. Flames shot high in the air.

The U. S. Bureau of Mines is working in conjunction with the city authorities in investigating the case, locating sources of inflammable waste, etc.

In furnishing a striking example of the great danger residing in sewer explosions or in the existence of causes which may produce sewer explosions, this second Pittsburgh case is a valuable one. The recurrence of the explosion in the same sewer reinforces the proof by showing that the explosion of last November was not an isolated case, but an occurrence due to a continuously existing cause. It is now the city's duty to find and remove that cause.

A Catastrophe without a Parallel

With almost the suddenness of lightning from a clear sky there has come upon the world during the past week the sudden outbreak of a war involving all the great powers of Europe. Of the vast disaster involved in such a war, it is well nigh impossible to conceive. The whole civilized world is aroused to sympathy and offers of aid when by some cataclysm of nature or some failure of man's work a few hundred or a thousand people lose their lives and a few million dollars' worth of property is destroyed. But the destruction resulting from such a conflict to the death as that which has begun in Europe may cause, in a very short time, the death of a million men and the destruction of wealth amounting to a billion of dollars.

It is difficult for even the most farsighted of economists or statesmen to forecast the results which may follow from this war; but it has already been made evident that even the threatening danger of such a war has had far-reaching results in our own country. The universal upsetting of values which swept over every country of Europe within the space of two or three days was felt immediately in our own country, and compelled the closing of every American stock exchange and of many of the exchanges in which other commodities are bought and sold.

Some of the amateur statesmen in our legislatures and even in Congress have been for years agitating against these exchanges, and have sought to close them by process of law. Now that this result is actually brought about by other causes, thousands of business men in all parts of the country find themselves in serious difficulties because of the loss of the facilities which these exchanges afforded.

It has been often and truly said that the United States is probably nearer to absolute economic independence than any other country in the world. When the emergency required, she could close every port, mount a guard on every frontier and absolutely cut off all intercourse with foreign nations. There would be little difficulty, when once the economic adjustment was effected, in supplying all our own requirements, both as to food products and manufactured goods. But nothing short of stern military necessity could compel such an economic readjustment; and the loss and suffering and disaster involved in making it would by itself constitute an overwhelming calamity.

In the year ending June 30 last, government statistics, made public on Aug. 5 by the Department of Commerce, showed that we imported from foreign nations goods to the value of $1,893,000,000, and we sent abroad during that time $2,364,000,000 worth of goods. Over a billion dollars' worth of this was in the form of finished manufactures.

The United States is just harvesting probably the greatest grain crop it has ever secured. The European war will make an enormous market for foodstuffs. It seemed at first that the clash of armies on the plains of Europe meant the opening of a gold mine for a million American farmers, but the eager speculators for a rise on the exchange were suddenly confronted with the problem of how the grain was to be transported and delivered to the warring nations in Europe. With all the great naval powers of Europe engaged in a life and death struggle, any merchant vessel taking wheat to the port of a hostile power would be subject to capture. Doubtless the wheat will go, in some way, for food is as necessary to the armies (which, as the saying is, travel on their stomachs) as are guns and ammunition; but the heavy risks involved in its transfer across the ocean and to its final destination may absorb so large a part of the final price that the American wheat grower or wheat dealer may have his expected large profits turned into a loss. This is merely a typical illustration of the dangers and perils and sudden changes which this unprecedented war may bring about. Many thousands will doubtless be made suddenly rich by these lightning changes in the markets and in industry, but many other thousands will as suddenly find themselves facing poverty.

The events of the past week have furnished a marvelous illustration of the extent to which modern commerce and industry is governed by international conditions in economics and in finance.

In the preparation for war during the past week, all the nations of Europe have been grabbing for gold, and not only the nations but the financiers, and not only the financiers but the people. Every French peasant, merchant and manufacturer besieged the banks, seeking to draw his savings in the form of gold, to be carefully hoarded for use in dire necessity. Similar occurrences went on in Germany and even in England. Indeed it is doubtful whether the United States itself could long retain its stock of gold if the doors of international exchange were left open so that Europe could find means to obtain the precious metal. On the other hand, however, there may come a backward flow of gold to this country as soon as the nations abroad, under the stern pinch of necessity, are obliged to have our food products and our manufactures and have nothing to buy them with but gold, because of the stoppage of their own production.

One of the most certain results of a great European war will be a world-wide scarcity of investment capital and a consequent rise in the ruling rate of interest. Indeed such a rise has already taken place, partly as a result of the wars fought during the last dozen years and even more of the preparations for war on an enormous scale which the European nations have made. About the close of the 19th Century, prior to the Boer War in South Africa and the Spanish-American war, the market value of investment funds in the highest-class securities was not far from 3%. During the past year or more the average price has been probably 4 to 4½%. Where the price of capital will go to in the event of a general European war, long continued, can only be conjectured. Such a war would destroy to a large extent the great reservoirs of investment capital in the principal European nations, to which all the rest of the world has resorted for the funds with which to carry on economic and industrial development. It may easily be that a year hence 5% or 6% or even 7% may be the ruling price for investment funds of the highest class. The rate on funds invested in ordinary enterprises, involving more or less risk, such as attaches to almost every private enterprise, must, of course, be correspondingly higher.

The far-reaching results of such a change in the value of capital it is impossible to foresee in full detail. It would have, of course, a vast effect upon the prices of commodities of every sort and of real estate. It will greatly limit the carrying out of works of permanent improvement, in which engineers are so largely concerned, since capital will be difficult to obtain and can only be secured at a high price. It will mean the cancellation of a great number of new enterprises because the reservoirs of capital that were to have sustained them will be dried up.

It can only be hoped that the emergency may bring about new demands for industry and ability to offset those that are cut off. This may indeed be the case. Practically the whole world is dependent on Europe and the United States for its supply of manufactured goods. But from now on the factories of Germany and France and England will be barely equal to the demands made upon them for home consumption, depleted of their labor forces as they will be by the call to arms. In South America, in Africa, in Asia and even in Australia, therefore, manufacturers of the United States will find markets for their products never before opened. A way must be found, of course, to transport these goods across the seas. Doubtless the matter of naval supremacy will be the first to be settled, and if this should result favorably to Great Britain, the British merchant marine will be as available for this work as in the past. We shall doubtless see also a powerful movement to create an American merchant marine, and Congress may revise our navigation laws so that this result may be achieved.

Of especial interest to many engineers is the question what is to be done concerning the half dozen great international engineering congresses which were scheduled for next year.

Besides the great international engineering congress to be held in San Francisco, together with numerous other international congresses relating to many branches of science and industry arranged for there, the International Railway Congress was to assemble next year at Berlin, the International Society for Testing Materials at St. Petersburg, the International Navigation Congress at Stockholm and the Congress of Mining and Metallurgy at London. Doubtless all these congresses will have to be indefinitely postponed. It has been suggested that the American engineers might offer to welcome these various congresses in the United States. But even if it were attempted to hold the meetings here, the attempt could hardly result otherwise than in failure. With the great nations of the world at each other's throats, it is not to be expected that their representatives, many of them government officials, could be brought together in peaceful and friendly conference only a few months hence. Indeed, who is wise enough to foresee the profound changes in nations, in politics, in policies, in races, which may grow out of this terrific conflict? It sounds like a mockery, the circular before us regarding an international exhibition of art and civilization to be held at Dusseldorf next year. But that is only one of several such international events, including our own great exposition at San Francisco, which must be either abandoned or, if held, must do without exhibits from the chief industrial nations of Europe.

It is not our function to discuss the historic causes which have precipitated this catastrophe upon the world nor to portray—what no words can portray—the incalculable suffering and misery which it brings to countless millions.

We may properly, however, point out here that in the opinion of many observers the cause of the war is to be traced not merely to deep social and national prejudice and hatred, but to the vast preparations for war which Europe has made. There is an economic limit to the burdens which a nation can bear. The competitive struggle for superiority in armament had reached the breaking point. The Europe of today has spent more by far on warfare in time of peace than the Europe of Napoleon spent to wage war. The time had come when these vast armies and navies must either be set in motion or reduced, and no nation could reduce its powers of defence without inviting conquest by its rival.

The best that may be hoped from the present terrible conflict is that when it is ended by peace, it may be a peace accompanied by universal disarmament, a peace that shall relieve the nations from those crushing burdens of preparation for war and leave them free to solve those problems of social readjustment which are the pressing problems of this century.

Letters to the Editor

Deterioration of Railway Property

Sir: I am endeavoring to obtain authoritative information relative to the physical deterioration of certain materials used in railway construction, and wish to know if data have ever been compiled that will show the ratio of deterioration of ballast, rails, ties, bridges, etc., due entirely to weather conditions, as against deterioration due entirely to wear from traffic.

For instance, it has been arbitrarily assumed that ties deteriorate 75% on account of weather conditions and 25% on account of traffic, and that ballast is deteriorated 90% by weather and 10% by traffic.

If you can refer me to any authorities or to publications treating with the above as I have outlined it, it will be much appreciated.

R. W. Le Baron,

Engineer Examiner of Joint Facilities, Chicago Great Western Ry.

Chicago, July 3, 1914.

[Probably these matters have been investigated by the railway and government valuation engineers, and we shall be glad to receive information for the benefit of our readers.—Editor.]

Highway Location in Mountainous Country

Sir—The recent good-roads crusade has marked an epoch in road building, and has been responsible for a heavier and more costly type of road construction than is really necessary or justifiable.

When state governments commenced spending millions on roads, the old "[illegible]" and "prairie schooner" passed into the limbo of a bygone day. The railroad locating engineer was called in to survey the trail for automobile and motor-truck traffic.

There is no question but that a railroad engineer was of all men best adapted for this work, but in approaching the new task, the theory of the old ideas clung to him and refused to be shaken off. The most persistent idea was the one that dealt with the grade line—the old locator would look at his Plate "A" profile paper and draw on his grades from 2000 to 5000 ft. long; the idea of breaking grade every 200 to 300 ft. if necessary, he felt to be a sacrilegious act on the part of one who had sat at the feet of Wellington.

The early freighting of the west was done over roads that had some of 20% and 25% grades. One would not say these were desirable, but they were the best the country afforded at a reasonable cost.

State roads are being built over mountain ranges in the West where the distance development is excessive, and where the maintenance cost will always be a constant tax on the road, solely to appease the worshippers of the 5% maximum grade fetish. To do this, they are willing to loop the loop, build figure 8's and design a road looking like a Moorish maze—in other words they go all around Riley's barn to get to the door.

At least 90% of the future traffic on these roads will be by power-driven vehicles, where distance is a greater factor than grade. It would be better in mountainous country to build 2 or 3 miles of 8% grade to cut out one mile of distance.

Action and re-action; it is the same old story; from having roads with 20% we have gone to the other extreme of 5%. No engineer in the State of Washington will be able to use his judgment on the matter for a state law has been passed to tie him down to 5%. In rough and rolling country one should never hesitate to break grade to keep down construction costs, taking care that the drainage is being cared for as well.

Highway location is still in its infancy, a few more railroad ideas will have to be almost forgotten. There is as much difference between a road and a railroad, as there is between an oak and cherry tree.

An 8% grade is low enough for a maximum grade in the mountains or very rough hilly country, and will result in a better road in every respect. It is, of course, presumed that the locator will only use a higher rate of grade when necessary, and only after a careful trial of a lower rate.

Regarding curvature—anything up to a 40° curve is allowable on mountain work. Curves of 20° and upward can be used in any place, where the P. C. and P. T. are in sight along the long chord of the curve.

This letter is only a plea to be allowed to use a higher rate of grade where it is shown to be necessary, especially in cutting out loops and long winding developments on mountain roads. The saving in distance, surfacing and maintaining the same, besides eliminating dangerous curves will more than repay its use.

F. W. Harris

Engineer, Washington State Highway Commission.

Renton, Wash., June 6, 1914.

Following the Crowd in the Valuation of Public Utilities

Sir—It is becoming less and less the privilege of modern city dwellers to see a flock of sheep in their natural habitat, but the pastoral game of "follow the leader" is ever new. Aside from inventions and their applications, there is but little really new in the principles of true engineering. However, even eminent engineers, as well as jurists, continue to enunciate "principles," "axioms," "conditions," "premises," "rules," "variations," etc., concerning the valuation of public utilities, as if there was something radically new about it, and others, striving to keep in the procession, immediately rush into the field, with notions similar to those of their fourfooted friends before mentioned.

As a matter of fact, scarcely have there been two im-

portant cases, so alike in conditions, that any one set of rules would equally apply. The writer has no desire to criticize or condemn such rules as have been put forward, or to offer substitutes therefor, but rather to call attention to the foolishness of following any sets of rules or precepts or court declarations, without first giving a very thorough study and analysis to the particular case that may be under consideration.

From the earliest eras of man, transfers of the ownership of property and rights have taken place, either solely through direct negotiation between the parties interested, or with the aid of friends called in to depreciate or bolster up the respective ideas of value; in more difficult cases, there has been resort to supposedly impartial judges. Now what more is it today? Nothing—except that in the sharper business competition of the present, perhaps greater general injustice prevails, with less regard for personal rights and consequently more frequent recourse to impartial tribunals.

As against some greater disregard for personal rights, there is a growing public view that corporate rights, as represented by real investment in public utilities, must be protected and the actual investor of money and brains, be guarded against too great a Socialistic sentiment; hence the multitude of legal proceedings to establish rates and values. These result in great masses of testimony, too rarely well digested, concerning original cost, cost of reproduction, going value, depreciation, earning value, reasonable profit, etc. Almost without exception, however, in the cases noted in very recent years, local circumstances have very properly had a strong influence in final determinations.

A privately owned public utility may be the chief means of developing a community, yet that fact may not be reflected to large extent, in the costs of construction or operation, or in its business profits at time of proposed public acquisition, while the future might hold promise of an ultimately profitable investment. No ordinary rules of acquisition would provide for such a return as the owners should justly receive to compensate them for actual, even though intangible, results of their forethought, investment and energy; in fact, most rules as laid down would virtually penalize the owners for having entrusted their capital to works so slow in returning hoped-for profits.

All such problems need to be approached with absolutely unbiased minds and without preadopted notions of the procedure to follow. Any intelligent engineer, familiar with costs of construction, expenses of operation, actual depreciation, and the conditions attending development and carrying on of similar business, can begin to attack the problem. He must then carefully study the physical and financial history of the enterprise, the local circumstances attending inception of the project, the community attitude and response and the probable future outlook, and he must pay some attention to the business intelligence exhibited by the management in handling its trust.

If financial markets have handled the utilities securities in an active manner, one criterion of value can be set up, but not by any means a binding one, without other verification. One utility, under the writer's notice, depended for much of its value on what might be done in the future through the use of powerful influences and business acumen, rather than on earning value at the time of investigation, for its immediate sales market had been virtually lost for the time being. Yet the utility represented millions actually invested, and upon which there might well be abundant later return.

What rule or principle as yet laid down would establish a fair value in such a case? None!

Valuations are for three main purposes: (1) to secure for a community the control of a privately owned utility at a price reasonable to the public and just to the owner; (2) to secure for the public, rates for service rendered, that shall be as low as possible, yet yield a fair business return upon the capital invested and brains used for management; (3) to establish a value upon which just taxes shall be levied.

To some extent, if the "signs of the times" do not change their indication of strong Socialistic tendencies, similar policies will soon obtain, concerning other private enterprises that deal with commodities which have become necessities for public use. Discussion of that division of the subject, however, is not pertinent here.

The formulation of valuation rules is educational; the more that appraisal problems are studied, analyzed and described in detail, the better for law and engineering, and the better for clients. But beware of being sheep.

The foregoing little lay sermon was inspired by some late valuation articles, reports, and decisions with which I have been edified. The complacency of their authors, has been the immediate cause of jotting down the above comments. If they find appropriate place in ENGINEERING NEWS, I hope they may not be without service.

LOUIS L. TRIBUS.

Tribus & Massa, 86 Warren St., New York City.
July 16, 1914.

Design of Crane Runway Girders

Sir—In the interesting account of the new shops for the Lima Locomotive Corporation, given on p. 1002 of your issue of May 7, I notice that an 80-lb. crane rail on an inverted 15-in. channel is described as "resting" on the top flange of the runway girder. I should much appreciate further particulars of the attachment of this channel to the top flange, as from theoretical considerations the more rigid it is the less economical is the combination for resisting the horizontal side thrust.

This paradox can be explained as follows: If the channel is designed to take side thrust and is not made part of the runway girder designed to take the vertical load, the extra stress in the channel, due to the vertical load, will be very small, as the total vertical load will be carried by the channel and girder, each taking an amount directly proportional to its moment of inertia.

If the channel is securely riveted to the top flange, the vertical load will cause it to be more highly stressed than any part of the top flange, so that less side thrust than before is needed to stress it to its maximum allowable limit unless the girder itself is very strong sideways.

The strength relations of the channel and girder may be expressed mathematically as follows: Let

B_h = Horizontal bending moment;

B_v = Vertical bending moment;

M_h = Horizontal section modulus of the channel;

M_v = Vertical section modulus of the girder;
f = Allowable stress in each.

If both channel and girder are designed just strong enough to deal with the horizontal and vertical loads, respectively,

$$f = \frac{B_h}{M_h} = \frac{B_v}{M_v}$$

If they are riveted together, let

$M_h(1 + a)$ = New effective section modulus resisting horizontal bending.

$M_v(1 + b)$ = New effective section modulus resisting vertical bending.

Then, if the combination is still adequate

$$f = \frac{B_h}{M_h(1 + a)} + \frac{B_v}{M_v(1 + b)}$$

That is,

$$f = \frac{B_h}{M_h} - \frac{a}{1 + a}\frac{B_h}{M_h} + \frac{1}{1 + b}\frac{B_v}{M_v}$$

but

$$f = \frac{B_h}{M_h} = \frac{B_v}{M_v}$$

$$\therefore \frac{a}{1 + a} = \frac{1}{1 + b} \therefore ab = 1$$

That is, if the channel increases the strength of the girder by one-third, the girder must increase the strength of the channel by 300%, a highly improbable contingency.

Wm. A. Green, A. M. Inst. C. E.,
Asst. Engineer, R. A. Skelton & Co.

London, England.

[We referred the above letter to the Worden-Allen Co., of Chicago, which designed and built the shops in question, and have the following reply—Ed.].

Sir—Relative to the crane-runway girders in the locomotive shop of the Lima Locomotive Corporation, the undersigned is unable to recollect the exact method of fastening the channel to the top flange angle of girders. There were, however, sufficient rivets connecting the channel to the flange angles so that this channel is part of the girder.

Using the same notations as in the above discussion, the equation $F = \frac{B_v}{B_m}$ does not state the exact condition. The moving load passing over the girder will produce a certain deflection, but the stiffness of the channel about a plane parallel to its web being negligible it will deflect the same amount as the girder, producing a stress from the vertical load in addition to a stress from the bending moment from the assumed side thrust. This shows that it is impossible to design a girder which will take care of the side thrust independently of the vertical load.

Were it possible to obtain the above conditions, however, the result of the calculation based upon the assumption that the channel is part of the top flange does show that the increment by which the section modulus of the girder in the vertical plane is increased is equal to the increment by which the section modulus of the top flange in the horizontal plane is increased, a result that cannot be true considering the respective sections and their respective lever arms.

Furthermore, it is questionable if the term $\frac{B_v}{M_v}$ in the calculation dealing with the channel and girder separately is equal to the term $\frac{B_v}{M_v}$ in the calculation dealing with the channel being part of the girder. Considering the channel as part of the girder, the center of gravity will rise up toward the top a certain amount, giving a different section modulus. For this reason it is the opinion of the undersigned that the terms and questions are not equal and hence cannot be interposed from one equation to the other.

It is true that the channel, considered as part of the girder, will increase the girder strength. How much it will increase it, however, has to be determined in each individual case. The above discussion shows the fallacy of the conclusion reached that if the channel increases the strength of the girder by one-third, the girder increases the strength of the channel by 300%.

Frederick Hoffman,
Engineer, Worden-Allen Co.

Commercial National Bank Bldg., Chicago,
July 21, 1914.

NOTES AND QUERIES

The inquiry in this column some weeks ago in regard to the construction of reinforced-concrete cooling ponds has been answered satisfactorily by several engineers. We hope to have a description of one or more such tanks in an early issue.

A Wind-Wrecked Gantry Crane, Marion, N. J.

The wreck of the 150-ton gantry crane at the Marion Generating Station of the Public Service Electric Co., of New Jersey, noted in our issue of last week, is very

Fig. 1. [illegible] End of Crane before Accident

FIG. 2. GENERAL VIEW OF OVERTURNED CRANE

interestingly shown in the accompanying views. The span of the crane was 150 ft. 2¼ in., 43 ft. 1 in. high to upper chord, with wheel bases 27 ft. long. The principal operating features of the crane are shown in Fig. 1 of the tower nearer the station.

The cross structure of the crane carries a belt, which can be supplied with coal from the belt conveyor running parallel with the station. The coal is conveyed on the crane belt to about the center where it is tipped, falling to storage piles. When it is desired to return the coal from the piles to the station, the clam-shell bucket places the coal into the hopper over which it is suspended (Fig. 1). After being crushed it is carried up to the belt on the stationary structure, running parallel to the travel of the crane. The track on which the crane travels is 300 ft. long and is not provided with bumpers at the end.

A high wind on July 23 carried the crane from one end of its track to the other at rapid speed. When it reached the end of the track the forward trucks went off onto the ground, a distance of about 8 ft., where they sank. The crane, of course, fell over in the direction of its motion, not only wrecking itself but also a yard locomotive. The position of the crane after its fall is shown in Fig. 2. Fig. 3 shows the wreckage of the crane and the locomotive. The small views at the right of Fig. 3 show the manner in which the forward wheels sank into the ground after derailment. The bearing cap of one is shown to be broken, leaving the wheel nearly buried.

The crane is damaged beyond repair and it is expected that a new one will be erected in its place. The damage is estimated at $50,000. The crane was furnished ten years ago by the Robins Conveying Belt Co., New York City. It was braked by a locking device on a reduction shaft from the driving motor. It is claimed by the electric company that all driving wheels were locked in this manner at the time of the accident.

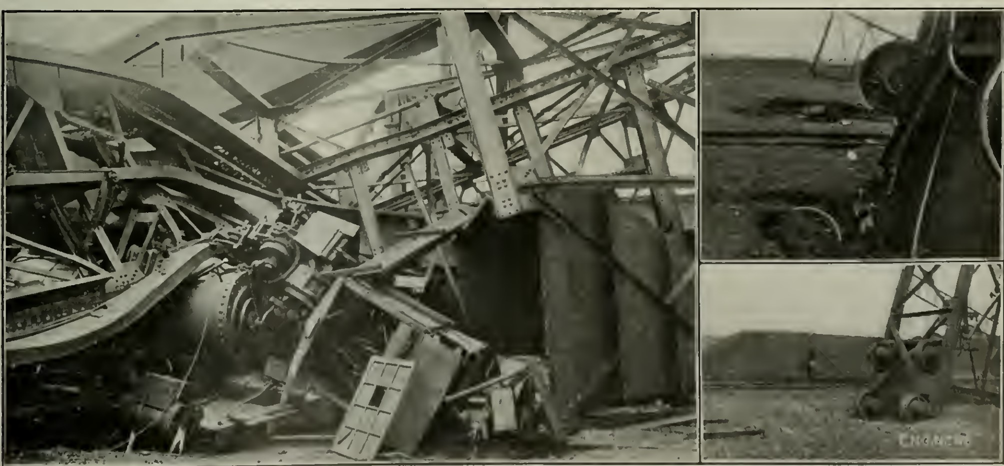


FIG. 3. (LEFT) POSITION OF YARD LOCOMOTIVE BENEATH WRECK. (RIGHT) DETAILS OF DERAILMENT
(The structural excellence of a locomotive boiler is exhibited in a remarkable manner in the left-hand view.)

Noteworthy Concrete Structures on the Lake Erie & Eastern R.R.

The Lake Erie & Eastern, a six-mile extension of the Pittsburgh & Lake Erie Ry. through the city of Youngstown, O., is a high-level line and includes a large number of bridges and viaducts, some steel and some concrete. Noteworthy innovations in design and construction are found in these structures, as will be seen from the following notes on the concrete structures. The steel structures will be reviewed in a later article.

A location sketch (Fig. 1) of the Lake Erie & Eastern shows the three river crossings and the adjacent viaducts.

FIG. 1. SKETCH MAP OF LAKE ERIE & EASTERN RY.

The line departs from the four-track P. & L. E. line at Struthers (a few miles south of Youngstown), crosses the Mahoning River to the right bank, and ascends on embankment and hillside cut until, opposite the center of Youngstown, it enters on a one-mile stretch of embankment, street-crossing and viaduct construction up to the second bridge over the Mahoning near the city filter plant (Crossing No. 1, in Fig. 1). Thence it cuts through high ground for one-half mile and crosses the river a third time, swinging back to the right bank along the Ohio Works of the Carnegie Steel Co.; here a [illegible]-ft. length of the embankment is made of poured slag, retained along the river bank by a wall laid up of [illegible] slag blocks. Beyond this fill the line crosses the river the fourth (and last) time, and a few hundred feet beyond it crosses over seven railway tracks (Erie, Baltimore & Ohio, Pennsylvania and joint) on a long skew, by means of a long wall structure decked with I-beams bedded in concrete. About a quarter mile farther on is a similar crossing, but over only five tracks and not quite so sharply skewed. The present work terminates with that structure, leaving the line [illegible] ft. above ground.

The location west of this point is not finally decided; it will lead to a connection with the Pennsylvania line at Girard or to another point near Niles Junction.

The line is very costly. Some of the work quantities are: Grading [illegible] cu. yd.; concrete masonry [illegible] cu. yd.; steelwork, [illegible] tons.

The four river bridges are steel truss and plate-girder structures. Some approach viaduct, the railway crossings and all street bridges over the railway are also steel, on concrete piers or walls. The street undercrossings are all concrete arches, however, and wherever viaduct construction was required by right-of-way limitations concrete viaducts were built, except that on the river flats near the filter plant steel viaduct on concrete piers was used in harmony with city water-works requirements.

ARCH-WALL CONCRETE VIADUCT

The concrete viaduct (Figs. 2 and 3 show one portion) is an original and ingenious type of structure. It consists of two longitudinal walls interrupted by arched openings at intervals of 32 ft., which break up the lower part of the wall into piers $9\frac{1}{2}$ ft. long. At each such pier a cross-wall connects and braces the two longitudinal walls, but this cross-wall carries no vertical load other than its own weight. Across the main walls is laid a deck of 15-in. I-beams spaced 18 in. apart c. to c., and these are surrounded by and bedded in a $19\frac{1}{2}$

FIGS. 2 AND 3. ARCH-WALL VIADUCT ON LAKE ERIE & EASTERN RY., NEAR CROSSING OF THE B. & O. R.R., YOUNGSTOWN, OHIO

in. thickness of concrete, which carries a normal ballast-and-tie railway track.

The drawing Fig. 4 shows a typical portion of this viaduct. Dotted lines indicate the horizontal construction joint in the longitudinal walls, by which the walls are divided into (1) piers with curving overhang portions on either side, and (2) a longitudinal girder over these piers, shaped so as to complete the curve of the pier overhang and form a semicircular arch top of the opening between piers. The openings do not represent the structural character of the wall, however; the action is purely that of piers and girders.

In the view Fig. 5 some of the forms for the arch-walls and cross-walls can be seen.

Where the viaduct joins an embankment, the end cross-wall is made very thick—30 in.—and forms a reinforced slab diaphragm between the longitudinal walls to take the earth pressure. There are no wings, however, the earth being allowed to slope down around the concrete structure on its natural slope. Where the viaduct is so high that the toe of the slope may reach the second cross-wall, this (in its lower portion only) is also built heavy to resist earth pressure.

The walls have vertical bars projecting from the top, which bond into the concrete filling of the deck.

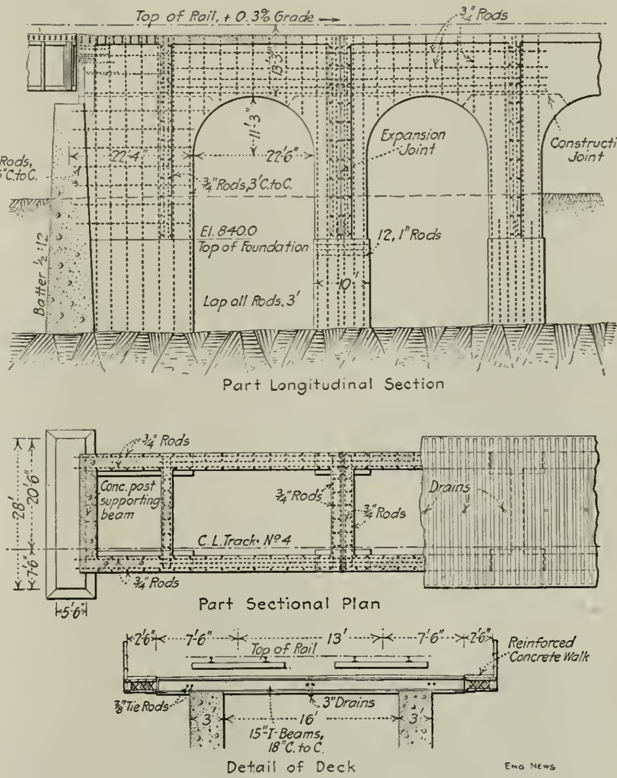


FIG. 4. ARCH-WALL VIADUCT ON LAKE ERIE & EASTERN

SPECIAL CONCRETE-PILE FOUNDATIONS

Concrete piles of a new type are employed as foundation for a considerable length of this concrete viaduct, and also some other viaduct and bridge piers of the line. These piles, described in a recent issue of ENGINEERING NEWS (June 25, 1914, p. 1412), consist of premolded reinforced-concrete inserts set into a hole made by driving a steel casing into the ground, and are grouted into the hole while the casing is pulled. Besides the novelty of the piles, a remarkable feature of these foundations is the high pile-load, 50 tons working load per pile with impact, or about 40 tons without impact.

The piles are 16 in. in diameter, by about 20 ft. long. Test loads of 60 tons produced no permanent settlement that could be measured.

FIG. 5. FORMWORK FOR ARCH-WALL VIADUCT, LAKE ERIE & EASTERN

CONCRETE SKEW ARCHES

The most important of the six concrete arch street-crossings is at Mahoning Ave., Youngstown, with a span of 64 ft. square, or 85½ ft. measured on the skew. The length of barrel, 82 ft. 10 in., is divided into four rings by construction joints parallel to the arch faces, so that the rings necessarily act as skew arches. The drawing Fig. 6 shows this arch.

A skewback construction joint (not shown) was made to stepped outline, with faces of the steps normal to the arch pressure-line. The forms for the abutments were cut to the appropriate stepped outline at the top, and the concrete screeded off, to produce this stepped joint.

These arches are founded on the soil direct, a good gravel stratum being available for a footing some 7 ft. below the surface.

The end faces of the arch, and the showing faces of the wings, were rubbed after removal of forms. The inside of the arch barrel was left as it came from the forms; while it shows the joints of the lagging,

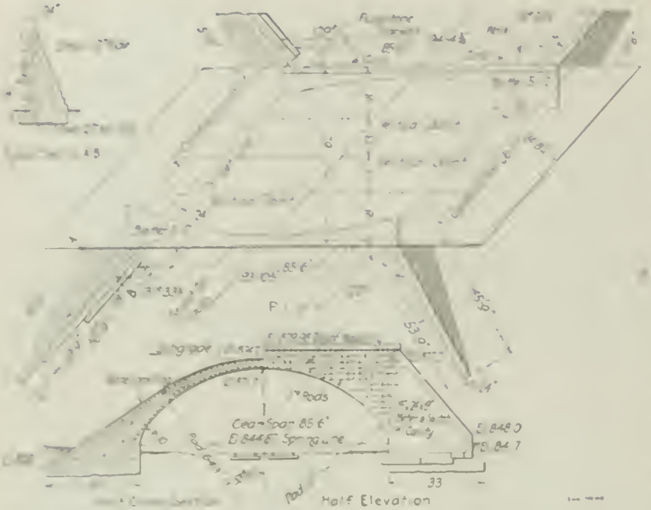


FIG. 6. HEAVY CONCRETE SKEW ARCH, MAHONING AVE. CROSSING OF THE L. E. & E. RY., YOUNGSTOWN, OHIO

the surface is satisfactorily good.

WALL-AND-BEAM CROSSINGS OVER RAILWAY TRACKS

The long skewed 5-track and 7-track railway crossings (Fig. 7) are composed of a deck of transverse plate-girders, closely spaced, carried on longitudinal walls between alternate pairs of tracks. The walls are offset past each other successively, corresponding to the stepped outline of the beam deck (as seen in plan).

The longest of these walls is over 500 ft. in length. The height above ground is 25 ft., and the greatest depth of foundation below ground is 22 ft. The walls go down to rock, but where the depth to rock exceeds 12 ft. the part below ground consists of individual piers 12 ft. long and 12 ft. apart in the clear, the continuous wall beginning just below ground line.

The walls contain both longitudinal

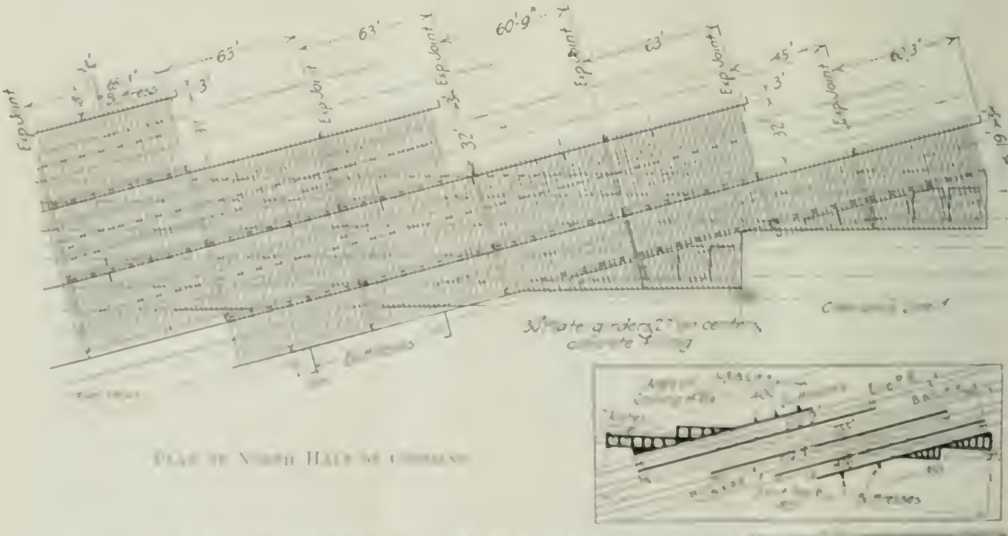
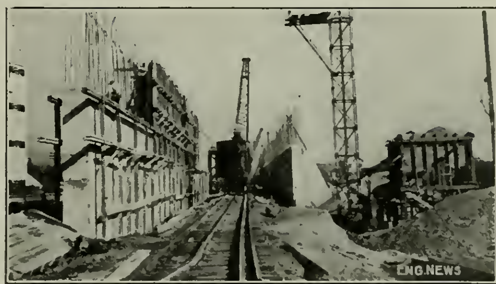


FIG. 7. WALL AND GIRDER CROSSING OF L. E. & E. RY., OVER SEVEN RAILWAY TRACKS AT BRIER HILL STEEL WORKS



FIGS. 8 AND 9. CROSSING OF LAKE ERIE & EASTERN RY. OVER SEVEN RAILWAY TRACKS, DURING CONSTRUCTION

and vertical reinforcement. They were made in construction sections 45 to 65 ft. long, all steel being interrupted at the joint, for expansion and contraction.

Concreting was done in large part by tower and chute, one set-up being sufficient to cover about 80% of the crossing. The larger of the two crossings, built by the Duquesne Contracting Co., is so spread out that although concrete was chuted over 300 ft. the farther wall could not all be reached in this way. For this portion, the concrete was delivered by the chutes to buckets at ground level, and these hoisted by locomotive crane and dumped into the forms. The other crossing, built by the McKelvy-Hine Co., did not require this expedient.

WARPED-SURFACE RETAINING-WALLS

Some uncommon retaining-walls occur at different points of the line. The walls are all of gravity section, but in a few cases they were built with a base capable of carrying an increased height of wall, for later changes in track arrangement. In such places the wall is in shape the bottom portion of a full-height wall, and the top width is therefore abnormal. No steel bond is provided for the future upper section.

A more special form of wall was used at the southeast abutment wing of the third Mahoning River bridge, making a transition from the normal 1:12 batter of the bridge abutment to the 1:4 batter of the slag river-wall. This wall, Fig. 10, has warped surface both front and back, the back batter changing on account of change in elevation of footing. But the face is not a simple warped surface. At one end the profile of the wall shows an upper vertical portion and below this a 1:12 battered portion; at the other end the batter is continuous 1:4 from top of wall to footing. The face thus consists (in theory) of two warped surfaces tangent at one end of their intersection; in actual construction the shape was produced by bending the lagging to the profile frames, and probably varies from the theoretical surface form.

Less complex warped surfaces occur at other retaining-walls. But most of the walls have stepped back, to take advantage of the weight of the earth backing.

MATERIALS

Slag is used extensively on the Lake Erie & Eastern. Besides its use in poured and block-cast embankment construction, it is used for all sub-ballasting, this being granulated slag.

However, no slag was used in the concrete. Other concrete work in Youngstown frequently employs crushed slag for sand and coarse aggregate—granulated slag is unsuitable—and good results are reported. The railway work however was all built with Pittsburgh sand and gravel from the Ohio River.

ENGINEERS AND CONTRACTORS

The construction work, under J. A. Atwood, Chief Engineer, and A. R. Raymer, Assistant Chief Engineer of the Pittsburgh & Lake Erie Ry., was directed by F. J. Mannah, Assistant Engineer (succeeding E. F. Wendt), with R. T. McMaster in local charge as Resident Engineer. All designs were prepared in the office of A. R. Raymer. Albert Lucius, New York, is the Designing and Consulting Engineer for all steelwork.

The work was divided into three line contracts. The southerly part, which is largely rock excavation and embankment, was carried out by H. A. & R. L. Culbertson. The middle section, of rock excavation and embankment,

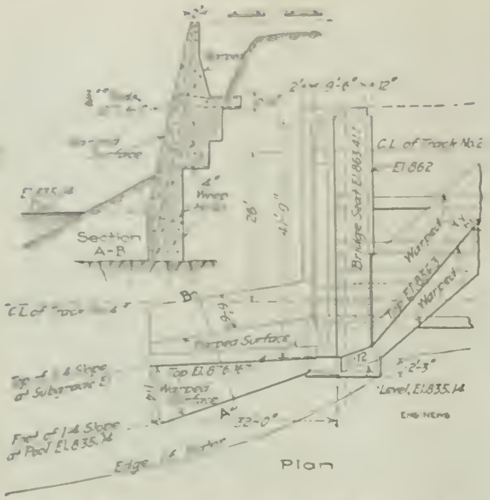


FIG. 10. WARPED-SURFACE RETAINING-WALL AT MAHONING RIVER CROSSING NO. 3, L. E. & E. RY.

and the upper railway crossing, were done by the McKelvy-Hine Co. The concrete structures of the northerly part, and the earth excavation between the second and third river bridges, were done by the Duquesne Contracting Co. The McClintic-Marshall Construction Co. built and erected the steelwork, including the I-beam and plate-girder decking. The concrete filling of the deck is being done by the McKelvy-Hine Co.

All structures are now complete except the lower river bridge (at Struthers) and the concrete filling of the viaduct deck. Embankment has still to be finished at several points, and an earth cut widened as it was taken out only wide enough for a construction track because the material could not be moved to the points where fill was needed until completion of the line.

High-grade track, with screw spikes and four-hole tie-plates carrying 100-lb. rail, is to be used on the line.

The Official Opening of the Cape Cod Canal

After five years of continuous construction work the famous Cape Cod Canal, between Buzzards Bay and Cape Cod Bay on the coast of Massachusetts, was formally opened for the traffic of vessels of 15-ft. draft on Wednesday, July 29. The projected depth of the canal is 25 ft., but the opening for vessels drawing 15 ft. was an event of no small historical significance, since the canal project is about as old as the State of Massachusetts. Its construction was begun and abandoned so many times, and the date set for its final completion changed so frequently, that the Cape Cod natives long ago despaired of witnessing so notable an event as the passing of an excursion steamer carrying several hundred passengers.

The official opening was first announced to take place on July 4, but the ceremony on that date had to be revised to the passing of a boat part way across the waterway by August Belmont, the New York capitalist, who is President of Cape Cod Construction Co. The ceremonies of July 29 were more elaborate. A special train was provided by the canal company from Boston to New Bedford, which brought the Governor of Massachusetts and other notable guests.

At New Bedford, all invited guests were taken on board the "Rose Standish," a Boston excursion steamer, and under an escort of seven United States torpedo-boat destroyers, several private yachts, tugs and other craft, the "Rose Standish" proceeded to the head of Buzzards Bay, the western entrance to the canal. After reaching the entrance to the five-mile channel, which forms the western section of the canal, the naval escort, with the exception of one torpedo-boat destroyer, returned to Buzzards Bay. The official fleet then passed through the canal from west to east, arriving in Cape Cod Bay in about one hour and a half.

About all the native and summer residents of the Cape appeared to have congregated on the banks to welcome the passage of the fleet and the enthusiasm was quite infectious. On arriving in Cape Cod Bay, the fleet was turned about and returned through the canal to the Buzzards Bay entrance, where the party was landed and speeches were made by Governor Walsh, of Massachusetts, August Belmont, of New York City, and others.

Work on the canal was begun by the Cape Cod Construction Co. on June 19, 1909, by placing the first stone on the 3000-ft. breakwater at the eastern entrance on Cape Cod Bay. Most of the excavation was done by dredges working in from both ends. About 800,000 cu. yd. in the central section were removed by steam shovels. By building dams across the channel at each end of the section these shovels were kept at work until the excavation was 15 ft. below sea level.*

The maximum difference in sea level at the two ends of the canal, due to difference in tides in the two bays, amounts to about 8 ft. The current due to this difference was estimated at about 4 mi. per hr., but from all appearances this velocity is greatly exceeded in the present 15-ft. channel. It is evident that all the problems of operation and maintenance are not yet solved; and it may be found necessary to add a tide lock, which was a part of all the early plans for the canal. The swift currents at times of spring and neap tides, like that of July 29, are sure to cause difficulty in navigating barge tows through so narrow a channel (100 ft. at the bottom), as well as the problem of caring for the silt that the swift current is surely going to deposit in the Buzzards Bay approach channel.

The canal is to be operated as a commercial enterprise. Tolls range from $1 for a canoe or row boat up, according to recent press reports.

The engineering staff of the Cape Cod Construction Co. consists of William Barclay Parsons, Chief Engineer, Eugene Klapp, Deputy Chief Engineer; Charles T. Waring, Resident Engineer, and A. S. Ackerman, Senior Assistant Engineer. The contractors were, the Degnon Contracting Co., the Furst-Clark Construction Co., C. W. Reynolds, the E. W. Foley Construction Co., the Pennsylvania Steel Co., the T. A. Scott Co., the Wilson & English Construction Co., and the Holbrook, Cabot & Rollins Corporation.

*A full account of the construction methods on the Cape Cod Canal was given in "Engineering News," Feb. 16, 1911; a historical sketch of the enterprise and a description of the topographical features of the locality were given in "Engineering News," Jan. 4, 1912.

The Official Opening of the Cape Cod Canal, July 29

(1) On board the "Rose Standish": the Sandwich (eastern end of the canal.
(3) Looking to the east across Cape Cod Bay.
(5) Buzzards Bay entrance to canal and railway drawbridge.
(7) Sandwich marshes.

(2) Torpedo-boat destroyer escort, one of which passed through the canal.
(4) Curved section west of Sagamore.
(6) Highway drawbridge at Sagamore.
(8) Highway drawbridge at Buzzards Bay.

Bridge and Ferry Building by Engineer Corps of Austrian Army*

The accompanying view shows a detachment of the Austrian Engineer Corps engaged in erecting a temporary bridge. Austria maintains no mounted engineers. A unit of three wagons are assigned to each cavalry regiment of 900 sabers. Three classes of bridges can be built with the material in these wagons:

(a) NORMAL BRIDGE—Whole pontoon supports, four balks per bay, three-panel roadway, suitable for the passage of all arms accompanying a cavalry division. Maximum length, [illegible] ft.; width, 7 ft. 10 in.; 15-ft. bays.

(b) HALF [illegible] BRIDGE—Whole pontoon supports, three balks per bay, two-panel roadway, suitable for cavalry in file. Length, [illegible] ft.; width, 5 ft. [illegible] in., 15-ft. bays.

(c) FOOTBRIDGE—Half pontoon supports, two balks per bay, one-panel roadway, for men on foot only; horses swimming below bridge. Length, 162 ft.; width, 2 ft. 7 in.

None of these bridges is very strong. With the normal bridge (the strongest) field guns must be unhitched and moved across by hand. The lighter bridges require that the troops separate from the ammunition, baggage and provisions. Hence the most practical of the three is the normal.

For the crossing of streams, ferryboats are relied upon to a greater extent than bridges. Each unit of three wagons contains parts for two landing stages and a rope ferry of two or three pontoons. The usual ferry consists of three pontoons lashed gunwale to gunwale and decked over. It will carry either:

Six horses and riders;

Two guns and limbers, without horses;

Two field wagons and [illegible] men;

Fifty-five armed men;

Sixty unarmed men.

The passage of a cavalry division across a stream of average size requires from one to two days, depending whether the horses are swum over.

The pontoons are built with steel frames covered with galvanized sheet steel. The bottom is covered by a flooring of strips of planks. They draw, light, about 1½ in. and are thus [illegible]

Length	10 ft. 10 in.
Beam	4 ft. 7 in.
Depth	2 ft. 0 in.
Thickness of skin (about)	0.025 in.
Weight	408 lb.
Displacement	4810 lb.

GERMAN BRIDGE EQUIPAGE

As a comparison with the bridge data given for the Austrian army engineers, it is interesting to note that the German engineers erect much more substantial pontoon bridges. Each regiment of German cavalry (600 sabers) is assigned two pontoon wagons loaded with bridge material and tools and equipment for repair and demolition. The equipage carried with a cavalry division (six regiments) is supposed to be able to build the following bridges:

(a) NORMAL BRIDGE—One whole pontoon to each bay, using saddles, three-panel roadway, 157 ft. 6 in. long, 9 ft. 10 in. wide, able to carry cavalry in file, men leading horses, guns and wagons with two horses.

(b) LIGHT BRIDGE—Half pontoons alternating with pontoons, two-panel roadway, 221 ft. long, 6 ft. 3 in. wide, to take cavalry in file.

AUSTRIAN ENGINEER CORPS BUILDING A PONTOON BRIDGE OVER THE DANUBE RIVER

(c) FOOTBRIDGE—Half pontoons, one-panel roadway, 315 ft. long, [illegible] ft. [illegible] in. wide.

The footbridge has little value as the men must separate from supplies; it vibrates badly and the pontoons act badly even in mild currents. The light bridge is suited to short raids where no artillery is required. The main dependence, however, is placed in the normal bridge.

Partial Failure of Standley Lake Dam, Near Denver, Colo.

(Correspondence)

The Standley Lake Dam, lying about 12 miles northwest of the City of Denver, Colo., has been reported by the daily press within the last few days to be in danger of failure, and an examination was made on Saturday, Aug. 1, 1914, by the State Engineer of Colorado, accompanied by Messrs. A. L. Fellows, W. M. Reynolds, conducted by John E. Hayes, Engineer of The Denver Reservoir Irrigation Co., with a view of ascertaining the extent of the failure, the possibility of further failure, and other matters, and the attendant danger.

The Standley Lake Reservoir was constructed for the most part between the years 1909 and 1911. It consists in the main of an earth embankment 7000 ft. in

*From a Report to the Board of [illegible], Vol. [illegible], [illegible] "Professional Memoirs," March-April 1914.

length, and was constructed to a height of 113 ft. at the lowest place, and tapering to nothing at the two ends of the embankment. It was constructed with slopes, 2 horizontal to 1 vertical, on each side, with two berms on the lower face. The two outlets are of concrete and appear at the present time to be in good condition. The material, which seems to be of rather poor quality, was for the most part placed from dumping cars, run lengthwise of the embankment upon high trestles, and does not appear to have been tamped, rolled or sprinkled or packed in any way, excepting by impact of the falling material. The trestles rest upon lines of piling along and parallel with the axis of the embankment. Settlement in the dam, since construction, has been very large, being apparently some 10% of the height of the dam. Water was impounded in the reservoir in 1913 to a depth of 79 ft. at the outlet, and in 1914 to a depth of 83 ft. The plane of saturation appears to be very flat, but investigations regarding this phase have not as yet been completed.

The upper face of the dam is riprapped with about 2 ft. of large boulders, shaped as broken from the quarry, and roughly laid by dumping. In general, it would not seem to have been very greatly affected by wave action, excepting in a few places, one of these places being opposite to the point where the partial failure has just occurred.

During the last week of July, 1914, a partial failure of the back of the dam near the center of the embankment occurred. About 300 ft. in length of the rear, one-half of the embankment bulged at the lower face to some extent, the line of breakage extending to the inner edge of the crest of the dam. The old line of trestle appears to have been pushed out for a distance of 10 or 15 ft. The management immediately ordered the water to be turned out from the dam, and the water has now been lowered from a depth of 83 ft. to a depth of 76 ft., and will be lowered to a depth of from 65 to 70 ft., at which depth of water there would appear to be no danger of further failure at the present time. Extreme care is being exercised, watchmen being kept constantly at the point of settlement as tremendous damage would be done to cultivated lands, railroads and houses lying below the dam.

The State Engineer, who is giving the matter his personal attention, has issued instructions as to what is to be done at once in connection with the matter. For the present it is safe to say that no damage to property lying below the dam is likely to occur, and the partial failure, while of great interest to the engineering profession, is not likely to result in damage to anyone other than the Denver Reservoir & Irrigation Co.

The Railway Rate Decision

The long expected decision of the Interstate Commerce Commission on the petition of the railways in the territory east of Chicago to advance their freight rates an average of 5% was made public on July 29, but the exciting events in Europe so diverted the attention of the newspapers that comparatively little publicity has been given to the decision. This is unfortunate, as it is one of the most important decisions ever handed down by the Commission. It is a lengthy document of over 100 pages, but its conclusions may be briefly summarized as follows:

The Commission assents to an advance in rates substantially equal to the amount asked for in what is known as Central Freight Association territory, which includes the region west of Buffalo and Pittsburgh, and east of the Mississippi River. The advance in freight rates are refused to the lines east of Pittsburgh and Buffalo. Commissioners McChord and Daniels filed dissenting opinions.

The Commission agrees that the railways have established that in many cases they are entitled to earn larger net profits from their business than they are now receiving. The Commission holds, however, that the way to secure these net profits is not by a horizontal increase in all freight rates but that the rates should be placed on a more just and scientific basis. Instead of advancing all rates, the rates should be advanced on those classes of traffic which are now clearly unremunerative.

The Commission further points out that the chief cause of deficient profits in the railway business is that passenger traffic is being carried at too low rates. It urges that steps be taken to separate passenger expenses from freight expenses in railway accounting, and expresses the belief that if the two-cent-a-mile laws are shown to be unjust to the railways, the public will acquiesce in amendment of these laws so that fares may be increased to a remunerative basis. The Commission further proposes that the railways investigate the expenses they now incur in furnishing various classes of free service in connection with freight shipment, together with the cost of soliciting freight and passenger traffic. The Commission finds that on 88 railways the expense of soliciting business in the year ending June 30, 1913, was $4,298,000.

Among other suggestions of the Commission as to the methods by which the railways can increase their revenues are a further reduction in the issue of passes, a study of methods for increasing freight-car efficiency, and methods of economizing in fuel and in other large items in operating expenses.

Two other suggestions of the Commission which point very closely to the recent revelations in connection with the New Haven system and the St. Louis & San Francisco are, first, the proposition that railways should sell all the properties they now hold that they cannot use for transportation purposes. The railways in the territory to which the report refers have invested more than $684,000,000 in such property, and about one-fourth of this investment returned no income whatever last year. The second suggestion is as follows:

> We suggest that an investigation be made with a view to determining to what extent the cost of construction or of acquiring properties or capital or of operation is being increased through the holding by directors, officers or employees of interests with other concerns with which the carrier has dealings.

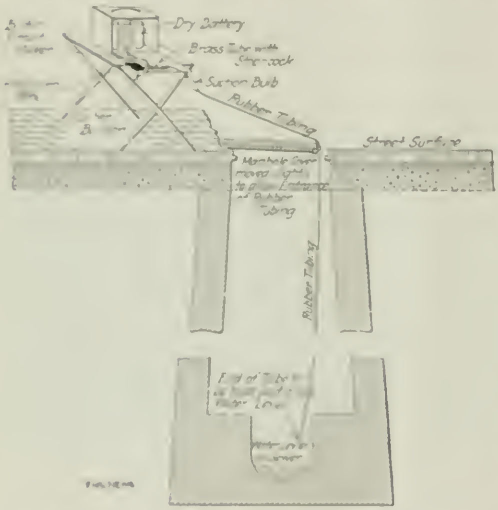
The plain intimation here is that the operating expenses of railways are being increased in some cases through the existence of graft in connection with the purchase of supplies or the acquirement of property. That there is some ground for this assertion recent investigations have proved. The Commission announces that it is itself conducting an independent investigation of this matter.

The most important point in the whole decision is the explicit recognition of the Commission that the railways are entitled to charge rates high enough to earn a fair return on the capital invested, provided, of course that the properties are honestly and efficiently managed.

It is doubtful, whether there will be another petition for a general horizontal advance in rates. In view of the opinion of the Commission now given, the problem of increasing rates must be solved by attacking the matter in detail and by following out to a considerable extent, where practicable, the suggestions of the Commission.

Simple Apparatus for Testing Sewer Air for Explosive Mixtures*

Experiments made by Prof. A. L. Dean, of Yale University, have proved that an explosive mixture may



APPARATUS FOR TESTING SEWER AIR FOR EXPLOSIVE MIXTURES, DEVISED BY PROF. A. L. DEAN, YALE UNIVERSITY

be made of only one part of gasoline to 15,000 parts of air by volume; or 1 gal. of gasoline to 2000 cu. ft. of air. This shows how small an amount of gasoline in a sewer may cause serious damage if ignited.

Prof. Dean has designed a simple, ingenious and apparently practical device for testing the air in sewers, without sending a man into the sewer to obtain a sample of the air. This apparatus is shown in the accompanying sketch. The apparatus is to detect gasoline vapors, which are heavier than air; lighter illuminating gas may be detected by odor at the top of the manhole, although the apparatus will show if there is enough to form an explosive mixture.

A long rubber tube is let down into the manhole, through a small opening left by just starting off the cover, after sounding for depth to find the length of tube necessary to reach nearly to the surface of the sewage. The bulb is worked until both the rubber tube and bulb are filled with sewer air. Then a small, collapsed rubber toy-balloon is slipped over the firing end of the short piece of brass tubing, to which the long rubber suction tube is attached.

Projecting from the brass tube into the balloon are the ends of two insulated wires from the dry-battery cells, the wire ends being connected by a fine platinum wire. When the balloon is well filled with sewer air by pumping with the bulb, the stop-cock in the brass tube is shut, to prevent backfiring, and the electric circuit is closed by pressing a button. The heated platinum wire explodes the balloon if the sewer air is of an explosive mixture.

*Abstracted from a recent report by Henry J. Kellogg, [illegible] City Engineer, New Haven, Conn., on "Explosions in Sewers."

Analyses of Tubercles from the Interior of a Cast-Iron Water Main*

Samples of tubercles from the cast-iron pipe which enters the High Hill Reservoir gatehouse of the New Bedford, Mass., water-works, were collected and analyses of the soft central or middle portion thereof and of the tubercles as a whole were made. Results of these analyses are as follows:

ANALYSES OF TUBERCLES—Sample marked No. 3, soft central portion of tubercles from 48-in. cast-iron pipe:

Silica and insoluble matter	3.24
Ferric oxide Fe_2O_3	69.12
Alumina and lime Al_2O_3 and CaO	Traces
Sulphuric anhydride SO_3	1.36
Water of hydration H_2O	26.28
Carbon dioxide CO_2	None

Sample marked No. 4, whole tubercle from 48-in. cast-iron pipe as above:

Silica and insoluble matter	1.7[illegible]
Ferric oxide Fe_2O_3	68.62
Alumina and lime Al_2O_3 and CaO	Traces
Sulphuric anhydride SO_3	1.65
Water of hydration H_2O	28.16
Carbon dioxide, CO_2	None

The accompanying illustrations show photographs of some of these tubercles, removed during the inspection of the pipe in May, 1913. The same pipe was inspected five years previously, in May, 1908. During that period, the tubercles had grown considerably in size. The extent of this growth is best indicated by the four outer rings, which can be clearly seen in the illustrations, showing the under or contact side of the tubercle.

*From recent annual report of the Water Board of New Bedford, Mass.

NEWS NOTES

A Broken 20-In. Water Main in New York City flooded the subway excavation on 7th Ave. at 33d St. at 1 p.m., Aug. 3.

An Auto Truck Wrecked a Timber Bridge over the Pennsylvania Canal near Merrlesville, Penn., on July 29.

An Explosion in a Cable Manhole of the Edison Electric Illuminating Co., of Boston, on July 27, blew off the manhole cover.

A Water-Supply Standpipe Collapsed [illegible] in [illegible], Ill., on July 18, flooding adjacent streets. The standpipe was full at the time.

The Flooring of a One-Deck Porch built near the ground collapsed while crowded during a thunderstorm, on July 29, at Keyport, N. J.

The Effects of European War are seen in the recent decision of the Southern Power Co., and the Piedmont & Northern Ry. Co. (allied), not to let the contracts announced for July 5, and amounting to several hundred thousand dollars. It is reported that the plans for a fourth auxiliary steam plant (10,000 hp.) will be held up, although some contracts have been let.

Projects of the city of New York to the extent of $50,000,000 are reported indefinitely postponed. This includes the New York County court house ($20,000,000), the Kings County court house ($2,500,000), the South Brooklyn marginal freight railway ($12,000,000), and various other improvements. While general retrenchment is planned, it is announced that rapid-transit subway and dock-improvement work under way will be carried forward with as little interference as possible.

A Sewer Explosion at 23d St. and Seventh Ave., New York City, on July 27, hurled a manhole cover into the air and sent a column of flame upward. A section of wood-block pavement was ripped up. Sand was used to extinguish the fire in the sewer.

A Locomotive Boiler Exploded on the Erie R.R., near Corning, N. Y., killing the engineer and fireman and injuring another man, on July 31. At about the same time, a tube blowout occurred on an Erie locomotive at Montclair, N. J., injuring the engineer and fireman.

A Cloudburst Flooded Telluride, Colo., on July 27. In the business district, 120 stores were sunk in 8 to 20 ft. of mud; many residences were wrecked. The town is situated in a canon. A dam which retains the water supply for the town was destroyed. Two persons were killed.

Ten Large Forest Fires were reported on July 27 in western Montana and northern Idaho. One of the fires, which was started by campers near the Hearst Lake reservoir, which furnishes Anaconda, Mont., with water, heavily damaged the timber area to the west of the lake.

A Construction Elevator Collapsed at the three-story extension to the Dixmont Hospital, Pittsburgh, Penn., recently, injuring seven workmen. The contractor stated that the men had no right on the hoist and had been instructed to keep off. The fall was claimed to have been not over 14 ft.

The "Incemore" Was Held Responsible for the collision, on June 17, with the North German Lloyd steamship "Kaiser Wilhelm II," by the British Admiralty Court, on July 17. Sir Bargrave Deane in rendering his decision said he found that the "Incemore" had made a mistake in giving a signal that she had stopped when as a matter of fact she had not done so.

A Tow-Barge Demolished a Steel Bridge Span of the Dover bridge over the Choptank River, about 4 mi. from Easton, Md., on July 17. The tug "Rescue," of Baltimore, with two barges in tow, loaded with stone, and bound for a wharf above the bridge, attempted to pass through the open draw, on a strong flood tide. One of the barges struck the bridge, breaking off a number of wood piles, which caused a 70-ft. steel span to drop in 40 ft. of water.

A Gate Accident on the Welland Canal, in which the two headgates of Lock No. 8, St. Catherines, Ont., were carried away by the steamer "Sarnor," of the Lake Erie & Quebec Transportation Co., of Montreal, while upbound to Ashtabula for coal, at about 10:45 a.m., on July 27, delayed navigation for about 10 hours. The rush of water carried the vessel and the gates out into the reach below. The level above No. 8 is short, while the level below is a mile long, consequently practically no water overflowed and there was no washing away of the banks. It will be necessary to place two spare gates before navigation can proceed. The damage is estimated at about $4000. The accident was caused by the engineer putting the vessel ahead in response to a signal to reverse the engines. A 1¼-in. cable was snapped before the gates were struck.

Retired Municipal Employees to the number of about 8000 drew pensions from New York City last year, the total amount of money paid out in pensions being about $4,000,000. The size of the pensions varied all the way from $50 to $6000.

A New Proposal for the acquisition of the Spring Valley water system has been reported made by the city of San Francisco. The City Advisory Water Committee proposes purchase at $34,000,000, the company keeping the larger part of its Pleasanton lands, but giving the right to draw unreservedly on the subterranean waters, and holding its Lake Merced lands except for a marginal strip sufficient to prevent pollution. The company also would be reimbursed for outlay on Calaveras dam. Settlement of the Spring Valley rate case is included.

The Installation of Automatic Sprinklers for fire protection may be compelled by the Fire Department of New York City, according to a decision of the New York Court of Appeals. A property owner refused to install a sprinkler system in his loft building when ordered to do so by the Fire Commissioner. The case was carried to the Court of Appeals, which has affirmed the decisions of the lower courts, sustaining the authority of the Fire Commissioner to order such protective devices installed. It is stated that over 100 orders for the compulsory introduction of sprinklers in New York were on file awaiting the decision in this case.

The McClintic-Marshall Claim on the Panama Lock Gates has been referred by Congress to Col. George W. Goethals, Governor of the Canal Zone, for investigation. Colonel Goethals is to report his findings in detail to Congress. As noted in "Engineering News," Mar. 26 and Apr. 9, 1914, pp. 704, 806, the McClintic-Marshall Construction Co., of Pittsburgh, Penn., who built and erected the steel lock gates for the Panama Canal, recently presented to Congress a bill for extras on this work, amounting to about $2,400,000. Its principal claim was that a grade of workmanship had been enforced in the inspection that was far more costly to execute than the workmanship described in the specifications, and that went beyond any demands of efficiency.

New Mole for San Francisco Bay—A contract for the construction of a mole to replace the trestle now being used by the Key Route System, in San Francisco Bay, was awarded on July 27 to the San Francisco Bridge Co., for an estimated price of $475,000. When this work is completed, the mole will be 100 ft. wide and 11,000 ft. long. There are 1,100,000 sq.ft. of surface to be filled in to a height of 6 ft. above high tide. The average depth is 18 ft. At the end of the land mole there will be a wharf, set on creosoted piles, which will extend an additional 4200 ft. out into the bay toward San Francisco. The company sought the right to fill in under this wharf, but the United States authorities denied them the privilege. The company will make the entire stretch a stone and earthen fill as soon as authority from the government can be obtained.

Automatic Block Signals on the Pennsylvania R.R.—On Sept 1, with the completion of an elaborate plan of improvements in its automatic block-signal system, the Pennsylvania R.R. will have more four-track line operated under automatic signals than any other railroad in the world. At a cost of $6,000,000 in the past three years, 253 miles of main lines have been equipped. By Sept. 1, the main line between Pittsburgh and New York and Philadelphia and Washington will be equipped. The signal system on this road, east of Pittsburgh and Erie, represents an estimated investment of approximately $18,000,000, of which $1,750,000 is in the electro-pneumatic interlocking switch and signal system in the New York station and on the electric line between Sunnyside Yard, L. I., and Manhattan Transfer, N. J. It takes a normal force of 1800 men to maintain the road's signals and it costs $1,500,000 a year.

Fast Trains on English Railways have been reviewed in the engineering supplement of the London "Times," with lists of the various fast schedule runs. Of 62 runs from London, the highest record is 59.4 m.p.h. for 107 miles. The lowest is 36.2 m.p.h. for 730 miles, part of this being over unfavorable lines in the Highlands of Scotland. There are 21 of 45 to 50 m.p.h., 27 of 50 to 55 m.p.h., and 14 of 55 to 60 m.p.h. The three longest nonstop runs were from London to Plymouth (Great Western Ry.), 226 mi. at 54.8 m.p.h.; to Rhyl (London & Northwestern Ry.), 209½ miles at 52.7 m.p.h., and to Shipley (Midland Ry.), 206 mi. at 50.4 m.p.h. There were nine nonstop runs of over 100 miles. The fastest runs, however, were not from London; Darlington to York (Northeastern Ry., 44¼ miles), 61.7 m.p.h.; Leicester to Nottingham (Great Central Ry., 22½ mi.), 61.3 m.p.h. The following table is a list of the 14 fastest runs from London in 1913:

City	Railway	Miles	Time Hr.	Time Min.	Speed
Bath	Gt. Western	107	1	48	59.4
Bristol	Gt. Western	118½	2	00	59.1
Exeter	Gt. Western	174	3	00	57.8
Oxford	Gt. Western	63½	1	7	56.8
Leicester	Gt. Central	103	1	49	56.7
Leicester	Midland	99¼	1	45	56.5
Birmingham	London & N. W.	113	2	00	56.5
Nottingham	Midland	123¼	2	12	56.1
Worcester	Gt. Western	120½	2	9	56.0
Sheffield	Gt. Central	164¾	2	57	55.8
Liverpool	London & N. W.	192¼	3	28	55.4
Birmingham	Gt. Western	110½	2	00	55.2
Salisbury	London & S. W.	83½	1	31	55.1
Plymouth	Gt. Western	225¾	4	7	54.8

Bridge Building Prosperity in Iowa—Iowa counties have let a million dollars' worth of bridge contracts since Jan. 1. They will let contracts for probably half a million more before the end of the year. These figures cover only the work which has been contracted at public lettings. They do not cover the small work that has been let privately. They do not cover any part of the bridges and culverts the 99 coun-

[illegible] are [illegible] Engineers in close touch with [illegible] that the day labor work and the small private contract work will total at least [illegible] for the first half year. In 42 counties no public lettings have been held. These counties are either doing all their work by the day labor system or are completing work contracted for last year. Several counties have held two lettings and [illegible] —From the July "Service Bulletin" of the Iowa State Highway Commission.]

PERSONALS

Mr. Thomas Turnbull, M. Can. Soc. C. E., of Winnipeg, Man., has been appointed Assistant Chief Engineer of the Canadian Northern Ry.

Mr. W. K. Winterhalter, of the firm of Berry & Winterhalter, Consulting Engineers and Agriculturists, San Francisco, Calif., has been appointed Consulting Agriculturist of the Spreckels Sugar Co., San Francisco.

Mr. C. R. Hubbard has resigned as President and General Manager of the Wheeling Steel & Iron Co., Wheeling, W. Va., in order to retire from active business. He has been the managing head of the company since 1892.

Prof. R. K. Chandler, Dean of the engineering division of the [illegible] Agricultural and Mechanical College, has resigned his position to become Head of the Mechanical Engineering Department at the New Hampshire College, Durham, N. H.

Mr. Samuel S. Webber, M. Am. Soc. M. E., has resigned as Chief Engineer of the Trenton, N. J., plant of the American Steel & Wire Co. Mr. Webber was connected with the Trenton Iron Co. before it became a part of the American Steel & Wire Co.

Mr. John L. Billard, of Meriden, Conn., widely known for his connection with the transactions by which the Boston & Maine R.R. was acquired by the New York, New Haven & Hartford R.R., has resigned as Director of the New York, New Haven & Hartford R.R. and the New England Navigation Co.

Prof. [illegible] H. Danforth, for the past six years with the U. S. Naval Experiment Station and the post graduate department of engineering of the U. S. Naval Academy, has been appointed Professor of hydraulics and mechanics at Case School of Applied Science, Cleveland, Ohio.

Mr. Charles E. Brown, Assoc. M. Am. Soc. C. E., for the past six years with the U. S. War Department in local charge of the construction of the Colbert Shoals Canal, Tennessee River, has been appointed Assistant Field Engineer, Division of Valuation, Interstate Commerce Commission, Southern District, with headquarters at Chattanooga, Tenn.

Mr. A. [illegible] Ackerman, Assoc. M. Am. Soc. C. E., Senior Assistant Engineer, Cape Cod Construction Co., builders of the Cape Cod Canal, has been promoted to be Resident Engineer, succeeding Mr. Charles T. Worthy, Assoc. M. Am. Soc. C. E., who has been appointed Superintendent of [illegible] Mr. Ackerman was educated at the Massachusetts Institute of Technology and has been on the Cape Cod Canal work for several years.

Mr. Charles T. Worthy, Assoc. M. Am. Soc. C. E., resident engineer in charge of construction of the Cape Cod Canal, has been appointed Superintendent of [illegible] of the canal, with headquarters at [illegible], Mass. Mr. Worthy succeeds Mr. H. W. [illegible], M. Am. Soc. C. E., now Chief Engineer of the Bureau of Highways, Borough of Manhattan, New York City. In 1911 [illegible] he was Division Engineer of the canal. The Chief Engineer is Mr. William Barclay Parsons, M. Am. Soc. C. E., consulting engineer, New York City.

OBITUARY

[illegible]

[illegible] served three years during the Civil War. Following the war he went into railway bridge work. Later he was Roadmaster of the Connecticut division of the Boston & Maine R.R., which position he held for nearly 21 years. He joined the staff of the Rail Joint Co. of America in 1897 and traveled extensively for the company for many years.

Dr. John Galbraith, Past-President, Can. Soc. C. E., Dean of the faculty of applied science and engineering at Toronto University, Toronto, Ont., died July 22, at his summer home on Georgian Bay. He was born in Montreal in 1846 and graduated at Toronto University in 1868. After graduating, he engaged in railway work, and in 1878 became Professor of engineering in the Ontario School of Practical Science, of which he was appointed Principal. In the early days of that institution, Dean Galbraith taught all the branches of engineering himself, and in the face of great difficulties succeeded in building up the school to the position it at present occupies. When it became affiliated with the university, Dr. Galbraith was appointed Dean of the faculty of applied science. He was one of the three commissioners appointed to investigate the collapse of the Quebec Bridge in 1907. Dr. Galbraith was one of the founders of the Canadian Society of Civil Engineers, and in 1908 was elected President of the society. Among other honorary positions which he held were the Vice-Presidency of the Engineering Section of the British Association for the Advancement of Science and the Vice-Presidency of the Engineering Section of the American Association for the Advancement of Science. [A more complete biography and a portrait of Dr. Galbraith were published in "Engineering News" of Feb. 6, 1908, at the time of his election to the presidency of the Canadian Society of Civil Engineers.]

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.
Aug. 20-21. Annual meeting in New York City. Secy., F. H. Harman, Room 101, Union Station, St. Louis, Mo.

AMERICAN PEAT SOCIETY.
Aug. 20-22. Annual meeting at Duluth, Minn. Secy., Julius Bordollo, 17 Battery Place, New York City.

AMERICAN BOILER MANUFACTURERS' ASSOCIATION.
Sept. 1-4. Annual convention in New York City. Secy., J. D. Farasey, E. 37th St. and Erie Ry., Cleveland, Ohio.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 7-10. Annual meeting in New York City. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

NATIONAL ASSOCIATION OF PORT AUTHORITIES.
Sept. 8-10. Annual convention in [illegible], Md. Secy., Wm. Joshua Barney, 24 Broadway, New York City.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.
Sept. 8-11. Annual meeting at Chicago, Ill. Secy., L. C. Ryan, Sterling, Ill.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.
Sept. 8-11. Annual convention in Nashville, Tenn. Secy., A. P. Dane, Reading, Mass.

NEW ENGLAND WATER WORKS ASSOCIATION.
Sept. 9-11. Annual convention in [illegible], Mass. Secy., Willard Kent, Narragansett Pier, R. I.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Sept. [illegible]. Convention in Atlantic City, N. J. Secy., Clarence W. Pike, Electrical Bureau, Philadelphia, Penn.

ILLUMINATING ENGINEERING SOCIETY.
Sept. 21-24. Annual convention in Cleveland, Ohio. Secy., Joseph D. Israel, 29 W. 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Sept. 22-24. Annual meeting in [illegible], N. Y. Secy., C. C. Rosenberg, Times Building, Bethlehem, Penn.

American Society of Agricultural Engineers—[illegible] meeting of the Society will be held in Madison, Wis., [illegible]. The preliminary program has not been issued. The Secretary is F. M. White, Madison, Wis.

National Paving Brick Manufacturers' Association—The [illegible] annual meeting will be held at Buffalo, N. Y., Sept. [illegible], with headquarters at the [illegible] Hotel. The business meeting will be held on the morning [illegible] and [illegible] sessions will be held on "A Study of Brick Pavement Construction for Country Highways". [illegible] The Assistant Secretary is H. H. Macdonald, [illegible], Cleveland, Ohio.

American Public Health Association—The annual meeting of the Association will be held in Jacksonville, Fla., Nov. 30-Dec. 4. The secretary is Prof. S. M. Gunn, 755 Boylston St., Boston, Mass.

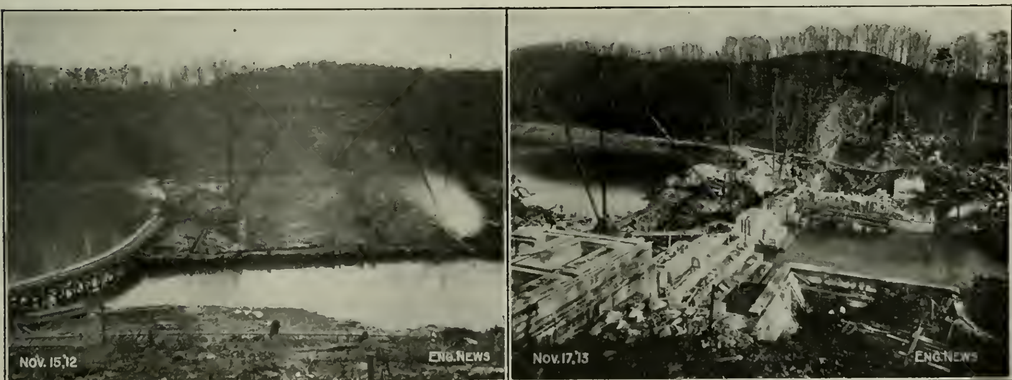
Engineering News

VOLUME 72 AUGUST 13, 1914 NUMBER 7

The New Loch Raven Dam at Baltimore, Md.

By Ezra B. Whitman*

The new Loch Raven Dam, which is being built for the purpose of augmenting the watei supply of Baltimore, is rapidly nearly completion. The necessity for the increased supply was recognized about ten years ago by Alfred M. Quick, who was then Water Engineer, and he proposed building a large impounding reservoir in the valley of the Gunpowder River. In 1908 the State Legislature passed an Enabling Act appropriating $5,000,000 for the purpose of making this improvement in the city's supply. This loan was ratified by the vote of the people in the fall of the same year.



Figs. 1-2. Loch Raven Dam for Water Supply of Baltimore, Md., in November, 1912, and November, 1913

Before proceeding with the construction of the dam in the valley of the Gunpowder, however, the city administration decided to call in outside experts, and John R. Freeman and Frederick P. Stearns were called upon to go over the entire question of improving the water supply for Baltimore. These gentlemen, after a most careful and thorough investigation, submitted a report on March 25, 1910, in which they recommended that the water supply be increased in practically the same manner as that recommended by Mr. Quick, viz., by building a large impounding reservoir in the valley of the Gunpowder River and by the building of a filtration plant.

Present Sources of Supply.

At the present time Baltimore takes its water from two sources. The main source of supply is from the Gunpowder River, which has a drainage area of 308 sq. miles above the existing dam. This dam is built of stone and is about 25 ft. in height above the bed of the river and is located about seven miles northeast of the city limits. The reservoir created by this dam is known as Loch Raven and originally had a capacity of 510 million gallons. This capacity has been greatly reduced by deposits of silt since the dam was completed in 1881. This long, narrow reservoir, extending between two high hills for a length of four miles, is now filled to such an extent that it has but little larger cross section than the normal cross-section of the river. By 1900 the capacity of the reservoir was only 78 million gallons, although dredging had been carried on from 1896 to 1900.

In 1900 the city purchased a suction dredge, which was operated continuously until the fall of 1911, the mud from the bottom of the reservoir being pumped through a long pipe line to a point below the old dam. This dredging increased the capacity of Loch Raven from 78 million gallons to about 178 million gallons. It is calculated that the annual deposit of silt from 1881 to 1909 was 226,000 cu.yd.

The annual yield of the Gunpowder River, according to records kept by the Water Department for the past 27 years, has averaged about 280 million gallons per day. The minimum flow of the stream, however, has been as low as 55 million gallons per day. The present water consumption of Baltimore is about 75 million gallons per day. From these figures it can be seen that if sufficient storage is obtained to store the waters, which at the present time passes over the dam during rainy periods, the stream flow of the Gunpowder River is sufficient to supply Baltimore with water for a number of years in the future. It is for the purpose of supplying this storage

*Formerly Water Engineer, City of Baltimore; now of Greiner & Whitman, Consulting Engineers, Baltimore, Md.

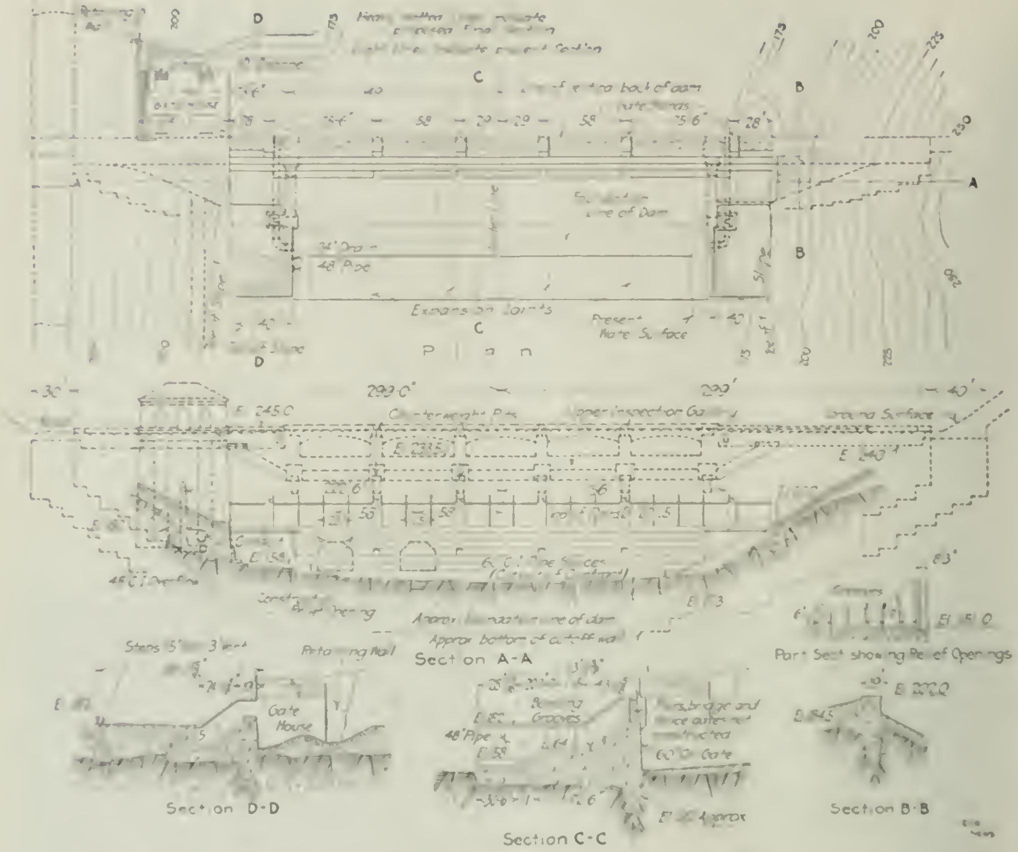


Fig. 3. Details of Construction of New Loch Raven Dam, Baltimore, Md.

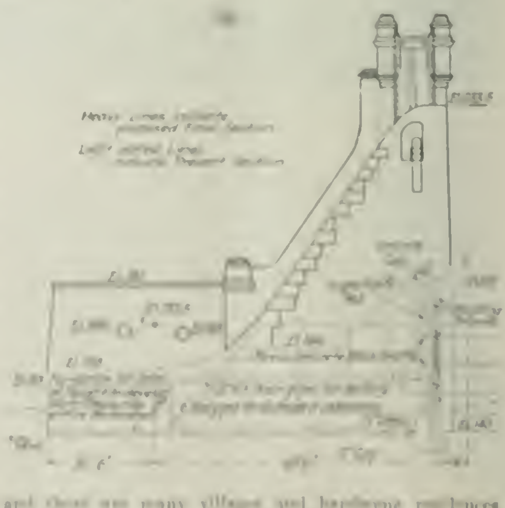
(Upper drawing shows present section with final proposed section dotted; lower drawing shows final section with present section dotted.)

that the new dam at Loch Raven is being constructed.

From the gate house at the old dam at Loch Raven a tunnel seven miles long and 12 ft. in diameter leads to Lake Montebello, just within the city limits. This lake has a capacity of 436 million gallons and is connected by a 12-ft. tunnel with Lake Clifton, which has a capacity of 290 million gallons.

The second source of supply for the city is from Jones' Falls at Lake Roland. Jones' Falls has a drainage area above the Lake Roland Dam of about 30 sq. miles, and it was first used as a source of the city's supply about 50 years ago. Lake Roland is about five miles north of the city. The original capacity of Lake Roland was 500 million gallons of water. This capacity has been largely reduced by deposits of silt, but by means of dredging its present capacity is about 300 million gallons.

The population of the Jones' Falls watershed is over 150 persons per square mile and is increasing very rapidly. The stream flows through the Green Spring Valley, which has become a fashionable suburb of the city,



and there are many villages and handsome residences springing up in this valley. In addition to the pollution from the Green Spring Valley, two of the largest towns

in Baltimore County, Towson and Lutherville, are located on streams emptying into Lake Roland, after flowing only a few miles. The sanitary condition of this source of supply is rapidly becoming a menace to the city, but it cannot be completely abandoned until the new dam is completed at Loch Raven. The average daily yield of the Jones' Falls watershed is about 35 million gallons of water per day.

A masonry aqueduct 5 ft. wide, 6 ft. 4 in. high and about four miles long leads from Lake Roland to the Hampden Reservoir, which has a capacity of about 49 million gallons. Hampden Reservoir is connected with Druid Lake by cast-iron pipes, and Druid Lake has a capacity of about 428 million gallons.

During periods of heavy rain, when the Jones' Falls or Gunpowder River are in a very turbid condition, the gates at Lake Roland and Loch Raven are closed and the muddy water is allowed to go to waste, while the city is furnished with clear water from the storage lakes at Montebello and Clifton from the Gunpowder supply and at Hampden and Druid lakes from the Jones' Falls supply.

It can be readily seen that this method of bypassing the muddy water makes it impossible to make use of the greater part of the run-off of the quick thunder showers falling in the summer time, and it has often been necessary to draw down on the available storage supply in the city limits at a time whe nthe stream flow has been very low. This condition of affairs, however, has been remedied to some extent by the use of alum to settle the turbid waters in Lakes Montebello and Hampden. Before the introduction of the use of alum it had been necessary on several occasions to turn very muddy and turbid water into the city mains, very much to the disgust of the entire population of the city.

Capacity of New Dam.

A careful survey was made of the valley of the Gunpowder River for a distance of 10 miles above the old dam, from which it was possible to compute the capacities of reservoirs behind dams with variable crest elevations, and Table I shows the available storage and other data for dams built to various crest elevations:

TABLE I

Contour elevation	Area, acres	Capacity between contours, million gal.	Total capacity below contours, million gal.
320	11,350	64,863	190,956
300	8,557	48,756	126,093
280	6,407	18,466	77,337
270	4,928	14,508	58,871
260	3,977	11,642	44,363
250	3,169	9,059	32,721
240	2,391	3,695	23,662
235	2,144	3,253	19,967
230	1,866	5,343	16,714
220	1,442	4,116	11,371
210	1,116	3,131	7,255
200	770	2,166	4,124
190	489	1,323	1,958
180	211	458	635
170	97	177	177
158	....	....	.....

Messrs. Stearns & Freeman, from the stream-flow records of the department, computed Table II, showing the amount of storage that would have been required to supply from the Gunpowder River different daily quantities of water throughout the greatest droughts of 27 years prior to 1910. They first reduced, however, the stream-flow records on an average of 6% from the quantity shown by the departmental records in order to allow for obstructions on the spillway and for a different formula for computing the flow over the dam:

TABLE II

Average daily water consumption. (Million gal.)	Available storage capacity required. (Billion gal.)	Storage in equivalent inches depth over drainage area of 308 square miles	Length of longest continuous period that reservoir would have been below spillway crest
90	2 3	0.37	
100	3.5	0.56	
110	4.7	0.75	
120	6.2	1.16	1 year 2 months
130	8.6	1.61	1 year 2 months
140	10	1.87	1 year 6 months
150	13	2.44	1 year 7 months
160	16	3.00	1 year 7 months
170	21	3.94	1 year 8 months
180	27	5.06	1 year 10 months
190	38	7.13	3 years 0 months
200	47	8.81	3 years 8 months
210	57	10.7	3 years 10 months
220	66	12.4	3 years 11 months
230	75	14.1	4 years 1 month

Messrs. Stearns & Freeman also prepared Table III after a study of the water consumption of the city for a period of 39 years, and the growth in population of the city, in order to estimate the number of years in the future that the city could safely take it supply from the Gunpowder River:

TABLE III

Year	Years from now	Probable population: Per cent. growth for decade	Probable population: Estimated total	Probable quantity water used per capita per day, gal.	Total quantity of water probably required. Average million gal. per day
1915	5	..	660,000	130	86
1920	10	20	720,000	135	97
1930	20	17.5	850,000	145	123
1940	30	15	980,000	150	147

The crest of the dam can be carried to an elevation of 237 ft. above mean tide without making it necessary to flood the tracks of the Northern Central Ry. near Phoenix, Md., or to flood the town of Cockeysville, Md. To carry the flood line higher than this elevation would have caused a greatly increased expense. It will also be seen from Table I that the dam, with a crest elevation of 237 ft., would give a reservoir with a capacity of about 21 billion gallons. Table II shows that a reservoir with this capacity would give an average daily water consumption of 170 million gallons per day, which is approximately 2½ times the present consumption of the city. This amount of water, it will be seen from Table III, would probably meet the needs of the city until 1950 or later.

Another very important reason for carrying the flow line to this height is that it will make it possible to suply the water from the resulting reservoir by gravity to the filtration plant, which will in turn discharge the water at sufficiently high level to suply the middle service of the city without pumping and furnish a greater water pressure in the low-service district of the city, which is at present fed by gravity from the present Loch Raven Reservoir with a water elevation of 171 ft. A.M.T.

In order to make the greater part of this 21 billion gallons available, however, it will be necessary to build a pumping station to pump the water to the filters before the water falls more than ten feet below the crest of the proposed dam.

Owing to certain legal complications in connection with the purchase of property in the valley of the Gunpowder, it was first decided to build the dam to a crest elevation of only 192 ft., which would give a storage capacity of little over two billion gallons instead of the 21 billion gallons. This dam with a crest elevation of 192 ft., continued with the existing storage reservoirs in

the city, which have an available storage of about $1\frac{1}{2}$ billion gallons, gives a total storage of $3\frac{1}{2}$ billion gallons. This would furnish a safe daily capacity of about 100 million gallons of water.

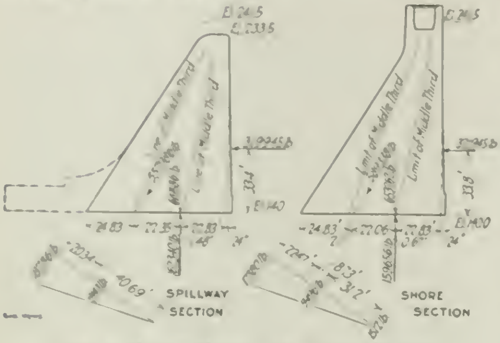


FIG. 4. STRESS SHEET FOR FINAL SECTION

It also developed that it would not be possible to build a dam with a crest elevation of 237 ft. and a filtration plant out of the \$5,000,000 loan available for improving the water supply. The present city administration does not desire to ask for a further loan in order to build the higher dam, as the city is already greatly burdened with loans in carrying out the extensive improvements which have been made since the great Baltimore fire in connection with the new docks, new sewerage system, new street paving for the entire city, extension of the parks and improvement of the fire department and school systems. It has therefore been determined to build a reservoir which will have a crest elevation of 192 ft. at the present time, although the foundations for this dam have been laid of sufficient width, not only to extend the dam to an elevation of 237 ft., but to extend it to a further elevation of 280 ft. if this should be deemed desirable in the future.

DESIGN OF THE DAM

The accompanying diagrams (Figs. 3 and 4) show the sections of the dam which will be required when the crest is raised to an elevation of $233\frac{1}{2}$ ft. It is proposed to secure a water level of $237\frac{1}{2}$ ft. by placing flashboards along the crest. In designing the dam provisions were made for flood water 8 ft. over the top of the masonry of the spillway, and an upward pressure is figured on the horizontal joints and on the bottom of the dam, which is equivalent to two-thirds of the head of water at the upstream face, diminishing to zero at the downstream face of the dam.

The failure of the dam at Austin, Pa., at about the time that the designs for the Loch Raven Dam were being completed emphasized the necessity of taking every precaution to prevent upward pressure under the bottom of the dam and internal stresses within the body of the dam itself, due to water making its way into horizontal joints.

In order to take care of upward pressure under the base of the dam, a system of underdrains has been provided beneath the main foundation and next to the rock. A 12-in. drain with open joints is placed on the downstream side of the cutoff wall along the line of the bottom of the foundation of the dam, as shown on Fig. 5. Connecting to this drain are a number of 6-in. underdrains surrounded by gravel, which rest on the rock foundation, and it is expected that any water which may make its way through the cutoff wall or through the seams of rock on which the dam is built, will enter this drainage system without causing any appreciable upward pressure on the base of the dam.

The 6-in. underdrains are placed at intervals of approximately 30 ft., and they find outlet in risers leading to the top of the foundation apron near its lower end.

The author was familiar with the vertical porous drains used in the construction of the Olive Bridge and Kensico dams in connection with the improvements of the water supply of New York in order to intercept seepage through the body of the dam. It seemed more logical, however, that drains for this purpose should be placed horizontally across the construction joints, where the seepage would most naturally occur.

The upstream side of the dam for a thickness of about 7 ft., as shown on Fig. 3, is built of 1 : 2 : 4 concrete, laid in such manner that horizontal joints occur at vertical intervals of 8 ft. At these horizontal joints on the downstream side of the 1:2:4 concrete wall are laid conduits consisting of porous concrete tile laid in grooves left in this wall. These tiles are 14 in. square, 3 ft. long and are made of a dry 1:4:8 mixture, with the 6-in. interior diameter. Expansion joints are provided across the dam parallel to the axis of the stream at intervals of approximately every 60 ft., and at each expansion joint there is a vertical well to which the horizontal drains are connected. These vertical wells lead to a gallery

FIG. 5. DETAILS OF DRAIN PIPES IN LOCH RAVEN DAM

which extends throughout the length of the dam and which get free discharge into the tail water on the downstream side of the dam.

Fig. 4 shows a section of the dam which is now being built to an elevation of 192 ft., and how the dam will be raised to the proposed crest elevation of 237.5 ft. The last three feet of the heights to bring the dams to these levels will be secured by means of flashboards.

Two 36-in. drain pipes are provided at elevation of

inverts of 164 ft. A.M.T., one on each side of the spillway, and these will make it possible to drain the lake should it ever be found necessary to do so. These gates will also be used while filling the relief openings which have been left in the first half of the dam to carry the water of the river during the construction of the second half.

Gate House

The gate house which will control the flow of the water into the city is built into the dam near the west bank of the stream, and will be so constructed that there will be duplicate gates which will make it possible to send water to the city through either one or both of the two gate chambers. Should any gate get out of order it will be possible by means of stop planks to shut the water out of the gate chamber, and a 24-in. drain for the gate chamber is provided, which will discharge into the tail waters of the dam. Provision is also made in this gate house to take water from varying depths.

During the summer time, when trouble may be experienced from the presence of algae growths, the water for the city will be drawn from the bottom of the lake, as experience has shown that the algae growths are much more numerous in the top layers than in the bottom layers. Should the dissolved oxygen become exhausted in the lower layers, and in times of turbid waters, when the top waters will settle clear much more rapidly than the bottom waters of the lake, the water will be drawn from the top.

The conduits connected with the two chambers of the gate house are each 8 ft. in diameter and will be brought together just below the gate house into one 10-ft. conduit, which is connected with a 10-ft. steel pipe line. This steel pipe is surrounded by concrete on the outside and lined with mortar on the inside, which lining has been placed by means of a cement gun, and is reinforced with wire mesh.

The gate house, when it is raised to the height recommended by the consulting engineers, will be provided with a hydro-electric plant which will generate electricity, the turbine being operated by the water passing to the city and by using the waste waters in excess of the water being consumed by the city. This current will probably be carried into the city limits and be used at the filtration plant.

The house which will be built over the gate chamber at the present time will be merely a temporary one of wood. A more permanent structure of stone or concrete would have to be soon torn down, as it is possible that the dam will have to be extended to the height recommended by Messrs. Freeman & Stearns in the course of the next ten years.

Bonding High Dam to Present Structure

When it is decided to carry the present structure up to the height originally recommended, it is proposed to place several rows of porous drains along the steps of the present dam, so that any water getting into the joint between the old and the new work will be intercepted before it can produce internal stresses, which would threaten the safety of the dam.

In order to bond the new structure to the old, large plum stones are placed projecting above the finished surface of the present structure, and these stones will be of great assistance to keep the new structure from sliding on the old. (Fig. 7.)

Fig. 6. Foundation Pit, Showing Seamy Rock Formation

Fig. 7. Plum Stones Imbedded in Present Dam Crest for Future Bonding

If it is decided that these plum stones will not furnish sufficient strength to prevent the sliding of the dam, holes can be drilled at regular intervals along the crest of the present structure, and iron bars can be grouted into these holes and extended into the new structure. It is believed that the system of drains combined with the plum stones and the iron bars will provide sufficient strength against sliding and provide for a sufficient bond between the new work and the old.

Materials of Construction

The stone of which the dam is constructed is taken by the contractors from a quarry located on the property of the city on the west bank of the stream, just below the old dam and about one-half mile below the bend where the new dam is being constructed. The larger stones taken from this quarry are used as plum

stone, while the smaller pieces are crushed by the contractor in order to furnish stone for the concrete. The stone from the quarry is a low grade of limestone, and it is also crushed and rolled in order to secure sand for the concrete. On account of its hardness, the contractor has experienced considerable difficulty in getting enough sand by this method to carry on his work, and he has been forced to buy sand from Baltimore city, from a company which secures the sand by dredging Baltimore harbor and the surrounding waters.

As already noted, the cutoff wall which extends below the foundation line and to the top of the upstream face of the dam is built of 1:2:4 concrete. The main body of the dam is built of 1:2½ concrete, in which are placed plum stones which amount to from 20% to 33⅓% of the total volume of the masonry in the dam, depending upon the part of the structure in which the plum stones are placed.

Every carload of cement that is used in the dam is sampled and tested before the contractors are allowed to use it.

CONSTRUCTION

The new dam is being built in the old Loch Raven Reservoir and the first half of the masonry was constructed inside of a coffer-dam, built to within about 50 ft. of the eastern shore of the old lake (Fig. 1.) This coffer-dam was built of two rows of interlocking steel sheet piling placed about 15 ft. apart. There was about 15 ft. of mud and earth in the bottom of the old lake overlying the rock, and the sheet piling was driven through this mud and earth to solid rock. Upon the completion of the coffer-dam and in carrying out the earth excavation in the bottom of the lake, it was found very difficult to hold the earth on the inside face of the sheet piling so as to furnish proper support for the steel piling and the contractor was forced to place large stones on the inside of the coffer-dam against the inner row of sheet piling, which stone was afterwards used for the plum stone in the dam wherever it could be recovered.

This coffer-dam for the first half of the construction was very tight and the water was kept down in it by the use of a single 4-in. pump which did not need to operate constantly.

The rock encountered in the excavation is a mica schist, varying in hardness according to the amount of mica which was present. The rock was of a very seamy character, although there was little or no percolation through it excepting in the top seams, and the cutoff wall, which it had been proposed to carry down 30 ft., was stopped at a depth of about 15 ft. below the general excavation of the rock. Owing to the seamy character of this rock, which is shown in one of the accompanying views (Fig. 6), and the sharp tilt of the strata, there was no attempt made to secure a level bottom for the foundation, and the underdrains were placed over the seams between the strata at intervals of about 20 ft., instead of at right angles to the main underdrain on the downstream face of the cutoff wall.

The dam itself was built in blocks, forms being used to secure these blocks. The joints between these blocks were so arranged that there is no continuous horizontal joint throughout the dam.

Both the excavation and the placing of the concrete and the plum stones were handled from a number of derricks, which can be seen on Figs. 2 and 8.

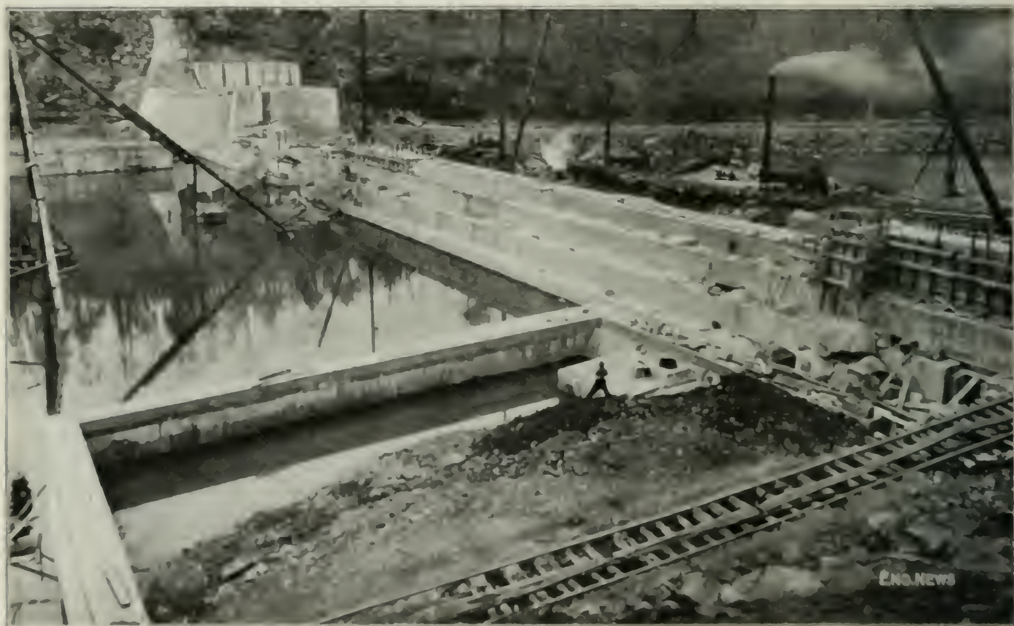


FIG. 8. VIEW OF LOCH RAVEN DAM, TAKEN MAY 1, 1914, SHOWING PRACTICALLY COMPLETED PRESENT STRUCTURE

When the first half of the masonry structure was completed, the contractors, largely through overconfidence bred by the ease with which the water was handled in the first half of the dam, built the portion of the coffer-dam parallel to the axis of the stream and upon the completed structure of wooden plank instead of the steel sheet piling.

When the coffer-dam for the second half of the dam was completed it was found that this portion of the coffer-dam leaked very freely and the work of proceeding with the structure of the second half of the dam was delayed for several months before the coffer-dam could be made sufficiently tight to work inside of it.

PERSONNEL

The original plans for this dam, before being revised by the writer, were drawn by former Water Engineer Alfred M. Quick, and the design and construction have been directly under the supervision of Emory Sudler, then Division Engineer of the Gunpowder Supply improvements. The Assistant Division Engineer, P. A. Beatty, assisted in the design of the dam and has been in immediate charge of its construction and the construction of the roads, conduits and bridges, which are incidental to the construction of the dam. The Resident Engineer at the dam was Talbott Todd, who resigned his position with the city to take charge of the construction of the dam for the contractors in August, 1913. Mr. Todd was succeeded by Everett Patterson, who is now the Resident Engineer in charge of this work.

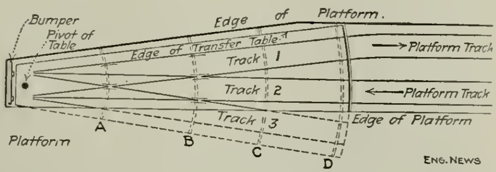
A Swinging Transfer Table for Shifting Locomotives

In the new Snow Hill station of the Great Western Ry. at Birmingham, England, there is a pair of stub tracks for local service and it was desirable to provide means for promptly switching out the engine of an inbound train. This is effected by the use of a segmental or fan-shaped transfer table, pivoted at the extreme end of the tracks. This is shown in the accompanying cut.

The table has three tracks radiating from the pivoted end. Two of these tracks are normally in line with the converging ends of the inbound and outbound tracks. When a train stops on the inbound track, the engine is uncoupled and runs onto the transfer table. This is then swung to bring its engine track in line with the outbound track, and at the same time its third track is lined up with the inbound track. In this way the pit is kept closed all the time and there is no liability of derailing cars in case of accidental movement while the engine is being moved. As soon as the engine is run off, the table is returned to its normal position. It will be understood that the station has high platforms, level with the floors of the cars, so that the transfer-table pit and the dead side of the table extend under the platforms.

The table is about 70 ft. long, with widths of 13 ft. and 39 ft. at the inner and outer ends. This width is between the centers of the two side or radial girders, and these girders are connected by four curved transverse girders, between which are framed parallel longitudinal girders, all covered by a steel deck. Under each cross-girder is a curved rail on the floor of the pit, for wheels carried by the girder framing. The pivot and bumping block are carried by a substantial masonry pier.

Upon the framing (beneath the deck) is mounted a motor-driven drum, upon which is wound a cable having its ends anchored to the sides of the pit. The travel (at the circular end of the table) is about 8 ft. 6 in. The



PLAN OF SWINGING TRANSFER TABLE FOR SHIFTING THE LOCOMOTIVE OF AN INBOUND TRAIN TO AN OUTBOUND TRACK AT THE SNOW HILL STATION OF THE GREAT WESTERN RAILWAY, BIRMINGHAM, ENGLAND

(A, B, C, D are transverse girders of the table, with wheels riding on curved tracks in the floor.)

operation is controlled by a lever on the platform and this is interlocked with the signal equipment, so that the table cannot be operated without the knowledge of the signalman who handles the train movements at the station.

The Magnitude of the Aluminum Industry is shown in the following table, which gives the production since the beginning of the industry in 1883 and the domestic consumption of the metal since 1904:

1883	83	1900	7,150,000
1884	150	1901	7,150,000
1885	283	1902	7,300,000
1886	3,000	1903	7,500,000
1887	18,000	1904	8,600,000*
1888	19,000	1905	11,347,000*
1889	47,468	1906	14,910,000*
1890	61,281	1907	17,211,000*
1891	150,000	1908	11,152,000*
1892	259,885	1909	34,210,000*
1893	333 629	1910	47,734,000*
1894	550,000	1911	46,125,000*
1895	920,000	1912	65,607 000*
1896	1,300,000	1913	72,379,000*
1897	4 000,000		
1898	5,200,000	Total	377,737,779
1899	6,500,000		

*Consumption. The figures for 1913 do not include the weights of imported leaf aluminum, valued at $1228; table, kitchen and hospital utensils, valued at $40,947, and "All other manufactures" of aluminum, valued at $353,844. The secondary aluminum produced in 1913 was 2198 short tons; the quantity of recovered aluminum contained in alloys was 2456 short tons.

The use of the metal is now being extended on a much larger scale, as in the construction of welded tanks, cooking vats and vessels which are employed by brewers, preserve manufacturers, fat recoverers and in similar industries where a metal that will conduct heat, will not corrode and is not poisonous is essential.

Other uses for aluminum vessels on a large scale are in the manufacture of essences and syrups, varnishes, fatty acids, edible oils and nitric acid. A large number of firms abroad are using aluminum in the varnish-making industry. Welded aluminum tanks are now being employed for obtaining and measuring acid and for piping and conveying the acid in the works. A number of aluminum tank cars have been made for the conveyance of strong nitric acid in bulk and the results have been satisfactory. The use of aluminum wire as a conductor in long-distance power-transmission schemes is not new. A recently developed branch of the aluminum industry is the manufacture of powdered metal which is used extensively as a paint pigment, in explosives, in lithographing and in printing. Aluminum foil, though not exactly a new product, is now being used on a larger scale than ever before, owing to improved methods in its manufacture after long and expensive experiments which have reduced its cost appreciably. Aluminum foil has partly displaced tinfoil for wrapping articles such as cheese, chocolate candles and tobacco.

Design and Construction of Outfall Sewer, Carlisle, Penn.

By [illegible] Bryan*

The main outfall sewer conveying the sewage from the borough of Carlisle, Penn., to the disposal plant is about 1.7 miles in length (see plan and profile, Fig. 1). It is constructed of 18- and 24-in. double-strength terra-cotta pipe. It follows in the general course of the Letort Spring, a shallow stream which flows through the eastern portion of the borough.

Design of the Outfall Sewer

The sewer was designed to carry the sewage from a population of 27,000, and was designed on the assumption: (1) that the average amount of sewage contributed to the system per capita per day would be 100 gal., and (2) that there would be an infiltration of ground water into the main amounting to 5000 gal. per mile of sewer per day.

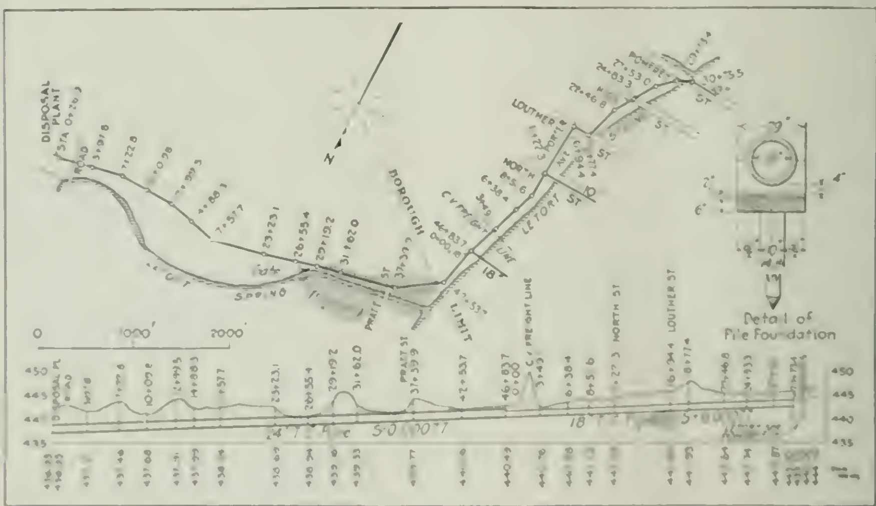


Fig. 1. Plan and Profile of Outfall Sewer, Carlisle, Penn.

The sewage from the town is discharged into the main outfall at three points, the sizes of the branch sewers being 10, 12 and 15 in., respectively (see article on this sewerage system in general, by the present writer, in Eng. News of July 2, 1914). The total fall available between the point where the main sewer draining the southeastern portion of the borough joins the outfall at the corner of North and East streets, and the site selected for the plant, is 9 ft. The velocity of flow through this sewer was fixed at 1¾ ft. per sec. and the gradient determined in accordance therewith. At every 90° point on the line a drop of 1 in. was made in the manhole at that point, and at the other turns the amount of fall allowed in the manhole varied from ¼ to ½ in., depending upon the sharpness of the turn.

A careful study was made of the topography of the section through which the sewer passed, and the sewer was so located as to permit its construction in the shallowest cut possible and at the same time provide a covering of at least 2 ft. over the pipe. This was considered essential because the line, once outside the borough limits, was laid out through cultivated fields.

Construction of the Sewer

Bids for the construction of the outfall were received in March, 1913, and the contract was awarded to the lowest bidder, J. L. Dick, of Scottdale, Penn., at $13,098.

Excavation—Construction work was not started very promptly as the contractor had other work which he wished to finish, and again, in the judgment of the engineer, the work was not of sufficient magnitude to raise any doubt as to the contractor's ability to finish it within the specified time limit of 180 days. Work was started in June, however, and, as a comparatively small force was employed, it was not finished until February, 1914. The principal cause of this delay was the fact that the contractor expected to have only a small quantity of rock excavation, but once construction work was started a large amount of rock was encountered. The contractor, not being well equipped to handle this rock, kept opening up more and more trench in the hope of finding some dirt excavation, with the result that he finally had 3000 lin. ft. of trench opened and no pipe laid. At this point the engineer was obliged to [illegible] this procedure and no further trench was laid out until the pipe had been laid in the trench already opened up. Progress on this portion of the work was necessarily slow because the contractor did not have the machinery to handle the work economically nor did he seriously consider the purchase of suitable apparatus until the work was nearly completed. Figs. 2, 3 and 4 give an idea of the amount of rock encountered at points where little or no rock was anticipated.

During construction, no serious difficulty was experienced. The majority of the excavation was in dry material, only about a half-mile of the pipe being laid in wet trench. Probably the worst stretch encountered lay

*[illegible]

between High and Pomfret streets (Fig. 1) where the line passed through a truck patch. Here the material excavated was a sort of marl, saturated with water. It provided no foundation for the pipe and a pile-and-plank foundation was built to support it (Fig. 1). This entire section had to be closely sheeted, and it was found necessary to drive the sheet piling fully 2 ft. below the invert of the pipe to prevent the material from breaking through underneath the sheeting. The crossing under the freight track of the Cumberland Valley R.R. was made in tunnel and was carried through without trouble, although the tunnel was about 150 ft. long and was driven through filled ground.

Rock Drilling—The rock on the outfall sewer was drilled by means of Rand jack-hammers or butterfly drills, operated by steam (Figs. 5 and 6). Two of these hammers were operated by an 8-hp. vertical boiler, which supplied steam to them through 1-in. pipe. It was found that the steam could be carried a distance of about 150 ft. from the boiler before condensation became too great to permit the operation of the hammers. This necessitated the moving of the boiler every 300 ft. When but

Construction Views on the Outfall Sewer at Carlisle, Penn.

(Figs. 2, 3 and 4 show the unexpected amount of rock encountered. Figs. 5 and 6 show steam jackhammers or butterfly drills at work.)

one drill was in use it was found that steam could be carried from 200 to 250 ft. before becoming too cold.

From the results obtained by this contractor in drilling the rock in the manner described the following conclusions have been drawn: (1) Butterfly drills operated by steam will not put down holes in solid rock over 5 or 5.5 ft. in depth. (2) Where a seam of soft or shattered rock is encountered the steam drill will clog and refuses to go through, often necessitating shooting shallow holes and redrilling after cleaning out the soft seam. (3) The heat under which the operator was obliged to work was excessive, and this heat and the exhaust steam necessarily tended to reduce the efficiency of the operator. In deep cuttings and also under certain atmospheric conditions, steady work was impossible. (4) The cost of the maintenance and operation of the plant was excessive. The writer is convinced that the cost of drilling the rock on this work could have been more economically handled by the use of a portable air compressor.

SEWER JOINTS—As stated, the entire 24-in. portion of the line was constructed during the summer months and at a time when there was little or no water in the trench to contend with. Joints were made in the usual manner, using a rich cement mortar which was prevented from passing through to the inside of the pipe by first wrapping a strand of jute around the spigot end of each pipe as it was inserted into the bell end of the pipe previously laid. To further aid in keeping the mortar in place, a piece of muslin 9 in. wide was wrapped completely around the joint and held in position by tying at the top of the pipe. An inspector was present on the work practically all of the time, and was especially careful to see that the bottoms of the joints were well made and the pipe well laid.

During the winter months, the meadow marked A on Fig. 1 is flooded by the authorities of the Carlisle Indian School for the purposes of a skating pond, and under present conditions about 1200 lin.ft. of the outfall sewer along this meadow is subjected to a head of about 6.5 ft. of water, amounting to a pressure of about 1.5 lb. Under these conditions the infiltration of ground water into the sewer is excessive. Measurements taken at the manhole nearest the point A have shown a stream 10 in. deep flowing through the sewer.

A careful examination of the barrel of the pipe has failed to reveal any excessive leakage at any one joint, but water seemed to enter the pipe through numerous pores in each joint. Various attempts to repair this leakage have proved in general unsuccessful. The writer is satisfied that the joints were carefully made and the pipe well laid, and this at a time when the ditch was dry.

Leakage at this point is unquestionably increased by the fact that throughout this distance the pipe is laid in a shallow cut, and through rock. For this reason the back-filling is much more porous than it would have been had the pipe been laid in dirt excavation.

The fact that so much leakage has developed under the conditions cited has raised in the mind of the writer the question whether after all cement joints are the most satisfactory joints for vitrified sewer construction.

COST OF CONSTRUCTION

The unit prices upon which the contractor's bid was based were as follows:

Material	Diam. in.	Depth ft.	Price
Terra cotta pipe	24	0 to 4	$1.30 per lin.ft.
Terra cotta pipe	24	4 to 6	1.52 per lin.ft.
Terra cotta pipe	24	6 to 8	1.82 per lin.ft.
Terra cotta pipe	24	8 to 10	2.22 per lin.ft.
Terra cotta pipe	24	10 to 12	2.72 per lin.ft.
Terra cotta pipe	18	4 to 6	1.33 per lin.ft.
Terra cotta pipe	18	6 to 8	1.48 per lin.ft.
Terra cotta pipe	18	8 to 10	1.53 per lin.ft.
Terra cotta pipe	18	10 to 12	1.58 per lin.ft.
Terra cotta pipe	18	12 to 16	1.82 per lin.ft.
Terra cotta pipe	18	16 to 18	2.25 per lin.ft.
Rock excavation			2.85 per cu.yd.
Brick manholes			4.00 per vertical ft.
Cast-iron frames and covers			18.00 apiece complete
Concrete masonry			6.50 per cu.yd. in place

The price paid by the contractor for labor was $2 per day of 10 hr.

The final estimate for this work amounted to $21,735, or a cost to the borough of $2.91 per lin.ft. of completed sewer, including engineering and inspection. Records kept during the construction show, up to the point where the line crossed High St. (Fig. 1), a profit of about $800 to the contractor. It is probable that this profit was lost in the construction of the remaining distance to Pomfret St. on account of the difficulties to which reference has previously been made.

The cost of the outfall sewer will be met by a general assessment on the assessed valuation of the entire borough.

This sewer was designed by and constructed under the supervision of T. Chalkley Hatton, now Chief Engineer of the Sewerage Commission of Milwaukee, Wis. The writer was the resident engineer in charge of construction and Leo D. Skemp was the superintendent of construction.

A Controversy Over the Question of Force Account versus Contract Work at New Orleans

We have recorded in recent issues of ENGINEERING NEWS the extent to which some cities are carrying on work at the present time by the direct employment of labor, or by force account as it is commonly called, instead of by letting contracts. In our issue of July 16 we described the manner in which the city of Minneapolis is carrying out over three and one-half million dollars' worth of construction work without letting contracts. It is the general rule, however, that this plan of carrying on work meets with serious opposition. In many states stringent statutes are in force requiring that all public work shall be done by contract and shall be advertised and let to the lowest bidder. There are many engineers who believe that while in exceptional cases work can be carried on efficiently by day labor, the general liability to political interference, etc., is such that on the whole the contract system is to be preferred.

The city of New Orleans is just now the seat of a lively controversy respecting the manner in which the extensions of its waterworks and sewerage system should be made. As many of our readers will recall, the building of a sewerage system for New Orleans was not undertaken until 1903. In the four years from 1903 to 1907 a large amount of work was done. The main trunk and outfall sewers were constructed and a large part of the business and residence portions of the city were provided with sewers. All this work was done by contract.

In September, 1907, bids were received on four addi-

tional contracts for sewer extensions. These bids were found to be about one-third greater than the engineers' estimate of the cost; and this fact, together with the limited appropriation available, caused the bids to be rejected. The Sewerage and Water Board then determined to undertake the construction of these sewers by force account after receiving a legal opinion that they had authority to carry on the work in this way.

In the six years since that time all work on sewer extension work has been done by force account, no contracts being let. The Board has built in this time 193 miles of sewers, from 8 in. to 27 in. in diameter, at a total cost of $1,312,000. The work done by contract previous to that time had cost about $5,000,000. In 1910 the Board further adopted the policy of building by force account all extensions to the city's water distribution system. Heavy construction work on the city's storm-water drainage system, however, is still done by contract.

As was to be expected, the conduct of work by force account excited criticism and antagonism. Claims were made that the Board had no legal right to carry on its work in this manner. The controversy appears to have become a political issue and was carried into the State Constitutional Convention held last fall. This convention inserted a clause in the constitution empowering the Board to continue to do its work either by force account or contract until Sept. 1, 1914, providing that any single piece of work exceeding in cost $25,000 should be let to contract and further providing that the State legislature, at its session in the spring of 1914, might determine whether the permission to the Board to work by force account might be extended beyond Sept. 1.

In view of the large amount of criticism and discussion concerning the work done under the direction of the Board, a special investigation committee was appointed in December last, consisting of Messrs. J. F. Coleman and Arsene Perrilliat, and Prof. W. B. Gregory. This committee was requested to report as to the comparative cost of the work done by force account and by contract, and also as to the organization and efficiency of the Board's staff with the adequacy or inadequacy of the salaries paid.

This committee presented its report, May 6, 1914, and stated that the design and execution of the drainage, storage and water systems of New Orleans are exceptionally good and reflect great credit upon those who are responsible therefor. The committee then proceeded to a discussion of the relative merits of contract work and force account, and concluded that under the same terms and conditions the work could be done by contract at a lower cost and yet with a reasonable profit to the contractor. The committee therefore recommended that the work of extending water, drainage and sewer conduits should hereafter be done wholly by contract, but that the making of sewer and water house connections and the maintenance of the system should be done by the Board's own forces. The committee also made an elaborate report upon the organization of the Board's engineering and other departments and submitted certain recommendations for its reorganization.

At the same meeting of the Sewerage and Water Board, at which the report of the investigating committee was presented, George G. Earl, General Superintendent for the Board, submitted a report emphatically contradicting the investigating committee's statement as to the advantages of contract work and showing that in every respect the city had been the gainer by the adoption of the force account plan. Mr. Earl stated that on the contracts for which the bids were rejected in the fall of 1907 their execution by force account showed a saving of at least $562,000 to the city as compared with the prices bid by the contractors. Engineers desiring a forceful discussion, pro and con, of the subject of force account vs. contract work would do well to apply to the Sewerage and Water Board of New Orleans for copies of the reports.

Following these two reports, the Board instructed its counsel to submit to the legislature a bill which would permit it to continue the policy of doing work by force account within the limit fixed by the constitution. It further submitted the whole matter to a board made up of Messrs. Rudolph Hering, George W. Fuller and Harrison P. Eddy. The report of this board, dated June 20, 1914, has just been printed. This board fully sustains the Water and Sewerage Board of New Orleans in its policy of carrying on work by force account. One of the strongest paragraphs of its report we quote as follows:

> If the legislature should decide to discontinue the right of the board to do force account work, it will place the city in the embarrassing position of being obliged to accept the prices bid, whether high or low, or not do the work. Should the bids appear to be too high, the board, of course, can reject them and call for new bids with a delay of from three to four months; but if the board cannot do the work with its own forces these bids may be practically as high as at first. In other words, the board will be entirely at the mercy of the contractors at times when contractors are busy and bidding high prices as well as when there is a scarcity of work, and even in case of a combination of bidders to artificially inflate prices.

In addition to the report, Messrs. Fuller and Eddy gave testimony before committees of the Louisiana legislature on June 22. The legislature before adjourning enacted the bills desired by the Sewerage and Water Board, giving it permission to continue to carry on work by force account. These bills were transmitted to the Governor who submitted them to a so called "pocket veto." Had he returned them to the legislature with a veto message, it is said that they would have been passed over the veto as the vote in their favor was nearly unanimous. By merely retaining the bills, however, in his possession until after the legislature had adjourned the bills failed to become law.

Good Roads for Little Money are being constructed in Louisiana, where rock and other expensive road-making materials are rare. The work is done under the State Highway Department, which is a subsidiary department of the Board of State Engineers. The Highway Department, in all its work and discussions before the Farmers' Institutes and other meetings, has tried to make it clear that road improvement does not necessarily mean the construction of the highest type of roads, except under certain traffic conditions, but attention should be given to those methods by which the best results can be obtained with the money that is, or will be, available for the various highway projects. The accompanying table gives a summary of road work during the past six years.

Parish	General Character	Mileage	Cost	Average cost per mile
Natchitoches..	Earth	37.23	$29,021.01	$779.51
DeSoto..............	Sand-Clay	50.39	43,797.59	869.17
Ouachita...... ...	4¼ Miles Graveled, 13 Miles Earth	17.25	25,089.16	1,451.44
Rapides............	Earth	3.57	3,273.50	916.91
East Baton Rouge.	Earth	22 22	23,400.53	1,053.13
Orleans............	Earth	15.50	16,110.11	1,039.36
City of Baton Rouge	Wide Gravel	0.82	5,023.08	6,125.71
St. John the Baptist	Earth	8.00	7,200.00	900.00
Total............		154.98	$152,914.98	

Road-Oil Specifications and Tests*

By Clarence B. Osborne†

In the preparation of specifications for asphaltic oil for road building the engineer has three problems presented: (1) He must have requirements controlling the chemical purity of the oil, i.e., he desires an oil that is free from foreign material and products of decomposition produced during refining; (2) He must control the chemical composition of the oil; (3) he must control the physical properties of an oil so that it will actually perform its proper function in the road construction.

Specifications for chemical purity of road oil are as follows:

(1) It shall not contain more than one-half of one per cent. of sediment by volume.

The presence of even ten times this amount of sediment is not detrimental, as the oil in use on the road eventually carries as high as 90% of mineral aggregate. This specification is used to prevent the buying of sediment at the price of road oil.

(2) It shall not contain more than one per cent. of water by volume.

The presence of water in a road oil makes the oil difficult to handle when heated above 212° F., because the steam formed makes the oil boil or froth. Also, as in the case of sediment, unless the proper deduction is made water will be paid for at the price of road oil.

(3) It must, when freed from water, be soluble to at least ninety-nine and five tenths per cent (99.5%) in pure carbon disulphide.

This will give the per cent. of bitumen in the road oil.

(4) The bitumen soluble in carbon disulphide must be soluble in carbon tetrachloride to the extent of at least ninety-nine per cent (99%).

The failure to pass this specification is supposed to be an indication of an over-heated or "cracked" oil. Carbon tetrachloride is not a stable solvent in bright light and the solubility test is influenced if the test is performed in bright light.

Another specification sometimes used to determine a "cracked" oil is as follows:

(5) In CCl_4 bromide solution. The bitumen soluble in carbon disulphide must be soluble to the extent of at least ninety-nine and eighty-five one hundredths per cent (99.85%) in a solution of one hundred and thirty-five (135) milligrams of bromine to one hundred (100) cubic centimeters of the carbon tetrachloride when twenty-five (25) cubic centimeters of the solution are poured on two (2) grams of the oil in an Erlenmeyer flask, which is then placed in the dark for three (3) minutes, the solution being [illegible] filtered through a Gooch crucible using a suction equal to a column of mercury more than eight (8) inches high.

When the solution has all passed through, the crucible is washed with pure carbon tetrachloride, dried at some temperature between two hundred and twelve (212) to two hundred and twenty degrees Fahrenheit and weighed.

This test had its origin in the examination of vegetable and animal fats. The unsaturated fatty acids form insoluble bromides. The bromide carbon disulphide solvent is not stable, however. An oil having an excess of 0.15% of insoluble material would fail to pass this specification, and yet this failure might be due entirely to the unstable solvent.

The specifications to govern the different constituents that make up the bitumen of the road oil are partly included in the specifications numbered (3), (4) and (5).

The road oils are generally classified as to their asphalt content. This asphalt is not a definite chemical compound determined by chemical analysis. To determine the asphaltic content, the road oil is hardened by heating it in an asphalt oven at a high temperature. Part of the light or volatile oils, is driven off in this heating and the residue is hardened. The degree of hardness is measured by the depth of penetration of a No. 2 needle when acting under a load of 100 grams for five seconds, the residue being maintained at 77° F. If the needle penetrates 8 mm. in this test the residue, called asphalt, is said to be asphalt of 80 penetration. As can readily be seen, this residue may contain many different bitumens. The test is not a measure of a definite chemical compound.

If the assayer for copper should call all the metal extracted "copper" when the metal was of a certain hardness, then it can readily be seen that any alloy of soft and hard metals that made this certain hardness would be classified as copper. This is the practical result of the specification for a road oil when it is required to contain a certain percentage of asphaltum.

The early oil-bound macadam roads built with asphaltic oils usually required an oil containing 70 to 75% of asphalt of 80 penetration. This oil was not heavy, that is, it lacked body (i.e., low viscosity), and it was a weak binder but it was easily applied to the road surface.

The use of pressure tank wagons with sprayers for applying heated road oil has made it possible to use an oil of much higher asphalt content and of higher viscosity. The road oil that is now commonly demanded for oil-bound macadam, or for bituminous-covered concrete highways, is one that contains 90% of 80 penetration asphalt. The following specifications are suggested for such an oil:

(6) It shall contain 90 per cent. of 80 penetration asphalt.

This per cent. of asphalt is determined by heating 20 grams of the road oil in a 3-oz. salve tin in a standard asphalt oven, the temperature of the oven being maintained at 400° F. When the asphaltic residue has a penetration of 80, the oil shall not have lost in excess of 10% by weight.

The asphaltic content is the classification of the oil refineries of their different grades of road oil. The specification is of value more on this account than for any information of practical value furnished to the road builder.

(7) It shall show [illegible] not less than [illegible] degrees Fahrenheit.

This requirement prevents the use of an oil carrying very volatile constituents that would readily evaporate and might also be dangerously combustible at the time the oil was being sprayed on the road at the high temperature necessary for spraying.

The physical properties of a road oil are of the greatest importance to the road builder. The following specifications deal directly with the measurement of the important physical properties.

(8) It shall show a float test of not over 100 seconds when tested at 32° Fahrenheit temperature. This test is described in Bulletin No. 38 issued by the Office of Public Roads, United States Department of Agriculture.

*Abstracted from the "California Highway Bulletin" [illegible] 1914.

†Assistant, California Highway Commission.

This float test is the measurement of the viscosity of a road oil. The requirement will prevent the use of excessively viscous road oil, one that is difficult to apply and is slow to absorb the mineral aggregate necessary to the building up of the proper wearing surface.

(9) The oil shall show a specific viscosity of not more than one hundred (100) when tested with the Engler viscosimeter at a temperature of two hundred and twelve (212) degrees Fahrenheit.

This test will prevent the use of an oil that is too viscous to be readily applied to the road surface from the oil-spraying wagon.

(10) It shall show an adhesive test of not less than 300 seconds for three revolutions with the Osborne adhesive machines, when the oil is tested at a temperature of 77 degrees Fahrenheit, the load being 3 kilograms.

This test is the measure of the oil's power to prevent relative motion of two concentric cylinders when the oil acts as a binder between the surfaces of the two cylinders. The inner cylinder is 1.995 in. in diameter, the outer cylinder is 2 in. in diameter, the outer cylinder being in the form of a loose collar 2 in. wide. Its inner surface is coated with the oil to be tested. The outer surface of the inner cylinder is coated with oil and the collar then forced on the inner cylinder, which is maintained in a stationary position.

The outer collar is wound with cord to which a three-kilogram weight is attached; the pull of this weight causes the collar to revolve; the thin film of road oil between the two cylinder surfaces offers a resistance to this turning. The temperature of the oil being tested is maintained at 77° F. by means of water circulating in the inner cylinder. The measurement of the adhesive value of the oil is the length of time required for three complete revolutions of the collar.

Oils containing the same percentage of asphaltum will often show the greatest difference in their binding properties. Oils possessing the same viscosity will likewise often show a wide difference in adhesiveness.

As an example, one oil may be largely made up of heavy lubricating grease, another may be very free from lubricating material but they may both flow through a given-sized orifice at the same rate, when heated to the same temperature, that is, they have the same viscosity. The lubricating oil would lack binding power and be unsatisfactory for road construction; the other would be desirable. The adhesive specification would prevent the use of the unsatisfactory lubricating oil.

The asphalt contained in a road oil is required by some road builders to possess a certain ductility.

(11) The ductility of the asphalt which has been reduced to a penetration between 75 and 85 shall not be less than 110 centimeters.

This test is made with asphalt maintained at 77° F. and the pulling shall be at the rate of 5 cm. per min., using the Dow ductility machine.

There is a woeful lack of uniform specifications for road oil and uniform methods of performing the tests. In the determination of the asphaltic content of an oil, the temperature for the asphalt oven is specified sometimes at 325° F., and from that to as high as 500° F.

The dish containing the road oil during the reduction is in some laboratories as small as a thimble, and in others, large enough to hold 500 grams; sometimes cylindrical, and other times semispherical in shape. Some tests require the use of an oven, others require heating in the open air. As has been shown, the "asphaltic content of an oil" is, at best, a rather indefinite term, and when we have added to this the different methods used and the wide range of equipment used, the "asphaltic content" becomes even more of a vague description.

The asphaltic road oils are, for the most part, a by-product of the oil refineries. They are a relatively cheap material. This cheapness saves the road oils from being adulterated with other material. It is expensive to add anything to the oil. The natural oil itself rarely carries undesirable material. The tests for water and sediment will take care of foreign materials brought in by the crude oil.

Some road engineers have regarded oil containing sulphur as dangerous to use because the sulphur is supposed to make the product unstable. Many oils and asphalts carrying sulphur have given good service for long periods of time and if sulphur does tend to make the oil unstable, this action is too slow to be of importance in the life of the oil used in the road construction.

Notes on Maintenance of Wachusett Reservoir

By J. A. Cushman*

Much has been published concerning the construction of the Wachusett Dam and Reservoir of the Boston Metropolitan Water Supply, but little has been written about its maintenance. A few interesting, if not important, points have developed since this great reservoir was completed and filled, which maintenance engineers, and indirectly, construction engineers as well, may find valuable.

Survey Reference Marks

The first is in regard to the maintenance of construction benches, reference hubs or traverse points, and intermediate triangulation stations.

The bottom of the Wachusett Reservoir was striped of all soil. Preliminary to this stripping, the whole area was laid out in 500-ft. squares over which elevations were taken every 25 ft. The corners of the large squares were marked by chestnut hubs, 3 in. square on top and tapered to about a ½-in. sq. in their lengths of 3 ft. These hubs were guarded by triangular fences to prevent their being disturbed as the soil was removed. Of course, a great proportion of these hubs were within the site of the reservoir—only a comparatively few of them on the edges coming above the high-water line. In the final clearing of the basin all the hubs below the flow-line and all which were on the edge and liable to be washed in, were removed, leaving very few points for future use.

In a reservoir several miles long, the lack of a few such points is liable to cause considerable inconvenience, to say the least, at some time. The writer, therefore, suggests that, before such wholesale removal, new hubs or points be placed on the line of hubs to be removed, so far above the ultimate flowline as not to be disturbed, undermined or washed away, and that all such hubs or points be properly guarded and tied in to permanent structures. This also applies to bench marks which will be submerged or undermined by the rise of the water. All hubs and benches already above the flowline should be carefully preserved and removed from time to time as it becomes necessary.

*Assistant Engineer, Wachusett Department Metropolitan Water and Sewerage Board, Clinton, Mass.

A few new triangulation stations should be established, the old ones which are liable to be of use should be renewed, new flag poles placed and the trees and brush around them kept cut down. The cost of this work does not amount to a great sum coming under regular maintenance accounts and done a little at a time in the year's work, but may mean considerable expense and trouble if the work is left to accumulate for several years, and more still if it is left undone.

Reservoir Slope Erosion

The second point is in regard to the action of wind and waves on the steep slopes and their consequent erosion. In the original stripping of the Wachusett Reservoir, rules were made for the guidance of engineers and inspectors. These rules were designed to allow for the action of waves in the full reservoir. For steep slopes the rules were as follows:

Where the margin is along a steep sandy slope it is expected that the shore will gradually take a 3 to 1 slope between [illegible] and [illegible] or between high and low water. Below [illegible] the final slope may be assumed as ½ to 1 and above [illegible] as 1 to 1. Sections of the natural slope should be taken by survey or otherwise plotted to convenient scale, and the assumed slopes, as above, drawn on these sections so as to give approximately equal areas above and below the intersection of the 3 to 1 slope with the natural slope. (See sketch A, Fig. 1.) Strip to intersection of 1 to 1 slope with natural surface.

In case of very steep slopes extending to a considerable elevation above high water and where it is probable that erosion will cause landslides extending to the top of the slope it will be necessary to strip the entire slope. (Sketch C, Fig. 1.) Where it is necessary to strip to the top of the steep slopes the clearings should be carried back about 15 ft. beyond the top of such slope.

On the accompanying sections of two steep slopes, are shown this original stripping point as located according to the above rules, and also the flowline and top of bank as actually existing in 1911, three years after the reservoir was first filled. The first section (Fig. 2) is of a bank on the north shore of the basin exposed only to south and east winds, while Fig. 3 is on the south shore and is exposed to northeast, north, northwest and west winds. In each of these cases, the bank had been eroded by wave action at its base, and had slid, necessitating much additional stripping. The second of these banks is still changing and it is anticipated that it will continue to do so for some time to come. The action of the wind as well as of the waves is very noticeable on this bank—a layer of sand several inches in depth having accumulated on the top of the bank and in the woods behind it. The ma-

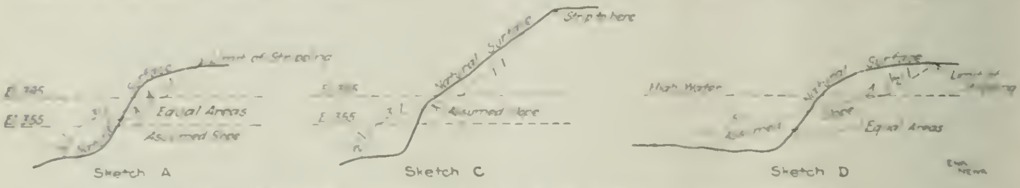


FIG. 1. SKETCHES ILLUSTRATING THE DESIGN OF STEEP RESERVOIR BANKS

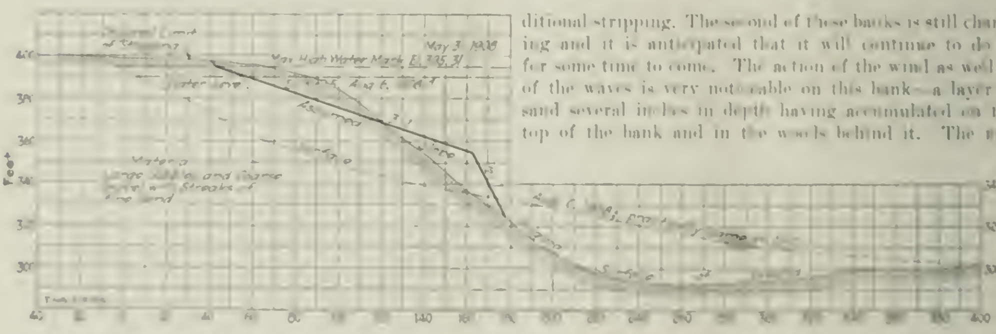


FIG. 2. SLOPE OF NORTH SHORE OF WACHUSETT RESERVOIR AS ORIGINALLY STRIPPED AND AFTER HAVING BEEN FILLED THREE YEARS

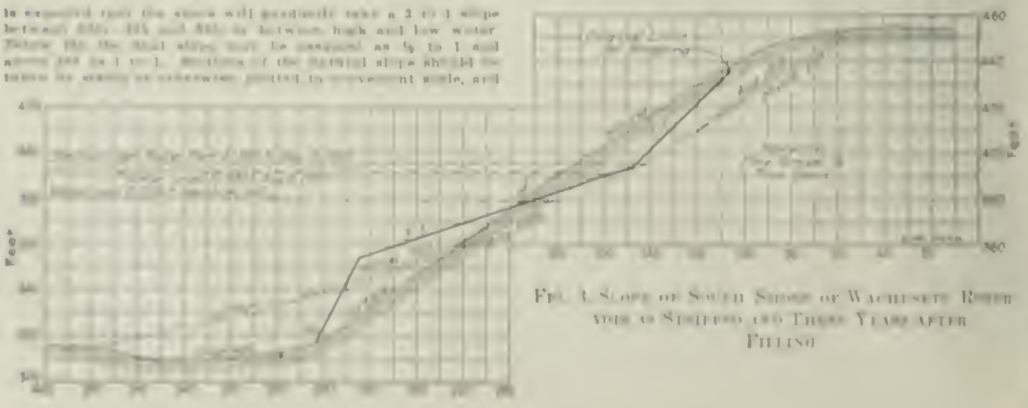


FIG. 3. SLOPE OF SOUTH SHORE OF WACHUSETT RESERVOIR AS STRIPPED AND THREE YEARS AFTER FILLING

(4) North bank in original condition; that is, before stripping or grading. (5) North bank, from another viewpoint, after having been subjected to high water; the water surface here shown is 45 ft. below high-water level. (6) Bank on south shore after high water. These views may well be compared with the profiles, Figs. 1 to 3, which show some of the original slopes, the stripped or graded slopes and the subsequent slopes after the reservoir had been filled and drawn down.

FIGS. 4 TO 6. VIEWS OF BANKS OF WACHUSETT RESERVOIR, SHOWING EFFECT OF WATER ON BANK SLOPES

terial in this bank is much finer and more compact than that in the first case.

This is a condition where the appearance of the original slopes was not such as to indicate that such great erosion would take place. The view, Fig. 4, shows the north bank before stripping (on the extreme right) and Fig. 5, the same bank after the high water of 1905, which was still 15 ft. below the flowline. Fig. 6 shows the bank on the south shore in 1904. Notice that the bank material in Fig. 6 is much finer than that shown in Fig. 5.

As a result of this experience it would seem that the ultimate slope attained by a coarse gravelly material containing many cobbles, acted upon by waves, will be between 2 to 1 and 5 to 1, the last probably being the permanent slope. As a modification of the diagram shown in Sketch *A* (Fig. 1), the writer would suggest that shown in Sketch *D*, substituting slopes of 5 to1, and 1½ to 1, for the slopes of 3 to 1 and 1 to 1 as shown in Sketch *A*, and omitting entirely the steeper slope of ½ to 1. Actual sections show that if there is a change of slope below low water it is even flatter than 5 to 1.

Shallow Flowage

Experience has shown that an area which is flooded only for a few months in a year and then for a depth of less than 5 ft., will grow up to goldenrod, sweet fern, blackberry vines, and small poplars, birches and alders, in a very short time, causing an unsightly and marshy appearance to the locality, which is undesirable in a public water-supply. Such conditions should be noted during construction and the work done at that time, as it is much more expensive for a small maintenance gang to do this work, than it would have been for the contractor's gang to do it, while at work on this part of the project, with its larger outfit of tools and men.

Reforestation of Drainage Areas

The last point is in connection with the work of reforestation. In 1909, E. R. B. Allardice, Superintendent of the Wachusett Department of the Metropolitan Water Board, in an article published in Engineering News, on "Reforestation of the Marginal Lands of the Wachusett Reservoir," stated: "Thus far, no serious fires have occurred, though several have started which would have caused great damage but for the effectual protection given."

In 1911, the reservation was visited by several serious fires. One, caused by sparks from a locomotive started on adjoining land, and spread by a moderate wind, swept a width of 2000 ft., over three, three-rod roads and over three 15-ft. interior forest roads, and was only stopped at a 30-ft. state highway by the combined efforts of about 25 men with hand extinguishers and shovels. If there had been no one there it would have jumped that obstacle as it had the earlier ones. This fire completely destroyed white pines 10 to 15 years old, averaging 12 to 15 ft. in height. Another fire, caused, presumably, by a cigar or cigarette butt carelessly thrown from a passing electric car, crossed two 15-ft. forest roads but was stopped at a 30-ft. highway. Both fires were on land formerly used for pasturage or cultivation and the pines were the tallest growth.

These two fires demonstrated the usefulness of a fire guard less than 30 ft. in width, at least. It is extremely doubtful if the second fire could have been stopped at the 30-ft. highway if the growth had been higher, as the fire-fighters could not have stood the heat. All the fires which have occurred and been overcome on this reservation have shown the wisdom of having fire guards (40 ft. is none too wide), and of keeping them mowed and cleared, if they are to be at all efficient as such.

It is not the desire or purpose of the writer to decry the use of 15-ft. interior roads. The more interior roads there are the more chances there are of limiting the fire to a small area, especially if it is discovered early in its career. They are also indispensable in getting into the reservation for the purpose of spraying for brown-tail and other caterpillars, hauling out wood from improvement clearings, and many other purposes. But it is his desire to emphasize the need of enough wider fire lines, kept mowed, to provide adequate and safe spaces in which to operate efficiently against a serious fire.

The Kansas City Street-Railway Franchise

The difficulties into which the Kansas City Street Ry. system had fallen and the attempt of the receivers and courts to secure a satisfactory reorganization based on an appraisal and a franchise scheme outlined by B. J. Arnold were noted in Engineering News of May 22, 1913, together with a summary of Mr. Arnold's work in the case. After long negotiations, a compromise franchise between the city and the railway company was evolved more or less along the lines of the Arnold suggestions, and this was approved at a municipal election on July 7, in spite of considerable opposition.

The New Franchise

LIFE TERM—The term is 30 years with provisions for forfeiture and purchase by the city before expiration under conditions which protect the capitalization. At termination the company has rights securing the allowed capitalization of that date. The city may thereafter make new arrangements with the old company, cause the purchase of the system by other interests, operate the system itself or require the present company to continue temporarily.

CAPITAL—The compromise figure of $25,619,000 is taken as the total value of property in Missouri to be represented by capital (plus extensions and betterments since May 1913). Of the total $6,300,000 represents intangible items. The last named amount is to be amortized from surplus earnings divisible between city and company, with the intention that capitalization and tangible value may eventually be alike. (This amount is to be indirectly amortized by building extensions out of the city's share of surplus profit as noted below.)

The company is to provide each year such fresh capital as will, with its share of surplus profits, amount to from $[illegible] at first to $925,000 at the end. Such sums will correspondingly increase the capitalization figures. However, if net earnings exceed or fall below 30% of gross receipts for any year the annual amounts to be provided above are to be correspondingly increased or diminished.

CONTROL—The city is to participate in control and management through representation on the board of directors and on a board of control. The latter will comprise one man appointed by the company, one man appointed by the city, and a third member in the event of differences of opinion. Salaries will be paid by the company. This board will have control of routes, schedules, character of equipment and construction, system of accounts, charges to capital, classification of expenditures, auditing, etc. The company and city may each remove its representative or may apply to the courts for removal, for cause, of the other party's representative.

There will be five directors acting for the city and six for the company. The former are to be appointed hereafter by the local Court of Appeals from lists furnished by the mayor. (Initial incumbents were selected at the recent franchise election.)

Under the board of control will be the general manager

For the board of control, P. J. Kealy has been selected by the company and Robert P. Wood (a consulting engineer) by the city and have been installed by the receivers. The name of the company has been changed to Kansas City Railways Co.

REHABILITATION—Up to $1,500,000 is to be spent at once on one viaduct line. For three years, five miles of single track per year are to be built in specified locations and 25 new cars per year added. The city will pay the cost of new tracks in Union Station plaza and retain title thereto. An additional $250,000 per year is to be spent for immediate extensions to be fixed by the board of control.

EXTENSIONS—After three years, the city, by ordinance, may require any extensions not proved manifestly unnecessary—up to four track miles per year. Any extensions must be made which the board of control finds will earn operating expenses and 6%.

DIVISION OF INCOME—A guaranteed cumulative earning of 6% on the agreed capitalization is provided. From the net income the following items are to be subtracted in order: (1) expenses of management, operation, maintenance and taxes, (2) 6% return, and (3) liabilities for injuries and damages. Any surplus then remaining is to be credited to the city but used by the company for additions and extensions, until $6,300,000 shall have been expended. After this point the surplus is to be credited two-thirds to the city and one-third to the company. Until ordained otherwise, the city part of divisible surplus profits is still to be used for additions or extensions or for reduction of capital, and to that extent the city acquires a right in the property. Use of city's share in extensions may not increase capital figures. When the city's right reaches one-half the total capitalization the city becomes the owner of the system but the company possesses then a lien on the property to secure its remaining share of the capitalization.

Under operating expenses, etc., noted above, an allowance is made for maintenance, repairs, renewals and depreciation at least 16% of the gross earnings of the previous year. For damage claims not less than 4% is to be allowed. With expenditures less than these allowances, the balance is to be credited against excesses of the following years.

FARE—A five-cent rate of fare for adults will be continued with universal transfers. There will be a half fare for children of 8 to 12 years. No passes are to be issued but employees, firemen and policemen ride free. However, the city may use its proportion of divisible excess profits for the reduction of fares, although it may not do this in such a way so as to materially reduce the amount of the company's share below a sum which the company would have received if the rate had not been reduced. (This evidently is intended to provide a certain stimulation of traffic with reduced fares to compensate for the unit reduction.)

INTERURBAN LINES, EXPRESS, ETC.—Connections with interurban lines continue as before and until changed by city ordinance on six-month notice. Such operating rights may be revoked by the city for cause. Interurban cars are to be operated in the city by city-company crews and new fares retained as on ordinary cars. For interurban connections, 15% of the amount received by interurban companies from passengers entering the city goes to the local company.

PUBLIC ACQUISITION—When the city secures right to half the system by application of its share of divisible profits, it becomes the owner, with the company holding a lien on the property for its former share. By paying the company cash for its share of ownership and by paying the cost of redeeming mortgage bonds (with 3% premium) the city may become sole owner. When the city secures half ownership as above the company loses all right to the divisible profits. Prior to this critical point the city may buy out the company by paying for capital, cost of redeeming bonds, and the value of right to participate in surplus profits.

Criticisms of the Franchise

The franchise was criticized before election on the ground that the compromise valuation included certain intangible elements which should have been omitted because they represented money lost in an admittedly speculative period of the road's development. The reasonableness of 5% was admitted by the opponents of the ordinance, but the 6% allowed was held in effect to increase the capitalization to $36,000,000.

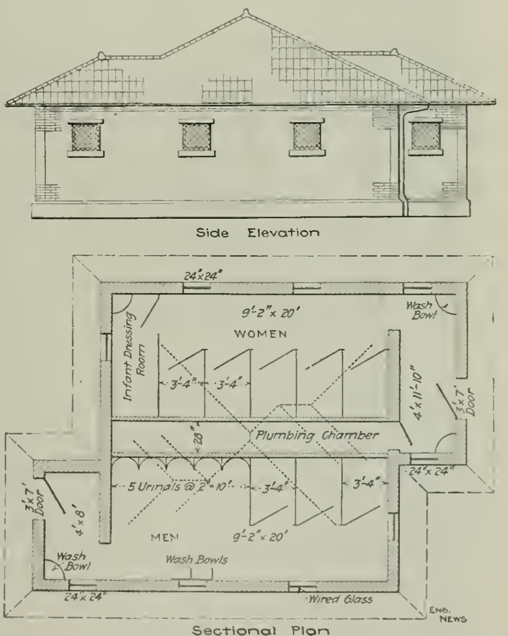
The scheme of dual control by company and city was claimed to violate every principle of good management and to tend to result in continual litigation.

Making the expenses of injuries and damages subordinate to the 6% preferential return on capitalization was attacked, it being held that these should not be separated from operating expenses, the first item to be subtracted from gross earnings.

The capitalization of betterments was criticised on the ground that the most careful maintenance and renewal will never bring the property much above Mr. Arnold's finding of 79% good-as-new.

A Public-Comfort Station with a New Feature

The plans herewith show a public-comfort station which will be built in the city of Youngstown, Ohio. The designs were made in the city engineer's office (F. M. Lillie, City Engineer; L. T. Fawcett, assistant engineer



Floor Plan and Side Elevation, Lincoln Park Public-Comfort Station, Youngstown, Ohio

in charge of the design). The plans show an arrangement similar to that used elsewhere, but with an interesting addition in the shape of an infant's dressing room, which is partitioned off from the women's compartment.

Brick walls, tile roof on wood roof-framing, a brick main dividing wall, and concrete floors, form the shell of the structure. The interior partitions will be of wood, as unfortunately the appropriation happens to be too small to provide slate or other fireproof partitions.

The design secures what is believed to be a structure of excellent appearance at a low cost. The cost is estimated at $2500, of which the plumbing makes up nearly $1000.

Recent Developments in Granite-Block Paving

SYNOPSIS—This article summarizes the evolution which has taken place in granite-block paving practice and gives the new specifications adopted by the Committee of Consulting Engineers of the City of New York for work during the current season. These specifications are the product of about four years' careful study, experiment and investigation, and present the latest practice of some of the most noted pavement experts in this country.

During the past four years an evolution has taken place in granite-block paving, indeed an evolution nearly as marked in practical results as that from the old cobblestone pavement to the first squared block pavements. The granite-block pavements now being laid in New York City, Philadelphia and other large cities, are nearly as smooth as brick, less than half as noisy as the best granite block laid five or more years ago, yet retaining all the advantages which make granite block best for heavily traveled city streets. Instead of large roughly shaped blocks, 7 in. or more in depth laid with seldom less than 1-in. joints filled with sand, smaller, carefully squared blocks 4 in. deep and laid with not greater than ½-in. joints filled with a bituminous binder, now constitute first-class standard practice.

Since a concrete foundation for first-class granite-block pavement has become universal practice the necessity for the large-sized blocks has disappeared. The blocks themselves instead of constituting the whole pavement are now made to serve as a wearing surface only, as with asphalt and wood block. The more accurately shaped blocks laid with small closer joints are the result of a determination by pavement experts that the additional expense of about $1 per sq.yd. for the pavement is justified by the improved wearing qualities, better appearance and other advantages obtained by the new specifications. The present cost of the new type in New York City varies from $4 to $4.75 per sq.yd., including a 6-in. concrete foundation.

The closer joints tend to eliminate the rounding off of the top edges of the blocks, which results in constantly widening the gap between blocks and making a rough noisy pavement, after a few years' service. The best practice is no longer to insist upon the hardest obtainable granites, but to use tough, medium-hard granite which will wear uniformly instead of those which experience has shown will acquire a polished hump in the center and rounded edges under severe traffic conditions.

Fig. 1. View of Lafayette St., New York City, Showing Example of Granite Block Paving under New Specifications

Granite block, even that laid under the new specifications, is, of course, noisier under steel tire and horse-drawn traffic than either asphalt or wood block, and it is not as easy to clean; yet its slightly roughened surface gives a good foothold for horses' hoofs and in durability it is and always will be superior to all other types of pavement, and it is the easiest to repair. It is always likely to remain the only satisfactory pavement for streets which carry a heavy trucking traffic.

During the past four years many thousands of square yards of new granite block have been used in repaving New York City streets. These have been laid under constantly improving specifications which have been redrawn and modified from time to time by conferences between the paving experts in and about New York City and the quarry men. Several inspection trips were made

by the city engineers through the various quarries in North Carolina, Massachusetts, New York, Maine, New Hampshire, where are the principal sources of granite paving blocks for New York City, in order to determine the probable output and to insure an understanding on the part of the quarry men of the requirements.

The granite-block pavements resulting from this study, care and experience are of a smoothness never before obtained. Fig. 1 shows a view of Lafayette St. near Pearl St., which is typical of these new pavements. Fig. 2 is the same pavement in the course of construction.

The final specifications for this class of work are essentially the joint product of the Committee of Consulting Engineers of the City of New York. In order to accelerate the present season's work in the Borough of Manhattan, some slight changes and additions were made in Committee's specifications, which may or may not be finally adopted by all the boroughs. As these new 1914 specifications present the experience, study and present practice of some of the best known paving experts in this country, they are of extraordinary interest and value to all municipal engineers. Of special interest are the sections relating to the joint filler; cement grout is not used; and the specifications here given for bituminous filler were especially prepared by Dr. Felix Keeberg, chemist of the Bureau of Highways of the Borough of Manhattan, after a careful study, for the purpose of making a comparative service test of the relative values of coal-tar and asphaltic paving cement.

Fig. 2. Lafayette St. Pavement during Construction

It is stated by the Chief Engineer of the Bureau of Highways of the Borough of Manhattan that the method of preparing the joint filler as a mixture of paving cement and hot dry sand has not been formally adopted by the other Borough Engineers, but is introduced in the belief that a method successfully used abroad, and which has been experimentally used in this borough on repair work during the past year with entire satisfaction, will be an improvement on the previous method of first filling the joint partly full of sand and pouring paving cement on top of it. This latter method has resulted in a ten-

Fig. 3. Old and New Granite-Block Paving at Lafayette and Pearl Sts.; Showing Care Taken to Shape Blocks around Manhole Heads on New Pavement

dency toward the use of too much sand and too little paving cement.

The specified foundation is a 1:3:6 gravel or broken-stone concrete, 6 in. thick.

GRANITE-BLOCK PAVEMENT

SECT. 1. EXCAVATION AND FOUNDATION—The roadway shall be brought to a uniform subgrade, and shall be rolled with a steam roller until the surface is thoroughly compacted. Portions of the roadbed inaccessible to the steam

FIG. 4. OLD AND NEW GRANITE-BLOCK PAVING, LAFAYETTE AND PEARL STS.

roller shall be ... with a small ...

[illegible]

from this width, and within the limits for width of blocks specified above.

For use in street railway tracks the blocks may have a maximum length of 11½ in., the other dimensions remaining the same as specified above.

When approved by the engineer the blocks may be of such other dimensions as special construction may make necessary.

DRESSING—The blocks shall be approximately rectangular on top and sides and uniform in thickness. They shall be so cut that the joints between individual blocks when laid shall average not more than ⅜ in. The head of the block shall have no depression greater than ¼ in. from a straight edge laid in any direction and parallel to the general surface of the block.

HANDLING—Care shall be used in handling the blocks so that the edges and corners are not chipped or broken.

SECT. 4. SELECTION—The stones from each quarry shall be piled and laid separately in different sections of the work and in no case shall the product of different quarries be mixed.

SECT. 5. INSPECTION BEFORE DELIVERY—The paving blocks will be inspected at the quarry or at the dock as unloaded; and if the percentage of blocks failing to conform to these specifications found in 1000 blocks, as unloaded, shall exceed 15%, the whole cargo will be condemned and will not be used on the work.

If permitted by the engineer the percentage of unsatisfactory blocks may be determined from the examination of another 1000 blocks, but if this is permitted, before delivery

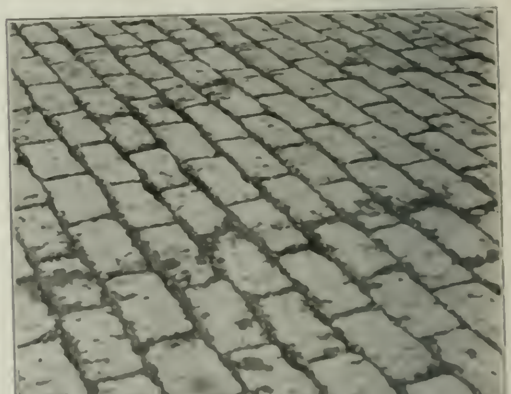


FIG. 5. GRANITE-BLOCK PAVEMENT IN FULTON ST., NEW YORK CITY, LAID IN 1912, WITH ½-IN. JOINTS—AN INTERMEDIATE STAGE IN THE DEVELOPMENT OF BETTER GRANITE-BLOCK PAVEMENTS

on the street the unsatisfactory portion of the cargo shall be removed and not delivered on the work.

Acceptance of a cargo as described will not be considered as acceptance of all individual blocks and the engineer and his assistants will have the right to reject any block at the site of the work not conforming to the requirements of the contract.

SECT. 6. FOUNDATION CONCRETE SURFACE—The top of the concrete foundation shall be brought, by screeding or otherwise, to a grade which shall not vary from ¼ in. [illegible]

any point from a surface parallel to and 6 in. below the finished surface of the pavement.

SECT. 7. SAND BED—On this concrete shall be laid a bed of clean, coarse sand, free from gravel, over ⅜ in. in diameter. The bed shall not exceed 1 in. in thickness and be sufficient to bring the surface of the pavement, when thoroughly rammed, to the proper grade.

SECT. 8 LAYING BLOCKS—Upon this bed the blocks shall be laid in straight courses from curb to curb and at right angles to the lines of the street, except when otherwise directed by the engineer. The grade and crown shall be as shown on the plan or as directed. End joints shall be broken by a lap of at least 3 in., and adjoining stones in the same course shall not vary more than ¼ in. in width. The blocks shall be set in contact at end joints and with side joints as

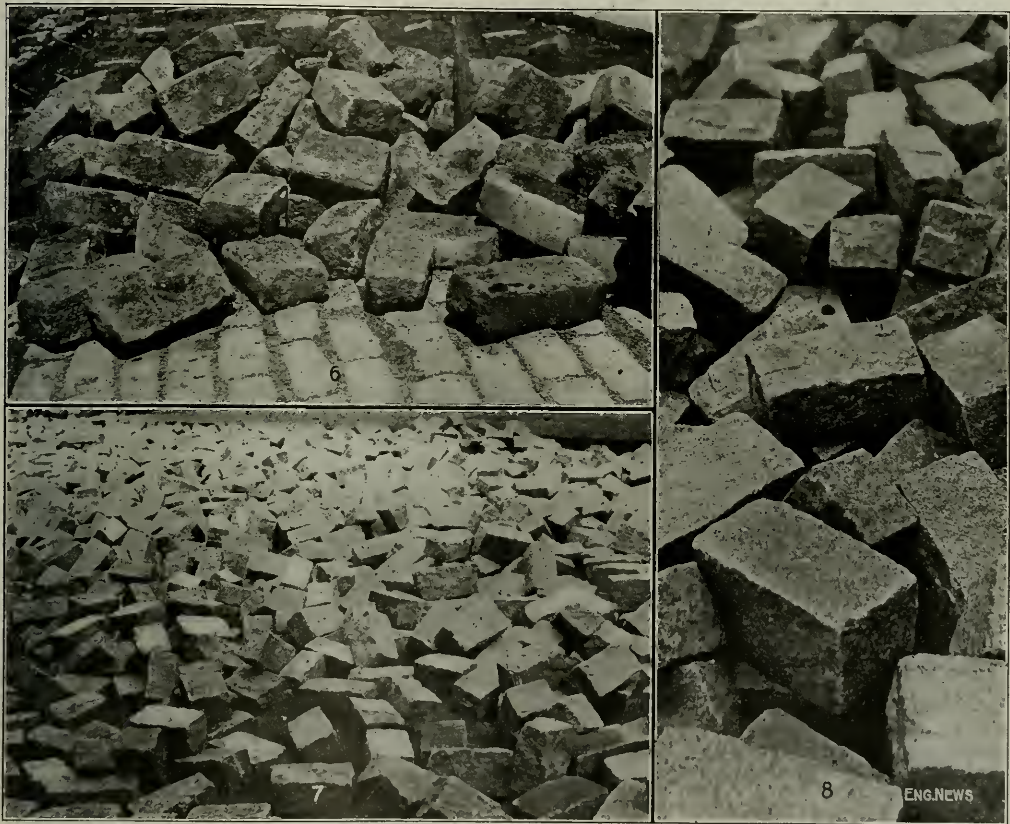


Fig. 6. Pile of Old-Style Granite Blocks

Figs. 7 and 8. New Granite Blocks, Jane St., New York City; Illustrating More Regular and Uniformly Shaped Blocks Required by New Specifications

nearly uniform as practicable and averaging not more than ⅜ in. between individual stones.

Guide blocks or head stones shall be set at such intervals as directed by the engineer.

SECT. 9. RAMMING AND ADJUSTING—After the blocks are laid they shall be rammed to a solid bearing, any low blocks being taken out by means of tongs and raised by adding sand to the bed, and the whole rammed again to a fair and even surface. No sand shall be placed in the joints, but, if permitted by the engineer, a small quantity of clean, dry sidewalk grit may be put into the joints, in amount only sufficient to pin the blocks and prevent them from rocking. The joints shall be adjusted and unsatisfactory blocks taken out with tongs. No pinch bars shall be used except by special permission of the engineer. No sand shall be placed in the joint except when mixed with bituminous filler as specified hereafter.

A sufficient number of rammers shall be employed so that all pavement laid may be rammed and joints filled before work ceases each day.

SECT. 10. JOINT FILLER—The joint filler used shall be a mixture of paving cement, described hereafter, and hot dry sand in the proportion of 1 part sand to 1 part paving cement by volume, or as much sand up to that proportion as the paving cement will carry. The sand shall be clean and sharp, and all of it shall pass a 10-mesh screen. It shall be thoroughly mixed with the paving cement by stirring or otherwise.

The mixture shall be poured into the joints until they are full and remain full, repouring being done if necessary so that they shall remain permanently filled flush with the surface of the pavement.

SECT. 11. COAL TAR PAVING CEMENT—The coal tar paving cement shall be a straight run residue obtained from the distillation of coal tar and shall comply with the following requirements:

(a) Melting point shall be not lower than 110° F. nor higher than 125° F.

(b) Free carbon shall not be less than 20% nor more than 35%.

(c) Specific gravity at 77° F. shall not be less than 1.22 nor more than 1.30.

(d) Specific gravity of the distillate to 670° F. shall not be less than 1.06 at 110° F. compared with water at the same temperature.

The contractor before beginning work on any contract shall obtain from the engineer a statement in writing as to the melting points desired for that particular contract and a variation of 5° F. either way will be permitted from this melting point, but within the limits as indicated above.

SECT. 12. THERMOMETERS IN KETTLES—The kettles in which the coal tar paving cement is heated on the street shall be equipped with approved thermometers and the paving cement shall be heated to a temperature of not less than 2[illegible]° F. nor more than 3[illegible]° F. and shall be poured when between these limits.

FIG. 9. DIFFERENCE BETWEEN OLD- AND MODERN-DRESSED GRANITE-BLOCK PAVEMENTS ON MARKET ST., PHILADELPHIA, PENN.

SECT. 13. ASPHALTIC PAVING CEMENT—The asphaltic paving cement shall be obtained by the distillation of an asphaltic petroleum at a temperature not exceeding 700° F., and shall comply with the following requirements:

(a) It shall be homogeneous.

(b) Melting point shall not be less than 130° F. nor more than 14[illegible]° F.

(c) Solubility in carbon tetrachloride shall not be less than 99[illegible]%.

(d) Penetration at 77° F. shall not be less than 60 nor more than 1[illegible], the penetration test being made with a No. 2 needle for five seconds under a load of 100 grams, and the penetration at 1[illegible]° F. shall not exceed three times the penetration at 77° F., the condition of time and load being as above established. The contractor before beginning work shall obtain from the engineer a statement in writing as to the penetration desired for any particular contract and a variation of not greater than ten points either way from this penetration will be permitted.

(e) Ductility at 77° F. shall not be less than 40 cm. at the penetration called for.

(f) It shall not lose more than 3% by volatilization when maintained at a temperature of [illegible]° F. for five hours, nor shall the penetration of the residue, after such heating be less than one-half the original penetration.

SECT. 14. THERMOMETERS IN KETTLES—The kettles in which the asphaltic paving cement is heated on the street shall be equipped with approved thermometers and the paving cement shall be heated to a temperature of not less than [illegible]° F. nor more than [illegible]° F., and shall be poured when between these limits.

SECT. 15. All tests will be made in accordance with the [illegible] Methods of Tests on file in the office of the engineer.

SECT. 16. [illegible]—The appliances for [illegible] the materials for filling the joints shall be of such [illegible] as will permit the [illegible] to [illegible] and all joints of [illegible] shall be [illegible] before the [illegible] of work for the day.

SECT. 17. [illegible] TRAFFIC [illegible]—No traffic of any description shall be permitted on the pavement until the joints have been completely filled with the bituminous [illegible], and it has had time to harden.

SECT. 18. MORTAR UNDER RAIL HEAD—Where there are car tracks in the street the spaces between the web of the rail and the paving blocks and directly under the head of the rail shall be filled with a stiff mortar, composed of 1 part of portland cement and 3 parts of clean sharp sand. This mortar shall be carefully struck so that it will not project beyond the vertical plane of the edge of the rail head, and it shall be kept in position until the paving has been laid. This mortar furnished and placed will be paid for at the price bid for concrete within the railroad area.

SECT. 19. REPAIRS AND RESTORATIONS—In making repairs to the pavement, or restoring the pavement over openings, the materials used shall conform in all respects to the requirements for the original pavement. The adjoining pavement and foundation and so much of the earth under the foundation as may be necessary and directed shall be removed by the contractor for the proper restoration and repair of the pavement. The concrete base shall be removed for a distance of 6 in. beyond the extreme limits of the area of earth disturbed. All joint surfaces of concrete shall be cleaned and coated with portland cement grout, and the wearing surface of the pavement shall be replaced over an area extending at least 3 in. on all sides beyond the area of the new concrete, all courses being toothed or racked back.

The price for restoring the pavement shall include the cost of all materials and labor necessary to properly complete the work as described above, and the maintaining of the same during the remainder of the period of maintenance.

SECT. 20. CONTRACT PRICE TO INCLUDE—The price bid for granite paving shall include the cost of all materials and labor necessary to furnish and lay the granite paving complete, and the cost of adjusting and bringing to the new lines and grades such curb and flagging and abutting pavements as may be deemed necessary by the engineer, except as otherwise provided, and maintaining the pavement for one year.

FIG. 10. LAYING A "NIDGED" GRANITE-BLOCK PAVEMENT IN GLASGOW, SCOTLAND

(From a photograph taken in July, 1911 by Geo. W. Tillson, Consulting Engineer, Borough of Brooklyn, New York City.)

The excellent results obtained under these specifications in the Borough of Manhattan, New York City, are no less due to the better quality of materials used than to the more rigid and efficient inspection system developed under the administration of the present Chief Engineer of Highways, H. W. Durham.

Inspectors are instructed to select blocks of uniform width and depth for each course and to see that each block

is laid on a full bed of sand and struck in at the base so as to bring the stone in contact with its neighbors in the preceding course, which insures the closest possible joint. The inspectors are also instructed to see that the joints in the line of traffic are close and that the alignment of the courses is true. The operation of ramming is not permitted to approach within 20 ft. of the paving. After ramming, the pavement is backrammed whenever the surface looks uneven.

Under the new Pittsburgh, Penn., specifications recently put into effect, new stone-block pavements are laid with blocks from 5 to 5½ in. in depth, on a sand cushion 1½ to 2 in. thick, and with joints filled either cement grout or bituminous material. The total thickness of the completed pavement including 6 in. concrete base is to be not less than 13 in.

During the last year the first pavement of this type was put down in Philadelphia on Market St., and W. H. Connell, Chief of the Bureau of Highways, in his recent report has this to say regarding the new pavement: "The new type of granite block forms a pavement almost as smooth and easily cleaned as asphalt, yet sufficiently durable to withstand the wear of heavy traffic."

In Great Britain, paving engineers have occasionally gone even further in specifying regularly shaped blocks. The accompanying illustration, Fig. 10, is from a photograph taken in Glasgow, Scotland, in July, 1913, by George W. Tillson, Consulting Engineer of the Borough of Brooklyn, New York City, who gives the following explanation:

"The blocks were what they called nidged, that is, they were dressed. As a matter of fact, as can be partially seen in the picture, the blocks were dressed on all sides but the bottom, and fine axed on the top. The pavement was the best I have ever seen but cost $6.25 per sq.yd. It was located on a street-car street and replaced an asphalt pavement which had been down for about ten years."

A Notable Decrease in Electric-Railway Traffic Resulting from Increased Fare

In December, 1911, the Hudson & Manhattan R.R., which operates two pairs of electric-railway tunnels between New York City and New Jersey communities, raised the fare on the northerly, or uptown, tube from five to seven cents. The changes in traffic resulting from this move are reflected in the traffic figures regularly reported to the Public Service Commission for the First District of the State of New York and published in its regular reports.

Ticket sales at stations on the northerly line in question uniformly showed a marked decrease for each month in 1912 compared with a corresponding period for the year before, and this decrease continued, though perhaps not quite so markedly, during 1913. For 1912 the general decrease of 17.6% (15,723,000 to 12,956,000) is to be compared with an increase of 22.8% for 1911. For 1913 the uptown traffic dropped to 12,295,000, a further loss of 5.8% from the 1912 figures.

The southerly, or downtown, tubes showed an increase of 28.2% for 1912 (12,090,000 to 15,498,000), compared with 9.5% increase in 1911 over 1910. Much of this, however (the rise from 216,900 to 1,020,000), was due to joint-line operation over the Pennsylvania R.R. to Newark. Deduction of joint-line tickets results in a decrease of 2.9% for 1912 in place of an increase of 6.6% for 1911. For the calendar year 1913, the total downtown traffic was 22,430,000, an increase of 44.7%. Of this, 5,568,000 was due to joint-line tickets, and the strictly tube traffic was 16,861,000, an increase of 47.4%.

It is seen, therefore, that the slump in regard to the downtown tube was only temporary and is not easily explained; but it may be assumed that the trouble on the uptown line was due to the reluctance of patrons to pay the 40% rise in fare, so long as there existed reasonable ferry and surface lines.

In the 1912 report of the Public Service Commission there is an interesting estimate of the probable loss of revenue to the company from this move, which evidently has proved unwise. It should be noted, however, that the increase in fare was not in any sense an extortion, or even unfair, as the company's lines were of very heavy first cost and their operation under a five-cent fare was giving deficits.

The added revenue for 1912 from two-cent tickets was $509,390 (17½%), and the total number of passengers carried would have yielded at five cents a gross income of $2,903,962, but the drop in passengers carried one way meant a loss, at the old rate, in round-trip fares of $276,730, not considering the normal increase in traffic manifest between 1910 and 1911 (23%). If a prospective increase as low as 15% were killed off by the new fare, then $235,850 in round-trip fares were lost to gross revenue. This added to the above $276,730 gives a probable minimum loss of $512,580 to be compared with $509,390 actual gain shown.

For 1913 the further drop of 661,000 passengers going one way meant a direct loss of $342,800 over 1911, at five-cent fares and round trips. If there would have been an increase of as little as 15% in traffic per year under the old rate, the number of passengers further lost in the second year would have risen to 4,717,000, which means a total probable annual loss of $814,500, to be set off against the $459,000 actual gain in gross revenue for 1913 over 1911 through the seven-cent fare.

In its further discussion of this situation, the Public Service Commission holds that the operating expenses of the Hudson & Manhattan R.R.—16.5c. per car mile —are too high for a rapid-transit road, yet for 1913 this has gone up to 17.4c. The corresponding figures for the subway are 10.4c. and 10.1c., respectively. The operating costs per passenger in 1912 and 1913 were 2.16c. and 2.31c.; on the subway these figures were 2.15c. for both years. The passengers per mile of track (3,500,000 in 1912, 3,494,000 in 1913) is high, but below the New York City subway (4,130,000 and 4,290,000). On account of short lengths of haul, the Hudson & Manhattan passengers per car mile is higher, 7.6 in 1912 and 7.4 in 1913, compared with 4.7 and 5.1 for the subway. The car hours per mile of track, 26,471 in 1912 and 24,015 in 1913, is held to be low compared with 45,430 and 46,300 for the subway. From such figures it is argued by the Commission that the company should have aimed to increase the density of its traffic rather than the yield per passenger. The short haul, compared with that of the subway, it is urged, allows, without overcrowding, a very dense traffic—as great as 7,000,000 passengers per track mile per year.

The Southern Alberta Land Co.'s Irrigation Project

By W. St. J. Miller*

SYNOPSIS—An extensive irrigation system near Medicine Hat, Alta., is described. There will be a composite earth and concrete dam and a concrete intake on the Bow River, a 44-mile canal leading to a large storage reservoir formed by several dams, some 45 miles more of main canal and a large mileage of laterals. About 200,000 acres will eventually be under water.

An irrigation system designed to cover 200,000 acres of land is being constructed by the Southern Alberta Land Co., Ltd. The project lies between Medicine Hat

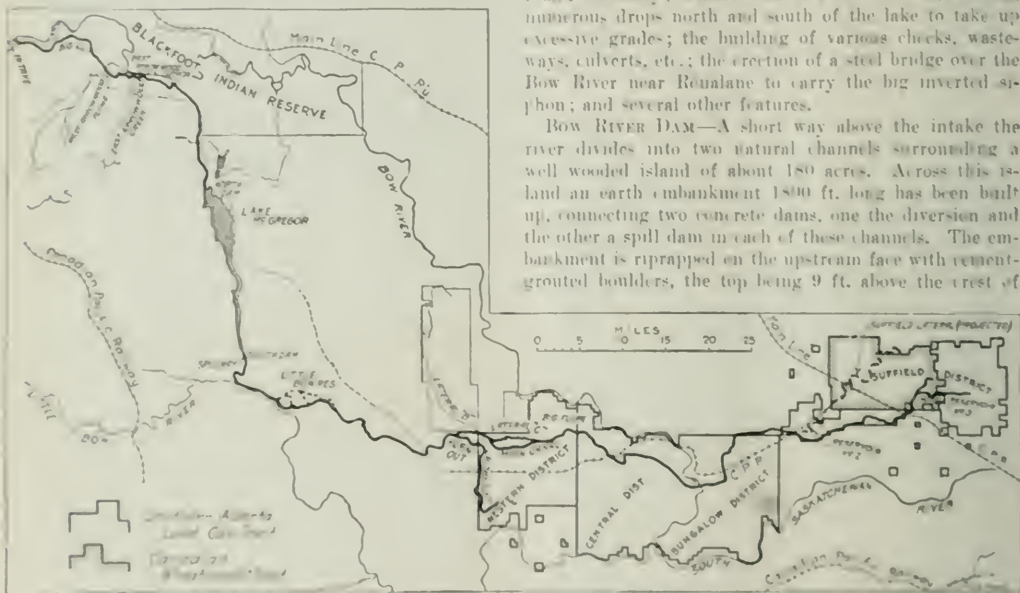


Fig. 1. General Map of Irrigation Project of the Southern Alberta Land Co.

and Calgary and to the southward of the large irrigation system of the Canadian Pacific Ry. (see the two maps, Figs. 1 and 2, for outline and general location of the scheme).

Altogether the company owns or holds options on 400,000 acres of land, of which [illegible] are to be irrigated under government requirements. Work was begun in 1909 but thus far only a few laterals have been excavated. These will be extended in 1915 so as to make possible the irrigation of [illegible] acres. The laterals will be extended as demanded.

Construction under the recently appointed Chief Engineer, D. W. Hays, was carried on vigorously during 1913. As in many similar projects, the work necessarily covers an extensive area, requiring extremely skillful executive ability, and here we evidently find the right man in the right place.[4]

Elements of the System

The main canal from the intake to Lake McGregor Reservoir is some 44 miles long; the lake itself has a length of 21 miles, and from the South Dam of the lake to the western boundary of the company's tract is a stretch of about 45 miles.

Recent operations have consisted chiefly in enlarging the original canals to care for the increased capacity found necessary; construction of a new intake; erecting numerous drops north and south of the lake to take up excessive grades; the building of various checks, wasteways, culverts, etc.; the erection of a steel bridge over the Bow River near Ronalane to carry the big inverted siphon; and several other features.

Bow River Dam—A short way above the intake the river divides into two natural channels surrounding a well wooded island of about 180 acres. Across this island an earth embankment 1800 ft. long has been built up, connecting two concrete dams, one the diversion and the other a spill dam in each of these channels. The embankment is riprapped on the upstream face with cement-grouted boulders, the top being 9 ft. above the crest of the dams. These two dams are a necessity in order to sufficiently raise the surface of the water in the river to pass into the main intake supplying the canal system.

Intake—The intake structure for the diversion of the necessary amount of water from the Bow River, not far from Gleichen, is nearing completion under the supervision of Division Engineer F. A. Wallace. This is entirely of concrete, having a floor width of 58½ ft., and total length of 206 ft. Of the total length, 123 ft. are above and 83 ft. below the gates. There are four gates, each 10 ft. wide by 8 ft. high, of the "Stoney" type, ope-

*Assistant [illegible] Engineer, Southern Alberta Land Co., Medicine Hat, Alta., Canada.

[4]The head office of the company is in the city of Medicine Hat, Alta., where a large staff of engineers [illegible]. The home office is at [illegible], London, Eng. [illegible] of Vancouver, B. C., late Chief of the Department of Irrigation Works in India, is Consulting Engineer in Canada, and [illegible] of engineering and technical adviser to the London office [illegible] as consulting engineer.

ilar to those in the Assuan Dam in Egypt. On the south side, 27 ft. above the gates, is the turnout leading the water to the main canal feeding the entire system. This inlet is 64 ft. wide and 50 ft. in length, consisting of five arched openings 10 ft. in width and 16 ft. long, with a roadway on top. The supply is regulated from a platform by the removal or addition of wooden "needles" resting inclined against horizontal I-beams spanning the five openings (Fig. 2).

Fig. 2. Headgates of Main Irrigation Canal

Fig. 3. West Arrowood Flume

The walls throughout the intake are step-battered on the outside and partly straight, partly step-battered on the inner or water side. The floor is entirely of boulder concrete except a length of 25 ft. at the piers and abutments for the gates where it is topped with a layer of hammer-dressed boulders. The floor slopes above the gates 1:50 and below the gates 1:20. A 10-in. I-beam acts as a sill on which the gates will rest. A peculiar feature of the "Stoney" gates is that the water-tight joint is on the upstream or pressure side of the gates instead of the downstream side, as is more usual. Close contact is assured by the wedging action of a system of rollers.

Fig. 4. East Arrowwood Siphon

Fig. 5. Notch Type of Drop
Fig. 6. Flashboard-Wier Type of Drop

Deep Cut—About five miles southwest of the intake the canal emerges from the river valley toward a high plateau, which necessitated a very deep cut varying from 64 ft. to about 40 ft. over a distance of 8700 ft. The cut in this section was a source of much trouble and annoyance to the contractors on account of the nature of the ground, which consists principally of gumbo with numerous sand pockets and springs, causing frequent slides.

Flumes—The next features are the flumes spanning several wide creek-beds. These are of wooden construction, carried on trestles with four-post bents 16 ft. c. to c., of a maximum height of 52 ft. The flume across the West Arrowwood Creek (Fig. 3) is 1200 ft. in length, of rectangular section, 16 ft. by 10 ft.

Inverted Siphons—The East Arrowwood Creek is spanned by a pair of inverted siphons of wood-stave construction, each $7\frac{1}{2}$ ft. in diameter (Fig. 4). These con-

nel with concrete portals at each end. Between here and the lake are two more box flumes besides a wasteway and three large concrete drops.

LAKE MCGREGOR RESERVOIR—At the northeast corner of the lake is a dam 3600 ft. long on the crest, and 48 ft. high, containing some 325,000 cu.yd. of earth. At present, it has not been decided what form of structure will be necessary to deliver the water from the main canal to the lake reservoir. This reservoir, known as the Lake McGregor Reservoir, is formed in a naturally dry coulee, 21 miles long, and at the widest part about 12,000 ft. across. Toward the southern end, the reservoir narrows down to a few thousand feet between precipitous banks. The capacity of the reservoir will be somewhere in the neighborhood of 300,000 acre-ft. There will be a concrete structure at the southern or outlet end, east and west of which will extend the existing earth dam,

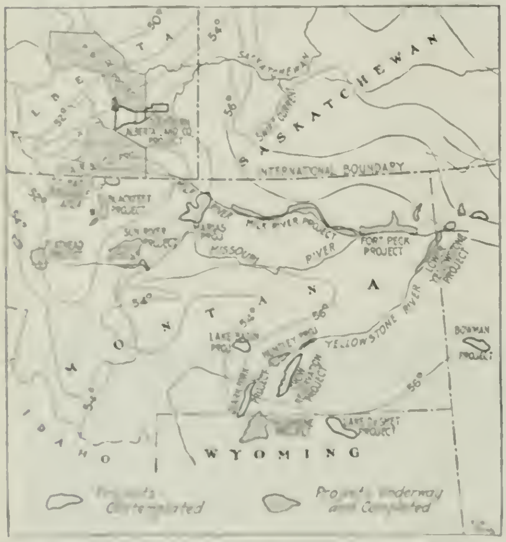


FIG. 7. SKETCH MAP OF VARIOUS IRRIGATION PROJECTS IN ALBERTA, MONTANA AND WYOMING

faced with concrete from the toe to the water level at the upstream face, only. This dam is 2100 ft. long on the crest, 40 ft. high and 85 ft. wide on the top. At the downstream toe a gravel-covered rock-filled drain is being placed to provide a drainage system for the dam.

MAIN CANAL AND CANAL STRUCTURES—The velocity in the main canal throughout the project will vary considerably, depending on the nature of the material. An average velocity of 2.5 [illegible] per sec. in natural earth to as high as 10 [illegible] in flumes or concrete sections will probably be the range.

Leaving the North Dam there is a stretch of ten miles of canal to the proposed Little Bow Reservoir, which will have a capacity of approximately 30,000 acre-ft. From here, the water will pass through an outlet structure, thence over several concrete drops to the natural [illegible] to the Alberta Land Company's lands.

One of these drops is shown in Fig. 5, which gives an idea of the size of these important structures. This particular one is of the "closed" type. The walls and floor are heavily reinforced. Concrete is mixed 1 part cement to 7 of sand and gravel, 5-in. boulders being used in the foundations and $2\frac{1}{2}$-in. boulders in the walls. The following quantities were required:

Concrete	275 cu.yd.
Steel	15.7 tons
Forms	11,000 ft., b.m.
Paving	450 sq.yd.
Excavation	700 cu.yd.
Back-fill	2900 cu.yd.

Such a drop would take about three months to build complete. Another drop of the flashboard weir type is shown in Fig. 6.

From the before-mentioned turnout the main canal crosses the company's own holdings as far as Suffield and beyond. In this section, the main features of interest are the so called "Big" or "Mile-wide-valley" flume already constructed. This is 5000 ft. long with a 16x8-ft. box, approximately 30 ft. high. A wood-stave siphon, 8 ft. in diameter, which will be 6540 ft. in length, will carry the water originally coming from the Bow River across the same river. The steel bridge to carry this siphon has six spans of 120 ft. each, resting on concrete piers. This was supplied by the Wisconsin Bridge Co., and is designed to carry highway traffic also.

This is the last of the bigger structures on the project. All that is required to be done from here to the Suffield District is the extension of the present system of laterals from the main canal as necessity requires.

A noticeable feature in this project is the part that reinforced concrete is playing. With the exception of the flumes and wood-stave pipes, all the structures are of this solid construction. In no case will the water be permitted to exceed a maximum depth of 8 ft. in canals.

As already mentioned, this description must be incomplete at the present stage of development. It, however, covers what has already been done in this important scheme to date; also the work that is under way and at present projected for completion. It will convey some idea of the size of the undertaking, and the great expense attached to a development of this character. Something like 2,000,000 cu.yd. of dirt had to be removed in the Big Cut alone, and as many as seven hundred men have been on the payroll at one time.

Division Engineer C. H. Bee has charge of all the work on the Little Bow Division, and J. E. Lloyd and H. C. Bender on the remaining two divisions, covering the Western, Central and Suffield districts.

COMPARATIVE TEMPERATURE, RAINFALL AND DUTY-OF-WATER DATA

Some interesting compilations have just been completed to determine the economic duty of water required by the farmers in this section during the irrigating season. The irrigation factor and losses by seepage and evaporation become matters of great importance in planning a system for irrigation, and it was to assist in the attainment of this necessary information that the following data were compiled.

A search was made through the statistical records of the meteorological and climatological services of Canada and the United States as far back as 1888. From these records were tabulated the yearly mean temperatures per month during the growing season, in this particular case taken from April to October inclusive. The average of these mean temperatures extending over as many years as were recorded was then obtained. In this way, a fairly

reliable mean temperature for the seven months was found for every recording station in the three Western Provinces, British Columbia, Alberta and Saskatchewan, as well as many places in Montana and Wyoming. The locations of these particular stations with their temperatures were platted on a map on which were also shown the various irrigation projects in the Northwest (see Fig. 7). By means of interpolation, isothermic lines were projected for the various degrees, from which result useful comparisons can be made.

By a similar method, a map has been compiled showing the total amount of precipitation over the same period of seven months. This total for each town is an average of the total rainfalls extending over as many complete years as it was possible to obtain. Isoplethic lines were interpolated in exactly the same manner as was done for the isotherms.

These maps prove very useful in many ways, particularly in showing relative characteristic conditions of this country as compared with those of the northern part of the United States where irrigation projects are extensively developed. The maps also assist in determining the quantity of water required for irrigation. In certain Montana projects, a limit of 3 acre-ft. was agreed upon in the first place which has since been reduced to 2 acre-ft., and it is now conceded in the northern States that 1½ acre-ft. would be an adequate amount for proper irrigation.

A particular advantage in extensive irrigation systems where water passes slowly through many miles of main canal and lateral irrigation ditches, with the water exposed to the bright sun of long summer days, is in the amount of heat absorbed by the water. Aside from the question of applying water to a thirsty soil, its warm temperature materially aids the luxuriant growth of products of the land not otherwise attained.

Track Layouts for Industrial Plants

The design of the track layout and sidewalk connections of industrial and manufacturing plants is a matter which should be entrusted to the engineer more largely than is generally the case, but in many cases the engineer is called in simply to stake out tracks according to a prearranged plan which in many cases might be modified with advantage to the convenient and economical working of the plant.

In a paper on "Economical Design of Factory Buildings," read before the Civil Engineers Society of St. Paul, W. E. King (Secretary of the Toltz Engineering Co.) referred incidentally to the desirability of the proper study of the sidetrack requirements. This paper is published in the June number the *Journal* of the Association of Engineering Societies (St. Louis, Mo.), and is followed by a discussion on the particular point noted above by George H. Herrold (St. Paul). An abstract of this part of the paper and the discussion is given below:

Mr. King—The track should be long enough to hold as many 40-ft. cars as the factory will need to load and unload in any one day. In isolated places, where the cars are not set so often, it must be long enough to allow for all the unloading and loading between each setting by the switch engine. Sidetracks for loading and unloading should be level. The rules of the railway, of the state and interstate railway commissions, and the state labor laws, are determining factors in the amount of room required for sidetracks.

Plans of the proposed sidetrack connection should be submitted to the railway, and assurance obtained that it is willing to put in the desired connection. If the sidetrack must cross the public road it is well to make sure of the necessary permit before putting money into the lot.

Mr. Herrold—One of the problems in connection with factory construction is trackage. It has fallen to my lot in several instances to design a track layout for factory and industrial enterprises, and I have been impressed with the fact in many cases that neither the architect, engineer nor owner had given the matter of trackage any thought, relying on the supposition that after the land had been purchased and the building was up the tracks could be got to it in some way. This is a serious oversight, as an important factor in the success of an industry is the quick and economical handling of the raw material to the factory and the finished product away from it.

In designing such trackage the engineer must not only be familiar with the daily car requirements of the factory, but also with railway switching methods in general and the particular switching services which can be obtained from the company which will handle the cars. It would be exceptional conditions which would permit of more than two switches per day; one in the morning to place the cars and one in the afternoon to remove them. Railway companies do not have switch engines waiting to place a car or remove a load whenever desired.

My experience leads me to believe that designers of factories have little conception of permissible grades or curvature for practical switching. Their plans often result in requiring additional land for right-of-way and a longer track than necessary, and even the building of trestle work or the making of excessive fills in order to bring the track to the factory at the proper level and give the length of track along the factory which should be level to permit shifting of cars during the day by hand.

The common factory switch costs approximately $185 in place; track, 82c. per running foot; low trestles, $9 per running foot, and grading for the roadbed about 20 to 50c. per running foot, per foot of fill. These items of cost and the running maintenance should be taken into consideration. Then there will be monthly bills from the railway for patrol and track repairs, even on the factory's own track, if the railway company is to operate its switch engines over it.

The simplest trackage possible is one switch and a stub-track running along the factory. This may serve the purpose for small outputs, but in general a double-end track is more desirable, as it facilitates the handling of the cars. No switching can be done on a stub track without disturbing all the cars, and this will stop the loading and unloading of the cars at the factory during the switching operations. With a double-end track, cars can be set in from one end and taken away from the other. If the business requires a different class of cars for the finished product than for the raw material, then the empties and loads can be placed at the factory doors in the morning, in the order required, and the loads and empties removed from the other end of the track in the afternoon without disturbing any cars not yet unloaded or being loaded.

Where the business is large enough, two more tracks are preferable. One track should run on each side of the factory; one for raw material loads only and the other for loading and out-going loads only. In general, each track should have a car capacity (between the clearance point of switches) equal to twice the number of cars to set on it. This permits the moving of the entire string of cars past the factory by hand, using a pinch-bar or car-puller between regular switching. A factory of this size should be designed to begin its processes on one side of the factory and deliver the finished product on the other side ready to be loaded into the cars in order to eliminate cross handling.

Track scales and track must be considered. Scales should always be under cover, and where possible on a separate track from the loading and unloading track. If the factory track should be on a curve, the scale track must be so built as to provide a straight track on the scales and for 40 ft. on each side, and if the same track must be used as a thoroughfare track then dead rails must be provided. These two latter provisions are required by the Minnesota Railroad and Warehouse Commission.

The cost of transportation of raw materials to the factory and the cost of distribution are largely affected by trackage facilities, and closer attention to this phase of the problem may save years of grief. A first-class factory poorly located with reference to trackage, resulting in awkward switching facilities, is only half a factory.

Continuous-Rail Crossing for Track Intersections

The severe wear and high maintenance cost of track intersections, especially under modern heavy railway equipment, makes it very desirable to substitute a con-

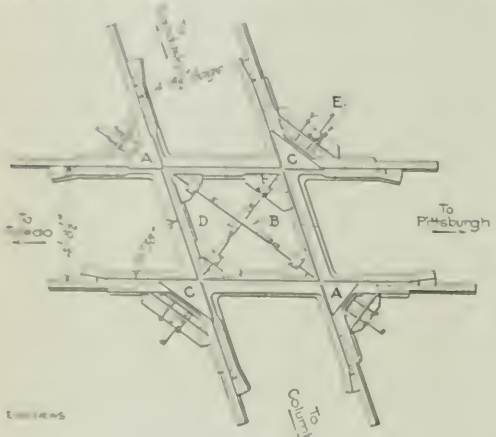


FIG. 1. PLAN OF CONTINUOUS-RAIL CROSSING
J. H. EYMON, MARION, OHIO, INVENTOR

tinuous-rail crossing frog for the ordinary frog, providing a satisfactory device is available. The devices so far designed are of two types, having sliding and revolving blocks at the rail intersections. A continuous-rail crossing which is now being tried in service is of the sliding type, each corner of the crossing having a movable block whose lateral motion (diagonal to the track centers) gives a continuous rail for one or other track. The construction and the operating mechanism are very simple.

In the plan, Fig. 1, the two sliding blocks (A) are moved by the operating rod (B), while the two blocks (C) are moved by the rod (D). The rods are connected for simultaneous movement, and if the crossing is equipped with signal interlocking plant they are connected up with the interlocking mechanism. The two smaller rods (E) at each block are the bolt blocks for locking the blocks in whichever position they are set. Each of the operating rods is cranked horizontally at each end, and this part of the rod passes through a sliding cam in the base of the crossing block. Thus a longitudinal movement of the rod shifts the blocks in a direction laterally to that of the rod and diagonally to the center lines of the tracks. Turnbuckles on the rods permit of adjustment of the throw.

The operation will be understood clearly from Fig. 2. Here the crossing is set to give continuous rails for the track running from left to right. When the other track is to be cleared, the throw of the lever gives a stroke to the flat operating rods and the blocks move in a diagonal direction upward (from the bottom of the view) and outward. This movement clears the flangeways of this second track and closes those of the right and left track. The two round rods behind each sliding block are those of the locking mechanism, and they partly conceal the ends of the operating rods.

The crossing shown in Figs. 1 and 2 is at the intersection of the main track and Sandusky branch of the Toledo Division of the Pennsylvania Lines, at Carrothers, Ohio. It is built to conform to the 85-lb. rails of the Am. Soc. C. E. section, and has a flangeway or throat width of $1\frac{3}{4}$ in. The entire crossing is of manganese steel, and is built in four sections, as shown. There are 28 trains daily on the Toledo branch and 32 trains on the Sandusky branch, and it is safe to assume that the crossing is thrown once for each of these trains. Besides this, Carrothers is a setting-off point, so that nearly every train switching there passes over the crossing at least twice in addition to its regular movement.

This crossing was built by the Indianapolis Switch & Frog Co. (Columbus, Ohio) for the Eymon Continuous Crossing Co., of Marion, Ohio. The inventor is J. H. Eymon, of Marion.

FIG. 2. CONTINUOUS-RAIL CROSSING ON THE PENNSYLVANIA LINES AT CARROTHERS, OHIO
(The crossing is set for the track from left to right.)

Cast-Iron Pipe with Screw-thread Joints has recently been put on the market by Jas. B. Clow & Sons of Chicago. The screw threads are cut on the lengths of pipe by dies similar to those used for threading wrought-iron pipe. Cast-iron couplings are used and the entire pipe line is thus kept homogeneous. This pipe is claimed advantageous, therefore, for locations where ordinary wrought iron or steel pipe suffers seriously from corrosion. It is stated that the cast-iron pipe is already being used for waste drains in [illegible] and [illegible] to steam heating [illegible].

Cantilever Span of the Bloomfield Viaduct, Pittsburgh

The Bloomfield Viaduct, Pittsburgh, will create an important line of communication across Junction Hollow, a ravine through which the Pennsylvania R.R. and the Pittsburgh Junction R.R. (B. & O.) enter from the bank of the Allegheny River at 33rd St. The viaduct is located on the line of Ridgway St., and will connect Grant Boulevard on the south, or city side, with Liberty Ave. at Main St. on the north of Bloomfield side.

The Dravo Contracting Co. built the piers, for about \$85,000, and the Fort Pitt Bridge Works is fabricating and erecting the superstructure, for a price of about \$255,000. The cost of land, \$75,000, and paving, \$15,000, will bring the total cost to near the appropriation of \$500,000.

The viaduct is a deck-cantilever structure with 400-ft. main span. It crosses about 185 ft. above the lower railway tracks (P. J. R.R.), and descends on a steady grade of 3.9% from south to north. The total width is 50 ft., with 34-ft. roadway. A uniform paneling of 20 ft. is used throughout the length of the steelwork, including the 20-ft. tower spans. The total length of superstructure is 1740 ft. 10 in., but retained embankments at the ends bring the total length up to 2099 ft.

The long north approach contains eight 60-ft. plate-girder spans and two 120-ft. truss spans; then follows the cantilever structure with 120-ft. anchor arms, 20-ft. towers, 140-ft. cantilever arms, and 120-ft. suspended span; the south approach has one 120-ft. truss span and two 60-ft. girder spans. The steel erection is being handled by a gantry cantilever traveler on each end. Derricks set on the approach spans raise the material from street level to the deck and feed it forward to the travelers.

The general and detail design of the bridge was made in the city's Bureau of Construction, under N. S. Sprague, in direct charge of T. J. Wilkerson, Engineer of Bridges.

FIG. 1. PRESENT APPEARANCE OF THE BLOOMFIELD CANTILEVER VIADUCT, PITTSBURGH

(Pittsburgh Junction R.R. in hollow, Pennsylvania R.R. on southerly bank; view taken July 21.)

FIG. 2. HOISTING TO PLACE AN ENTIRE TRUSS AFTER ASSEMBLY ON GROUND

(120-ft. span adjoining north anchor arm; view taken June 6.)

FIG. 3. TRAVELER STARTING ERECTION OF SOUTH CANTILEVER ARM

(Pennsylvania R.R. tracks at foot of pier. View in opposite direction from Fig. 1. Date June 30, 1914.)

Reconstruction of the Queensboro Bridge

The Queensboro or Blackwells Island Bridge over the East River, connecting East 60th St., Manhattan, with Queens Borough, New York City, is to have its floor system and deck arrangement partly reconstructed. Plans were recently submitted by the city's Department of Bridges to the Board of Estimate. The reconstruction is for the purpose of accommodating the new rapid-transit lines which are to cross the bridge.

The bridge is a cantilever structure having two channel spans of 1180 ft. and 984 ft., respectively, with an intermediate or anchor span of 630 ft. over Blackwells Island. It was completed in 1908, but its two decks were left in a condition different from that contemplated in the design. The arrangement as built is shown by the diagrammatic cross-section, Fig. 1. In the original design, the upper deck was to carry four rapid-transit railway tracks between trusses and footwalks bracketed outside; the lower deck was to carry four trolley tracks and a central roadway as shown in Fig. 1.

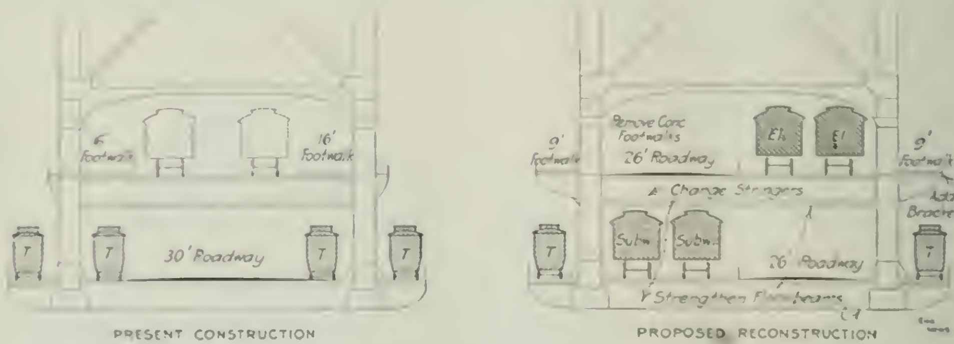


Fig. 1 Fig. 2

CROSS-SECTIONS OF QUEENSBORO (BLACKWELLS ISLAND) BRIDGE, SHOWING PROPOSED REARRANGEMENT

Shortly before the bridge was completed, grave doubts arose over its strength, largely in consequence of the collapse of the Quebec bridge some months before. The weight of the Blackwells Island Bridge greatly over-ran the dead-load assumed in the design, and the members were proportioned for maximum probable traffic rather than maximum possible congestion. Investigations of the strength of the bridge were made for the Department of Bridges by Boller & Hodge and W. H. Burr separately, and the results (reported in ENGINEERING NEWS, Nov. 19, 1908, pp. 556-558) indicated that four rapid-transit lines would overstress the truss members seriously. Partly as a result of these doubts and investigations, the upper deck brackets were omitted, and sidewalks were constructed on the outer set of upper-deck stringers, as shown in Fig. 1 (the construction of these sidewalks was described in ENGINEERING NEWS, Jan. 28, 1909, pp. 94-95).

As the plans of the Public Service Commission call for four rapid-transit tracks across the bridge, it is now necessary to make some rearrangement. However, the adoption of the original deck plan, or of any plan giving only 30 ft. roadway, is strongly opposed by inhabitants of the Borough of Queens who claim that vehicle traffic absolutely demands a full deck width of 52 ft. Further, it is inconvenient to carry to the upper deck the subway trains approaching the bridge from the west in tunnel.

The plan now proposed meets these demands by using half of the lower deck and half of the upper deck for roadway (thus giving two 26-ft. roadways), placing two subway tracks on the other half of the lower deck and two elevated-railway tracks on the upper deck and taking care of the trolley tracks and the footwalks on brackets. All this is represented by the sketch, Fig. 2.

No member of the main trusses of the bridge will require to be altered for this reconstruction. The following changes will have to be made, however: The footwalks removed; brackets attached outside the upper deck and new (narrow) footwalks built, with a board floor instead of a heavy concrete floor; two sets of the upper-deck stringers removed and roadway stringers substituted; the other pair of upper-deck stringers shifted slightly to suit 10-ft. rapid-transit cars; some upper-deck floor-beams strengthened; the lower-deck roadway and the two inner trolley tracks removed and a roadway built on half the width; on the other half width, roadway stringers removed and subway-track stringers substituted; and the lower-deck floor-beams strengthened.

The loadings now used by the Department of Bridges and the loadings used in the design of the Blackwells Island Bridge are: Trolley, 1160 lb. per lin.ft. (formerly 1000); elevated railway, 1810 (formerly 1700); subway, 2000 (formerly elevated-railway loading). Also, for the present purpose a live-load of 40 lb. per sq.ft. of sidewalk is considered justified, because with such a loading and a speed of movement of 3 mi. per hr. about 10,000 persons can cross the bridge in either direction per hour, which is regarded as far beyond any possible traffic over the bridge. The chance of crowding on the sidewalks on special occasions is considered of no importance because it may be prevented by the Police Department, because it is not likely to cover the full width of the sidewalk, and because the sidewalk loading is not critical in the design or safety of the bridge anyway.

With regard to possible concentration of train-loading, the Bridge Department counts on spacing trains

apart as described below by automatic block-signals in such a way that four lines of track will not produce greater stresses (and generally lower stresses) than ordinary double-track arrangement. Using the most unfavorable position of loading which the block-signals will permit, the calculations of the Bridge Department show maximum stresses as follows:

Tension in the top chord, about 500 lb. in excess of the originally specified working-stress of 30,000 lb. per sq.in. for nickel-steel; compression, no stress attaining the value allowed by the formula $20,000 - 50\frac{l}{r}$, which is the specification formula modified by the recommendations of Boller & Hodge and W. H. Burr. The department regards the bridge as absolutely safe under the traffic loads which it will carry when rearranged as per Fig. 2. Austin Lord Bowman, Chief Engineer, reported as follows to F. J. H. Kracke, Commissiner of Bridges: "No strengthening of any member of the main trusses is necessary to allow traffic to be carried across the bridge under this plan."

Signaling the Bridge

The arrangement of block-signals on the four rapid-transit tracks will be unique: On each of the four rapid-transit tracks, block-signals will be set at intervals of about 100 ft. and each will be equipped with an automatic stop, so that trains are spaced positively. On each deck the trains will run right-handed in both directions, so that there is one eastbound track and one westbound track on each side. Calling the two eastbound tracks "parallel tracks" and an eastbound and westbound pair "opposing tracks," the following functions will be performed by the signals: Following trains on the *same track* will be spaced 3400 ft. apart.* Trains on *parallel tracks* will be spaced 600 ft. apart. Trains on *opposing tracks* will be without influence on each other except at a block section 600 ft. long in the middle of each channel span, but here the arrangement will be such that one pair of parallel trains (600 ft. apart) must pass through and out of the block before the opposing pair can enter the block.

The effect of this latter arrangement will be that the middle of each channel span, which is the portion having the greatest influence on stresses in the bridge, cannot be occupied by more than one pair of trains, and this pair at 600-ft. spacing, which is sufficient to reduce the effect to that of a single train at midspan.

The theoretical capacity of this signaling system with a speed of 29 mi. per hr. will be 45 trains per hr. per track. Allowing for a certain amount of delay for each train, a real capacity of 41 trains per hr. per track is counted on.

*At a speed of 29 mi. per hr., this distance of 3400 ft. corresponds to 88 sec. The operation in the present Interborough subway does not secure closer spacing of trains in regular service than 90 to 110 sec.

Terminals and Connections

The trolley tracks on the brackets of the lower deck will swing outward at the west approach and descend into tunnels passing west along 59th and 60th St., respectively, south and north of the two subway tunnels leading from the lower-deck rapid-transit tracks of the bridge. At Third Ave. (about 1200 ft. west of the end of the bridge approach), the trolley tunnels will have descended sufficiently to pass under the subway tunnel and will connect with each other in a transverse loop station under the roadway of Third Ave.

At the east end of the bridge the trolleys will connect directly with the Queens trolley network.

A terminal structure at the east end of the bridge will provide for the elevated- and subway-train traffic interchange. In approaching this terminal the various tracks will change their levels so as to bring the eastbound tracks to one level and the westbound tracks to another level. The lines continue thence easterly into Queens Borough.

At the west end of the bridge the Second Ave. elevated tracks connect directly with the upper deck of the bridge by a viaduct structure.

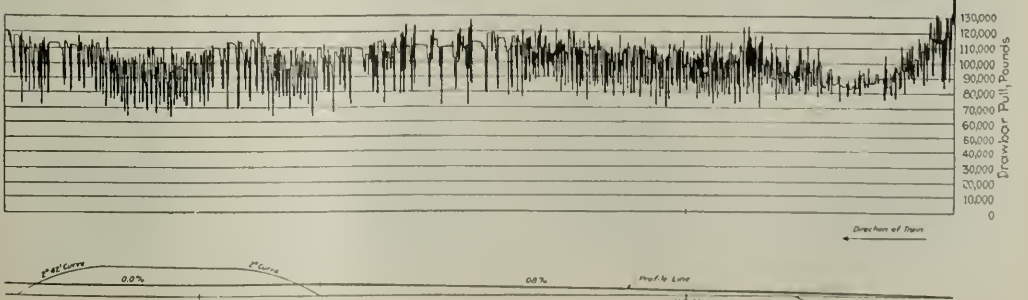
The greatest approach gradients are: Rapid-transit tracks, 5.2%; roadways, 5.8% at Manhattain end and 5.4% at Queens end. Most of the vehicle traffic at present consists of power vehicles, so that steep grades are not seriously objectionable.

The total cost of putting the bridge into shape for operation, according to Fig. 2, is estimated at $3,024,000.

F. J. H. Kracke is Commissioner of Bridges, A. L. Bowman is Chief Engineer, C. M. Ingersoll is Traffic Engineer, and E. A. Byrne is Deputy Chief Engineer.

World's Largest Locomotive Tested for Tractive Effort

The big articulated locomotive of the Erie R.R., described in Engineering News of May 7, p. 1046, was subjected to a hauling-capacity test on the Susquehanna division on July 23. The test was made from Binghamton, N. Y., to Susquehanna, Penn., a distance of about 23 mi. The locomotive was at the head of a train of 250 fifty-ton steel gondolas loaded to full capacity, and a dynamometer car. The train weighed 17,912 tons, exclusive of the locomotive, which weighed about 422 tons, and the



Typical Section of Dynamometer Record of Hauling-Capacity Test

length of the train was 8547 ft. The grade was practically level, the maximum being 0.09%, with 5° curvature.

Pushers were in readiness to assist in getting the train under way and were used in making the start from Binghamton; but at Great Bend, where the locomotive took on water, pushers were not used in starting. They pushed the slack forward until the lead locomotive had all the cars moving, after which they were uncoupled and followed the train for emergencies. Communication was maintained between the head and rear of the train by portable telephones, which made it possible for the pushers to work efficiently with the lead engine at starting. The maximum drawbar pull is shown in the accompanying section of the dynamometer record. The following tabulation gives the main facts:

Number of cars in train	251
Total weight of train excluding locomotive	17,912 tons
Total length of train	1.6 mi.
Maximum speed obtained	14 mi. per hr.
Maximum drawbar pull	13[illegible]0 lb
Minimum drawbar pull	67,000 lb.

These data were furnished by R. S. Mounce, Engineering Department, Erie R.R., New York City.

Fig. 3. Side View of Tubercles

Analyses of Tubercles from the Interior of a Cast-Iron Water Main

The illustrations intended to accompany the analyses of samples of tubercles from the cast-iron pipe at the High Hill Reservoir gate house of the New Bedford, Mass., waterworks, described in ENGINEERING NEWS of last week, p. 328, are shown herewith. Each ring shown in illustrations of the bottoms of the tubercles, Fig. 2, represents about a year's growth.

Fig. 1. Tops of Tubercles from the Interior of a Cast-Iron Water Main

Fig. 2. Bottoms of Tubercles, Showing Rings of Annual Growth

Editorials

The Effect of Increases and Decreases in Street-Railway Fares

At the last mid-year conference of the American Electric Railway and allied associations early this year, figures were presented to show that one- and two-cent reductions of street-railway fares did not result in the notable increase of traffic which some advocates of lower fares claimed would come. From the studies of the riding habit in several American cities, where reductions were to be observed, it appeared that the general business experience in stimulation of trade (directly proportional to unit-price reduction) was not followed, and the tenable statement was made that this law had a limitation when very small unit prices were concerned—as these required a much larger percentage reduction to have appreciable effect. Admitting for the moment that these figures truly reflected the habits of American riders, the converse cannot be said to be true—that increases in fare do not work a material reduction in travel. A striking illustration of this point is seen elsewhere in the discussion of the experience of the Hudson & Manhattan railroad, which operates rapid-transit tunnel lines between New York City and New Jersey. This company raised the fare from five to seven cents on one line. There was ample excuse for doing this in the continuing deficits which the company bore as the result of operations. However, the results show that it undoubtedly was an unwise move. In the first year under the increased fare there was a drop of 17.6% and in the second year a further drop of 5.8%. In the two years which have elapsed, the gross income has been increased by this raise a total of some $970,000 over what they were, but against this increase has to be set off the very probable loss of $1,300,000 gross gain which the company would have made had the traffic continued to grow at about half the rate it was growing when the new fare was put into effect. Incidentally, the traffic on this line has to compete with good ferry and surface-car service and possibly will remain some 40% below what it might be under a five-cent fare. The company has a heavy investment in tunnel construction and needs to cultivate in every way the growth of traffic.

Causes of Railway Derailments

Accident Bulletin No. 50 just issued by the Interstate Commerce Commission gives statistics of accidents occurring on United States railways during the last quarter of 1913, and shows some interesting facts regarding the causes of derailments. The total number of derailments on steam railways during the three months was 2307, but only 576 of these were due to defective roadway, while 1091 were due to defective equipment. Broken rails were responsible for 128 derailments, while 245 derailments were due to broken wheels; 102 to breaks or defects in axles or journals; 162 to breaks or defects in brake rigging, and 116 to breaks or defects in draft gear. Broken arch bars caused 73 derailments and rigid trucks 65. It is worth noting also that this quarter included the month of December, one of the winter months, when most rail breakages occur.

We have no wish to minimize the importance of measures to secure sound railway rails, free from the danger of breakage, but it is at least worth careful consideration that only one-fifth of the derailments due to defective track were caused by broken rails and that there were nearly twice as many derailments due to defects of rolling stock as to all the defects in the track. Considering the character of the labor necessarily employed in track work and the large territory that has to be covered, with the general tendency of railway financial authorities to economize as much as possible in expenditure on track repairs, the above showing is most creditable to the engineers and the men under their direction who are responsible for railway-track maintenance in the United States.

The statistics of derailments from rail breakage in the above report prove, what every railway engineer pretty well knows, that the great bulk of the steel rails in service on American railways are sound and tough and equal to the tasks imposed upon them. If this were not the case, rail breakages under the extraordinarily heavy wheel loads and high speeds common in American railway practice would be many times as numerous as they are.

This same Accident Bulletin also shows, however, that there are a few very bad rails in service. Two examples of rails of this sort are given in this report. One is a rail which broke under a freight train on the Southern Ry. in North Carolina Mar. 31, 1913, and was found after the accident to be separated into nine pieces, the shortest about 7 in. long. This was an 80-lb. rail rolled in November, 1904, and the cause of the breakage was traced to transverse fissures in the rail head.

A much more remarkable case of rail breakage, however, occurred on a coal-trestle siding in Washington, D. C., on Oct. 31 last. A Pennsylvania R.R. switching locomotive pushed some loaded coal cars on the siding and started to haul away four empty cars. It had moved barely two feet when one of the rails under it broke and the locomotive tipped over and fell to the ground 14 ft. below. The siding was laid with 85-lb. rails laid on ties two feet apart on centers. The ties appear to have been badly decayed, but this was no excuse for the rail breaking instead of bending under the static weight of the locomotive. Manifestly, such brittle rails anywhere in railway track are a dangerous menace. The chief object of those who draft specifications for steel rails and those who carry them into execution should be to prevent any such brittle and dangerous material being placed in the track.

Steam Distribution from Central Stations

The report published in our issue of July 30, on the condition of the mains of the New York Steam Co., is the first valuable technical information that has appeared for a long time concerning the distribution of steam through city streets.

In many cities of the country there are steam mains through which steam is distributed from central stations at low pressure, for heating purposes only. Usually the business is carried on by electric lighting companies, who thereby utilize the exhaust steam from their engines much more profitably than they could do by discharging it through a condenser. In New York City, however, the New York Steam Co. distributes steam at nearly 100 lb. pressure under a considerable mileage of streets in the crowded downtown business district.

At the time this plant was originally built, the distribution of power from a central station was comparatively a new development in engineering, and several systems were in competition. In some of the English cities, extensive systems of mains were laid down for the distribution of power by water under high pressure. In the United States at that time also many water companies looked with favor on the use of water taken from the city mains under pressure for operating hydraulic elevators, small motors, etc. In France the Popp system of compressed-air distribution attracted world-wide attention and was copied on a smaller scale in several other cities. Besides these systems there was the mechanical distribution of power by belts and ropes, of which the cable railway so extensively developed in the '80's was the most remarkable development.

The system of the New York Steam Co., when originally put down, was designed to compete with these other systems of power distribution. Its promoters claimed that the ready use of the high-pressure steam in existing steam-engine plants, with its availability for heating as well as power, made the steam distribution the most advantageous system; and their dream was that similar plants would be constructed in many other cities.

In the early years of operation of the New York system, very serious troubles were experienced with the street mains. The heat losses from the system were very heavy, the great amount of condensation and resulting troubles with expansion and contraction compelled the frequent digging up of the streets; and the general impression among engineers was that steam mains underneath city streets were an unmitigated nuisance.

For the past fifteen or twenty years, however, little has been heard concerning the New York Steam Co.'s operations. It has continued to carry on its business but without very greatly extending its field, and the improvements it made to its system of mains, following the troubles of twenty years ago, have seemed to obviate much of the difficulties then complained of. The report, which we printed two weeks ago, however, makes it evident that its steam mains are only less objectionable now than they were in the early days and that the difficulties experienced with them are such that were the mains not already in the streets, certainly no city government run on business principles would grant a franchise for putting them there.

It must be remembered that the earth underneath New York City's streets is already filled so full of underground pipes that it is difficult to find room for any more, especially in the narrow downtown streets where the high-pressure mains of the steam company are chiefly laid. To a certain extent, however, the above statement applies to steam mains anywhere and especially to those using high pressure. It is true that by using a much higher class of work in the laying of steam mains with ample provision for heat insulation and free expansion, it is possible to put in a system that will be much less troublesome; but such improved mains add materially to the cost of the system and experience indicates that the cost of distributing steam through city streets, at least under the conditions prevailing in New York, is so heavy that there is little profit in the business.

Of course, under present-day conditions electric power distribution has put all other systems out of the running and no engineer at the present day would seriously consider building a plant to distribute steam for power generation. Even in the distribution of steam for heating purposes, the indications are that the limitations of distance are important, and that the most successful plants are those operating in comparatively limited territory.

Finding Money to Pay for Street Paving

A good many cities are wrestling with the problem of radical improvements in their street pavements. The general use of automobiles has developed a public opinion far more sensitive to the disadvantages of poor street pavements than existed a dozen or twenty years ago. The rough stone block paving which was accepted without question in former years is now severely criticised. The public demand is for wood block, asphalt, brick, close-jointed stone block, or some other type of pavement with a smooth surface. But to substitute such pavements for the old and badly worn pavements of which every city possesses a large mileage, and to pave the miles of streets not paved at all, means the expenditure of a very large amount of money. The abutting property owners object to bearing the burden of this work and rightly so, since the large amount of traffic which an improved pavement draws to a street is an injury rather than a benefit to residence property. On the other hand, to raise money by a general tax levy for wholesale repaving would raise the current tax rates to a point which the public would not stand for. Hence a bond issue seems, in most places the only method available of raising money. On the other hand, most cities are already carrying a burden of debt which is partly made up of bonds issued to pay for pavements which have already been worn out; hence this dangerous plan of financing is properly condemned by engineers and others.

In Cleveland, Ohio, the question of what to do about the city's pavements has recently been thoroughly investigated by a citizens committee of 15, organized by a general committee made up of representatives of civic organizations. The president of the committee of 15 was Dr. Chas. S. Howe, the president of the Case School of Applied Science. Among other members of the committee were Messrs. Chas. A. Otis, James R. Garfield and Frank C. Osborn. The committee's report, which was presented on July 20, shows that of the 826 miles of

streets in Cleveland abou. 500 miles are paved. Fully one-half the paved streets need some repairs and at least 50 miles need repaving at once. The city has not been spending enough money on pavement maintenance to keep the streets in order and the pavements are growing worse every year. In addition to this, the Cleveland Street Railways Co. has neglected its obligation to keep well paved the space between its tracks and one foot on each side. These repairs were postponed while the company was engaged in its long fight over its franchise rights; and since then, the company has expended as little as possible on paving work.

The taxpayers of the city pay 85% of the road tax raised in Cuyahoga County and they pay also $407,000 each year in state road taxes. Thus the tax payers of the city pay annually over $800,000 for the building of roads outside of Cleveland.

The committee proposes to deal with this situation as follows: It recommended that the city should provide about $150,000 a year for new paving; and where streets are repaved, one-half should be paid by the property owners and one-half by the city, the total amount to be raised by the city for this purpose being about $670,000 per annum. This money should be raised by general taxation and not by an issue of bonds. The committee further recommended that efforts should be made to have the laws amended so that a part of the taxes paid by city property owners for state and county road purposes should be expended on streets within the city.

It was further recommended that a part of the funds required for repair and maintenance of city streets should be raised by the assessment of a wheel tax on all vehicles.

Still another important recommendation of the committee was that the entire work of paving, repaving and paving maintenance should be under direction of a Commissioner of Streets. Such an officer is provided for in Cleveland's new charter, but has never been appointed. The committee recommended that the Commissioner of Streets should be a thoroughly trained civil engineer who has specialized in road and pavement work and should receive a salary of at least $4500 per annum.

This is the first case on record, as far as we recall, where an organized protest has been made against the taxation of cities for the construction and maintenance of country roads. For some years past, through the development of state and county road work, the tendency has been to place upon the large taxpayers of the cities a large part of the burden of building and maintaining better country roads. That protest against this burden would be heard sooner or later was to be expected.

Through Routes Versus Terminals

The City Club, of Chicago, has just published a notable monograph, entitled "Through Routes for Chicago's Steam Railroads," which is well worth the study and careful thought of any engineer interested in the problem of city transportation. The author of the pamphlet is Mr. Geo. Ellsworth Hooker, Secretary of the City Club of Chicago. Mr. Hooker was also secretary of the Special Street Railway Committee of the Chicago City Council in 1897-8. Mr. Hooker's monograph is a quarto of some 90 pages, profusely illustrated with maps and diagrams, and to the engineer interested in city transportation is of much broader interest than the discussion of the local problems at Chicago.

The scheme which Mr. Hooker sets forth has the backing of so eminent an engineer as Mr. Bion J. Arnold. In March last, Mr. Arnold presented before the City Council Committee on Railway Terminals a preliminary study to show the possibility of applying the through-routing principle to the Chicago steam railways engaged in local passenger service.

The local passenger traffic in Chicago is now moved by surface street railways carrying 600,000,000 passengers per annum at an average speed of 9 miles per hour, elevated railways carrying 164,000,000 passengers at an average speed of 14 miles per hour, and suburban steam railway lines carrying 42,000,000 passengers at an average speed of 24 miles per hour. Mr. Hooker argues that a much larger proportion of the local railway traffic should be carried by the steam railway lines, which, by the way, he assumes are shortly to be altered to electric traction.

It is, however, impossible in Chicago's densely crowded central district to find the room for the large amount of rolling stock which would be required if the suburban steam railways run into the present crowded terminals in and close to the business distrct. Mr. Hooker urges, therefore, that there should be through routing of this local passenger traffic. For example, a steam railway train leaving the northern suburb of Evanston should not be stopped and turned to retrace its journey when it reaches the station in the central district, but should continue on southward to Hyde Park or some other farther point in the southern suburban zone, where it can be stopped and turned to retrace its through journey. Mr. Hooker discusses the principle of through routes in connection with other cities as well as Chicago, such as New York, Boston, Paris, London and Berlin, and considers its application also to street railway traffic. It is this latter feature we believe which most deserves the attention of engineers.

The electric street railway system in most American cities, unfortunately, has been developed without very much system or plan. The question on what streets it should be located has depended much more upon the prejudices and inclinations of the property holders in that street than upon the need of good service for the whole city. There has, however, grown up in most cities a system under which all or nearly all the street railway lines radiate from the various suburbs to some point in the business center, and in numerous cities the congestion in the business center as a result now presents a serious problem.

Boston, with its narrow and crooked streets, was the first American city to feel that problem in an acute form and the construction of the first Boston subway was the result. New York City has had for more than a score of years an aggravated case of crowded terminals in the center of the city at the Manhattan end of the old Brooklyn Bridge. A similar congestion once existed at the Brooklyn end of the same structure and millions of city money was used to obtain additional room for the Brooklyn terminal of this bridge. When through routing of cars across the bridge was established, the Brooklyn terminal crush disappeared as if by magic.

As we have remarked above, there are numerous cities

in which the problem of the congestion of street cars in the center of the city has become a very serious matter. We have in mind one city of a half a million population where the crowding of passengers on the cars all day long and not in the rush hours merely is nothing short of scandalous. Such conditions would not be permitted for a single day on a street railway in any city of Germany or England. The management of the company, which has long been notorious for its inefficiency and absolute disregard of public necessity and convenience, has long made the stock excuse that the crowded condition at the business center prevented the running of any more cars. It has at last awakened to the fact that the congestion on its lines is seriously limiting its traffic growth and so delaying the movements of its cars as to materially cut down its earnings, and it is therefore proceeding to invest a very large sum of money in the construction of a great terminal passenger station and car depot near the center of the city. The value of a reservoir of cars at this point is debatable, but it seems likely that the congestion above referred to might have been remedied at a small part of the cost by intelligent through routing of cars.

It will not escape notice that this principle is of even broader application. One reason for the vast reduction of transportation costs that has taken place in the last fifty years has been the steady development of through routes for both passengers and freight. The consolidation of railways into great systems thousands of miles in extent has put an end to the changing of cars and the shifting of loads every hundred miles, or less, which was common in the days when a multitude of little railway companies owned short lines in New England and the Middle States. In fact, in all manufacturing and transporting fields the effort is to make the process continuous.

Letters to the Editor

Window Protection More Important than Structure in Fireproof Buildings

Sir—Your article, "A Real Fireproof Building," in the July 16 number does not sufficiently emphasize the fact that what saved the reinforced-concrete storehouse was its small windows with their double-protection wire-glass in metal frames plus inside automatic shutters. The reinforced concrete had nothing to do with its salvation. The concrete walls are cracked in many places and the reinforcement is exposed in a few places but some of the cracks were apparently present before the fire.

Given this double window protection, a brick building, even with wood-posted construction, would have resisted the fire just as well—a fact proved by the unscathed condition of the boxes just below the windows inside, and the sprinkler heads 3 ft. away from the windows which did not go off. It should be noted also that the very small windows and the inside shutters hinged at the top to swing down would be impracticable for buildings like factories, office buildings and stores.

The power house of the Salem Electric Light Co., near the Naumkeag Mills, a brick building with large windows of wire-glass in metal frames, was a much better example of the kind of windows required in ordinary mercantile buildings. It came through the fire with only a small amount of blistered paint on the inside. The old [illegible] used as a storehouse by the Naumkeag Co. was a brick building with double metal doors, no windows, and a [illegible] roofing on wooden boards. The fire did not penetrate it.

The buildings which were saved clearly emphasize again the necessity for the protection to be taken against outside exposure, such as brick or concrete outside walls, noncombustible roofs and thoroughly protected openings.

CHARLES W. KILLAM.

Ass't. Prof. of Architectural Construction.

Harvard University, Aug. 3, 1914.

"A Dry Land Mattress on the Mississippi;" the Sequel

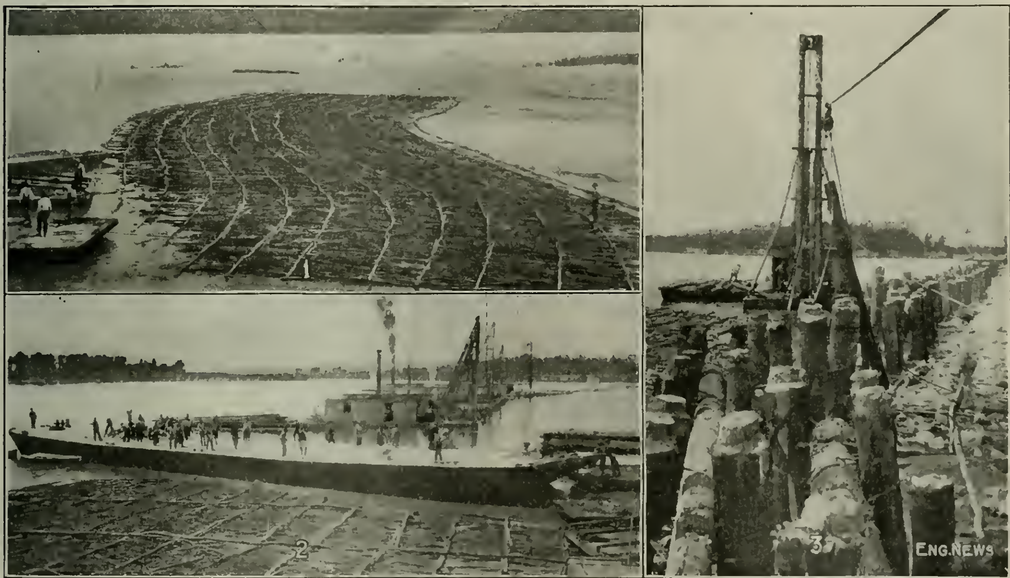
Sir—The quoted title heads a description, in ENGINEERING NEWS, June 4, 1914, p. 1243, of a mattress on the Mississippi, near Chester, Ill., constructed on the ground in order that the piledriving and mattress construction could be prosecuted simultaneously, when conditions were favorable.

The hoped for "rise," sufficient to float the plant over the bar, was forecasted by the Missouri River gage reports about the middle of June, and preparations were then made to begin the work at the earliest possible moment. Unfortunately the river did not reach a working stage until the latter part of the month, and valuable time was lost on account of Sundays and holidays; mattress construction and piledriving were begun on June 19, when soundings showed 2 ft. of water over the mattress end.

From the highest point of the mattress to end—[illegible] ft.—the slope was 1½%, consequently difficulty was experienced the first day in maneuvering the two piledrivers placed on the work. Additional drivers were placed as the river rose, until at the crest (June 22, "Belle of Memphis 'Forecast'" = 30.5 ft. St. Louis gage), six were in commission. Knowing that the rise would be of short duration and probably barely sufficient to float the drivers over the high point of the mattress, mooring piles were driven upstream and the building drivers dragged, to the extent of their engine capacity toward the bar top. Fig. 2 shows the far drivers back upward, working in 11½ ft. of water.

Great haste was necessary with the mattress construction on account of a second ridge or prong of the [illegible] that had to be crossed farther inward, Fig. 1. While it was not thought that the second ridge could be reached before the water began to fall, yet it would have been both economical and advantageous to build to the ridge, since scour usually takes place at the exposed end of a

hurdle mattress. In this endeavor aid was rendered, for a few days, by the river. The swift current in combination with the shoal water formed an undertow or suction under the plant, which caused a continuous scour of one to two feet in front of the unsunk mattress. However, as the water fell the scour decreased and failed to overcome the river fall and the rise of the bottom; the brush barge grounded, necessitating the launching and sinking of the mattress (Fig. 2). The direction of the weaving plant was reversed; the bows of the light-draft flats were shoved on the bar ridge and mattress building proceeded in the opposite direction until an overlap was made with the mattress previously sunk. By reversing the plant and direction of mattress construction, 300 ft. of mattress was added to the length. Fig. 2 shows the mattress thus constructed with preparations for weighting; the overlap and the hurdle end are in the foreground, the second ridge of the bar and river channel in the background.



FIGS. 1-3. LAYING A MATTRESS ON THE MISSISSIPPI IN VERY LOW WATER

Across the bar, piles were driven tip down. A greater cross-section of pile was thus obtained where the greatest breaking strength was needed.

At the top of the first ridge too shoal water for the piledrivers caused a small gap to be left in the hurdle, which was closed by cutting holes in the mattress and jetting in the piles. Fig. 3 shows a driver jetting piles 75 ft. distant.

During this "rise" 1000 ft. of hurdle and 1300 ft. of mattress was built, of which 300 ft. of mattress, in advance of the hurdle, is ready for piling on the next rise above the 20-ft. stage, St. Louis gage. That this "rise" will occur before the spring of 1915 is extremely doubtful.

F. Y. PARKER,
U. S. Assistant Engineer.

July 24, 1914, St. Louis, Mo.

On the Necessity of Heavier Pavement Foundations

Sir—I hope the article by Daniel B. Goodsell, on "Pavement Foundations for Heavy Traffic," in ENGINEERING NEWS of July 23, will call forth thorough discussion of the subject by municipal engineers in this country. It has long been my opinion that in laying pavement foundations, which to all intents and purposes should be useful for from 30 to 50 years, municipal engineers are extremely shortsighted in continuing to recommend 6 in. as the maximum thickness. This thickness is barely sufficient under favorable conditions for present traffic; and no account is taken of future growth in size of loads.

Everyone knows the pressure that is brought to bear on city officials to lower the first cost on all public improvements, and this must be credited as one of the extenuating circumstances which may have influenced the engineer against his better judgment. Four- and five-inch foundations, however, are altogether too common in the United States, and are entirely inadequate for even present needs.

All will agree that wheel loads have been increased enormously within the past five years with no apparent limit in sight for the future. A rich 6-in. portland cement concrete foundation may be strong enough to carry the heaviest load over ordinary sized depressions in the subgrade, without actually breaking down, but this is not all that is required of a pavement foundation.

The foundation must be rigid enough to maintain the wearing surface without appreciable deflection or vibration. For these purposes, mass as well as strength is essential just as in a reciprocating-engine foundation the mass necessary to absorb the vibrations determines the size, rather than the amount of load carried.

The increase in the speed of heavy loads due to motor trucks, has been as severe on old pavement foundations as the increase in the weight of the load itself. Every one has undoubtedly felt the violent jarring and shaking of the entire surface of a pavement during the passage of a loaded motor truck going 10 or 12 mi. per hr., especially if the pavement was slightly uneven. Recent experiments at the U. S. Bureau of Standards have shown that the effect of a slowly moving load of three tons on a block pavement laid on a 6-in. foundation could be detected as much as 110 ft. away. Any wearing surface is more or less injured by these constant deflections and vibrations.

Kansas City, a year ago, increased the thickness of foundation on business streets and trafficways from 6 to 8 in. of 1 : 3 : 6 portland cement concrete, and on residence streets from 5 to 6 in. No foundation is laid less than 6 in. thick, and several streets have been repaved with a new foundation 8 in. thick. Eight inches on residence streets and 10 or 12 on business streets should be required and will probably be specified as soon as the public will allow it.

In Kansas City, the entire cost of all paving, repairing or repaving is assessed directly against the abutting property, the owners of which consequently think they ought to have a deciding voice in what they have to pay for. There are a great many streets with a 6-in. natural-cement-concrete foundation, which the Engineering Department is recommending be replaced in nearly all cases of repaving. Why a foundation, which has stayed right where it is for 15 yr. should have to be replaced is often a mystery to the taxpayer.

It is my observation that a weak or insufficient foundation (and this does not necessarily mean a sunken or fractured base) is more of a detriment to asphalt and creosoted wood-block than it is to cement-grouted brick or stone-block. The last two named pavements are in a way partially self-supporting and apparently distribute loads over greater areas of base and subgrade.

Engineers should give the question of pavement foundations more careful and serious consideration; in which case, they will undoubtedly specify leaner mixtures and much thicker bases, which is in conformity with foreign practice mentioned in Mr. Goodell's article.

CLARK R. MANDIGO,
Assistant City Engineer.

Kansas City, Mo., July 27, 1914.

NOTES AND QUERIES

Preparation and Sale of Assessors' Maps—[illegible]

[illegible]

which has gone into any such work as this comprehensively, and the experience of anyone whether successful or not, would be gladly welcomed.

We have been asked where the flexible rail joint for steam-shovel tracks, described in our issue of Mar. 12, can be purchased. The joint illustrated herewith was invented by Peter J. Thull, and is manufactured by the Thull Rail Joint Co., 2218 West Superior St., Chicago, Ill. The device consists of

THE THULL RAIL JOINT IN SERVICE

two steel castings, bolted to and projecting beyond the rail end. Each casting is secured to its rail by a single bolt. The joint permits a certain amount of longitudinal flexibility.

An Efficiency of 79.8% for an [illegible] centrifugal pumping unit has been recorded by the [illegible] River Rice Irrigation Co., [illegible], Texas. The plant of this concern contains [illegible] driven from [illegible] and [illegible] the new unit tested which comprised a [illegible]-in. double-suction centrifugal pump [illegible] to a [illegible] four-valve engine.

The average results of an [illegible] test were as follows:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

The test was under the [illegible] of [illegible], [illegible] and [illegible] representing various parties [illegible]. The pump was designed by A. [illegible] of New Orleans, and built by the [illegible] Centrifugal Pump & Machine Co., Philadelphia. The engine was built by the Harrisburg Foundry & Machine Co., Harrisburg, Penn.

The City-Manager Plan of Municipal Government

By Paul E. Kressly*

The city manager is the latest innovation in the government of American municipalities, and strange to say, he is a direct indirect result of the Galveston hurricane. When fourteen years ago wind and wave conspired to wreck the Texas island city, the conditions created by the catastrophe demanded so much progressive and constructive work of the City Government that the old system of a board of aldermen and the usual string of independent elective officers broke down. A group of business men petitioned the state government to suspend the local government and replace it temporarily with a commission of five men. This was done, and the whole city was put under the control of these men, on a strictly business administration. The commission in a few days accomplished what a city council would have required months to do.

Des Moines, the Iowa capital, took up the idea, and improved upon it, and from that beginning the commission form of government has spread with surprising rapidity through the United States, and a peaceful revolution in four hundred cities has swept away the boards of aldermen, mayors and a host of minor officials and has set up new municipal governments on a plan so simple that the services of the "political boss" are not required to direct them.

The whole nation looks on with amazed enthusiasm, while the people in these towns not only get control over their government but keep it, election after election.

How and Why the Commission Plan Fails

The commission form of government has placed in the hands of the people an effective instrument of control; a governing organization which is continuously exposed to the full glare of public opinion, which really came from the voters, and which was sincerely anxious to obey them. While this form of government is a vast improvement over the form in general use up to seven or eight years ago, there is unquestionably room for still more improvement. In some of the cities it has proved very successful, while in others it has been a complete failure. This must not be regarded as a defect in the form of the government, but rather as due to the inefficiency of the members composing the commission. Take, for example, Wichita, Kan., where, as everywhere else, the commission plan was hailed five years ago as a "business plan" of city government which would settle all the difficulties under which the town had been laboring. Recently, the commission in this city has authorized the issue of $88,000 in five-year bonds to cover current deficiencies. After four years of the new rule, that does not look like good business. A little searching into the local situation reveals certain things which are directly or indirectly responsible for this condition.

One of the members of the Wichita commission is an ex-street laborer. Street work as a laborer is an honest calling, but does it give a man quite the preparation for managing one of the departments of a city as important as Wichita? There was doubtless excellent reason for electing him, for the labor people had an unquestionable right to select one of their men to represent them in a city's governing body. The man in question had a reputation for integrity and honesty, but even commission government has not made him a good business manager.

Here, then, is one trouble with the commission plan which the Wichita incident brought out in a graphic way: It is only by accident that you can secure five men who will be at the same time representatives of recognized divisions of the people and properly equipped for administrative service.

What, then, is the substantial and permanent contribution of commission government to the city problem? The one great thing it has done is to demonstrate beyond a shadow of a doubt the wisdom of giving over to a single elective governing body all the municipal powers. It has given the people a workable instrument, so far as general regulation is concerned, but it has failed to give the governing body the means with which to translate the general will of the people into detailed acts of government in the most effective way. A five-headed government carries with it the possibilities of friction, leads to inefficiency, which, in turn, leads to waste and even corruption. Furthermore, *municipal experts cannot be secured by popular election.*

The City Manager as Single Executive Officer

The city-manager plan does away with this five-headedness of municipal administration and substitutes a single head, not with advisory powers merely, but, subject to certain safeguards, with the powers of administrative "life and death," through actual control of appointments and removals.

The chief executive or city manager is not an elective officer, but is appointed by the council. He therefore does not divide responsibility with the council, but is subordinate to it. He need not be, at the time of his appointment, a resident of the city, but may be chosen from anywhere in the country. He is not chosen for a definite term, but holds office so long as he gives satisfaction to his superiors.

The controlled-executive plan filters everything through a group. It reduces the personal equation. Without loss of administrative unity, it abolishes one-man power. A single man may have his ups and downs, his freaks and fancies, his militant points and his passive ones, his natural bents and moods, his pet departments and projects. A board, or commission, or council, or parliament, has none of these things—to a group such excesses are relatively impossible. Even if all the members were cranks, their combined judgment would be reliable—they would neutralize each other.

This plan corresponds to the general manager under the board of directors in a business corporation. It gives the stability of the combined judgment of many men on matters of policy, but leaves execution to a single-headed controlled executive establishment.

For the highest efficiency we must put the chief administrative official, as well as subordinate officials of the same sort, on a professional basis. This means simply that we must leave his selection and his indefinite retention to some person or body that is in a position to examine his work closely and therefore judge of it intelligently, and that we must also take the matter out of politics, not by incessantly harping on the desirability of doing so, but by relieving him of all except purely administrative duties. That is not saying, you will notice,

*City Manager and City Engineer, Inglewood, Calif.

to mean anything, that "the people cannot be trusted to choose" the chief administrator. It is implying merely that they are not in a position to do so to advantage, and that if the official in question is given the veto and other policy-determining functions, neither the people nor anybody else can be expected, no matter how well they realize the advantage of experience in administrative work, to do anything but oust him as often as his opinions are not in conformity with those of the majority.

We are confronted with the question: From what profession or calling shall this important position of city manager be filled? My answer is, that the city manager should be a civil engineer, with municipal-engineering experience; who should also possess the additional qualifications of an economist, a financier, and have executive ability.

What other profession has men who are better qualified as municipal experts than the engineering profession? Are not the members of the engineering profession, in the course of their education, field work and research work, peculiarly qualified for executive duty developed by their training and experience? Engineering is perhaps as much a matter of common sense as of education, and the engineer, to succeed, must have both. Therefore, a capacity to get at the facts in any case, supplemented by good judgment, are predominating traits, characterizing this profession more prominently as essentials than is the case with any other profession or calling.

The City Manager of Inglewood, Calif.

The board of trustees of the city of Inglewood followed the very rational plan of appointing their city engineer, the writer, as city manager, he having served the city in the capacity of city engineer for two years. In the ordinance passed by the board creating this new position, practically all of the executive and administrative powers of the trustees are delegated to the city manager, and they have given him their personal assurance of their loyalty in anything he might undertake to perfect the organization and place the affairs of the city on a business basis.

The ordinance was passed on Mar. 2, and legally did not take effect until 30 days thereafter, but the board deemed it necessary that I be appointed and assume the duties of city manager at once. This procedure naturally caught me unprepared. However, I made the best of the situation, and began immediately to formulate plans.

My ideals as a basis upon which to erect the superstructure of my organization were efficiency and economy. In order that my administration should be successful, I was compelled to strictly adhere to my ideals and, in consequence thereof, I was obliged to make quite a few changes in the organization of several departments. On account of having been city engineer, I was familiar in a general way with the weaknesses of the various departments, and in order that they be corrected, I determined that the requisites of all employees should be efficiency, economy, loyalty and honesty, and that employees who possessed these qualifications should be retained, regardless of their political faith.

With the requisites thus set forth, a few dismissals were necessary, as this city, like many others, was not without political officeholders who held positions regardless of their qualifications or fitness.

I will not attempt to describe the reasons for the dismissals, but I wish to state that if any of my fellow-engineers ever receive the appointment of a city-managership, and they are obliged to dismiss employees, they need not be discouraged by threats and wild epithets being hurled at them by "political bosses," and their followers, since this is a natural procedure in the course of uncovering the "efficient" and "economical" work of their "pets." There is an erroneous impression grounded in the minds of so many municipal employees that they are not required to do as much work as for a private corporation; that they need not take any particular interest in the work; that working hours need not be observed; that they can take a leave of absence of a few hours every now and then, without consulting the head of the department, and at the same time be entitled to full wages; that they need not be courteous and accommodating to the public; that they can waste materials or supplies because the city pays for them. They labor under the pretext of the old political saying "to the victor belongs the spoils," and are therefore justly entitled to be given employment, and to do whatever they please, irrespective of the quality or quantity of the work performed, or of their value and worth to their employers, or interest taken in the business affairs of the city.

Specific Achievements at Inglewood

The following is a brief summary of some of the important movements undertaken and changes made in the various departments of Inglewood:

1. The removal of inefficient and incompetent men from the city service.
2. Requiring all employees to obtain an order, signed by the city manager, for the purchase of machinery, tools, supplies, materials, etc.
3. Accounting system installed and providing balance sheets of all accounts.
4. Limiting all city departments to a limited expenditure, and providing for an emergency fund, all within the actual revenues of the city.
5. Monthly detailed reports from each department.
6. Installation of unit-cost system, where practical in all departments.
7. Enlarging and defining the duties and powers of the Park Commission to exercise control and supervision of all parks and street tree planting, and of beautifying the street and avenue parkways by the formation of assessment districts to pay the costs and expenses thereof.
8. Arranged with electric light and telephone companies to have poles removed from streets and avenues into alleys.
9. An Ordinance prohibiting the trimming of street trees by property owners, and delegating these duties to the park commission and prohibiting the destruction of shade or ornamental trees, shrubs and flowers, and prescribing penalties therefor.
10. A Resolution providing for the removal of weeds from street parkways at the expense of the property owners.
11. Commission Appointed to Revise Building Ordinance.
12. Commission, composed of five members, one each from Grammar School Trustees, School Teachers, Parent-Teachers Association, Women's Club and City Manager, to arrange for the improvement and beautifying of school grounds.
13. Providing more convenient and enlarged quarters for the Public Library.
14. Establishing more stringent rules and regulations governing the care of buildings and equipment in the Fire Department.
15. Increased the efficiency of the Building, Plumbing and Electrical Inspection Department, and placed it on a revenue-producing basis.
16. Motorcycle officer ordered to strictly enforce ordinances pertaining to speeding on boulevards, and prohibiting heavy hauling on certain avenues.

17. Arrangement made with Fire Engineer to coöperate with City Marshal' department to receive calls for his department, thereby greatly increasing the efficiency of the Police Department.
18. Consolidating the City Engineer's and Street Superintendent's office, which heretofore were entirely separated; the City Engineer having had charge of all new improvements, while the Street Superintendent had charge of the maintenance and repairs.

FIG. 1. MOVING LARGE STEEL GRAIN TANKS AT CHICAGO

(Each tank is cut in two. The upper part is raised by the gallows frame while the lower part is moved out on rollers. Then the upper part is lowered and moved out in the same way.)

19. The removal of incompetent, inexperienced men from the service of the street department, and placing competent, experienced and able-bodied young men in their places, reducing the force to half the number.
20. Systematizing the work of the Street Repair and Maintenance Department, and establishing a unit-cost system for the various classes of street work.
21. Provision for a material supply yard adjacent to Railroad, and the housing of roller, graders and other implements.
22. Movement under way to require all public-utility corporations to take out permits for all street excavations, and requiring a deposit with street superintendent, an amount sufficient to cover the expense of replacing street surfaces to the original condition. Said work to be performed by the street superintendent.
23. The collection of rubbish and garbage.
24. Placing of receptacles for paper, rubbish, etc., along the principal streets of the city.
25. Effected the coöperation of the Police Department with the Health Department in enforcing quarantine ordinances and the strict enforcement of all ordinances pertaining to the health of the citizens and cleanliness of premises.
26. Compelling all employees to observe the following working hours; 8 a.m. to 12 m. and from 1 to 5 p.m.
27. Permission must be obtained from the heads of department before any employee is permitted to leave his regular duties.
28. Requiring an inventory of all office furniture, fixtures, supplies, machinery, tools, material, etc., to be submitted to the city manager.

The ordinance creating the city managership in Inglewood, defines his duties and powers, and gives him authority to exercise control over all departments, but expressly excepts the legal department from the operation of the ordinance. In my opinion, based upon past experiences, this is a serious defect. The city attorney should be under the control of the manager, because there is not a single department in any city which causes more delays in public-improvement proceedings than the legal department. These delays are a handicap to the engineering department, oftentimes proving to be an additional expense, which could have been avoided if the city manager exercised control of that department.

Moving Large Steel Grain Tanks

The moving of large steel storage tanks a distance of about five miles is interesting work in connection with the removal of the Albert Dickinson Co., seed merchants, of Chicago, to a new plant at Washtenaw Ave. and 35th St. near the Drainage Canal. The old plant was at Taylor St. and the Chicago River, but the site is being cleared for the new terminal work of the Pennsylvania Lines. The equipment included 22 steel storage tanks 60 and 40 ft. high and 30 and 40 ft. in diameter, weighing 40 to 50 tons each. As these were in good condition it was desired to move them to the new plant. The tanks are covered with conical tops supported on light radial trusses.

The method adopted was as follows: A timber gallows frame was built, large enough to straddle a 60-ft. tank, and having two sets of hoisting tackle on the crossbeam. This was set up over a tank, and the hoisting hooks attached to two sling plates bolted to the top of the tank, as shown in Fig. 1. The rivets of the middle circular seam were then cut out by hand, and the upper half of the tank was lifted by the tackle. Then the lower half was raised by jacks sufficiently to allow of placing under it four heavy timbers, with blocking and wedges to support it at various points. Under this supporting frame were

FIG. 2. THREE SECTIONS OF TANKS ON A SCOW, READY FOR UNLOADING AT THE NEW SITE

two lines of timbers with planking, forming roller runways for the wooden rollers used in moving buildings.

The lower section of the tank was then hauled out by a hoisting engine, the block of the hauling rope being hooked to a bridle attached to the two side timbers of the supporting frame. A similar frame was then built and the upper section of the tank lowered upon it. These frames remained under the tanks throughout their removal. Each section of tank was held in shape by an interior frame of four timbers, with blocking between these

and the tank shell, there were also interior ties of wire cable attached to threaded rods which passed through rivet holes and were secured by nuts.

A double-track roller runway was built through the yard to the river bank, and the tank sections hauled on this and onto a large deck scow, the scow holding three sections, as shown in Fig. 2. The scow was then towed down the river and the Drainage Canal to a point near the new plant. A roller runway, supported on piers of blocking, was extended from the deck to the bank, and the tanks were hauled off by a horse winch. The final disposition has not been decided. They may be erected on a site adjacent to the canal, or they may be moved to the site occupied by the rest of the plant. In the latter case, they will have to be raised and transferred across two railway embankments and a small canal.

This work was undertaken by the John Eichleay, Jr., Co., of Pittsburgh, Penn., which makes a specialty of moving houses and other structures. They state that the tanks could have been moved without cutting them apart but for the large number of electric wires and cables strung along the drainage canal. The river trip was somewhat slow, as there were 17 bridges to pass (including a four-track bascule bridge with each section operated independently). The Western Ave. swing bridge over the canal has no operating machinery, and had to be operated by the tugs, which cast loose the scow and hitched their tow lines to chains hanging from the ends of the adjoining bridge.

A Hydraulic Sand-Mining Plant

By R. A. Boehringer*

Between Lewistown, Penn., on the east and Huntingdon on the west, the Juniata River cuts through sandstone ridges, which run approximately north and south. These ridges, between the Blue Mountains on the east and the Allegheny Mountains on the west, consist mainly of silicon dioxide, which finds extensive application in the manufacture of glass of all kinds, fine plaster, crucible steel, fire brick, by railways for use on slippery rails, and in the purification and filtration of chemicals and water.

The ridges occur in the form of sand rock, which is both quarried and mined by a number of different companies for the manufacture of sand. The total output of commercial sand from the companies in this locality is about 1500 tons daily. The largest of these companies is the Pennsylvania Glass Sand Co., and this concern has installed a hydraulic sand plant near Vineyard, Penn., which is unique in this part of the country.

The buildings of the new works are located at the foot of a steep hill, with the quarry about 100 ft. vertically above. Across a small ravine above the quarry a masonry and concrete dam has been built, forming a reservoir of 500,000 gal. capacity, which distributes water to the

*Division Engineer, Water Supply Commission of Pennsylvania, Harrisburg, Penn.

General View of Hydraulic Sand-Mining Plant, Vineyard, Penn.

[illegible] the Juniata River [illegible]

monitor, the quarry, the sand-washing machines and the boilers.

In the operation of the quarry, the general method of procedure at first was to use the hydraulic process when there was sufficient soft material encountered, and to blast the rock when the stream from the monitor was unable to supply sand to the washing machines. In this way, it was found that about 50% of the average daily output of 125 tons of sand could be produced hydraulically. Later experience has shown that except where it is necessary to loosen ledges of the harder rock with dynamite, blasting is no longer required, and it has been superseded by the hydraulic method.

A 6-in. pipe is laid to the middle of the quarry floor, to which a 6 to 7/8-in. monitor is attached. The monitor is detachable, so that it will not be injured when blasting. The monitor plays upon the face and floor of the quarry, loosening and bringing large blocks of rock to the floor, and washing the loose sand and small stones into the opening of a trough at the lower end of the quarry, toward which the floor slopes.

On account of the trouble in fastening and unfastening the monitor, a 2½-in. fire hose with a ¾-in. nozzle is now used most of the time, and is fastened on taps on the pipe line which encircles the quarry. With one man at the hose and one to keep the troughs clear, they can deliver to the reduction house from 25 to 40 tons of sand per hour. An exploration drift shows that the material becomes better and is more easily mined hydraulically as the hillside is washed back farther.

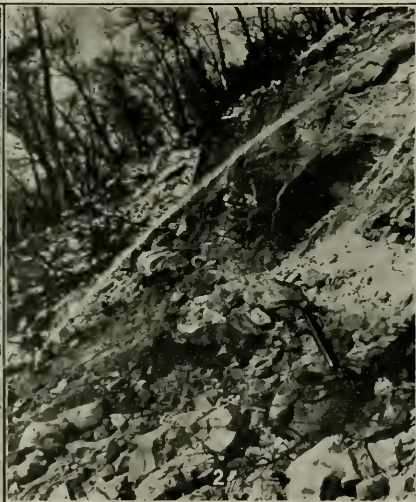
The sand and water are carried in a 10x12-in. flume 50 ft. to the reduction house, where it enters a revolving screen. This is a double screen, with a ½-in. mesh on the inside and a 12-in. mesh of No. 20 wire on the outside. The function of the inside screen is to receive the raw material, screen out the sticks and twigs which come from the thick forest cover of the quarry, and to take out the small stones, which are wasted. This waste, however, amounts to very little.

From the revolving screen the sand is shot through a short trough direct to the washing machines. These machines consist of an inclined box with four alternating screws and troughs. The sand comes from the revolving screen into one end of the washing machine. A screw, working in the machine, carries the wet sand to the top of the inclined box, where a jet of water plays on the sand, washing it down a trough, beside and parallel to the screw, to the bottom of the box. Here a second screw carries the wet sand to the top of the box, where a second jet washes the sand down a second trough to the bottom of the box. This operation is repeated in the third screw and trough, after which a fourth screw carries the clean sand to the top of the inclined washer, where the sand is dropped off on a belt conveyor and carried to huge piles, where the water is allowed to drain off before shipping the sand.

The large blocks of rock in the quarry are blasted and broken up, loaded into dump cars on narrow-gage tracks, and pushed by the quarrymen to a rock crusher in the reduction house. Leaving the rock crusher, the stone is further ground up in a revolving mill, from which it passes into a revolving screen. From the screen, stones which escaped crushing are returned to the grinding mill, while the sand drops into washers similar to those which clean that brought to the reduction house by the hydraulic process.

After the crusher sand leaves the washers, it is carried by a belt conveyor, working on V-shaped rollers, to the drain and dry building, where it is dumped into great piles, where the water is permitted to drain off. When the sand is dropped from the conveyors, it contains from 25 to 28% of water; after standing 48 hours, it still contains about 12%.

The drain and dry house has a storage capacity of 3600 to 3800 tons of sand. The storage space occupies the middle and one side of the building, while the other side is occupied by the dryers. The latter consist of a brick prism filled with steam pipes. The top is open to



Figs. 1 and 2. Typical Parts of Quarry Face

Fig. 3. Flume to Plant

[illegible] the wet sand, while the bottom is V shaped, with a [illegible] traversing the length of the dryer at the bottom of the open V.

Between the storage space and the dryer is a concrete wall on which a traveling bucket-conveyor is mounted to take the sand from the drain piles to the dryers. The buckets are loaded by hand, and with the exception of the work done in the quarry and in placing the finished sand in box cars, this is the only place where the sand is handled. In the drain and dry building, however, provision has been made for the future installation of a traveling crane operating a grab bucket, which will be used in moving the wet sand from the piles into the dryers.

From the dryers the sand will be carried by a belt and a bucket conveyor to a 20-mesh screen near the top of a 57-ft. tower, where the pebbles are separated from the fine sand. From this screen the finished product will be carried by a short bucket conveyor to large bins in the top of the tower, from which it can be shot straight down into cars on a side track below.

NEWS NOTES

A Covered Wooden Bridge Burned on the Schuylkill & Lehigh Division of the Philadelphia & Reading Ry., near Kempton, on July 30.

Two Houses Collapsed. Undermining from an adjoining cellar excavation caused a house, in Toronto, Ont., to collapse, on July 23.

A house in Evansville, Ind., collapsed, on July 28, while being wrecked.

A Derrick Car Turned Over on the western viaduct approach of the Hell Gate Bridge of the New York Connecting Railway, at E. 142d St., the Bronx, on Aug. 1, killing one man. The derrick was used for erecting steelwork. Its capacity was [illegible] tons.

The Supports of an Old Timber Bridge Failed at Branford, Conn., on July [illegible] under the weight of a cartload of [illegible]. Although the bridge settled, the flooring was firm enough to permit the cart to proceed safely to the road beyond. A number of boys sitting on the rail, fishing, were [illegible].

A Timber Bridge Collapsed under the weight of a wagon-load of [illegible], at [illegible], on July 21, injuring the driver. The length of the bridge was about 17 ft.

On July [illegible], near [illegible], Kan., a county bridge over the [illegible] River fell under the weight of a milk wagon. The bridge was about [illegible] ft. long.

A Disastrous Wreck Occurred at Tipton Ford, Mo., on [illegible], when a Kansas City Southern Ry. passenger train and a [illegible] motor car met in a butting collision, [illegible] [illegible]. Press dispatches state that the car had orders to wait at a point [illegible] of Tipton Ford, but the orders were [illegible]. [illegible]

Another Timber Pier Fire [illegible]

[illegible] ons were injured. Included in the fire damage is the damage to stored freight, which was in the warehouse. The Pacific Alaska Navigation Company's steamship "Admiral Farragut" was lying alongside the Grand Trunk pier waiting to sail for San Francisco when the fire started. The liner, which had all her cargo and most of her baggage aboard, cast loose and escaped damage. The fire started near the river end of the pier and spread toward the shore. As is common in pier fires it was most difficult to fight.

From Gen. H. M. Chittenden, Port Commissioner of Seattle, we have had the following word:

"The present slips are altogether too narrow and business has been seriously handicapped on that account. Although it is rumored that the Grand Trunk Pacific is to rebuild its pier in concrete, what should be done is that the port district should take over the Grand Trunk and the Coleman piers and rebuild as one pier, thus doing away with the narrow intermediate slip. It is quite possible, however, that the city will hesitate on account of the heavy cost. The new port district wharves are of timber, sprinkler protected, with the warehouses and other structures of concrete. With proper fire measures and reasonable precautions such structures need not be so dangerous as is commonly supposed. Whether in a particular case the fire risk justifies the heavy extra cost of concrete work must be decided by the circumstances. Certainly no hard and fast rule is possible, and there is no justification of unnecessary financial sacrifice simply to meet more effectually one feature of construction and use."

The Pathfinder Reservoir of the North Platte Project (Nebraska-Wyoming) of the United States Reclamation Service was filled for the first time in June, 1914. On June 27 the storage amounted to about 1,085,000 acre-feet and water to a depth of 0.9 ft. was running over the spillway.

Water Deferrization and Demanganation at Lowell, Mass., in accordance with the scheme outlined in our issue of July 9, 1914 (p. 107), has been authorized by the city council. An appropriation of $190,000 for the work has been made. Robert J. Thomas is Superintendent of Water-Works at Lowell.

The "Adamson Bill" amending the "General Dam Act" of Congress (as approved June 21, 1906, and amended June 23, 1910) passed the House, Aug. 1. It was read twice in the Senate, Aug. 5, and referred to the Committee on Commerce. This is the administration measure to facilitate and regulate the development of water power on navigable streams.

The Snoqualmie Tunnel of the Chicago, Milwaukee & St. Paul Ry. through the Cascade Mountains was holed through on Aug. 1. The tunnel ranks among the very long railway tunnels in the United States, having a total length of about 12,000 ft. It reduces the summit level of the line crossing the range 413 ft., saving also 4 miles in distance, while the line which will be abandoned was subject to heavy snowslides.

Freight Transportation on an Inland Waterway Route is being developed by the Chicago, St. Louis & Gulf Transportation Co. on the Illinois & Michigan Canal [illegible] freight from Chicago and vicinity to points on the Illinois and Mississippi Rivers. In order to bring freight to the waterway its promoters have made surveys for a terminal railway from La Salle, Ill., to Oglesby, connecting a number of large cement plants and manufacturing establishments. An interurban railway from La Salle to [illegible], Ill., is also proposed.

Commercial Opening of Panama Canal. The Secretary of War has announced that the Panama Canal will be opened to traffic on Saturday, Aug. 15, to vessels drawing not to exceed 30 ft. of water. This stipulation is made because of the conditions at Cucaracha slide, which, although greatly improved, would not admit of the passage of vessels with absolute safety drawing a greater depth of water. This restriction, however, probably does not affect any vessel now using the Panama route regularly, either in the Atlantic or Pacific.—"The Canal Record."

Use of Streets for Construction Purposes. The blocking of a street adjacent to a building under construction by the storage of construction materials, etc., was prohibited by ordinance at Houston, Tex., on July [illegible]. It is now required that the contractor secure from the city engineer a permit for the use of a portion of the street. [illegible] the walk can be used on only one adjoining street, to be designated by the city engineer. As soon as the building material can be placed inside the new structure, the city engineer has the power to revoke the permit. The penalty for violation is a fine of not less than [illegible] per day, [illegible] [illegible] will forfeit the right to obtain permits thereafter.

A Railway Tunnel five miles in length under the Jura Mountain range in Northern Switzerland was holed through on July 10. The work of construction is described in "The Engineer," London, of July 24. The tunnel is located about two miles south of Basel, on the German frontier of Switzerland. The old line from Basel south to Olten, which also has a tunnel about 1½ mi. long, has long grades of 2.6% and a much higher summit level than the new line built to pass through the new 5-mi. tunnel. The new tunnel is built for double track and is lined throughout, concrete having been used in most places. Work upon the tunnel was begun Feb. 1, 1912, and the contract date for completion was Jan. 13, 1915. The contract price was £792,709, with a bonus of $60 a day for each day's advance in the completion of the work.

Applications for the City Managership of Bristol, Va., are wanted. The facts in the case are thus stated in a letter to this journal, written by John H. Gose, City Clerk.

The city of Bristol, Va., is considering the employment of a competent man, with experience in engineering, to act under the supervision of the City Council as Executive Manager for the city, to perform the duties of street and water commissioner, have charge of all construction and repair work, the employment of all labor in these departments, and to purchase all supplies and material under the supervision of the Purchasing Committee of the Council. Salary per month will likely be fixed at $125 or upward. Applicants will please state age, ability to handle labor and an outline of the various positions held and the length of time in each, as far as practicable, and furnish such recommendations as they may desire. Also state salary expected.

Applications for the position should be addressed to John H. Gose, City Clerk, Bristol, Va.

Statistics of the World's Merchant Marine, made public by the Department of Commerce on Aug. 8, are of special interest in view of the probability that the European war will compel the United States to embark largely in ocean shipping. The merchant ships of the world aggregate 47,000,000 gross tons, of which 40% belong to Great Britain, 11% to the United States, 11% to Germany, 5% each to Norway and France, 3% each to Holland, Italy and Japan. While the United States is second only to Great Britain in volume of shipping, the great bulk of its ships are engaged in the lake and coasting trade, the total so engaged being 9,800,000 tons, while our total shipping in foreign trade is only 1,027,000 tons. It is of interest to note further that while the total capacity of the world's merchant shipping has doubled in the past twenty years, the number of vessels employed is about the same as twenty years ago, indicating that the average tonnage of merchant vessels has doubled in that time.

A New Steel Bridge with Concrete Floor Was Moved late position recently, on the Lehigh Valley R. R. at Wende, N. Y. (Erie County), replacing a lighter structure. The work was quickly performed. F. E. Schall, Bridge Engineer of the railroad, provides the following data:

The bridge is a double-track deck plate-girder bridge 98 ft. long, consisting of four girders, reinforced-concrete floor, waterproofing, brick waterproofing protection, stone ballast and track. The reinforced-concrete floor is supported upon I-beam cross girders resting on top of the plate girders, each track separate.

The new bridge was erected to the north of the old bridge, all complete, including the steelwork, concrete floor, ballast and track. After the proper seasoning of the concrete, the girders between the two tracks were blocked to form a unit laterally, for movement.

The tracks were cut and the old bridge rolled southward on timber bents; then the new bridge was rolled into position, both tracks simultaneously.

The weight of the steelwork including reinforcement steel is 521,000 lb., the weight of the concrete, waterproofing and protection, stone ballast and track is about 850,000 lb., a total of 1,371,000 lb. or 685½ net tons.

The Largest Diesel Oil Engine yet built in America is said to be one just shipped by the Lyons Atlas Co. of Indianapolis. It is rated at 600 b.hp. with an overload capacity of 15% with an 890-b.hp. maximum. It is a vertical four-stroke cycle engine with cylinders 21x30 in. and has been shipped to the Hawaiian Commercial & Sugar Co. to supersede a steam plant for pumping water for irrigation. The engine is direct-connected to a two-stage turbine pump capable of delivering 15,000,000 gal. of water per day under 200-ft. head. The builders have furnished the following statement as to the conditions under which the engine was built and the tests to which it was subjected:

"The purchaser required that the engine should operate continuously 710 hours out of each 720 hours per month at rated load, using the ordinary 14% to 18% asphaltum-base California fuel oil, similar to that used in the purchaser's steam plant, and which is the only grade available on the Islands.

"The test was conducted by the chief engineer of the Hawaiian Commercial & Sugar Co., and the engine was given a preliminary, continuous run of 48 hours with eastern paraffin-base fuel after which all parts connected with the combustion chambers were inspected in order to determine a basis for comparison between the effect of the two fuels. It was then subjected to a 144-hour continuous run at full load with fuel shipped by the purchaser from California to the manufacturer's works. At the completion of this run the combustion chambers were again examined, and as there was no evidence of deposit on the heads, valves or pistons, the engine was accepted and is now en route to the Islands, to be erected by their own engineers without any assistance from the manufacturer."

A Report to the Dayton Flood Prevention Committee, of Dayton, Ohio, has been published. The report was made by a Special Board of Consulting Engineers of eight members, and approves the plans for the proposed Miami Conservancy District made by the Morgan Engineering Co., of Memphis, Tenn., and Dayton, Ohio. The original intention was to submit the report to the Conservancy Court created to pass on the petition for the establishment of the proposed district, but litigation having postponed the hearing indefinitely, it was decided to publish the report without further delay.

The eight members of the Special Board of Consulting Engineers were: Gen. O. H. Ernst, Washington, D. C.; J. A. Ockerson, St. Louis, Mo.; Gen. H. M. Chittenden, Seattle, Wash.; T. W. Jaycox, Denver, Colo.; J. H. Fuertes, New York City; W. A. O'Brien, Cape Girardeau, Mo.; Charles H. Miller, Little Rock, Ark.; and Morris Knowles, Pittsburgh, Penn. The report is 20 printed pages in length. It reviews briefly flood conditions in the Great Miami Valley in general and the 1913 flood in particular, and considers possible remedial measures. The Board concluded that protection by channel improvement for the entire river would cost about $100,000,000 against $18,000,000-$20,000,000 for detention basins and limited channel improvements, and that the maintenance cost would be correspondingly heavy and light, respectively. The final opinion of the board was as follows:

(1) That floods as great as that of 1913, and even greater, are liable to occur at any time, and preventive measures should be carried out which will control floods about 20% greater than that of 1913.

(2) That permanent flood protection for the Miami Valley by means of channel enlargement alone is impracticable.

(3) That detention basins, supplemented by limited channel improvement, do offer a satisfactory solution of the problem.

(4) That the success of such plan for flood control requires that the flooded area of the Miami Valley above the Whitewater River be considered as a unit.

(5) That the works of the type suggested, properly designed, located, and constructed, will not only provide satisfactory and economical protection from floods, but they will be so massive and substantial as to fully justify confidence in their integrity, and satisfy every reasonable question of stability.

It may be added that the plans here passed upon were made under the immediate direction of Arthur E. Morgan, of the Morgan Engineering Co., with the advice of the following consulting board: John W. Alvord, of Chicago; Prof. Daniel W. Mead, of Madison, Wis., and Chicago, and Prof. S. M. Woodward, of Iowa City, Iowa.

PERSONALS

Mr. R. A. Baldwin has been appointed Engineer of Maintenance-of-way of the Ontario grand division of the Canadian Northern Ry., Eastern lines, with headquarters at Toronto, Ont.

Mr. Jesse K. Giesey, Assoc. M. Am. Soc. C. E., Assistant Engineer of Hering & Gregory, Consulting Engineers, New York City, has resigned to take charge of sewer work in York, Penn.

Mr. E. C. Deal has been appointed Vice-President and Chief Engineer of the Carolina & Yadkin River Ry., with headquarters at Greensboro, N. C., succeeding Mr. J. P. Clark, resigned.

Mr. William A. Hansell, Jr., M. Am. Soc. C. E., formerly with the city engineering department of Atlanta, Ga., has been elected Superintendent of Public Works of Fulton County, Ga.

Mr. J. D. Evans, formerly Chief Engineer of the Central Ontario Ry., at Trenton, Ont., has been appointed Division Engineer of the Ottawa division of the Canadian Northern Ry., with headquarters at Ottawa, Ont.

Mr. G. F. Stickney, M. Am. Soc. C. E., Supervising Engineer

of the New York State Barge Canal, Albany, N. Y., has been granted three months' leave of absence to go to Pittsburgh, Penn., to make the preliminary estimates and plans for the Ohio & Lake Erie Canal. The work will take about three months.

Mr Arthur F Ballou has resigned as Superintendent of the Providence, R. I., Water-Works Department, to become connected with the National Board of Fire Underwriters. He is succeeded as Superintendent by Mr Carleton Scott, Assistant Engineer, City Engineer's Office of Providence.

Mr William J Hazeltine has been appointed City Engineer of Mansfield, Ohio, succeeding Mr Emmet Merkel, resigned. Mr Hazeltine is an engineering graduate of the Ohio Northern University, class of 1911, and has had some street and road experience in New York and New Jersey.

Mr W C Schade has been appointed General Manager of the Phoenix Iron Works Co., Meadville, Penn., effective Aug 15. Mr Schade resigned as President of the Cherry Tree Iron Co., Cherry Tree, Penn., last February, but his resignation was not accepted owing to the inability of the company to find a suitable successor.

Mr Charles O Tappen has resigned as Chief Engineer of the Northern Power Co and the Hannawa Falls Water Power Co., Potsdam, N. Y., and has opened an office as Consulting and Constructing Engineer, 2 Rector St., New York City, specializing in hydro-electric power, transmission, public utilities engineering, valuation and appraisal work.

General Joseph Joffre, Commander-in-Chief of the French Army in the present European War, is a notable civil engineer. He is a graduate of the École Polytechnique, Paris, France. He saw much of his early service with the engineer corps and has had charge of railway construction in West Africa and harbor work in Madagascar.

Mr Othmar Hermann Ammann, M Am Soc C E, Assistant Chief Engineer of the New York Connecting R.R., which is building the Hell Gate steel arch bridge, is among the foreign army reserve officers who have been called back to their native countries. Mr Ammann is a reserve officer in the Swiss Army and has returned to Switzerland to offer his services.

Lord Horatio Herbert Kitchener, the new head of the English War Office, is an engineer by education and experience as well as a soldier. Lord Kitchener is a graduate of the Royal Military Academy at Woolwich, and entered the Royal Engineers in 1871. Between 1874 to 1882 he had charge of extensive survey work in Palestine and the island of Cyprus. For several years he was head of the Royal Engineers.

Mr A J Hills, former Superintendent of the Canadian Northern Ry., at Toronto, Ont., has been promoted to be General Superintendent of the Ontario grand division of the Canadian Northern Ry., Eastern lines, in charge of operation, maintenance-of-way and motive power, with headquarters at Toronto, Ont. Mr Hills is an engineering graduate of the University of Toronto, and for several years following his graduation in [illegible] he was with the construction department of the Canadian Northern Ry. at Winnipeg, Man.

Mr Frederic A Delano, M Am Soc C E, former President of the Wabash R.R., now President of the Chicago, Indianapolis & Louisville Ry., has been appointed a member of the Federal Reserve Board. Mr Delano is also a member of the Government Commission on Industrial Relations, to which he was appointed by President Taft. He takes the place on the Federal Reserve Board made vacant by the withdrawal of Mr Thomas D Jones. Mr Delano is a well known writer on railway and transportation problems, and is a civil and mechanical engineer of many years' experience. He was born in Hong Kong, China, in 1863, but spent most of his boyhood years at Newburgh, N. Y., where he prepared for Harvard College. Mr Delano graduated at Harvard in 1885 and the following summer joined a survey party of the Chicago, Burlington & Quincy R.R. in Colorado. In the fall of that year he became a machinist apprentice at the shops of the railway at Aurora, Ill. Two years later he was placed in charge of the bureau of steel rail inspection tests and records. After a year as Assistant to the Second Vice-President, he was appointed Superintendent of Freight Terminals at Chicago, Ill., where he remained for nine years. Later he was Superintendent of Motive Power and, from 1901 to 1905, was General Manager. For a few weeks in 1905 he was Consulting Engineer to the United States War Department and the Philippine Commission, after which he returned to the railway service as Vice-President of the Wabash R.R. He was elected President in 1911; later he was Receiver. He was elected President of the Chicago, Indianapolis & Louisville Ry. in the latter part of 1913.

Regarding his recent nomination to the Federal Reserve Board, Mr Delano is quoted by a New York "Times" correspondent as follows:

If President Wilson should nominate me, and my nomination were confirmed by the Senate without quibbling, I should feel it my duty to accept. I neither want the place nor have I sought it, and I certainly could not take it if my record were not such as to warrant my confirmation without a personal examination. But if I am appointed without any solicitation on my part, I shall accept it, as I believe it would be my duty to do so.

OBITUARY

William Barstow Strong, former President of the Atchison, Topeka & Santa Fé Ry., died Aug. 3. He was born in Vermont in 1837.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.
Aug. 20-21. Annual meeting in New York City. Secy., E. H. Harman, Room 101, Union Station, St. Louis, Mo.

AMERICAN PEAT SOCIETY.
Aug. 20-22. Annual meeting at Duluth, Minn. Secy., Julius Bordollo, 17 Battery Place, New York City.

AMERICAN BOILER MANUFACTURERS' ASSOCIATION.
Sept. 1-4. Annual convention in New York City. Secy., J. D. Farasey, E. 37th St. and Erie Ry., Cleveland, Ohio.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 7-10. Annual meeting in New York City. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

AMERICAN FOUNDRYMEN'S ASSOCIATION.
Sept. 7-11. Annual meeting at Chicago, Ill. Secy., A. O. Backert, Cleveland, Ohio.

NATIONAL PAVING BRICK MANUFACTURERS' ASSOCIATION.
Sept. 9-11. Annual convention at Buffalo, N. Y. Secy., Will P. Blair, 832 B. of L. E. Building, Cleveland, Ohio.

NATIONAL ASSOCIATION OF PORT AUTHORITIES.
Sept. 8-10. Annual convention in Baltimore, Md. Secy., Wm. Joshua Barney, 29 Broadway, New York City.

ROADMASTERS AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.
Sept. 8-11. Annual meeting at Chicago, Ill. Secy., L. C. Ryan, Sterling, Ill.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.
Sept. 8-11. Annual convention in Nashville, Tenn. Secy., A. P. Dane, Reading, Mass.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 9-11. Annual convention in Boston, Mass. Secy., Willard Kent, Narragansett Pier, R. I.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Sept. 15-18. Convention in Atlantic City, N. J. Secy., Clayton W. Pike, Electrical Bureau, Philadelphia, Penn.

ILLUMINATING ENGINEERING SOCIETY.
Sept. 21-24. Annual convention in Cleveland, Ohio. Secy., Joseph D. Israel, 29 W. 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Sept. 22-24. Annual convention in Bluff Point, N. Y. Secy., C. C. Rosenberg, Times Building, Bethlehem, Penn.

American Society of Agricultural Engineers—The annual meeting of the Society will be held in Madison, Wis., Dec. 28-30. The preliminary program has just been issued. The Secretary is F. M. White, Madison, Wis.

American Road Congress—The Fourth American Road Congress will be held at Atlanta during the week of Nov. 9. State Highway Engineer Fletcher, of California, has been elected president and will preside at the opening session. One of the subjects for discussion is "Systematic Road Management," including the organization of working forces and the methods of reporting and recording work. This subject will be presented by Hon. Chas. J. Bennett, State Highway Commissioner of Connecticut. State Highway Engineer Keller, of Alabama, will deal with the subject of "Engineering Supervision." Among the various phases of construction and maintenance of all types of roads, the construction known as the sand-oil method, involving the use of a mixture of asphaltic oil and sand, will be thoroughly discussed. This type of road is in use in the Cape Cod region of Massachusetts and in the vicinity of Palm Beach, Fla. Fairfax Harrison, president of the Southern Ry., is scheduled to speak on the relation between the railroads and the wagon roads. The present headquarters of the Congress is in the offices of the American Highway Association, Colorado Building, Washington, D. C.

Engineering News

VOLUME 72 AUGUST 20, 1914 NUMBER 8

Great Northern Ry. Improvements at Seattle, Wash.

By E. E. Adams*

SYNOPSIS—The Great Northern Ry. line through the northern part of Seattle has been relocated and elevated and all street grade crossings eliminated. A new double-track steel bridge crosses Salmon Bay, and has a 200-ft. bascule span for the channel. The girder spans crossing streets have a concrete-slab deck with ballasted tracks. One of the channel piers was built in a timber crib sunk in place, and having the lower part of the concrete deposited by a tremie.

In connection with the improvement of the Great Northern Ry. between Everett and Seattle, Wash., the line within the city is being improved.† This work consists in replacing the old single-track line by a new double-track location at higher elevation, and building a new bridge over the Salmon Bay Waterway, which forms the west entrance to the U. S. Government canal connecting Puget Sound with Lake Washington. It was provided that : (1) all street crossings should be under or over the new grade; (2) the compensated grade should not exceed 0.1%, with curvature as light as possible; (3) the roadbed should be wide enough for four tracks. The location is shown in Fig. 2.

The city council granted the franchise in June, 1912, and a permit for the crossing of the waterway was secured from the U. S. Government. Construction was undertaken at once, and the work comprised three parts: (1) the new line from Metum (the station at the north city limits) to Interbay, at the head of the company's freight yards; (2) filling the trestles extending two miles from Interbay along the water front; (3) the bridge over Salmon Bay Waterway. The work was under the direction of the engineering department of the Great Northern Ry.: R. Budd, Chief Engineer (now Assistant to the President); Alex. Stewart, Assistant Chief Engineer; O. S. Bowen, Resident Engineer (now principal Assistant Engineer). The writer was Assistant Engineer during construction.

Fig. 1. New Bridge with 200-Ft. Double-Track Bascule Span over the Salmon Bay Waterway at Seattle, Wash.; Great Northern Ry.

(The girder spans at the ends of the bridge have a reinforced-concrete slab deck for ballasted track. The four girder spans nearest the channel have open-floor construction.)

Building the New Line

The work on the north section, from Metum to Salmon Bay, involved rebuilding 2½ miles of track on a new grade of 0.1%. The old track followed a sinuous alignment along the bottom of the high bluffs, and the relocation crossed and recrossed above it at heights up to 23 ft. As the old track was under continuous train movement, it was decided to divert traffic to a temporary track on a pile trestle, one mile long, along the shore; this was parallel to the new track location and along the line of the toe of slope of the new four-track embankment, Fig. 2.

The trestle served to carry traffic during the construction period, and served also as a temporary bulkhead to

†The railway terminals of Seattle were described and illustrated in "Engineering News," Aug. 8, 1912.—Ed.

*Assistant Engineer, Great Northern Ry., Seattle, Wash.

protect the earth embankment from being washed away. The temporary planking of this bulkhead trestle was later reinforced by about 40,000 cu.yd. of riprap rock. The location and grade of the trestle will be maintained and in future the tracks will serve docks and warehouses along this section of the waterfront. About 310,000 cu. yd. of hardpan and blue clay were moved by a steam shovel, 4-yd. side-dump cars, and small locomotives.

The south section of the line, from Salmon Bay to Interbay, was located through a sparsely settled section of the city, and followed the general contour of a broad flat side hill, the tracks being from 25 to 90 ft. below the surface. All of the streets which were not vacated and those which provide the best channels for street traffic will be carried over the tracks on bridges. In order to eliminate overhead bridges at street crossings not vacated, the railway purchased an additional strip of property and deeded to the city a street or boulevard 100 ft. wide and a mile long, near the top of the slope of the cut and parallel to the tracks. This is shown in Fig. 2 (Gilman Ave. extension), and will form part of a highway to the northwestern part of the city. For this new street, over 50,000 cu.yd. of earth were excavated and deposited on tide flats as filling for new freight yards and terminals.

part of the material excavated from the cut on the south section of the line revision was used in filling these trestles, where at high tide the water reaches a maximum depth of 27 ft. A bulkhead was constructed of piles, plank, brush and rock to retain the fill. About 100,000 lin.ft. of piling and 515,000 ft. b.m. of timber were used in the construction of the bulkhead, behind which 560,000 cu.yd. of earth fill was placed. The bulkhead was reinforced with 12,000 cords of brush and 90,000 cu.yd. of loose rock, delivered on scows from across the Sound. By filling the trestles, the railway company eliminated a heavy annual maintenance expense and reclaimed 16 acres of land.

Bridge over Salmon Bay

The double-track steel bridge crosses the Salmon Bay Waterway approximately 1000 ft. west of the entrance to the lock of the U. S. Government canal. The channel width is 150 ft., but as the bridge is on a skew (67° 37'), the bascule channel span is 200 ft. long c. to c. of bearings. The base of rail is 65.25 ft. above low water. The bridge, Fig. 1, is 1140 ft. long, with 725 ft. of double-track plate-girder spans; 235 ft. is open-deck construction and 490 ft. (over city streets) is the standard ballasted track section on reinforced-concrete deck slabs with

Fig. 2. Plan of Relocation of Great Northern Ry. at North End of Seattle, Wash.

As electric street-car tracks crossed the new line, the railway agreed to relocate these tracks on the new boulevard, which gave them a better grade and a more direct route, and avoided interference with the construction work. The street-car company has since secured a franchise for continuous operation at the new location.

Temporary bridges were constructed to accommodate street traffic over the cut. These were removed after the cut was completed to grade, and other bridges constructed at the streets which were not vacated. Over 1,250,000 cu.yd. of earth were excavated on the south section, of which 750,000 cu.yd. were taken from the cut for the new tracks. On account of the extreme depth of the cut, the steam shovels worked in tandem, one above the other. This eliminated the danger of slides and facilitated handling the cars. Standard railway equipment was used throughout this section of the work, and conveyed the excavated material from two to six miles through the terminal yards.

Filling the Tide Land Trestles

From Interbay the line follows the Seattle water front for over two miles on creosoted-pile trestles. The greater

curb walls (Fig. 1). The channel is crossed by a 200-ft. Strauss trunnion bascule span, with a 54-ft. girder span at the trunnion end (north), and a riveted-truss through span of 165 ft. at the south end. The steel girder approaches and the 165-ft. truss span were erected in advance of the bascule span, which was assembled and riveted in the open position (82°). This span is operated by two 100-hp. electric motors; it has also a 25-hp. gasoline engine for the gear auxiliary power, and emergency hand gear.

Bridge Substructure

The substructure comprises 17 piers and two abutments. Piers Nos. 1 to 6 were built first, and then Nos. 11 to 17. The piers in the waterway, Nos. 7 to 10, completed the third section. Borings indicated blue clay, with pockets of sand and gravel and traces of water; hence concrete piling was specified for the foundations of all land piers and timber piling for the waterway piers. Actual excavation, however, indicated that piling was not required, and all pier footings were redesigned for a total loading of 3 to 4 tons per sq.ft., actual soil tests being carried out for all piers.

The concrete was proportioned 1:3:6 for the footings, and 1:2½:5 for the batter and reinforced portions of the piers. Separate concrete plants were erected for construction of piers 1 to 7 on the south side, and piers 8 to 19 on the north side. In each case the sand and gravel were unloaded from scows and cars by a clam-shell bucket hoist, which delivered it to receiving bins, whence it ran by gravity to the mixers. The concrete was elevated in towers, and distributed by gravity through wood chutes to the different piers, except that for the piers at the extreme ends it was delivered by carts on elevated platforms.

The original specifications provided that the waterway piers should be constructed in open coffer-dams, but the bids on this feature showed that for Pier No. 7 (the pier carrying the truss span and the movable end of the bascule) a great saving could be made by using some other method. The method adopted consisted of preparing and sinking a timber crib for the base of the pier and depositing the concrete through a tremie up to an elevation of 4 ft. below low water. The crib was constructed in the water, floating at the site of its permanent location, where a dipper dredge had previously located the pocket for the pier base to a depth of 50 ft. below high water (7 ft. below the ultimate bottom of the canal).

The crib was 25x70 ft., and 53 ft. high. Extreme care was exercised in fastening the timbers so as to form one unit. It was divided into four sections with cross timbers spaced 4 to 6 ft. apart. The horizontal timbers were bolted to the vertical timbers which anchored the whole crib and provided against separation due to flotation. On account of a tidal range of 18 ft., it was difficult to keep the crib properly balanced and anchored; twice it tipped on its side and had to be righted.

The completed crib was sunk into place during low tide by loading it with steel rails placed in pockets or racks on the outside. On account of the slightly uneven bottom, the crib did not rest in a perpendicular position after being sunk, and as the cutting edge had no effect on the hard subsoil this was removed by a sea diver who succeeded in bringing the crib to within 6 in. of being truly perpendicular on the longitudinal axis.

The tremie was of heavy 10-in. wrought-iron flange-connected pipe, and was made in sections so that it could be shortened as the concrete mass increased in depth within the crib. The concrete was delivered to the tremie by a gravity chute, which greatly facilitated the work. A total of about 1100 cu.yd. of concrete was delivered to the crib in a continuous mix. The charge in the tremie was lost only when the tremie was lifted from one section of the crib to another. The concrete was made rich with cement (1:1.75:3.17), and the gravel aggregate was a fine grade. No coarse gravel was allowed and this seemed to result in a good steady flow through the tremie.

In order to dry the upper portion of the crib, clean the top concrete and prepare for the upper form work, the old method of inclosing the crib with canvas was used with success, after several other methods of calking the seams, etc., had been tried. After the canvas was placed around the crib, two centrifugal pumps (8 in. and 6 in.) kept the interior of the crib dry and the balance of the concrete was placed in the open. This pier is shown in Fig. 3.

The two smaller piers on the north side of the waterway (carrying the tower at the trunnion end of the bascule) were so located that a coffer-dam could be constructed around them and the work carried on in the open. Round piling constituted the outside and inside stiffeners. Wakefield sheet piling was then driven within this and tied with steel rods and the whole interior filled with earth. Within the dam, 4x8 in. sheet piling was driven to prevent the earth from sliding into the pier pits. The bracing was of 10x10-in. timbers, placed in tiers about 4 ft. apart as the excavation progressed.

At high tide, the water reached a maximum depth of about 27 ft., thus subjecting the dam to alternate stresses, which would not allow the core of the dam to become set or hardened. A very disastrous blowout occurred at one of these periods and the whole work within the dam was submerged. After the dam was repaired the excavation was retarded by the great amount of silt which had entered at the time of the blow-out. A unique method of

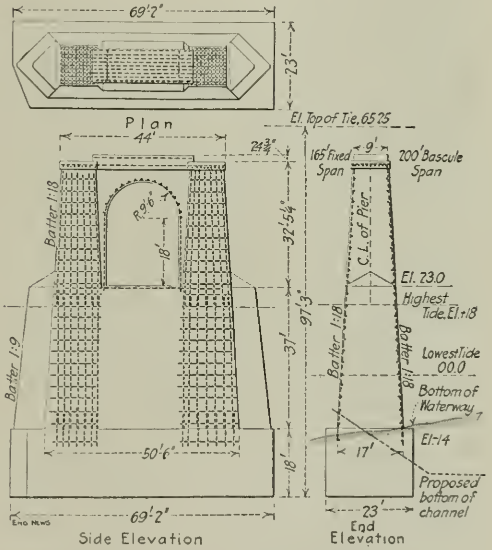


FIG. 3. REINFORCED-CONCRETE REST PIER OF THE BRIDGE OVER THE SALMON BAY WATERWAY; GREAT NORTHERN RY.

draining the water from the silt and mud consisted in sinking two wells on each side of the inside area. The water was then drawn from the wells by the centrifugal pumps and the excavation continued in the dry. At a depth of 50 ft. below high tide, the excavation was stopped, and the concrete was delivered through long wooden chutes to the forms built within the dam.

A total of 10,861 cu.yd. of concrete was placed in the substructure of the bridge, the railway company furnishing all the cement. A total of 17,888 cu.yd. of earth was excavated for the piers and abutments; 6065 yd. of this was included in the lump sum bid of preparing the three waterway piers for concrete, the balance being paid for as dry and wet excavation. The substructure was completed in 13 months by the Butler Construction Co., of Seattle.

Undergraduate Instruction in Highway Engineering

By T. R. Agg*

In attempting to outline collegiate work in highway engineering it is well to consider what kinds of things a graduate ought to know about highway work in order to become a useful member of the profession; and as many of these subjects deemed important should be taught as time and equipment will permit.

The conditions under which a college graduate will work when he first secures a position are exceedingly diverse in the various parts of the United States and the kind of specialized training in highway engineering that might fit a student admirably to take up the work in one state might not be so advantageous to him elsewhere. It would seem then that a training in highway work should first include those things which are of the nature of basic principles and generalities rather than those things which are matters of detail.

ETHICAL STANDARDS—The graduate should first of all realize that throughout his career he will deal with the public and with public officials. In his relation to the public he may become a leader or exemplar of the ideals of public service, which are economy and efficiency. He may drift along without giving offense to anybody and without accomplishing anything progressive; or he may ally himself with some political faction and conduct all work assigned to him in accordance with the well known principles of partisan politics rather than those of highway engineering.

No subject can be introduced into the technical training of the student that will have any particular bearing on the ethical standards which he sets up for himself. But the members of faculties have an unsurpassed opportunity to instill by personal contact the broad principles of professional integrity and a realization of the dignity and honor that may accrue from public service.

HIGHWAY ECONOMICS—The financing of highway and pavement construction involving as it does important economic principles, deserves a place in highway engineering instruction. Because of the ever increasing taxes which are levied for public improvements the time will come when engineers will be compelled to justify proposed expenditures by arguments which are economically sound. The choice of type of construction, the methods of financing and the extent of plan construction and maintenance are continually [illegible], and the bearing of each on any problem can be rightly determined only when the principles of economics and efficiency are applied. The basic principles of highway economics are comparatively few and may readily be given as supplementary to the work in general economics, which is included in many engineering courses.

ORGANIZATION AND ADMINISTRATION—The trend of highway administration is toward centralized authority such as is vested in County, State and National Commissions or Departments, and there is reason to believe that that tendency will be extended to include paving of cities and the performance of other public works. Such a development seems inevitable if the administration of highway work continues to increase in efficiency and to substitute sound engineering and economic principles for political chicanery in the building of highway structures. Highway engineering should, therefore, include a study of the methods of highway administration in effect in the United States and abroad and a comparison of the quality and cost of the roads produced by them, and of the safeguards thrown about the expenditures of public money in the various systems.

ROADS, PAVEMENTS AND HIGHWAY BRIDGES—The highway engineer should have a thorough knowledge of all of the types of the structures which he may be called upon to build, that is, of roads, pavements and highway bridges. The student should learn the history and the characteristics of each type, and the conditions of service for which each is adapted. He should know the underlying principles involved in the selection of a particular type for use under a known set of conditions. Many colleges now offer a course in roads and pavements that meets this requirement, or that could readily be modified to meet the needs of men who are preparing for highway work.

SURVEYS AND PLANS—The implements with which the highway engineer works are plans and specifications and the making of surveys is of course a prerequisite to the preparation of plans. The surveys for road and pavement plans do not involve any principle beyond those taught in courses in surveying in all colleges of good standing. Differences in the details of the methods of making the surveys are numerous, but these are usually easily and quickly mastered, and can readily be adapted to the requirements of different state and county authorities. It is a waste of time to attempt to teach the many special methods of making highway surveys to students in highway engineering.

The average plan prepared for highway or pavement construction, however, leaves much to be desired in the interest of completeness and clearness. The preparation of the plans involves the application of correct principles of highway design. It is believed that a course prepared in such a way as to emphasize the principles of correct design and the importance of complete and easily interpreted plans could properly be given to students in highway engineering.

CONTRACTS AND SPECIFICATIONS—A contract to build a highway structure or a pavement is a bargain between an individual or corporation and the public, the terms of which are set forth in the specifications. It follows then that these conditions should be set forth in clear and unequivocal English, that they should be concise and complete and be free from ambiguity, yet be drawn with a full understanding of the difficulty of anticipating all conditions, and therefore, providing for an equitable adjustment of all unforeseen contingencies. A course in highway specifications is an excellent adjunct to a course in roads and pavements because of the emphasis the writing of specifications puts upon each step in the construction.

Specifications for pavements are often drawn by attorneys rather than by engineers, or, they are copied from other specifications which have been in use. There is no valid reason why this should be true except that engineers have not given sufficient time or attention to the study of contracts and specifications. A course in the preparation of contracts and specifications for road and pavement work is, therefore, advisable as a part of the training for

*Professor in charge of highway engineering, Iowa State College, Ames, Iowa.

highway engineering. In many cases this work could be substituted for the general course in contracts that is usually given in engineering schools and thus avoid duplication.

NONBITUMINOUS ROAD MATERIAL TESTING—That the highway engineer should have a thorough knowledge of the materials used in construction and of the methods of testing and the significance of the results of tests is evident. Although much work remains to be done before all of the various tests for road materials will be standardized, there is now sufficient knowledge on the subject to warrant the introduction of a course in nonbituminous materials testing in a course in highway engineering.

BITUMINOUS MATERIALS TESTING—The very rapid development of bituminous road and pavement construction and the probability of a continued increase in the amount of this type of pavements makes it imperative to give some practice in bituminous materials testing. As with nonbituminous materials, much work remains to be done before all tests for bituminous materials can be standardized, yet sufficient knowledge and experience has been gained to enable the engineer to determine by suitable tests, with a fair degree of certainty, the value of any material submitted to him. In this work experience is of the utmost value, but if the routine tests are taught to the student, and he goes into the field of bituminous construction, he will rapidly learn to correlate the results of tests with the behavior of the materials in service.

DEVELOPMENT OF COURSES IN HIGHWAY WORK

There are two general methods that may be followed in the development of highway engineering, one being to give a 4-year course in highway engineering, the other being to permit students in civil engineering to take special work in highway engineering during the junior and senior years.

If a 4-year course is built around the instruction in highway engineering it will certainly be desirable to give during the first two years some of the usual general subjects if the student is to achieve the mental development necessary for a broad career. The last two years way engineering to the exclusion of such subjects as might be devoted very largely to subjects related to highway engineering to the exclusion of such subjects as water-supply, sewers, sanitation and general structures. Sufficient time would thus be available to cover practically the entire field of knowledge relative to highway construction.

If the option method were followed it would only be possible to teach the student where the facts in regard to highway construction may be obtained, how they may be used, and the general principles and the experience which are behind these facts. He could be taught to analyze a specific problem or situation in accordance with the recorded knowledge of highway engineering, and to find the solution, and to know when he had the correct one. A course of this kind necessitates spending much time in the study of mathematics, chemistry, physics, mechanics and allied subjects which are essential to the development of clear thinking and reasoning ability, and to the analysis and solution of problems.

If a course in highway engineering is developed along this line it simply involves substituting in the junior and senior years in the ordinary civil-engineering course a few subjects directly related to highway engineering. These subjects, in general, would displace other subjects of no greater value as general training. This procedure has the invaluable advantage of detracting but little from the possibility of a student's getting into other lines of engineering, if the field of highway engineering does not suit him, or if he fails to find his place therein.

The average undergraduate student has no clearly defined ideas as to what kind of work he wants to do after graduation, and many things may develop during his college years to change his ideas as to his future career. The college ought, therefore, to do everything possible to make well developed, clear thinking men, at the same time giving some practical preparation that can be used upon graduation to insure bread and butter while the man is finding himself.

The factors which make for success in the field of highway engineering are not primarily high scholastic attainments and great technical ability, although the more of these the man has the better, so long as some other things are included in his make-up. Ability to meet men of all classes, to deal harmoniously with other public officials and to address public meetings, coupled with a keen appreciation of the responsibilities and opportunities of public service are qualifications which weigh heavily in favor of the man who enters the field of highway engineering. If to these qualities is added a thorough training in the fundamental principles and practices of the profession of highway engineering, the graduate should be able to find an opportunity for a broad career in highway work.

It is suggested that the following subjects might be inserted in the junior and senior years of the ordinary civil-engineering course and thus give about all the desirable undergraduate instruction in highway engineering, and at the same time displace few studies of any more general value as mental training:

(1) HIGHWAY ECONOMICS—Second semester junior year, two credit hours. A study of the relation of highway improvement to the economic welfare; the principles of taxation for public improvements; and of financing road and pavement construction.

(2) ROAD AND PAVEMENT SPECIFICATIONS—First semester senior year, two credit hours. A study of the basic principles of specifications, and of the details of form and wording. This might be supplementary to the course in contracts and specifications often given in engineering courses.

(3) ROADS AND PAVEMENTS—First semester senior year, two or three credit hours. A study of the types of roads and pavements, methods of constructing them, and their relative values under varying conditions of service. This could be an adaptation of the usual course in roads and pavements, or, in many cases, the course in roads and pavements already being given would suffice.

(4) NONBITUMINOUS MATERIALS LABORATORY—First semester senior year, one credit hour. A study of the methods of testing nonbituminous road materials and of the significance of the results of tests.

(5) HIGHWAY ADMINISTRATION—Second semester senior year, two credit hours. A study of the methods of organization and administration for highway construction, including systems of maintenance.

(6) ROAD AND PAVEMENT DESIGN—Second semester senior year, three credit hours. A study of the principles of design of roads and pavements, exercises in the preparation of plans and estimates for road and pavement construction.

(7) BITUMINOUS ROAD MATERIALS LABORATORY—Second semester senior year, one credit hour. A study of the usual tests for bituminous road materials and of the application and significance of these tests.

(8) DESIGN OF HIGHWAY BRIDGES—Second semester senior year, two credit hours. A study of the design of the various types of highway bridges and culverts. This might well be given in connection with the course in structural engineering.

A Rating Chart for Centrifugal Pumps

By L. J. Beauford*

When an order for a centrifugal pump is given, usually the conditions under which the pump is to operate are stated and the selection of the pump to meet these conditions is left to the makers. The manufacturer's engineer makes his selection by reference to a rating chart which shows the performances of various stock pumps correctly.

The purpose of this article is to show how to lay out and use a graphical rating table which greatly facilitates the selection of a pump when the required speed, head and capacity are given. The chart is in reality a collection of speed-capacity characteristics of all the pumps of a given line, each operating at unit head, and over a certain range of efficiencies. It is usually laid out for one stage, but can easily be constructed for any number of stages. In this article only the chart for single-stages will be dealt with.

Before taking up the method of laying out the chart, it is necessary to call attention to the peculiar characteristic curve upon which it is based. Fig. 1 shows this. Unlike the ordinary performance curves, it is not drawn with head and capacity for coordinates, but with coefficients of peripheral velocity of the impeller and of radial exit velocity of the water. These coefficients are derived as follows:

$$K_u = \text{coeff. peripheral vel.} = \frac{U_2}{\sqrt{2gh}} \qquad (1)$$

$$K_{cr} = \text{coeff. radial exit vel.} = \frac{V_{cr}}{\sqrt{2gh}} \qquad (2)$$

U_2 = peripheral velocity of outside of vanes in feet per second;

V_{cr} = radial velocity in feet per second of water leaving impeller;

h = head per stage developed by pump;

g = acceleration due to gravity = 32.2 ft. per sec. per sec.

The coefficient K_u is the ratio of the actual speed of the impeller to the theoretical velocity of the water necessary to produce the head h. It may be either greater or less than unity, and depends largely upon the angle which the vanes make with the tangent to the outside of the impeller. In general, a forward curving vane will give a value of K_u less than unity, a radial vane unity, and a backward curving vane greater than unity. The coefficient K_{cr} also depends to a certain extent on this angle.

*[illegible]

When a new line of pumps is to be designed, a pump having the desired shape of characteristic is tested, and the $K_u - K_{cr}$ characteristic is plotted as shown in Fig. 1. Next, the values of the coefficient of discharge velocity for the various sizes of pumps to be made are assumed. The values of these discharge coefficients,

$$K_d = \frac{V_d}{\sqrt{2gh}} \qquad (3)$$

where V_d = velocity of water in the discharge pipe in feet per second, are such as former experience has shown to give good results. Fig. 2 shows graphically how the values of the discharge coefficient may vary with the size of the pump. Having assumed the discharge coefficient, the capacity of a pump for a unit head can be computed. The following notation will be used:

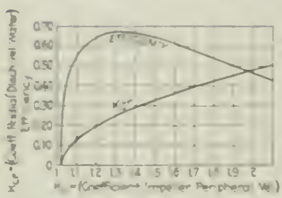


Fig. 1

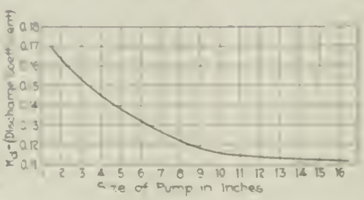


Fig. 2

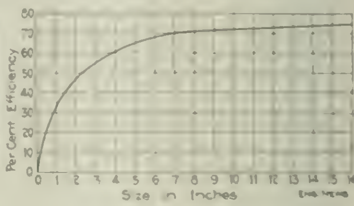


Fig. 4

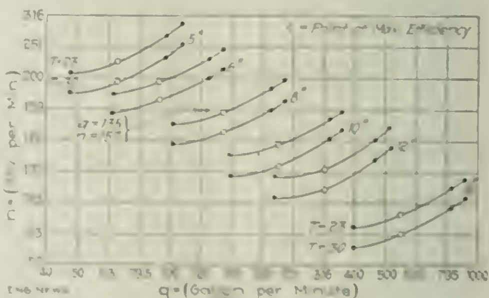


Fig. 3

Q = pump capacity, cubic feet per second;

N = r.p.m.;

K_d = discharge coefficient = $\frac{V_d}{\sqrt{2gh}}$ (3)

d = diameter of discharge, inches;

h = head per stage;

A = area of discharge, square feet, = $\frac{0.7854\,d^2}{144}$;

q = capacity of pump at unit head = $\frac{\text{gal. per min}}{\sqrt{h}}$

n = speed of pump at unit head = $\frac{\text{r.p.m.}}{\sqrt{h}}$;

D_2 = outside diameter of vanes, inches;

W_2 = width of impeller passage at exit;

T = type of impeller = $\frac{D_2}{W_2}$ (4)

Now

$$Q = \frac{q\sqrt{h} \times 231}{1728 \times 60} \qquad (5)$$

also $V_d = \frac{Q}{A}$, and by substitution,

$$V_d = \frac{q\sqrt{h} \times 231 \times 144}{1728 \times 60 \times 0.7854\, d^2} \qquad (6)$$

now by dividing both sides of this equation by $\sqrt{2gh}$, simplifying and remembering that $K_d = \frac{V_d}{\sqrt{2gh}}$ we get

$$K_d = \frac{q}{19.6\, d^2} \text{ or } q = 19.6\, K_d \, . \, d^2 \qquad (I)$$

From this equation the value of the discharge at unit head, or, as it is more frequently called, the "unit capacity," may be computed as soon as values are assigned to K_d and d. The speed in feet per second at unit head, or "unit speed," is found as follows:

$$K_u = \frac{\pi D_2 N}{60 \times 12 \times \sqrt{2gh}} \therefore N = \frac{K_u \times 12 \times \sqrt{2gh} \times 60}{3.14 \times D_2}$$

Dividing by $\sqrt{h}$ and reducing,

$$n = \frac{K_u \times 1840}{D_2} \qquad (7)$$

Were the values of K_u and D_2 known, the chart could now be laid out. But D_2 is usually unknown unless the chart is being drawn for an existing line of pumps. Of course D_2 could be assumed, but it is usually preferable to assume the type T of the impeller.

Assuming that 85% of the total area of the periphery of the impeller is available for the passage of water, we have

$$W_2 = \frac{gal.\ per\ min. \times 231}{V_{ra} \times 12 \times 60 \times \pi D_2 \times 0.85}$$

Dividing the numerator and denominator on the right by $\sqrt{h}$

$$W_2 = \frac{0.015\, q}{K_{cr} \, . \, D_2} \qquad (8)$$

Substituting $\frac{D_2}{T}$ for W_2,

$$D_2 = \sqrt{\frac{0.015\, q\, T}{K_{cr}}}$$

Placing this value for D_2 in equation (7) there results,

$$n = \frac{15{,}025\, K_u \sqrt{K_{cr}}}{\sqrt{q\, T}} \qquad (II)$$

Values for q and n may be obtained for any size of pump using any type of impeller, the values of K_u and K_{cr} being taken from the test on which the line is based. Four values of q and n are usually computed for each impeller represented. The points usually taken are the point of maximum efficiency, 90% of maximum efficiency—at a capacity lower than that at which maximum efficiency is reached, and 95% and 90% of maximum efficiency—at greater capacities than for maximum efficiency.

Application

The use of these formulas can best be made clear by sample computations. Take for example the case of a 6-in. pump.

d = 6 in.;
K_d = 0.132 (based on tests of existing pumps which give good efficiency. See Fig. 2);
T = 23 (assumed);
K_u = 1.25 (from test, see Fig. 1 and Eq. 1);
K_{cr} = 0.22 (from test, see Fig. 1 and Eq. 2);
Maximum efficiency = 67% (from test, see Fig. 1).

Calculation of q and n for 100% of Maximum Efficiency

$$q = 19.6 \times 0.132 \times 6 \times 6 = 93 \qquad \text{(from Eq. I)}$$

$$n = \frac{15{,}020 \times 1.25 \times 0.47}{46.2} = 192 \qquad \text{(from Eq. II)}$$

Calculation of Other Than the Point of Maximum Efficiency

Since K_u and K_{cr} are respectively directly proportional to the peripheral velocity of the impeller and the radial velocity of the water, it follows that n and q are, for a given pump, directly proportional to K_u and K_{cr}, respectively. If, therefore, it is desired to find the values of q and n with the pump operating at other than maximum efficiency, it is necessary only to write the following equations and solve.

$$n_x = \frac{n_{100} \times K_{ux}}{K_{u_{100}}} \qquad (III)$$

$$q_x = \frac{q_{100} \times K_{crx}}{K_{cr_{100}}} \qquad (IV)$$

If it is desired to find the values of q and n when the pump is operating at 90% of its maximum efficiency, and delivering less water than it would at maximum efficiency,

$$efficiency = 0.90 \times 0.67 = 0.603$$

By reference to the impeller-velocity characteristic (Fig. 1), it is seen that the values of K_u and K_{cr} corresponding to an efficiency of 60.3% and a minimum discharge are $K_u = 1.15$ and $K_{cr} = 0.155$. Substituting in equations III and IV,

$$n_{90} = \frac{192 \times 1.15}{1.25} = 177 \quad q_{90} = \frac{93 \times 0.155}{0.22} = 65.5$$

The points on the front of the curve, that is when the pump is discharging more than its normal amount of water, are found in a similar manner. Fig. 3 shows such a chart plotted on logarithmic paper for a complete line of pumps, sizes varying from 5 to 16 in., and for two types of impeller for each size.

Use of Chart—When an order for a pump is received the values of q and n are immediately calculated from the conditions of operation, by means of the equations $q = \frac{gal.\ per\ min.}{\sqrt{h}}$ and $n = \frac{r.p.m.}{\sqrt{h}}$, and the point plotted. The impeller having the next value of n below that found is taken, and if the difference is large the tips of the vanes are cut back. (This is done to bring the speed up to that required. It is readily seen that cutting back the vanes increases the speed when it is remembered that for any given impeller the outside diameter of the vanes must attain a certain peripheral velocity in order to produce a certain head.)

Suppose, for example, that an order came in for a pump to deliver 1500 gal. per min. against a head of 250 ft. when running at a speed of 1760 r.p.m. The pump will obviously consist of two stages, for while a head of 250 ft. per stage is possible, it can usually be attained only at the sacrifice of efficiency. The head per stage is then 125 ft.

$$q = \frac{1509}{\sqrt{125}} = 135 \qquad n = \frac{1760}{\sqrt{125}} = 157$$

The pump determined by these values of q and n is thus plotted as shown on Fig. 3. The impeller chosen will be the one having the next highest values of q and n. In this case an 8-in. pump having a type 23 impeller would be chosen and the same cut back a little. The pump would operate at about 98% of its maximum efficiency. From Fig. 4, it is seen that the maximum efficiency of an 8-in. pump operating at 125 ft. per stage is 71%. The efficiency of the pump selected would therefore be about 71% × 0.98 = 69.5%.

Moving Sand by Pumping*

A pump without pistons or plungers, especially designed for pumping sand or fine coal, was recently placed on the market. The operation is simple. The steam is admitted into one cylinder at a time, forcing out its contents. The vacuum in one cylinder and the pressure in the other drive over the steam-control valve. The steam by this operation is introduced into the chamber just filled with the pumped mixture. The pump operates without any mechanical parts and the only moving element is the steam valve, which has a movement of about $\frac{3}{8}$ in. The valves are either of the ball or flat type. Balls are used for the discharge valve and in some cases for the suction. The balls are usually of rubber; the flat valves are also of rubber.

The pump is claimed to have a very high vacuum and hence a strong suction, which, of course, is very necessary in sand pumping. The pump was patented in 1900 and placed on the market at that time, but it was not adapted for handling sand until recently. It is claimed that a mixture of at least 35 to 45% sand can be easily carried. Wherever the sand comes in contact with turns or elbows, the pump is heavily reinforced; parts of the casting are 2 in. thick. This pump can also be used for handling fine coal or crushed rock. The pump is built by the Nye Steam Pump & Machinery Co., 701 Northwestern Ave., Chicago, Ill.

AN INSTALLATION

The accompanying views show the pump in action at Fern, Ind., at the sand mine of the Root Glass Co. Until the pumps are installed, the mine was operated by numerous belt conveyors, and by sand-washing screws. By this familiar method, a certain amount of the sand washed was carried off by the water and lost. Traveling belts were costly to replace and wore rapidly.

At the mine, rock is reduced by blasting to about 70% sand. This sand is washed to a sump pit, located in the center of the mine, by means of water jets and is then

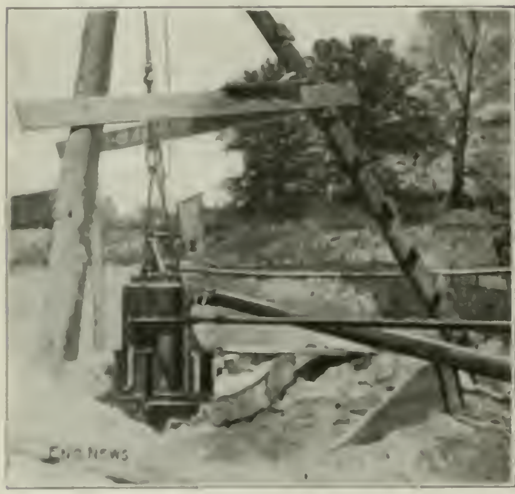


FIG. 1. PUMP IN OLD SAND-SETTLING BASIN

(Basin was to be emptied, so pump was installed temporarily to remove the storage sand.)

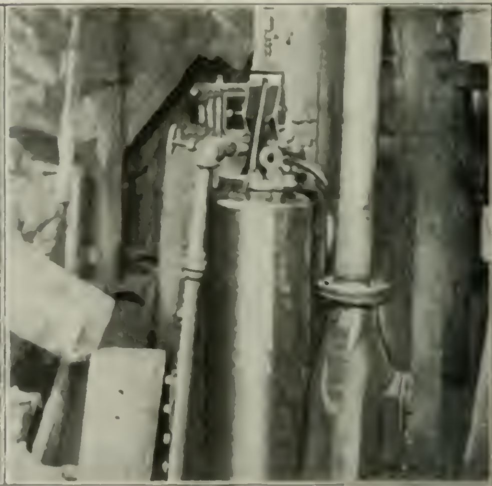


FIG. 2. NO. 5 PUMP, FERN, IND.

(All sand shipped from this mine passes through the pump shown.)

picked up by a 4-in. pump (5-in. suction and a 4-in. discharge) and discharged upon separating screens. Sand is then washed down to a sump in the building, located under a 5-in. pump (6-in. suction and a 5-in. discharge).

The rock at the mine, not broken up by the blast, is placed in a crusher, from which it falls into a sump, located under another 4-in. pump. The discharge of this pump with that of the first-mentioned pump is carried into the sump under the 5-in. pump. In this way, the latter pump handles all the sand to be shipped, elevating it vertically 35 ft. and horizontally 60 ft. to the cars. There it empties into a sand-and-water separator, which automatically opens and closes as the sand deposits in its bottom. The water in the separator rises to the top, runs over and is carried off by piping.

Not only is the sand conveyed through the action of the pump, but it is thoroughly scrubbed by its passage through it.

It is claimed that the installation of the pump caused

*Abstracted from information furnished by the Nye Steam Pump & Machinery Co.

the average production of this mine from 120 tons per day to 480 tons, and that whereas the cost of production by the old method was $2 per ton, the pumping method cost but 57c. per ton.

New Locomotive Terminal of the Central R.R. of New Jersey

The large new locomotive terminal of the Central R.R. of New Jersey, at Communipaw, N. J., is one of the principal features of the reconstruction of the passenger terminal at Jersey City, N. J., described in Engineering News, of July 30, 1914, p. 238. The locomotive terminal is located on the south side of the main-line tracks, about one mile west of the passenger terminal, and is in close proximity to the freight yards on the opposite side. It consists of two roundhouses governed by two connecting 100-ft. turntables. The number of locomotives handled per day in summer averages about 300, which includes all the usual performances of a terminal character, e.g., cleaning fires, dumping ashes, coaling, supplying sand and water, washing boilers, and inspecting, together with any light running repairs which may be necessary. The trackage of the locomotive terminal amounts to about 11 miles.

The soil is principally of cinder fill varying in depth from 2 to 10 ft. on blue clay, sand and bog. In consequence, all the buildings rest on piles, except the west half of one of the roundhouses, where the ground conditions are favorable for masonry footings. The foundations consist of timber piles and concrete piers where the concentrated loads are imposed, with reinforced-concrete wall girders supporting the building walls. The power house, which is in this group of buildings, rests on a concrete slab 4 ft. thick, extending under the entire building, which in turn is supported on piles equally spaced. All the buildings are constructed of reinforced concrete, steel and brick, with steel sash and concrete floors. The roofs are covered with 3-ply built-up asbestos-felt and asphalt roofing.

Power House—The power house, which furnishes power for lamps and motors throughout the terminal, is 125x92 ft. in plan. Six 250-hp. water-tube boilers arranged in three batteries of two each are installed; while space is provided for an additional battery. Automatic stokers are used. Draft is obtained with a 100-ft. steel stack and two turbine-driven blowers. Looped feed-water and steam lines are used. An open feed-water heater takes the exhaust of auxiliaries and raises the boiler supply to 200° F. The coal-and-ash-handling arrangements are such that the railroad cars used to bring in coal are loaded with ashes on the same track.

Three 600-kw. 2250-volt turbine-driven alternators are installed, with space for a fourth. Two 2500-cu.ft., compound, steam, two-stage air compressors furnish air for the engine terminal and for the interlocking system. The main control board is located on the engine-room floor, with the high-tension switches in the basement, with the transformers. High-tension current is led to a service substation near the passenger terminal and stepped down to 550, 220 and 110 volts. The lower voltages for use near the power station are secured from transformers in the basement.

Roundhouses—The two roundhouses—one 34-stall, 100-ft. and one 32-stall, 90-ft.—are constructed with reinforced-concrete piers, columns and roof girders, with

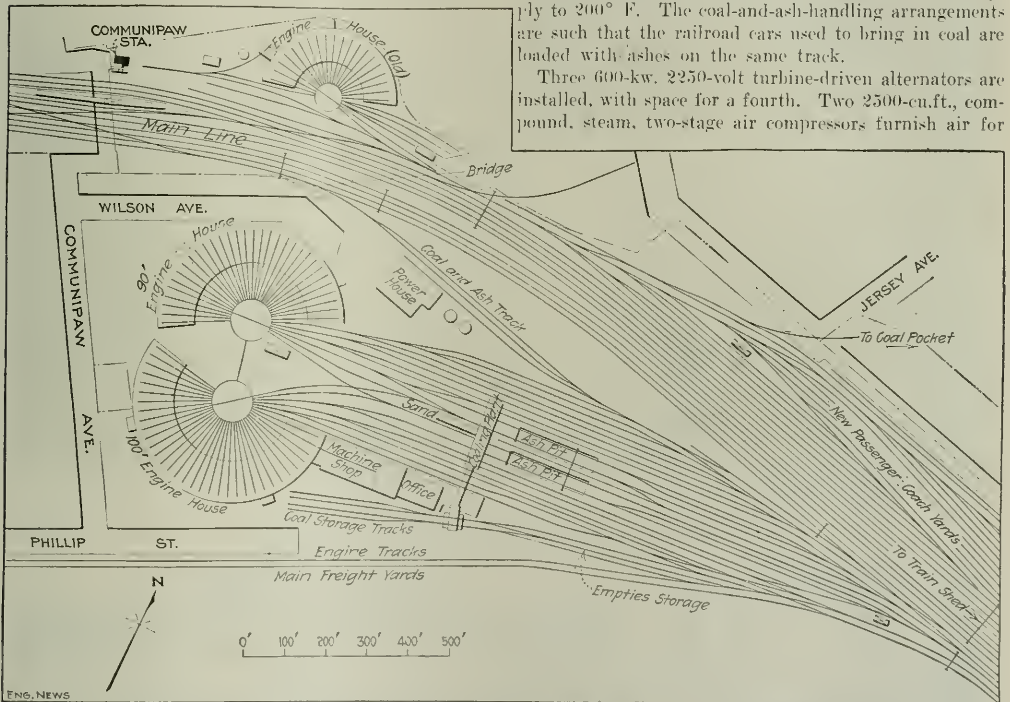


Fig. 1. General Layout of Locomotive Terminal of Central R.R. of New Jersey

hollow tile and concrete walls. The rear wall consists of concrete piers approximately 3 ft. wide with steel sash between. This arrangement permits of a maximum window space, both for lighting and ventilation. A row of hinged sash is provided over each stall. There are other ventilators as well, which provide an outlet for any gases collecting under the ceiling. Both houses are heated by the indirect system. The fans and heaters are located in fan houses, of which there are two in each building.

FIG. 2. INTERIOR OF ONE OF THE TWO ROUNDHOUSES

(Showing transite pits and asbestos-board smokejacks.)

The hot air is delivered through underground ducts and discharged through outlets located in the pits and around the rear wall. The floor wearing surfaces are concrete throughout and reinforced along the sides of the pits to provide bearing for jacking.

The entrance doors to the stalls are hinged on plate frames which are entirely separate from the building construction proper, and so fastened to the building columns that the accidental wrecking of a door will not damage the building structure.

TURNTABLES—Each roundhouse is served with a 100-ft. turntable of heavy construction, operated by electric tractors. Owing to the extreme depth of these turntable pits and the shallow grade of the sewer in the vicinity it was necessary to provide against the sewage backing up into these pits by constructing a deep sump pit, into which both pits drain. Automatic ejectors discharge this drainage into the nearest sewer at a higher level.

COALING STATION—The main building of the coaling station spans eight tracks and serves an additional track at each end. It is 168x54 ft. in plan by 55 ft. high, and of reinforced concrete throughout. The bunkers rest on I-beam girders incased in concrete; the hopper bottoms are built of reinforced concrete and hollow tile.

There are three longitudinal bunkers, with a capacity respectively of 430 tons of bituminous, 813 tons of broken (anthracite) and 430 tons of buckwheat coal. These bunkers are divided into four compartments by transverse concrete partitions. Each track is served by three coal chutes, so that a locomotive on any one of the ten tracks may be coaled with either bituminous, broken or buckwheat coal.

The conveying machinery is divided into two separate and distinct units, each with a capacity of 100 tons per hour. The entire machinery is electric driven. Guards are placed over all exposed gears as protection to the attendants; and there are eleven emergency stations from which the entire machinery can be shut down by pressing a button.

West of the coaling station are the coal-storage tracks, with a capacity of forty cars. Provision is here made for thawing out frozen coal in the cars on these tracks, by means of live steam.

SAND HOUSE AND CINDER PITS—Sand is dried and stored in a building west of the coaling plant. It is of reinforced concrete, 100x16 ft. and 40 ft. high. After the sand is dried, it is screened and elevated by means of compressed air to two storage tanks of 15-cu.yd. capacity

FIG. 3. COALING STATION OF 1700 TONS CAPACITY

(Separate three longitudinal bunkers [illegible] each track is served by three chutes, one from each bunker. [illegible] shown at top of building.)

each, located on top of the coaling station. These tanks deliver sand to the locomotives through cast-iron delivery pipes; and 10 wrought-iron telescope spouts serve the ten tracks.

The cinder pits, which are of the submerged type, are located about 60 ft. east of the coaling plant; each is 200x30 ft. by 12 ft. deep, and of reinforced concrete. Each pit serves two tracks which are 26 ft. c. to c. The cinders are removed from the pits by electric traveling cranes, operating a 1⅝-cu.yd. clam-shell bucket. Aside from the economy and speed of handling engines over these pits, this arrangement permits of the coaling of engines from cars by means of the clam-shell bucket, should occasion arise.

A tunnel is provided from the power house to the roundhouse for carrying all steam, air and water piping, and also all wires and cables for lighting parts of the building. This tunnel is of heavy reinforced-concrete construction, waterproofed, 6 ft. wide, 10 ft. high, and 367 ft. long, with a branch running to the 90-ft. roundhouse. The tunnel is well lighted. The power cables to the station terminal are carried in a tile and concrete underground duct line located in a paved driveway just north of the new coach yards and station.

The locomotive terminal was built by Westinghouse, Church, Kerr & Co., and designed by them in coöperation with the Central Railroad engineers.

Interlocking System

While not a part of the locomotive terminal, the interlocking system which governs all movements into the new trainshed described in last week's issue, and all movements in and out the locomotive terminal proper will be described here. The first interlocking plant related to this whole reconstruction work to be placed in service, was the one at the Van Nostrand place, about 3 mi. west of the North River. Next, on Mar. 12, 1911, the interlocking plant at Communipaw was put in service. The latter plant, located just west of the Communipaw station, governs the movement of trains across the New York-Newark Branch into the freight yards south of the station, and on down to the water front; also the movement of freight and coal from the south side of the main-line track to the west end of the main freight yard, across the main line to the main Jersey City freight station on Jersey Ave., and to large coal pockets located north of the passenger-terminal yard. This plant also governs movements in and out of the new locomotive terminal.

The movement of trains into the trainshed is governed by two plants; No. 1, the larger, controlling the shed tracks, while No. 2 governs engines into the locomotive terminal. One 179-lever tower, located south of the main track, about 800 ft. west of the new trainshed, is being built, which will replace both of the older towers. Each track in the new trainshed will be provided with at least two means for entry or exit, reducing the chance of blockades as the towerman will have the choice of several routes.

The interlocking plants were installed by the Union Switch & Signal Co., Swissvale, Penn.

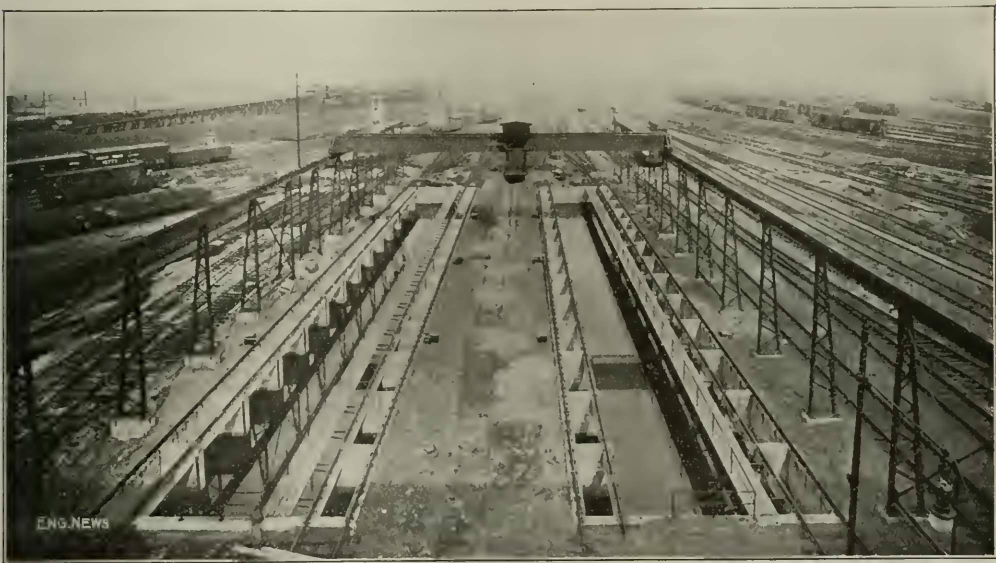


Fig. 4. The Cinder Pits

(Ashes are removed from the pit by a 1⅝-cu.yd. clam-shell bucket on the crane shown. This same crane and bucket can be used for coaling purposes should occasion arise.)

Passenger-Coach Yard

The new passenger-coach yard will cover the ground once occupied by the old coach yard, engine terminal, coaling plant, and repair shop, which are now situated west of the trainshed and at the new Communipaw engine terminal.

The new coach yard and interlocking system controlling the new trainshed tracks will contain about 35 mi. of trackage, of which 25 mi. is new construction, and

1 yd. 332 track relocated. All trackwork was installed by the railroad by its maintenance-of-way department.

Central Railroad Co. Organization

The construction work was accomplished under the supervision of the Engineering Department of the Central R.R. of New Jersey: J. O. Osgood, Chief Engineer; A. E. Owen, Principal Assistant Engineer; J. J. Yates, Bridge Engineer; A. M. Zabriskie and H. E. van Ness, Assistant Engineers of Design; and C. M. Titsworth, Assistant Engineer in Charge of Construction.

Difficulties in Initial Operation of a 110,000-Volt Transmission Line

By Frank G. [illegible]*

The freedom from operating difficulties which may be secured, even in the initial period of operation of a very high voltage electric transmission line, where proper attention has been paid to every detail of design and construction is illustrated by the experience of the Georgia Ry. & Power Co., with its Tallulah Falls line.

This system was first put into operation Sept. 20, 1913, and regular service began Oct. 17. As already noted (Engineering News, Jan. 29 and Apr. 16, 1914) the Tallulah system comprises the power house, transmission line, five substations and a terminal station in Atlanta. Power is generated at 6600 volts, stepped up to 110,000 volts and distributed over steel tower lines of about 275 miles in length. The ultimate capacity of the development will be 80,000 kw., the present installed capacity being 70,000.

Voltage was first impressed on the section between Tallulah Falls and Atlanta with all apparatus connected thereto, and regular operation continued to Dec. 22 without the slightest interruption from defective apparatus. At this time an insulator failed on an air-break switch at Buford, on a section of tower line between the power plant and the Atlanta terminal station. This caused an interruption to the service of 15 minutes' duration. The same trouble was experienced with the same insulator again on Feb. 10. On Mar. 14, the first insulator on the 110,000-volt tower line gave way on the branch section between Atlanta and Newnan. This was the first line trouble encountered after the operation was begun and in fact has been the only trouble to date. There was no loss of insulators or equipment when voltage was first put on the lines, and the interruptions mentioned above are the only ones which have been encountered due to defective equipment. This is very remarkable, considering the large number of substations and switching stations which are connected to the lines where insulation trouble is so liable to occur. There has been no loss of transformers, or any electrical equipment of any character except a few small instruments such as current transformers and high-tension bushings; these did not cause any interruptions but simply showed weakness and had to be removed.

There has also been unusual success in the operation of both high-tension and low-tension electrolytic lightning arresters. These arresters have been charged repeatedly since operation was begun without the slightest noticeable disturbance to lines or apparatus, nor have the disturbances been reflected to any indicating instrument.

The engineering design shows many points of individuality and no money was spared to secure permanent safety of mechanical details. Aside from points discussed in earlier articles, the following are of interest.

The generators were among the first water-power machines to have spiders of rolled-steel plate to avoid possible unseen defects in steel castings—an important factor in protection against mechanical failure of a high-speed rotating element. This is especially important when it is considered that all waterwheels are liable to attain runaway speed, and in some instances actually have with disastrous results. Furthermore, the rotors in the machines are designed to hold a runaway speed of 1.7 times normal for one hour (maximum kinetic energy about 1,250,000 ft.-lb.).

Again, in anticipation of unavoidable serious variations in electrical operation, the generators are designed for an excitation of not more than 250 volts, normal ex-

Exterior and Interior of Telephone Station; Transmission Tower, Showing Main Line Cables (Above) and Telephone Wires (Below)

*[illegible], Consulting Engineer, [illegible] Broadway, New York City.

citer voltage, at 10,000-kw. load, 80% power factor and generator voltage of 7260 (normal voltage being 6600). This design for adverse conditions makes possible an absolute control of generator voltage, even under the worst possible line conditions, giving sufficient leeway to vary the voltage through a wide range of power factor without ever exciting the generator fields. This has been found of further value since the generators operate at normal rating with almost no temperature rise, making it feasible to increase the normal rating of the machines if such should be necessary under average operating conditions.

The high-tension wiring of the switch house is of copper tubing with bends made to fit designed forms and supported so as to give symmetry and the appearance (as well as the fact) of mechanical permanency to the entire layout. Where the high-tension wiring leaves the switch house, instead of the usual wall bushings (with a weather housing apparently intended to apologize for their inefficiency) oil-filled 150,000-volt wall bushings of special design are used, requiring no outside covering; when designed these were an advanced and original construction but one now coming into broader use.

The steel towers bore two ground wires and were considerably heavier than any heretofore installed in the South—the idea being that the cost of some extra metal is much cheaper than one failure and the consequent effect on the service. In the design of these towers particular attention was given to the condition of the heavy sleet which they would be called upon to withstand in this territory (a historical fact).

The substation in Atlanta in addition to being the largest outdoor type in the world, embodies features equally original. Special attention has been given as far as possible to eliminating high-frequency disturbances at the station, and this has been effected by unique but simple arrangements. The lightning arresters are tapped off at the end of the incoming lines as usual—but the horn gaps and arrester tanks are placed so as to furnish a straight path from the line to the tanks, enabling the latter to receive the dynamic blow of any oscillatory discharges while the power lines are turned through two right angles and a choke coil before entering the substation.

It might be interesting also to note that many of the high-voltage lines previously put into operation have been operated at a voltage considerably lower than that for which the lines were designed; for instance, lines designed for 110,000 volts have usually been operated at but 88,000 and for 140,000 volts have been operated at 120,000. This system herein referred to was designed for 110,000 volts and is actually operated at from 111,000 to 118,000.

The chief difficulty which has so far been experienced in the operation of this system has been one which has occasioned difficulty on all systems of high-tension lines. That is with the telephone line. This is of No. 4 copper-clad steel wire, strung on the steel towers some distance beneath the power wires. The telephone booths consist of portable sectional station houses—painted dark green and stationed within the square steel towers.

The telephone wire was originally supported on pin-type insulators—but it was found it could not thus be kept insulated from ground as the insulators punctured almost as rapidly as they could be replaced—and the service was extremely unsatisfactory. After several schemes failed, the entire line was restrung on high-voltage insulators. This was done between Tallulah Falls and Atlanta (about 90 miles), using suspension-type insulators with a special "S" hook. Now the talking is excellent and uninterrupted. Exhaustive tests and numerous oscilligraph records have shown the actual induced effects on the telephone line due to the power lines above. These data could not be secured with the line as first constructed because of the poor insulation, and have probably never before been secured with a similar transmission system; they should greatly influence the future design of such systems. The potential to ground induced on the telephone lines is between five and six thousand volts, and checks very closely with the theoretical. This potential, however, can be lowered somewhat by the use of a special drainage coil of heavy current capacity; there is also other protective equipment, like horn arresters, disconnecting switches, insulated platforms, etc.

In many cases it has been necessary to do switching with both low- and high-tension oil switches, but no damage has resulted to any equipment, and no surges of any consequence have been set up on the line as a result.

One incident of interest occurred at the power house. Lightning struck one of the feeders running to the Southern Power Co.'s system near the power-house building. The surge entered the building through the high-tension wall bushing, followed the high-tension wiring through the oil switch and was reflected by the transformers back to a post-type insulator which flashed through the brickwork to the steel column inclosed therein, a distance of some four feet and then went to ground. The only serious result was the loss of the copper tubing connecting the terminals of the transformer. This disturbance occurred, however, before the installation of the electrolytic arresters on this feeder, and the feeder was not protected by any other similar apparatus.

A similar incident occurred on June 4, when the entire district was visited by a severe lightning storm. The Tallulah system remained in operation, while several of the adjoining systems were repeatedly knocked out, the only effect felt on the Tallulah lines being a momentary drop in voltage of approximately 40%. This caused a few railway rotary converters in Atlanta to drop out of service for a few minutes, and occurred twice.

Charles O. Lenz, 71 Broadway, New York, was the chief engineer for the entire development from preliminary report to completion. C. E. Bennett has been the Assistant Electrical Enginer in charge of construction.

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The Increasing Weight of Railway Rolling Stock—In 1829 a locomotive with two axles coupled, running on rails weighing 34.2 lb. per yd. weighed 5 tons, which was equal to 300 times the weight of rails per meter.

In 1846 an engine with three axles coupled, weighing 22 tons, ran on rails weighing 84.6 lb. per yd. This came to 630 times the weight of rails per meter.

In 1880 an engine with four axles coupled, weighing 56 tons, ran on rails weighing 81.6 lb. yer yd. This came to 1330 times the weight of rails per meter.

In 1911 a six-axle-coupled Golsdorf engine, weight 96 tons, on rails weighing 96.77 lb. per yd., gave a ratio of 2000. In 1911 also, in the United States, a "Mallet" engine with ten axles coupled, weighing 245 tons (adhesive weight), represented a ratio of 4600 times the weight of rails of 111 lb. per yd.; but this ratio, which is very high, is due to some extent to an exceptional weight per axle.

If adhesive force be taken as one-sixth of the weight, it will be found that the ratio of the tractive force at wheel tread to the weight of rails per meter has varied according to the values: 50—105—225—333—750.—Anatole Mallet before the Paris meeting of the Institution of Mechanical Engineers.

Recent Railway Construction in Chile

By Charles P. King*

SYNOPSIS—The Chilean Longitudinal Ry. is a part of the projected Pan-American Intercontinental Ry. Only a short section of about 93 miles of the Longitudinal Ry. remains to be built. This article describes in detail the general features of the line from Tacna to Port Montt, 2200 miles long, mentioning and describing connecting railways to the coast, and all the other principal railways in Chile, projected, under construction and completed. The effect of recent railway construction on the development of the mining industry is outlined. Much information is given about the needs and expected expansion of various industries for the benefit of engineering, contracting and equipment companies.

With the joining of the rails of the northern and southern sections of the so-called Chilean Longitudinal Ry. at Yerbas Buenas, about 70 miles north of the port of Coquimbo, on Nov. 22, 1913, Chile has almost completed its part of the proposed Pan-American Intercontinental Ry. Only a short section of about 93 miles, which will connect Arica in the north with the Nitrate Ry. at Jaz Pampa, now remains to be built in order to give to Chile a great trunk line over 2200 miles long, running due north and south from Tacna in the extreme north to Port Montt at the end of the habitable part of Chile in the south.

By far the greater part of this system has been built by the Chilean Government and is under Government control; and about 1000 miles of this has been built within the past three years. Unfortunately, a uniform gage does not exist, due to the fact that some of the connecting links of the system were built some years ago; but by far the greater part of the system between Arica and Santiago, the capital, is meter gage. Between Santiago and Port Montt it is all 5-ft. 6-in. gage. Between Tacna and Arica, in the extreme north, an English company has been operating about 37 miles of 5-ft. 6-in. gage railway for many years past. This road forms the first link of the Chilean portion of the Pan-American Ry.

Proposed Arica to Jaz Pampa Section—Between Arica and Jaz Pampa, a distance of 93 miles, the government will soon build a meter-gage railway. From Jaz Pampa, about 30 miles inland from the seacoast [illegible] Pisagua, the Pan American Ry. is continued a distance of about 155 miles to Pintados, over the lines of the Nitrate Railway Co., Ltd., another English company operating a [illegible] line [illegible] between the ports of Pisagua and Iquique, serving the many nitrate works back of the coast in this section.

Pintados and Pueblo Hundido Section—The next link south, the first or northern section of the recently completed Longitudinal Ry., between Pintados and Pueblo Hundido, [illegible] a distance of about 436 miles of meter-gage road, was formally turned over to the government by the contractors, MacDonald, Gibbs & MacDougall. The concession for the construction and operation of this road was first signed by the government on Apr. 23, 1910, with the Chilean Longitudinal Railway Construction Co., Ltd., and the Chilean Railway Finance Co., Ltd., which later transferred their rights to the Chilean Northern Railway Co., Ltd.

This latter company entered into a contract for the construction of the line with the Chilean Construction Co., Ltd., which in turn sublet the contract for the carrying out of the work to MacDonald, Gibbs & MacDougall. All of these companies are English, but an American, Judge Coyne, of Tennessee, was largely instrumental in securing the concession and in forming the company that will operate the road for a period of 25 years. The contract price for the construction of the road was $15,275,000. Most of the locomotives required for construction work and afterward turned over to the operating company were purchased in Germany. The reason for the purchase of most of this equipment from the Germans, as given to the writer by one of the contracting company, was that quick delivery could not be obtained from American builders and the lowest price obtainable from English builders was $1425 per locomotive (for Moguls) higher than the German price.

It was further stated, however, that these German engines have not proved first-class, and that the most of them will have to be scrapped soon. It might, therefore, be well for builders of motive-power equipment and rolling stock to keep in touch with the Chilean Northern Ry. Co., Ltd., the operators of the road, addressing them either at their London offices at 7 Princes St., E. C., or in Santiago, Chile, Calle Agustinas 718.

The railway from Pintados to Pueblo Hundido for the most part was of easy construction, traversing desert country and crossing the enormous nitrate deposits back of the ports of Taltal, Aguas Blancas, Antofagasta and Tocopilla, a route which allowed the permanent works to be of a comparatively simple nature. There are no tunnels and only one bridge in its entire length and the maximum gradient is 4%. The sharpest curve has a 100-m. radius. The rails are 50 lb. per yd. and the sleepers are native wood.

From this northern section the railway is continued over a section of meter-gage railway built by the Public Works Department of the government, a distance of about 160 miles to Copiapo.

[illegible] Section—From Coquimbo south to [illegible], a station on the [illegible] branch of the State Railways, about 140 miles from Santiago, the road was built (the rails were joined on Nov. 23 last, as mentioned above) by a French company, the Régie Générale de Chemins de Fer au Chili, having offices both in Paris and Santiago. The contract for the construction and operation of this road for a period of [illegible] years was signed by the government with the Howard Syndicate, Ltd. (another English concern), which in turn made a contract with [illegible] & Co. for the construction work. In March, 1911, due to financial difficulties, both the Howard Syn-

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*[illegible] Church St., New York City.

Fig. 1. Map of Chile, Showing Projected Railways, Railways under Construction and Existing Lines

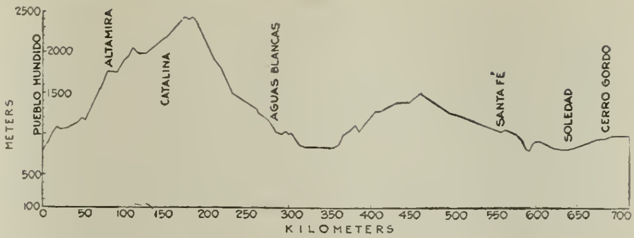

Fig. 2. Profile of the Chilean Longitudinal Ry. from Pintados, the Junction East of Iquique, to Pueblo Hundido, the Junction East of Chanaral

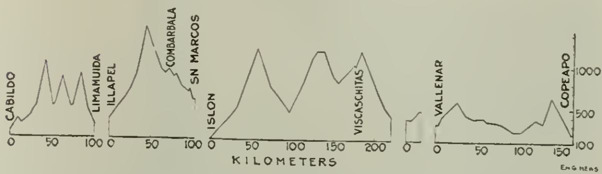

Fig. 3. Profile of the Chilean Longitudinal Ry. from Copiapo, the Junction East of Caldera, to Cabildo, the Southern Terminus, North of Santiago

Courtesy Bulletin Pan-American Republics

Fig. 4. Tunnel through the Andes Mountains on the Trans-Andean Ry. from Valparaiso to Buenos Aires

[illegible] and Griffin & Co. gave over control of the road to the French company.

This section is about 310 miles in length, meter gage, and the contract price for its construction was $20,130,000. The road was a most difficult one to build, presenting many engineering problems. There are many tunnels, the longest being the Espino tunnel, 1730 ft., bored through solid rock and at an elevation of 4800 ft. above sea level. There are also three other good sized tunnels just north of Cabildo, one of 4150 ft., one of 3380 ft., and one of 2500 ft., besides a number of smaller ones,

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Fig. 5. Bridge on the Cabildo R.R. Branch of State Rys.

making construction expensive, for which the contractors [illegible] to have lost considerable money.

At the station of Limahuida, about 75 miles north of Cabildo, a section about 14 miles in length built by the Public Works Department to connect the interior [illegible] of Illapel with the port of Los Vilos is used to connect Limahuida with Illapel. Between San Marcos and [illegible] [illegible] the port of Coquimbo another section of 180 miles built by the Public Works Department is utilized. [illegible] about 72 miles of this [illegible] is 5 ft. 6-in. gage, a third rail has been laid to meter gage. Just north of Cabildo at the station of Palquico, the road is built as [illegible] for a distance of 10 miles, although the grades [illegible] from 3% to 6%. Just north of Illapel, the track [illegible] for a distance of about 16 miles [illegible] a section of [illegible] The grade [illegible] the Espino tunnel mentioned above. It is stated that this rack section cost $[illegible] per mile to build.

Most of the rolling stock and motive-power equipment used in the construction of this section was also purchased in Germany and Belgium, although some [illegible] locomotives, built by the [illegible] Locomotive Corporation of [illegible], were used in the construction of the rack sections.

The Regie General des Chemin du Fer au Chile, the builders, although now having difficulties with the government over the question of settlement, caused by their construction losses, will, it is fully believed, carry out their contract to operate the road for 30 years; and if so, they will be obliged to purchase considerable motive-power equipment and rolling stock.

From Cabildo, the end of the southern section of the Longitudinal to the Capital, Santiago, the Pan American route follows the recently built branch of the State Rys. to Calera, a distance of 72 miles, where it joins the main line of the State Rys. between Valparaiso and Santiago, all of which is 5-ft. 6-in. gage.

Effect of Railway Development on Mining and Industries

Already the opening up of the southern section of the Longitudinal has stimulated the mining industry in the district between Cabildo and Copiapo, and as both north and south sections traverse an extensive mineral zone containing copper, iron, silver, nitrate, borax, etc., it is fully believed that the road will be the means of largely developing these industries in a section that has been heretofore but little worked.

Nitrate Works—The Longitudinal Ry. is crossed at several points by private railways, mostly English, which serve the many nitrate works, carrying nitrate to the ports of Pisagua, Caleta Buena, Junin, Tocopilla, Mejillones, Antofagasta, Caleta Coloso, Taltal, and Chanaral. This nitrate industry is Chile's most important one. The export duty on the $2\frac{1}{2}$ to 3 million tons of nitrate exported annually, mostly from the above ports, is about 60% of the revenue of the entire country, and the nitrate is about 70% of all the exports.

The present price of nitrate alongside vessel in the above ports is $1.90 per quintal (100 lb.), and the export duty on the same is $12.50 per [illegible] ton. It is said there is sufficient nitrate in Chile to last another 75

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Fig. 6. View of Nitrate Works on Longitudinal Ry.

years, and as the Longitudinal Ry. now taps numerous nitrate fields, it is expected that these lands, which are owned by the government, will soon be disposed of by public sale, as provided by law, to be worked by private parties. With the aid of the connections with English nitrate lines, mentioned above, the Longitudinal Ry. and

the various intersecting government-owned railways will also be of great aid in the development of the important and growing copper and iron mining industry of the country.

Copper Mines—The American promoters, the Guggenheims, have for many years past been large buyers and shippers of copper ore from Chile to the States and for the past few years have worked a large mining property, including a smelter and 46 miles of railroad, in the south under the name of the Braden Copper Co.* The Braden Ry. is a heavy-grade road of but 2-ft. 6-in. gage connecting Rancagua on the main line of the Chilian State Rys. with the mines at Teniente and is operated by eight 42-ton Shay-geared locomotives.

Just recently the Guggenheims, under the name of the Chile Exploration Co., have purchased a very large copper property back of the small port of Mejillones, 12 miles north of Antofagasta and it is said they will invest an enormous sum of money in its development, among other things building a 40-mile meter-gage railway from Mejillones, and 11 miles of standard-gage railway about the plant.

A syndicate headed by William Braden, formerly President of the Braden Copper Co., before it was sold to the Guggenheims, has recently acquired large copper properties back of Chanaral, to which property they will, it is said, soon build a railroad and erect a smelter, etc.

There are also fair sized smelters at Gatico (near Antofagasta) and Guayacan (near Coquimbo), both operated by Chilian companies, and it is expected, due to the fact that shippers will now be able to get their ore to the coast at a much lower rate than formerly by making use of the Longitudinal Ry., that there will be a couple or more new smelters erected near Antofagasta.

*Described in "Engineering News," May 22, 1913.

Arica-La Paz Ry.—Large quantities of copper ore are now shipped regularly from the port of Arica, in the extreme north, but this ore is mostly from the Corocoro mines in Bolivia and comes into Arica over the recently finished Arica-La Paz Ry.*, which was opened to traffic in July last, having been built by the English contractors, Sir John Jackson & Son, after a Chilian company, the Sindicato de Obras Publicas, had failed. The locomotives in use are German—Esslingen, Borsig and Henschel—and the cars are all steel, both passenger and freight, from the Middletown Car Co., Middletown, Penn. At present there is but one through train a week over the road in either direction, and while the traffic is bound to increase it will be many years before it will be an important freight road or one that will pay. In fact, it was built mainly for political reasons.

Courtesy Bulletin of Pan-American Republics
Fig. 7. Railway Bridge over the River Lute, on the Antofogasta & Bolivia Ry.

Antofogasta & Bolivia Ry.—The Antofogasta & Bolivia Ry., a 2-ft. 6-in. gage railway running from Antofagasta to Oruro, Bolivia, a distance of 574 miles, crosses the Longitudinal or Pan American route at Baquedano, and is an important factor in the development of several small copper mines near Calama and the very important group at Collahuasi, on a short branch road at an elevation of 15,814 ft. above sea level. At San Pedro station (193 miles from Antofagasta and 10,700 ft. above sea level) are situated the collecting reservoirs, blasted out of solid rock, built by the railway company at an expense of about $5,000,000 to supply the town of Antofagasta, the nitrate works and its own service with water, for no other fresh water can be obtained except by condensing the sea water.

The main railway has to reach an altitude of 13,000 ft.

*Described in "Engineering News," Nov. 27, 1913.

is 920 miles. At 12,000 ft., mile 240, it runs alongside a wonderful lake of borax, 24 miles long, owned and worked by the Borax Consolidated Co., and said to be the largest single deposit of borax in the world, and the main source of the world's supply.

At about 295 miles from Antofagasta, the road crosses the river Loa on what is said to be the highest viaduct in the world and certainly one of the most interesting engineering structures in the world. The level of the rails on the viaduct is nearly 10,000 ft. above the sea and at a height of 336 ft. above the surface of the waters of the river below. The viaduct consists of six lattice-girder spans, of 80 ft. each in the clear, supported on steel trestle towers. At Huari, mile 497, there is the mysterious fresh water lake Poopo, which receives 212,000 cu. ft. of water per minute, and only 2000 cu. ft. flows out of it. There are also many other wonders of nature along this line, among them the snow-capped volcanoes of San Pedro and San Pablo, from the former of which there is a steady column of smoke constantly ascending, and the giant Ollague, over 20,000 ft. high.

There are many branch lines (some recently built) tapping the main road serving the nitrate works and copper mines adjacent; the principal ones are those to the Aguada nitrate fields, a distance of 70 miles, to the port of Mejillones, and to the Collahuasi copper mines, a distance of 60 miles. There is also a private railway from Uyuni, mile 373, to the famous Huanchaca silver mines, now being worked by an American company.

The principal branches of the Antofagasta & Bolivia Ry., however, are the recently completed ones from Rio Mulato (mile 443) to the old Bolivian city of Potosí and from Uyuni (mile 379) to Tupiza, near the Argentine border of Bolivia, a distance of 113 miles. The former railway, while but 108 miles in length, was by far the most difficult and expensive to build as it traverses broken, wind-swept and often snow-covered country almost its entire length, winding around mountain after mountain and through deep cuttings through solid rock, and, at mile 51 from Rio Mulato the rails reach an elevation of 15,814 ft. above the sea, making this the highest railroad in the world. Both of these roads were built by American contractors.

The Antofagasta & Bolivia Ry. has also recently built a meter gage railway from Oruro, the end of their main line in Bolivia, to Cochabamba, a distance of 124 miles.

About four years ago, this company acquired the control of the road built by an American company from Oruro to La Paz, a distance of 127 miles, which, with the branches mentioned above, gives a big and growing traffic, with the result that it has been decided to widen the gage to meter and substitute 70-lb. rails for the old 60-lb. rails now in use.

Courtesy Bulletin of Pan-American Republics

FIG. 8. PORT AND RAILWAY TERMINAL AT TALCAHUANO

For the increasing traffic and the change in gage, the company will soon be in the market for rolling-stock equipment, cars, rails, etc. While the company is English, with head office in London, offers by American manufacturers desirous of doing business with it will undoubtedly receive every consideration. It was reported some little time ago that the control of this road had been obtained by the Brazil Ry. interests (offices at 71 Broad St., New York), but the facts are that while the Farquhar interests did obtain about $10 million worth of stock of this road, they were forced to hypothecate it with English banks almost immediately, and the control of the company is still strictly English.

IRON MINES.—The Bethlehem Steel Co. is also now building a short railroad from its recently acquired iron-ore deposits at Tofo, near Coquimbo, to a small port just north. It is stated that these deposits, acquired

from a French company, contain over 100 million tons of about 67% ore, mostly on the surface.

Railways South of Calera and Santiago

From Calera south, the Pan American route is continued over the main line of the Chilian State Rys. (5-ft. 6-in. gage) to Osorno, a distance of 665 miles. From Osorno to Port Montt, the end of the habitable part of Chile, a distance of 79 miles, the road was only recently finished and turned over to the government. It also is 5-ft. 6-in. gage.

From the port of Lebu, about 300 miles south of Valparaiso, a road of 101 miles in length, 5-ft. 6-in. gage, to Los Sauces, on the main line of the State Rys. is being built under government guarantee by an English company, the Chilian Eastern Central Ry. Co., Ltd.; but this company is now temporarily financially embarrassed and active construction work has been stopped. This road, when finished, will open up a rich mineral and farming section for development, and give a better outlet for the large quantities of good coal mined at and near Lebu.

On the island of Chiloe, just south of Port Montt, the Chilian Government has just finished the construction of a 62-mile, 75-cm. gage railway from Ancud to Castro.

Smaller Railways

Several shorter railways have also been built for the government during the past two years, such as the 17-mile meter-gage railway connecting the port of Papudo, north of Valparaiso, with Ligua on the Longitudinal Ry. A considerable mileage has been built by private companies, especially in the nitrate section, but enough has been written here to show conclusively that Chile has progressed rapidly with railroad building during the past few years, and while this rate of progress will not be kept up there are still quite a number of roads which the government have ordered surveyed and will very likely order to be built soon. Among the projects now pending is the proposed railway from Santiago to Valparaiso via Casablanca to avoid the heavy grades on the present line. They are also studying the question of electrification of the present road between these two cities, and there is some talk of this work being carried out instead of building the road via Casablanca, but due to the heavy initial cost of electrification and the present bad economic condition of Chile, this latter plan will probably fall through.

Trans-Andean Railways

While there is at present one trans-Andean railway connecting Valparaiso and Buenos Aires,* the Chilian and Argentine Governments contemplate the building of two other roads to connect these countries, one in the north from Caldera to Buenos Aires putting the arid nitrate section of Chile in touch with the rich agricultural section of the Argentine, and another line in the south from Valdivia to connect with the Argentine Great Southern Ry. at San Martin de los Andes, on the Chilian border.†

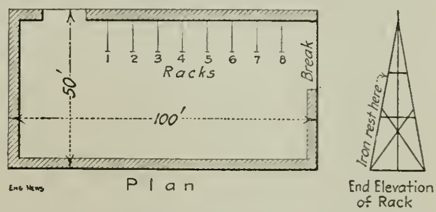
Either of these lines would reduce the climb over the present trans-Andean road about one-half, which would make them practical freight routes, while the present railway can only be used profitably for passenger and light freight and express service. The northern line will require a tunnel of only 1640 ft. to pierce the Andes at the point selected; while to build the present trans-Andean line a tunnel over a mile long at an elevation of almost 12,000 ft. was necessary.

The Chilian State Rys., not including the roads recently built and mentioned in this article, have about 600 locomotives and over 7000 cars in use and the government will buy in the near future 100 more locomotives and over 1000 cars.

*Described in "Engineering News," Jan. 4, 1912.

†Surveys for this railway described in "Engineering News," Feb. 12, 1914.

A Brick Wall Wrecked by an Interior Blow—A three-story brick wall of a large warehouse owned by the Huey & Philps Hardware Co., Dallas, Tex., was wrecked in a remarkable manner when a wood rack for holding iron bars, rods, slats, etc., failed under load. Tracks of the Texas & Pacific Ry. pass the building on the side which failed, and it is suggested that vibration caused by a heavy freight



(The racks were built of timber in the manner shown. The collapse of rack 1 with its load caused the other racks to fall successively, from impact.)

Fig. 1. Plan of 3rd Story, and End Elevation of Supporting Frame for Steel Rack, Etc.

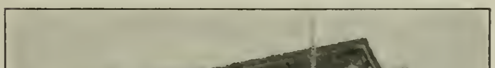


Fig. 2. Showing Break in Wall

train probably unbalanced the load on rack No. 1, which was the first to fall, so that it collapsed against No. 2, and so on successively, finally breaking down the wall. The manner of this accident is shown in Fig. 1, and the result in Fig. 2. The accident occurred during the night, July 10, and no one was injured.

Changes and Enlargements of the Water-Purification Plant, Youngstown, Ohio

Extensive changes of an interesting character are now being made in the water-purification plant of Youngstown, Ohio. The present settling reservoirs are to be replaced by much larger ones, and the old reservoirs are to be used for new mechanical filters above and for clear-water storage below. The existing mechanical filters are to be raised to a level suggested by the flood of 1913, and during the process their piping and gutter systems will be rearranged. The flow of the Mahoning River is to be regulated by the construction of a large dam, and a new pumping station is being built adjoining the filters.

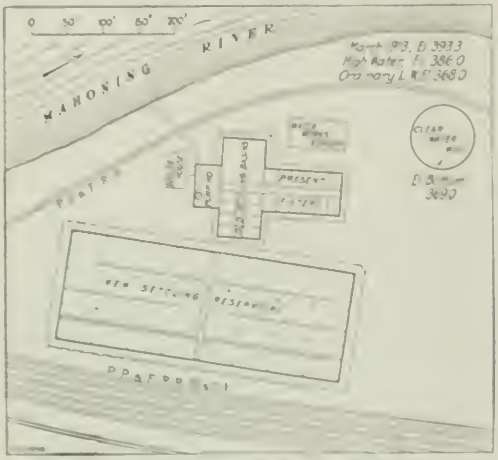


Fig. 1. General Layout of Water Purification Plant, Youngstown, Ohio

Increase of capacity is demanded by the growth of the city. The daily consumption is increasing each year by nearly a million gallons. The existing plant (Fig. 1), comprising twelve 1,000,000-gal. units, is overtaxed by the present requirements of the city. To meet future needs a set of 16 additional units of the same size is being built.

The principal element of trouble in the raw water is high iron content and general turbidity. The old basin, 55x135 ft., was far too small to give an adequate sedimentation period, and the filters, overloaded by their normal duty, were further taxed by having to handle a water insufficiently cleared in the settling basin. Two new settling basins were laid out, close alongside the filter plant, of aggregate dimensions 150x400 ft., with about eight times the area and three times the length of flow available in the old basin. The new basins (Fig. 2) are wholly of reinforced-concrete construction, with buttressed outer walls and continuous slab floor. The basins are 19 ft. deep.

When the new basins were projected, the elevations of the old basin and filters were adopted for the new work. The flood of March, 1913, however, 8 ft. above any prior record, rose some $2\frac{1}{2}$ ft. over the filter-house floor, and it was then decided to raise the new work $3\frac{1}{2}$ ft. for safety against future great floods. Part of the excavation for the first of the new settling basins had already been carried down to the footing-level first intended, and this was refilled to the new elevation. This basin is completed and in operation, and concrete work on the walls and floor of the second basin is in active progress.

The old basin, $20\frac{1}{2}$ ft. deep, gives a depth of 24 ft. up to the new level of top, for filter and clear-water-basin construction. A reinforced-concrete slab and beam floor, on columns 16 ft. on centers longitudinally, is to be built $9\frac{1}{2}$ ft. below the new top of the side walls (Fig. 3). Below this a clear height of $11\frac{1}{2}$ ft. will be available for clear-water storage. The floor will carry the 16 new filters, 11 ft. 8 in. by 22 ft. 3 in. inside, $8\frac{1}{2}$ ft. deep, separated by a central longitudinal distribution gallery 10 ft. wide in the clear.

Removal of the baffle walls in the old basin is now going on, to be followed by construction of the new bottom slab and lining, intermediate floor and filters. When these

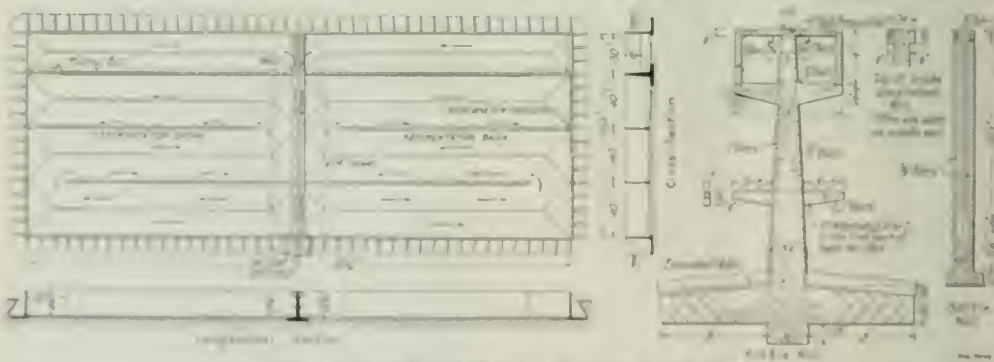


Fig. 2. New Water Settling Reservoir, Youngstown, Ohio

Fig. 3. Converting Settling Basins into Mechanical Filters and Clear-Water Basin, Youngstown, Ohio

... completed, the old filters are to be put out of service and rebuilt to a level 3½ ft. higher, and with new water feed and collecting systems, all as shown by Fig. 4.

Removal of the pumping station from the east bank to a location alongside the filter plant is being prepared for

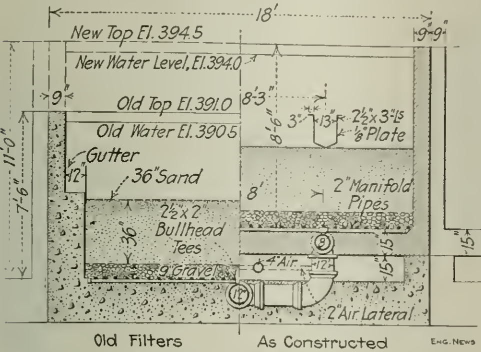


Fig. 4. Reconstructing a Mechanical Filter at Youngstown, Ohio

by foundation work at the new site. A contract was let recently for the chimney of the new station, a reinforced concrete stack 10x200 ft. (238 ft. high above foundation). Soft clay and a thin stratum of quicksand underlaid by hard gravel form the subsoil of the site. The foundations will be carried down to the gravel, some 20 ft. below original ground surface.

The contract for the filter-plant construction is being carried out by W. H. Henderson, of Youngstown. Heller Bros. are contractors for the pumping station. The Weber Chimney Construction Co. will build the new stack. Contracts for the pumping machinery have not yet been let.

The present filter equipment is said to be producing a highly satisfactory effluent. Treatment with hypochlorite has not been used at Youngstown, and is not contemplated. In April, the tests of the filtered water are reported as showing only two 10-c.c. samples with B. Coli, no coli found in 1-c.c. samples. The interval between washings averages 24 hr. with the new settling basin in operation, whereas before that period the worst conditions called for washing every 4 hr.

F. M. Lillie is City Engineer of Youngstown, and J. S. Lewis is Superintendent of Water.

A Large Open-Air Swimming and Wading Pool

An open-air public swimming and wading pool has been built in the Fair-Ground Park at St. Louis, Mo., which is said to be the largest ever built. The pool is approximately circular, but is divided into two unequal parts by a wide promenade, as shown in Fig. 1. The pools, sand beach and dressing rooms occupy about five acres.

The larger portion is the swimming pool, 440x270 ft., with a maximum depth of 10 ft. at the driving platform; its area is 99,724 sq.ft. and it holds 751,000 gal. of water. It has a 4-in. and a 6-in. supply main under 30-lb. pressure, and a 15-in. and 16-in. drain; it can be filled in 44 hr. and emptied in 20 hr. The smaller portion is the wading pool, 315x120 ft., with a maximum depth of 42 in. It has an area of 31,520 ft. and contains 361,500 gal. of water. It is supplied by a 6-in. main under 30-lb. pressure, and has a 12-in. drain, so that it can be filled in 5½ hr. and drained in 2 hr. The bottom is of reinforced-concrete slabs 2½ in. thick, laid on a bed of well-rammed cinders, and having expansion joints spaced 8x20 ft. These joints are constructed as shown in Fig. 2. The diving platform also is of reinforced concrete.

The dressing-room building contains 236 dressing rooms, besides children's rooms, locker rooms, toilets, shower baths, etc. It is so arranged that bathers going to the pool walk through a shower bath, while those coming from the pool walk through a shallow concrete foot

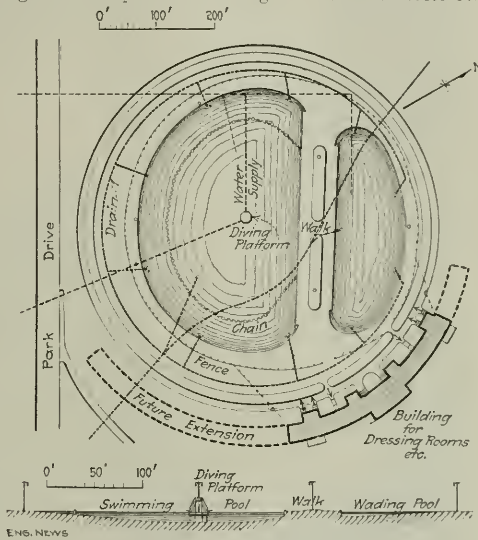


Fig. 1. Plan of Swimming and Wading Pool in the Fair-Ground Park, St. Louis, Mo.

bath, to prevent tracking sand and dirt into the rooms. On the opening day the pools were used by 10,000 persons.

The pools and building were designed by Geo. E. Kessler & Co., landscape architects, St. Louis, and were built under the direction of Nelson Cunliff, Superintendent of Construction of the Park Department. All work on the pools was done by the park employees, and the contract

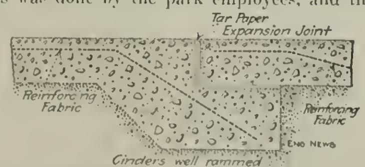


Fig. 2. Expansion Joints in Floor of Swimming Pool

for the building was let to Godfrey & Hirsch, of St. Louis. The approximate cost was as follows: grading and shaping, $13,000; concrete, $9000; sand beach, $1000; building, $16,000; total, $39,000. The extension of the building will cost about $21,000, making a finished total of $60,000.

The Results of City Planning in Essen, Germany

By Harold M. Lewis*

The city of Essen, Germany, best known as the home of the Krupp Steel Works, and the center of the largest coal-mining and industrial district of Germany, has, in the last few years, come to be recognized as one of the leading cities in yet another development—that of modern city planning. It is especially interesting in this respect, as it is still under the impetus of a rapid growth, which first made apparent the need for a large and comprehensive street plan, and the growth of this new plan and the contrast between old and new methods can be readily observed at this time.

The population of Essen, on Mar. 1, 1914, was 325,259, an increase of 172% over the figures for 1900, which were 118,862. During this period several outlying districts were joined to the city and, further, such additions now under consideration will bring the total to nearly 500,000. In the year 1910, of the wage earners in the city, 92.15% were receiving annual incomes of only 216 to 720 dollars, and therefore the housing plans of Essen must provide for an enormous number of cheap homes. The problem of combining cheapness, attractiveness and healthfulness, however, is being successfully solved. The bettered conditions in the last respect is shown by the fact that in the years 1900 to 1910 the death rate of Essen was decreased from 25.81 to 12.45 per 1000.

Essen is situated on a high plateau, the largest part of which slopes northward to the Emscher River and a smaller section of which drops off suddenly toward the Ruhr River on the south and east sides. The problem of fixing upon a comprehensive and adequate street plan was complicated by several factors. First of all by the topography of the land, which is decidedly rolling and at the outskirts of the city is sharply cut by valleys running in various directions and which must be bridged over in order to afford a satisfactory prolongation of the main traffic streets. A second important factor is the presence of the Krupp Steel Works in the very center of the city and occupying a large site which is cut by comparatively few streets. There are also about fifteen coal mine shafts scattered over the city and the plants connected with these and their immense piles of stone wastes form yet another impediment to a complete street plan. Moreover, the city is covered by a network of railroads to furnish transportation facilities for the products of the Krupp Works and the various coal mines, and in many places subsequent crossings under these railways (they are practically all on embankments) cause long detours.

An examination of a map of Essen shows a very complete system of radiating streets leading toward the center of the city, but as these approach the old section they become almost hopelessly lost, as there are no adequately wide streets cutting across the old part of the city. There are, however, a couple of such streets already planned to relieve the existing conditions. This old section might be described as a series of squares and market places connected by narrow, winding and often hilly streets. It has been found necessary to place one track of the trolley line on Kettwigerstrasse on a back street, and the remaining track runs so close to the sidewalk that a pedestrian cannot safely walk too close to the curb. At the time of the daily closing of the Krupp Works this street presents a scene very similar to Nassau St., in New York City, at the noon hour.

A stranger passing from this section of the city to the new district south of the Central R.R. Station would at once notice a difference. The streets are much wider and many of them are attractively planted with trees and shrubbery. Public parks and lawns, which were noticeably absent in the old part of the city, are everywhere within easy reach. One similarity is apparent, and that is that the streets at first seem to be hopelessly tangled and crooked, but as soon as their arrangement is studied it becomes apparent that this is a carefully planned disorder.

The whole street system is worked out with the primary aim of a characterization of the streets, and there is probably no other city in which this fundamental German idea has been so completely developed. The aim of the planner was to furnish, throughout the city, constantly new and varied vistas, not only in respect to the houses and their relations to the streets, but also in the width and arrangement of the individual streets. The completeness with which this has been carried out is shown by the fact that the range of vision in the streets is, as a rule, limited to 650 to 1000 ft. The main traffic streets are often exceptions to this rule, but every opportunity has been taken to avoid monotonous stretches on these.

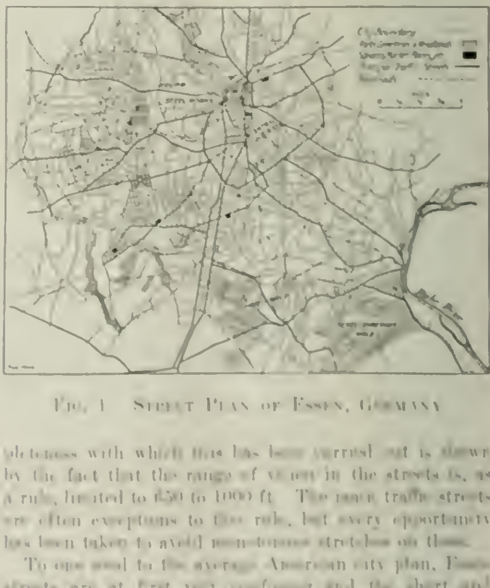


Fig. 1. Street Plan of Essen, Germany

To one used to the average American city plan, Essen streets are at first very confusing and the short and crooked streets perhaps lose some of their attractiveness when they become solidly built up to the sidewalk line with ordinary houses, and the lack of any long views may give a crowding and oppressive effect. A distinct advantage of the irregular system is the readiness with which large open places can be created at the main intersections by the cutting off of sharp corners, and advantage has been taken of this in Essen.

Not only do the streets differ from each other, but in many cases the individual streets are unsymmetrically arranged so as to avoid any chance of monotony. That is, the sidewalk is often a wide promenade on one side and an ordinary sidewalk on the other. Several very attractive streets are arranged with a single line of trees

*Engineer, [illegible]

FIGS. 2-6. SOME STREETS IN THE CITY OF ESSEN

(1. Beethovenstrasse, showing very narrow paved roadway and planting strip on one side. 2. Richard Wagnerstrasse, showing festooned vines in planting strip. 4. Moltkestrasse, an attractive curved street. 5. Kettwigerstrasse, in the old section. 6, Irmgardenstrasse, a typical short street in the new section.)

which are placed along a wide and principal footway. Another attractive arrangement is made with three rows of trees by placing the main footway between two of them on one side. Even the stereotyped system with two rows of trees is varied by surrounding one by a grass plot and the other with mosaic-stone pavement. Richard Wagnerstrasse has on one side an attractively planted parkway about 35 ft. in width between the houses and the main sidewalk, as seen in Fig. 2.

It has been attempted to segregate the residences in small groups each of which shall have its own retail stores. An open market place is also usually provided for each residence section. This plan has been greatly aided by the Krupp Co., which has established throughout the city a series of colonies for its employees. The most interesting of these are Magarethenhöhe, a colony for the Krupp officials, and Altenhof, in which the old and decrepit employees are provided with charming homes, each

designed for a man and wife. These colonies are among the most attractive parts of Essen.

The system of parks in the new part of the city was laid out with a view of placing one of the larger parks within five to ten minutes' walk from any section, and this has been practically realized. The total park area is not large, as it was in 1910 only 7.4% of the total area of the city, or about 191 sq.ft. per inhabitant. Essen is, however, much better off in this respect than this figure indicates, due to the large tracts of woodland just south of the city and along the Ruhr River. This district can be reached in fifty minutes by foot or twenty minutes by trolley from the center of the city and so is readily accessible and is much frequented by the people of Essen. There were in 1910 16.8 sq.ft. of playgrounds for each child in the city.

Essen is primarily a city of low buildings, and the tendency seems to be for the height to decrease rather than increase. This is in part due to the great chance of damage to high or large buildings due to the settlement of the land over the coal mines by which practically the whole city is undermined. Evidences of this settlement can often be seen in the old walls and buildings. The height of buildings in the city is distributed about as follows:

Four stories in height—10% of the total area.

Three stories in height—26% of the total area.

One or two stories in height—54% of the total area.

The group system of buildings has been well developed and has helped greatly in forming variety in the street fronts. Steep tile roofs are usually used, as giving a more attractive appearance and individuality than the monotonous line of flat roofs prevailing in the solidly built up parts of so many cities.

The results have been obtained with the aid of a strict building ordinance, a liberal land policy and a concentration of power under one head. As in most of the German cities the city is divided into several districts according to the use of the land and the regulations for each district are somewhat different. A summary of the restrictions for maximum height and unbuilt areas follows:

	District 1	2	3	4	5
Max. height of buildings	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Unbuilt area [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]

Ordinarily, the height of a building must not exceed the width of the street it fronts upon, although under certain conditions an additional two meters is allowed.

The great detail with which the plans have been worked out can be illustrated by two examples, which are by no means exceptional. In Messelstrasse, one of the houses in a block of three-story houses was limited to two stories in height so as to afford from a neighboring street a view of a large and handsome school building. Again, in a plan recently made for an outlying section, arrangements have been made with the evangelical church association to build a large and monumental church at the proposed intersection of five main streets.

The entire plan for the new sections of the city and the modifications of the old plan were designed and are being carried out under the direction of Beigeordneter Dr. R. Schmidt, the chief engineering official of the city of Essen, to whom I am indebted for most of the above statistics.

The Teredo in Fresh Water—Contrary to general belief the teredo may exist in fresh water, as the following experience proves. The United States snagboat "Waco" was built about three years ago of long-leaf yellow-pine, with rake planks of oak. Before launching the hull was painted with

FIG. 7. A STREET IN THE KRUPP COLONY OF "ALTENHOF"

FIG. 8. A STREET VIADUCT CROSSING THE PARK

carbolineum. Soon after its completion at Jeffersonville, Ind., the "Waco" started on a trip to the Brazos River in Texas. Altogether the boat spent 2½ months in tide water, including the time working below Mile 19 in the Brazos River. The effect of the tide is perceptible up to this point, although there are no signs of barnacles or teredos in the wharves above Mile 25.

After passing Mile 19 the "Waco" spent the next two years and ten months working her way upstream to Mile 171, from which point she was returned and hauled out for repairs. An examination of the hull planking was made and found to be fairly well honeycombed by the teredo, necessitating the renewal of all bottom planking and the greater portion of the gunwales. Some of the specimens of the teredo that were examined were ⅛ in. in diameter and 18 in. long, all alive and healthy at the time the planks were removed.

The following analysis of Brazos River water taken at Mile 118 shows a high percentage of salt as compared [illegible] those that contained in samples taken from the Guadalupe River.

	Parts per million
Iron and alumina	11.[illegible]
Silica	14.[illegible]
Calcium carbonate	[illegible]
Magnesium carbonate	[illegible]
Sodium sulphate	[illegible]
Sodium chloride	[illegible]
Alkalinity, expressed as sodium bicarbonate	[illegible]

It is possible that the gradual transfer of the "Waco" from salt water to fresh, together with the natural saltiness of the river, has been a factor in preserving the life of some of the teredos that had gotten into its planks.

There is no doubt that the specimens were genuine teredos, as they showed all the characteristic features, and the holes left by them were lined with calcareous matter. [B. C. Mc[illegible] in the "Professional Memoirs" of the Corps of Engineers and Engineer Department at Large, July-August, 1914, p. [illegible]]

The Old Cleveland Trainshed Roof

The remarkable old trainshed roof of the Union Passenger Depot in Cleveland, Ohio, whose demolition was described in our issue of June 11, 1914, pp. 1294-1297, was a relic of early days of iron framing that merited close study by all structural engineers. It was built in the days when combination cast-and-wrought-iron construction was yet in flower. Like many other combination structures, it was highly individual, showing original ingenuity in every part.

A separate source of interest is the fact that, though the safety of the roof was at all times precarious (or at least none too ample) judged by modern standards, the roof stood almost half a century without accident or trouble. Alarm was raised concerning the structure about 40 yr. ago—in 1877—and again in the '80's was it criticized. Besides being doubtful in its iron framing, its expansion and contraction rocked one of the two supporting walls—in default of good roller construction. At one time, too, a storm actually broke some parts of the rod tie-work in the roof. But it suffered no vital accidents, and has remained until taken down, 49 yr. after its construction.

Reproductions of the two old drawings of the roof trussing are shown in Figs. 2 and 3 herewith. So far as can be determined, these drawings were made at the time of construction—one of them undoubtedly before construction, since the roof itself exhibited several departures from the drawing.

General Description

The trainshed was 600 ft. long. The roof trusses, spanning 180 ft. and spaced 12 ft. apart, were of double-pitched outline and looked something like ordinary roof trusses. But they probably were arches, as all the web members, except one strut on each side, were tension rods, forming a sort of spiderweb bracing system that suggests rigid arch-rib action of the rafters or upper chord. The web system includes a main tie-chord, an auxiliary tie or middle chord, and various diagonal tension rods. The strut near the lower third of either rafter was simply butted to its connections at top and bottom; it probably took only the local panel-load, and had minor effect (if any) in bracing the rafter against arch distortion.

The general design is such as to defy stress-analysis. But some approximate calculations lead B. R. Leffler, Bridge Engineer of the Lake Shore & Michigan Southern Ry., to state that the stresses in the truss may have been considerably in excess of 30,000 lb. per sq.in. under dead-load alone. He also states that the weight of iron in the roof is only half of what would be found in a structure of modern design, a fact which itself points to high stresses.

FIG. 1. INTERIOR OF CLEVELAND UNION DEPOT TRAINSHED, LOOKING ALONG THE LINE OF STRUTS

(Except for one strut on each side, all the web-members of the truss are tension members.)

Top Chord or Rib

The rafter or arch rib, 21 in. deep, was made of four wrought-iron bars, 6 in. wide by about 5/8 in. thick, with

[illegible] cross-shaped spreaders or spiders between, held together by pairs of assembly bolts running through from bar to bar. The drawings show only upper and lower flange bars, but in the roof itself every arch-rib had also two web bars (Fig. 4). These were apparently afterthoughts, as noted below. They were held apart by two sets of cast-iron angle or filler blocks in the upper and lower forks of each spider, seated against the middle rib of the spider arms, and notched for two through-bolts.

The spiders in the straight part of the rafter were planed square on the eight abutting corner-faces. Those of the middle part had their radial faces planed to a consistent taper, which made this part of the rafter a circular segment. An obtuse angle was formed at the junction of circular and straight portions, by a filler block at the upper flange, between adjoining spiders, welded to the upper flange bars.

The original plan (Fig. 2) appears to have contemplated using two narrow [illegible] bars each in upper and lower flange of the rib, instead of one 6-in. bar. The two easterly trusses of the trainshed were built this way, but all the other trusses had single 6-in. bars (Fig. 3).

The peculiar trainshed construction used in this roof was apparently used in some other buildings also. Old records of the Lake Shore at hand seem to show this. But no [illegible] are [illegible] below.

The [illegible] for the roof [illegible] were [illegible] to the [illegible] flange of the rib by the [illegible]. Of the two bolts at each cross, one

Fig. 2. Old Drawing of Cleveland Trainshed Roof

[illegible] Scale of details, 3 in. per foot. 19 trusses

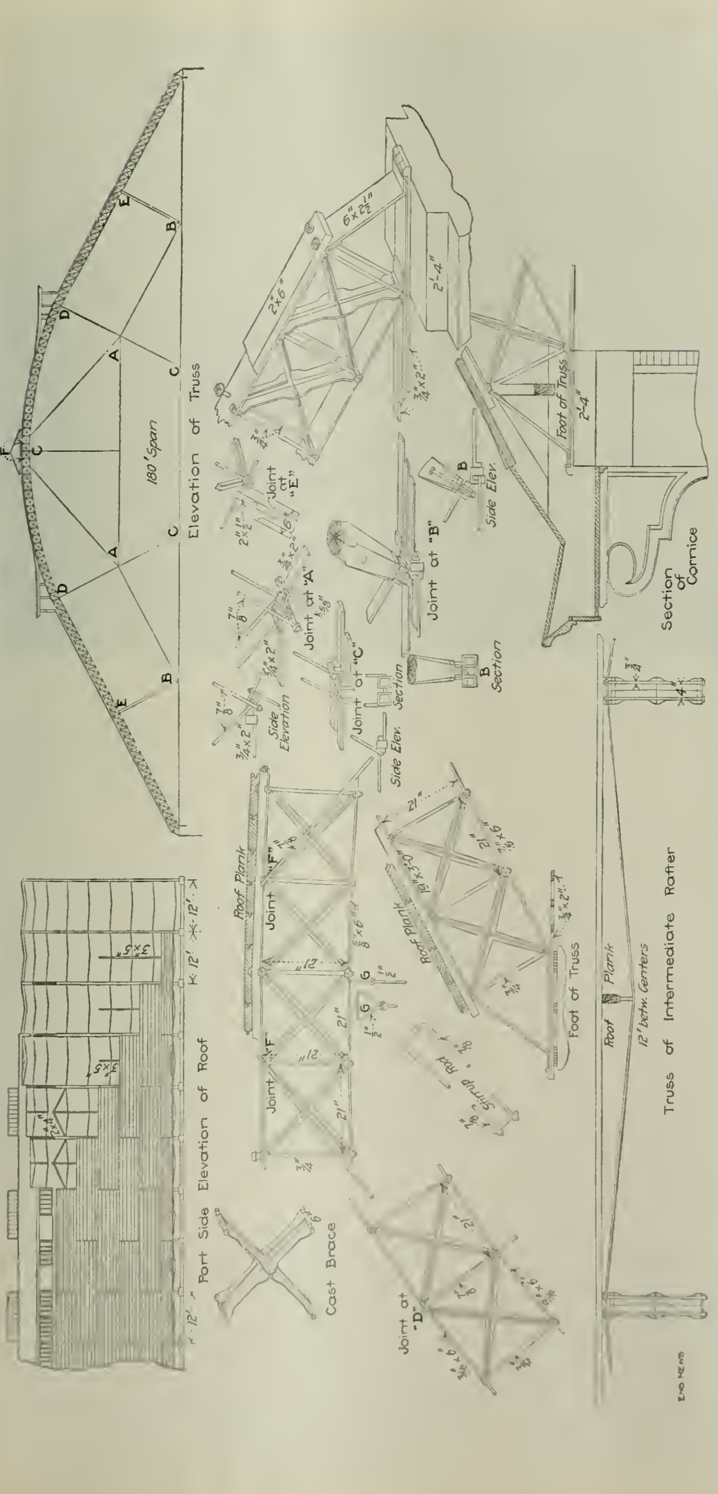


FIG. 3. DRAWING OF ROOF

Bearing title: "Iron roof truss, Union Passenger depot, Cleveland, Ohio."

had its nut raised about 2 in. above the top flange on a gas-pipe spacer, and this spacer passed through the spiking piece, and allowed the nut to secure it in place; the nut of the other bolt was seated directly on the flange bar.

The side bars, as already noted, were probably added after the roof was erected. Their most curious feature was a screw-joint at the beginning of the segmental crown portion. Here the pair of side bars of the lower part is terminated by a block between the bars, facing a similar terminal block of the side bars of the crown section. In the 5 or 6-in. space between the blocks was a right-and-left screw passing through both blocks, its middle part shaped to take a wrench. If these side bars were added some time after construction, to reinforce the ribs, this screw connection may have been used as a means of making the side bars share in the compressive stress carried by the rib.

Each rib was seated on and built into the wall masonry of the south wall of the trainshed, but at the north or lake-side wall was seated on a series of ¾-in. rollers, resting on the stone wall-plate. There was no evidence of motion at the roller bearing, and above the wall-plate the masonry was carried up to meet the roof planking, thus enveloping the arch ribs and tending to prevent expansion motion. This north wall was taken down in the demolition of the roof, and its masonry was found to be quite loose, i.e., not bonded by its mortar, and the horizontal joints of the wall in many places showed the en-

Fig. 1. Interior View toward Demolition Traveler, Cleveland Union Depot

(At the extreme right is the line of web struts corresponding to that seen in the middle of Fig. 1. The [illegible] middle part of the roof has only tie-rods in its web. The form and make-up of the arch rib are shown clearly in the silhouette of the [illegible].)

[illegible] of wall. From this it is believed that the trusses did not move on the wall, but that expansion and contraction of the ironwork was taken up by rocking of the wall.

The [illegible] strut in the web system (see Fig. 1) is shown in Fig. 2 as a 10½-in. [illegible] trussed with four ¾-in. rods. It was built as a [illegible] strut, however, and Fig. 3 shows it so. The latter drawing is therefore evidently of later date than Fig. 2, but, as some details, e.g., the connection of the diagonal rods at the crown, are not quite the same as there shown, it was probably made before the roof was built — as a final construction drawing perhaps.

Tension Members

The lower chord and the auxiliary tie or middle chord were made of flat bars ([illegible]). The splices in these bars were located at the joints of the web system, and were in all cases made as sketched in Figs. 5 and 6. Upset ends were forged, and these were hooked into each other and the joint then secured by slipping a welded square ring over the connection.

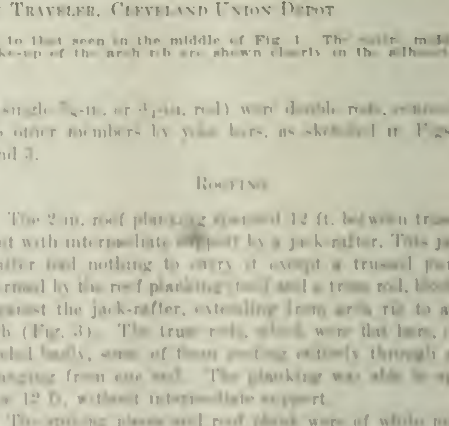
A [illegible] was found at all these joints. The welded wrought-iron ring was backed up by one or two [illegible], [illegible] so the joint [illegible]. The adjoining sketch, Fig. 6, shows such a ring, traced from the object. These must have been applied after the roof was erected, to strengthen the joint against [illegible] due to its eccentricity of pull, [illegible] on the wrought-iron rings.

The [illegible] members (except the crown hanger, a single ⅞-in. or ¾-in. rod) were double rods, connected to other members by yoke bars, as sketched in Figs. 2 and 3.

Roofing

The 2-in. roof planking spanned 12 ft. between trusses, but with intermediate support by a jack-rafter. This jack-rafter had nothing to carry it except a trussed purlin formed by the roof planking itself and a truss rod, blocked against the jack-rafter, extending from arch rib to arch rib (Fig. 3). The truss rods, which were flat bars, corroded badly, some of them rusting entirely through and hanging from one end. The planking was able to span the 12 ft. without intermediate support.

The springing pieces and roof plank were of white pine, the planks were fastened by wrought-iron nails. The covering was slate on tar paper, fastened with copper nails



Figs. 5-6. [illegible] and [illegible] Ring for Reinforcing the Tension Bar Splices, Cleveland Trainshed

FIG. 7. WEST WALL OF CLEVELAND UNION DEPOT

(The narrow masonry piers, and the cast-iron intermediate columns with plain base and cap plates, offer little resistance to a colliding train, yet they stood the full 49 years since 1865 without harm. At some time in that period the north intermediate column was taken out to make room for a crossover; the north pier buckled, and timber centering was put in to support the arch.)

None of the roofing material had been removed during the life of this structure, and at the demolition it was found in excellent condition.

For further details, the drawings, Figs. 2 and 3, can be referred to.

One fact bearing on the action of the roof truss in carrying load is to be noted. About 40 ft. inward of the south wall there was a longitudinal wall inclosing the waiting-room, etc., for the whole west half of the trainshed. The brickwork of this wall extended up to the roofing, and where it came under the bottom flange of the rib the brickwork had been built solid up against the iron. In the demolition the upper part of this wall was torn out. The result was a small but measurable deflection, $\frac{1}{4}$ to $\frac{1}{2}$ in., over the line of the wall, indicating that some of the roof weight had rested on the partition.

History

The front of the station building bears the date 1865, agreeing with the date on the first drawing (our Fig. 2). B. F. Morse, who died a few months ago, was Constructing Engineer for the structure. It is a remarkable coincidence that the train which carried his body to burial went through the trainshed on the very day when demolition of the old shed was begun.

Early records relating to the roof have not been found. A letter from Morse to John Newell, General Manager of the Lake Shore & Michigan Southern, written Mar. 26, 1877, is the earliest, aside from the two drawings here reproduced. Morse had become City Engineer of Cleveland in 1867, soon after completion of the trainshed, and was in this position at the time of writing the letter.

Criticism and Reinforcement

Mr. Morse's letter refers to criticisms of the roof, to a report made by a Mr. Wilson of Philadelphia, and to tests of some tension splices which the latter had made. It also relates that Mr. Morse made a private examination of the roof, and found the stress in the various tension joints to be not over 3 to 4 tons per square inch. He makes some suggestions for reinforcement; one of them shows (by sketch) side bars applied to the two lower panels of the rafter. This suggests that the side bars were added to the roof after 1877, and probably they were put on for the full length of each rafter, as found in the roof just demolished.

Later, in the early '80's, the roof was criticized and its strength declared doubtful, by S. W. Robinson, engineer to the Ohio Railroad Commission, but there is no record that anything was done to meet this criticism.

About 1885, a great north storm, blowing on the lakeside of the roof, broke a number of the crown diagonals on that side, at the same time buckling the corresponding south crown diagonals. The broken bars were replaced, and the roof appears to have suffered no permanent damage.

In recent years, the corrosion began to give trouble at some local points. As already noted, some of the jack-rafter truss-rods rusted through, but no attention was paid to this as the plank safely spanned the 12 ft. between trusses. But four years ago, in 1910, over a

point in the shed where engines of passenger trains stand were frequently and longer than elsewhere, the assembly bolts of the rafters (the bolts passing through from upper to lower flange plates) were found to be seriously weakened by corrosion. All the badly weakened bolts, in fact about one-fourth of all the bolts in the roof, were replaced, one by one, by steel bolts—the original ones were wrought iron. These rafter assembly bolts were important as they prevented the collapse of the rafter, and consequently that of the whole roof.

Last fall it was found that the new steel bolts were corroded almost as badly as had been the wrought-iron bolts, which they replaced, three years before. This fact made it clear that the problem of maintaining the roof was likely to become exceedingly difficult. A specially thorough examination of the roof, extending over two months (and not completed even in that time) further emphasized the difficulties attendant upon frequent close inspection and repair. With further regard to the indeterminate system of the trussing, and the probable high stresses existing in the main members, the engineers when called upon for definite assurances as to the safety of the roof declared the roof unsafe. Plans for its demolition were started at once, and were carried out during May and June, 1914.

Condition of the Iron

The ironwork of the roof shows almost negligible corrosion in its main members. The cast-iron spiders of the rafters are practically free from rust; the flange bars and large tension bars, while rusty, do not seem to have suffered much loss of section. The rafter-assembly bolts were much rusted, as noted above, and similarly the thin flat tension bars of the jack-rafters and the crown hangers of the trusses lost much from rusting. These exceptions, however, form only a small part of the total ironwork of the roof. Considering the severe exposure to locomotive gases, steam and atmospheric moisture, the condition of the roof is remarkable. In those parts of the framework south of the waiting-room partition, i.e., outside the open (train-shed) space, the iron is almost perfectly preserved, being barely tarnished.

The woodwork of purlins, etc., is as well preserved as the iron. The slate and tar-paper covering protected it fully from decay.

The removal of the old roof was wholly a safety measure, as the new Union Station now being planned for will be located half a mile or more to the eastward. The platforms of the old station are being covered by butterfly sheds pending completion of the new station.

The data for the preceding description were given by B. R. Leffler, Bridge Engineer, Lake Shore & Michigan Southern Ry., Cleveland, Ohio, who is in charge of the demolition work and previously was responsible for the maintenance of the roof. The copies of the old drawings were also obtained through his courtesy.

Coal, the Contractor and the Lien Law

An interesting decision was handed down in February by the New York Court of Appeals to the following effect as stated in the syllabus:

Coal sold to a contractor and builder of a state highway and consumed in generating steam in the boilers of road rollers and traction engines used on the contract, is not material furnished in the construction of the highway, within the meaning of the Lien Law and is not therefore the subject of a lien (Sec. 5 of Lien Law).

It happens not infrequently that arguments arise as to just what material should be considered as entering into construction work. In the case under consideration the point to be decided was whether coal sold to a contractor and builder of a state highway and used in the boilers of road rollers and traction engines on a contract, was a material furnished for the construction of the highway, within the meaning and intent of Sec. 5 of the Lien Law, which reads as follows:

> A person performing labor for or furnishing materials to a contractor, his subcontractor or legal representative, for the construction of a public improvement pursuant to a contract by such contractor with the state or a municipal corporation, shall have a lien for the principal and interest of the value or agreed price of such labor or materials upon the moneys of the state or of such corporation applicable to the construction of such improvement, to the extent of the amount due or to become due on such contract, upon filing a notice of lien as prescribed.

The Court held that inasmuch as the coal was not applied directly to the highway or absorbed by it, the price of the coal in question was not a lawful subject for the lien.

In supporting its conclusions the Court referred to other important decisions on this same point. One of these decisions read:

> We are of the opinion that there is a plain distinction between materials so used [coal burned in engines used on work] and materials that enter directly into the work and become a part of it, or those that are consumed by being applied directly to substances to be moved or changed to make a place for the structure or be incorporated into it.—[Sampson Co. vs. Commonwealth, 202 Mass., 326.]

The decision of the Court of Appeals on this point recalls other decisions in this same field. It has been held that materials used in a coffer-dam constructed especially to make possible the building of the dam contracted to be built and which were in effect destroyed by their use in the coffer-dam or subsequent loss were the lawful subject of a lien.

As illustrating distinctions which must be drawn in defining materials used directly on road construction, other decisions of the New York Court of Appeals have held that dynamite used in breaking up frozen earth so that excavation could go forward was material furnished for the improvement of real property, and its furnishing the lawful subject of a lien. On the other hand, the rent of a steam shovel leased to a contractor for use in the construction of a public improvement, is not the lawful subject of a lien inasmuch as the machine after the construction work is completed is in practically the same condition as it was before the work was started.

The decision as regards the attachability of coal used in the operation of a contractor's plant appears to be very fair. Had the decision been otherwise, much confusion would follow, for it might be argued upon the same principle, that oil used in the lubrication of contractor's tools, and even food eaten by laborers and perhaps clothing worn by them, are all consumed in the construction of a building or other structure and hence are lienable materials. While this might not be true, such materials have neither physical nor immediate connection with the structure at any time. They are auxiliaries which make possible the operation of tools, machinery or men, which in their turn act upon the structure. This decision will probably be widely quoted.

Editorials

Commercial and Engineering Opportunities in South America

Never was there a more opportune time to press the introduction of American products in the development of the great engineering, mining and industrial enterprises of our South American neighbors. With all the other industrial countries of the world busy destroying one another, with no safe Atlantic merchant marine but that which plies between the American republics, the time has come for South America to turn to us for many manufactures which cannot now come from Europe.

Particularly timely, then, is the detailed account of the constructional activity of one of the most active of our Southern neighbors, a field which has already been extensively entered by American engineers and manufacturers. We recommend a perusal of the article on another page of this issue, "Recent Railway Construction in Chile," to manufacturers of railway and contractors' equipment. The author, Mr. King, has recently returned from a long business engagement in Chile, and has made his article specific enough to be of much value to live and foresighted American manufacturers.

It should be remembered, however, that Chile is but one of several of our prosperous South American neighbors who can no longer look to Germany, Belgium and England for locomotives, cars, steel and other equipment. When these South American countries once begin the extensive introduction of American products, let the manufacturers see to it that those products will ever afterwards be preferred.

With the right kind of commercial relations more friendly and intimate communication is inseparable, and the opportunity for American engineers to coöperate with their Southern brethren in great wealth producing enterprises must become greater than ever before.

An Object Lesson in City Planning

The average engineer, especially the engineer who has no connection with municipal work, probably regards city planning as a sort of amiable fad, with very little relation to the practical conditions and possibilities of American cities. If any such engineer, however, has the good fortune to visit the cities of modern Germany and view them with his eyes open, he soon realizes that city planning is something of enormous importance and enormous possibilities.

Elsewhere in this issue we publish an interesting account of what city planning has accomplished in the City of Essen, Germany, written for ENGINEERING NEWS, by Harold M. Lewis (son of Nelson P. Lewis, Chief Engineer of the Board of Estimate and Apportionment of New York City). Essen has become world-famous as the center of the great Krupp iron and steel industry. The Krupp works themselves form the nucleus about which the city has grown, and the shafts of numerous coal mines also emerge in the heart of the city.

Most American engineers know pretty well the appearance of the average American industrial town in the coal-mine and steel-making sections of Pennsylvania or Ohio; the long lines of dreary hovels in which the workmen live, the crude tawdriness of the business streets; the heaps of discarded tin cans; the tumble-down shanties and sheds; the barren hills and valleys surrounding. All these are only too familiar. The American who visits Essen, expecting to find there such sights as these, familiar in an American industrial city, has the surprise of his life awaiting him. Mr. Lewis' description and the photographs accompanying his article do faint justice to the beauty of streets and parks and buildings in this German city, where 90% of the workers earn less than $700 a year.

These beautiful results in city planning at Essen are obtained by comparatively simple means. Compare the variety in the street plan of Essen with the monotonous checkerboard regularity governing the layout of streets in almost every American city. Compare the narrow, well paved, well kept streets of Essen and their liberal provision of space for grass and trees, with the streets of the average American city, all laid out to one uniform width, and presenting usually a narrow strip of macadam or paving lined on each side with a broad stretch of weeds. Essen and other progressive German cities show the possibilities from *planning* a city's development, instead of letting it proceed on the plan of Topsy, who "just growed."

A Belief in a Shortage of Engineers

An Arkansas correspondent sends us an editorial in the "Christian Science Monitor," entitled "Why a Shortage of Engineers," containing the statement that "never before has the demand for civil engineers been so far ahead of the supply." Our correspondent remarks that from his own observations in recent travels over the country he found a situation exactly the reverse.

It should be added that the journal referred to based its statement as to the shortage of engineers on the report that the railway valuation work under the Interstate Commerce Commission was proceeding slowly because the U. S. Civil Service Commission had not yet been able to supply enough junior engineers for the work of surveying.

It is evident that the "Christian Science Monitor" has formed an opinion on very limited evidence. Those who are directing the work of railway valuation preferred to go ahead rather slowly at the start and test their methods by actual trial before putting parties at work in all parts of the country. There was at one time, in-

[illegible] some difficulty in securing certain men for special work on the valuation force under the conditions and the salaries offered, but it is a very far cry from such a condition to the conclusion that there is a shortage in the supply of good engineers.

The Cost of Building the Panama Canal

The widely published official figures of the cost of the Panama Canal have possibly given the general public an exaggerated idea of the cost of the canal as a piece of engineering work. The statement has been made that the entire cost of the canal to the United States when completed will be in the neighborhood of $400,000,000, and it is a natural conclusion that the bulk of this expenditure has gone into the work of digging the canal and constructing the locks.

It will surprise many engineers even, we doubt not, to learn from figures published in the last number of the "Canal Record," that up to Mar. 31, 1914, the entire expenditure on the canal in the Department of Construction and Engineering had been only $201,087,000. The total expense up to the same date for all purposes connected with the canal was $322,651,000. The chief items in the account, apart from construction and engineering, were in round numbers, civil administration, $7,000,000; sanitation, $17,000,000; fortifications, $5,000,000, and general items, $90,000,000. Under this latter head are included the payment of $40,000,000 to the French Canal Co. and $10,000,000 to the Republic of Panama. There is also included under this head very heavy expenditures for the reconstruction of the Panama R. R., the construction and repair of buildings and the cleaning up of the cities of Colon and Panama. Of course, all these expenditures were necessary to the canal work, but it ought to be more generally understood that in the actual building of the canal, including the cost of the machinery used in its construction, the entire expenditures have only been, in round numbers, $201,000,000.

Rerailing Frogs Protect Bridges

Derailment of a train is serious enough anywhere along the railway line, but it is most serious when approaching or upon a bridge. For a long time it has been the ideal of bridge engineers to make the roadbed just as safe over a bridge as it is elsewhere, to create structures which will carry the normal roadbed across the opening in such a way that both the operating department and the maintenance department need no other notice than that a bridge is there. Perhaps that ideal may be reached in the future. At present we are still very far from it. Means for protecting bridges from the special danger of a derailed truck or axle on a bridge have therefore been often discussed, time and time again, beginning many years ago.

"Engineering News" only a short time ago (Apr. 30, 1914, p. 991) suggested that in many cases a marked advantage may be secured in the direction of safety by erecting fender or buffer posts along the track or at the approach to a bridge. This introduced a distinctly new element into the discussion. The [illegible] wreck on the New Haven and the [illegible] bridge wreck on the Wabash gave special point to the suggestion. Now comes news that a less radical and more generally known expedient offers such increase of safety as to make its adoption a plain matter of good business.

The danger of derailments on a bridge lies not only in the chance that the projecting car may strike the trusses and thereby break down the bridge, but also in the probability that the derailed truck or axle will tear up the bridge floor. Rerailing frogs, placed in the inner guard-rails on the approach to the bridge, eliminate this danger by catching the derailed wheels and guiding them back to place on the rails. The Pittsburgh & Lake Erie Ry. uses this arrangement at nearly all of its bridges. The experience of that railway, we learn, indicates that the rerailing frogs are effective in taking care of derailed wheels. The track-inspection men report, from time to time, that marks of derailment show on the track, and that they disappear at a rerailing frog: clear evidence that a derailed axle was prevented from doing extensive damage to a bridge, with the chance of wrecking a train.

A single train wreck may easily cost more money than enough to place rerailing frogs at all the bridges of a fair-sized railway system. If one wreck a year is prevented by them, are they not a good investment?

The Utilization of the Catskill Water-Supply in New York City

It is expected that the new Catskill water-supply will be available for distribution in New York City by Jan. 1, 1916. A report has recently been made by I. M. de Varona, who has just been retired as Chief Engineer of the Department of Water Supply, Gas and Electricity, of New York, setting forth a proposed plan for the utilization of the Catskill supply by the city.

Contrary to the popular belief, the volume of the new Catskill supply now developed will be less than that now taken from the Croton watershed. Croton water, therefore, will continue to be used and the Catskill supply will serve to supplement it. The area of the Croton watershed drainage area is 360 sq.mi. The area of the Esopus drainage area, the only part of the Catskill water-supply now developed, is 255 sq.mi. Eventually, however, it will be possible to supplement the supply from the Esopus watershed with water from the Rondout, Schoharie and Catskill drainage areas, with an additional area of 522 sq.mi. This will make a total area available on the west side of the Hudson River of 777 sq.mi.

Mr. de Varona's report, however, deals only with the Esopus water-supply now to be available. The estimated safe yield from the Esopus is set at 250,000,000 gal. per day. This may be compared with the 336,000,000 gal. which is the estimated safe yield of the present Croton supply, and 150,000,000 gal. per day which Brooklyn now receives from its driven-well system on Long Island. The most important feature in connection with the new Catskill supply is that it will be delivered to the Borough of Manhattan at a head of 295 ft. above tide water.

The present Croton supply comes to the city at so moderate a head that large areas of the city located on high ground have to be supplied by pumping the Croton water. The Brooklyn supply being from driven wells, all requires pumping. The first use of the Catskill water, therefore, will be to supply the high areas in all the bor-

oughs and do away so far as possible with the expense of operating pumping machinery. In the accompanying two tables, Mr. de Varona summarizes the water consumption in each section of the different boroughs supplied at a different pressure, and in the second table he indicates the future supply for each of these various services.

Based on the estimated consumption for 1915, the water consumption for the various services in the different boroughs of New York is shown in Table I.

TABLE I.

Borough	Service	Elevation of normal water-level, ft.	Estimated consumption m.g.d.
Manhattan	Tower	336	0.5
	High	280	26
	Intermediate	218	66
	Low (*)	119	173
Bronx	High	290	15
	Intermediate	193	33
	Low (*)	134	22
Brooklyn	High	260	12
	Intermediate	200	16
	Low	172	108
Queens, 1st and 3rd wards	High	250	16
Richmond	High	453	1
	Intermediate	330	3
	Low	228	9

Table II shows the order and distribution of the sources of supply for each service after the introduction of the Catskill supply, the selection being based on hydraulic gradient and cost.

TABLE II.

Borough	Service	Primary source (*)	Secondary source
Manhattan	Tower	Catskill pumped	Catskill pumped
	High	Catskill full pressure	Catskill
	Intermediate	Catskill reduced pressure	Croton pumped
	Low	Croton	Croton
Bronx	High	Catskill full pressure	Catskill full pressure
	Intermediate	Catskill reduced pressure	Croton pumped
	Low	Croton	Croton
Brooklyn	High	Catskill full pressure	Catskill
	Intermediate	Catskill reduced pressure	Catskill
	Low	Catskill reduced pressure	Brooklyn system
Queens	First ward	Catskill full pressure	Catskill or Bklyn. system
	Third ward	Catskill full pressure	Queens system
Richmond	High	Catskill pumped	Catskill
	Intermediate	Catskill pumped	Catskill
	Low	Catskill full pressure	Southfield Blvd. station

(*) Primary source is the supply to be utilized in 1916 for the given service. The secondary source is the supply that will be drawn on when the increased demand necessitates a re-adjustment of the sources of supply.

It will be seen from these tables that Catskill water will be utilized to supply all of Brooklyn, Queens and Richmond, and all of Manhattan and the Bronx, except those areas now on the low pressure. These low-pressure areas, however, at present use about 195,000,000 gal. of water per day, so that they will form an important part of the water consumption. This will leave nearly 150,000,000 gal. a day of the Croton supply and the entire Brooklyn driven-well system available to supplement the Catskill supply whenever increasing water consumption makes it necessary.

It must be remembered that the 250,000,000 gal. estimated as the safe yield of the Esopus watershed is estimated on the basis of what it will yield year in and year out, including seasons of extreme drought. Inasmuch as the city has the large storage of the Croton watershed and the Brooklyn driven-well system to fall back upon in case of emergency, it will be feasible to draw a much larger supply than this from the Catskill watershed without serious danger.

In addition to this, Mr. de Varona recommended, in a report made to the Commissioner of the Department, on Nov. 21, 1913, that pumping machinery be installed to raise the pressure of the Croton supply, especially in those areas of the city where the height of the buildings necessitates the general use of pumps and tanks by the individual consumers. It is estimated that not less than $1,000-000 per year is spent by water consumers in this district for repumping the Croton supply to force it to the higher stories. The additional pressure upon the supply in this district resulting from installing city pumping stations would also increase the efficiency of fire-protection all over this area, which includes many congested-value districts not already covered by the high-pressure fire system.

It may very likely seem that the new water-supply from the Catskills will furnish such an unlimited amount of water that it can be used and wasted *ad libitum*. If this idea prevails, however, it will be a very short time indeed before New York will have to start up the pumping machinery which will be laid aside when the Catskill supply is introduced and only a very few years before the danger of water shortage will again menace the city.

Mr. de Varona presents a table showing the estimated average consumption of Greater New York from 1915 to 1925, assuming that no introduction of water meters and no systematic waste prevention are undertaken after the Catskill supply is introduced. The total available supply from the Esopus, Croton and Long Island drainage areas, with the small amounts from the Bronx and Bryan Rivers and the local water-supplies used in the Boroughs of Queens and Richmond, totals a safe yield of 766,000,000 gal. per day. Mr. de Varona's tables show that in 1920, only four years after the introduction of the Catskill supply, the water consumption of Greater New York, assuming as before that waste goes on unrestricted, will be 775,000,00 gal. per day, or greater than the safe yield of all the supplies now available. If, however, New York City will proceed with the introduction of water meters to restrict its waste, then Mr. de Varona estimates that the combined supplies now available will be sufficient until the year 1925.

This means, however, that in a very few years the city will again have to go to the expense of pumping a large part of its supply. The only way to obviate this would be to proceed with the development of the Schoharie, Rondout and Catskill supplies to supplement the flow of the Esopus. These can be developed at comparatively small expense and the aqueduct from Lake Ashokan in the Esopus watershed to New York City has been made of a capacity sufficient to carry the water from these additional drainage areas. These three additional areas will contribute a safe yield of 234,000,000 gal. a day to New York City. If waste is allowed to proceed, however, and water meters are not introduced, even this additional vast amount of water will be all required by the year 1926, according to Mr. de Varona's figures.

It is clearly evident, therefore, that New York should proceed at once to supplement the flow into Lake Ashokan by driving the Schoharie tunnel. It should also proceed with the introduction of water meters over the entire area of Greater New York. The total cost to the city of the water now supplied to the various boroughs averaged $18.80 per million gallons. The total cost of the Catskill supply from the Esopus watershed will be $97 per million gallons. This cost will be very greatly reduced, however, when the flow through the Catskill aqueduct is increased by the addition of the water from the other Catskill drainage area.

It is entirely clear that New York's great and costly water-supply ought to be carefully conserved. Abundant though it seems to be, the wisdom of proceeding diligently with the introduction of water meters and measures to prevent waste is proved by Mr. de Varona's figures.

Letters to the Editor

Air Valves on Water-Supply Lines

Sir—The discussion concerning air valves on water-supply mains, in your issue of July 30, is interesting and valuable. The writer agrees thoroughly with the main conclusions of Mr. Berry. As a corollary he remembers a case where a pipe some two miles long, extending from a pumping station to a reservoir, was full of water. The gage pressure at the pumping station indicated 120 lb. per sq.in.; no water was being supplied by the main, and the pumps were stopped. A valve near the reservoir was closed and immediately the pressure dropped in the pumping station from 120 lb. down to 105 lb., although the valve was at the same elevation as the water in the reservoir. This illustrates the simple phenomenon that might ordinarily be overlooked, that as soon as a valve is closed tight on a single line, in which no flow of water occurs, the pressure at the low point will immediately drop to that which would be caused by the highest elevation of water between the valve and the gage, less the atmospheric pressure. If the main were absolutely tight, the pressure would doubtless remain at the original amount, but the slightest leakage, which exists in all practical cases, would produce the phenomenon above described.

J. W. LEDOUX,

Chief Engineer, American Pipe & Construction Co.,
Philadelphia, July 31, 1914.

Promoting Safety on Construction Work in Wisconsin

Sir: An editorial in ENGINEERING NEWS of July 16, suggests that greater attention to the safety of workmen on construction jobs will result from New York's new Employer's Liability Law. In Wisconsin, some of the opinions and predictions of that editorial have already been verified by experience.

In Wisconsin, both factory inspection and the administration of the Compensation Act have for three years been carried on by the Industrial Commission. Until recently the time and money available for safety work have been directed toward the prevention of accidents in shops and factories; this year the Commission has started a similar campaign in construction work.

Only a small percentage of accidents can be prevented by law, which is, however, a necessary foundation for further work. The Wisconsin law simply requires that all places of employment shall be made safe; the Commission is to fix reasonable standards of safety. The "General Orders on Safety in Building Construction" (only 30 in number, and very brief) were drawn up by an advisory committee, composed of four building contractors and four labor-union representatives. The orders cover the following subjects: Scaffolds, openings in floors; ladders, elevators, derricks and other machinery; temporary floors on skeleton buildings; piling of material; notes on stepping on nails, and first-aid outfits.

The enforcement of these orders requires inspection. Such inspection—and in fact the entire department—not only must be nonpolitical, but must be free from any violent partisanship as between capital and labor. Inspectors must be men who understand that the success of their efforts consists in arousing the sympathetic interest of the employer in safety, rather than in detecting technical violations of the law.

The Commission's records show that over 80% of building accidents are caused by carelessness. Such accidents cannot be prevented by laws or by mechanical safeguards only.

The Commission has distributed a "Safety First" poster suitable for posting on the job, containing simple instructions to workmen regarding the most common causes of accidents. Every month it sends out copies of typical accident reports, which especially illustrate the disastrous effects of carelessness. These reports also can be posted on the job.

The best way to secure the interest and coöperation of workmen in eliminating carelessness and reducing accidents, is to give the workman an active part in promoting safety. On a small construction job the "safety organization" may consist simply of one man in each gang, appointed as safety inspector to report all dangerous conditions to the foreman. The man chosen for this work must naturally be reliable and observing and should preferably be one whose duties take him about the job. This plan is now being tried out in Milwaukee. On larger work there should be frequent meetings of the different foremen to take up questions involving more than one gang, such as ironworkers dropping tools or rivets on masons below.

On a large job a safety man might well be employed. In large industrial plants the safety man is now recognized to be just as necessary as the master mechanic or the chief electrician. He acts as secretary of the central committee and keeps track of everything on the job which pertains to safety.

SIDNEY J. WILLIAMS, Building Inspector,
Wisconsin Industrial Commission.

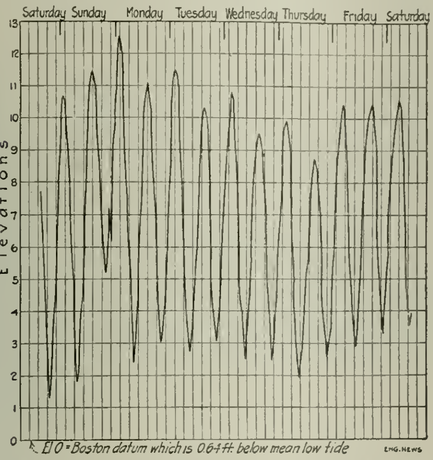
Madison, Wis., Aug. 4, 1914.

Abnormal Tide Fluctuation at Boston

Sir—Although a continuous record of the height of tide-water in Boston Harbor, at the Charles River Dam, is kept by means of an automatic water-stage recorder, the man on duty on the wall of the lock is required to observe the stage of the tide every half-hour and to enter it in a book.

When, one Monday morning, early last March, the lock operator examined the book and found that, during the

previous night, the tide had apparently failed to go down to the normal stage of a low neap tide by 2½ ft., and that after rising 2 ft., it had apparently changed its mind and gone down again more than a foot before finally ris-



TIDE RECORD AT CHARLES RIVER DAM, BOSTON, FEB. 28-MAR. 7, 1914

ing, and that in addition, when it did come in, it rose to the height of a spring tide before receding, he quite naturally accused the observer of inability to read the height on the gage board.

The lock-man maintained that he was right and the dispute was settled by examining the automatic gage record shown herewith, which showed that the peculiar fluctuation had actually taken place.

The explanation is, of course, that a strong easterly wind, by blowing the sea-water in, first prevented the tide from flowing out and that it caused a small rise in the upper harbor before the tide actually turned. A slight subsidence in the wind then permitted an ebb which was soon overcome by the incoming tide which, also on account of the assistance of the east wind, proceeded to rise to a greater height than is usual for neap tides. The wind had stopped by Monday morning and the tidal fluctuations again became normal.

E. C. S.

Boston, Mass., July 28, 1914.

The Cleveland Municipal Electricity Rates

Sir: Responding to an implied invitation to criticize the figures in ENGINEERING NEWS, July 30, upon Cleveland's new municipal electric plant, I beg to ask if the total cost of the power plant of $50 per kw. of capacity means the installed capacity of 25,000 kw., or the commercial capacity to deliver energy to the switchboard for distribution and use? The figure of $50 per kw. would indicate that the former is the case. If so, I submit that it is not good practice to undertake to deliver the installed capacity of the plant, and if I am correct, the cost per kilowatt of the true capacity of the station is in excess of $50, by an amount depending upon the figure which represents such true capacity.

Is there not an error in the figure of 0.52c., which is given as the cost of distribution alone in the case of the Brooklyn plant? If, as stated, the total operating cost of both generation and distribution for the Brooklyn plant last year was 1.49c. per kilowatt-hour, and of this the station cost was 0.79c., the cost of distribution alone should be 0.7c.

There are other criticisms which may be made of the figures used, some of which are noted in the article. There also seems to be an opportunity to criticize the ethics of the proposition that a business having been developed by private capital, a municipality should by competition in such business force rates to a basis determined solely by the cost of construction and operation of the most modern facilities for performing the service.

FRANK SILLIMAN, JR.

Philadelphia, Penn., Aug. 6, 1914.

[The 0.79c. mentioned by our correspondent above should have been printed 0.97c., as noted later on the same page. This leaves the 0.52c. as correct. In regard to the other parts of the letter, it should be noted that the discussion in question attempted only to present, so far as we could ascertain, the tangible basis on which the Cleveland officials based their hopes of financial success with their 1c.-3c. electricity supply.

There are numerous obvious manipulations of the figures there presented, which may be of interest in further examining the chances of success, although it was not considered desirable to make all the possible arrangements. Among such is the proportion of installed station capacity to be considered as a reserve. Further, taking the figures used, assessing fixed charges on peak-load customers only, and assuming initial conditions of supplying only peak-load energy, the estimated cost per kilowatt-hour then will approach the maximum rate imposed.

Beyond this, there may be some problematical capital expenses only hinted at in our discussion, as where it was noted that the private company had attractive rates for off-peak power and that such business would have to be fought for by the municipal department. Such a struggle means investment in "going concern," which the municipality must make—willingly or not. The company now possesses the business and presumably has capitalized a certain cost of building it up. The new plant comes into the field unencumbered by such a capital burden, but also handicapped by lack of its opponent's favorable business; to improve its load the city plant must assume the expense of building up new business. A plant like this cannot altogether work on a basis of original cost, without burdening the taxpayers.

On the ethical side, of course, if a company has really been denied the privilege of amortizing dead capital expenditures and cost of intangibles, it does not seem common justice to let a competitor step into a fully developed industry. But in the absence of specific denial of the amortization privilege, failure to secure the needed sums out of earnings would seem to be chargeable against the ability of the managers. If a company has not been able to secure the desired amortization fund out of its earnings and still to make attractive prices, but hopes to be able to recover sooner or later, then it should frankly state its case to the public before or as soon as destructive competition begins to loom up.—ED.]

The 200,000-Hp. Development of the Mt. Shasta Power Corporation on the Pitt River, California

Brief mention was made in ENGINEERING NEWS, July 16, 1914 of a seven-mile tunnel being built by this company as a part of a hydro-electric power project. The following information has since been secured on the other features of this development.

FIG. 1. GENERAL LOCATION OF PITT RIVER DEVELOPMENT, RELATIVE TO SACRAMENTO VALLEY AND COAST CITIES

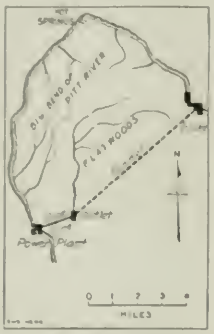


FIG. 2. PRELIMINARY PLAN OF RIVER DEVELOPMENT

The corporation is not given in current lists of public utilities, etc., so that its status has remained hidden to many. It is interesting to note, therefore, that the company was incorporated in California in 1912 by C. L. [illegible], Jos. Haber, Jr., A. M. Moore, and Edgar [illegible], Lilienthal, McKinstry & Raymond being the attorneys. The capitalization was then placed at $10,-000,000.

The location of this proposed plant is on the Pitt River near Redding at the head of the Sacramento valley. Its

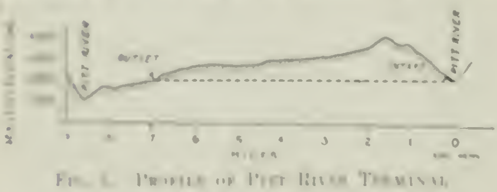


FIG. 3. PROFILE OF PITT RIVER TERMINAL

[illegible] purposes, it is planning to furnish power for the mining [illegible] railroads to the north, and to the [illegible] industries of the cities and towns of the Sacramento Valley as far south as Oakland, a transmission distance of [illegible] miles.

The plan of development involves the construction of a tunnel [illegible] ft. long. From the tunnel outlet the water may be conveyed in a pipe or open conduit and pipe to the power house, a total distance from the intake portal of a little less than one mile. The static head is [illegible] ft. and the minimum discharge of the river taken from daily gage readings for the past six years is [illegible] sec.ft. In 1902 the flow was 2560 sec.ft.; in 1903 it was 2850 sec.ft. The power in the minimum flow is 262,000 hp., and it would require only 76.5% efficiency of turbines and generators to secure 200,000 hp. at the feeders; with ordinary transmission losses, 175,000 hp. should be the possible delivery to San Francisco. The designed tunnel section, 16x19 ft., will carry more than the minimum flow.

Water rights were located in 1906, since when extensive surveys have been made, lands purchased, and riparian rights acquired covering practically the entire length of the river between the intake portal and power house, a distance of about 20 miles. Work has been started on a 7x8-ft. heading at each end of the tunnel and a little more than one mile of these headings has been driven. Air compressors, ventilating fans, electric lights, etc., operated by water power have been installed at each end of the tunnel. The company with W. A. Cooper, San Francisco, as Chief Engineer, is pushing its construction and arranging plans to deliver power to meet certain market demands which it expects.

In accordance with present designs, the Pitt River development promises to be one of the few 200,000-hp. plants; it should show the shortest conduit per horsepower capacity in California, the longest tunnel in this country and the largest in the world for water power.

An Automatic Petroleum-Tank Fire Extinguisher*

An automatic tank-fire extinguishing equipment consisting of standpipes placed around and connected to the storage tank, as shown in Fig. 1, was recently tested with satisfactory results, at the Bayonne, N. J., refinery of the Standard Oil Co.

The first test was run on July 22 in connection with a roofed tank 40 ft. in diameter. The fire apparatus consisted of four standpipes 30 in. in diameter, the same

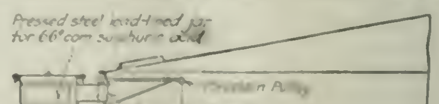
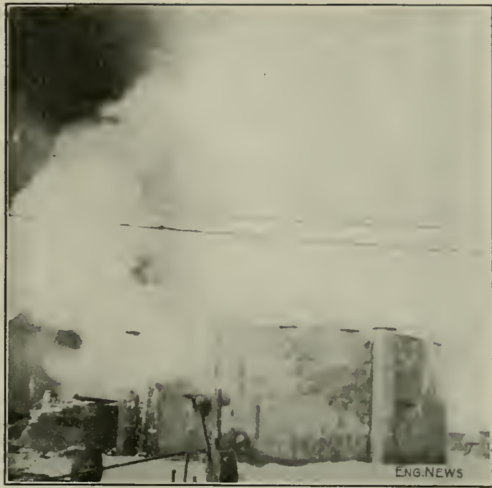


FIG. 1. ERWIN FIRE EXTINGUISHER FOR OIL STORAGE TANKS

height as the tank, arranged outside and against the tank at intervals of 90 deg. There was a direct outlet into the tank from the standpipe, about 12 in. wide by 8 in.

*Information furnished by Charles S. Swartz, General Manager, Erwin Co., Milwaukee, Wis.

Fire at its height



One minute 30 seconds later

FIGS. 2-3. FIRE EXTINGUISHING TESTS AT BAYONNE, N. J., JULY 22.

deep, at the top of the tank. These standpipes contained about 1 gal. of a solution of sodium carbonate and soap bark per square foot of oil surface. Lead-lined sulphuric acid containers were suspended from the top of the standpipes, and connected to a phosphor-bronze cable containing standard fusible links, controlled by a series of triggers. The cable and fusible links were arranged to permit frequent inspection.

In the test, water was admitted to the tank to within 3 ft. of the top; 3000 gal. of Mexican crude oil and some naphtha were floated upon the water, and a torch applied. When the fuses melted, the acid dropped into the chemical solution in the standpipe and the resulting foam started instantly into the tank through the opening. The fire was automatically extinguished in 9 sec. by a 14-in. layer of foam.

On July 24, another test was run, in which the fire was permitted to gain headway (Fig. 2). The roof and automatic devices were removed, and the standpipes arranged to operate by hand on a 75-ft. cable, so that the acid could be released at will. The water in the tank was lowered 6 ft. It was thought by some that the foam in issuing from the discharge opening would be destroyed to a certain extent, and that its swift delivery across the surface of the oil would be impossible. On the water in the tank, 3000 gal. of Mexican crude oil and 100 gal. of gasoline were floated and ignited. The fire was permitted to rage for five minutes, when one of the standpipes was operated. It made little impression. The remaining standpipes were released 30 sec. later and the fire was extinguished in one minute (Fig. 3).

FIG. 4. APPEARANCE OF FOAM AFTER SEVERE FIRE

A Visible Interstate Boundary Line—As probably almost every reader knows, the city of Texarkana is on the interstate boundary of Texas and Arkansas. An enterprising local newspaper suggests making use of this unusual feature as an advertising asset; it says:

This state line we have running through our city, instead of being a source of contention and misunderstanding, if properly appreciated could be made the basis of a business condition which few other cities of America have the privilege of using.

Some time ago it was suggested that as an advertising feature, it would be a good idea to lay a row or two of white brick up the state line and across Broad street to indicate to visitors just where the line really is located.

In this connection it was suggested by one of the members of the improvement committee this morning that when State Line Ave. is paved, it being understood that the character of paving on both sides would be in conformity, it would be a good idea if a line of different color could be placed in the center of the street on the state line, and extending from the depot to the postoffice.

This recalls the aerial voyage of Tom Sawyer and Huck Finn; after travelling all night there was some question whether they had passed over the State of Illinois, but the point was settled by the green landscape; they hadn't made the Indiana line yet because in all the geographies they ever studied Indiana was pink, and Illinois green.

Progress of Work on the New Buildings of the Massachusetts Institute of Technology

At the time the accompanying photograph was taken, July 31, the concrete foundations of the new buildings of the Massachusetts Institute of Technology in Cambridge, Mass.,* were practically all in place. The amount of this work may be gauged when it is remembered that the sum of the sites of the various buildings is between 2500 and 3000 ft. For these foundations, piles have been driven for all outside and interior walls and for piers. A considerable part of the concrete work for the walls to the level of the first floor was also in place.

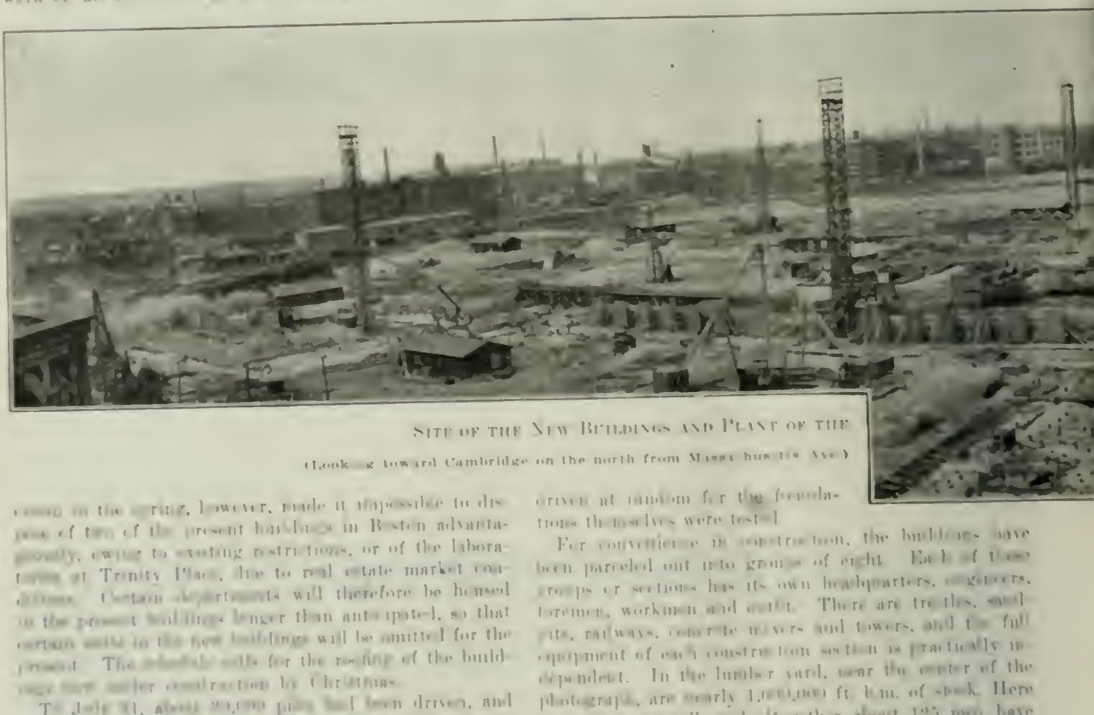
Work was held up for a time by changes in the original scheme of construction, which was to carry on the work on all the buildings simultaneously. A court decision in the spring, however, made it impossible to dispose of two of the present buildings in Boston advantageously, owing to existing restrictions, or of the laboratories at Trinity Place, due to real estate market conditions. Certain departments will therefore be housed in the present buildings longer than anticipated, so that certain units in the new buildings will be omitted for the present. The schedule calls for the roofing of the buildings now under construction by Christmas.

To July 31, about 20,000 piles had been driven, and 3000 more are to be placed for the library-building foundations. About half of all the piles are 50-ft. hard pine and the other half are oak, 35 ft. long. Each pile is designed to carry a load of 10 tons.

The new buildings are on made land, and preliminary to construction, extensive tests and investigations were carried out to determine its bearing power. The determination of the character of the subsoil was undertaken by Prof. W. O. Crosby, a graduate of the Institute, who was consulting geologist for the Catskill aqueduct, New York. He made a systematic subsoil survey by means of 64 borings. Prof. Crosby's report shows that in the vicinity of the present land a tongue of gravel extended into an old glacial lake. The Institute grounds are largely clear of peat, which was apparently extensively formed on neighboring areas.

Incidental to the work of construction, the contractor, the Stone & Webster Engineering Corporation, also made a series of investigations, including about 73 additional borings to a depth of 80 ft. Besides these about a dozen other borings were made in the vicinity, outside of the Institute grounds. At present, 12 other borings are being made within the foundation lines for the new library building, to determine the areas of hard driving.

Besides soil borings a series of tests were made on the bearing power of piles, 68 tests in all. Ten concrete piles were tested to loads up to 100 tons each. Wood piles were tested up to loads of 15 tons each. Only wood piles were adopted for construction. Some of the piles are driven to 55 ft., but the average depth of the glacial drift is from 12 to 30 ft. In addition to the tests already noted, 8 piles driven at random for the foundations themselves were tested.



SITE OF THE NEW BUILDINGS AND PLANT OF THE

(Looking toward Cambridge on the north from Massachusetts Ave.)

For convenience in construction, the buildings have been parceled out into groups of eight. Each of these groups or sections has its own headquarters, engineers, foremen, workmen and outfit. There are trestles, sand pits, railways, concrete mixers and towers, and the full equipment of each construction section is practically independent. In the lumber yard, near the center of the photograph, are nearly 1,000,000 ft. b.m. of stock. Here there is a sawmill, and altogether about 125 men have been kept busy making forms for concrete work. A mile of railway track makes every facade approachable for freight.

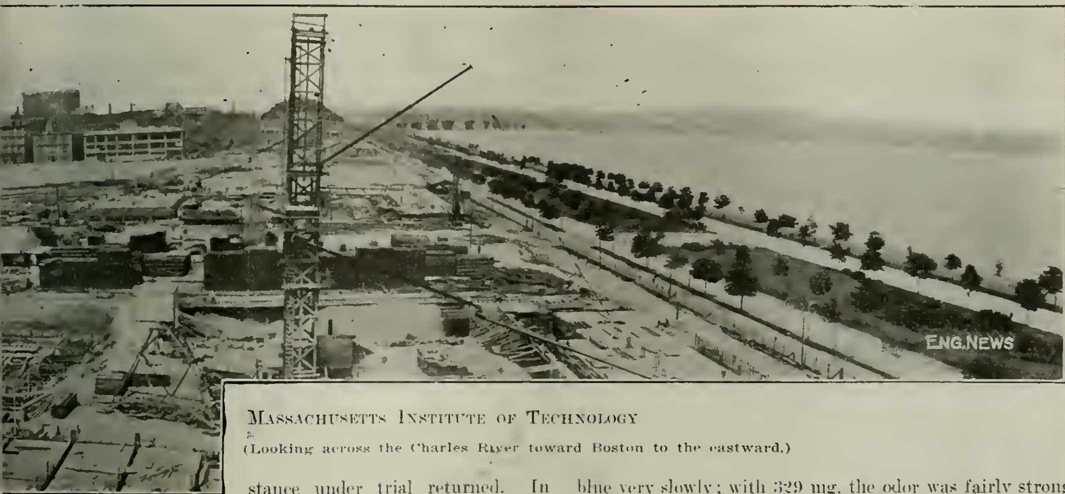
*For a description of the plans and scheme see "Engineering News," Nov. 20, 1913, pp. [illegible]

Further Studies of the Deodorizing Effects of Ozone

The published reports of Drs. F. O. Jordan and A. J. Carlson (See ENGINEERING NEWS, Nov. 27, 1913), which were unfavorable to the general use of ozone in ventilation and therapeutics, naturally raised a storm of criticism from more or less interested parties. Some of this was mere assertion, but there has been also the very desirable result of a careful scientific scrutiny of

the procedure of the investigators named. One of the most interesting and illuminating counter-investigations is that made by J. C. Olsen and W. H. Ulrich, of the Brooklyn Polytechnic Institute and reported in a paper at the Troy meeting of the American Institute of Chemical Engineers, June 19, 1914.

The original investigators (Jordon and Carlson) experimented with a considerable number of odorous substances and reached the broad conclusion that ozone masked but did not destroy odor. Their method of procedure consisted of exposing the substance, giving off odor until the smell was noticed in a small closed room. Then a commercial ozone generator was operated until a strong counter-odor was produced. Observations were made from time to time of the smell in the room and it was observed in many cases that the ozone odor gradually disappeared and that the odor of the peculiar substance under trial returned. In some cases the ozone was introduced again and the observations repeated.



MASSACHUSETTS INSTITUTE OF TECHNOLOGY

(Looking across the Charles River toward Boston to the eastward.)

Olsen and Ulrich criticized the earlier investigators for apparently neglecting to consider that any destruction to be found would be an oxidizing process and one in which a definite amount of oxygen would be required to oxidize a definite amount of odor substance, and for not knowing whether or not they had supplied sufficient ozone at any time to oxidize more than a fraction of the odor substance in the air. The counter-investigation was made to consider these factors.

They took up first hydrogen sulphide, 34 parts of which would require 48 parts of ozone for oxidation. They found, with 7.6 mg. of hydrogen sulphide liberated per cubic meter of room atmosphere, that no odor was noted and lead-acetate paper turned brown very slowly. A faint odor was detected with 15 mg., a distinct odor with 61, and a strong odor with 211. In comparison with this they found that the odor of ozone was marked when there was present only 1 mg. per cu.m., the limit of observation being 0.1 mg. A concentration of 1 mg. ozone would have masked the odor of 61 mg. hydrogen sulphide and by the action of the ozone less than 1 mg. of the 61 would be oxidized—leaving sufficient hydrogen sulphide unattacked to give the characteristic odor.

Atmospheres of hydrogen sulphide and ozone were combined with respective concentrations of 25 and 35.6 mg. per liter, under which conditions there should be just enough ozone to oxidize the hydrogen sulphide. The ozone odor was very pronounced at first, but after it had disappeared there was no odor of hydrogen sulphide. A slight acidity of the residual atmosphere was detected on exposure of blue litmus paper. Some oxidation was reported in check trials with atmospheric oxygen.

Observations were also made with ammonia; of this, one part would be oxidized by about four parts of ozone. With 10 mg. per cu.m. no characteristic odor was noted and no action was found upon litmus paper. With 21 mg. there was very faint odor and reaction; with 82 mg. the odor was quite distinct and the red litmus turned blue very slowly; with 329 mg. the odor was fairly strong and the litmus turned blue slowly; with 1000 mg. the odor was strong and reaction rapid. Atmospheres of ozone and ammonia were mixed in concentrations of 35.6 and 125 mg. per cu.m., respectively. As the action was slow, 24 hr. was allowed for it. Some oxidation was found, though not the destruction of the full 8.5 mg. theoretically expected. (Foreign investigators have reported finding no reaction between ammonia and ozone.)

Studies were made with oil of cloves. The amount of ozone necessary to oxidize the vapor of oil of cloves could not be calculated, but the investigators believed that it would require several times more than equal weight. It was found that as little as 66 mg. oil evaporated per cu.m. of atmosphere resulted in a strong smell. On mixing the oil-of-cloves atmosphere and ozone, with concentrations of 36.6 and 33 mg. per cu.m., respectively, it was found that first there was a distinct smell of ozone, but this gradually disappeared and was replaced by a sweet odor which had no resemblance to the original cloves. This was interpreted as meaning that the strong smelling constituents were partially oxidized. The reaction, however, was not entirely regular. The formation of the sweet aromatic residue was repeatedly observed, though at times the original odor of cloves persisted.

The First Large Ship Through the Panama Canal

The official opening of the Panama Canal to the commerce of the world took place Saturday, Aug. 15, with very little pomp or ceremony.

On Aug. 7, the "Cristobal," a 9600-ton steamship of the Panama R.R. Co., made the passage from the Atlantic to the Pacific in $11\frac{1}{2}$ hr., and returning in $8\frac{1}{2}$ hr.

The "Cristobal" is a steel twin-screw steamship of 9606 gross tons and 6195 net tons burden. It is $489\frac{1}{2}$ ft. long and 58 ft. in beam, drawing 25 ft. of water.

The passage was made without accident other than some minor difficulties with the towing locomotives.

The Steamship "Cristobal" in Culebra Cut, Aug. 7, 1914; 9600-Ton Steamer, $489\frac{1}{2}$ Ft. Long, 56 Ft. Beam

Tugs, barges and dredges had been passed through the canal before, but this was the first large steamship.

On Aug. 15, the official party, including Col. George W. Goethals, Governor of the Canal Zone, and about 75 officers made the trip from the Atlantic to the Pacific in the "Ancon," of the Panama Railroad Co., a sister ship of the "Cristobal." The passage of the Gatun locks was made in 70 min., and the whole trip took 9 hr.

The Canal is now open to all vessels not drawing more than 30 ft. of water; this includes war vessels of the European nations now at war, but no warship of a belligerent nation may remain longer than 24 hr. within the limits of the canal.

The principal work remaining to be done is the deepening and widening of the channel through Culebra cut.

NEWS NOTES

An Old Wooden Bridge Collapsed just after an automobile had passed over it, at Pickering, Ont., on Aug. 6. The structure was called Maxwell's Bridge. Its span is given as 100 feet.

A 50-Hp. Boiler Exploded at a shop in Unicorn, Penn., at 10:30 p.m., Aug. 6. It was lifted from its brick setting and hurled through a wall into a field across the road, a distance of about 130 ft. The crown sheet was thrown about 50 ft. away. The brick stack and the rear of the shop were wrecked. Press reports state that the fire had been banked as usual that night, at which time the steam pressure was about 30 lb.

A Gate Accident on the Welland Canal—An unusual accident occurred at Lock 12 of the Welland Canal, on Aug. 9, which stopped transportation for about 24 hours, according to the acting superintending engineer, at St. Catharines, Ont. The steamer "Winona," of the Montreal Transportation Co., upbound to Port Colborne for grain, had just entered the lock; one footgate had been closed and the other was about to be closed when the canal linemen, who are hired by vessels navigating the canal, opened wide the valves in the upper gates. The strong current was stopped by the steamer and crashed against the closed gate, [illegible] with it [illegible]. This sudden [illegible] caused a surge in the lock, which carried the vessel [illegible] against the headgates [illegible]. The rush of water from Lock-12 reach carried them [illegible] away and [illegible] the steamer into the reach below, [illegible] the footgates. The canal banks at the head of lock 11 were badly [illegible]. The ship was not damaged. Four piles were installed before traffic was resumed. The damages were estimated at $5000.

The Greater Winnipeg Water Supply project, for bringing water from Shoal Lake, 96 miles [illegible] of the city, is [illegible]. The entire right-of-way for the aqueduct, 97

miles, has been cleared of timber and the work for its drainage is proceeding rapidly, while about 40 miles of grading has been done for the construction railway over the route and about 20 miles of track have been laid. Plans and specifications have been completed for the construction of 85 miles of the gravity-flow concrete aqueduct, which will extend from Indian Bay to the storage reservoir site southeast of Transcona, a few miles from Winnipeg. Pipe lines will run from this reservoir to the city. Bids for the aqueduct work will be opened Sept. 19. The total cost of the project is estimated at $13,000,000, and the construction work will occupy probably five years. The project is under the direction of the Greater Winnipeg Water District. S. H. Reynolds is Chairman of the Commissioners; W. G. Chase is Chief Engineer; James H. Fuertes, New York City, is Consulting Engineer. An outline of the project as recommended by a board of consulting engineers consisting of Rudolph Hering, Frederic P. Stearns and James H. Fuertes was printed in "Engineering News" of Sept. 25, 1913.

A Telephone Block System is to be installed by the Southern Ry. on the Atlantic Division, between Macon, Ga., and Ooltewah Junction, Tenn., 225 miles. The present telegraph block system consists of one telegraph wire. The telephone block is to consist of two wires, this arrangement being effected by utilizing the present telegraph block wire and a telegraph message circuit. Each office on this block circuit will be equipped with two bells, one for the north block and one for the south block, with the telephone so installed that it can be connected with either set. The lines will be so arranged at the offices that when a block office is closed the line can be cut through. The wires used for the telephone block will be used also for a telegraph circuit from Atlanta to Macon, and for another circuit from Atlanta to Ooltewah Jct., into Chattanooga, Tenn. In order to take care of the heavy Florida traffic last winter, the telephone block system was put in operation between Macon and Jesup, and was found so satisfactory that it has now been decided to extend the system. The management has also authorized the installation of a Simplex telephone block circuit between Monroe, Va., and Greensboro, N. C., 120 miles. The work is under the direction of W. H. Potter, Superintendent of Telegraph.

PERSONALS

Mr. R. C. Harris has been appointed Resident Engineer of the Alberta division of the Canadian Pacific Ry., at Calgary, Alta.

Mr. J. T. Brown has been appointed Resident Engineer and Superintendent of Bridges and Buildings of the Canadian Pacific Ry., Alberta division, at Cranbrook, B. C.

Mr. George Stahl has been appointed City Engineer of Milwaukee, Wis., succeeding Mr. J. A. Mesiroff, who resigned some time ago to become Consulting Engineer of the Western Engineering & Construction Co., of Milwaukee.

Mr. Donald F. McLeod, Assoc. M. Am. Soc. C. E., former City Engineer of Saranac Lake, N. Y., recently of New Glasgow, N. S., Canada, has been made City Manager of Lakeland, Fla.

Mr. A. G. Kinyon, formerly Locomotive Fuel Engineer of the Clinchfield Fuel Co., Spartansburg, S. C., has been appointed Superintendent of Locomotive Operation of the Seaboard Air Line Ry., with headquarters at Portsmouth, Va.

Mr. H. J. Saunders, Assoc. M. Am. Soc. C. E., formerly Consulting Engineer with offices at Valier, Mont., has been appointed Office Engineer, Division of Valuation, Interstate Commerce Commission, Western District, with headquarters at San Francisco, Calif.

Mr. Arnold Pfau, M. Am. Soc. M. E., Consulting Engineer of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., one of the foremost designers of hydraulic turbines, is being detained in Switzerland, where he went to visit his old home. Mr. Pfau is a native of Switzerland and is eligible for army service there.

Mr. W. E. Thomas, Assoc. M. Am. Soc. C. E., former Resident Engineer of the Flushing improvement of the Long Island R.R., New York City, is now District Manager at Charlotte, N. C., for Weston & Brooker, Inc., of Columbia, S. C., designers and builders of sanitary sewerage systems and sewage disposal works.

Mr. Frederic A. Delano, M. Am. Soc. C. E., whose appointment as a member of the Federal Reserve Board was noted in our columns of last week, has resigned as President of the Chicago, Indianapolis & Louisville Ry., to accept the appointment. He is to be Vice-Governor of the Board and will have headquarters at Washington, D. C.

Mr. R. W. Creuzbaur, M. Am. Soc. C. E., Consulting Engineer, New York City, has been appointed Engineer of the City of Elizabeth, N. J., to supervise the city's part in the grade-crossing elimination and improvement work of the Pennsylvania R.R. and Central R.R. of New Jersey in that city. Mr. Creuzbaur will devote only a portion of his time to this work.

Mr. King Lo, a resident of Canton, China, is studying highway work as an official representative of the Chinese Government in the main office of the New York State Highway Department, Albany, N. Y. Mr. Lo is a graduate of Rensselaer Polytechnic Institute. His education and practical experience are at the expense of the Home Department of the Chinese Republic.

Mr. Roger L. Morrison, Jun. Am. Soc. C. E., of the road department of the United Gas Improvement Co., of Philadelphia, Penn., has been appointed Professor of highway engineering at the Agricultural and Mechanical College of Texas, succeeding Mr. R. J. Potts, resigned, as noted in our personal columns of July 9. Mr. Morrison is a graduate of the University of Illinois, class of 1911, and of the Columbia University course in highway engineering.

Mr. E. J. McCaustland, M. Am. Soc. C. E., formerly Professor of municipal and highway engineering at the University of Washington, Seattle, Wash., President and Sanitary Engineer of the Washington State Board of Health, has been appointed Dean of the Faculty of Engineering at the University of Missouri, succeeding Mr. Howard B. Shaw, who has resigned to become Chief Engineer of the Missouri State Public Service Commission, as noted elsewhere.

Mr. Howard B. Shaw, Assoc. Am. Inst. E. E., formerly Professor of electrical engineering and Dean of the Faculty of Engineering at the University of Missouri, has been appointed Chief Engineer of the Missouri State Public Service Commission. Mr. Shaw is a graduate in civil engineering of the University of North Carolina, class of 1890, and received the degree of A. M. at Harvard University in 1894. For two years, he was an Assistant in the electrical engineering laboratory of the Lawrence Scientific School, Harvard University, and since 1896 he has been connected with the faculty of the University of Missouri.

Mr. George W. Boschke, who resigned as Chief Engineer of the Oregon-Washington R.R. & Navigation Co. on May 1, has been appointed Engineer in charge of the San Francisco, Calif., offices of Twohy Bros., of Portland, Ore., railway contractors. Mr. Boschke began his railway engineering experience in 1886 with the Southern Pacific Co. He had charge of the construction of various lines in Texas, and in addition to his connection with the Southern Pacific Co., was Engineer in charge of construction of the Galveston, Tex., seawall. He was Chief Engineer of the Oregon-Washington R.R. & Navigation Co. from 1905 until May 1, 1914.

Mr. David B. Steinman, Jun. Am. Soc. C. E., former Professor of civil engineering at the University of Idaho, has been appointed Special Assistant Engineer of the New York Connecting R.R. Hell Gate Bridge, New York City, to temporarily succeed Mr. O. H. Ammann, M. Am. Soc. C. E., who has returned to his native country of Switzerland to serve in the army, as noted in our issue of last week. Mr. Steinman is a graduate in civil engineering of Columbia University, class of 1909, and received a Ph. D. degree there in 1911. For a short time he was connected with engineering staffs of the Board of Water Supply and the Public Service Commission in New York City, and since 1910 has been Professor of civil engineering at the University of Idaho.

Col. Merritt H. Smith, M. Am. Soc. C. E., whose appointment as Chief Engineer of the Department of Water Supply, Gas and Electricity was noted in our personal columns of July 9, was the guest of honor of 700 enthusiastic engineer and contractor friends at a dinner at the Biltmore Hotel, New York City, Aug. 13. Although the weather was unusually hot, the hotel accommodations were taxed to the utmost. The guests included Mayor John Purroy Mitchel, all three members of the Board of Water Supply, the Borough President of Manhattan, and other prominent city officers. Mr. J. Waldo Smith, Chief Engineer of the Board of Water Supply, was toastmaster. Many old-time members of the Board of Water Supply engineering staff, now prominent in the public works of other cities, journeyed to New York to attend; and the meeting was more of the nature of a college alumni feast than anything else. Col. Smith has been one of the most popular members of the engineering corps of the Board of Water Supply, and has done much to inspire the feeling of good fellowship and the esprit de corps for which this engineering staff has been famous.

OBITUARY

John P. Holland, famous as the inventor of the Holland submarine boat, died at his home in Newark, N. J., Aug. 12. He was born in Paterson, N. J., 73 years ago. His first submarine boat was built in 1877 and launched in the Passaic River in 1878.

Charles T. Healy, a well known land surveyor and civil engineer of Los Angeles, Calif., died at his home in that city Aug. 3, aged 85 years. He went to California in the pioneer days, 60 years ago, and for many years was engaged in land surveying and civil engineering. He is said to have surveyed many of the original plots in Los Angeles and Long Beach.

Joseph J. Cox, a prominent Kansas contractor, died Aug. 4 at his home in Lawrence, Kan., after an illness of more than six months. He was born in Seymour, Ind., Oct. 6, 1853. In 1870 he moved with his parents to a farm near Lawrence, Kan., where he was married in 1872. Subsequently he went into contracting and during the long course of his business life completed many important structures.

Charles Webster Danforth, New York Manager of the Pittsburgh Steel & Iron Co., Pittsburgh, Penn., died Aug. 9, in the Grand Central Station, New York City, while about to start on a vacation. He was born in New Haven, Conn., and was a graduate of Sheffield Scientific School, Yale University, class of 1896, in civil engineering. He was formerly with the American Bridge Co., of Pittsburgh.

Donald M. Philbin, recently General Manager of the Great Northern ore properties in Minnesota and formerly General Superintendent of the Lake District of the Great Northern Ry., died Aug. 6, at his home in Duluth, Minn., after an illness of over a year. He was born in Montreal, Que., in 1857, and at 17 years of age began his railway experience as a clerk in the construction department of the Chicago & Northwestern Ry. From 1877 to 1886 he was in charge of the ore docks of the Chicago & Northwestern Ry. at Escanaba, Mich., and for two years in charge of the ore docks of the Milwaukee, Lake Shore & Western R.R. at Ashland, Wis. In 1890 he was appointed Division Superintendent of the Duluth, South Shore & Atlantic Ry., and from 1893 to 1896 was General Manager of the Duluth, Missabe & Northern Ry. Subsequently he was an operating officer of lines which became a part of the Great Northern Ry.

Edward C. Johnson, recently Commissioner of Public Works of Los Angeles, Calif., died Aug. 2, at his old home in Belfast, Maine. He was a graduate of the Massachusetts Institute of Technology, and for several years was on United States Government Survey work in the West. He first came into public notice in Los Angeles during the investigation of the Los Angeles Aqueduct, when he was appointed a member of the investigating committee as an engineering expert. Following his work here he was appointed a member of the Harbor Commission and upon the resignation of Gen. Adna R. Chaffee from the Board of Public Works, a few years ago, Mr. Johnson was appointed to succeed him, and as such had charge of the aqueduct work. For the last eight months he had been in failing health, and some weeks ago returned to his home in Maine and resigned his office in Los Angeles shortly afterward. Mr. Johnson is survived by a widow and a daughter eight years old.

Alfred P. Trautwein, M. Am. Soc. M. E., Vice-President of the American Welding Co., Carbondale, Penn., died Aug. 5 at his home in Scranton, Penn. He was born in New York City in [illegible] and graduated in mechanical engineering at Stevens Institute of Technology in 1876. He went to Carbondale in [illegible] as Consulting Engineer of the Hendrick Manufacturing Co. Later he organized and was President of the Carbondale Machine Co. He also aided in organizing the Carbondale Chemical Co., the Carbondale Instrument Co., the American Welding Co., and numerous other enterprises. He was a member of the Engineers' Club of Philadelphia and a Past-President of the Scranton Engineers' Club. He was also a Past-President of the Engineering Society of Northeastern Pennsylvania. Mr. Trautwein was a trustee of Stevens Institute and a director and trustee of many other business, educational and philanthropic institutions. He is survived by a widow and four daughters.

[illegible] Oestreich, M. Am. Soc. C. E., Senior Assistant Division Engineer, Public Service Commission, First District, New York, died Aug. 11 at Atlantic City, N. J., aged [illegible] years. He was born in New York City and attended the public schools and New York University. He joined the engineering staff of the old Rapid Transit Commission as Assistant Engineer at the beginning of the New York City subway work in 1900, and ever since then continued in the employ of the city. He had charge of construction of the section of the present subways on Lafayette St. and 4th Ave., between Great Jones and 19th St. Later he had charge of important construction on the Centre St. loop. Recently he had been in charge of sections of the Fourth Ave. subway in Brooklyn. Mr. Oestreich was married on June 10, 1914, to Miss Stella B. Eccles, of Trenton, N. J., and went to Atlantic City on his honeymoon. While there he contracted blood poisoning from a scratch on his face. He was a prominent member of the Brooklyn Engineers' Club and of the Municipal Engineers of the City of New York.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.
Aug. 20-21. Annual meeting in New York City. Secy., E. H. Harman, Room 101, Union Station, St. Louis, Mo.

AMERICAN PEAT SOCIETY.
Aug. 20-22. Annual meeting at Duluth, Minn. Secy., Julius Bordollo, 17 Battery Place, New York City.

AMERICAN BOILER MANUFACTURERS' ASSOCIATION.
Sept. 1-3. Annual convention in New York City. Secy., J. D. Farasey, E. 37th St., and Erie Ry., Cleveland, Ohio.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. 7-10. Annual meeting in New York City. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

AMERICAN FOUNDRYMEN'S ASSOCIATION.
Sept. 7-11. Annual meeting at Chicago, Ill. Secy., A. P. Backert, Cleveland, Ohio.

NATIONAL PAVING BRICK MANUFACTURERS' ASSOCIATION.
Sept. 9-11. Annual convention at Buffalo, N. Y. Secy., Will P. Blair, 832 B. of L. E. building, Cleveland, Ohio.

NATIONAL ASSOCIATION OF PORT AUTHORITIES.
Sept. 8-10. Annual convention in Baltimore, Md. Secy., Wm. Joshua Barney, 29 Broadway, New York City.

ROADMASTERS AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.
Sept. 8-11. Annual meeting at Chicago, Ill. Secy., L. C. Ryan, Sterling, Ill.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.
Sept. 8-11. Annual convention in Nashville, Tenn. Secy., A. P. Dane, Reading, Mass.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 9-11. Annual convention in Boston, Mass. Secy., Willard Kent, Narragansett Pier, R. I.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Sept. 15-18. Convention in Atlantic City, N. J. Secy., Clayton W. Pike, Electrical Bureau, Philadelphia, Penn.

ILLUMINATING ENGINEERING SOCIETY.
Sept. 21-25. Annual convention in Cleveland, Ohio. Secy., Joseph D. Israel, 29 W. 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Sept. 22-24. Annual convention in Bluff Point, N. Y. Secy., C. C. Rosenberg, Times Building, Bethlehem, Penn.

ATLANTIC DEEPER WATERWAYS ASSOCIATION.
Sept. 23-26. Annual convention at New York. Secy., Addison Burke, Philadelphia, Penn.

American Boiler Manufacturers' Association—The 26th annual convention will open at 10 a.m., Sept. 1, at the Waldorf-Astoria Hotel, and close with an executive session Friday morning, Sept. 4. There will be four business sessions and probably a trip to Coney Island Wednesday evening. The annual banquet will be held at 7:30 p.m., Sept. 3. The secretary is J. D. Farasey, East 37th St. and Erie Ry., Cleveland, Ohio.

Illuminating Engineering Society—Among the papers to be presented at the annual meeting in Cleveland, Ohio, Sept. 21-26, are the following: "Factory Lighting," Hogue and Dicker; "Planning for Daylight and Sunlight in Buildings," Marks and Woodwell; "The Effects of Room Dimensions on Efficiency of Lighting Systems," Ward Harrison; "Illumination of Light Shafts," S. H. Sharp; "The Locomotive Headlight," J. L. Minick; "Physiological Effect of Light on the Body," E. C. Titus.

American Foundrymen's Association—At the annual meeting to be held Sept. 7-11, at Chicago, the following papers will be presented: "The Second-Story Foundry," G. K. Hooper, Detroit; "Molding Sand Tests," Dr. Richard Moldenke, Watchung, N. J.; "Test of Malleable Cast Iron," Enrique Touceda, Albany, N. Y.; "The Electric Furnace in the Steel Foundry," W. L. Morrison, Welland, Ont.; "Some Defects in Steel Castings and Remedies for Them," John Howe Hall. The Secretary is A. P. Backert, Cleveland, Ohio.

Engineering Literature

CONTENTS

CORRESPONDENCE

Continuation of Title-Page Date Discussion

Sir—I have read with interest Dr. C. T. Hutchinson's letter published in your issue of July 16, in which he denounces the use of the term "Second Edition Revised" to designate the current issue of my book on "Electric Power Conductors."

The book under consideration has 324 pages, exclusive of the index. In anticipation of the exhaustion of the first edition, 14 new pages of electrotype were made and 29 pages had their electrotype altered or corrected, a total of 43 pages, or 13⅓% of the entire number of pages in the book. This percentage reduces to 12 if the 4-page rubber specification is omitted. I said in the preface that "nearly 10%" of the pages had been more or less altered. It will thus be observed that I understated the proportion rather than overstated it as intimated by Dr. Hutchinson. Nevertheless, I do not think that the minor alterations would have justified calling the book a second edition, but I do believe that the changes on about 20 of the pages were ample warrant for doing so. The book, altered as described above, was issued as a second edition at the suggestion of the publisher and with my approval. There was ample respectable precedent for this action and none that I know for any other course.

If the book had been sold as a reprint of the first edition, a great deal of confusion would have resulted in making references. For example, if an engineer were to order wire insulated in accordance with the specification in the first edition of "Electric Power Conductors," and if both editions were known as first editions, the manufacturer would be at a loss to know what to supply, and the purchaser would not be sure of getting what he wanted.

I am in sympathy with Dr. Hutchinson in deploring the uncertainty incident upon the use of the word "edition." The whole trouble is that the word "edition," and its various qualifying terms, do not mean the same thing to different people. Thus, it is evident that to Dr. Hutchinson, the term "Second Edition Revised" means what the publishers usually call "Entirely Rewritten."

I believe that Dr. Hutchinson could have employed his talent to better advantage if he had taken the trouble to write a constructive letter suggesting a series of terms to describe the different varieties of revisions of a book. If such a letter had been written and followed up by an effort to have its recommendations adopted by the publishers as standard, Dr. Hutchinson would have rendered a distinct service.

Wm. A. Del Mar.

70 East 45th St., New York City, July 30, 1914.

REVIEWS AND NOTES

A New Edition of Whipple's Microscopy of Drinking Water

Reviewed by Desmond FitzGerald*

THE MICROSCOPY OF DRINKING WATER—By George Chandler Whipple, Gordon McKay Professor of Sanitary Engineering, Harvard University and the Massachusetts Institute of Technology. With a Chapter on "The Use of the Microscope," by John W. M. Bunker. Third edition, rewritten and enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xxi + 409; 73 illustrations; 25 plates. $4, net.

More than one water-works engineer will figuratively toss his hat into the air and shout "Hurrah!" at the appearance of a third edition of Whipple's book; firstly, because the book has proved itself already of real practical assistance in water-supply practice; and secondly, because this new edition is a demonstration of the popularity of a good scientific treatise on the microscopy of drinking water; in fact, the day is fast approaching when no manager of a water-supply system can afford to be without it, and the day is already here when libraries which are looking around for standard treatises, welcome it to their shelves.

In addition to pointing out the connection between odors and tastes in water and the life histories of its organisms, Prof. Whipple tells us all about different methods of treatment to cure the troubles that attack water-supplies.

The new edition is a book of about the same size as the previous edition, but a brief examination shows that it contains a considerable amount of new material, to keep abreast with the times. There has been a slight rearrangement, by which the space formerly given to bibliog-

*Consulting Engineer, Brookline, Mass.

[illegible] is reduced, and 86 more pages of printed matter added. The plates are now slightly colored as once suggested by ENGINEERING NEWS.

The book is divided into two parts, part one discussing sanitary problems, and part two dealing with a more technical classification of microscopical organisms. The first part has been expanded from thirteen to eighteen chapters, in order to embrace a fuller discussion of different treatments of water-supplies. The question of stripping of reservoir sites is discussed and the use of the microscope is made easier by a special chapter, written by an expert, Dr. John W. N. Banker.

There is nothing left to be desired at the present time in any of the chapters which deal with the collection of samples, methods of examination, limnology, and seasonal distribution of organisms.

In regard to soil stripping, the reviewer thinks that not enough attention has been paid in the public discussions of the subject to the importance of discriminating more fully in the local conditions as regards the desirability of stripping the sites of reservoirs. Even in very large reservoirs, he believes it will eventually be found advantageous to carry out certain modifications of the principles of shallow-flowage treatment and stripping; such, for instance, as were applied to Basins 2 and 3 of the Boston Water-Works System in 1881, 1882 and 1883. There, for a comparatively small expenditure, thousands of stumps were removed which were found to be in a particularly offensive condition of change, shallow-flowage places were filled with loam and mud, removed from adjacent areas, and a better quality of water secured.

The Hopkinton and the Sudbury basins were the only ones of the Boston system where all organic matter was removed from the bottom and sides of the reservoirs and the shallow places filled. In small supplies and small reservoirs, where the incoming water has but little time for improvement by storage, it is especially desirable to consider shallow-flowage treatment and at least partial stripping, and under some conditions, it is desirable to treat the reservoirs to a certain extent even if filtration is to be added. Owing to the fact of the enormous differences existing in local conditions the services of a competent expert are generally required.

All water-works engineers will welcome the chapters on [illegible] growth of organisms in water pipes, and the fine plates and classifications of algae and other growths. Prof. Whipple has done a good life's work already in popularizing the use of the microscope in the solution of important sanitary problems connected with public and private water-supplies. It now only remains for him to show in detail how a large water-supply system like that of the Metropolitan District of Boston is guided almost daily by the studies in its laboratory of the condition of the various reservoirs and the life of the organisms, and how that information is made available in the practical management of the supply.

The [illegible] Steel Co., Chicago, Ill., is rolling six specially slender I-beam sections, which have greater resistance of bending in proportion to the weight than standard I-beams. A little book just issued lists them, and also gives a table covering the standard I-beams. The new shapes are 24, 21, 18, 15, 12 and 10 in. deep, and range 4 to 7 lb. lighter than the American standard section. The addition of a 21-in. section in place of the usual 20-in. I-beam makes the progression of depth more uniform.

These shapes are naturally intended mainly for application in buildings where web thickness and provision of extra thickness against rusting are not usual factors.

Physics for Engineering Students

MECHANICS AND HEAT—By William Ballantyne Anderson, Associate Professor of Physics, Iowa State College. New York and London: McGraw-Hill Book Co., Inc. ("Physics for Technical Students.") Cloth; 6x9 in.; pp. xi + 349; 153 text illustrations. $2, net.

Prof. Anderson here presents the classic elements of physics, though only partially by strictly classical methods of teaching. The volume may be called "elementary" in the sense that it is adapted to first classes of collegiate grade, though it is too advanced a text by which to introduce the subject to a young student for the first time.

The application of natural laws is made real by practical applications at every turn, though the book is not of the "natural-philosophy" variety so much in favor at the present for teaching rudimentary physics. The author, however, does not use the inductive method of reasoning from observed particular phenomena to general laws, but seems to prefer that familiar scheme, which multitudes of teachers are breaking away from, of giving definitions, broad statements and, finally, applications. The author voices the familiar complaint that engineering students lack grasp of fundamental principles of physics; but he does not strike at the root of the evil—the failure of the much tried deductive methods of teaching science to approximate natural mental processes in the investigative mind. The need for improved equipment of engineering students is seen, but the author aims to secure it by overhauling old practices and appending practical application and problems. That makes the teaching text better than some older ones by just as much as it departs from them. It can probably be used with marked success on students who have some previous knowledge of natural phenomena and general laws gained by inductive processes of instruction. But the greatest attainable success, it would seem, is to be secured by pursuing to the limit the procession from particular facts to general laws, for that is what every engineering investigator must do in after life. This text is not in harmony with such a plan.

The book starts with fundamental dimensions and measurements and presents vector quantities; it discusses rectilinear and rotary motions, leading up to general concepts of force, energy and power. Then elementary machines are presented at the end of Part I. Part II concerns itself with the properties of matter—at rest and in motion. Part III includes thermometry, calorimetry, general heat phenomena, meteorology and heat engines.

A GLOSSARY OF ROAD TERMS—By H. Percy Boulnois, M. Inst. C. E., Borough Engineer of Portsmouth, City Engineer of Liverpool, Deputy Chief Engineering Inspector of the Local Government Board. London: St. Bride's Press, Ltd. Cloth; [illegible]; pp. 71. Two shillings net.

Readers of British engineering journals are often puzzled as to the meaning of some of the technical terms used. For instance, "boning" is leveling by eye with crossheads called "boning rods"; "kerb" is a curb; a "[illegible]" is a gulley constructed partly under a "kerb"; a "sump pit" is a "gulley pit," or "catch pit," or in plain American, a catchbasin. There are numerous

other British terms, which we believe the average American reader would need to have defined, if the context did not generally show what our English cousins were writing about. Hence this little book may be of real service to American readers of English highway literature.

A Compendium of Copper Metallurgy

REVIEWED BY PROF. F. W. TRAPHAGEN*

METALLURGY OF COPPER—By H. O. Hofman, Professor of Metallurgy, Massachusetts Institute of Technology. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. xiv + 556; 548 illustrations. $5, net.

This second volume in Hofman's new metallurgical series is maintaining the high standard of the first number on "General Metallurgy."

The author has given a very complete review of the subject and the work will serve many metallurgists as a handy compendium on the subject. Matters are discussed in very great detail and the illustrations, in many cases dimensioned, could be used as working drawings. Much valuable information is condensed in the numerous tables.

The more important chapters are those on smelting and on leaching of copper ores and on electrolysis. In attempting to present an exhaustive treatise in which he has fairly succeeded, the author has been compelled to discuss many devices and practices which in some cases are obsolete and in others used only under exceptional conditions.

The experienced metallurgist will be but little embarrassed by this, but the reader of little experience in the metallurgy of copper may have much difficulty in sifting the wheat from the chaff.

One excellent feature introduced in this series is the constant reference to original authority for every important statement. This gives very great value to the work and enables readers to follow up in detail any particular matters in which they may have especial interest.

Numerous typographical errors mar the work. These will, of course, be removed in a second edition, which will be certain to be called for. It is understood that an edition in German is already arranged for and we look for editions in other languages, for the book is especially complete and uptodate.

A final report of the "Committee on Runoff from Sewered Areas," appointed May 1, 1907, by the Sanitary Section of the Boston Society of Civil Engineers, appears in the *Journal* of the Society named for June, 1914. The report describes a number of rain gages and automatic sewage-flow recorders, giving the price of each one available. It also contains text and tables giving the results of rainfall and runoff studies in various cities. There is a bibliography. The report occupies 90 pages. The Committee included George A. Carpenter, City Engineer of Pawtucket, R. I., as Chairman; Harrison P. Eddy, Consulting Engineer, 14 Beacon St., Boston, Mass., as Secretary and six other members.

A paper entitled "Mechanical Treatment of Sewage in Germany," translated from a German article by Dipl.-Ing. Endris, Engineer with the City of Hamburg, Germany, and author of numerous papers on the art of sewage treatment, forms the major portion of a bulletin issued by the Sanitation Corporation, 50 Church St., New York City, bearing the date of May, 1914. Aside from some introductory matter, the paper is devoted almost wholly to the evolution and present design and uses of the Riensch-Wurl screen. This screen has been quite extensively used in Germany, and the company named above proposes to introduce it in the United States.

*Professor of Metallurgy and Assaying, Colorado School of Mines, Golden, Colo.

FIELD MANUAL FOR PLANE SURVEYING AND RAILROAD CURVES—By R. C. Yeoman, Dean of Engineering, Professor of Civil Engineering, Valparaiso University; City Engineer of Valparaiso, and E. A. Tucker, Instructor in Surveying; Assistant in Civil Engineering, Valparaiso University. Valparaiso, Ind.: M. E. Bogarte Book Co. Cloth: 5x8 in. $2.

The new idea in this book is its arrangement and purpose. It is intended to take the place of a text on surveying and to be the field supplement of lectures and assigned reading in standard texts. The size and make up of the pages are similar to a standard field notebook. First comes a double page with sample notes and sketch of an ordinary surveying problem or exercise, then two blank pages for the student to duplicate the problem, or one similar. In this manner the book is divided into seven groups of problems; pacing problems, chaining problems, leveling problems, compass and sextant, transit problems, astronomical surveying and railroad curves. Altogether there are 44 exercises.

There is no criticism of the book, but one may well question the expediency of teaching surveying in this manner. Is it better to tell a young man what you want done and leave it to his initiative and ingenuity to devise the best ways and means, with the help of necessary textbooks and verbal instructions, or to give him a cut-and-dried problem and say, go thou and do likewise? To help train a real engineer we would prefer the former.

POWER AND POWER TRANSMISSION—By E. W. Kerr, Professor of Mechanical Engineering, Louisiana State University. Third edition, thoroughly revised. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xii+391; 325 illustrations. $2, net.

The changes seen between this, the third, and the previous edition (see these pages for May 14, 1908), are in the nature of making the book uptodate—since it has been widely known as an acceptable teaching text for such technical students (like chemists and some civil engineers) as did not plunge deeply into mechanical engineering, but still required some knowledge of power applications. Some of the changes in illustration evidently have been made to improve the appearance of the pages in the reader's eye.

The most marked peculiarity of this useful compilation of scattered information is its continued silence about electric motors and generators—undoubtedly the simplest and most efficient devices of power transmission. A treatise is not needed on them but something is required for convenience in using this book in class.

INFLUENCE DIAGRAMS for the Determination of Maximum Moments in Trusses and Beams—By Malverd A. Howe, M. Am. Soc. C. E., Professor of Civil Engineering, Rose Polytechnic Institute. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. vii + 65; 42 text figures. $1.25, net.

By systematizing the process of plotting the influence line for any member of a plane truss or frame subjected to moving load, Prof. Howe does a service of great value, particularly to those who—now and in the future—are studying the subject of trusses. The book is written

in a [illegible] short style, which makes it easy to read and [illegible], and it gives us that unusual phenomenon, a small book.

[illegible] bridge engineers at present have a clear idea of the meaning of influence line, they do not make very extensive use of these lines. A simple mechanical rule, by which an influence line can be sketched or drawn in a moment, without analytical study of the frame, is sure to make their use more common. This book should therefore find a large circle of readers and users. The fact that it develops the subject far enough to cover swing spans, arches, etc., makes it worth the study even of the experienced bridge engineer.

A Motorcycle Book and Chart

MOTORCYCLES, SIDE CARS AND CYCLE CARS. A Comprehensive Non-technical Treatise Defining All Forms of the Lighter Self-Propelled Vehicles, Principles of Operation, Construction and Practical Application of Components in Leading American and Foreign Machines. By Victor W. Page, author of "The Modern Gasoline Automobile," "The Modern Gas Tractor," "Automobile Questions and Answers," etc. New York: Norman W. Henley Publishing Co. Cloth; [illegible]. pp. [illegible]; 349 illustrations. $1.50.

LOCATION OF MOTORCYCLE POWER-PLANT TROUBLES MADE EASY—A Complete Chart Outlining the Common Derangements that Interfere with Proper Action of Engine and Auxiliary Systems. Arranged by Victor W. Page, author of "Motorcycles, Side Cars and Cycle Cars," etc. New York: The Norman W. Henley Publishing Co. Heavy Paper. Sent prepaid to any address on receipt of 25c.

Two previous books by this author on the modern gasoline automobile and on questions and answers relating to automobile design were reviewed in these columns on Feb. 13, 1913, and Jan. 15, 1914. The present book is similar in style to the previous volumes but deals exclusively with motorcycles and their recent development into what are known as cycle cars. The book is somewhat more elementary in its treatment than the books relating to automobile work above referred to, but like them is deserving of high commendation for the thoroughness and [illegible] of the treatment given to the subject.

This book should prove a useful aid to the numerous [illegible] who own and use motor bicycles. It is doubtful, however, whether the cycle car will have any such large use in this country as it has secured in France and England. The very low price at which a regular automobile can be procured in this country makes it difficult for the cyclecar manufacturers to compete with them. [illegible]

[illegible]

C. H. [illegible], 1307 E. [illegible] St., Cleveland, Ohio, [illegible] a [illegible] chart of the familiar parallel-scale variety, which is printed on a matt-surface celluloid. The chart can be used by drawing pencil lines across the scales instead of merely laying a ruling edge across, and in this way is considerably more useful or convenient than a chart without this feature. The scales are arranged for both steel and wooden beams; in the case of steel beams they indicate the depth and section directly.

OIL PRODUCTION METHODS.—By Paul M. Paine, Assistant Superintendent, Honolulu Cons. Oil Co., and B. K. Stroud, Petroleum Engineer, formerly Superintendent, Monte Cristo Oil & Dev. Co., Field Superintendent, Universal Oil Co. With a Chapter on Accounting Systems by W. F. and W. B. Sampson, Expert Accountants with Klink, Bean & Co., San Francisco, Calif. Western Engineering Publishing Co. Cloth; 6x9 in.; pp. 240; 216 text illustrations. $3, postpaid.

According to the preface this book has been prepared in response to a demand for a work describing, in a manner that may be understood by the layman, how oil wells are drilled and oil produced. The first two chapters are of general interest, describing the distribution, properties and uses of petroleum and the geological conditions under which it is found. The next two chapters describe drilling equipments and methods, and are of interest to those who have to make drill holes for other purposes as well. The fifth chapter covers the exclusion of water from oil sands, and the other three chapters describe the operation of the wells, handling of the crude oil and an accounting system for the business-like conduct of oil-well operation.

SYMMETRICAL MASONRY ARCHES. Including Natural Stone, Plain-Concrete and Reinforced-Concrete Arches. For the Use of Technical Schools, Engineers and Computers in Designing Arches According to the Elastic Theory.—By Malverd A. Howe, M. Am. Soc. C. E., Professor of Civil Engineering, Rose Polytechnic Institute. Second edition, revised and enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xi + 241; 35 illustrations and 6 folding drawings. $2.50, net.

Some important additions make this second edition a distinct modernization. However, the favorable comments by Prof. Wm. Cain, in reviewing the first edition in our issue of Nov. 15, 1906, give as good a characterization of the book now as then. The tables of arches have been supplemented by a table giving arches built within the last ten years. The arch-coefficient method presented by the author in Engineering News of June 2, 1910, forms the 10-page Appendix B; its tables of coefficients will be found of much use. Formulas for unsymmetrical arches are grouped in another appendix, thus serving the occasional need where symmetry cannot be maintained.

The author says that most of his text has been rewritten.

Our attention has been called to an error in the heading to the brief review of [illegible] Congrave's "Rock Excavating and Blasting" printed in our issue of May 21. The book was published by the author and not by the National Fire-Proofing Co. of Pittsburgh, as stated in the review. The material comprising the book, however, had appeared in serial form in a magazine entitled "Building Progress," published by the company named. Mr. Congrave may be addressed at 21½ W. [illegible] St., Philadelphia, Pa.

PROCEEDINGS OF NATIONAL CONFERENCE ON CONCRETE ROAD BUILDING—Held at Chicago, February [illegible], 1914. [illegible] Secretary, [illegible] Chicago. Paper; [illegible].

At the closing session of the National Conference on Concrete Road Construction, held at Chicago last Febru-

ary, it was voted that the full proceedings of the conference should be published. There were presented at that conference the reports of 15 committees, each of which dealt with some especial feature of concrete road work. Each of these committee reports received more or less discussion. There were also half a dozen papers and addresses. All this matter has just been issued in a well printed and well bound volume, which will doubtless receive the careful study of every engineer in any way interested in the subject of the conference. The volume opens with several pages on recommended practice in concrete road building, which were adopted by the conference, as reported by the Committee on Resolutions.

Electrical Insulations

MOLDED ELECTRICAL INSULATION AND PLASTICS—By Emilie Hemming. New York: Ward Clausen Co. Cloth; 5x8 in.; pp. 207; 36 plates and text figures. $3.

Mr. Hemming has succeeded in producing that modern rarity in technical literature, an entirely new book. The literature of electrical engineering, chemistry, ceramics, etc., has scattered through it, of course, a large amount of material relating to modern insulating materials, especially those of the plastic varieties, but so far as we are aware, all the information available on these products has remained scattered until this attempt to present it between the lids of one volume.

The author describes the advances which have been made, particularly in late years, in molded insulations for all sorts of electrical service, and then classifies the products of the present day under nine heads—organic hot-molded, organic cold-molded, inorganic cold-molded, ceramics, rubber compounds, organic plastics, synthetic resins, hardened fibers, molded mica. Before discussing the several classes in further detail, some forty-five pages are devoted to a description of the raw materials which enter into all of these various classes. This description includes the fundamental chemical elements, mechanical properties, etc., of a great variety of materials—asbestos, clay, mica, silica compounds, cement, earths, resins, vegetable fibers, mineral waxes, oils, solvents, rubber, and chemicals such as phenol, formaldehyde, etc.

Then follow details of making and using the classes of materials. All this material is reduced to its simplest and briefest form and should be understood without especially deep knowledge of chemistry, electricity or even of manufacturing processes. In the first group ("Class A, hot-molded organics") is discussed the use of shellac binders (or substitutes) with wood pulp, magnesia, lime, sand and asbestos. In the second group ("Class B, cold-molded organics"), the materials employed are much the same, but solvents take the place of heat in obtaining fluidity. The third group ("Class C, cold-molded inorganics") uses compounds of silica, alumina, lime and magnesia, or hydraulic cements with the same inorganic fillers named. "Class D" covers ceramics; "Class E," rubber compounds; "Class F" organic plastics—celluloid and casein; "Class G," the synthetic resins resulting from the reaction between phenol and formaldehyde; "Class H," vulcanized fiber; and "Class I," mica imbedded in binders.

The physical properties of completed articles are reviewed—life, ease of working, dielectric strength, mechanical strength, resistance to weather and heat, chemical inertness and appearance. Here is restated, under these respective heads, what is related before in discussing the several materials.

There is a long section on the limitations of molding and the attention that has to be given to good design of dies. Some 18 full-page plates illustrate various articles molded from these several varieties of material; accompanying page texts describe their use and note reasons for using the particular materials shown. Finally the results of some definite electrical, mechanical and thermal tests are shown.

How to Cast Steel

THE STEEL FOUNDRY—By John Howe Hall, Consulting Engineer. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. ix + 271; 37 text illustrations. $3, net.

REVIEWED BY WM. R. CONARD*

The author gives a comprehensive description of the various processes of steel founding.

As a book for use in our institutions of learning, it should be of value to both the teacher and the student.

Again, it is of value to the man who is a consumer of steel in that it describes plainly the results obtained by the various processes and the advantages and disadvantages of each process.

It is particularly valuable to anyone entering this branch of industry or investing money in this line in that it gives in addition to the various processes, well considered estimates of costs and similar data which the layman might not know how to figure out. And in the last place, it is of especial value to the man who is actively engaged in the steel business as it brings all of the various methods under one cover, describing them all. The author has apparently endeavored to cover all phases of the industry from the factors which enter into the choice and cost of a given process to the laboratory where the results of the processes are analyzed.

PUBLIC ROADS AND HIGHWAYS COMMISSION OF ONTARIO—Report of 1914. Toronto: Office, Commissioners of Public Roads. Cloth; 7x10 in.; pp. 277; illustrated, and accompanied by six folding maps.

In addition to the regulation highway-commission report, this book is of interest because it contains a compendium of highway organizations in Canada and the United States. There is also a very interesting historical sketch of road development in Ontario. The most important part of the report is perhaps a study of the relation of farm values and agricultural improvement to highway improvement in the Province of Ontario.

A short, popular, but useful and forceful account of the "Salem Conflagration" (Salem, Mass., June 25 and 26, 1914) has been written by Franklin H. Wentworth and published by the National Fire Protection Association (87 Milk St., Boston, Mass; price 10c.). Lessons from the fire are, of course, drawn. A folding map and a few halftone views are included.

A table for estimating the cost of joints in 4- to 18-in. cast-iron pipe has been compiled for distribution by the Leadite Co., of Philadelphia, Penn. It shows for both lead and leadite the pounds of calking material required per joint, and the cost per joint, per foot of pipe and per mile of pipe. The quantities and costs given are based on American Water-Works Association standard

*22 High St., Burlington, N. J.

[illegible] parts. The table has been printed on a [illegible] card, and although issued primarily for advertising purposes, will interest water-works men.

NEW PUBLICATIONS

[As far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by including postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

ABWASSERREINIGUNGSANLAGEN IHRE LEISTUNGEN UND IHRE KONTROLLE VOM CHEMISCH-PRAKTISCHEN STANDPUNKT—Von Prof. Dr. K. Thumm, Abteilungsvorsteher an der Königl. Landesanstalt für Wasserhygiene in Berlin-Dahlem. Berlin: August Hirschwald. Paper, 6x9 in., pp. 92. 2.80 Marks.

ADDENDUM, BEING THE FIVE CHAPTERS ON MODERN ROAD CONSTRUCTION Reprinted from "Asphalts" 1914 Revised Edition—By T. Hugh Boorman. New York: The William T. Comstock Co., 23 Warren St. Paper; 7x10 in., pp 169-191, illustrated. 25c. if sold separately; incorporated in new edition of book, price of which is $2.

AIR-BRAKE CATECHISM The Only Practical and Complete Work Published Treating on the Equipment Manufactured by the Westinghouse Air Brake Company, Including the ET Locomotive Brake Equipment; the K (Quick-Service) Triple Valve for Freight Service, the Type L High-Speed Triple Valve, the P C Passenger-Brake Equipment and the Cross Compound Pump, The Operation of All Parts of the Apparatus Is Explained in Detail, and a Practical Way of Finding Their Peculiarities and Defects with a Proper Remedy Is Given—By Robert H. Blackall. Entirely revised to date. New York: The Norman W. Henley Publishing Co. Cloth; 4x7 in.; pp. 411. 179 illustrations. $2.

AMERICAN MACHINISTS' HANDBOOK and Dictionary of Shop Terms. A Reference Book of Machine Shop and Drawing-Room Data, Methods and Definitions—By Fred H. Colvin, M. Am. Soc. M. E., Associate Editor of the "American Machinist," author of "Machine Shop Arithmetic," "Machine Shop Calculations," "American Machinists' Grinding Book," "The Hill Kink Books," etc., and Frank A. Stanley, M. Am. Soc. M. E., Associate Editor of the "American Machinist," author of "Accurate Tool Work," "Automatic Screw Machines," "American Machinists' Grinding Book," "The Hill Kink Books," etc. Second edition, thoroughly revised and enlarged. New York and London: McGraw-Hill Book Co. Leather; 4x7 in.; pp. xxvi + 6[illegible]; numerous illustrations. $3.

FLIGHT WITHOUT FORMULAE. Simple Discussions on the Mechanics of the Aeroplane—By Commandant Duchêne, of the French Génie, author of "The Mechanics of the Aeroplane." Translated from the French by John H. Ledeboer, Editor, "Aeronautics," joint-author of "The Aeroplane." New York and London: Longmans, Green & Co. Cloth; 6x9 in.; pp. 211; 84 text figures. $2.25, net.

GASEOUS IMPURITIES IN THE AIR OF RAILWAY TUNNELS—By Atherton Seidell and Philip W. Meserve. Hygienic Laboratory Bulletin No. 92. Washington, D. C.: United States Public Health Service. Paper, 6x9 in., pp. [illegible], illustrated.

GEOLOGICAL AND TOPOGRAPHICAL MAPS: THEIR INTERPRETATION AND USE. A Handbook for the Geologist and Civil Engineer—By Arthur R. Dwerryhouse, Lecturer in Geology in the Queen's University of Belfast. London: Edward Arnold. Cloth; 6x9 in.; pp. 133; 90 text figures. [illegible], net.

[illegible] BEIM [illegible] FLUSS [illegible] TZE UND MENGENBESTIMMUNG [illegible] Von Dr.-Ing. [illegible]. Leipzig and Berlin: Wilhelm Engelmann. Paper, 8x11 in.; pp. [illegible]; 27 text figures. [illegible] Marks.

[illegible] VALVE GEARS AND VALVE SETTING. A Practical Treatise Which Explains the Mechanism of Valve [illegible] [illegible]

[illegible]

[illegible]

PRACTICAL CALCULATIONS FOR ENGINEERS. For the Use of Engineering Students, Apprentices, Mechanics, Foremen, Draftsmen, and Others Practically Engaged in Engineering Work—By C. E. Larard, M. Inst. C. E., M. I. Mech. E., Head of the Mechanical Engineering Department at the Northampton Institute, London, and H. A. Golding, Assoc. M. I. Mech. E. Third edition, revised. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Co. Cloth, 5x8 in.; pp. xii + 387; 175 illustrations. $2, net.

PRACTICAL RATE MAKING AND APPRAISEMENT—By William D. Marks, author of the "Finances of Gas and Electric Light and Power Enterprises, 1900," and of Other Technical Papers and Works. South Hadley, Mass.: Office, Presidents House. Cloth, 5x8 in.; pp. 263. $3, postpaid.

PROCEEDINGS OF THE SEVENTH SANITARY CONFERENCE OF THE HEALTH OFFICIALS OF CONNECTICUT—Held at New Haven, Mar. 26, 1914. Hartford, Conn.: State Board of Health. Paper, 6x9 in., pp. 51.

A PUBLIC HEALTH SURVEY OF TOPEKA—A Report by Franz Schneider, Jr., Sanitarian, to the Topeka Improvement Survey, May, 1914. An Inquiry into Social and Living Conditions in the City of Topeka Made for the Purpose of Basing a Program of Community Advance upon the Facts of Local Problems. Under the Direction of the Department of Surveys and Exhibits, Russell Sage Foundation, 130 East 22d St., New York City. Paper, 6x9 in., pp. 98, illustrated.

RAHMENFORMELN: Gebrauchsfertige Formeln für einhüftige, zweistielige, dreieckförmige und geschlossene Rahmen aus Eisen- oder Eisenbetonkonstruktion nebst Anhang mit Sonderfällen teilweise und ganz eingespannter Träger—Von Dr.-Ing. A. Kleinlogel, Privatdozent an der Techn. Hochschule Darmstadt. Berlin: Wilhelm Ernst und Sohn. Paper, 7x10 in. pp x + 351; 338 illustrations. 11 Marks.

THE RAILWAY LIBRARY, 1913—A Collection of Noteworthy Addresses and Papers, Mostly Delivered or Published During the Year Named. Compiled and edited by Slason Thompson, Director of Bureau of Railway News and Statistics, Railway Exchange Bldg., Chicago, Ill. Cloth; 6x9 in.; pp. 469; illustrated. 50c.

RECENT COPPER SMELTING—Edited by Thomas T. Reed. San Francisco, Calif.: Mining and Scientific Press. London: The Mining Magazine. Cloth, 6x9 in.; pp. 459, 93 illustrations. $2.50.

REPORT OF THE SPECIAL BOARD OF CONSULTING ENGINEERS TO THE DAYTON FLOOD PREVENTION COMMITTEE (Mar. 26, 1914)—Dayton, Ohio: Dayton Citizens' Relief Commission. Paper, 7x10 in., pp. 25.

REPORT TO THE MERSEY & IRWELL JOINT COMMITTEE (May, 1914)—By Hugh Stowell, M. Inst. C. E., Chief Inspector, 44 Mosley St., Manchester, England. Paper, 6x9 in.; pp. 37.

Besides reviewing the river inspection work of two years, this report contains tabular information regarding the large number of sewage-treatment works in the Mersey and Irwell drainage areas.

ROBERTS-AUSTEN: A RECORD OF HIS WORK. Being a Selection of the Addresses and Metallurgical Papers, Together with an Account of the Researches of Sir William Chandler Roberts-Austen, Hon. M. Inst. C. E., Inst. Mech. E., Inst. M. & M., Am. Inst. M. E., Late Chemist and Assayer of the Royal Mint, Professor of Metallurgy in the Royal School of Mines, author of "An Introduction to the Study of Metallurgy," and Editor of Griffin's Metallurgical Series. Compiled and edited by Sydney W. Smith, Assistant Assayer at the Royal Mint. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Co. Cloth; 6x9 in.; pp. x + 282, portrait and 23 plates. $6, net.

TABLES ANNUELLES DE CONSTANTES ET DONNÉES NUMÉRIQUES, de Chimie, de Physique et de Technologie. Vol. III, Année 1912. Publiées sous le patronage de l'Association internationale des Académies par le Comité international nommé par le VIIe Congrès de Chimie appliquée (Londres, 2 Juin 1909). Paris (VIe): Ch. Marie, Secrétaire général du Comité international, 9, rue de Bagneux. Cloth; 9x11 in.; pp. xlix + 5[illegible]. American Agents: The University of Chicago Press.

TASCHENBUCH FÜR BAUINGENIEURE—Herausgegeben von Max Foerster, Geh. Hofrat, ord. Professor an der Technischen Hochschule in Dresden. Second edition. In two parts. Berlin: Julius Springer. Cloth; 5x8 in.; pp. xvi + 2[illegible]; [illegible] text figures. 20 Marks.

TASCHENBUCH FÜR DEN MASCHINENBAU—Herausgegeben von [illegible] H. Dubbel. Berlin: Julius Springer. In two parts. Cloth; 5x8 in.; pp. xi + 14[illegible]; [illegible] text figures and [illegible] tables. 16 Marks.

U. S. BUREAU OF THE CENSUS—Washington, D. C. Cloth; 9x12 in.

Population, 1910: Thirteenth Census of the U. S., Vol. IV, Occupation Statistics. Pp. 615.

Financial Statistics of Cities Having a Population of Over 30,000: 1912. Pp. [illegible].

UNITED STATES GEOLOGICAL SURVEY—Washington, D. C. Paper, 6x9 in.

Quality of the Surface Waters of Washington—By Walton Van Winkle. Water-Supply Paper 339. Pp. 1[illegible].

The Production of Mineral Waters in 1913, with a Discussion of Their Radioactivity—By R. B. Dole. (Mineral Resources of the United States, Calendar Year 1913—Part II. Pp. 2[illegible].)

The Transportation of Débris by Running Water—By Grove Karl Gilbert. Based on Experiments Made with the Assistance of Edward Charles Murphy. Professional Paper 86. 9x12 in.; pp. [illegible].

VORLESUNGEN ÜBER WASSERKRAFTMASCHINEN—Von Dr. Phil. Dr.-Ing. R. Camerer, [illegible] Professor der Maschinenlehre an der Kgl. Techn. Hochschule München. Leipzig and Berlin: Wilhelm Engelmann. Cloth, 7x10 in.; pp. xxvii + 577; [illegible] text figures and 55 tables. [illegible] Marks.

Engineering News

VOLUME 72 — AUGUST 27, 1914 — NUMBER 9

The Design and Construction of the Bassano Dam: Part I

By H. B. Muckleston*

SYNOPSIS—A part of the immense irrigation system of the Canadian Pacific Railway, southeast of Calgary, is a composite dam consisting of an earth embankment 7000 ft. long and 35 to zero ft. high, an Ambursen hollow reinforced-concrete dam, 750 ft. between abutments, 39 ft. high to the crest, which is divided into 24 openings each 27 ft. long, provided with Stoney gates 11 ft. high; and a reinforced-concrete headwork, at right angles to the dam proper, having five 20-ft. openings, closed by Stoney gates 14 ft. high. The dam is designed to pass 100,000 sec.-ft. of water with 14 ft. on the crest. The dam rests on a stratum of clay, beneath which is sand containing water under slight pressure. The floor of the dam is pierced by weep-holes and iron pipes extend from the bridge level of the dam to and through the clay. A floating timber apron is placed below the dam. Construction was carried on in extremely cold weather. Salamanders beneath tarpaulins supported on horses were used to thaw frozen ground to a depth of 6 ft. for excavation. Concrete work was not stopped until the temperature fell below —15° F. The water and gravel were heated and all forms were double boarded. The sluice gates are protected against frost by housing and by an electric-heating system.

The Canadian Pacific Railway Co. has recently completed, as a part of its great irrigation project, one of the most notable overfall dams now in existence.

The dam, which is located on the Bow River, about one hundred miles southeast of Calgary, is noteworthy not only because of its dimensions and the composite character of its construction, but also because of the unusually great depth of water which it is designed to pass over its crest during floods.

The Irrigation Project

The map, Fig. 1, gives a general idea of the country covered by the irrigation system and shows, besides the main canals and ditches, the location of the principal watershed and drainage lines. It will be noted that much of the greater part of the irrigated area is on the North or Red Deer River slope of the divide, and that consequently only a fraction of the water diverted will ever return to the Bow River. The total irrigable area commanded by the system is, in round figures, some 440,000 acres. The canal system, to reclaim this large area, involved moving some 21,000,000 cu.yd. of excavation in all classes; over 100,000 cu.yd. of concrete were built into the structures on the main, branch and secondary canals; and 9,500,000 ft. b.m. of timber were used in flumes, bridges and the structures on the smaller ditches and laterals. The total mileage of canals and ditches is in excess of 3000. It will be seen, therefore, that the project is exceeded in magnitude by few outside India and by none on this Continent.

The first surveys for this project were made by the writer in 1906. They were confined to securing general information and to making rough estimates of the area which could be irrigated and the cost of the diversion

Spillway or Overfall Portion of Bassano Dam, Canadian Pacific Irrigation Project

*Assistant Chief Engineer, Department of Natural Resources, Canadian Pacific Railway, Calgary, Alberta.

works, based on several assumptions as to crest elevation of the proposed dam. These surveys showed that the project was feasible from an engineering point of view

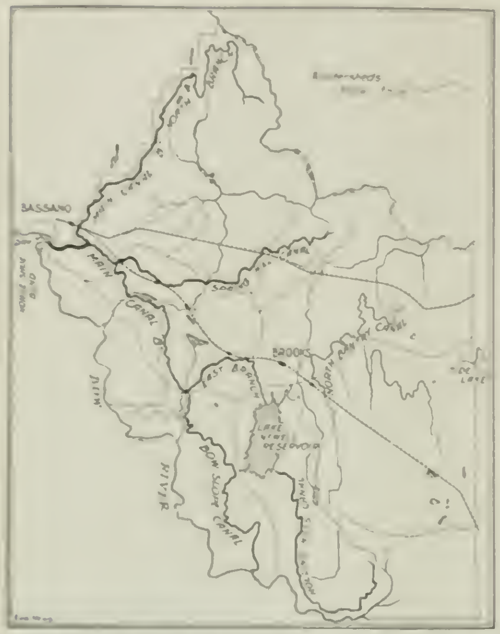


FIG. 1. MAP OF CANADIAN PACIFIC IRRIGATION SYSTEM, EAST OF CALGARY, ALBERTA

and that it could be built within the limit which had been set as to cost. Further surveys were made in 1909, and the crest elevation finally fixed after several alternative preliminary locations of the larger canals and a closer examination of the areas which they commanded.

DESIGN OF THE DAM

It will be noted from the map, Fig. 1, that at the point B (Bassano) the divide between the rivers is very close to the Bow, only 600 ft. away in fact. At this point begins a wide valley known as Crawling Valley, which cuts clearly across the country from the Bow River to the Red Deer. Toward the Red Deer River it falls about 40 ft. in 15,000 ft. in the upper reaches, while toward the Bow the fall is 90 ft. in [illegible] ft. The average depth of this valley is about 70 ft., and its width about 600 ft. As the summit of the pass [illegible] was [illegible] 30 ft. above the river it offered a splendid opportunity to divert water for irrigation, provided it proved feasible to construct a dam of some height across the river valley.

Fig. 2 is a general site plan showing the location of the dam. The left bank of the river, which forms the outside of the horseshoe, is a high clay cut bank or cliff, varying from 150 to 200 ft. in height, with practically no beach whatever at the bottom except in very extreme low water. The right bank or inside of the horseshoe is a gravel beach gradually sloping up to a silt bank at high-water mark. The tongue of land inside the horseshoe slopes gradually up from the toe of the slope to the general bench elevation of the adjoining country. It shows visible evidence that it has been built by the river, as the stream gradually cut its way down and widened the sweep of the curve.

Fig. 3 is a general profile showing the result of the borings put down to determine the character of the foundations. Under the clay at a varying depth is a stratum of unknown thickness composed of a coarse water-bearing sand, not quite free running but weakly cemented. Most of the boreholes were stopped when the sand stratum was reached, but a few were carried deeper in an effort to reach the bottom of the sand, though without any success. It was found that the water in the sand was under a slight pressure, which was measured and found to correspond roughly with the fall in the surface of the river in a distance of about 3000 ft. This was thought to indicate that the overlying clay pinched out somewhere upstream, and three boreholes were put down to ascertain if this was so. It was found that at 2600 ft. upstream from the site the clay was only 2 ft. thick. The theory that the water found access from the river was confirmed by subsequent observations on the pressure head in the sand compared with parallel readings of a gage rod in the river. The similarity of the curve was unmistakable, though there was a lag in phase amounting to 30 hr., for which no satisfactory explanation has yet been offered.

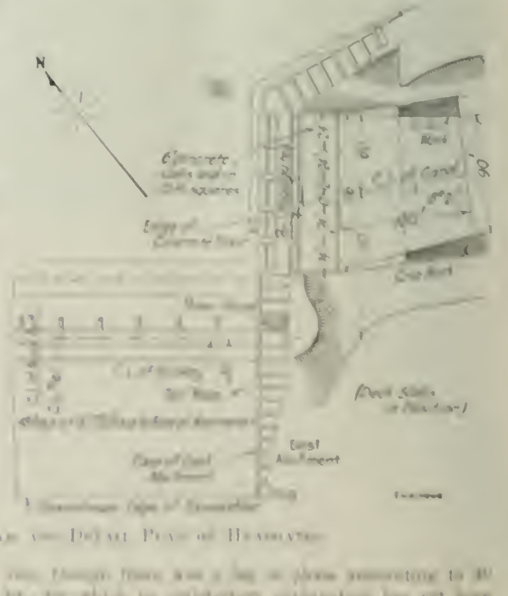


FIG. 2. GENERAL PLAN OF BASSANO DAM AND DETAIL PLAN OF HEADWORKS

The strata under the tongue of land inside the horse-

shoe are similar to those under the river except that the gravel layer is very much thicker and is overlaid by a stratum of silt left behind by the river as it gradually cut its way down.

When the dam was first proposed, very little was known of the hydrology of the river, the few discharge records that were available being unsatisfactory in that they gave little or no indication as to the maximum floods which might be expected. The only refuge, therefore, was a careful series of gagings and a search for flood marks. From these gagings and what flood marks could be found it was estimated that a flood of 100,000 sec.-ft. was possible, and the dam was designed to pass this quantity with 14 ft. of water on the crest. This corresponds to a runoff of 12.5 cu.ft. per sec. per sq.mi. from a drainage area of 8000 sq.mi.

The range in discharge of the river is very wide, varying as it does from a minimum in winter of about 1200 sec.-ft. to the calculated flood discharge above given. Ordinary spring and summer freshets seldom rise much above 30,000 sec.-ft., though considerably larger floods of short duration are not infrequent.

The time factor in flood rises in the Bow is important, variations of 20,000 sec.-ft. in discharge in 10 or 12 hr. being by no means unusual and often coming without much warning. Owing to the narrow valley and steep slope of the river bed the pondage area above the dam is comparatively small, not over 3500 acres, during low stages. It was therefore very necessary that means be provided for rapid working of any crest sluices, and also that the earth dam be given an unusual freeboard above ordinary pool level.

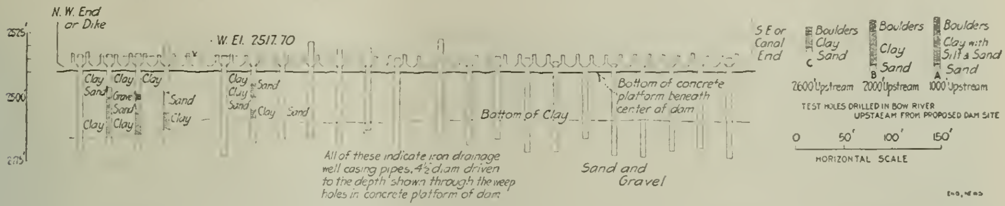


FIG. 3. MATERIAL PENETRATED BY DRAIN PIPES 9 FT. UPSTREAM FROM CENTER LINE OF BASSANO DAM

The dam as finally built consists of two or rather three parts: (1) an earth embankment 7000 ft. long, built on the right bank inside the horseshoe; (2) a reinforced-concrete spillway section, built in the river bed; and (3) a reinforced-concrete canal headwork built at right angles to the spillway and integral with it.

The embankment varies in height from 35 ft. to zero. It was designed to have a top width of 24 ft., with 4 to 1 wet slope and 3 to 1 dry slope, and to have a freeboard at ordinary high stages of 9 ft. The thickness as built is much in excess of what the above dimensions would indicate, as a large surplus of material from the canal cut was wasted over the back of the earth dam, resulting in a top width varying from 40 to 100 ft. The wet slope is protected from erosion by a concrete paving surmounted by a curved parapet wall to prevent any wave wash from going over.

The spillway is 720 ft. between abutments. It is of the typical Ambursen section (Fig. 4). The crest is divided into 24 openings, each 27 ft. long, closed when required by Stoney sluices 11 ft. high. The headworks consist of 5 openings, each 20 ft. wide, closed by Stoney sluices 14 ft. in height.

The general design of the composite structure was determined by the Railway Company's engineers after a careful study of all the conditions above outlined. Having decided that the cellular type of reinforced-concrete construction would best meet requirements for the spillway and headworks, the detailed design of these parts was placed in the hands of the Ambursen Company, who also undertook the superintendence of construction. All drawings were approved by the Railway Company's engineers before becoming effective. Both design and construction were carried out under very complete specifications approved by both the Railway Company and the Ambursen Company.

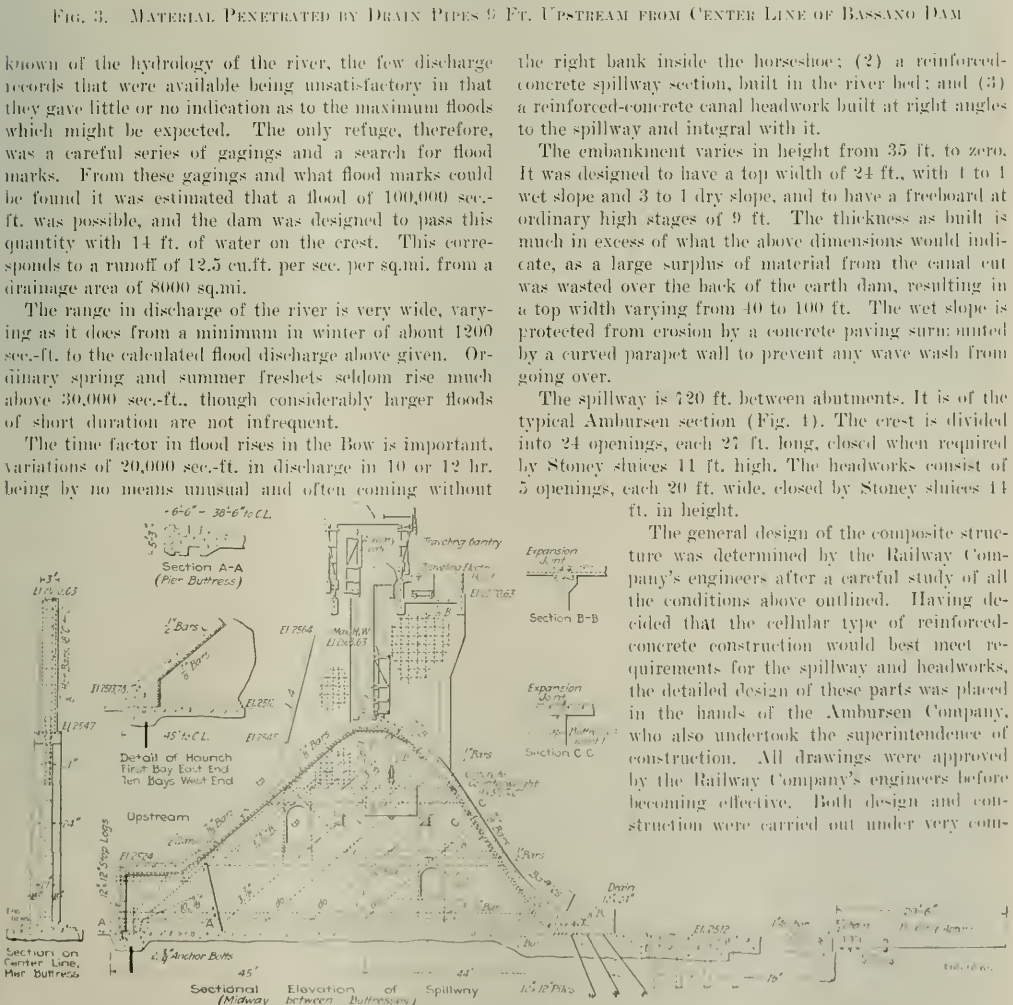


FIG. 4. SECTIONS OF BASSANO DAM

The maximum allowable unit stresses used in the design of all parts of the structure were as follows:

Bearing power of foundations	2.5 tons per sq. ft.
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

All the above maximum unit stresses are considered [illegible] based on [illegible] due to the greatest external flood head, namely, 14 ft. above [illegible] and no allowance made for effect of ice [illegible].

For all members of the structure the steel is so designed as to take the entire tensile stress without aid from the concrete. For all bottoms, walls, [illegible] steel is inserted in such quantities as will insure against [illegible] cracking due to temperature stresses and vibration.

All cement was tested at the works and [illegible] to conform to the specifications of the Canadian Society of Civil Engineers.

[illegible]

As mentioned above, the water contained in the sand stratum is under pressure, and strong presumptive evidence existed that this pressure was equivalent to the head of a point about 3000 ft. upstream. If the presumption were true the upward pressure on the clay might, under certain circumstances, be more than the superincumbent weight, and accordingly steps were taken to relieve it. This was accomplished by twenty-four 5½-in. [illegible] wells bored through the clay and extended [illegible].

Sluice Gates—Of the sluice gates, a great many different types were considered, the choice finally narrowing down to Tainter gates as against the Stoney free-rolling pattern. The latter were finally decided on, for, while the Stoney involved a considerable increase in cost, it was felt that they would be better suited to the conditions and more certain in operation. The gates are handled from [illegible] and are counterweighted to [illegible] of their [illegible]. The [illegible] is calculated for a loading [illegible].

[illegible]

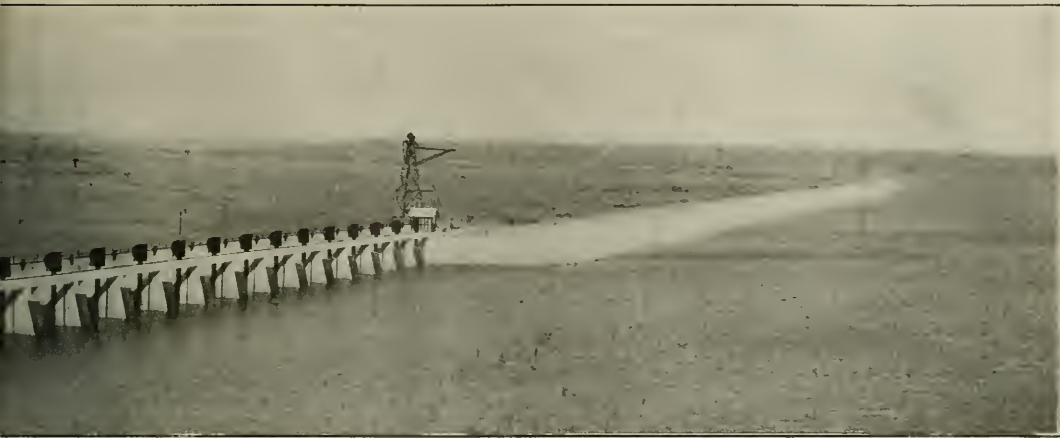


FIG. 6. HEADGATE STRUCTURE, SPILLWAY AND EARTH EMBANKMENT OF BASSANO DAM

PROTECTION OF SLUICE GATES AGAINST FROST BY HOUSING AND ELECTRIC HEATING—One of the problems in the design of the dam to which a great deal of study was given was the effect of the peculiar winter climate on the structure and its operation. One of the salient features of the irrigation project is the large interior reservoir lying south of Brooks—Lake Newell on the map (Fig. 1). It is intended to fill this reservoir during the winter months when the canals are not required for irrigation purposes. This involves very delicate control of the discharge of the canals in order to avoid trouble from ice jams and consequent possible breaching of the canal banks. It will be seen, therefore, that under no circumstances must the crest sluices ever be allowed to become inoperative through frost. To guard against this a very complete system of electric heating for the gates has been installed and special precautions in the way of housing have been taken to insure that all the canal head sluices and two of the crest sluices shall be free from ice at all times.

The effects of ice shove or expansion on the static stability of the dam were very carefully considered and allowed for. It was felt, however, that even so it would be wise to treat the cause rather than the effects, and steps are therefore taken to keep a trench open close above the piers.

Fig. 6 shows across both pages the entire dam and headgate structure at Bassano Dam. On the left is the headgate and stretching away to the far background on the back is the earth embankment.

The construction of the dam will be described in a later issue.

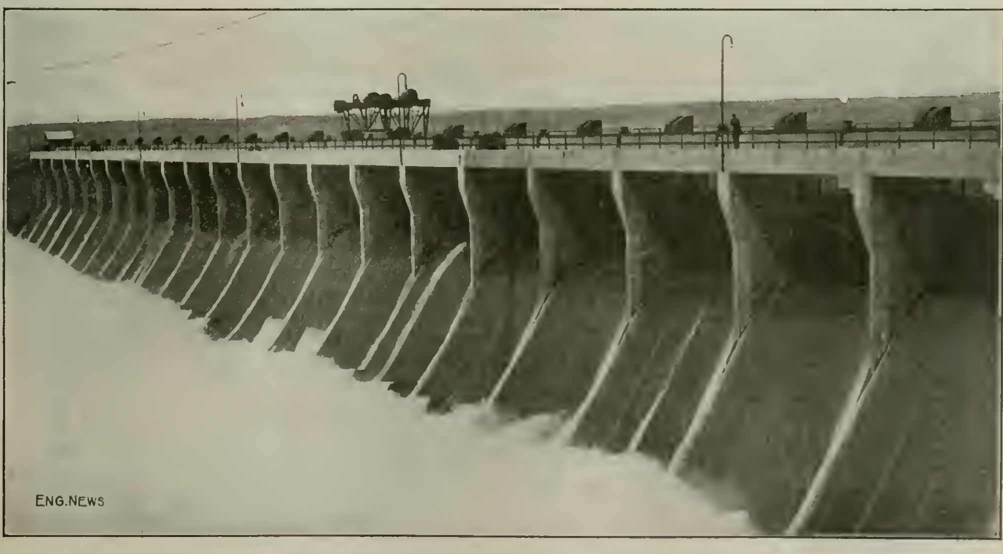


FIG. 7. BASSANO DAM, LOOKING UPSTREAM AFTER COMPLETION

Construction of a Small Sewerage System for Garfield, N. J.

By Russell S. Wise*

The construction of some 30 mi. of sewers for Garfield, N. J., partly in wet ground, the laying of house connections and other features of this work, including record keeping, seem worth putting on record in view of the comparatively little recent information regarding such work readily available to engineers.

Garfield, N. J., a borough in Bergen County, lies about 12 mi. west of New York City. It has an area of about [illegible] sq.mi., and a present population of over 12,000. Topographically, it is broken into three ridges, with the valley of the Passaic River on the west, the Saddle River Valley on the east and south, and the flat land of Saddle River Township on the north.

In designing the sewer system of the borough of Garfield, it was decided at the outset [illegible] to drain to three points on the Passaic River and to discharge a small system into the Saddle River. Four sewage treatment plants were planned; three, each of a capacity of 1,000,000 gal. daily, were to be built on the easterly bank of the Passaic River, and the fourth, having a capacity of 100,000 gal. daily, was located on the north bank of the Saddle River. Those which were to be built along the Passaic River were intended to be abandoned as soon as the auxiliary sewer to be constructed by the Passaic Valley Sewerage Commissioners was in readiness to receive the sewage of Garfield.

The sewerage system, as designed, covered all of the streets, [illegible] and proposed, which were shown upon the official assessment map of the borough. The sewers have, however, been built only in the most populous sections of the borough. Up to July, 1914, about 30 mi. of main sewers have been constructed. Connections from the sewers to the curb have, in all cases, been laid.

The system, which is now considered to be completed, has cost about $[illegible]. Of this sum, a bond issue of $[illegible] was voted by the people to defray the cost of the [illegible] sewers and disposal plants. The remainder of the cost was met by moneys raised from the sale of improvement certificates [illegible] [illegible] at [illegible] and afterwards changed to [illegible] when it was found difficult to dispose of these certificates at the lower rate.

The contract was let to [illegible] & [illegible], of [illegible], N. Y., and the work began July [illegible], 1911.

Trenching machines were used upon most of the work. [illegible] machines [illegible] the most satisfactory work on a good deal of the trenching in the [illegible] sections of the borough was in [illegible] [illegible] with boulders and occasional layers of red shale. The [illegible] [illegible] of this material, boulders and shale, with [illegible] to itself. When sheeting was necessary, the machine's elevating wheel was hoisted to the top of the trench, legs were cleared and placed in position and the [illegible] and the sheet [illegible] without injury to any portion of the machinery, and no loss of time in moving the machine occurred. In [illegible] the machine [illegible] from [illegible] to [illegible] lin.ft. of trench [illegible] ft. in depth per day of [illegible] hours.

In the central portion of the borough, ground water was encountered at a depth of 1 to 10 ft. below the surface, in fine sand and some distance down in a bluish clayey quicksand which resembled thick blue paint. No attempt to lay the sewer pipe in water was made.

In excavating in quicksand, or quaking soils, it was found that laborers, with strong backs, who would stand very still, could skim off the soil in thin layers without causing any appreciable flow of water and the bottom of the trench would be in excellent condition to place a foundation of gravel and sand; whereas, the laborers who moved around and used their feet in digging would soon bring about watery conditions. The trench would cave in and come up under the sheeting almost as fast as it was dug out and so cause trouble and expense in laying the pipes.

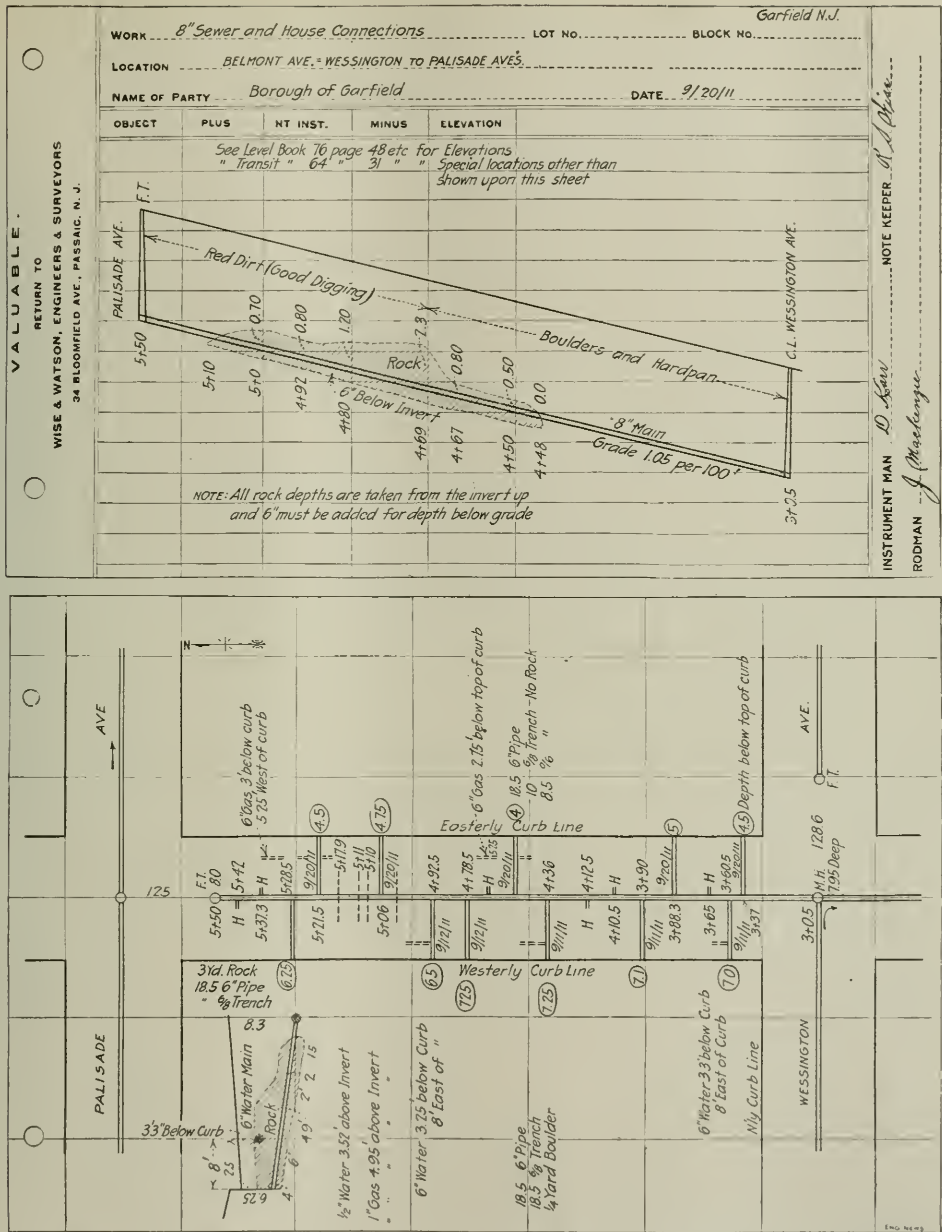
In all quicksand trenches, foundations of gravel, varying in depth from 6 to 18 in., depending upon the nature of the material, were laid. The extra excavation for the foundations was paid for by the cubic yard. The gravel foundations seemed to check the flow of water sufficiently to lay the pipe, and proved very satisfactory. In a few cases, where the gravel foundations did not fulfill the requirements, concrete was placed upon the gravel. This was done by excavating the trench 50 to 60 ft. in advance of the pipe and tamping a comparatively dry mixture of 1:3:5 concrete into the gravel. After leveling the concrete to within 1 in. of the grade of the outer bottom of the bell of the pipe, the concrete was allowed to set 24 hr. The pipes were then laid upon this foundation by raising the grade of the trench with the same mixture. After jointing, as described further on, the concrete was raised to the springing line of the pipe and in some cases was sloped from the springing line to the top of the pipe. The backfilling with dry material then proceeded, covering the pipe about 2 ft., and the balance of the trench was filled with the original material. So far the pipes seem to be in good line and grade.

In sheeting quicksand trenches, a strip of sheet iron about [illegible] in. wide and the length of the sheeting was nailed on one edge of the planks, the sheeting being driven with the sheet iron on the outside of the trench. The sheet iron overlapped every joint and the pressure of the earth outside forced the iron tightly against the sheeting and so made a very nearly watertight sheeting. Where concrete foundations were placed and the sheeting [illegible] to be left in, this proved to be very [illegible].

A special or cloth-wrapped joint was used in all wet trenches. This was made by tying a strip of cloth about [illegible] in. wide and [illegible] in. longer than the length of the circumference of the pipe. The cloth was [illegible] both ends about [illegible] in. wide and one-quarter the length of the cloth [illegible] [illegible] the [illegible] end of the pipe. The pipe was then placed in the trench and after setting true to line and grade and calking the joint with [illegible] [illegible] [illegible] of the [illegible], which was of the [illegible] and [illegible] [illegible], a 1:1 mixture of sand and cement was tightly pressed into the joint and neatly beveled. The cloth was then drawn over the joint and rubbed on the outside with neat cement. With this joint there was little danger of water leaking into the pipe or of the cement being washed from the joint, and at the present time there has been very little ground water noticed in the sewers.

House connections, of [illegible] pipe, were put from the

*[illegible] [illegible] [illegible] [illegible] [illegible] in charge of construction of Garfield sewers.



Final Record Plan and Profile of One Block of the Sewerage System of Garfield, N. J.

sewer to 1 ft. inside of the inner face of the curbs. As the work progressed, each property owner was consulted as to his wishes and the connection placed just where he wanted it. Hubs were placed in front of every 25-ft. lot in addition to those connections run to the curbs. Where there was much vacant property, connections were run to the curb at the rate of about five to the hundred feet of sewer.

Chimneys or standpipes were built on all sewers where the depth was 12 ft. or more below the established grade of the street. They were encircled with a 6-in. shell of concrete extending from a point 6 in. below the outer bottom of the pipe to the bends from which the house connections were run. Wherever it was practicable, in order to serve two opposite houses, the chimneys were topped off with Y's and the cost so divided, for under the

assessment of the costs, the costs of such house connection must be kept separate and assessed upon the property according to its actual cost. The cost of the main sewers is to be assessed in accordance with the usual rule.

The keeping of the records for the house connections was much more difficult than that of the main sewers, as many of them were laid months after the main sewers were laid. During construction of the sewers, the position of the house connections was determined and the station marked on the face of the curb, or where there was no curb, at right angles to the Ys which were placed in the sewers. Besides helping to keep the records correct, this was a great help to the contractor as considerable time would have been lost if the engineer or inspector having the location of the connections was on some other part of the work. Where it was decided to carry the connection to the curb, the letter "C" was marked upon the curb or fence and at intermediate points where Ys only were to be placed for future connections, the letter "H" was marked upon the curb. After these connections had been inserted and approved, the letters were cut in the curb which would enable the plumbers to readily find the pipe. When the connection was inserted, the station was recorded, together with the length of pipe laid, the depth of trenching under the different classifications, the rock, special joints and any special work. From such data the engineer was enabled to prepare the final drawings, showing in detail, block by block, everything which would be required by the assessment commissioners in preparing their report of assessments, also by those in charge of the operation and maintenance of the sewer system. A record was also kept of all underground structures, such as drains, water and gas pipes, which might be useful in other improvements of the streets of the borough. A record plan and profile are reproduced herewith.

The backfilling was done with a backfilling machine, designed and built by Mr. Martin, of the firm of Martin & Miller. The trench was settled with a water jet, the water being furnished by the borough at the rate of $1.10 per 1000 cu.ft., measured by a meter attached to the hydrants. This method effected a big saving to the contractor as they could backfill a much greater length of trench per day than would otherwise have been possible.

Cost of a Damp-Proof Timber Floor

By J. [illegible]*

Engineers are frequently called upon to design and build floors in industrial buildings where water under a head is not encountered, but where protection against dampness must be provided. This applies to basement and ground floors where the practice was formerly to carry such floors on heavy timbering, supported by piers, thus providing an air space and lately usually by laying the floor directly on a concrete base and spiking to strips embedded in the concrete.

Neither of these methods proved ideal. Most recent and successful practice is to introduce a damp-proof construction under the wood surface directly on the ground. If water is present, a system of subsurface drainage is necessary, consisting of open-tile drains and broken stone or gravel on which is placed a foundation of broken stone, gravel, or cinders coated with sufficient tar to bond under light rolling.

Where the ground has sufficient natural drainage and no tile is required, the foundation course is laid directly on the ground. On this foundation is spread a layer of tarred sand in which planks are bedded by ramming and on which the hardwood wearing surface is laid and nailed. A floor of this character provides a rigid foundation for machinery and will support the heaviest materials in storage. Many of these floors are in use in mills and factories throughout New England.

The writer recently built a damp-proof floor of this kind by day labor, on which a careful record of cost was kept. The floor was laid in the basement of a manufacturing building on the natural earth, hardpan and sand, without underdrains, and carrying machinery, rapid steel in racks and square steel piled solid in storage.

The owner, wishing to secure a long-lived floor, purchased kyanized hemlock for the 3-in. underfloor and had two-ply felt and a layer of pitch placed between the plank and top flooring. The ground was prepared by the contractor for the building by rolling or puddling, therefore, the costs given in the accompanying table are for materials and labor above the ground.

The soft-coal cinders used for the foundation course were purchased from the railroad and delivered in cars on a siding from which they were shoveled directly into the basement where used. Materials were delivered and the work performed in the winter, so that storage in the basement obviated the necessity of heating the cinders when mixed with the tar. Tar was purchased from the local gas works and 13 gal. used per cu.yd. of cinders.

The cinders were spread, rolled and tamped to a thickness of 4 in., the shrinkage from measurement in cars to place was 56%. Sand and tar were heated outside the building and mixed in the basement. This mixture, while warm, was spread over the cinders and screeded off 1½ in. above the bottom of the plank; planks being laid to grade for screeding. Into the sand while still warm, the 3-in. planks were firmly bedded by ramming.

For specially prepared tars, 30 to 40 gal. per cu.yd. of sand are specified. On this work the greatest amount of tar that the sand could be made to contain, without making a soft, wet mixture, was 33 gal. per cu.yd., the same kind of tar being used in both cinders and sand. The writer has knowledge of floors where the tar has come up through the joints in both plank and top floor due, no doubt, to an excess of tar in the sand.

The difference in volume of sand in place and in carts, due to compression and to inequalities of surface of cinder layer was 45%. The plank was 3-in. kyanized hemlock, planed one side to a uniform thickness of 2¾ in. and not less than 8 in. wide, random lengths, square edged and saw butted. End to break joints and the planks were set driven tightly together. There was no loss of plank in cutting.

Over the plank were placed two layers of felt and one of pitch. The felt weighed 14 lb. per 100 sq.ft. and was laid to break joints one-half the width of the sheet; no pitch was allowed to come in contact with either plank or top floor. The loss in area of felt due to lapping was 11%.

Over the felt and at right angles to the plank was laid a maple floor 1⅛ in. thick. This flooring was square edge, 3 in. wide, and nailed with 10-penny finish nails through the top every 8 in. on alternate sides.

*18 Chapel St., Somerville, Mass.

The waste and shrinkage due partly to laying, but mostly to manufacture, was 40%; in other words, while the market price of the flooring was \$45 per M. the shrinkage in manufacturing that must be paid for, plus a small loss by waste in laying, brought the cost up to \$63 per M. Builders are familiar with shrinkages in manufactured lumber, but engineers, not having occasion to use it so frequently, are not so familiar and are surprised when as for instance, they purchase 5-in. V-sheathing for building a field office, to find that it covers a width of only 3¼ in. and that the Western rules for inspection of hard pine allow ⅛ in. less than the Eastern, which in turn allow an ⅛-in. or more, less than full dimension for square timber and plank.

Referring to the accompanying table, the quantities in Column 3 are the quantities purchased in the market, as for instance, 4 in. of cinders in place amount to 0.151 cu. yd. measured in cars, or 36% (in Column 6 of table) more than the place measurement and similarly for sand, felt and top floor, there being no loss in laying the 3-in. plank.

In this work, two distinct classes of labor or trades were employed, roofers in this case and carpenters, and though they worked together, their organizations were separate. For this reason, the combined items for superintendence is high and that for superintendence of roofers unnecessarily so. Reducing the item for superintendence of roofers and using untreated plank and leaving out the felt and pitch between plank and top floor, the cost would be reduced as shown in Column 7 of the table.

COST OF DAMP-PROOF FLOOR

1	2	3	4	5	6	7*
Materials and labor	Thickness of material in place	Quantity per sq.yd.	Unit cost	Cost per sq.yd.	Per cent of waste and shrinkage	Cost per sq.yd.
Cinders.......	4 in.	0.151 cu.yd.	\$0.50 per cu yd.	\$0.076	36	\$0.076
Tar in cinders		0.0381 bbl.	2.00 per bbl. (57 gal.)	0.076		0.076
Sand..........	1 in.	0.045 cu.yd.	1.00 per cu.yd	0.045	68	0.045
Tar in sand....		0.0276 bbl.	2.00 per bbl. (57 gal.)	0.055		0.055
Felt....	2 ply	3.10 lb.	35.00 per ton	0.054	21	
Pitch on felt		3.32 lb.	17.00 per ton	0.028		
Teaming, tar..			0.50 per hr.	0.039		0.039
Labor, roofers..			0.375 per hr.	0.433		0.358
Supt., roofers..			0.50 per hr.	0.100		0.078
Kyanized plank	2¾in.	0.027 M.	33.50 per M.	0.905	00	0.756
Maple top floor	1$\frac{1}{16}$in.	0.0134 M.	45.00 per M.	0.603	40	0.603
Nails.........		1.2 lb.	2.10 per cwt.	0.027		0.027
Carpenters....			0.41 per hr.	0.475		0.475
Labor.........			1.75 per day	0.230		0.230
Supt..........			0.50 per hr.	0.080		0.080
Totals...	9 in.			3.226		2.898
			Materials	1.869		1.638
			Labor	1.357		1.260

*Cost omitting felt, pitch on felt, labor placing felt and pitch and using untreated Hemlock plank @ \$28.00 per M.

Australian Ironbark Pins in Pin-Keyed Joints

By H. D. Dewell*

The following account of the tests of two bolted and keyed timber joints using Australian ironbark (Red) may be of interest, as supplementing the tests described in Engineering News of Mar. 19, 1914.

The joints tested were as shown in Fig. 1, the pins being lathe-turned. The properties of the red Australian ironbark are given by a trade publication as follows:

	Lb. per sq.in
Modulus of rupture in bending (54x6x4 in.).........	17,600
Tensile strength	22,000
Compressive strength (12x3x3 in.)..................	9,500
Shearing strength (6x6x2 in.)......................	2,100

This wood has a straight grain, contrasting in this respect with the Hawaiian Ohia. The timber also has a much higher specific gravity than the Ohia.

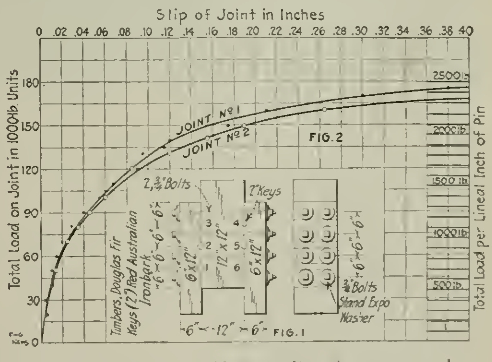
Referring to Fig. 1, pins 2 and 5 were placed with the grain vertical, pins 1, 3, 4 and 6 with the grain horizontal. The bolts were ¾ in., with standard Exposition washers (see the article above referred to). The following table gives the result of the tests:

COMPRESSION TESTS OF TWO PIN-KEYED JOINTS WITH IRONBARK PINS

(Six 2-in. pins 12 long, per joint.)

Load thousand lb.	Slip, in inches: Splice A	Splice B	Average	Remarks
JOINT 1				
10	0.0	0.0	0.0	
20	0.01	0.0	0.005	
110	0.08	0.06	0.070	
120	0.10	0.08	0.090	
130	0.11	0.08	0.095	Pin 2 slight crack
140	0.12	0.12	0.120	Pin 5 slight crack
170	0.30	0.30	0.300	Pin 1 slight crack
180	0.58	0.58	0.580	Max. load.
Load JOINT 2				
30	0.01	0.0	0.005	
40	0.02	0.0	0.010	
50	0.03	0.0	0.015	
140	0.20	0.11	0.155	
150	0.23	0.15	0.190	
160	0.31	0.22	0.265	Pin 2 cracked
168 (Max.	0.58	0.49	0.585	Pin 2 sheared

Fig. 2 shows the load-deformation curves. While the curves show no very definite yield-points, the values of 1875 lb. and 1600 lb. per lin.in. of pin have been taken as representing the elastic limit of the two joints. The



Pin-Keyed Joints for Test of Red Australian Ironbark Pins, and Curves of Results

working value of these pins in design was taken at 800 lb. per lin.in. of pin, representing a factor of safety of 2 on the yield-point.

The failure of the joints was due primarily to the crushing of the Douglas fir. While both the maximum load and the yield-point load per unit length of pin were less than those shown in the Ohia pins (6 in. long) of the previous tests, an extended series of tests alone would determine the relative efficiency of the two timbers.

The above tests were made for the Panama-Pacific International Exposition by the civil-engineering laboratory of the University of California and were used in connection with the framing of the timber portion of the Main Entrance Tower.

*Chief Structural Engineer, Panama-Pacific Exposition, San Francisco, Calif.

Chicago Bridge Work by Day Labor

By Harry J. McD[illegible]*

SYNOPSIS—The employment of the day-labor system for municipal construction work is on the increase, and in Chicago this system has been adopted with success on extensive sewer work and some bridge work, while it has been decided to adopt it also for one of the new waterworks tunnels. The following article describes the construction of seven fixed bridges over the north branch of the Chicago River by day labor.

During the year 1913, the city of Chicago constructed several fixed bridges by day labor. The term "fixed bridge" is used by the city to designate all types of bridges other than those constructed over the navigable parts of the Chicago River. There are seven fixed bridges over the west fork of the North Branch of the Chicago River within a distance of four miles, and this article relates to the construction of these bridges at their respective locations by the use of day labor. Fig. 1 is a view of the Central Park Ave. bridge.

The bridges are all similar for one of the locations, and are of the plate-girder deck type with concrete substructures. Excavation for the substructures was made through loam, gravel and stiff blue clay to a depth of at least 8½ ft. below low water to allow for a possible future dredging of this stream.

The superstructure design is shown in Fig. 2. The main girders are 73 ft. 8 in. long, with the floor system designed to carry the heaviest city traffic. The roadway is 24 ft. between curbs, paved with 4-in. creosoted-wood blocks on 3-in. creosoted subplanking laid tight on 4x6-in. creosoted stringers spaced 1 ft. [illegible] in. c. to c. The two 8-ft. walks are of reinforced-concrete flat-slab construction. The sidewalk railing on the bridge is of ornamental cast construction, and joins the concrete parapet walls carried on the wing walls of the substructure.

The wing walls of the substructure end in a circular return and come to within 2 ft. of the property line. All streets are 66 ft. wide. The esthetic treatment of both the substructure and superstructure was recommended by the Chicago Plan Commission, and the resulting structure is quite effective in appearance, as shown in Fig. 1.

The Commissioner of Public Works* is the executive head of the city of Chicago for work of this class. The City Engineer† is the executive of the Bureau of Engineering, and one of its departments is the Division of Bridges and Harbor,‡ under which division this work was done. The field organization consisted of an engineer (the writer) acting as general superintendent; an instrument man as timekeeper and material clerk; a foreman of carpenters, cement mixers and laborers and in charge of substructure construction, and a foreman of bridge and structural-iron workers in charge of erection of the superstructure. The rates of wages per hour (union scale) were 80c. for foremen, 72½c. for hoisting engineman, 65c. for carpenters, and 40c. for laborers.

Contracts were made in the usual manner for furnishing and delivering the superstructure steel and creosoted

FIG. 1. BRIDGE AT CENTRAL PARK AVE., WEST FORK OF THE NORTH BRANCH OF THE CHICAGO RIVER

(Typical of seven bridges built by day labor under the Department of Public Works, Chicago)

lumber at each bridge site. Steel, stone, gravel, cement, reinforcing steel and lumber were delivered to the bridges under requisition made on the city's yearly contract for these supplies. Smaller supplies, such as nails, wire, bolts, etc., were secured through the city purchasing agent.

Material costs under the contracts were as follows: cement, $1.[illegible] per bbl. net; torpedo sand, $1.70 per cu.yd.; stone or gravel, $1.65 per cu.yd.; lumber (average) $[illegible] per M ft. b.m.; superstructure steel, 2.01c. per lb. An additional charge of 3c. per bbl. on cement and 10c. per cu.yd. on sand, stone, or gravel was made for each mile or fraction thereof beyond a defined territory.

The plant consisted of a 10-ton stiff-leg derrick with a 50-ft. boom, a 16-hp. steam-hoisting engine, four 1-yd. self-dumping steel buckets, a steam pump, a gasoline-driven concrete mixer of 8-ft. batch capacity, and the other necessary smaller equipment.

The average depth of excavation was 16 ft. below the curb grade, and each pit was sheathed tight to blue clay, due to the water-bearing gravel and the proximity to the river. No extraordinary conditions were encountered. Excavation of the blue clay was laborious, however, as

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*L. E. McGann, Commissioner of Public Works.
†John Ericson, City Engineer.
‡Thos. G. Pihlfeldt, Engineer of Bridges and Harbor.

it could only be loosened in small chunks by the use of mattocks. Keeping the clay water-soaked was found advisable.

Cost and Progress of Work

The substructures at N. 40th Ave. and N. 48th Ave. were started during the fall of 1912, but all work was suspended before the end of the year. Work was again started May 9, 1913, and three other substructures (at Central Park Ave., Kedzie Ave. and 56th Ave.) were completed during the year. The substructure at Forest Glen Ave. was 90% completed on Dec. 31, and was entirely completed Jan. 29, 1914.

The superstructure steel for N. 40th Ave. was delivered on the site July 2, the erection completed Aug. 12 and the roadway opened to traffic Sept. 1. Erection of 48th Ave. superstructure was started July 31, completed Sept. 3, and the roadway opened to traffic on Oct. 1.

The next superstructure steel arrived Oct. 21, and was erected at Central Park Ave. and this bridge opened to traffic on Dec. 20.

The steel for the Kedzie Ave. superstructure arrived on Dec. 4, erection was completed Dec. 27, and the roadway opened to traffic Feb. 14, 1914. Erection of the superstructure at 56th Ave. was started Dec. 29, completed Jan. 28, and the roadway opened to traffic Feb. 26. At Forest Glen Ave. the delivery of the steel was started Feb. 9, but was tied up until Feb. 20 by a strike on the company furnishing the material. Erection was completed Mar. 12, and the roadway opened to traffic on Apr. 7, 1914.

The old structure at Kedzie Ave. was a wrought-iron through-truss bridge, 63 ft. long and 36 ft. wide over all, that had been used at another location. This truss was "house moved" to Foster Ave. and erected on timber bents set on concrete foundations. Its present location is an unimportant thoroughfare and it is expected that it will serve 10 yr. or more at this, its third place of usefulness. While being moved, the truss was carried on two sets of 12x12-in. timbers, 6 ft. c. to c., placed symmetrically to the center of the bridge. Using wood rollers on a timber runway and a crab, this 35-ton truss was moved 1300 ft. and set up on bents for $383.50.

For excavation, backfill, coffer-dam, sheathing and pumping, the cost on the several jobs varied from $1.23 to $1.55 per cu.yd. The substructure concrete (1:3:6) varied in cost as follows:

Labor for handling sand, stone and cement to mixer, mixing and placing in forms, $1.291 to $1.108 per cu.yd. Part of this variance in the cost of labor was due to the uneconomical method necessary in handling the material, as it was compulsory to keep the narrow roadways open and the material was scattered along the side of the road for a distance of 600 ft. from the bridge on each side of the river.

Material cost $3.778 to $4.558 per cu.yd. of concrete. This variance was due to difference in length of haul for delivery.

Forms, including labor and material, cost $1.580 to $1.986 per cu.yd. of concrete.

The erection of the steelwork was done without the aid of power machinery and all riveting was by hand. The cost varied from 0.75 to 0.77c. per lb.

The creosoted wood-block pavement with sub-planking and sleepers cost for material $4 per sq.yd.; the labor for placing averaged 81½c. per sq.yd. for roadways without car tracks and $1.40 on the roadway with car tracks.

The widths of the roadways leading to the bridges were in most cases about 18 ft. and these were widened to meet the approaches of the new bridge at a cost varying from 74.7 to 95.1c. per cu.yd.

Advantages of Day-Labor Work

It is only natural to inquire as to the advantage of doing this class of municipal construction work by day labor. The two important elements to consider are time and cost.

The old adage that "large bodies move slowly" is applicable to any corporation of the size of the city of Chicago. This is as it should be, for it is absolutely necessary that every precaution be taken to safeguard the city's interest by each of the several different departments having jurisdiction in the making of contracts. In contract work, considerable time elapses between preparing the plans and specifications, awarding the contract and starting the work, due to the different steps and procedures. A great portion of this work and time is saved with the day-labor system as the Commissioner of Public Works instructs the City Engineer to proceed with certain work, and the latter similarly instructs the Engineer of Bridges and Harbor, so that within a short time substructure work can be started. At the same time, detailed plans and specifications can be prepared and a contract entered into for furnishing the superstructure, which (with an ordinary condition of the steel market) can be obtained by the time it is needed.

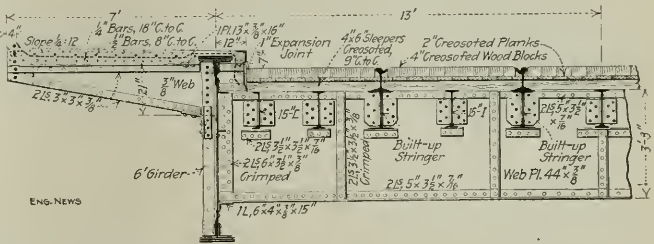


Fig. 2. Half Cross-Section of Plate-Girder Bridges over the West Fork of the North Branch of the Chicago River

It is not uncommon for the low bidder on some new work to be busily occupied with his equipment in an attempt to finish other contracts. This condition is the cause of a continuous fight on the part of city officials in an attempt to get the contractor to start the new work with such an organization as will guarantee the completion at the time specified. With the work being done by the city direct, the man in charge realizes that his own welfare is at stake if the proper progress is not made.

The cost of supervision in day-labor work is eliminated. The engineer and instrument man in charge of day-labor work would have the same relative positions in contract work. The two inspectors on contract work who supervise the proportioning of the concrete aggregates and the

placing of the same are eliminated. Also the inspectors on the erection of the steelwork and the laying of the roadway and sidewalk pavements.

Another source of saving is the middleman's profit in handling the superstructure material. Another advantage as regards cost is due to the fact that when contracts are let for small jobs of this size, the low bidder is frequently a small contractor poorly equipped or new at the business, and although the city may get the benefit of a low bid, the contractor is working at a disadvantage and if at a small margin of profit, his whole aim is to work as cheaply as possible, and little attention is paid to the time it takes him to complete the work. This results in a general dissatisfaction to those living adjacent to the work and an increase in the cost of supervision.

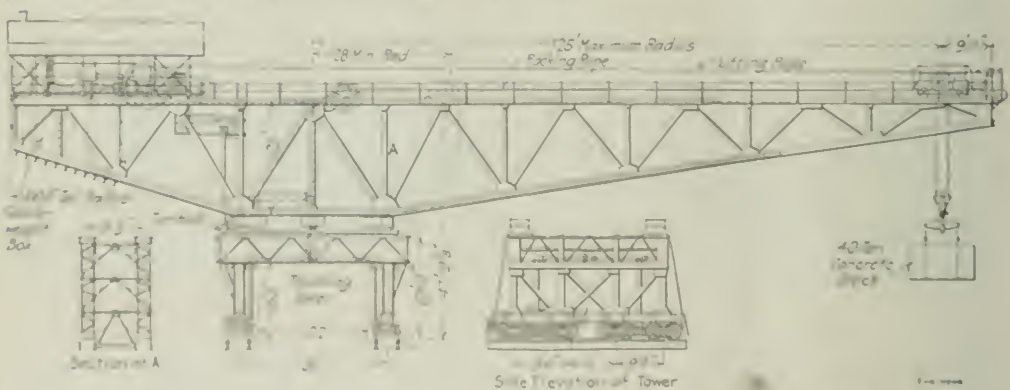
Anyone connected with municipal contract work appreciates the dread of having to encounter extras. In day-labor work, there is no worry about extras. Even with the utmost precaution in preparation of plans and specifications, unforeseen conditions frequently arise and upset the best calculations. Operation under day labor permits changes to be made during construction, when the necessity occurs, without the accompanying troublesome negotiations required on contract work.

There is one important condition absolutely necessary to successful prosecution of this class of work and it is the willingness to retain only such men on the payroll as are capable of doing justice to the work assigned them. In this respect, the writer cannot give too much credit to his superiors for their support. There is an idea that municipal employees are not compelled to render equal service to that required by a contractor. When such a condition is found, it is due usually to the man in charge. The writer has not [illegible] to have an inefficient man [illegible] on the payroll but was expected to dismiss all such men immediately.

Revolving Cantilever Crane for Harbor Construction Work

The revolving and traveling cantilever crane shown in the accompanying cut belongs to a type of machine used very extensively by English engineers and contractors in the construction of breakwaters and other harbor work in various parts of the world.

This crane has a pair of trusses 11 ft. 3 in. apart, 185 ft. 6 in. long, with a working arm of 125 ft. and a tail or counterweight arm of 60 ft. 6 in., the latter carrying the engines and boiler and a counterweight box. The trusses are mounted on a live-ring turntable 31 ft. diameter on the top of a tower consisting of a heavy girder frame on a pair of side trusses. The crane travels on two tracks of standard gage, spaced 30 ft. c. to c., but instead of single rails for the tracks there are double rails carrying 36-in. wheels which have wide flat tires with central flanges riding between the rails. There are four four-wheeled trucks on each track, or 32 wheels in all. Each pair of rails is secured to a bed-plate on a pair of I-beams.



Traveling and Revolving Cantilever Crane for Setting Concrete Blocks on Harbor Work at Fishguard, England

(Stothert & Pitt, Builders, Bath, England)

The main engine has cylinders 11x18 in. It operates the hoisting cable, the cable for racking the trolley along the boom, the swinging gear and the propelling gear. The latter consists of bevel-gear drives to four countershafts (between the trucks), from which the axles are driven by chains. It has an 8-part hoisting tackle, with a vertical travel of 60 ft., and can hoist 40 tons at 8½ ft. or 7 tons at 18 ft. per min. The trolley has a travel of 97 ft., and can run at 22 ft. or 45 ft. per min. with the above loads. The crane can travel at 32 ft. per min. with a 40-ton load, and can make a complete revolution in three minutes. The box in the short arm contains about 100 tons of pig iron for a counterweight.

This crane is to be used in setting stone and concrete blocks for the harbor work of the Great Western Ry. at Fishguard, on the Welsh coast, for which Topham, Jones & Railton are the contractors. It was built by Stothert & Pitt, of Bath, England, and was tested with 50-ton loads after completion.

Our information and drawing are from *The Engineer*, of London.

The Lime Product of the United States in 1913 was [illegible]

Some Remarkable Photographs of a Large Blast

The accompanying five illustrations show in a remarkable manner the progress of a large blast of 125 tons of black powder. The illustrations on the right are taken from one side of the hill to be removed and the two lower pictures on the left are taken from the opposite side.

The upper picture represents the ground surface before the explosion. The second picture was taken at the instant of the explosion, before the explosive gases had fully commenced to break through the earth crust. The third picture on the right shows the broken surface after the blast. The two lower pictures are self-explanatory and give a very fair idea of the amount of rock removed.

The blast was a part of the construction work on the Prince Rupert, B. C., terminal of the Grand Trunk Pacific Ry., done last winter by Foley, Welch & Stewart, Contractors, of St. Paul, Minn., and Vancouver, B. C. For the photographs we are indebted to Wm. T. Donnelly, Consulting Engineer, New York City, who is building a large dry dock at Prince Rupert, a description of which was given in ENGINEERING NEWS, Jan. 4, 1912, p. 1.

The general character of the shore of Prince Rupert is bold and rocky and the railway entrance required some heavy grading. The Grand Trunk Pacific Ry. reaches the coast by the Skeena River valley, about 15 miles to the south, and, crossing to Kaien Island, where is located Prince Rupert, at its southern end, closely follows the shore to and along the water front of the city. Where four years ago was a complete wilderness is now a thriving city and seaport of several thousand inhabitants and many business institutions.

The Hydraulic Dredge "Niagara" and Its Work in the Saginaw River

One of the heaviest and most powerful hydraulic dredges of moderate size is the "Niagara" designed primarily for work in the hard material beneath the Saginaw River between Bay City and Saginaw, Mich.

dredging equipment, which was developed by the Bucyrus Co. The hull (built by the Manitowoc Ship Building and Dry Dock Co.) and other machinery, is of interest secondarily.

The cutter head (Fig. 3) is unusual. It is a six-bladed type 100-in. diameter, and of nickel-chrome steel. The blades carry socket-fitted teeth, three on one blade and four on the next. The cutter shaft is 11½ in. in diameter at the cutter end and 10 in. at the other. The gearing at the top of the dredging arm is mounted on a cast-steel bedplate for rigidity. The suction arm is a 77,000-lb. plate girder (see Fig. 1). The A-frame, braced beams, etc., have all been made correspondingly heavy. The pump is extra heavy (of nickel-chrome steel) weighing 71,000 lb. exclusive of engine. The casing is unlined. The engine is a 1000-hp. triple-expansion marine type

Fig. 1. Forward End of Dredge "Niagara"

This work is being done by the U. S. War Department and contract was let to G. H. Breymann & Bro. of Toledo. One of the two sections was sublet to the Duluth-Superior Dredging Co., of Duluth, owners of the "Niagara."

The channel which is being improved extends from the 18-ft. curve in Saginaw Bay to the junction of the Tittabawassee and Shiawassee Rivers, a distance of 21½ miles. This channel is to be 200 ft. wide at the bottom and 18 ft. in depth. The total excavation amounts to over 4,000,000 cubic yards, of which [illegible] cu.yd. is included in Section 1 which Breymann Bros. did [illegible] of the work with [illegible] dredges [illegible] that part of the channel from Bay City to Saginaw Bay. The Duluth-Superior Dredging Co. is working two 20-in. hydraulic dredges, the "Niagara" mentioned before and the [illegible]. The former is being used on the hard material at the lower end of [illegible] and the latter [illegible] Saginaw, working from the middle [illegible] toward the upper end of the section.

The material encountered in Section 2 consists largely of sand and clay for a distance of about [illegible] miles. For the remaining [illegible] miles it is very hard [illegible] clay, or hardpan, with a large quantity of stones of various sizes. Therefore the "Niagara" was designed for digging this material and the construction and [illegible] provided with [illegible]

The greatest interest in the "Niagara" lies in its

Fig. 2. After End of Dredge "Niagara"

(built by Marine Iron Works of Chicago); it has a speed of 200 r.p.m. and can pump the dredged material through a 5000-ft. pipe line 10 ft. above water.

The cutter engine is a double-cylinder 12x15-in. type of heavy construction for 200-lb. boiler-gage pressure. The cutter gears are large and extra heavy. The spuds (Fig. 2) are of ¾-in. steel pipe, lap-welded, 39½ in. in diameter and 67 ft. long. They carry cast-steel points.

The hull is 135 ft. long and 11 ft. deep, with 43-ft. beam. There are two longitudinal bulkheads from end to end and three transverse. Coal bunkers are in the side compartments below deck and abreast of the boilers. To minimize vibrations, the engine and pump foundations are built on high floors across the hull. The ladder well forward is made of ⅝-in. shell plate and heavily braced. Trolleys over the engine and pump facilitate inspection and repair. Over the machinery and boilers is a two-story steel deck house. The lower house has the kitchen, dining room and crew's washroom. The upper house has the officers' washroom and bath and sleeping quarters for 36 men. The operating room is forward and elevated; the many large windows give the operator unobstructed view of the work.

The general plan of operation is similar to any other hydraulic dredging job. The material excavated from the channel is pumped on to the bank of the river to form a levee upon which is to be built a road connecting the cities of Saginaw and Bay City.

The "Niagara" started digging June 5, 1913, and dug until it was laid up for the winter on Dec. 23. During this period it worked 3018½ hr., and was delayed for various reasons, 1008½ hr. All but 193 hr. of the time charged to delays was consumed in shifting pipe lines and in the other normal operations which necessitate stopping the pump. Of this 193 hr., the major portion was due to the wearing out of the pump casing and parts

Fig. 3. Cutter Head of Dredge "Niagara"

of the suction and discharge pipes which pass through the hull, due to the unusually hard character of material pumped.

During this working season, the dredge excavated a channel 14,600 ft. long to a depth of about 17.5 ft., with an average width of 235 ft. The maximum depth of cutting was 7.4 ft., and the total amount of material removed, 910,000 cu.yd., of which 730,323 was pay material, the remainder being taken outside of specified channel lines.

The dredge "Enterprise" dug 940,000 cu.yd. between Apr. 22 and Dec. 13.

Washington, D. C., Street-Cleaning Methods

By J. W. Paxton*

SYNOPSIS—This is the third of the series of articles describing Washington municipal street-cleaning methods. The previous articles appeared in Engineering News *of July 9 and Aug. 6. This article describes the office methods of planning and keeping in touch with the field work.*

Office Methods

Unit of Work Done—In order to obtain unit costs, it was necessary that a measure of the street-cleaning work done should be established. It was hoped that a unit could be found in which elements of the area swept, amount of dirt collected, length of haul, etc., would be combined in a proper proportion, but this still seems impracticable.

Former contractors were paid by the 1000 sq.yd., and as this unit was generally used elsewhere, it was thought advisable to adopt it for purposes of comparison. However, suburban street cleaning more than any other, brings out the faults of such a unit based on area alone. When a street is very dirty or washouts occur, most of the effort is expended in loading and hauling, and at times only 1000 or 2000 sq.yd. are cleaned per day, while under favorable conditions the area may run as high as 50,000 sq.yd.

Street Intersections—Formerly in making payment to the contractor, it was necessary to have accurate and official information of the areas of streets and alleys, which was obtained from the Surface Division of the Engineer Department. For purposes of computation, it was necessary to divide the area of each street into small sections, the most convenient being the areas between cross streets and the intersections common to two or more streets (Fig. 1). This information, together with the kind of pavement, is arranged on white cards 5x8 in. in size, ruled for four rows of three columns each; the column heads are "limits," "area" and "pavement" (kind of).

Street intersections carry the traffic from at least two

*Superintendent of Street Cleaning, Washington, D. C.

FIG. 4. PART OF A SURFACE DIVISION MAP, SHOWING METHOD OF DIVIDING STREETS INTO STREET CLEANING AREAS

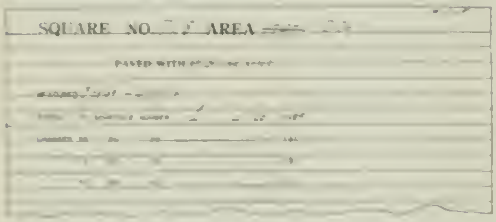


FIG. 5. FRONT FACE OF ALLEY CARD

[illegible] it is reasonable to suppose that they need twice the amount of cleaning. As a matter of fact, they are cleaned twice as often as the remaining portions [illegible] in showing the area cleaned, they are so credited.

ALLEY MEASUREMENTS—For alley measurements, a 3x5-in. index card has been arranged, which shows on the face, the square number, area and kind of pavement, date measured, and the number of the schedule on which the alley in each square appears (Fig. 5). On the reverse side is a sketch of the alley (Fig. 6). This sketch is not drawn to scale but is valuable in showing exactly what is included in the measurement given.

FIG. 7. [illegible]

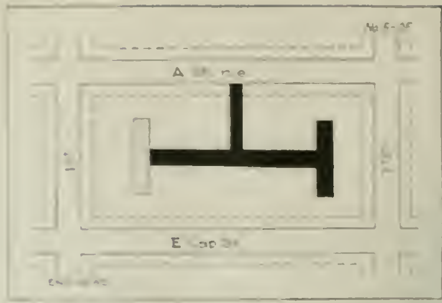


FIG. 6. REVERSE SIDE OF ALLEY CARD

In many cases, a number of private alleys open on a general public alley, but are not cleaned. From time to time, these private alleys are made public and they are added to the schedule. In the illustration shown, the area originally cleaned is solid; the cross-sectioned portion was condemned and added to the schedule nearly four years later, so the face of the card shows both the original and new areas.

SCHEDULES—Each foreman, other than those of the hand patrol and alley gangs, is furnished with a schedule (Fig. 7), printed on green paper 8½x14 in., on which the areas of the streets are printed. The foreman checks off the portions of the streets as they are cleaned, fills in the spaces for information in regard to equipment, quantities of dirt removed and water used and returns the schedule to the office, where the total area is figured and credited to his gang.

It is not practicable to print the schedules in the order in which the streets are to be cleaned, as delays for any reason would disarrange any regular route. Regular intervals must exist, however, as far as possible, between the cleaning of each street.

The schedules for alley cleaning differ from those for surface-street cleaning, only in the fact that they are printed on white paper and the square numbers and boundaries replace the names of the streets. The squares are arranged in [illegible], and must be cleaned in the given order. The [illegible] area is entirely cleaned each day, so no schedules are required.

Schedules are made up in the office, [illegible] covered with sheet celluloid, [illegible] and then printed on a [illegible]. Of the final maps which result from this study, one is kept of the hand-patrol areas and [illegible], one of all machine-broom and flushing territory, a third of the suburban and [illegible] territory, and a fourth of the alleys. A [illegible] map is also kept on which the kind of sweeping given each street is shown at a glance.

All schedules are considered as orders to the foreman. If temporary or permanent changes are to be made, a [illegible] form, properly filled in describing these changes, signed by the Superintendent or one of his assistants, is issued to the foreman, who uses this form as his authority until [illegible], or until new schedules are issued on which the correction has been made.

GARBAGE RECORDS—Information is often desirable as to the dates on which certain streets or alleys have been

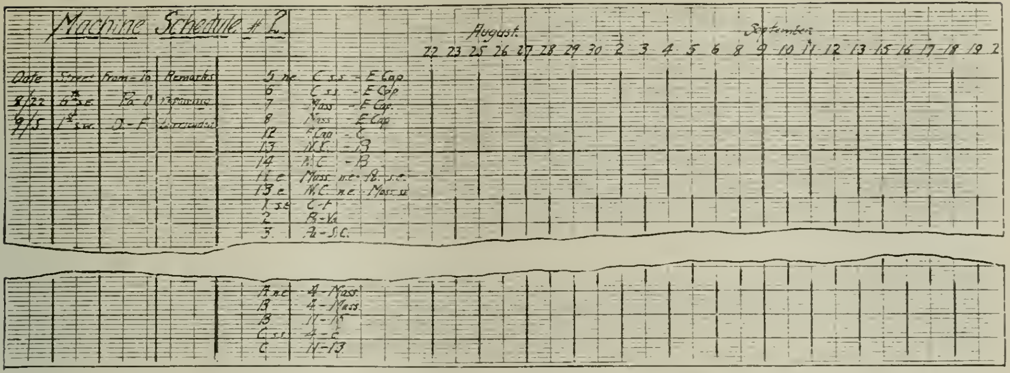


FIG. 5. GRAPHICAL METHOD OF KEEPING TRACK OF STREETS CLEANED, AND OF SEEING THAT SCHEDULED ATTENTION IS GIVEN TO EACH

cleaned, or streets washed or oiled. Previously this necessitated a long search of old schedules, but a simple graphical method of keeping this record has been devised, which is also useful in showing at a glance whether streets have received regular attention for extended periods.

On the machine schedule (Fig. 4), Second St., S. E. from Pennsylvania Ave. to Virginia Ave. is checked, indicating that it was cleaned on Sept. 5. This is shown in the graphical method devised to keep track of streets cleaned (Fig. 5) by a vertical line opposite the street and under that date. From machine schedules of other dates, similar information is plotted, showing this street was also cleaned Sept. 8, 10, 12 and 15. One such plot is kept for each street-cleaning gang, whether machines, alley, suburban, or washing; each plot usually running for three months.

Apparent errors on the part of the foremen in checking streets cleaned are very likely to be caught up in making this profile. A printed correction slip has been adopted to call to the attention of the field force any such errors which may appear, this slip being made up by the clerk who keeps the profile, and it is sent out to the foreman who then writes an explanation on the slip and returns it to the office.

The area cleaned, dirt removed, equipment employed and water used, as reported on these schedules, is posted daily on the Work Summary Sheet (Fig. 6). From the Time Reports (described in the article in ENGINEERING NEWS, July 9, 1914), the number of men employed and the hours worked are obtained semimonthly and this information likewise entered on the form, Fig. 6, giving a complete record of the physical work performed, etc. The hand-cleaning foremen, not having schedules, the dirt collected is reported by them on the Sack Report (Fig. 7).

Nov.	#1 Machines Rockwell								#2 Machines Klooter								#3 Machines Ladd								#4 Machines Shaw #3-CF								Nov.
	Spr.	Mach.	Carts	Men	Hours	Loads Dirt	Loads Water	Area	Spr.	Mach.	Carts	Men	Hours	Loads Dirt	Loads Water	Area	Spr.	Mach.	Carts	Men	Hours	Loads Dirt	Loads Water	Area	Spr.	Mach.	Carts	Men	Hours	Loads Dirt	Loads Water	Area	
1	-	3	5	13	8	25	-	275,845	-	3	5	13	8	18	-	268,952	-	3	5	13	8	15	-	252,113	1	3	5	16	8	10	10	293,154	1
2	1	3	5	14	8	30	24	255,173	1	3	5	14	8	20	25	270,040	1	3	5	13	9	20	32	259,775	1	3	6	16	8	32	22	240,199	2
4	1	3	5	14	8	20	29	270,914	1	3	5	14	8	20	26	272,061	1	3	5	13	8	20	29	272,692	1	3	5	15	8	18	20	293,155	4

FIG. 6. SUMMARY OF WORK DONE AND FORCE EMPLOYED

500 8-19-13 #2-CF

STREET CLEANING DIVISION

WASHINGTON D C

SACK REPORT

E. S. Holland FOREMAN
SECTION #3 FROM Nov 5th TO Nov. 10th 1912

ROUTE	WORKED BY	5	6	7	8	9	10				TOTAL
1	2	20	18	19	17	18	17				109
2	"	18	17	16	18	17	19				105
3	"	20	14	15	19	16	17				101
4	"	25	23	28	23	20	27				140

FIG. 7. REPORT OF DIRT COLLECTED ON HAND PATROL

One-Inch Sheet Asphalt on a Concrete Base—The California State Highway Department is surfacing a part of the main coast road south from San Francisco with 1-in. of sheet asphalt laid on a 5-in portland cement concrete base. This section of road is in the suburbs of San Francisco and is designed to carry a moderately heavy city street traffic, about 75% of which is motor vehicles. The old roadway was built of waterbound macadam, 12 ft. wide and 6 to 12 in. deep. The new pavement is 24 ft. wide with 8-ft. earth shoulders. The maximum gradient is 4%. The foundation is 1:3:6 concrete; after the foundation is thoroughly set it is painted with a hot liquid asphalt mixture composed of one part by volume of asphaltic cement to two parts of engine distillate. The asphaltic cement is first heated to about 325° F., and when it is cooled to 250° F. the distillate is added and mixed in. This mixture is poured on the concrete surface from buckets. The consistency of the paint coat is made to vary with the porosity of the concrete surface. On this binder coat is laid the 1-in. course of asphalt mixture composed of sand, limestone dust and asphaltic cement. This is heated and put on at a temperature as close to 325° F. as possible. The very thin layer cools so rapidly that it is necessary to follow the hot hand rollers with a 5-ton or 8-ton steam-roller just as soon as can be done. The binder paint coat was a late addition to the specifications. It was found that the 1-in. surface on the asphaltic paint binder moved or melted very little under the roller as compared with that laid directly on the dry concrete. Although the economy of this type of construction is yet to be proved it has thus far given every assurance of being well adapted to conditions. [Information taken from an article by E. B. Rine in the "Iowa Engineer."]

Construction Camp for the Town of Torrance, Calif.

By Ralph Bennett*

In the construction of localized works of considerable magnitude, such as long tunnels, power houses, dams and similar structures remote from cities of considerable size, it is necessary for the employer to make provision on a considerable scale for the relatively permanent residence of large numbers of men. These towns, or camps as they are commonly called, should be as inexpensive as is consistent with proper housing.

A camp, whether temporary or permanent, should be located on gently sloping ground which will provide satisfactory drainage.

The most important requisite is water. Provision should be made for securing a supply which will be ample and uncontaminated during the entire duration of the work. Water should come to the camp under sufficient pressure for ordinary tank use and should be supplied through pipes 3 or 4 in. in diameter so that one or two fair-sized fire streams can be used. There should be a 2-in. hose outlet with 100 ft. of $1\frac{1}{2}$-in. cotton factory fire hose located to cover every building.

As a matter of fire protection, as well as of convenience, all buildings should be wired for electric lights, and the use of lanterns should be restricted to those classes of work which require portable outdoor lights.

*Consulting Engineer, Los Angeles, Calif.

Fig. 1. General Layout of Construction Camp for Town of Torrance, Calif.

Tents are not of sufficient durability and do not afford a comfortable enough shelter for use except in summer camps. The construction for permanent camps need not necessarily be of heavy material. It should in fact be of as light material as is consistent with necessary rigidity. The buildings should be of cheap lumber and should involve the least possible amount of labor. The salvage material should be of value for other work.

The accompanying illustrations show a series of buildings designed by the writer for the use of the Dominguez Land Corporation's employees in the construction of the town of Torrance (see Fig. 1 for general layout).* The buildings are intended to be occupied intermittently during a period of several years by a force of from 40 to 100 men. Their construction is believed to contain some features of merit. The designs involve the use, without cutting, of stock sizes of material for nearly all portions of the buildings.

The structures composing a permanent camp are usually a cook house, dining room, one or more bunk houses, a stable for horses and a commissary or company store. To these there is frequently added a wash house and sometimes a number of cottages for married men.

Cook House and Dining Room—In the cook house, the item of most particular interest is the roof and window arrangement. A shed roof is considerably cheaper to build than any other style. In the design shown (Fig. 2), necessary stiffness is secured for both the roof and the building by the use of a simple nailed truss under every rafter. The window openings are practically continuous, are screened on the outside and have the sash mounted against the inside of the boarding without frames. These sashes can be leaned back during the summer or pulled up to close the openings, as the climate warrants. This side of the cook house should preferably face the east or northeast in order to obtain the early morning sunlight without becoming overheated during the afternoon. The high windows furnish an even light on all tables and produce satisfactory ventilation with but little draft. In a cook house larger than the one shown there should be a door opposite each runway. All doors must be of ample size and arranged to swing out. All openings must be screened.

*Previous articles on this new town may be found in "Engineering News" of Oct. 16 and Dec. [illegible], 1913, and Jan. [illegible], 1914, the latter under the title "[illegible] Methods in Locating and Planning a New Town."—Ed.

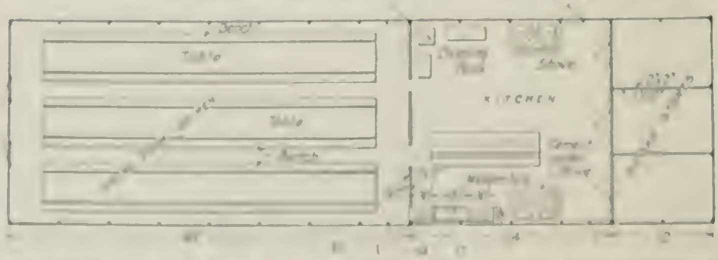


Fig. 2. Cook House and Dining Room, Torrance Construction Camp

The main stove should be of ample size and should be set on a concrete or brick or rock base large enough to be safe from accidental ignition. Distillate-burning stoves are now universally used on the Pacific Coast. They are more economical, even in the woods, than wood or

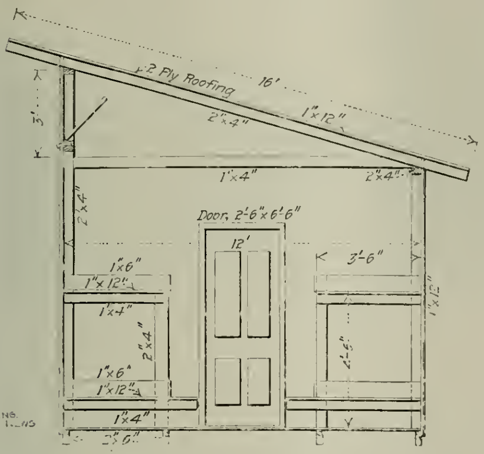


Fig. 3. Cross-Section of Bunk House, Torrance Construction Camp

coal stoves, the fire produces a better heat and the cooking is more even. The stove should have a water-back with large storage-tank.

The larger the sink and drainboard the less trouble there is in retaining flunkeys. The tables should be covered with white oilcloth. White enamel ware appears to give better service than any other style of table furnishing. Benches and tables should be substantial. The tables should be 4 ft. wide. This class of furniture is thoroughly satisfactory for camp use.

If, as is now frequently the case, the management provides and occasional lecture or moving-picture show, this, high-ceiling room is quite satisfactory.

Bunk House—The bunk house (Fig. 3) is in its general arrangement typical of a large number of bunk houses in use in California. The use of a shed roof with high windows furnishes better light and air than does the old-style peak roof. In this particular house the bunks are unusually commodious and are provided with a continuous seat alongside of each lower bunk in preference to a single central bench. Steel bunks are sometimes substituted for the wooden frames. They have the advantage of being vermin-proof, but the disadvantage of leaking loose straw and other material more or less continuously. Except in very severe climates, no stove should be permitted in a bunk house. If there is a very considerable number of employees, the construction of a number of medium-sized bunk houses is much to be preferred to the use of a single large building. The loss in case of fire is less and the men are better satisfied in that they can separate by nationalities and trades.

Certain classes of employees, such as cooks, stable men, foremen and superintendents, require separate houses in any case. Shed-roof buildings of the same type can be used but subdivided crosswise into the necessary number of apartments.

Loafing Room, Bath and Wash Room—A combined loafing room, bath and wash room should be constructed in a camp housing less than 100 men. In larger camps these can be separated to advantage. The stove here should have a water-back to supply water for the shower baths and for washing the mens' clothing. There should be with it a tank of very considerable size. If the employer furnishes small wash tubs in place of the traditional 5-gal. oil cans, the men will appreciate them. For washing the face and hands, there should be a row of faucets located out of doors in the sun above a wooden trough equipped with graniteware wash basins.

Sanitation—The sanitation of the camp and minor policing should be in charge of a sweeper or sweepers who would clean up daily, supply necessary wood and start the wash-house fire before the end of the day. He should keep all buildings locked during the day and when unoccupied.

Ample supplies of disinfectant should be allowed and there should be a periodical whitewashing of the entire property.

Night shift employees should be, so far as is possible, segregated into a separate bunk house.

Water closets equipped with first-class plumbing should be installed in any camp where the duration of the work will warrant it. They are more sanitary and agreeable in every way than the best possible sinks, and have the very great advantage that they can be so screened as to minimize the possibility of fly-transmitted infection.

The most serious foe of health in the camp is the fly. Flies live on garbage and breed in manure. Manure should be hauled away daily and garbage should be kept covered. A number of fly-traps similar to the one shown by Fig. 4 should be located around the camp and emptied very frequently. The trapped flies can be stunned by dashing distillate or gasoline into the cage and can then be shaken out and burned.

Stables—A camp of any size employs a large number of horses and they, with their feed and equipment, occupy a stable of considerable magnitude. The preferred arrangement of camp stables places the mangers lengthwise of the center line with the feed on one side and the animals on the other. Center-post construction will be

Fig. 4. Fly Trap for Construction Camp

more economical here than a single-span shed roof. If the stalls are on the south side of the building and are somewhat sheltered from the prevailing wind, that side of the stable can be left almost entirely open. The depth back of the animals should be ample for a convenient

runway. The harness of work animals is almost always hung on a bracket opposite the animal, but there should be a locked harness room for storing and repairing spare equipment. The bigger the corral and the more use there is made of it, the less trouble there is in maintaining the health of the animals. A great many horse diseases are communicated by dirty water in drinking troughs. Series troughs should not be used on account of this possibility. Small short individually filled troughs emptied and cleaned daily are much to be preferred.

Most of the miscellaneous wagons used by a modern camp are of the type known as heavy farm wagons. These can now be had all steel with roller bearings at a less price than in any other form and require not over two-thirds as much tractive power and require but very little maintenance or upkeep.

Gasoline Tractors for Southern Road Work

By G. B. Buchanan*

While gasoline power has been in use on Northern and mid-Western road work for several years, its introduction into the Southern States, and especially the southeastern tier of coastal states is very recent. One of the first tractors to be purchased by a county for use on the roads of Virginia was bought by Caroline County last year. Some observations of its work, cost and economy should interest road builders in other parts of the South.

Conditions of Work—A tractor for use on Southern roads must have a broad range of uses. County road work heretofore has been done generally in a crude, slipshod way, with mule teams and hand labor. The roads are narrow, curves sharp and grades steep. There are few culverts, and in many cases the bridges are too weak to carry tractors. Many portions of the roads run through timber so that any effort to widen them necessitates much clearing.

Type of Tractor—Several designs of tractor were investigated, but the type finally selected was a combination kerosene-gasoline, 50-25-hp. tractor made by the Ohio Tractor Co., of Marion, Ohio, costing $3000. A 25-15-hp. tractor was first received and tried out, but its drawbar pull was found too light for the heavy grades encountered—often 8 to 10%—and, also, the loose sand of the river valleys made it impossible to move the tractor with the extra weight put on the frame for rolling purposes. As stated above, conditions in the South Atlantic States differ from conditions in the mid-Western prairie sections, for which the gasoline tractor apparently was designed.

While the tractor developing 25 hp. on belt and 15 hp. on drawbar pull met requirements as a roller and tractor for light pulling, it was seen that there would be so little rolling done and so much heavy pulling needed that the 50-25-hp. engine would be more suited to the present needs of the county. Developments have fully justified the selection made.

The motor is an opposed-cylinder, heavy-duty type, burning kerosene in several grades, or gasoline. It has been found that more tractive power is developed on gasoline. While this costs more, it has been proved that 1 bbl. of gasoline will last as long as $1\frac{1}{4}$ bbl. of kerosene, as well as produce more power. The conditions being such that there is no way of telling what kind of work will develop during the day's progress it has seemed better to burn gasoline. The fuel tank holds a full barrel, which has lasted variously from 7 to 10 hr., running on heavy to light work.

Grubbing—Heretofore, grubbing has been done by hand labor. It was thought the tractor could be used for pulling the stumps, but after a few successful efforts the gears were badly smashed. Damage to gears amounting to $150 was made on a tree stump which could have been blown up with less than a dollar's worth of dynamite. It is still believed, however, that applying belt power to a windlass-rigged stump puller will prove successful.

Comparison of Cost with Mule Power—The tractor has been used in all traction work formerly done by mules, besides being used for some belt power, for which mules, of course, could not. The tractor regularly hauls in grading two large-sized Buckeye blade graders. These are of a much heavier type than commonly used in the

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Fig. 1. Type of Gasoline Tractor Used by Caroline County, Va.

Fig. 2. Kind of Road Conditions; Tractor Climbing an 8% Grade

FIG. 3. TYPE OF BRIDGE WHICH MUST BE REPLACED WHERE TRACTORS ARE TO BE USED

FIG. 4. NEW REINFORCED-CONCRETE BRIDGE; TWO 26-FT. SPANS; COST $2200

South, and to each six mules are regularly hitched. The graders are also set very much deeper than is possible for any mule team to handle. A cross-section area about 50% greater is cut by the tractor-drawn tool.

METHOD OF USING GRADERS—One grader is hitched with an angle coupling so that it runs in the ditch. The steering gear is locked to hold it in this way. This does away with the need for a steersman, who is needed on mule graders. The blade of this grader is sunk obliquely to the required depth, varying from 6 in. over the blade depth in soft land to a cut of about 12 in. in hard clay or packed gravel. There is practically no rock near the surface in this county. Gravel is used exclusively as surfacing material on improved roads.

The second grader is hitched to a double-length pole, so as to follow the first grader and catch the dirt thrown from the ditch and push it farther toward the crown. Usually this lands the earth dug from the ditches in the right place, and it is seldom necessary to make more than two trips over a section of road to bring the crown to the desired height.

Work has been done in which no less than ten trips of the mule-drawn graders were not equivalent to two trips of the tractor outfit. Another great advantage in using the tractor is that the angle hitch for the ditch grader allows the motive power to travel in the center and hard part of the road. Where the ditches are low and swampy, as much of the valley and low-lying roads in this section are, mules have frequently mired in the mud; or it was impossible to use machine graders at all, so ditches had to be dug by hand at great expense.

COMPARATIVE COSTS—There is some work tractors cannot profitably do, such as light hauling for patching ruts and filling from borrow pits with scrapers. In all other lines, however, this tractor has proved the economy of motor power over mule power.

It is, of course, difficult to arrive at a definite cost price per cubic yard for moving dirt from ditch to crown in road-grading work. But as close a calculation as it has been possible to make indicates that this tractor has moved such earth, in a particularly easy situation for mules, for 2.8c. per cu.yd. By mule power the cost has been 3.2c.

FIG. 5. GRADER AND TRACTOR OUTFIT

FIG. 6. ROAD GRADED WITH TRACTOR AND GRADERS

our county, which means a saving of 9.4c. per cu.yd. These figures cover labor, fuel, lubricating oil, etc., for tractor and [illegible] costs, labor, [illegible], for mules, but not depreciation charges.

[illegible] work has [illegible] for mules, [illegible] with no stumps and moderately soft soil, the tractor cost will show more favorably than a seasonal average, in which [illegible] were called upon to perform all kinds of work.

[illegible] on the [illegible] steep grades [illegible] the [illegible] road administration has permitted, the [illegible] cost will [illegible]. I believe it safe to say that were a seasonal average computed it would show a saving of at least [illegible] per cu.yd. in favor of the tractor.

Because its newness to Southern road officials, and the consequent large amount of "trial motions" they required for other hauling, Mr. Tractor has moved at least 100,000 cu.yd. of road material in Caroline County in the past year, which would indicate a saving of $1000 over the same work done by mules.

The depreciation of the tractor may be figured at $800, while a maintenance account (not fuel or oil, but repairs, etc., to engine itself) of close to $400 has been incurred. However, the largest item of this was for broken gears resulting from [illegible] and this, of course, had better be charged to "experiment" than bona fide maintenance.

It would seem that it has cost $1200 in overhead charges to operate the tractor for a season, but it has effected a saving of approximately $1000 in actual operation costs on grading. In addition to this should be mentioned the belt power supplied, and some hauling economy. On the whole, taking into consideration the fact that the tractor revolutionizes road work wherever it is introduced, and that some time is always needed to adapt the new apparatus to old conditions, the evidence is all in favor of the gasoline tractor's economy.

Irrigation by Pumping Underground Waters in Nevada—The [illegible]

[illegible]

Recent Improvements in the Wire Drag Used by the United States Coast Survey; Its Possible Use as a War Machine

The long wire drag or sweep as developed and used by the United States Coast and Geodetic Survey in hydrographic surveying was quite fully described in Engineering News of Dec. 1, 1910, as most of our readers will probably recall. Since then several improvements have been made in its manipulation, which add much both to its effectiveness and efficiency.

Three wire drag parties are now at work on the coasts of the United States, one near Portland, Me., one in Buzzards Bay and the other on the West coast in Alaska. The importance of this work in effectively and finally verifying charted depths and in discovering uncharted shoals and menaces to navigation is being more fully appreciated, and Congress is even now being urged to pass a special appropriation of $200,000 for work in Alaska, where too frequent shipwrecks on uncharted rocks have shown the inadequacy of the ordinary sounding method on a rocky bottom.

The accompanying illustrations show the present method of handling a wire drag 6000 to 11,000 ft. long. The drag—longer, heavier and stronger than that formerly used—requires larger and more powerful towing boats. The boat shown is a gasoline power tug, about 70 ft. long and 15 ft. beam, especially rigged for a season's work.

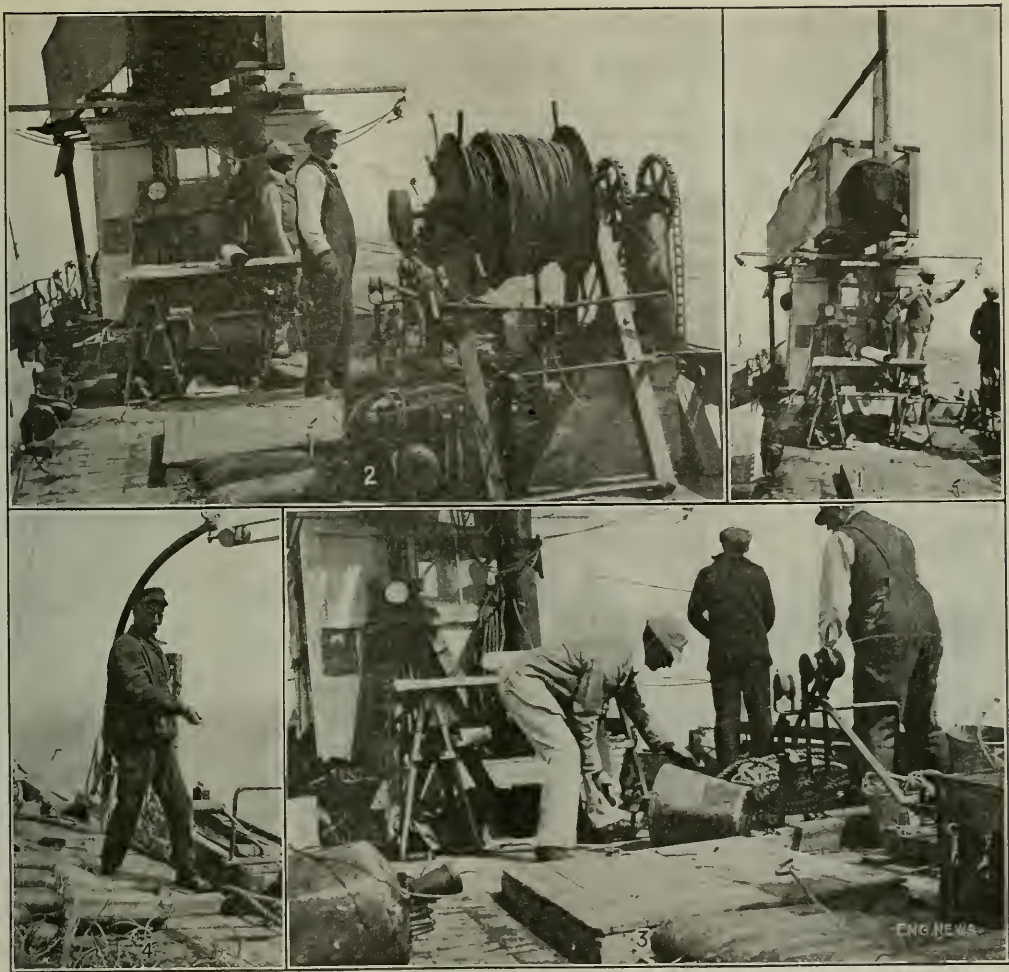
The necessity for frequent communication between the towing boats, which may be a mile or two miles apart, led to the development of the signal system shown in Fig. 1, consisting of three cloth-covered balls, red, blue and white, operated by levers behind the drafting table. The black ball in front is raised and dropped on the hour as a time signal, so that the clocks and watches of both boats may be set to the same time. These four balls are mounted on a binder framework, which can be swung so that its broadside is always toward the other boat.

The ball signal system is supplemented by the U. S. Navy wigwag system of hand flag signals, which permits any kind of a message. The party is now experimenting with wireless telegraphy as a means of drag control. Fig. 1 also shows the drafting table and equipment. The progress of the drag is plotted as the work proceeds.

Fig. 2 shows the apparatus for setting out and taking in the drag. As those familiar with our previous article will recall, the wire drag is merely a horizontal wire suspended, at an adjustable depth, from buoys which are separated [illegible] ft. longitudinally.

The length of the upright wires, or the depth of the horizontal wire, is adjustable to the depth to be cleared, making proper allowance for a tide. Towing the drag from each end, of course, sweeps a strip of bottom and any projection catches and holds the bottom horizontal wire.

The horizontal wire is held down and kept horizontal by [illegible] weights attached to the base uprights. The two ends of the drag are fastened to large towing buoys. Wood floats are attached to the bottom wire at intervals between the buoy uprights. In rolling the drag it is therefore necessary to detach floats, buoys and weights as well as wind up a [illegible]



Wire Drag Work of the United States Coast Survey

Fig. 1. Signal system on leading towboat. Fig. 2 and Fig. 3. Taking in drag with power reel. Fig. 4. Taking off weights, buoys, etc., on bow.

uprights, the wire parts of which remain attached to the bottom wire.

To drive the reel a 2½-hp. gasoline motor is provided. The control of the engine and reel is by levers, handled by the man in the middle of Fig. 3. In Fig. 3 is also shown a pulley device, moved back and forth horizontally by a power-driven cam, to distribute the wire on the reel. Practically the only actual handling of the drag is done by the man on the bow, Fig. 4, who detaches the weights, floats and buoys. He is safeguarded from the incoming wire and attachments by a rope netting.

Obviously the longer the drag the more efficient the work may be done, dependent, of course, on local conditions. The longer drag would not have been possible except by the introduction of methods of mechanical manipulation. With mechanical handling the various safeguards mentioned were essential to the prevention of accidents, especially in reeling in the drag.

It may be interesting to our readers, in view of the great naval battles which are being fought, or are about to be fought in the European War, to know that it is possible to turn the wire drag into a very effective machine for finding out and destroying mines intended to blow up warships. In dragging the coast off New London, Conn., two or three years ago, several practice mines, planted by forces in the mimic war then in progress, were unearthed, and occasionally brought to the surface, by the wire-drag party under N. H. Heck, Assistant, Coast and Geodetic Survey, who is chiefly responsible for the wire drag as it now exists.

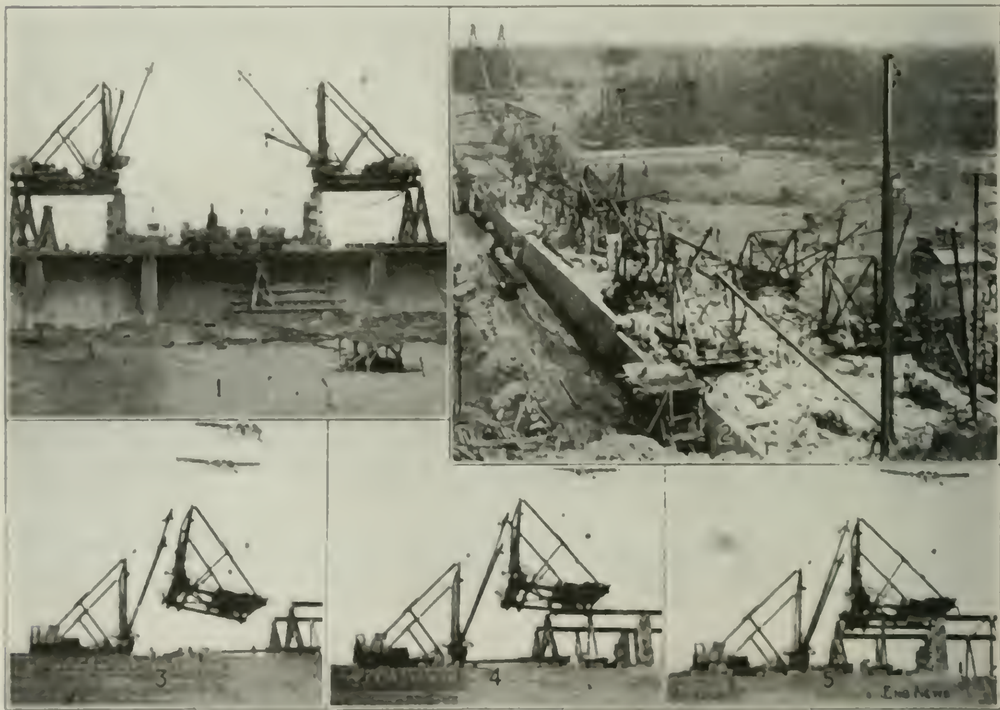
Automobile Exports from the United States in the fiscal year ending June 30, 1914, were valued at $40,136,565, as compared with $39,325,000 for 1913, the latter being the highest on record before this year. Nearly half of the automobile exports were sent to Europe. Imports of automobiles in the year 1914 were only 300 cars valued at about $620,000, as compared with 1624 cars valued at nearly $3,000,000 in 1909.

Field and Office

Shifting Derrick Travelers, Kensico Dam

By Wilson Fitch Smith*

The masonry construction of Kensico Dam, now being built by the City of New York as a part of the Catskill Water Supply System, was described in an article published in ENGINEERING NEWS, May 21, 1914. Briefly, the masonry is being placed by a number of stiff-leg derricks mounted in pairs on travelers. The travelers are carried on elevated tracks supported on masonry piers 25 ft. high (Fig. 5). In the lower portion of the dam, there were two parallel traveler tracks running the length of the dam and the travelers were arranged in pairs, facing each other on each track, so that four travelers or eight derricks served each section of the dam between expansion joints, which are about 80 ft. apart (Fig. 1). The tracks permit the travelers to be readily moved from one section to another as the masonry is completed up to the elevation of the tracks. Above 242, at which the width of the dam is 106 ft., but a single traveler track is used, carrying six travelers permitting three sections to be built simultaneously. The end sections of the dam joining the hillsides are constructed by guy derricks.



FIGS. 1-5. SHIFTING TRAVELERS FROM LOWER TO UPPER LIFT, KENSICO DAM

(Fig. 1. Two travelers working on lower lift. Fig. 2. Looking along Kensico dam showing parallel traveler tracks in foreground and single track in background. Figs. 3-5. Stages in lifting traveler.)

The raising of these travelers to the new elevation tracks as each succeeding lift of the dam is completed is an interesting operation.

The travelers are heavy braced timber frames 30 ft. wide and 50 ft. long, each carrying two stiff-leg derricks with 85-ft. booms operated by double-speed, 75-hp. electric hoists. Fully equipped with counterweights, each traveler weighs about 100 tons. The traveler track consists of two rails 30 ft. apart, each carried on a line of girders made of 24-in. Bethlehem H-beams, 39.5 ft. long. Two spans just cover a section between expansion joints, so that the girders are alternately supported on portions of the expansion joint being built or

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of concrete blocks to form piers 25 ft. high in advance of the rest of the joint facing, and on removable framed timber pedestals in the center of each section between the expansion joints; thus obviating entirely the concrete piers used in the lower portion of the dam which were so conspicuous a part of last year's work. This present arrangement is shown in Fig. 1.

After the masonry is completed up to the elevation of the traveler track in several adjoining sections, the expansion-joint-block piers are erected for the new level and the tracks put in place. On the completion of the masonry in the last section allotted to any pair of travelers, one traveler is dismantled by removing the hoist, booms and the counterweights, which are regular concrete blocks used in the expansion-joint facing. This work is done by the cableways and reduces the weight of the traveler to about 48 tons. Then the two cableway hoists are attached to the back end of the traveler by a running bridle and the two derricks of the companion traveler are attached to the front end of the traveler. By concerted action, the traveler is lifted to the elevation of the new tracks (Fig. 3). The cableways are then moved so that the suspended load is drawn over the new tracks (Fig. 4) and guided by the derricks the traveler is carefuly lowered onto the new tracks. This traveler is then reequipped and the other dismantled, and the operation repeated, the upper traveler now helping the lower one to its new position.

The last change, the one illustrated, required less than seven minutes to lift the traveler from rail to rail, and the elapsed time for the complete change from the last masonry placed by these derricks on the lower level to the first placed on the new level was 24 hours, the work being conducted only in daylight hours. As far as possible these shifts are made on Sunday. Fig. 2 is a general view of the dam from the west hill, showing the upstream face. In the foreground four travelers are completing a section to Elev. 242. To the left the single traveler track is erected at Elev. 264.5, and one pair of travelers are being lifted to the new track, as described in this article, while at the farther end of the dam masonry is being placed in a section above Elev. 242.

The dam is being built under the direction of the Board of Water Supply of the City of New York, by H. S. Kerbaugh, Inc.

Forms for Concrete-Encased I-Beam Floor

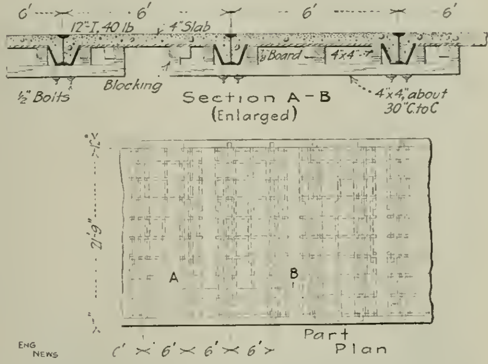
By M. J. Lorente*

In the construction of a private residence of reinforced concrete at Grosse Pointe Farms, Mich., the writer used for one of the floors—a concrete slab with concrete-incased I-beams—a special type of form which was dictated by certain local conditions, but which should prove economical for similar floor designs. A detail of the formwork is given in the accompanying cut.

The main portion of the floor, comprising close to 4000 sq.ft., is supported on 12-in. 40-lb. I-beams, spaced from 6 ft. to 7 ft. 6 in. on centers. The material available on the job for the forms was a large quantity of 4x4-in. timbers ranging in length from 8 to 13 ft., and a considerable amount of ⅞-in. sheathing, all of which had previously been used.

*37 Woodlawn St., Lynn, Mass

The 4x4-in. timbers were in excellent condition, but the sheathing was in pretty bad shape, owing to its poor quality and to the rough handling it had met. So



Details of Formwork for Concrete Floor with I-Beam Stringers

bad was its condition that very little was sound for a greater length than 7 ft. Such being the case, and as the sheathing could be of no further use after the second floor, the writer decided to put up the forms in such a way as to preserve the 4x4-in. timbers as much as possible and to cut only the sheathing.

A set of 4x4-in. timbers had two holes bored near each end, so that they could be secured tightly by two ½-in. bolts to the lower flanges of two adjacent beams, leaving an overhang of about 1 ft. 6 in. at either end. The bolts were bent to fit the flanges of the beams but were not flattened, as is commonly the case. On these cross-timbers were placed other 4x4-in. timbers running parallel with the beams and brought up to the desired height by blocking underneath. Two lines of these longitudinal timbers were placed the proper distance from the beams to allow for the haunches, and another line was placed in or near the middle of the panel. On these timbers was nailed the sheathing, which had to be cut the same length as the clear distance between the top of the haunches. The bevel was formed by sheathing resting on the edge of the beam flanges and the top edge of the longitudinal timbers close to the beams.

The cross timbers were bolted only in alternate panels. In the other panels four lines, instead of three, of longitudinal timbers were used, two close to the beams and two along the ends projecting from the cross-timbers in the adjacent panels. When the exact length could not be made up, the longitudinal timbers were placed side by side so as to avoid cutting. With the timbers close to the beams, cutting was imperative in a few cases, as the timbers had to be in line in order to provide a straight bearing for the boards forming the haunches.

Ribbed Glass to Prevent Drip at Skylights—The elimination of condensation drip from the underside of skylights is claimed to be effected by the use of ribbed or corrugated glass. A special glass for this purpose, with eight ribs or convolutions per inch, has just been put on the market by the Pennsylvania Wire Glass Co., Pennsylvania Building, Philadelphia, Penn., and called "Aqueduct" glass. It is ¼-in. thick, and wired. This ribbing is claimed to have the maximum capillary action.

An Interesting Method for Railway Rechaining

In rechaining the Cleveland Short Line Ry., a unique method was employed. The total distance from Collinwood, where this double-track belt line leaves the L. S. & M. S. Ry., east of Cleveland, to the junction with the same line at Rockport, west of the city, including wye connections with the C. C. C. & St. L., B. & O., and Lake Shore, is 20 miles. Following the standard practice of the Lake Shore, the base line was measured along the center line of the westbound main track.

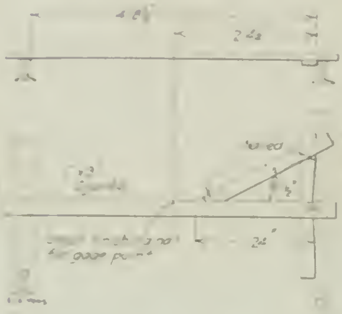


Fig. 1. Track T-Square Used in Rechaining Cleveland Short Line Ry.

The equipment consisted of a 100-ft. steel tape (correct at 70° F., with 10-lb. pull, tape supported at the ends, spring balance at the head end, temperature scale and thermometer on the rear end), a steel brush for cleaning the rail, and two T-squares made of 1x3-in. cypress. These T-squares (Fig. 1) were the special feature of the method of rechaining. The work was carried on intermittently as other work permitted, by the regular field party engaged on construction on the Short Line: assistant engineer, instrumentman, and two chainmen. Each station number was painted on the rail, using white-lead-and-oil, so that the work of making a complete resurvey of the line might be facilitated. No pluses were taken other than marking on the rail the location of mile posts.

In operation, one of the chainmen acted as rear chain, and the other handled the T-square at that end; the instrumentman and assistant engineer worked in similar positions at the head end. At the beginning, one T-square, coinciding with the zero station, was held firmly against the rail and watched to prevent any motion while the measurement was being made. The other T-square, placed in approximate position while the head chain was getting into position to make the measurement, was moved back or ahead a little as the tension was being applied by means of the balance, until the small finishing nail centered in the notch on the 100-ft. point on the tape. Then the head chain reached over and made a line with a slate pencil across the head of the rail along the side of the T-square, held firmly in place by the assistant engineer.

As soon as [illegible] checked, the man handling the rear T-square brought it quickly to the head chain, who started with it to the next station. The assistant engineer, with pot and brush, painted a line down the side of the rail, and painted the station number on the base in figures as large as the width of the base of rail permitted. The station was checked by having the rear chain call out the number of the one he had just left. As an extra precaution against error, everyone in the party carried the station in mind. By carrying the rear T-square ahead and leaving the head one in place for the rear chain to use, any error due to resetting was eliminated.

It was the intention originally to measure with the tape flat on top of the rail on tangents and to use the T-squares on curves only. But on the day the rechaining was begun, considerable difficulty was experienced in getting the tape to lie flat on top of the rail on the first tangent, on account of a high wind. After the first curve had been passed, the use of the T-squares was continued as an experiment on the tangent; so much better progress was made than on the first tangent, that they were used for the balance of the work. Their continual use gave also a uniform unit of measurement, for the reason that the tape was in suspension at all times and under uniform conditions of pull, instead of supported on tangent and suspended on curves.

Rapidity and Cost

No very definite figures as to number of miles to be chained in a day, or cost per mile, can be given, for the reason that the work was done intermittently. On the basis of an 8-hr. day, an average of 1 hr. of which was consumed in going to and from the work, about 4.5 mi. per day was covered. This average may be regarded as a minimum, inasmuch as a considerable quantity of ballast (freshly distributed) had to be dug through to lay bare the base of rail for painting station numbers.

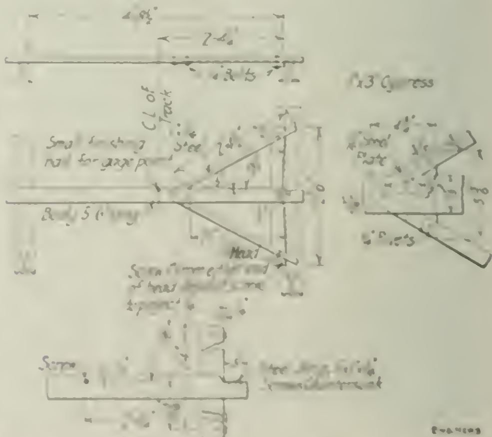


Fig. 2. Improved Track T-Square, Designed for Rechaining a Long Railway Line

The cost of the work averaged about $3.25 per mile, and included only salaries of the four men. On a more extensive job, expenses of the party would be included, but such increase would be somewhat balanced by the employment of lower-salaried men.

ACCURACY

At the west end of the line, an opportunity was had to compare the T-square method with 9 mi. of base-line chaining, which had been done previously with considerable precision, using tripods carrying knife-edges as a part of the equipment. By the tripod method, 1000 ft. was checked back with a permissible variation of 0.01 ft. The difference between the T-square and tripod methods on the 9 mi. was 0.27 ft., or 0.03 ft. per mile.

If a considerable amount of accurate track chaining is required to be done, especially where a fairly high percentage of curvature exists in the alignment, or where the work must be done during the inclement months, the T-square method has advantages apparent to anyone who has chained center line over stone ballast, or through snow and slush. It could be employed to take pluses where objects lying a considerable distance from the track are to be located closely, for instance, in chain surveys of yards and stations. The general custom of taking a plus to a half foot, when the point in the track from which the object bears at right angles is determined by sighting along a tie or by swinging the arms, is of doubtful propriety.

The T-squares used in the rechaining of the Short Line, Fig. 1, were made by a rodman, using material at hand and with as little expenditure of time as necessary, for the reason that the method was considered of doubtful utility and at the most applicable to curves. Since it proved on trial quite economical when degree of accuracy is considered, it might be worth while to make a more substantial tool after the manner of Fig. 2. A good patternmaker would charge about $7 for each.

For information concerning the method of rechaining, we are indebted to John F. Schwed, Office Engineer with the Chief Engineer of the Wheeling & Lake Erie Ry., who was in charge of the rechaining on the Cleveland Short Line. Fig. 2 is a design made by a railroad engineer in anticipation of a large rechaining job.

A Novel Circular Computer

A computing device, based on the principle of the slide-rule, is shown in the accompanying illustration. This computer is claimed to be more accurate than a 20-in. slide-rule, yet possesses an advantage over the regulation slide-rule in being more easily read and operated, and in having a scale for the addition and subtraction of numbers. The gradration is also unique, and much more legible than that of the standard slide-rule scale.

The device consists of a metal frame, to which is fixed a ring plate *B*, a revolving metal disk *A*, about 10 in. in diameter, with two rows of graduations (shown at *C*), the outer a logarithmic scale like that of a slide-rule for operations of multiplication and division, and an inner scale of equal division for addition and subtraction. The figures and divisions of the logarithmic scale are black and of the number scale red. As the main divisions on these disk *A* scales would be hidden at the point where they are read *C*, they are placed outside of the ring plate *B*, where they are always in view. On the fixed ring plate *B* there are exactly similar scales and divisions.

The procedure in using the computer is as follows: With the handle *E* pressed down, revolve the disk *A* until the number to be multiplied (or added to) appears at the index *C*. Lift the knob *E*, raising which clamps the lower plate at the index reading. With the handle still raised turn the arm *D* to the multiplier (or number to be added) on the ring *B* scale. When *D* is set, press down the knob *E*, in which position it clamps the arm *D* on its

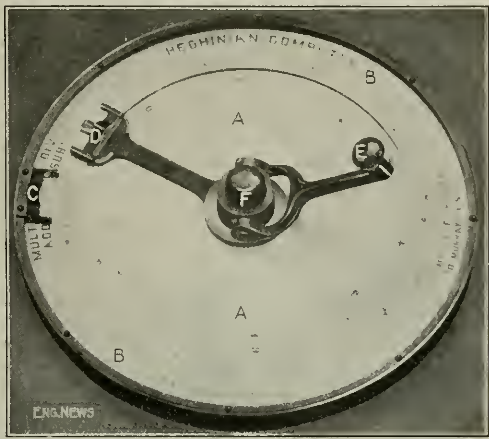


FIG. 1. CALCULATING DEVICE INVENTED BY G. G. HEGHINIAN OF BROOKLYN, N. Y.

reading and unclamps the movement of the lower disk *A*. Now move the arm index *D* by revolving the lower disk *A* to the hair line of index *C*, and we read on the scale at *C* the desired result. If the result is to be divided by any number, instead of moving *D* to the index, move it to this number, and the final result appears at the index at *C*.

In the illustration the index slide *D* is shown set on the logarithmic scale and the index slide *C* on the number scale. These slides cover the scale not in use and thus avoid confusion. Slide *D* is shown equipped with a semi-cylindrical magnifying glass.

The operations of subtraction and division are, of course, the reverse of the process given for multiplication and addition. The result is always read at the index *C*.

Fig. 2 shows some of the details of construction of the computer, which is made throughout of metal, the plates being silver plated. The system of graduation was devised for this computer and makes the close reading of the scale particularly easy. The head *F*, Fig. 1, contains a spiral spring, as shown in the cross-section, Fig. 2,

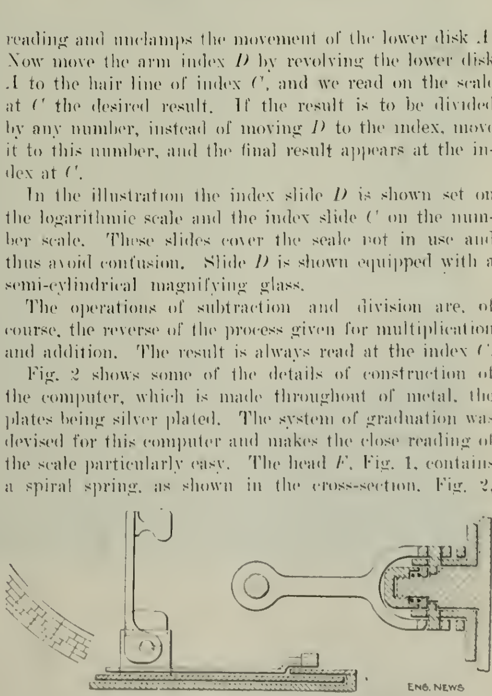


FIG. 2. STRUCTURAL PARTS OF THE HEGHINIAN COMPUTER

which prevents the binding of the plates and takes up any wear on the cam by which the clamping of the plates is accomplished.

The device is called the Heghinian Computer and is

the invention of Irving G. Hag[illegible], a civil engineer, graduate of the Massachusetts Institute of Technology, now is a consulting asphalt expert, at 407 Hamilton Avenue, Brooklyn, N. Y. The maker is F. J. Bernard, 75 Murray St., New York City, and the instrument is made to sell for about $[illegible].

Settlement of a Pile Foundation

A bad case of foundation failure is illustrated by the accompanying views, showing parts of two newly con- [illegible] at least two feet farther down before stopping at hard bottom, and that the soil was not good for more than ¾ ton per sq. ft. Beyond this fact and the known depth to rock the character of the old pile foundation is not known in detail as there was no inspection. The piling plan of the architect (J. Fred Pelham, New York City) shows a double line of staggered piles placed 18 in. c. to c. under all walls; but this was not strictly followed as the presence of large boulders at the front of the site necessitated a certain amount of excavation there and the placing of concrete foundations. This explains why the settlement of the buildings was not more general.

CRACKED WALLS DUE TO FOUNDATION SETTLEMENT

[illegible]

structed apartment houses on [illegible] Place near the Grand Boulevard, the Bronx, New York City. These buildings were founded on wood piles, as the ground is swampy for a depth of 25 to 30 ft. down to rock. Short piles were used, not driven to rock, and under the load of the completed buildings they settled, causing the walls to crack as shown.

Engineers who examined the case for the owners' company found that all the piles they uncovered could be [illegible]

To restore the buildings, [illegible] steel piles were jacked down under the settled portion of the walls. To prevent the possible collapse of the walls, steel cables were tied across inside the buildings at all cracked sections and drawn tight. In the case of one of the buildings, which was in worse condition than the other, timber floats of [illegible] construction were placed in the cellar and in the back yard connected by steel beams which passed the masonry. As this shoring settled under the load of

the settled portion of the building, the cribwork was jacked until firm bearing was secured.

Part of the new steel piling is 12-in., driven with a steam hammer; the remainder of the piles are 9-in., forced down by jacking against the weight of the wall. Sections of the wall were broken out to admit the new piles, which were driven to refusal, blown out with air, reinforcing-rods placed in them, and the tubes filled with concrete. In all, about 80 of these piles were put down along the wall, designed to carry a load of about three tons each.

At the time the buildings were erected, only occasional inspection was given to the piledriving, according to the usual practice of the building bureau. At present, however, the Bronx buildings bureau inspects all piling jobs by keeping an inspector on the job steadily until the piledriving is finished. However, Henry Morehead, Superintendent of the bureau (but not in office at the time these two apartment houses were constructed) says that he considers it an outrage that this should be necessary.

There was no general contractor on this work; contracts for the several elements were let by the owner under the name of the Defender Construction Co.

The Error in Design of Columns for Bending

By J. P. J. Williams*

Columns subjected to bending moment in addition to direct axial compression, are usually designed by an approximate method, which neglects the effect of deflection upon the value of the bending moment. Formulas and diagrams based upon this approximate method by which required areas can be found were given by Mr. Paaswell, in the Engineering News of June 26, 1913, p. 1333. It will now be shown that a relatively simple formula can be used to obtain the error or correction to be applied to the approximate value of the area to obtain the true area required. The percentage of error resulting from the use of the approximate formula is then easily noted.

Let

- A = Total required area of column by the approximate formula (or diagrams);
- A_e = Same area as obtained by more exact formula;
- $A_c = A_e - A$ = error or correction to be applied to A;
- P = Total direct axial stress in pounds;
- M = Maximum bending moment in pound-inches;
- h = Depth of column in direction of bending;
- r = Radius of gyration about an axis perpendicular to the plane of bending;
- s = Allowable unit-stress by column formula;
- l = Unsupported length of column in inches;
- E = Coefficient of elasticity in pounds per square inch;
- k = Constant depending upon end conditions (= 32 for fixed ends; 10 for pin ends; 24 for one fixed, one pin end.)

Also, let $\dfrac{M\left(\frac{h}{2}\right)}{r^2}$ be called P_b, and $\dfrac{P\left(\frac{l}{r}\right)^2}{k\,EA}$ be called K.

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The approximate formula generally used can then be given in the following form:

$$A = \frac{P}{s} + \frac{Mh}{2r^2s} = \frac{P + P_b}{s}$$

As developed in standard textbooks on the subject, the more exact formula for total stress s is:

$$s = \frac{P}{A_e} + \frac{\frac{1}{2}Mh}{I - Pl^2 \div kE}$$

By substituting A_er^2 for I, and assuming for practical purposes that $\frac{A_e}{A} = 1$ in the second term of the second denominator, the value of A_e is found to be:

$$A_e = \frac{P + \dfrac{M\left(\frac{h}{2}\right)}{r^2 - \dfrac{Pl^2}{kEA}}}{s} = \frac{P + \dfrac{M\left(\frac{h}{2}\right)}{r^2\left(1 - \dfrac{Pl^2}{kEAr^2}\right)}}{s}$$

$$= \frac{P + \dfrac{P_b}{1-K}}{s}$$

Therefore

$$A_c = A_e - A = \frac{\dfrac{P_b}{1-K} - P_b}{s} = \left(\frac{K}{1-K}\right)\frac{P_b}{s}$$

This A_c is the error on the side of danger when columns are designed by the approximate formula

$$A = \frac{P}{s} + \frac{Mh}{2r^2s}.$$

In most cases the error is only a very small percentage of area A. But the error varies directly with K and with P_b, and therefore increases with increased slenderness $\left(\frac{l}{r}\right)$ and increased bending moment.

Procedure—In designing columns with the use of the foregoing, proceed as follows: Assume depth h, obtain r by approximate ratio (see Engineering News, May 23, 1912, p. 991), compute $P_b = \frac{Mh}{2r^2}$, and then $A = \frac{P + P_b}{s}$. Next compute $K = \frac{P}{kEA}\left(\frac{l}{r}\right)^2$, and finally A_c, and determine the percentage of error.

Stump Pulling and Grubbing Machine

In the clearing and development of large tracts of land, the grubbing and removal of stumps quickly and economically is a problem, for modern conditions do not favor the old practice of leaving the stumps to rot or to be burned and pulled out piecemeal as the farmer can find time for such work.

There is a large field for machines which can do this work effectively at low cost, and the accompanying cut shows a machine which has been designed for this class of work. It is self-propelling, while light enough to travel over soft ground. It is designed to grub out the smaller stumps as well as to pull the large stumps, thus doing the entire work of clearing rapidly and at reasonable cost.

The machine consists of two parts, the tractor (with

Stump-Pulling and Grubbing Machine for Clearing Land

hoisting engine, and the hoisting tripod. When at work, the latter rests on shoes on the ground and is entirely free from the tractor. For moving from stump to stump, the tripod is tilted and raised so as to be carried clear of the ground by the tractor. The tractor has a 20-hp. horizontal engine and a vertical boiler. The engine is geared through a [illegible] clutch to the traction mechanism driving the rear wheels. For hoisting, the power is applied to two drums mounted at the front end of the frame, geared to give a powerful pull. For raising and lowering the tripod there is an auxiliary drum mounted on the gallows frame at the rear of the machine.

[illegible]

The wire rope from one of the drums leads to a pair of blocks suspended from the top of the tripod, and the [illegible] power can be increased by varying the number and arrangement of the sheaves. It is stated that a pull of about 45 tons, which is easily within the capacity of the machine using a pair of 3-sheave blocks, is ample for pulling stumps up to 7 ft. diameter. After the stump is pulled, it is the work of a few moments to tilt the tripod, move to the next stump, and drop the tripod into position again. It is only necessary to use the tripod for stumps of the largest size, which are usually a small percentage of the total. All the lighter growth and smaller stumps are pulled by the ropes running forward directly from the drums.

[illegible]

The tripod also affords a means of piling the stumps. For this operation, the rope is run through a block at the top of the tripod and the tripod guyed to a stump in the rear. The stumps can then be [illegible] at a higher speed on the drums being provided for this purpose, and they are readily dragged up into piles of considerable height.

This machine is being introduced by the Pioneer Land Clearing Machine Co., 1220 First National Bank Bldg., Chicago. On work in Ogemaw County, Michigan, the machine has pulled 200 stumps per day, the stumps ranging from 8 to 36-in. diameter.

A Model Town, known as Morgan Park, is being built within the city limits of Duluth by the Minnesota Steel Co., in connection with its new steel works at that city. [illegible]

Traveling Car-Tipple on the Sag Canal

In the construction of the Chicago Drainage Canal a most important feature was the use of various forms of machinery for the removal of excavated material. One type of machine consisted of a traveling tipple or car dump, the cars on which received material from the steam shovel and dumped it to form a spoil bank at a suitable distance. Machines of this type have been used on other canal work, and are now being employed on part of the Sag Canal, which is an auxiliary channel extending from the Calumet River to the "Sag," a point on the Chicago main drainage canal. This Sag Canal was described in our issue of Jan. 23, 1913.

The new car tipple noted above is in use on contract section No. 9 of the canal work, 5500 ft. long. The cross-section here is 180 and 36 ft. top and bottom width, 37 ft. deep, with side slopes of 2 on 1, and 100 ft. width of berm. The rock lies at an average elevation of 10 to 12 ft. above the grade line of the bottom of the canal. The plan is to remove all the material above the rock in one cut, the steam shovel being placed in such position that it can take out the full section of the canal. It loads the material into two cars running on the incline of the tipple; each car holds two dipper loads, and while one car is being loaded the other is being dumped.

The steam shovel is of the stripping type (ENGINEERING NEWS, Apr. 2, 1914), having a 75-ft. boom and 3½-yd. bucket; its upper part revolves on a main frame supported by four four-wheel trucks on two parallel tracks. Fig. 1 is a view of the entire plant, and shows the dipper about to deposit its contents in one of the two cars of the double-track incline or tipple.

The construction of the tipple is shown in Fig. 2. It consists mainly of two triangular trusses spaced 16 ft. c. to c., with the horizontal part of the bottom chords supported on two cross-frames. Each frame is carried by seven pairs of wheels on a standard-gage track, these tracks being 75 ft. apart, c. to c., laid parallel to the line of the cut, and the inner track being near the edge of the slope. The outer part of the structure forms a cantilever 80 ft. long, with its end about 60 ft. above the ground, and beyond its end projects the car-dumping platform. The boiler and machinery mounted on the deck serve to counterbalance the cantilever arm.

On this structure are laid two tracks, upon each of which runs a 7-yd. four-wheel car operated by a cable. To extend these tracks into the cut, so as to put the cars within the reach of the steam shovel, there is an apron 30 ft. long, hinged to the main frame and having at its lower end a 12x12-in. oak bolster which rests on the slope. Eyebars at the outer corners of the apron carry sheaves for tackle, led over masts on the main frame. Once a day the machine has to be moved forward about 30 ft., and the method of raising the apron during this movement is one of the special features of the new machine. The ends of the hoisting cables passing over the masts are attached to one of the dump cars. Then by hauling the car up the incline the apron is raised and held until the machine has been moved forward to its new position. As the steam shovel advances, the machine is moved forward by means of a hauling tackle and blocks, one block being hitched to an anchor or deadman.

FIG. 1. TRAVELING CANTILEVER CAR TIPPLE ON THE SAG CANAL, CHICAGO, DELIVERING MATERIAL FROM STEAM SHOVEL TO FORM THE SPOIL BANK

At the upper end of the cantilever each track has a pivoted dumping platform 16 ft. long, the outer end of which carries the 5-ft. sheave for the car cable. The ends of the track rails are curved upward so as to embrace half the diameter of the front wheels of the car, thus holding the car firmly upon the track. To the tail end of the platform is attached a cable leading to a pendulum counterweight suspended in the truss.

As the loaded car runs upon the tilting platform, stirrups at the rear engage with dogs on the platform so as to hold the car in place. When it runs against the curved stop rails it automatically trips a latch which holds the platform, and the continued pull of the hoisting cable (together with the weight of the car) causes the platform to tilt on its horizontal shaft to the position shown by the dotted lines. The counterweight at the same time is raised to horizontal position, as shown, its effect increasing as the tipple is being revolved. The hoisting cable being slackened, the counterweight overcomes the weight of the empty car, and pulls the platform to its normal position. Fig. 3 shows the platform in the dumping position.

The equipment includes a 100-hp. horizontal boiler and a hoisting engine with cylinders 10½x12 in. The drums

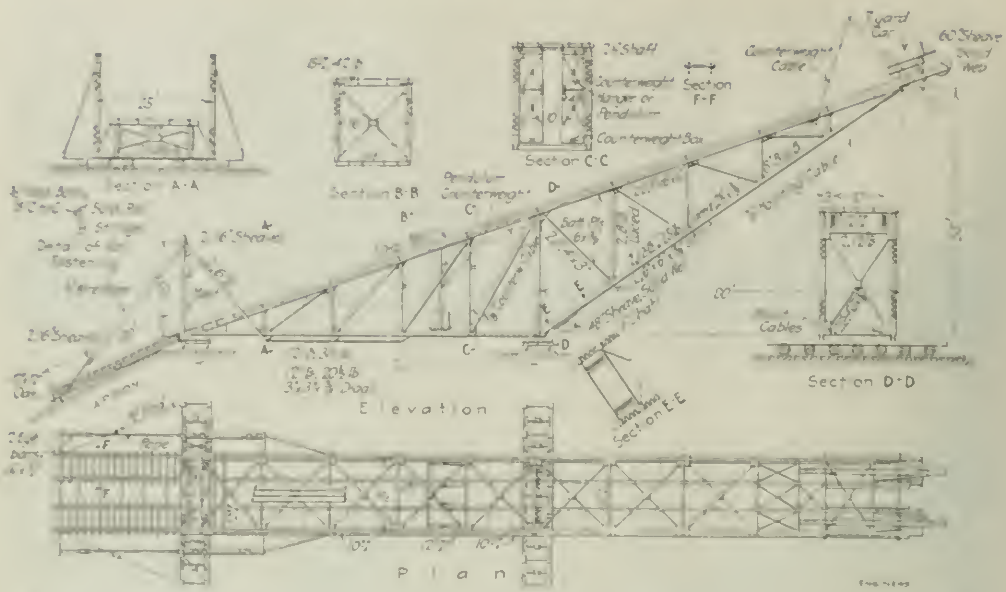


FIG. 2. DETAILS OF TRAVELING CANTILEVER DUMP OR TIPPLE, SHOWING THE DUMPING PLATFORM AND THE APRON EXTENDING INTO THE CANAL EXCAVATION

are 48 in. in diameter, placed tandem, and have band frictions and brakes. The friction bands are operated by steam rams. The speed of the hoisting cables is about 300 ft. per min. The engine is mounted on a separate car on the track nearest the slope of the cut. This is done in order to put the operator in a position where he has a full view of the cars throughout their entire travel.

The machine is used by the Byrne Bros. Dredging & Engineering Co., of Chicago, which has the contract for this section of the Sag Canal. It was designed by the Page Engineering Co., of Chicago. It is very similar to the machine used by Gahan & Byrne, contractors, on the main drainage canal (as already noted). The loads hoisted are greater, however, so that the present machine is somewhat heavier. It also has the new arrangement for raising the apron, as described above. It is too early to give any records of monthly output or daily average, as a good part of the work so far has been in starting the cut and getting the steam shovel down into the pit. However, the contractors state that 2000 yd. have been moved in a single shift, and that this is not its greatest capacity.

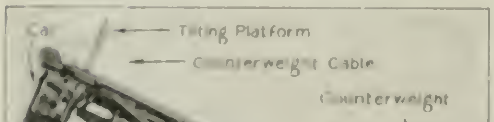


FIG. 3. CAR BEING DUMPED AT HEAD OF CANTILEVER TIPPLE

Calculating Earthwork Cross-Sections

WELLS' METHOD—Various opinions have come to us regarding the method of calculating earthwork cross-sections given by L. W. Wells on p. 1203, of the issue of June 11. F. E. Foss, professor in charge of the department of civil engineering, Cooper Union, New York City, considers Mr. Wells' method "much more cumbersome than that based upon subdividing the area into triangles, which consists in multiplying the cut or fill by the difference in the distances out from the center." Another correspondent states that practically the same method is given in Nagle's "Field Manual for Railroad Engineers" pp. 189-190 (1897 ed.). Others have called our attention to the similarity of Mr. Wells' method to that given in our own columns in 1902, as noted in our issue of July 9, p. 89.

C. E. Gibler, of Greeley, Colo., writes that he has used the method given by Mr. Wells for years and has calculated hundreds of miles of cross-sections for railroads, highways and ditches by it. He says:

I am acquainted with numerous other engineers who also favor and use it. On the other hand, I am acquainted with many who are strongly prejudiced against its use, principally for the reason that its proof is not obvious, and they have long used the easily proven trapezoidal method.

The method advocated by Mr. Wells, which the writer has always designated as the "triangular method," is quick, and is less tiresome, and, by reason of occasioning no mental subtraction and addition, less prone to error, than the trapezoidal method.

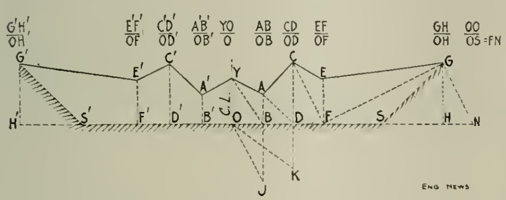
There are an infinite number of ways in which the truth of the method may be proved, but many would lead into a maze of calculations from which it would be nearly impossible to extract the relationship between the notes and the area.

The writer therefore believes that a study of the proof given herewith will convince many, not only of the truth of the method, but also of its simplicity; and prove that this triangular method is really a very close relation to the beloved trapezoidal method.

The accompanying figure represents a section in excavation in irregular ground, which for the sake of this analysis is made symmetrical about the center line. The left half is divided into trapezoids, and the right half for proof by the triangular method. Double areas are considered for the sake of convenience exactly as they are in the trapezoidal method.

Above the figure is a set of notes indicated by letters instead of numerals.

The manipulation of the notes has been fully explained by Mr. Wells and so will only be reviewed here in analysis.



ADDITIVE AREAS

Notes		Figures
YO × OB =	The double area of triangle	YOB
AB × OD =	" " " "	ABY and ABD
CD × OF =	" " " "	ACD, FCD, and OBJ in which BJ = CD
EF × OH =	" " " "	CEF, GEF, and ODK, in which DK = EF
GH × OS = GH × FN =	" " " "	GFN wihch equals GFS plus GSN

SUBTRACTIVE AREAS

OH × Zero = Zero		
GH × OF = GH × SN =	The double area of triangle	GSN
EF × OD = DK × OD =	" " " "	ODK
CD × OB = BJ × OB =	" " " "	OBJ
AB × Zero = Zero		

We have therefore deducted each of the external triangles and have remaining the area of the half section considered, (neglecting the operation of dividing by two) Q. E. D.

A brief examination of the left half of the figure discloses the reason for the external triangles in the analysis. Considering C'D' we observe that for double areas in the trapezoidal method it is multiplied by the distance to the intermediate on either side of B'D' and D'F', or all told, B'F', whereas in the triangular method CD is multiplied by OF, which is in excess of the amount B'F' by the amount OB, and we have, therefore, to exclude a triangle whose base is OB and whose altitude is the equivalent of CD, or the triangle OBJ, etc.

LOVELACE'S METHOD—O. G. Bunsen, of 1882 San Berbard St., Austin, Tex., writes that for the last 20 years he has used a method of calculating the end areas for earthwork formulas which is practically identical, but more concise, than that given by E. S. M. Lovelace in ENGINEERING NEWS, May 28, p. 1200; and he inherited it from engineers who came before. The difference is that the horizontal axis OX, or reference line, instead of being the H.I., as in Mr. Lovelace's method, is the grade level. The field notes are recorded to show the actual cuts and fills.

Referring to Mr. Lovelace's demonstration of notes taken from Sta. 41, and Fig. 3, p. 1201, the notes would read:

Sta.	Elev.	Grade		Left		C		Right		
41	97.40	91.50	$\frac{0}{10}$	$\frac{+1.7}{12.5}$	$\frac{+3.8}{8.0}$	$\frac{+5.9}{\text{sta.}41}$	$\frac{+7.2}{6.0}$	$\frac{+6.4}{13.0}$	$\frac{+6.9}{20.4}$	$\frac{0}{1}$

By Mr. Bunsen's rule; $2A$=algebraic sum of the products obtained by multiplying each distance out by the difference of the adjacent heights either side of the distance out, always taking the height between the center and the distance out as the minuend.

$$2A = 10(1.7 - 0) + 12.5(3.8 - 0) + 8.0(5.9 - 1.7) + 6.0(5.9 - 6.4) + 13.0(7.2 - 6.9) + 20.4(6.4 - 0) + 10(6.9 - 0) = 298.56.$$

$$A = 149.28.$$

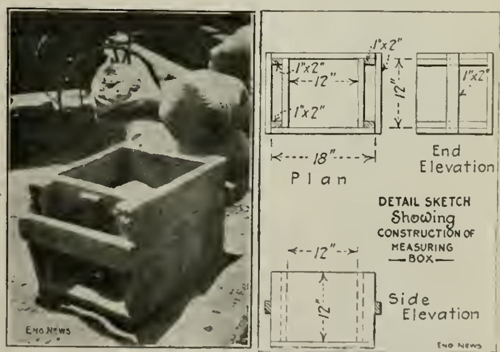
The value of this rule, Mr. Bunsen says, consists in that it is automatic, following a fixed routine, thereby avoiding the error of skipping some of the data. The rule is general and can be applied to any kind of a cross-section.

This method is similar to the one given by C. F. Koppisch in the issue of June 11, p. 1303, which is criticised by Mr. Lovelace as follows:

My method given in "Engineering News" of May 28, p. 1200, is a general one, independent of any particular method of keeping field notes. In the notes as given on p. 1201 the numerators are the actual rod readings and the denominators the actual distances out from center. While it may be a convenience in some cases to have notes recorded as showing the actual cuts and fills, so far as arriving at the area of the section is concerned, nothing at all is gained and time is lost in subtracting the rod readings from the grade-rod reading in the field and so recording them. The method under discussion is principally of use where the sections have numerous intermediate readings, and then any device that will save time either in the field or office is of value.

NOTES

A Good Detail for Measuring Boxes—Measuring concrete materials accurately is essential to good work. On one section of the Passaic Valley Sewer, the contractors, Frazer & Burchenal, are using a small rotary batch mixer and measuring sand and cement in home-made boxes which are built as shown in the accompanying sketch. These boxes are made throughout of 1-in. material; the end pieces afford not only a good tie, but a very good handle by which the boxes can be lifted.



A CUBIC-FOOT BOX USED TO MEASURE CONCRETE MATERIALS FOR A SMALL BATCH MIXER

Boston's Lone Skyscraper—The accompanying illustration shows the stage of construction on the tower surmounting the Boston, Mass., Custom House, on July 31. This building is about 325 ft. high, or about half the height of the Woolworth Building in New York City; yet it is Boston's single skyscraper, because Boston has an ordinance limiting the height of any building to 125 ft.—and the United States Government is the only landholder who can violate the law

TOWER OF THE CUSTOM HOUSE, BOSTON, MASS., JULY 31

with [illegible]. When the city of Boston wanted to build its new office building [illegible] ft. high, it had to go to the state legislature to get exemption from the general law, [illegible] just [illegible] nothing.

Plaster Statuary Is Being Placed on the [illegible] Pacific [illegible] Wicked [illegible] shown in the accompanying [illegible] placed on [illegible] of the [illegible] buildings. [illegible] The locomotive crane is mounted on railway tracks [illegible] the exhibition buildings. [illegible] ft. is [illegible] the statuary is placed [illegible] at the [illegible] where it is to be [illegible] with the [illegible] The locomotive crane is only used in placing the statuary [illegible] the statuary [illegible] at a height of [illegible] ft., where [illegible]

A Device for Computing Stream Flow—It is interesting to [illegible]

free end with a carriage-maker's clamp [illegible] as a base on which to slide the triangle.

Frank Weber, of Owyhee, Nev., [illegible] to have designed

SET-UP FOR COMPUTING STREAM FLOW

this device for stream gaging while in the Albany office of the U. S. Geological Survey. He [illegible] useful in gaging streams which have wide daily fluctuations.

PLACING STATUARY ON THE PANAMA-PACIFIC EXPOSITION BUILDINGS WITH A LOCOMOTIVE CRANE

Editorials

Immediate South American Needs

When the serious nature of the present European war was realized, the Bureau of Foreign and Domestic Commerce of the United States Department of Commerce directed the various consuls in South America to report on the classes of goods most required in their localities now that European imports have ceased. These reports, which have just been circulated, have interest to manufacturers of engineering materials, and indirectly to those engineers who may contemplate entering the South American field, for if American material is to go south, American men will undoubtedly follow.

While a large part of the goods now required are outside of the engineering field the demand for cement and steel is widespread even thus early, which would indicate that construction work is either in progress or in prospect and that contractors supplies are going to be a need of the immediate future. The various cities and their specific engineering needs are as follows: Para—cement, manufactured iron; Rio de Janeiro—cement, steel wire; Montevideo—cement; Lima—cement, steel rails, tools, machinery, explosives; Bogota—machinery, railroad supplies, engines, cars, rails, bridges.

An Engineering Study of Smoke from Pittsburgh Boiler Plants

From time to time we have noted the smoke-prevention investigations in Pittsburgh regarding which, up to the present, only general information has been available. There now comes to hand a bulletin of the Mellon Institute of Industrial Research of the University of Pittsburgh, giving data on the operating conditions and smoke production of 147 stationary boiler plants (191 stacks) in Pittsburgh variously equipped with and without machine stokers. The general results of this survey are of wide interest, as comparing the relative smoke production of various systems of firing fuel under commercial operating conditions which are likely to be seen anywhere. Briefly reviewed, these data show that the 51 common hand-fired plant stacks, while under observation, produced no smoke 30 minutes out of an hour: 11 stacks from Dutch-oven furnaces were smokeless 34.5 minutes, the 36 chain-grate stoker plant stacks were smokeless 38 minutes, the 60 front-feed stokers 23 minutes, the 21 side-feed stokers 11 minutes, and the 12 under-feed stokers 13 minutes. The minutes per hour of producing 60% black smoke, or denser, for all these plants were: hand fired, 12; Dutch-oven, 5.2; chain grate, 2; front feed, 15; side feed, 2; and underfeed, 1. The average densities of smoke, compared with black, were: hand fired, 23%; Dutch oven, 13.6%; chain grate, 11%; front feed, 27%; side feed, 8%; and underfeed, 7%. The interesting point is the failure of front-feed stoker plants to work as well as the hand-fired boilers.

A New Danger for Bridges

By liberal use of scissors and paste on a recent issue of the Service Bulletin of the Iowa Highway Commission, we are enabled to present the following gem:

Treacherous danger lurks in the old style bowstring type of iron bridge. There are thousands of them on main traveled roads in Iowa.

You can see the danger in the rotten wooden bridge. The signs of decay are unmistakable. You cannot see the danger in the old crystalized iron. Your first intimation of danger in the age weakened structure comes with the sudden snapping of rods and beams and a crashing of wooden floor timbers. Between the two, the old bowstring is more treacherously dangerous than the rotten wood.

There was little thought of danger on the Rutland bridge when a steam traction threshing outfit started across. Yet half a minute or so later the whole outfit lay at the bottom of the Des Moines River.

There was no thought of danger when a similar outfit steered upon the Thornton bridge, yet only a projecting shelter formed by a self-feeder on the separator which striking the engine as the bridge went down kept a small space between the separator and the engine and saved the lives of the engineer and the steersman (sic).

Every man who has crossed one has noticed the trembling of the structure and the rattle of the rods and members of the bridge. The metal in them has every inducement to crystalize.

We restrict the above quotations to the essentials. Were it not for this we would go on and relate, still quoting, how thousands of these bridges, freshly painted and good looking, are "waiting, veritable death traps set with the fickly hair trigger strength of crystalized metal."

In the past bridges have broken down because they were overloaded; that is to say, either loads were run upon them which were greater than they were designed for, or being perhaps poorly designed or built they were unable to carry the loads which the design supposed them good for. But now we learn that there is a third and more lurking danger—one that has a "fickly hair trigger strength."

In view of the great importance of this to bridge engineers and the vast public which occasionally uses bridges, we call upon the editors and backers of the Service Bulletin of the Iowa Highway Commission to present all obtainable and necessary facts on the new danger and to thus demonstrate it to the world in order that all may take proper steps for protection. Since the old superstitions about the so-called crystallization of structural metal have long ago been killed off, something new must have been discovered in Iowa. We call for the facts.

It may be, of course, that the real danger to bridges is not the "fickly hair trigger strength" above referred to, but the Iowa Highway Commission itself. If that be the case, the nation at large is not in as great danger as Iowa; at the same time the process of cure is simpler.

Why Not Preserve the Natural-Cement Industry?

A few years hence the engineer who happens to be engaged on a piece of work where he prefers, for certain reasons, to use natural cement, or, as it is perhaps most commonly termed, Rosendale cement, will find, we fear, that he cannot obtain it in the market. It seems to us that this would be a serious misfortune and that the engineers of the country will do well to consider whether they ought not to make a larger use of natural cement. For it rests absolutely with engineers whether this industry shall survive or whether it shall become one of the lost arts.

Most engineers of mature years know that up to about 15 years ago most of the cement used in the United States was natural cement and natural cement only. In 1890, for example, over 7,000,000 bbl. of natural cement were produced in the United States. In the same year only 335,000 bbl. of Portland cement were made in the United States and 1,940,000 bbl. were imported. Not till 1896 did the annual production of portland cement in the United States exceed a million barrels; and in that year nearly 8,000,000 bbl. of natural cement were produced. In 1900 the production of portland cement exceeded the production of natural cement for the first time. Since then the production of portland cement has increased by leaps and bounds, amounting to 92,-097,000 bbl. last year. The natural-cement industry has declined meantime, falling below 1,000,000 bbl. for the first time in 1911.

It may be said that the reason for the decline of the natural-cement industry is a commercial one. Portland cement made by modern processes in huge plants is produced at so low a figure that the natural cement, produced on a comparatively small scale and by old-fashioned methods, could barely compete with it even if the two materials stood on an equal footing in the market. Of course, they do not stand on an equal footing. Portland cement is recognized as on the whole a superior material to natural cement, so the purchaser, or the builder, or the engineer says, "since the difference in cost is so little, let us specify the best material."

If this were indeed the whole story, then we might look upon the disappearance of the natural cement industry with equanimity. But is this the case? Some of the older engineers, thoroughly experienced in the use of natural cement, can testify to the excellence of this material when properly handled. It has moreover some characteristics which portland cement does not possess. It is for one thing slow setting, and slow setting by nature and not by reason of artificial additions to the mixture. In the second place it lends itself readily to a number of uses to which portland cement is not by any means so well adapted. It works under the trowel like lime mortar, with a smooth, buttery consistency that conduces to good workmanship. Portland-cement mortar, on the other hand, has little consistency and it is very difficult to give it exactly the right texture to handle well with the trowel. A great deal of work has to be finished either too dry or too wet for the best results.

Again, natural cement has a record of experience back of it that is possessed by very few works in portland cement. It is true a great deal of the old works in natural cement were laid with an admixture of lime mortar. There are, however, plenty of old structures standing in the State of New York and elsewhere, which were built in the days when natural cement was practically the only reliance of the engineer and whose condition today gives eloquent testimony to the excellence of that material. In contrast with this must be placed some of the experiences in recent years in connection with the disintegration of certain structures built with portland cement. The cause of this disintegration is still a matter of controversy among cement experts.

Of course, it is believed that the causes of this disintegration will in time be discovered and removed; and we are by no means suggesting that portland cement does not fully deserve its present high reputation. It does seem worth while, however, for engineers not to lose sight of the merits and excellence of natural cement for works to which it is adapted. As we pointed out in the beginning, the great trouble is that if they continue to neglect the use of natural cement they will soon be in a position where they cannot secure this valuable material no matter how much they may happen to want it.

A Dangerous Attack upon Standard Time

Some of the older readers of Engineering News may remember the confusion that existed throughout the United States prior to 1883 with reference to time. Since the true astronomical time, measured by the movement of the sun, differs at every point on the earth's surface, every city and town, if it used the astronomical time for its own location, would have a time different from every other city not on the same meridian.

Up to the late '70's, nearly all the railways of the United States were comparatively small isolated lines. The general practice was for a railway to take the astronomical time of the city where its principal offices were located and use that time for all points along its line. Small towns and cities usually used the same time as the railway, but larger cities often used their own time for local purposes and it was common to hear "city time" and "railway time" referred to. Connecting railways at a junction point often used different times, so that in the same city three or more different times might be in use.

To the general public, this meant a vast amount of confusion and uncertainty. To the railways it meant, in addition, a very serious danger. There was always risk that some employee's watch would be by mistake set to some city time instead of railway time or that there would be confusion between the relative times of connecting railways.

When railway consolidation and expansion and the construction of the great transcontinental lines began, the absolute necessity for radical reform in the matter of time became evident. It was this, in fact, which first brought the railway companies together for general conference in an organization which was the predecessor of the present American Railway Association, and was for years known as the General Time Convention.

It is worth noting that the most influential figure in bringing about the adoption of the present system of standard time was an eminent civil engineer, Sir Sandford Fleming, of the Canadian Pacific Ry. Another who

deserves special credit for this great reform was also a well known civil engineer. Mr. W. F. Allen, who still continues his responsible work as General Secretary of the American Railway Association. The present system of standard time was the result of more than two years of thorough and careful study. It was adopted on Nov. 18, 1883, and for more than 30 years has continued in use. No one who realizes the chaos and confusion and danger that existed in connection with matters of time distribution previous to 1883 would dream of countenancing any movement that might cause a return to those conditions even in part.

On May 1, 1914, an ordinance became effective in the city of Cleveland which makes Eastern time, instead of Central time, the legal standard in that city. A traveler to Cleveland who sets his watch back an hour when he passes Buffalo, finds when he reaches Cleveland that he must set his watch an hour forward again to Eastern time. If this were all, it would be a local matter affecting Cleveland only; and so long as its citizens choose to put up with the annoyance and difficulties due to having local time one hour different from the time of the railways entering the city, it would be of little importance elsewhere. Cleveland, however, is bringing strong pressure to bear upon the railways entering the city to induce them also to change to Eastern time. Other Ohio cities seem to have a vague idea that there is something progressive involved in this change and are agitating for a similar action, and it is even proposed that the entire State of Ohio shall adopt Eastern time as its standard.

If this movement should be forced through—and there is danger that it may be, in view of the control over the railway companies now held by the State Railway Commissions—it will necessitate a complete revision of the points of change from Eastern to Central time all the way from the Canadian border to the Gulf of Mexico.

The executive committee of the American Railway Association has seen and realized the danger. In a report presented at the last meeting of the Association, the committee says:

> If the system of uniform standard time is to be changed in a way which may threaten its impairment or destruction, the final action taken should be at least as deliberate and unanimous as at the time of its adoption. Certainly individual railways or communities ought not to pursue a course which may be detrimental to other railways or to the public interest, without competent and careful consideration being given to the effect upon those interests.

It is difficult to see any justification whatever for Cleveland's action in changing its local time from Central to Eastern. If the motive in making the change was to give the city its true astronomical time instead of the standard railway time, then nothing has been gained. Cleveland is situated about midway between the meridians of 75° and 90° west of Greenwich, on which Eastern time and Central time, respectively, are correct. Thus, while the Central time is half an hour behind Cleveland's true astronomical time, Eastern time, which it has now adopted, is half an hour ahead.

We understand the argument brought forward in Cleveland is that in using Central time the day's work begins half an hour later than it should, and continues half an hour later in the evening. By the change to Eastern time, however, men now go to work half an hour earlier than Cleveland's true astronomical time, and quit half an hour earlier at night. If what the City wanted was to run on true astronomical time, then it should have adopted, not standard railway Eastern time, but a local time of its own, which, if made exactly half an hour different from the Central time, would have caused comparatively little confusion. If, however, the city wished to accomplish the thing it has now effected; to wit, to set the time of beginning and quitting work an hour ahead, it was not necessary to interfere with standard time at all, but simply order that factories and other places of work which now begin at seven o'clock, Eastern time, should start at six o'clock, Central time. The results obtained would have been absolutely identical with those that the present plan secures, and there would have been no upsetting of the system of railway standard time. It may be claimed that the unions and others would object to men being compelled to start work at six o'clock in the morning instead of seven, yet this is exactly what they are compelled to do by the change to Eastern time instead of Central time. Calling a horse by a different name does not change its color.

We hope the railway companies of Ohio, and the public authorities over them, will appreciate the dangers to the present satisfactory system of standard time which will result if railway-time standards in Ohio are changed to correspond to the whims of different localities. The matter of standard time is too serious and important, and is too far reaching in its effect to be a proper subject for municipal interference.

Letters to the Editor

Tidal Currents in the Cape Cod Canal

Sir—In your issue of Aug. 6, 1914, p. 321, you gave an interesting account of the opening of the Cape Cod Canal, and made reference to the operative problems that will be met in working a 100-ft. canal in a tidal current.

As you state in your article, the canal prism is not yet completed; for many reasons it was desired to commence operations before completion.

The canal is of special interest in connection with the study of hydraulics, inasmuch as it is perhaps the only waterway of comparatively uniform cross-section connecting open bodies of tide water with considerable difference in tidal elevations. It will provide a means of determining questions of flow of water through channels of large cross-section, which are hardly covered by the existing hydraulic formulas, necessarily based on canals of much smaller dimensions.

The tides in the two bays are substantially half tide apart; that is to say, when it is mean sea level on one end it will be high or low tide on the other, and the

maximum difference in both directions on mean tides is about 5 ft.

Until the canal is completed no final or accurate determinations of the velocity of the current are obtainable. First measurements made through that portion of the canal where the depth is the minimum and where consequently the total current for the moment is at the maximum, show a current at the top of the tide for the average cross-section of the canal of 2.47 knots, and with a current very much less than this in those portions of the canal where it is full depth, or where the width is in excess of the 100 ft. This, of course, disposes of statements which have found their way in the press of currents greatly in excess of the above.

When the canal is completed it is my intention to make a complete analysis of tidal conditions and currents and publish the same in a paper.

From July 30 to Aug. 16, although limitations to a draft of 15 or 16 ft. were placed upon the boats that could be passed through the canal, 188 boats used the canal exclusive of the contractors' plant, of which 166 went through under their own power and 22 in tow.

There is no erosion, the water in the canal being perfectly clear.

Wm. Barclay Parsons,
Chief Engineer, Cape Cod Canal.

New York City, Aug. 19, 1914.

Another Proportional-Flow Weir; Sutro Weir

Sir—The article by Prof. E. W. Rettger, "A Proportional Flow Weir," Engineering News, June 25, 1914, is of particular interest to the writer, and prompts him to call attention to a type of weir known as the Sutro weir, invented a number of years ago by the late Harry H. Sutro, and first applied to practical water measurement in October, 1908. A brief description and illustration of three of these weirs of one million gallons per day capacity each appears on p. 212 of the "Proceedings of the American Water Works Association," 1912, in a paper by F. H. Bruckenbach, describing the water-softening plant at Owensboro, Ky.

Owing to the sudden death of Mr. Sutro before any permanent record had been made of the calculations involved in the evolution of the mathematical expression for the shape of the weir opening, the benefit of his analysis of the problem was almost wholly lost. A number of weirs had been constructed, however, and were in use, and a carefully conducted test on one of small capacity showed the discharge to be in direct proportion to the head within an extremely small percentage of error. It thus fell to the writer's lot to analyze the problem anew and to derive the equation on which the shape of the curved side of the weir opening is based.

The Sutro weir differs from the shape suggested by Prof. Rettger only in two minor points. First, only one side of the opening is curved, the other being a straight vertical edge. Second, instead of employing the simple form in which the breadth of the opening approaches infinity as the head approaches zero, which shape, for obvious reasons, is undesirable practically, the base of the weir is limited to a convenient dimension and for a very small height the opening is rectangular. It has been found that for water the minimum height of this rectangle is about $\frac{1}{2}$ in.; for smaller heights the coefficient of discharge becomes erratic.

Referring to Fig. 1, the weir opening is seen to be bounded by the vertical sides AG and BD (BD being made as small as practicable), the horizontal crest AB, and the curved portion DFH above the rectangle $ACDB$.

Let Q_1 be the discharge through the rectangle $ACDB$ due to the head h above the top of the rectangle. Then

$$Q_1 = \tfrac{2}{3}\, b \sqrt{2g}\,[(h + a)^{\frac{3}{2}} - h^{\frac{3}{2}}] \qquad (1)$$

where a is the height of the rectangle. Next, consider a thin strip EF of thickness dy and length x, situated a distance y above CD; dQ_2, the discharge through this strip due to the head $h - y$, will be

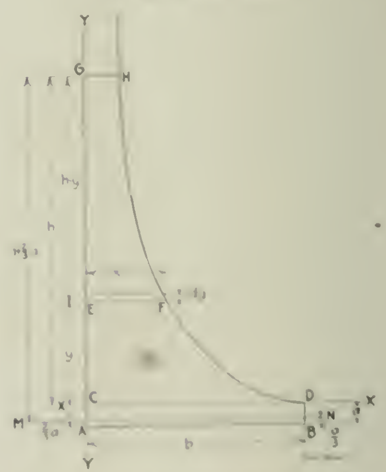
$$dQ_2 = \sqrt{2g}\,(h - y)^{\frac{1}{2}}\, x\, dy$$

The expression for the total discharge of the curved portion of the weir therefore is

$$Q_2 = \sqrt{2g} \int_0^h \sqrt{h - y}\; x\, dy \qquad (2)$$

If the total discharge of the weir be called Q, then

$$Q = Q_1 + Q_2 = \tfrac{2}{3}\, b \sqrt{2g}\,[(h + a)^{\frac{3}{2}} - h^{\frac{3}{2}}] + \sqrt{2g} \int_0^h \sqrt{h - y}\; x\, dy \qquad (3)$$



The object being to determine the shape of the weir such that the discharge is proportional to the head above a given datum line MN (Fig. 1), a general expression for the discharge Q is readily found. The datum line MN may be taken at any position between the base AB and the top CD of the rectangle. For convenience of calculation as well as of practical operation, the line MN is taken a distance of one-third the depth of the rectangle above AB.

The general expression for Q thus becomes,

$$Q = K\,(h + \tfrac{2}{3}\, a) \qquad (4)$$

where K is a constant whose value is to be determined.

Since the proportionality must hold at all points above the top of the rectangle $ACDB$, eq. (4) must hold when $h = 0$, in other words, when the depth of water is just equal to the depth of the rectangle.

Substituting $h = 0$ in eq. (3) and (4),

$$Q = \tfrac{2}{3}\, b \sqrt{2g} \times a^{\frac{3}{2}}, \text{ and } Q = \tfrac{2}{3}\, K a$$

whence

$$K = a^{\frac{1}{2}} b \sqrt{2g} \qquad (5)$$

Substituting the value of K in (4),

$$Q \tfrac{2}{3} b \sqrt{2g} \left(\tfrac{3}{2} h a^{\frac{1}{2}} + a^{\frac{3}{2}}\right) \qquad (6)$$

$$Q = \tfrac{2}{3} b \sqrt{2g} \left(\tfrac{3}{2} h a^{\frac{1}{2}} + a^{\frac{3}{2}}\right)$$

Equating the right-hand members of (3) and (6),

$$\tfrac{2}{3} b \sqrt{2g} \left(\tfrac{3}{2} h a^{\frac{1}{2}} + a^{\frac{3}{2}}\right) = \tfrac{2}{3} b \sqrt{2g} \left[(h + a)^{\frac{3}{2}} - h^{\frac{3}{2}}\right] + \sqrt{2g} \int_o^h \sqrt{h - y} \, . \, x dy$$

Transposing and simplifying,

$$\int_o^h x \sqrt{h - y}\, dy = \tfrac{2}{3} b \left[a^{\frac{3}{2}} + \tfrac{3}{2} h a^{\frac{1}{2}} + h^{\frac{3}{2}} - (h + a)^{\frac{3}{2}}\right] \qquad (7)$$

Expanding $(a + h)^{\frac{3}{2}}$ by the binomial theorem,

$$\int_o^h x \sqrt{h - y}\, dy = \tfrac{2}{3} b \left[h^{\frac{3}{2}} - \tfrac{3}{8} a^{-\frac{1}{2}} h^2 + \tfrac{1}{16} a^{-\frac{3}{2}} h^3 - \tfrac{3}{128} a^{-\frac{5}{2}} h^4 + \tfrac{3}{256} a^{-\frac{7}{2}} h^5 - etc.\right] \qquad (8)$$

It is evident that $x \sqrt{h - y}$ is identical with, and may be replaced by, a series which, where integrated with respect to y and after substitution of the limits, will give a resultant series identical with the right-hand member of eq. (8). It is evident on inspection that this condition is fulfilled when,

$$x = A_1 + A_2 y^{\frac{1}{2}} + A_3 y^{\frac{3}{2}} + A_4 y^{\frac{5}{2}} + A_5 y^{\frac{7}{2}} + etc. \qquad (9)$$

where A_1, A_2, A_3, etc., are constant coefficients whose values are to be determined.

Inserting this expression for x in $\int_o^h x \sqrt{h - y}\, dy$,

$$\int_o^h x \sqrt{h - y}\, dy = A_1 \int_o^h \sqrt{h - y}\, dy + A_2 \int_o^h \sqrt{hy - y^2}\, dy + A_3 \int_o^h y \sqrt{hy - y^2}\, dy + etc. \qquad (10)$$

Integrating separately each term of eq. (10),

$$\int_o^h x \sqrt{h - y}\, dy = \tfrac{2}{3} A_1 h^{\frac{3}{2}} + \tfrac{1}{8} \pi A_2 h^2 + \tfrac{1}{16} \pi A_3 h^3 + \tfrac{5}{128} \pi A_4 h^4 + \tfrac{7}{256} \pi A_5 h^5 + etc. \qquad (11)$$

It is seen that the powers of h (the only variable) in the right-hand member of eq. (11) are identical with the powers of h in the right-hand member of eq. (8); also that each of these series is equal to $\int_o^h x \sqrt{h - y}\, dy$, which justifies the use of eq. (9).

Equating the right-hand members of (8) and (11),

$$\tfrac{2}{3} b \left[h^{\frac{3}{2}} - \tfrac{3}{8} a^{-\frac{1}{2}} h^2 + \tfrac{1}{16} a^{-\frac{3}{2}} h^3 - \tfrac{3}{128} a^{-\frac{5}{2}} h^4 + \tfrac{3}{256} a^{-\frac{7}{2}} h^5 - etc.\right] = \tfrac{2}{3} A_1 h^{\frac{3}{2}} + \tfrac{1}{8} \pi A_2 h^2 + \tfrac{1}{16} \pi A_3 h^3 + \tfrac{5}{128} \pi A_4 h^4 + \tfrac{7}{256} \pi A_5 h^5 + etc.$$

Equating the coefficients and solving for A_1, A_2, A_3, etc.,

$$A_1 = b; \quad A_2 = -\frac{2}{\pi} a^{-\frac{1}{2}} b; \quad A_3 = \frac{2}{3\pi} a^{-\frac{3}{2}} b;$$

$$A_4 = \frac{2}{5\pi} a^{-\frac{5}{2}} b; \quad A_5 = \frac{2}{7\pi} a^{-\frac{7}{2}} b; \ etc.$$

Substituting these values in (9),

$$x = b - \frac{2b}{\pi} a^{-\frac{1}{2}} y^{\frac{1}{2}} + \frac{2b}{3\pi} a^{-\frac{3}{2}} y^{\frac{3}{2}} - \frac{2b}{5\pi} a^{-\frac{5}{2}} y^{\frac{5}{2}} + \frac{2b}{7\pi} a^{-\frac{7}{2}} y^{\frac{7}{2}} - etc.$$

$$= b - \frac{2b}{\pi} \left[\frac{y^{\frac{1}{2}}}{a^{\frac{1}{2}}} - \frac{1}{3} \frac{y^{\frac{3}{2}}}{a^{\frac{3}{2}}} + \frac{1}{5} \frac{y^{\frac{5}{2}}}{a^{\frac{5}{2}}} - \frac{1}{7} \frac{y^{\frac{7}{2}}}{a^{\frac{7}{2}}} + etc.\right] \qquad (12)$$

But,

$$\sqrt{\frac{y}{a}} - \frac{1}{3}\left(\sqrt{\frac{y}{a}}\right)^3 + \frac{1}{5}\left(\sqrt{\frac{y}{a}}\right)^5 - \frac{1}{7}\left(\sqrt{\frac{y}{a}}\right)^7 + etc. = tan^{-1} \sqrt{\frac{y}{a}}$$

Therefore,

$$x = b\left(1 - \frac{2}{\pi} tan^{-1} \sqrt{\frac{y}{a}}\right) \qquad (13)$$

which is the equation of the curve DFH with respect to the axes XX and YY.

To determine the shape of a weir of specified capacity either a or b, and h may be made suitable dimensions, and b or a found by substituting the proper quantities in eq. (1), Q_1 being proportional to the ratio of $\tfrac{2}{3} a$ to $(h + \tfrac{2}{3} a)$.

The values of all constants being known, values of x corresponding to given values of y may be found from eq. (13).

The Sutro weir has been used on a number of water-purification plants, being particularly adaptable to the control of proportional chemical-feeding devices. The patent is owned by L. M. Booth Co., of New York, on whose water softeners the weir is also used.

E. A. Pratt,
Assistant Chief Engineer, N. Y. Continental Jewell Filtration Co.
New York City, July 7, 1914.

A Wonderful Pump

Sir—If by chance you think that there are no brilliant mechanical minds in the wild and wooly West, the following item from a local paper will refute such a view:

> There is now being exhibited a new pump which the inventor, James Peterson, of Provo Bench, claims will revolutionize the pumping systems now in operation. This new invention is so constructed that the water in a great measure lifts itself. The pump is composed of two pipes or outlets, which act as a balance, and when in operation, the pumps will run with one-half the power that is necessary under the present systems in use. Demonstrations of the pump are now going on in different parts of the state. In speaking of his new invention, Mr. Peterson stated that his pump would lift 100 lb. of water with 50 lb. of energy, while with the pumping plants now in operation it takes 100 lb. of energy to lift 70 lb. of water. Mr. Peterson has also invented a new gasoline traction plow, which works on the principle of a spading fork.

If, as claimed, the pump will develop 200% efficiency, it is more than likely that it will indeed "revolutionize the pumping systems now in operation." Neither can the brilliancy be questioned of the idea of using water so that it, "in a great measure lifts itself."

L. M. H.

Provo, Utah, Aug. 14, 1914.

Gate Structures for Irrigation Canals—Concrete as a material for gate structures in American irrigation canals is beginning to displace wood, its durability overcoming the disadvantage of higher cost. Bulletin No. 115 of the U. S. Department of Agriculture purposes to submit to engineers such designs for gate structures for controlling the flow of water in ditches or canal systems as are adapted to different localities. Small and medium-size structures, for the most part, are described in the new bulletin. It does not attempt to exhaust the subject, but merely gives examples of structures which have satisfactorily served the purpose for which they were erected. As regards material the opinion of the investigator seems to be that a structure of combined wood and concrete, using the latter for inaccessible parts and wood for easily replaced parts, is the best practice.

Righting a Tilted Grain Elevator

SYNOPSIS—The Transcona grain elevator of the Canadian Pacific Ry. has a storage house about 200x75 ft., consisting of 65 bins 93 ft. high on a foundation slab, all of monolithic reinforced concrete. This structure, weighing some 20,000 tons, settled on one side till it stood at an angle of 27°, because of compression of soft strata. Concrete piers have been sunk to rock to form a secure foundation, and by excavating beneath the high side the structure is being righted so that it will come to rest on these piers, but at an elevation lower than its original level. Similar foundation piers have been put under the adjoining working house of the elevator, the foundation which did not settle.

The extraordinary case of the settlement and tilting of the storage-bin section of a large grain elevator near Winnipeg, until it stood at an angle of about 27° from

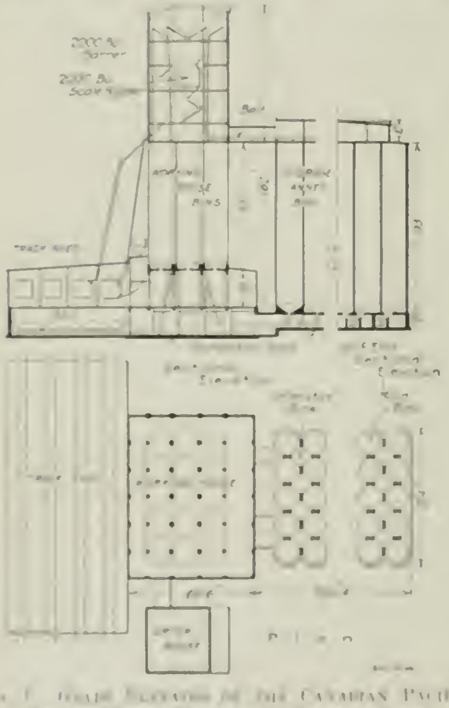


FIG. 1. GRAIN ELEVATOR OF THE CANADIAN PACIFIC RY. AT NORTH TRANSCONA, SHOWING THE ORIGINAL SLAB FOUNDATIONS

the vertical, was described in our issue of Nov. 6, 1913. We are now able to give some information as to the methods employed to check further movement, to restore the structure to a vertical position, and to place it on more stable foundations.

The grain elevator in question is that of the Canadian Pacific Ry., located at North Transcona, 4½ miles east of Winnipeg. It consists of two units, the working house, containing the cleaning, weighing and other machinery, and the bin house or the annex, consisting of the storage bins proper. The latter is the part which gave trouble. The structure was built by the Barnett-McQueen Co., of Fort William, Ont., in 1912, and was put into service in September, 1913. The entire structure is built of reinforced concrete, with the exception of a few brick curtain walls in the working house. Its construction is shown in Fig. 1.

The working house is 44x90 ft. in plan, and is 162 ft. high from the base of rail to the roof. It is provided with a 16-ft. basement in which the belts for transferring the grain from cars to conveyor boots are located, together with belts for transferring the grain from the annex to the working house. The first section of 20 ft. above ground is occupied almost entirely by the cleaning machines. Above this point there are 15 bins 13 ft. diameter, 70 ft. high, surmounted by several floors containing the garners and weighing machines, together with the necessary machinery for loading grain into cars. The general design is shown in Fig. 1.

The bin house consists of 65 circular bins 14 ft. 4 in. diameter, and 48 diamond-shaped bins occupying the spaces between the circular bins. The bin bottoms were originally at about ground level. All bins are 93 ft. high, and are surmounted by a cupola 10 ft. high, making the original height of this structure from ground level to roof about 103 ft. The bin walls are of concrete 6 in. thick, reinforced for bursting pressures and for vertical loads. The storage capacity is 1,000,000 bushels.

As regards the foundations, each of these buildings originally rested on a reinforced-concrete mat, designed to spread the loads over the entire area occupied. The under side of the mat of the working house was at a depth of about 15 ft. below ground level, while that of the bin house was 10 ft. below ground level. These foundations were independent of each other.

Borings were taken immediately after the failure and the soil found to be of a very treacherous nature, consisting of blue clay to a depth of 41 ft. below ground level. The upper 33 ft. of this clay was fairly stiff, but the lower 8 ft. was very soft and contained a great deal of water. Below the clay, from about 41 ft. to 50 ft. below ground level, was found gravel, together with a whitish clay which was very soft and contained a great deal of water. From 50 ft. to a depth of 55 ft. below ground level was found a layer of disintegrated limestone, and below this was bedrock.

These soil conditions appear to prevail over the entire district, and from work which has been done on the Red River at Winnipeg and on the same river at Kildonan it would appear that the bed of clay is very uniform in thickness. Load tests made before construction indicated that the soil could carry a load of 4 to 5 tons per sq.ft., while the actual load under the building was only about 3½ tons per sq.ft.

The elevator was first put into operation in the fall of 1913. In October, when the bin house is said to have contained 875,000 bushels of grain, a slight settlement was noticed but this was not of a serious nature. About Oct. 17, the settlement became very serious, and it is said that the building settled vertically a distance of nearly 1 ft., at which point it began to cant over in an easterly direction. The settlement continued for about

24 hr., until the whole building was leaning at an angle of about 27° from the vertical, and the westerly side of the foundation mat had sunk to an average depth of 29 ft. below its original elevation. At this point, movement ceased, the lower side of the mat having reached a stiffer stratum of the soil.

Fig. 2 shows the condition of the building after settlement, the conveyor cupola and roof structure having fallen off. At the right is the working house, with its track shed. Holes were cut in the bins and the grain removed, being delivered to cars by a temporary belt conveyor.

Strange to say, the working house was not seriously affected by the movement of the soil under the bin house. It suffered no damage beyond a few cracks in the walls adjacent to the annex, and there are no records which would show that any settlement took place in this building.

Soon after the failure, the Foundation Co., of Montreal, was called in to devise a scheme for underpinning the working house, the foundations for which it was feared might fail. That company was also asked to consider various means by which the bin house itself might be righted and restored to service.

After a number of conferences between the railway company's engineers and the officials of the Foundation Co., it was decided that the working house should be underpinned immediately by means of piers carried to bedrock. It was decided also that it was quite practicable to shift the bin house back into a vertical position, and when the actual moving was completed, to underpin it also by means of concrete piers carried to the rock.

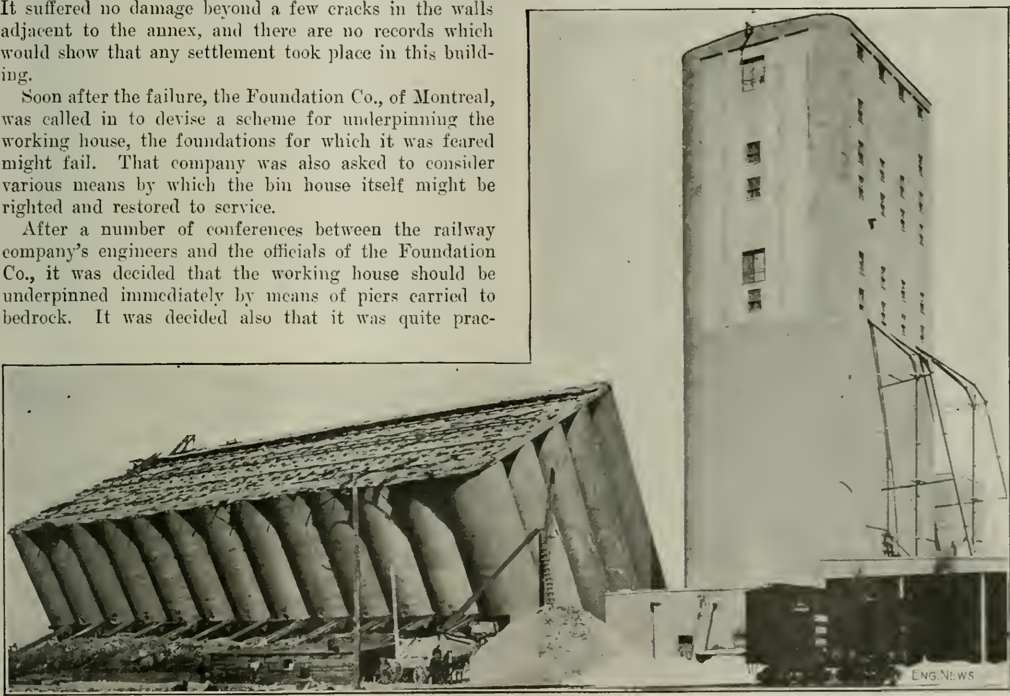


Fig. 2. The Storage Section or Bin House of the Elevator in Its Tilted Position, with Shoring in Place. At the Right Is the Working House

Underpinning the Working House

In January last, work was commenced on the underpinning of the working house. The scheme decided upon was to sink a pier under each column of the building. On account of the height of the building and the heavy column loads, it was necessary to shore the building completely before attempting to excavate under the columns themselves. In order to provide supports for the shoring, 16 small piers were sunk along the outside walls of the building, these piers being arranged to take the heels of the pusher timbers and to serve afterwards as supports for the outside walls.

At the westerly end of the building, four piers were sunk to rock in order to take the loads from the pushers at this point, these piers being located in such a position that they would serve as foundations for the columns of a possible future extension. A very complete system of heavy timber shoring was then installed, consisting of sets of 12x12-in. pushers heeling on the piers previously sunk and catching the heads of the columns immediately under the bin floors (Fig. 3). These timber pushers, together with the columns, the bin floors, and the foundation mat, formed a very effective truss system by which the load of the building could be transferred to the temporary piers.

Of the shoring piers above described, the first eight (located at the four corners of the building) were built by means of sectional cast-iron cylinders 4 ft. diameter, sunk to rock by excavating the material from the inside in the manner usually employed in sinking caissons. The shoring carried by these eight piers was then installed so as to give the building sufficient support to permit of the balance of the piers being put down as open wells with wooden sheeting held in place by interior iron rings, commonly known as the Chicago method. The piers inside the building were then commenced and were carried to rock by the Chicago method.

In order to get access to the under side of the columns for the purpose of sinking these piers, it was necessary to cut through the floor of the building adjacent to the column footings and to sink small shafts from which short tunnels were run to points directly underneath the columns. Fig. 3 shows the layout of the piers and the

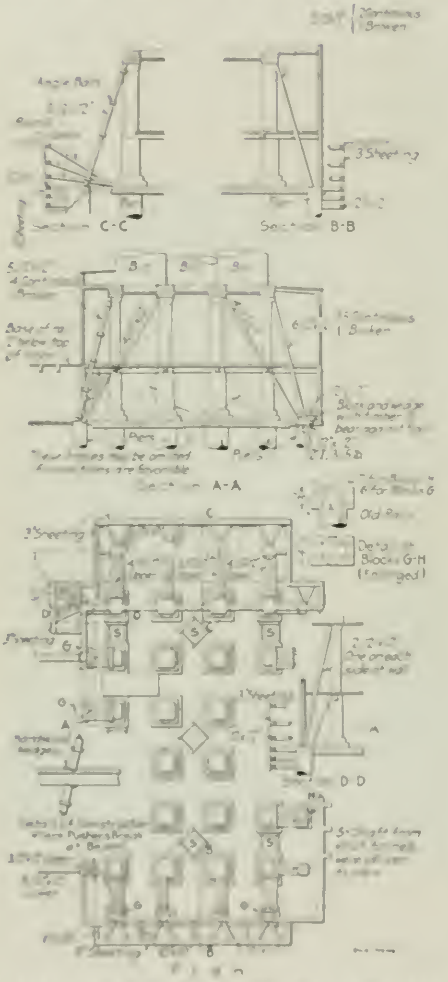


Fig. 3. Underpinning the Foundation of the Working House with Piers Carried to Rock

methods used in shoring the building, together with the location of the shafts and tunnels to the piers.

STRAIGHTENING THE BIN HOUSE OR ANNEX

Upon the completion of the underpinning of the working house, steps were taken to commence the work of straightening the bin house. In general, the scheme which is being adopted consists in righting the building by excavating the earth under the high side. It is expected that it will be quite practicable to bring the building back to a vertical position, although the structure will then be at a lower elevation than when first built. This fact, however, will not interfere with the operation of the elevator.

As stated above, it is the intention to provide new foundations for the bin house, these to consist of piers 7 ft. diameter, spaced approximately 15 ft. c. to c., and carried to rock. Fig. 4 shows the layout of these piers and shows also in general the position that the structure is expected to occupy after the completion of the turning movement. On all interior piers which are located under the "contacts" between the bins, the upper section of the pier is made 7 ft. square, so as to enable the loads to be properly transferred to the piers through the walls forming the passages underneath the bins. The exterior piers are provided with a corbel, heavily reinforced, so as to take the loads from the overhang of the bins, this corbel being extended about 4 ft. beyond the inner edge of the pier so as to minimize the effect of eccentric loads on the pier itself.

Fig. 5 shows the condition of the bins at the commencement of the turning operations, which were proceeded with in the following manner: A trench was first excavated along the high side of the building and along the ends, this being stepped off at the natural slope of the soil, and being carried to a depth sufficient to enable excavation to be carried on underneath the mat. The surplus material from this excavation was handled by means of dump wagons.

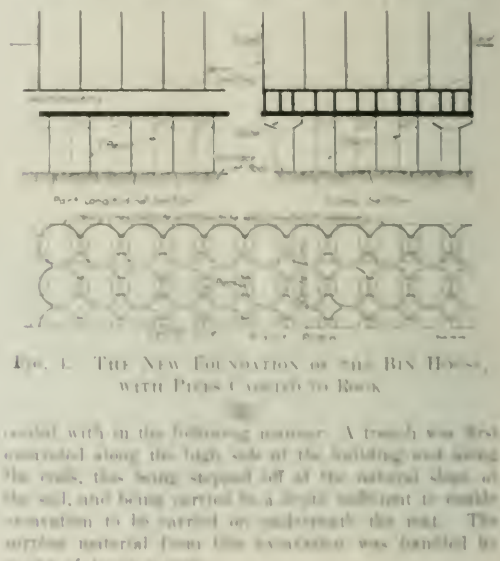


Fig. 4. The New Foundation of the Bin House, with Piers Carried to Rock

Work was then commenced on the sinking of the line of piers along the low side of the building, it being the intention to block the building temporarily from these piers so that they would form a fulcrum about which the structure might be rotated some 35°.

Excavation was then commenced under the mat itself, being carried out in the form of drifts, driven transverse to the longitudinal axis of the building, leaving a triangular core of earth between adjacent drifts. It was the intention that as the mat was dropped this triangular core would offer increasing resistance to the movement and that the whole operation could be controlled by gradually cutting away the earth from the sides of this core. The surplus material from the excavation under the mat was removed by means of belt conveyors, one of which is clearly shown in Fig. 5. The condition of the building preparatory to making the first movement is shown at the left in Fig. 6.

While work was being done on the line of piers under the low side and while the drifts were being driven under the mat, work was rushed on all of the other piers, it being the intention to have the piers completed before the structure had moved through the first 15°.

These piers under the annex are being sunk by the Chicago method, that is, by sinking open wells, with wood sumps from which the water could be handled by centrifugal pumps, thus materially lowering the general groundwater level.

At the end of July, 85% of the piers had been sunk and concreted and the building had been rotated about the low line of piers at the rate of about 4 in. per day, the total drop at the high side of the mat being about 5 ft.

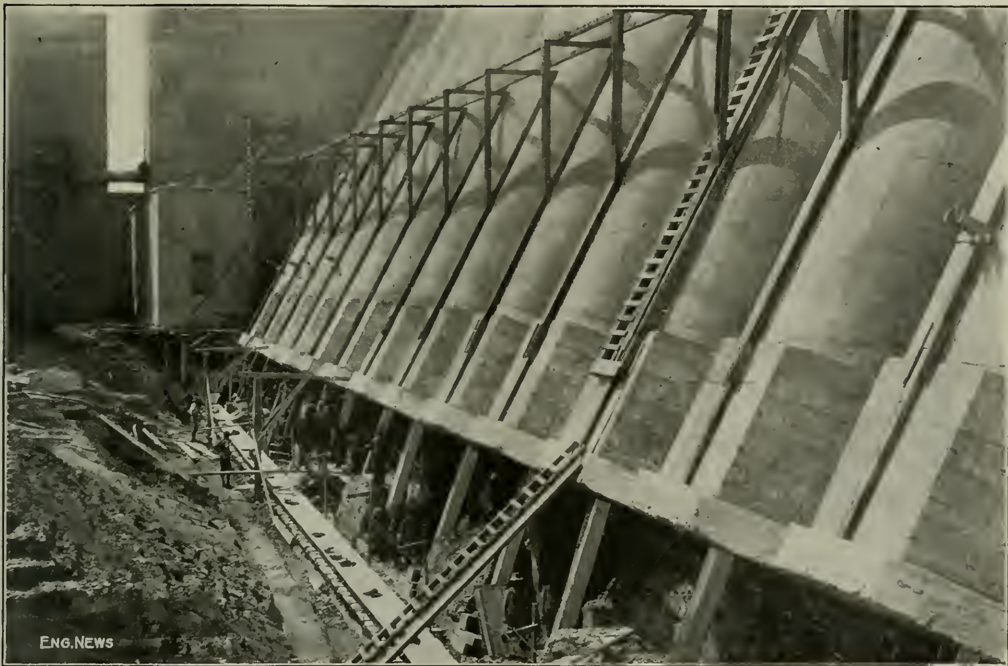


Fig. 5. Preliminary Excavation under the High Side of the Tilted Bin House of the Transcona Elevator, Canadian Pacific Ry.

lagging held in place by iron rings, which are removed as the pier is concreted. Considerable difficulty was experienced in the sinking operations on account of the large volume of water encountered in the gravel overlying the rock. This difficulty was more pronounced in the case of the first piers sunk, but the water was successfully controlled by using some of the piers as temporary The movement of the building is being controlled by the earth cores assisted by shoring screws and short posts under the mat, as indicated at the left of Fig. 6.

As stated above, it is the intention to thus drop the building about the line of piers under the low side through 15°, which will bring the structure into the position shown at the right of Fig. 6. This being accomplished, it is anticipated that the balance of the turning movement can be made about the center line of piers, the load being controlled by means of groups of heavy jacks on the two lines of piers under the low side. This arrangement is shown clearly in Fig. 6.

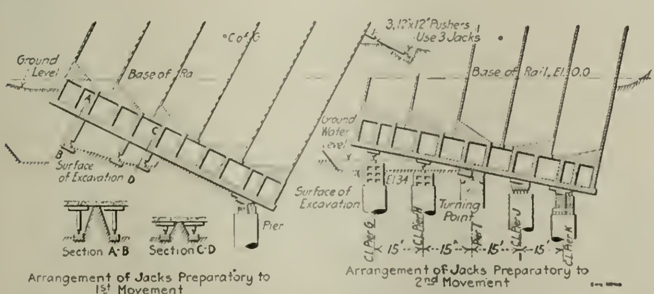


Fig. 6. Methods of Restoring the Storage House to a Vertical Position (but at a Lower Elevation)

During the progress of the work, it has been found that the movement of the structure can be controlled perfectly in the manner outlined above, and thus far the work has been entirely successful. Naturally in an undertaking of this kind, it is necessary to move carefully step by step, and in shifting a weight of some 20,000

tory, it has been deemed advisable to move very slowly and to anticipate as far as possible all points at which trouble may develop. We are informed that it now seems assured that the building can be straightened, and that all operations can be carried out substantially as originally planned.

The underpinning and straightening operations are being carried out by the Foundation Co. (Limited), of Montreal and Vancouver, Canada, and we are indebted to that company for information and drawings. The work is under the direction of J. G. Sullivan, Chief Engineer of the Canadian Pacific Ry. (at Winnipeg); and Frank Lee, Principal Assistant Engineer, is in charge of the work for the railway company.

In this connection, we may refer to the similar settlement of a reinforced-concrete warehouse building in Tunis (Africa), which was righted somewhat in the same way as described above, assisted by loading the high side of the floors. In this case, the building when righted stood at an elevation 15 ft. below its original level. This work was described in ENGINEERING NEWS, Apr. 25, 1907.

An Air-Lift Pump with "Booster" for Horizontal Delivery

A water-supply independent of the city mains was desired by the Fort Pitt Brewing Co., of Sharpsburg, Penn., and to meet this requirement it was decided to sink wells along the bank of the Allegheny River. There are three wells, 150 ft. apart. The nearest is about 1350 ft. from the [illegible] at the plant, and as the water was to be raised by the air-lift system some special means was required to force the water horizontally for this distance. For this service an air "booster" is employed. From the cistern a high-pressure pump delivers the water to an elevated tank.

The air-lift adopted is of the Sullivan type, in which a thorough mixture of the air and water is aimed at. This is considered to give less slippage of air and consequently higher efficiency, than the original Pohle plan of alternating "plugs" of air and water. The air (at 34 lb. pressure) is carried down outside the well casing in a 1-in. pipe, which at the bottom enters the elbow of the foot-piece or nozzle within the pipe. This nozzle, Fig. 2, is about 12 in. high, $1\frac{1}{2}$ in. inside diameter and it is pierced with rows of holes $\frac{1}{4}$ in. diameter, having an

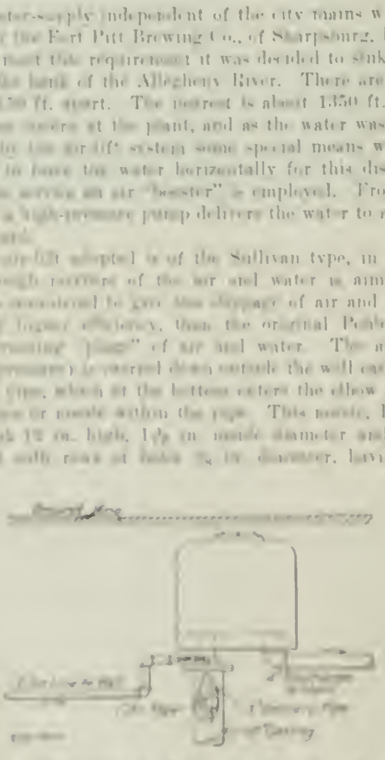


FIG. 1. BOOSTER AT HEAD OF AIR-LIFT WELL TO FORCE WATER THROUGH 1350 FT. OF HORIZONTAL PIPE

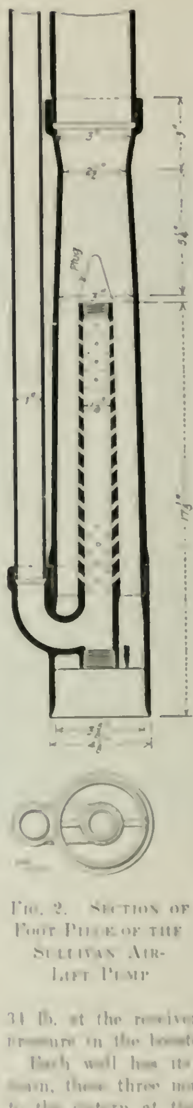


FIG. 2. SECTION OF FOOT PIECE OF THE SULLIVAN AIR-LIFT PUMP

upward inclination of 15°. There are four holes in each circle.

This arrangement insures a very thorough mixture of the air with the body of water. Above the nozzle the 3-in. delivery pipe is reduced to $2\frac{1}{2}$ in. diameter in order to increase the velocity, and above the foot-piece the diameter is increased to reduce the velocity at discharge.

The "booster" at the head of the well is shown in Fig. 1. It consists of a cast-iron chamber 30x30 in. with bottom connections to the well-delivery pipe and the discharge main. The delivery pipe extends up into the chamber and the stream of air and water discharged from it strikes a mushroom plate, which aids in the separation of air from the water. The end of the discharge main also extends up into the chamber and has its end slotted, while a drop pipe or sleeve over this end compels the water to pass upward before entering the pipe. A baffle-plate checks the splashing, and maintains comparatively still water around the discharge.

There is an open exhaust for the released air to escape to the atmosphere, but this is throttled by a valve so as to retain sufficient pressure above the water in the chamber to force it through the discharge pipe to the required distance. With the exhaust pipe full open it will discharge air and water, but the valve is closed until only air escapes. The operating pressure is 34 lb. at the receiver of the compressor, and the back pressure in the booster chamber is about 11 lb.

Each well has its own booster, and 4-in. discharge main, these three mains connecting with an 8-in. main to the cistern at the plant, where it discharges under water. The capacity of the cistern is about 18,000 gal.

Air is supplied by a straight-line compressor having a steam cylinder 12x12 in. and an air cylinder 14x12 in. This runs at 116 r.p.m., with a piston displacement of 248 cu.ft. of free air. The guaranteed capacity of pumping was 150 gal. per min., but the actual delivery (of the three wells) is 240 gal. per min. The theoretical horse-power is 10 hp., and with 26 i.hp. in the steam cylinder the efficiency (or relation of i.hp. to work done) is 40%.

The wells are 115 ft. deep, 10 in. diameter for 66 ft. and then 8 in. to the bottom. The strainer, which is located at the bottom of the 10-in. casing, is 10 in. diameter and 15 ft. long. The pumping head in the wells is 40 ft., and the elevation above the wells (including friction) is 15 ft., making a total lift or head of 55 ft. The

submergence of the foot-piece is 75 ft., or 58% of the depth.

Fig. 3 shows one of the boosters as installed temporarily, with the air-exhaust pipe extending above it. When completed, each booster and its pipe will be inclosed in a concrete chamber beneath the ground, the exhaust pipe being bent to discharge downward within the chamber.

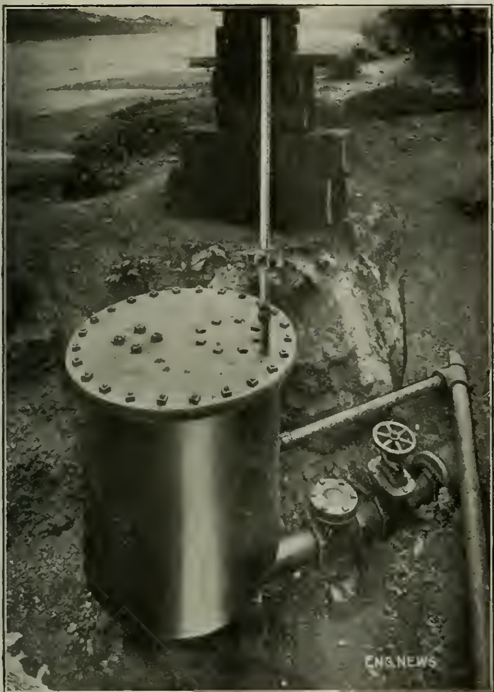


FIG. 3. BOOSTER CHAMBER ON AIR-LIFT WELL AT SHARPSBURG, PA.

The plant was designed by the Federal Engineering Co., of Pittsburgh, of which J. R. Kommer is President. The contract for the air-lift system and compressor was awarded to the Sullivan Machinery Co., of Chicago, and the details were worked out by John Oliphant, of that company, to whom we are indebted for plans and information.

Type of Boats for the New York State Barge Canal

The completion of the New York State Barge Canal is still some years away, but the prospective opening of certain branches is near enough to make necessary the consideration of the type of boat which will be best suited to the canal. A recent statement by the State Engineer and Surveyor, John A. Bensel, indicates that some difficulty is being met in planning the proper type of tow boats and barges. In the *Barge Canal Bulletin*, July, 1914, Mr. Bensel says:

A western manufacturing company, desirous of obtaining its raw material at a minimum of cost and of lessening freight charges on that portion of the finished product shipped east, recently made an investigation as to the comparative costs of rail- and water-borne transportation. The company found that it would not be desirable or economical to break bulk at any intermediate port and that the cargo vessel must be specially adapted, not only for safe carriage, but for cheap and rapid loading and unloading alongside warehouses or vessels.

The ship builders have found it impracticable to design a steamer that will satisfy the requirements of the Federal government for steam craft navigating the Great Lakes and also to keep within the limitations imposed by the Barge canal, such as restricted clearance of 15½ ft. under bridges and other fixed structures, at high navigable stage, the narrow width of 75 ft. in land sections and shallow depth of 12 ft.

The most promising solution of the problem for the company thus far devised is a fleet of two barges each 300 ft. in length and 40 to 43 in width, with an equal number of barges about 250 ft. long with 35 to 40 ft. beam, together with the requisite number of tugs about 50 ft. long, to tow one large and one small barge through the canals, and large sized lake tugs to tow a fleet of barges through the Great Lakes and rivers.

Boats having about 40 ft. beam cannot meet nor pass in the land sections of the canal where the bottom width is 75 ft. Numerous passing basins, where the canal prism is widened to at least 100 ft., will be necessary, if large sized boats are allowed to navigate the canals. Several such basins have already been constructed and there are also some natural formations of wide waters. Boats 300 ft. long can make all the curves in the canals, but as they will take up full width of channels while rounding the worst bends, they may have to slow down to a speed of about two miles an hour at those places.

It is likely that the largest number of vessels that will be built for canal use will be for fleet service and will be about 150 ft. long with a 22-ft. beam, that size permitting lockage of four at one time, one of the four being a power boat.

Another type of boat that will be used will be about 300 ft. long, the beam being from 40 to 43 ft. This type will probably be used for service on the Great Lakes. Undoubtedly most of the new boats will be of steel construction.

In vessels having a length of 300 ft., freight will be carried cheaper through the canal than in boats of smaller size. A single steamer could make better time through the new canal than a fleet of smaller boats.

Navigation of the land sections of the canal will probably be restricted to a maximum speed of about six miles an hour. The time for a single lockage will probably average 20 minutes.

A single steamer, while traffic is comparatively light, will make the run from Buffalo to Waterford in about 55 hours, but the average time will be about 72 hours for the 350 miles. In the Hudson River the time from Waterford to New York will be about 15 hours for the 150 miles.

Notes from Engineering Schools

A correspondence school for electric-railway men is being planned between the American Electric Railway Association and The International Correspondence Schools, Scranton, Penn. The courses will show general separation into mechanical- electrical- and civil-engineering branches—one being for young men in the shop, another for employees of the track and structures departments, and the third for those in power-house, substation and line work.

MUNICIPAL UNIVERSITY OF AKRON—A college of engineering has been established and five-year coöperative courses will be given. Applicants for entrance have been assigned to preliminary shopwork for this summer; regular instruction will begin in September. As usual, the students will be grouped in two sections alternating at work (commercial employment) and under instruction. Each school year will cover eleven months, one week vacation being allowed at Christmas and three weeks in late summer. Degrees of M. E. and C. E. will be given.

NEWS NOTES

A Tornado [illegible] Wilkes-Barre, Penn., on Aug. 2[illegible], killed five persons, injured [illegible] more and wrecked about [illegible]. The damage was confined to an area four blocks square.

Gas Explosions in Three Manholes at the foot of Market St., Philadelphia, on Aug. 1[illegible], lifted the covers with such force that one was broken when it struck the under side of the elevated-railway structure.

Many Forest Fires are raging in Montana and northern Idaho. Press dispatches state that more than 2000 national-forest fires have occurred this season, of which 1[illegible] have been in Montana and Idaho, 2[illegible] or more in California, and [illegible] in Oregon and Washington.

A Steamship Collision between the "[illegible]" of the [illegible] Transportation Co., from New York to Baltimore, and the British steamer "Westland" from Antilla to New York, occurred about 17 miles above the Northeast End Lightship off the Delaware Breakwater on Aug. 18. The bows of both vessels were damaged, but not seriously.

A Large Gasoline Tank Exploded in a garage in McConnelsville, Ohio, on Aug. 17, killing five persons and seriously injuring three others. The accident was caused by a spray of gasoline from the tank contacting with the hot engine of an automobile. All but one of the victims were in the garage at the time.

A Steel Lath-and-Plaster Ceiling Collapsed in the main operating room of the Keystone Telephone Co., Philadelphia, Penn., on Aug. 16, burying [illegible] telephone girls. Press dispatches state that firemen who examined the ceiling after its collapse stated that the plaster was spread too thickly over the laths, its weight pulling out the staples which supported the laths.

A Brick Foundation Wall Was Pushed In by earth pressure on the outside, at Allston, Mass., on Aug. 21, killing two men and severely injuring four others. The wall section which collapsed was about [illegible] ft. long by 10½ ft. high. A space [illegible] ft. wide between the wall and the sidewalk, and [illegible] were filling [illegible] space with [illegible] dirt when the accident occurred. A block of one-story stores is being erected on the site.

Broken Sewer Floods Montreal Subway Undercrossing—A [illegible] on Mill St., early in the morning of Aug. 16, broke the sewer from the Pointe St. Charles district in Montreal, [illegible]. The Wellington St. undercrossing [illegible] mile distance was flooded as a result and traffic was stopped there until [illegible]. The street [illegible] broke two [illegible] water mains [illegible] were shut off within a couple of hours. A new sewer is being placed on Mill St. parallel to the old one and at the point of the collapse the trench was open to a depth of [illegible] ft.

Two Building Collapses [illegible]

[illegible]

An Unexpected Loading [illegible]

[illegible]

and the rails, which fell in 2[illegible] ft. of water, have all been recovered.

Chinese Builders Win Hawaiian Contract—The War Department, Washington, D. C., awarded the contract for the construction of part of the army hospital at Fort Shafter, Hawaiian Islands, to a Chinese firm, on July 29. This is said to be the first time on record that the U. S. Government has let such a contract to a foreign firm, especially to Chinese, who are prohibited from competition with American labor in the United States. The Chinese firm was the lowest bidder for the hospital, at $119,[illegible].

A Municipal Coal Mine—The City Council of Sydney, N. S. W., has adopted a report of the city electrician, according to "The Commonwealth Engineer," to acquire a coal mine, for the use of the department, within a radius of 70 miles by rail from Sydney, and a reasonable distance from the seaboard. During the year 1913, the city paid £28,[illegible] for the coal used at powerhouses. It is estimated that this will increase to an annual charge of £50,000 in two years. It is stated that no proposition will be considered for a mine with less than 10,-000,000 tons in reach.

The Bureau of Public Utilities Research, proposed by Director of Public Works Morris L. Cooke of Philadelphia, and Mayor Blankenburg, is receiving wide support. A convention to organize the movement, to which representatives of city governments throughout the United States will be invited to send delegates, will probably be held in Philadelphia Nov. 12 to 14 next. The Bureau will have as initial trustees, Louis D. Brandeis, lawyer, of Boston; C. R. Van Hise, President University of Wisconsin, Madison; S. S. Fels, manufacturer, Philadelphia; F. W. Taylor, consulting engineer, Philadelphia; F. A. Cleveland, Director Bureau of Municipal Research, New York City; L. S. Rowe, Professor of Political Science, University of Pennsylvania, Philadelphia; C. F. Jenkins, publisher, Philadelphia; Felix Frankfurter, Professor of Law, Harvard University, Cambridge. (See "Engineering News," July 2, 1914, for outline of aims of this bureau.)

The Concrete Eating Crawfish has now arrived to rival the oft-heralded steel worm that devours railway rails. The Kansas City, Mo., "Star" of Aug. 11 tells all about him in the following words:

> A persistent crawfish found no difficulty in [illegible] the supposedly solid concrete floor of a sewer built by W. C. Mellies, president of the Kansas City Concrete Pipe Company.
>
> The picture [shown in the original, a pen and ink sketch of a sewer section some [illegible] ft. in diameter with a [illegible] crawfish of chicken lobster size in the immediate foreground —Ed.] was introduced as evidence in the taking of depositions in the damage suit of the Kansas City Concrete Pipe Co. against The Star.
>
> The sewer was a [illegible] concrete sewer on Brookside Boulevard, south of Sixty-[illegible] St.
>
> The "crawdad" had scooped out a large amount of concrete in its journey through the concrete wall.
>
> A hole made by another one of the [illegible] a block and a half away under similar conditions.
>
> It is to be hoped that the crustaceans do not travel in [illegible] battalions.

Flood Protection Work at Lafayette, Ind., [illegible] The Brown St. bridge [illegible] washed out by the flood of 1913, [illegible] The Main St. bridge [illegible] construction will probably be completed by the end of the year. This bridge consists of steel girders [illegible] concrete, replacing the old Whipple truss spans. [illegible] length in order to provide additional waterway, and the floor is [illegible] ft. above the original elevation.

The [illegible]

The Rebuilding Commission at Salem—At Salem, Mass., a good work is going forward under the direction of the Rebuilding Commission. [illegible] of fireproof building materials is being held and every effort is being made to develop a better understanding of the essentials of fire-resisting construction.

A great deal of space at the exposition is given over to educational work directed toward a more intelligent use of building sites. Many slides are exhibited to show the owner the best way he can use the typical [illegible]-ft. lot in Salem, how he can join with his neighbors to so place their dwell-

ings as to get a maximum of light, air, yard, etc. The Commission is directing an able campaign against the notorious "three-decker," showing how better two-story dwellings affording more room than the "three-decker" can be built at comparative cost and in the same space. The exhibition includes drawings and photographs and perspectives of some of the best known recent work in housing development. The work of this Rebuilding Commission is of great interest, showing how the community spirit, awakened and well-directed, can make for better living.

The Inter-River Drainage District of Missouri, comprising 127,500 acres, lying in Butler County, between the Black and St. Francis Rivers, has had plans for drainage and flood protection made for it by the Morgan Engineering Co., of Memphis, Tenn. The plans have been adopted by the Board of Supervisors of the District. A large percentage of the area outlined is subject to overflow from both of the rivers named. The works proposed include 58 mi. of levees, which would require 2,500,000 cu.yd. of earth. The levees would have a top width of 6 ft., side slopes of 2 to 1, and would average from 8 to 11 ft. in height. Dipper dredges could be used in the construction of the greater part of the levees, as also in the construction of a proposed system of ditches. The ditches would have bottom widths ranging from 12 to 55 ft., and depths of from 7 to 13 ft., and would aggregate 208 mi. in length. The ditch excavation would run up to some 8,000,000 cu.yd. of earth. For highway intersections 55 wooden bridges are proposed. The estimated cost of carrying out the project is about $1,250,000, or an average of $10.25 per acre of land benefited. The engineers named have completed the location survey for the ditches and leves, and assssors have been appointed for assessing the cost. As soon as the assessment roll is completed and confirmed by the court, which will probably be in about six months, it is expected that contracts will be let.

A New Passenger Station at Pocatello, Idaho, is to be built for the Oregon Short Line R.R., at a cost of $150,000 for the building and concourse and $175,000 for passenger yard trackage and other facilities. The station and tracks are at the street level. The building will be at the side of the tracks and 32 ft. from them, the intervening space being the concourse, which will be covered for a width of 22½ ft. The building will be 225 ft. long The central portion, 90x77 ft., three stories high, will have on the first floor the main waiting room (86x40 ft.) with ticket office, baggage checking counter, etc. The wings are 68x60 ft., two stories high, one containing the baggage and express rooms and the other containing the dining and lunch rooms. The upper floors will be occupied by the railway offices. There will be a hot-water heating system.

The building will be of fireproof construction throughout. The exterior will be of grey stone for the first story, and the upper stories will be of dark red brick, laid in ornamental pattern, with cut stone trim. The roof will be of asbestos shingles. The building was designed under the direction of E. E. Adams, Consulting Engineer of the Union Pacific System, and the construction work (which will be started at once) will be under the charge of Carl Stradley, Chief Engineer of the Oregon Short Line R.R. The architects were Carrere & Hastings, of New York, and the contract has been let to the Lynch-Cannon Engineering Co., of Salt Lake City, Utah.

The Need of an Investigation of an Additional Water-Supply for Philadelphia has been questioned by John C. Trautwine, Jr., formerly Chief of the Bureau of Water, in an open letter to Morris L. Cooke, Director of Public Works. Mr. Cooke some time ago asked the city council of Philadelphia for $15,000 to study the water-supply problem of Philadelphia, with special reference to an additional supply, including possible recourse to other sources than the present Delaware and Schuylkill River intakes within the city limits. Mr. Trautwine, in his open letter to Mr. Cooke, says:

(1) The works are now pumping, filtering and distributing at least twice as much water as the people can use and enjoy, and at least half of that water is thrown away, unused, by about one-fifth of the population, who thus victimize the other four-fifths.

(2) The waste could be stopped, the supply thereby rendered abundant, the use of water by the people increased, the quality rendered ideal, the cost diminished, and the present works relieved from overstrain, for a fraction of the amount which it is now proposed to expend immediately for works which would not then be needed. This would postpone, perhaps for twenty years, all necessity for enlarging the works.

(3) The water, brought to the city's present intakes by the Delaware and Schuylkill rivers, is absurdly ample for a dozen cities like Philadelphia.

(4) Therefore it is not necessary to seek other sources of supply; and no commission of experts is necessary to find out what is the matter with the city's water-supply.

In support of his contention, Mr. Trautwine quotes as follows from Director Cooke's reports for the years 1911 and 1912:

We are undoubtedly fortunate in lying at the junction of two such magnificent waterways as the Delaware and Schuylkill. But it is not wise to allow this good fortune to be given as an excuse for a profligate waste of water—a waste certainly amounting to one-half of all we use.

From a study of the results obtained from other cities, there is hardly a doubt that, if meters were placed on those properties wherein waste is detected, the consumption would be so reduced that a good supply could be maintained in all sections of the city.

PERSONALS

Mr. F. D. Nauman has been appointed Division Engineer of the Baltimore & Ohio R.R. at Garrett, Ind., succeeding Mr. John Tordella, promoted.

Mr. E. N. Sheffield, Assoc. M. Am. Soc. C. E., recently Civil Engineer in the Land Department of the Central R.R. of New Jersey, has opened an office for the general practice of civil engineering and surveying at Nashua, N. H.

Mr. Dan C. Miller has resigned as Instructor in civil engineering at the University of Michigan, to become Assistant Professor of civil engineering at the Agricultural and Mechanical College of Texas, College Station, Tex.

Mr. Leonard S. Doten, M. Am. Soc. C. E., formerly Civil Engineer in the office of the Quartermaster-General, U. S. Army, has been appointed Hydraulic and Sanitary Engineer in the same office, a new position recently created by Congress.

Mr. D. W. Gross, Assoc. M. Am. Soc. C. E., Engineer of Construction and Chairman of the Valuation Committee of the Atlantic Coast Line R.R., has been appointed Valuation Engineer and has been relieved of all duties as Engineer of Construction.

Mr. Walter F. Beyer, former Assistant Engineer in charge of the Division of Lighthouses, Panama Canal, has resigned from the canal service. Mr. Beyer went to the Isthmus in February, 1911, and had charge of the project of lighting and buoying the canal. Previous to going to Panama, Mr. Beyer was for many years connected with the United States Bureau of Lighthouses.

Mr. Arthur N. Winslow, recently Chief Draftsman of the Eastern Bridge & Structural Co., Worcester, Mass., has been appointed Professor of structural engineering at the University of Idaho, succeeding Mr. D. B. Steinman, Jun. Am. Soc. C. E., resigned, as noted in our issue of last week. Mr. Winslow is a civil engineering graduate of the Massachusetts Institute of Technology.

Dr. Karl Imhoff, Consulting Engineer, of Essen, Germany, will probably not be able to make his trip to the United States in September, as he had planned. It is stated by Mr. S. Fischer Miller, President of the Pacific Flush Tank Co., United States and Canadian representatives of Dr. Imhoff, that all communications addressed to Dr. Imhoff in their care will be forwarded as soon as relief from present difficulties in Europe will permit.

Mr. Harry C. D. Nutting, recently Assistant to the President of the Wisconsin Public Service Co. and the Wisconsin Ry., Light & Power Co., Milwaukee, Wis., has opened an office in the First National Bank Bldg., Milwaukee, as Public Utility Expert and Engineer. Mr. Nutting is a graduate in engineering of the University of Illinois and was formerly an Engineer with the Wisconsin Railroad Commission and Electrical Engineer at the U. S. Government Arsenal, Rock Island, Ill.

Mr. W. R. McCann, M. Am. Inst. E. E., Supervisor in the former Division of Erection, Panama Canal, has resigned and returned to the United States. Mr. McCann joined the canal staff in 1907 in the department of lock and dam construction. He resigned in 1908 to take a special two-year course in engineering at the University of Wisconsin, and he was reappointed to the canal service in 1910, as Assistant Engineer, First Division. Under the Electrical and Mechanical Engineer, Edward Schildhauer, M. Am. Soc. C. E., Mr. McCann designed the entire electric transmission system of the Panama Canal, and as Supervisor, has had charge of the installation. Before going to the Isthmus in 1907, he was for three years with the Chicago Edison Co.

OBITUARY

John [illegible] Barnes, a retired Mechanical Engineer, died Aug. 18, at his home in Brooklyn, N. Y., aged 76 years.

Thomas G. Carlin, a contractor, of Brooklyn, N. Y., died Aug. 21 at his home in that city. He was born in Brooklyn, Nov. 27, 1859, and was a brother of P. J. Carlin, Superintendent of Buildings of the Borough of Brooklyn.

Isaac Dell Barton, a former railway official, died Aug. 21, at his home in Flushing, N. Y., aged 80 years. He was at different times Assistant Superintendent of the New York & Harlem R.R., General Superintendent of the Long Island R.R., and General Superintendent of the Brooklyn Elevated R.R.

Henry K. Howell, M. Am. Soc. M. E., Industrial Engineer, Principal Assistant in charge of the organization department of Charles T. Main, M. Am. Soc. M. E., Mill Engineer and Architect, Boston, Mass., died at his home in Boston, Mass., Aug. [illegible]. He was born June 1, 1870 in Charlestown, Mass. His experience in mill work was extensive. He was engaged for several years in organization work in textile mills, for some time he was with Edward A. Buss, Consulting Engineer, of Boston, Mass., with Lockwood, Greene & Co., also of Boston, and for the past eight years had been associated with Charles T. Main.

Darius Miller, President of the Chicago, Burlington & Quincy R.R., died Aug. 23, at Glacier Park, Mont., following an operation for appendicitis. He was born at Princeton, Ill., Apr. 3, 1859. At 18 years of age he entered the employ of the Michigan Central R.R., as a stenographer in the general freight office. Later he served in various clerical capacities with the St. Louis, Iron Mountain & Southern Ry., the Memphis & Little Rock R.R. and the St. Louis, Arkansas & Texas Ry. He was Traffic Manager and later Vice-President of the Missouri, Kansas & Texas Ry., Vice-President of the Great Northern Ry., and Vice-President and President of the Chicago, Burlington & Quincy R.R.

Henry L. Oestreich, M. Am. Soc. C. E., Senior Division Engineer, Public Service Commission, First District, New York, whose death was noted in our issue of last week, was born in New York City, Feb. 18, 1878. After graduating from New York University in 1898, he entered the office of Charles B. Brush, Consulting Engineer, Jersey City, N. J., where he remained until 1897, during which period he had charge of much important work. From 1897 to 1900, he was with the Bureau of Highways of the Borough of the Bronx, New York City, as Assistant Engineer. Mr. Oestreich entered the service of the old Rapid Transit Commission in 1900, and his subsequent work was given in the obituary notice of last week. [From Robert Ridgway, Engineer of Subway Construction, Public Service Commission.]

John N. McClintock, for many years a civil engineer of Boston, Mass., died Aug. 12 at his home in Dorchester. He was born in Hallowell, Maine, 67 years ago, and was the son of a [illegible]. He was a brother of William E. McClintock, M. Am. Soc. C. E., former Chairman of the Massachusetts Highway Commission, and James Y. McClintock, M. Am. Soc. C. E., County Engineer of Monroe Co., Rochester, N. Y. He graduated from Bowdoin College in 1867, and for several years was an officer of the United States Coast and Geodetic Survey. Later he practiced civil engineering in Boston, and was President of the American Sewage Disposal Co. and the American Water Purification Co. He was the author of a "History of New Hampshire" and many magazine articles, and was at one time editor of the "New Hampshire Magazine." He is survived by a widow and a son, John Cook McClintock, a Boston architect.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN [illegible] MANUFACTURERS' ASSOCIATION.
Sept. [illegible]. Annual convention in New York City. Secy., J. [illegible], [illegible] St. and [illegible] Ry., Cleveland, Ohio.

AMERICAN MINE SAFETY ASSOCIATION.
Sept. [illegible]. Annual meeting in New York City. Secy., H. M. Wilson, Bureau of Mines, Pittsburgh, Penn.

AMERICAN FOUNDRYMEN'S ASSOCIATION.
Sept. 7-11. Annual meeting at Chicago, Ill. Secy., A. O. Backert, Cleveland, Ohio.

NATIONAL PAVING BRICK MANUFACTURERS' ASSOCIATION.
Sept. 9-11. Annual convention at Buffalo, N. Y. Secy., Will P. Blair, 832 B. of L. E. building, Cleveland, Ohio.

NATIONAL ASSOCIATION OF PORT AUTHORITIES.
Sept. 8-10. Annual convention in Baltimore, Md. Secy., Wm. Joshua Barney, 29 Broadway, New York City.

ROADMASTERS AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.
Sept. 9-11. Annual meeting at Chicago, Ill. Secy., L. C. Ryan, Sterling, Ill.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.
Sept. 8-11. Annual convention in Nashville, Tenn. Secy., A. P. Dane, Reading, Mass.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 9-11. Annual convention in Boston, Mass. Secy., Willard Kent, Narragansett Pier, R. I.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Sept. 15-18. Convention in Atlantic City, N. J. Secy., Clayton W. Pike, Electrical Bureau, Philadelphia, Penn.

ILLUMINATING ENGINEERING SOCIETY.
Sept. 21-2[illegible]. Annual convention in Cleveland, Ohio. Secy., Joseph D. Israel, 29 W. 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Sept. 22-24. Annual convention in Bluff Point, N. Y. Secy., C. C. Rosenberg, Times Building, Bethlehem, Penn.

ATLANTIC DEEPER WATERWAYS ASSOCIATION.
Sept. 22-26. Annual convention at New York. Secy., Addison Burke, Philadelphia, Penn.

INTERNATIONAL IRRIGATION CONGRESS.
Oct. 5-9. At Calgary, Alta. Secy., Andrew Miller, Industrial Commissioner, Calgary.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 12-16. Annual convention at Atlantic City, N. J. Secy., E. B. Burritt, 29 West 39th St., New York City.

NATIONAL COUNCIL FOR INDUSTRIAL SAFETY.
Oct. 13-15. Annual "Safety Congress," at Chicago, Ill. Secy., W. H. Cameron, Continental Bank Building, Chicago.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
Oct. 20. Convention at Los Angeles, Calif. Secy., C. A. Lichty, 319 North Waller Ave., Chicago, Ill.

Roadmasters and Maintenance-of-Way Association—The 32d annual meeting will be held Sept. 9-11 at the Auditorium Hotel, Chicago. Besides the various committee reports there are to be addresses by a number of railway engineers and officials, and an extensive exhibit of railway materials and appliances will be arranged in one of the large halls of the hotel. The president is T. F. Donahoe, B. & O. R.R.; secretary, L. C. Ryan, C. & N. W. Ry., Sterling, Ill.

New England Water-Works Association—The Committee of Arrangements has endeavored to make the 33d annual convention, to be held in Boston, Mass., Sept. 9-11, at the Copley-Plaza Hotel, of particular value to water-works superintendents, and to that end "superintendents' sessions" will be held on the afternoon of Sept. 10 and the morning of the 11th. Included in the rest of the program are the following papers: "Construction of Dams," A. E. Walden, Baltimore County Water & Electric Co.; "Electrolysis," E. B. Rosa, Bureau of Standards; "Allowable Leakage from Water Mains," E. G. Bradbury, Columbus, Ohio; "Lessons from the Salem Fire," Frank A. McInnes, Boston, Mass. Demonstration of water-main cleaning will be given. Liberal entertainment will be provided, with especial regard for the ladies. The secretary is Willard Kent, Narragansett Pier, R. I.

American Chemical Society—The convention scheduled to be held this fall in Montreal, Que., was canceled on Aug. 15 on account of the war between Great Britain and Germany. The following is quoted from a telegram sent C. L. Parsons, Secretary of the Society, by Prof. R. F. Ruttan, Chairman of the Montreal Committee of Arrangements:

The harbor, canals, etc., are under martial law. The excursions were off, as the steamboat company canceled our contract for steamers for the canals and harbor.

No German member of the Society would naturally come to British soil and all with German names would be questioned at the boundary. Many are even now turned back. We felt that the exclusion of so many prominent members of the Society was a high price to pay for a meeting here.

Any foreigners would be subjected to disagreeable formalities and conditions on coming here just now.

It would be impossible to attract to the Convention the slightest public interest in Montreal, outside a few dozen chemists. No one would come to the Conversazione or the garden parties we had arranged, and while there would surely be the feeling of good fellowship among ourselves, it would be overshadowed by the tragic war we are in at present.

Mr. Parsons states that "the present outlook is that the next meeting will be in New Orleans, Apr. 1-3, 1915." The office of the Secretary is in Washington, D. C.

Engineering News

VOLUME 72 SEPTEMBER 3, 1914 NUMBER 10

Seros Power Development, Lerida, Spain: Diversion Dam and Canals

By J. C. Stevens*

SYNOPSIS—The Seros Project, from which the Spanish city of Barcelona is to derive a supply of electricity, is of unusual interest from its 17 odd miles of supply canals, its long diversion dam, its four regulating reservoirs, its numerous control gates, its high-head power house, etc. The important features of diversion dam, canals, and gates are disclosed in this article, together with interesting notes on the construction work. The regulating reservoirs, earth dams and power house will be described in a subsequent article.

✕

The notable hydro-electric development described below is indicative of a great change in Spanish internal affairs, a few words on which are necessary to explain the reasons for such work as herein outlined.

One important cause of the disastrous effects of the internal dissentions and external invasions, which caused Spanish colonial power to slip away, has undoubtedly been the lack of attention to the development of natural resources. A large part of the Spanish population has been content with a hand-to-mouth existence and internal improvements have been extended to only moderate achievements. In recent years, however, relief from the burden of foreign possessions and foreign wars has given a great impetus to internal development. In Cataluna especially is this true. The backbone of national prosperity is agricultural development and nowhere is this more forcibly seen than in this district. Such advances have induced material advances in all other lines of activities: manufacturing industries have sprung up on all sides in a country where labor is yet comparatively cheap and raw materials plentiful.

Lower Concrete-Lined Canal; Seros Power Development, Lerida, Spain

Hence, the existing industries, the latent possibilities for further advance, the well developed agriculture, and all the attendant necessities for transportation and manufactured articles, render Cataluna a fruitful market for commercial power.

At almost the exact spot of one of Cæsar's important operations against Pompey (49 B.C.) is the work herein described. Cæsar found his enemies at Lerida on the banks of Rio Segre (called "Llerda" on the "Sicorio" in his *Commentaries*). During the 40 days' fight that fol-

*Spalding Bldg., Portland, Ore (formerly Project Engineer, Ebro Irrigation & Power Co., Ltd., Barcelona, Spain).

Fig. 1. General Plan and Profile of Seros Project

[...]owed, Cæsar diverted the river into several channels, each 30 ft. wide, and so reduced the volume of water in the main river as to render it fordable for his cavalry. In this manner he surprised his enemies in their camps, completely routed them, and closed a campaign as remarkable for its brevity as for its success. Where Cæsar diverted this river, the modern engineer has done likewise but for the peaceful purpose, then unknown, of generating electricity.

This development is in the hands of the Barcelona Traction, Light & Power Co., through its subsidiary, the Ebro Irrigation & Power Co., Ltd., which has under way three hydro-electric projects on Rio Segre and its principal tributary, Rio Noguera Pallaresa: (1) The Gerri project; (2) the Talarn Dam and Pallaresa Canal; (3) the Seros project. The first was started as a 3000-hp. temporary plant for construction service but has become a 4000-hp. permanent station and has been in operation since February, 1913. Near Talarn, a concrete dam 86 m. (282 ft.) high will impound 210 million cubic meters (170,000 acre-ft.) in a river valley; at the dam is to be a power house and tail water carried 18 km. in canal to a second station. The Talarn dam was 10% completed on May 1, 1914. The Gerri and Talarn sites are adjacent and some 135 km. northwest of Barcelona; the Lerida project is 80 km. southwest of Gerri and 110 km. east of Barcelona. The power generated will be largely used in Barcelona and outlying districts. Transmission lines connect the two projects and from a mid-point branches the Barcelona line.

The present article (and the subsequent one) will deal solely with the Seros project which was completed in April, 1914. The project consists briefly of (1) a diversion dam and intake structures to pass a flood of 157,000 sec.-ft., and divert 2120 sec.-ft. for power purposes; (2) an upper canal 11.8 miles in length lined throughout and leading to (3) the regulating reservoirs created by seven earth dams and giving an available daily storage of 2210 acre-ft.; (4) a lower canal 2.62 miles in length, exclusive of reservoirs, with a capacity of 1940 sec.-ft.; (5) forebay and penstocks; (6) the power house and transformer station where four 16,000-hp. turbines are installed and where the voltage is raised from 6000 to 110,000 for transmission to Barcelona; (7) a tailrace that returns the waters to the river.

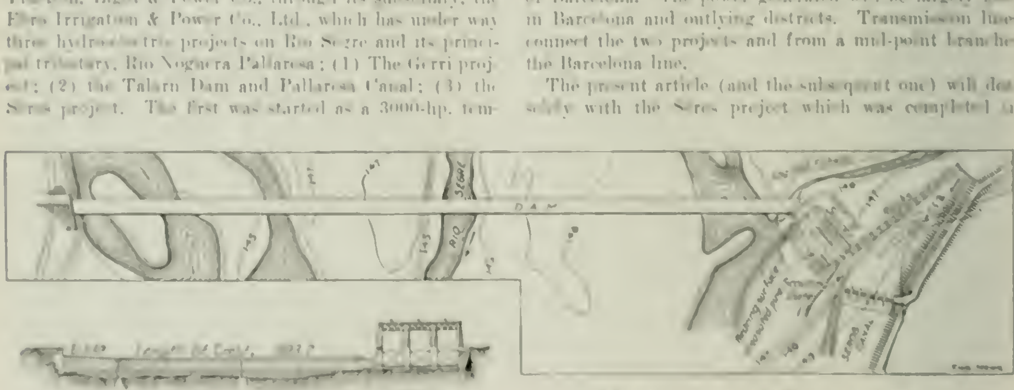


Fig. 2. Diversion Dam and Intake

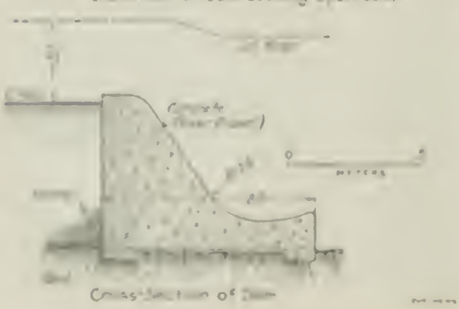


Fig. 1 is a general map of the Seros Project and a condensed profile of the power canal. The total length from diversion dam to tailrace is 28.4 km. (17.6 mi.). The total natural fall in the river between these points at low stage is 52 m. (170.6 ft.).

Upper Canal

Headworks—The general arrangement of the dam, intake, racks, sluice gates and canal gates is shown in Fig. 2. As the river carries considerable gravel at time of flood, the three large sluice gates are placed in such a manner as to scour out any accumulation of débris in front of the racks. These gates are 8.0 m. (26.25 ft.) long by 5.7 m. (18.70 ft.) wide with a clear lift of 7.0 m. (22.97 ft.); they are of the Stoney type, hand operated.

Fig. 3. Sluice and Canal Gates

The floor of the discharge channel in front of the sluices is of creosoted pine 6 in. thick, held in place by 45-cm. (17.7-in.) I-beams partly embedded in the concrete. The planks lie in the direction of the flow of water and are so arranged as to be readily replaced when worn.

The removable racks, 30 in number, are placed in 15 bays as shown in Fig. 2. The rack bars are a special type, spaced 15 cm. (5.9 in.) apart in panels 2.0 m. (6.56 ft.) wide. A traveling differential chain block is used to elevate them for cleaning or repairs.

The intake gates are six in number, also of the Stoney type, 3.4 m. (11.15 ft.) long by 6.0 in. (19.68 ft) high. with a lift of 3.8 m. (12.47 ft.), to be operated by hand. The bottom of the intake forebay has an inclination of 1.5% towards the canal gates. Just in front of these gates is a sand trap and a sluice gate to return to the river the débris that may pass the racks.

Overflow Dam—The dam is of the ogee overflow type, shown in Fig. 2. The foundation is a fairly hard sandstone of varying thickness. The surface is very irregular and heel and toe trenches are excavated into it as shown. Immediately below this sandstone is a stratum of indurated clay varying from 5 to 15 ft. in thickness, and practically free from seams.

No apron was built below the dam as it was decided to wait until the effect of overflowing water on the river bed below the dam could be studied; then if necessary, a protecting apron will be added. This will not be difficult as all ordinary water can be diverted into the canal or passed through the sluice gates and the toe of the dam unwatered.

During construction, the plan was first tried of driving a row of steel sheet piling in line with the upstream face in order to reduce excavation and serve as a cutoff, but the plan was not successful and was abandoned. The piling did not reach solid material but was bent and doubled so badly by the small gravel that most of it had to be removed by hand before the excavation could be completed. No serious difficulty was encountered in excavating by the ordinary methods in open trench and unwatering by motor-driven centrifugal pumps. The river channels were diverted by timber and stone coffer-dams to alternate sides of the stream bed and finally through the large sluice gates while the closure was made.

The total length of the overflow proper is 393.2 m. (1290 ft.) and the logway opening is 4.5 m. (14.8 ft.) with a low buttress between them of 3.5 m. (11.5 ft.), making a total length between abutments of 401.2 m. (1316 ft.). The dam is capable of passing a maximum of 3750 cu.m. per sec. over the ogee section, 650 through the sluice gates and logway, and 60 into the canal—or 4460 (157,000 sec.-ft.) in all. Fig. 3 shows the completed canal gates and sluice gates.

Power Canal—The first 19.2 km. (11.8 mi.) of the power canal has a grade of 0.00015 and a capacity of 60 cu.m. per sec. (2120 sec.-ft.) and is concrete lined throughout. Fig. 4 shows the type sections for this canal. It will be noticed that these approach the "economic section" i.e., maximum capacity for minimum perimeter and cross-sectional area. This was adopted even at the expense of deep excavation in order to minimize right-of-way and lining costs.

The upper canal for about half its length traverses intensively cultivated lands and a complicated network of irrigation and drainage ditches. In order to pass these ditches without disturbing existing conditions, small inverted siphons were used. In all, there are 43 siphons in the upper canal. These were made of thin steel pipe, with stove-pipe joints, placed in a trench and surrounded by concrete. At the entrance to each is a settling basin, concrete lined, and a grating which prevents floating trash from entering the siphon. In nearly all cases, the velocity is sufficiently high to prevent sedimentation. If, however, they do silt up, they are readily cleaned by passing a cleaning rod made of spring-steel bars smoothly joined in lengths of 14 ft. These act as a needle which is pushed

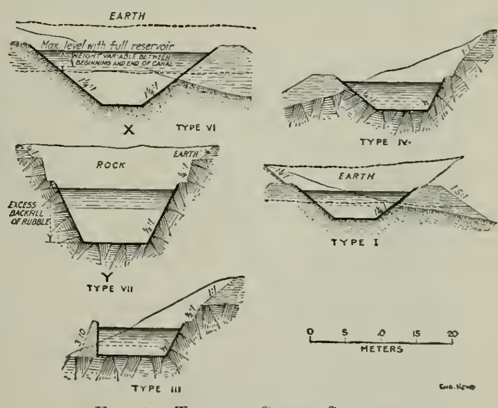


Fig. 4. Typical Canal Sections
(Sections X and Y for Lower Canal)

through the mud or trash and by means of which a rope is drawn through the siphon. To the rope is attached a series of buckets on a chain to remove silt and finally a spherical brush is drawn through, which completes the cleaning.

CANAL LINING—As indicated in the type sections, Fig. 4, the lining is of concrete 10 cm. (3.93 in.) thick. The mixture used was 1:3:6 cement, sand and river gravel (gravel screened to pass in any direction through a 2-in. ring). Attempts were made to place this lining without forms, but the plan was abandoned as it was found to be impossible to place the 4 in. of concrete on a slope of 1¼ on 1 without making it so very dry that its impermeability was seriously impaired.

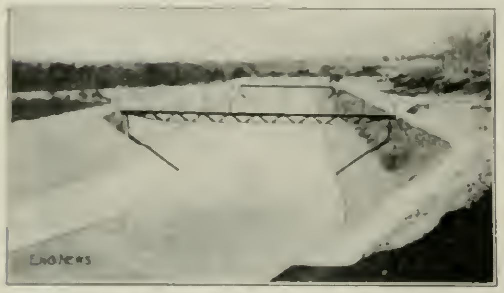


FIG. 5. UPPER CANAL HALF LINED

The lining was first carried to 3 m. vertical height only, in order to allow the made banks to settle as long as possible before lining. The remaining 1.7 m. was placed after water was in the canal. Fig. 5 shows a section of canal completed except for the upper strip of lining.

Part of the lining was let by contract and part was done by the company. Figs. 6 and 7 show the forms used by one of the contractors, and a sample of the finished surface. In this system the form boards were placed from the canal side of the [illegible] uprights. This was advantageous in that the trimmed slope was not touched and hence the green concrete was kept free from dirt that would otherwise be knocked onto it. This system also had the advantage of being more elastic, as one side could be lined at a time and thus the lining gang could follow the slope trimmers more closely. The most rapid work, however, was done by company forces using the system shown in Fig. 7. At first continuous mixers were used but they could not compete either in cost or quality of work with hand mixing, and they were therefore abandoned. In the design of the canal, a coefficient in Kutter's formula of n = 0.015 was used for concrete surfaces.

STOP LOGS AND WASTE GATES—At three nearly equally distant points on the upper canal, stop-log structures (see profile, Fig. 1) are provided by means of which the water in any section may be held if necessary. These [illegible] and [illegible] their chief purpose during the [illegible] of the canal. In each section also there are waste gates with discharge capacity aggregating 17 cu.m. per sec., with the canal full, by means of which any section may be [illegible].

LOWER CANAL

[illegible] above the power station the canal becomes a series of [illegible] some of which were closed by earth dams to create four regulating reservoirs. The disposition of these is shown in Fig. 1. These four reservoirs are connected by a lined canal having a net length, exclusive of reservoirs, of 4.22 km. (2.62 mi.) and a capacity at low reservoir of 120 cu.m. per sec. (4240 sec.-ft.), leading to the penstocks of the power house. The bed of this canal has a grade of 0.00026 while the top of the embankment is level at an elevation 1.0 m. above the maximum operating height of water in the upper reservoir. In this manner the head due to fluctuations in the reservoirs is not lost. In designing this canal, the velocity head in the canal was assumed to be lost at the entrance and reproduced anew at the exit of each of the four reservoirs outlined above.

Typical cross-sections of the lower canal are shown in Fig. 4 (marked "X" and "Y"). The same thickness of lining (3.9 in.) is used in this as in the upper canal. Fig. 9 shows lining in progress and gives an idea of the size of the canal and its great depth relative to its bottom width. This type was selected to facilitate control of the elevation of water surface in the reservoirs from the power house and to make the canal responsive to the fluctuating demands upon it.

This canal is provided with a special stop-log structure at its upper end where it leaves the first reservoir (see Fig. 1) and a set of four waste gates just before entering the forebay. By means of these, the storage water may be held in the reservoir and the lower canals and reservoirs emptied, or the water may all be passed through the canals and reservoirs and returned to the river without passing through the power house. These stop logs are of interest. The channel is divided into three portions by two piers

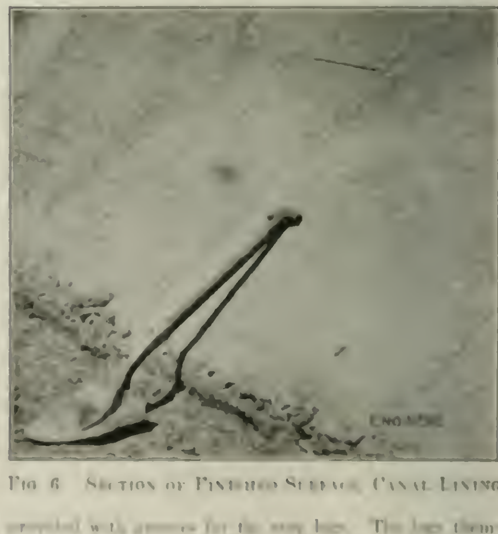


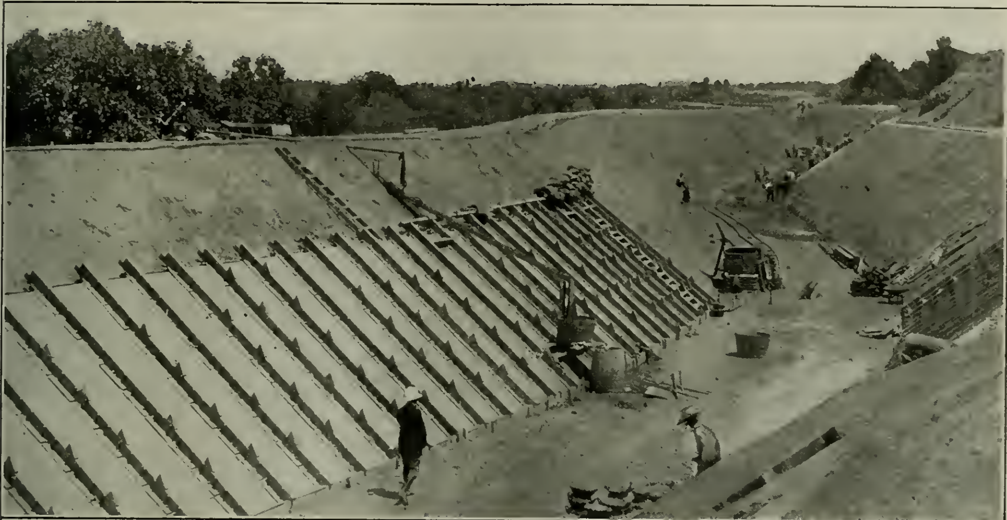
FIG. 6. SECTION OF FINISHED SURFACE, CANAL LINING

provided with grooves for the stop logs. The logs themselves are made up in leaves 15×1¼ ft. each, of 12-in. timbers, bound with angle irons and fitted at the ends with rollers. [illegible] plates project upstream at right angles to the stop logs and bear against an angle set in the stop-log grooves to prevent the excessive leakage that would otherwise occur.

These stop logs are suspended in the grooves by cables provided with a trip, by means of which they may be

dropped instantly into place. Provision was planned to force the logs down by suspending other logs to channel columns that would bear on the stop log that had been dropped, but it was found that the momentum the log gained before striking the water was usually sufficient to carry it to its seat. Fig. 10 shows the structure (combined bridge and stop) with one opening closed, and three stop logs suspended in each of the other openings, ready

course, could not be avoided, and on account of the comparatively thin lining it was necessary that the water be raised slowly in order that the effect of this settlement could be observed and any needed repairs made at once. It was observed on some of the higher embankments that the earth settled inwards toward the canal, the first evidence being a crack between the lining and the embankment. As fast as these cracks opened, drill holes were made be-



FIGS. 7 AND 8. PLACING THE CONCRETE LINING IN THE UPPER CANAL, SEROS PROJECT
(Fig. 7. Contractor's method. Fig. 8. Method of company force.)

to be dropped. As each leaf weighs two tons, a traveling chain block, shown in the figure, was necessary to handle them. This arrangement is temporary and more permanent gates will be installed later.

TESTING OF CANAL

The filling of the canals was accomplished with no serious consequences. Settlement of the earth banks, of

hind the lining with long drills at intervals of about 18 in., and an almost liquid puddle of clay and water poured into them. In this manner, the support for the lining was maintained and the lining preserved intact. As soon as the bank had taken its settlement no further difficulty was experienced.

Very little lining was broken by settlement, and wherever it did occur, it could nearly always be traced to poor

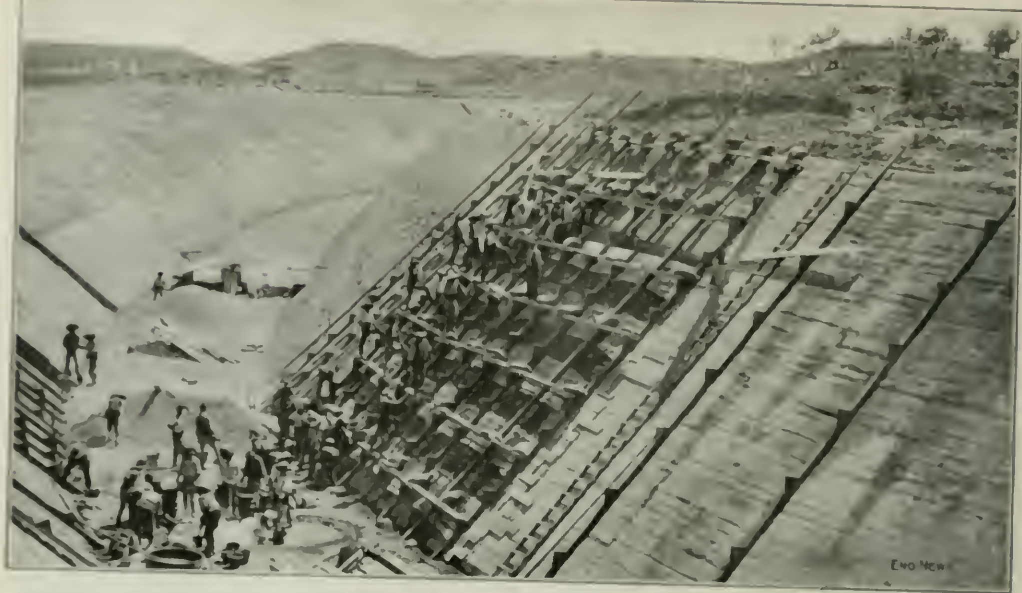


Fig. 9. Lining the Lower Segre Canal

conduit between the upper and lower strips of lining. In spite of eternal vigilance and inspection, the upper strip of lining was begun in a few places before the old surface had been properly squared and cleaned, with the result that when settlement occurred, the upper strip of lining would be taken with the earth, breaking or cracking at the joint. Repairs of this joint was necessary in not over 200 m. of its length, which is very little, considering that this joint was about 15,000 m. long. In all, not over 2000 m. of embankment required treatment after settlement.

Work on the whole project was carried through with speed. Active construction started in January, 1913, and water reached the station forebay Mar. 10, 1914—in 15

Fig. 10. Stop-Log Structure, Lower Canal

months. The right-of-way covered 317 hect. ([illegible] acres); the excavation, inclusive of borrow for earth dams was [illegible] cu.yd.; [illegible] cu.m. ([illegible] cu.yd.) of masonry and concrete were placed. The various gates and mechanisms came from Ransomes & Rapier, Ltd., of London; racks and screens were made by [illegible] and Konegan of Zurich. Practically all the structural steel was furnished by the Blaw Steel Construction Co., of Pittsburgh, Penn., U. S. A.

Organization

The work was carried out by the Ebro Irrigation & Power Co., Ltd., under the supervision of the Pearson Engineering Corporation, Ltd., of New York City. The following officials were in charge of the work: F. S. Pearson, President; A. W. K. Billings, Vice-President and Managing Director; Fred. W. Abbot, Manager of Construction; J. A. Sargent, Chief Engineer.

The work was executed under the inspection of the Public Works Department of Spain: Sr. Don José Bares, Chief Engineer for the Province of Lerida.

Checking a Landslide in a railway cut by breaking up the slope with massive blocks of concrete built in trenches running up the slope was practiced with success on the [illegible] & [illegible] Ry. in Switzerland. A sidehill cut had been made through an ancient landslip, the material consisting of clay and loam mixed with boulders and tree trunks, underlaid by a bed of [illegible]. A longitudinal crack about [illegible] ft. long appeared in the slope of the cut, and similar cracks developed in the ground above the edge of the slope, while 33 ft. from this was a main road. A retaining wall was proposed, but it was evident that this would be overturned or carried away before the concrete could set. As an emergency measure, massive concrete blocks were built in the slope, the excavations being carried into the hard material over which the loose mass was sliding, so that the blocks could not move down the slope.

Four blocks, 33 ft. apart, were built, but as the slide continued to squeeze out between them two additional intermediate blocks were built. The slope then stood, but the pressure was so great as to partly raise the blocks, revolving them on their lower ends so that they tended to approach a steeper slope. One block moved outward [illegible] in. at the top, its foot remaining stationary. The trouble was due to water in the soil, but there was no time to put in any drainage system, and some immediate action was necessary in view of the main road above the cut and the possibility of starting a slide of the whole slope of the mountain above the cut.

Electric Shifting Locomotives on a Cleveland Ore Dock

At the ore-unloading plant of the Ohio & Western Pennsylvania Dock Co., in Cleveland, Ohio, electric locomotives are used for spotting the cars underneath the unloading plant. When an ore vessel is brought alongside the pier, its hatch covers are removed and the 17-ton grab buckets at the bottom of the traveling legs are dropped into the hold and pick up a load of ore. They

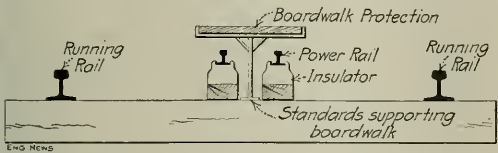


Fig. 1. Cross-Section of Track for Electric Switching Locomotive, Showing Protected Electric Conductors at the Ore-Unloading Plant of the Ohio & Western Pennsylvania Dock Co., Cleveland, Ohio

laid in the center of the track and covered by a board walk so that there is no danger of accidental contact with these rails. The accompanying cross-section makes the arrangement clear.

To enable the locomotive to move the cars on the track parallel with that on which the locomotive runs, a heavy braced arm projects from the side of the locomotive and can be rotated on a horizontal axis so that the arm can either be held vertical or can be dropped so that its projecting end comes against the poling iron on the end sill of the car. These steel arms are lowered or raised by compressed air and are under control of the operator in the locomotive cab. Thus the operator can drop this arm between any two cars and work the train of which they are a part forward or backward along the track. It will be seen that by this arrangement of switching the danger which accompanies the common use of poling locomotives on parallel tracks to the cars to be moved is obviated.

The electric locomotives were built by the Baldwin Locomotive Works and are equipped with Westinghouse motors and electrical machinery. They have a total weight of 25 tons carried on four wheels. We are informed that the three electric locomotives in this plant

Fig. 2. Three Views of the Electric Shifting Locomotive

then rise out of the hold and are traversed inward until they can drop their load into a 50-ton weighing hopper. As soon as the hopper is filled, a valve is opened and its contents are discharged into an ore car on the track below.

It is necessary to accurately spot the cars beneath the ore hopper to prevent the dropping of ore between the cars and this spotting has generally been done by heavy switching locomotives. The difficulty with this system is that the engineer on the switching locomotive at the end of the train cannot see well where to place the car and has to be governed by signals and it is difficult to accurately move a long train of cars by a locomotive at the end. In addition, the smoke and gas from the locomotives are very injurious to the steelwork of the unloading plant. These difficulties have all been overcome on the docks in question by the installation of a narrow-gage track between each pair of railway tracks on which narrow-gage tracks run electric shifting locomotives. These locomotives take their current from a pair of live rails

moved last year 60,000 cars on this dock. The general plan of the use of these electric switching locomotives on parallel tracks, with the movable arms for operating the cars, was the idea of Chas. E. Cole, superintendent of the dock company, and we are indebted to him for the information and illustrations here presented.

⁂

Triplex Safety Glass—By-Triplex Glass is built up by layers of glass and sheets of celluloid (xylonite), and is manufactured by the Triplex Safety Glass Co., Albemarle St., W., London, England. On June 27 its resisting properties were thoroughly tested. An army service rifle and ammunition were used at a range of 300 yd., with the following results: (1) 1¾-in. glass. Bullet struck the glass almost in the center, but only penetrated the first thin layer, $\frac{1}{16}$-in. thick. The intermediate and back sheets were cracked; the back, however, remained smooth. (2) 1⅜-in. thick. Bullet struck bottom left-hand corner, penetrating one layer of glass and one of celluloid without going farther. (3) A 1¼-in. piece was badly damaged, but as not penetrated.

An important quality of this glass is that although it may be badly cracked it still remains airtight and waterproof, on account of the celluloid between the layers of glass.

Water Filtration and Softening Tests at Cleveland, Ohio

By Hippolyte Gruener*

SYNOPSIS—A working-scale coagulating basin and mechanical filter were constructed and tested at Cleveland to obtain information for guidance in designing a mechanical-filtration plant. The tests have included (1) alum; (2) ferrous sulphate and lime, and (3) lime alone as coagulants, as well as lime for softening. Boiler and laundry tests have been made as well as studies of after deposits and growths on the filter sand. Slow sand filtration has also received attention.

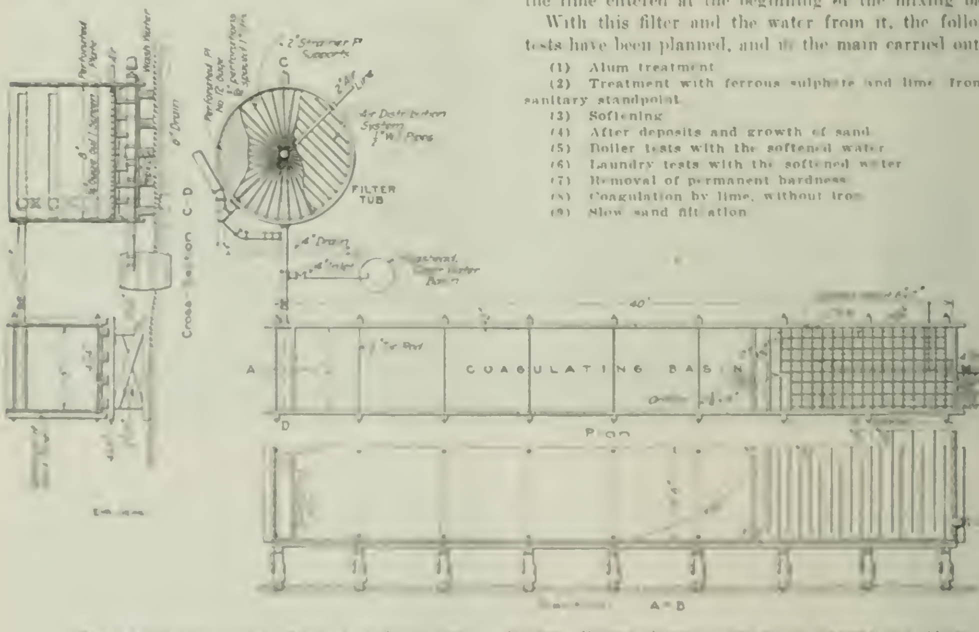
The Ohio spring floods of March-April, 1913, had such a bad effect upon the Cleveland water-supply as to lead the city authorities to adopt a general plan for water filtration. Accordingly, in May, 1913, Mayor Newton D. Baker appointed a Filtration Commission of five members, whose names are given at the close of this article, to study the situation and to make recommendations. It was decided at the outset that mechanical filters would be used but it seemed desirable to make a careful study of local conditions and to establish and operate a test plant before deciding on all the features of the new purification works.

The experimental or experiment plant, which was put in operation in July, 1913, consists of a coagulating tank and mechanical or rapid sand filter, shown by the accompanying line drawings. The intention was to operate the filter at the rate of 100,000 gal. a day but on account of the small size of the coagulating tank the filter has been operated at a 50,000-gal. rate. When the filter is worked at this rate, the detention period in the coagulating tank is $2\frac{1}{2}$ hours. The filter was equipped for using air preliminary to reversing the flow of water in washing, but the air wash was seldom used, as the pressure of the wash water, run from an elevated tank, was sufficient for ordinary purposes.

When the difficulties of manipulation had been overcome, this filter gave very good results, especially after the introduction of a very efficient mixing device. This consists of a series of baffles, through which the water moves for 30 minutes through a total distance of 1050 ft. Ordinarily, the iron was introduced at the pumps, while the lime entered at the beginning of the mixing baffles.

With this filter and the water from it, the following tests have been planned, and in the main carried out:

(1) Alum treatment
(2) Treatment with ferrous sulphate and lime from the sanitary standpoint
(3) Softening
(4) After deposits and growth of sand
(5) Boiler tests with the softened water
(6) Laundry tests with the softened water
(7) Removal of permanent hardness
(8) Coagulation by lime, without iron
(9) Slow sand filtration



Plan of Coagulating Basin and Mechanical Filter, Water-Testing Station, Cleveland, Ohio

(1) Alum Treatment—The turbidity and bacterial content of Lake Erie water vary, but the more important dissolved solids fluctuate very little. The alkalinity is about 90 to 95 p.p.m., with practically no extent of free carbon dioxide or of normal carbonate. There are in addition 16 p.p.m. of permanent hardness, mainly sulphate. With this alkalinity the water responds to alum treatment and the first trials were with this coagulant. The turbidity of the raw water during the period of trial was only 7. Beyond the removal of this turbidity and the study of the difficulties of manipu-

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lation, this test had little value, as it was deemed advisable to change to lime and iron before good results were obtained.

(2) LIME AND IRON PRECIPITATION—This absorbed the chief interest on account of its relation to the possible softening of the water. After the difficulties of manipulation had been overcome and the final method of procedure adopted, the filter produced water which showed a turbidity of zero, and only once fermentation with lactose-bile in 10 c.c. This was during a period of six months, during which period 118 tests were made. The raw water showed considerable gas for 70% of the time. The special features which mark this long period of practically perfect results, were, aside from the general improvement in the handling of the plant, the large dosage of lime, and the diminution of the rate of filtration from 130,000,000 gal. per acre daily to 70,000,000, and finally to about 50,000,000. This lower rate was adopted in order to attain the desired time, 2.5 hr., in the coagulating basin. And this rate is the one which corresponds, with few exceptions, to the results reported in this article. For part of the time, during which only 2 to 3 grains of lime per gal. were used, with 0.5 grain of iron, the effluent was good. But the question of softening was kept so definitely in view that the dosage of lime was early adjusted to this end, and the sanitary efficiency worked out on this basis. The dosage finally settled on was: lime, 4.3 grains per gal.; iron, 0.5 grain per gal. The mean rate of filtration at this dosage was 51,500,000 gal. per day.

The data for the period of successful operation are as follows: Time, Nov. 8, 1913, to May 1, 1914, or 6 mo.; Number of tests, 118.

	Raw water	Filtered water
Mean turbidity	47	0
Mean bacterial count (agar)	46	3
Fermentation, per cent. of days	70	1

In the early stages of the operations some trouble was experienced by high counts, due to bacterial growth in the filter bed. This was remedied by occasional introduction of small amounts of bleaching powder into the wash water.

The main purpose of the filter was established by this series of tests, namely, the certain production, for a long period of time and during varying conditions of season and state of the raw water, of an effluent free from turbidity and also from coli (as shown by presumptive tests).

(3) SOFTENING—As soon as it was clear that satisfactory sanitary results were obtainable by lime and iron treatment, the emphasis of the tests was laid upon the softening. The reason which prompted these experiments was that it seemed desirable to obtain for the city the best water in every respect. Although the raw water is not extremely hard, it is hard enough to warrant its softening if this can be accomplished easily. The cost of softening will be more than repaid in the saving of soap, and the added comfort in home and laundry will be clear gain. There are industries in which the use of soft water would be advantageous, and in some boiler practice, at least, the improvement may be noteworthy.

An analysis of the water is given below. The amount of lime required may conveniently be measured by the total carbon dioxide in the form of acid carbonate, plus the magnesium present as carbonate. This will remove the excess carbon dioxide which holds the calcium and magnesium in solution as acid salts, and changes the magnesium carbonate into the less soluble hydroxide. More lime converts the sulphate and chloride of magnesium into hydroxide also. These changes are shown by the equations:

1. $CaH_2(CO_3)_2 + Ca(OH)_2 = 2CaCO_3 + 2H_2O.$
   $MgH_2(CO_3)_2 + Ca(OH)_2 = MgCO_3 + CaCO_3 + 2H_2O.$
2. $MgCO_3 + Ca(HO)_2 = Mg(OH)_2 + CaCO_3.$
   $MgSO_4 + Ca(OH)_2 = Mg(OH)_2 + CaSO_4.$
   $MgCl_2 + Ca(OH)_2 = Mg(OH)_2 + CaCl_2.$

The calcium carbonate and magnesium hydroxide are usually assumed to be insoluble, but where results are considered exactly, their solubility is not to be neglected, and, in the water treated as above, the hardness left in the water on their account is about 35 p.p.m. In addition, the soluble sulphates and chlorides are not converted to an insoluble form, and this hardness is unchanged. The amount of lime required for softening is: for half-bound CO_2, measured as $CaCO_3$, 95 p.p.m.; for $MgCO_3$, in addition, 13 p.p.m.; total, 108 p.p.m. Expressed as CaO this is 61 p.p.m. or 3.5 grains per gal.

Experience showed that the best results were obtained when enough lime was added to precipitate all the magnesium salts, namely, 21 p.p.m. as $CaCO_3$ or a total of 4.2 grains per gal. (73 p.p.m.) The amount applied varied from 4 to 5 grains, on account of imperfections in the feeding device, the average for the time under discussion being 4.35 grains. Due to this irregularity of feeding, the daily records for dosage and softening effect do not correspond, and the averages of the whole period need to be taken for a proper conclusion. These averages were: lime applied, 4.35 grain per gal.; iron, 0.50 grain. The average alkalinity for this period was 38; total hardness, 57. The average alkalinity to phenolphthalein for the period was 15. There were unusually high phenolphthalein alkalinities, for which the explanation was not evident; but in general, as long as the phenolphthalein alkalinity is not more than half the methyl orange alkalinity, it is true that there is no excess of lime present. The raw water had an average alkalinity of 88.5 and a hardness of 104.

Analyses of the raw and filtered waters, expressed as $CaCO_3$ p.p.m., with samples taken when the hardness was low, were as follows:

	Raw	Filtered
Calcium	82	29
Magnesium	34	24
Total hardness	116	53
Soap hardness	110	49
Alkalinity, methyl orange	95	35
Sulphate	14	18
Chloride, over alkali	2	2
Hardness by this test	111	55
Total solids	139	74

There have been a few results even more favorable than this typical one, but they could not be consistently obtained. The long series of experiments, both bottle and by means of the filter, indicated that we had here the best conditions. Less lime means incomplete precipitation; more lime means free calcium hydroxide and more hardness.

It is evident from the many series of bottle tests and from the long-continued filter test, that the Cleveland water is easily softened to the extent of about 50%. The residual hardness consists of the original permanent hardness, 16 parts; of hardness added by the ferrous sulphate, 3 parts; and of the hardness due to the solubility of the so called insoluble calcium carbonate and mag-

nesium hydroxide. This last item seems to be somewhat variable, at least under the conditions offered by the test filter, and a study of the data fails to reveal the causes of the variations. The evident means of control are proper dosage, thorough mixing and agitation, and finally filtration through sand. Aside from these variations, within narrow limits, no difficulties of permanent importance developed. The water was absolutely attractive in appearance and flavor, and sought after for drinking purposes by such as had the opportunity.

The time covered fall, winter and spring, with a range of temperature of the water from 61° to 33°. The effect of this change of temperature was not apparent.

The amount of wash water used at the beginning was high, 5 to 6%. With increased skill, use of baffles, lowering the rate of operation, and with bleaching powder in the wash water, it was reduced to about 1.5%. At the rate of 150 m.g.d., the time between washings was only 4 to 6 hours. When the rate dropped, the time increased correspondingly. Later, however, when the rate was 50 m.g.d., the time was increased in much greater proportion, namely, to about 40 hours.

(4) AFTER DEPOSITS AND GROWTH OF SAND—So far, no objection or obstacle has developed which threatens to interfere seriously with the plans for softening as just outlined. The effluent will be saturated or even supersaturated with carbonates of calcium and magnesium and magnesium hydroxide. Which of these are present, and whether the substances are present as supersaturated solutions or in colloidal condition, or whether the reaction is retarded, are questions difficult to answer. The quickest and most practical solution of the problem is an empirical one. That is, if there are no serious deposits, the matter may be passed over. If there are serious deposits, they must be prevented by the addition of carbon dioxide or by regulation of the dosage, with consequent lessening of the softening effect.

With abundant access of air, the absorption of carbon dioxide might be sufficient to eliminate the danger. But it is unlikely that absorption of that gas will be of any importance in the short passage from the filter to the mains. Artificial addition of carbon dioxide may be considered within the bounds of possibility, but for the present this may be left out of account. The thorough mixing by the baffles, followed by four hours settling and by filtration through sand, may solve the problem. What experience we may refer to in St. Louis, New Orleans and Columbus has been reassuring. At the test filter no deposits have come to the attention of the operator. Plates left in the water at the outflow showed traces of calcium carbonate after several months. Three litres of water standing in large flasks for six months deposited a total of [illegible] gram of calcium oxide and 0.0001 gram of magnesium oxide. A piece of porcelain having an area of 80 sq.cm., including both sides, was left in the water two months, after which 0.0012 gram of calcium oxide were found to be deposited on it. On the other hand, as already stated, there has been no evidence of deposit in any way ordinarily noticeable.

The sand is found to grow [by accretion] and its renewal must be considered as a part of the regular plan. A specimen of the sand from the filter, after being in use 10 months, was found to lose 7.4% of its weight when treated with dilute hydrochloric acid; another specimen, after 11 months, lost 17.5%. The composition of this incrustation was determined and found to be as follows: Fe_2O_3, 3.6%; $CaCO_3$, 90.7%; $MgCO_3$, 3.6%. Sand from the lower layers showed less incrustation, namely, about 7%, with the same chemical composition as that shown above.

In the upper layers of the filter considerable amounts of the sludge collected in soft masses, which penetrated to a depth of 6 to 8 in. and were not removed by the routine washing. The sand could be cleaned completely when removed from the filter and washed with some agitation. The composition of this sludge is: matter insoluble in HCl, 4%; Fe_2O_3, 3.0; $CaCO_3$, 87.15; $MgCO_3$, 4.03%. If this is reduced to the composition of the soluble matter only, we have: Fe_2O_3, 3.1%; $CaCO_3$, 90.8%; $MgCO_3$, 4.2%. That is, nearly the same composition as the incrustation on the sand.

Although the sand growth introduces complications, there may be some compensations in connection with it. The growth represents a diminution in the hardness of the water, and, what is more important, probably removes that portion of the dissolved substances which might afterwards settle out in the pipes. With respect to this precipitating effect of the sand, the record of a series of six bottle experiments and nine test-filter experiments will be of interest. In these the water was softened with lime, iron also being used, and soda added to remove the permanent hardness. Part of this water was filtered through paper, and part through sand, with the following results:

	Methyl orange alkalinity	Hardness soap
Bottle experiments		
Sand	37	36
Paper	43	43
Test filter experiments		
Sand	38	53
Paper	44	58

(5) BOILER TESTS—Two tests of the filtered and softened water have been made in the boilers of the pumping station. The softening of the whole city supply for the sake of boiler practice has not been suggested. If, however, a gain in this respect could be shown, it would give increased impetus to the interest in softening for domestic reasons. The records of two tests are as follows:

(1) 43 days. Water used, about 9,[illegible] lb.
Raw water using soda as boiler compound: Flue scale, 121 lb. Total scale and mud, 193 lb.
Filtered water: Flue scale, 42 lb. Total scale and mud, 64 lb.

(2) 30 days. Water used, about 6,[illegible] lb.
Raw water: As first test. Flue scale, 14 lb. Total scale and mud, 83 lb.
Filtered water: Flue scale, 12.5 lb. Total scale and mud, 39 lb.

Even if improved efficiency in the use of the boilers cannot be demonstrated, the difference in amount of scale is very large. The scale from the softened water, as is to be expected, contains larger proportions of calcium sulphate and of magnesium, and is noticeably firmer but not enough so to make any difference in the use of the cleaning machines.

(6) LAUNDRY TESTS WITH THE SOFTENED WATER—Two tests were made. The first at a city institution where only towels were laundered. The saving of soap, measured somewhat crudely, was about 25%, or even more, and the work seemed to the operator to be better done. The second test was carried out at a large commercial laundry, under the personal supervision of the superintendent. His estimate of the saving of soap and supplies was 65%. No marked difference in the quality of the work was apparent.

The question of the amount of soap saved by the

use of softened water is a difficult one to answer, as estimate forms such an important factor in every calculation. For the present purpose, it will be enough if it can be shown that the cost of softening is covered by the saving of soap. Until more exact knowledge is obtained, Whipple's estimate that at least 1 gal. of water is softened for every 100 gal. of water used, may be considered sufficiently conservative. Further using his formula ("Value of Pure Water," p. 27), the saving of soap at 5c. per lb. amounts to $360 for 60,000,000 gal. of water softened from 115 to 55. On the more conservative basis of the chemical equivalent between the calcium and the soap, the saving would be $125, which is about equivalent to the total cost for coagulants, and if at all correct, must be safely above the cost incurred for the softening only.

(7) Removal of Permanent Hardness—This amounts to 16 p.p.m. in the raw water, and is increased to about 19 parts by the added sulphate. Bottle experiments indicate that soda will remove this completely, when added in theoretical amounts, well agitated with the lime and subsequently filtered through sand. The mean result of six experiments thus conducted, with somewhat varying minor conditions, was: alkalinity to methyl orange, 37; soap hardness, 36. Consistent results better than this average could probably be obtained. This would give a very satisfactory softening. The first experiments made with the test filter have not been equally satisfactory, due perhaps to inadequate agitation. But even if the later tests confirm this result, it is hardly likely that this further softening will be adopted for the permanent filter, as the cost will be too great. The 1.2 grain soda required, amounting to 5 tons a day, would cost $100 for 60,000,000 gal. This would be for a reduction of only 19 parts, and is possibly in excess of the advantages obtained, especially when the handling of another chemical and all it involves is considered. Yet according to Whipple's calculation, even this would be paid for by the soap saved. A reduction of the hardness to 30% sounds attractive.

Coagulation by Lime, without Iron—The test was run for five days, with no modifications besides the omission of the iron. At the end of this time, the filter was required for other work. The inefficiency of the coagulation from the bacteriological standpoint was soon demonstrated. The second day there was a trace of gas; the third, 30%; the fourth, 35%; the fifth, 50%, each in 10 c.c. The turbidity during these same days was 0.0, trace, 2.5. The unfavorable impression was confirmed by the results from bottle experiments dealing with the sedimentation in the tank.

(9) Slow Sand Filtration—A slow sand filter was operated for several months until the freezing weather interfered. The filtration was efficient from the standpoint of turbidity. The bacterial results were not uniform. A number of periods of satisfactory results were obtained, from which it might be inferred that after all the manipulative difficulties had been overcome, the filter would operate satisfactorily. As, however, all considerations had led to the adoption of the rapid type, no further tests seemed necessary.

The writer must disclaim credit for a very considerable portion of the investigations recorded above. The test filter was operated under the general direction of the Filtration Commission of Cleveland, with the coöperation of the Water Department. H. B. Hommon, G. E. Flower, and G. D. Makepeace have been in direct charge of the test filter. The members of the Filtration Commission are as follows: President, A. W. Smith, Professor of Chemistry, Case School of Applied Science; Secretary and Consulting Engineer, R. Winthrop Pratt; Dr. Wm. T. Miller, member State Board of Health; Hippolyte Gruener, Professor of Chemistry, Western Reserve University; and Dr. R. G. Perkins, City Bacteriologist and Professor of Hygiene and Preventive Medicine, Western Reserve Medical School.

Ohio Experience in the Use of Road Oils*

Poor results in the use of oil treatments frequently come from the fact that the surface had not been previously cleaned in a proper manner. If possible, the surface should be swept with horse sweepers, and afterward with hand brooms, so as to remove the dust from between the stones to a depth of from 1/4 to 3/4 in. The heavier the grade of oil used, the more important it is to have a clean surface on which to apply it. The surface should be dry and the warmer the air temperature the better.

There has been considerable discussion during the past year concerning sprinkling of the stone with water before applying the bitumens, it being claimed by some that better results are secured. While during a dry, dusty time, better results may be obtained by first lightly sprinkling the stone with water before applying the bitumen, this information is likely to be misleading; for it is believed that it is not the presence of water that might cause the better results, but the effect the water has in cleaning the dust which gives a better adhesion of the oil.

Hence, we would conclude that if sprinkling with water before applying the oil is done, it should be only on hot, dry days, and then sufficient time given after the sprinkling for the water to practically all evaporate before the oil is applied. Therefore we are still warranted in saying that bitumens should be applied only to dry, warm surfaces. During June, July and August is the best time of the year to apply such materials to the road.

The amount of oil that should be applied to the road at any one time will depend upon the condition of the road surface, the quality of the oil used, and the nature of the traffic. In general, it may be said that a couple of light applications during the year will give better results than a single heavy application of the same amount of oil. For the lighter oils, on a comparatively smooth surface, an application of not to exceed 1/8 gal. per sq.yd. may be all that should be applied at one time, while on a rough, pitted surface (with the binder swept from the top surface of the road to a depth of from 1/4 to 3/4 in.) as much as 3/4 gal. per sq.yd. of the heavier oils might give more satisfactory results.

The aim should be to put on just sufficient oil (and screenings) to form a thin mat over the surface of the road. This mat should not be of any appreciable depth over the surface of the larger stones, but sufficient to well seal up the voids between them. This will hold the binder in the stones and make the road surface water-tight.

A medium heavy cold oil will cost from 4½ to 6c. per gal., delivered in tank cars. The cost of applying the cold oil varies from ½ to 1c. per gal., while the cost of applying the hot oil will vary from 1½ to 3c. per gal.

*From Bulletin No. 27, Ohio State Highway Department, June, 1914.

The Design and Construction of the Bassano Dam--Part II

By H. B. Muckleston*

As stated in my previous article [Eng. News, Aug. 27, 1914, p. 425] the Bassano Dam is located on the Bow River, and is a part of the immense irrigation system of the Canadian Pacific Railway which extends from near Calgary, Alberta, many miles to the eastward. The dam is a composite structure, consisting of a long earth embankment and an Ambursen reinforced-concrete spillway section, provided with Stoney gates, flanked on one side by reinforced-concrete head gates, also provided with Stoney gates.

Layout of Plant

Construction was commenced in October, 1910, with the erection of the plant and building of Coffer-dam No. 1. Fig. 1 shows the general layout of the construction plant. Three cableways with spans of 975 ft. were erected, requiring tail towers 95 to 85 ft. in height on the west shore, and head towers from 47 to 55 ft. high on the east shore. The two upstream cableways, which were used for handling forms and concrete, each had a carrying capacity of three tons, whereas the downstream cableway, used extensively for gravel, had a capacity of five tons.

Gravel—A gravel pit, located about 500 ft. west of the west abutment and on the upstream side of the earth dam, was opened up, requiring about 16 ft. of stripping. The gravel was found to be naturally well graded, fairly clean, and containing about 30% excess of sand. The stripping and excavation was done with a [illegible] bucket mounted on a traveling [illegible] car. The stripping was [illegible] done during the night, and in the daytime the gravel was excavated and loaded in dump wagons or a [illegible] under the gravel cable. From here it was [illegible] which was picked up by the cableway and carried to the [illegible] of the [illegible] plant. Two [illegible] gravel pipes, with [illegible] controlling gates, conveyed the gravel from the bin to two measuring hoppers located above the two 1-yd. Smith mixers (Fig. 2).

Cement and Concrete Handling—The cement, which was stored in a cement shed with a capacity of 800 bbl., was by means of an overhead conveyor carried to a hopper whence it was shot down through a 12-in. pipe into a bin placed between the two mixers. The bin was equipped with two spouts in which were fixed measuring slides for the different mixtures, and the cement was in this way distributed to the measuring hoppers which contained the gravel. The whole of the dry mixture was then by a tripping device dumped into the mixers. The two upstream cableways, located directly above the mixers, picked up the concrete buckets, which were of the controllable bottom-dump type, and carried them to wherever concreting was under way. Here the concrete was transferred to a controllable bottom-dump car, which traveled on sectional track resting on the forms. The maximum output of this concreting plant was 350 cu. yd. per 10-hr. day.

Owing to the considerable size of the construction plant, well appointed repair shops were installed so that delays might be avoided and repairs and general maintenance carried out in an efficient manner.

The size of crew engaged varied considerably from time to time, the maximum number being about 750. The unskilled labor was principally Italian, the skilled labor being of all nationalities. Suitable bunk houses and dining rooms for each class, electrically lighted and steam heated, were built, and a waterworks and sewerage system installed. As the river water was contaminated to some extent, especially during the summer, all water for drinking and cooking was [illegible].

All plant and construction materials were shipped to Bassano, a railway station about four miles from the dam, from which point the hauling was done partly by teams and partly by traction engines.

As the high-water period generally commences about the middle of May and lasts well into August, it was necessary to have each section so far advanced in construction before that time that work could be continued even if the cofferdams were flooded. The general con-

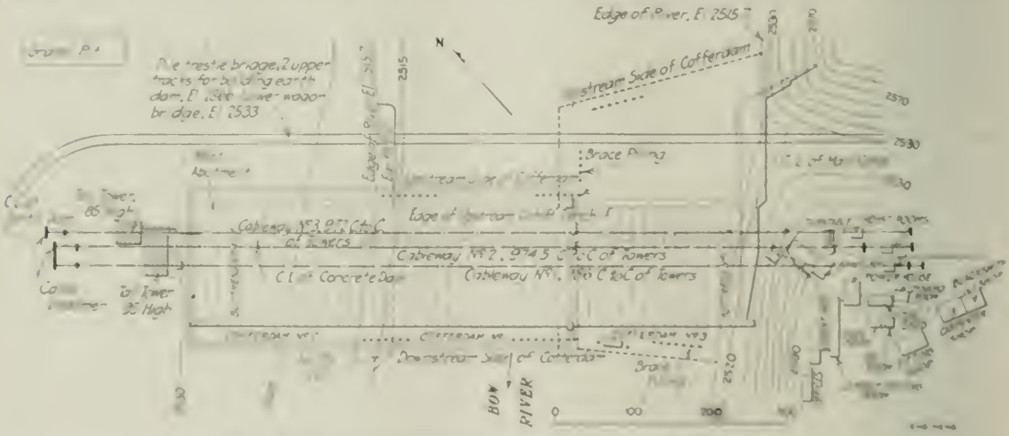


Fig. 1. General Layout of Construction Plant for Bassano Dam

*Assistant [illegible] Engineer, [illegible] Canadian Pacific Ry., Calgary, Alberta.

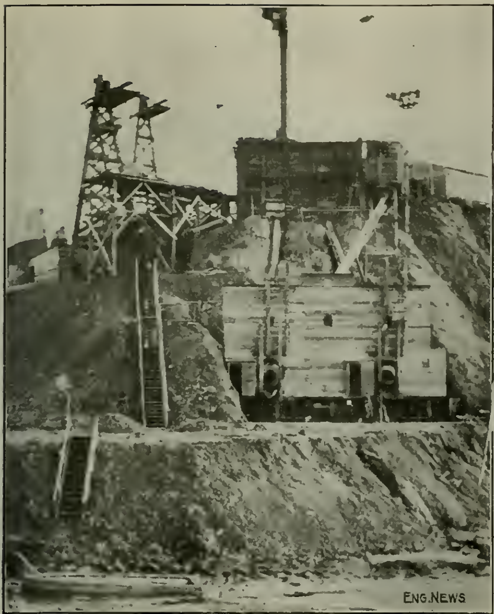


FIG. 2. GRAVEL BIN AT BASSANO DAM, WITH GATE-CONTROLLED PIPES LEADING TO MEASURING HOPPERS OVER CONCRETE MIXERS

struction program was therefore arranged accordingly.

COFFER-DAMS—The first coffer-dam constructed took in the central third of the structure, and the river was passed through the easterly third. Upon completion of the central third to a level above high water, the coffer-dam was removed and the river passed through between the buttresses. The westerly third was then started, upon completion of which the easterly third was commenced, with the river passing through the central and westerly section, the design of the type of structure lending itself admirably to such a procedure (see Fig. 3). The coffer-dams consisted of two rows of piles 12 ft. apart, the piles in each row being 8 ft. c. to c. The outside row carried walings supporting 3-in. tongued-and-grooved sheet piling, which was driven with a steam hammer, the back row acting as brace piling. As the river is fairly shallow at the dam site, the greatest depth at low water being only 8 ft., no particular trouble was experienced in the construction of the coffer-dams.

FORMS—All forms used were sectional. Fig. 4 shows their general arrangement, which has been described in various articles on similar dams in the ENGINEERING NEWS. One departure from general practice, however, was that of removing one entire group of forms together by means of the cableways and reërecting them without taking them apart. This process is shown by Fig. 5, where a whole set of forms for the side of one of the buttresses is being removed for reërection elsewhere.

EXCAVATION—Most of the excavating was done by teams, wagons and slip scrapers. As the work was continued all the year round, special arrangements had to be made for thawing out the ground. At the end of the day tarpaulins 100x150 ft. were supported by means of horses over the excavation and numerous salamanders placed underneath and kept stoked overnight. In the morning the canvas and the salamanders were removed and work continued. In this way it was possible to gradually thaw the frost out of the ground, although in places it was frozen 6 ft. deep.

PROGRESS—Concrete was first poured in Floor Bay No. 17 on Mar. 22, 1911, and continued without interruption practically until November, 1912, when the bulk of the concrete had been placed.

During the time no stops were made except when the

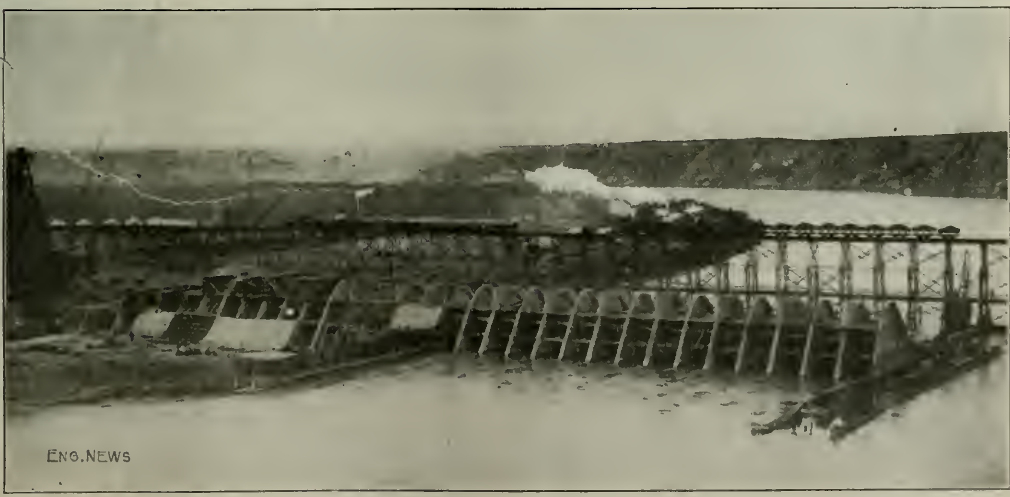


FIG. 3. BASSANO DAM UNDER CONSTRUCTION, AUG. 1, 1911

(The central third is passing water between the buttresses; the left-hand third is under construction; the right-hand third not yet begun.)

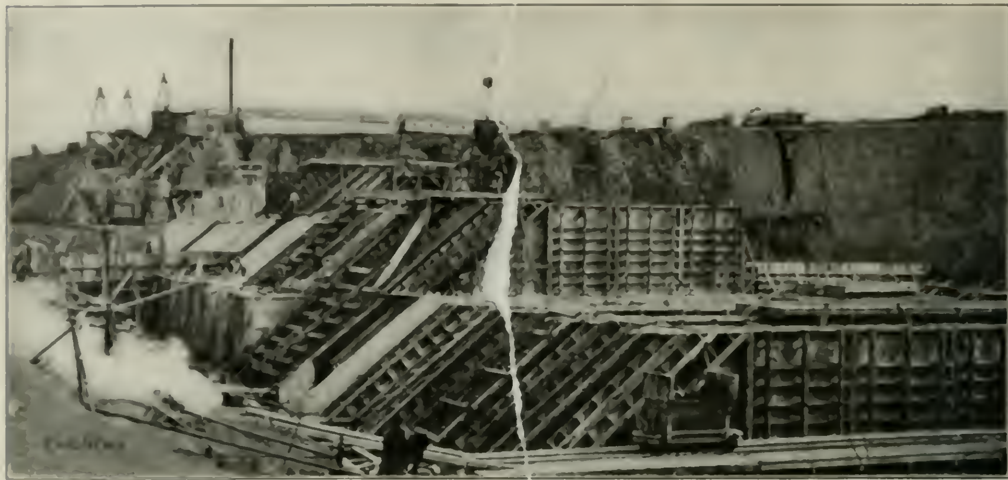


FIG. 4. GENERAL ARRANGEMENT OF SECTIONAL FORMS, JULY 15, 1911

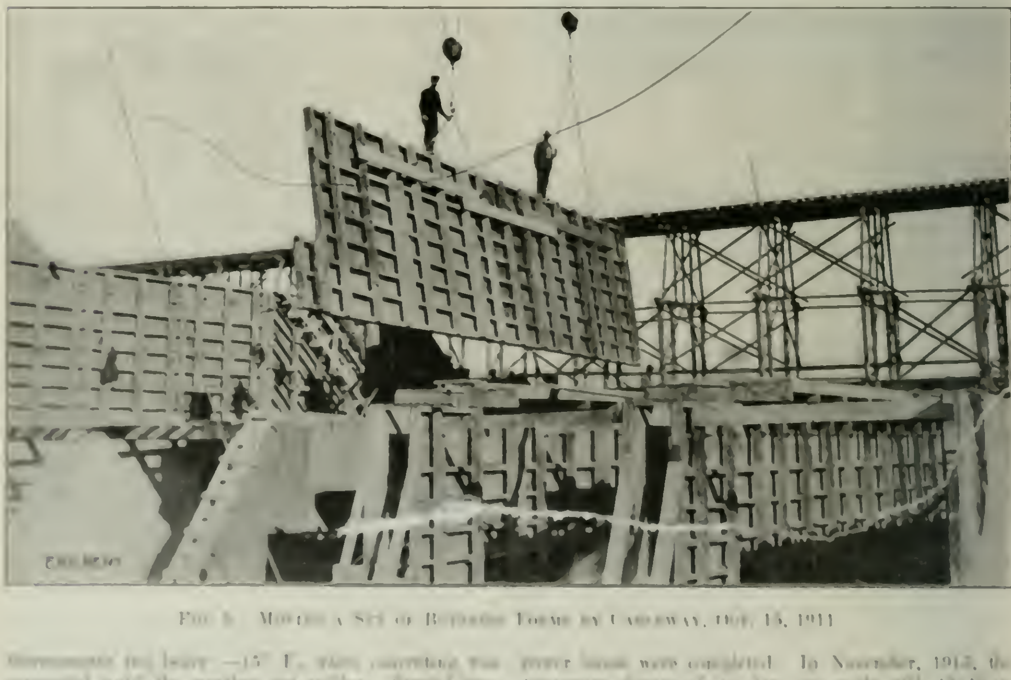


FIG. 5. MOVING A SET OF BUTTRESS FORMS BY CABLEWAY, OCT. 15, 1911

thermometer [illegible] —15° F., when concreting was suspended until the weather got milder. Special provisions were made where the plant was located for heating the water and gravel, and as all the forms were double-boarded no difficulty was experienced in keeping the concrete from freezing. In fact, it was noted on many occasions that the concrete would still be steaming hot when the forms were removed about four days after the concrete was placed. Construction was resumed in April, 1913, and completed in May, 1914, during which period the spillway walls and the piers over the headgates and power house were completed. In November, 1913, the temporary closure of the dam was made with 12x12-in. stop logs, as shown in one of the details in Fig. 3, followed immediately with the permanent concrete closures, the driving of the piling under the lower part of the ogee curve and the concreting of same.

The piles, which were 12x12-in. square timbers shod with cast-iron points, were driven to an average depth of 25 ft., with two 1½-ton steam hammers, in inclined leads. This work was done inside a coffer dam built on the concrete carpet and the river taken care of by means

of the two 6-ft. under sluices in the middle of the structure (Fig. 6). The gravel fill inside the dam was pulled by trains running on the bridge deck and loaded by a steam shovel located at a gravel pit at the west end of the earth dam. The gravel was dumped into hoppers and conveyed to the interior of the dam by means of spouts passing through holes cut in the crest.

Sluices—The Stoney sluices and all their machinery for both the dam and the headworks were manufactured by Ransomes & Rapier, Ltd., of London, England. They are of the usual type, working on free rollers and stanched by a rubber-covered round rod hung in the angle between the pier and the skin of the gate. Each sluice is provided with means for hoisting by hand. Power operation for the crest sluices is provided for by four movable trolleys on the bridge, arranged to engage any one of the operating shafts. In the case of the canal head sluices a separate motor is provided for each gate. In order to prevent any possible damage from over-winding, each gate is equipped with a limit switch which breaks all electrical connections when the gates approach within 3 in. of the full travel at either end.

The design for the gates and operating mechanism was worked up by the manufacturers under specifications drawn up by the engineers of the Railway Company. The gate, guides and machinery were shipped in the knockdown, and erected by the Railway Company under the supervision of an expert erector sent out from England. So well had the work of manufacture been done that the various parts went together with little or no subsequent alterations or fitting

Auxiliary Gate—As an emergency closure in case of accident to the main crest sluices, a special auxiliary gate is provided. This gate is similar to the permanent gates except that the position in the guides is reversed so that the skin is on the downstream face of the girders instead of the upstream face, and that an endless chain of live rollers working on the gate is provided instead of the rigid roller trains provided for the main sluices.

The auxiliary gate is handled by a gantry crane running on rails on the bridge girders. As the gate will be used but seldom, no provision is made for counterweights or power operation.

Power Plant—As stated above, the time factor in flood rises is so small that special provision was necessary to insure very rapid operation of the crest and canal sluices. To provide electric power for this work, a small power plant was built in a chamber provided for the purpose in the east abutment. The plant consists of a 180-hp. reaction turbine, with Woodward governor, connected by belt to a 100-kv.-a., three-phase, 60-cycle, 2400-volt generator. The plant is equipped with step-down transformers furnishing current at 110-220 volts for the operation of the motors and for a complete lighting system in the dam and about the headworks.

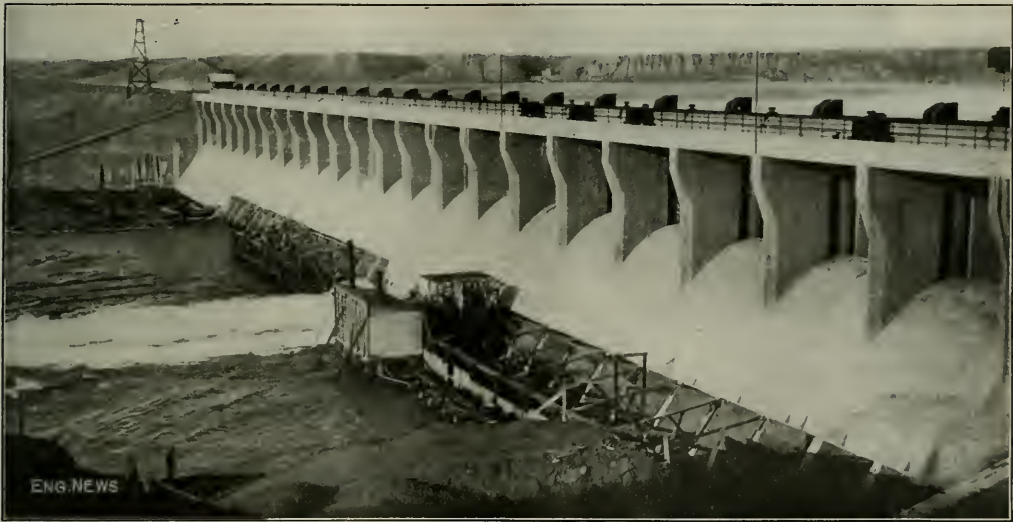


Fig. 6. Making the Permanent Concrete Closure of the Bassano Dam; Nov. 30, 1913
(The river flow is being passed through two 6-ft. under sluices.)

A view of the finished dam, looking along the top from the head-gates end, is shown by Fig. 7.

Earth Embankment—The earth embankment (Fig. 8) was built of selected material from the canal cut. The specifications provided for the most approved methods of construction by spreading and rolling the materials in thin layers and for sprinkling if found necessary. The rear half of the dam is underdrained in order to steepen the plane of saturation, and to intercept any possible flow along the surface between the dam proper and its foundations. Before commencing construction, the foundation surface was carefully stripped of surface soil and thoroughly plowed to give a good bond.

The contractor for the earth portion commenced work by building a double-track narrow-gage trestle across the river. On the right bank, this trestle was continued as two single-track trestles about 100 ft. apart. The material was loaded into dump cars and hauled by locomotive to the dam, where it was dumped from the tres-

FIG. 7. LOOKING WEST ALONG THE TOP OF THE BASSANO DAM

tles and spread by four-horse Fresno scrapers. The continual trampling by four horses abreast, and the thin spreading which this method resulted in, gave such a thoroughly dense bank that the clause of the specifications relating to rolling was not exacted.

At the connections with the spillway the earth was very carefully spread and compacted. A good proportion

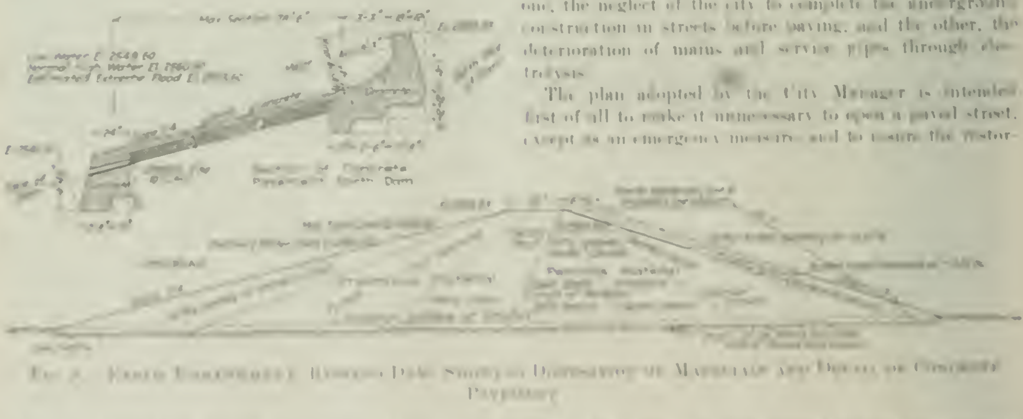


FIG. 8. EARTH EMBANKMENT, BASSANO DAM, SHOWING DISPOSITION OF MATERIALS AND DETAIL OF CONCRETE PAVEMENT

of this work was done by flushing the material by means of a jet of water under pressure. The material available was not very well suited to the process, being an unusually pure blue clay, and the result has not been entirely satisfactory, owing to the very long time required for the bank to drain.

CONTRACTORS—The preliminary designs for the dam and the surveys for the project of which it is such an important part were made by the [illegible]. The detailed designs for the spillway and headgates were made by the Ambursen Hydraulic Construction Co.

H. Siebens was resident engineer for construction of the concrete work, and has assisted in the preparation of this article. A. J. Raymond was Superintendent of Construction. A. Fromm-fer, Division Engineer, was in charge of construction of the earth embankment and paving, and the excavation of the canal.

The work as a whole was under the direction of A. S. Dawson, Chief Engineer of the Department of Natural Resources, Canadian Pacific Railway Co., Calgary, Alberta.

Regulation of the Opening and Restoration of Pavement Surfaces in Springfield, Ohio

By GEORGE L. BINKLEY*

Since the first of the present year, when the city of Springfield, Ohio, installed the commission-manager plan of government, much attention has been given by the city officials to the problem of street maintenance. One of the first steps of City Manager Charles E. Ashburner was the adoption of an economical and efficient system of street repairing.

Early in January, an investigation was conducted into the history of street repairing, as shown in the records of the city during the year 1913, and it was found that permits had been issued for nearly 800 trenches in improved streets, in addition to the openings made by public-service corporations. An examination of the streets, as well as the methods of backfilling and repaving, showed that practically every trench made during the preceding year was a potential chuck hole. The investigation showed the need for trench work to be due chiefly to two causes: one, the neglect of the city to complete the underground construction in streets before paving, and the other, the deterioration of mains and service pipes through electrolysis.

The plan adopted by the City Manager is intended first of all to make it unnecessary to open a paved street, except as an emergency measure, and to insure the restoration of the surface as satisfactorily as good workmanship makes possible. The assistance of the Bureau of Standards at Washington was secured in an effort to reduce the deterioration of underground metallic construction, and the public-service corporations operating electric-railway lines in and through the city have readily agreed to cooperate in the general plans of electrolysis mitigation.

*[illegible], Springfield, Ohio.

Laws for the Preservation of Pavements

The present charter of the city of Springfield provides that after the paving of a street, no excavations can be made within a period of five years from the date of the completion of the work, excepting by permission of the city commission, in which four-fifths of the members concur. Following up the opportunity thus opened, it was decided to include in all resolutions of necessity, which constitute the first legislative step in street-paving procedure, a notice to the owners of property fronting upon the street to the effect that all sewer, water, gas and other connections must be installed previous to the commencement of the pavement-construction work: and that in the event of the failure of any property owner to comply with that notification, the city reserves the right to construct such connections, and assesses the cost against the property to be benefited.

Furthermore, it was decided that the paving of a street should not take place until every other form of improvement in the street had been provided. Previously, macadam streets had been torn up in a number of instances for the construction of sewers, and brick- and sheet-asphalt streets were trenched for considerable distances to install telephone, telegraph and electrical conduits. The new method of procedure calls for a study of the probable needs of a street in the way of underground construction during the life of the street paving, and the making of ample provision for the needs before the paving work starts.

Restoration of Pavement

It was recognized, however, that these precautionary measures would not entirely eliminate the necessity for opening paved streets, and that the policy of street maintenance would not be complete without some provision being made to insure the restoration of the street surface, where trenches were made.

Cash Deposits—The city consequently decided to assume all responsibility for the repair of trenches in the future. An ordinance was passed, repealing the legislation previously in force, which had required persons opening paved streets to give bond for the satisfactory repair of the paving, and substituting therefore a provision for the issuance of permits for street openings only when deposits are made to cover the cost of the trench repair.

Permits—Plumbers and all others desiring to dig trenches in streets are required first of all to file an application in the office of the city engineer, upon a form furnished by the city for that purpose, stating the name of the applicant, the location and purpose of the opening, the length and depth of the trench, and the names of all persons interested, or to be benefited by, the work to be done.

The city engineer is required to prepare and to keep on file a schedule of the estimated cost of backfilling and resurfacing in various kinds of street paving, and from this schedule the amount of the deposit required is determined. The permit issued to the applicant contains all the information upon the application, together with a statement of the amount of the cash deposit, and the dates between which the opening may be made. The permits are numbered serially, and a daily report is made to the city auditor, showing the amount deposited for each permit, while the cash deposits are turned over to the city treasurer each day, and placed in what is known as the Special Repair fund.

Inspection of Underground Work—A carbon copy of the permit is turned over to a plumbing inspector who passes upon the quality of the work installed before the trench is backfilled. After having completed his work, the holder of the permit notifies the engineering department of that fact in writing, and after it has been ascertained that the plumbing inspector has approved the work so far as it has been completed, a postcard is mailed to the holder of the permit, notifying him that at 7 a.m. of a given day the city will assume responsibility for the trench. Until that time, the person or company holding the permit is responsible for barricades and red lights on the trenches.

Pavement Repairs—In backfilling the trench, the earth is firmly tamped, the street paving removed for a foot or so back from the edge of the trench and a new concrete foundation laid with its edges upon firm earth which has not been disturbed. The wearing surface is then added, and the work finally passed upon by an engineer.

The street-repair foreman makes a report to the chief engineer upon the cost of backfilling and resurfacing each trench, giving the expense for labor and material. This report is certified to the city auditor, who issues a warrant to the treasurer for a refund of any balance left in each deposit, or collects from the holder of the permit any amount in excess of his deposit, should the expense of backfilling be greater than the estimate. Should the holder of a permit fail to pay an excess charge, he would be refused any further permits.

Charges for Pavement Repairs—In the schedule showing the estimated cost of backfilling and resurfacing trenches, three classifications are made, according to the depths of trenches. The first classification includes all trenches of 30 in. or less in width, and 4 ft. or less in depth. The second classification includes all trenches between 4 and 7 ft. in depth, and restricts their width to 30 in. The third classification permits of a 40-in. width, and a 12-in. depth.

The charge per lin.ft. of trench in the various kinds of street paving, in each classification, is shown by the accompanying table:

TABLE SHOWING CHARGES FOR BACKFILLING AND RESTORING PAVEMENT

Surface	First	Second	Third
Brick	$1.02	$1.20	$1.61
Sheet asphalt	1.34	1.52	1.74
Asphalt block	1.59	1.74	1.99
Asphaltic concrete	1.24	1.42	1.86
Medina stone	2.11	2.32	2.54
Granite	2.11	2.32	2.54
Wood Block	1.74	1.92	2.14
6-in. waterproof macadam (mixed)	0.71	0.92	1.32
6-in. waterproof macadam (penetration)	0.59	0.77	1.17
8-in. waterbound macadam	0.41	0.62	0.97
8-in. gravel	0.31	0.52	0.84

Special estimates are prepared for trenches not included in the general classification given above and charges made accordingly.

The plan appears to be satisfactory all around. The plumbers, some of whom at first objected, are now practically a unit in expressing their approval, as it relieves them of the necessity of keeping repair gangs. The public, previously dissatisfied with the condition of the streets, is at present waiting to see what the results of the new plan will be, but are not giving expression to any noticeable criticism.

Water-Supply of Boulder, Colo.

By Clare V. Mann*

Few cities in the world have a water-supply drawn from so high an elevation and so pure and abundant as Boulder. The elevation of the sources is from 2 to 2½ miles above sea level. The character and location of the drainage area insures a high degree of purity. The average consumption (and waste) is seldom below 200 gal. per capita per day and in the dry summer months often reaches 400 gal.

Boulder, the seat of the State University of Colorado, is a city of 10,000 inhabitants, situated 29 miles northwest of Denver, and at the extreme eastern base of the foothills of the Rocky Mountains. The elevation of Boulder above mean sea level is 5350 ft.

The water-supply of Boulder is derived from the Silver Lake drainage area, 8.73 sq.mi. in extent, varying in altitude from 10,200 to 13,500 ft. above sea level, and lying at the crest of the Continental Divide, 20 miles due west of Boulder. The annual precipitation over the entire watershed averages from 40 to 45 in., the major portion of which falls in the form of snow from September to May, inclusive. A small portion of this snow, lying on southern slopes, is melted as it falls, or in the course of a few days or weeks. The remainder is piled by the strong westerly winds into enormous drifts in the ravines and deep recesses of the watershed, there to remain until melted away in the warm and sunny days of June, July and August. One of the drifts which so accumulates has never melted entirely away. It is, in fact, a true glacier, one of the very few now existing in Colorado. It is situated near the top of Arapahoe Peak and is called the Arapahoe Glacier.

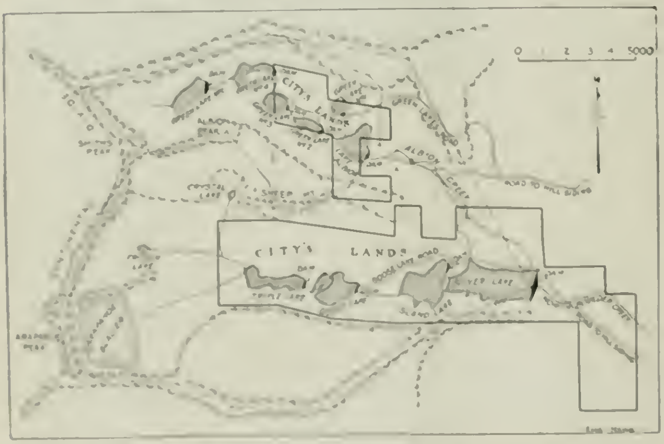


Fig. 1. Map of Water-Supply Drainage Area, Boulder, Colo.

The lesser portion of the annual precipitation falls as rain, hail or sleet during June, July and August, and serves to augment the melting of the snows. As an example of the monthly distribution of precipitation, the measurements found for 1911—a normal year—is given:

PRECIPITATION IN INCHES, SILVER LAKE WATERSHED, 1911

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
5.85	6.20	7.60	7.90	1.70	1.20	4.[illegible]	2.12	2.70	2.50		1.65	43.66

The percentages of runoff and of loss from evaporation have not been determined.

In the Silver Lake Watershed, there rise the north and middle branches of North Boulder Creek, otherwise known as Albion Creek and Arapahoe Creek, respectively. The normal flow of Albion Creek varies from 1 sec.-ft. or less in December and January, to from 20 to 25 sec.-ft. in June, July and August. The flow of Arapahoe Creek varies from 1 to 4 sec.-ft. in December and January, up to as high as 60 and 100 sec.-ft. in June, July and August.

Along the headwaters of each of the two branches of North Boulder Creek there lie (Fig. 1), at short distances from each other, 10 natural lakes, of glacial formation. Viewed from the top of Arapahoe Peak, these lakes, with their crystal-clear water and their setting of wild and rugged mountain peaks and dense pine forests, form a bit of scenery which, once seen, can never be forgotten. Fig. 2 is a view of the chain of lakes on Arapahoe Creek. The names are as follows: Triple Lakes, Goose Lake, Island Lake, and Silver Lake.

In 1904, because of the pollution of the old source of supply—Middle Boulder Creek—with tailings and slimes from the mines and mills above the old Lower Intake, it became necessary for Boulder to seek a new source of supply above the region of possible pollution. The city purchased a number of the lakes in the Silver Lake Watershed, and acquired title, by special Act of Congress and otherwise, to a considerable portion of the lands within the watershed, and adjoining the lakes. Surveys were made at each dam site, and preliminary work was done in excavating outlet channels at each lake. The contemplated areas, capacities, and heights of the several reservoirs, together with the original estimates of the cost of development, were as follows:

Reservoir	Area, acres	Capacity, million gal.	Height dam, ft.	Cost
Triple Lakes	[illegible]	[illegible]	[illegible]	[illegible]
Goose Lake	[illegible]	[illegible]	[illegible]	[illegible]
Island Lake	[illegible]	[illegible]	[illegible]	[illegible]
Silver Lake	[illegible]	[illegible]	[illegible]	[illegible]
Albion Lake	[illegible]	[illegible]	[illegible]	[illegible]
Total		[illegible]*		[illegible]

*One thousand million gal.

At the present maximum rate of consumption, this amount of storage (one year's filling) would be sufficient to last the city for two years.

To eliminate waste and all possibility of pollution of the water enroute from the lakes to Boulder, a steel gravity pipe line was built in the summer of 1906. It is approximately 9 miles in length, and has its intake at the "Intake Reservoir," a point on North Boulder Creek, six miles below Silver Lake, at an elevation of 8900 ft. above sea level. This reservoir has a capacity of 9,300,000 gal. The lower end of the line discharges into the head-gate chamber of the old gravity pipe line in lower

*Boulder, Colo.

Boulder Cañon, situated on Middle Boulder Creek at a point approximately three miles west of Boulder, and 5950 ft. above sea level. The pipe line consists of 3800 ft. of 12-in., 16,800 ft. of 15-in. pipe and some 27,000 ft. of 18-in. pipe, all pipe ¼ in. thick, lap-welded longitudinally. Joints are made with cast-iron bells, which receive the ends of two consecutive pipes. The points are calked with oakum and lead in the usual manner.

From the old intake of the lower Boulder Cañon pipe lines, the water is conveyed to the city through several thousand feet of 24-in. wood-stave and 20-in. cast-iron pipe and through a separate 15-in. steel gravity line. Sunshine and Chautauqua reservoirs serve to equalize the pressure on their respective distributary systems, which are operated separately and also provide some protection in case of a serious fire, or break in the main supply-pipe lines. They have capacities, respectively, of 5,775,000 and 3,712,500 gal.

Since completing the Mountain Pipe Line, in 1906, the city has actively undertaken the development of its mountain reservoir system. In 1908, a timber crib dam 30 ft. in height, with loose rock fill, was completed at Goose Lake, at a total cost of $26,216. In June, 1910, active construction was begun on a 60-ft. cyclopean rubble-concrete dam at Lake Albion. This dam is now two-thirds complete, and to date has cost nearly $210,000. When complete, the dam will contain 17,315 cu.yd. of masonry.

In the summer of 1911, excavation was made at Silver Lake for the foundations of a rock-fill dam 35 ft. in height. A contract was subsequently let to the Peter O'Brian Construction Co., of Denver, for placing the rock fill, and otherwise completing the dam. Owing to a failure to find suitable foundations within from 15 to 25 ft. of the depth indicated on the contract drawings, Mr. O'Brian refused to execute his contract, and on Aug. 20, 1912, the work was abandoned. Since that time, no further real progress has been made on the dam, but the city has done some prospecting and other preliminary work which should have been done in the beginning. In all, about $30,000 have been spent on the dam to date. At this writing, new plans for a rock-fill structure are under consideration, and it is expected that work will shortly be commenced in accordance with them.

No plans of a definite character have so far been made for dams at Island and Triple lakes, and it is probable that none will be made in the near future. For additional storage, an effort is being made to gain possession of the five Green Lakes lying above Lake Albion.

FIG. 2. CHAIN OF LAKES ON ARAPAHOE CREEK; PART OF WATER-SUPPLY OF BOULDER, COLO.
(Beginning in the foreground the lakes shown are named as follows: Triple, Goose, Island, Silver.)

With the dams completed, which are contemplated or now under construction, and with the Mountain Pipe Line extended up North Boulder Creek to a point above the Denver, Boulder & Western Ry., the City of Boulder will have a water system of which it may well be proud, and which, in the semi-arid State of Colorado, will be worth at least $1,000,000.

The writer was Resident Engineer on the Albion Dam during the construction seasons of 1910, 1912 and 1913, and Inspecting Engineer on Silver Lake in the season of 1912.

Russian Thistles Caused Breaks in the Irrigation Canals of the Truckee-Carson Project in June, 1914, according to the United States "Reclamation Record" for July-August. The only information on the subject is:

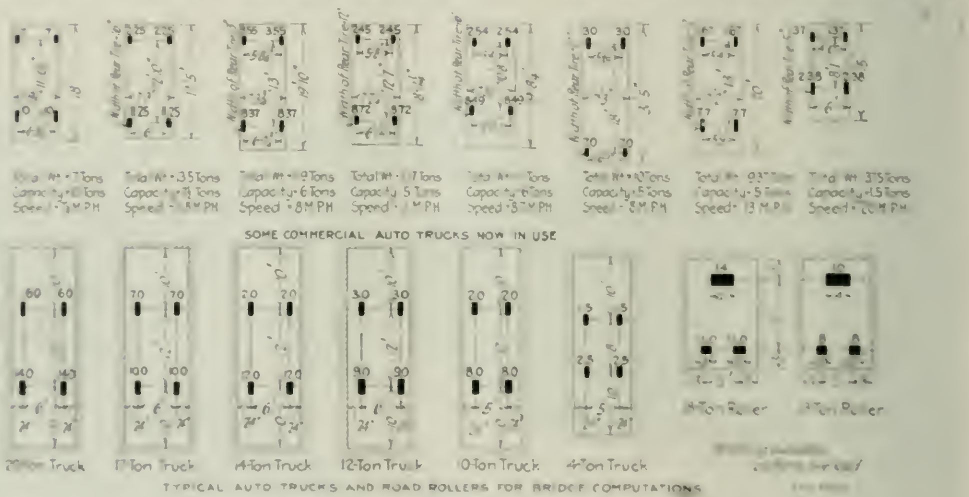
The accumulation of Russian thistles in the canals formed dams in the structures and caused many breaks in laterals which kept the repair force busy. This nuisance decreased towards the end of the month.

Motor-Truck Loading on Highway Bridges

By L. E. Mannheim* and R. W. Gastmeyer*

It is desired in the following article to call attention to the inadequacy of a large percentage of our highway bridges to accommodate the heavy automobile traffic of today. It appears to be a fact that automobile-truck designers are blindly turning out machines which neither ordinary highway bridges nor highway macadams will sustain.

Recently, there have been several published reports of failures of highway bridges. These failures are causing railroads and other corporations, as well as states and municipalities, owning highway bridges for whose strength they assume the responsibility, to take an active interest in the weights of auto trucks being placed upon the market. It is time that some one in authority call a halt to the excessive wheel loads our modern trucks are assuming, or at least that the state authorities inaugurate the practice of posting signs on all highway bridges limiting the loads permissible, and at the same time regulate the concentrations permitted on state highways.



Load Diagrams of Auto Trucks and Road Rollers

Old Loadings and Modern Loads

The customary loading assumed for the design of a highway bridge in the past has been a certain uniform live-load alone, possibly a typical heavy wagon or road-roller, or a uniform live-load with a concentration. These types of loading, of course, had their origin at a time when traffic conditions were readily taken care of by such assumed loads. But these *older types of loading* are inadequate for purposes of design to take care of modern conditions; they should be replaced by some types of typical motor trucks. Most auto trucks now give greater axle concentrations than any roller heretofore used, and with less favorable distribution.

Greater Velocity of Motor Trucks—The chance that two rollers might be on a bridge at the same time was so remote that it was never deemed practical or fair to design floor-beams for that loading. Today it is a common occurrence that *two motor trucks* pass each other on a bridge.

Modern trucks traveling at the rate of 12 mi. per hr. can be stopped within a comparatively short distance; this sets up *longitudinal stresses* in the floor system. Further, where the planking is not adequately tied down, the longitudinal forces may prove destructive to the floor surface.

Better *protection fences* must be given trusses to protect them against possibility of collision.

The trucks, traveling at a much greater speed than the rollers, produce *more jar and sway*, which require stiffer bracing.

Centrifugal forces will act on bridges occupying a sharp bend in the roadway, an effect which was negligible with slow-speed rollers.

Thus, many conditions arise which have heretofore never been encountered in simple highway-bridge design. What is more, trucks are frequent in their passage, while rollers come along quite infrequently, and as a result we have not merely occasional overload but a daily repetition of the overloading.

Comparative Figures on Trucks and Rollers

Accompanying this article is a diagram showing concentrations and wheel spacing, as well as outside dimensions of various trucks which are being sold today. From these examples certain typical trucks are recommended to be used for designing new bridges as well as for investigating old bridges. It should be noted that the area assumed as covered by the typical trucks is based on the idea that the truck is in motion; possibly more than 12 ft. in the direction of traffic would be justifiable, but the distance is at least a conservative one.

The table accompanying shows the comparison between trucks representing actual present-day operation and two common types of road rollers, 18 ton and 10 ton, and

*Engineering Department, New York Central R.R., Grand Central Terminal, New York City.

COMPARATIVE BRIDGE MOMENTS FROM ROLLERS AND AUTO TRUCKS

Maximum moments in thousand foot-pounds for a width of bridge equal to the width of roller or truck.
Impact is included as follows:

For rollers, 25%

For trucks and uniform load, $\frac{150}{L + 300}\%$ where L = loaded length in ft.

Trucks assumed to be surrounded by uniform live-load of 100 lb. per sq.ft for spans over 15 ft.; rollers without uniform live-load except for floorbeam moments of 18-ton roller.

Figures in parentheses ( ) are ratios $\frac{\text{Load or moment from truck}}{\text{Load or moment from 13-t. roller}}$

Figures in brackets [ ] are ratios $\frac{\text{Moment from truck}}{\text{Moment from uniform L.L.}}$

TYPE OF LOADING		20-ton truck	17-ton truck	14-ton truck Dump-cart type	10-ton truck	13-ton roller No U.L.L.	18-ton roller No U.L.L.	Uniform Live-Load
WHEEL CONCENTRATION		14 (1 75)	10 (1 25)	12 (1 5)	8 (1.0)	8.0	11 0	
	Span, ft.							
MOMENTS	10	104 (2 08)	74 (1 48)	89 (1.78)	59 (1 18)	50	69	21
	12	124 (2 08)	89 (1 48)	107 (1.79)	71 (1 18)	60	83	29
	15	155 (2 07)	111 (1 48)	133 (1.78)	89 (1.19)	75	103	45
	20	206 (2 04)	147 (1 45)	176 (1.74)	118 (1.17)	101	138	81
	30	343 [1 90]	262 [1 45]	279 [1.54]	191 [1.06]	180	246	181
	40	509 [1 61]	405 [1 28]	405 [1.28]	287 [0.91]	260	356	317
	50	696 [1 42]	572 [1 16]	550 [1.12]	400 [0.82]	340	469	492
	60	913 [1 30]	768 [1 10]	725 [1.04]	540 [0 77]	421	581	701
FLOOR-BEAM MOMENTS (10-ft. panels)	Width, ft.						18-ton roller with U.L.L	
	15	106 (2 04)	78 (1 50)	93 (1.79)	71 (1.37)	52	76.5	
	20	169 (2 22)	128 (1 69)	134 (1.76)	115 (1.51)	76	122 8	
	25	243 (2 36)	188 (1.82)	216 (2 10)	169 (1.64)	103	178	
	30	327 (2 60)	257 (2 04)	291 (2 31)	232 (1.84)	126	242	

in designing bridges. While the uniform live-load is generally omitted in design when using a roller (except possibly when an 18-ton roller is used on city bridges), the writers feel justified in using a uniform live-load of 100 lb. per sq.ft. as a possible load that might be present simultaneously with the trucks.* There are several reasons for this assumption: three or four inches of well packed snow or ice would give 15 or 20 lb. per sq.ft.; timber might be piled alongside of the roadway for repairing an adjacent roadway and sidewalk; the assumption of a uniform load provides for all other traffic—such as trailers, if the truck is being used as a tractor, or a horse team near the truck; and, in general, the practice of using the uniform live-load simultaneous with the concentrations serves as a load factor-of-safety.

The moments in the accompanying table are for a width equal to the assumed width of truck or roller. *The moments include impact,* taken as 25% of the live-load in the case of the roller, and 150 ($L + 300$) in the case of the motor truck, L being the loaded strength of span in feet.

From this table, it is readily seen how these trucks are loading most bridges considerably beyond the loads employed in design. Considering the elastic limit of steel as about 32,000 lb. per sq.in., and our designing stress at 16,000 lb. per sq.in. in tension, it can be seen (from the columns showing ratios of moments of the trucks and rollers) how near the elastic limit a great many bridges are being worked. Especially is this true of the floor-beams and stringers, where the ratios of actual loads to designing loads run high, and it should be borne in mind in examining the table that the truck moments on the floor-beams do not take into account the case of two trucks passing.

While in the table of comparative moments a higher impact percentage has been used in figuring the trucks than in figuring the rollers, yet the moments produced by the trucks are so great that they would still be excessive if the impact effects were reduced to those employed for the rollers. It must be remembered that the roller was a slow-moving load and the resulting impact stresses were accordingly low; 25% of the live-load ought to cover the impact effect for an ordinary roller. The modern truck is capable of operating at a rate of about 12 mi. per hr., and the driver seldom if ever slows down the machine when on a bridge. An impact allowance of 50% would probably be required to cover the resulting stresses. The jar caused by these heavy trucks is often felt in houses set far back from the street, even when the pavement is asphalt in good condition, and the corresponding effect on a steel bridge can readily be imagined.

In the course of an investigation of the strength of a series of old highway bridges using truck loads similar to those given in the tables, it was found that the older bridges were not designed with uniform strength throughout to take care of the loads of today; and no doubt these old highway bridges referred to are typical of highway bridges in general. The floor-beams and stringers often are found to be considerably weaker than the main girders or trusses. The increase in loading due to the trucks shows most on the floor-beams and stringers because of the large percentage of load concentrated on the rear axle,* and the capacity of the bridge is largely limited by these members.

Recommendations

Posting Capacity of Existing Bridges—Since the older bridges are now carrying loads considerably in excess of the loads for which they were designed, and since the modern loads introduce new forces on our bridges in the way of impact, centrifugal forces, braking effects, etc., it is urgently desirable as a safety provision that bridges be posted for their permissible loading.

Posted signs at the approaches of highway bridges should state the heaviest total weight of loaded truck permissible. Drivers should know the weight of their trucks empty, the amount of load on the heavier axle, and the total capacity. As a rule, drivers lack this essential information.

Loadings for Future Design—For future designs some departures must be made by engineers to conform to the modern conditions. The following requirements are suggested:

Class A bridges to be designed for a 20-ton truck as per diagram, surrounded by a uniform live-load of 100 lb. per sq.ft., to take care of heavy city traffic.

*The uniform live-load is considered as loading the clear roadway only on the area surrounding that assumed as occupied by the moving truck. For spans exceeding 60 ft. in length this uniform live-load could be materially reduced in amount.

*In the case of dump carts, over 80% of the total load is usually on the rear axle

Class B bridges to be designed for a 12-ton truck as per diagram, surrounded by a uniform live-load of 100 lb. per sq.ft., to take care of suburban and state-road traffic.

Class C bridges to be designed for a 6-ton truck with distribution of load on axles similar to those shown, surrounded by a uniform live-load of 80 lb. per sq.ft., to take care of light country traffic.

If the clear roadway is wide enough to permit two trucks to pass, the floor system should be designed of corresponding strength, roadways over 16 ft. wide in the clear would come under this provision.* Class A and Class B bridges should provide for specified trolley loads in localities where such loads prove heavier than the truck loads. The bracing on these bridges should be effectively riveted stiff members. The planking should be well anchored and the floor-beam should be amply braced against stresses induced by sudden braking. All connection details should be worked out so that bracing members will prove efficient against vibration and lateral sway.

The dump truck will always require a heavy floor system if the scheme of dumping from the rear is adhered to, because of the large percentage of load balanced over the rear axle. Some form of center or side dump could be devised which would give more favorable concentrations for floor-beam and stringer design.

Class B loading should prove ample for almost any truck, and it is recommended as the most generally applicable type of loading. It should prove satisfactory for the occasional operation of any of the heavier types of trucks. A bridge designed for two Class B trucks passing each other will not be much heavier than most Class B bridges designed under the older types of loads, and the weight will be much better distributed to give a bridge of uniform strength throughout.

FUTURE INCREASE IN TRUCK LOADS?

After all, the above loads will not take care of all possible increases in highway loads unless legislation is enacted limiting load concentrations. There might be no limit to these concentrations if truck manufacturers are permitted to continue unrestricted. This would appear to be a matter of State regulation and surveillance. To blindly design bridges to take care of uncalled-for future increases in loading would involve a wasteful expenditure of money; and railroads and other corporations owning bridges, and finally the taxpayers, would be the ultimate losers.

A Bit of Early American Water-Works' Equipment

An old gate valve which was a part of the appurtenances of the old cast-iron water-storage tank of the Manhattan Co., New York City, described in ENGINEERING NEWS of July 23, is shown in the accompanying illustration. We have been unable to obtain any exact information as to the time this valve was installed, but if it was as old as the tank it dated back to the beginning of the last century.

The body of the valve was of cast iron, the stem, yoke rods and bolts of wrought iron, and the gate itself was a sheet of cast iron connected to the screw stem by a loose bolt. Although all the company's street mains were of wood—bored logs, yet the tank fittings were all cast iron.

Cast-iron water pipes were made and used for some purposes as early as the middle of the 18th century, but curiously enough were objected to for mains carrying a potable water supply as unhealthful. In the latter part of the 18th century and the first part of 19th century, when the London water pipes began to give out because of increased pressures, it was proposed to substitute pipes of bored stone for the wood mains, as the popular clamor against iron pipes was formidable. Patents were granted to two or three inventors for stone-pipe boring machines, and considerable money was invested in the industry.

EARLY WATER-WORKS GATE VALVE

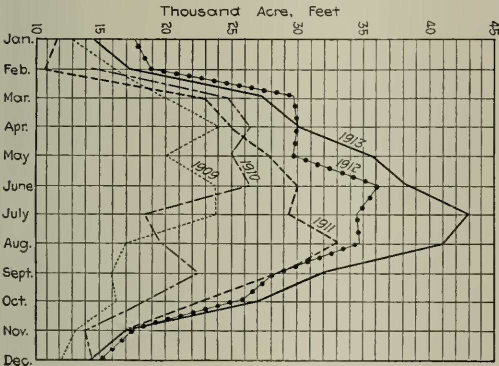
For the photograph shown we are indebted to Alfred D. Flinn, Deputy Chief Engineer of the Board of Water Supply of the City of New York. Mr. Flinn and other officials of the Board of Water Supply probably would have liked to see the old valve preserved in some museum as a relic of the city's history, but the city's historical societies could not be interested in a mere engineering curiosity, and the old valve was broken up for junk.

*[illegible]

Irrigation Operations of Imperial Water Co. No. 1 for the Year 1913

Intensive cultivation on land below sea level in what only a few years ago was a sun-parched desert has been made possible by diverting the water of the Colorado River into that portion of the extreme southern portion of California which is now known as the Imperial Valley. Water for this district is supplied wholesale by the California Development Co. to a number of companies which distribute it to farmer's canals. We have received from Ray S. Carberry, Superintendent of Imperial Water Co. No. 1, a copy of his annual report for the year 1913 and have taken from the report a number of unusually interesting and valuable operating and cost facts and figures.

The company operates 330 miles of canals. These canals cover 115,520 mi. of irrigable land. During 1913



Monthly Deliveries of Water to the Imperial Water Co. No. 1 for the Years 1909 to 1913, Inclusive

the company executed 33,964 orders for water and paid the parent company for 337,349 acre-ft. of water, which was delivered to 101,796 acres of crops. On this work an average of 172 men were employed per day for a working year of 300 days.

The accompanying diagram shows the amount of water delivered to the company by months during the past five years. The maximum demand in 1909 and 1910 was in April, but since then it has ranged from June to August. In 1913, July was the maximum month.

Unaccounted-for water in 1913 amounted to 11.06%, which was the difference between the measured amount received by the company and the measured quantities delivered to individual consumers. For earlier years the unaccounted-for water was as follows: 1912, 13.9%; 1911, 15.9%.

The 11.06% of water not accounted for in 1913 represented a gross charge against the company of \$20,737, reduced to \$1996 by an allowance of 10% on the part of the parent company.

The difference between what may be termed the wholesale and retail deliveries is explained in Mr. Carberry's report as follows:

The difference of \$20,737.47 may be accounted for in seepage, evaporation, waste, stock water and error in measurements, of which the waste water is a principal factor in crowding our ditches during the peak load, which results in considerable overflow of the banks, occasioned by the stockholder's ditch, as well as the company's ditch, being in an undesirable condition for conveyance of the maximum amount of water at that time of the year.

Your Board, by authorizing the charging for stock water, has saved several dollars; not that the charge for any large amount was made, but the fact that stock water was charged for reduced materially free irrigation under pretense of stock water.

The errors of measurement will be further investigated and studied in hopes that some further information may be given to you relative to this condition.

Cost figures for cleaning canals, clearing canals, cutting brush, widening and shaping banks, "Canal V'ing," dredging and for automobiles are given in the report as follows:

CLEANING CANALS—During the year we cleaned 339 mi. of canal, at a cost of \$35,826, or \$105.68 per mi., as compared with 343 mi. of canal at a cost of \$88.61 per mi. for 1912, or 465 mi. at a cost of \$60.64 in 1911, or 562 mi. at a cost of \$43.81 per mi. in 1910. The gradual increase of cost may be attributed to the increased amount of material necessary to be removed by cleaning occasioned by increased capacity required at such times as the increased quantity of silt, growth and difficulties of labor conditions, effect this class of work.

CLEARING CANAL on 50 miles cost \$1984, or \$38.68 per mi., as compared with 101 mi. at a cost of \$80.58 per mi. in 1912, or 194 mi. at a cost of \$35.39 per mi. in 1911. This decrease is accounted for by the fact that little clearing and more cleaning has been done, therefore increasing the cost of one and decreasing the cost of the other.

CUTTING BRUSH on 300 mi. of canal cost \$1054, or \$33.51 per mi., as compared with 200 mi. at a cost of \$18.98 per mi. in 1912, or 392 mi. at a cost of \$20.71 per mi. in 1911, or 346 mi. at a cost of \$43.45 per mi. in 1910. The increase per mi. in this class of work is attributed to the fact that considerable heavy growth was cut during the year that had not been attempted during the previous years.

DISC AND GRADER—During the year we have continued the use of disc and grader outfits on our canal banks, with the result of widening the banks, removing the "V" rolls, discouraging the growth, and in some places making the banks suitable for travel, and for the use of mowing machines to keep down the growth. This work during the year has cost \$4851 in covering 296 mi. of canal, or \$16.39 per mi., as compared with 280 mi. at a cost of \$14.88 per mi. for the previous year.

CANAL V'ING still proves the best method for cleaning the canals where same is practical. The detailed amounts and costs of this work are as follows:

	1910	1911	1912	1913
Total cost	.....	\$21,437.78	\$26,142.08	\$26,471.20
No. of miles of ditch V'd	362	364	481	431
Cost per mi. for V'ing...	\$25.94	\$16.76	\$17.05	\$21.99
Cost per mi. repairs to engine	15.66	16.29	13.43	14.31
Cost per mi. repairs to V's	5.56	5.09	3.93	2.38
Cost per mi. fuel and oil	.....	5.96	6.52	6.69
Cost per mi. Mexican labor	13.58	14.80	13.42	16.04
Total average cost per mi.	\$60.74	\$58.91	\$54.35	\$61.41

DREDGING—During the year the Stockton dredges and the Austin dredge, referred to in my report of a year ago, have been practically in continual operation. On the first of August an additional Stockton dredge as purchased, which also had been in continual operation since that time. During the latter portion of the year a contract was made with the Schlatter Dredge Co. for experimental work with their dredge at 15c. per yd.

As this method of work is comparatively new, it may be of interest to note that the Stockton dredges have worked on 37.3 mi. of canal and excavated 188,708 cu.yd. of material at a cost of 10.7c. per yd. Austin dredge worked on 33½ mi. of canal, removed 96,712 cu.yd. of material at a cost of 16.8c. per cu.yd., to Water Company No. 1, while the Schlatter dredge worked on four miles of canal, removed 3862 cu.yd. of material for 15c. per cu.yd. The total mileage for the year for these dredges amounts to 74.8 mi., total yards for these dredges for the year amounts to 287,282 cu.yd. and total cost to Imperial Water Co. No. 1 is \$37,150.98, or 12.93c. per cu.yd.

The repairs on the Stockton dredges have amounted to \$1353 for operating 17 months, or \$79.40 per month, which is quite nominal compared with repairs needed for caterpillar engines. It is certainly a question as to how we would have been able to deliver water throughout the past year had not this 287,282 cu.yd. of material been removed.

[illegible] you will note that we have worked on [illegible] as compared with 118 mi. in 1912, [illegible] while our statement shows but [illegible] mi. in our system; this gives you some idea of the amount of work required to maintain the delivery of water as long as the peak load remains in the latter part of the summer.

AUTOMOBILES—During the past four years we have used three cars and they have traveled 66,331 mi., the cost of [illegible] as follows:

	Overland cars 1910	1912	Hupmobile
[illegible]	[illegible]	[illegible]	[illegible]
Miles [illegible]	19,147	22,858	24,026
[illegible] gal.	1,166	1,814	1,461
Total [illegible]	31,123	[illegible]	[illegible]
Total [illegible] cost	1,860	1,411	1,027
[illegible] cost per mi.	[illegible]	0.0617	0.0427
Total [illegible]	[illegible]	12,413	41,913
Total cost per mi.	0.1688	0.1054	0.0796
Average mi. per gal. of gasoline	9.59	12.39	16.14
Average cost per mi. for [illegible]	[illegible]	0.0187	0.0125
[illegible] per mi. of travel	0.0511	0.0250	0.0213

The distribution of irrigation costs for the past three years and the acre-ft. of water delivered and the cost of water per acre-ft. were as follows:

The acreage of crops in 1913 was 101,796, divided as follows: Alfalfa, 59,279; barley, 19,257; corn, 12,[illegible]; cotton, 1741; melons, 3125; vineyard, 910, asparagus, [illegible]; truck, [illegible]; miscellaneous, 1104.

The increased amount of water used per acre of crop, as shown in the table, is "attributed to the increase in summer crops and the decrease in winter crops; more alfalfa, corn and cotton and less barley."

	1911	1912	1913
Canals	$94,756.11	$[illegible]	$56,698.82
Dredging			35,320.61
Distribution of water	23,158.81	[illegible]	20,946.[illegible]
Live stock, etc.	7,664.6[illegible]		747.68
Salaries, general	12,443.32	13,[illegible]	13,[illegible]05.67
Engineering			4,5[illegible].96
Zanjero houses and phones	1,[illegible]50.3[illegible]	2,1[illegible]	933.64
Tools and repairs	1,386.1[illegible]	1,7[illegible]	3,430.[illegible]
Expense, general and miscellaneous	[illegible]	[illegible]	[illegible]
Structures	1[illegible],423.80	[illegible]	[illegible]
Equipment, new			11,6[illegible]
Total	$[illegible]	$[illegible]	$[illegible]

COMPARATIVE COST FOR PAST FOUR YEARS

Year	Total cost	Acre-ft. delivered	Cost per acre-ft. delivered, cents	Acre-ft. per acre*
1910	$171,6[illegible].11	236,161	73.[illegible]	[illegible]
1911	15[illegible],[illegible]31.5[illegible]	274,66[illegible]	[illegible]	[illegible]
1912	158,454.6[illegible]	318,12[illegible]	[illegible]	3.15
1913	[illegible]	337,3[illegible]	[illegible]	3.[illegible]

*This column has been added here, using figures given elsewhere in the report.—Ed.

We are informed by Mr. Carberry that he will gladly mail copies of his complete report to any engineer requesting him to do so.

Worcester Water-Works Plant and Operating Methods

SYNOPSIS—The city of Worcester, Mass., does all its water-works construction, repair and maintenance by municipal day labor. In this article is a description of the organization, plant and operating methods, together with notes on local water-works practice. [illegible] independent bureaus of the Water Department, one under a Water Commissioner and one under a Water Registrar; work of the 12 divisions under the Water Commissioner, work of the Water Registrar's bureau, regulations governing the use of water, shop, stables and [illegible], use of cement-lined [illegible] pipes, [illegible] boxes, etc.

The city of Worcester, Mass., is notable because for many years it has constructed practically all its public works by municipal day labor. Yet there is no public-works organization as a whole. There are a City Engineering Department, Street Department, Sewer Department, Water Department, each independent. Aside from the actual survey work and work preliminary to construction, the City Engineer acts merely in an advisory capacity, and has no power to enforce his recommendations. Every department works out its own problems largely in its own way. Some of those [illegible] by the Water Department are given in the following columns.

The population of Worcester served with city water is about [illegible]. The [illegible] consumption of water is about [illegible] billion gallons, [illegible] of which is metered. The average daily consumption is nearly [illegible] million gal., and the per capita consumption is about [illegible] gal. per day. The whole cost of supplying water, including maintenance and interest, runs about [illegible] per million gallons. The supply comes from several reservoirs by gravity; there are no pumping stations.

ORGANIZATION OF THE WATER DEPARTMENT

There are two independent bureaus of the Water Department, one under the Water Commissioner, George W. Batchelder, which has charge of reservoirs, distribution system, operation and maintenance; the other bureau is under the Water Registrar, George C. Hunt, and looks after the reading of meters, collection of water rents, etc. The organization of the bureau under the Water Commissioner is shown in the accompanying sketch, Fig. 1.

All orders given in this bureau must have the approval of the Water Commissioner. Acting under the direction of the Water Commissioner, the General Foreman has supervision over Divisions 1 to 9 inclusive, shop and emergency calls, stock and supplies, pipe yard, service pipes and stop boxes, fire pipes and hydrants, repairs, hydrant inspection, shop accounting and construction. Foremen in charge of Divisions 10, 11 and 12, meter repairs, [illegible] pipe inspection and reservoirs, receive their instructions and make their returns directly to the Water Commissioner.

WORK OF THE VARIOUS DIVISIONS

Each division is in charge of a foreman who acts under the orders of the Water Commissioner, as transmitted to him directly or through the General Foreman. A list of the various divisions, their work and the approximate number of men employed in each, follows:

DIVISION 1—SHOP AND EMERGENCY.—This division includes the shop and emergency crews, except as otherwise provided for. The force employed is about 25 men. Emergency calls are here taken care of and the emergency men act under orders of the division foreman and report to him, day or night, any serious disturbance in the distribution system, such as sudden drops in pressure, reported leaks, broken hydrants, etc.

DIVISION 2—STOCK AND SUPPLIES—This division has charge of all stock and supplies at the East Worcester St. yard, which is adjacent to and part of the shop and stable layout. The division foreman furnishes all supplies when presented with properly signed requisitions, and is held responsible for the contents of stock room and yards. The men employed in this division are included in the 25 listed under Division 1.

DIVISION 3—PIPE YARD—All the large pipe, fittings,

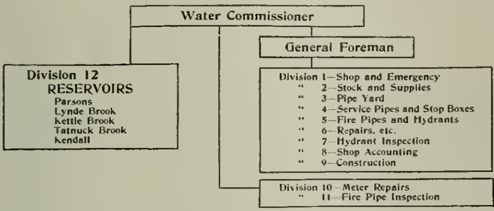


FIG. 1. ORGANIZATION SCHEME, WORCESTER, MASS., WATER DEPARTMENT

gate valves, specials, etc., are unloaded directly into dump cars and stored in the Albany St. yard, which is about a quarter of a mile from the other material yard, shop and stable. About $130,000 in stock is here kept constantly in hand. This yard is in charge of a subforeman who keeps in touch and is answerable to the foreman of Division 2. There are about five men employed in Division 3.

DIVISION 4—SERVICE PIPES—All installations of service pipes, small pipe extensions, resetting and regrading of service and stop boxes made necessary by street changes, and such other work as may be directed, are performed by this division. The whole force of the division is about 30 men, divided into five gangs, each in charge of a subforeman.

DIVISION 5—FIRE PIPES AND HYDRANTS—This division has charge of installing fire pipes, elevator pipes, fire hydrants, standpipes, flushing hydrants, drinking fountains and watering troughs, and has charge of the maintenance and repair of all these except drinking fountains and standpipes. The division force is about 18 men, divided into three gangs, each under a subforeman.

DIVISION 6—REPAIRS AND MAINTENANCE—This division has charge of all general repairs to service pipes, drinking fountains, standpipes, service shutoffs, removing and replacing meters, etc. The force consists of 10 men in two gangs, each under a subforeman.

DIVISION 7—HYDRANT INSPECTION—Five men have the work of inspecting, maintenance and minor repairs to fire hydrants.

DIVISION 8—SHOP ACCOUNTING—The men in this division, four in number, are included in the force under Division 1. This division has charge of all accounts kept at the East Worcester St. shop and yards, and is in reality a subdivision of Division 1, although its chief is responsible only to the Water Commissioner and General Foreman.

DIVISION 9—CONSTRUCTION—All construction work, and this includes construction work on reservoirs and new reservoirs, the installation of mains, replacements, repairs, maintenance, etc., employing 150 men, is done by this division, under four general foremen. The department owns an Austin trenching machine, the work of which was referred to in ENGINEERING NEWS, Aug. 6, p. 312, and numerous other uptodate equipment, which is used by the construction division.

DIVISION 10—METER REPAIRS, LIGHT MACHINE WORK, ETC.—This division has charge of the testing and repairing of all meters, which employs three men. The meters are installed by the employees of Division 4, as a part of the service connection. The house inspection and reading of meters is done by the men under the Water Registrar, as hereafter described. The meter-repair division makes tests of all new meters delivered at the shop, and makes necessary repairs to all meters taken off of services for any cause. The foreman keeps a careful record of all meters received at and delivered from his division, and sends copies of these records to the office of the Water Commissioner.

DIVISION 11—FIRE-PIPE INSPECTION—This is a one-man division, although he may have assistants assigned when necessary. He sets all small meters on fire-service lines, has charge of all inside valves on fire-protection services, reads and inspects meters on fire-service pipes, the Venturi meters at reservoirs, and has entire charge of the inspection of fire-service pipes. He makes daily reports direct to the Water Commissioner.

FIG. 2. STOCK YARD ON EAST WORCESTER ST.: TOOL HOUSES AND SHEDS

Division 12—Reservoirs. This division includes the caretakers or foremen in local charge at the various reservoirs, each of whom reports direct to the Water Commissioner.

General.—Under the General Foreman are three men detailed to make general emergency repairs. There is also a spare foreman ready to take the place of any regular foreman, assume emergency duties and perform any service he may be directed to by the Water Commissioner or General Foreman. Every man in the department is assigned to one or the other of these divisions and takes orders from the foreman in charge of that division. This, in general, is the rule of the organization, yet in cases of emergency all men are expected to carry out such directions as may be given them by the Water Commissioner, General Foreman, or such foreman as shall be in charge at the time.

Bureau of the Water Registrar

This bureau is locally called the Water Income Division of the Water Department. The bureau employs six meter readers and two inspectors. Every meter is read once a month. The meter readers are employed every working day in the year in reading meters, and each is held personally responsible for the condition of meters in his territory. The reader makes returns of the meter readings to the office each day and he also posts the readings on a card on the premises of the owner, so that the owner may always know the quantity of water being consumed each month.

The inspectors' duties are to inspect the fixtures in houses whose month's consumption is out of the ordinary. Each day the readings turned into the office by the meter readers are compared in the office, and, if the consumption of any house is much in excess of the average, and there appears no reason for the increase, an inspector is immediately sent to examine the house-service fixtures. If the fixtures are found imperfect, the owner is immediately notified of the exact condition, thereby being able to take advantage of this information if he desires.

The city has at present about 18,000 meters. As Mr. Hunt says, the financial success of a water department depends largely upon the accuracy of the water meters and it is of the greatest importance that the meters be examined and tested frequently. About 3000 meters are taken out each year and repaired at the expense of the Water Department, unless they have been injured by frost or otherwise through negligence of the property owner. If the meter is worn out, a new one is installed at the expense of the owner. The total cost to the department of meter repairs in the year 1913 was $10,315.

Regulations Governing Use of Water

There are the usual ordinances governing the introduction and use of water, all applications being sent to and handled by the office of the Water Registrar. All service pipes and appendages laid in the street are furnished and maintained by the city. From the street line to the outlet of the meter on the house side of the stopcock all pipes and fixtures are furnished, placed and repaired by the city at the expense of the owner. Bills for metered water are payable semiannually, in March and September. If bills for water or fixtures are not paid within 40 days after notice, the water is shut off and an additional charge of $2 made. Water users are charged $2 for shutting off and letting on water, when making repairs on premises, or for any other reason. All injuries to service pipes, street mains, hydrants, or other fixtures caused by ex-

Fig. 3. Shop and Stable, Worcester, Mass., Water-Works

FIG. 4. ALBANY ST. STOCK YARD, WORCESTER, MASS., WATER-WORKS

cavations in putting in sewers, drain, or other pipe are charged to the owner of the premises for whom the work is done. Installing meters is optional with the owner. All private fire services are metered at the expense of the owner.

Shop, Stable and Yards

Fig. 2 shows the East Worcester St. yard of t'e Water-Works Department. On the right are wagon and automobile sheds and on the left a row of individual tool houses, one for each service pipe gang. The corner of the building on the right is the stable and on the left the shop. Fig. 3 is a view of the shop and stables taken from the rear of the yard. Fig. 4 shows the Albany St. stock yards.

The shop was built in 1908 and is a thoroughly uptodate water-works repair plant in every respect. On the first floor are the offices, general shop and storage room for tool chests, etc. On the second floor are the meter repair shop and the meter-testing room. Fig. 5 shows the interior of the meter repair shop, which is equipped as shown with lathes, drills, grindstone, etc., for light ma-

FIG. 5. INTERIOR OF METER REPAIR SHOP, WORCESTER, MASS., WATER-WORKS DEPARTMENT

Fig. 6. Storeroom, Worcester Water-Works Shop

chine work. On the third floor are carpenter and woodworking shop and storerooms. The fourth or top floor is all storeroom, as shown in Fig. 6. Everything is orderly and well arranged as may be judged from the illustrations, which were taken under the direction of one of the editors, without previous warning to the shop foremen.

In the basement are additional machine tools and equipment for handling, repairing and storing the heavier appurtenances. From this basement of the shop there is a subway to the basement of the stable, which is utilized as a storeroom for service pipe, cocks, connections, hydrants and hydrant parts, etc., as shown in Fig. 7. Here is kept emergency repair equipment for serious breaks.

On the main floor of the stable overhead is a garage, as most of the vehicles now used by the Water Department are motor-driven. There are eight motor vehicles in all, two touring cars, one runabout, one 3-ton truck and four smaller trucks like the one shown in Fig. 3.

These small trucks are used for emergency work, but to be always ready to answer hurry calls the emergency wagon shown in Fig. 8 stands with harness ready to drop in place. This wagon is equipped with various kinds of apparatus for shutting gate valves, and making hasty repairs, lanterns, tools, etc. To answer these emergency calls, a crew of five men is always on duty, working in 8-hr. shifts.

The apparatus for quick closing of main gate valves consists of a rod wrench, which is put down the manhole, a wrought-iron frame fitting in the manhole opening, with a center ring to hold the wrench rod, and an ordinary wagon wheel which fits over the top of the wrench rod. The valve can be closed very readily and very rapidly by turning the wagon wheel.

Over the main floor of this building is the stable proper which is now used by but one or two horses.

Notes on Operation

Service Pipes—All service pipes are cement-lined 1-in. and 1¼-in. wrought-iron pipe. The lining is done by the municipal labor crews in the winter when other work is slack. The cost of the pipe with cement lining per lin.ft. is 4.75c. for 1-in. and 7.84c. for 1¼-in. pipe. The pipe is sold to the property owners at 10% increase over these prices.

All service connections are made by lead goose-neck connections with the mains, to take the water-hammer and shock. There are now no curb cocks inserted for cutting off house services. Instead, a regulation corporation cock is inserted alongside the main, in the street. The cock is inclosed in a cast-iron box made in two sec-

Fig. 7. Stable Basement Storeroom, Worcester Water-Works Department

FIG. 8. STABLE, WORCESTER WATER WORKS DEPARTMENT; EMERGENCY WAGON

tions (Fig. 9), one tapered, straddling the service pipe and resting against the main (A), and the other (B) cylindrical with a flanged circular top, which lies flush with the street surface. The tapered lower part admits of adjustment to the depth of main below street surface. It is stated that little or no trouble is experienced with this type of service cut off.

FIG. 9. SERVICE CONNECTION BOX

The Department owns two or three large pipe-tapping machines and is in every way equipped to do all the construction and repair work often done in other cities by contract.

Mine Cave-ins are so general, almost continual, and the resulting casualties so high, that the United States Bureau of Mines has just issued a circular discussing safety measures applicable to the circumstances. There were employed in and about metal mines of the United States in 1912, 169,199 men, of whom 110,056 worked underground, and 59,143, on the surface. There were 661 fatal accidents—522 underground and 139 on the surface; of these, 212 were caused by falls of rock or ore, representing 32.1% of the total number of men killed on the surface and underground, and 40.6% of the number killed underground. Copper mines showed the largest percentage of men killed from this cause, with iron mines second. Lead and zinc mines showed about the same percentage of fatalities as gold and the miscellaneous metal mines, and were third in order. This indicates that the greatest number of accidents from falls of rock or ore occur in ore bodies of great width.

As in the case wherever men are employed, the personal equation can prevent more accidents than a superabundance of mechanical safety devices. A knowledge of the nature of the ground and the proper method of timbering is essential to efficient working. That rock or ore falls because of lack of support is axiomatic, and the circular claims that the usual tendency whether drifting or stoping is to use too little timber, or to wait too long before placing the timber. All loose rock should be removed from the face, back, and sides as driving progresses, and should be done immediately on returning to the place after blasting. A common cause of falls is failure to use enough blocking about the timber. Where the ground has a tendency to fall or slough off, there should be no space left over the timber sets or lagging. All loose rock should be pulled down, and the spaces filled in solidly with rock or tightly blocked with pieces of timber. The dropping of pieces no larger than a baseball has killed men.

No infallible rules for detecting dangerous ground can be laid down, on account of varying ground conditions in different mines, and even within the same mine. The usual method of spotting a dangerous piece of rock overhead is to tap the suspected place (gently at first) with a pick handle. If the sound given out indicates that it is loose it is called a "drummy," and although it may stand for years, certainty demands that it be pulled down at once. A study of the accidents occurring in a certain large mine showed that most of the falls occurred in what was thought to be safe ground. The obvious reason was that in treacherous ground greater care was exercised. The company owning this mine arranged for closer inspection of workings, and thereafter used twice as much timbering. It is said that after a six-months' trial the reduction in the number of accidents from falls amounted to 50%.

A Large Reinforced-Concrete Mat Foundation for a Seventeen-Story Office-Building

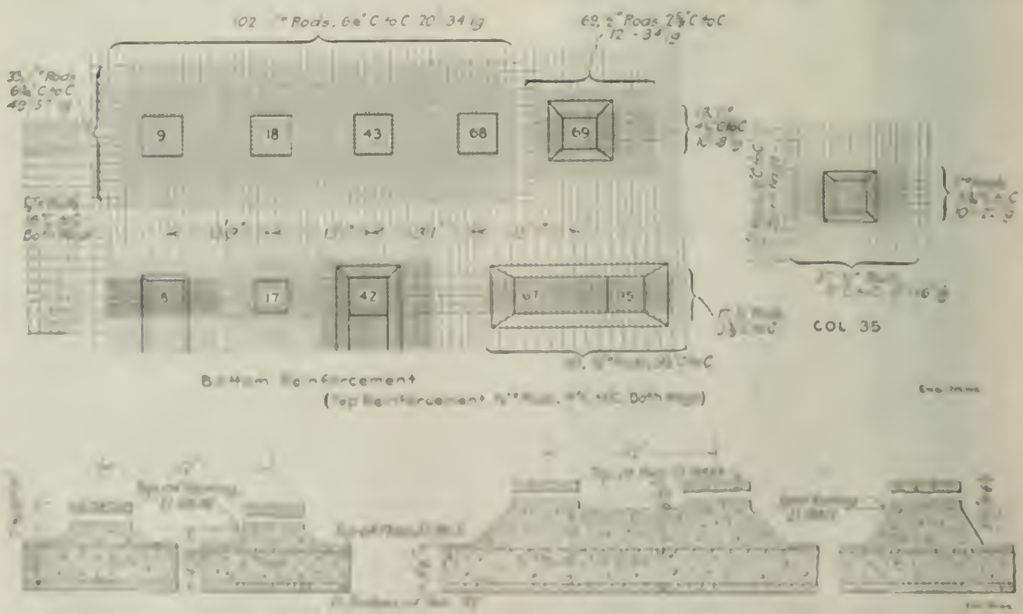
The two accompanying drawings represent the foundation slab or mat of reinforced concrete on which rests the 17-story office-building portion of the new passenger terminal of the Michigan Central Ry. at Detroit. This unusual type of foundation was employed because the character of the subsoil did not promise any better results from deep foundations, piers, piles, or the like, than could be secured with shallow footings, and at the same time a base slab was desirable to forestall unequal settlement. The advantage of economy lay with the mat foundation by a large margin.

Footing Plan, West Half of Mat

Elaborate piledriving and loading tests and soil-loading tests were made on the site of the proposed station before the foundation design was settled on. The site is a mile or more from the central business district of Detroit, and no high or heavy buildings exist near-by, so that reliable precedent was lacking. The deep bed of clay underlying Detroit, averaging over 100 ft. to rock, varies in physical character so much that the downtown practice in heavy foundations could not be taken as applicable to the case.

The conclusion from the soil-loading tests was that at cellar level a loading of 2 tons per sq.ft. of loaded area could be carried without appreciable settlement. The pile tests, on the other hand, did not indicate that any advantage in stability or economy would result from the use of piles; at the same time there remained some doubtful features in the behavior of the piles under long-continued test loading, which suggested that working on piles should be kept very low, possibly below 15 tons per pile. The engineers of the railway company concluded in favor of a mat footing, and their opinion was confirmed in the report of Olaf Hoff, who was called in consultation.

The mat footing as designed for the 17-story building is a 42-in. slab of concrete reinforced at top and bottom by continuous layers of rods. Under the single-story waiting-room and concourse portions, north and south of the office-building, the slab is 30 in. thick. At the edges the slab is extended somewhat beyond the footing-width of the outer columns, to prevent any possible bogging action, i.e., settlement at the edges of the mat from lateral flow of the clay subsoil. The bottom of the



Reinforced-Concrete Mat Foundation under Michigan Central Terminal and Office-Building, Detroit, Michigan

mat (Elev. 92) is 2 ft. below the mean level of the Detroit River (Elev. 94), and 27 ft. below ground level in front of the building.

The loads of the columns bear on the mat through spread reinforced-concrete footings proportioned as if for direct soil support, but at the higher loading of 4 tons per sq.ft. This is intended to reduce the bending moments in the mat. The reinforcement of the mat is proportioned empirically.

The mat was built by concreting direct on the floor of the cellar excavation. It was necessary to place the concrete in sections (defined by vertical bulkheads), but the continuity of the reinforcement makes the mat in effect a monolith.

The mat was built in June, 1912. Up to the present, no settlements of any kind have been detected by careful leveling.

The design of the foundation is due to George H. Webb, Chief Engineer of the Michigan Central Ry. The company's architect, Edward W. Smith, and W. B. Goddard, Jr., Structural Engineer, collaborated in the work, and carried out the detail designing. Geo. A. Fuller Co., contractors for the entire station building, constructed the foundation.

Track Elevation in Chicago

The elimination of grade crossings of streets and railways in Chicago represents one of the most extensive and costly engineering works in the country. The work has been in progress for some 22 yr., and the report of the city's Commissioner of Track Elevation in 1911 showed that the work then done amounted to 110 miles of road and 843 miles of track, at a cost of $66,256,000. A future total of 192 miles of road and 1265 miles of track was then estimated.

Figures compiled recently by R. H. P. Ford, Engineer of Track Elevation of the Chicago, Rock Island & Pacific R. R., show that at the present time about 1000 miles of track have been elevated, and 1285 subways built, at a cost of over $75,000,000, while when completed, this work will comprise some 2185 miles of track and 2600 subways, with a total cost of $175,000,000. Of this enormous cost, about 98% is paid by the railways, 1.7% by the city and only 0.3% by the street railways and other public-service corporations. The city's share is in assuming all costs of damages to adjacent property due to the track elevation, and the corporations bear the expenses of the necessary changes to their property in the streets and alleys.

In other cities there are more or less costly sections of track elevation (or sometimes track depression) to eliminate grade crossings at certain points, but in Chicago the work comprises long continuous stretches of line, and the project as a whole covers practically all railway lines within the city limits.

The flat country in which Chicago is located led naturally to the early railways approaching and entering the city on the ground level, and they were extended gradually through the city to terminal points, being built either in the streets or on purchased right-of-way. At one time there was a policy of elevating important streets and carrying them across long groups of tracks by viaducts, but this was abandoned some years ago, as the long approach grades were unfavorable to street traffic, while the multiplication of elevated approaches (both on the viaduct streets and on intersecting streets) would cause serious depreciation of value of property. Some of the viaducts have been replaced by subways, and while a number still remain, no new ones have been established for a long time, the fixed policy being the ultimate elevation of all the railway lines.

The Chicago track-elevation movement dates from 1892 when the Illinois Central R.R. secured an ordinance for the elevation of its tracks between 51 St. and 67 St., in order to be able to handle the heavy local traffic during the Columbian Exposition. The city created its track elevation department in 1897, and this was conducted until 1907 by the late John O'Neill, who realized that this was a matter of a definite and comprehensive policy of track elevation for the entire city.

The typical track-elevation work consists of a solid fill or embankment contained between concrete retaining-walls on each side and the concrete abutments of bridges over the streets. There is practically no viaduct work utilizing the space beneath the tracks. It is of a very comprehensive character, including main lines with from four to ten tracks, and in relation to these there are stations, terminals, yards and innumerable sidings and industry tracks. Further, the work has to be done largely in busy districts, and in all cases provision has to be made for carrying on the railway, street railway and street traffic. This involves special difficulties in the planning and execution of the work. At certain points it is complicated by railway-grade crossings. In some of these cases, the railway grades have been separated by means of a double-deck construction, one railway viaduct crossing above the other. In other cases, however, the conditions have not permitted such an arrangement, and it has been necessary to retain the railway grade crossing, but removing it from the street level.

For the numerous bridges across the streets, the designs vary on different roads. In some cases there are steel through bridges, with girders between the tracks, but this prevents any shifting of tracks or the placing of switches to accommodate future conditions, and will be a source of trouble when electrification of the terminal lines is commenced. In other cases, deck-girders or self-supporting through-floor steel spans have been used, which present no obstructions above the road bed.

Of late years the all-concrete subway bridge has come into use on several lines, the floor consisting of massive concrete slabs which are set in place on the concrete abutments and intermediate piers or bents by means of powerful wrecking cranes or derrick cars. These also provide an unobstructed floor. As different railways sometimes occupy parallel and adjacent right-of-way, many subways present the curious feature (and unfavorable appearance) of two distinct types of construction.

The track elevation in progress at different points of the Chicago railway system presents interesting examples of different designs and methods of execution for work of the same general class. The work must be done on a restricted right-of-way, with a frequent service of trains to be provided for. On account of the density of street traffic, the city will not permit the closing of more than a few consecutive streets at one time, so that a stretch of track-elevation work must be divided into sections, in each of which the operations are separate and distinct. This

complicates the work and the handling of trains, lengthens the time occupied by the work, and adds materially to the cost.

As far as the results are concerned, the railways benefit by greater facility of traffic, and the reduction of damage claims due to accidents at street crossings. The public benefits by the greater facility and safety of street traffic, and the traveling public shares the benefit gained by the railways. The city gains in the general improvement of its traffic conditions and in the greater safety of its population. In this respect, it is of interest to note that grade-crossing accidents in Chicago declined steadily from 19 deaths and 173 total personal accidents per million population in 1899, to 6 fatal and 39 total per million in 1911.

While it is true that the work of track elevation has to some extent been forced upon the railways by the city, much credit is due to the railways for their foresight in recognizing the necessity of the work and in cooperating liberally with the city. And it must be remembered also that practically the whole of the expense of this very costly work is borne by the railways. It is specially worthy of note that in the general policy of track elevation in Chicago and in the planning and execution of the various sections of work, there has been on the whole, the very desirable feature of harmony and cooperation between the railways and the municipal authorities.

Acceptance Test of a High-Duty Triple-Expansion Pumping Engine at Bissell's Point Station, St. Louis Water Works

By Geo. M. Peek*

In 1912, specifications were drawn for two new pumping units to be installed in Engine House No. 2 at Bissell's Point, St. Louis. These two pumps were to take the place of one old [illegible] bucket-and-plunger machine which was installed in 1891. This old engine was [illegible] by the [illegible] Foundry & Machine Co., of Philadelphia, at a cost of $[illegible]. It had a rated capacity of [illegible] gal. per 24 hr. against [illegible] lb. water pressure when supplied with steam at [illegible] lb. pressure. The tests on this engine showed it to develop a duty of 61,860,000 ft.-lb. of work per 1000 lb. of steam. The original boilers for supplying steam for this engine were [illegible] type. In 1898 these were replaced by four water-tube boilers fitted with inclined-grate stokers. The boilers carried a steam pressure of 75 lb. which was reduced, to a large [illegible], to [illegible] lb.

[illegible] April, 1912, bids were opened and the contract for the two new 20,000,000-gal. pumping engines, to be completed and erected on foundations prepared by the Water Department, was awarded to the Holly Manufacturing Co., of Buffalo, for $[illegible]. The specifications called for the completion of one unit in 10 months and the other in [illegible], but the company was granted an extension of time.

The contract called for a duty of 165,000,000 ft.-lb. of work per 1000 lb. of steam (160 lb. pressure and 100° superheat) when pumping against a pressure of 125 lb. in a discharge pipe whose elevation was 105.25 and with the elevation of water level in the wet well at 95. The engine was required to deliver all of the condensate back to the boilers. The contract called for a bonus of $1000 for each million foot-pounds of work done by the engine in excess of 165 million and a forfeiture of a like amount for each million the duty fell short of the guarantee. One unit was put in service in September, 1913, and was tested Apr. 23 and 24, 1914.

The design shows a vertical flywheel type with single-acting outside-packed plungers, each located under one

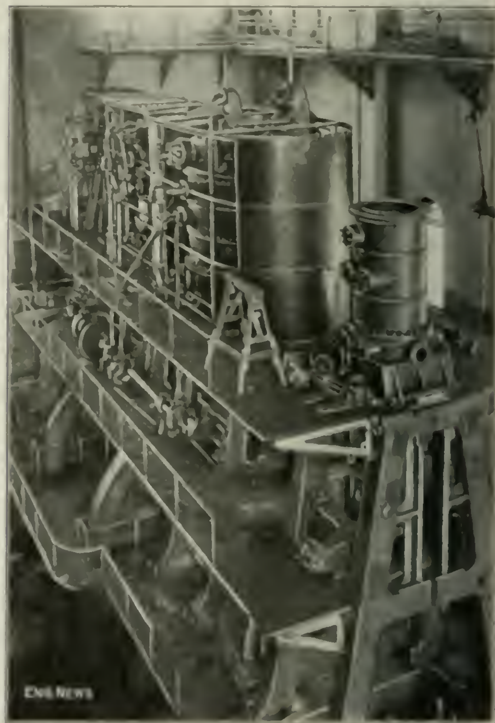


FIG. 1. THE 20,000,000-GAL. PUMPING ENGINE AT THE BISSELL'S POINT STATION, ERECTION NEARLY COMPLETED

of the cylinders. Each cylinder has a single piston rod and [illegible] distance rods connecting the plunger with the crosshead. The pump ends are arranged for direct flow and have removable steel valve [illegible]. This arrangement is shown in Fig. 2.

The valve gear is worked from a layshaft, which in turn is driven from the main shaft through bevel gears. All valves are located in the heads and, except the low-pressure exhausts, are of the multi-ported Corliss type. The low-pressure exhaust valves are poppets. All cylinders are jacketed and arranged so that the steam passes from the jacket of the high-pressure cylinder to that on the intermediate, then to the one on the low-pressure.

The cylinders are supported on A-frames, which extend

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Fig. 2. Valve Deck of New Bissell's Point Engine

to bedplates resting on top of the air chambers. The bedplates are arranged so that they may be supported on jacking columns in order that any air chamber may be removed without disturbing any of the superstructure of the engine. The plungers are semichilled and ground. Pump chambers are of ca t steel.

The pistons are of cast iron, in one piece, fitted with cast-iron rings, and are finished and polished on both sides. The cylinder heads are polished on the inside. The cylinders are covered with 85% magnesia insulation. The valve cages are of semisteel and the holding down bolts are of manganese bronze. The crossheads are of cast steel and are fitted with solid bronze shoes.

TABLE 1. DETAILS OF 20,000,000-GAL. HOLLEY PUMPING ENGINE; ST. LOUIS WATER-WORKS

1. Diameter of Steam Cylinders; 34, 64, 98 in.
2. Character of Metal; cast iron.
3. Thickness of inside shell; 1½, 1¾, 1⅞ in.
4. Width of Jacket Space; 1, 1, 1⅛ in.
5. Thickness of Outside Shell; 1⅝, 1⅞, 2 in.
6. Volume of Receivers; First, 206 cu.ft., Second, 291 cu.ft.
7. Thickness of Piston Head; 12 in. throughout.
8. Piston Packing Rings; Cast iron.
9. Number of Piston Rods; One to each Cylinder.
10. Diameter of Piston Rods; 8 in.
11. Stroke of Piston; 66 in.
12. Revolutions per Minute; 20.
13. Diameter of Steam Valve; 6, 9, 10, 12 in. Corliss, 21 in. Poppet.
14. Location of Valves, All in Heads.
15. Type of Valve Gear. Corliss with poppet exhaust on low pressure.
16. Size of Main Connecting Rod; 8 and 9¾ in. diameter.
17. Length of Main Shaft; 12 ft. 7½ in.
18. Diameter of Main Shaft; 23 [illegible] in.
19. Diameter of Main Journal; 20 in.
20. Length of Main Journal; 32 in.
21. Metal in Main Shaft; Fluid compressed steel.
22. Size of Cranks; Hub 33 in.; Web 30 in.
23. Size of Crank Pin Journal; 12½x11 in.
24. Diameter of Flywheel; 20 ft.
25. Weight of Rim of Flywheel; 30 tons.
26. Diameter of pump barrel — Force Chamber, 5 ft. 4 in.; Suction Chamber, 5 ft. 4 in.; Suction Air Chamber, 4 ft. 6 in.; Discharge Chamber, 4 ft. 5 in.; Plunger Chamber, 5 ft. 5¾ in.
27. Metal in Pump Barrel; Cast Steel.
28. Diameter of Cage Plates; 5 ft. 5¼ in.
29. No. Valves each Suction Cage Plate; 247.
30. No. Valves each Discharge Cage Plate; 247.
31. Total number Valves each Pump; 1482.
32. Total Area of Valves each Suction Cage Plate; 1368 sq.in.
33. Total Area of Valves each Discharge Cage Plate; 1368 sq.in.
34. Diameter Valves; 3¾ in.
35. Proportion Valve Area to Plunger Area; 164%.
36. Material in Valves, Seats, Stems and Springs; Rubber, Gun Metal, Bronze, Brass.
37. Lift of Valves; ⅝ in.
38. Diameter of Plungers; 32⅝ in.
39. Speed of Plunger; 220 ft. per min.
40. Total Displacement per Revolution; 716.5 gal.
41. Number of plunger or distance rods; Four to each plunger.
42. Diameter of plunger rods; 5 in.
43. Diameter of discharge pipe; 36 in.
44. Diameter of suction pipe; 42 in.
45. Cooling surface of condenser; 1800 sq.ft.
46. Number of tubes in the condenser; 701.
47. Size of tubes; 1 in. o.d.
48. Metal in tubes; Brass.
49. Size of air pump; 24x66 in.
50. Size of boiler feed pump; 3¼x66 in.
51. Size of air compressor; 3x66 in.
52. Total estimated weight; 875 tons.

The condenser is a water-works surface type with steam passing through the tubes. It is located in the suction pipe and all the water pumped passes through it. This arrangement might be criticized since it reduces the temperature of the condensate to very nearly that of the water pumped and gives cool boiler feed. It is proposed to install an exhaust feed-water heater on this engine to increase the B.t.u. duty. A method of bypassing only a part of the water pumped through the condenser is followed with some of the pumps of the Department but after considering all of the working conditions it was decided that the scheme adopted was the best.

Among the miscellaneous items of interest are the following: governor controlling the cutoff of the high-pressure cylinder with hand-controlled cutoff on the intermediate and low-pressure cylinders; a sight-feed force lubricator from which feed connections are made to all rotary valve stems, the throttle and intermediate-cylinder side pipes; a central oiling system with filters and oil tanks; a two-stage air compressor for supplying air to the air chambers. Further details of the pumping engine are summarized in Table 1, which shows the data required of the contractor with his bid.

Table II gives the data which was obtained from the test log sheets. The figures given are averages for 24 hr.

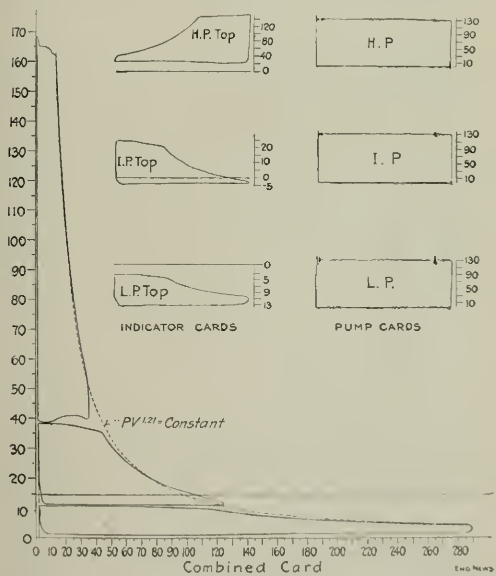


Fig. 3. Straight and Combined Steam-Cylinder Cards and Pump Diagrams; New Bissell's Point Engine

Table III gives the results as calculated from the data given in Table II. The discharge pressure was measured by means of a mercury column. The specific gravity of the mercury when at 58.18° and compared with the water pumped, at the same temperature, was found to be 13.58. The weight of a cubic foot of water at this temperature was taken to be 62.38 lb.

TABLE II. TEST LOG DATA, ST. LOUIS 20,000,000-GAL. HOLLEY PUMPING ENGINE

1. Steam Pressure, 159.41 lb. per sq. in.
2. [illegible]
3. Superheat (as read by thermometer), 191.5°
4. Vacuum, 28 in.
5. Temperature of Exhaust, [illegible]
6. Reading of Pressure Mercury Column, 301.5 ft.
7. [illegible]
8. Average Temperature of Mercury Column, 76.1°
9. Elevation Water in Wet Well, 95.31
10. Diameter H. P. Plunger, 32.82 in.
11. Diameter [illegible] Plunger, 32.818 in.
12. Diameter L. P. Plunger, 32.81 in.
13. Stroke of H. P. Plunger while running, 65.875 in.
14. Stroke of [illegible] Plunger while running, 65.828 in.
15. Stroke of L. P. Plunger while running, 65.806 in.
16. Water Pumped in 24 Hours (actual plunger displacement), 20,576,500 gal.
17. Water Pumped in 24 Hours (Venturi meter readings), 20,600,000 gal.
18. Weight of Condensate, 230,165 lb.
19. Weight of First Receiver Drain, 1883 lb.
20. Weight of Second Receiver Drain, 8209 lb.
21. Weight of Jacket Drain, 11,763 lb.
22. Total weight of steam, 252,020 lb.
23. Weight of steam per hour, 10,503.7 lb.
24. Temperature of water pumped, 58.45°
25. Temperature of Condensate, 61.73°
26. Temperature of First Receiver Drains, 263.101°
27. Temperature of Second Receiver Drains, 197.705°
28. Temperature of Jacket Drain, 164.27
29. Plunger leakage per hour, 333 lb. (Specification allowed 100 gal.)

Fig. 3 shows a set of indicator cards. This set was taken at a time when all of the conditions were as near as possible to those of the specifications. All indicator cards both steam and pump ends, were taken every hour and were taken simultaneously by electric control. Fig. 3 also shows a combined card made from the set of ordinary cards after they were corrected for the spring calibration. The curve $pv^{1.21}$ = *constant* is the nearest pv^n = *constant* curve to that shown by the indicator cards*.

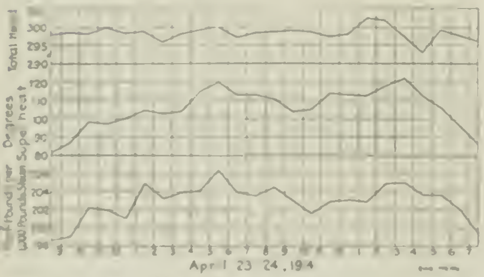


FIG. 4. HEAD, DUTY AND SUPERHEAT CHARTS FOR TOTAL RUN OF BISSELL'S POINT ENGINE

Fig. 3 shows also the set of pump cards corresponding in time to the other cards. Fig. 4 is a chart showing the relation between duty, superheat and total head pumped against for the test run. The duties were figured hourly and do not take into account the small correction due to the temperature of the mercury column. The maximum duty, after making all corrections, of 202,105,616 ft.-lb. per 1000 lb. of steam at 160 lb. pressure and 100° superheat, is the highest of which the writer has any knowledge.

The test was conducted for the City of St. Louis by L. A. Day, Chief Mechanical Engineer of the Water Department and the writer. The Holly Co., represented by D. A. Decrow, Chief Engineer, and H. E. Gibbs, who prepared the pump for testing. There were 25 observers taking readings during the test.

*[illegible]

TABLE III. AVERAGE TEST RESULTS, ST. LOUIS 20,000,000-GAL. HOLLEY PUMPING ENGINE

1. Absolute steam pressure, 174.03 lb. per sq. in.
2. Superheat (corrected emergent stem thermometer), 105.23
3. Average value of superheat in duty, 10° equals 1,000,000 ft.-lb.
4. Pressure by mercury column (corrected for temperature), 301.13 ft.
5. Total head pumped against (95.31 — 92 + 3.31; 301.013 + 3.31 = 297.703), 297.703
6. Gallons per revolution, 714.137
7. Weight water pumped per revolution, 5957.7 lb.
8. Average revolutions per hour, 1200
9. Duty, foot-pounds per 1000 lb. steam without correction for excess in superheat,

$$\frac{1200 \times 5957.7 \times 297.703}{10,503.7} = 202,625,616$$

10. Deduct for 5.23° of superheat, net duty, 202,105,616 ft.-lb. per 1000 lb.
11. Heat per pound superheated steam, 1256 B.t.u.
12. Total heat delivered to engine, 316,625,[illegible] B.t.u.
13. Heat per pound condensate, 29.87 B.t.u.
14. Total heat in Condensate, (13) × (18), 6,874,431 B.t.u.
15. Heat in one pound of First Receiver Drains, 231.8 B.t.u.
16. Total heat in First Receiver Drains, (15) × (19), [illegible] B.t.u.
17. Heat per pound Second Receiver Drains, 167.63 B.t.u.
18. Total heat Second Receiver Drains (17) × (20), 1,374,563 B.t.u.
19. Heat per pound jacket drains, 132.15 B.t.u.
20. Total heat Jacket drains (19) × (21), 1,554,[illegible] B.t.u.
21. Total heat rejected, 10,240,071 B.t.u.
22. Heat consumed by engine, 306,384,969
23. Total foot-pounds work done in 24 hr., 51,[illegible],697.[illegible]
24. Duty, foot-pounds of work per million B.t.u. consumed by engine,

$$\frac{24 \times 1200 \times 5957.7 \times 297.703}{306,384,969} = 166,719,796$$

25. Water horsepower developed, 1074.91
26. Steam per water horsepower-hour, 9.77

The Remarkable Success of Typhoid Vaccination in France and the French colonies was brought before the engineers of the Ponts et Chaussées of France by Prof. H. Vincent of French Academy of Medicine, in a paper published in the Annales des Ponts et Chaussées, May-June, 1914. Prof. Vincent described in detail the nature of the vaccination and its effect on the individual and presented finally a table showing the comparative morbidity and mortality records in a number of small epidemics and particularly among the French army resident in northern Africa. These figures in the original are given for each town and city camp and state the number of non-vaccinated and vaccinated persons with the number of cases of typhoid and deaths from typhoid in each class.

A compilation of the figures shows that in [illegible] nonvaccinated persons the average typhoid rate was 63 per thousand, whereas in 15,[illegible] persons subjected to the same conditions but vaccinated against typhoid, the morbidity rate was practically nothing, there being reported only two cases. In the non-vaccinated class the typhoid rate was as high as 195 per thousand in the epidemic at Avignon (July, 1912) and 168 per thousand in the army camps in western Morocco in 1914.

The Fuel-Briquetting Industry in the United States in 1913 was characterized by a net decrease of two in the number of operating plants and a decrease of 17% in quantity but an increase of [illegible] in the value of the manufactured product. The United States Geological Survey explains this condition by stating that briquetted fuel in the United States is essentially a domestic fuel for which there was less demand in 1913 owing to the mildness of the winter. The explanation for the higher values in the face of decreased demand appears to be in the general enhancement of values of all industrial products in that year. In the production of briquets, seven plants used anthracite culm or fines, one used semi-anthracite, one used anthracite and bituminous slack, mixed in proportions of 1 to 1, one used anthracite culm and bituminous slack, principally the former, five used bituminous or semi-bituminous slack, and two used carbon residue from gas works making gas from petroleum; eight plants used coal-tar pitch for binder, one asphaltic pitch, [illegible] and five mixed binders of [illegible] and [illegible].

The total production amounted to 181,[illegible] short tons valued at $1,[illegible] compared with 22[illegible],[illegible] tons valued at $[illegible] in 1912. The production for the four years preceding 1912 was as follows: 1907, 66,[illegible] tons; 1908, [illegible] tons; 1909, [illegible]; 1911, [illegible].

Editorials

Columbus' noted egg-balancing feat finds a sort of parallel in a modern pile test, where the engineer sets a 40- or 60-ton load on the top of a slender pile of doubtful verticality and straightness, and expects it to stay put while he measures the settlement of the pile. A correspondent recommends guying such loads; yet the Pittsbugh tests and the Panama-Pacific Exposition tests (in our issue of July 30, 1914) were successful without guying.

The prominent fact of the matter is that pile testing has hitherto been thought very unimportant, so that descriptions or discussions of proper methods of pile testing are scarce as snowflakes in June. The same is true of soil-loading tests. Both kinds of test give highly valuable information, and (in our view) are destined to find wide use in the future. At the same time, both tests may prove to be either inexpensive or very costly, depending on the way the test is arranged. And, what is even more important, the information furnished by the test may be instructive or seriously misleading, again depending on the test method. There is room for fuller study of the subject.

⁂

Detroit has foundation problems quite peculiar to itself. Many different solutions are to be found among the structures erected in that city, each one being found of interest. Among them not the least is the remarkable foundation of the new Michigan Central terminal and office building. We believe it is little exaggeration to class this foundation among the notable examples of building-foundation work of the last half dozen years.

No other 18-story steel-frame building of modern times rests by means of a very thin shell of reinforced-concrete directly on deep clay soil of uncertain and variable character.

A discussion of the problem presented in the case, and of the solution adopted, is of course outside of the editor's sphere, and may be safely left to the members of the profession competent for it. But to supplement our descriptive article, we should note that in the course of the design, one expedient was recommended which later was not embodied in the structure, and commentators may well consider its bearing on the case. This was a line of sheeting, which was to be driven around the edge of the reinforced-concrete mat, some 15 or 20 ft. into the soil below, to act as a confining curb, a protection against possible localized outward flow of the clay under the foundation pressure. This expedient was recommended by a highly conservative and competent engineer, but was finally overruled. As built, the foundation subsoil has no restraint to outward flow, and no such flow is expected.

⁂

It is alarming to learn that under traffic conditions which exist in many parts of the country standard practice in designing highway bridges is inadequate (this means *unsafe*) for short spans—spans up to 50 or 60 ft. Bridges have been designed to carry road rollers (and only one roller at a time), while the actual traffic requires them to carry much heavier motor trucks, and two of these will often pass each other on a bridge. Further, when a truck going at a speed of 6 to 10 miles an hour bumps along over a rough bridge-floor, there is a respectable amount of impact, although talk about highway-bridge impact has hitherto been regarded as highly academic, not to say hairsplitting.

It may be thought that the statements and conclusions given by Manville and Gastmeyer on another page of this issue are overdrawn and needlessly disquieting. But the engineers of Cuyahoga County, Ohio, recently took action along exactly the same line of thought; they carefully reviewed all bridges under their charge to learn how they are stressed under motor loads, so that those bridges which cannot safely carry modern freight-truck traffic may be known, and warning notices posted to limit their loading.

The fact is that commercial motor trucks have grown amazingly in number, and at the same time heavier and heavier capacities and axle-concentrations have been employed. This has progressed to a point where the safety of road bridges is menaced. The truck builders are not to be blamed, for they merely followed the demands put forward by truck users; they went about their own business in the tacit belief that bridges as well as roads could carry anything that might cross them.

Bridge engineers are notoriously conservative. They design only for existing loads, rarely looking toward a speculative morrow. The Pennsylvania Highway Commission some time ago established a 24-ton truck as standard for designing bridges on main roads near cities; in New Jersey a 20-ton truck is assumed; and possibly some other authorities are equally progressive. But in the main the growth of street and road loadings has left highway bridge practice in the rear. It is necessary to revise the current standards.

The immediate need, however, is to study existing road bridges, decide what loads may be allowed to pass over them, and post notices stating the limit of allowable load. This duty rests in part on the states, but in larger part on the counties, who are the real road authorities. Public safety requires them to act.

⁂

Preserving Concrete Linings On Fresh Canal Banks

The difficulties in placing concrete on newly made slopes in such a way that it will hold its form and alignment, are so frequently noted that instances of conspicuous success are of unusual interest. Therefore attention is directed to the description, elsewhere in this issue, of the work on lined canals for the Seros power project near Barcelona, Spain. Here are to be seen some 17 miles of relatively deep canals connecting the diversion works, regulating reservoirs and penstocks. Attempts

to spread an impervious lining on the slope of $1\frac{1}{2}$ on 1 were futile and forms had to be used. Only three-fifths of the height of bank was lined at first, the work being completed after water had been in and the initial settlement obtained. In testing out this construction, any serious displacement of the lining was anticipated by watching for the development of cracks between concrete and earth at the top of the bank and forcing a clay puddle into the dangerous spots to maintain continuous support. Only something like $3\frac{1}{2}$% of the canal banks required any treatment.

It is also interesting to note that similar means was successful in sealing incipient settlement cracks of the seven earth dams on this project (to be described in a subsequent issue), so that the combined leakage, including that through the rock strata of the hillsides was under 3 sec.-ft., or 7/100% of the normal flow from storage.

The Next Convention of the New England Water Works Association

The New England Water Works Association, which will meet in annual convention at Boston next week, occupies a unique position. By establishing a non-resident membership, publishing an excellent quarterly journal, and later on by holding some of its annual conventions outside of New England, this organization with a local name has achieved high rank among the national technical societies of America.

While being a national society, the New England Water Works Association has served admirably not only the geographical section indicated by its name, but also the more local needs of the Boston metropolitan district. The sectional and local needs have been met by the maintenance of rooms and a library in conjunction with the Boston Society of Civil Engineers and by its monthly luncheons, which keep up social relations and afford a never-neglected opportunity for the presentation of papers and for informal discussions of the problems of the water-works superintendent and engineer. The rooms, library and monthly meetings are, of course, open to all non-resident members [illegible] avail themselves of the privilege, and the monthly meetings go far in providing live material for the *Journal*, which through several decades has been a [illegible] binding all the members together, regardless of geographical location and all other [illegible] conditions.

For a few years the New England Water Works Association equaled, if it did not exceed, the American Water Works Association in membership, as it had long surpassed it in usefulness to the water-works profession. Recently the American Association has forged ahead in membership, got out from under various clouds, started a quarterly *Journal*, made possible the formation of sections throughout the country, and established a New York section. The American Association is not yet in position to have permanent headquarters, but there is reason to hope that this may be possible within a few years.

Although we have no reason to think that the officers of the New England Water Works Association are [illegible] in their aims lest their organization be forced back into New England territory and there cramped and confined by the American Association, we have no doubt but that the New England officials are awake to the friendly rivalry that exists. One of the claims made in behalf of the American Association is that it surpasses the New England Association in usefulness to superintendents. Unless we are greatly mistaken, a careful analysis would show that most of the papers and notable committee work in each association have been contributed by engineers rather by superintendents.

However all this may have been in the past, the program of the New England Water Works Association for its convention to be held at Boston, on Sept. 9 to 11, devotes several sessions exclusively to superintendents. This is a desirable thing to do. The superintendents make up a high percentage of the membership of all the water-works associations. Water-works are constructed in relatively brief time, but have to be operated 365 days and nights in the year. Strangely enough, relatively few papers dealing with strictly operating problems are presented, and there are practically no books on water-works operation in existence. It is sincerely to be hoped that the superintendents' sessions at the Boston convention next week will be fully attended and the papers extensively discussed.

How May I Become an Engineer?

Although not so specifically put, the above title is the question a correspondent is asking when he writes:

> Some time ago there appeared in your magazine an editorial urging young men who have an engineering education and who are willing to "rough it," to go out West and, starting out as county surveyors or in any other capacity in the employ of some municipality, endeavor to build up a general engineering practice. Will you kindly suggest a way in which a young engineer hesitating to spend a good deal of his ready money in order to get to a part of the country, which is to him as yet shrouded in a haze of mystery, and there wait until he is lucky enough "to strike a job," may get in communication with someone who could give him more definite information before he ventures out of his home city? I believe that a suggestion of this kind would be welcomed by a good many young engineers.

First let us correct an erroneous conclusion our young friend has evidently drawn from our editorial, "A Neglected Opportunity of the Engineering Graduate" (Engineering News, Dec. 11, 1913, p. 1196), in which we pointed out, from very good evidence on another page of the same issue, that many county surveyors and county engineers in some of the Middle Western States are incompetent and ignorant, and that young engineering graduates were neglecting their opportunities in not getting in line for those offices.

We did not then, and, so far as we know, never have urged young men to go West and ask for positions as county surveyors and engineers. County engineer jobs are not to be had that way; unfortunately, as we have said before, many are too much mixed with politics. Neither have we [illegible] advice or suggestions to offer our young friend as to how to secure those positions, since there are other things he will have to learn first. But we will undertake to offer for his perusal, and by chance the perusal of the "many other young engineers" referred to, a few truths that it is time he and they knew.

First, this is a tough year for the new engineering graduate. Jobs in engineering work are few and hard to

get. Second, there are a great many engineering college graduates; an estimate of 5000 per annum is conservative, from what might be termed first-class technical schools and universities. More than that, according to the United States Immigration statistics for the fiscal year ending June 30, 1912, some 1500 admitted aliens were professional engineers, who are for the most part in this country now, although present European conditions will restrict such immigration for a few years to come. Hence from the nature of things, competition for work in the lower ranks of engineering is keen.

Another point to be remembered is that graduation from a technical school doesn't make an engineer. If the institution from which our correspondent has just been graduated has granted him the degree of Civil Engineer, why so much the worse for our young friend if it has aroused in him visions of his glad welcome into the ranks of real engineers. All other things being equal, his chance of becoming a civil engineer is better than that of a fellow who has not had the advantages of a technical education; but that is all that can be said.

He would like to know how to begin as an engineer; he needs to know the prime requisites of an engineer. First and foremost, and the one that is most frequently neglected and overlooked, is a natural inclination, or an inherited or otherwise acquired predilection for mathematics and the natural sciences. The natural inclination must be more than a desire for an outdoor life and the pleasure of tramping through green fields and shady woods. Secondly, and hardly less to be considered, are self-confidence and self-reliance. There never was a successful engineer without these, however modest and unassuming in outward demeanor. A third and by no means the least prime requisite is industry—a real love and enthusiasm for engineering work as such, and a genuine joy and innate pride in results accomplished.

As to the first of these requisites, we do not know how our correspondent stands; he alone is judge of that; but we do know that our technical schools and universities are turning out annually many bright young men who have taken engineering courses solely from having been misled by extravagant and utterly untrue pictures of the lives and prosperity of the rank and file of civil engineers. Many an engineering graduate comes to a realization of his special fitness for some other work before he has been out very long. He seldom has cause to regret his technical education, if it were really an education and not the memorizing of a conglomeration of facts and formulas.

On the second essential requisite, we should judge our correspondent needs enlightenment. If a young man is able-bodied and not afraid of manual work, and is free from family responsibilities, he certainly should not be afraid of starving, even if he has not had the advantage of nearly 20 years of schooling, as most technical graduates have.

There is not a contractor, railway or other corporation, or individual, who would not employ an able-bodied American college man in preference to a foreign "roughneck," if the college man were willing to roll up his sleeves and get to work. Such a job isn't inviting, but it offers experience that can be gained in no other way; it offers an opportunity to get into contact with construction work and with engineers, and without these no man ever yet progressed very far as an engineer.

This year, jobs are not coming to the engineering graduate; owing to the tremendous outflux of engineering graduates, it is doubtful if that time ever comes again. In England, young graduates pay a premium for the chance to work at engineering. Some of our graduates might prefer this method, but they are not the stuff of which American engineers have been made. More than one railway officer and chief engineer has started his career as a sectionhand; college men have not infrequently started in this way, and doubtless every one of them who has afterward attained success feels very proud of his early experience, as he has a right to do.

If one lacks self-reliance, there is no better way of curing this failing than to prove to himself that he can earn his bread and butter by the sweat of his brow. This isn't an idle fancy or a theoretical discussion; it is based on personal experience, and the experience of many another man. We sympathize with our young friend, but if a fellow hesitates to leave home and free board for fear of not being able to earn his living, he would better have stayed at home always than have gone to an engineering school.

As to industry, it is hardly worth while to elaborate, since every man ought to know that it is the only key to success in any line of work. Not all men who are industrious are successful, by a long shot. Yet it is safe to say no man was ever very successful as an engineer who wasn't industrious. Of course, one soon learns that opportunity cuts a big figure; or will we say just pure dumb luck? But luck in the game never comes to one who doesn't join in the game. This is just as true in engineering work as in almost any other.

Engineers and contractors, as Col. H. G. Prouty says, are the stuff that soldiers were made of; in the field, they are generally a rough and ready lot, used to forming quick judgments and making quick decisions. "He who hesitates is lost," is just as true of the engineer as of the soldier in the field of battle. No one of these men is going to think the worse of a young man for having served as a laborer or in any capacity that meant real serviceable work. There are no social distinctions in a construction camp, and an extra-bright laborer stands a far better chance of winning the respect, friendship and assistance of his employers, and of the engineers he comes in contact with, than an unknown "tenderfoot" who wants to be guaranteed a good position before leaving home and father's dining table.

We don't say "Go West, young man." If a recent item in a Western contemporary be correct, no less than 2000 applications for positions have been received for work on the proposed Hetch Hetchy Reservoir of the city of San Francisco. Evidently, the West offers no more and no better opportunities than the East, except that in the West there is a more democratic attitude toward work in general.

However, there are opportunities in both the East and West for men who are strong enough in body and purpose to handle a pick and shovel, run a dinky, a steam shovel, a concrete mixer, work with a hammer and saw, and a thousand and one other jobs, which the average engineering graduate turns up his nose at. These jobs are not inviting, truly, but they offer a means of earning a livelihood and they offer one way to enter the ranks of engineers; a way that many a bright, clever and ambitious fellow has made use of before now.

Letters to the Editor

Balancing the Load in a Pile Test

Sir—In your issue of Aug. 6, 1914, you describe load tests on concrete piles at North Side Point Bridge approach, Pittsburgh. From the sketch accompanying this article it would appear extremely difficult if not physically impossible to maintain such a large water tank in absolute balance over the pile. Would it not be more satisfactory to make such a test by supporting a tank on a platform on top of the pile and attaching to the sides of the tank horizontal guys, which would not affect the vertical action of the load?

T. L. Condron.

Monadnock Block, Chicago, Aug. 20, 1914.

Use of Current Meters in Large Pipes

Sir—In the June 11, 1914, issue, you published an article by K. A. Heron entitled, "Current Meters for Measuring the Flow in Large Pipes." Reference is made to experiments at the Minnequa steel plant of The Colorado Fuel & Iron Co., where both meters described "have been in use for several years." The statement is made that "the experiments were conducted and the meters designed by A. A. Weiland and the writer under R. M. Hosea, Chief Engineer of The Colorado Fuel & Iron Co."

Your attention is called to the *Journal* of the Western Society of Engineers, Chicago, May 17, 1911, and Engineering News, May 25, 1911, where is a paper, "Measuring the Flow of Water in large Pipe Lines," in which the record of experiments and the work referred to by Mr. Heron is authoritatively given. The meter illustrated by him in Fig. 1, was designed and constructed by J. S. J. Laille (deceased), mathematical instrument maker, Denver, Colo., early in 1908, in response to a request for a meter that could be inserted into a pipe line through a 4-in. gate valve, quite a time prior to Mr. Heron's employment by this office. The meter illustrated in Fig. 2 was first constructed in the shops of the Colorado Fuel & Iron Co., Pueblo, Colo., in 1908 and 1909 from plans made in this office, drawn by R. G. Hosea, and embodying his ideas and those of A. A. Weiland, H. A. [illegible] and other engineers and employees of the company. This was also prior to Mr. Heron's employment, except as [illegible].

The meter giving satisfactory results, an improved [illegible] was prepared and submitted to W. & L. E. Gurley with the request for such additions and improvement as their wide experience might suggest. The mechanism for [illegible] the counter was shown in Gurley's *The* [illegible] and the meter as constructed by W. & L. E. Gurley and put into practical form in a [illegible] manner, as shown in the writer's paper before the Western Society. Mr. Heron worked under direction on [illegible] for this improved device in this office in 1909, for a time. Before and after this date he was regularly employed as concrete inspector until leaving the service in June, 1910. Mr. Weiland was engaged in water-investigation work with the writer in 1908 and 1909, but left the service of the Colorado Fuel & Iron Co., Feb. 15, 1910, before the improved meter was built or used.

Some work was done with the pitometer in our pipe lines, by Mr. Weiland, and he made the suggestion of inserting an electrical meter in a closed pipe in the same manner as the pitometer (as shown in E. S. Cole's article "The Pitometer & Water Works Losses," in the 1906 *Proceedings* of the American Water Works Association). The putting into practical form was, however, done by Mr. Laille and others and Mr. Heron had nothing to do with it. He was probably not familiar with the facts when he prepared his article. For the reasons given in Engineering News, May 25, 1911 (and in the present letter), the design was given publicity.

The foregoing gives the bare statement of facts which the writer believes he is in a better position to do than Mr. Heron. In fairness to all concerned, I request publication of this letter.

R. M. Hosea,

Chief Engineer, The Colorado Fuel & Iron Co.

Pueblo, Colo., July 3, 1914.

[Mr. Heron has offered the following comments:]

Sir—As suggested by Mr. Hosea, I was not aware that a description of the meters had been previously published. The publications mentioned are not available at the moment, but if Mr. Hosea's description was in the same manner as is his letter it is not too late to extend the credit he has given for this work. He has [illegible] relegated me to a "thinking part," and then [illegible] Mr. Weiland's leaving the service of the company "before the improved meter was built or used."

I was connected with the Colorado Fuel & Iron Co. for the greater part of four years, and most of this time was spent in the Water Department of the company on various engineering work. From three years' close association with Mr. Weiland, and with an intimate knowledge of the operations of the water department, I have always understood that this electrical meter was developed solely by him, and was made by Mr. Laille in the manner suggested by Mr. Weiland, who was in charge of water investigations for the company in 1908-09-10. I assisted Mr. Weiland in the rating of this instrument and in a number of experiments during the summer of 1909.

In the early part of 1910, Mr. Weiland left the service of the company. I had been associated with him for a time, and shortly before he left we started the preparation of plans of what was then the improved meter. The meter as constructed by W. & L. E. Gurley was according to a set of plans that were prepared in their entirety by me (under the general direction of Mr. Hosea), applying the [illegible] experience in this line of Mr. Weiland. As Chief Engineer of the company, Mr. Hosea

was responsible for all the work of the engineering department, and may choose without question whatever credit he desires for his work.

Mr. Hosea seems to think that I am claiming too much credit for the part I took in this work when, as a matter of fact, I was merely describing an interesting method of water measurement in the development of which I had assisted.

K. A. HERON.

Modesto, Calif., July 16, 1914.

Opportunities for Engineers in the Argentine; A Warning

SIR—After reading the editorial in ENGINEERING NEWS, Aug. 20, p. 407, on the opportunities offered by the present European war to American commerce and engineering in South America, it has seemed advisable that a note of warning in regard to conditions of employment be sounded for some of your readers who may have drawn false conclusions from your remarks.

A young structural draftsman recently informed the writer that he had been devoting special attention to skewed work for the reason that the people of the Latin-American countries are swayed by their artistic natures to such an extent that their architects design very complicated roofs, domes, cupolas, etc., on all their buildings; and, since not many draftsmen are skilled in detailing such work, it follows that there must exist a demand for those with the necessary qualifications.

Granting without question the great amount of queer roofs to be seen in South America, the conclusions drawn are quite wrong. It must be remembered that industrial work in South America and in Europe is regulated by very different customs from our own.

The functions of the American engineering draftsman are carried out by two types of men. The first is merely a mechanical copyist, who makes tracings or show drawings from the sketches of engineers. His pay in the Argentine is about \$65 per month, which, considering the high cost of living, is about equivalent to \$50 in this country. He works slowly, but with skill, and produces drawings beautifully lettered and elaborately finished, often in colors.

The second type is that of the German "techniker," somewhat similar to the "designing" or "engineer draftsman" of our better railway bridge drafting rooms. He is competent to and does design simple structures and prepares the detailed pencil drawings for the tracers. His pay is about \$130, or, say equivalent to \$100, and is very seldom increased.

A "techniker" is a graduate of a "technikum" or school offering two-year courses in specialized branches of engineering. Its graduates are often men of much practical experience, who have wished to study some of the theory underlying their work, and they rank considerably above the average American structural draftsman.

There are many such men in South America, but frequently their place is filled by young Italian, German, Austrian or Scandinavian civil-engineer graduates of the great European universities, who are willing to work for small salaries while learning the language of the country or while "revalidating"* their degrees.

The cost of living is particularly high in Buenos Aires, where American shoes cost \$8 to \$10 per pair, Stetson hats \$10 each, collars \$2 per half dozen, etc. A small and uncomfortable room with meager board in the native style will cost \$50 to \$75 per month. In spite of these excessive expenses, many young Europeans have flocked to Brazil, Uruguay and the Argentine. Often these men have enjoyed excellent educational advantages; yet they are used to much lower salaries and more modest conditions of living than our young men, and hence are willing to work for the small wages mentioned.

Only a few of the foreigners have been able to leave South America to return to their countries since the sea has been closed to merchant steamers. Great numbers will pour into the southern countries at the close of the war. It should be perfectly evident that our draftsmen, clerks and high-grade artisans, with all the national ignorance of and disinclination to learn foreign languages, will be able to offer very little real competition to these men.

The case is not very different for engineering graduates. In the Argentine, for example, as I have shown in my letter in ENGINEERING NEWS, Apr. 30, 1914, p. 979, the cost of "revalidation" is so high, the time so long and the requisite knowledge of Spanish so unusual, that no private practice could ever be obtained. As employees of American companies, engineers are apt to become much dissatisfied with living conditions, unless the salaries paid are very high.

It should, of course, go without saying that it is useless to expect any success in South America unless one speaks Spanish or Portuguese. A large part of the passenger list of every steamer to Rio or the Plate is made up of soi-disant engineers "looking for a job." Most of them return in a sadder and wiser frame of mind after a very short visit. The writer has even seen American mechanics who have journeyed all the way to Buenos Aires "on speculation." He is not speaking of the threshing machine operators who come on contract. When it is realized that in Buenos Aires a 10-hr. day's wage for brick masons is less than \$2.50, or for carpenters \$2, the utter folly of such "speculation" is seen.

To turn to the more general aspects of the case: South America has no floating capital of its own and does not usually borrow it directly to accomplish public works of great magnitude, preferring rather to grant long-time concessions to foreign capitalists, who naturally purchase all supplies in their own countries. Thus the great port of Rosario was built, and is operated, by a French syndicate. Most of the railways are English. Mineral enterprises are English and American. Many of the electric plants and most of the quebracho forests are German. The meat-packing industry is fast being controlled by Americans. Only in accordance with the amounts that American capitalists are able to invest in other enterprises will engineering work be carried out with American materials.

It is probable that England will keep the seas clear for her enormous commerce, which will continue with but temporary interruptions. With French wines, silks, objets d'art, etc., we do not compete. The opportunity, such as it is, presents itself to us to acquire the trade of Belgium and Germany in metals and manufactured goods. This may, perhaps, last only as long as the war. We are absorbing at present about all that is economically

*"Revalidating" engineering degrees here means practically the process of obtaining a license as Civil Engineer.

[illegible] of South American products, and the general principles of commerce will act to prevent us entirely and permanently supplanting those countries, for they can consume very much more of the South American exports than we.

Our opportunity is for establishing and extending the market for certain articles which we manufacture better, or more cheaply, than the European countries. Many of these are already in the field, and others, such as electrical supplies (in which our present trade is weak), cement, structural materials and small manufactured goods, could secure a decided foothold—only, however, in case our manufacturers will adopt the most modern methods of selling. Let the market be seriously studied as to its [illegible], demands and possibilities. Spanish-speaking representatives, who have some understanding of the customer's character, must be found. Unfortunately, these are few and far between.

What I have said applies mainly to the East Coast countries. On the West Coast, our commerce and enterprises have been developing for some years in a healthy manner. The opportunity for increases is good, but is strictly limited by a very much smaller population and purchasing power than in the princely East Coast republics.

This letter is written not in pessimism, for many opportunities do now exist for the wise and adaptable manufacturer, but as a warning against over-rashness on the part of adventuresome men, young or old.

Cyrus T. Brady, Jr.

615 Lake St., Elmira, N. Y., Aug. 24, 1914.

The Waterproofing of the Muskogee Reservoir

Sir: In one of your recent issues, there appeared a full-page advertisement dealing exclusively with the merits of a waterproofing material applied to the interior surface of a [illegible]-gal. reservoir designed by the writer for the City of Muskogee, Okla. The inference in the advertisement is plain that the waterproofing is wholly responsible for the excellent results secured.

The specifications covering the construction of this reservoir did not contemplate the use of any special waterproofing material. The only waterproofing called for was two coats of neat cement wash to be applied with a whitewash brush on the inside of the basin, the second coat to be applied before the first one had had time to get very hard. The writer is of the opinion that any special waterproofing for such a structure is unnecessary to secure the degree of water-tightness called for in the specifications under which the reservoir was constructed. However, as the contractor was under contract to keep the leakage within the limits of the specifications, he would be [illegible] the additional precaution, entirely at his own expense, of [illegible] a patent waterproofing ingredient in the cement wash called for under the specifications.

Under ordinary conditions the writer is opposed to the use of waterproofing ingredients in the concrete or waterproofing applications to the exposed surface. It is far better to put the value of waterproofing materials into the concrete work itself by adding more cement and [illegible] better workmanship. In general, the use of waterproofing ingredients or applications tends to poor construction work, the contractor counting upon the waterproofing to materially help out careless construction. At Muskogee, Okla., the faithful work done by the contractor in mixing and placing the concrete was ample assurance to the writer that the structure when completed would be water-tight within the limits of the specifications.

The writer has designed a number of reinforced-concrete reservoirs in which neither waterproofing ingredients nor applications were counted upon for water-tightness, and in many cases not only a water-tight but a practically damp-proof construction was obtained. That it is possible to obtain with concrete, water-tightness sufficient for all practical purposes is an established fact. In the past two years the writer has constructed four identical sewage pumping stations, three at Harrison, N. Y., and one at Moorestown, N. J., in which the pumping pits are constructed below the ground-water level and subjected to hydrostatic heads ranging from 7 to 10 ft. In three of these pumping stations, a satisfactory damp-proof construction was obtained. In the fourth case, the contractor had considerable trouble from leakage and sweating, which can only be attributed to poor workmanship, and which necessitated the use of a waterproofing application to meet the requirements of the specifications.

In addition to the Agency Hill Reservoir, the writer also designed and constructed for the City of Muskogee, a 6,000,000-gal. reinforced-concrete settling basin in which no waterproofing ingredients or applications were used. The water-tightness of this structure came well within the specifications, which were similar to those for the Agency Hill Reservoir.

Alexander Potter

Havana, Cuba, Aug. 20, 1914.

NOTES AND QUERIES

A Formula for Columns Subjected to Bending, given in our issue of Aug. 27, p. [illegible], by Prof. J. [illegible] contained a slight typographical error. In the final formula for [illegible], middle of second column, the denominator should have the figure 1 in place of the letter l. The corrected formula thus reads: [illegible]

A. M. V., [illegible], Chicago, Ill., [illegible] whether he can collect [illegible] [illegible]

Pulling Steel Sheet Piling [illegible] after the work is done is not always an easy matter. In some of the bridge foundation work for the Grand Trunk Pacific Ry. along the Fraser River, in British Columbia, the hoisting hook inserted in the hole in the pile would tear through the web, splitting pile to the top. In one case the metal above the hole [illegible] and developed such intense heat that the folds were welded together.

A Large Sewer Tunnel at St. Louis

A costly piece of sewer work which has been undertaken at St. Louis, Mo., and which involves the unusual feature of working under pressure, is the Mill Creek joint district sewer. Its purpose is to relieve the old Mill Creek sewer, which is now working far beyond its capacity. The new sewer will be at a low level, as shown by the profile, Fig. 1, with drop shafts from several sewers above it. It will take the storm flow of the old sewer by means of a drop shaft near Vandeventer Ave. It will be 20,000 ft. in length, of which 18,200 ft. will be in rock tunnel, with 1800 ft. at the outfall built in open cut. The flow capacity is 3300 cu.ft. per sec.

the method of payment in tax bills, which necessitates the financing of the entire cost by the contractor.

On account of congestion in the main valley, the sewer is laid out along the ridge on the south side. To the east of Theresa St. the territory is built up almost solidly, being in the old part of the city. Core borings with diamond drills were made at frequent intervals, in order to obtain a reliable knowledge of the depth and character of the rock. The tunnel will be driven from a number of shafts, the approximate location of which is shown on the plan.

The tunnel is of horseshoe section, 16½ ft. high and 16½ ft. wide at the springing line. The principal sections in tunnel and in open cut are shown in Fig. 2. For the tunnel, which will have 60 to 90 ft. of rock

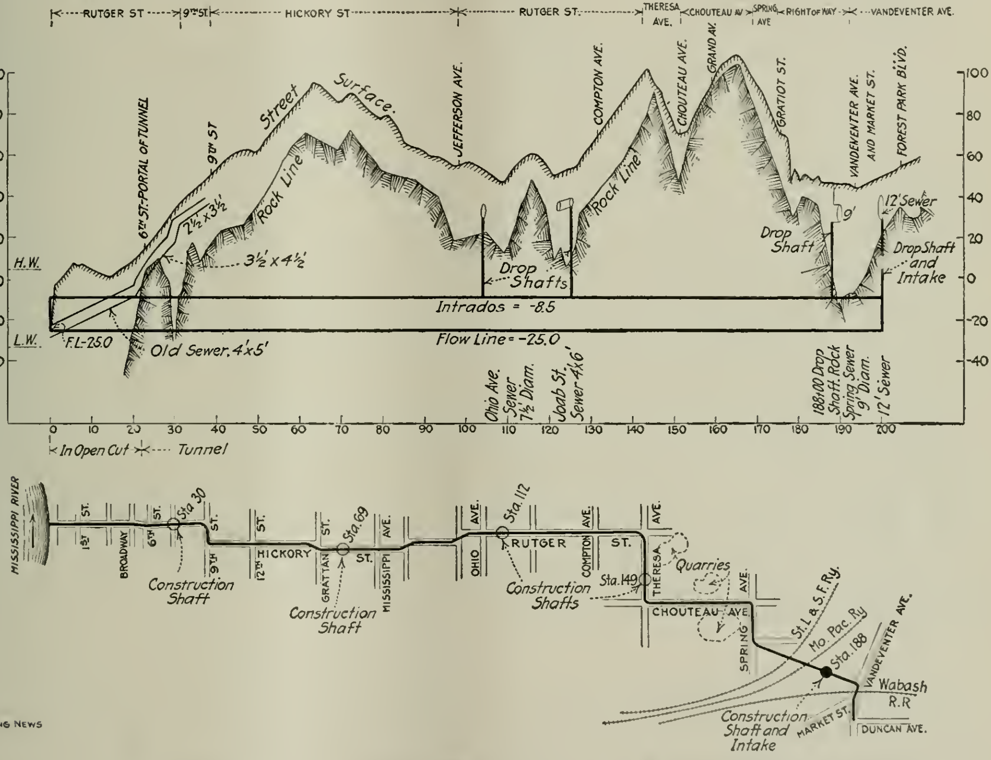


Fig. 1. Plan and Profile of the New Mill Creek Joint District Sewer, St. Louis, Mo.

The special features of the work include the following: (1) The design of a sewer as a pressure tunnel in order to construct the tunnel as far as possible through solid rock; (2) the consequent level flow line; (3) diversion chambers with peculiar overflow weirs in order to conduct storm water to the tunnel and ordinary sewage to the old Mill Creek sewer; (4) special drop shafts leading the flow from the diversion chambers in the high-level sewers into the tunnel; (5) the use of granite aggregate in the concrete work of the chambers and drop shafts; (6) the design of the reinforced-concrete section in open cut; (7) protection of the outlet by reinforced-concrete sheet-piling; and (8) most important of all,

cover, section (A) is to be used where the line of solid rock is more than 16 ft. above the springing, and section (B) where this line is 7 to 16 ft. above the springing on both sides. For open-cut work, with 25-ft. till, section (C) is to be used in rock, and section (D) in soft ground. These latter sections will have vitrified brick lining for the invert. The quantities are as follows:

	Tunnel		Open cut	
	Sec. A	Sec. B	Sec. C	Sec. D
Excavation, cu.yd.	11.74	13.39	5.89*	....
Concrete (within neat line), cu.yd.	2.88	4.53	2.61	4.91
Vitrified brick (cu.yd.)	.....	.....	0.21	0.21
Steel reinforcing bars, lin.ft.	.....	.....	112,500	298,000

*Excavation below springing.

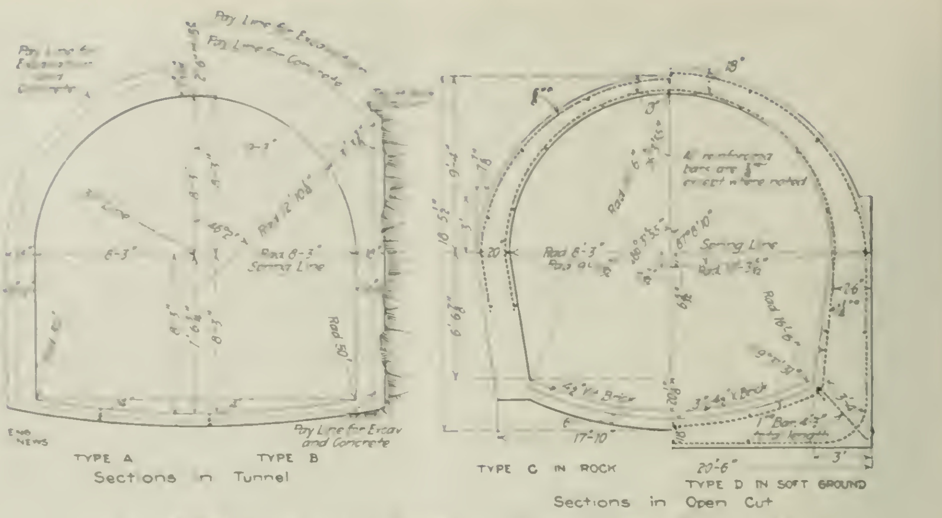


FIG. 2. CROSS-SECTIONS OF MILL CREEK JOINT DISTRICT SEWER, ST. LOUIS, MO.

In regard to the system of payment, which limits the work to contractors having strong financial backing, the notice to bidders stated as follows:

> Payment is to be made by special tax bills, divided into three parts, the first payment being due 30 days after the work is completed and service had on the property holders by the sheriff, the second payment in one year, and the third and last payment in two years from the time service is had on the property holders by the sheriff. All deferred payments will bear 6% interest. In case the property holder defaults on any payment, all becomes due and bears 8% interest.

The work was let out in two sections, one of 9500 ft. (including the outlet), and the other of 10,500 ft. Both were let to the Carter Co., of New York, as the lowest bidder. The contract prices were, respectively, $1,399,-[illegible] and $1,672,500, while the estimates were $1,500,000 and $1,700,000. The work is under the direction of J. A. Hooke, sewer commissioner. For plans and information we are indebted to W. W. Horner, principal assistant engineer of the Sewer Department, Board of Public Improvements.

Railways in Time of War

By H. Raynar Wilson*

The terrible war now raging on the European Continent has drawn attention to the important part played by railways in the mobilization and transport of troops, horses, guns, stores and commissariat. The importance of securing absolute possession of the lines and uninterrupted passages for the traffic was so great in England that the railways passed automatically into the possession of the State by an Order in Council made on Aug. 4, the day when war between Great Britain and Germany was declared. British railways are now under the control of an Executive Committee composed of the General Managers of some of the principal English Railways and of the leading Scottish [illegible]. Power to do this was obtained in 1871 by "The Regulation of Forces Act." This legislation allows the State to take possession of "any railroad [or tramway] in the United Kingdom and of the plant belonging thereto." Full compensation, as may be agreed between the parties for any loss or injury they may have sustained by the exercise of the powers is to be paid; in case of dispute the amount to be settled by arbitration.

On the European Continent the railways of Germany and Belgium are State-owned, and those of France, Austria and Russia that are not actually State-owned are practically so. In Germany there are, it is known, lines strategically laid out for military purposes, whilst in France the lines principally concerned, that is, the Northern and the Eastern, although privately owned, have always been recognized as of importance when the day arrived that found France again at war with her Eastern neighbor. It will also be remembered that it is claimed that military considerations contributed greatly to the plans of Bismarck for the State purchase of the railways of Prussia.

No railway in Great Britain has been constructed in which military considerations have entered; the only benefits that have weighed have been those of the public. There has, however, been a railway proposed that has secured not only the approval but the support of the military authorities. This was for a road known as the Outer London, which was to link up, on the outskirts of London, some of the southern and some of the northern lines. The proposals have been before Parliament on three occasions but, strange to relate, in view of the present terrible events, they have been rejected.

British railways enjoy several advantages in the matter of transportation of troops. There is, for instance, the short distance between the main centers. From Aberdeen, in the north of Scotland, to London, is 540 miles; from Edinburgh to London, 400 miles; Carlisle to London, 300 miles; Liverpool to London, 200 miles; Plymouth to London, 250 miles, and so on. Then, practically, all the lines are double-tracked—all those used for military purposes certainly are—and the main lines are [illegible]. Yet another benefit is that all are protected

*[illegible] Road, London, N. W. England.

by the absolute block system, but the stations being so close together, the permissive system can be readily adapted.

But the two chief advantages lie in the numerous alternative routes and the nearness of the stations to each other. There are, for instance, three routes, all direct, between London and Portsmouth, four between London and York, four between London and Liverpool, three between Liverpool and Hull. The benefit of the short distance between stations is that supposing troops are being sent from the area A to the port of E; they can be entrained at B, C, D, three stations in the neighborhood of A, and detrained at F, G, H, three stations in the vicinity of E. This, if trains are to be run at ten-minute intervals, would give half an hour for each train to load at B, C and D, respectively, and the same time at F, G, H, for unloading.

At the time of writing no details are available as to the movements of trains in Great Britain.

Before leaving this subject, it may be of interest to American readers to learn that Major-General Klein, an officer of high rank in the German army, strongly objects to the electrification of the main lines of Germany, because the destruction of a power house, or of the electrical supply, might seriously affect the rapid mobilization of troops. He also points out that Socialism was very strong in the ranks of electrical workers, which might be another adverse factor.

This warning was issued about 18 months ago, and in it the writer sees an explanation for the delay in opening electric traction through the Mount Cenis tunnel dividing France and Italy. Trains have been worked electrically on the Italian side between Bussoleno and the frontier town Bardonecchia for over a year. The writer, when visiting the works in June of this year, asked why they did not run through to Modane, in France, seeing that the installation was complete throughout. He was told that it was for international political reasons.

NEWS NOTES

Ohio Road Improvement Work is progressing with unprecedented speed. Before Jan. 1, 1915, it is expected to have approximately 900 miles of road under contract for improvement. [Ohio State Highway Department Monthly.]

A Headgate on the Welland Canal Was Carried Away at Lock No. 6, St. Catherine's, Ont., on Aug. 23, by the steamer "John K. Ketchem," owned by the Reid Wrecking Co. A footgate was also torn away, and the steamer dropped to the lower reach. The damage was small and traffic was not interrupted more than four hours.

A Gasoline-Tank Car Exploded near Savoie, La., on Aug. 28, killing four men and seriously injuring three others. The car was part of a freight of the New Orleans, Texas & Mexico R.R. Press dispatches state that the explosion followed the slipping of a chain attached to the car. It is thought that a spark might have been struck in this manner and ignited the gasoline.

Three Railway Bridges Burned—A bridge over the Ohio River ,at the foot of Sixth St., Cincinnati, Ohio, burned on Aug. 24. A bridge of the Wabash R.R. burned one mile east of Wilcox, Mo., on Aug. 16. The structure was about 200 ft. long and 30 ft. high. On Aug. 18, the pile approach to the little Pappio Bridge of the Union Pacific Ry., near Omaha, Neb., was destroyed by fire.

A Marine Collision between the "Admiral Sampson," of the Pacific-Alaska Navigation Co., and the Canadian Pacific steamer "Princess Victoria" resulted in the sinking of the "Admiral Sampson" off Point-No-Point, Wash., on Aug. 26. Press reports state that the steamer sank in four minutes, with a loss of 11 lives. It is alleged that neither vessel was making more than three knots an hour, in a heavy fog. The "Victoria" rammed the other vessel directly on a line with the after hatch, opening a 12-ft. gash in the hull, where fuel oil was stored, crushing several large containers. The oil caught fire. The "Victoria," which had kept her nose pressed into the hole, backed away as the flames enveloped both vessels. The lost vessel was of 2262 gross tonnage and 16 years old.

Improved Engineering Conditions in New York State—In the past two weeks the paper mill industry in northern New York has shown marked improvement owing to conditions arising from the European war. There seem to be several causes, such as the impossibility of securing foreign sulphite pulp much of which has come from Germany and Scandinavia, the uncertainty of obtaining material for ground-wood pulp from Canada as rapidly as usual, and the increased demand for extra editions of newspapers. This particular commercial improvement has materially brightened the prospects of engineering work generally in this locality where a large amount of civil and mechanical design has been held in abeyance.

Rules for Storing Gasoline in New York State were recently formulated by Fire Marshal Ahearn, as follows:

On and after Dec. 1 all existing buildings or other structures used as garages, with a capacity for housing more than four vehicles, shall immediately comply with the orders of the State Fire Marshal.

Repair shops shall not be maintained within a garage.

Torches, forges, fire or flame, or any electrical apparatus capable of emitting an exposed spark shall not be used or maintained in a garage or motor-vehicle shop. Heating shall be by steam or hot water.

No person shall conduct or maintain a garage, or keep or store any volatile inflammable liquid in connection therewith without a license or permit being obtained therefor, in accordance with the provisions of the State Fire Marshal law.

Gasoline or naphtha tanks will not be allowed under sidewalks. For those already installed reasonable time will be given to have them removed and reinstalled in compliance with the orders of the department.

Gasoline or naphtha tanks must be buried at least 3 ft. from the surface of the ground and proper piping connected to garage or curb outlet.

Smoking is at all times prohibited in garages.

No pits will hereafter be allowed.

No building or parts thereof shall be converted into a garage or used as such unless of fireproof construction.

Sand-Lime Brick Produced in the United States in 1913 was valued at $1,238,325, and represented the work of 68 firms. The value of sand-lime brick marketed and the number of operating plants which reported to the U. S. Geological Survey rose rapidly until 1907. In 1908 there was a decrease, in common with other industries. In 1909 and 1910 there were slight increases; in 1911 the lowest value ($897,664) was reached since 1904. In 1912 and 1913 there were gains, the total for 1913 being the maximum, though the number of active firms reporting was three less than in 1912. Last year the number of bricks manufactured was 189,659 M. The average price per M. for common sand-lime brick was $6.27 in 1913, as compared to $6.46 in 1912, and $6.09 in 1911; for front brick it was $10.61 in 1913, as against $10.41 in 1912, and $9.53 in 1911.

Michigan has been the leading state in number of plants and in value of production of sand-lime brick since the beginning of the industry in this country, with the exception of 1906. Twelve plants reported for 1913. The second state in number of operators was New York, which reported five.

Building Troubles in Russia—From a recent number of "Le Genie Civil" it appears that the number of building accidents, particularly those taking place during the construction of private dwellings, in St. Petersburg, Russia, has led the Russian Imperial Technical Society to initiate an investigation into the causes of the accidents. This investigation has shown that the owners of these dwellngs and more particularly the contractors, are generally lacking in any technical instruction, and, in addition, that there does not exist any competent municipal control able to make up for these defects in experience and knowledge. It also appears that there are no rules limiting the load which can safely be supported by different materials or different types of construction and that the contractors always are trying to make the low price material work as much as possible. Finally, they decided that in addition to the ignorance of the builders, there was a decided lack of understanding between the builders and their workmen.

To remedy these defects the investigators recommended that the city organize a building department with authority to supervise private construction and to fix maximum loads which should be allowed. To limit the use of poor material the committee recommended that a severe penalty should be imposed for the purchase of poor material, particularly when that material resulted in failure. To increase the knowledge of construction among both workmen and superiors the investigators concluded that it would be necessary

for the higher technical societies to create some technical societies of a lower order which might give instruction to [illegible]. Finally, the commission recommended that there should [illegible] an employers' liability law which would insure workmen against accident caused by the negligence of their superiors.

The Tai Tam Tuk Reservoir, now under construction for the water supply of Hongkong, China, will have a storage capacity of [illegible] U. S. gal. According to a brief note in the "[illegible] and Eastern Engineer" for July, 1914, the reservoir "is designed to catch the overflow from the Tai Tam proper and the Tai Tam intermediate reservoirs." Thus far the construction has proceeded to the extent of diverting streams and making it possible to store 60,000,000 U. S. gal. for use by pumping. The construction work "is being carried out under the supervision of the Public Works Department," and will require five years more for completion.

The Annual Improvement Work on Missouri Roads by volunteer laborers took place Aug. 19, 20 and 21. It is stated in newspaper reports that the number of volunteers was less by [illegible] than the number which turned out last year, when the scheme was inaugurated, but this is made a matter of congratulation by stating that many residents of cities turned out last year who proved to be more ornamental than useful, while this year the volunteers were farmers and country residents capable of doing a day's work. Governor Major spent the whole three days with a gang of 25 convicts. The Governor is optimistic enough to believe the state is a gainer by $1,[illegible] as a result of the three days of popular road work.

Trade of the United States With Other American Countries in the year ending June 30, 1914, aggregated $1,303,-[illegible], or 3[illegible] of the commerce handled by domestic ports. Of this, 956 million was with North America and 347 million with South America, according to recent statistics of the Department of Commerce, Washington, D. C. Imports from North American countries into the United States, valued at $[illegible], were chiefly from Canada, Cuba, Mexico, Central America and the British West Indies. Exports to these countries, amounting to $[illegible]29,000,000, were chiefly to Canada, next [illegible] Cuba, Central America and Mexico. Although the trade of the United States is very extensive in North America, this is not the case in South America. In Argentina, Brazil and Chile, for instance, only about 1[illegible] of the imports were from this country.

The Last Spike [illegible] a new railroad was driven at Nova, Ohio, Aug. 17. This event, now rare in the East, marked the completion of the Lorain, Ashland & Southern R.R., 78 miles long. It begins with a belt line at Lorain, on Lake Erie, and runs south to [illegible], on the Pittsburgh, Fort Wayne & Chicago R.R. (Pennsylvania System). It crosses two branches of the Lake Shore & Michigan Southern, the Wheeling & Lake Erie, the Cleveland, Cincinnati, Chicago & St. Louis, the Northern Ohio, the Baltimore & Ohio and the Erie roads. Most of the line has been built within a year and a half, though the [illegible] miles between the Erie and Pennsylvania lines [illegible] and Ashland) has been built 1[illegible] years. The road is [illegible] for about $[illegible],000, or $[illegible]6,000 per mile. [illegible] schedule operation will begin Sept. 1. Freight will be hauled by steam trains and passengers by storage-battery cars.

Another Concreting Record at Arrowrock Dam.—The June "[illegible] Record" gave what was believed to be a world's record for concrete placing with [illegible] mixers while at the Arrowrock Dam, [illegible] Project in April, 1914. The record was broken during May, according to July-August issue of the same journal. The following figures for the two months show that the April record was substantially exceeded in every particular during May:

	April	May
Total yardage for the month	[illegible]	[illegible]
[illegible]	6	6
[illegible]	3	3
[illegible]	18	18
[illegible]	3	3
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Average [illegible] per day	[illegible]	[illegible]
Average [illegible] per hour [illegible]	[illegible]	[illegible]

A Remarkable Highway Bridge.—For [illegible] months a brick pavement with a concrete foundation on a rural road in [illegible] County, Ohio, has bridged a gap [illegible] ft. long and [illegible] ft. wide over a washed-out roadbed. The pavement was illustrated in "Engineering News" of [illegible] p. [illegible]. According to the August issue of "Dependable Highways," the [illegible] of National Paving Brick Manufacturers Association, this same pavement is still in use with no other safeguards than a few timber props and a guard rail to keep vehicles from venturing over the edge of the projecting shelf. The pavement is near Tinker's Creek, on the Durham road, where the washout occurred in March, 1913. It is said that after the washout, the road authorities attempted to break up the pavement with sledge hammers, but it resisted so tenaciously that traffic was allowed on it, and the road has been in use ever since. The chief cause of delay in backfilling the road foundation has been a project to divert the road to a new location.

Iron Ore Output in 1913 Largest.—The crude iron ore mined in the United States in 1913 amounted to about 62 million long tons, compared with 55 million in 1912, an increase of about 12[illegible]. The iron ore shipped from the mines in 1913 was about 60 million tons, valued at $131,000,000, compared with about 57 million tons, valued at $107,000,000 in 1912. The average price of ore per ton for the whole country in 1913 was $2.19, compared with $1.88 in 1912. These statistics include the ore used for fluxing other metallic ores at smelters in the Middle and Western States, but do not include the iron ore sold for the manufacture of paint. The latter ore in 1913 amounted to about 17,000 tons, valued at $[illegible],000.

Iron ore was mined in 28 states in 1913, the five largest producers were, Minnesota, Michigan, Alabama, New York and Wisconsin. The output of the Minnesota iron ranges amounted to five-eighths of the total. The Lake Superior district, comprising all the mines in Minnesota and Michigan and those in northern Wisconsin, mined 84.5% of the total.

A Report on the Reservoir Break at Turlock, Calif., described in "Engineering News," July 9, 1914, has been made by a committee of the affiliated commercial organizations of this irrigation district, confirming the probable causes set forth before. The report states (1) that the water forced its way through the south wing of the outlet gate on account of poor workmanship, (2) that the break was due to faulty filling behind the concrete bank lining, (3) that the fills along the north side of the Davis reservoir are faulty and porous, (4) that abnormal and alarming flows preceded the break but that the operating officials did not heed the warning. It is also reported (5) that the gate proper is undamaged, and (6) that there is good material available for an impervious earth fill. The committee recommends (1) strengthening all present fills "under the advice and immediate supervision of a first-class experienced engineer," and (2) appointing a general manager and superintendent for the district of "acknowledged ability and experience" to have control and supervision of the entire irrigation system, of the employing and discharging of employees, of the purchasing of supplies and auditing of bills. Several of the district directors have resigned.

An Ocean Car Ferry Steamer for through freight service between the United States and Cuba is being built for the Florida East Coast Ry. by the William Cramp & Sons Ship & Engine Building Co., at Philadelphia. It will run between Key West and Havana. It resembles the car-ferry steamers operating on Lake Michigan, having the bow and sides carried up to a deck over the track deck, so as to give a high freeboard in rough weather, while the stern is open for the passage of cars. The stern end of the track deck is shaped to fit the recessed end of the [illegible] pier, so as to adjust the boat and shore tracks in proper line. The boat was designed originally to be [illegible] ft. long, carrying [illegible] cars, but as built it is 3[illegible]0 ft. long and has capacity for [illegible] cars. It is [illegible] ft. wide and [illegible] ft. deep, and has a speed of [illegible] knots with 2[illegible] tons cargo load. There are four tracks, and when the cars are in place their bodies are supported by blocks, so that they cannot swing on the truck springs when the vessel is rolling. The double bottom has tanks for feed water and for water ballast when the vessel is light. There are also two tanks for carrying molasses, with pump equipment for handling this cargo.

The machinery consists of two triple-expansion engines, developing [illegible] hp. at [illegible] r.p.m., and steam is supplied by [illegible] boilers. Special arrangements are made for fitting guns to adapt the boat to naval or transport service. The officers and crew's quarters are in superstructure on the upper deck. The boat is nearly ready for launching and will be named the "Henry M. Flagler," after the late president of the railway, who originated the idea of the Key West extension (with its [illegible] viaducts) and the Cuba car ferry.

Proposed Municipal Water-Works for Birmingham, Ala., were reported upon by Julian Kendrick, City Engineer, on Aug. 1[illegible]. This report is printed in full in the Birmingham "Age-Herald" of Aug. 1[illegible], from which we have taken the following. Mr. Kendrick reports that a municipal plant can be built on the [illegible] River, where there is enough water to supply a city several times the size of Birmingham. The

site of the proposed pumping plant is at Glover Ferry between the proposed location of Locks 7 and 8, near the point where the Atlanta, Birmingham & Atlantic R.R. crosses the river. From the pumping plant a 48-in. force main is designed to be laid by way of Sterretts, passing through Coosa and Oak Mountains by means of tunnels, to a reservoir and filter site, near East Irondale, thence to the city's distribution system. The pumping plant will consist of one 12,000,000-gal. and two 8,000,00-gal. pumping engines—a total pumping capacity of 28,000,000 gal. per day. The pumps will operate against a head of 460 ft. The force main will be 117,600 ft., or 22.3 miles long.

Two storage reservoirs are planned at Slades Mountain with a total capacity of 300,000,000 gal. at an elevation of 800, or 35 ft. above the surface of the distributing reservoirs of the Birmingham Water Works Co. The proposed filter plant is designed to take 26,000,000 gal. per day. From the filter plant to the city's distribution mains, 32,000 ft. of 48-in. main will be required, and it is planned to spend about $1,500,000 on the distribution system. The estimated cost of the whole is approximately $4,500,000.

Under the present contract with the Birmingham Water Works Co., the city is required to pay 15c. per 1000 gal. for water, $55 per year for each fire hydrant, and the rate to private consumers ranges from 8c. to 30c. per 1000 gal. Mr. Kendrick reports that the city can sell water from the proposed plant for 10c. per 1000 gal. at a net profit of $52,560 per annum.

Temperatures of Ingots and Rails in Rail Rolling were measured by the Bureau of Standards at four rolling mills recently. The purpose was to determine prevailing practice regarding rail-rolling temperatures, find out what the shrinkage clause in rail specifications amounts to and determine if possible what parallel there is between physical properties of rails and rolling temperatures.

There is practical uniformity among the several mills for the rolling temperatures of ingots for steel rails, the range being from 1975° F. to 2085° F. There is no very considerable difference among the finishing temperatures of the rails at the hot saws, the range being about 1615° F. to 1815° F, the average, 1715° F., is 520° above the critical range of rail steel. Chemical analyses and micrographic examinations, together with tests of the chemical properties from samples of the rail whose tempertures have been observed, showed no particular relation between these various factors and the rolling temperatures.

The observations covered both openhearth and bessemer steel, the former having 0.65 to 0.70% carbon, and the latter 0.40 to 0.50% carbon. The melting points of the steel range from about 2680° F. to nearly the melting point of iron at 2786°. The critical point of the steel on heating was about 1350°, and on cooling —about 1230°.

The doefficient of expansion for openhearth and bessemer steel was found to be different. Between 0 and 1800° F. the linear coefficient per degree Fahrenheit was 0.0000081 for bessemer, and 0.0000087 to 89 for openhearth. On this basis the shrinkage allowance of 6¾ in. in 33 ft. fixed by the American Society for Testing Materials in 1909 specifications allows temperatures of 1947° F. to 2055° F., which is very far above the critical range of the steel. Thus the specification, the Bureau points out, does not serve its avowed purpose of limiting the finishing temperature to a value slightly above the critical range.

PERSONALS

Mr. J. W. Barrie, Principal Assistant Engineer of the Florida East Coast Ry., has resigned, and the office has been abolished.

Dr. George F. Swain, Past-President of the American Society of Civil Engineers, of Harvard University, was married on Aug. 21 to Mrs. Mary Augusta Rand, daughter of Mrs. George W. Batchelder, of Ipswich, Mass.

Mr. Fred. W. Lepper, M. Am. Soc. C. E., recently Supervisor of Construction of the building of the Bureau of Engraving and Printing, Washington, D. C., has been transferred to Augusta, Ga., to supervise the construction of the new Post Office building.

Mr. H. A. Butz, for the past four years Chief Engineer of the Dominion Iron & Steel Co., Ltd., Sydney, Nova Scotia, has resigned. The company has discontinued all construction work for an indefinite period, due to present war conditions. Mr. Butz was formerly with the Garrett-Cromwell Engineering Co., Cleveland, Ohio.

Mr. Morgan. K. Barnum, recently General Mechanical Inspector of the Baltimore & Ohio R.R., has been promoted to be Superintendent of Motive Power, with headquarters at Baltimore. He is a graduate of Syracuse University, class of 1884, and began his railway experience as a special apprentice in the shops of the New York, Lake Erie & Western R.R. at Susquehanna, Penn.

Mr. Hale Holden, Vice-President of the Chicago, Burlington & Quincy R.R., has been elected President to succeed the late Darius Miller, whose death was noted in our issue of last week. Mr. Holden was born in Kansas City, Mo., in 1869, and is a graduate of Williams College and Harvard Law School. His railway service began in 1907, and from 1910 to 1912 he was General Attorney of the Chicago, Burlington & Quincy R.R.

Mr. Ant. Decarie, Chief Inspector of the sewer department, northern division, Montreal, Que., and three of his Assistant Inspectors have been dismissed for alleged incompetency and irregularity in connection with the construction of the Notre Dame de Grace sewer. The dismissal of Mr. E. Pelland, Engineer in charge of the sewer department, for alleged graft in connection with the construction of this sewer, was noted in our issue of July 23, 1914.

OBITUARY

T. C. Chase, former Building Inspector of Denver, Colo., and for the past seven years connected with the construction department of the Denver Union Water Co., died Aug. 21. He went to Denver in 1879 from Massachusetts.

Edgar Thaddeus Welles, Vice-President of the Wabash R.R., died Aug. 22, at his home in New York City. He was born in Hartford, Conn., Aug. 29, 1843, and was the son of Gideon Welles, Secretary of the Navy under President Lincoln.

William E. Harwig, Supervisor of Bridges and Buildings of the Lehigh & New England R.R., died Aug. 24, at his home in Phillipsburg, N. J. He entered the service of the Lehigh Valley R.R. in 1878, and for 10 years, 1902 to 1912, was Supervisor of Bridges and Buildings.

Bernhardt W. Pohler, for 24 years an engineer with the American Bridge Co., died July 27. He was born in Denmark, Mar. 10, 1858, and graduated from the Royal College of Denmark in 1884. He is survived by a widow, whose present home is 4440 Dover St., Chicago, Ill.

Charles F. Baker, until about six months ago Mechanical Engineer of the Bay State Street Ry., Boston, Mass., died recently in East Orange, N. J. He was born in Vermont 59 years ago. In 1893 he was Master Mechanic of the West End Street Ry., Boston, Mass., and was later with the Boston Elevated Ry. as Superintendent of Motive Power and Equipment. In 1904 he was President of the American Electric Railway Association.

Roderick J. McD. Parke, Assoc. M. Can. Soc. C. E., Consulting Engineer, of Toronto, Ont., died Aug. 25, at his home in that city. Mr. Parke was the designer of one of the first long-distance electric transmission lines in Canada, that from Ragged Rapids, on the Severn River, to Orillia. He also designed light and power plants for numerous towns in Ontario. As Consulting Engineer for the Canadian Government, he had charge of the design of the lighting equipment of the Welland Canal.

Berthold Charles Kaiserling, recently with the city engineering department of San Antonio, Tex., was accidentally killed July 5, by a passenger train of the Southern Pacific Ry., at Galveston, Tex. Mr. Kaiserling was a civil engineer of wide experience in Mexico and South America, and he had just left the employ of the city of San Antonio to accept a position in South America. He had been with the engineering corps of the Mexican Central Ry. and of the Guayaquil & Quinto R.R. in Ecuador. At one time he was in charge of harbor work at Vera Cruz, Mex. He had also seen service in Guatemala. Mr. Kaiserling is survived by a widow, whose home is 113 Oak St., San Antonio, Tex.

William de Hertburn Washington, M. Am. Soc. C. E., Consulting Engineer, New York City, died Aug. 30, at the New York Hospital, from cerebro-spinal meningitis, after an illness of three days. He was born in Baltimore, Md., June 29, 1868, and traced his descent to John A. Washington, a brother of George Washington, of Mount Vernon, Va. He was for a time in the consular service in Canada. About 20 years ago, he came to New York City and for several years was President of the Hydraulic Construction Co. Later he was in the real estate business. Of recent years, he has been

[illegible] as a [illegible] engineer [illegible] member of the [illegible] of engineers which [illegible] New York State highway work [illegible].

Prof. Adolf Martens died on July [illegible], 1914, at 64 years of age. For [illegible] years he had been Director of the Royal Prussian testing laboratory, first at Charlottenburg, and since [illegible] at Gross-Lichterfelde. Raising this institution to [illegible] among testing laboratories was Martens' great work. His name will be longer remembered, however, by his metallographic work (martensite, the chief constituent of hardened steel, is named after him), by his endurance tests [illegible] of them still running), by his designing [illegible] original and improved instruments and machines for testing (the mirror extensometer and the diaphragm pressure-gage are among the best known), and by his efforts [illegible] testing [illegible] scientifically reliable [illegible]. In the latter regard he stood virtually alone, yet [illegible] enough to leave a long enduring impress on the testing world. Among other writings, he published an authoritative work on materials, which has been translated into English. He was one of the active spirits of the International Association for Testing Materials; his visit to America at the 1912 congress of that body in New York is doubtless remembered by many American engineers.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN MINE SAFETY ASSOCIATION.
Sept. [illegible]. Annual meeting in New York City. Secy., H. D. [illegible], Bureau of Mines, Pittsburgh, Penn.

AMERICAN FOUNDRYMEN'S ASSOCIATION.
Sept. [illegible]. Annual meeting at Chicago, Ill. Secy., A. P. [illegible], Cleveland, Ohio.

NATIONAL PAVING BRICK MANUFACTURERS' ASSOCIATION.
Sept. [illegible]. Annual convention at Buffalo, N. Y. Secy., Will [illegible], Cleveland, Ohio.

NATIONAL ASSOCIATION OF PORT AUTHORITIES.
Sept. [illegible]. Annual convention in Baltimore, Md. Secy., [illegible], New York City.

[illegible] AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.
Sept. [illegible]. Annual meeting at Chicago, Ill. Secy., L. C. [illegible], Ill.

[illegible] CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.
Sept. [illegible]. Annual convention in Nashville, Tenn. Secy., A. [illegible], Mass.

NEW ENGLAND WATER WORKS ASSOCIATION.
Sept. [illegible]. Annual convention in Boston, Mass. Secy., [illegible], R. I.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Sept. [illegible]. Convention in Atlantic City, N. J. Secy., [illegible] Bureau, Philadelphia, Penn.

ILLUMINATING ENGINEERING SOCIETY.
Sept. [illegible]. Annual convention in Cleveland, Ohio. Secy., [illegible], New York City.

RAILWAY SIGNAL ASSOCIATION.
Sept. [illegible]. Annual convention in [illegible], N. Y. Secy., [illegible], Penn.

[illegible] ASSOCIATION.
Sept. [illegible]. Annual convention at New York. Secy., [illegible], Philadelphia, Penn.

INTERNATIONAL IRRIGATION CONGRESS.
[illegible]

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 12-16. Annual convention at Atlantic City, N. J. Secy., E. B. Burritt, 29 West 39th St., New York City.

NATIONAL COUNCIL FOR INDUSTRIAL SAFETY.
Oct. 13-15. Annual safety congress at Chicago, Ill. Secy., W. H. Cameron, Continental Bank Building, Chicago.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
Oct. [illegible]. Convention at Los Angeles, Calif. Secy., C. A. [illegible], Chicago, Ill.

Kansas League of Municipalities—The League [illegible] will meet at Lawrence, Oct. [illegible], to discuss the [illegible] of cities [illegible].

Central Railway Club—[illegible]

Upper Mississippi River Improvement Association—The [illegible]th annual convention will be held at Stillwater, Minn., Sept. 16-[illegible]. Invitations have been sent to the Governors of Iowa, Missouri, Minnesota and Wisconsin, to the Mayors of all municipalities in the Upper Mississippi Valley, and to kindred waterway associations. The Secretary is L. H. Boswell, Quincy, Iowa.

American Electric Railway Association—The annual convention of this Association and its affiliated bodies, the American Electric Railway Accountants', Engineering, Claims and Transportation and Traffic Associations, will be held in Atlantic City, Oct. 12-16, at Young's Million Dollar Pier. At the same time the American Electric Railway Manufacturers' Association will hold an exhibit of electric-railway appliances. The secretary is E. B. Burritt, 29 West 39th St., New York City.

The American Boiler Manufacturers' Association—The program for the 26th Annual Convention of the Association, to be held in New York City, Sept. 1-4, has been arranged as follows: Addresses of welcome will be delivered by Hon. Henry Bruere, City Chamberlain, and Charles R. Lamb, a director of the Merchants' Association of New York. The business session will be held that afternoon, and in the evening the reception at the Waldorf-Astoria. At other sessions the following committees will report: Uniform Specifications, Uniform Boiler Laws and Uniform System of Cost Keeping, and Topical Questions. The banquet will be held on the evening of Sept. 3.

National Council for Industrial Safety—The third annual "Safety Congress" will be held at the La Salle Hotel, Chicago, Oct. 13 to 15. There will be addresses, reports of committees, papers, moving-picture displays and also an exhibit of safety devices and methods. Different sessions will be devoted to government work, the economics of safety, industrial hygiene, safety in transportation and public service, and safety in manufacture.

According to the [illegible] report of the secretary, the Council established its headquarters in Chicago in October, 1913. It has now 731 member companies or firms with 2155 representatives in the council, having about [illegible] employees. One of the principal activities of the organization is in the distribution of bulletins [illegible] and other information relative to the safety movement. President, R. W. Campbell, Illinois Steel Co., Chicago; Secretary, W. H. Cameron, Continental and Commercial Bank Building, Chicago.

Central States Water-Works Association—The 18th annual convention was held at the Windsor Hotel, Wheeling, W. Va., Aug. 25 to 27, inclusive. The address of President J. C. Martin, of Wellington, Ohio, covered briefly the history of the Association and the problems which were [illegible] before it and its members in the increasing density of population and the contamination of streams. F. W. Collins, Superintendent of the Water Department of Manistee, Mich., described the working of the commission plan of city government in Manistee, which has a population of about [illegible], where it has evidently been an unqualified success. C. H. [illegible], City Engineer of Wheeling, described various methods used to filter and treat Ohio River water by the cities which are obliged to use it for potable water supplies. The paper [illegible] chiefly in elementary principles of water purification. He stated that Wheeling had been [illegible] negligent in regard to water purification and that the typhoid fever death rate for the [illegible] years ending in 1913 was [illegible] per 100,000 per annum. In July, the city voted for a filter plant, and the city engineering staff are now working on plans and surveys. The system of water purification which received a preferential vote of the people last July is the [illegible] system, invented by L. [illegible], of Charleston, W. Va., and was described by him in a paper on the filtration and purification of the Ohio River water. Mr. [illegible] described the method by reference to the plant now in operation at Parkersburg, W. Va., as the best [illegible], which has been in operation for three years. This plant consists of [illegible] strainer [illegible] in the bed of the river. These strainers are joined to collector pipes leading to pump wells on shore. The water is filtered by the natural sand and gravel bed of the river itself. For washing the filter bed if it becomes [illegible], water may be forced back through collector pipes and strainers. The method adopted by the city of Wheeling in selecting the type of water purification plant to be built is a [illegible] one, [illegible] by the W. L. [illegible], engineer of the West Virginia State Board of Health. On the afternoon of Aug. 27 an excursion was made to the Wheeling city waterworks. The place selected for the next convention is [illegible], Ohio. The following officers were elected: President, F. W. Collins, Manistee, Mich.; Vice-President, [illegible]; Secretary, [illegible]; Treasurer, [illegible].

Engineering News

VOLUME 72 SEPTEMBER 10, 1914 NUMBER 11

The Farmville High Bridge across the Appomattox Valley

By F. P. Turner*

One of the longest and highest bridges on the Norfolk & Western Ry., known as Farmville High Bridge, has just been rebuilt as a double-track structure in connection with the extension of double-track between Roanoke and Norfolk, Va.

Historical

The line here crosses the Appomattox River and Valley, 145 miles west of Norfolk, Va., and the first bridge was built in the year 1853 as a part of the South Side R.R., connecting Petersburg and Lynchburg, Va. Information obtained from the files of the Engineering Department shows that the road was located after a careful study of the intervening country by C. O. Sanford, Chief Engineer, and built under his direction to secure not only a low first cost but an economical operation.

Briefly described, this line, after rising out of the James River Valley at Lynchburg, follows the top of the ridge which divides the waters of the Appomattox and Roanoke Rivers, in an easterly direction to Petersburg. On this location, grades of 16 ft. per mile could easily be obtained. The one exception to this is near Farmville, where it left the ridge route and crosses high above the Appomattox River Valley, returning again to the summit of the ridge several miles to the eastward.

The Chief Engineer's report shows that several conditions influenced the doption of this route. Chief among them may be mentioned:

(1) The loss of a large amount of tonnage from Farmville if the ridge route had been followed.

(2) The residents of Farmville made an urgent appeal for the line to pass through their town, and raised a subscription to purchase stock amounting to $100,000. This, in the early stages of railroad development, was a matter of considerable moment.

(3) The adoption of the Farmville route would advance the completion of the road one year.

(4) This route was 5 miles shorter than the ridge route.

The greatest obstacle to the construction of this line was the expensive bridge over the Appomattox River and Valley.

First Bridge—The bridge as originally built was 3400 ft. long, varying in height from 60 ft. at the abutments to 100 ft. at the river; clear spans 105 ft. in length. Previous to this time longer bridges, not so high, and higher bridges, not so long, had been built, but taking the length and height together this was thought to be the largest bridge in the world.

From a standpoint of economy, wood instead of iron was chosen for the superstructure, and was also given consid-

*Bridge Engineer, Norfolk & Western Ry. Co., Roanoke, Va.

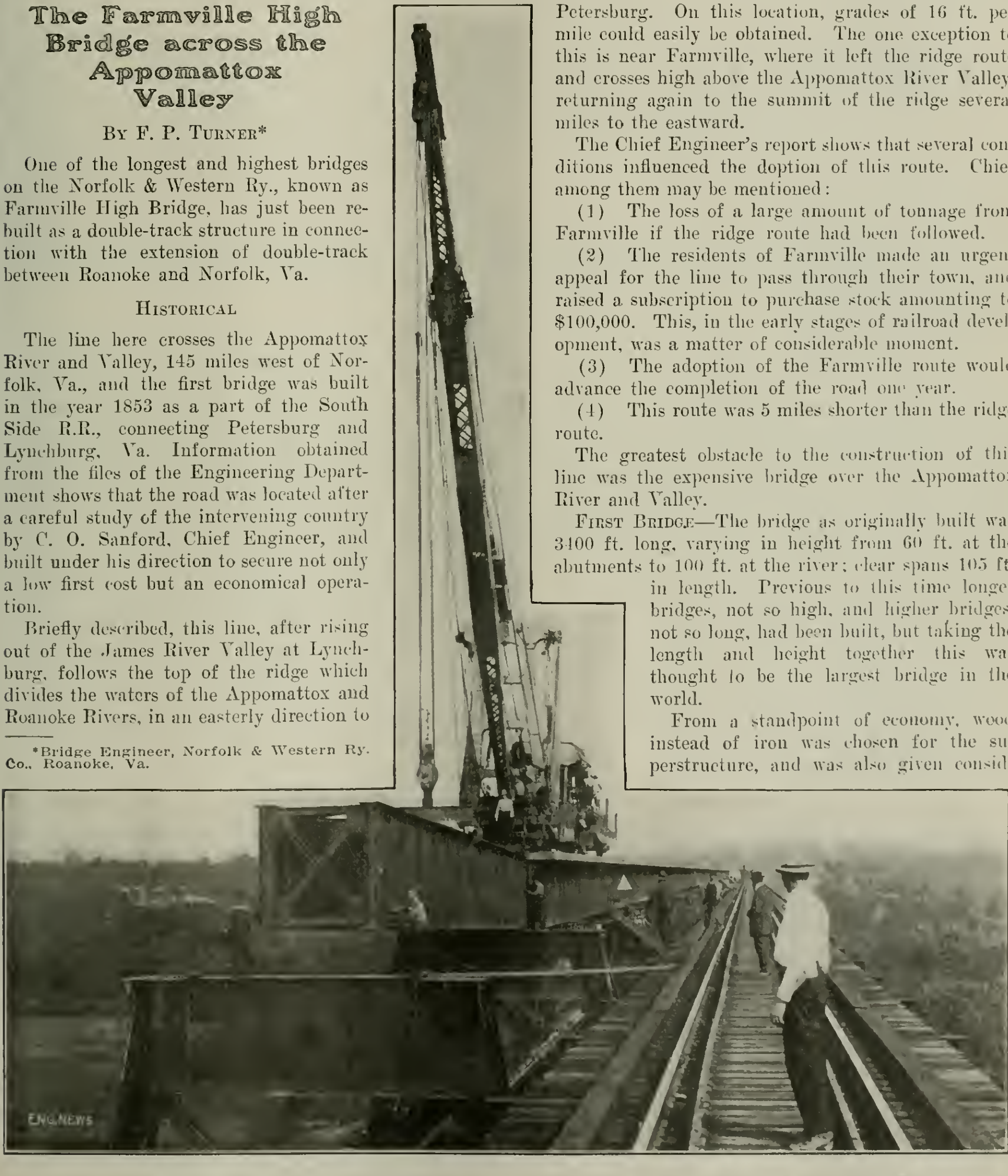


Fig. 1. Placing a Completely Riveted 72-Ft. Plate-Girder Span on the Farmville High Bridge, N. & W. Ry.

erations for the piers. After an examination of a number of higher structures built of brick in several cities of the United States, and having greater unit pressures at the bottom, the successful results obtained warranted the selection of this type of construction for the piers. This decision too was influenced somewhat by the presence in the immediate vicinity of the bridge of a brick clay of superior quality, which would make the estimated cost of the piers about one-third that of stone construction.

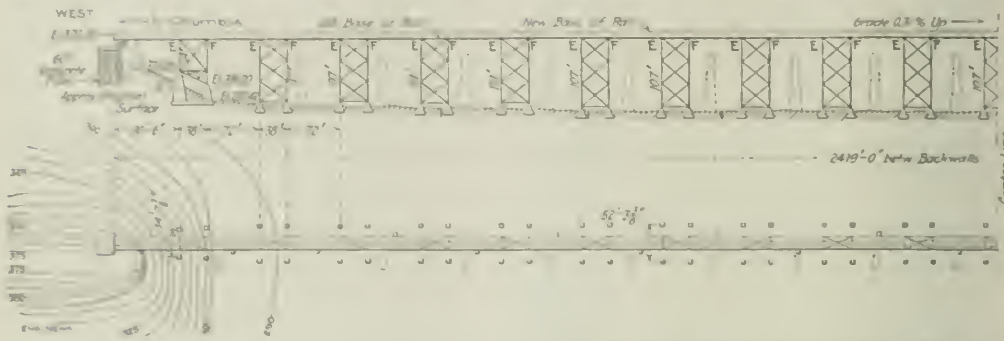


FIG. 2. PLAN AND ELEVATION OF THE NEW FARMVILLE

The abutments were built of rubble masonry, and the bases of the piers to a point 3 ft. above the high-water mark were built of stone masonry with cut beds and joints. The foundations extended about 8 ft. below the ground, resting on clay and gravel. The piers were of brick masonry 8x22 ft. at the top; 14x27 ft. at the bottom and were 82 ft. high above ground. The foundations of those adjacent to the river probably extend to solid rock.

Wood superstructure was anchored to the foundation by iron rods passing entirely through the piers in shafts left for the purpose. The estimated cost of the wooden trusses of the superstructure was $18 per lin.ft., and the total cost of the bridge was $167,500. It was built to carry engines weighing 32 tons, although the ones in use at that time weighed only 16 tons.

SECOND BRIDGE—The superstructure was rebuilt in 1870 as a metal structure, the length being reduced to 21 spans, 110 ft. $3\frac{1}{4}$ in. c. to c. of end bearings. It consisted of deck Fink trusses, built by the firm of Smith, Latrobe & Co., of Baltimore, of Phoenix Iron Co.'s material. The bridge was designed for a live-load of about 1850 lb. per lin.ft. of track; the spans weighed about 70,000 lb. each and were in service until 1886.

THIRD BRIDGE—In February, 1886, proposals were invited to strengthen the Fink trusses or construct a new bridge capable of sustaining loads that agree with Cooper's E-24 class, followed by a uniform load of 3000 lb. per ft., the present trusses having only 50% of the strength to safely carry this weight.

Deck Pratt trusses, built of iron, with steel eye-bars, were adopted and were fabricated and erected during the summer of 1886, the contractors being the Edge Moor Iron Co. & Frederick H. Smith. These spans were 12 ft. $4\frac{1}{2}$ in. c. to c. of trusses, 15 ft. 9 in. c. to c. of chords, and consisted of seven panels 15 ft. 9 in. each, making a total length of 110 ft. 3 in. c. to c. of bearings. The ties rested directly on the top chord. The weight of metal per span was about 60,000 lb., and the bridge cost $75,000 erected in place. The record of erecting shows that five of these spans were erected under traffic in 12 days.

FOURTH BRIDGE—The 1886 spans, resting on the brick piers, carried the increased traffic until 1901, when they were reinforced by the addition of a third truss placed midway between the existing ones and braced to them. A metal floor system was added at the same time, the floor-beams resting on top of the three trusses, the middle truss being designed to carry 48% of the live load from a concentration of four 15,000-lb. axles, 5 ft. c. to c., with a uniform load of 1000 lb. per lin.ft. of track at a 10-ft. interval in either direction. These spans were built by the American Bridge Co.'s Edge Moor plant, the material being soft steel except the eye-bars, which were of medium steel.

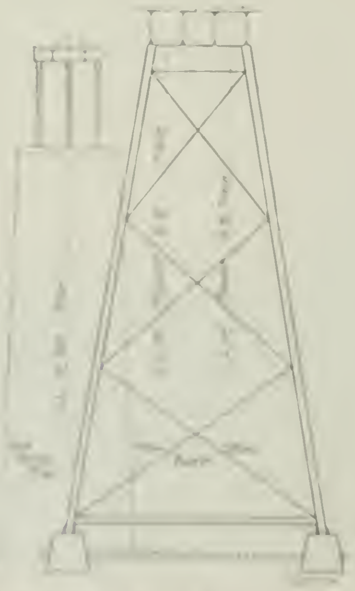


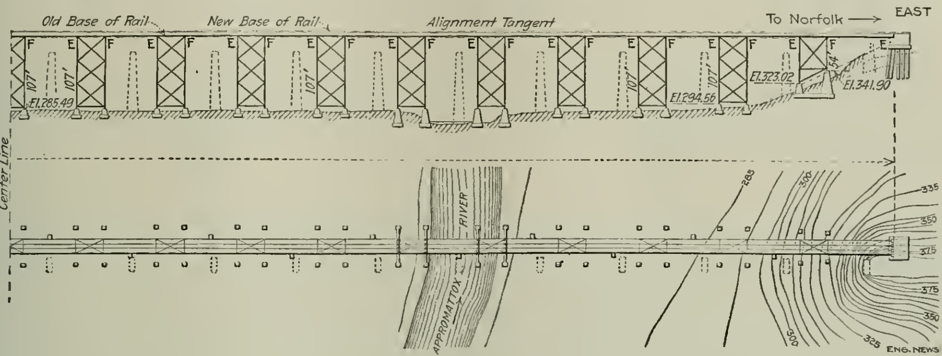
FIG. 3. COMPARATIVE CROSS-SECTIONS OF OLD AND NEW BRIDGES

The installation of the third truss and floor system was made under traffic, the grade being raised about 2 ft. to accommodate the new floor system. This latter structure carries safely the present-day traffic, with axle loads as high as 57,000 lb.

Present Bridge

As stated above, the brick piers supporting these spans have shafts in them tapering in size from top to bottom. This condition, together with the vibration from heavy traffic, caused several of the piers to crack near the top. A number of years ago the piers were strengthened by placing bands of steel bars, at about 8-ft. intervals from the top, around the piers, connecting to angles running down the corners. These bands are clearly shown in the views.

Increased traffic which required the extension of the double-track lines into this territory, together with the appearance of additional cracks in the piers from time to time, caused a study to be made of plans for renewing this bridge for a double-track structure. Surveys were made and plans prepared in the latter part of 1912 for the construction of a double-track steel viaduct, with the center line of the near track parallel to and 20 ft. to the north of the center line of the existing bridge. The cross-section, Fig. 3, shows the relation between the old and the new structure, it being such as to permit the construction of the foundations and the erection of the steelwork without endangering the old substructure, superstructure, or interfering with traffic. Curves, near each end of the bridge, permitted the alignment to be easily adjusted on account of the offset.



High Bridge and (Dotted) the Old Substructure

Revision in the grades in this territory made it necessary to raise elevation of the base of rail on the new structure about 7 ft. higher than the old, in order to keep within the ruling grade of 0.3 against the eastbound coal traffic.

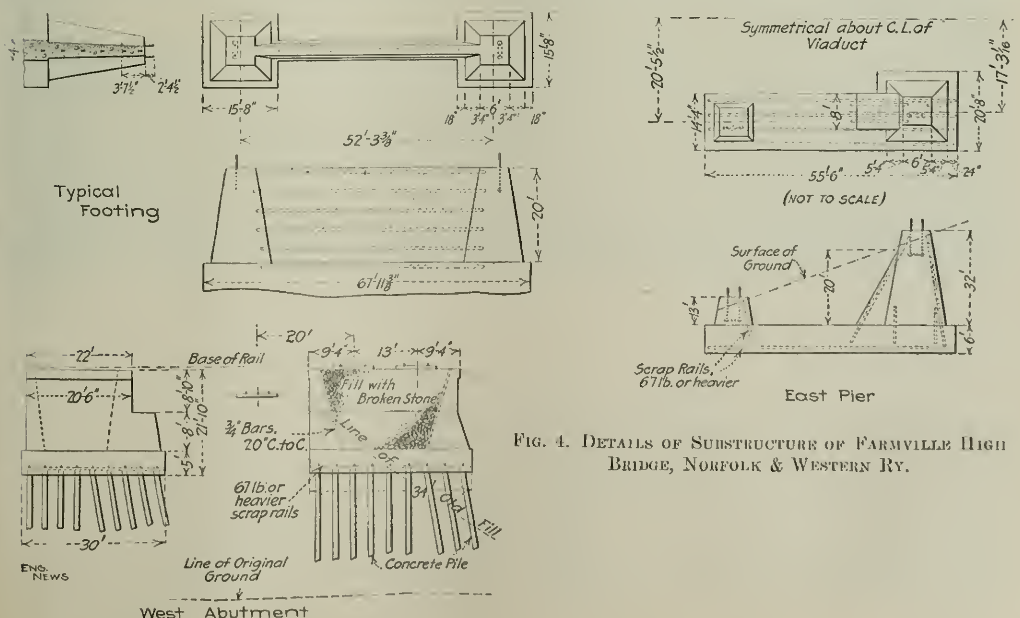


Fig. 4. Details of Substructure of Farmville High Bridge, Norfolk & Western Ry.

The approach embankments at the two ends were made from borrow pits, with short haul, the material being excavated with steam shovel and dumped from light trestles alongside the fill. The materials available for making the fills contained minerals of soapstone and talc formation, which gave it a disposition to slip, slides having previously occurred several times in the old embankment from this same cause. This matter was given careful consideration in the preparation of plans for the new structure, with the result that slopes of two horizontal to one vertical were adopted for the fills. As a further precaution the fill was made in three lifts, the material being placed in the outer edges of all slopes with scrapers after dumping from cars and kept in horizontal layers. A ditch was cut about 25 ft. from the foot of the slopes to care for drainage at the base. The approach fill at the west end is about 1800 ft. long; at the east end about 400 ft. long; the two contain 171,000 cu.yd.

The Cummings type reinforced-concrete piles was selected and manufactured at the site and driven by the Cummings Structural Concrete Co., of Pittsburgh, Penn. They are octagonal in section; 17 in. between parallel sides for 20 ft., tapering to 9-in. section, 15 in. from the point; their design is shown in Fig. 5. Heavy spiral reinforcement, ⅜-in. round, ¾- to 1½-in. pitch, is used near the top to resist the blow of the hammer. The piles were molded during the summer and fall of 1913 on platforms underneath the bridge. The reinforcement was placed in the forms and blocked away from the boards so that concrete would properly cover the metal. The top board was left off for pouring the concrete.

The mixture was 1:2:4, with one additional bag of cement per cubic yard of concrete, or about 1.75 bbl. of cement per cubic yard. Broken limestone, size 1 in., was used. Forms were removed after two days and piles were then allowed to cure from 30 to 60 days before driving.

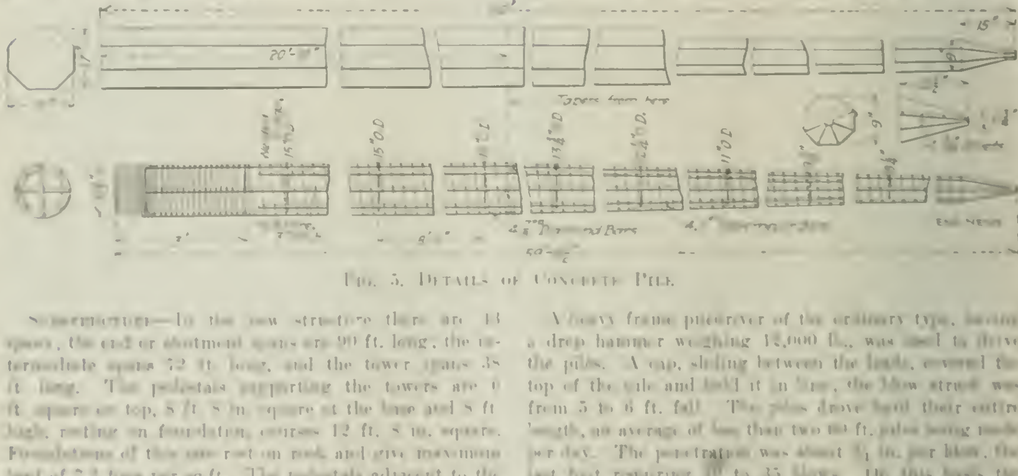


Fig. 5. Details of Concrete Pile

Substructure.—In the new structure there are 13 spans, the end or abutment spans are 90 ft. long, the intermediate spans 72 ft. long, and the tower spans 38 ft. long. The pedestals supporting the towers are 6 ft. square on top, 8 ft. 8 in. square at the base and 8 ft. high, resting on foundation courses 12 ft. 8 in. square. Foundations of this size rest on rock and give maximum load of 7.3 tons per sq.ft. The pedestals adjacent to the river were tied together with concrete struts, reinforced with steel rods, to prevent the accumulation of drift between them.

The pedestals supporting the first tower on either end vary from 20 to 40 ft. high, and the two on either side of the viaduct have a continuous foundation parallel with the track, the upper or higher pedestal is also buttressed with concrete, reinforced with steel rails, to resist the earth pressure from the fill which spills around it. The [illegible] in Fig. 2 shows the arrangement clearly. The foundations adjacent to the river, and practically all others in the low ground, extend to rock, a distance of about 25 ft. below ground.

The abutments, U-shaped, rest on the old fill about 30 ft. below the base of rail. Broken stone fill [illegible] used between the wing walls and earth spills around the [illegible]. Steel-rail reinforcement was liberally used in the [illegible] and wing walls of the abutments to counteract the tendency to crack from any slight settlement that may occur from shrinkage of the fill.

Precast reinforced-concrete piles, cast at the bridge site, were adopted to support the two abutments. Lengths of 30 to 60 ft. were required to make these pedestals to the original ground line. The outside piles were driven on a batter.

A heavy frame piledriver of the ordinary type, having a drop hammer weighing 12,000 lb., was used to drive the piles. A cap, sliding between the leads, covered the top of the pile and held it in line, the blow struck was from 5 to 6 ft. fall. The piles drove hard their entire length, an average of less than two 60-ft. piles being made per day. The penetration was about ¼ in. per blow, the last foot requiring 30 to 35 blows. On this basis the piles have a resistance of 40 tons as calculated by the Engineering News formula, the actual load being 25 tons, including the weight of the pile, which is 6 tons; pressure per square foot on foundation bed, 1.6 tons. Good results were obtained in driving, only a small number being damaged at the top. These were cut off 3 to 4 ft. from the end.

The concrete for the pedestals and abutments was made according to Norfolk & Western standard specifications of 1:2:4 mix, with broken limestone to pass through a 2-in. ring, all dirt and dust being screened out. Good sand was secured by pumping from the river.

Plant.—The contractor's plant was located on the low ground near the west end of the bridge. All material was delivered to this plant by a low-grade track leaving the main line about one mile west. The contractor's equipment consisted of a 10-ton locomotive crane, with orange-peel bucket, used for excavating foundations. This crane also handled the concrete buckets when depositing into forms, the pile hammer to drive sheet piling and many other kinds of work in connection with this contract. Cars were used for handling the concrete from the mixer to the various pedestals, a construction track having been laid between the pedestals from one end of the work to the other. Concrete mixers, derricks, hoisting en-

gines were supplied to meet the requirements of handling the materials rapidly when needed. Work on the foundations and fills began in May, 1913, and was completed in April, 1914, a total of 10,908 cu.yd. of concrete being placed.

SUPERSTRUCTURE—The viaduct was designed according to the Norfolk & Western specifications of 1911 for a live-load of five 55,000-lb. axles, 5 ft. c. to c., and a uniform load of 5500 lb. per foot on either end at 10-ft. intervals. Double-web cross-girders, 7 ft. deep, were used at the top between the columns to furnish support for the two center girders, the outside girders resting di-

four angles 6x4x$\frac{9}{16}$ in., two webs 24x$\frac{9}{16}$ in., double laced on the inside, with 3x$\frac{5}{8}$-in. lace bars. Columns are built in two sections, with a batter of 2 in. in 12 in.; the base plates are 4 ft. 2 in.x5 ft.x1$\frac{1}{2}$ in. thick, and are anchored to the pedestals by two 1$\frac{3}{4}$-in. bolts 6 ft. long, built 3 ft. 6 in. in the concrete with an anchor plate 6 in. wide, placed on the lower ends of the bolts.

The longitudinal and transverse bracing is a double system, capable of taking both tension and compression, and is made up of four angles 5x3$\frac{1}{2}$x$\frac{3}{8}$ in. and 6x4x$\frac{3}{8}$ in., with single lacing 2$\frac{1}{2}$x$\frac{3}{8}$ in. for transverse bracing, and double lacing the same dimensions for the longitudi-

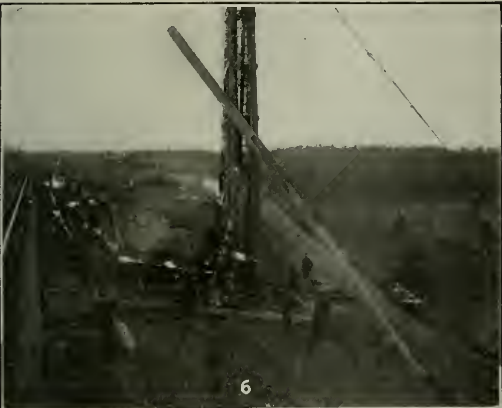


FIG. 6. SLINGING A 60-FT. PILE ONTO THE DRIVER

FIG. 7. THE PILES IN PLACE

FIG. 8. WEAVING THE REINFORCEMENT

FIG. 9. DRAGGING A PILE FROM THE YARD UP TO THE DRIVER

FIGS. 6-9. DRIVING CONCRETE PILES ON FARMVILLE BRIDGE ACROSS APPOMATTOX VALLEY

rectly on the column cap, diaphragms and stiffeners being used under the bearings of the center girders. The deck girders, spaced 6 ft. 6 in. c. to c., are 7 ft. 6$\frac{1}{2}$ in. deep, back to back of flange angles. A standard floor of 8x10-in. bridge ties 12 ft. long, dapped to 9$\frac{1}{2}$ in. and spaced 13 in. c. to c., is used, with 6x8-in. guard timbers outside the rails, notched down 1 in. over the ties, and 85-lb. steel guard rails inside.

The columns are made up of one cover-plate 28x$\frac{9}{16}$ in.;

nal bracing. The bottom struts are made of two 15-in., 33-lb. channels, double laced. Tower bracing in a horizontal plane is made of four angles 5x3$\frac{1}{2}$x$\frac{3}{8}$ in., double laced.

ERECTION—The girders, with the exception of the two 90-ft. spans, were delivered completely riveted in pairs, and unloaded on the east end at grade alongside construction tracks. All the column sections, bracing and cross-girders were delivered and unloaded alongside the con-

FIG. 10. ERECTING THE NEW FARMVILLE BRIDGE OF THE NORFOLK & WESTERN RY., ACROSS THE APPOMATTOX VALLEY

struction track running between the pedestals on the low ground.

The bottom section of each bent was erected and all bracing placed, using a 75-ton locomotive crane working on the low track. The top section of each bent was assembled and left standing alongside the bottom section, where it could be lifted to its final position with a [illegible]-ton derrick car, using an 80-ft. boom, and working from the completed viaduct above. The top section of the rear bent of each tower was placed, the derrick car standing at the end of the track over the preceding tower. The 72-ft. girder span, weighing 36½ tons, was next run out on a truck to the end of the track, and set off on the [illegible] in a temporary position; the derrick car then backed off the bridge so the truck could be gotten out of the way, whereupon [illegible] returned and placed the span in position. The tower was then completed and the tower span placed.

Erection of the steel began, Apr. 1, 1914; the first span was placed, Apr. 7; last span placed, June 9; erecting completed, May 11 [illegible], June 18, and traffic diverted over the new structure, June 20.

As the double track has not reached the immediate vicinity of this bridge, girders for only one track are placed at this time. The total weight of metal is [illegible] lb. Metal in the 72-ft. towers, per foot of length, weighed [illegible] lb.; per foot of track it weighed [illegible] lb. Girders, per foot of track, weighed [illegible] lb.; total weight of bridge as constructed, [illegible] lb. per lin.ft. of track.

ENGINEERS AND CONTRACTORS

The work was started under the direction of Chas. S. Churchill, Chief Engineer; Chas. C. Wentworth, Principal Asst. Engineer, and J. E. Crawford, who, as Bridge Engineer, prepared masonry plans and supervised the design of the steelwork. It was completed under the direction of J. E. Crawford, as Chief Engineer. A. Branch, Assistant Engineer, was in charge of all double-track construction and W. W. Vail was Resident Engineer on the work.

The Virginia Bridge & Iron Co., of Roanoke, Va., designed the steelwork, furnished and erected the structure.

Messrs. W. W. Boxley & Co., contractors, of Roanoke, Va., built the masonry and approaches.

A Fireless Locomotive for use at powder magazines and [illegible] has been supplied to the British army [illegible]. The engine was built by Andrew Barclay, Sons & Co., of Kilmarnock, Scotland.

Asphaltic Concrete Surfacing for Suburban Roads, Chicago, Ill.*

Suburban roads about Chicago have cost approximately 20c. per sq.yd. per year to maintain, and at no time has there been a road with a smooth wearing surface. In three years, the cost of upkeep on each macadam road, it is estimated, will approximately equal the first cost of an asphaltic concrete surface, 2 in. thick, which can be placed by municipal forces for between 50 and 60c. per sq.yd.

The low cost of this work is largely attributed to the planning of the work, provision of modern municipally owned equipment and to the efficiency of the organization. It is estimated that the macadam road covered by 2 in. of asphaltic concrete will not require any repairs for five years and that with reasonable repairs, this pavement will last 20 years.

The repair and maintenance of roads and pavements in Chicago is under the general direction of the Superintendent of Streets and under the immediate supervision of the general foreman in charge of the gangs, which are distributed in different sections of the city. The planning of the work is done by a number of civil engineers who report directly to the superintendent in charge of street repairs. In all cases, the street-repair foreman in charge of gangs works in conjunction with the superintendent of the ward in which the work is being done.

All asphaltic material required for the repair of pavements and roads is manufactured by the Bureau of Streets at the municipal asphalt plant and by a portable asphalt plant. These materials are transported by municipally owned vehicles, and the work is done by the organization which is recruited from civil-service lists.

*Mainly from an article prepared for the Journal of the Chicago Automobile Club, by J. L. Jacobs, Efficiency Engineer in Charge, City Service Commission, Chicago, Ill.

The portable asphalt plant can be moved about on the outskirts of the city where it is proposed to resurface macadam streets with bituminous top. This reduces the cost of long team haul, which is usually a large factor in the cost of repairing pavements. Under this arrangement material is received on the track beside the portable plant where it is manufactured and transported to the job by 5-ton motor trucks, recently purchased by the Bureau for this work.

Appropriations have been provided and specifications prepared for another portable plant which is to be used to utilize old asphalt top, which heretofore had to be transported and discarded at a large cost. The old asphalt will be brought to this portable plant, crushed and reheated together with new material, and taken back to the job to be used as binder. In this way the expense of long haul and waste of old material will be materially reduced and the capacity for new work will be proportionately increased.

In order to keep all the equipment in good condition, shops and storage sheds have been provided, and all the equipment is overhauled during the winter months, so there is little or no breakage or delay on account of run-down equipment during the working season.

Careful cost records are kept of the repairs to various types of pavement, and yearly averages are published in the report of the Public Works Department.

Engineering Vernacular as Interpreted by a Lawyer—An erecting contractor, who was building part of one of the great suspension bridges across the East River in New York, visited a law office and undertook to explain his troubles to a law student in the office. The would-be lawyer made notes and, confessing that he did not thoroughly understand the situation, made a report in substance as follows:

A Traveler was on the lower cord of the approach span of the Williamsburgh Bridge and was sustained by four Guys. Each Guy was held fast by two dogs, after passing through an opening in the tail piece. Tony, an Italian, had just been sent out and had given two of the dogs a fresh bite on the longest Guy, when they let loose, one of the Guys slipped, and the Traveler tipped over and threw the counter-weights into the air, and they went down on the street below and killed a man.—From an address by John C. Wait before the Civil Engineers' Society of Cornell University.

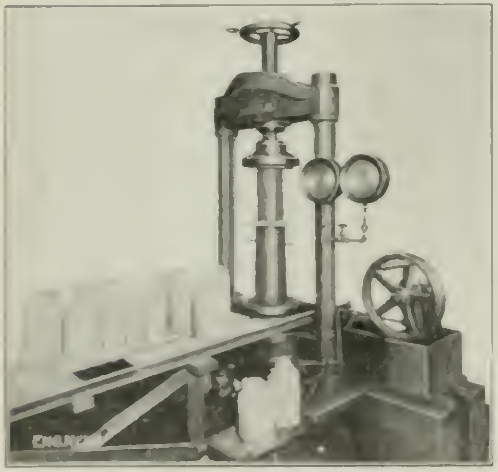
Type of "Pierce-Arrow" Motor Truck Used for Handling Hot Asphalt Paving Mixtures, Chicago, Ill.

Field Tests of Concrete for Municipal Work at Kansas City, Mo.

By F. S. [illegible]*

The early tests on concrete used in municipal work at Kansas City, included the usual tests on cement and sand but the tests on the large aggregate were confined to some very primitive investigations which consisted in making comparative mixes with different aggregates, placing them in similar molds, and at the end of certain periods, breaking them by striking repeated blows with a hammer. The quality was determined by the manner in which the concrete resisted the impact of the blows.

At best, this was a most unsatisfactory test and about a year ago the city started a systematic method of testing aggregate, and in fact, concrete, by taking samples of all concrete on the job and subjecting the samples to



[illegible] Compression Machine for Testing Concrete Cylinders Used by Kansas City, Mo.

compressive tests through periods up to one year. The city now has a 200,000-lb. hydraulic compression machine and one dozen 8x16-in. cast-iron cylindrical molds formed on a true surface. These molds are taken to the place where concreting is in progress, and without the previous knowledge of the contractor, the concrete is caught in a bucket as it is discharged from the mixer, and filled into the molds. No two molds are filled from the same batch, which possibly accounts for the wide variation in compressive strength of sets of cylinders at the same age. A [illegible] gas-pipe flattened at one end is used to tamp the concrete in the molds, and in tamping it [illegible] to make the cylinders as near like the concrete as it is deposited in the work as possible. [illegible] are noted.

The molds are allowed to stand until the concrete has set, usually from 12 to 24 hr. before removing to the laboratory, where the forms are taken off and the concrete cylinders are placed in a storage tank, which is kept filled with water at a temperature of about 70° F. The storage tank is a rectangular-shaped concrete box, 5x22 ft. in plan, 2 ft. 4 in. deep; it has a floor drain at lowest point for drawing off the water and a 3/4-in. perforated steam pipe runs the entire length of the bottom for heating the water in cold weather, as it is outdoors in an areaway.

The accompanying view shows the machine with a cylinder in position for crushing, and several tested cylinders in the foreground showing manner of fractures. It will be noticed that the openings between the uprights and the distance between platens of the machine is much greater than necessary for testing concrete cylinders, but it was so designed in order to make crushing tests (known as the knife-edge test) on sewer pipe up to and including 27 in. in size. The cast-iron stool saves using a long and cumbersome adjusting screw.

When making tests, a rubber plate about 1/4 in. thick is placed on the stool, the cylinder is set upon this, and another rubber plate placed on top. These plates are used to even up any irregularities there may be in the end surfaces of the cylinders and are believed to be superior to plaster of paris. The top platen, which is suspended from the adjusting screw on a ball-and-socket joint, is now screwed down firmly, and the load applied. As will be noticed, the machine is in reality a hydraulic jack, operated with a three-plunger hand-power pump, and the load is applied from underneath on the bottom platen.

Two gages are used; one is graduated in 50-lb. readings up to 10,000 lb., and the other is graduated in 500-lb. readings up to 200,000 lb. Each gage is equipped with a marker hand which registers the highest ultimate load attained. The load is applied at the rate of about 35,000 lb. per min.

As a rule the cylinders crush off at angles of about 45° on either top or bottom end, though some of them split from end to end into two or more prismoids. Observation has shown that concrete is quite green at 7 days, and is still improperly cured at 28 days. It would seem that much better results could be obtained from concrete if it were not subjected to live loads until after the 28-day period.

There is given also herewith a table of compression tests. As before noted there is a wide variation between tests of the same age, and complaint might be made against these discrepancies, but the writer has only attempted to make tests as near like the material used under working conditions as is possible, and no effort was made to obtain a concrete that would show uniformity in testing.

Contractors on city improvements are permitted to use any brand of cement they choose so long as it complies with the city's specifications, which are those of the American Society for Testing Materials, but it so happened that only three brands are shown in the table; they are standard brands of this district. A careful study of the chart will convince most readers that conditions and workmanship play by far the most important part in the manufacture of good concrete, and irregularities shown in these tests cannot be attributed to the cement.

In Test 12, cement "A" shows the highest results obtained, while Test 11 with the same brand of cement, same mixture, and same style of mixer, but by different contractors, shows the lowest. Test 5, cement "B," with

*[illegible] City Engineering Department, Kansas City, Mo.

TABLE SHOWING COMPRESSIVE STRENGTHS OF FIELD-MADE CONCRETE, KANSAS CITY, MO

No.	Date	Con-tractor	Class of work	Style of mixer	Brand of cement	Mix-ture	Consistency	Aggregates	Pounds per square inch 7 days	28 days	90 days	180 days	Weather	Temp. °F.	
1	5-28-13 p.m.	A	Concrete pav. alley.	Con-tinuous	A	1 : 3 : 5	Quaking	2-in. native limestone—clean, hard and uniform in size.	815 715 994 Avge. 841	934 964 1385 1094	3400 1600 2500	1770 2020 1895	Fair	90°	No aggregates failed in 7- or 28-day tests,—fractured freely in 90-, 180- and 360-day tests.
2	6-18-13 a.m.	B	Concrete base for brick paving.	Batch	C	1 : 3 : 6	Wet	Old concrete base crushed and screened about 2-in. size—clean.	520 460 520 Avge. 500	695 805 750	1050 1070 950 1023	950 1180 1065	Fair	80°	Old concrete mortar failed in each test—limestone aggregates, contained in old concrete, did not fracture in any test.
3	8-28-13 p.m.	E	"	Hand mixed	B	"	Quaking	Old concrete base. Hand crushed, not screened.	300 480 280 Avge. 353	560 720 740 673	960 1150 900 1003	1050 1250 1100 1133	Fair	85°	Old mortar failed in each test. Limestone aggregates did not fracture in any test.
4	9-24-13 p.m.	G	"	Batch	B	"	Wet	Old concrete base. Hand crushed and forked—not very clean.	310 200 230 Avge. 257	360 250 230 280	550 540 420 503	900 750 710 787	Cloudy	80°	On account of damp weather but little sand or dirt was separated by forking. No aggregates failed.
5	10-6-13 a.m.	K	"	"	B	"	Very wet Sloppy	"	780 600 Avge. 690	460 1050 410 640	700 802 1160 887	1780 1780 1500 1687	Cloudy	70°	Aggregates were fairly clean for material of this class—mix. A few of the rock in old concrete aggregates failed in 180-day test.
6	10-8-13 p.m.	I	"	"	A	"	Quaking	2½-in. native limestone, about ½ of which was old curbstones. Hand crushed, clean.	240 320 310 Avge. 290	590 590 450 543	950 1400 810 1053	1850 1040 1900 1597	Fair	75°	Aggregates fractured in 180-day test.
7	10-30-13 p.m.	N	Base for asphalt	"	A	"	Wet	Old concrete base. Hand crushed. Extra clean.	260 250 240 Avge. 250	860 760 1150 907	1210 1290 1280 1260	1220 1200 1210	Clear	45°	Temperature dropped to 30° during the night and concrete was quite soft when brought to laboratory.
8	10-13-13 a.m.	B	Base for brick paving blocks.	"	C	"	Wet, sloppy	Old concrete base. Machine crushed and screened clean.	670 860 660 Avge. 730	900 1050 1040 997	1490 1480 1240 1403	1660 1900 1730 1763	Fair	65°	Aggregates were quite uniform in size and clean.
9	8-25-13 p.m.	C	Monolithic sewer	"	B	1 : 2 : 4	Wet.	1-in. native limestone. Crusher run. Clean.	260 200 380 Avge. 280	400 1280 330 670	1030 650 910 863	1200 1300 1450 1317	Clear	100°	Aggregates fractured in 180-day test.
10	8-28-13 a.m.	D	Sidewalk	"	A	"	Quaking.	"	300 480 280 Avge. 353	850 660 600 737	1700 980 930 1203	1650 2000 1450 1700	Clear	90°	A few aggregates failed in 180-day test.
11	8-29-13 p.m.	F	Reinforced concrete sewer pipe.	"	A	"	"	¾-in. native binder. Crusher run.	740 700 600 Avge. 680	1300 1220 1280 1267	2500 1850 2140 2163	1960 2750 1900 2203	Clear	100°	This cement was more thoroughly mixed than is commonly practiced. Aggregates fractured freely in 90- and 180-day tests.
12	9-30-13 a.m.	I	Curb.	Con-tinuous	A	"	Dry.	¾-in. native limestone. Crusher run, not very clean.	950 1030 1010 Avge. 997	1840 1440 1680 1657	3020 2050 2300 2685	2870 2730 2640 2747	Clear	80°	Aggregates fractured in 28-, 90- and 180-day tests.
13	10-2-13 a.m.	J	Sidewalk.	"	C	"	Not well mixed. Very dry.	¾-in. native binder. Screened on No. 10 screen.	520 740 600 Avge. 640	1230 773 973 991	700 802 1160 887	1240 750 960 983	Clear	80°	Mixture was so dry as to be impossible to make a dense concrete. Water oozed from cylinders when load was applied. No aggregates fractured in any of these tests.
14	11-20-13 p.m.	O	Curb.	"	A	"	Very dry.	½-in. native grit, coated with yellow clay.	280 340 300 Avge. 307	470 360 380 403	580 530 480 530	740 720 780 747	Clear	70°	The cylinders were porous and crumbly. No aggregates fractured in any of these tests.
15	10-24-13	L	Concrete paving.	"	B	1 : 2½ : 4½	Wet.	2-in. native limestone—clean and uniform in size.	400 280 340 Avge. 353	660 680 630 657	1040 1040 1040 1040	1250 1600 1080 1163	Clear	65°	Temperature dropped to about 35° and it was about 36 hr. before concrete was hard enough to remove from the moulds.
16	10-24-13 a.m.	M	"	Batch	A	"	"	2½-in. native, clean and uniform in size.	310 170 250 Avge. 280	500 620 530 550	1000 880 960 947	500 1340 1180 1007	Cloudy	40°	Temp. dropped to 24° during the night and the cylinders froze quite hard—were allowed to remain in molds 24 hr. in laboratory till concrete thawed out and took initial set.
17	11-12-13 p.m.	H	"	"	A	"	"	2-in. native, clean and uniform in size.	250 500 Avge. 375	1480 1620 950 1350	2150 1440 2500 2197	2720 1530 2125	Cloudy	65°	Sand was black and dirty looking. Aggregates fractured in 28-, 90- and 180-day tests.
18	11-20-13 p.m.	H	"	"	A	"	Quaking.	"	340 460 350 Avge. 383	800 550 650 667	1550 1400 930 1293	1440 1320 1400 1387	Clear	75°	A few aggregates fractured in 90-, 180- and 360-day tests.

Missouri River sand used in samples 6, 7, 8 and 10. Kaw River sand used in all others. Kaw River sand is coarse and sharp. Voids in loose sand = 32.2%. Compacted 29.9%. Missouri River sand is quite fine. Voids in loose sand = 31.6%. Compacted 27.0%. Quality of limestone aggregates in these tests was quite uniform. Aggregates marked "Crusher Run" include, from size indicated, to and above a No. 10 screen. Old concrete base aggregates referred to in tests Nos. 2, 3, 4, 5, 7 and 8 were made from Natural cement, the old mortar failed in each test, including the 7-day. Tests indicated that limestone aggregates seldom fail under 1400 lb. pressure per square inch. 360-day test on No. 1 (2070 and 2940 lb.)—avge. 2555 lb. 360-day test on No. 2 (1530 and 1410 lb.) average 1470 lb.

a 1:?:? mix and an aggregate of broken up old concrete made from natural cement shows an ultimate load of 1087 lb. per sq.in. in 184 days while Test 9, with the same brand of cement, a 1:2:4 mix and a $^3/_4$-in. native stone aggregate shows an ultimate load of only 1317 lb. per sq.in. at the same age.

A person may easily determine the thoroughness of which a batch of concrete is mixed by its looks, but our tests have demonstrated the foolishness of anyone attempting to judge its qualities by observation. A well graded sand and aggregate with hardly enough cement to hold them together, may be mixed so thoroughly as to look quite rich, while a batch containing plenty of cement, but with a [illegible] aggregate, and not so thoroughly mixed may appear quite "poor and lean." When the writer was taking sample No. 12, by observing the mixers, he considered it very poor and noted it accordingly, and No. 18 was noted as being very good, but actual tests have given results which were exactly the opposite, showing the uncertainty of trusting to observation alone.

It is believed that the 8x16-in. cylindrical molds are the best suited where aggregates of 1 in. in size or over are used, as this size permits the large pieces of aggregate to [illegible] well, and eliminates the arching effect which would [illegible].

There are no specifications requiring tests of the above [illegible] character, for the work, so far as has been experimented, and for the purpose of collecting data. The results obtained in [illegible] cases have been different from what were expected, and in some instances have been a surprise, yet it is felt that they have been more than paid for the trouble and expense.

The Sale of Bottled Mineral Water in the United States [illegible]

The Present Status of Small Cube Granite Block Pavements

As noted in the article on "Recent Developments in Granite Block Paving" in ENGINEERING NEWS, of Aug. 13, 1914, there is a growing tendency to reduce the size of granite paving blocks. Where specifications formerly called for blocks 7 and 8 in. deep, the present practice is to specify 4½ and 5 in. What is the minimum depth and size of blocks?

For durability 3½ in. of granite answers every purpose of 5 in., since wear is seldom appreciable on the surface of granite blocks in any pavement. For rigidity, the present practice is to depend upon a good portland cement concrete foundation and not upon the wearing coat, whatever its type. For a foothold for horses'

FIGS. 1 AND 2. VIEWS OF "DURAX" GRANITE BLOCK PAVEMENT, BROOKLYN NAVY YARD, NEW YORK CITY

feet and [illegible] the smaller the blocks and their arrangement in non-regular courses, the better the practical results. For cheapness, if the small blocks can be produced by machine at less cost than the larger hand-shaped blocks, the less stone will be required, and the cost of freight and haulage, which is a very large item, will be much reduced. As to noise, the smaller stone surfaces with asphaltic filler between appear to be less noisy than the present standard-size block pavement.

In the matter of adopting small granite cube pavements foreign practice has been much in advance of American practice. Small granite cube pavements have been used on German streets and roads for more than 20 years. They have been extensively used in many English and European cities. About [illegible] sq.yd. have been laid in Chile and about 1,000,000 sq.yd. in Argentina, South America, where a large percentage of the blocks are imported from Sweden and Norway as ballast for westbound ships.

In the United States, the first small cube or "Durax" pavement was laid in the Brooklyn, N. Y., Navy Yard in 1913 (Figs. 1 and 2). Since then pavements of this

type have been laid in Louisville, Ky., Cincinnati, Ohio, Columbus, Ohio, Troy, N. Y., Danville, Va., Salisbury, N. C., and contracts are pending in several of our large Eastern cities. During the year 1912 about 2,300,000 sq.yd. of "Durax" or, as they are known in Europe, "Kleinpflaster" pavements were laid.

"Durax" Pavement Construction—The common European practice for city streets is to bed the blocks evenly on 3/4-in. of stone chips, or sand, on a concrete foundation, the thickness of which is made to vary with the kind and density of traffic to be carried. After the blocks are placed, the joints are filled with clean stone chips and rammed to a solid bearing. After ramming, the joints are flushed with stone chips and poured full of a bituminous mixture heated to about 300° F. Enough mixture is used to fill the joints completely, making the pavement impervious. Cement grout filler may be used, but in this case the pavement is less elastic and more noisy. Finally, about 1/2-in. of sand is spread on the surface of the finished pavement and left to work into the joints.

On roads in suburban districts an old macadam base

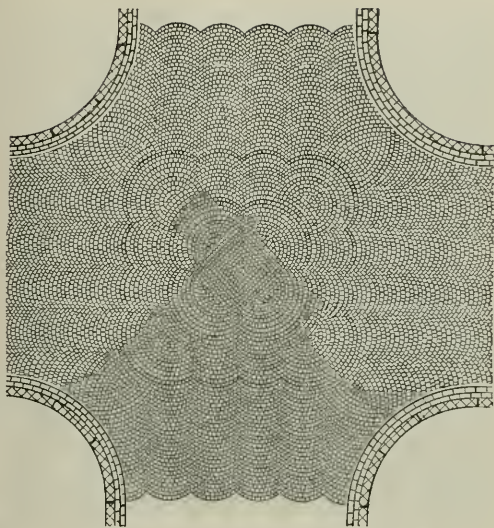


Fig. 4. Street Intersection Pattern, German Design

has been used successfully for a foundation. On these roads the blocks are laid on a 1-in. layer of sand and the joints are filled with sand only, after which the surface is wetted, rammed and rolled with a 5-ton roller. This gives a surface of the nature of a macadam road, but owing to the larger and hand-placed stone wearing coat it is, of course, more durable under dense or heavy traffic.

Ordinarily, the blocks are not laid in straight courses, but in an oyster-shell pattern (Fig. 3), that is in concentric interlocking segments of circles or diagonal courses. The advantage claimed for this method is, that the opposite wheels of a vehicle are not likely to be on the joints between stones at the same time, which reduces the jar and the subsequent wear and tear on the vehicle. A further advantage claimed is that this arrangement better distributes the wear on the pavement.

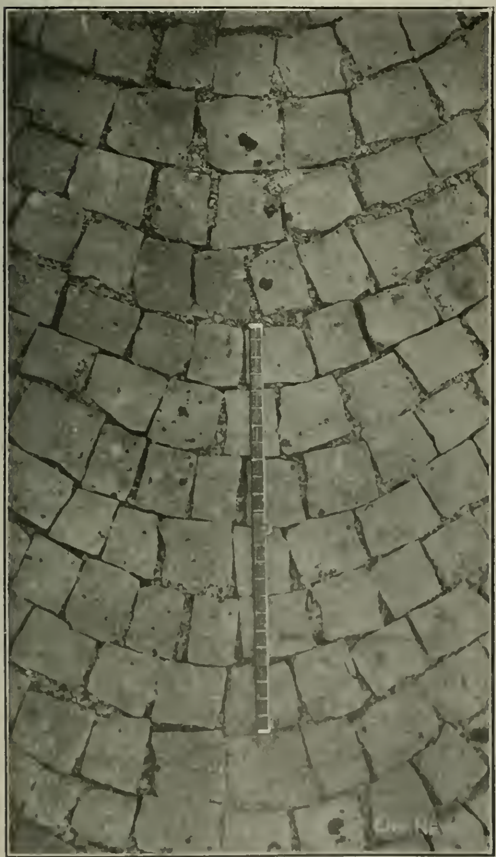


Fig. 3. Oyster-Shell Pattern for Laying "Durax" Blocks

American Experience

The specifications for the Brooklyn Navy Yard pavement provided that the "Durax" blocks should be irregular cubes, the edges to vary from 3½ to 2¾ in.; that the blocks should be laid in close contact with no joint exceeding 1/2-in. and in concentric interlocking segments.* The blocks under these specifications, were to show a compressive strength of not less than 30,000 lb. per sq.in., and a coefficient of wear of not less than 15 (French standard).

In Danville, Va., the cubes were of medium-grained granite 3½ in. to 2¾ in. in size. P. F. Brown, Assistant City Engineer, furnishes the following statement:

> We used machine-made "Durax" cubes (furnished by the Harris Granite Quarries Co., of Salisbury, N. C.). The pavement is bedded on a ¾-in. sand cushion upon a 5-in. concrete base, and is bonded with an asphalt paving filler (Texaco No. 39) using 2 gal. of filler per sq.yd.
>
> This pavement was laid by the city forces, using our regular block pavers. The cubes are laid in straight lines across

*See article in "Engineering News" Mar. 27, 1913, p. 629, "A Comparison of Recent Bids for Various Types of Paving in the New York Navy Yard," by Walter H. Allen.

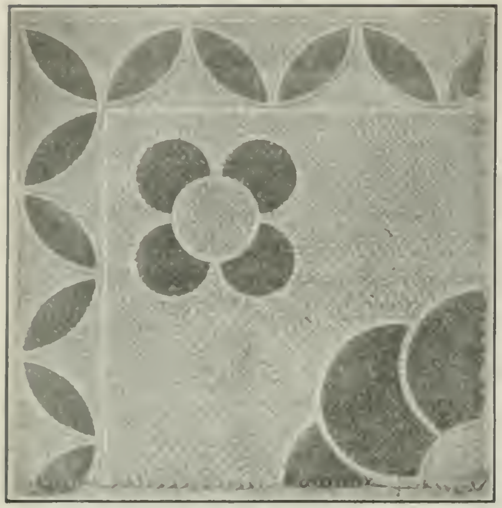


FIG. 5. STREET INTERSECTION OR COURT-YARD DESIGN; SHOWING POSSIBILITY OF MOSSAIC WORK

the street at right angles to the curb. The pavement cost $[illegible] per sq.yd., of which the concrete base (1:3:6 mixture) cost $[illegible] per sq.yd. It might be of interest to note that the labor account for laying "Durax," including preparing sand bedding and applying asphalt filler was $[illegible].24 per sq.yd.

This is an excellent pavement, giving a smooth waterproof surface, comparatively noiseless and free from dust, and on account of the smallness of the blocks furnishes an excellent foothold. We are well pleased and feel confident that it will prove most satisfactory.

The "Durax" blocks are generally more irregular in shape than the standard granite blocks now required for first-class city pavements, but being machine made can be turned out cheaper than the more perfectly shaped hand-cut blocks. Their cubical shape also gives the advantage that the most suitable one of the three depths may be used, which makes possible a pavement of fairly uniform thickness in spite of the irregular faces of the block.

REPAVING WORK—The $3\frac{1}{2}$-in. granite cubes are particularly adaptable for repaving city streets which have a good foundation left over from the former surfacing. The depth of the cubes being practically the same as wood blocks, brick and asphalt surfacing, the new surface may be placed without removing the old foundation or changing the grade.

POSSIBILITIES OF THE SMALL CUBE PAVEMENT—There are two points in pavements laid with small cubes which stand out pre-eminently. One, the ease with which warped and irregular surfaces may be paved in well rounded and pleasing curves, as is illustrated in Figs. 1 and 2 of the Brooklyn Navy Yard work. The other point is the possibility of artistic mosaic work in courts, public squares, etc., using different colored stones, as illustrated in the diagrams, Figs. 4 and 5, from the German journal "Die Strasse." While engineers, and perhaps especially highway engineers, are seldom interested in the esthetic points of construction, this is a point which will appeal to architects and city planning experts.

The small granite cube type of pavement is not patented. As noted before, it has been used in Europe for many years; but the extensive increase in its use in recent years is due largely to the method of manufacture by the Wern stone-cutting machine, which was fully described in ENGINEERING NEWS, Mar. 28, 1912, p. 614.

The First Water-Works in America are said to have been constructed in 1754 by Hans Christopher Christiansen to supply the Moravian settlement at Bethlehem, Penn. The water-works included a pump of lignum-vitae, of 5-in. bore.

FIG. 6. "DURAX" GRANITE BLOCK PAVEMENT CONSTRUCTION IN BUENOS AIRES, ARGENTINA; IMPORTED SWEDISH BLOCKS

Constructing a High-Pressure Gas Line to Louisville, Ky.*

By Lewis S. Streng†

The construction of a 12-in. steel pipeline for carrying natural gas from Inez, Ky., to Louisville—a distance of 180 mi.—presented many difficulties. The work was commenced Aug. 8, 1913, and completed and tested on Mar. 12, 1914.

The unusual difficulties of the undertaking were due largely to the nature of the country. The work on the Louisville end was simple compared to that in the mountains. Delivery of material was a problem. In some places, the nearest railway was 40 mi. distant, and the wagon roads hardly deserved the name. A team would start from Paintsville with two lengths of pipe, the load amounting to less than a ton, and return light, taking three days for the round trip. After 150 teams had made several trips, the roads were in miserable condition, requiring a repair gang to keep them passable.

On the Louisville section, much foreign labor was employed, but not back in the hills. The mountaineers drove the foreigners out of the country. The mountaineers were splendid workmen. They would walk four or five miles before daybreak, do a day's work and go back home with a lantern.

The steel pipe used was 12 in. inside diameter, 3/8 in. thick, weighed 45 lb. per ft., and averaged 20 ft. to the length or "joint" as it is called. Each joint was tested at the mill at 1000 lb. per sq.in. pressure and carefully inspected for defects. The couplings used were steel forgings of the familiar Dresser type, consisting of a central ring, two rubber-compound gaskets and two followers drawn up by steel bolts. Screw pipes were used in all river and creek crossings, with leak collars with rubber gaskets placed over each of the screw couplings, and over all this was bolted a heavy split-iron casting, or river clamp. Under all rivers, two lines were laid with valves and Y's at either end.

At railroad crossings, the pipe was placed in a 20-in. cast-iron casing, fitted with valves, on either side of the right-of-way. Eventually, a second line will be laid, with provisions for cutting out any section desired. In case of trouble, the check valve will prevent the escape of gas from the Louisville end.

Testing—The line was tested as laid before any of the couplings were backfilled. For testing purposes, two temporary compressor stations were erected, one on the Kentucky River, about 7 mi. above Frankfort, and the other on Mud Lick in Johnson County. The line was pumped up to 350 lb. per sq.in. pressure, and then carefully inspected for leaks. The excellent results obtained by this method were shown by a 48-hr. acceptance test of the whole line last February. At 350 lb. per sq.in. pressure, the leakage in 24 hr. was less than 1/4 per cent.

Construction Procedure—The construction force was organized in two divisions, one for the mountains and one for the Blue Grass, each in charge of a general superintendent. The headquarters of the mountain division was at Paintsville, with a territory to be covered of about 65 mi. The other division was about 115 mi. long, with headquarters at Lexington. Each division had two large gangs, with full camp equipment. These gangs started at the compressor stations and worked toward the ends of the divisions. In addition, each division had a special gang which installed the river, creek and railroad crossings. After more than half the work was finished, another gang was organized to hasten the completion of the work. The number of men in each gang varied from 200 to 500.

During the preceding summer, a survey had been made, and most of the right-of-way obtained. Stakes were set every 200 ft. and the first job of the construction gangs was to clear the right-of-way from 16 to 20 ft. wide. The digging crew then roughed out the trench, throwing the earth to one side; the other side being left clear for pipes. Where rock was encountered, a drill gang came next and the way blasted. After them came the graders, who trimmed the trench to proper dimensions, normally 18 in. wide by 36 in. deep.

Changes of grade up to perhaps 5° could be made in the couplings; but in general the straight pipe was laid at an even grade, and fire bends made where necessary. A small gang went ahead inspecting the pipes, dressing off any roughness at the ends, and making the necessary bends.

The pipe was then laid on skids over the trench and the couplings fitted. After a section had been finished, the lengths varying from 100 ft. to a half-mile, according to topography, the gang came back and lowered the pipe into the ditch.

Lastly, followed the backfilling gang. On level stretches, teams with drag-scrapers were used. On the slopes, breakers were built to hold the fill and leave the couplings exposed. Following the laying of the sections in the trench and their testing out, a small gang covered the couplings and trimmed up the fill.

The task of hauling material was a serious problem, as has been described, but that of stringing the pipes along the right-of-way was even more difficult. At convenient locations, the pipe could be unloaded where desired, snatch teams being added as required. Frequently, however, block and tackle were required. Five or six teams were sometimes needed to move a single joint.

On some of the trenching, gasoline-driven drag-line ditching machines were used. In good going, they could dig 2000 ft. of 18x36-in. trench in a day; but they were useless on grades, or where rock was encountered. They traveled very slowly and lost much time by necessary detours.

The best day's work reported by any of the gangs was about one mile of ditch. Occasionally, a pipe gang would report as high as 6000 ft. of pipe laid in a single day; in the rough country, 750 ft. was an average day's work. At times, when practically the whole trench was through rock, a gang of 200 men could not make more than 200 ft. per day.

*Extract from a paper presented before the Engineers' and Architects' Club of Louisville, Ky.

†Louisville Gas & Electric Co.

An Argument for Municipal Engineers—As street paving is without doubt one of the most important municipal functions, it is the plain duty of city officials to keep the pavements in good condition. We believe that if funds are not available for all of the city activities which are being assumed, that it becomes necessary for the city, as it would for a business firm or individual, to retrench; retrenchment should curtail those activities which are not primarily functions of municipal government, in order that those functions which are clearly the duty of the municipality may not be impaired. —Report of the Municipal Committee of the Cleveland Chamber of Commerce on "Cleveland Pavements," April, 1914.

Diaphragm Measurements of Water in Open Channels

By C. R. Weidner*

The measurement of large quantities of water, with a reasonable degree of accuracy, is a problem whose solution is often a laborious, expensive and time-consuming procedure. A device which will simplify the operation without decreasing the accuracy of the measurement was invented about nine years ago by Prof. Erik Anderson, of the University of Stockholm. It is termed the diaphragm or moving-screen method of gaging water. The method has been used in Europe with considerable success for the testing of turbines. Its accuracy, however, was not determined until recently, when the Swiss Bureau of Hydrography conducted a series of experiments for that purpose. The results of these tests showed a high degree of precision, and this article has been prepared with the object of bringing the device to the attention of American engineers.†

The diaphragm method of gaging is essentially a modification of the float method, in which the velocity is integrated over the entire area. Its use is, however, restricted to the measurement of water flowing in a channel of uniform cross-section. The apparatus consists of a diaphragm suspended from a car, which runs on a carefully lined and leveled track laid on the canal walls. The frame of the car and diaphragm is built of steel tubing or light angle iron; the wheels of the car are usually made of aluminum and run on ball bearings. The diaphragm frame is covered with oiled canvas or some light metal and pivoted about a horizontal axis in the direction of the current, so that it can readily be immersed or withdrawn without causing an appreciable rise in the elevation of the water surface. When a measurement of the velocity is being made a clutch holds the diaphragm in a vertical position. Figs. 1 and 2 show the rating canal and diaphragm in use at the J. M. Voith turbine-testing station, at Heidenheim, Germany. The cross-section of an installation at Notodden, Norway, is given in Fig. 4.

The method of procedure in obtaining a gaging is quite simple. A measured distance is first laid off along the canal walls. The diaphragm is then dropped into the stream at a point far enough upstream, so that it will have obtained uniform motion by the time it reaches the beginning of the measured distance. The diaphragm dips into the water quietly without disturbing the regimen of the stream. The time of transit over this distance is observed, from which the velocity of the diaphragm can be computed. The mean velocity of the water is usually assumed to be the same as the velocity of the diaphragm. A correction should, however, be made for the frictional resistance of the car, and for the velocities in the clearance between the diaphragm and the periphery of the canal, which are not integrated by the diaphragm. In well designed apparatus this frictional resistance and the clearance are so small (usually about ½ in.) that no serious error is caused by neglecting their effects, especially since they have a tendency to counteract each other on account of the smaller velocities occurring near the periphery. To obtain the discharge the cross-sectional area of the water must be known; the depth of water in the channel is, therefore, constantly observed during a gaging.

The chief advantage of this method is the rapidity with which the measurement can be made. This is of importance especially in the testing of turbines, where it is rather difficult to keep operating conditions constant for a time sufficient to obtain a good current-meter measurement. In testing turbines installed at power stations, weir measurements are often impracticable on account of sacrificing part of the available head, and current-meter gagings, although the least expensive, require skilled observers, an accurate rating of the instrument and considerable time in computing the discharge. A complete diaphragm gaging can be made in a few minutes and the result computed immediately.

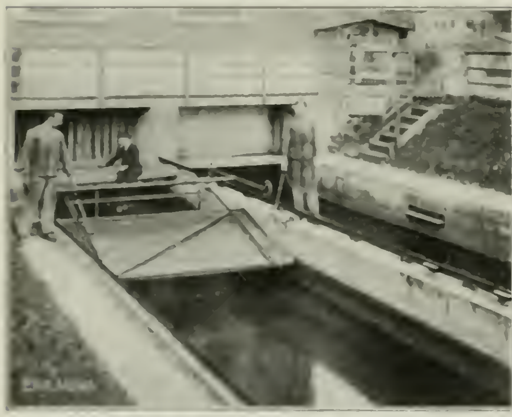


Fig. 1. Diaphragm before Dipping

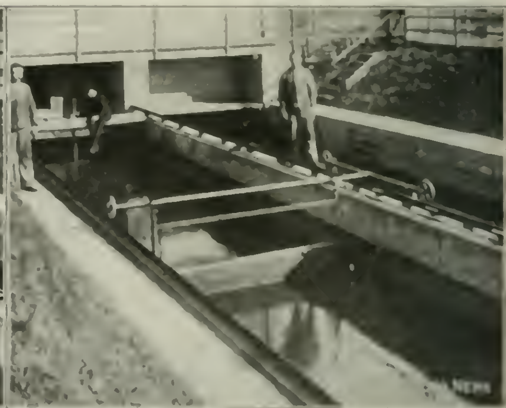


Fig. 2. Position of Diaphragm during a Gaging

(Rating Canal and Diaphragm in Heidenheim, Germany)

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*Instructor in Hydraulic Engineering, University of Wisconsin, Madison, Wis.

†This method of measurement was [illegible]

Fig. 3 shows the schematic arrangement of an electrical recording device used in conjunction with the diaphragm at the J. M. Voith station at Heidenheim. K_1, K_2, K_3 are three electromagnets; pens L_1, L_2, L_3 are attached to the armatures of these in such a way that a break in the line traced on a moving chart, occurs whenever the circuit is closed. Next to the rail A, on which the diaphragm car runs, an electric circuit P has been arranged with 11 contact points spaced 1 meter apart. The battery N_1 and switch O_1 are connected in series with the

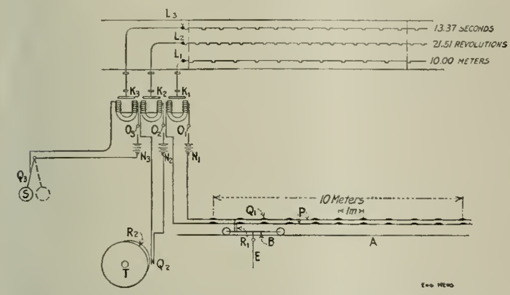


FIG. 3. WIRING DIAGRAM OF RECORDING APPARATUS AT HEIDENHEIM

electro-magnet K_1. When the shoe R_1 on the car B passes over the contact points Q_1, the circuit is closed; this fact is shown on the paper by a break in the line traced by the pen L_1. A similar arrangement is used to record the number of revolutions of the turbine. The eccentric R_2 on the turbine shaft T closes the circuit Q_2, and the pen L_2 records a break in the line for each revolution. The third pen L_3 is connected to the time circuit, every half-second being recorded on the chart. With a similar recording device used at the Berlin Technische Hochschule, two additional pens actuated by floats record the elevations of the water in the head- and tail-races.

The discharge at the Voith testing station was formerly measured by current meters, as the head was too small to permit the use of a weir. The current-meter gaging took from ½ to ¾ hour and if one considers that several measurements of the discharge must be made for a complete turbine test, it may readily be seen what a saving in time the diaphragm method accomplishes.

The disadvantages of the diaphragm method are that a channel of sufficient length and uniform cross-section must be available, and that the cost of installing the necessary apparatus is rather high. A diaphragm and its appurtenances installed at the hydro-electric plant at Ackersand, Switzerland, cost approximately $580, which includes the recording apparatus. For these reasons, the method is limited to the measurement of moderately large quantities of water, and its application will probably be restricted to hydraulic laboratories, turbine-testing stations, and places where the apparatus can be used often and first cost is, therefore, not such an important factor. For high-head power plants or small low-head plants, the installation of the diaphragm apparatus would be of considerable commercial importance, inasmuch as the operating efficiency of the turbines could be obtained at all times with a few simple measurements.

The new method could also be applied to discharge measurements in the main canals of irrigation systems, for the successful operation of which the measurement of the water is essential. It is not likely that any device can supersede the weir, for the measurement of the flow in small laterals; but for the larger canals the diaphragm method possesses advantages which in some cases would make its use preferable to either the weir or current meter. In many channels there is not sufficient fall to permit the use of a weir, and in others the silt-bearing streams affect its accuracy. Rating flumes could easily be calibrated and a recording device installed to give a record of the total flow.

Professor Andersson has used the method extensively in the Scandinavian countries for testing turbines at power plants; and in places where a suitable canal was not available a wooden flume was built. Wherever possible, a length of from 50 to 100 ft. was chosen for the rating flume, but in some cases it was possible to get a length of only 33 ft. The actual gaging distance was then only from 10 to 13 ft. Where the car and track were not available, the diaphragm was guided by wooden strips in the passage over the gaging distance. Some of the canal sections were quite large, as quantities as high as 830 cu.ft. per sec. have been measured.

Diaphragm measurements are subject to the following errors: (1) in observing the time of transit; (2) in observing the depth of water; (3) in estimating or neglecting the frictional resistance of the car; (4) the velocities in the clearance; (5) the wind pressure on that part of the apparatus not submerged; (6) the possibility of the diaphragm rubbing against the periphery of the canal;

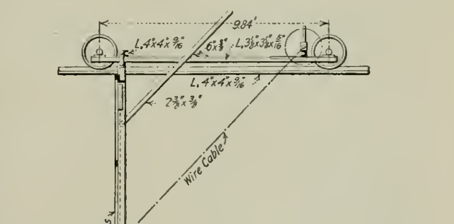


FIG. 4. CROSS-SECTION OF DIAPHRAGM AND CAR USED AT NOTODDEN, NORWAY

(7) foreign matter becoming wedged between the diaphragm and periphery.

As previously mentioned an extensive series of experiments* was made by the Swiss Bureau of Hydrography to determine the accuracy of the diaphragm method by

*The details of these experiments will be published shortly in a bulletin of the University of Wisconsin, abstracted from "Vergleichs-Versuche mit Flügel und Schirm-Apparat zur Bestimmung von Wassermengen," by Otto Lütschg, Adjunkt der Schweizerischen Landeshydrographie, Bern, Switzerland. Price, 1.50 francs.

comparison with weir and current-meter measurements. The results of these experiments may be summarized in the following conclusions:

(1) The diaphragm gagings checked the meter gagings in all cases within 1%; the discrepancies being in some cases positive and in others negative. (2) The diaphragm gagings checked the weir gagings in all cases within 3%. (3) The rating canal for diaphragm gagings should be of sufficient length to overcome the effect of pulsations in the stream. (4) The diaphragm should be placed in a vertical position in making a gaging. (5) The diaphragm method of gaging will give equally good results with perturbed flow as with parallel flow.

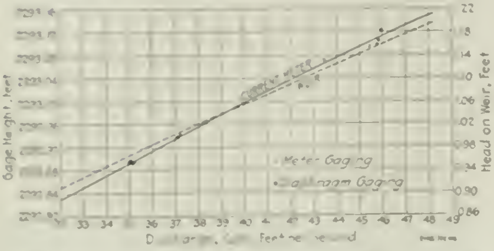


FIG. 5. COMPARISON OF SIMULTANEOUS DIAPHRAGM AND CURRENT-METER GAGINGS

In these experiments the current-meter gagings were considered more accurate than the computed weir gagings, because the weir was not of standard form and it was difficult to select the proper coefficients. The results of the different gagings have been plotted and are shown in Fig. 5. The solid curve represents the average of the plotted meter gagings; while the dashed curve is the computed weir-discharge curve. From this diagram it can be seen that the diaphragm gagings check the meter gagings very closely. The differences range between such small limits, that for most practical purposes they are of no significance. Theoretically, the results of the diaphragm gagings should be too small rather than too large, as the velocity of the diaphragm is retarded by the frictional resistance of the car, for which no correction was made. It seems, however, that the effect of this resistance is offset by the smaller velocities existing in the clearance between the diaphragm and the periphery of the canal, which are not measured by the diaphragm.

The application of the diaphragm is obviously limited; but no one method will apply to all situations. Past experience with the diaphragm in Europe has been very satisfactory; and it will undoubtedly come into use in this country, where suitable canals are available and the cost of installation is not too great. In view of its advantages and accuracy, the diaphragm method deserves recognition as a valuable contribution to the science of hydrometry.

Rigid Overhead Conductors for Electric Traction, Michigan Central Terminal, Detroit

The Michigan Central Tunnel under the Detroit River at Detroit, built in 1910, is equipped for electric traction with bottom-contact third-rail identical in form and arrangement with that used in the New York Central terminal at New York City. The same equipment was extended into the new terminal yard and station about a mile west of the tunnel, completed a few months ago. However, some special requirements in the east approach to the station called for various short sections of overhead conductor, and in the trainshed of the station overhead conductor is used exclusively. The conductor-rail potential is 660 volts.

A rigid-conductor overhead system was designed for these uses. It is working satisfactorily, and while relatively high in cost it appears to be an excellent solution of the problems of the case.

RIGID SUPPORTS—In the trainshed, which is of the low-roof type, the rigid overhead conductor-rail is supported by hangers bolted direct to the roof framing of the trainshed. In the yard, transverse bridge supports were built at intervals of about 100 ft., spanning one, two or three tracks as required. The bridges are similar to signal bridges, or to the bridges used for cable overhead work in such systems as that of the New York, New Haven & Hartford electric zone (New York, N. Y., to New Haven, Conn.). The bridges support longitudinal trusses, one over each track, and to the bottom chords of these trusses are attached transverse beams to which the conductor-rail supports are bolted.

The relative arrangement of track and bridges is indicated by the sketch, Fig. 1, showing in plan a part of the east station approach trackage.

FIG. 1. PART OF UNDERGROUND TRACKAGE IN EAST APPROACH OF MICHIGAN CENTRAL TERMINAL, DETROIT

CONDUCTOR-RAIL AND HANGERS—While the third-rail (at track level) is a 70-lb. bullhead rail, the overhead conductor is a 30-lb. T-rail of standard rail section, though of special composition. It is held in two-piece porcelain insulators engaged by hanger straps which fit in T-notches in the sides of the insulator. The details above the insulators vary with the nature and position of the supporting structure. Several typical hanger constructions are grouped in Fig. 2.

CONDITIONS REQUIRING OVERHEAD CONDUCTOR—The crossovers in the approach tracks, though laid out for No. 8 frogs, involve a gap between facing ends of third-rail of as much as 90 ft. On the westbound or upgrade tracks, where the gradient is 1% and over, so long a period of no current-supply to a train (using a single locomotive-long gaps in the power-supply as prevail in the upgrade tracks of the east approach; the gradient at the east end of the trainshed is 1%, and a large part of a train would still be on the heavy grade (hence requiring heavy power) while the locomotive was on the crossover. Therefore, the addition of the crossovers led to providing overhead conductor at the crossovers, and for simplicity and to eliminate any chance of men or tools getting in contact with conductor rails in the care and inspection of cars and interlocking equipment, the overhead system was adopted for the entire length of all the trainshed tracks, eleven in number.

J. C. Mock, Electrical Engineer of the Detroit River Tunnel Co., was in charge of the design of this equipment, under George H. Webb, Chief Engineer.

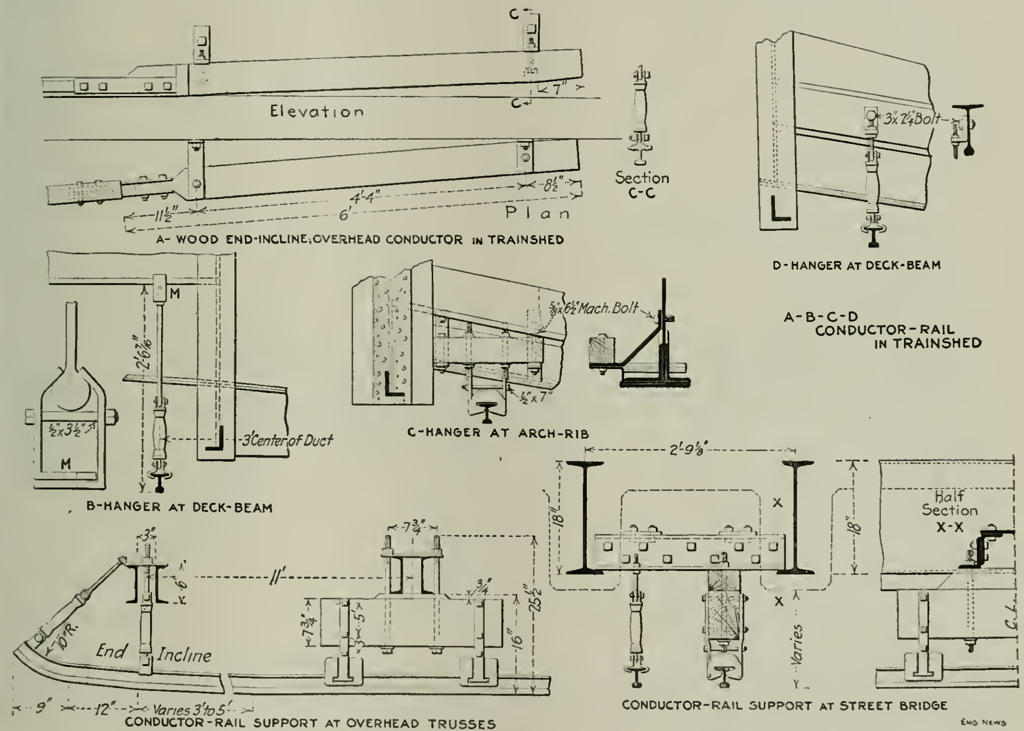


FIG. 2. OVERHEAD CONDUCTOR-RAIL HANGERS IN APPROACH AND TRAINSHED OF MICHIGAN CENTRAL TERMINAL, DETROIT

unit) would produce enough retardation of the train to bring about harmful jerking when the shoe makes contact again. On this account, it was considered essential to provide overhead conductors for bridging the gaps. No such conductors are provided on the eastbound or downgrade tracks, or on the west side of the station, where the gradient is only 0.23%.

In the trainshed, the use of third-rail (at ground) was contemplated at first. This was on the basis of continuous unbroken tracks through the shed. But later, for convenience in handling trains, crossovers were laid between the pairs of tracks at midlength of the trainshed. These introduce the same considerations in the matter of

Paying for City Street Pavements—An investigation of the methods in vogue in 50 large American cities of paying for pavements has been made by a committee of the Cleveland, Ohio, Chamber of Commerce. The results are as follows:

New Paving—

In 62% of these cities the property pays all.
In 6% the property pays 50%.
In 10% the property pays more than 50% and less than 100% except in one city where the property pays 30%.
In 22% of these cities the city pays all.

Repaving—

In 42% of these cities the property pays all.
In 10% the property pays 50%.
In 8% the property pays between 50% and 100%.
In 40% the city pays all.

Approximately 25% of the cities pay the major part of the original paving, while 40% of the cities do the major part of repaving.

The Seros Hydro-electric Development near Lerida, Spain

Regulating Reservoirs, Earth Dams and Power House

By J. C. Stevens*

SYNOPSIS—The diversion dam, canals and gates of the [illegible] hydro-electric development at Seros, near Barcelona, Spain, were described in the previous issue. The present article is complementary, describing the seven earth dams which create the four regulating reservoirs, together with the power house.

Regulating Reservoirs

The water withdrawn from the River Segre near Lerida for the hydro-electric plant near Seros is led through some 17 miles of canals, the construction of which has already been described. About three miles before reaching the power house, the canal line crosses a series of low valleys, seven of which were closed by earth dams to create four regulating reservoirs. The arrangement of these is shown in the general plan (Fig. 1).

The embankment for Dams 1, 2 and 3 were made largely from borrow pits excavated by steam shovel and by standard graders, the former working in borrow pits on the hill sides above water line of the reservoir and the latter in the beds of the "barrancos" upstream from the dams. The remaining dams were made by slip, wheel scrapers, carts or push cars in a manner to best suit the local conditions of each. About one-half of the total earth embankments were taken from the canal section. Steam rollers were used on Dams 1, 2 and 3, but on the others a smaller roller, drawn by mules, was used. This roller was made of a series of cast-iron disks or wheels, with faces about 1½ in. wide. They were fixed on parallel axles and interlocked to keep the wheels from clogging with mud. The bed could be loaded with stone to any desired weight.

Fig. 1. Regulating Reservoirs, Lower Canal, Station and Tailrace

Dams

The following table gives general quantity data for each of the earth dams:

Dam No.	Maximum height, ft.	Maximum width of base, ft.	Length of crest, ft.	Cu. yd. embankment	Sq. yd. paving
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total				[illegible]	[illegible]

In Fig. 2 is shown plan and cross section of Dam 3, the largest of the group. The same general design is followed for the remaining six.

The cut-off trench on Dams 1 and 2 was excavated about 4 ft. deep in the bed of the valley, and then a row of steel-sheet piling was driven in the bottom of the trench to refusal. Some of these penetrated to a depth of 12 ft. The trench was then back-filled with puddle, inclosing the upper end of the steel sheeting.

On the canon sides, the cut-off trenches were refilled with puddle as the dams were raised. Where the trenches cut the horizontal rock strata of the canon sides, keys were built into the rock that also projected well into the puddle, forming a sort of cut-off collar to break the seepage plane along the faces of the rock strata. These keys are shown in Fig. 2.

The foundations of all dams were well stripped of all vegetable matter and the portion under the "B" section

*[illegible]

was excavated 1½ ft. minimum, to insure a good bond with the original ground.

Outlet pipes were laid in trenches excavated in the original ground at the sides of the cañons under Dams 1, 2 and 3. These pipes were 1.0 m. diameter, made of 6 mm. steel plate, riveted in 6-m. lengths, and joined by heavy cast-iron flanges bolted together. The trench was then refilled with concrete, leaving a minimum thickness of 20 cm. around the pipe. A large cut-off collar surrounds the pipe at the point where it crosses the puddle trench, and smaller collars project from the concrete at each joint of the pipe. Above the concrete, the trench was refilled with clay and gravel puddle, which joined with the earth embankment of the dam.

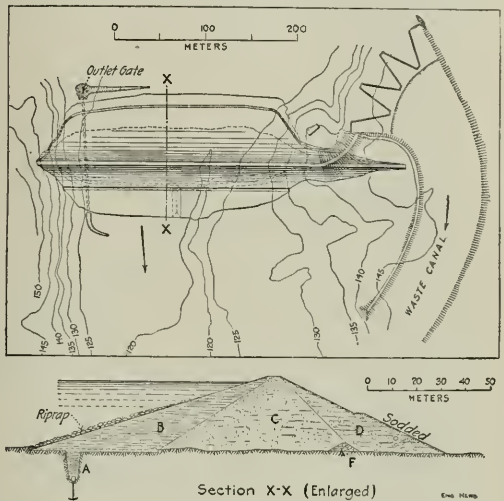
At the upper end of the pipes is a reducer section and a gate valve, 80 cm. diameter, operated by a torsion shaft with the mechanism on top of a tower frame.

The first reservoir is formed by Dams 1, 2 and 3. The connection between Dams 2 and 3 is an unlined channel 40 m. (131.2 ft.) wide on the base, with side slopes roughly ½ on 1, the bottom being level. The second reservoir is formed by Dams 4 and 5, the connection between them being an unlined canal with bottom width 18.0 m. (59.06 ft.) and side slopes 1 on 1. The third reservoir is formed by Dam 6 and the fourth by Dam 7. No spillways are provided for the second, third and fourth reservoirs, but a spillway at the left end of Dam 3 (Fig. 2) will provide a discharge capacity of 296 cu.m. per sec. (10,000 sec.ft.) under 0.65 m. (2.25 ft.) head. This is of the "zigzag" type, 304 m. (997 ft.) long, and operates entirely on freeboard. A discharge channel with 300 cu.m. per sec. capacity discharges the water into the cañon below the dam. This spillway will not come into action except in the case of an unprecedented flood on the drainage area above the dam, coincident with the stoppage of the power canal. The power canal has sufficient capacity for all known floods.

Filling Reservoirs and Testing Dams

The filling of the reservoirs was attended with some settlement, and consequent cracking of the earth dams. The seepage for each was carefully collected and measured over Cippoletti weirs, readings being taken every two hours. The total seepage from all of the seven dams did not exceed 3.0 sec.ft. with reservoir full. The seepage increased uniformly with the head, but whenever the head remained stationary, there was noticed a tendency to decrease.

Little or no seepage occurred through the dams themselves, but nearly all of it occurred in the horizontal strata of porous rocks that are exposed in the side of the cañons. Seepage through these original hillsides could not be prevented. In some cases the seepage appeared below the dam, in some it came to the surface within the section of the dam near the back side. Where this occurred, deep trenches were dug into the hillside, following the toe of the embankment, with spurs where necessary to intercept the water. These trenches gave an easier outlet for the water and prevented saturation of the earth embankment. They were refilled with large, broken stone of a uniform size to prevent caving. The rock dike, Fig. 2, answered its purpose of a blind drain, and in nearly all cases water began to weep from them after the reservoirs were filled. The greatest seepage occurred from Dam 1. A spring of crystal-clear water developed from the outlet of the rock dike, that runs about 80 gal. per min. with the reservoir full. The water undoubtedly came from the cañon side and followed the rock dike to its outlet at the lowest point of the valley. The remainder of the seepage came from the horizontal rock strata in the cañon sides except a small portion that appears as ground seepage in the valley below



The materials designated by letters in the cross section are:

CLASS A—Puddle refill of the cutoff trench; equal parts of clay and bank gravel in which all stones over 1 in. diameter were rejected. Clay and gravel hand mixed at the side of the trench and shoveled into it, thoroughly mixed with water and compacted by tampers.

CLASS B—Natural bank clay, free from stones larger than 2 in. diameter, spread in 8-in. layers inclined at about 3% towards the upstream face of the dam, sprinkled and rolled.

CLASS C—Borrow run earth, or clay and gravel of coarser material than Class B. In placing the finer and more compact material was placed in the upstream portion. To accomplish this the "C" section was divided into four equal parts and the limiting sizes and quantity of stones were fixed in each quarter in such a manner as to secure as far as practicable a gradual decrease in the imperviousness from the front to back faces of this section without sacrifice of density.

CLASS D—Borrow run of coarse material, on earth and gravel with larger stones intermingled and spread in layers of about 30 in. with only sufficient rehandling to insure a dense mass and at the same time pervious to water filtration.

CLASS F—A rock dike built transversely across the dam near the lower face to act as a blind drain to relieve any filtration that may penetrate the face of the dams.

Fig. 2. Earth Dam No. 3, Seros Project

the dam. A trench was dug along the entire length of the toe of this dam, and all saturation of the body of the dam effectively prevented in this manner. The total seepage from the dam is 30 liters per sec. (1.05 sec.-ft.) with reservoir full.

Transverse settlement cracks developed along the shoulders of the embankment on all dams. These cracks continued to widen from a hair crack to about 1½ in. wide in some cases, and then appeared to remain stationary. They were sealed by drilling 3-in. holes along the crack and refilling with a liquid clay puddle.

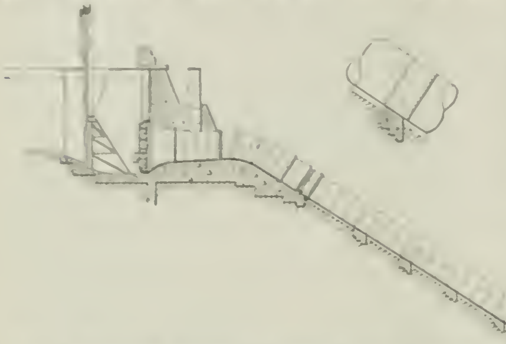
Dam No. 3, which will take its place among the high earth dams of the world, showed very little settlement and comparatively little seepage. The total seepage with reservoir full was 0.64 sec.-ft., all of it coming from the rock strata in the original hillsides.

It is next to impossible to build an earth dam that will not leak, and as long as the seepage water remains clear there is no apprehension. To have completed seven

earth dams on one project in which the combined leakage is less than 3 sec.-ft., or 1 part in 1000 of the flow from the reservoir, is a source of no little satisfaction to the writer.

Generating Station

The power house is provided with four 16,000-hp. Francis-type turbines on vertical shafts, each direct connected to a 10,000-kv., 50-cycle, three-phase alternator generating at 6000 volts and revolving at 250



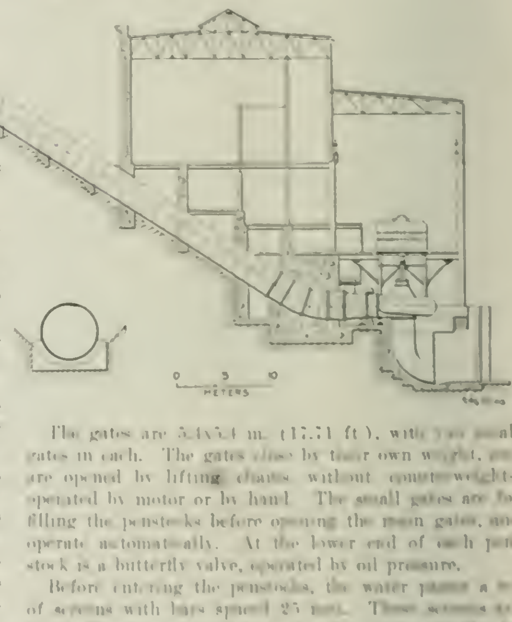


Fig. 3. Sections through Power House, Penstocks and Forebay

r.p.m. Room is left for a fifth unit of similar dimensions. The maximum head is 49.5 m. (162.5 ft.) and the minimum 46.0 m. (151 ft.). Excitation is secured by two 600-hp. 600-r.p.m. turbines direct connected to 300-kw. generators, or by a motor-generator set. Current is stepped up from 6000 to 110,000 volts in the transformer house, which is built as a portion of the main station.

The substructure is massive concrete and includes the anchor block for the penstocks and the foundations for the turbines. The latter have their draft tubes formed in the solid concrete. The generator floor, walls, crane tracks, roof trusses and inside steel work are supported by structural steel columns. The walls and partitions of the superstructure are of local brick. The roof is a 5-in. concrete slab, laid on ribbed metal and waterproofed with asphaltum. Some of the floors were also of concrete slab with ribbed metal and plain round steel-rod reinforcing, but the greater portion are of concrete supported by brick arches resting on the I-beam flanges of the floor system. The Spanish masons are very adept at building the brick arches, a single board cut to the span and rise desired serving them for centering forms. An 80-ton crane traverses the generator room and a 20-ton type runs over the transformers. There is the usual machine-shop equipment.

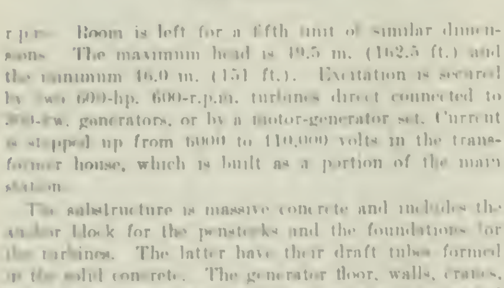


Fig. 4. Power House Exterior, Showing Forebay

The penstocks for the four main units are of 10-cm. (3/8-in.) steel throughout, 3.0 m. (9.84 ft.) inside diameter, equipped with expansion joints, just beyond the upper elbows, which are anchored in the forebay wall. The lower elbows are imbedded in an anchor block, integral with the general foundations. The reducing section and gate for the fifth unit have been installed. The exciter penstock is 1.2 m. (3.94 ft.) in diameter, anchored similar to the main penstocks. At the lower end it divides into two branches and supplies water for the two exciter turbines. Each penstock is provided with a vent pipe just below the gate, that extends 1 m. above high water in the forebay.

The gates are 5.4x5.4 m. (17.71 ft.), with two small gates in each. The gates close by their own weight, and are opened by lifting chains without counterweights, operated by motor or by hand. The small gates are for filling the penstocks before opening the main gates, and operate automatically. At the lower end of each penstock is a butterfly valve, operated by oil pressure.

Before entering the penstocks, the water passes a set of screens with bars spaced 25 mm. These screens are in duplicate, each being suspended independently by lifting chains running over a chain block, by means of which one screen may be removed for cleaning while the other is in service.

The entire project was built very quickly. Active work began in January, 1913. Water reached the forebay on Mar. 10, 1914, or 15 months thereafter. The construction of the project involved the quantities shown in the following table:

Right of way	717 hectares = 1800 acres
Excavation exclusive of borrow for dams	[illegible]
Embankment in dams	[illegible]
Structural steel	[illegible]
Concrete and masonry	[illegible]

Turbines and penstocks were furnished by Escher Wyss & Co., of Zurich, Switzerland; the various gates and gate mechanisms were from Ransomes & Rapier, Ltd., of London; racks and screens came from Aumund Gerecke & Komagen, of Zurich. The electrical equipment was made by the General Electric Co., of Schenectady, N. Y.

U. S. A. Practically all of the steel was furnished by the Blaw Steel Construction Co., of Pittsburgh, Penn., U. S. A.

The work was carried out by the Ebro Irrigation & Power Co., Ltd., under the supervision of the Pearson Engineering Corportion, Ltd., of New York. The following are the officials in charge of the work: F. S. Pearson, President; A. W. K. Billings, Vice-President and Managing Director; Fred W. Abbot, Manager of Construction; J. A. Sargent, Chief Engineer. The work was executed under the inspection of the Public Works Department of Spain, Sr. Don José Bores, Chief Engineer for the Province of Lerida.

A Dangerous Piece of Subway Construction

Building the Boylston Street subway in Boston* past a poorly founded church tower, the Old South Church, cor. Dartmouth and Boylston St., was described a short time ago by L. B. Manley before the Boston Society of Civil Engineers, the work having been successfully completed. Prior to this, the operations at Old South Church have been withheld from publicity, the engineers of the Boston Transit Commission apparently having in mind the chance of a bad accident.

The stone tower adjoins the church and is continuous with its masonry; it is a rectangular prism, 25x28 ft., with turrets and a stubby spire, 231 ft. high above sidewalk. It stands within 20 ft. of the street line. The Copley Square Station of the subway comes right opposite. Although the northerly station platform is omitted along the church, and though the subway itself was crowded over to the opposite (south) side of Boylston St. as far as possible, the subway comes within 27 ft. of the tower foundation, and within about 35 ft. of the tower itself. The tower rests on a spread footing, 37x42½ ft., of granite, supported on piles.

The subsoil here is filled material for about 20 ft. below sidewalk level, resting on 90 to 100 ft. of silt and clay, with pockets of sand and gravel in its upper 16 ft. The piles on which the church tower rests were driven into this stratum and were cut off about 6 ft. above the bottom of the fill, or about 15 ft. below sidewalk level. The bottom of the subway structure is 30 ft. below sidewalk, or about 15 ft. below the base of the tower foundation masonry. The double-track subway structure and station integral with it are a reinforced-concrete structure designed strong enough to distribute its load uniformly over its base area, so as to avoid the possible difficulties of a pile foundation.

The church tower (with foundation) is estimated to weigh 5000 tons, giving a uniform base pressure of 3.8 tons per sq.ft. However, shortly after the completion of the tower in 1875, it started to lean toward the street, finally attaining a maximum lean in the direction of the corner of about 3 ft. This increases the pressure in the lower corner of the foundation. With a 30-lb. wind in the same direction, the greatest soil pressure under the tower at the leeward corner nearest the street would be over 5 tons per sq.ft. The number and length of the piles are not known, but in any event the pile loading is greatly excessive. Under these circumstances, there was good reason for fearing that the subway excavation, only 27 ft. away, and 15 ft. below the bottom of the masonry, might start a soil movement which would threaten disaster.

A reassuring feature is the fact that in this whole region there is direct evidence that the ground has subsided or shrunk vertically to an amount of from several inches up to 2 ft. The indications are that this is due to a compression and settling of the great depth of silt. If the leaning of the tower could be charged against this same effect, there would be no reason to assume the tower foundation to be weak.

The Boston Transit Commission prescribed in detail the method of construction to be followed at the Copley Square Station, and assumed the responsibility for the safety of the tower if its prescriptions were followed.

It was decided not to try to underpin the church tower, but to depend upon the old foundation and conduct the subway work in such a way as to prevent any possible movement of earth. The essence of the method was building the subway in successive transverse slices, 12 ft. long in the direction of the subway, each fully sheeted, one slice of the subway structure being completely built before the next slice ahead was excavated more than 10 ft. Steel sheeting around the slice was driven before excavation, and this sheeting in turn was stiffened and supported by constructing a "self-supporting" concrete back-wall against the inside of the sheeting in a narrow trench. The back-wall and the sheeting were always driven and built half a slice ahead, and the back-wall being reinforced with horizontal rods, it had support at its rear end against the finished subway structure and at its forward end against the 5-ft. section of trench in which it was built; in addition, the wall was fully braced across the width of the subway excavation. Immediately upon completing the general excavation of a slice, the floor was surfaced off with concrete, waterproofing placed, the permanent reinforced-concrete floor constructed and then the side walls, columns and roof beams placed, and concreting completed.

Extensive grouting of the subsoil was done in connection with these operations, both before beginning excavation and after completion of the subway. Preliminary to the general excavation, the westerly end of the work was inclosed by a cutoff wall of steel sheeting on the line of Dartmouth Street, and the portion west of this line (i.e., in front of the church) was grouted with cement; grout forced in through 2-in. pipes jetted into the clay every 5 to 10 ft. The air pressure used for grouting was generally 50 lb. (90 lb. proved too high).

After completion of the subway structure, the space back of the longitudinal line of sheeting nearest the church was also grouted as thoroughly as was possible, in order to consolidate the soil near the church tower foundation and fill any voids that might have been created.

The subway construction progressed quite rapidly under the circumstances; the average time for constructing one 12-ft. slice, after work was fairly started, was seven days. The dangerous section was completed by December, 1913.

The tower increased its lean by about 1 in. during the operation, measured at a point about two-thirds of the height of the tower from the street. A settlement of ½ in. of the lowest point was noted.

*See article "New Subway Construction in Boston," "Engineering News," Dec. 11, 1913, pp. 1190-1192.

Concrete Lining, Franklin Canal, Rio Grande Project

By L. M. Lawson*

By Act of Congress, the benefits under the Reclamation Act were extended to the State of Texas. The Franklin Canal, which has been in existence for a number of years, was purchased by the Reclamation Service, to be reconstructed and enlarged and become the main canal to serve the 15,000 irrigable acres in the El Paso Valley. On the completion of the Elephant Butte Storage Dam, the total area to be irrigated under the entire project will be 180,000 acres, of which 20,000 lies in the Republic of Mexico. The Franklin Canal has its intake just above a concrete diversion dam in the Rio Grande near the city of El Paso. From this point it follows at the base of a steep slope along the river for one mile, passes through the lower portion of the city of El Paso on Eighth St. and continues through the central portion of the valley, a distance of 15 miles. Its maximum capacity, when purchased by the Government, was 100 sec.-ft. and approximately 12,000 acres were in limited cultivation under the irregular supply from the natural river flow.

The intake structure, the diversion dam, alignment, the bridge crossings and general condition of the canal were inadequate for the irrigation of any increased area and temporary structures would cost in maintenance, in a short time, more than permanent concrete structures.

The reconstruction plans proposed a new intake at the end of the diversion dam; a settling basin with sluice gates to discharge the heavy sand into the river; lining with concrete the portion along the river bank, and providing a rubble wall for river-protection; lining the 6000-ft. section through Eighth St., El Paso; the enlargement of the earth section below the city, and providing necessary concrete and timber and steel bridges and structures. With this enlargement it would be possible to divert 150 sec.-ft., permitting the area under cultivation to be increased from 12,000 acres to 15,000 acres.

The lining on Eighth St., which will be considered first in this article, was decided on as necessary in order to discharge the increased quantity within the right-of-way (25 ft.) granted by the city. The franchise provision, taken over with the canal when purchased, made it possible for the city authorities to enforce covering the canal through the city limits. To overcome this objectionable feature, a new franchise was submitted and passed, which specified certain bridge and fence work in lieu of the cover. The old earth-lined canal occupied 44 ft. of the 70-ft. street and was crossed by five steam railways, two electric roads and three wooden street bridges. There were also 11 sewers crossing the canal bottom from 6 in. to 3 ft. above bottom grade.

The plan of cross-section adopted, permitted the greatest width of roadway on either side, and it is the intention of the city authorities to park and otherwise improve the remaining portion of the street. Soil and drainage conditions permitted a 1½ to 1 side slope of the lined section on Eighth St., the 4 in. of concrete being placed with forms. In the settling-basin section, the side slopes were 1 to 1, with the concrete placed without forms. On account of the narrowing of the section (see Fig. 1, Sec. 4) and the low elevation of the banks of the old canal, forms

CONCRETE-LINED CANAL, RIO GRANDE IRRIGATION PROJECT, EL PASO, TEX.
[illegible]

*Assistant Engineer, Rio Grande Project, U. S. Reclamation Service, El Paso, Tex.

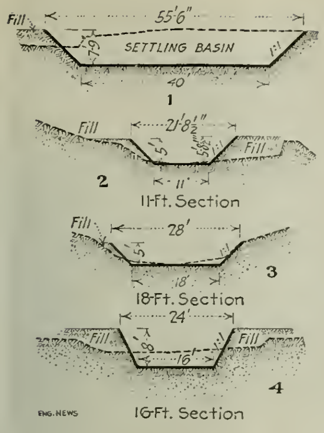


FIG. 1.

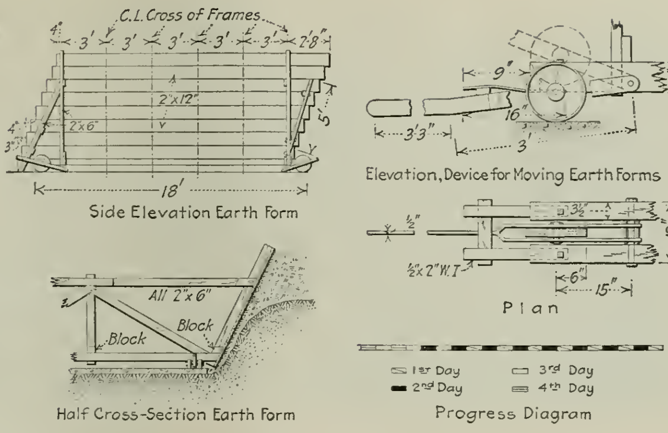


FIG. 2.

FIGS. 1-3. SECTIONS OF FRANKLIN CANAL, RIO GRANDE IRRIGATION PROJECT, AND DETAILS OF EARTH AND OF CONCRETE FORMS

were devised to permit the earth being tamped in place before concrete was poured. The procedure on the Eighth St. section was as follows: The bottom was excavated to the new grade, which in most cases was from 12 to 20 in. lower than the original grade. The sides were then trimmed roughly to line with slip scrapers, depositing the earth within easy reach to facilitate the back filling. The 4-in. concrete floor was then laid.

The earth form (Figs. 2 and 4) was then placed on the floor. This form weighed about three tons and was built to the outside lines of the concrete and could be easily lined up on the concrete floor. On each corner there was a steel lever and wheel. By lowering this lever the weight of the form was placed on wheels, which permitted the form to be rolled along on the concrete floor to the next position. When in the right position the levers were raised and the form allowed to rest on the concrete floor in position for back filling and tamping. The earth in most places was a light sandy loam, which, after being sprinkled and tamped, remained in place very satisfactorily (Fig. 5). After the form has been back filled to the required height, which in most cases was about 8 ft., the levers were lowered. This raised the form about 6 in., making enough side clearance so that it could be moved ahead without disturbing the tamped earth. There were three of these forms, one with each concrete gang. Some 12 to 14 men on the earth gang easily kept ahead of the concrete crew. The best progress in eight hours was 16 form lengths or 320 ft. The concrete forms (Fig. 3), which followed the earth forms were very similar in design, differing only in that the sides could be pulled toward the center before the form was raised. The equipment for each concrete gang was a ½-yd. mixer, 8 concrete buggies, one earth form and 6 concrete forms.

The alternate method of placing the sides was adopted. A runway over the forms was first used but this was afterwards abandoned as it strained the forms and the continual jar increased the tendency to float. The pouring took place on both sides at the same time. The earth bank

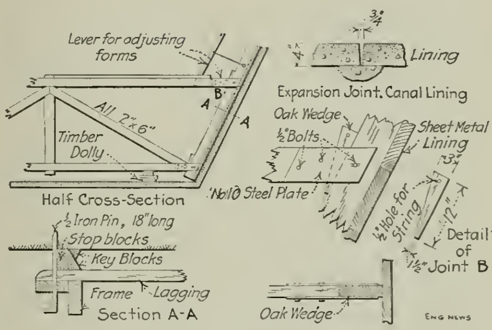


FIG. 3.

was sheltered by a piece of sheet iron and the concrete was brought up equally on each side, about 2 ft. at a time. The concrete used was a wet 1 : 3 : 5 mixture, without reinforcement. It was well tamped and spaded back of the forms.

Considerable difficulty was experienced in handling the forms at a number of bridge crossings and while all bridges were to be replaced with reinforced-concrete structures, several street crossings had to remain in a passable condition. On account of the short time in which to complete the work and furnish the spring-irrigation water, a large force of men was employed, working two shifts a greater part of the time. The limiting conditions on the work, where not hampered by bridges, sewer crossings and traffic restrictions, were the number of concrete forms per gang, as the ordinary concrete gang can handle 12 forms as well as six. One gang, where not hampered by the above obstructions, made nine 18-ft. sections in 8 hours with six 18-ft. forms.

In the settling-basin section the procedure was somewhat different. After excavation by teams, the floor was laid. The sides were then roughly trimmed, after which 2x4's were laid every 10 ft. (Fig. 6) along each side of the floor on a 1 to 1 slope. The concrete for the sides was mixed to a good pasty consistency, carried to the point of

FIG. 4. FORM FOR EARTH BACK-FILLING GOING INTO POSITION

FIG. 5. EARTH SECTION OF BACK-FILLING COMPLETED, READY FOR CONCRETE

up in wheelbarrows and placed on the concrete slope with a square pointed, short-handled shovel and lightly tamped with the back of the shovel. An important point in placing the sides is to have the shovelers throw the concrete so that it lands in a compact mass with no tendency to spread, which gives a more even and better mass. It was interesting to note the addition of water to the mix as the men gained proficiency in the work. Beginning with a dry mix, they soon could handle it fairly wet. As soon as the 10-ft. space was filled, the 2x4's were removed and the space left was filled with concrete. The concrete as placed was left with a rough surface. A thin 1:3 mortar was made to plaster this surface and applied a few minutes after the concrete had been placed. Expansion joints were placed every 50 ft. throughout this section (see detail, part of Fig. 3).

The work on this division includes the lining of three different sections. Some of the best day's work on them were as follows:

	Sq. ft.
500 lin.ft. of floor 11 ft. wide	5[illegible]
286 lin.ft. of sides 7 ft. 11 in. high	[illegible]
276 lin.ft. of sides 7 ft. 8 in. high	[illegible]
370 lin.ft. of sides 11 ft. high (settling basin)	[illegible]

The length of slope in the settling basin is 11 ft. and though this was placed with little difficulty it is about the limit in height for one course.

Instructions to begin this work were received on Dec.

FIG. 6. PLACING CONCRETE LINING WITHOUT FORMS; SETTLING BASIN OF FRANKLIN CANAL

20, 1913. Immediately material was ordered, men and teams secured and an organization assembled to handle this work in the three months available time. On Jan. 20, 1100 men and 700 animals were at work. The laborers were Mexicans receiving $1.25 per day; carpenters were, with a few exceptions, Americans and were paid $5 per day of eight hours. In general the skilled labor was selected from various construction companies in El Paso. On Mar. 23, water was diverted into the completed canal and irrigation for the El Paso Valley began. Portions of

FIG. 7. CONCRETE-LINED CANAL ON 38° CURVE, EL PASO, TEX.

the finished structure are shown by the front-page view and by Fig. 7.

Tables I and II show the total quantities and unit

TABLE I. COST OF CONCRETE LINING ON EIGHTH ST., EL PASO (STA. 78-146)

(This lining was 4 in. thick at top, 5 in. at bottom. The canal had a bottom width of 16 ft., ½ to 1 side slopes, and a depth of 7 ft. 8 in. (Fig. 1); all side work was placed with special movable forms. A 1: 3: 5 mix was used.)

Total quantities			
Cu.yd.	Lin.ft.	Sq.ft.	Total cost
2649.6	6066.7	203.835	$33,649.92

Items	Unit costs Cu.yd.	Lin.ft.	Sq.ft.
1. Engineering, superintendence and inspection	$0.491	$0.199	$0.0063
2. Form work, labor, material	2.120	0.925	0.0275
3. Concrete, materials, mixing	5.290	2.310	0.0687
4. Concrete, placing, finishing	1.650	0.720	0.0215
Total	$9.551	$4.154	$0.1240
5. Backfilling, trimming	3.150	1.370	0.0410
Total	$12.201	$5.524	$0.1650

No. 3 includes cost of material, $3.54 per cu.yd., and all expenses incident to mixers and mixing, labor and repairs. The mixers made 25 separate moves and setups on this work.

No. 5 includes all handwork necessary before placing concrete but not the rough excavation to line and grade by teams. The original canal was 28 to 36 ft. wide, and about 3.5 ft. deep. The banks wer raised 18 in. to 2 ft. and the remainder of the 8 ft. of depth was in excavation.

No general office expenses are included.

TABLE II. CONCRETE LINING STATIONS 0-38

(This includes three different water sections (see Fig. 1). No. 1, stations 0 to 6; No. 2, along river, stations 6 to 20; No. 3, along river, stations 20 to 38. All lining was 4 in. thick, laid up without forms on a 1 to 1 slope. The slope lengths on Sec. 1 were 11 ft., on Sec. 2 and 3, 7 ft. 1 in. to 7 ft. 8 in.)

Total quantities		
Cu.yd.	Sq.ft.	Total Cost
1546.8	129.324	$13,145.23

Items	Unit costs Cu.yd.	Sq.ft.
1 Engineering, superintendence, inspection	$0.491	$0.006
2 Forms, labor, materials	0.243	0.003
3 Concrete, materials, labor	5.290	0.066
4 Concrete, placing, finishing	1.062	0.013
Total	$7.086	$0.088
5 Backfilling, trimming	1.425	0.017
Total	$8.511	$0.105

For conditions relating to Nos. 3 and 5, see footnotes to Table I.

costs of this work. The night work increased the cost probably 10% and with a less rush job a material reduction in all items is possible. All work was carried on by force account under eight-hour-day law. Otis L. McIntyre was Assistant Engineer in direct charge of the work, assisted by F. W. Cater, Assistant Engineer.

Old Wood Sewers in Boston, Mass.

(CONTRIBUTED)

The sudden sinking of small sections of the surface of some of the downtown streets in Boston, Mass., caused by the collapse ot old wood sewers, has created considerable interest in them locally from time to time and has led to speculation as to the probability of serious damage being caused by such subsidence.

From an investigation by Edgar S. Dorr, of the Sewer Division, Public Works Department, it appears that in 1909 there were over ten miles of wood sewers in Boston. Many of them had been paralleled by masonry sewers or had been abandoned for some other reason, but it is estimated that even now there are in use not less than six miles of old wood sewers, which ought to be rebuilt very soon and that the cost of replacing them with permanent materials would be about $600,000.

These wood sewers were built many years ago, long before any comprehensive system of sewerage with intercepters and pumping stations was thought of, and as they were largely in low or filled lands and below the level of high tide, they were well soaked twice a day and consequently were not liable to decay as wood was cheap at that time, such sewers were economical to build. Under the conditions then existing the use of wood for sewers was good engineering.

In 1884, the growth of the city and the pressing need of discharging the sewage at more remote points led to the construction of an intercepting system from which the sea water was excluded by means of tide gates. This made a radical and unfavorable change in the condition of the wood sewers which, instead of being thoroughly wet twice daily, were wet only when they were filled by a very heavy rainfall. Long periods usually intervened between wettings and the decay of the tops of the sewers, beginning then, has been going on ever since, until now they are in such a condition that breakdowns are becoming increasingly frequent. Although they have not yet caused any serious damage, it is apparent that before long it will become necessary to replace them with modern sewers.

The Popularity of Engineering is shown in many ways. At a meeting of the Connecticut Master Plumbers' Association, a member objected to the name plumbers and said they should be called "sanitary engineers."

Field and Office

A Cable Drag Scraper on Mississippi Levee Work

The firm of R. H. & G. A. McWilliams, of Chicago and Memphis, has recently perfected and has now under operation on the Mississippi, near Memphis, Tenn., a cable drag scraper which is proving very successful in the construction of levees. The machine consists of the familiar drag-scraper bucket hung on a cable between two towers, one a braced tower of considerable height and independent rigidity, located back of the levee to be made and the other, a single low A-frame with counterweighted

Fig. 1. Looking toward levee. Fig. 2. Looking toward tall tower

A Cable Drag Scraper Building Levee at Scanlon's Landing, Mississippi River

dead-man to balance the cable, located about 500 ft. riverward. The cable is pulled by a donkey engine located at the high or shore tower. The bucket picks up the earth from the borrow pit between the towers and drags it along to the levee where it is dumped, the empty and full bucket sliding over the levee, serving to compact the fill.

The device serves admirably to fulfil the usual Mississippi levee specifications, which require that the levee be located from 1000 to 2000 ft. back from the river with earth for its construction taken from a shallow (3- to 8-ft.) borrow pit between the levee and the river.

The accompanying views show the machine in operation. Fig. 1 is a view from the low or river tower looking toward the levee under construction. The counterweight and trucks for moving the tower are clearly shown. Fig. 2 is taken looking riverward and shows the bucket just after dumping and the tracks made by the bucket in scraping up the borrow pit. In Fig. 2, the bucket is just dumping on the levee.

The McWilliams cable work now in use at Scanlon's Landing, is moving about 1800 cu.yd. per day at a saving of about 30% over the team-scraper methods usually employed. A 2½-cu.yd. bucket is used and it deposits layers of from 18 to 24 in. The round trip of the bucket averages about 2 minutes.

Excavating Railway Cuts with a Grading Machine

By J. R. Taft*

This method of taking out railway cuts is unusual, as local conditions in general do not permit the use of such an outfit except for work which may be spread over comparatively large areas at shallow depths, such as soil stripping, borrow pits, and the like.

The Halite & Northern R.R. is a standard-gage steam railway about 3½ mi. long, from Halite to near Retsof, Livingston County, N. Y. It is operated and maintained

by the Genesee & Wyoming R.R., which furnishes connections with six trunk lines. The roadbed width at subgrade is 20 ft. in cuts (14 ft. 6 in. between ditches) and 16 ft. on fills, with slopes of 1 on 1½. The subgrade is about 18 in. below top of rail, with 7 in. of ballast under the ties. Fig. 1 gives the profile of the line.

Owing to the rolling character of the country, consequent long haul, and apparent absence of rock or stone, the contractors decided to take out the cuts by grading machine and wagons. The cuts so excavated contained altogether about 20,000 cu.yd., place measurement, or 57% of the yardage of the entire line, which averaged about 11,000 yd. per mile and aggregated about 35,000 cu.yd. Of the 20,000 cu.yd. in the cuts indicated, 94% was removed by machine. The remaining 6% was

*2 Church St., New York, N. Y.

unfavorable for machine work, being either root-bound surface soil or high places at the bottom of cuts.

An Austin elevating grader, hauled by a 20-ton steam tractor, was used for the work. The wagons were of 1½-yd. capacity, of the bottom-dump type, with three mules to each wagon. The outfit was supplemented with a light grading equipment of fresno, wheel and drag scrapers, for use in places inaccessible to the grading machine.

The material encountered was a stiff clay, hard and brittle when dry, but so plastic and slippery when wet as to be unworkable. Much ditching and draining were necessary. The work of grading was started about the middle of October, 1911. Owing to the effect of unfavorable weather upon the material, the grading machine was helpless during the greater part of November, December and January. Operations were suspended during February and March, 1912, and were resumed about the middle of April.

It was demonstrated early in the grading that a 20-ft. cut is too narrow for a machine to work in and load wagons when the cut has reached a depth too great for the wagons alongside to "straddle" the top edge of the slopes. This workable depth may be taken at about 3 ft. To secure additional width, the contractors were allowed to excavate as shown in Fig. 3. When the cut had

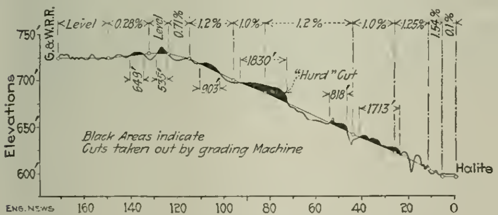


FIG. 1. PROFILE OF HALITE & NORTHERN RY.

reached a depth where the toes of the slopes were 30 ft. apart, the sides were taken down vertically to within 5 in. of subgrade.

The material shown in the hatched areas at the bottom was then cast into the double-hatched areas at the sides. In ordinary material this is not good practice. The results as a whole have proved generally satisfactory, and this method provided more room for working without enlarging the size of the cuts and thereby increasing the quantity of material to be moved.

Even a 30-ft. cut did not provide sufficient room for loading all the material direct to wagons working in the cut. There was plenty of room when excavating along either side of the cut and for about one-third the distance across the bottom from each side. In taking out the middle third, however, considerable rehandling was necessary. This meant that about one-third of the material was cast up on the sides, to be raked down by slopers into a position from which it could be again picked up by the machine. In order to do this, the machine was obliged to work casting up alone, which resulted in much "lost motion". This condition was relieved by putting the teams on light grading elsewhere while the machine worked casting up without the wagons, as shown in Fig. 2.

In material of this character, for about every 60 ft. the machine traveled, a wagon load of a little less than 1 cu.yd. place measurement, would be passed over the

FIG. 2. EXCAVATING A CUT WITH A GRADING MACHINE
(The machine is casting the dirt on the slope, to be shoveled down and loaded later.)

belt conveyor. Thus about 15 yd. were cast up for rehandling for each furrow so made through a cut 1000 ft. long. Therefore, in taking out the middle portion of the cut (six lifts of about 12 furrows each) the quantity of material turned over for a second handling runs into considerable yardage.

When the output of an organization is dependent upon a single one of its units, the results of its operation are measured by the efficiency of that unit. Therefore, to secure the most satisfactory results the unit must be worked to its economical capacity. This is not so difficult of accomplishment when operating under favorable conditions. On this work, however, such conditions did not exist. Bad water kept the boiler of the traction engine in a choked and leaky condition. Owing to this and the long water haul to reach some of the cuts, an extra tank wagon was required part of the time.

Stones embedded in the tough material when caught by the plow point threw severe strains into the whole apparatus, causing some of the most serious breakdowns. Such strains were relieved, however, by the shearing of the bolt in the plow frame which took the force of the impact. Hundreds of these bolts were broken and replaced, causing unrecorded delays of 5 to 15 min. each. The cramped area while working in certain cuts made it impossible at times to water the boiler from the tank wagons while in motion, which resulted in further delays at the turns. Owing to street paving and other activities in the cities, together with highway construction in near-by towns, it was extremely difficult to procure men and teams at a reasonable figure. Farmers were unwilling to subject their horses to the hard work of moving material of the nature encountered.

The total time of 119 days in which the machine was working in the cuts, and which does not include the removal of about 4000 cu.yd. from a borrow pit under more favorable conditions, may be classified as follows:

	Days	Per cent.
Unnecessary delays:		
Lack of duplicate parts	6	5
Delayed by work elsewhere on the line	5	4
Total	11	9
Necessary delays:		
General repairs	6	5
Wet ground	43	36
Total	49	41
Total delays	60	50
Machine in operation	59	50
Total working time	119	100

It will be evident that the work as a whole was not executed under favorable conditions. Eliminating the item of wet ground from the total working time of 119 days, 76 days were consumed in excavating about 20,000 yd., or a daily average of about 260 yd. This is less than

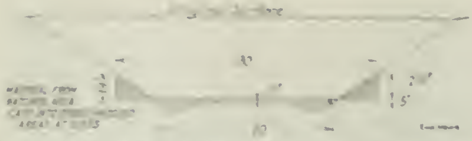


FIG. 3. EXCAVATING A 24-FT. CUT TO A TEMPORARY WIDTH OF 30-FT. TO ENABLE A GRADING MACHINE TO BE USED

half of what might be reasonably expected from a machine of this type working in similar material but in less constricted areas.

The contractor's daily expense for the operation and maintenance of this outfit may be considered as given in the accompanying table:

TABLE OF CONTRACTOR'S DAILY EXPENSE FOR GRADING

(A) At Working Point	
Foreman (member of firm)	$6.00
Tractor engineman	4.00
Tractor steersman	2.00
Machine operator	3.00
Tank-wagon driver	2.00
Extra tank wagon with driver	5.50
	$22.50
Fuel, oils, etc., for tractor	5.00
Six dump-wagon drivers at $2	12.00
Two dumpmen at $2.25	4.50
	[illegible]
Total at working point	$44.00
(B) At Camp	
One blacksmith	$3.00
One barnman at $40 per month and board	2.00
One cook at $40 per month and board	2.00
	$7.00
Corral expenses for 25 head of mule stock	20.00
Total at camp	$27.00
Total of (A) and (B)	$71.00
For insurance, interest, depreciation, etc., 12½%	9.00
Grand total	$80.00

Assuming $80 as a fair figure for daily expenses, the cost of moving 260 cu.yd. per day is about 31c. per cu. yd. Board with lodging in camp was furnished the men at $4.50 per week, which was practically at cost. Corral expense is based on oats at 61c. per bushel, loose hay at $21 per ton, and straw at $10 per ton, all haulage by contractor.

With the exception of the barnman and cook, who were carried monthly, the contractor's force was employed on an hourly basis. In the event of extensive repairs or delays from various causes, the men were either put on other work or temporarily laid off. Although changing during working hours from one type of work to another does not lead to economical results, it sometimes avoids a total loss.

The writer found it useful to maintain a chart showing grading performance, a portion of which and covering operations in the "Hurd" cut is shown in Fig. 4. For this chart, sheets of ordinary cross-section paper were used. To indicate grading-machine operation, the sheets were ruled vertically into days of 12 hr., each horizontal square representing one hour. Normal working days of 10 hr. were from 6:30 a.m. till 6 p.m. with 1½ hr. for lunch at 11:30. The number of wagon loads was recorded in the field with a punch counting machine by the engineman on the tractor. This daily record, with due consideration of voids in the material as loaded, served for a rough check on the quantity of earth moved as figured from the cross-section sheets.

This work was under the direction of W. H. Coverdale, Consulting Engineer, 66 Broadway, New York, N. Y., who acted as Chief Engineer, and for whom the writer was Superintendent of Construction.

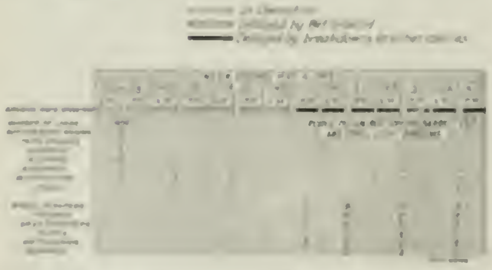


FIG. 4. TYPE OF CONTRACTOR'S WEEKLY LABOR REPORT ON RAILWAY EXCAVATION WITH AN ELEVATING GRADER

An Excavating Traction Grader

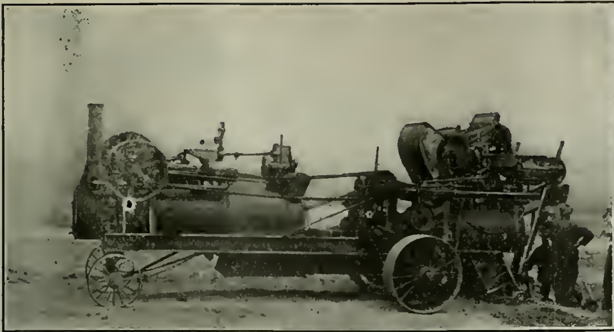
A machine specially designed and built for street-grading work, practically a heavy shallow-trench traction digger, is now in operation in Chicago. In this equipment, the excavating unit, a vertical flight of heavy digging buckets, carried on a triangular frame, is mounted on the rear of a long 4-wheeled truck. At the top, the flight of digging buckets has two points of support, carrying it almost horizontally over a transverse belt of steel slats, which distributes the excavated material to either side as required. On the truck is mounted a horizontal boiler with superimposed horizontal engine. The rated capacity of the machine is from 40 to 60 cu.yd. per hour.

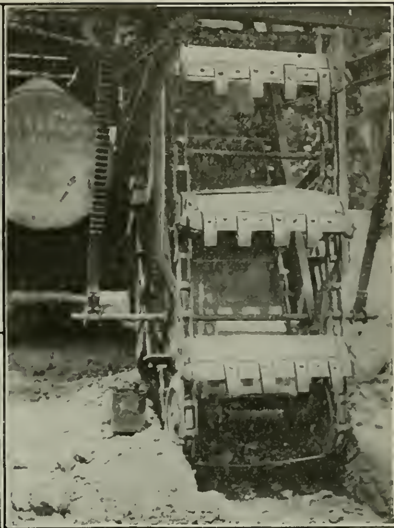
Three principal elements make up the equipment, the digging and elevating unit, the distributing unit and the truck, power equipment, traction, steering gear, etc. The digging system embraces a flight of 11 heavy buckets 33 in. wide, with an individual capacity of ½ cu.ft. This flight revolves so as to dig upward and into the earth, and along the lower side works in an elevator channel of heavy steel plate. The digging buckets travel at a speed of about 140 ft. per min. The buckets are fitted with detachable and renewable teeth and cutting edges.

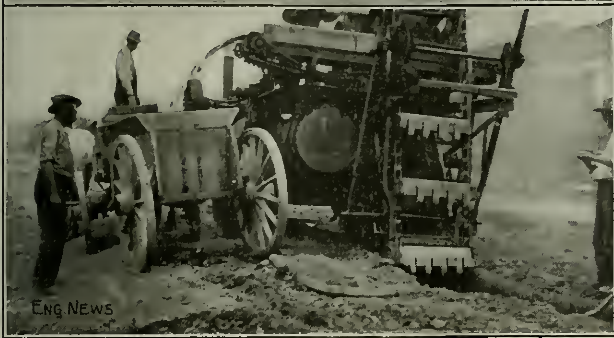
The buckets dig a trench 33 in. wide, 4 in. to 36 in. deep. The train of buckets is mounted off center, so that the outer edge of the trench is 8 in. outside of the tread of the rear traction wheel. This allows digging close up against a curb. The depth of digging is controlled by means of a rack and pinion on each side.

When digging, the grader moves forward automatically, an eccentric rod from the main countershaft and a dog and ratchet carrying a slow motion down to the rear wheels by sprocket and chains. The machine is driven forward at a speed of from 5 ft. to 20 ft. per min., depending on the material.

The transverse distributing unit, a belt built of steel cross-slats on rollers 11 ft. apart, is mounted so as to be fed by the buckets as they dump and, moving at about 300 ft. per min., dumps the material into wagons on either side. The belt is 18 in. wide, and the slats are turned







Excavating Traction Grader

The Digging Buckets

Machine Loading a Wagon

up at both ends so as to form a retaining channel. The conveyor can be run so as to load wagons at either side, as the work may require.

The bed of the truck, built of heavy steel sections, is about 18 ft. long. The rear traction drive is 48 in. in diameter with a 10-in. tread. The pilot wheels are 30 in. in diameter with the same tread.

A horizontal 25-hp. boiler is carried in the bed of the truck; superimposed upon the shell of the boiler, and rigidly bolted to it, is a 15-hp. horizontal engine, driving by chain to a transverse countershaft, located midway of the machine. The machine is driven from the countershaft by sprocket and chain.

The illustrations show this grader at work in W. 56th St., Chicago, on work under contract by C. F. Conway. The equipment was designed by J. C. Clark, and built by the H. B. Sackett Screen & Chute Co., Chicago. Mechanical details were worked out by P. A. Peterson of the Sackett company.

Tie Dating and Tie-Plates for Treated Ties: L. & N. R.R.

For marking treated ties with the date of laying, in order to keep record of their life, the Louisville & Nashville R.R. uses nails having the two last figures of the year stamped in the head. This is very general practice, but difficulty in keeping the records occurs sometimes through the head of the nail being broken or damaged so that the date mark cannot be read. To provide against this, a system has been adopted of indicating the date by the position of the nail in the tie, as shown in Fig. 1.

This road uses zinc-treated ties on tangents and creosoted ties on curves, and protects the latter against mechanical wear by means of metal tie-plates. The form of the tie-plate is shown in Fig. 2. It is of the shoulder type, and has two ribs on the underside, the depth of these ribs being sufficient to secure the plate against displacement but not sufficient to injure the wood or penetrate the more heavily treated exterior portion of the tie. The circular holes are for screws attaching the plate to the tie without relying upon the hold of the rail spikes.

For information as to the above we are indebted to W. H. Courtenay, Chief Engineer, and J. B. Lindsey, Superintendent of Treating Plants, Louisville & Nashville R.R.

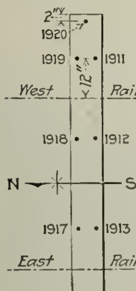


FIG.1 TIE DATING

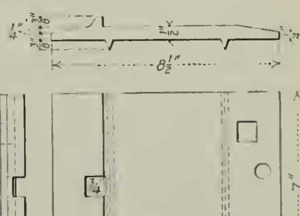


FIG. 2 TIE-PLATE

Marking and Protecting Treated Ties on the Louisville & Nashville R.R.

Fig. 1. Side View of Hydraulic Fill Replacing a Trestle; Spokane, Portland & Seattle Ry.

A 40-ft. Railway Bank Made by Hydraulic Fill

Probably the highest railway embankment ever made by hydraulic fill is on the Spokane, Portland & Seattle Ry, along the Columbia River. It is made of fine sand pumped from the river. The elevation of track is 60 ft. above low water, and the fill has an average height of 40 ft. In Fig. 1, the partly completed bank is seen from below, while Fig. 2 is a view on top of one of the levels.

The dredge "North Bank" was designed and built for the embankment work. In Fig. 1, this dredge is just visible in the extreme left background. It has a wood hull, 148 ft. by 34 ft. There are two 250-hp. Scotch marine boilers, and a horizontal compound engine of about 600 hp. A full equipment of pumps, hammer rigging, shop machinery, etc., is provided. The dredge has both jet and mechanical agitators, and a specially designed high-lift sand pump with 18-in. suction and discharge.

The slopes of the finished embankment are $1\frac{3}{4}$ to 1. The bulkheads for retaining the material are composed of 2x4-in. stakes, 4 ft. apart, on which are nailed 1x12-in. boards. The end bulkhead, built in this manner, is 30 ft. high.

Riprap was placed on the river side of the fill; the back side covered with cliff droppings to prevent the sand from blowing away.

The hydraulic method of making the fill secured three important advantages: cheapness, no interruption of traffic, and absence of settlement and maintenance when the fill is completed.

William Gerig, vice-president and chief engineer of the Pacific & Eastern Ry., supervised the construction of the embankment and designed the dredge.

Fig. 2. Top of Partly Completed Hydraulic Fill

The Danger of Projecting Nails—The simplest and best thing to do is to educate the men who are responsible for leaving the nails in the board. Teach them the importance from a safety standpoint of pulling the nails out, or bending them over and hammering their points in, in a proper manner. It is safest, of course, to remove the nails entirely, but the next best thing is to hammer them in. But if they are bent over and hammered down, the work should be done in the right way. A nail bent so that the point remains a quarter inch or an eighth inch above the level of the board is still dangerous, because it is likely to tear the flesh or catch in the side of the shoe, and if the end of the nail stands up by as much as a quarter or half inch, there is danger of the point entering the upper or soft leather of the shoe. In bending and hammering down a nail, the pointed end should first be turned over at right angles by means of pliers or the claw of a hammer. The body of the nail then is bent over and hammered down so that the pointed end enters the board. All danger is then removed. [From "The Travelers Standard," Travelers Insurance Co., Hartford, Conn., June, 1914.]

Raising a 240-ft. Cableway Tower to 280 ft.

The Tunkhannock Viaduct, now under construction on the Scranton-Hallstead line revision of the Delaware, Lackawanna & Western R.R., at Nicholson, Penn., is the largest and highest concrete bridge in the world. It consists of ten 180-ft. full centered concrete arches with two 100-ft. approach arches and has a total length of 2375 ft., with a height of rail above the lowest point of the valley of 242 ft. (see Engineering News, Aug. 28, 1913, p. 417). The construction of the viaduct is being carried out by means of two parallel twin-span cableways, with spans of 1525 ft. and 1510 ft., respectively, on either side of a central tower.

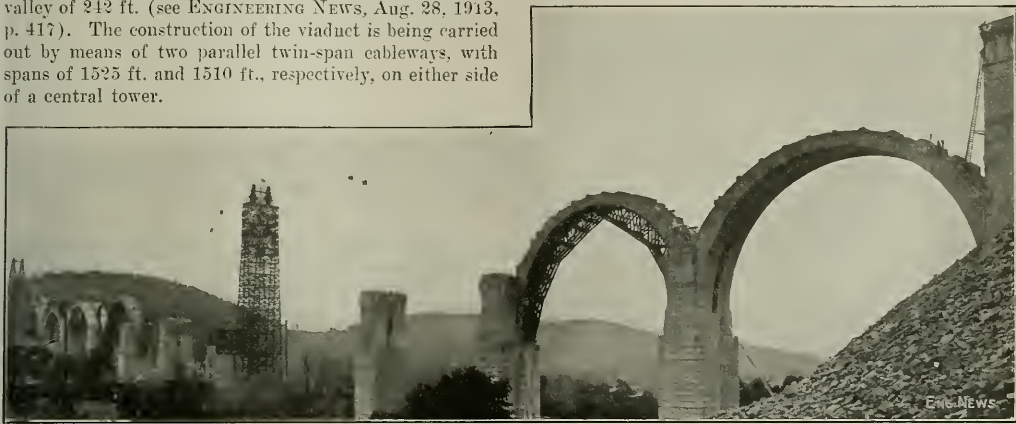


Fig. 1. The Tunkhannock Viaduct, D. L. & W. R.R., under Construction, Showing in Center the 280-Ft. Cableway Tower

The main cables are each $2\frac{1}{4}$ in. in diameter and are fitted with high-speed carriages and shock absorbing fall rope carriers. Each cable was designed for an average load of 7 tons, but is being used to carry 10-ton loads in emergencies. The end towers are independent pyramidal structures cross-braced mainly at the top lift, with each part carrying at its top the sheaves for one cableway. The middle tower, however, is a thoroughly cross-braced single tower 40x60 ft. at the base and running up to a height of 240 ft. All towers are built of timber.

At the time the cableways were erected it was decided to build the center tower high enough only to give clearance for building the main piers and arches, but not high enough to complete the superstructure. However, after the work was started the contractor decided to use the cableway for the full construction of the bridge, which necessitated the elevating of the middle tower 40 ft. from its previous height of 240 ft. to a final height of 280 ft. The elevation of the tower was completed while work on the cableway was being carried on, with a short delay for shifting the cables to the new height.

In elevating the tower two separate pyramidal timber frameworks were built on top of the tower. while the cableway was in service, and on top of each of these frameworks was placed a new balancing device similar to one which remained in service on the 240-ft. elevation, and which is described below. When this elevation was completed, the cables were slacked off so that they rested on top of the viaduct, were then unshackled and their ends raised and joined through the sheaves of the new compensating device. According to the contractor, no difficulty was experienced in putting on the additional 40 ft. or in changing the cables. The tower was apparently as rigid as it was before the 40 ft. were added. The guys bracing the lower tower were left as before, and, in addition sixteen 1-in. guy lines were added to the new upper works. In the accompanying view (Fig. 1) the raised tower is shown with the two extra frames in place. The old pyramidal frames carrying the old compensating device were left in (in second lift below top of tower. Fig. 1).

The compensating device is shown in detail in Fig. 2. It consists of a structural steel frame securely bolted to the top of the timber framework and carrying, pendulum fashion from an upper pin, two steel plates through the bottom of which are pinned plates clamped to the opposite main cableways. The control and button ropes pass over sheaves at the top of the steel frame. around sheaves mounted near the bottom of the frame and back to the end towers. The pendulum pinplate is

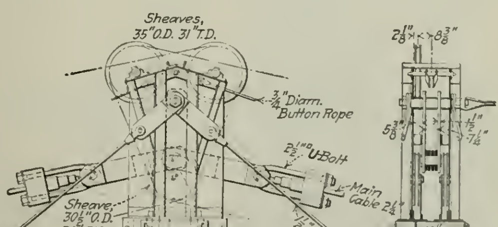


Fig. 2. Compensating Device for Long Span Twin Cableway Towers. [Patented by the Lidgerwood Mfg. Co.]

designed to permit an opposite cableway to take up the pull of an overloaded cableway on the other side and thus relieve the tower of the more severe overturning effort which would be induced by a rigid connection. Two of these balancing frames are mounted on the middle

power, one for each parallel cableway, and they are guyed to each other and to the ground.

The bridge is being built for the Delaware, Lackawanna & Western Ry., under the direction of George J. Ray, Chief Engineer, by Fuckwer & Bush, Inc. The cableway was designed and constructed by the Lidgerwood Manufacturing Co., and the patented compensating device was designed by W. J. A. Rankine of the company.

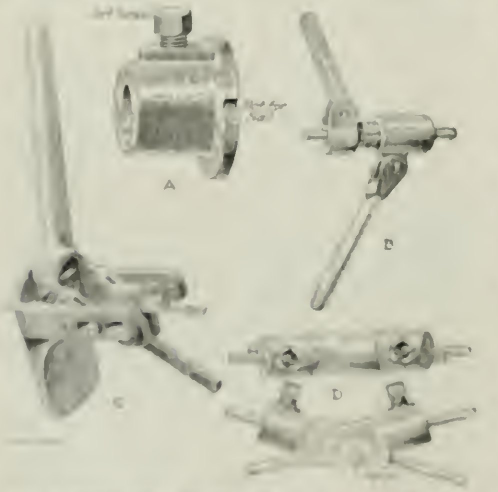
Clamp for Tie-Rods in Concrete Forms

Rod ties for concrete forms are often preferable to wire ties, and a special clamp fastening which is being introduced to hold and secure the rods is claimed to be simpler and more effective than a threaded rod with nut and washer, while it is applied in much less time. The clamp, shown at (*A*) in the accompanying cut, is a sleeve which fits over the rod, and is locked to it at any position by means of a set screw which forces the rod against a V-slot. The clamps can be nailed to the forms to prevent them from being lost. Should the form bulge or spread, a tightening wrench (*B*) is put over the end of the rod and operated as a screw jack to force the form into place.

In many cases the rods are inclosed in sleeves, but for cases where they are embedded in the concrete, a special pulling device (*C*) is used to remove the rods. This grips the projecting end of the rod and has a lever by which a powerful pull is exerted. If used before the concrete has taken a complete set, this will remove the rods without bending them and without defacing the surface of the concrete. If the rods are to be left in for any length of time, they should be jarred so as to loosen the grip of the concrete, and then they may be removed when convenient.

The clamp may be used also with outside tie rods, as in forms for columns and girders, and a special double clamp and saddle (*D*) is used to take both ends of hooped clamp rods on circular columns.

These devices have been used extensively in building construction work, and also on the retaining walls of track elevation work in Chicago. They are made by the Universal Form Clamp Co., 1214 W. Madison St., Chicago.



Clamp Fastenings for Tie-Rods in Concrete Forms

Putting a Sewer On the Map by a Subterranean Survey

By J. E. Schwaab*

The City of Alton, Ill., is contemplating the installation of a sewer system to take care of that part of the city known as North Alton. The only feasible outlet for this sewer system is the present main sewer known as the Piasa St. sewer, which consists of an arched-over creek, bearing a similar name, running through the heart of the city.

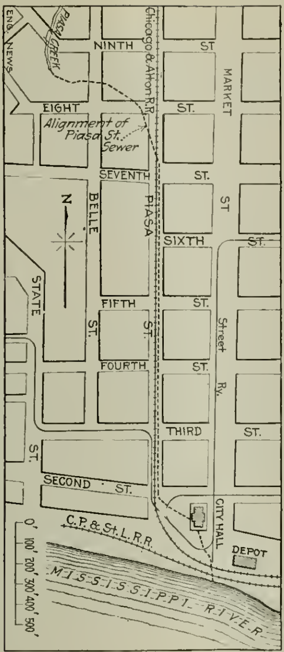
Fig. 1 Survey Party about to Start a Subterranean Sewer Survey, Alton, Ill.

This creek was arched over in 1858 but no record was made of its exact location with reference to present streets. Since then, several extensions have been made, making a total of 8078 ft., which have been arched over with arching varying from 9 to 12 ft. in span. It is now proposed to extend the arching over of this creek to North Alton for the main outlet for the proposed North Alton sewer.

This fact has given Assistant Engineer W. C. Vincent the rather unique experience of making a survey of the present Piasa St. sewer, to determine if the size, location and condition of same would warrant its being used as the outlet of the proposed sewer.

The method of procedure did not differ essentially from the ordinary transit survey, but had the additional feature of working in running water and sewage. At the outlet into the Mississippi River, the water had backed up into the sewer for a distance of 300 ft. This necessitated

*City Engineer, Alton, Ill.



SKETCH PLAN, SHOWING LOCATION OF PIASA ST. SEWER, ALTON, ILL.

the use of small boats. Hip boots proved ample in making the balance of the survey.

The task was accomplished in the following manner: (1) Transit points were established in the center of the sewer at each angle point. This was done by building up a pile of stones high enough so that the top stone protruded above the surface of the water. (2) Starting at the outlet of the sewer as 0.0, the distance along the center line was chained and pluses taken to the transit points as above described. (3) Angles and levels were obtained. This was one operation, levels being taken with the transit while securing the angles. This avoided an extra trip through the sewer.

The first set-up was made at the outlet, a sight taken on the transit point at the first angle and a backsight taken on the opposite side of the Mississippi River. The next set-up was made at the first angle point, a backsight taken at the outlet and a foresight at the next angle point. This was continued throughout the entire length of the sewer. Miner's lamps were used throughout the work, by which the rod sights were easily obtained.

The alignment and levels thus secured were rerun on the surface, as a location of the sewer was desired in respect to the city streets; and it was particularly desirous to know if it ran under the City Hall Building.

Quite a few surprises resulted as to the actual location of the old sewer. It was found that the sewer ran under the southwest corner of the City Hall at a point directly underneath a very bad settlement of the south wall of the building. This wall is now in a precarious condition.

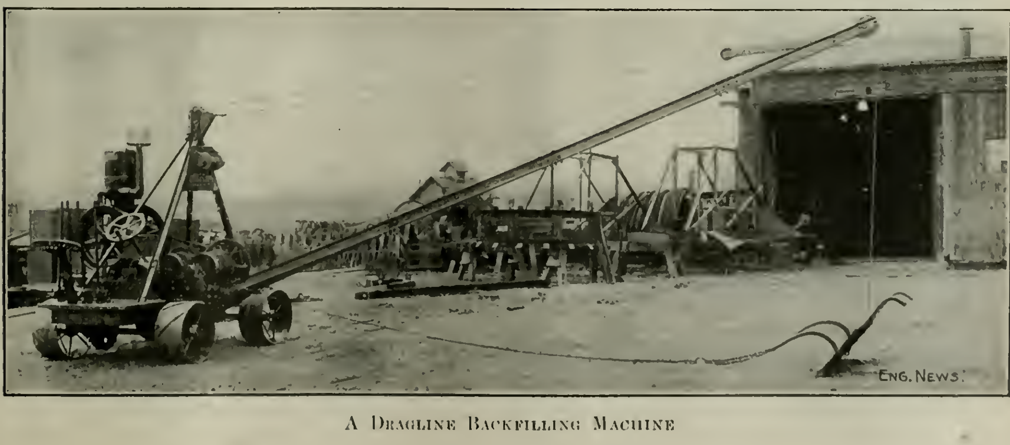
A feature not usually encountered on surveys was the vast number of bats. In several places they could be seen swarmed up on the roof of the sewer like bees. When they were disturbed by our lights they caused a commotion which was not particularly agreeable.

On a whole, the task was not as disagreeable as one might anticipate, yet it must be admitted that the fresh air and sunlight were greatly appreciated at the end of the day's work.

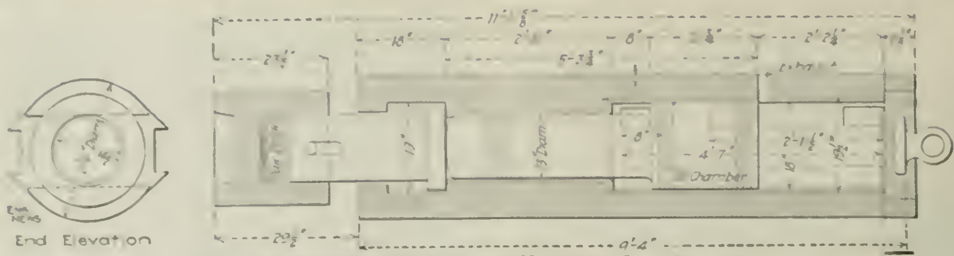
A Drag-Line Backfilling Machine

In pipe-trenching work where machines are used for excavation, the cost of backfilling (by hand) is frequently higher than that of excavation, and there is opportunity for considerable saving in this item by the use of machines instead of hand labor. The backfilling machine shown in the accompanying cut operates on the drag-line principle, the tractor traveling along the side of the ditch opposite to that on which is the spoil bank, and hauling the scraper to and fro.

The tractor has a frame 7x10½ ft., mounted on four 30-in. wheels with 18-in. tires, giving a wheelbase of 5½ ft. and a width of 5 ft. 9 in. over wheels. At one side is an A-frame, from the head of which is guyed a boom, giving a maximum reach of 22 ft. A 10-hp. gasoline engine drives a double-drum hoisting engine, and



A DRAGLINE BACKFILLING MACHINE



WILHELM DIFFERENTIAL-CYLINDER VALVELESS PILE HAMMER

also the propelling gear. The clutches of the two drums are operated by pedals, leaving the operator's hands free to work the steering wheel and the lever of the propelling-gear clutch. The boom is in four sections, put together with bolts, so that its length can be varied as required. The heel section is of V-shape, with broad base, and the head section carries the guy attachment and the sheave of the hoisting cable. The weight of the machine is 5500 to 6000 lb. Its traveling speed is 2 m.p.h.

The scraper is handled by a loading or drag line and a hoisting line. When in position behind the spoil bank (as shown), the loading line is hauled in, dragging the scraper to the edge of the trench, while the hoisting line is paid out. The latter line is then hauled in, pulling the scraper back, while the loading line is paid out. The scraper is set in position by hand, as shown, and the man may or may not keep hold of it, according to the requirements. A Fresno scraper is shown, but any kind of scraper bucket may be used.

The machine has worked at the rate of five or six strokes per minute in handling heavy clay that had been exposed for several months and had became practically a solid mass. It is designed for work with trenches up to 6 ft. wide and 20 ft. deep. It is built by the F. C. Austin Drainage Excavator Co., Railway Exchange Building, Chicago.

A Valveless Automatic Pile Hammer

A new pile hammer is just being put out which has the remarkable feature of containing no valve. The piston itself acts as its own valve, by allowing the working fluid (steam or air) to flow through by-pass ports from the ring-shaped space below the head of the piston into the main cylinder area when the top of the stroke is nearly reached. The great point of advantage of the hammer is its extreme simplicity; at the same time practical tests up to the present have indicated that it works smoothly and effectively, so that it is likely to prove an ideal contractor's tool.

Besides its extreme simplicity, an obvious feature of the hammer is the absence of any thin rod connecting the piston and the ram or striking point. This means the elimination of [illegible] breakage, and positively brings the full weight of piston and ram into action. On the other hand, the steam efficiency of this hammer is below the best steam-engine requirements. The hammer will work with air or steam.

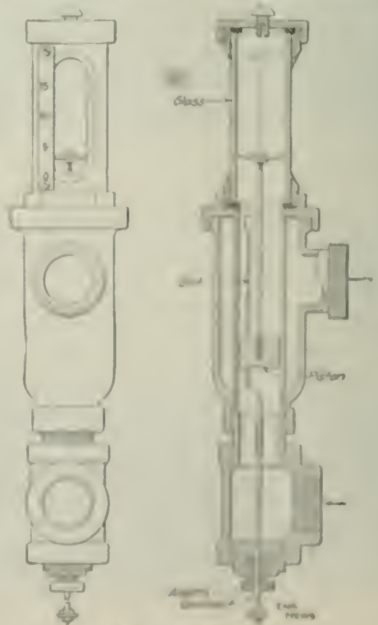
It should be noted, in addition to what the drawing shows, that two oil chambers run the full length of the main cylinder at two opposite points. These are formed in the body of the cylinder wall and are covered by the lining, but supply oil to the piston by means of a number of small oil holes through the lining. These oil chambers can be filled from the outside of the cylinder; they hold enough oil to last three or four days.

The pile cap forms an integral part of the hammer in this construction. An oak cushioning block is placed between the body of the cap and the plug or die. The latter projects into the end of the cylinder body and is held in a cross-slide in position to receive the blow of the hammer. The arrangement is fully explained by the drawing.

This new hammer was invented by J. E. Wilhelm, Cleveland, Ohio. It is being built by the Contractors Machinery Co., 2511 Elm St. N. W., Cleveland. The sizes which have been built up to the present include a 275-lb., a 500-lb. and a 1000-lb. hammer. A 5-ton hammer is now being built. The smaller hammers strike about 200 blows per minute, the large hammers probably 150 or more.

NOTES

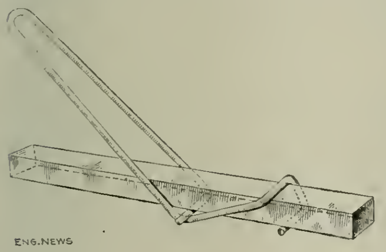
A Simple Flow Meter for indicating the flow of liquids in pipes has been designed and patented by J. F. Vaughan, of the Stone & Webster Engineering Corporation, Boston, Mass., which is applicable to a large number of piping systems, such



A SIMPLE FLOW METER

as cooling, heating, lubricating, refrigerating, boiler supply, etc. The instrument is very simple in theory and construction; it consists merely of a cylindrical chamber, with suitable pipe connections, enclosing a slotted tube with a sliding piston, on the top of which is a rod and scale indicator. When the liquid enters the lower orifice (see accompanying sketch) it enters the slotted tube through the bottom and pushes up the piston in proportion to the amount of flow, or until the orifice is large enough to allow all the flow to escape. Above the flow-measuring tube is a glass tube enclosing the piston rod with its indicator and a scale graduated to gallons per minute. An alarm system for calling attention to a stoppage or a fixed minimum of flow is provided by a brass rod set through a stuffing box at the bottom of the cylindrical chamber; on the descending piston coming in contact with the rod an electrical circuit with a lamp or bell is made. The contact rod may be adjusted to project any length into the chamber. The flow measured is proportional to the area of the slots in the cylindrical chamber, which in turn is proportional to the rise and fall of the piston. It is claimed by the makers that under test the indicator gives practically a straight line calibration over a large range, and the loss of head in operating the instrument has been found negligible, not exceeding 0.04 lb. per sq. in. with a capacity of 15 gal. per min. Screens may be used in connection with the meter, where the water or other liquid is dirty. The meter is easily cleaned by unscrewing the top and slipping out the slotted tube and glass. The Vaughan flow meter is made by W. & L. E. Gurley, Troy, N. Y., and is listed at $20 for 20-gal. capacity and $50 for 100-gal. capacity.

A New Stirrup for use in concrete reinforcement can be snapped onto the main bar very quickly and easily, and holds itself in place by a spring-friction grip. These results are secured by the peculiar bent shape of the lower end of the stirrup. The sketch explains it.



These stirrups are made (stock sizes) of ¼- and ⅜-in. round rod, in various lengths, and are intended to go on bars of ¾- to 1¼-in. size. The Diamond Expansion Bolt Co. (90 West St., New York), is the maker.

To place the stirrup on the bar, the forward hook end is slipped around the bar, and then the rear loop spread apart, dropped over the bar, and locked together again.

Breaking Up a Sunken Steel Barge—The drill barge "Teredo," a steel hull 112 ft. long, 36 ft. beam and 8 ft. deep, was sunk in the Culebra Cut on the Panama Canal by the disastrous explosion of July 20 (noted in Engineering News, July 23, 1914, p. 223). The barge was so damaged as to make impracticable its raising intact so it was broken to pieces under water and raised in sections. This breaking up was done by blowing apart the steel plates with dynamite placed in old fire hose, laid along the lines which it was intended to cut. The "Canal Record," July 29, 1914, states that by this method a clean cut was made in the plates and the sections easily lifted out.

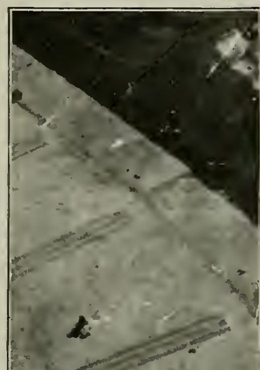
The Problem of Durable Bridge Flooring for Country Bridges—In very many cases the condition of bridges on state and county highways is not at all in keeping with the character of the highway. In the case of new construction, so far as possible, new bridges should be provided, which will be of a character corresponding to the highway improved. In cases where this is impossible existing plank floors should be replaced with some form of improved flooring, either concrete, if the structure is of sufficient strength to carry it, or creosoted blocks. This will in the end be found to be an economical measure as the increase in travel induced by the improvement to a highway subjects old bridges to an additional strain which many of them are not calculated to withstand. If such bridges were removed to some location where traffic is not so trying, and a modern bridge built at the point of improvement, both structures would last for many years.

The matter of providing satisfactory floors for those bridges which are not of sufficient strength to carry a concrete floor in addition to the live loads which they may be called on to carry, is a very serious problem. The annual cost of renewing ordinary plank floors is very great and is constantly increasing. Also it is yearly growing more and more difficult to get plank which will make a satisfactory floor. The loose, warped and twisted floors, which are getting to be so common, are a source of great annoyance to travelers and a big expense to the towns which have to maintain them. Treated wood blocks are recommended, for these may be used on many bridges whose strength will not permit the use of concrete, and when once properly laid are very nearly indestructible.

On those bridges where the cost of wood blocks is too great, a very satisfactory floor may be made by 2x4-in. scantling set on edge, spiked together one by one as they are laid, and finished with a surface coat of hot tar and sand, fine gravel or stone screenings. This makes a smooth, noiseless and durable floor and is very much cheaper than plank laid in the ordinary way. ["New York State Highway News," July, 1914.]

Orienting Oneself in the Heart of Boston—The accompanying picture is not a wall. It is a view of the sidewalk at the feet of the photographer. The sidewalk is at the corner of Hawley and Franklin St., in the city of Boston, Mass. The streets of Boston are said to follow the cowpaths of colonial days. Every uninitiated traveler in Boston believes this is true.

We don't know who is responsible for the brass marker shown in the sidewalk at the bottom of the accompanying illustration, but it is a pity the city government of Boston does not adopt the scheme generally, for even Bostonians are hazy on the points of the compass. The new Custom House tower, forming a conspicuous landmark, is said by natives to be in a different place on the horizon, when viewed from certain locations, than that which they would have naturally supposed.



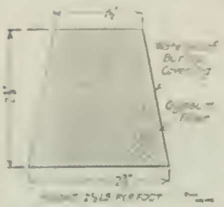
Brass Meridan in Sidewalk, Franklin and Hawley St., Boston, Mass.

The proper marking of street corners is a part of the municipal public work which is frequently overlooked. One fault to be found with Boston is that many street corners are not marked with the names of the streets, or at least there is no uniform method of posting signs. The design and erection of street sign posts, or sign and lamp posts combined, is a legitimate part of a city engineer's work, and is just as important to a well ordered city as clean streets.

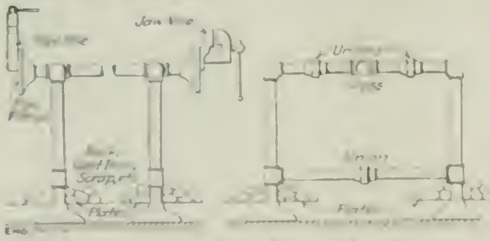
Pockets for Small Surveying Instruments — A correspondent, Frederick W. Salmon, of Birmingham, Ala., has found a convenient method of transporting various small instruments on surveying and other trips. These instruments include a watch with hand reading to ⅕ sec., for estimating distances by sound, flow of water, etc.; a passometer or pedometer, preferably the passometer; a pocket azimuth compass or pocket sextant with clinometer, for most pu-

posse the azimuth compass with a rifle to sight preferred, a pocket aneroid barometer compensated for temperature, a clinometer reading to 25 ft. and to $\frac{1}{10}$ in. on the measuring wheel, a 25-ft. steel tape in a leather box. To comfortably transport these six instruments Mr. Salmon has his pants made with six "watch pockets" below the belt line, three on each side of the center line. These pockets have flaps over them and buttons, to ensure that nothing will be lost from them in boating or riding horseback. By having the pockets made when the clothes are made there is no extra expense. The pockets are a little larger than the ordinary "watch pockets," about 3¼ to 4 in. wide at the mouth. Mr. Salmon finds that the instruments "ride better in this location than in vest and coat pockets."

A Composition Gypsum Nailing Strip or Floor Sleeper has recently been developed by the U. S. Gypsum Co., Chicago, Ill., to be used in place of the usual wooden nailing strip in concrete floors or walls. Timber embedded in concrete is very apt to decay in a short time or at least to swell when damp, and thus crack the concrete. The composition material should be free from both of these defects. The "nailing screeds" as they are called, are made in standard 6- and 8-ft. lengths of the section shown herewith. The material is a compound of gypsum and sawdust sheathed with a heavy burlap fabric. Each section is molded under pressure, and, after the filler has set, is kiln-dried, waterproofed, and cut to length. The material takes and holds nails.



A Convenient Portable Pipe-Fitting Bench which can be quickly knocked down or set up by unscrewing or screwing six unions is illustrated by the accompanying cut, sketched by a reader from a bench in actual use, but improved by him in a few details. The legs are loaded with heavy rock or this device for stream-gaging, while in the Albany office of the U. S. Geological Survey. He claims it to be especially useful in gaging streams which have wide daily fluctuations, using material as shown to make the bench firm. The dismantled bench occupies but little space. Boards can be placed lengthwise on the top of the bench, making it adaptable to many uses.



COLLAPSIBLE PIPE-FITTERS' BENCH

Efficiency Chart of Car-Loading Gang—With the accompanying chart, the efficiency of a car-loading or unloading gang can readily be estimated by the foreman, when the cost of the day's operation and the number of cubic yards handled are known. Efficiency in the following three operations can be computed: (1) unloading cinders, (2) loading rock ballast, (3) right-of-way ditching. As an example, suppose a certain day's expense was \$60 and the quantity of ditching handled 400 cu.yd. From the figure 60 on the abscissas, rise vertically to the intersection with the diagonal 400-cu.yd. line, move horizontally to the center line of unit cost, finally (still horizontally to the right) to the vertical line representing the operation performed, at which point the efficiency is indicated by the intersecting diagonal. In the case considered, the unit cost was 15c. and the efficiency 76%. The standard basis of ditching right of way is 11½c. per cu.yd.

This chart was prepared by H. A. Lloyd, Erie R.R., Jersey City, N. J., and published in the "Bulletin" of the American Hoist & Derrick Co.

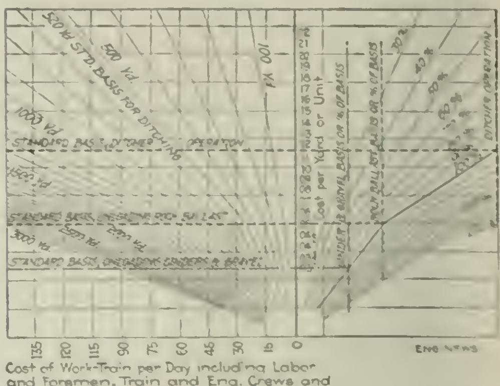


CHART COMPARING STANDARD BASIS WITH WORK-TRAIN OPERATION

Lighting a Dam at Night—The accompanying figure shows the artificial illumination provided at the new Coon Rapids Dam of the Northern Mississippi River Power Co., some six miles above Minneapolis. The structure is 2470 ft. long and has a 1000-ft. spillway surmounted by a footbridge on piers and 78 Tainter gates, 32x8 ft. A line of 100-watt tungsten lamps has been placed on goose-neck standards, one at each gate stand, to expedite foot passage and to facilitate, in dark hours, the work of handling the gates and clearing away ice and logs in some seasons. The Coon Rapids development was described in "Engineering News," July 16, 1914, and a daylight view was shown of the dam.

NIGHT LIGHTING OF DAM ON MISSISSIPPI RIVER AT COON RAPIDS

Editorials

The editorial and publication offices of Engineering News were moved on Sept. 1 to the recently completed Hill Building, at the northwest corner of 36th St. and Tenth Ave., in New York City. The building, which has been especially designed in its structure and equipment for the use of the Hill Publishing Company, is easily accessible from any part of the city by transfer to the westbound 34th St. cross-town surface cars, which pass the building. The editors of Engineering News will be glad to see any of their friends at their new home.

Five Successive Bridges on One Site

The article in this issue on the Farmville Bridge of the Norfolk & Western Ry. is of especial interest to the bridge engineer because the five successive structures which have been erected on this site since 1853 typify to a fair degree probably the changes in bridge engineering practice which have taken place within the memory of engineers still living and in active practice. The original wooden structure, at the time claimed to be, combining length and height together, the greatest bridge in the world, cost only $167,500, or about $50 per lin.ft., of which probably two-thirds was the cost of the brick piers.

It is noteworthy that this wooden structure was in service for 17 years, a longer life than any of the structures which have succeeded it.

The Fink trusses of 1870 were replaced in 1886; but curiously enough the structure of 1886 weighed less per lineal foot than the structure it replaced, though it was supposed to carry nearly twice as heavy a rolling load. Those were the days when bridge builders and designers were exercising ingenuity in saving metal. It is noteworthy that the 1886 structure required strengthening at the end of fifteen years, as did a good share of the bridges built about that time.

Direct comparison of the weight of the early bridges with the present structure cannot be made since the early bridges were trusses resting on brick piers, while the structure just completed is a steel viaduct. It is at least interesting to note, however, that while the 1886 bridge weighed only 540 lb. per lin.ft., the new steel viaduct weighs 2900 lb.

A Record Penetration for Concrete Piles

A few months ago, we called attention in these clounms to the extreme length to which it is possible to cast reinforced-concrete piles, citing then the new docks at Havana and at Halifax, at each of which piles nearly 80 ft. in length were uniformly used. In both of these structures, however, as in most places where such extreme pile lengths are used, the piles were driven in deep water, so that nearly half the pile is above ground. While this condition increases the strength requirements of the driven pile, because of the necessity of designing for the unrestrained column, at the same time the shattering action of driving the entire 80-ft. length is avoided. In the abutment piles of the Farmville High Bridge, which are described on page 522 of this issue, the condition is reversed, and the entire 60-ft. reinforced-concrete pile is driven through an old fill, which makes extremely hard driving.

So far as our records and recollection go, these piles are the longest reinforced-concrete piles ever driven for their full length through ground. Testimony of the engineer in charge that the average penetration throughout the whole length was only 3/4 in. per blow, and that the final penetration was from 1-30 to 1-40 of an inch, is sufficient evidence of the solidity of the old fill. That the piles stood up under such battering does great credit to their design and construction and incidentally is a testimonial as to the strength of the reinforced-concrete precast pile in general.

Lessons from Some Field Tests of Concrete

It must be that a number of government and private corporations engaged in concrete work are now making consistent and regular field tests on concrete, but very few of such tests have been reported. The scarcity of figures of this sort makes all the more interesting the table given by E. F. Wallace of the City Engineer's Department at Kansas City, Mo., in his article on another page in this issue on field tests of concrete for municipal work at Kansas City. At the same time the figures provoke certain thoughts regarding the application of such tests to the concrete designer's art.

We believe that the argument in favor of field tests is that it brings to the testing machine the precise material about which information is desired. A laboratory-made concrete (or even field-made concrete for laboratory purposes) must necessarily be of a higher grade than that made by the workman without any idea on his part that it is to be used for a test. In spite of this obvious fact, the lessons learned from any field test have more of an indirect effect on concrete making generally than a direct effect on the structure under test because, under present conditions, by the time the results of the tests are known, it is too late to change or remove any concrete that may fall below specification.

Suppose, for instance, at the end of 28 days, the blocks taken from a certain structure may test in compression only 650 lb. per sq.in., as with a number of the blocks in Mr. Wallace's table. By that time it is quite possible, in fact it is very probable under the usual methods of construction, that the particular concrete from which the sample was taken would be sustaining a load fully equal to the load for which it was designed under an ordinary specification unit stress of, say, 650 lb. per sq.in. What can the designer or the constructor do? By this time this concrete is buried far down in the structure or is at least so far back in the structural process as to make its

proved extremely difficult if not impossible. The sole advantage gained from the test is an indication to the engineers that either such concrete should be designed for unit stresses much lower than those used or that, in future, measures should be taken to use different methods or materials in making concrete. A byproduct of the test will be the serious concern that the designing engineer ever after has for the safety of this particular structure.

An especial instance of the fallacy of this kind of testing comes to mind in the recollection of the design of a monster concrete bridge which some years ago was widely advertised as projected in New York City. This bridge was to be designed under the assumption that the concrete in it would stand at the end of thirty days a unit stress of 3000 lb. per sq.in. in compression. At the time of this announcement, we were curious to know what the engineers would do if at the end of 30 days they found that certain concrete in the middle rib of this bridge, for instance, had stood only 2000 lb. per sq.in. Would they have torn out the whole arch-rib until they reached this particular concrete, or would they have posted notices on the finished structure stating that only two-thirds of the designed load was allowed to cross the bridge? Obviously, to make field tests of maximum utility, some very accelerated test must be devised.

A second and possibly more important feature of Mr. Wallace's test is the extremely low value that the field concrete attained. It is quite common to assume that 1 : 2 : 4 concrete at the end of 30 days is good for 2000 lb. per sq.in. in compression. On the basis of this assumption the unit compressive stress in concrete has been consistently boosted through the past ten years from 300 lb. per sq.in. to 650 and in some cases to 800 lb. per sq.in., and it is within our knowledge that certain enthusiastic supporters even claim 1000 lb. per sq.in. is not excessive. In contradiction to this, our readers will remember that W. A. Aiken, an experienced concrete tester, stated, at the recent meeting of the American Society for Testing Materials, that the crushing strength of broken stone or gravel concrete made up under ordinary field conditions will not average over 1500 lb. per sq.in. at the age of 30 days.

The Kansas City test, however, on actually made concrete shows that even this figure is high, for the 1 : 2 : 4 concretes in the table run from 403 lb. to 1657 lb., with an average of 954 lb. per sq.in. at the end of 28 days and even at the end of a half year only two out of the lot reached a higher value than 2000 lb. per sq.in. With the somewhat leaner mixtures, which were quite probably as rich as much nominal 1 : 2 : 4 concrete, the unit stresses are very much lower.

Should not such figures serve to indicate to concrete designers that the time has almost come when unit stress in concrete cannot be boosted much higher? The Kansas City concrete was practically all made for structures where great strength is not particularly necessary and undoubtedly on this account the construction and the inspection dropped below what it would have been in a high-class structure, but the remarkably low figures obtained and the perfectly obvious lack of uniformity in the strength obtained from the different takings from the same batch should at least give pause to the builder of designers and building-code makers. Field concrete is not laboratory concrete, and ordinary field concrete is not even comparable to carefully made field concrete. The adoption of a high unit stress predicates the utmost care in the supervision of the concrete making and placing.

The Business Situation and the Outlook

For a month past two subjects have absorbed the public interest almost to the exclusion of all others. The first is, of course, the gigantic struggle now in progress in Europe. The second is the effects of that conflict upon the United States. Great as is the interest felt here in the daily reports from the vast battlefields of Europe, the people of this country are most concerned with the effects of the war which they themselves experience. And the most important of these effects is not the great increase in the cost of living, due to the rise in price of all food products, heavy though the burden that brings upon all classes, from richest to poorest. More serious than this is the widespread paralysis of business, taking away employment and the means of subsistence from hundreds of thousands, and this at the very time when their small savings are most rapidly used up by the high cost of the necessaries of life.

There is probably no industry which is more severely affected by the present financial paralysis than the business carried on by engineers and contractors. Construction work on new enterprises either for corporations or cities is almost invariably carried on by borrowed money, hence cutting off the supply of funds puts an immediate stop to new work.

It is a question of greatest interest, therefore, how long before the financial machinery of the world will be again set in motion. By what means and from what source can money again be obtained to finance the important construction work now suspended all over the country?

There can be no doubt, as we pointed out in these columns a month ago, that higher rates for investment capital is one of the certainties of the future. While the war continues, those European countries which have been the chief reservoir for investment capital to supply the rest of the world, will require all the capital their people can furnish to take care of their war expenditures. When the war ends, Germany and France and England will need vast amounts of capital to make good the destruction wrought by the war and to rehabilitate their industries.

The investors of the United States, therefore, are the chief source to which borrowers must resort for a long time to come, not alone to carry on work in the United States itself, but in South America and Africa and Asia and Australia as well.

For the moment, it is true, investment business in the United States is almost at a standstill, due first to the stoppage of a large part of our important financial machinery, such as the stock exchanges, but also to the general lack of public confidence. And the last cause is as important as the first. Until the public realize that this vast war catastrophe, after all, affects only a small part of the world's inhabitants, and that the great mass of its people are going on as before, producing and selling and buying, furnishing a vast market for food, and clothing and manufactured goods—in short, until the public realizes that this great world calamity, with all its evils

and losses will also furnish great commercial opportunities to the United States, public confidence here will not be fully reëstablished.

On the other hand, when this happens—when the dam that now holds back industry is broken, a flood of phenomenal business activity may follow. It was so during our own Civil War. Vast though the destruction and disaster that then went on within our own borders, the paralysis of business at the outbreak of the war was followed by a business boom that made great profits for factories throughout the North.

The foundation conditions now exist that may bring about such a wave of business activity. The nations of Europe are eager to obtain the food products of North and South America, which are as necessary to their military operations as arms and ammunition; the price is a secondary consideration. This means hundreds of millions of dollars additional profits to the farmers of the United States and to the ranchers of Argentine. Merchants in Asia and Africa and South America are already seeking to purchase in the United States, the cloth and hardware and other merchandise which they are unable to obtain from Europe. Here again prices will be fixed on a more liberal scale than they have been under the stress of international competition. They will doubtless have to because the higher cost of living will sooner or later make necessary an increase in the wage scale.

And at no time in our history have the possibilities of raising in the United States a vast amount of capital for investment been anything like so favorable as today. A quarter century ago, an enormous amount of Eastern capital was pouring into the states from the Mississippi River to the Pacific to transform a region still virgin into farms and towns and cities. That region is now itself wealthy and is not only furnishing to a large extent the capital required for its own further development, but is buying bonds and stocks issued elsewhere.

As our own construction news columns show, engineering work in the United States is not by any means at a standstill, notwithstanding the European war. Cities are going ahead with necessary extensions of sewerage and water-supply and street-paving systems. States are proceeding with highway improvement. In general, the financing of these works just now is being taken care of directly in the locality affected. Trust companies or savings banks or the city's sinking-fund commission take the bonds, where bonds are issued, or the work is carried on by the proceeds of a tax levy or from assessments on the property benefited.

There is no doubt that the financing of such work could proceed on a much larger scale were only the financial exchanges open so that a price for investment securities might be established. At present investors are loth to purchase stocks or bonds lest they use up their available capital and find themselves unable to purchase if some more favorable opportunity is offered when business on the Exchanges is resumed.

The volume of investments could also greatly increased, it is probable, were better means adopted to reach the small investor. During the Civil War, the firm of Jay Cooke & Co. accomplished wonderful results in raising capital for the Government's necessities by popularizing the sale of Government bonds. In the Spanish-American War of 1898, the Government's offer of a 3% loan directly to the public met with an amazing response.

It must not be overlooked, either, that the ruling rate for capital has an important influence upon the amount of capital which can be obtained. Let safe bonds at six per cent. or seven per cent. be open to public subscription, and large amounts of money will be saved and invested which would be spent if the only return offered were the two per cent. of the Post Office savings banks or the four per cent. of the ordinary savings bank.

Prior to the outbreak of the war, a considerable amount of public service bonds bearing a 6% interest rate were being offered. It does not seem unreasonable to expect, therefore, that many concerns may find it now necessary to pay 7% to float bonds and doubtless an even higher rate on short-term loans.

Of course, such a high rate for capital greatly limits the field in which it can be profitably used. It also operates to materially alter the character of engineering design. The engineer to meet present conditions must solve the problem of accomplishing a desired result at the least outlay, even if he considerably increases the cost of maintenance thereby. He will probably have to cope also with high prices of labor, for the advance in the price of foods and the cost of living will inevitably tend to raise wage scales or at least prevent a reduction.

This is in fact a return to the economic conditions which existed in the '70's and early '80's, and the methods used by engineers then will have to be copied by the engineers of today. Fortunately the principal engineering materials, steel, cement, lumber, brick and stone, are not likely to have their cost increased to anything like the figure prevailing forty years or more ago. An exception might be made in the case of lumber; yet at present the stoppage of building work has made lumber more of a drug in the market than it has been for a score of years; and cargoes from the North Pacific coast through the Panama Canal to Atlantic coast markets are likely to keep down lumber prices to a moderate level for many years to come.

There will, therefore, be no need to go so far in economizing material in designing as the engineer of forty years ago went; and the development of labor-saving machinery since that time should enable the engineer nowadays to do far better work at a low labor cost than was possible then.

As to the question when it will be safe to again set in motion the financial machinery of the country, it would be difficult to prophesy. It is evident, however, that the first essential is the restoration of public confidence. With that accomplished, bankers and investors will release funds, which they are now carefully guarding for that the first essential is the restoration of public confiuse in possible emergencies.

Buying and selling of securities are in fact being carried on to a greater or less extent by private arrangement in the manner customary before exchanges were established, but of course, at far greater cost and trouble to both buyer and seller. It may safely be asserted, however, that the stock and other exchanges will be reopened just as soon as restoration of business confidence has proceeded to such an extent as to make reopening safe. Those who are responsible for the operation of these exchanges are themselves suffering such heavy financial loss through the closure of the exchanges that they are certain not to postpone reopening a single day beyond the period absolutely necessary.

Letters to the Editor

On the Necessity of Heavier Pavement Foundations

Sir—"The proof of the pudding is in the eating." On this basis, I beg to radically differ from your correspondent who on page 367 of your issue of Aug. 13, makes these statements:

(1) Four- and five-inch foundations are entirely inadequate.
(2) Municipal engineers are extremely shortsighted in continuing to recommend 6 in. as the maximum thickness.
(3) Eight inches on residence streets and 10 and 12 in. on business streets should be required.

Your correspondent's position seems to be based on:

(a) Observation of poor concrete, particularly that made of natural cement, which is no criterion for requirements of sound portland cement concrete.

(b) A statement that we must build for the future and that, as traffic increases, heavier foundations will be required than may be sufficient at the present time. In this he seems to overlook the immense crushing strength of a slab of good sound portland cement concrete having a depth of 4 in. That crushing strength is very much greater than the weight of any load which is likely to ever pass over any road surface, even though the stress on the concrete were not, as it is, very greatly relieved by the wearing surface, say 2 to 6 in. deep, depending on the character of the wearing surface.

In a paper before the American Society of Municipal Improvements at its 1909 Convention at Little Rock, on the subject of "Paving Practice with Respect to Crowns of Roadway Pavements and Concrete Foundations," the writer made the statement that, "under ordinary conditions of well rolled subsoil, 4 in. of first-class portland cement concrete is as good for a pavement foundation as 1 ft., provided the concrete is not disturbed after it is put in place until thoroughly set," and he referred to a then two-year experience as follows:

In the year 1907 the company with which the writer is connected had a contract for laying "Bitulithic" pavement on several streets, aggregating about 36,000 sq.yd. The specifications provided for foundations of rolled broken stone, grouted with bitumen.

On grading the street, a very weak clay subsoil and many recently filled trenches [illegible], on account of which the city officials permitted a change to 4 in. of portland cement concrete. Before the surface was laid on the concrete, [illegible] to be otherwise disturbed. It had become thoroughly set, and such that the wagons drawn by horses could travel through it. The 17-ton 3-wheel road roller used in consolidating the bituminous surface made no depression in the foundation.

Two years later the writer examined the streets and found them all in perfect condition, with the exception that some points over some trenches had settled. As a whole, would 8 in. of concrete have been practically any better than the 4 in. used?

But some engineers will say 4 in. of concrete is not sufficient over newly filled trenches, to which the answer is, neither is 6 in. nor 8 in., and the remedy for such cases is properly backfill trenches and as an additional precaution, provide an extra 6 in. or even a foot of concrete over and extending a few inches beyond the trench. In other words, put extra concrete where it is needed, i.e., over the trench, and don't use several times as much extra concrete over the entire street, on probably nine-tenths of which it is not required.

Based on a wide experience during the intervening five years, he has seen nothing to shake the correctness of his opinion expressed in that paper. The writer goes so far as to say, without fear of contradictory proof, that if a 4-in. portland cement concrete base has failed anywhere, it is due to one of the following causes, none of which are such as to make the general adoption of that depth of concrete undesirable.

(1) An unusually insecure subsoil which is seldom met and which should have been specifically considered by the engineer while making his plans and specifications or while the work was in progress.

(2) Poorly backfilled trenches which should have been guarded against, as they developed in rolling the subgrade, not by placing an inch or two of extra concrete over the whole street where it is not needed, but by perhaps an additional 6 to 12 in. over the weak trenches and extending 6 in. outside the trench on either side. This treatment not only provides a slab of concrete 10 to 16 in. deep, resting on solid earth on either side of the trench, which would probably successfully bridge over the trench and overcome any subsequent settlement, but would generally accomplish that essential end by the use of much less extra concrete than an extra inch or two over the whole street, which would not accomplish the desired end.

(3) Weak street railroad construction, the vibration of which naturally tends to shatter the pavement for a considerable width beyond the ends of the ties. For use with modern heavy interurban and other cars, the concrete from end to end of ties should extend from 6 in. below the bottom of ties to the bottom of the wearing surface, providing, say 18 in. of solid concrete in the railroad area. Then if a heavy rail and closely spaced heavy ties are used, there will be practically no vibration of the track and no damage to the surrounding pavement. If, however, the width between tracks and curb is less than say 16 ft., it is a wise precaution to provide 6 in. concrete for the pavement foundation outside of the railroad area.

(4) Poor concrete, perhaps the most fruitful cause of which is the laying of the pavement surface before the concrete is *thoroughly set*. Under ordinary conditions, I would rather guarantee a pavement surface laid on 4 in. of well set concrete than on 6 or even 8 in. of concrete as green as that which the public, and often engineers who should know better, demand, or the contractors want to cover, so as to get the street "finished."

While urging greater intelligent economy than is perhaps generally practiced in the laying of concrete pavement foundations, the writer deprecates the quite general, and he believes unwise, tendency toward laying thinner wearing surfaces in order to reduce the first cost. The only office of the foundation is to prevent either settlement, vibration or shattering of the foundation by the stress of vehicles passing over the pavement surface. It

has been proved that under ordinary circumstances, that result can be accomplished by either a 4-in. continuous slab of good sound portland cement concrete or by a sound macadam foundation. It is also well known that good portland cement concrete sets harder and harder with age, and I believe the increased stress of increased traffic is nearly nil.

The wearing surface, on the other hand, takes the wear, and, whatever the character of surface, more or less abrasion exists; and it rapidly increases with increased volume of traffic. When any given pavement surface is worn to less than a certain depth the surface is then too thin to sustain the weight and other conditions of traffic.

The difference in labor cost and general expense items connected with the laying of any wearing surface to a depth say one inch more or less than any given standard, is very slight, so that practically the only difference in cost is that of the surface materials.

Against this is what may be termed the "factor of wear" in connection with a greater or less depth of wearing surface. Suppose for instance, that any given wearing surface will not sustain the weight of traffic after its depth is reduced to say 1 in., then if the surface as originally laid has a depth of 2 in., the "factor of wear" is 1 in. If, however, the same character of surface is originally laid to a depth of say 1½ in., then the "factor of wear" is reduced to ½ in.—a decrease in durability of 50% in order to effect a saving in first cost of possibly 20%.

In the case of monolithic bituminous surfaces another point should be considered; to wit, that if the depth of wearing surface as laid is materially more than 2 in. after compression, there is grave danger of not getting perfect compression and the danger from that point outweighs the advantage of increased depth.

In conclusion, in the writer's judgment, true economy demands:

(1) Provide a solid foundation, but not to an unnecessary depth.

(2) Don't "skimp" in depth or in the quality of wearing surface in order to reduce the first cost. This in the end will prove to be poor economy even though the first cost is reduced.

GEO. C. WARREN.

50 Temple Place, Boston, Mass.

Boat-Design Difficulties on the New York State Barge Canal

Sir: In your issue of Aug. 27, 1914, p. 469, under the caption "Type of Boats for the New York State Barge Canal," you reprint an official statement on this subject emanating from State Engineer and Surveyor John A. Bensel. No one will question Mr. Bensel's authority on all subjects dealing with the design and construction of the canal, but when he trenches on the province of the naval architect, he shows himself rather "at sea," as one might expect. I particularly object to his statement:

> The shipbuilders have found it impracticable to design a steamer that will satisfy the requirements of the Federal Government for steam craft navigating the Great Lakes and also to keep within the limitations imposed by the Barge Canal, such as restricted clearance of 15½ ft. under bridges and other fixed structures, at high navigable stage, the narrow width of 75 ft. in land sections and shallow depth of 12 ft.

At this stage the shipbuilder and naval architect will want to ask why, if it appeared desirable to the Canal Board that the vessels trading through the canal should also traverse the Great Lakes, were these vexatious limitations Mr. Bensel refers to allowed to be imposed in the construction of the canal.

It is surely self-evident that the New York State Barge Canal must compete with the St. Lawrence system of canals which connect the Great Lakes with the head of ocean navigation at Montreal and must always be handicapped by the fact that the St. Lawrence route does permit of the passage of a combined lake and canal freighter.

The St. Lawrence Canal Locks, in fact, permit vessels of 250-ft. length by 43-ft. beam by 14-ft. draft to pass through, a size of vessel that can go anywhere on any sea in the world and though, owing to rather special construction and peculiar conditions in Canadian navigation, these vessels do not, as a rule, leave Canadian waters, they do trade on the Atlantic coast and go to Europe occasionally and have no difficulty in going anywhere. Now the really extraordinary thing is that if the new Barge Canal locks are only 14 ft. deep, they could take much larger vessels than the Canadian locks, say 300-ft. length by 44-ft. beam easily, which, at the 14-ft. draft of Canadian Canal, would carry over 3000 tons dead weight and could steam all over the Great Lakes and, in fact, all over the globe. In spite of this, by some extraordinary oversight, the bridges on the New York State Barge Canal give a clearance of only 15½ ft., a perfectly absurd dimension for any suitable type of craft with sea-going features, and the earth sections with a bottom width of 75 ft. are equally unsuitable for this ideal ship for which the canal ought to have been designed.

It is quite evident from his other remarks on the best types for use in the New York State Barge Canal that Mr. Bensel does not realize what happens when you attempt to canal a vessel 250 ft. by 40 ft. beam through a section of 75-ft. width with curves the same width as the tangents. A little experience in this line will show that in the least cross wind the vessel, possibly running light, will never be off one bank or the other, that two boats will inevitably collide when attempting to pass, and that to tie one or other of them up to allow the other to pass is to reduce the capacity of the canal to a very serious extent.

It has always seemed extraordinary to naval architects and shipbuilders who have looked into this thing that not the slightest attempt seems to have been made in designing the canal, to decide beforehand what types of boats would be the most suitable and the most likely to be built for use thereon.

Mr. Bensel refers to a solution of this problem by using strings of large steel barges, small tugs being used in the canal and large tugs out on the Great Lakes. It would be interesting to have Mr. Bensel state in what way barges for Great Lake work do not suffer from the restrictions which he states preclude the possibility of shipbuilders producing a combination steamer for canal and Lake work.

The fact is that long experience with the design and operation of Canadian vessels for use in the St. Lawrence Canal and Great Lakes trade have convinced Canadian owners that the tow barge in any form is a failure when competing with the full-sized, full-powered cargo boat

FIGS. 1 AND 2. SHELTER SHEDS ON QUEENSLAND RAILWAYS, AUSTRALIA, OF UNIT SYSTEM REINFORCED CONCRETE

that can take care of herself under all circumstances. This refers to vessels for the handling of the great staple cargoes of grain, coal, pulpwood, package freight and similar cargoes which will constitute the principal traffic for the New York State Canal. In my opinion the only solution now left to the naval architect under the extraordinary conditions imposed upon him is to devise a steel hull with fair shipshape form, large rudder, and biggest possible engine and propeller which will travel absolutely independently, be able to negotiate all bends without touching the banks or tying up, and be seaworthy enough to go round from port to port on Lakes Erie and Ontario without running the risk of disaster. It can be done, but the dimensions will be very far short of anything which Mr. Bonner has indicated, and very inferior in size and capacity to the competing Canadian canal types, and for that most unfortunate handicap the users of the New York State Barge Canal will have to hold the naval architect and the shipbuilder free from blame.

JOHN REID.

17 Battery Pl., New York City, Aug. 28, 1914.

Reinforced-Concrete Shelter Sheds on an Australian Railway

Sir—I was much interested in reading the article on p. 737, of the issue of Apr. 2, 1914, of ENGINEERING NEWS, describing the adoption of reinforced concrete for construction of shelter sheds. A similar method of construction was adopted by the Railway Department of Queensland, Australia, four or five years ago, and I give herewith views of our buildings, thinking they may be of interest.

Upon the report being made by the Engineer for Construction of the great expenditure involved in the maintenance branch of the railway for the upkeep of the wooden structures used for shelter-shed accommodation, and with a desire for a more economical method of construction, it was decided to erect in place of the wooden buildings, reinforced-concrete structures.

Upon such a decision being made, designs were prepared on the unit system with a view to facilitating erection and carrying out extensions in the quickest manner with a minimum of labor.

A general description of the method adopted, together with the accompanying view, will readily convey to the professional mind the general principles thereof.

Piers or dwarf walls are erected under the building for the reception of the superstructure, according to the requirements of the site. Beams reinforced with ½-in. rods are then placed in position. These piers are holed to receive the reinforced verticals of the side and end wall. The verticals are rebated on each side for the reception of 4-ft. by 2x18-in. wall slabs, rough cast on the outside, reinforced with netting, the reinforcing rod at the top of the vertical being extended to such length as required to receive the wooden plate placed for the reception of the rafters of the roof, and the rods at the

bottom of the vertical being bedded in the floor beams.

The floor is of concrete 4 in. thick, reinforced with rods as required, and made in 4-ft. squares. The roof is constructed of wood and covered with tile, giving the building a neat and serviceable appearance.

The cost does not exceed that of a wooden structure of corresponding size.

The unit adopted is 4 ft. for all work, that length being a measure common to all designs in our country stations. By this means additions to or deductions from can be easily effected.

R. E. SEXTON,
Engineer in Charge of Construction, Queensland Railways.

Brisbane, Queensland. June 8. 1914.

NOTES AND QUERIES

In "Engineering News," July 9, 1914, p. 72, it was stated that the puddle core wall of the Throttle dam in Raton, N. M., was faced with No. 12 gage corrugated galvanized "Ingot Iron." We have since learned that what was used was No. 20 gage corrugated painted "Ingot Iron."

Locomotive Cab Signals and Audible Track Signals in Europe

Cab signals (audible or visual) on locomotives, as auxiliary to fixed signals beside the track, have been tried only to a limited extent in this country, but have been applied extensively in Europe for the past 40 or 50 years. At the meeting of the Institution of Mechanical Engineers, of Great Britain, at Paris, in July, papers were read describing the use of cab signals on five French railways. In all cases the contact is made by a wire brush on the engine on a contact bar placed between and parallel with the rail. From the papers noted above we have compiled the following particulars as to practice on French railways.

NORTHERN RAILWAY—This road has used such signals for some 40 years. With the present equipment the contact bar or track device is set either opposite the signal or at a distance which may be as much as 650 ft. It is an oak beam 4 in. thick, 6 in. wide, and 6½ ft. long, the wood being boiled in oil for insulating and preservative purposes. It is supported on iron blocks, with its top 9½ in. above the ties and about 4 in. above the rails. The entering end is beveled off, and is protected against hanging parts on the trains by a timber 5 ft. long placed in advance of it and having its top inclined. Where trains pass at speeds of over 30 m.p.h. a second contact bar is placed against the end of the first one to insure sufficient duration of contact. The wooden bar is faced with a brass plate (on wood or porcelain washers), having riveted to the underside a square copper block which is connected to the battery wire.

The contact brush on the engine consists of a series of hard but elastic copper wires soldered to a metal plate. From this a cable leads to the electro-magnet operating the cab whistle, while the other wire from the electro-magnet is grounded through the wheels and rails. The warning apparatus has a whistle with a lever which carries a plunger valve, working in a tube connecting the whistle with the boiler or a compressed-air chamber. The lever is pulled down by a rod having a heavy spring which tends to hold the valve open, but this rod is held up normally by its lower end resting on the arm of an electro-magnet. When a current is sent through the coils of this, the magnet ceases to attract the armature, so that the arm drops and the lever is pulled down by the spring, opening the valve and causing the whistle to sound until the engineman restores the apparatus to normal position by pressing a lever.

The signal is a disk on a tall rod, which revolves on its vertical axis, and the disk has a switch operated by a finger keyed to the post which supports the rod. When the disk has revolved 70° from the "clear" position the switch makes the circuit with the track contact mechanism. The same switch operates a bell at the station to indicate the position of the signal. For the track contact there is a 12-cell battery, with its positive pole connected to the brass contact plate and its negative connected to the switch. For the station bell there is an eight-cell battery, both batteries being placed in a small concrete chamber at the foot of the signal post.

In connection with the device described there is an indicator giving visual and audible warning at the station and signal cabin when a train passes the distant signal. This has two track contacts, the first sounding the cab whistle and the second sounding a bell at the station or signal cabin; this operates for every train (or engine), regardless of the position of the signal. The apparatus in the signal cabin is a vibrating bell and a miniature blade or disk.

EASTERN RAILWAY—The system is in general similar to that of the Northern Ry., but two track contacts are used, one near the signal and the other at a distance which may be as great as 1300 ft., so that if the signal is at "stop" the engineman has an advance warning and then a second warning at the signal. The wood bar, however, has been replaced on this road by a "gridiron" of steel bars or angles, in order to eliminate contact failures due to frost.

Controlling apparatus (for which various devices have been tried) is used to prevent the engineman from shutting off the sound too quickly. In addition to this, the operation of the cab signal is recorded automatically on the continuous chart of the speed recorder, with which French locomotives are commonly equipped. The apparatus sounds a bell when the engine passes a "clear" signal, thus giving the engineman a positive indication for either position of the signal.

SOUTHERN RAILWAY—The track contact apparatus is about 12 ft. long, and the battery is on the engine instead of on the ground. A steam whistle is used, and there is both warning and recording apparatus. When an engineman sees a "stop" signal, he shifts the handle of the control apparatus and thus causes a mark to be made on the speed-indicator chart, the mark showing whether or not he has operated the device in proper time. On reading the signal, the brush on the engine makes contact with the track device, and the circuit is closed, the current operating the valve of the whistle device and two special pens in the speed indicator. The engineman can shut off the whistle device by closing the valve. This road has 20 locomotives and 30 automatic signals equipped in this way.

STATE RAILWAYS—Four cab-signal devices are being tried on this system: The Cousin (55 engines), the Van Braan (28), the Eastern Ry. (27), and the Augereau (2 engines).

PARIS, LYONS & MEDITERRANEAN RY.—This road is making experiments with 140 engines on 258 miles of line having 316 disk signals. Electricity is used only to close the circuit, all operations being done mechanically. There is an automatic device for releasing the horn and discharging compressed air through it, and another device for marking the speed-indicator chart. On engines having air brakes, the air is taken from the brake receiver; otherwise a charged receiver is placed on the engine.

PARIS & ORLEANS RY.—For over 50 years this road has employed apparatus for placing torpedoes and giving an audible signal besides the track instead of in the cab. The torpedoes are placed when the signal is set at the "stop" position, and severe punishment is prescribed for men who pass a "stop" signal. The signal is set at such a distance from the point to be protected as to enable a train to be stopped before reaching it, even if the engineman does not shut off steam and apply the brakes until he hears the torpedoes. The sound is loud enough to be heard by the trainmen and passengers. The system is considered by Mr. Solacroup (Superintendent of Motive Power) to be preferable to a cab signal, and the value of its moral effect is seen in the fact that there is no record of any accident having occurred due to a train running past a "stop" signal.

A Machine Plowing Record is reported from Fremont, Neb., where a gasoline engine "caterpillar" traction engine pulled a gang of 24 plows and turned 28 ft. wide, 7 to 8 in. deep, at 2⅛ miles per hour, equivalent to about 7¼ acres per hour. The tractor was a Holt type, with six 7¼x8-in. cylinders, developing 130 b.hp.; the caterpillar track consisted of an endless chain of treads on each side, 2 ft. wide and 10 ft. in circumference. The plow was made up of four six-base Oliver units handled with one hitch.

Putting a Concrete Lining, Later a New Skin, on an Old Hull

By Horace M. [illegible]*

The general deterioration of the steel hull of a steam launch after 14 years' service, demanded unusual methods to save the boat. The first protective measure was to line the hull with cinder concrete reinforced with chicken wire. This served for several years when the shell was so thin that it was feared the concrete would drop out. A new steel skin was then put on.

The hull was 65½ ft. long, 10½-ft. beam, and was 4 ft. deep amidships; the plating was of soft steel, 11¼ lb. per sq.ft. The draft was 20 to 24 in., according to load, and the wheel 36 in. in diameter. The wheel revolves in a tunnel, and when the boat is not under way only about two-thirds is below the water line; but it is submerged while running, the water rises and fills the tunnel.

The boat was originally driven by a triple-expansion direct-connected steam engine, which developed 90 to 100 hp. at 300 r.p.m., and attained a speed of 13.6 mi. per hr. in still water. Later a quadruple-expansion condensing engine was installed, which, though it developed 135 hp., increased the speed only to about 15 mi. per hr. At [illegible] hp., the speed was 17½ mi. per hr.

The boat was built in 1887 at a cost of $10,000 and purchased by the United States government in 1902 for half that amount, for purposes of inspection and light towing on shallow rivers.

Fuel consumption was small (about 180 lb. of coal per hr.), costing 40 cents. Storage capacity, however, was only about three tons, which limited travel between coal piles to about 30 hours. The crew comprised a pilot, engineer and fireman.

In 1909, the engine and boiler were removed and a 50-hp. four-cylinder, four-cycle gasoline engine installed. The gasoline consumption is 6 gal. per hour. The storage capacity is 120 gal. A new pilot house was constructed suspended half in the engine room and half extending above the roof, so as to give pilot-house control and enable one man to run the boat.

When the boat was 11 years old, "pinholes" developed all over the plating and the plates were so rusted that it became an every-day occurrence to knock a hole in the bottom during low water and sink the boat.

This state of affairs was met by a concrete lining. The hull, inside, was thoroughly scraped and cleaned. Chicken wire was spread over the ribs, and cinder concrete was tamped down through the mesh all over the bottom of the boat, extending well up on the sides above the waterline. The lining was from 4 to 5 in. thick at the keel and thinned toward the sides of the hull. The added weight was 8000 lb., which increased the draught 4 to 6

Fig. 1. Sinking Dry-Dock; Boat Floating, Water Filling Shell
Fig. 3. New Skin Applied

Fig. 2. Raising Dry-Dock, Boat Lowering into Shell
Fig. 4. Boat with New Skin Leaving Dry-Dock

*[illegible]

in. The boat now worked satisfactorily for three or four years when the steel plates had grown so thin that it was feared the concrete would drop out through the bottom. In other respects, the boat was in good condition.

In dry dock, templates were made to fit the bottom, at intervals of 2 ft. From these a timber frame was built with ribs of 2x4-in. pine. Metal plates of No. 10 gage were bolted transversely on the outside of this frame, with seams lapped and riveted, with thin tar paper between the lap of the metal plates. The timber frame was then removed.

The dry dock was flooded, the boat floated over the shell, and the dock was raised. Guide posts placed the boat accurately above the shell as the dock came up. Melted paving pitch was poured in the space between the hull and the new skin. A 2x4-in. wood nosing strip running around the top of the new construction was bolted on through the shell and hull. About 7000 lb. of concrete were taken out of the hull, leaving only the concrete which was under the engine bed. After the work was finished, the draft was 18 in. forward and 27 in. aft.

The shell cost $419, and the labor of constructing it about the same amount. It is expected that the new skin will last 12 or 15 years. A new hull would have cost from $3000 to $4000.

The accompanying photographs show the boat at several stages of the work.

The Transportation of Debris by Running Water*

By Grove Karl Gilbert

Scope—The finer débris transported by a stream is borne in suspension. The coarser is swept along the channel bed. The suspended load is readily sampled and estimated, and much is known as to its quantity. The bed load is inaccessible and we are without definite information as to its amount. The primary purpose of the investigation was to learn the laws which control the movement of bed load, and especially to determine how the quantity of load is related to the stream's slope and discharge and to the degree of comminution of the débris.

Method.—To this end a laboratory was equipped at Berkeley, Calif., and experiments were performed in which each of the three conditions mentioned was separately varied and the resulting variations of load were observed and measured. Sand and gravel were sorted by sieves into grades of uniform size. Determinate discharges were used. In each experiment a specific load was fed to a stream of specific width and discharge, and measurement was made of the slope to which the stream automatically adjusted its bed so as to enable the current to transport the load.

The Slope Factor—For each combination of discharge, width, and grade of débris there is a slope, called competent slope, which limits transportation. With lower slopes there is no load, or the stream has no capacity† for load. With higher slopes capacity exists; and increase of slope gives increase of capacity. The value of capacity is approximately proportional to a power of the excess of slope above constant slope. If S equal the stream's slope and σ equal competent slope, then the stream's capacity varies as $(S - \sigma)^n$. This is not a deductive, but an empiric law. The exponent n has not a fixed value, but an indefinite series of values depending on conditions. Its range of values in the experience of the laboratory is from 0.93 to 2.37, the values being greater as the discharges are smaller or the débris is coarser.

The Discharge Factor—For each combination of width, slope and grade of débris there is a competent discharge k. Calling the stream's discharge Q, the stream's capacity varies as $(Q - k)^o$. The observed range of values for o is from 0.81 to 1.24, the values being greater as the slopes are smaller or the débris is coarser. Under like conditions o is less than n; or, in other words, capacity is less sensitive to changes of discharge than to changes of slope.

The Fineness Factor—For each combination of width, slope and discharge, there is a limiting fineness of débris below which no transportation takes place. Calling fineness (or degree of comminution) F and competent fineness ϕ, the stream's capacity varies $(F - \phi)_p$. The observed range of values for p is from 0.50 to 0.62, the values being greater as slopes and discharges are smaller. Capacity is less sensitive to changes in fineness of débris than to changes in discharge or slope.

The Form Factor—Most of the experiments were with straight channels. A few with crooked channels yielded nearly the same estimates of capacity. The ratio of depth to width is a more important factor. For any combination of slope, discharge and fineness, it is possible to reduce capacity to zero by making the stream very wide and shallow or very narrow and deep. Between these extremes is a particular ratio of depth to width ρ, corresponding to a maximum capacity. The values of ρ range, under laboratory conditions, from 0.5 to 0.04, being greater as slope, discharge and fineness are less.

Velocity—The velocity which determines capacity for bed load is that near the stream's bed, but attempts to measure bed velocity were not successful. Mean velocity was measured instead. To make a definite comparison between capacity and mean velocity it is necessary to postulate constancy in some accessory condition. If slope be the constant, in which case velocity changes with discharge, capacity varies on the average with the 3.2 power of velocity. If discharge be the constant, in which case velocity changes with slope, capacity varies on the average with the fourth power of velocity. If depth be the constant, in which case velocity changes with simultaneous changes of slope and discharge, capacity varies on the average with the 3.7 power of velocity. The power expressing the sensitiveness of capacity to changes of mean velocity has in each case a wide range of values, being greater as slope, discharge and fineness are less.

Mixtures—In general, débris composed of particles of a single size is moved less freely than débris containing particles of many sizes. If fine material be added to coarse, not only is the total load increased but a greater quantity of the coarse material is carried.

Modes of Transportation; Movement of Particles—Some particles of the bed load slide; many roll; the multitude make short skips or leaps, the process being

*Author's prefatory abstract of Professional Paper 86, U. S. Geological Survey, Washington, D. C. The paper itself is "based on an experiment made with the assistance of Edward C. Murphy," at the University of California.

†Capacity is defined for the purposes of this paper as the maximum load of a given kind of débris which a given stream can transport.

[illegible] suspension. When particles of many sizes are moved together the larger ones are [illegible].

MODES OF TRANSPORTATION, COLLECTIVE MOVEMENT—When the conditions are such that the bed load is small, the bed is molded into hills, called dunes, which travel downstream. Their mode of advance is like that of eolian dunes, the current eroding their upstream faces and depositing the eroded material on the downstream faces. With any progressive change of conditions tending to increase the load, the dunes eventually disappear and the débris surface becomes smooth. The smooth phase is in turn succeeded by a second rhythmic phase, in which a system of hills travel upstream. These are called antidunes, and their movement is accomplished by erosion on the downstream face and deposition on the upstream face. Both rhythms of débris movement are initiated by rhythms of water movement.

APPLICATION OF FORMULAS—While the principles discovered in the laboratory are necessarily involved in the work of rivers, the laboratory formulas are not immediately available for the discussion of river problems. Being both empiric and complex, they will not bear extensive extrapolation. Under some circumstances they may be used to compare the work of one stream with that of another stream of the same type, but they do not permit an estimate of a river's capacity to be based on the determined capacities of laboratory streams. The investigation made an advance in the direction of its primary goal, but the goal was not reached.

LOAD VERSUS ENERGY—The energy of a stream is measured by the product of its discharge (mass per unit time), its slope, and the acceleration of gravity. In a stream without load the energy is expended in flow resistances, which are greater as velocity and viscosity are greater. Load, including that carried in suspension and that dragged along the bed, affects the energy in three ways: (1) It adds its mass to the mass of the water and increases the stock of energy *pro rata*. (2) Its transportation involves mechanical work, and that work is at the expense of the stream's energy. (3) Its presence reduces the mobility of the water, in effect increasing its viscosity, and thus consumes energy. For the finest elements of load the third factor is more important than the second; for coarse elements the second is the more important. For each element the second and third together exceed the first, so that the net result is a tax on the stream's energy. [illegible]

[illegible]

also, but the rates of increase are less than in stream transportation. Capacity is reduced by roughness of bed.

VERTICAL VELOCITY CURVE—The vertical distribution of velocities in a current is controlled by conditions. The level of maximum velocity may have any position in the upper three-fourths of the current. In loaded streams its position is higher as the load is greater. In unloaded streams its position is higher as the slope is steeper, as the discharge is greater and as the bed is rougher.

PITOT TUBE—The constant of the Pitot velocity gage—the ratio between the head realized and the theoretic velocity head—is not the same in all parts of a conduit, being less near the water surface and greater near the bottom or side of the conduit.

NEWS NOTES

A Ditching Machine Broke a 6-In. Water Main in Springfield, Ohio, on Aug. 27.

A Broken Water Main in Brooklyn, N. Y., flooded the new Seventh Ave. subway at 21st St. to a depth of 12 ft.

An Elevator Cable broke in a building in Philadelphia, Penn., on Aug. 28, injuring the three occupants of the car.

An Undermined Wall Failed in Toronto, Ont., on Sept. 1 and fell into the adjacent excavation for a large office building. At about 1 p.m., the side wall of the building settled, opening a crack in the front. It was immediately attempted to shore up the wall, but at 8 p.m. half of it fell.

Floods in Manila, P. I., followed a week's heavy rain. During the 48 hours ending at midnight, Sept. 1, the precipitation was 16.4 in. A message from Governor-General Harrison states that the lowest sections of Manila were flooded to a depth of 3 to 5 ft. Eight persons were drowned.

A Survey of the Street Trees of the Borough of Manhattan, New York City, is being made by the Landscape Engineer of the State College of Forestry at Syracuse. In one ward only 200 shade trees were found on 12 mi. of residential streets, or one to 110 ft.

Magnesite from California will take the place in the United States of that formerly imported from Austria, but now held up by the European War. A fleet of Jeffrey Quad motor trucks is already hauling the American product to Tidewater, Calif., for shipment through the Panama Canal.

Disbursements for Rapid Transit Subway Work in New York City from the beginning of the existing system to June 30, 1914, aggregate $100,338,171.45, of which some $48,000,000 is represented by the Interborough system now running; the remainder has been spent on the dual system under way. These figures are exclusive of real estate purchases. The total of contracts awarded for the new lines aggregated $11[illegible],918,169 on Aug. 1[illegible].

The First Liquefied Chlorine Gas Plant for Disinfecting a Municipal Water-Supply in Massachusetts was put into use on Sept. 1 at Wakefield. The town takes its supply from Crystal Lake, which, while providing a clear, sparkling water, is liable to occasional pollution. The use of liquefied chlorine gas as a sterilizing agent was recommended by Edward C. Sherman, Consulting Engineer of Boston, who is supervising the operation of the plant, which was installed by the Electro-Bleaching Gas Co. of New York. It has been under test for about six weeks and has given satisfactory results, reducing the bacterial content to very low counts. Charles A. Dean is Chairman of the Wakefield Water Board.

Protection of Pedestrians in front of a garage which motor [illegible]

American Production of Industrial Materials, formerly imported [illegible]

the U. S. Department of the Interior. Secretary F. K. Lane, on Sept. 3, called a conference of manufacturers of coal-tar, pharmaceutical and general chemical products to find out in what ways the Government could aid in supplying the present deficiency. The normal importation of coal-tar dyes alone amounts to $7,000,000 per year. There were some 25 representatives present. It was definitely suggested (1) that there should be a system instituted in this country similar to the one in England, whereby if a foreign patent is not used and manufactured within a reasonable time, it will be opened to use by American manufacturers, and (2) that a law should be passed whereby unfair competition will be cut off. This last would preclude the practice which it is alleged is now followed of selling foreign products below the costs of manufacture. It was further suggested (3) that the secretary use his efforts through the State Department to secure permission for the exportation of dyestuffs from Germany, and (4) that the wisest way to develop a great coal tar product industry in the United States was to establish a government plant whose primary purpose should be the making of nitro derivatives of coal tar and other materials needed for explosives by the War and Navy Departments. The startling statement was made that the United States today was absolutely dependent on Germany for some of the essential elements in smokeless powder, and that if Germany stopped their manufacture or prohibited export to his country, America would be helpless.

It is reported that the experimental potash plant at Searles Lake, Calif., will be arranged for continuous production on as nearly commercial basis as possible. The initial output will be five tons per day, but a plant is under construction to turn out 120 tons.

PERSONALS

Mr. Frank C. Miller has been appointed City Engineer of Sacramento, Calif., succeeding Mr. Albert Givon, Assoc. M. Am. Soc. C. E., resigned.

Mr. C. M. Buck, Assoc. M. Am. Soc. C. E., of Guthrie, Okla., has been appointed Division Engineer of the Atchison, Topeka & Santa Fé Ry., with office at Emporia, Kan., succeeding Mr. F L. Guy, resigned.

Mr. W. D. Warren, formerly Division Engineer of the New York, New Haven & Hartford, Conn., has been transferred to Providence, R. I., to succeed Mr. W. T. Spencer, Assoc. M. Am. Soc. C. E., promoted.

Prof. John C. Olson, formerly of the Polytechnic Institute of Brooklyn, N. Y., has been appointed Professor of Chemistry and head of the department of chemistry at Cooper Union, New York City.

Mr. W. J. Miller, Master Mechanic of the St. Louis Southwestern Ry. of Texas, at Tyler, Tex., has been promoted to be Superintendent of Motive Power of the company with headquarters at Pine Bluff, Ark., succeeding the late T. E. Adams.

Mr. Harrison P. Eddy, M. Am. Soc. C. E., of Metcalf & Eddy, Consulting Engineers, Boston, Mass., has been appointed Consulting Engineer of the city of Dayton, Ohio, in connection with the improvement of the sewerage system of that place.

Mr. Jamees N. Hatch, M. Am. Soc. C. E., Structural Engineer for Sargent & Lundy, Consulting Engineers, Chicago, Ill., has resigned to open an office for private practice at 1525 Old Colony Bldg., Chicago. He intends to specialize in appraisal and valuation work.

Mr. H. E. Kellenberger has been appointed Senior Signal Engineer of the Central district of the Division of Valuation, Interstate Commerce Commission, with headquarters at Chicago, Ill. He was formerly Superintendent of Signals on the Chicago Great Western Railway.

Mr. W. J. Gough, Assoc. M. Am. Soc. C. E., formerly Assistant Engineer of the Coronado Beach Co., San Diego, Calif., has been elected Vice-President and Superintendent of the Los Angeles & San Diego Beach Ry., succeeding Mr. R. B. Talbot, resigned, to engage in other business.

Mr. C. F. Yardley, Track Supervisor of the New York, New Haven & Hartford R.R., at Providence, R. I., has been promoted to be Division Engineer of the Central New England R.R., at Hartford, Conn., to succeed Mr. H. E. Astley, promoted to be Division Engineer of the New York, New Haven & Hartford R.R., at Hartford, Conn.

Mr. Harry R. Kurrie, General Attorney of the Chicago, Indianapolis & Louisville Ry., has been elected President to succeed Mr. F. A. Delano, M. Am. Soc. C. E., resigned, as noted in our issue of Aug. 20. Mr. Kurrie is 39 years old and entered the service of the Chicago, Indianapolis & Louisville Ry. in 1902 as Assistant General Solicitor.

Mr. Charles Saville, Assoc. M. Am. Soc. C. E., has resigned from the firm of Hering & Gregory, Consulting Engineers, New York City, and will spend the coming winter in Boston, Mass., taking a graduate course at the School for Health Officers at Harvard University and the Massachusetts Institute of Technology. His home address is Waban, Mass.

Mr. J. A. Lindstrand has been appointed Senior Architect in the Central district of the Division of Valuation, Interstate Commerce Commission, with headquarters at Chicago, Ill. Mr. Lindstrand was for fifteen years in the Architect's office of the Chicago, Burlington & Quincy R.R. and for the past eight years has been Architect for the Chicago, Milwaukee & St. Paul Ry.

Mr. A. H. Whiteside, former Manager of the power and electric department of the Allis-Chalmers Co., Milwaukee, Wis., has been appointed Vice-President and General Sales Manager of the Goulds Manufacturing Co., of Seneca Falls, N. Y. Mr. Whiteside succeeds Mr. W. E. Davis, who has been obliged to give up some of his active duties due to injuries sustained several months ago.

Mr. Fred M. Baumgardner has been appointed Senior Inspector of Motive Power in the Central district of the Division of Valuation, Interstate Commerce Commission, with headquarters at Chicago, Ill. His experience has been with the Mechanical Department of the Union Pacific R.R. and Illinois Central R.R., having served as Round House Foreman, General Foreman and Masted Mechanic on the latter road and having recently been made Master Mechanic at Clinton, Ill.

Mr. Fred B. Corey, F. Am. Inst. E. E., for 11 years in the engineering department of the General Electric Co., Schenectady, N. Y., and for the past three years Engineer of Inspection and Tests of the Union Switch & Signal Co., Swissdale, Penn., reporting to the General Manager, has resigned that office to open an office at 404 Arrott Bldg., Pittsburgh, Penn., as Consulting Engineer, specializing in inspection methods and organizations for manufacturing companies. He will also specialize in electric railway signaling and allied subjects.

Mr. D. K. Van Ingen has been appointed Second Assistant Field Engineer in the Central district of the Division of Valuation, Interstate Commerce Commission, with headquarters at Chicago, Ill. He was educated at Rensselaer Polytechnic Institute, and has been with the Chicago & Northwestern Ry., Choctaw, Oklahoma & Gulf R.R. and New York Central & Hudson River R.R., having been Assistant Engineer in charge of valuation work on yards and terminals in Iowa on the Chicago & Northwestern since 1913, and within the last month he was appointed Chief Draftsman in the valuation department of the same road.

Mr. W. E. Van Hook has been appointed Office Engineer for the Central district of the Division of Valuation, Interstate Commerce Commission, with headquarters at Chicago, Ill. He is a graduate of the University of Wisconsin. The first five years after graduation he was on railroad work in location, construction, maintenance and valuation work with the Chicago & Northwestern Ry., Chicago & Alton R.R., and the Chicago, Milwaukee & Puget Sound R.R. For the past three years he has been with the Illinois Railroad & Warehouse Commission and later the Public Utilities Commission of the State of Illinois.

Mr. Truman P. Gaylord, Assoc. Am. Inst. E. E., District Manager of the Westinghouse Electric & Manufacturing Co., at Chicago, Ill., has been elected Acting Vice-President to succeed Mr. H. D. Shute, promoted, as noted elsewhere. Mr. Gaylord graduated in electrical engineering from the University of Michigan in 1895. Until he joined the staff of the Westinghouse Electric & Manufacturing Co. in 1899, Mr. Gaylord was Assistant Professor of electrical engineering at the Armour Institute of Technology and with the Chicago Edison Co. He was appointed District Manager of the Chicago office of the Westinghouse Co. in 1902.

Mr. B. B. Kelliher, M. Can. Soc. C. E., has resigned as Chief Engineer of the Grand Trunk Pacific Ry. on account of ill health. Mr. Kelliher was born in Ireland in 1862 and graduated from Dublin University. He served an apprenticeship in civil engineering in his native country and in 1886 came to the United States, where for four years he was with the engineering corps of the Union Pacific R.R. For 14 years he was a railway and mining engineer in the Northwest and in the Rocky Mountain States. He joined the staff of the Grand Trunk Pacific Ry. in 1904 as Division Engineer at Winnipeg, Man., and a year later was made Chief Engineer.

Mr. W. A. Christian, M. Am. Soc. C. E., formerly First Assistant to the Chief Engineer of the Chicago Great Western R.R., has been appointed by the Interstate Commerce Commission Senior Civil Engineer in charge of the roadway and track department for the Central district of the Division of Valuation, with headquarters at Chicago, Ill. Mr. Christian graduated from the University of Cincinnati and his early work was with the Baltimore & Ohio, Chesapeake & Ohio, and C. C. C. & St. L. railroads. In 1891 he was Assistant County Engineer of Hamilton County, Ohio, and from 1895 to 1902 was with the United States Army Engineer Corps as U. S. Assistant Engineer in charge of plans and estimates for river and harbor improvements. He was then with the Big Four R.R. for about a year on maintenance work, and from 1903 to 1907 was again with the U. S. Army Engineer Corps as U. S. Assistant Engineer in charge of plans and estimates for concrete movable dams in the Ohio River. Since 1907 he has been with the Chicago Great Western R.R. as Assistant Chief Engineer.

Mr. Henry D. Shute, Assoc. Am. Inst. E. E., Acting Vice-President of the Westinghouse Electric & Manufacturing Co., Pittsburgh, Penn., has been elected Treasurer to succeed Mr. T. W. Siemon, who recently resigned to become Secretary-Treasurer of the Union Switch & Signal Co., Swissvale, Penn. Mr. Shute is an electrical engineering graduate of the Massachusetts Institute of Technology, class of 1892, and in 1893 entered the employ of the Westinghouse Electric & Manufacturing Co. as an apprentice. He entered the engineering department of the company in 1897 and a year later was transferred to the commercial department. In 1901 Mr. Shute was promoted to be the head of the alternating current division of the commercial department, and two years later was made Assistant to the Vice-President, in which position he had much to do with the development of heavy electric traction and single-phase railway work. He has been Acting Vice-President since 1910.

OBITUARY

William A. Stern, senior member of the firm of Stern & Silverman, which controls many street and electric railway properties and holds a franchise for a tunnel under the Delaware River at Philadelphia, died Sept. 4, at his home in Philadelphia. He was 54 years old.

Jacob H. Olhausen, former General Superintendent of the Central R.R. of New Jersey, died at his home in New York City, Sept. 2, aged 76 years. He entered the service of the Philadelphia & Reading Ry. as a water boy. He was successively promoted to be brakeman, conductor, and eventually Division Superintendent.

Henry Harbinson Sinclair, M. Am. Inst. E. E., a prominent electrical engineer of Los Angeles, Calif., died Aug. 31 at his home in Pasadena. He was born in Brooklyn, N. Y., 57 years ago. He went to California in 1889 and became connected with several large hydro-electric projects. He acted as consulting expert in the organization of the Great Western Power Co., of San Francisco, Calif., of which he later served as Vice-President. He was a well known yachtsman and twice the winner of the ocean race from San Francisco to Honolulu. He is survived by a widow, a son and a daughter.

Moritz George Lippert, for almost half a century connected with the drafting department of the Phœnix Bridge Co. and its predecessors, Phœnixville, Penn., died at his home in Phœnixville, Aug. 30. More than 200 young engineers and draftsmen have been trained under him as Chief Draftsman during the many years he had been with the company. Mr. Lippert was born Nov. 19, 1846, the son of [illegible] in Leipzig, Germany. He graduated from the Royal Polytechnic Institute at Dresden and for several years practiced his profession in Germany. In 1869 he came to the United States and settled in Phœnixville, where in the previous year the firm of Kellogg, Clarke & Co. had opened an office for designing and erecting iron bridges and kindred structures. This firm was reorganized in 1871 as Clarke, Reeves & Co. and 1884 was transformed into the Phœnix Bridge Co. Under the late [illegible] as Chief Engineer of Kellogg, Clarke & Co., Mr. Lippert was appointed to take charge of the drafting room, where he continued for many years. Besides his professional work he found time for many public and philanthropic activities. For many years he was the moving spirit and director of a town cooperative society for supplying groceries and other commodities. As Secretary of the local board of health he performed a vast amount of work, doing it so thoroughly that his reports became models to be followed by the health authorities of other towns. For many years he served as Secretary of the local hospital board. The local newspaper pays this tribute to his sterling qualities:

> No citizens of this country—native or naturalized—ever fulfilled all the duties of citizenship more conscientiously and more intelligently than did Mr. Lippert. Personally he had an equable temper, or under perfect control, a keen sense of justice and a saving sense of humor. He was exacting only with himself, to all others he was most lenient and most forgiving. With the formal courtesy of the old world softened by his contact with the new, he was most companionable and most lovable. He loved the world and the world loved him and will miss him.

Mr. Lippert is survived by a widow, a daughter, two sisters and a brother, F. George Lippert, Assistant Engineer of the Phœnix Bridge Co.

ENGINEERING SOCIETIES

COMING MEETINGS

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.
Sept. 15-18. Convention in Atlantic City, N. J. Secy., Clayton W. Pike, Electrical Bureau, Philadelphia, Penn.

ILLUMINATING ENGINEERING SOCIETY.
Sept. 21-25. Annual convention in Cleveland, Ohio. Secy., Joseph D. Israel, 29 W. 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Sept. 22-24. Annual convention in Bluff Point, N. Y. Secy., C. C. Rosenberg, Times Building, Bethlehem, Penn.

ATLANTIC DEEPER WATERWAYS ASSOCIATION.
Sept. 22-26. Annual convention at New York. Secy., Addison Burke, Philadelphia, Penn.

INTERNATIONAL IRRIGATION CONGRESS.
Oct. 5-9. At Calgary, Alta. Secy., Andrew Miller, Industrial Commissioner, Calgary.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 12-16. Annual convention at Atlantic City, N. J. Secy., E. B. Burritt, 29 West 39th St., New York City.

NATIONAL COUNCIL FOR INDUSTRIAL SAFETY.
Oct. 13-15. Annual "Safety Congress," at Chicago, Ill. Secy., W. H. Cameron, Continental Bank Building, Chicago.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
Oct. 20. Convention at Los Angeles, Calif. Secy., C. A. Lichty, 319 North Waller Ave., Chicago, Ill.

INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS.
Oct. 20-23. Annual convention at New Orleans. Secy., James McFall, Roanoke, Va.

AMERICAN ROAD CONGRESS.
Nov. 9-14. Atlanta, Ga. Permanent headquarters, American Highway Association, Colorado Building, Washington, D. C.

International Rubber Congress and Exhibition—Among the international congresses scheduled this year and next is the Rubber Congress set for Sept. 8-Oct. 18, 1914, at Batavia, Java. Although we have not been informed of the abandonment of the Congress in view of the European war, it is quite possible this has been done. An extensive program had been prepared. The local secretary is Dr. A. A. L. Rutgers, Buitenzorg, Java.

American Peat Society—At the 8th annual meeting of the Society, held in Duluth, Minn., Aug. 20-22, the following papers were presented:

"General Drainage Work, or Reclamation of Swamp Areas," Dr. Joseph Hyde Pratt, State Geologist of North Carolina; "Latest Development in the Peat Gas Producer," F. B. Haanel, Department of Mines, Ottawa, Canada; "The Possibilities of Peat in the Beneficiation and Smelting of Iron Ores," Prof. Peter Christianson, University of Minnesota; "Converting Peat into Fuel, and the Origin and Nature of Muskeg Peat," Prof. Chas. A. Davis, U. S. Bureau of Mines; "The Peat Industry in Ireland," Thomas Tomlinson, Dublin, Ireland; "Peat Briquetting," Dr. J. McWilliam, London, Canada; "Briquettes from Peat and Petroleum," Robert Biel, Sacramento, Calif.; "Practical Demonstration of Herbein's Patent by a Small Working Model of the Herbein Briquetting Machine," C. A. [illegible], Cleveland, Ohio; "How to Prepare a Peat Bog for Fuel Making," Gustave Carlson, Farnham, Ont., Canada; "Application of Machinery on Peat Deposits," L. A. Krupp, Findlay, Ohio; "Economic Aspect of Peat in America," John N. Hoff, New York; "Reclamation of Swamp Lands of Carolina and the South Atlantic States," Prof. J. D. Wood, University of Nebraska; "Comparative Costs of Drying Peat Fertilizer with Fuel Oil and Coal," John Wiesmer. The Secretary is Julius Bordollo, Kingsbridge, New York City.

A City Managers' Convention will be held in Springfield, Ohio, Dec. 2-4. For information regarding the convention Charles E. Ashburner, City Manager, Springfield, Ohio, should be addressed.

Engineering News

VOLUME 72 SEPTEMBER 17, 1914 NUMBER 12

Concrete Arch Bridge with Ornamental Tile Panels, Philadelphia

By Jonathan Jones*

The city of Philadelphia has just completed a concrete arch bridge which, while it presents no structural features that are not standard in that city, is unusual in the prominence given to colored-tile panels, inserted in the concrete parapet, as a medium of decoration.

The bridge crosses the cut of the North Pennsylvania R.R., which for about a mile bisects the attractive residential district of Oak Lane. To provide for the considerable traffic which will take advantage of this crossing, and to accord with the type of dwelling characteristic of Oak Lane, this street, known at present as 66th Ave., is planned of 80-ft. width (50-ft. cartway and two 15-ft. sidewalks) and the bridge is built of full street width.

The clear span is 40 ft. and the skew about 75°, making the span on bridge axis 41 ft. 6¼ in. The clearance over outer rail of the double-track railroad is 16 ft. and the soffit curve adopted is an ellipse of 8 ft. 10⅝-in. rise.

The bridge is designed to carry as live load a 40-ton truck on any part of the roadway and 100 lb. per square foot of sidewalk. No reinforcement is used in the arch, the thickness at crown being 24 in. and the maximum stress in the concrete, 500 lb. per sq.in. No hinges are used and the six buttresses into which the arch stress is delivered take bearing on footings of a micaceous gneiss. The arch ring concrete is 1 : 2½ : 5, with the maximum possible amount (about 30 to 40%) of one-man stone embedded normal to the line of arch pressure.

The wing walls are parallel with the street, and are completely severed from the arch ring and spandrels, to prevent cracks being occasioned by the motion of the latter. The vertical joint thus formed is lined with asbestos felt to insure a separation, and is concealed by the relief of the pilasters on each side of the span. This joint is waterproofed with a coal-tar membrane, and drained with a dry-wall backing.

Fig. 1. Railing of 66th Ave. Bridge, Philadelphia, Showing Colored-Tile Inset

The spandrel wall is also cast independently of the arch ring, and after the slacking of the centers. The parapet is of solid concrete, with light reinforcement in the top to take care of slight temperature movements in the arch ring and in the parapet. The simple lines of the parapet are well brought out by the views, also the sharpness of the edges and the rough texture of the surface, which was obtained by using a ¾-in. crusher-run stone and scrubbing the next day after pouring.

On the outside, the parapet panels are recessed in the 8-in. wall. On the inside, these sunk panels are replaced by flush panels of dull-glazed Grueby tile, principally of terra

*Assistant Engineer, Bureau of Surveys, 532 City Hall, Philadelphia.

tone and such some dark green and blue. The proportion of tile area used, with the simplicity of the concrete in which it is set, makes the tile the distinctive feature of the design.

To insure the permanency of these tile inserts, it was at first intended to cast them as 3-in. reinforced slabs at the tile setter's shop, then to support these slabs in the parapet forms and concrete them solidly in place. Because, however, of the extreme difficulty of so supporting these heavy slabs as to obtain a perfect vertical curve from end to end of the bridge, and also because to wait for the slabs to cure would have delayed the concreting of the parapet until cold weather, it was decided to leave recesses in the concrete and set the tiles by the piece.

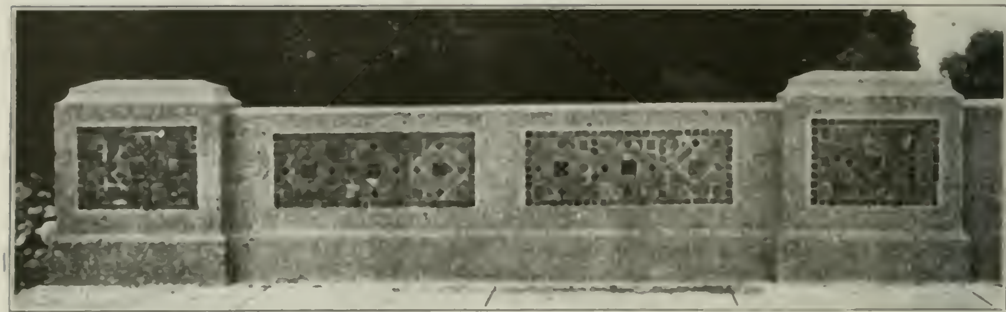


Fig. 2. Near View of Tile in Place

Fig. 3. Pilaster with Arrangements Preparing for Ceramic Tile

Accordingly, a 4-in. recess was formed in the concrete, and the form was left in place over winter as a protection to the edges, the bridge being thrown into use as soon as the back filling was completed. Clamps of 1/4-in. rods were cast in the parapet, as shown in Fig. 3, projecting into the space left for the tile backing. In the spring, when all danger from frost was over, the concrete was roughened and the clamps were laced at random with wire and the recess then filled with cement mortar to within 1 in. of the finished surface, as many panels being filled in a day as the tile setters could finish the next day. By this precaution it is felt that the slab of new material is locked to the older concrete without any reliance on adhesion, of which, however, considerable was obtained, and that in turn the tile are an integral portion of the new slab.

As there are in Philadelphia some examples of exterior tile work laid fifteen years ago with less refinement of method, it is not feared that frost or other agencies will dislodge these ornaments. To finish, the tile were pointed with neat cement, scrubbed with weak acid to remove cement stains, washed free of acid and coated with linseed oil.

The bridge was designed and the construction controlled by the Bureau of Surveys, Department of Public Works, George S. Webster, Chief Engineer; Richard Walsh was the general contractor, and the Wm. Moore Co., subcontractor for the tile work.

Some Gas-Explosion Experiments Leading to the Possibility of a New Floating-Piston Pump

By C. J. B[illegible]*

The gas-explosion experiments described below were performed in the mechanical laboratories of the University of Michigan during the spring of 1914, to see how efficient an explosion of gas and air could be made without compression of the charge previous to the explosion. The apparatus used consisted of a constant-volume explosion apparatus slightly altered to adapt it to these particular experiments. It consisted of a mixing chamber (with city-gas, water, air and sewer connections) where the desired proportions of air and gas were mixed at atmospheric pressure. An inlet tube led from this to the explosion chamber for the transfer of a charge. The explosive mixture used consisted of one volume of city gas and six volumes of air, as this proportion gave the greatest

*[illegible] Ave., Chicago, Ill.

pressure when exploding at constant volume. Knowing the volume of the explosion chamber and the proportions of the mixture, the amount of gas burned during the explosion could be found (one seventh of total amount in the explosion chamber with the above mixture). The B.t.u.'s in the city gas ran about six hundred, which gave a pretty accurate method of figuring the total amount of heat available for work during the explosion. To get the actual amount of work done during the explosion, a U-shaped pipe was fitted to the explosion chamber and in it a known amount of water was poured before each explosion. The force of the explosion was expended in shooting the water out of the nozzle at an angle of 45° with the horizontal. Knowing the weight of the water placed in the nozzle and the velocity of the water as it left the nozzle the kinetic energy of the water as it left the pipe would be equal to one-half the mass times the velocity squared; neglecting the slight friction losses in the nozzle this energy would be equal to the work done on the water by the force of the explosion. The water, as it left the nozzle, took the path of a parabola and fell some distance out from the nozzle. The velocity of the water as it left the nozzle was easily computed after measuring the horizontal distance from the end of the nozzle to the floor where the water hit. The formula used was*

$$V = \sqrt{\frac{32 s^2}{h + s}}$$

where V = velocity of water leaving nozzle in feet per second; s = horizontal distance from the floor beneath the nozzle to where the water hit, in feet; h = vertical distance from end of nozzle to floor, in feet.

Having found the nozzle velocity in feet per second, as above described, the work expended upon the water by the force of the explosion was found in foot-pounds by multiplying one-half the mass of the water by the velocity squared, dividing this result by 778 to change to B.t.u.'s, then dividing by the B.t.u.'s available in the gas burned during the explosion and multiplying by 100 gives the per cent. efficiency of the explosion.

The earlier experiments showed an efficiency of from 4 to 5%. Later, as the apparatus was improved and more suitable amounts of water were used, results showed an efficiency of over 10%.

The explosions were noiseless, the expansion being carried down to or below atmospheric pressure in ejecting the water from the nozzle as indicator cards taken of the explosions plainly showed.

There is no doubt that with improved experimental apparatus and further investigation along this line, the best results obtained by the writer could be surpassed. An efficiency of 10% surpasses the thermal efficiency of many two-cycle explosion engines now in operation and compares favorably with the thermal efficiency of many four-cycle engines under working conditions.

The success of the Humphrey gas pump has shown the possibilities of the liquid piston. Perhaps the cited results of these experiments might tend to show some commercial possibilities of a liquid piston-pumping engine which does not use compression of the charge previous to explosion. The possible advantages of such a liquid-piston pump over one of the Humphrey type would be the small initial cost and larger capacity—due to the greater number of explosions per minute. The Otto Langlen Gas Engine is a notable example of a type of gas engine which did not use compression previous to the explosion of the charge. The thermal efficiencies of the different tests of this engine ran from 14 to 17%, which compares favorably with the government tests of modern four-cylinder four-cycle engines which use compression previous to ignition of the charge.* This compression lowers the

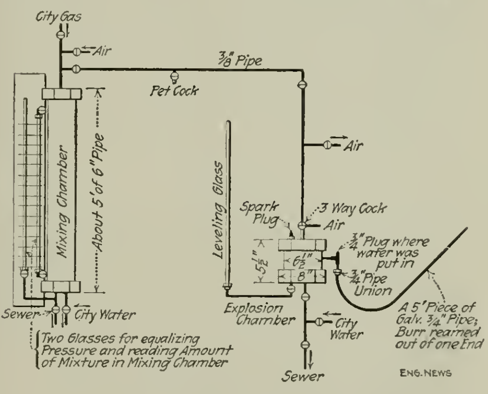


Diagram of Gas-Explosion Apparatus

mechanical efficiency and introduces thermodynamic losses.

The effect of the rate of expansion upon the efficiency of explosion is interesting. Take the two limiting cases of explosions—the first at constant volume, where the mechanical work done by the explosion is nothing and the efficiency is zero because the space is nothing.

The other limiting case is where the force becomes zero. This is illustrated by an explosion at atmospheric pressure. The force of the explosion is almost completely unrestrained, the work and efficiency of the explosion in this case is almost zero. Assume that the explosion is completely unrestrained, as would be the case if the theoretical piston could move out as fast as any increment of pressure is generated behind it, while the flame is propagated through and combustion takes place in the exploding mixture; then the force, the work done, and the efficiency of the explosion will all be zero.

The most efficient explosion will undoubtedly lie between the two limiting cases. The indicator card of the

*If V_y and V_x are the vertical and horizontal components of V, T is the time, in seconds elapsed between water leaving nozzle and reaching floor, and e is the nozzle angle with the horizontal.
Then

$$s = V_x t = V \cos e\, T$$
$$h = g/2\, T^2 - V_y T$$
$$= g/2 \frac{s^2}{V_x^2} - V_y \frac{s}{V_x}$$
$$= g/2 \left[\frac{s}{V \cos e}\right]^2 - \frac{V \sin e}{V \cos e} s$$
$$= g/2 \frac{s^2}{V^2 \cos^2 e} - s \tan e$$

For 45°

$$h = \frac{g s^2}{V^2} - s$$
$$V^2 = \frac{g s^2}{h + s}$$
$$V = \sqrt{\frac{32 s^2}{h + s}}$$

*Some later tests, reported by the Society of Automobile Engineers, on 30-hp. motors, showed thermal efficiencies running from 6 to 12%. With 85% mechanical efficiency, the overall figure would range from 5 to 10%.

-est would be represented by a straight vertical line. The indicator card in the second case would be represented on the pressure-volume diagram by a horizontal line. Theoretically, the most efficient indicator card for separate atmospheric explosions, not considering the great radiation loss during expansion, would be explosion at constant volume, followed by adiabatic expansion to atmospheric pressure.

There are so many variable factors entering here that it would be almost impossible to determine just what rate of expansion would be most efficient. It was determined experimentally in the following manner. The mixing chamber contained enough charges for several explosions. By using the same mixture for a number of explosions and keeping other conditions the same, the amount of water used in the nozzle was varied from a small to a large amount. It was found that 700 c.c. of water gave the greatest efficiencies for this particular apparatus. The smaller amounts would be shot farther but not enough farther to make the work done on the water as great as if the larger amount was used. Amounts of water over 700 c.c. would not be shot as far and the work done on the water would figure out to be less. Still larger amounts of water would almost completely deaden the explosion. The greater inertia of the larger mass of water would greatly retard the expansion of the charge to the extent that the bulk of the available energy was lost by radiation as heat.

By regulating the amount of water discharged each time, the pump could be made to operate at a rate such that the expansion would occur under conditions most favorable for the greatest efficiency. A further advantage of the liquid-piston pump of this possible type is that less time elapses during the expansion with the continuously accelerated piston than with the accelerated and retarded motion of the piston found in reciprocating gas engines. The longer time required to make a certain expansion, with the accelerated and retarded motion results in a greater radiation loss.

In glancing over some late tests made on 30-hp. automobile motors reported by the S. A. E., the thermal efficiencies ran from 6 to 12%. Assuming a mechanical efficiency of 85%, the overall percentage would range from 5 to 10%. The overall efficiency of explosion apparatus not using compression previous to ignition ranged from 5 to 10%. This is the reason that I made the statement that I thought the experiments would warrant the commercial application of the principle involved in these experiments to liquid-piston pumping apparatus.

The New High-Pressure Fire-Service System of Boston

[illegible]

Boston was one of the first cities in the United States to lay a separate pipe line solely for fire-protection purposes, about one mile of such pipe having been laid in 1898, to be supplied with salt water from the harbor by fireboats.

A general-alarm fire at Dover and Albany streets on Aug. 9, 1910, required the use of 11 fire-engines, while at the same time 18 other engines were engaged at a second-alarm fire on High St. Fifteen engines from surrounding cities rendered aid and it was evident that, in this situation, the protection of the city as a whole, as well as that of adjoining municipalities, was seriously weakened. It appeared, therefore, that steps should be taken to guard against the dangerous possibilities of a like situation in the future. After full consideration, the installation of a high-pressure fire-service system was adopted as the best and most practicable solution of the problem, in that it would furnish the most reliable form of protection to the high-value district, since it could deliver more water at high pressure than all the steam fire-engines now in the service of the city operated at one time.

The construction of such a high-pressure fire-service system became assured when a legislative act authorizing the Commissioner of Public Works to prepare the necessary plans and proceed with the construction was accepted by the city government. Upon the passage of an appropriation order by the City Council and its approval by the Mayor, on July 1, 1911, an engineering corps was organized as the High-Pressure Fire-Service Branch of

BOSTON FIRE-SERVICE

Pipe weights in pounds—see Fig. 1

Diam. of pipe, in.	Weight per ft. of barrel	Weight of bell	Number of lugs	Weight per lug on bell	Weight per lug on spigot end	3 ft. Weight with lugs	3 ft. Weight without lugs	4 ft. Weight with lugs	4 ft. Weight without lugs	6 ft. Weight with lugs	6 ft. Weight without lugs	12 ft. Weight with lugs	12 ft. Weight without lugs	Weight of lead for standard joint
8	60.1	74	4	30	61	371	280	442	347	581	488	[illegible]	[illegible]	[illegible]
12	108.1	138	4	36	72	641	536	778	663	1041	934	1541	[illegible]	[illegible]
16	215.6	203	6	50	125	1016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	318.9	421	6	63	173	[illegible]	1277	1864	[illegible]	[illegible]	[illegible]	[illegible]	4147	[illegible]

FIG. 1. JOINT FOR STRAIGHT CAST-IRON PIPE, NEW HIGH-PRESSURE FIRE SERVICE, BOSTON, MASS.

the Water Service and a consulting engineer for the pumping-station equipment was retained. The laying of the pipes has just been begun (August, 1914).

The area which will be protected by the system contains about 550 acres, comprising the whole of the 345 acres which the Underwriters term the congested-value district and adjacent territory through which it is necessary to lay pipe to serve the high-value area. For the protection of a district of this character, the capacity of the system should be such that 30,000 gal. of water per min. can be delivered about any block and 15,000 gal. of water per min. on any single building, and the system has been designed to meet these requirements.

The location of the pumping station has not yet been determined definitely, although it is very probable that it will be near Fort Point Channel, in the vicinity of the South Terminal Station, where it will be out of reach of a great conflagration. New mains will run to the station to supply the water needed for the high-pressure service, which must be ample in amount.

Motor-driven centrifugal pumps have been selected as the most reliable and economical type of equipment to install. Electrical energy will be supplied, over duplicate circuits, from the power plants of the Edison Electric Illuminating Co. Each pump will be capable of delivering

3000 gal. per min. at a pressure of 300 lb. per sq.in. Separate fireproof rooms containing the high-voltage electrical apparatus will be located in the rear of a switch-

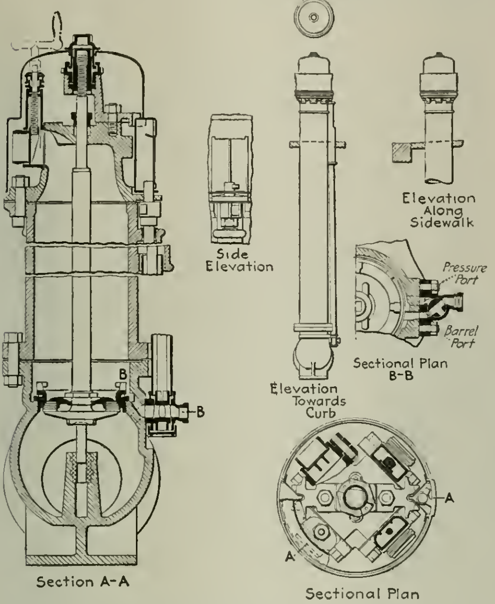


Fig. 2. Hydrant for New High-Pressure Fire Service, Boston, Mass.
(Patent applied for by J. A. Rourke*.)

board from which the pumps and motor-operated valves will be controlled. Fire alarms and orders from the Fire Department will be received over a fire-alarm circuit and a separate signal system which will be installed. Telephone service, over dupicate wires, will be provided by the telephone company.

A duplex distribution system, composed of two independent pipe systems with their mains on alternate streets, has been designed, thus insuring continuity of water-supply in case of the failure of a main in either leg of the system. About 13 miles of pipe, from 12 to 20 in. in diameter, will be required to build the system and cast iron has been selected as the best material for the purpose.

The first high-pressure systems were laid with steel pipe but cast iron was quite generally adopted later, flanged joints being used. Such joints occupy considerable space and are undesirable in streets so crowded with underground structures as are those of Boston. The selection of a bell-and-spigot pipe of special design, the details of which are shown in Fig. 1, followed an exhaustive series of tests on pipes and joints made by the Public Works Department. These tests included joints made with lead and with various alloys of lead, antimony and tin. It was found that an alloy consisting of 96% lead and 4% antimony afforded the necessary holding strength, but that a tight joint could not be made with it. The best results were obtained with 96% lead, 2% antimony and 2% tin, a joint resulting which held a pressure of 600 lb. per sq.in. on a 20-in. plug with no leakage. This alloy was therefore adopted for all joints adjacent to branches, offsets, bends and dead ends where holding strength is necessary. The specifications require that the alloy shall be made by melting the lead in a large pot, adding the proper proportion of antimony, previously melted in a separate pot, and then adding the tin.

*J. A. Rourke is Mechanical Engineer, High Pressure Fire Service, of the Public Works Dept. of Boston.

All pipes, after laying, are to be tested by water pressure at 400 lb. per sq.in. and the leakage must not exceed ½ gal. per lin.ft. of pipe joint per 24 hours.

The mains will be so equipped with gate valves that a break in a pipe will necessitate putting out of service not more than three hydrants and each valve will be set in a manhole large enough to permit of easy access for maintenance and repairs. The valves are of special design, made to suit the requirements of the service.

The hydrant adopted, shown in Fig. 2, was also designed in the Public Works Department. It is simple in design, reliable and efficient, and has a capacity of 2000 gal. per min., which is equivalent to that of three fire engines. Each hydrant will be set on a branch provided with a gate valve, as shown in Fig. 3, thus providing for cutting out any hydrant without affecting the flow in the mains. About 450 hydrants will be placed within the area covered by the system, or about one hydrant to each 40,000 sq.ft. of area, which will enable the capacity of the system to be concentrated where needed through hose lines of moderate length.

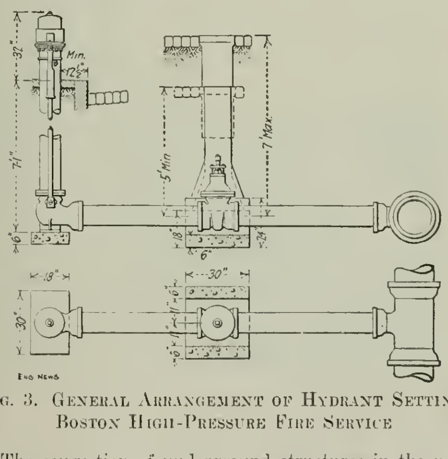


Fig. 3. General Arrangement of Hydrant Setting, Boston High-Pressure Fire Service

The congestion of underground structures in the narrow streets makes the work of laying the high-pressure pipe very difficult. To enable the work to be done to the best advantage and at a minimum expense, plans have been made, based on a transit survey, showing all existing structures and enabling the selection of the most feasible locations.

The high-pressure fire-service system will enable a large number of powerful streams to be concentrated on a fire in a shorter time than with fire engines, and with much fewer men and less apparatus. This will, in turn, enable the protection of the remainder of the city to be maintained during the progress of a fire in the district covered by the system in addition to providing ample protection to the highest values in the city during the progress of a possible conflagration in the congested, frame-structure, residential districts.

The New Girard Point Grain Elevator at Philadelphia

By S. Ingberg*

SYNOPSIS—The new Girard Point grain elevator of the Pennsylvania R.R. at Philadelphia has concrete bins, with a total capacity of 1,078,700 bushels. The foundation consists of piles capped with a large reinforced-concrete slab, with a waterproofing course. The basement being below high-water level, the lower ends of the elevator boots are enclosed in steel tanks as an additional precaution against water. All machinery is electrically operated. One of the interesting features of the article is the description of the way in which the grain is handled from the time it is removed from cars until it is shipped for transportation.

A large terminal grain elevator for transfer and storage purposes has been erected at Girard Point, Philadelphia, for handling the export business of the Pennsylvania R.R., as the traffic overtaxes the present facilities. It is located at the mouth of the Schuylkill River, and was built for the Girard Point Storage Co., which is a subsidiary of the railway company.

The general plan of the plant is shown in Fig. 1, and Fig. 2 is a view of the buildings when practically completed. The cross-section and plans in Fig. 3 show not only the design and construction, but show also the arrangement of the conveyors and other apparatus for handling, weighing and distributing the grain. The loaded cars are delivered to a large yard (at the left of Fig. 1) having 12 tracks, spaced 13 ft. c. to c. and on a descending grade of 1% toward the elevator. These converge into six tracks extending to the elevator.

The track shed where the grain is delivered from the railway cars is 144x144 ft., with six tracks spaced 20 ft. c. to c. Adjacent to this is the working house 92x144 ft., from which a conveyor bridge extends along the dock to deliver grain to vessels. Above the first floor of this building are 29 cylindrical concrete bins 13 ft. diameter and 74 ft. high, and above these is the cupola, 62x82 ft., and 93 ft. high, containing the distributing machinery, etc. The storage house consists of 51 cylindrical bins 15 ft. diameter and 96 ft. high, surmounted by a working floor for the conveyor belts which deliver grain to the bins. Provision is made for increasing the size of the plant when required.

The working house, with its track shed and conveyor gallery, has a capacity for storing 240,000 bu., receiving 28,000 bu. per hr., shipping 60,000 bu. per hr. from the dock, and cleaning and separating 10,000 bu. per hr. The storage house has a capacity of 837,000 bu., and the dryer has a capacity of 3000 bu. per hr. It should be noted that one of the bins of the working house is utilized for a freight elevator and spiral stairway, and is not available for grain. The details of the bin capacity are as follows:

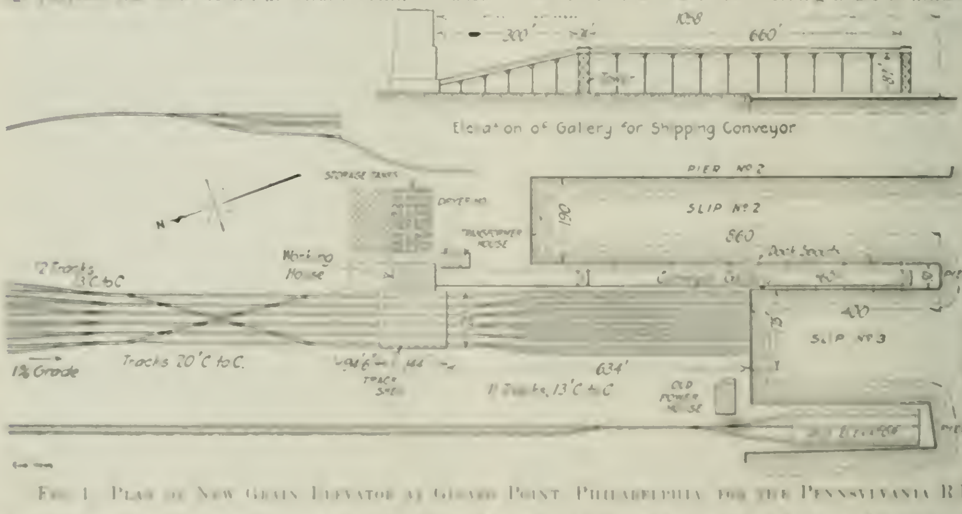


FIG. 1. PLAN OF NEW GRAIN ELEVATOR AT GIRARD POINT, PHILADELPHIA, FOR THE PENNSYLVANIA R.R.

	Bu.	Bu.
Working house:		
[illegible] circular bins	[illegible]	[illegible]
[illegible] interspace bins	[illegible]	[illegible]
[illegible] outerspace bins	[illegible]	[illegible]
Total		241,200
Storage house:		
[illegible] circular tanks	[illegible]	[illegible]
[illegible] circular tanks	[illegible]	[illegible]
[illegible] interspace tanks	[illegible]	[illegible]
[illegible] outerspace tanks	[illegible]	[illegible]
Total		[illegible]
Grand total		1,078,700

STRUCTURAL FEATURES

The structures are of reinforced-concrete throughout, with the exception of the steel gallery for the dock conveyors. Borings at the site showed about 50 ft. of mud and clay, followed by gravel and sand to about 60 ft., with rock at two points 64 ft. and 101 ft. from the surface. The foundation is a reinforced-concrete slab (with side walls rising above water level), supported on wood piles 60 ft. long. These piles carry an average load of 16 tons,

*Structural Engineer, James Stewart & Co., Chicago.

and under the working house and the storage annex they are spaced 27 in. c. to c. in each direction.

The bottom foundation slab and foundation walls are waterproofed with a 6-ply felt membrane cemented with a pitch compound. This membrane extends 6 in. above the extreme high-water line; it is underlaid with 9 in. of concrete and on the outside of the walls it is protected by 5 in. of brick. As a further precaution against the water, which at times comes 3 ft. above the basement floor, there is a system of inside drains laid in the basement slab and emptying into the boot pits. In the latter, one on each side of the house, is located a sump served by an automatic motor-driven pump, the operation of which is controlled by a float. This, with the use of water-tight steel tanks around the boots, is thought to insure the operation of the elevator during periods of extreme high water and to prevent stagnant water from collecting in any portion of the building.

THE WORKING HOUSE—Fig. 1 shows the construction of the slab under the working house. The depressions for the boot tank ($8\frac{1}{2}$ ft. on the receiving side and $6\frac{1}{4}$ ft. on the shipping side) were filled with sand after the steel tanks were placed, and the fill covered with a 4-in. concrete slab.

Fig. 4 shows also other details of the working house, a cross-section of which is given in Fig. 3. Its columns (the larger of which are loaded to 1,500,000 lb.) are reinforced with spiral hooping and vertical rods, as are also those in the first story. The latter are shown in Fig. 4, together with a plan of the girders and slab supporting the bins. The walls of the bins are 6 in. thick (7 in. on the exterior side of the outer bins). The reinforcement consists of vertical bars and horizontal hoop bands, the latter spaced 12 in. vertically. Each band consists of two semicircular bars, with overlapping ends, the bands breaking joint in the several courses.

THE STORAGE ANNEX—This building (at the right in Fig. 3) has its bins or tanks supported on a 16-in. top foundation slab bearing on piers, two for each tank, as shown in the foundation plan on the same cut. The bottom slab, 4 ft. in total thickness, is reinforced with bands of bars in the top and bottom. The bands in the bottom are laid in two directions and under the piers, while those in the top are laid in four directions, directly and diagonally between the piers. The 16-in. upper slab has four-way reinforcement, supplemented by circular bands around the openings for the draw-off hoppers at points of maximum tension and compression. The bottom foundation slab was made heavier than the stress requirements would demand, on account of the desirability of placing the basement floor above mean high water without the use of a false floor.

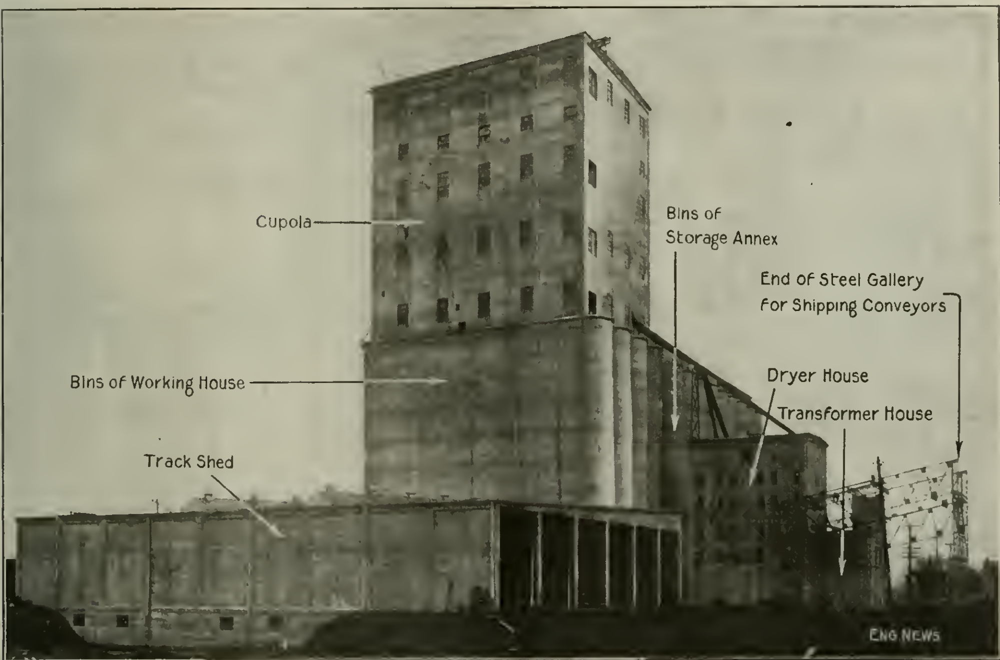


FIG. 2. COMPLETED BUILDINGS OF THE GIRARD POINT GRAIN ELEVATOR

The circular reinforcement for the tanks consists of flat bars ($1\times\frac{1}{4}$-in. to $1\times\frac{1}{8}$-in.), spaced 12 in. apart. Each band is made up of two lengths, lapping $3\frac{1}{2}$ in., each band breaking joints with those above and below it. No mechanical means are employed for bonding the two pieces other than the concrete, which has a minimum thickness of $1\frac{1}{2}$ in. between the bars and with a fair unit-bond stress forms an efficient joint.

FORMS—The bins and the working-house cupola were built with moving or sliding forms. These are composed of vertical staves 4 ft. high, nailed to circular chords made up of 2x8-in. planks cut into segments. They are

moved up by screw jacks working on the vertical jacking bars embedded in the bin walls. The jacks and yokes are shown in place in Fig. 5. This method of forming is not only found to effect an economy in time and expense, but also to give a smoother surface than is ordinarily obtained with stationary form work.

Conveyor Bridge.—The bridge or gallery (Fig. 1) extending along the dock, and carrying the shipping conveyors, consists of an inclined portion 300 ft. long in six spans of 50 ft., leading up from the working-house gallery to tower No. 1, and a level portion between the towers 660 ft. long in 11 spans of 60 ft. In the towers are the motors and drives for the four 36-in. belt conveyors contained in each portion of the bridge. The [illegible] construction of the bridge is shown in Fig. 6. It has two side trusses carrying the floor at their lower chords and a center truss beneath the floor. The trusses are of similar design except at the end connections. The [illegible] of the center truss are carried into the columns by means of a triangular end truss consisting of double-channel struts riveted to the columns. The arrangement of trusses [illegible] the ends of the floor beams and leaves a clear space above the floor for the conveyors.

The floor beams consist of 15-in. channels [illegible], and on these are laid the T-bars for receiving the book-tile floor (Fig. 6). The tiles are 3x12x18 in. and are covered with a 1-in. cement mortar finish. The roof is made similar to the floor except that the beams have single flanges with laced web, and the book tile is covered with 1-in. mortar finish, on which is laid a 5-ply composition tar, felt and gravel roof. The sides are covered with No. 22 galvanized corrugated siding.

Construction Plant

Sand and gravel from barges in the slip are unloaded by a clam-shell bucket into a receiving hopper discharging onto a conveyor, as shown in Fig. 7. This leads up an incline to a maximum height of 45 ft. for discharging into the stock piles, the sand being discharged by a stationary tripper 10 ft. from the end of the belt where the gravel is discharged. Trains of 1-yd. charging cars are run successively past the sand, gravel and cement, the proportioning of the aggregate being effected by marks placed on the sides of the cars. They are then run to the charging tower, and hoisted and discharged into the latter.

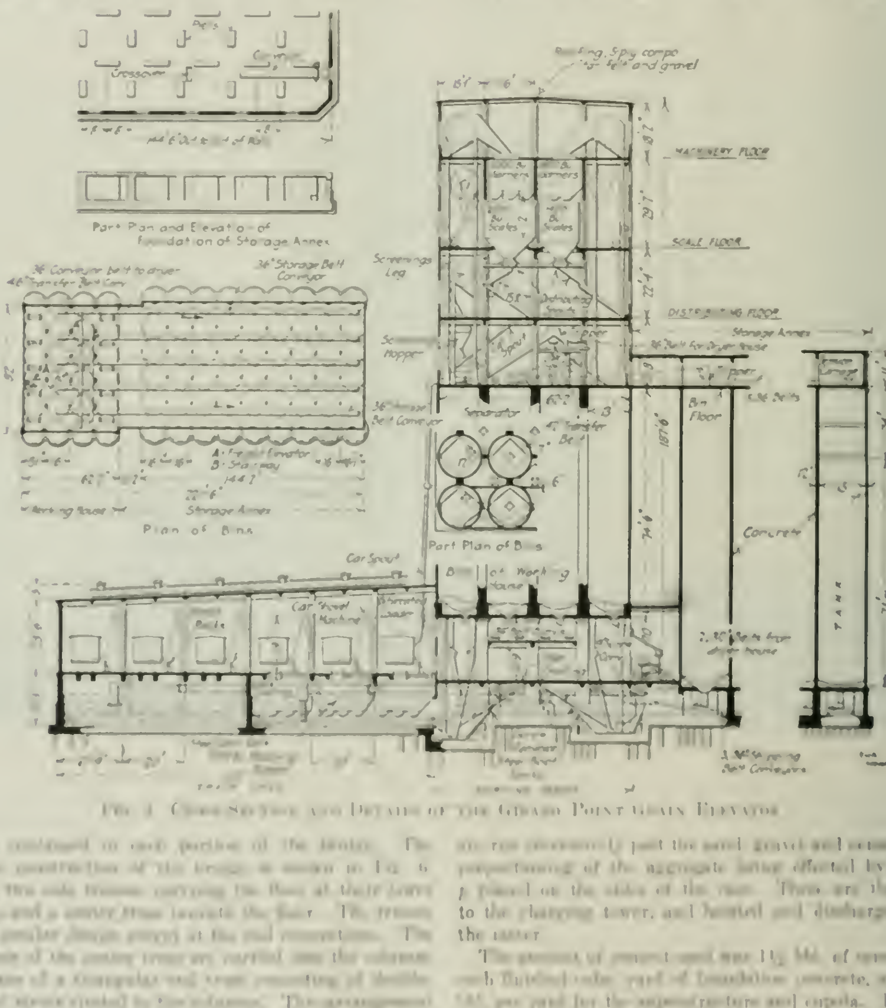


Fig. 4. Cross-Section and Details of the Girard Point Grain Elevator

The amount of cement used was 1½ bbl. of cement for each finished cubic yard of foundation concrete, and 1¾ bbl. per yard for the superstructure and cupola. Enough sand was used to fill the voids in the gravel, plus 5%. The concrete was mixed to a fluid consistency and spaded in place to avoid the formation of pockets. The aggregate being taken in by barge was subject to irregular delivery due to stormy weather, thus making it necessary to use stock piles.

Two hoist towers were erected for hoisting the gravel

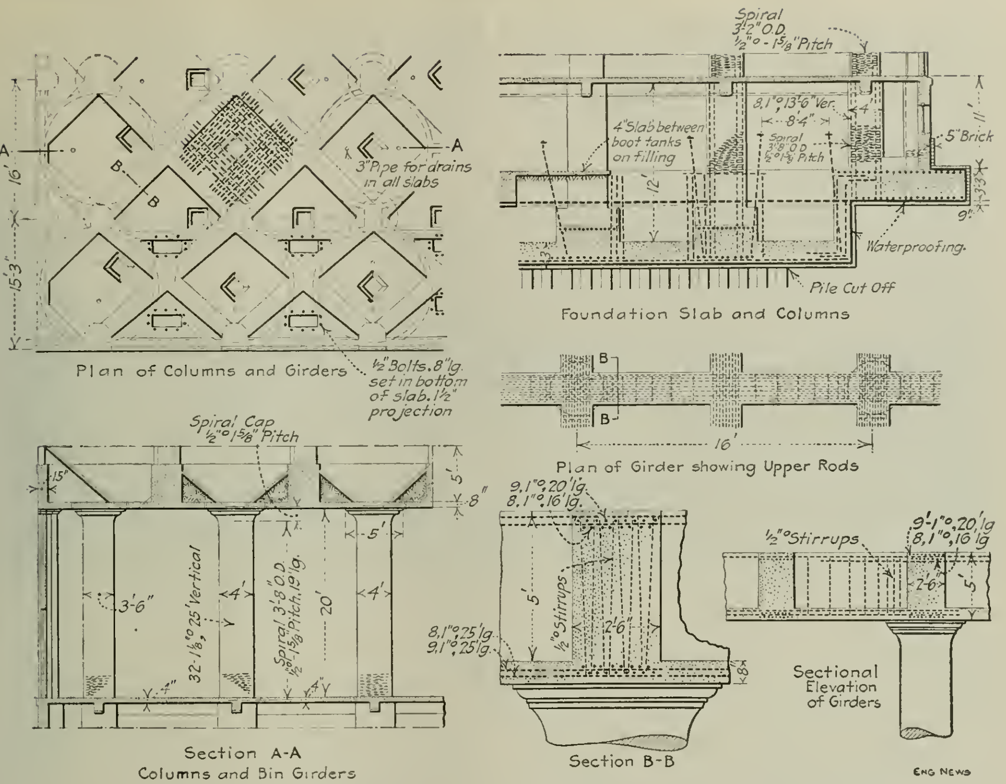


FIG. 4. DETAILS OF THE WORKING HOUSE OF THE GIRARD POINT GRAIN ELEVATOR

concrete, one serving the storage tanks and the other serving the working house, track shed and dryer house. A 1-yd. storage hopper receives the concrete from the hoisting bucket and serves the push carts used for depositing it in the forms.

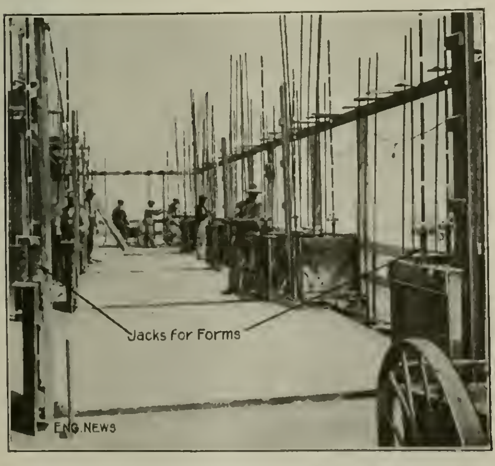


FIG. 5. REINFORCING AND JACKING RODS OF THE ELEVATOR BINS, WITH SCREW JACKS FOR RAISING THE FORMS

The job was organized and material received in October, 1912. The pile-driving contract was finished by February, 1913, and all concrete was laid from April to October following. The greatest number of men employed at one time was 350, with an average of 250 during the concreting season. The progress and the results in quality and finish of concrete attained with both moving and stationary forms were exceptionally good. As much as 10 ft. of vertical rise per day was made with the moving forms.

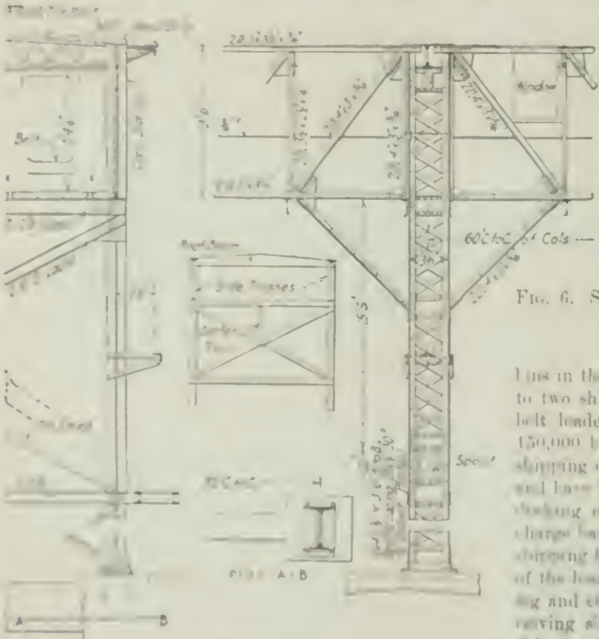
OPERATION OF THE ELEVATOR

RECEIVING—Grain is received from cars on six tracks in the track shed (Figs. 1 and 3), and each track crosses two receiving pits. The cars are hauled to and from the pits by cables operated from a six-drum car-haul machine in the north pit. At each pit is a power shovel (supported from the track-shed columns) which can unload at the rate of a car in 15 min. This is a plow hauled by a cable and drum and handled by a man in the car. The whole operation of spotting the car and unloading requires an average of 30 min. The gain drops into a 2000-bu. receiving hopper from whence it is spouted on the receiving belts. The slides under these hoppers are operated by an interlocking lever mechanism so designed

as to allow only one hopper to discharge on the belt at any one time. The receiving hoppers rest on ledges formed in the concrete walls of the track pits.

There are four 36-in. receiving belts (one for each battery of receiving pits), each having a rated capacity of 15,000 bu. per hr. and each discharging into a receiving leg of equal elevating capacity. The receiving belts and the lower portion or boot of the elevating legs are inclosed by the waterproof steel boot tanks. Noted above that the receiving legs and the shipping legs can be used for shipping. The receiving and shipping legs have rope drives connected to 125-hp. motors. The 32-in. elevator belt has two rows of 15x8-in. buckets placed 13-in. c. to c. vertically.

The grain is discharged into the receiving garners (Fig. 5), each of 2000-bu. capacity. These have concrete sides and steel hopper bottoms with nine discharge openings which afford means for quickly and evenly filling



the scale hoppers. The latter are also of 2000-bu. capacity, supported on the scale levers, and each discharges through a rotary valve into movable spouts. Each spout has two rotary joints which enable it to be doubled back upon itself, so that each spout commands an annular area on the distributing floor whose radii are the lengths of the spout when extended and doubled back.

There are 108 spout holes in this floor, from which spouts lead as follows: (1) to the working house bins; (2) to the five 36-in. belt conveyors discharging into the storage bins; (3) to the 42-in. reversible transfer conveyor on the gallery between the bin floor and the distributing floor, the tripper spout on this conveyor discharging the grain into spouts leading either to the working house bins or upon the conveyors running to the storage bins; (4) to the car spout which leads down the side of the house into the track shed and can be used for loading cars standing on the first track; (5) to the 36-in. dryer belt (on the gallery beside the transfer conveyor), discharging into a swinging spout or turnhead which can deliver to any one of the four spouts leading to the dryer house.

This system of spouting makes it possible to reach any bin in either the working house, storage annex or dryer house from any one of the nine scales, besides affording facilities for direct loading into railway cars. To reduce the number of spouts, most of them are made compound, having one or two openings in the distributing floor and another for the tripper spout (of the transfer conveyor) at the gallery floor. The belts over the storage tanks are so placed that one conveyor can serve two rows of circular bins or the row of interstice bins directly under the conveyor. Fig. 8 is a view of this floor with the conveyors and trippers and the spout holes.

SHIPPING—The 12-in. circular bins and 15 interstice

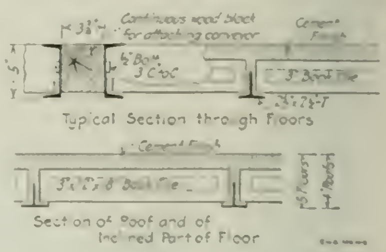


FIG. 6. STEEL BRIDGE OR GALLERY FOR THE SHIPPING CONVEYORS

bins in the center of the working-house group can deliver to two shipping belts by means of turnhead spouts and belt loaders. These bins have a combined capacity of 150,000 bu. and as the receiving ends of the four dock-shipping conveyors are under them it is possible to weigh and have in readiness an average cargo in advance of the docking of the ship. These central bins can also discharge back into the boots of the adjacent receiving and shipping legs. The six circular bins on the shipping side of the house can discharge into the boots of one receiving leg and either of two shipping legs, and those on the receiving side can spout into two receiving legs and one shipping leg.

Grain is drawn from the storage annex by means of the three 36-in. belt conveyors in the basement, each discharging into one shipping leg. These are similar in design and capacity to the receiving legs. The belts and draw-off spouts are located so that each belt receives grain from two rows of circular bins and one or two rows of interstice bins. The spouting of grain in the cupola from the shipping legs is similar to that from the receiving legs (already described) except that the shipping scales are of 1400 bu. and the shipping garners of 1800-bu. capacity.

The grain to be shipped is discharged into either one of the 77 working-house bins which spout directly onto the four 48-in. shipping belts running on the inclined portion of the bridge to the first tower. Here they rise and discharge onto the four 36-in. conveyors extending the full length of the level portion of the bridge (660 ft.)

and serving the dock spouts. The first six of these spouts deliver to the east side only, there being a berth on this side only, as shown in Fig. 1. The others deliver on both sides, as ships can lie on both sides of the outer portion of the dock. In either case, the dock spouts can be supplied from any one of the four conveyor belts by means of the compound spouts under the trippers.

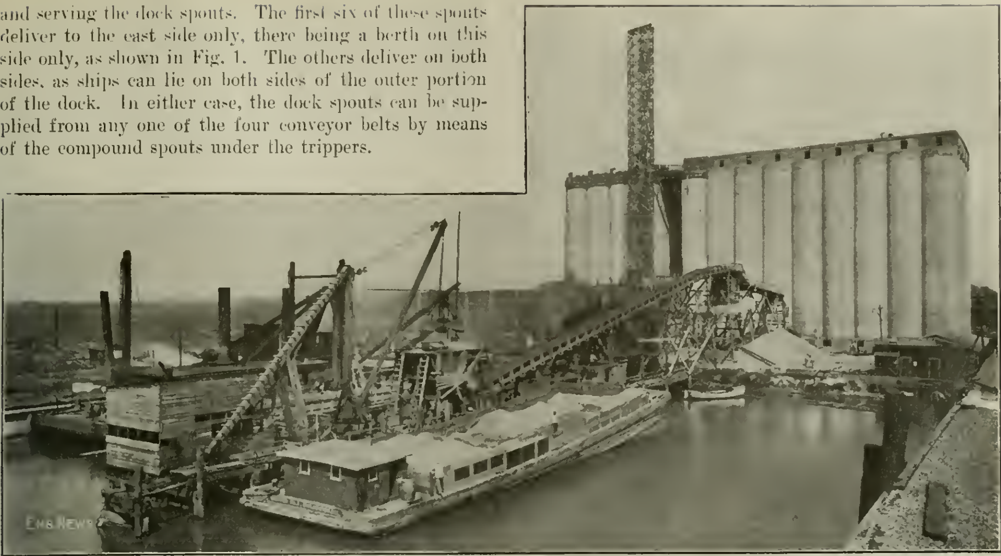


Fig. 7. Supply and Construction Plant for the Girard Point Elevator

The clam-shell derrick unloads concrete material from the barges to a hopper feeding an inclined conveyor, which delivers the material to stock piles. The concrete is raised in the tower and dumped into wheeled buckets for distribution to the forms.

These dock spouts are 66 ft. 7 in. above the dock (or 71 ft. 9 in. above mean high water) and have an extreme horizontal reach of 60 ft. when inclined 9 on 12, as shown in Fig. 9. This enables them to load the largest boats and to load into the farther of two ordinary vessels placed side by side. The channel and slips have been dredged to a depth of 35 ft. below low water.

Cleaning and Drying—The space between the working house and storage house is utilized for cleaning grain and handling grain from the dryer. There are four separators, each pair with a capacity of 10,000 bu. per hr., discharging the clean grain into two elevator legs. The screenings are delivered by screw conveyors to a leg which elevates them to a hopper on the distributing floor, from which they are fed to a second separator on the bin floor. This latter will handle 4 to 6 tons per hour. The valuable portion of the screenings is discharged into the working-house bins, while the coarse matter and dust are delivered to one of these bins which is used as the dust bin of the dust-collecting system.

The cleaner legs are utilized also for elevating the grain from the dryer, the belts from which discharge into these legs. The grain to be dried is spouted from any one of the receiving or shipping scales onto the 36-in. dryer conveyor on the gallery above the bin floor at the end of which is the turnhead for discharging into the spouts leading to the dryer house, as described above. The house has four units, each of 750-bu. capacity. From the garners the grain is charged into the dryers, the air for which is driven through the steam coils of two heaters located in the center panels on the same floor by two motor-driven fans located below them on the cooler floor. After drying, the grain is passed through the coolers and into the discharge hoppers located under them, from whence it is spouted onto either one of the dryer belts by means of compound belt-loading spouts.

The dust-collecting system is operated by two fans. A fan on the machinery floor collects the dust from the floor-sweeps in the cupola, the garners over the scales and the cyclone chamber over the screening separator, and discharges it into a cyclone located over the screenings bin. The other fan is on the first floor, taking the dust from the basement and first-floor sweeps and the four cyclones connected with the cleaning machines, and discharging it into the cyclone located over the screenings bin. There are 4 floor sweeps in the basement of the working house, 8 in the track-shed, 12 in the storage annex, 2 on the first floor and each of the cupola floors of

Fig. 8. Interior of Conveyor Floor above the Bins of the Storage Annex

There are five 36-in. conveyor belts, each with a traveling tripper to deliver the grain from the belt to the various spout holes in the floor.

the working house and one at the end of each of the five storage conveyors over the storage annex. The system is capable of taking dust simultaneously from all the dust collectors for the cleaning machines, garners and eight floor sweeps.

MISCELLANEOUS EQUIPMENT—The working house has a 1200-lb. freight elevator, extending from the first floor to the machinery floor, and there is also a spiral stairway, both occupying one of the bins. An elevator for tickets extends to the scale floor. An inter-communicating telephone system connects all parts of the plant, each instrument being arranged so that it may call any other, and two instruments are so equipped that they can ring all telephones simultaneously to call the superintendent or foreman at any part of the plant. Speaking tubes extend between the bin floor and scale floor, and communication between the shipping conveying gallery and the scale floor is had by means of electrical signal bells. A double-lamp signal (red and green) for each elevator leg is located on the first and scale floors, and a similar [illegible] signal system affords communication between the men unloading grain from the tracks and those operating the machinery on the first floor.

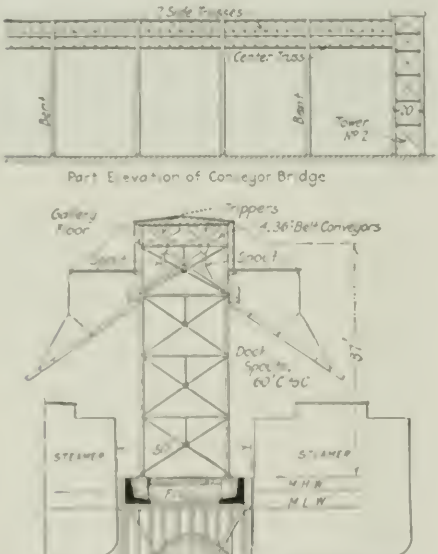


FIG. 9. CROSS-SECTION OF SHIPPING GALLERY AND PIER OF THE GIRARD POINT GRAIN ELEVATOR, PHILADELPHIA, PENN.

POWER EQUIPMENT

Current is received from the Philadelphia Electric Co. through three high-tension leads coming into the tower of the transformer house built in connection with the dryer house. The voltage is stepped down from 13,200 to 440 for the motors and 220 for the lighting system. There are 30 motors (2105 hp.) of the induction type, three-phase, 60-cycle, and wound to operate at constant speed. They are provided with starting compensators of such capacity as to start the motor under light load without requiring more than 50% excess current. As dust explosions are frequently caused by the passing of an electric spark through a dust-laden atmosphere, the entire installation is so designed that no circuit can be made or broken in the open, and precautions are otherwise taken so that no circuit can be broken due to accumulations of dust.

In general, the machinery for a grain elevator consists of relatively few but massive parts, but these must be proportioned to withstand heavy wear. The item of machinery whose adaptation has more than anything else made possible the modern grain elevator, is the conveyor belt. The belts for the receiving, shipping and cleaner legs are made of 6-ply 32-oz. duck, having the several plies cemented together with rubber compound. The outside is covered with a $\frac{1}{32}$-in. coat of rubber, vulcanized and finished. The conveyor belts are similarly made in 4-ply. The stretch in the belts is provided for in the case of the elevator belts by giving the bottom or boot pulley vertical travel in a slotted bearing frame; and in the horizontal conveyors the end or tail pulley is mounted on an adjustable frame giving it a 3-ft. travel. The head or driving pulley is connected to the motor through a countershaft to reduce the speed.

Rope drives are used almost exclusively, the manila transmission rope varying from $\frac{7}{8}$ in. to $1\frac{1}{4}$ in. Tension carriages are chiefly of the vertical finger-guide type with tension weight varying with the rope from 200 to 300 lb. and a travel of $1\frac{1}{2}$ to 2% of the total length of rope in the circuit. Bearings in the form of pillow blocks are of the spherical ball-and-socket type, ring oiling and dustproof, whereas floor stands are made rigid. An automatic journal alarm system has connections to all bearings except the conveyor roller bearings.

ENGINEERS AND CONTRACTORS

The elevator was designed and built by the grain elevator department of James Stewart & Co., of Chicago, of which department R. H. Folwell is Chief Engineer, and W. R. Sinks is General Manager. J. S. Johnson had charge of the construction work for the contractors. W. H. Cookman is architect for the Girard Point Storage Co., and its engineer is A. C. Shand, Chief Engineer of the Pennsylvania R.R.

Electric Lights for Use in Gas Charged Rooms should be low candlepower [illegible] lamps, according to tests made by the Bureau of Mines. These tests showed that when incandescent lamps of high candlepower were broken in an atmosphere charged with inflammable gas, the gas was ignited in a large proportion of the cases. Tungsten lamps ignited the gas in [illegible] to [illegible]% of the tests. The 8 candlepower, 110-volt carbon incandescent lamp, however, caused only one ignition in twenty tests, and this was a test made by breaking the tip from the bulb and allowing the gaseous mixture to enter in a small stream which did not break the filament. For additional safety it is recommended that wiring for electric light where gas is present should be installed in iron pipe conduits. If switches are used where gas is liable to be present the switch boxes should be made gas-tight. As an additional safeguard the incandescent bulbs may have heavy glass outer globes and metallic shields outside.

A Land-Drainage Problem in Missouri

By Charles H. Miller*

The St. John Levee & Drainage District, in the southeast section of Missouri, embraces the greater part of New Madrid and Mississippi counties, with a total area of 315,000 acres. It must provide for the drainage of an area of 425,000 acres (all of which should be included eventually in the district), bounded on the north by the Commerce Hills, on the west by the Sikeston ridge, and on the east and south by the Mississippi River. Part of this (40,000 acres) is now included in two smaller districts having outlets direct to the Mississippi River.

The first dredges were operated about 25 years ago, when land could be bought at $1.25 to $4 per acre. Since then, 15 drainage districts and 4 levee districts have been organized under the county-court law, and several hundred miles of ditches and 50 miles of levees have been built. The prices of these lands now range from $15 to $125 per acre. A map of the district, with the present and proposed works, is shown in Fig. 1.

Although it is probable that the St. John district eventually will take over and handle all the drainage and levee work, this cannot be done yet because of the many legal and political complications. The present aim of its managers and engineers therefore is to hurry the completion of the levee system; agreements have been made with the several levee districts as to where the work should be done, and each district will handle its part of the work to conform to the general scheme.

There will be much more difficulty in effecting an equitable consolidation of the several drainage districts. Some of these have purchased right-of-way and have constructed proper outlets, but many others have not done this. They all owe their existence to the county courts, and naturally one county will not be much concerned as to results outside of its boundaries. As some of these districts have been operating for many years, it is difficult to convince the landowners therein that they still owe something to the owners lower down, or that they should assist in the work of providing a different outlet for the surface waters.

A large part of the problem at this time is to control this drainage work and the levee work (without actually taking it over); continuing it so as to bring about one economical and complete scheme for the whole territory, and getting the different boards and interests to patch up their old differences and to work together in enlarging and extending the improvements. The scheme at this time is to provide only the levee work and the main trunk drainage.

In the reclamation of the overflow lands of the Mississippi Valley the real difficulties are more largely legal than engineering, and are brought about by the many political subdivisions that usually exist in one drainage district, we having as yet failed to reach that stage of progress where in the consideration of large public improvements we can wholly eliminate petty political jealousies.

Existing Conditions

Practically all the runoff from the entire territory passes into the Mississippi River through three channels (two natural and one artificial): James Bayou, St. John Bayou, and Lee-Rowe ditch. Connecting this ditch directly with the river was an ill advised proceeding, as an efficient outlet could have been secured at much less expense through James Bayou, and we would not be confronted at this time with the necessity of closing the mouth of this ditch. There is much sandy soil in this district, except in the lower portion.

In this territory there has been expended over $2,000,000 in reclamation work, and many drainage ditches have been constructed (mostly in the upper portions of the district). In addition, there is a line of levee (approximately 55 miles) along the Mississippi River extending to the south end of Mississippi County. This must be enlarged in order to afford reasonable protection to the land, practically every acre of which lies below the grade

Fig. 1. Map of the St. John Levee and Drainage District in Missouri, Showing the Present and Proposed Works

line here, and of course much below the grade line further up the river; and hence is always subject to overflow from a break in the levee, especially if the flood is of long duration.

Because of breaks near the upper end of the levee, during the floods of 1912 and 1913, approximately 300,000 acres were overflowed. Had the levee remained intact its entire length, then only about 190,000 acres would have been overflowed, this embracing the area now subject to back-water overflow from the head that obtains at the lower end of the levee in Mississippi county. This head can be reduced about 6 ft. by constructing an interior ditch to carry to St. John Bayou the waters from James Bayou and Lee-Rowe ditch, thus permitting the closing of their present mouths so that the levee can be extended

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[illegible] and on to the mouth of St. John Bayou. Then only about 140,000 acres will be subject to back-water overflow or are so situated as to be below the high-water mark at New Madrid, thus requiring pumping for final reclamation.

Although practically every acre of this district is subject to overflow, fully 285,000 acres are so situated as to be above back-water overflow that would enter at the mouth of the St. John Bayou. Therefore, it is possible to drain these lands by gravity and without pumping by simply constructing a high-level collecting ditch and discharging the waters into the river between levees that are above high-water stages. The recent high waters have demonstrated the fact that the present levees are not high enough to be safe and new grade lines have been established.

Additional Work Necessary

The work that is necessary in order to protect and reclaim these lands may be divided into two general classes:

1. Enlargement of levees and construction of additional levees, with flood gates at St. John Bayou.

2. Drainage ditches and pumping plants to dispose of the surplus rain water falling upon these lands:

A. To collect the waters from all the lands above back-water overflow and conduct them through a high-level ditch to the Mississippi River.

B. To conduct to St. John Bayou, through a low-level diversion ditch, the balance of the waters that would flow out at James Bayou and at Lee-Rowe ditch, so as to permit of the closing of these outlets, and thus lower the head of the back water.

C. Collection ditches on the lands below overflow and a pumping plant to take care of the surplus rain water during periods of overflow in the Mississippi River, or when the flood gates must be closed.

With the undeveloped condition of the low lands, it was deemed inadvisable to attempt the construction of pumping plants, and detailed estimates were not made to cover this and the necessary collecting ditches. It is possible to carry the drainage through the Sikeston Ridge and into the Little River valley and thence to an outlet through St. Francis River, thus saving the permanent expense of the operation and maintenance of pumping plants. But the [illegible] in the way of such a solution at this time are [illegible]. However, without pumping plants, but with flood gates in the levee at the mouth of St. John Bayou (which would be required to exclude the flood waters from the Mississippi) [illegible] large portions of these low lands, especially when the rainfall is light, would receive material benefit, and thus would [illegible] for considerable portions even with heavy rainfall.

For all of the above work except item (C), the estimated cost is approximately $[illegible]. There is [illegible], however, that the U. S. Government will aid (as it has in the past) in the construction of the levees, so that the direct expense to the land will not be so great.

After a careful consideration of the general project by many of the large landowners it was deemed best not to attempt the construction of the high-level ditch at this time, but to go ahead with the low-level diversion ditch and the extension of the levee system (Fig. 1). This will give the greatest benefit for the least expenditure in the shortest time, and will permit the development of much additional land which later on would be in a better position to bear a portion of the larger burden.

The question then arose as to the possibility of a portion of the whole work being able to serve the purpose for the time being, without adding something to it that would be thrown away later. Regarding the levee work there could be no difference; but it was necessary to investigate carefully the situation on account of the low-level diversion ditch being required to take care of the additional surface water which it is planned to carry (eventually) through to the river in the high-level ditch. Near the head of the low-level ditch is located what has been termed the "Ten-Mile Pond basin"; this is composed of several ponds that are joined together and embraces an area of approximately 6800 acres, and can be utilized for temporary storage, without causing injury to any good land, while the ditch is operating to carry the water through to St. John Bayou.

Runoff and Hydraulic Conditions

Drainage districts designed in this territory for $1\frac{1}{2}$-in. runoff have never had overflow troubles, and the capacity of the sandy soil to absorb rain water is very great. It was decided that it would be sufficient for areas of over 300 sq.mi. to figure for $\frac{3}{4}$-in. runoff in 24 hr., and $1\frac{1}{4}$ in. for smaller areas; no very small areas having to be considered in the work thus far planned.

Considerable interest centered in the fact that much water flowed in several of the existing ditches during the very dry season of 1913, due to subsurface flow. The head of the system of ditches was investigated without finding any inflow, in fact at a point 10 miles below the head the flow was practically nothing. At different points this subsurface flow was found to be 0.68, 0.37 and 0.26 sec.-ft. per sq.mi. The sandy soil carries much subsurface flow, and the actual construction of ditches collects this flow and carries it to the low-level lands, where it must be taken care of by ditches or by pumping, depending upon the stage in the river.

The levee grade line is placed at about 3 ft. above the high-water marks established at the time of the recent extreme flood, except at the lower end. There an increment of approximately 1 ft. has been added to overcome an assumed increased flood height on account of the leveeing of the basin above, as well as on account of a special levee likely to be constructed on Kentucky Point, just across the river from New Madrid, which will prevent these waters from flowing across a narrow neck at that place.

For the ditch design, Kutter's formula with the factor $n = 0.025$ (except for special cases) has been used; and combining the assumed rate of runoff with the fall as found on the ground, the proper-sized ditch is obtained by the "cut and try" method. As the proposed main ditches do not follow the general direction of the slope of the country (averaging about 1 ft. per mile) they have to be designed with much flatter slopes, particularly the high-level ditch. The elevation of the grade of the bottom is fixed at the upper end by local conditions of drainage; then where it intercepts inflowing ditches at a grade which is more than a few feet below their present bottom grade line, concrete spillways or drops must be provided.

The required height of the levee along the high-level ditch at points some distance from the mouth is a matter of considerable speculation, there being no way that we could find whereby, with the many variable conditions, it

was possible to figure out anything that would be better than a guess. Hence, they were placed at about 4 ft. above the assumed back-water.

In the location of this high-level ditch the same question of back-water height had to be considered in figuring what portions of the territory could be expected to drain by gravity during extreme floods in the Mississippi River. The best that could be done was to work from the actual conditions that took place during the recent flood as to back-water slopes, which slopes, on account of the breaks in the present levee at the time, were necessarily much disturbed.

City Front Levee at New Madrid

Although the city has been overflowed previous to 1912, the flood has never been more than 1 to 3 ft. deep, and has caused very little damage. The overflows of 1912 and 1913 were high enough to flood the city to depths of 5 to 7 ft. and demonstrated the fact that levee protection is absolutely necessary.

Some 15 years ago, the river bank along this entire front was protected with brush and riprap revetment which has prevented further erosion since that time. However, from the experience with similar work at other places, there is no positive assurance that breaks might not occur, and therefore it was deemed entirely inadvisable to try to protect this front with a concrete flood wall and the question of an earth levee was taken up.

At first, it appeared that there was no escape from property and right-of-way damages that would be equal to or greater than the cost of the levee embankment itself. Then consideration was given to the proposition of acquiring through the second block from the river only right-of-way enough for the levee and borrowing material from some point outside the city. Thus the front street, with the residences on either side, would be left without levee protection. To place such a levee in the front blocks would be unsafe.

Finally, it was decided to plan for the use of the front row of blocks, and with a suction dredge, pump in from the river sufficient material to construct a levee having a base about 200 ft. wide with 10-ft. crown and slopes about 1 on 10, first having raised all serviceable buildings so that they will be above the new levee, calculating to get a price per yard that will be enough lower to make up for the greater yardage.

Inverted Siphons

In order that the surface water from that part of St. John Bayou bottom which will be above the proposed high-level ditch or floodway, may be permitted to reach the mouth of the bayou, a large inverted siphon must be placed underneath the floodway. Other siphons must be placed under this floodway to provide gravity drainage for the lands on the east side of the Sikeston Ridge. As more or less silt will be carried during periods of flood, provision must be made for easily cleaning these siphons.

Ditch and Levee Construction Equipment

For the work heretofore built, as well as for that which is now under way in this section of the country, the floating-dipper dredge is used almost universally for the ditching, and teams with scrapers are used for the levees. In levee work the restrictions as to width of berm and depth of borrow pit make machine work more expensive than team work as a rule, but the time is rapidly approaching when some form of drag-line excavator will be in use more generally.

For the different classes of work now contemplated (Fig. 2), and considering all of the special conditions obtaining, we would expect to use the following equipment: (A) low-level ditch; a floating dipper dredge, of about 3½ cu.yd. capacity, or drag-line excavator. (B) High-level ditch; some form of large-sized drag-line excavator, preferably one on each berm. (C) Standard levee; teams and scrapers, drag-line excavator, or steam-shovel and dump cars. (D) Special levee; a floating suction dredge with about a 12-in. pump.

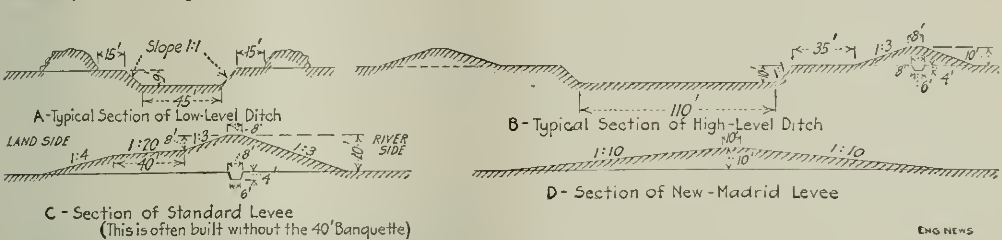

Fig. 2. Proposed Ditch and Levee Cross-Sections

In most of the ditches constructed in this territory considerable trouble has been experienced on account of the banks sliding, due no doubt in a large measure to the sandy subsoil. One of the best ways of overcoming this trouble is to construct the ditches with flat slopes. The floating-dipper dredge does not prove a satisfactory machine for making such slopes, and allowance is made for this by digging to a greater width of base; calculating that the ditch will still be of sufficient size after the sliding has ceased. Most of this sliding usually takes place within a short time after the ditch is first unwatered, and these slides follow no law, hence the result is not only a very unsightly piece of work, but often an inefficient one.

Although the design calls for slopes of 1 on 1, the writer is convinced that as a rule for this territory when the depth of ditch is more than 6 ft. it would be better not to have the slopes steeper than 1½ to 1 and that it will prove economical in the end to pay the increased first cost for such construction.

In scarcely any other class of work is there as much variation in unit price as in earthwork and to give figures without going fully into general details as to conditions, etc., is largely a matter of speculation. In general for this work we estimate that the prices will fall within the following limits (contractor's profit included);

dredge work, 3½ to 5c. per cu.yd.; drag-line work, 10 to 15c.; suction dredge, 12 to 18c.; team work, 16 to 25c.; steam-shovel work, 25 to 40c. On the suction-dredge work, the equipment cost will be large per unit because the amount of work is small.

Before the entire scheme is completed, the quantities will approximate the following: floating-dredge work (low-land ditch), 970,000 cu.yd.; drag-line work (high-land ditch), 10,500,000 cu.yd.; suction-dredge work, 200,000 yd.; team work (all classes), 6,500,000 cu.yd.

Maintenance Experience with a Bituminous-Top Concrete Automobile Highway

In 1908, a private corporation was formed to build and maintain a motor speedway from the outskirts of the borough of Brooklyn, New York City, through the center of Long Island. The purpose of the road, according to an address by W. K. Vanderbilt, Jr., one of the pro-

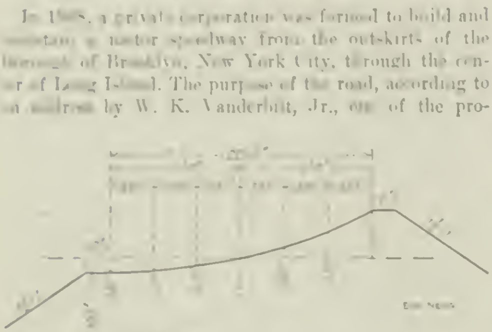

Fig. 1. Cross-Section of Automobile Highway on a 15° Curve

moters, was "to build a highway free from all grade crossings, dust and police surveillance."

A right-of-way 100 to 200 ft. wide and 45 miles long was purchased, and every season since 1908, and including that year, a section of pavement has been laid, the last in 1911. It was originally intended to have a pavement 22 ft. wide, but after the first section was completed the subsequent sections were made only 16 ft. in width.

This road, known as the Long Island Motor Parkway, furnishes an excellent study in road maintenance under special conditions. It is operated as a toll road. Nothing but pleasure motor vehicles and motorcycles are allowed. [illegible] is all supervised by a single individual, so that the road as a whole is an interesting experiment with the particular types of construction adopted. The problem, as is readily seen, is resolved into maintenance against weather and natural conditions, rather than against traffic, so that the opportunity to study this element by itself is unique.

Construction

Subgrade—The road is built for the most part through a naturally well drained sandy loam, such as covers the greater part of Long Island. Much of the route is comparatively level, the principal grades being gentle slopes, although some of the approaches to highway and railway crossings have grades as steep as 8%. In occasional instances, where the natural drainage was poor, tile underdrains were inserted. The earth subgrade was rolled and surfaced to the crown of the finished pavement.

Pavement—Methods of construction varied slightly from year to year. The section of 8½ miles built in the summer of 1908 was a 5-in. reinforced-concrete pavement. No contraction joints were inserted at the time of construction.

Because the glare of the white surface was objectionable, a bituminous material was subsequently sprayed on and sanded, forming a very thin carpet. After the construction of this first section, no reinforcement was used, and a plain concrete base, with bituminous top coat, was constructed, as explained farther on.

The reinforced-concrete pavement was constructed by spreading over the finished subgrade a thin layer of trap rock, 2 in. in greatest dimension. On this layer of crushed stone was spread a wire netting of American Steel & Wire Co., No. 12, 4-in. triangular mesh. Above the wire was spread another thin layer of stone, of 2-in. size; the whole depth of stone not exceeding 5 in. after rolling with a 10-ton steam roller.

The crushed-stone bed was filled with portland cement grout mixed 1:1:1, cement, sand and trap rock, pea size, was poured into the interstices, according to the patented Hassam process. The surface was rolled with a 10-ton roller until no water flushed to the top; the surface was then finished with hand tampers and brushed with rattan brooms. No smoothing or troweling was done, so the surface was left moderately rough and gritty. Shoulders were constructed of earth, compacted by rolling on a 3-ft. strip each side of the pavement. This pavement was guaranteed for five years.

The section built in 1909-'10 was 17½ miles long and

Fig. 2. A 15° Curve Designed for 40 Miles per Hour

was constructed of a 6-in. plain gravel-concrete base with a 1½-in. "Amiesite" top, a patent bituminous process that is included under the general classification, bituminous concrete. The concrete was mixed in the proportion of 1 bag of cement to a cubic yard of gravel. The surface of the concrete was left rough, and stones 1½ to 1 in. in size were set in the soft concrete and left projecting. On this was placed the 1½-in. wearing coat of 2 parts sand and 1 part gravel mixed with bituminous binder, according to the specifications for the Hassam Co.'s "Amiesite." The concrete surface was given a thin coat of bitumen before the wearing coat was spread. The wearing coat itself was spread and rolled like sheet asphalt with a 5-ton roller.

Fig. 3. Mile Straightway, Part of Vanderbilt Cup Race Course in 1908

1 was used; this inverted curved section had the low point 2.67 ft. below the outside shoulder. The particular curve shown in Fig. 1 was one of 14°, or one of 410-ft. radius. It was designed for a speed of 40 miles per hour. Fig. 2 is from a photograph of the same curve.

Subsequent sections built in 1911, '12 and '13 were constructed of a 4-in. gravel-concrete base with a 3/8- to 1/2-in. bituminous wearing coat of the type known as "Hassamite." The coating was sprayed on in two coats under about 300 lb. steam pressure. This pavement is guaranteed for 10 years.

Cross-Sections—The pavement cross-section has an average total crown of about 4 in. or only about 1/2 in. to 1 ft.; in some places the crown appears less. On curves, a superelevation and dished cross-section shown in Fig.

Traffic and Maintenance

Traffic—The traffic, as already noted, is entirely pleasure motor vehicles with pneumatic tires. The largest day's record is 1500 cars, and an average day's traffic is 100 cars. The speed limit is 40 miles per hour, although on straight-way sections, cars ordinarily travel at a much higher speed. In 1908, '09, '10, the Vanderbilt Cup Race course included a part of the parkway, and the speeds approached 100 miles per hour.

Maintenance—There has been but very little repair work necessary. This consisted merely in patching the bituminous top coat and in inserting expansion joints. At the beginning of the spring season a 3-man gang can in three weeks make all nthe necessary patches. The old surface is first swept clean and then a heated bituminous mixture of 2 parts bitumen and 1 part sand is applied, spread with a stub broom and covered with gravel. Rolling is not resorted to. The only other repairs necessary have been in about 60 instances on hot summer days when the pavement expanded sufficiently to bulge. Where this happens, the pavement is cut out and an expansion joint inserted.

Fig. 4. Holes in Bituminous Carpet, 1908 Reinforced-Concrete Pavement

Fig. 5. Typical Transverse Crack

PRESENT CONDITION OF ROAD—The accompanying views were taken the first week in May of this year, before the regular spring patching, and just as the pavement appeared after the winter and during the spring season. Fig. 3 is a view of the one-mile straightaway stretch of road on the reinforced-concrete pavement put down in 1908. This is in excellent condition. The transverse contraction joints and cracks are filled with material from the top coating and the surface is comparatively smooth and noiseless.

In several parts of this section of pavement, places were found like those shown in Fig. 2, where the thin bituminous-wearing coat had broken out. In almost every instance, the concrete surface beneath was very smooth. These holes in the top coat, it appears, are due to water and frost between the concrete base and the bituminous coat, and frequently occur season after season in the same place, owing to the difficulty of making a waterproof patch.

Fig. 5 shows a typical transverse crack, of which there were many. Fig. 6 shows a typical longitudinal crack, of which there were very few. Fig. 7 shows a form of incipient disintegration due to the failure or erosion of the earth shoulder; water apparently has found its way between the concrete and the sub-base; such instances, however, are rare.

Fig. 8 shows an experimental expansion joint installed during the last year; this is the only one of the kind in the road, the others being of a more simple construction as described below. This joint consists of two $\frac{1}{8}$-in. soft-metal plates with a strip of felt between. The concrete has practically broken away from the plates, and the felt works out of the joint, leaving a bad appearing and bad riding break in the road surface. In placing expansion joints at places where the pavement actually heaves in hot summer weather, the regular practice has been to cut away about a 12-in. transverse belt of pavement and insert a $\frac{1}{2}$-in. strip of felt, on each side of which is placed a 6-in. width of tar macadam.

Expansion joints were not used on the original construction, as already noted, but were inserted thereafter by the contractor at such points as required. As the pavements were laid under long-term guarantees, the contractor was allowed to follow his own beliefs regarding the necessity of expansion joints with the proviso that any damage due to expansion would be repaired under the guarantee, and joints inserted where necessary before the expiration of the guarantee period.

The general appearance of the surface of the pavement is that of a tar sidewalk. The surface is rough and gritty and yields a black char which coats the tread of the rubber tires. Fig. 9 illustrates the character of this surface.

As a whole, the pavement has resisted weather conditions for various periods of from one to six years with very fair success; and with the moderate amount of repairing referred to (less than $150 a year for the entire road), and an occasional coat of tar and gravel, the pavement is apparently good for many years, under the traffic it now carries; but its value as an example of this type of construction is, of course, limited by conditions which seldom exist elsewhere. It serves chiefly as an example in differentiating between disintegration due to wear and tear and that due to weather.

The President of the Long Island Motor Parkway is W. K. Vanderbilt, Jr., the Manager is A. J. Kenealy,

FIG. 6. TYPICAL LONGITUDINAL CRACK

FIG. 7. INCIPIENT FAILURE DUE TO LACK OF SHOULDERS

Fig. 8. Old-Style Expansion Joint, with Metal Plates

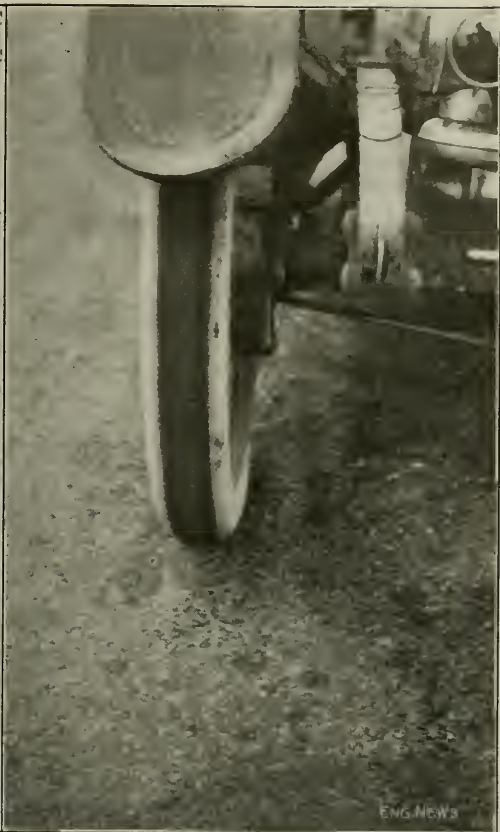

Fig. 9. Character of Road Surface

Mineola, N. Y.; the Chief Engineer of Construction was E. G. Williams, and the contractor the Hassam Paving Co., of Worcester, Mass.

The Railway Gage Problem in India

The railways of India aggregate about 18,260 miles of 5½-ft. gage (The Indian standard gage) and 11,750 miles of meter gage, besides some 3000 miles of narrower gages (24-in. and 30-in.). With various railway systems more or less isolated, the break of gage is a serious source of delay and inconvenience, and as there is strong possibility that the railways may have to serve a strategic purpose, the troubles due to break of gage are of military as well as commercial significance. In certain cases a third rail has been laid on standard-gage stretches of line to link together independent meter-gage systems, but this is merely a makeshift. This "battle of the gages" extends over an area of 1,800,000 sq. miles and effects a population of 260,000,000.

The problem of the unification of gage in India has been brought forward again recently by Sir Guilford Molesworth, consulting engineer, in a paper read at a meeting of the East India Association, in London. He pointed out that as far as cost of construction is concerned, there is very little difference. The saving in earthwork is small (not exceeding 3% even in embankments 50 ft. high. The cost of large bridges per mile forms a large proportion of the total cost of the railways, but this cost is affected but slightly by difference in gage. In the case of three large bridges aggregating nearly three miles in length a comparative estimate for the meter and 5½-ft. gages showed a difference of only 3%, the cost of abutments, piers, foundations and river training works being practically the same for both gages.

The narrow-gage movement affected India some 40 years ago, and the meter-gage was adopted for certain lines in 1873 on the sole ground of economy of construction. The actual saving, however, was slight, and at the present time there is practically no difference in cost. One of the principal items of saving on the early lines was in the light track and equipment, but instead of 35-lb. rails and 12½-ton locomotives the meter-gage lines now have 60-lb. rails and 40½-ton engines. Light railways of standard gage can be built as cheaply as those of narrow gage, and can carry ordinary equipment, with the

exception of the heavy mountain locomotives. The question of uniformity of gage is distinct from that of the comparative merits of broad and narrow gage, but Mr. Molesworth considers the 5½-ft. gage the better for transporting the heavy agricultural produce which forms the chief part of the railway traffic in India, besides being the better for the transport of artillery and war material.

As to the military aspect, as long ago as 1873 Lord Roberts made a strong protest against break of gage in the frontier railways, pointing out the inevitable confusion and delay due to the transfer and rehandling of material or troops instead of running military trains through to their destination. This protest led to the abandonment of projects for narrow-gage frontier lines, and to the widening of some 1000 miles of lines that had been built. However, with the present lack of uniformity throughout the country, it is impossible for the railway administration to deal properly with great congestions of traffic, as rolling stock cannot be transferred from one line to another to meet the contingencies which arise in India due to flood, famine, heavy crops, concentration of troops, and other causes.

It is considered that the proper remedy is to convert the meter-gage lines to the 5½-ft. gage, but the mileage to be changed is so extensive that the only practicable course is to adopt a fixed policy for the gradual conversion of the lines as their traffic outgrows their capacity or as opportunity may offer. On some meter-gage lines the limit of capacity has been reached, and the question has arisen whether these should be double-tracked or converted to 5½-ft. gage. It is considered that the latter would give ample increase in capacity, at much less cost, and with the advantage of reducing the difficulties of the gage problem.

The Use of Lime in Water Purification

By Charles P. Hoover* and Russell D. Scott†

SYNOPSIS—The use of lime in water purification is gaining ground. It is already being used at New Orleans, St. Louis, Cincinnati, Columbus, Oberlin, McKeesport, Fargo and many smaller places. Saginaw, Mich., expects to soften its water with lime, and Cleveland is soon going to soften its lake water with lime. Numerous letters from sanitary, municipal and railroad engineers asking for information on lime treatment of water have led the authors to prepare a review of the subject in general and to give special information regarding experience with the lime process at Columbus. Besides the information on Columbus Lime Treatment, this article will deal with lime-treating methods and experience in that city.

The advantages of adding lime to a hard magnesium water, such as is being treated at the Columbus water-softening and purification plant, are as follows:

(1) The water is softened.

(2) Intestinal and pathogenic bacteria are killed and thereby the water is rendered safe hygienically.

(3) The water is purified.

(4) Color is removed.

(5) Lime-softened water is less corrosive to iron pipe, hence no trouble is experienced from the accumulations of "red water" in dead ends of the distribution system.

(6) The sterilizing action of lime prevents bacterial growths.

(7) Nothing is added to the water that was not there originally, as the lime combined with CO_2 present in the water as lime $(CaCO_3)$ calcium carbonate which is insoluble and is removed.

SOFTENING WATER WITH LIME

In order to reduce the temporary hardness of water to the lowest possible figure, lime should be added in quantities just sufficient to absorb the free and half-bound carbon dioxide, and to precipitate the magnesium. If more lime is added than is necessary to absorb the carbon dioxide and to combine with the magnesium, then the water will be overtreated with lime and will have a caustic reaction.

Under ordinary operating conditions, in softening water with lime for municipal purposes, care should be exercised in order to reduce the temporary hardness to the lowest possible figure, and still not have residual or excess lime in the softened water.*

If the alkalinity to phenolphthalein is more than one-half the total alkalinity, too much lime has been added and the water will contain caustic alkalinity; on the other hand, if the phenolphthalein alkalinity is less than one-half of the total alkalinity not enough lime has been added and the water contains bicarbonate alkalinity.

The ideally lime-softened water should contain neither caustic nor bicarbonate alkalinity.

The following table shows in parts per million the relation between alkalinity by phenolphthalein and that by erythrosine or methyl orange in the presence of bicarbonates, normal carbonates and hydrates.

No.	Phenolphthalein alkalinity in parts per million	Total alkalinity by methyl orange, parts per million	Hydrates	Normal carbonates	Bicarbonates
1	44	[illegible]	44	[illegible]	[illegible]
2	44	[illegible]	[illegible]	[illegible]	[illegible]
3	44	[illegible]	[illegible]	44	[illegible]
4	44	[illegible]	[illegible]	[illegible]	[illegible]

Sample No. 1 consists of lime; No. 2 contains too much lime; No. 3 contains exactly the correct amount of lime; No. 4 contains too little lime.

During the past five years the average alkalinity of the Scioto River water at Columbus has been reduced from 155 parts per million to 48 parts per million, and

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*The following tests should be made in order to guard against [illegible].

The [illegible] by titrating 100 c.c. of the softened water with N/50 [illegible] as an indicator.

(2) [illegible] alkalinity by titrating 100 c.c. of the water with N/50 [illegible] as an indicator.

*[illegible]

†[illegible]

the average caustic alkalinity has averaged 1.5 parts per million.

History of Lime Sterilization

Lawrence Experiments—The first detailed study of lime treatment, known to the authors, was made by Allen Hazen at the Lawrence Experiment Station, in 1888. On adding lime to crude sewage he noted a progressive bacterial reduction with increasing quantities. Adding just enough lime to soften the sewage he found a bacterial reduction of 97.9%, and still higher percentage when excess lime was present.

Experiments at Cincinnati—Lime was added to water, with the idea of sterilizing it, at Cincinnati, in 1899 by the Ohio Sanitary Engineering Co., under the supervision of Geo. W. Fuller, who noted a high bacterial reduction in the treated water (94.5%) but attributed it specifically to coagulation rather than to sterilization.

Excess-Lime Method—Dr. A. C. Houston, Chemist of the Metropolitan Water Board, London, England, in the Eighth Research Report of the Metropolitan Water Board, proposed an excess-lime method of sterilizing water. His conclusions were founded on his observations, that quicklime added to raw Thames water in the proportion of 1 part of quicklime to 5000 parts of water, kills B. Coli in 5 to 24 hours and inferentially but certainly, the microbes also of epidemic water-borne diseases, for example the typhoid bacillus.

He proposes purposely to overdose a part of the water with lime, so as to bring about a known bacterial effect, and then after a suitable interval, to mix this portion with enough water, adequately stored or sterilized with ozone or hypochlorite, to neutralize the excess lime. He states in his report that the excess lime is responsible for germicidal action, and that if just enough lime is used to neutralize the bicarbonate alkalinity of the water, no bactericidal action is effected. It is noted in looking over the results of Dr. Houston's work that the excess lime was indicated by the red color produced when phenolphthalein was added to the treated water. The fallacy of this method of measuring excess lime has been stated in a previous paragraph and needs no further comment, but we suggest that this method of chemical technic may have led Dr. Houston to believe that he was using a large excess of lime, when in reality he was measuring the normal carbonates of calcium and magnesium, and not the excess lime.

Experiments at Columbus, Ohio—It has been observed that bacterial tests made for the presence of intestinal bacteria, in the softened water, collected from the outlet of the sedimentation basins at Columbus, Ohio, are negative 92% of the time in 1 c.c. portions. An investigation was made to learn just why the lime-softened water was so free from intestinal bacteria.

The results of bacterial tests made on lime-softened water containing no excess lime at the Columbus water-softening and purification plant, during the past four years, and also the results of numerous laboratory experiments lead us to believe that the action is not necessarily due to the toxic effect of excess lime, but that intestinal bacteria are killed when just enough lime is used to neutralize the free and half-bound carbon dioxide in the water. Bacteria belonging to the colon or typhoid group seem to require carbon dioxide for their develpment.

If two samples of water, one containing CO_2 and the other free from CO_2, be inoculated with typhoid or colon bacilli, these organisms will live in the carbonated water, but will die in water free from CO_2. This was demonstrated in the laboratory of the water-purification plant in several ways:

(1) Samples of well water free from intestinal bacteria but containing free CO_2 were divided into two portions. One portion was boiled until all the CO_2 was expelled and was then carefully cooled to prevent absorption of CO_2 from the atmosphere. The other portion was not boiled. Both portions were inoculated with typhoid and colon bacilli. These organisms lived in the water that had not been boiled, or in any other words, the water that still contained CO_2, but they died out completely in 48 hours time in water that was free from CO_2.

Even supplying the boiled water with oxygen did not render it suitable for sustaining bacterial life.

The results of these experiments tend also to support the contention that excess lime is not the essential factor in producing a water unfavorable to the growth of intestinal bacteria, because in this case lime was not used to absorb the CO_2.

(2) Samples of the softened water collected from the outlet of the sedimentation basins, containing no free and half-bound CO_2, were inoculated with from 5000 to 10,000 intestinal bacteria per c.c. After 24 hours, these samples became free from these organisms. On the other hand these organisms inoculated into the softened water after it had been carbonated with CO_2 lived and sometimes even increased in numbers.

Over 1000 bacterial tests were made on samples of river water, first inoculated with enough crude sewage to introduce from 3000 to 8000 colon bacilli, and from 40,000 to 50,000 total numbers of bacteria, per c.c. These samples, after being inoculated with sewage, were softened with lime. Bacterial analyses were made after 5- and 24-hour intervals. In order to find out whether or not the bacteria were simply dragged down mechanically by the precipitate, or were actually killed, samples of clear supernatant solution were tested, then the samples were vigorously shaken and a second set of tests made.

The results of these tests indicate that lime has a selective action. Intestinal bacteria are destroyed but the reduction of total number of bacteria is not high. Intestinal bacteria are killed and not simply removed by the precipitated carbonates, because the number of intestinal bacteria was no higher in the samples that were shaken than they were in the samples of supernatant liquor. Twenty-four hours contact is not sufficient to insure sterilization of intestinal bacteria, unless the water is overtreated with lime.

Treatment of Sewage Effluents with Lime

Effluents from the sewage-disposal plant at the Ohio Girls Industrial School were treated with lime. The sewage plant at the Girls Industrial School comprises septic tank treatment, sprinkling filters and slow sand filtration.

The raw effluent from the Girl's Industrial School showed the following bacterial analysis:

Quantity of [illegible] tested, c.c.	Gas production in lactose broth. Period of contact, hr. 5	24	48	72
10	+	+	+	+
1	+	+	+	+
[illegible]	+	+	+	+
[illegible]	+	+	+	0

+ = positive reaction. 0 = negative reaction.

Samples were treated with 8.5, 9.3 and 11 grains of lime. The latter proved to be just enough to neutralize the temporary hardness and leave no excessive lime.

The following table shows the bacterial results obtained after the lime treatment:

Period of contact: 5 hr., 24 hr., 48 hr., 72 hr.

Grains per gal. of lime added: 8.5 9.3 11 0 8.5 9.3 11 0 8.5 9.3 11 0 8.5 9.3 11 0

Gas production in lactose [illegible]	+	+	+	+	+	+	+	+	0	0	0	[illegible]
[illegible]	[illegible]	+	+	+	+	0	+	+	0	0	0	[illegible]
[illegible]	+	+	+	0	0	0	0	0	0	0	0	[illegible]
1 [illegible] c.c.	+	+	+	0	0	0	0	0	0	0	0	0

+ = Positive reaction. 0 = Negative reaction.

The results show that excess lime is not necessary, provided sufficient period of contact is allowed.

The results of additional experiments on sewage effluents show that the disinfecting action is not complete when large amounts of organic matter are present.

Conclusions as to Water Disinfection by Lime

Many other laboratory experiments were made and the results of these experiments, as well as results of analyses of samples collected at different points in the plant, seem to indicate the following conclusions:

(1) When enough lime is added to water to absorb the free and half-bound carbonic acid, and to precipitate the magnesium, the bacteria of the colon and typhoid group are killed in 48 hours after being so treated, provided the water does not contain large quantities of organic matter.

(2) The germicidal action is effective in from 5 to 24 hours when an excess of $\frac{1}{2}$ to 1 grain per gal. is added beyond that needed to reduce the temporary hardness to the lowest possible figure.

(3) Intestinal organisms will not live in water containing no free and half-bound carbonic acid.

(4) Lime-softened water inoculated with typhoid organisms or with crude sewage soon becomes free from them.

(5) The action is selective in that certain harmless bacteria grow, but the disease-producing germs do not.

(6) Turbid water can be successfully disinfected by softening with lime and then allowing the turbidity to settle out, along with the precipitated carbonates. Turbid water has never been successfully disinfected with hypochlorite, because the bacteria imbedded in the suspended matter are not destroyed.

(7) The sterilizing action persists indefinitely. In a paper on water disinfection by chemical methods, Samuel [illegible] states the advantages of using chemicals that persist in their disinfecting action, in the following words:

[illegible]

[illegible]

[illegible] 3 grains excess lime would prove to be a very satisfactory and safe water for bathing purposes.

The advantage of caustic water over water sterilized with hypochlorite is that the disinfecting action of the caustic persists, and if the water should become contaminated with pathogenic organisms they will soon become attenuated, and finally die, because there is no carbonic acid in the water, and carbonic acid seems to be essential for their development; whereas a water sterilized by hypochlorite might be satisfactory at the time of being pumped into the pool, but as soon as all the hypochlorite has become dissociated, the chemical offers no resistance to the development of disease-producing organisms that might be introduced into the water by the bathers.

Sterilization of Water Mains

During the floods at Columbus, in March, 1913, it was necessary to stop pumping for a period of 24 hours on account of a section of 36-in. pipe being washed out by the flood water. The distribution system was drained, and the local health authorities advised the people to boil the water, fearing that the mains would become contaminated with surface water. Knowing from our experiments that B. Coli, B. typhosus, B. paratyphosus, and intestinal bacteria will not live long in caustic water, the method of treatment, after pumping was resumed, was as follows:

The water at the plant was treated with enough lime to neutralize the temporary hardness of the water and, in addition, enough to introduce from 1 to 2 grains caustic alkalinity. Samples of the water were collected from all parts of the city, and 24 hours after, the water taken from all parts of the distribution system, showed, by the chemical tests, the presence of excess lime or caustic alkalinity, the water was found to be bacterially pure. This treatment is safe, it does not introduce any taste into the water, and there is no evidence, except by chemical tests, to indicate the presence of causticity in the water.

Better Coagulation Is Effected by Lime Treatment

Lime reacts with the magnesium compounds present in the raw water to form magnesium hydroxide, a bulky, gelatinous precipitate which coagulates the suspended clay particles or mud as readily as the precipitates formed by sulphates of alumina or iron. During the period of the year when the river water is extremely muddy, lime is added to water at the entrance of the mixing tanks in quantities sufficient to introduce excess lime, and better coagulation is affected than when just enough lime is added to neutralize the temporary hardness. This is due to two factors: (1) Magnesium hydrate ($Mg(OH)_2$) is precipitated in the presence of free lime ($Ca(OH)_2$), and (2), in the presence of hydroxyl ions, the negatively charged clay particles are repelled and set in motion by the negative OH ions. They strike against each other and are held together by mutual attraction,[1] forming masses sufficiently large to settle readily. The causticity is neutralized by adding a small amount of alum to the settled water just before it goes to the filters.

The advantages resulting from this method of treatment are: Causticity kills intestinal bacteria, while [illegible]

[1] "The Action of Hydroxyl Ions on Kaolin Suspensions," P. Rohland. B. Chem. Ind. Kolloide II, 192-5.

other bacteria and mud are dragged down mechanically, thus leaving less for the filters to remove; consequently, the filter runs are lengthened and less wash water is used.

The average turbidity of river water treated at the Columbus water-purifications works, for the years 1910, 1911 and 1912, was 63 parts per million. After being treated with lime, soda-ash and alum, the water was allowed to settle for about 12 or 15 hours, and the average turbidity of the settled water was less than 5 parts per million. From June 1, 1912, to Jan. 1, 1913, the turbidity averaged less than 1 part per million, the settled water being so clear that the filters were kept in service on several occasions for a period of seven days without being washed. Even then they did not then show a negative loss of head. During the summer months, when the raw water shows a high average hardness, 250 to 300 parts per million, and low turbidity, the clarification is almost perfect.

Removal of Color

Sperry[2], Chemist in Charge of the Grand Rapids water-purification plant, found that the lime which is used for softening the water also succeeds, through the removal of magnesium, in reducing the color of water to a point as low as that which could be secured at much greater expense by the application of sulphate of alumina. Two or three grains of alum were required to reduce the color from an average of 32 parts per million to an average of 10 parts per million, whereas by using enough lime to neutralize the temporary hardness, and then using enough alum (¼ grain per gal.) to drag down the fine particles of the precipitated calcium carbonate, the color was reduced to 10 parts per million, and the hardness from an average of 188 parts per million to less than 100 parts per million.

Thus both hardness and color were reduced according to Sperry's[3] figures, at a lower cost than would be required for treatment with sulphate of alumina to secure equal decoloration.

The color at Columbus by the combined use of lime, soda and alum has been reduced from an average (covering a period of five years) of 30 parts per million to an average of less than 7 parts per million.

Lime-Softened Water Not Corrosive

Lime-softened water is not corrosive to iron pipes, and since the Columbus water-supply has been softened no trouble has been experienced from accumulations of "red water" in dead ends of the distribution system.

Carbonic-acid gas has a corrosive action on iron pipe, and when this gas is neutralized by the addition of lime to the water, it loses its corrosive property.

Very soft water, containing carbonic acid, attacks lead pipe, and such waters are sometimes treated with lime to make it noncorrosive to lead[4].

Final Step in Softening Process

Following the addition of lime or soda to a hard water, two treatments are essential: (1) The water and the added chemicals must be well mixed by agitation in stirring tanks or baffled mixing tanks to get the reactions well under way; (2) the treated water must be given as much time as possible for further softening reactions to take place and for the precipitates to settle. While a large percentage of hardness is thus removed, there are two means by which a further removal of hardness may be obtained:

(1) Addition of alum. Theoretically, 1 grain of alum should remove 8½ parts alkalinity and increase the sulphate hardness by the same amount. Using this amount at Columbus it is found in practice that at times as much as 30 parts per million of carbonate hardness will be removed, and the sulphate hardness increased from 0 to 6 parts per million. During the periods when the river water is hard, alum is regularly added to the settled water in amounts ranging from ¼ to 1 grain per gal. to secure this reduction in alkalinity. The explanation seems to be as follows: Part of the magnesium present in the raw water combines with the lime to form magnesium hydroxide, which is insoluble and is deposited in the settling basins. The remainder combines with the lime and soda to form a basic carbonate of magnesium, which does not precipitate but remains in a colloidal state. On the addition of alum this colloidal magnesium is coagulated and retained on the filter sand. (2) Passage through sand filters. The residual hardness of lime-softened water may be considerably lowered in this manner. The 30-in. sand layer in the Columbus filters removes about 20% of the hardness of the applied (settled) water, when the river water is at a maximum hardness, and it was found, working on a small scale, that a bed of sand 6 ft. deep would remove as much as 40% of hardness from the applied water.

This seems to be a manifestation of the phenomenon of adsorption, or increased concentration at a boundary surface. All substances of large surface magnitude possess this property of removal of compounds from solution without any chemical reaction taking place. Among such substances are: Charcoal, fuller's earth, cloth, and various colloidal substances, such as gelatin, albumin, starch, and finally aluminum hydroxide. It is probable that the removal of hardness by alum is a process both of coagulation and adsorption.

As a result of application of alum and of passage through sand filters, the hardness of the filtered water has averaged only 89.6% of that of the settled water. Of the hardness removed, three-fourths was in the form of carbonates and one-fourth in the form of sulphates.

A recent analysis of the scale deposit from the sand showed the following results:

	Per Cent.
Loss on ignition	43.00
SiO_2	2.48
Fe_2O_3 and Al_2O_3	2.21
CaO	46.24
MgO	6.24
	100.17
Organic matter	0.88
Ca., calculated to $CaCO_3$	82.6
Mg calculated to $Mg(OH)_2$	9.0

Although the accumulation of scale on the sand grains is troublesome (as will be explained in a following paragraph) it is advisable to remove this material from the water before pumping it into the distribution system, because if it were not removed by the filters, it would very probably be deposited on the walls of the distribution system and in the meters.

[2]Paper read before the 1912 meeting of the American Public Health Association.

[3]Paper read before the Colorado Springs meeting of the American Public Health Association.

[4]See paper read by Geo. C. Whipple before the New England Water-Works Association, Mar. 12, 1913.

At St. Louis, according to Monfort[1], trouble from incrustation in pipes and deposits of scale in meters, was encountered when unfiltered lime-softened water was pumped through the distribution system.

Sections of pipe have been recently cut from Columbus mains laid in 1908, the year the softening operation began, and no incrustation is noted.

No trouble with the meters has been encountered except in those meters containing galvanized parts. A white slimy deposit of zinc carbonate formed in these meters, which clogged them and interfered with the rotation of the disks.

TROUBLES ENCOUNTERED IN FILTERING LIME-SOFTENED WATER

As previously stated, the sand in the filter beds at Columbus is composed practically of two parts scale and one part sand. The sand has become so badly coated that the effective size has increased from 0.415 mm. to 0.62 mm.

The worst feature of this incrustation is due to the fact that the sand grains, after becoming coated, have a tendency to cement themselves together and form hard lumps. These lumps become as large as bushel baskets and are so hard that they have to be dug out of the bed in order to break them up.

It is necessary to shovel the sand from one filter bed to another about twice a year. This takes a force of five men about two weeks' time.

This lumping of the sand is, of course, very objectionable, as it prevents the wash water from breaking through the sand bed uniformly, and it causes the rate of filtration to be high in parts of the bed. Still the quality of the effluent is not materially affected, because the water is always sparkling clear and the bacteria, as has been explained, are eliminated by the action of the lime.

[1] Engineering Record, May 7, 1910.

Hints for Preparing Layout Plans for Bridges on Curve

By C. M. Luther*

SYNOPSIS—Factors of a bridge on curve which require preliminary determination are tilt of girders, location of axis, shape of bridge seats, angle between ends and axis, etc. The engineer must fix these matters before design can proceed. Various actual cases show their bearing on the design.

While the stress-analysis of railway bridges on curves has received adequate attention in technical literature, the preparation of layout plans for such bridges has been neglected. The results of this neglect are often painfully apparent. Therefore, a brief discussion of layouts of bridges on curves, and especially the relation of plate-girders to masonry, may be of some interest.

The eccentricity of the center line of track with respect to the axis of the bridge is an important factor in obtaining the distance between centers of the girders, and has a direct bearing on the design of the masonry. It is generally conceded that for all practical purposes the right bisector of the middle ordinate of the span may be taken as the trace of the central plane between girders on the plane of the ties. In other words, this bisector is considered to be the axis of the bridge, or the center line between girders, at the elevation of base of (lower) rail.

The simplest case of a bridge on curve is that of a single-span deck plate-girder bridge on simple curve. If the curve is quite flat, and the span short, so that the middle ordinate for the span does not exceed 1½ in., the chord of the span may be considered as the axis of the bridge at the plane of the ties; otherwise, the above-stated method should be used. Fig. 1 shows the general layout of a bridge on a 5° curve, in which the middle ordinate for the span is over 13 in. The length of the girders is 100 ft. out to out, and the clear length between the ballast walls 100 ft. 8 in., there being 4 in. between the end of the steel and the face of masonry at each abutment. The distance from the base of (lower) rail to the bridge seat is 12 ft. 2 in. In single-span

*[illegible] Engineer, [illegible] Mann & Co., Ltd., Toronto, Ont.

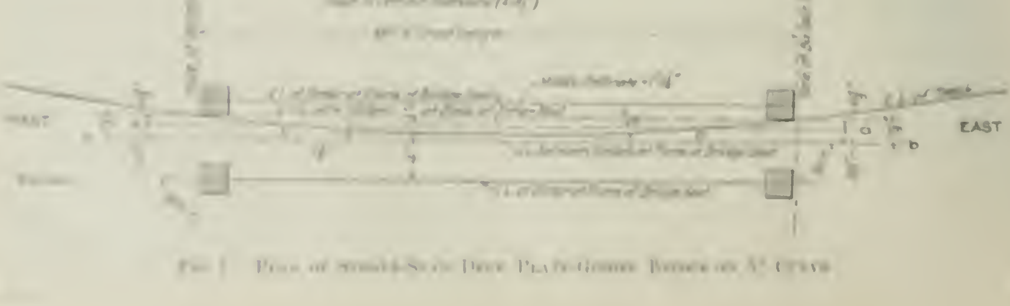

Fig. 1. Plan of Single-Span Deck Plate-Girder Bridge on 5° Curve

bridges, where the crossing itself is not skewed, it is undoubtedly the best practice to have the ballast walls at right angles to the line *a-a* (Fig. 1), and hence to the center lines of the girders. This insures girders of equal length.

The sketch shows two lines designated as center line between girders, *a-a* at the elevation of the base of (lower) rail, and *b-b* at the plane of the bridge seat. It is evident that when the girders are tilted (with an inclination to the vertical equal to the slope of the ties), the offset from the center line of track to the central plane between girders, *at the ends of the span,* will increase with the depth of the girders, attaining the maximum at the plane of the bridge seat, while the central plane between girders will, at the elevation of the bridge seat, approach the curve between points *P-P* (Fig. 1); and as a matter of fact, where the depth of the girders permits, it will even pass outside the curve, as is the case in Fig. 1. The importance of stating clearly, on the layout diagram, the position or elevation at which the center line between girders is taken, cannot be emphasized too strongly.

Therefore, after the center line of track is projected on the bridge seat, the center line between girders at that elevation must be located with respect to the center line of track. This being done, the correct position of the masonry plates and bolt holes on the bridge seat can readily be marked.

Fig. 2 is a section of the girders of Fig. 1, at the bridge seat of the west abutment. The total superelevation of the outer rail is $4\frac{1}{4}$ in., which corresponds to a train velocity of 36 mi.p.h. This superelevation gives the ties a slope of practically 1 : 14. In this bridge, the girders are inclined to the vertical with the same slope, so that the plane of the girder web is perpendicular to the plane of the ties; this eliminates the extra notching of the ties, and insures even bearing for them on the top flange.

In the abutments for this bridge, the bridge seat is made level, which leaves the entire slope of 1 : 14 to the shoes. The ballast walls, of course, following the ties, will also have a slope of 1 : 14. The abutment obviously is not symmetrical about the center line between girders.

In bridges requiring only a very flat slope of ties, the bridge seat of the abutment or pier may be made parallel to the plane of the ties. In that case the masonry members under both girders will be of equal depth.

Fig. 3 is the section of a half-through plate-girder bridge, at the end of the span. It is on a 5° curve; the girders are 63 ft. long and are spaced 15 ft. c. to c. The slope of the plane of the base of rail is 1 in 16, which very nearly gives a superelevation of $3\frac{3}{4}$ in. This slope is distributed between the bridge seat and the underside of the ties, the former taking two-thirds of the total slope and the latter one-third. This arrangement, in this bridge, is due to the Canadian Allis-Chalmers, Ltd. (formerly Canada Foundry Co., Ltd.). If the superelevation were small, the bridge seat could have been made level, leaving the entire slope to the ties, which would have been dapped to the required bevel over the stringers.

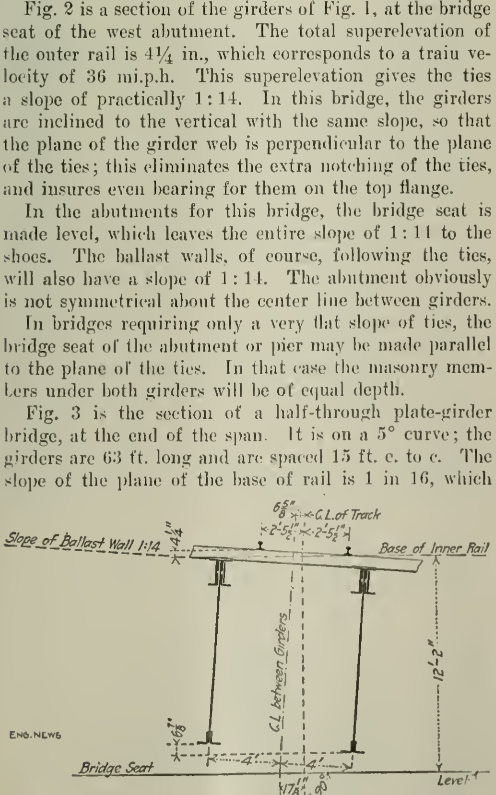

Fig. 2. Cross-Section, Deck Girder Bridge on Curve

It will be noticed that in Fig. 3 the stringers are located symmetrically with respect to the center line between girders. But theoretically the axis of the stringers is eccentric with respect to the axis of the bridge. While for short spans and flat curves, it is permissible to have the axis of the stringers coincide with that of the bridge, it is advisable for sharp curves and long spans (particularly in trusses, in which the floorbeams are spaced farther apart) to consider the panel length between the floor-beams as individual spans with respect to the stringers, and provide for the necessary offset.

In multiple-span bridges on curves, it is a good practice to have the faces of the ballast walls and the center lines of the piers normal to the curve, as shown in Fig. 4. They must be located clearly in reference to a definite line, say to the tangent at one end of the bridge. In

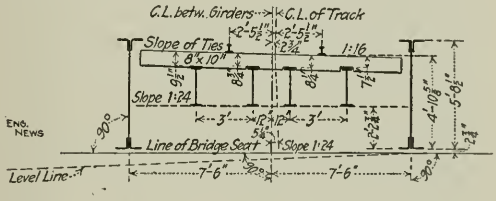

Fig. 3. Cross-Section of Half-Through Bridge on 5° Curve

(Two-thirds of slope in bridge seat, one-third in notching of ties.)

this layout, there will be two sets of girders, the inner and outer girders. The excess of the theoretical length of the outer girder over that of the inner may be expressed by the formula $E = 2\,H \tan \frac{1}{2}\,I$, where E is the excess, H the distance center to center of girders, and I the central angle of the span.

When the curve is rather flat, and the number of the spans comparatively few (three or four), the faces of the ballast walls and the center lines of the piers may all be made perpendicular to the long chord of the bridge. In that case, all the girders will be of same length theoretically, and the piers and abutments will be parallel to each other. But the angle between the center line of girder and the center line of pier will be different for each span, which is an obvious disadvantage.

In very few cases, where a bridge on curve crosses a street, a railroad, a canal, and other similar traffic channels, all at the same place, it becomes necessary to have all the piers parallel to each other and form an oblique angle with the long chord of the bridge. But this layout, for bridges on sharp curves and having more than five or six spans, should be avoided whenever possible, as it means a sharper angle of skew and longer piers at one end of the bridge, and the whole structure will have an unsightly appearance.

FIG. 4. LAYOUT DIAGRAM FOR MULTIPLE-SPAN DECK PLATE-GIRDER BRIDGE ON 6° SIMPLE CURVE

In steel viaducts, on curves, the transverse center lines of the pedestals should be at right angles to the chord of the tower span, i.e., the central plane between bents should be normal to the curve. With this arrangement, it is easier to have the base of the tower nearer the true rectangle, and, if the pedestals have the same elevation on top and the bents the same batter, there will be no skew connections in the framework of the tower. To have the transverse center lines of the pedestals normal to the curve must be condemned. Fig. 5 is the layout diagram of part of a viaduct on a 4° curve.

When a bridge is on transition curve, the same principles may be practiced in determining the center line between girders. It must be borne in mind, however, that the maximum ordinate will not occur at the middle of the span. When the bridge is on the sharper end of the transition curve, and the span is long, this feature must be taken into consideration, and the position where the maximum ordinate will occur must be located. Fig. 6 is the layout of a deck plate-girder bridge on the spiraled approach of a 6° curve. The easement curve is assumed to be a "cubic spiral." The offsets at the beginning and the end of the span, and at the point where the maximum ordinate will be, have been figured by the aid of the well known formula $x = \frac{d^3}{6RL}$ where x = the offset from the spiral to the initial tangent at the end of the first spiral-chord, d = length of the spiral-chord (10 ft. in Fig. 6), L = total length of the spiral, and R = radius of the circular curve. The offset at any other point, say S ft. from the beginning of the spiral, would be $x\left(\frac{S}{d}\right)^3$.

To find the point of the maximum ordinate to any span on the spiral:

Let

C = chord length of the span;

F = larger offset from one end of the chord to initial tangent;

f = smaller offset from other end of the chord to initial tangent;

l = distance from beginning of spiral to the required point;

Δ' = central angle of the spiral for length l;

Δ = central angle of (total) spiral for length L.

Then $\Delta' = \sin^{-1}\frac{F-f}{C}$. This means, of course, a deflection angle of $\frac{1}{3}\Delta'$ from the beginning of the spiral to the

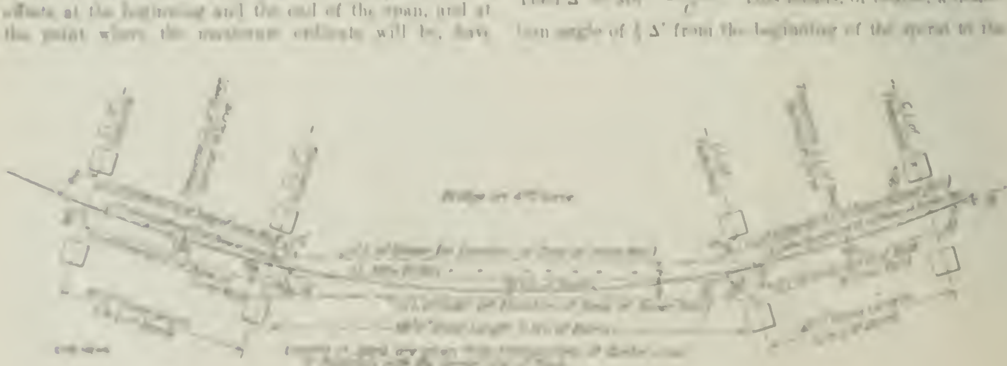

FIG. 5. LAYOUT DIAGRAM FOR VIADUCT ON CURVE

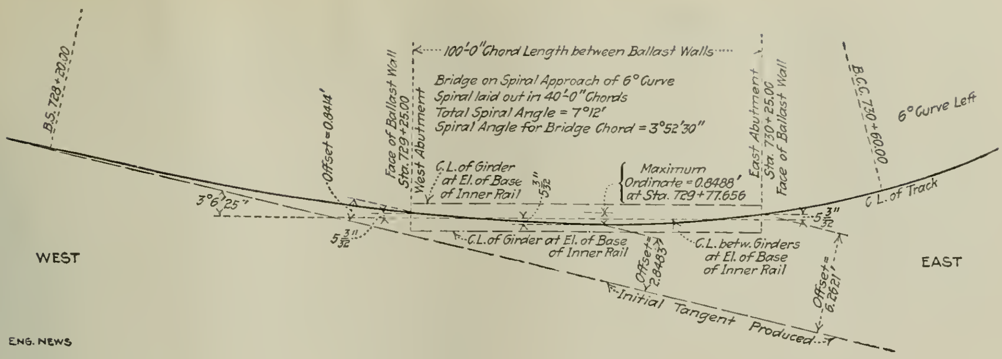

Fig. 6. Single Span on Spiral

required point. With these in hand, the station of the point can readily be computed, and the other elements determined.

Again, since the central angles, for different portions of the spiral, taken from the beginning of the spiral to its end, vary as the squares of the distances, the formula, $l = \sqrt{\frac{\Delta' L^2}{\Delta}}$ will at once give the station of the point required.

Regulations for the Sanitary Protection of the Sources of Water-Supply of Tacoma, Wash.

Strict rules for the sanitary protection of water-supplies drawn from surface sources are becoming more and more common. As an example from the far West we reprint the following from an ordinance of the city of Tacoma, Wash., passed April 2, 1913, which applies to the entire area of Green River above the water-works intake dam:

Sect. 1. The following sanitary regulations are hereby established to be observed by the inhabitants of the watershed of Green River, in King County, being all the areas of land draining into the lakes, rivers, springs, streams, creeks and tributaries flowing and emptying into said Green River above the dam constructed in Sect. 18, township 21 north, range 8 east, to wit:

(1) Every employer of labor, head of a family, hotel-keeper and lodging-house keeper within said watershed shall forthwith, upon ascertaining that any person on his premises is ill from any disease, notify the chief of the Green River police thereof.

(2) Each physician who shall attend a patient afflicted with a contagious or infectious disease within said watershed, shall forthwith notify the health officer of the city of Tacoma thereof; if no physician shall be attendant, the head of the family or other person having the care of the patient so afflicted, shall give the notice above provided for.

(3) The health officer and Green River police shall enforce all reasonable quarantine rules necessary to prevent the spread of any such contagious or infectious disease, and their orders in such respects shall have the same force and effect as similar quarantine regulations in the city of Tacoma.

(4) Every person suffering from typhoid fever, or other water-borne disease, within said watershed, shall be removed to a hospital in the city of Tacoma and there treated free of expense to such persons: Provided, That where such person has been contributing hospital dues to his employer, and is entitled to hospital treatment therefor, his removal and treatment shall be at the expense of the fund thus provided.

(5) No person shall cast into the flowing waters of said watershed, any garbage, manure, excreta, decayed vegetable or animal matter, or other rubbish; nor upon the ground within 500 ft. of the same; but all said material shall be burned up or else removed to the distance above prescribed.

(6) No person shall wade or bathe in any of the flowing waters of said watershed, or permit any animal to stand or wallow therein.

(7) All toilets and privies within said watershed shall be equipped with water-tight receptacles of proper size and permanent construction, and be so arranged as to enable them to be easily emptied or pumped out. Any such toilet or privy not so equipped may be condemned by the chief of the Green River police, and the defect shall thereupon be remedied by the owner or occupant of the premises within five days. When any such toilet or privy requires to be emptied or pumped out, the work shall be done under the supervision of the Green River police and to the satisfaction of the chief.

(8) Every employer of labor shall provide portable sanitary toilets and require the use of the same by employees doing work at a distance from their permanent camps or dwellings, and at any place within 1000 ft. of Green River or any of the lakes, springs or streams tributary thereto.

(9) No trespasser upon land not his own within said watershed shall camp or hunt upon such lands or fish in the waters of Green River or of any lake or stream tributary thereto, where they run or lie within such land.

(10) No unauthorized person shall remove or destroy any notice or sign posted in said watershed by the health officer of the city of Tacoma, or by his order in aid of preventing the pollution of the waters of said Green River.

The penalty for the violation of the ordinance is a fine of not more than $100 or a county jail term not exceeding 30 days, or both a fine and imprisonment.

The Garbage Collection and Disposal system for Chicago, as recommended by the City Waste Commission, was reviewed in our issue of April 9. The recommendations were adopted by the City Council in June, and appropriations were passed to provide for a technical staff to develop, install and commence the operation of the system, and to provide for the necessary plant. The plant already provided for includes the following: A reduction plant and incineration plant adjacent to the present reduction plant on the Chicago river at 39th St., $35,000; two incinerator plants at Goose Island and at Austin and Claremont Aves., $50,000 and $37,000; combined reduction and incineration plant (for unseparated garbage) at 95th St. and Stony Island Ave., $100,000.

The Commission recommended the disposal of garbage at a central reduction plant; the use of ashes and non-combustible waste for filling low ground; and the disposal of combustible waste at small incineration plants, one at the loading station of each of the 14 collection districts. An exception to this was a combined reduction and incineration plant at 95th St. (noted above) to serve two southern districts. The separation to be done by householders, metal and glassware to be recovered by sorting waste at the loading stations, and all the work of collection, transportation and disposal to be done by the city. Dr. Willis O. Nance (Alderman) is Chairman of the Chicago City Waste Commission.

Water Softening at Port Tampa

By Hiram McElroy*

The problem of good water for drinking and domestic purposes has been one of great difficulty in Port Tampa, Fla., ever since its first settlement.

During the early eighties, the Plant System, now known as the "Atlantic Coast Line Railway," built its road thru this territory and established its terminals at Port Tampa, where an abundance of deep water prevailed. Many thousands of dollars were expended from time to time in an attempt to secure water for boiler purposes, drilling no less than 25 artesian wells. An abundance

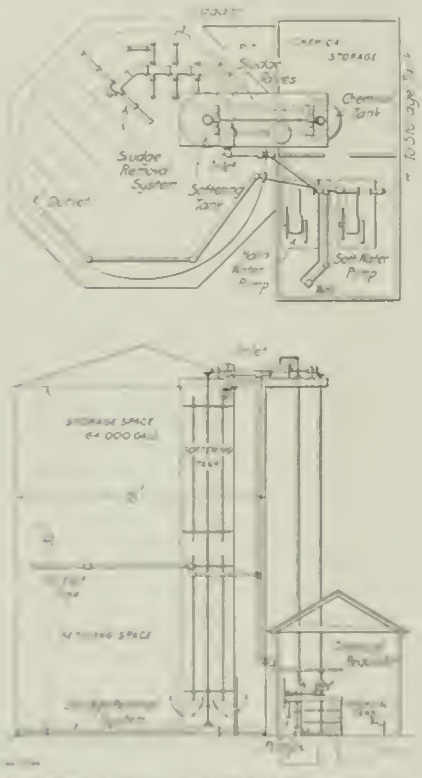

Fig. 1. General Design of Water-Softening Plant, Port Tampa, Fla.

of sulphur water was easily obtained at a depth of 60 to 80 ft., but the quality was so unsatisfactory that its use in boilers or for other purposes was prohibitive. The entire country about Port Tampa and several small lakes across Old Tampa Bay were fully investigated but with no apparent success. In the meantime, water had to be transported by tank cars from the upper parts of the state for the use of engines and shops and to supply the great ocean steamers.

At the time of the Spanish-American War, with 35,000 troops to handle through Port Tampa, together with thousands of horses to be loaded for the campaign against Santiago, the problem of securing even drinking water was perhaps the most serious menace facing the United States Government. A considerable portion of the sickness prevailing among our troops was doubtless due to this cause.

During 1910, the City of Port Tampa erected a municipal water-works plant for domestic and other uses. This plant has been very largely a failure, due to the very hard and ill smelling sulphur water. The citizens had very generally abandoned its use and resorted to the erection of tanks to be filled by rain water from the roofs of the houses, affording an excellent breeding place for mosquitoes. About the only use for the water plant was as a protection against fire.

In view of this condition, it became apparent to the city council that if the plant was to be commercially successful, a softer water must be furnished to its patrons. In March of the present year, the city council retained the writer as consulting engineer to investigate and report on what could be done to improve the city water-supply. The result of the investigation was a recommendation that a water-softening and purifying plant be installed in accordance with plans and specifications submitted. A contract was entered into with R. L. Davis, of Tampa, Fla., for the erection of such a plant, to be equipped with water-softening machinery furnished by the L. M. Booth Co., of New York.

The softening plant was put into operation in June of this year. Its construction is very simple and the plant may be said to operate automatically. No additional labor is required, the regular pumpmen doing the entire work.

Fig. 1 shows the general design and Fig. 2 is a general view of the plant as constructed. The plant has a capacity of 10,000 gal. per hr. of softened water and was installed complete at a cost of approximately $7000, including a storage capacity of 100,000 gal. of softened water. All equipment of the old plant was utilized.

Details of Operation

The water which is to be purified is taken from a 6-in. well 90 ft. deep, located in the pumphouse. It is delivered to the inlet box on the top of the softener by a gasoline engine and pump. The well pump, in addition to supplying the hard water to the softener, furnishes also the power to drive the agitators, an extension of the flywheel shaft serving as the driving pulley.

The chemical solution required to treat the raw water meets the water in the top of the softening tank. This is equipped with mechanical agitators and has a volume corresponding to from 15 min. to [illegible] min. flow when the plant is operated at full capacity of 10,000 gal. per hr. The reason that the period of reaction in the softening tank can be variable, although the plant is run at the given rate of flow, is because the storage space above the outlet pipe contains varying quantities of water due to the widely fluctuating demands. Above the outlet, there is storage for 64,000 gal. of softened water. This is available for instant use even though no raw water at the time is being pumped into the softener. It is, of course, the intention to maintain the tank nearly full at all times.

The function of the softening tank is to thoroughly mix the chemicals with the down-flowing water to insure that there will be no waste or loss of purifying chemicals. The mechanical agitation is an additional benefit in that it coagulates the precipitated impurities so that these will

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quickly settle out as soon as the quiet of the settling space is reached.

The rate of upflow from the bottom of the softening tank to the outlet in the settling space of this softener is 2.85 ft. per hr. This is sufficiently slow to effect a thorough clarification.

Suction for the soft-water pump is taken through the outlet pipe, 17 ft. above the foundation, which is at the bottom of the storage space. The soft-water pump delivers the softened water into a 60,000-gal. elevated steel tank mounted on a steel tower 125 ft. high, from which it is distributed to the city mains.

All of the work of attendance, except lubricating the shaft bearings on the top of the softener, is done at the ground level. The chemical tank (Fig. 3) is located in the chemical storage room of the pump house, so that it takes only a few minutes for the attendant to prepare the day's supply of chemicals. The proportional feeding of the chemical solution is controlled by a Booth automatic chemical-feed regulator.

The sludge-removal equipment consists of two sets of tile-pipe systems, each of which terminates in an 8-in. quick-opening gate valve. The sludge removal draws the precipitated impurities through 77 one and one-eighth-in. openings distributed over the bottom of the settling space. By the use of this system, the sludge is blown off each day. Only a small quantity of water, just enough to convey the precipitate, is used.

The chemicals used to soften the water are 2½ lb. of hydrated lime and 2.25 lb. of 58% soda ash, costing 3c. per 1000 gal.

The accompanying table shows the analysis of the water both before and after softening:

ANALYSIS OF WATER BEFORE AND AFTER SOFTENING, PORT TAMPA, FLA.

(Grains per U. S. gal.)

	Before	After
Calcium carbonate	16.62	0.31
Calcium sulphate	0.35	....
Calcium chloride	13.10	....
Calcium hydroxide	....	0.78
Magnesium chloride	4.78	....
Magnesium hydroxide	....	0.24
Iron oxide, Alumina	0.33	0.12
Silica	1.66	0.93
Suspended matter	0.25	....
Incrusting solids	37.09	2.38
Sodium carbonate	....	2.15
Sodium sulphate	....	0.38
Sodium chloride	28.63	48.30
Nonincrusting solids	28.63	50.83
Free carbon dioxide	0.66	....
Half-bound carbon dioxide	7.31	....
Volatile matter	7.97	....

FIG. 2. GENERAL VIEW OF PORT TAMPA WATER-SOFTENING PLANT

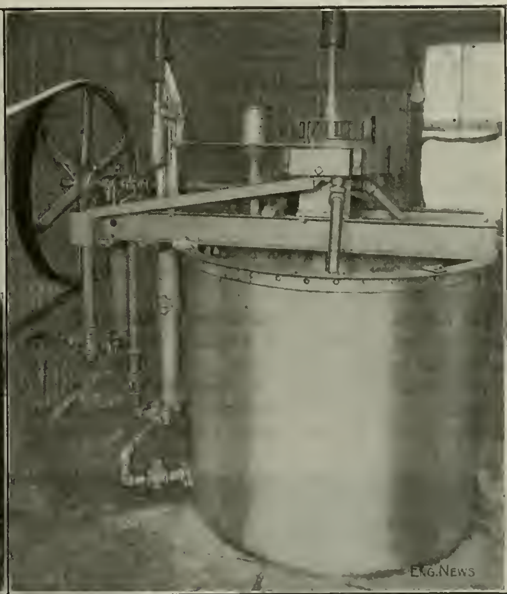

FIG. 3. CHEMICAL REGULATOR AND TANK, PORT TAMPA WATER-SOFTENING PLANT

The use of the softened water by many of the citizens of Port Tampa demonstrates beyond all question that the water softener is not only performing its function of rendering the water fit for domestic and laundry uses but has entirely removed the offensive odor and taste of the water. Instead of being compelled to put up with a vile, ill-smelling and bad-tasting sulphur water, the city is now supplied with a clear, sparkling liquid, free from its former objectionable minerals and bacteria.

Steel Passenger Cars for Indian railways are said to be under consideration by some of the railway companies, owing to the increasing price of teak wood and the decreasing price of steel. At present, steel freight cars are used extensively, and the modern passenger cars have steel underframes with wood bodies. In view of the intense and continued heat, special means of insulation and ventilation would be required for steel bodies of passenger cars.

1000-HP. Steam-Turbine Pumping Units in Charlottenburg, Germany

There are three 1000-hp. steam-turbines driving centrifugal pumps, in the Berlitzhof stations of the Charlottenburg Water Works, which are of interest for comparison with recent American practice. (These units were described in more detail in some notes on turbine construction for water-works service by B. Rosenfeld in "Fördertechnik," November, 1913, and in the "A. E. G. Journal," December, 1913.)

The first two machines were erected in Station 2; each has a surface condenser and auxiliary turbine to drive the air and cooling-water pumps. In the third machine, a water-works type of surface condenser was used—all the water pumped flowing through. This eliminated the cooling-water pump and allowed the air and condensate pump to be driven from the main turbine—which gave the advantage of higher economy to the auxiliaries. The air ejector is direct connected to the turbine shaft and is on the same bedplate with main pump and turbine. The condensate pump, below the condenser drain is on a vertical shaft driven by the main shaft through bevel gears.

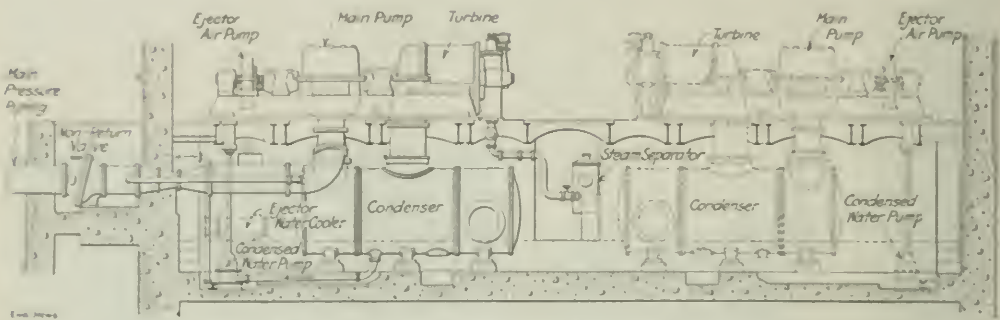

FIG. 1. ELEVATION OF BERLITZHOF PUMPING UNIT

The water enters the condenser (placed immediately below the unit) from the front and is taken out at the back up to the main-pump section inlet. In starting, the pump is primed by a steam injector. The machine can be started from the upper floor as the only machinery in the basement requiring care is the geared condensate pump and this needs no special attention in starting. The vacuum is increased as the turbine advances to normal speed. Only some three to five minutes is required for starting.

The pump has a capacity of 10,550 gal. per min. (15.2 million gal. per 24 hr.) at lifts of [illegible] to [illegible] ft. The guaranteed duty for this capacity varied from [illegible] million foot-pounds per 1000 lb. steam ([illegible] lb. gage pressure and [illegible]° F.) to [illegible] according to the lift. The acceptance tests were made at [illegible]-ft. head and the [illegible] when the guaranteed figure was exceeded by some [illegible]

FIG. 2. A 1000-HP. STEAM-TURBINE PUMPING UNIT; BERLITZHOF STATION [illegible], CHARLOTTENBURG

Editorials

Solid British Water Tank Engineering: 1793--1914

The recent demolition of the old water tank of the Manhattan Co., New York City (Eng. News, July 23, 1914) should not be passed by without noting that cast-iron water tanks are not only in common use in England today, but are still being constructed; at least they were only a few years ago and it seems fair to infer from a current advertisement that they still are. At the risk of embarassing American manufacturers of steel tanks by foreign competition from cast-iron tank makers, we reproduce with space reduction the following advertisement from the "Engineering Supplement" of the London *Times*.

CAST
IRON
TANKS.

LARGEST MAKERS IN
THE UNITED KINGDOM.

DRAWINGS, SPECIFICATIONS,
AND ESTIMATES ON
APPLICATION.

CONTRACTORS TO THE
ADMIRALTY, WAR OFFICE,
AND CROWN AGENTS.

NEWTON, CHAMBERS & CO., LTD.
THORNCLIFFE IRONWORKS NEAR SHEFFIELD

ESTABLISHED 1793.

It will be noted that the ironworks named was established in 1793. We have assumed in the heading to this note that it has been making cast-iron water tanks for a century. It would probably be equally safe to assume that it will continue the practice for another hundred years—and that the tanks will defy the elements for that length of time.

Why cast-iron water tanks, like pipe of the same material, were not widely introduced from England to the United States would be an interesting but not otherwise profitable subject for discussion. Suffice it to say that before metal water tanks were in great demand here, first wrought iron and then steel plates were readily available, and that where, as was so often the case, long railway hauls to the site and considerable artificial elevation were necessary for the tanks where there were obvious reasons for using lighter material than cast iron. At the same time British ideas of solid and durable engineering construction have led to a continuation of the use of a material and form of water-tank construction which seems in this country to be so much a relic of the past as to warrant the illustrated article on the old tank in New York City to which we referred in our opening paragraph.

We call attention to this contrast in British and American practice in no spirit of criticism, but simply as a matter of passing interest.

Color Decoration for Concrete Bridges

It is not so long since it was apparently a fundamental of bridge design that ugliness is a necessary accompaniment of strength. Happily, that day is gone, and the bridge engineer is now well aware that there is nothing essentially unmanly in accepting some of the architectural concepts of beauty, particularly in the design of concrete bridges, which lend themselves more readily to architectural treatment than steel bridges of more obvious structural composition. At the same time, such artistic treatment has been confined almost solely to disposition of line and mass and has only rarely invaded the field of decoration. Of the use of color decoration, the bridge designer has been especially chary, confining his efforts in that direction to some broad contrasts of mass color, such as the yellow and gray concrete faces of the Connecticut Ave. Bridge at Washington, or to some specially selected aggregate exposed in contrast, as at the Walnut Lane Bridge in Philadelphia.

Of late, there have been a few attempts at radical color decoration by the use of inset tile placed in pleasing line and form on exposed surfaces. One such bridge in which the decoration was on the exposed spandrel wall was built last year at Chicago, and was described in Engineering News some months ago. Another, and more radical example, is the railing of the 66th Ave. bridge at Philadelphia, described on the first page of this issue. The very pleasing effect gained in the Philadelphia bridge is well shown by the views which we print, although the tasteful contrast of color cannot be conveyed by the black and white reproduction. The views are sufficient, however, to demonstrate that, with proper care, and in the proper location, colored tile can be very effectively used to relieve that bareness of line with which concrete is always most economically placed.

The Military Value of Aerial Navigation

The rigid restrictions placed by the military authorities of Europe on the publication of news relative to the events of the war will delay for a long time the gathering of exact information concerning many questions which have hitherto been controverted and which this war is expected to settle.

A whole array of new weapons for attack and defense, by land and by sea, have been developed during the last dozen years and their efficiency is now being tested for the first time. In case a gigantic naval conflict should oc-

our during the war, the question may be settled whether the naval policy of the future will be to continue the building of these so-called superdreadnoughts or still larger and speedier floating fortresses, or whether these great engines of warfare shall be superseded by smaller and speedier ships, of which perhaps ten times as many could be built for an equal expenditure. Until the war is over, however, no detailed account of the behavior of naval vessels in action is likely to be made public.

A certain amount of information, however, is already obtainable bearing on the controverted question as to the value of aerial navigation in warfare. The news is fragmentary and indefinite, it is true, and much allowance must be made for exaggeration. All that has appeared, however, indicate that, as was suggested in these columns years ago, the military value of aerial navigation has been greatly overestimated in the popular mind. Its greatest value by far, without doubt, is for scouting purposes, to obtain information as to the disposition of an enemy's forces. To what extent the aeroplane operators have been successful in obtaining this information under varying conditions of wind and weather is likely for some time to come to remain a military secret with the chiefs of the contending nations.

As for the use of aeroplanes or dirigible balloons for actual attack, by dropping bombs on cities, forts or ships, it does not appear, from all accounts, that anything important in the way of actual destruction has yet been accomplished in this way. A certain value must be allowed, of course, to the panic produced by the appearance of a hostile aeroplane or dirigible over a city and the dropping of bombs upon it. On the other hand, the amount of destruction which it is possible to accomplish by this means has been demonstrated to be comparatively insignificant and can have, strictly speaking, no military value. Both aeroplanes and dirigible balloons have to fly at such a great height in order to escape [illegible] from long-range rifles and machine guns that if they drop bombs, it must be done haphazard for the most part and with little chance of hitting a definite object. On the other hand, the navigators of attacking airships have suffered fewer casualties than might have been expected during their flight over hostile cities, since it was soon found that the danger to those in the city from a hail of bullets directed at aeroplanes at a great height was greater than the danger from any bombs which the navigators might drop.

The Loss of German Products

It is only giving credit where credit is justly due to say that there is probably no other nation in the world whose sudden isolation commercially would cause such widespread loss as has been caused by the isolation of Germany. It is appropriate that this should be recorded here because Germany more than any other nation has won its important place industrially, not by reason of the wealth of natural resources or its geographical location, but by the skill and intelligence with which its people have attacked modern technical problems.

While engineers and chemists are generally aware of Germany's leadership in the field of science and technology, the events of the past few weeks have been a great object lesson to the general public. Few have realized the extent to which the whole world has relied upon German scientists, chemists, engineers and manufacturers for the supply of many materials necessary in the arts. Manufacturers in America and in England who were congratulating themselves on their enlarged opportunities for foreign trade in markets where the supply of German goods was cut off have in not a few cases found their own productive operations seriously hampered because they could no longer obtain certain materials from Germany.

As is well known, steel manufacturers were greatly worried to know what they were to do for their supply of ferromanganese. Manufacturers of fertilizers have had to face the possible shutdown of their works through the cutting off of the supply of German potash. In the textile industries, manufacturers suddenly realized that with access to German ports blockaded by warships there was every prospect that the supply of dyes and dyeing materials would be seriously interfered with. In the drug and chemical trade, prices doubled and trebled when it was realized that with further supplies from Germany cut off, the world would have to get along for a time without certain drugs and chemicals which have become well nigh essential both in the pharmacy and in certain industries.

The above list might be greatly extended. It is in fact only a statement of a few of the important staples, in the production of which Germany has been so preeminent that all the rest of the world has relied upon her to furnish them.

Surely, from a broad point of view, the victory which Germany has gained over the nations of the earth by its leadership in the conquest of the most difficult fields of industrial technology actually surpasses as a meritorious achievement any victory which its great military organization may gain by brute force.

It is said that most of these things for which we and other nations have been accustomed to rely upon Germany, could be produced here if necessary. This is true as relates to most of these materials, provided sufficient time were available, but sufficient time in most cases is a very long time. In the fertilizer trade, for example, investigations have been in progress for a number of years looking to the production of potash from natural sources in the United States. But what has been actually accomplished commercially is the merest trifle compared with the demand which must be supplied. To develop plants which will produce the amount of potash required by the fertilizer trade and other consumers in the United States, and at a cost consistent with commercial success, would require not months but years. Farmers and fertilizer manufacturers are anxious to know what they are to do in the meantime.

The same thing holds true of numerous materials in the dye and chemical trades. Physicians and druggists accustomed to use many of the varied products of coal tar, most of which have originated in and are solely produced by Germany, are in a quandary to know what they can do if the source of supply is entirely shut off.

It is of particular interest to note, moreover, that the manufacturers of England, Germany's great commercial rival, and present enemy, are almost as badly hit as those of the United States by the cutting off of the supply of German products. Our English exchanges reveal that while English manufacturers are making large plans for capturing the export trade in many lands which Germany cannot now reach, they find themselves handicapped at every turn by the cutting off of supplies which

they themselves have been accustomed to obtain from Germany.

Fortunately, the war has not yet closed all the avenues by which Germany can send out its product to the world. Through Holland, a neutral nation, shipments from Germany can reach tidewater and be distributed by neutral vessels.

Of course, the drafts on Germany's male population for the army have paralyzed a large part of Germany's industrial activity, but since an underlying motive of the war is the maintenance of the nation's commercial prestige, it cannot be doubted that Germany will use every effort to continue to supply her foreign customers, so long as any channels for the outlet of her exports remain open.

Cutting Down the River and Harbor Appropriations

It is a pity that the pressure of war news in the newspapers has prevented practically any public mention of the splendid fight which has been waged by Senator Burton, of Ohio, to eliminate from the River and Harbor Bill many millions of dollars of appropriations provided for worthless projects. The Federal government finds its income reduced at the rate of $100,000,000 per annum as a result of the European war. Instead of cutting down its expenditures, however, to correspond to this reduced income, it proposes to make up the deficit by laying additional taxes upon the public, and this at a time when taxpayers the country over are likewise feeling the effects of the war in reduced earnings and increased cost cost of living.

There are government expenditures which can hardly be cut down, but many of the items in the pending River and Harbor Appropriation Bill, as Senator Burton well showed in his keen analysis before the Senate, are as absolute a waste of money as if the gold were taken and thrown into the sea.

Of course, these items are defended on the plea that the expenditure of money by the government makes business for contractors engaged on government work and for firms who furnish their supplies and for the labor which they employ. This, however, is far from being a valid defense for the government expenditure; for if the government left this money in the hands of the taxpayers instead of collecting to spend on rivers and harbors, the taxpayers themselves would lay it out in the employment of labor, so that no more labor is employed in the one case than in the other.

It is now proposed to provide the additional revenue which the government requires, to the amount of $65,000,000, by collecting a tax of 3% on every freight bill paid. This, it is estimated, would yield in a year $65,000,000, or just about what the government proposes to spend next year on river and harbor improvements bill. Nothing could be clearer than the fact that if the railways were allowed to charge this 3% additional increased rates there would be in the railway treasuries during the year $65,000,000 more money available for works of permanent improvement. The contractors and their workmen would be employed on railway work instead of on waterways. As to the comparative public benefit of spending $65,000,000 on railway improvements and the same amount on river and harbor projects of the class condemned by Senator Burton, there could hardly be two opinions in the mind of well informed engineers.

The essential difficulty with the River and Harbor Bill, of course, and one which Congressmen themselves frankly recognize, is that it is in large part a "pork barrel" bill. A member of Congress or a senator is chiefly concerned to obtain a Federal appropriation to be expended among his constituents. Whether the expenditure is to serve any useful purpose or not appears to be a matter of small concern.

There are, of course, a certain number of meritorious and beneficial works for the improvement of navigation which the government properly carries on; but in order that the appropriations for these works may be passed it has come to be the custom to load up the River and Harbor Bill with appropriations for all sorts of absurd enterprises which yield no public benefit and are only planned to secure the votes of the Congressmen in whose district the money is to be spent.

Senator Burton chose a fortunate time for his campaign against this criminal waste, when the attention of the whole nation is directed toward the necessity of economy in all expenditures, public and private. His searching criticisms had such an effect that the Senate committee in charge of the River and Harbor Bill at the close of last week undertook a drastic revision of the measure, and it is reported as likely that some $20,000,000 of the appropriations carried will be eliminated before the bill is again presented to the Senate.

The Necessities of the Railways

The railways' presidents' appeal to the President of the United States last week has attracted wide public attention, as well it might in view of the figures which they presented. In the year which ended on June 30, the gross earnings of the railways of the United States decreased $44,000,000, and their expenses and taxes increased $76,000,0000. Their net income available for paying the interest on their debts, and their notes and other obligations falling due, purchase of new rolling stock and for making improvements, was therefore $120,000,000 less than in the preceding year. With railway finances at this low ebb, the war in Europe paralyzes the financial machinery of the world and makes a further enormous reduction in the volume of traffic and earnings, while shutting off any chance of reducing expenses by lowering wages because of the horizontal increase in the cost of living.

Besides all this, the railways in the territory west of Chicago have had to consent, at the request of the President of the United States, to an arbitration with their employees which will probably result in a further large increase in their expenditures. The railway financial situation is further aggravated by the fact that during the next year bonds and notes will come due, aggregating over $520,000,000.

Facing these conditions the railways appeal through the President to the public asking first of all that no further financial burdens be laid upon them; surely a reasonable request, and second, that in view of the above described situation, the public should recognize the absolute necessity that the railways shall secure additional revenue and that no obstacles should be placed by governmental agencies or other influences, in the way of measures to provide such revenue.

The reasonableness of this appeal is obvious. In fact, had not such an appeal been made by the railway presidents, it is entirely conceivable that it would have been the duty of President Wilson, himself, or of the Interstate Commerce Commission, to make such an appeal, for the railway business is a public business and not a private business, in any sense of the term. It is just as much a public business as if the railways were actually owned by the Federal Government and operated by Federal officials.

The firm or company which is engaged in manufacturing or in mining, or in buying and selling goods, may find business unprofitable, be unable to meet its debts, and be forced to suspend business entirely, as indeed thousands of private concerns doubtless will be by the strenuous times through which we are passing.

But the railway cannot suspend its operations; it is a public necessity that it should continue to run its trains and carry freight and passengers and mails. It must, in the long run, earn enough money not only to pay its employees and those who supply it with materials, but to pay the interest on its debts and a sufficient return besides to those who have invested their money in it, such that it will be able to obtain additional capital for the improvements that are all the time necessary for its efficient operation.

There can be no doubt whatever that one of the great factors in the remarkable success of Germany during the first month of the war, was the wonderful efficiency of the German railway system in the prompt transportation of the vast number of troops and their supplies. It is recognized in Europe that the railway system of a country is just as important a part of its military defense as its regiments of artillery or cavalry. And it is just as true that the efficiency of a country's railway system is a vital element in its commercial prosperity. It is not merely for the railway's welfare, but for the entire country's welfare that the railways of the United States shall be maintained in the highest state of efficiency, and this can only be done if their solvency can be preserved by provision of sufficient revenue to meet their necessities.

Letters to the Editor

The Meadi Sun Power Plant

Sir—I am glad to see the notice which you gave the Meadi sun-power plant on p. 1029 of your issue of May 7. You have been careful enough (which is more than many of the technical press have been) to point out that the engine end of the plant was in a poor state. It was terrible, the steam valves leaked, the piston probably leaked, and the slip of the irrigation pump varied from 10% to 35% according to speed and length of stroke, so it is wholly misleading and unscientific to give the overall efficiency without the careful explanation given in my paper. It would have been more "kind" on my part if I had said nothing (even unofficially as I did) about the overall efficiency, but I thought it more straightforward and scientific to state the facts and then to add some further facts which put the matter in its true light—all as a record of results really obtained. That is, I combined the actual steam production results obtained from the Meadi (Egypt) absorber with the actual steam consumption results obtained from the engine test in London, both sets of tests being made by me. This being done, it is shown that the best hour's run of August 22, 1913, would give [illegible] B.hp. for an acre of [illegible] to the absorber. This is equal to [illegible] B.hp. per acre, while the average power for the five hours' run on that day was [illegible] B.hp. per acre.

When enterprising people have spent some $[illegible] in experimental work, it is a good policy to give an accurate account of the stage to which they have carried their work, even if it be not a completed work, for it encourages others to go on with such efforts [illegible] the dissemination [illegible]. In fact they should be given full credit for their enterprise, for where would engineering be if there were no such "brave spirits"?

A. S. E. Ackermann.

25 Victoria St., Westminster, London.

Instruction in Highway Engineering

Sir—Prof. Agg's outline, in your issue of Aug. 20, of collegiate work which he considers desirable in the education of highway engineers, is most excellent; and what he says in regard to ethical standards puts the truth in words which cannot be misunderstood and should have great weight.

On the other hand, it seems to the writer, as a chemist, that Prof. Agg misunderstands the role that the laboratory plays in highway engineering when he says:

> sufficient knowledge and experience has been gained to enable the engineer to determine by suitable tests, with a fair degree of certainty, the value of any material submitted to him.

This, in the light of my experience, is not entirely true and Prof. Agg seems to recognize this fact as he adds:

> In this work (in the laboratory), experience is of the utmost value, but if the routine tests are taught to the student, and he goes into the field of bituminous construction, he will readily learn to correlate the results of tests with the behavior of the materials in service.

He recognizes the fact that experience, that is to say, a service test, is the main criterion by which the value of any material in use in highway construction may be judged. A laboratory examination will provide no such evidence, but, if a material has proved itself of value by service tests, it will be able to determine the characteristics which it possesses to which its success may be attributed. Reasoning by analogy or inference, such data may be used in comparing the proved material with those which are untried and, in this way, some opinion of the value, or lack of it, of the latter may be formed.

For the highway engineer, the field which the laboratory will chiefly fill is in the control or regulation of the character of bituminous materials, the proportions in which they are used and in affording a record for future reference.

It does not seem desirable that the student should be led to believe that the merits of new and untried bitumens can be determined in the laboratory. Valuable inferences can, without doubt, be drawn; but the long-time service test is the only method of reaching a decision.

CLIFFORD RICHARDSON.

New York City, Aug. 27, 1914.

The Concrete Mixing Plant at Elephant Butte Dam

Sir—In the article on the mixing plant at Elephant Butte, published in your issue of Aug. 6, under the head of personnel, it should have been stated that the preliminary plans were based on a general layout prepared by O. L. McIntyre, Assistant Engineer and former Master Mechanic at this place. This plant layout was followed very closely throughout the design. Mr. McIntyre also prepared the preliminary specifications for the crushers, elevators and conveyors. L. C. Hill, then Supervising Engineer, suggested the use of mechanical measuring devices similar to those used before in other places and the operating mechanism followed as a natural consequence owing to the size of the measures required.

The selection of the title of the above article was unfortunate as the real object was to describe the measuring devices and operating machinery in which this plant differs mainly from other plants. The acknowledgments were made with this point in view and since the plant was mentioned as a whole it is no more than right that Mr. McIntyre be given full credit for the general designs with which the writer had no connection.

L. J. CHARLES,
Assistant Engineer, U. S. Reclamation Service.

Elephant Butte, N. M., Sept. 3, 1914.

Engineering Opportunities in South America

Sir—The letter of Cyrus T. Brady, Jr., in ENGINEERING NEWS, of Sept. 3, entitled "Opportunities for Engineers in the Argentine; A Warning," is an opportune and valuable contribution to this subject; but the writer does not agree with Mr. Brady's statements relative to the cost of living in Buenos Aires.

Compared to that in some of our smaller cities, the cost of living in Buenos Aires would be considered high, as it is practically the same as it is in New York City. Owing to the costs of transportation and import duties, imported articles are naturally expensive; but food stuffs raised in the country and commodities manufactured and produced there are just as cheap as they are in the United States. Imported luxuries such as liquors and tobacco, which are subjected to high duties the same as they are in England, are exceedingly costly, although native wines are cheap. Undoubtedly the costs of the various articles cited by Mr. Brady are given in paper currency, which is approximately equivalent to one-half the value of our own money.

Nevertheless, Mr. Brady's letter brings out forcibly many important facts to which all engineers, as well as those contemplating the extension of their business in South America, should give serious consideration.

While a resident in the Argentine Republic, the writer made a very careful study of business conditions and opportunities in that country at a time when the North Americans there constituted a very small minority.

It must be borne in mind that the basic blood of the native people is Spanish and that they retain many of the traits and customs of that Latin race, just as we retain many of those of the English. Especially is this true of their temperament. Many Argentines went to the Paris Exposition and came back imbued with French ideas and French culture and they decided to make Buenos Aires a second Paris.

It is therefore not difficult to understand why so many Argentines have since sent their sons to France to study engineering and why for a long time French engineering practice and methods of construction have been in use in the republic. The style of architecture of the modern buildings and the methods of living among the wealthier classes are decidedly French.

The Germans, with their stubborn aggressiveness and expansive policy, have secured much of the business there and owe much of their success to the fact that they have studied the needs, temperament and customs of the people and have aimed to please.

South America has in the past secured its capital in Europe to finance practically all of its large projects and for this reason the English have large interests there. European nations have placed their capital in that country with the understanding that the necessary materials would be purchased from their people.

It is also true that many articles manufactured in the United States would find a ready market in the Argentine Republic because of their superiority to similar European products, if our people would only do as the Europeans have done, namely; study conditions there and "aim to please," instead of trying to force upon a foreign people our ideas and our customs and inferior goods; as many firms have tried to do in the past.

Because of our growing power and short-sighted business policy toward them, the Argentines have naturally been suspicious of our proposals; but when once these suspicions have been dispelled, and our sincerity demonstrated by a proper handling of their business placed with us, we will find that they are an enlightened, progressive, intelligent, patriotic and responsive people.

Every engineer who goes to the Argentine Republic will find that he must compete with European talent, and practice. He must learn Spanish and be willing to adapt himself to local conditions. He will find that "patience is a virtue," that gold cannot be picked up in the streets and that only gentlemen are tolerated. When the present war is over, many foreign engineers will undoubtedly go to South America because of the chaotic conditions at home so that technical competition is apt to be greater there than it is at present.

To those who seek business in that country, it must be borne in mind that Argentina is at present suffering from excessive land speculation and unsatisfactory crops; and being unable to float loans abroad, if its business is to become healthy, the United States must go to its relief. United States capital must be invested there in the near future, as Europe will need her own capital for her reconstruction after the war or for the war itself if it continues much longer.

E. L. VERVEER.

518 West 111th St., New York City,
Sept. 5, 1914.

Annual Convention of the New England Water Works Association

The well attended thirty-third annual convention of the New England Water Works Association, held at the Copley Plaza Hotel, Boston, Sept. 9 to 11, was a distinct advance on those of several years past. Seven sessions for business and the presentation of papers were held between Wednesday at ten and Friday at twelve. Except for a carefully planned series of doings for the ladies, all entertainment features were held in reserve until Friday afternoon and evening, when there was a boat and train excursion to Nantasket Beach, where dinner was served.

Besides two superintendents' sessions, at which a variety of practical papers were read and discussed, noteworthy features of the program were three committee reports and papers on the Salem fire, electrolysis and laying water mains so as to reduce leakage to a minimum.

The exhibit of water-works appliances made a new high-water mark. All told there were nearly fifty exhibitors, including four water-works departments. For the first time at a water-works convention, so far as we remember, a booth and chairs were provided for each exhibitor. There were four outdoor demonstrations on a working scale, as follows: Cleaning service pipes by a paper plug and a hand pump; gate-valve operation by a motor truck; calking lead joints by a pneumatic hammer driven from a portable air compressor; and cleaning water mains in a Boston street.

Committee Reports

A Standard Meter-Rate Schedule—Through Allen Hazen, Chairman, the Committee on Meter Rates presented a preliminary report, in which it submitted for discussion a standard schedule or form for meter rates. The proposed schedule deals with the basis of meter rates and not with the rates themselves, which should, of course, vary with local conditions. The schedule provides for domestic, intermediate and manufacturing rates, the first and last to determine the second, which would be half way between. Provision is also made for a service charge, made up of three parts: (1) 10% on the average installation cost of the meter and service pipe, or say $2.50 where the city puts in the service and sets a 5/8-in. meter, or $1 where the meter only is supplied by the city; (2) $1 per annum for meter reading, billing, etc.; (3) $2 per annum for water which passes the meter without being recorded. Where local objections to a service charge are sufficiently strong, the committee suggests that the service charge, so outlined, be divided by 60 and the quotient to the nearest cent added to the domestic rate on the first 60,000 gal., thus making a [illegible] rate.

The proposed domestic rate would apply to water consumed up to 300,000 gal. per annum, the intermediate to the consumption between 300,000 and 3,000,000 gal., and the manufacturing to all in excess of 3,000,000 gal.

The report included a summary table of actual meter rates charged by a considerable number of cities, with comparative figures for the rates recommended by the committee; also a number of diagrams.

After a brief and generally favorable discussion of this report it was voted to take up the subject at an early monthly meeting of the Association. Meanwhile printed copies of the report will be sent to members, with an invitation to submit written discussions.

Statistics of Water-Purification Plants—Through Geo. C. Whipple, Chairman, the Committee on Statistics of Water-Purification Plants submitted a preliminary report and expressed the hope of presenting a final report next January. Its studies have been divided as follows: (1) descriptive data; (2) analyses; (3) engineering; (4) financial, and (5) vital statistics. Tentative standard forms for general descriptions of water purification plants and for reporting water analyses in tabular form were presented. Seven tables of analyses are proposed. Three of these tables show for raw water its (1) chemical and microscopical character; (2) its turbidity and color; (3) total bacteria. The last four tables show for the water delivered to the mains its (4) chemical character; (5) turbidity and color; (6) total bacteria; (7) B. coli. All these data are shown as averages for each month and for the year, with number of test days, and with classified variations in turbidity, color and bacteria. For some of the most significant determinations both mean and median results are given. Two printed pages are well utilized to set forth why "percentage removal of bacteria" is unsatisfactory and has been thrown overboard.

Three "grades of control" of filter plants are proposed: (1) analyses of filtered water at daily or more frequent intervals, with the collection of engineering and other operating data by one or more attendants, constantly employed; (2) weekly or monthly analyses by a trained analyst, with simple daily tests by an attendant constantly on duty; (3) irregular and infrequent analyses, with no daily tests by the attendant.

There was no discussion of this report at the convention, but written discussion is invited. The report will be mailed to the members of the Association and will be brought up for oral discussion in the early winter.

Low Stream Yields—A vast amount of labor carried on for several years past was summarized in a report of 70 printed pages presented by F. P. Stearns, Chairman of the Committee on Low Water Yield of Catchment Areas in New England. The committee was appointed early in 1911 to gather data on the low stream flows of 1908-09-10, but as 1911 proved to be even drier and 1912 and 1913 nearly as dry the studies were extended over the later years as well. They were also extended geographically to cover the Croton River, Esopus, Rondout and Schoharie Creeks (New York City water-supply). Thus altogether 22 drainage areas in New England and eastern New York were studied. The report is really a monograph on the subject indicated. Besides rainfall and runoff records for the 22 drainage areas the general subject of stream yields and storage capacities is discussed. Tables of safe yields for the various streams are given. Numerous diagrams are included. The records and deductions are all the more significant because the recent dry period was drier (in New England) than the very dry years, 1879 to 1883, the driest on record so far as runoff is concerned, though rainfall records indicate still drier years before 1850.

In discussing the paper, Allen Hazen referred to the application of the law of probabilities to runoff and storage problems, contained in a paper which he presented earlier this year before the American Society of

Civil Engineers. Mr. Hazen agreed with Mr. Stearns' opinion that probably still drier years will occur as the records are extended, and that the new low records will again be outdone. Past practice has been to assume that dry periods will be repeated. The probabilities are that 19 out of 20 years will follow the past and that one year will be drier still. Mr. Stearns then expressed himself as quite in agreement with these remarks by Mr. Hazen and added that while lower rainfalls than those recorded must be expected the water consumption of a given city is ever increasing.

H. K. Barrows, commenting on the use by the committee of the FitzGerald evaporation studies, remarked that while these studies were excellent when made yet the few similar studies made elsewhere have given different results. He suggested that since evaporation tests are easily made they might well be carried out in various localities governed by different conditions.

Standard Specifications for Cast-Iron Pipe—In behalf of this committee, Frank A. McInnes, Chairman of the committee and President of the Association, stated that several meetings with manufacturers have been held but the committee is not yet ready to submit its final report [which report, it is hoped by many, will lead to a joint standard specification on the part of the New England and American Water Works Associations.—Ed.]

General Papers

Of 14 papers on the program, 12 were presented by the authors in person, and two, which had been printed for circulation at the meeting, were read by title, the authors not being present.

Allowable Leakage from Water Mains—E. G. Bradbury, of Columbus, Ohio, presented some remarkable records of low leakage from new water mains laid under rigid specifications and tested in the open trench before covering at Akron, Ohio. The leakage shown by 86 tests on a total of 16.76 miles of 4- to 30-in. cast-iron mains laid by contract averaged 83.4 gal. daily per inch-mile and on 8.9 miles of 6- to 10-in. pipe (38 tests) 61.7 gal. daily per inch-mile (leakage per mile for each in. diameter of pipe).

Dexter Brackett did not think it practicable to keep trenches open for testing pipe in thickly populated districts. Mr. Bradbury remarked that the length of open trench can be lessened by using more gates and that this will pay where it is necessary. His paper showed that the water saved by tight mains will pay for considerable extra capital outlay. W. C. Hawley said that in open-trench work he had found leadite very useful, because when jointing with that material short lengths of pipe can be tested readily. A. D. Flinn stated that in some special cases lead wool had been used advantageously.

Lessons from the Salem Fire—A unique study of the water-supply of Salem, Mass., during the recent conflagration was contributed by Frank A. McInnes and Clarence Goldsmith, of Boston. Besides summarizing actual fire-engine operations, the authors presented the main results of water-consumption experiments made after the fire, with outlet conditions as nearly as possible like those during the fire. The chief lesson drawn by the authors was that large connections between street mains and fire-sprinkler systems of protected buildings cause a great risk since, as in the Salem fire, falling walls may break these large services, causing so large a loss of water as to cripple the water-supply and fire service.

In remarks supplementing the paper Mr. Goldsmith stated that Boston limits sprinkler connections to a diameter of 4 in., but permits a number of connections of that size, generally 50 ft. apart.

A number of representatives of fire insurance companies made a stand for larger connections than 4 in. One of these speakers urged that the primary cause of the Salem conflagration was an undermanned fire department —27 men, some of whom were off duty. Had not the fire been allowed to get under way the breaks in sprinkler connections which bled the water-supply would not have occurred. Salem also needed much better building construction than it had.

Notwithstanding all that was said by others, the authors of the paper stuck to their opinion that the Salem conflagration was due to breaks in large sprinkler mains and that 4-in. connections would have been sufficient to supply the sprinklers at Salem, and that connections of that size, supplemented by fire engines coupled up through an outside siamese, would suffice and afford greater safety than a larger connection. This opinion seemed to be concurred in by all present except the insurance representatives.

Electrolysis—A review of the electrolysis studies made during the past few years by the United States Bureau of Standards was presented by E. B. Rosa, Chief Physicist of the Bureau. Many of the results have already been made available through various Technological Papers, and further papers are to be published.

So far as tests of pipe coatings have gone, these are of little service in presenting electrolysis. Insulating joints are more useful, but of limited value. Track drainage or pipe drainage must be the chief resort (assuming that a complete return-wire system is not used). There should be more coöperation in the prevention of electrolysis. In any event the burden of protecting underground structures from electrolysis should be borne by the street-railway companies.

Metering an Old City—How Boston is being converted from a practically unmetered to a metered city under mandatory state legislation passed in 1907, but little heeded until 1909, was told by James A. McMurry, Engineer-in-Charge Income Branch, Boston Water-Works. This legislation required that all new services be metered and that old services be metered at the rate of 5% a year. Some 5000 to 6000 meters a year are being set. At first this work was scattered over the city, but soon the practice of metering a whole district at a time was established. This not only saves installation costs but also affords an opportunity to make valuable studies of results obtained. Some 36,000 meters have been set, increasing the percentage of services metered from 6% in 1908 to 11% at the close of 1913. The effect on the consumption of the whole city can be seen and there has, of course, been a much more notable reduction in per capita consumption in the districts fully metered.

Other General Papers—Papers on "The Construction of Dams," by A. E. Walden, of Baltimore, Md., and on the "Miraflores Water Purification Plant," by Geo. M. Wells, of the Canal Zone, were read by title in the absence of the authors.

Papers at the Superintendents' Sessions

Eight papers were read at the two superintendents' sessions. Most of these brought out, as was intended, a goodly discussion.

HOUSE-BOILER TROUBLES.—F. F. Forbes, Brookline, Mass., told how changes from attic tanks to direct supplies for hot-water boilers has added to his worries. There were two boiler explosions in Brookline during the last year. The remedy suggested was expansion tanks. This suggestion seemed to meet with general approval by those who listened to the paper but one speaker urged that in addition to using expansion tanks hot-water plumbing should be inspected to insure good materials and workmanship.

MACHINE CALKING OF LEAD JOINTS.—At Waltham, Mass., as told by Daniel T. Higgins, a truck-mounted air compressor and pneumatic hammer is reducing the time and cost of calking water mains. The outfit cost only a few hundred dollars. It has also been fitted with an air drill, for use in rock trench excavation.

THE CARE OF GATES AND HYDRANTS.—Patrick Gear described how this is done at Holyoke, Mass. Each fire hydrant has a card record and is periodically inspected. In winter a lead is used to sound the hydrant for ice. If ice is found, it is thawed out and if water is found it is pumped out. Salt is used to prevent freezing.

As to gates, Mr. Gear had more to say about their design and material than upon their maintenance. He recommended a liberal use of brass parts where the members are specially liable to wear or corrosion, and that provision be made for cleaning sand from small as well as from large gates.

In the discussion of this paper one member told of the use of a pint to a quart of wood alcohol per hydrant to keep hydrants from freezing and another told of using crude glycerin.

WATER USES DIFFICULT TO CONTROL.—These, as outlined by Wm. F. Sullivan, Nashua, N. H., include water for building purposes, street and sewer flushing. The remedy is universal metering or at least metering all who practice abuses. Several speakers told of tricks to beat the water meter. The only way to prevent these is through sealing of the meter and its connections to prevent tampering.

THE AUTOMOBILE AS AN EFFICIENCY AGENT IN WATER-WORKS MANAGEMENT.—The uses and costs of eight motor vehicles at Worcester, Mass., were set forth by Geo. W. Batchelder of that city. The first automobile was introduced in 1909. Records have been kept for each car. The yearly operating costs range from between $200 and $300 for a Ford car to $1200 to $1300 for general-service cars and a large truck. The latter has been used extensively for hauling pipe and has been highly advantageous for heavy work, long hauls and emergencies.

PUBLIC WATERING STATIONS.—Frank E. Merrill, of Somerville, Mass., told how he had coöperated with the State Department of Animal Industry in efforts to reduce glanders by getting rid of common open horse-watering troughs. In their place, provision is made for filling pails carried by teamsters. A 10-in. cast-iron pipe is set in the ground at the curb line, cut off and set 18 in. above the sidewalk. A 3/4-in. service connection is topped with a cover, equipped with two self-closing faucets and a hose connection for filling pails and with a drinking fountain for human beings. Near the sidewalk a bowl for dogs and birds is placed. The outfit costs about $50 for material and $10 more for labor. Besides the primary object of helping reduce glanders, it is believed that these watering stations will save a considerable amount of water. The speaker exhibited one of the appliances, and referred also to another exhibit at the convention, showing how Boston has converted old common troughs to pail-filling stations.

Mr. Merrill introduced the State Commissioner of Animal Industry and the President of the Massachusetts Society for the Prevention of Cruelty to Animals, each of whom addressed the convention. The former was heartily in favor of, in fact largely responsible for, the widespread abolition of the common horse trough in the Boston Metropolitan District and cited both statistics and leading veterinarians and other authorities in support of his views. The latter opposed the innovation on the ground that lazy drivers would not take the trouble to get off their wagons and fill pails, and that, as a consequence, many horses would have to go for long periods without water, and would then injure themselves by overdrinking. He also cited figures which he thought proved that horse troughs have comparatively little to do with the spread of glanders. In conclusion he sought to clinch his claims by asserting that there are all sorts of germs everywhere—which no one denied.

LOW WATER CONSUMPTION IN MILTON, MASS.—D. A. Heffernan reported that Milton uses only 39 gal. of water per capita per day because (1) it has the universal meter system, extending to all uses of water except through fire hydrants; (2) because it insists on good construction, and (3) because of thorough inspection. The water department lays all service pipe to a point inside the building wall and allows no one except firemen to use fire hydrants.

USE OF THE MAGNETIC DIPPING NEEDLE IN LOCATING SERVICES AND GATE BOXES.—Edward D. Eldredge, of Onset, Mass., stated that in small places it is often necessary to find services after street grades have been changed and where no records have been made. The dipping needle will aid in this task, even through 6 or 7 in. of concrete sidewalk. L. M. Bancroft, of Reading, Mass., said he had located a service box by this means beneath 13 in. of concrete, and J. M. Diven, of Troy, N. Y., went Mr. Bancroft 1 in. better.

Annual Convention of the Roadmasters and Maintenance-of-Way Association

The 32nd annual convention was held at the Auditorium Hotel, Chicago, Sept. 8 to 11, with the President, T. F. Donahoe (B. & O. R.R.) in the chair. The attendance was large, and in connection with the meeting there was an exhibit of track materials, tools and appliances arranged in a hall adjacent to the meeting room. An unusual feature which is peculiar to the meetings of this association is that very few papers or reports are presented, but that these are discussed at such length that they more than suffice to occupy the time of the convention. There were nine sessions, eight of which were devoted mainly to business, and although only five reports were presented, some parts were accepted as information owing to lack of time for full discussion.

PROPER OPERATION OF TRACK TOOLS AND APPLIANCES.—This report, presented by J. W. Hall (N. Y. Central R.R.), opened with an explanation of the increasing use of machinery in track work, owing to its economy as compared with hand labor and to the increased weight and

size of many parts used in track construction. Motor cars in place of hand cars save time and energy of the track men, and enable the same number of men in a gang to do more work or a smaller number of men to do the same amount of work as when equipped with hand cars. Rail-handling machines for loading rails on cars and distributing new rails from cars not only do the work more expeditiously but eliminate the rough handling which may result in damage or fracture of the rails. For rail renewals, there are machines which, with three to six men, do the work otherwise requiring a large gang of men to handle long and heavy rails.

Other uses of machinery are in such heavy work as ditching, the distribution of ballast, and the spreading of filling material; and also in such light work as drilling and cutting rails, boring and dressing ties, driving screw spikes, tamping ballast, etc.

RAIL RENEWALS—This report was presented by A. M. Clough (N. Y. Central R.R.), and was discussed at great length in regard to the various phases of the work. There was considerable discussion as to whether or not ties should be respaced when new rails are laid, and the general opinion was that this is not necessary, while eliminating the work greatly reduces the time consumed. Several railways now leave the ties alone, simply dressing them at the rail seat where necessary, and adjusting them to give proper support at the joints. The report submitted the organization for a rail-renewal force, but some members were inclined to object to this, since no two roads would have the same conditions or use exactly the same force.

ORGANIZATION OF LABOR AND MATERIAL FOR TRACK MAINTENANCE—This report was presented by P. J. McAndrews (Chicago & Northwestern Ry.). It showed the great amount of money expended under the direction of the track department (averaging $10,000 per month per roadmaster), and advocated a system of organization in which the work of all the roadmasters of any one division would be under the supervision of some official who would direct the work of the division as a whole. This would avoid the trouble and expense due to operating separate work trains, rail-renewal gangs, extra gangs, etc., on each roadmaster's district. The report recommended the maximum length of line for the roadmasters or supervisors as follows: 50 miles of double-track, 100 miles of single track with heavy traffic or 125 miles in easy country with light traffic.

Another important recommendation was that track forces should be maintained permanently, throughout the year. At present, every railway cuts its force to a minimum in winter and increases it in the spring, when the supply of efficient men does not equal the sudden demand. This results in loss of time and money due to the continual employment of new and inexperienced men. Much of the work can be done as well in winter as in summer, and the work as a whole would be done better and at lower cost if spread over the year instead of concentrated in a few months, as under the present system. There was general agreement with the suggested system, but it did not appear that any roads have yet introduced it, the economies of track labor not being comprehended as a rule by railway officers.

TRACK ACCESSORIES—This report, which was presented by M. Donahoe (Chicago & Alton Ry.), dealt with a variety of matters, and the first of these were discussed in such detail that the remainder of the report was accepted as information, without discussion. In regard to rail joints, the committee recommended 24-in. angle bars, with four bolts, supplemented by a base or bridge plate where traffic is heavy. For frog guard-rails an 8-ft. length was recommended, but this was struck out, as there was a general opinion that longer rails are preferable, and that it is not desirable to specify the length.

There was considerable discussion as to whether bolts or clamps are the better for securing the guard rail to the track rail, and as to the use of tie-plates and rail braces at guard rails. Cast manganese guard rails were mentioned, but the members present had little experience with these. Other matters covered by the report were switches, frogs, switchstands, tie-plates, rail anchors or anti-creepers, screw spikes and drive spikes, track bolts of nickel-chrome steel, and the narrow-head "frictionless" rail for curves (ENGINEERING NEWS, July 2, 1914).

As to this last, only one member had experience, and he spoke of tests showing that with a train on a heavy grade the speed increased on curves having this rail on the inside, while it decreased on curves laid with ordinary rails. Some members spoke of getting the same result by shifting worn rails from the outer to the inner side of the curve, but it was pointed out that in such case the weight of the wheel comes on the overhanging side of the rail head and not directly over the web, as in the special narrow-head rail. Consequently this shifting of worn rails or curves was hardly desirable for track with heavy traffic and high speeds.

CLEARING AND POLICING RIGHT-OF-WAY—This report was read by J. P. Corcoran (Chicago & Alton Ry.). It dealt with such work as the cutting of weeds and grass, removing old rails and ties, the handling of scrap, maintenance of ditches and fences, and the clearing of yards and station grounds. Trackwalking and bridge inspection were included also. The report recommended the old practice of requiring the trackwalker to do all kinds of miscellaneous work during his trip, but this was objected to in the discussion. It is better for him to be simply an inspector, doing only such work as is essential to the safety of the track. The miscellaneous work of driving loose spikes, repairing fences, etc., can be done to better advantage in periodical trips of the entire section gang.

OFFICERS

Officers for 1914-15 were elected as follows: President, P. J. McAndrews, C. & N. Ry., Belle Plaine, Ia.; Secretary, L. C. Ryan, C. & N. W. Ry., Sterling, Ill. The next meeting will be held at Chicago in September, 1915.

The Annual Convention of the National Paving Brick Manufacturers Association

The chief features of interest to engineers in connection with the 11th annual convention of the National Paving Brick Manufacturers Association, held in Buffalo, N. Y., Sept. 9-11, were the discussion of inspection of paving brick and the excursions to various parts of Buffalo and the surrounding country to visit and inspect brick pavements in all stages of age and construction.

As to the inspection of brick, there appeared to be much dissatisfaction with present practice. The specifications

are constantly becoming more severe, and the manner of testing the brick after they have been distributed on the road to be paved, and there condemned, often works great hardships on both the paving contractor and the brick manufacturer.

Nevertheless there was no unanimous demand or apparently desire on the part of the brick manufacturers for universal factory inspection. The objections seemed to be a horror of having a corps of inspectors about the plant, as might be necessary if each buyer had his own personal inspector, and a frankly expressed fear that there would be subsequent difficulty in disposing of brick condemned by anyone of the inspectors—and it is necessary to dispose of the poorer as well as the best brick in order to run a brick plant at a profit.

Coupled to these objections were, of course, the usual ones that competent inspectors were rare, and differences of opinion as to what constituted good qualities in paving brick. To remedy the former one member proposed the training of engineering graduates at the plants by a few months' course in practical brick making. In regard to tests of paving brick it was generally conceded that the manufacturer is not safe from having his brick rejected unless he makes it test 2% better than that specified by the buyer, in order to provide for uncontrollable variations in the rattler test.

O. N. Townsend, of the T. B. Townsend Brick & Construction Co., Zanesville, Ohio, spoke strongly in favor of factory inspection, which had been tried on a large scale at his plant. He said it was the only means by which he could get a contractor to undertake the pavement of several miles of the Lincoln Highway under the Ohio State Highway Department specifications. So successful and satisfactory had factory inspection proved that he stated his plant would hereafter insist on it for all contracts; if necessary, he would pay the inspector. C. P. Mayer of the C. P. Mayer Brick Co., Bridgeville, Penn., spoke in much the same strain.

The only result of this discussion was an unofficial resolution adopted by the manufacturers at an informal conference with the paving-brick committee of the American Society of Municipal Improvements (E. H. Christ, Grand Rapids, Mich., Chairman) providing that it was the unanimous sense of the meeting that the paving-brick committee of the American Society of Municipal Improvements recommend to its society factory inspection of brick, for [illegible].

The following officers were elected: President, Charles J. Deckman, of the Deckman-Duty Brick Co., Cleveland, Ohio, who has been President since 1911; Vice-President, J. W. Robb, of the Clinton Paving Brick Co., Clinton, Ind.; Treasurer, C. C. Barr, of the Barr Clay Co., Streator, Ill.; Secretary, Will P. Blair, Cleveland, Ohio.

[illegible] of the association and [illegible] will appear in a later issue.

NEWS NOTES

A Water Tank Fell [illegible]

A [illegible] Water Main Burst [illegible]

A Freight Train Went Through a Flood-Weakened Bridge [illegible]

Sept. 1. Two men who are missing are thought to have been killed.

A Wood Bridge Collapsed under the weight of a load of gravel, at [illegible]ersville, N. Y., on Aug. 31, dropping team, wagon, gravel and two men into [illegible] Creek. Local reports state that the structure was weakened by high water resulting from heavy rains. The bridge was built four years ago. It failed when the load was halfway on the structure.

A Train Went Through a Wood Bridge on the Missouri, Kansas & Texas Ry. at [illegible] Creek bridge five miles south of Tyler, Tex., at 5 p.m. Sept. 1. The engine passed over the bridge, and, as far as can be learned from local reports, the oil tender left the track near the south end of the bridge. The baggage, combination and chair cars went through the bridge, which was a 16-bent structure.

Floods in Kansas City, Mo., on Sept. 7, damaged the Country Club district, the South Side along Brush Creek, the East and West Bottoms, Sheffield and other districts. Conditions were most severe in the southwestern part of the city and in Rosedale, a suburb, where the water reached a maximum depth of 25 ft. A 10-hr. rain, with a precipitation of 6.94 in., caused the floods. In addition to many flooded buildings, two railway bridges across Turkey Creek were carried out, and three persons were killed.

The Alaska Government Railway Surveys are reported to be making good progress. The parties in the field number about 110. Work will be suspended during the winter, but it is expected that actual construction can begin as soon as spring opens.

The Chicago Water-Works Intake Tunnel, which is to extend under the lake from Wilson Ave., is to be built by day labor. All bids were rejected and the City Council has granted authority to the Department of Public Works to carry on the work. It will be under the direction of John Ericson, City Engineer.

A High Discount Rate for Payment of Metered-Water Bills in Chicago will go into effect on Nov. 1 as the result of a city ordinance passed on July 2. The discount will be 25% on all meter bills paid within 30 days of the date of the bill. The present discount rate is 1[illegible]. The meter rate is 6[illegible] per 1000 cu. ft. or [illegible] per 1000 gal.

American Trade Opportunities in South America are to be investigated by the American Express Co. Two representatives of the company, Messrs. [illegible] and A. R. Howard, will sail from New York, Oct. 1, to visit the principal cities in Brazil, Uruguay, Argentine, Chili and Peru to investigate methods by which United States trade with South America can be developed.

Beginning of an Industrial-Education System is being attempted in the New York Public Schools. At present two schools in Manhattan, [illegible] in Brooklyn and [illegible] in Queens are being operated on a cooperative plan, which seems for the moment more [illegible] of plant than for definite industrial education. By dividing the school into two groups, or by [illegible] a duplicate school to use the same plant, it is possible to have one group in the classroom while the other is in the shops, library or playground.

The Last Section of the Harlem River Tunnel of the Lexington Ave. subway in New York City was sunk Sept. 1[illegible], 1914. This is the fifth of similar sections which have been successfully sunk to form the subway crossing under the river. Each section consists of a steel box of [illegible] ft. [illegible] ft.) long and wide enough to provide room for a four-track tunnel of [illegible]. This box is floated out over the [illegible] and sunk into a prepared position by filling with water. It is then filled with concrete and [illegible] to the next adjoining section already in place. The work is being done by the Arthur McMullen & Hoff Co.

Fewer Forest Fires on Cape Cod [illegible]

Manufacturers of Motor Vehicles [illegible]

ness. While the purchase of cars for pleasure and as a luxury will doubtless be seriously restricted for some time, the great casualties among horses in the war seem certain to cause a great shortage and still higher prices for horses not only in Europe, but in America. The high prices of grain and forage and the great demand for cattle, which seem certain to prevail for a good while to come, will also tend to discourage the raising of horses, and will make their keeping more expensive. All these things tend to favor the substitution of motor-driven vehicles for horses wherever the conditions permit.

The Proposed Standard Specifications for Steam-Boiler Construction framed by a committee of the American Society of Mechanical Engineers were considered at a public hearing at the Engineering Societies Building in New York City on Wednesday, Sept. 15. The hearing was attended by about 150 engineers representing the principal steam-boiler manufacturers and representatives of state boiler-inspection departments and also various societies interested in steam-boiler construction, inspection and use. John A. Stevens, of Boston, chairman of the committee, presided and opened the meeting with a statement of the causes which had led to the formation of a committee by the Society to frame standard specifications. Addresses were made by E. H. Wells, President of the Babcock & Wilcox Co., and Thomas E. Durbin, of the Erie City Iron Works, which emphasized the absolute necessity to the boiler-manufacturing interests of standard specifications suitable for adoption by all the states of the Union. After further general remarks, the meeting took up the proposed specifications for discussion in detail.

Suggestion for a Cantilever Bridge Across San Francisco Bay is made by C. E. Fowler in "Western Engineering," issue of Sept. 1914, on the basis of general designs which he has worked out. The plan is for a crossing between Telegraph Hill (San Francisco) and Oakland via Goat Island. The span from Telegraph Hill to Goat Island includes three cantilever spans of 2000 ft. with tower spans of 250 ft., and at either end a land span (cantilever arm and terminal suspended span) of 1350 ft. east of Goat Island the bridge would consist of an 880-ft. cantilever span, a mile and a half of viaduht, and about two miles of fill. In general design the structure is closely similar to the Forth Bridge, except that the suspended span is much longer, being 700 ft. The constructive details also show a leaning toward the Forth type. In particular the compression members are double-walled tubes, but instead of being circular as in the Forth bridge they are octagonal, with metal cross-sections up to 3600 sq.in. The cost of the bridge in its entirety is estimated at $75,000,000, of which the three-span cantilever structure between San Francisco and Goat Island is figured at $49,000,000.

A Reinforced-Concrete Building Collapse at La Ceiba, Honduras, on Aug. 19, was reported in a very generally circulated press dispatch as follows:

> Washington, Aug. 20—Forty British and American workmen were killed today in the collapse of the new concrete customs house at Ceiba, Honduras, according to a dispatch to the State Department.
> D. J. Klodt, formerly of San Antonio, Tex., was the only name given of those killed. Many workmen were burned under the ruins and smothered. A fire enveloped the structure after its collapse.

We are informed by H. J. Hill, Chief Engineer Vaccaro Bros. & Co., of La Ceiba, that the cabled report was greatly exaggerated. He states that the second floor of the reinforced-concrete customs house under construction at La Ceiba failed on Aug. 19, and in the collapse four workmen were killed outright, one fatally injured and three more slightly injured. The apparent cause of the collapse was a lean concrete, which failed immediately upon the removal of the falsework. As near as could be determined by Mr. Hill, who had nothing to do with the building, the proportions of the concrete was about one part cement to eight parts sand, with no gravel or broken stone in the mix. The building was designed for the contractor by B. G. Klodt, who was killed in the collapse. There was no inspection other than that of the builder.

Temporary Closing of Drawbridges to accommodate commuting traffic near large cities has been repeatedly urged by commuters, but the historical and apparently inalienable rights of water navigation over land traffic in practically every instance has prevented such closing. Commuters who have suffered from this refusal of the law to recognize modern conditions will appreciate the recent order of the Secretary of War approving amended regulations governing the opening of the draws of the Highway Bridge and the Pennsylvania R.R. bridge over the Potomac River at Washington, D. C., whereby both of those bridges are closed against water traffic between 8:20 and 8:50 a.m. daily, except to vessels employed or controlled by the Government.

It was suggested by the railway interests that the draws be closed from 7 to 9:30 a.m., and from 4 until 6 p.m. daily because of reported frequent delays to land traffic during these hours. Navigation interests, however, made a stout protest against such a long closed period and the War Department permitted only the morning closing. In recommending the closing General B. C. Kingman, Chief of Engineers, said:

> After due consideration of the evidence adduced at the public hearing and the papers in the case, it is thought that the closed periods advocated by those interested in land traffic would result in detriment to river traffic out of all proportion to the benefit to be derived by traffic over the bridges. On the other hand, a closed period of not longer than 30 min. during the morning rush hours appears to be necessary to accord some measure of relief to traffic over the bridges and will not in the opinion of this office impose an unreasonable hardship on water-borne traffic.

PERSONALS

Mr. Chas. W. Gates, Highway Commissioner of Vermont, has been nominated as the candidate for Governor on the Republican ticket.

Mr. S. S. Senter, formerly Engineer of Construction of the Wheeling & Lake Erie R.R., has been appointed Superintendent of Bridges and Buildings, with headquarters at Brewster, Ohio. The office of Engineer of Construction has been abolished.

Mr. Henry A. Woods, M. Can. Soc. C. E., Assistant Chief Engineer of the Grand Trunk Pacific Ry., at Winnipeg, Man., has been appointed Chief Engineer to succeed Mr. B. B. Kelliher, M. Can. Soc. C. E., resigned, as noted in our personal columns of last week.

Mr. Frank W. Skinner, M. Am. Soc. C. E., has resigned as Associate Editor of the "Engineering Record" and will devote his whole time to private practice, specializing in methods and plant for the execution of civil engineering construction, with office at 41 Sherman Ave., Tompkinsville, N. Y.

Mr. Frank F. Fowle, M. Am. Inst. E. E., Consulting Electrical Engineer, has closed his New York City office at 68 Maiden Lane, and has moved to Chicago, Ill., where he has been appointed one of the receivers of the Central Union Telephone Co., with headquarters at 212 West Washington St.

Messrs. Vrooman & Perry, Consulting Engineers of Gloversville and Amsterdam, N. Y., announce the dissolution of the partnership. Mr. Morrell Vrooman, Assoc. M. Am. Soc. C. E., will maintain offices at Gloversville and Amsterdam, and Mr. Charles ~ Perry, Assoc. M. Am. Soc. C. E., will open an office at 102 Hudson Ave., Albany, N. Y.

Mr. W. E. Duckering, recently with the Oregon Short Line Ry., at Pocatello, Idaho, has been appointed Instructor in civil engineering at the University of Washington, Seattle, Wash. He takes the place of Prof. C. W. Harris, who has been granted leave of absence in order to devote his time and attention to the development of some small water powers in the Cascade Mountains.

Messrs. J. Wharton Bartholow and George H. Willits have formed the Bartholow-Willits Engineering Co., of Galveston, Tex., and will engage in the general practice of civil engineering, with headquarters in the Reymershoffer Building. They will specialize in sewage disposal and public utility valuation. Mr. J. C. Nagle, M. Am. Soc. C. E., Chairman of the Board of Water Engineers, State of Texas, is Consulting Engineer of the new firm.

Mr. Frederick C. Noble, M. Am. Soc. C. E., Division Engineer, Public Service Commission, First District, New York, who has been in charge of the East River tunnel division of the new subways in New York City, has resigned. He has been in the city subway work since the first subways were built in 1900. It is understood that he has left the Public Service Commission to devote his whole time to private practice, much unfinished work having been left by his late father, Alfred Noble, Past-President of the American Society of Civil Engineers.

Mr. W. S. Moseley has been promoted to be Mechanical Engineer of the Carolina, Clinchfield & Ohio Ry., with headquarters at Erwin, Tenn. Mr. Moseley was educated at the Virginia Polytechnic Institute. He began railway work as a messenger boy in the auditor's office of the Norfolk & Western Ry. in 1894. From 1902 to 1909 he was a draftsman in the Mechanical Engineer's office, with the exception of two years when he was an instructor at the Institute. He was appointed a draftsman with the Carolina, Clinchfield & Ohio Ry. in 1909.

Mr. William F. Allison, M. Am. Soc. C. E., formerly Professor of [illegible] and sanitary engineering at the University of [illegible], has been appointed Professor of municipal and highway engineering at the University of Washington, Seattle, Wash., succeeding Prof. E. J. McCaustland, M. Am. Soc. C. E., whose resignation was noted in these columns Aug. 2[illegible], 191[illegible]. Prof. Allison is a graduate of South Dakota State College, Purdue University and Cornell University. He served as an Engineer Officer in the U. S. Volunteer Army in the Philippine Islands during the Spanish American War. He was formerly a member of the faculty of the Colorado School of Mines and City Engineer of Golden, Colo.

Prof. Granville R. Jones, Assoc. M. Am. Soc. C. E., Professor of sanitary engineering at the University of Kansas and Engineer of the Kansas State Board of Health, has resigned to accept an appointment as Professor of hydraulics and sanitary and water-supply engineering at the new engineering school of the Johns Hopkins University, Baltimore, Md. Prof. Jones graduated from Ohio State University in 1[illegible] and from the Massachusetts Institute of Technology in 1[illegible]. For two summers he was with the Pennsylvania R.R. in Chicago, Ill., and for a year was with the Mt. Vernon Bridge Co., Mount Vernon, Ohio. For five years following his graduation from the Massachusetts Institute of Technology in 19[illegible] he was employed at the water filtration plant at Washington, D. C.; during the last three years he was Assistant Superintendent. Since 1912 he has been at the University of Kansas.

OBITUARY

Parker Stafford, former Railroad Commissioner of Maine and a civil engineer, died Sept. 7 at his home in Bucksport, Maine. He was born in 1842.

Victor J. Hedden, President and Treasurer of the V. J. Hedden & Sons Co., builders, New York City, died Sept. 11, at his home in East Orange, N. J., aged 68 years.

Wilson Brown, a retired civil engineer and a former member of the engineering staff of the Pennsylvania R.R., died Sept. 11, at his home in Setauket, L. I., aged 63 years.

[illegible] F. Stevens, a retired civil engineer, died at his home in South Orange, N. J., Sept. [illegible]. He was born in 1832 and was a nephew of Edward A. and Robert Stevens, the founders of Stevens Institute of Technology.

[illegible] M. Markley, for many years Supervisor of Bridges and Buildings of the Peoria & Eastern division of the Cleveland, Cincinnati, Chicago & St. Louis Ry., [illegible], Ohio, died Sept. [illegible]. He was 67 years old and had been in the railway service for 42 years.

[illegible] S. Anderson, former General Manager and recently Treasurer of the Granite Ry., which was built and operated to develop the granite quarries of Quincy, Mass. He was born in Massachusetts in 18[illegible] and graduated from Harvard University in 18[illegible]. He was at various times Assistant Treasurer, Secretary and General Purchasing Agent of the Union Pacific Ry.

[illegible] A. [illegible], a prominent mechanical engineer and founder of the [illegible] Engineering Co., Allentown, Penn., died at his home in that city Sept. 1[illegible] [illegible]. He was born [illegible], N. Y., [illegible] years ago. He was a graduate of Stevens Institute of Technology and for several years was employed by the Jackson Manufacturing Co., [illegible].

[illegible] H. [illegible], General Superintendent of the North Works of the [illegible] Steel Co., at Chicago, died on Sept. [illegible]. [illegible]

ENGINEERING SOCIETIES

COMING MEETINGS

ILLUMINATING ENGINEERING SOCIETY.
Sept. 21-2[illegible]. Annual convention in Cleveland, Ohio. Secy., Joseph D. Israel, 29 W. 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Sept. 22-24. Annual convention in Bluff Point, N. Y. Secy., C. C. Rosenberg, Times Building, Bethlehem, Penn.

ATLANTIC DEEPER WATERWAYS ASSOCIATION.
Sept. 22-26. Annual convention at New York. Secy., Addison Burke, Philadelphia, Penn.

INTERNATIONAL IRRIGATION CONGRESS.
Oct. 5-9. At Calgary, Alta. Secy., Andrew Miller, Industrial Commissioner, Calgary.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 12-16. Annual convention at Atlantic City, N. J. Secy., E. B. Burritt, 29 West 39th St., New York City.

NATIONAL COUNCIL FOR INDUSTRIAL SAFETY.
Oct. 13-15. Annual "Safety Congress," at Chicago, Ill. Secy., W. H. Cameron, Continental Bank Building, Chicago.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
Oct. 20. Convention at Los Angeles, Calif. Secy., C. A. Lichty, 319 North Waller Ave., Chicago, Ill.

INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS.
Oct. 20-23. Annual convention at New Orleans. Secy., James McFall, Roanoke, Va.

AMERICAN ROAD CONGRESS.
Nov. 9-14. Atlanta, Ga. Permanent headquarters, American Highway Association, Colorado Building, Washington, D. C.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 6-9. Annual meeting at Boston, Mass. Secy., Charles Carroll Brown, Indianapolis, Ind.

NATIONAL MUNICIPAL LEAGUE.
Nov. 17-21. Annual meeting at Baltimore, Md. Secy., Clinton Rogers Woodruff, North American Building, Philadelphia, Penn.

AMERICAN PUBLIC HEALTH ASSOCIATION.
Nov. 30-Dec. 5. Annual meeting at Jacksonville, Fla. Secy., Prof. Selskar M. Gunn, Massachusetts Institute of Technology, Boston, Mass.

Association of Iron and Steel Electrical Engineers—The eighth annual meeting of the Association was held in Cleveland, Ohio, Sept. 15. The Secretary is W. T. Snyder, National Tube Co., McKeesport, Penn.

The Cleveland and the Detroit Engineering Societies held a joint inspection trip of Detroit industries on Sept. 12. A banquet was held in the evening. About 150 members of the Cleveland society went to Detroit on the Friday night boat, returning Sunday, Sept. 13.

National Association of Port Authorities—The third annual convention was held in Baltimore, Md., Sept. 8-10, and was well attended by representatives of practically all of the important ports of the country. This association was organized in 191[illegible] to bring together all those who are interested in port financing, management and construction. Necessarily, this is a rather limited field of membership, but in the short time since organization the association has a representation from almost all of the United States ports and by a revision in the constitution this year is expecting to take in the other prominent American ports.

The papers presented were as follows:

"Relation of Federal Government to the City in Port Development," Col. William M. Black, U. S. Army, New York; "The Engineer's Part in Port Development," Francis Lee Stuart, Chief Engineer, B. & O. R.R., Baltimore, Md.; "Baltimore Harbor," [illegible] F. [illegible], President and Engineer of Harbor Board of Baltimore; "Trade Organizations as a Benefit to the Commerce of the Port," Charles J. [illegible], Philadelphia, Penn.; "The Port of Los Angeles," Maj. Robert H. Raymond, [illegible], Los Angeles, Calif.; [illegible] [illegible] Jr., Chief Engineer, New Jersey Harbor Commission; "The Port of Seattle," [illegible] H. M. Chittenden, Seattle, Wash.; "Trend of American Port Construction," William J[illegible] [illegible], Consulting Engineer, New York; [illegible] J. F. Coleman, Consulting Engineer, New Orleans, La.; "The Port of Boston," [illegible], Boston, Mass.; [illegible] Harry C. [illegible], Secretary of [illegible]; [illegible] Department of Commerce, Washington, D. C.

The following officers were elected for the ensuing year: President, [illegible] F. Lackey, President of the Harbor Board of Baltimore; Treasurer, Harry C. [illegible]; Secretary, [illegible]. It was decided to hold next year's meeting at Los Angeles, in the fall of 1915.

Engineering Literature

CONTENTS

REVIEWS AND NOTES

Unique Hydraulic Experiments

REVIEWED BY EMIL KUICHLING*

THE TRANSPORTATION OF DEBRIS BY RUNNING WATER —By Grove Karl Gilbert. Based on Experiments Made with the Assistance of Edward Charles Murphy. Professional Paper 86. Washington, D. C.: U. S. Geological Survey. Paper; 9x12 in.; pp. 259; 92 illustrations.

This interesting publication gives an account of numerous experiments made during the past few years at Berkeley, Calif., for the purpose of ascertaining and studying scientifically the laws that govern the transportation of gravel, sand and other mineral débris by running water. The work was undertaken in connection with the investigation of serious problems caused by the overloading of certain rivers in California with the waste matter of hydraulic mining operations, and its results constitute much-needed additions to our stock of knowledge of physiographic geology and hydraulic engineering.†

Mineral matter is transported by a stream in two ways, the finer particles being held in suspension by the water and the coarser ones moving by sliding, rolling or leaping along the bed of the channel. The suspended material is easily obtained from samples of the flowing water, and much is known as to its quantity; but the amount of heavier matter that travels on the bed cannot be determined in this manner, and little information concerning it is yet available. The primary purpose of the experiments was to learn the laws which control the movement of the bed load, and especially the relation of this load to the stream's slope and discharge and to the size and shape of the material. Four factors were thus introduced besides the velocity of the current, and it is very probable that the width, depth and shape of the channel are additional factors.

Much attention was given to the mode of transportation of the bed material, whether by sliding, rolling or leaping. When the load is small, the bed is molded into ridges or hills, called dunes, which travel downstream, as the current erodes their upstream faces and deposits the material on the downstream faces. With progressive change of conditions tending to increase the load, the ridges or dunes gradually disappear and the channel becomes smooth or even; but with further changes the bed again becomes uneven and a system of dunes will form that appears to travel upstream, owing to erosion on the downstream face and deposition on the upstream face. Both rhythms of débris movement are initiated by rhythm of water movement.

An important distinction is also made between "stream" transportation and "flume" transportation. In the first the load traverses a plastic bed composed of its own material, while in the second, it traverses a rigid bed. "Capacity" and "competence" are also terms used to designate respectively the maximum load of a given kind of material which a given stream can transport, and the ability to start the movement. For example, a stream at its low stage cannot move the débris on its bed, but with increase of discharge the velocity increases until transportation or traction of a certain grade of material begins, and the *discharge* is then said to be competent for that grade; similarly, if the velocity is increased by an increase of slope so as to begin a movement of the bed material, the steeper slope is said to be competent.

The experiments were made mostly in two wooden troughs or channels of rectangular section, 31.5 and 150 ft. long, 1.96 ft. wide and from 1.4 to 2.4 ft. high. The first trough was hinged at its head so as to facilitate changes of slope, while the second was kept horizontal. By means of false bottoms different degrees of channel roughness were secured, and with temporary partitions in the long trough, curved and crooked continuous channels 1 ft. wide were formed. A third trough, 14 ft. long and 0.67 ft. wide, had its woooden sides replaced by plate glass for 3.5 ft. at its middle, and a fourth trough, made of galvanized sheet iron of semi-cylindrical form and 1 ft. wide, was used only in the experiments on flume traction. The results showed that in flumes the transportation of débris in gentle currents is usually by rolling and sliding, and that the capacity of the current increases with the coarseness of the material. In swift currents the principal movement is by leaping, and the capacity increases with the fineness of the grain. The capacity is always increased by increasing the slope and varies on the average with the 1.5 power of the slope; it also varies with the discharge in some irregular ratio.

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†An abstract of the Professional Paper here reviewed, prepared by the author to preface his volume, was reprinted in "Eng. News" of Sept. 10, 1914, pp. 563 and 564.

An attempt was also made to apply the experimental results to natural streams, but as the flow of a river is a highly complex phenomenon and the transportation of débris by it involves intricate reactions, this work was not accomplished satisfactorily. It was found that the load of transported material is related to the controlling conditions or factors in a very involved manner, and that the law of control for each condition was qualified by all other conditions.

The experience gained from the Berkeley experiments, however, is very useful in carrying out other experiments which may yield more accurate data of the same general class, and it is hoped that the well equipped hydraulic laboratories at Dresden, Karlsruhe and Berlin, where accurate models of river channels are available, will soon be able to furnish observations which will apply more fully to river engineering.

The author has referred to most of the studies of the subject that have been made in our own country and abroad, but cites only the general conclusions reached. The phenomena of subsidence and velocity at which particles of matter settle in still water are discussed very briefly, being regarded only as incidents to transportation, and similarly only a few data are given in regard to the quantity of matter carried in suspension by streams. From lack of reliable observations little information is given about the volume of material that is carried along river beds by traction, although an excellent general discussion of this subject is submitted. In the Yuba River at flood stages, the tractional load is given by the author as being equal to the suspended load; at the mouths of the Mississippi, Humphreys and Abbot estimated that the tractional load was 11% of the suspended load, and in contrast thereto, the elaborate study on the beds of the Rhone by Guerard is cited to show that the tractional load was about three times greater than the suspended load. Such enormous variations in estimates and observations indicate clearly the need of many further studies of rivers. It may also be mentioned in this connection that an extensive compilation of data relating to the suspended and tractional load of streams was recently published by Max Singer, C. E., in "Zeitschrift für Gewässerkunde," Vol. 11, 1912, pp. 233-275, and that out of 31 entries only 6 gave the relation between the two loads, the range being from 1.0 to 0.11, as in the foregoing.

Interesting studies were also made at Berkeley of the vertical velocity curves in the experimental channels and the pitot gage used therewith, and although the results of the experiments are mostly applicable to flume transportation, yet the book contains so much other valuable material that it will be an important acquisition to every student of river physics.

CAMBRIA STEEL: A Handbook of Information Relating to Structural Steel Manufactured by the Cambria Steel Co. Containing Useful Tables, Index Data and Formulas for the Use of Engineers, Architects, Builders and Mechanics. Prepared and Compiled by Charles E. [illegible], General Manager. Cambria Steel Co., Johnstown, Penn. Eleventh Edition. [illegible] pp. [illegible] illustrations. [illegible]

The 11th edition of the well known Cambria Steel Handbook has just been published. It appears to contain most of the matter of the previous edition, but has been revised in some particulars and has had considerable new matter added. The new matter consists mainly of the sections of new and heavier sections, tabulation of the properties of standard railway rails, and the amplification of the tabulation of American municipal building laws. Such standard specifications as have been revised since the previous edition have been changed to meet the new revision.

A German Pocket-Book for Mechanical Engineers

Reviewed by Winslow H. Herschel*

TASCHENBUCH FÜR DEN MASCHINENBAU—Herausgegeben von Ing. H. Dubbel. Berlin: Julius Springer. In two parts. Cloth; 5x8 in.; pp. xi + 1462; 2448 text figures and 4 tables. 16 Marks.

In the attempt to cover all branches of engineering, the well known German pocket book, Hutte, has grown to three volumes, but Engineer Dubbel, by confining his attention entirely to mechanical engineering, is able with only one volume of somewhat larger size, to go much more into detail in regard to the subjects considered. He evidently takes Hutte as a model, and aims to give the best methods, rather than a compilation of all the suggestions to be found in engineering literature. It is also his idea that such subjects of general application as mathematics, mechanics and elements of machine design, should be treated very fully, while special types of machinery should be briefly reviewed so as to give any engineer a fair idea of them, since specialists on particular forms of apparatus are acquainted with the books dealing exclusively and in great detail with their machines, and they would never go to a handbook for their information.

This point of view has a far reaching and beneficial influence on the arrangement of the book. The first section, mathematics, is very complete, and includes among subjects not usually found in handbooks, the graphical solution of equations, probabilities, least squares, Fourier series, and an extensive discussion of analytical geometry as applied to engineering problems. Much that is given under mechanics might be looked for elsewhere. Here, instead of under materials, may be found the calculation of springs and tables of permissible stress; the strength of rapidly rotating disks, which are most frequently used in steam turbines; the latest researches on journal friction by Stribeck, Lasche and Heimann; and the graphical method of calculating the stress in crane hooks.

Such fullness in the chapter on mechanics naturally leads to shorter chapters on special machines. Steam engines are covered in about a third of the space usually taken, the bulk of the material coming under thermodynamics in the chapter on mechanics. And yet the chapters on separate machines are very full in regard to details of construction which apply only to these particular types of machines, as in the case of valve gears, under reciprocating engines, or air chambers, under steam pumps. On the other hand, parts which have more general application are placed in the chapter on machine elements, which covers, in addition to the details which may be found in any book on the steam engine, such parts as riveted joints, couplings, bearings, springs, shut-off valves, belts and belt shifters. The application of Mohr's graphical method to the determination of deflection of crankshafts is considered at some length. In fact, throughout the book, free use is made of graphical methods, and of problems to illustrate the methods given.

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The design of hydraulic turbines occupies considerable space, since this is considered in Germany as the work of mechanical, rather than of civil engineers. Other subjects not usually covered with any degree of completeness in handbooks, are flywheels and governors, hoisting machinery and machine tools.

In the opinion of the reviewer, the book contains as much information as could reasonably be expected in an uptodate handbook for mechanical engineers, well selected and well arranged.

A Manual for Health Officers

PRACTICAL SANITATION: A Handbook for Health Officers and Practitioners of Medicine—By Fletcher Gardner, Captain Medical Corps, Indiana National Guard; First Lieutenant Medical Reserve Corps, United States Army; Health Commissioner of Monroe County, Ind., and James Persons Simonds, Professor of Preventive Medicine and Bacteriology, Medical Department, University of Texas; lately Superintendent Indiana State Laboratory of Hygiene. St. Louis, Mo.: C. V. Mosby Co. Cloth; 6x9 in.; pp. 403; 37 illustrations. $4.

The information and opinions given in this volume are for the most part rational and up to date. By means of concise treatment and the omission of considerable matter common to earlier treatises but, to say the least, not demanding repetition here, the authors have covered a wide range of sanitary topics in relatively brief space.

The book is divided into three parts: (1) Epidemiology, composing half of the volume; (2) General Sanitation, and (3) A brief section on Pathological Materials and some schedules for sanitary surveys and inspection. Most of Epidemiology deals with specific communicable diseases, but there are brief chapters on how to manage epidemics, on isolation and quarantine, hospitals and camps, and on disinfection. General Sanitation includes two or three pages on organization of the sanitary service, several short chapters on reporting vital statistics and 15 chapters on disposal of the dead, school and factory inspection, rats, flies and mosquitoes, soil pollution (privies) sewage and garbage disposal, milk, water, foods and nuisances. The longest of the 15 chapters has about 16 pages; several chapters are 2 to 5 or 6 pages in length.

As has been stated, Epidemiology takes up half of the volume. Such an allotment of space is proper enough if well utilized but as the book seems to have been written for physicians (serving as health officers or practicing medicine) it seems as though too much of this space was given to general notes on specific communicable diseases and not enough to methods of suppression.

Although we are inclined to approve rather than disapprove the brevity of most of the chapters dealing with General Sanitation, we must say that there seems to be some lack of balance in distribution of space here and also a lack of judgment in some of the facts and opinions expressed. Thus, one of the longest chapters under General Sanitation deals wholly with Water Analysis, and this is about all the book contains on water-supply. A chapter of half the length on Sewage Disposal lays too much stress upon the septic tank and subirrigation for isolated houses and mentions no other possible method of treatment.

Perhaps the most remarkable thing about the book, and one which we certainly shall not lay up against the authors, is the absence of not only a chapter but, so far as we can find, even a paragraph on plumbing. The word does not appear in the index.

It seems pertinent to ask, for whom was this book intended, what is its exact aim and how nearly does it serve its intended readers and fulfill its object? The subtitle reads: A "Handbook for Health Officers and Practitioners of Medicine." The preface declares:

This book was designed to fill a vacancy in literature. Up to the present there has never been a serious endeavor to provide within the covers of a single moderate-priced volume, a plain, nontechnical exposition of the duties of the health officer, written by one experienced in the routine and emergencies of the local sanitary service and familiar with the needs of the local health officer.

After a proper enough disclaimer of originality the Preface continues:

It aims simply to provide a safe way for the health officer to meet any emergency which may arise. Since sanitary officials in small places out of the reach of libraries are most in need of such a work, and since they are illy paid, the authors have endeavored to provide a book at a moderate price. . . .

It seems only fair to the authors to say that the foregoing statement of their aims partly answers some of our criticisms of their book and to add that they have gone far toward attaining their object. They would have gone still farther toward meeting the needs of medically trained health officers in our smaller American towns, it seems to us, had they cut out still more of the traditional general information about specific diseases and general sanitation and used the space thus saved for a fuller presentation, to repeat once more a few words from their Preface, "of the duties of the health officer" and "safe" means for him to take in meeting "any emergency which may arise." A large percentage of the information presented has only a remote bearing upon the actual duties of the average health officer as he sees and tries to meet them and a still larger percentage will be of little if any use to him in his routine work—much less in emergencies. This only means that the highly commendable work the authors have done in cutting out much of the kind of matter given in earlier treatises for health officers might have been carried further with great advantage, as might the insertion of more material which in plain terms tells the poorly informed average American health officer what he ought to do and how he ought to do it.

TECHNICAL MECHANICS, STATICS AND DYNAMICS—By Edward R. Maurer, Professor of Mechanics, University of Wisconsin. Third edition. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. 353; text illustrations. $2.50.

As a textbook for teaching mechanics, Prof. Maurer's book carries the impress of his long experience in teaching the subject to engineering students. The fundamental principles are stated, demonstrated and impressed on his mind, and applied in the solution of various special problems of technical construction or operation. Out of the great number of such problems met in practice, only a few can be dealt with in any single textbook, and the selection made by an author is apt to determine the reference value, if not the teaching value, of his book.

In Maurer's book, practically the only problems taken up for their own sake are suspended ropes and gyrostatic devices; other applications are used only to illustrate and make more concrete the instruction in the fundamental concepts and principles. In spite of this, the book has considerable reference value to the engineer in practice.

As compared with the first edition (reviewed in these pages, Jan. 14, 1904), the present edition is largely rewritten, and reillustrated, and is equipped with new working examples. The rewriting has been rearrangement as well as rewording of detail explanations; but since there is nothing new in the science of mechanics.

the chief fact to be noted concerning the rewriting is that the author's clear style of discussion characterizes this edition just as strongly as the first.

The larger changes announced in the preface are that a chapter on Attraction and Stress has been omitted, and a treatment of the gyrostat—not a very convincing treatment, by the way—has been added.

British Shop Costs and Production

REVIEWED BY ROSSITER R. POTTER*

ENGINEERS' COSTS and Economical Workshop Production —By Dempster Smith, M. I. Mech. E., Lecturer in Mechanical Engineering, Manchester Municipal School of Technology, and Philip C. N. Pickworth, M. Sc. Tech. [The "Mechanical World" Series.] Manchester and London: Emmott & Co., Ltd. Cloth; 6x9 in.; pp. xi + 248; 32 text illustrations. 4 Shillings, net.

From an American point of view, the value of this book is considerably restricted due to the differences between American and British industrial conditions and practice. The first four or five chapters on specifications, grades and prices of metals (chiefly of iron, steel and copper) apply, of course, simply to British conditions. The middle section, taking up the subject of machine-shop production, will be the most interesting to American readers, and in particular Chapters VI and VII on wage systems and shop organization and Chapter VIII, which presents a condensed discussion of Taylor's experiments with cutting tools and of the Berlin and Manchester experiments.

Chapters VIII to XII are based on a series of articles published in the *Mechanical World* some three years ago. Of these, Chapters X and XI give formulas for computing "standard times" for a few machine and hand operations. The times obtained by the use of these formulas, however, seem to be much too large if the work is to be done on a piecework or bonus basis. Much depends, of course, upon the nature of the piece to be worked upon. The formulas may be correct for the particular class of work the authors had in mind, but this they do not clearly define. Any engineer or manager who accepts these or any other general formulas at their face value and uses them to establish standard times for piecework in his own shop will be quite apt to come to grief.

The last part of the book takes up cost keeping, with a couple of chapters on British railway rates and on the shipment of goods from British ports. The chapters on cost keeping are decidedly elementary and of little use except perhaps to give a general idea of the subject to one entirely unfamiliar with it. In general, this book will not be of much importance to engineers or managers on this side of the Atlantic. But ignoring for the moment the present unsettled conditions due to the European war, the information on British metal markets, [illegible] methods and wage rates would be of interest to anyone contemplating a connection with some English engineering works.

[illegible]

[illegible] bulletin of the Mellon Institute series, [illegible] the progress of the Pittsburgh smoke and smoke [illegible] in general, [illegible] the first specific figures on the trouble makers in Pittsburgh. The bulletin gives a brief review of the agitation for improvement, summarizing the evidences of trouble, outlines some contributing causes of the evil like quality of fuel and local topography, and classifies the sources of smoke. All this, a little less than half the book, is preliminary to the discussion of a mechanical engineer's survey of stationary boiler plants. Here are described typical constructions and operating results with (1) hand fired; (2) chain-grate stoker; (3) front-feed stoker; (4) side-feed stoker and (5) underfeed stoker plants. The relative undesirability, as there operated, ranged in the order (3), (1), (2), (4), (5). One notable feature of the bulletin is a series of Pittsburgh views, taken from identical positions on clear and smoky days.

*[illegible]

A New Edition of Moyer's Steam Turbine

REVIEWED BY H. E. LONGWELL*

THE STEAM TURBINE. A Practical and Theoretical Treatise for Engineers and Designers, Including a Discussion of the Gas Turbine—By James Ambrose Moyer, M. Am. Soc. C. E., Professor in Charge of Department of Mechanical Engineering, Pennsylvania State College. Second edition, revised and enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xi + 376; 225 illustrations. $3.50, net.

The fact that the publishers have been encouraged to put out a second edition of a technical book is, as a general proposition, the best kind of evidence that it is a useful work. The first edition of Professor Moyer's treatise was published in 1908, and was reviewed in ENGINEERING NEWS of March 18, 1909.

This second edition does not differ much from the original, except by way of some additional pages of descriptive matter, and the insertion of a number of practice problems. The first six chapters are unchanged except for a couple of small additions to Chapter II, on the Elementary Theory of Heat, and Chapter III, on Nozzle Design. Chapter VII, on Commercial Types, has been augmented by 14 pages of new text and illustrations. Chapter IX, on Low-Pressure Turbines, has been enlarged to twice its original size, and gives a much more comprehensive discussion of this machine and the circumstances which justify its use.

Two new chapters have been inserted which treat briefly of Mixed-Pressure Turbines and Bleeder or Extraction Turbines—developments that were in the embryonic stage at the time the first edition of the book was published. The chapter on Marine Turbines has been enlarged from two pages in the first edition to eight pages in the present edition, and is still very brief, considering the enormous development that has taken place in this application of the steam turbine during the past eight years.

The final four chapters, dealing with Turbine Economy, Stresses in Rotors, Drums and Disks, Gas Turbines and Electric Generators, are practically identical with the corresponding chapters in the first edition. In view of the considerable advance in high-speed generator design and construction in recent years, it would seem that the author might have enlarged a little on this subject.

An appendix of six pages of practice problems enhances the value of the work as a textbook. An unusually well engraved entropy-total heat diagram, on a conveniently large scale, accompanies the book.

*[illegible] Westinghouse Machine Co., East Pittsburgh, Penn.

The subtitle, "A Practical and Theoretical Treatise for Engineers and Designers," is a trifle pretentious if the author refers to engineers who design and construct steam turbines. The work is hardly comprehensive enough to warrant this characterization. It treats the subject in a conventional manner, and is undoubtedly an efficient elementary textbook for students, or for power-plant engineers, who, while not wishing to specialize on steam turbines, may find it advantageous to have a good general knowledge of their theory, construction and practical application.

Engineering Geology

ENGINEERING GEOLOGY—By Heinrich Ries, Professor of Economic Geology, Cornell University, and Thomas L. Watson, Professor of Economic Geology, University of Virginia, and State Geologist of Virginia. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. xxvi+672; 175 illustrations. $4 net.

Many, if not all, the larger colleges offer no end of "courses" in geology, but too many engineering schools either fail to provide a course in geology suited to the needs of their students or else leave the ordinary student no time to take such a course if one is offered. This is unfortunate, because of the many relations of geological knowledge to sound engineering design and construction, as the nature of rocks available for road making, or to serve as foundations for heavy structures or to be pierced by tunnels.

A book which treats of geology chiefly from an engineering viewpoint is, therefore, a most welcome addition to our engineering literature, especially when that book is so complete and authoritative as to serve not only for a college textbook, but to form a valuable reference work for any engineer's library. As Dr. Ries is already known to many engineers through his splendid book "Economic Geology," and his books on building stones and clay products, little more need be said of the merits of the book before us.

A synopsis of the contents follows:

Rock-forming minerals, essential principles of crystallography (45 pp.); the general characteristics, mode of occurrence and origin of rocks (100 pp.); the structural features of metamorphism of rocks with references to engineering experience on the Catskill and Los Angeles aqueducts, etc. (68 pp.); rock weathering and soils, which a topographical engineer should understand to fully appreciate topographical features of the maps he draws (29 pp.); surface waters (rivers) including the geology of runoff and stream flow, erosion, transportation of sediment, delta formation, etc. (51 pp.); underground waters, treated from every viewpoint as sources of water-supply (47 pp.); landslides and their effects, (16 pp.); wave action and shore currents and their relation to coasts and harbors (38 pp.); the origin and relation of lakes to engineering work (18 pp.); the origin, structure and economic bearing of glacial deposits, containing much material of interest in connection with subsurface construction (15 pp.); building stone, their kinds, sources, properties and uses of various North American stones (64 pp.); limes, cement and plaster, their composition, sources, manufacture and properties (17 pp.); clay and clay products, their properties and uses (17 pp.); coal series, kinds of, origin, distribution in the United States, uses, etc. (35 pp.); petroleum, natural gas and other hydrocarbons, properties, occurrence, including solid and liquid bitumens (25 pp.); road foundations and road materials, geological conditions which affect permanence and stability, kind and character of rock, gravel and sand (27 pp.); ore deposits, nature and occurrence of all the more important metal ores, but not a detailed discussion of their distribution (42 pp.)

We have given the synopsis at some length because a glance through it will show the completeness of the book. Each chapter includes a list of references to more detailed information.

The only objection to this book is its weight, not metaphorically speaking, but actually, for it weighs upward of 3 lb. We have noted this objection to some engineering books before. We believe it is a serious objection, for most engineers are obliged to carry their working library from place to place, and even a few such books constitute too great a load for the average trunk. Even if the book is not to be carted about the country, it is still inconvenient, for no one wishes to hold a 3-lb. weight when reading.

DAS SPIEL DER KRAFTE IM VERBUNDBALKEN; Eine Darstellung der Lehre vom Verbund, von der Spannungsverteilung und Ermittlung in auf Biegung beanspruchten Eisenbetonkörpern—Von Georg Fischer, Regierungsbaumeister, a.D. in Posen. Lissa-in-Posen, Germany: Oskar Eulitz. Pasteboard; 7x10 in.; pp. 77; 53 text figures. 6 Marks.

Regarding the reinforced-concrete beam as an arch in its central portion and a beam with concrete and steel jointly in tension in the end portions, the author locates the stress transfer from concrete to steel mainly in the region near the ends of the arch, instead of finding maximum bond stress at the ends as is usually thought. He further reasons that end anchorages, deformed bars, etc., are either useless or unnecessary expedients. He prefers designing beams for the range below tensile rupture of the concrete, limiting the steel stress to the limiting safe elongation of the concrete; the elastic ratio is still to be determined by test, he declares. In such design, the tensile strength of the concrete is to be counted in figuring the moment.

A new good-roads periodical under the name of "Dependable Highways" has made its appearance. This is the official bulletin of the National Paving Brick Manufacturers' Association, published by the Secretary of the Association, Engineers' Building, Cleveland, Ohio. It is sent gratis to municipal officials, engineers, highway commissioners, contractors and manufacturers, and doubtless to any engineer requesting to be placed on the mailing list. The paper is, of course, devoted chiefly to brick roads and pavements, but it is announced that attention will be given to other phases of road work. Indeed the first issue, dated August, 1914, contains an article by J. T. Fetherston, Commissioner of Street Cleaning, New York City, on "Litter Prevention as a Street Cleaning Factor," which displays an intention to include other than articles exploiting brick-road construction. It was announced at the convention of the Society held in Buffalo, Sept. 9, 10 and 11, that the bulletin is already on a self-supporting basis.

The new specifications for brick pavements of the National Paving Brick Manufacturers' Association have been issued in booklet form and may be obtained by addressing the Secretary, Will P. Blair, Engineers Building, Cleveland, Ohio. The present booklet represents two years' work of a committee appointed to revise and draft new specifications. The specifications cover excavation, grading, drainage, and curbing, as well as pavement and foundation. The clauses in the specifications covering the testing of materials are adopted chiefly from those proposed by the committee of the American Society for Testing Materials.

Bituminous expansion joints at the curbs are specified, but transverse expansion joints are expressly prohibited. Cement grout and sand fillers only are provided for; the association does not recommend or advise bituminous filler

[illegible] pavements. The specifications for [illegible] [illegible], broken stone, old gravel or macadam and No. 2 paving brick. There are two distinct sets of specifications, one for city pavements and one for country roads.

[illegible]

[illegible] VALVE GEARS AND VALVE SETTING: A Practical Treatise Which [illegible] the Mysteries of Valve Setting, Shows the Different Valve Gears in Use, How They Work and Why; [illegible] and Slide Valves of Different Types are Illustrated and Explained—By Fred H. [illegible], Associate Editor "American Machinist." Third edition, [illegible] and enlarged. New York: Norman W. Henley Publishing Co. Cloth; [illegible] in.; pp. [illegible]; [illegible] illustrations. [illegible]

Three new chapters have been added to this book, which, in other respects, is the same as at the time of its first appearance more than ten years ago. The new matter relates to the Walschaerts, the Baker, and the Southern locomotive valve gears. The increasing size of locomotives has led to a wide application of the Walschaerts gear, which is placed on the outside of the connecting-rod in an accessible position. The other two valve gears mentioned are not extensively used, but their existence justifies their description.

NEW PUBLICATIONS

(So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by enclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.)

ANNUAL REPORT OF NEW YORK STATE ENGINEER AND SURVEYOR. [illegible] (Albany, N. Y.), 1913. Vol. I. Cloth; 6x[illegible] in.; pp. [illegible]; illustrated.

ASSOCIATION OF ONTARIO LAND SURVEYORS—Annual Report and Proceedings of Toronto Meeting, Feb. 17-19, 1914. Toronto: L. V. [illegible], Secy.-Treas. Paper; 6x9 in.; pp. [illegible].

BOARD OF WATER SUPPLY OF THE CITY OF NEW YORK [illegible] Annual Report, Jan. 1, 1914, Accompanied by Report of the Chief Engineer. Paper; [illegible] pp. [illegible]; illustrated.

FOUNDATIONS: A Short Text Book on Ordinary Foundations, [illegible] a Brief Description of the Methods Used for Difficult Foundations—By [illegible] [illegible], Professor of Civil Engineering, [illegible]. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. [illegible]; [illegible] text figures. [illegible] net.

[illegible] OF TABLES AND FORMULAS FOR ENGINEERS [illegible] Walter H. [illegible] [illegible]. New York and London: McGraw-Hill Book Co., Inc. [illegible] illustrated. [illegible] net.

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THE MECHANICAL [illegible]

[illegible]erties and Methods of Timber Testing—By Samuel J. Record, Assistant Professor of Forest Products, Yale University. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. vi + 165; [illegible] illustrations. $1.75, net.

MINERAL RESOURCES OF THE UNITED STATES (1912)—Part I, Metals. Part II, Nonmetals. Washington, D. C.: U. S. Geological Survey. Cloth; 6x9 in.; pp. [illegible] and [illegible].

MODERN TUNNELING, with Special Reference to Mine and Water-Supply Tunnels—By David W. Brunton and John A. Davis. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. vi + [illegible]; [illegible] text figures. $[illegible], net.

MONTANA INSTITUTE OF MUNICIPAL ENGINEERS—Proceedings of Annual Meeting, Great Falls, Mont., Jan. [illegible], Vol. I. Bozeman: C. C. Widener, Secy.-Treas. Paper; 6x9 in.; pp. [illegible].

NEW JERSEY STATE BOARD OF HEALTH (Trenton, N. J.)—Annual Report for 1913, and Report of the Bureau of Vital Statistics. Cloth; 6x9 in.; pp. [illegible]; illustrated.

OUR MINERAL RESERVES, How to Make America Industrially Independent—By George Otis Smith. Bulletin [illegible]. Washington, D. C.: U. S. Geological Survey. Paper; 6x9 in.; pp. [illegible].

THE POLLUTION OF BOUNDARY WATERS—Progress Report of the International Joint Commission (Jan. 16, 1914) on the Reference by the United States and Canada as to Whether or Not Such Pollution Extends Across the Boundary in Contravention of the Treaty of Jan. 11, 19[illegible], and If So, in What Manner or by What Means Is It Possible to Prevent the Same. Washington, D. C.: The Commission. Paper; 9x12 in.; pp. [illegible]; illustrated.

PUMPING BY COMPRESSED AIR—By Edmund M. Ivens, Jun. M. Am. Soc. M. E. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. vi + 244; 106 text figures. $3.

RAILROAD AND CANAL COMPANIES OF THE STATE OF NEW JERSEY—Annual Statements, Together with Report of State Director of the United New Jersey R. R. & Canal Co., 1913. Trenton, N. J.: E. L. Edwards, Comptroller of the Treasury. Cloth; 6x[illegible] in.; pp. [illegible].

REPORT OF THE COMMISSIONERS OF THE STATE RESERVATION AT SARATOGA SPRINGS, 1914 (Saratoga Springs, N. Y.)—Paper; pp. 109; illustrated.

Several special reports on noted European medical baths and springs are included with the stated report of the Commission. One of these special reports is by Charles G. Anthony, Consulting Engineer to the Commission. It contains some interesting notes on the piping and pumping of mineral waters, a phase of water-supply information seldom treated in print.

REPORT ON CANADIAN IRRIGATION, 1913—Part VII of the Annual Report. Ottawa, Canada: Department of the Interior. Paper; 7x10; pp. 173; illustrated.

SCALES for Ascertaining the Dimensions of Pipes, Drains and Sewers—By C. E. [illegible], late Superintending Engineer, Public Works Department, India, and Sanitary Engineer to the Governments of Burma and Eastern Bengal and Assam. New York and London: Longmans, Green & Co. Linen; [illegible]x7 in.; pp. 16. [illegible], net.

THE STORY OF THE NATIONAL FIRE PROTECTION ASSOCIATION and List of Its Publications. Boston, Mass.: Franklin H. Wentworth, Secy.-Treas., [illegible] Milk St. Paper; 6x9 in.; pp. 11.

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DIE VIRTUELLEN LÄNGEN DER EISENBAHNEN [illegible]

[illegible]

WATER-SUPPLY PAPERS, U. S. GEOLOGICAL SURVEY [illegible]

[illegible]

Engineering News

VOLUME 72 SEPTEMBER 24, 1914 NUMBER 13

Making a Water-Tight Junction of a Large Steel Pipe and a Rock Tunnel under a High Head

By Arthur W. Tidd*

A number of valleys are crossed by the aqueduct for the new water-supply for New York City in the course of the 92 mi. from the Ashokan Reservoir in the Catskill Mountains to the Hill View Reservoir at the New York City line. One type of aqueduct for such crossings is a line of riveted steel pipe laid across the valley at the surface of the ground. At such crossings, the pipe line is laid directly down the slope to the bottom of the valley and up the opposite slope to the hydraulic gradient, connection at either end with the cut-and-cover type of aqueduct being made through a siphon chamber at grade. In one case, however, the steel pipe terminates near the bottom of the valley and joins a pressure tunnel (Fig. 1). It is the method of making a water-tight connection between the pipe and the tunnel at this point with the aqueduct in service under a head of about 168 ft., that this article describes. The steel pipe is the Bryn Mawr siphon and the tunnel the Yonkers Pressure tunnel. The location is about four miles north of the New York City line and about two miles east of the center of the City of Yonkers.

Conical Portion of Steel Interlining, Junction of Bryn Mawr Siphon and Yonkers Pressure Tunnel, Catskill Aqueduct

(Looking from cylindrical portion toward the connection chamber. The sections are bolted in position ready for riveting.)

Design in Brief—The sectional plan at mid-height of the waterway and the vertical section on the center line of the aqueduct (Fig. 2) show the design in outline, which is, in effect, the continuation of the steel pipe of the siphon through the connection chamber and about 175 ft. into the tunnel, the pipe being completely embedded in the concrete lining of the tunnel. Four heavy special pipe castings and a 72-in. hydraulically operated gate valve are inserted in the line at the chamber. The steel lining of the tunnel, called the steel interlining, terminates in a steel diaphragm projecting outward all around at right angles to the axis of the tunnel. The interlining is designed to be absolutely tight against

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[illegible] after erection and before embedding in concrete.

The enlarged longitudinal section (part of Fig. 2) shows the principal features inside the tunnel. The rough excavation is smoothed up by a concrete lining, the steel interlining erected, the 2-in. annular space grouted and the 8-in. concrete inner lining placed to form the waterway. The steel diaphragm projecting outward into a narrow groove in the rock marks the end of the steel interlining and the end of the special measures designed to effect a water-tight junction of the pipe and the tunnel. Beyond the diaphragm, the construction is of the ordinary concrete-lined tunnel type, the three branch tunnels joining at the bellmouth to form the standard tunnel of 16 ft. 7 in. finished diameter.

The tunnel is in rock, of the Yonkers gneiss formation, somewhat faulted at the portal, but not enough to require timbering, and sound at the bellmouth. The two side branch tunnels, constructed for the two additional pipes of the Bryn Mawr siphon to be built in the future, are similar in every way to the center tunnel, including the heavy castings and the gate valve.

SPECIAL CASTINGS IN THE CONNECTION CHAMBER.—The 11-ft. 3-in. diameter, ½-in. butt-jointed, steel pipe of the Bryn Mawr siphon draws down by means of a special reducing section, about 13 ft. long, to a diameter of 8 ft. 10⅞ in., terminating in a calking ring of ¾-in. plate, 9 in. wide, riveted with countersunk rivets on the outside of the ½-in. shell of the pipe (see Fig. 3). The calking ring enters the socket of the first of the special castings, the reducing wall pipe. This socket is of unusual depth (24 in.), to enable the lead joint to be calked on the inside (see Fig. 4). The next casting is the expansion piece, of ordinary design, followed by a 72-in. hydraulically-operated gate valve. Next to the valve is the manhole pipe, the manhole, 36 in. in diameter, giving the only access to the tunnel other than through the intake shaft at Hill View Reservoir, when the gate valve is closed. The increasing wall pipe, the last of the line, follows. This casting has a socket end for the manhole pipe and a flanged end for the connection with the steel interlining of the tunnel which immediately follows.

The average weight of the various pieces is as follows:

	Lb.
Reducing wall pipe	[illegible]
Expansion piece	[illegible]
72-in. gate valve	[illegible]
Hydraulic cylinder	[illegible]
Manhole pipe	[illegible]
Increasing wall pipe	[illegible]

[illegible]

[illegible]

$1/8$-in. soft copper wire were used under the bolt heads to prevent leakage along the bolts. The joint between the reducing pipe and the expansion piece was poured, but with unsatisfactory results. A similar joint on one of the side lines was also poured, but with equally unsatisfactory results. Both side- and top-pouring-hole methods were used, and both joints had to be melted out and repoured, but finally an acceptable result was obtained. The rest of the joints were made with lead wool, calked with pneumatic calkers operated by compressed air under about 80 lb. pressure. The gasket for the joint at the manhole cover was a copper ring, H-shape in section and about ⅜ in. thick. The largest lead joint (diameter 9 ft. 2⅝ in.) was unusual on account of its size and also on account of its depth, about 8 in. Special calking tools were required to be made for this joint, and about 1200 lb. of lead wool were used. About 150 lb. were driven into the smallest joint.

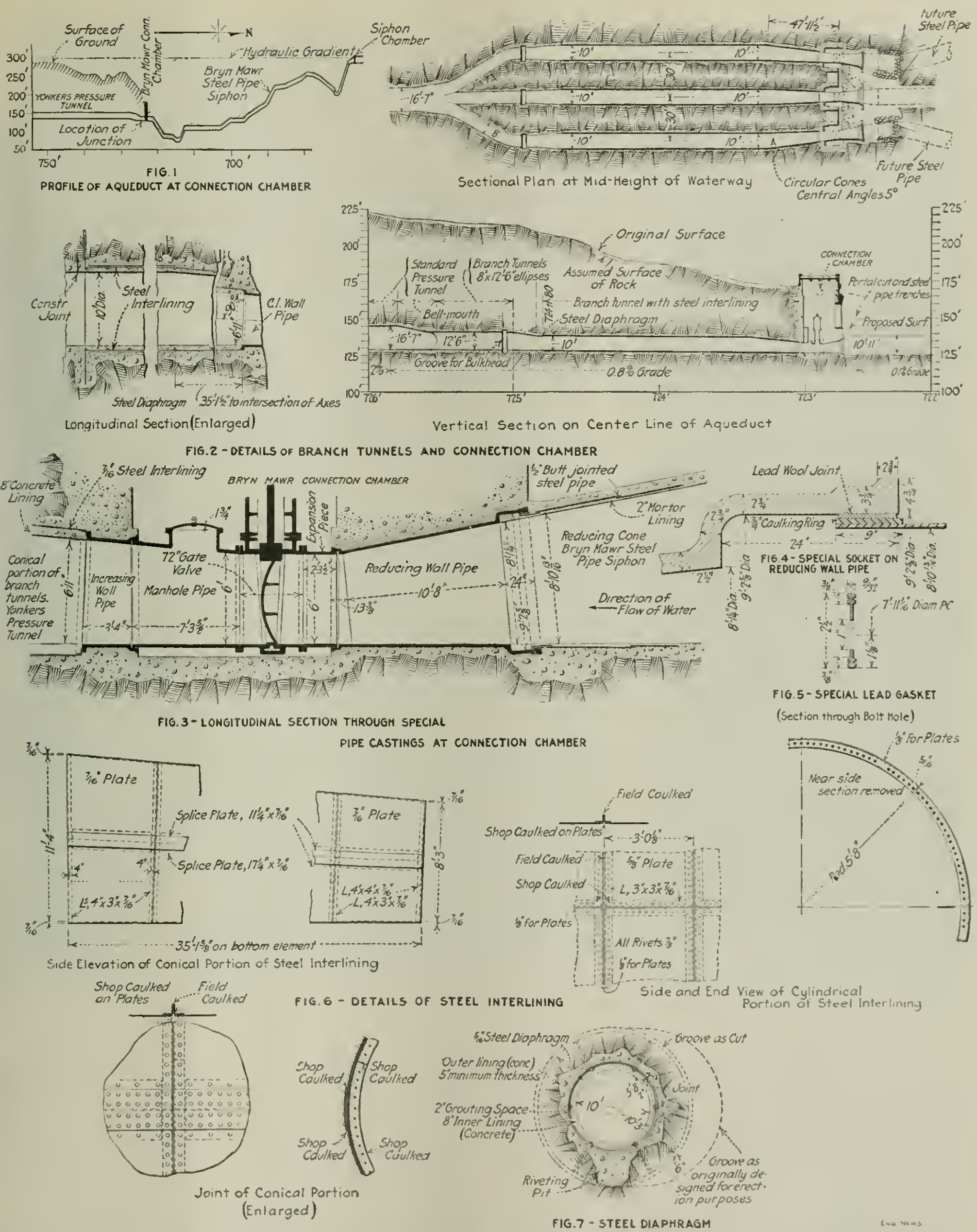
Fifty-six 1⅞-in. steel bolts were used on each flange of the 72-in. gate valve; thirty-two 1½-in. steel bolts with bronze nuts were used on the manhole cover and ninety-two ⅞-in. steel bolts were used to connect the increasing wall pipe to the end angle of the steel interlining.

The lead joint on the manhole pipe and on the expansion piece were made solid against longitudinal movement by driving many wrought-iron wedges between the spigot end and the base of the socket on the inside of the pipe.

OUTER CONCRETE LINING OF TUNNEL.—The first operation in the tunnel after excavation was the placing of the outer concrete lining of 5 in. minimum thickness to the rock and 11 ft. 8 in. inside diameter for the 110 ft. between the end of the conical portion of the steel interlining and the steel diaphragm, both to be described later. The cross-section was circular. The invert was first laid, 5 ft. in width, screeded and finished, using side planks set radially for forms. The "Jackson" forms were then set up for placing the rest of the section. The Jackson forms consisted of full-circle ribs of the diameter of the tunnel, made up of 5-in. I-beams with a 5-in. I-beam post in the center and two 5-in. channels riveted together back to back, set across the horizontal diameter. Bolted joints permitted the form to be dismantled, taken through the forms in use and reassembled for the next stretch. The forms were set at 5-ft. intervals. For the lagging, ⅛-in. steel plates [illegible] in. wide by [illegible] in. long, curved to the radius of the tunnel and stiffened by 1½ x 1½-in. angles, were used. The lagging was placed as the concrete rose.

A small amount of water from a general seepage and a few [illegible] was encountered, but gave no difficulty [illegible]. [illegible]

STEEL INTERLINING.—The steel interlining (see details, Fig. [illegible]), starting at the increasing wall pipe with a diameter of 9 ft. [illegible] in., increased in a distance of about [illegible] ft. to a diameter of 11 ft. [illegible] in. and continued with that diameter to the terminal steel diaphragm, a distance of about 100 ft. The first or conical portion was made of [illegible]-in. plate, butt-jointed, [illegible] about [illegible] ft. long [illegible]. The remainder or cylindrical portion was made of [illegible]-in. plate



FIGS 1 TO 7. JUNCTION BETWEEN BRYN MAWR STEEL SIPHON AND YONKERS PRESSURE TUNNEL, CATSKILL AQUEDUCT

and in segments, as described later. All had inward-turned angles for connecting and riveting the sections in the tunnel.

The first operation in the conical portion of the tunnel was the placing of a strip of the invert of the concrete outer lining from a point near the south wall of the connection chamber to the already completed concrete of the cylindrical portion. The invert was laid and screeded to a radius 2 in. larger than the steel. Across the invert were laid short lengths, about 5 ft. for the largest radius, of 6-in. 8-lb. steel channels with flanges (2 in. in width) upturned, bent to the radius of the steel interlining,

in which segments the sections of the interlining were erected. Beginning at the intersection of the cone and cylinder, one section of the cylindrical portion of the interlining having been first carefully placed and trued up in order to make a correct start, the first of the 6-ft. lengths of the cone was erected and the entire surrounding space between the steel and the rock filled with concrete. The 2-in. space beneath the steel on the invert was filled by pouring in thick grout and churning it thoroughly to insure complete filling. For the sides and arch, the concrete was placed by the usual methods, especial care being taken to tamp it thoroughly and to make a tight contact with the steel. The procedure was similar for each of the remaining sections of the cone, the section at the portal of the tunnel being the last to be placed and concreted. A grout pipe, to be described later, was placed in the top of each section extending to the rock.

The cylindrical portion of the steel interlining consisted of sections 3 ft. in length, each section being composed of six segments which, when riveted together, formed a circle of diameter 11 ft. 4 in. Each segment was of ⅝-in. plate, curved to the radius of 5 ft. 8 in., with a 3x3x⅝-in. angle riveted to each of the four edges of the plate. The angles were mitered at the corners and projected ⅛ in. beyond the edge of the plate all around. All joints were also calked where possible, a fundamental principle in the design, construction and inspection being to make the interlining in itself tight against leakage. In erecting the sections, 5 ft. lengths of 6-in. [illegible] curved channels were laid across the invert, as described for the conical portion. These formed the 2-in. grout space on the bottom, a feature of this portion of the design being an annular space 2 in. wide between the steel interlining and the outer concrete lining of the tunnel, filled with grout after the steel was erected and calked. The segments were erected without difficulty. All joints throughout the entire length of the interlining were riveted with the exception of the one at the intersecting main pipe. Pneumatic tools were used for all the riveting and practically all the calking. Soft steel wedges were driven into the openings at corners, etc., and calked. The thorough character of the work was proved by the very small amount of leakage when the 2-in. annular space was grouted.

STEEL DIAPHRAGM—At the termination of the steel interlining, a circular steel diaphragm or water stop was erected (Figs. 7 and 8), projecting about 4 ft. 6 in. beyond the interlining and at right angles thereto into a narrow groove cut in the rock. The diaphragm was riveted and calked to the steel interlining and grouted into the groove at the same time that the 2-in. annular space around the interlining was grouted.

The cutting of the groove proved to be very slow and expensive. The specification in the contract covering this work was as follows:

Sec. 75 A. The channels to be constructed under this item shall be of such depth as to permit the insertion of a diaphragm [illegible] ... top of the surrounding rock. They shall be completely cleaned of all debris and shall be kept clean until refilled, in accordance with orders. These channels shall be cut at such times that the erection of the steel interlining and the completion of all other work in the branch tunnels shall not be delayed.

The method to be used was the subject of much discussion. The cutting was finally done with ordinary rock drills mounted on columns, so as to permit radial cutting, the operation being that of cutting away the entire rock as with channeling machines. No other method was tried. The groove was started with a 3½-in. bit and somewhat smaller bits were used as the channel deepened. Two drills were usually used on one column. One of the greatest difficulties encountered was in guiding the drill so as to cut in a plane. Guides made of steel angles between which the drill could run, placed close to the rock, were tried but given up. The method finally adopted was to use the end of the steel interlining in its finally erected position as a guide, holding the shank of the drill against it while drilling. The hardness and texture of the rock varied, oftentimes within the space of a few inches, and occasional seams were encountered. Both these operated to throw the drill to one side and deflect the channel from its true plane. When this occurred, the only way to get the groove back onto line was to drill small shallow holes as nearly parallel to the plane of the groove as possible, shoot off the projecting rock with light charges, and make a fresh start with the drill. In spite of all the pains taken, difficulties were encountered from this source when rotating the diaphragm during erection. The average depth of cut was about 4 ft. for the groove in the east branch tunnel, 4 ft. in the center tunnel and 2.5 ft. in the west tunnel, the maximum cut being 4.5 ft. and the average area of groove cut (area of plane normal to axis of tunnel) 173.4 sq.ft. The average time per groove required for cutting was equivalent to 101 eight-hour shifts for one driller and one helper.

The steel diaphragm was ⅜ in. thick, 20 ft. 6 in. in diameter, and composed of six segments with field-riveted joints. The original design contemplated cutting the groove on one side of the tunnel to a sufficient additional depth, 4 ft. at the maximum, to permit the diaphragm to be rotated and shifted as each segment was attached and the radial joint riveted, until the full circle was completed, whereupon the diaphragm would be shifted back, brought into position and riveted to the interlining. It was apparent very soon after drilling commenced that it would be extremely difficult to cut the groove to such a depth and modifications of the method were studied, with the result that the contractor was permitted to excavate a riveting pit in the invert about 4 ft. square and 4 ft. deep. In this pit, each joint was exposed for riveting by rotating the diaphragm on the end of the interlining. Even with this modification, some trouble was experienced as the diaphragm was rotated, due to irregularities and projections in the groove.

GROUTING THE 2-IN. ANNULAR SPACE—The next step was to complete the lining of the tunnel up to and against the south side of the diaphragm, but not filling the groove. To prevent the entrance of concrete into the groove during concreting, the opening on each side of the tunnel from the invert well up to the crown was closed with brickwork about 8 in. square laid against the diaphragm and following the irregularities of the rock. The portion of the riveting pit and the diaphragm groove be-

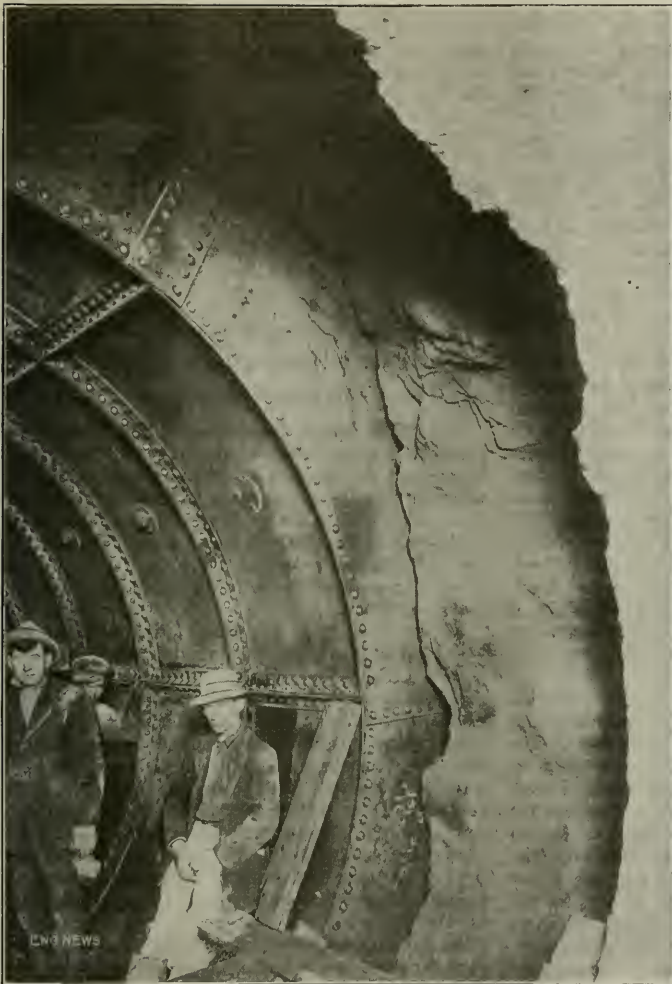


Fig. 8. End of Steel Interlining, Showing Steel Diaphragm Riveted into Place

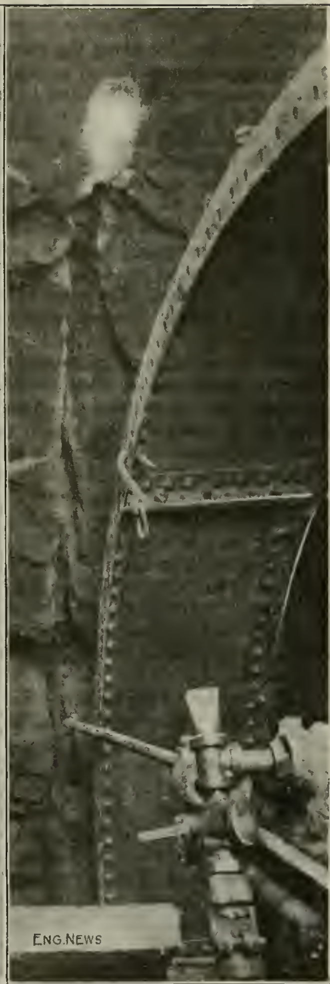


Fig. 9. Cutting Groove for Steel Diaphragm

low the invert was filled with 1 to 1 grout poured in through a grout hole in the bottom of the steel interlining. Grout pipes extending the full depth of the groove were placed in the invert, at the springing line and in the roof and concreted in.

After the concrete was thoroughly set, the 2-in. annular space outside the steel interlining was filled with grout, using the 2-in. grout holes provided in the segments of steel interlining for that purpose. These holes were formed by a threaded casting riveted to the steel to which the grouting apparatus was attached. A liberal number of segments with grout holes were provided and during erection they were placed at frequent intervals in the invert and arch and in the upper and lower quarter points. The spacing was not over 30 ft. for a maximum and usually much less. Grouting was begun at one end with a connection at the invert and to avoid forcing the grout to travel too far at least three connections were made. All holes were kept open as the grout rose and were not closed until a free and continuous flow of well mixed grout appeared. After the space was filled to a height of about 3 ft., connections were made to the holes in the crown and the grouting completed. The interlining was sounded with a hammer during the filling to expel the air and aid in insuring a complete filling at the top. After the grout had set, the grout holes were closed with cast-iron plugs. The grout was placed with a light pressure at first and reached a maximum of 60 lb. when finishing. The mix was 1 bag of cement, 1 bag of sand of about 0.9 cu.ft. volume and 85 lb. weight and about 12 gal. of water. Two grouting tanks of the Caniff type mounted on a movable truck were used, thus giving an almost continuous flow of grout.

Grouting Back of the Outer Concrete Lining—

After the grout had sufficiently set, holes were drilled through to the rock in order to grout any voids that might have been left along the rock during the placing of the outer concrete lining, especially in the roof, and also if necessary to fill the seams in the rock. In anticipation of this operation, 2-in. holes had been drilled and tapped in the steel interlining after erection by using a portable pneumatic drill and hand-driven special short taps. The holes were closed with a cast-iron plug during the grouting of the 2-in. annular space. The drilling was done chiefly with jap drills, a short length of 2-in. pipe being screwed into the hole to protect the threads and also to guide the drill. The holes were drilled through to the rock. The grout hose was connected directly to the hole in the steel interlining. A pressure of 200 lb. was tried first with the intention of forcing the grout as far as possible into the seams of the surrounding rock, but this caused an inward buckling of the steel interlining near the connection. Another hole was tried under 80 lb. pressure with a similar result but less in extent. The pressure was reduced to 50 lb., and no further trouble was experienced. The plates alone buckled, there was no deformation of the rib angles. The buckled areas were tapped where necessary and filled with grout. The grouting was completed using the 50 lb. pressure, and the holes closed with cast-iron plugs after the grout had set. Neat grout was used, mixed 1 bag of cement and 6 gal. of water. The 200 lb. pressure was produced by a Westinghouse high-pressure air compressor, taking power from the low-pressure air line at that time in service in the tunnel.

The Concrete Interlining—The final step was the placing and grouting of the [illegible] concrete lining inside the steel interlining to form the waterway. The steel was thoroughly cleaned and a strip of invert 4 ft. wide laid along the bottom. On this strip the forms were erected and the lining placed, the forms and method for the cylindrical portion being similar to that used for the outer lining, described in the first part of this article. The horizontal member of the form was in this case placed a little above the axis, and formed the support for the track and platform on which the concrete was delivered. In the curved portion, [illegible] wide wooden lagging were used. The concrete was mixed a little richer than 1 to 6. The coarse aggregate was 1 in. maximum diameter.

To secure complete filling around the legs of the angles on the steel interlining at the top, grout pipes were set when the concrete was placed and the space afterward filled with neat grout under about 50 lb. pressure. The pipes were set on the center line of every [illegible] of the interlining. At first, two pipes were placed about 1 ft. either side of the center, but later one additional pipe was used, one on each side just below the angle at the lower part of the arch segment. Grout pipes were also set in the invert portion and grouted at the same time as those in the cylindrical portion. Not all the holes appeared to be connected to, but at least one connection was made for every 3 ft. in length of tunnel and all holes not showing a flow of grout were [illegible].

Test—The hydrostatic test of the entire tunnel under the full working pressure indicated that the work was thoroughly done, for no leakage could be detected and [illegible]. The work was under about [illegible] head continuously for three months and under the full hydrostatic head of 168 ft. for the week next following. The grouting of the 2-in. annular space gave a very good demonstration of the tightness of the steel interlining under the moderate pressure used for that operation.

J. Waldo Smith is Chief Engineer of the Board of Water Supply, Frank E. Winsor, Department Engineer, and Chas. E. Wells, Division Engineer in charge of construction, Alfred D. Flinn, Department Engineer, Headquarters, and Thos. H. Wiggin, Senior Designing Engineer, were in charge of the design. The contractor was Geo. W. Jackson, Inc., of Chicago.

Manufacture, Test, and Use of Waterproofing Fabric

By Joseph Rosenzweig*

The Public Service Commission of New York (First District) is using enormous quantities (1,000,000 sq. ft. in the last six months) of treated woven fabrics for waterproofing the new subways now under construction in the City of New York. It was found difficult to get uniformity in the product, and a study of the subject was therefore made by the writer for the purpose of standardizing the manufacturing and testing of these saturated fabrics.

Waterproofing fabric is made of burlap saturated with asphalt or coal-tar pitch, and sprinkled with woodflour to prevent self-adhesion. Burlap is made of jute, which is the fiber obtained from the inner bark of the Asiatic plant, *Genus Corchorus*, of the Linden family. The woodflour is pulverized or granulated pulp, chiefly of cedar or white pine. Most of the burlap used for waterproofing is received from Dundee and Calcutta, in bales or rolls of from 1200 to 2000 yd. in length, the width being from 32 in. to 42 in. The finished fabric comes in rolls of from 100 to 200 yd. in length, the width varying sometimes from 29 to 30 in., the variation from the original width of burlap being caused by shrinkage due to saturation.

As the Public Service Commission is using coal-tar pitch for membrane waterproofing exclusively, it is highly desirable that the saturating flux and coating of the fabric should conform as closely as possible to the binder, and as heretofore no jute fabrics had been saturated and coated with coal-tar pitch, experiments were conducted to determine whether this could be done, and eventually it was found that fabrics of this nature could be produced, and it is now used on our work, together with asphalt-saturated fabrics.

Requirements of Fabric

It has been found that good waterproofing fabric [illegible] possess the following qualities:

1. The fabric should be thoroughly saturated and well coated, leaving sufficient open pores to permit the proper bonding of [illegible].

2. The fabric should be sufficiently pliable so as to conform to the [illegible] of the surface to which it is applied.

3. The burlap while being saturated should not be [illegible]

*[illegible], Public Service Commission of New York, First District, New York City.

charred, which may happen if the temperature of the saturant is very high.

4. The saturant should be of such material as not to have a deleterious effect on the burlap.

5. The finished roll of fabric should be easily unrolled, only sufficient woodflour to prevent self-adhesion being used.

6. The completed roll of fabric should be protected from warping, wrinkling or other injury by the insertion of a central core or spool made of wood or fiber.

7. The saturating flux should have a melting point of at least 140° F. and its temperature during the saturation process should be between 270 and 300° F.

To produce the above, experiments have shown that the burlap must be drawn through the saturant very slowly and remain immersed for as long a period as is required to draw a maximum of 10 ft. of the burlap through the saturant in 30 sec. when the saturant is at 270° F., the speed being proportionate to the temperature of the saturant, that is, the hotter the saturant, the less the time of immersion, and *vice versa*. This speed may be increased if the burlap is to receive a coating besides the saturation; that is, if the double process is to be used. The melting point of this coating flux (which is not to differ materially from the saturating flux) may be twice that of the saturant, but its temperature at the time of application must be the same as that of the saturant to effect complete adhesion.

Manufacture of Fabric

The method of saturating the burlap found to be most practicable and now in general use is as follows: A roll of burlap is passed through a series of hot rollers or hot coils for the purpose of evaporating all moisture, which sometimes amounts to 10% by weight, and never less than 3%. It is then rerolled (unless coils or rollers are near the saturating tank) and set up in a revolving stand in front of a long but shallow steel tank through which it is drawn at a depth of about 1 ft. below the surface of the saturating material contained therein, for a distance of about 15 ft. A short but very deep tank is equally as good as a long but shallow one, the burlap traveling through it vertically instead of horizontally. The saturant is heated and kept to any required degree of temperature by steam coils placed along the vertical walls of the saturating tank on the inside. From the tank it is drawn through two steam-heated compression rollers. The function of these rollers is to remove the excess saturant clinging to the burlap and press the remaining saturant into it. The pressure exerted by these rollers determines the percentage of open mesh remaining in the saturated product.

The saturated fabric is next drawn over an air space whose practical horizontal limit is about 20 ft. with the machinery used in most manufacturing plants, or drawn alternately over water-cooled rollers with bearings on floor and ceiling, whence it is sent over a series of drying rollers, which may be large or small, their function being merely to expose the saturated fabric for as long a period as is practicable to the cooling effect of the air. Instead of the open air space, a strong electric blower properly placed will accomplish the same result. The drying rollers are also used to spread on the surface a thin film of woodflour, after which the fabric is wound upon a collapsible spindle, from which it is easily removed, a simple measuring device showing that the required length has been rolled up. A core above referred to is then inserted, or the fabric may originally be rolled thereon, and the roll is then ready for shipment.

The burlap should show a uniform open mesh with a uniform thickness of thread in warp and woof, and in drawing it through the series of rollers for saturating purposes, care must be exercised not to subject it to too great a tension, as this distorts the mesh and weakens the fabric. The best burlap to use has been found to be that of between 7 and 8 oz. per sq.yd. incl. in weight. The saturating material may be either a pure or fluxed asphalt or a coal-tar pitch. There is no positive proof that asphalt is preferable to pitch as a binder or saturant, but in view of the fact that a coal-tar pitch is now used exclusively as a binder in the field for bonding the various plies of fabric, it is preferable as a saturant because asphalt and coal-tar pitch do not mix well.

Experiment has shown that while all asphalts are capable of being acted upon by acids, coal-tar pitch is affected by them to a much less extent. The asphalt should not be too brittle if fluxed; that is, if an asphaltic oil and gilsonite or grahamite are mixed in certain proportions to form commercial asphalt; the coal-tar pitch, on the other hand, should not contain more than 10% free carbon, because carbon, as well as the burlap proper, is not a waterproofing material, carbon giving body to the saturant, so to speak, and the burlap giving body or acting as reinforcement to the waterproofing membrane.

It may be asked, Why saturate burlap at all? To which the answer is, that workmanship in the field with reference to waterproofing a subsurface structure is not entirely dependable; the temperature of the binder is not constant, and often below what is necessary to saturate the raw burlap. It may also be asked why woodflour alone is satisfactory for preventing self-adhesion. Because anything else, such as soapstone, cork flour, powdered sand, or even coarse sawdust, is not absorbent, adds unbeneficially to the waterproofing membrane, and hinders the affinity between the binder and the saturating flux when the fabric is applied in the field. It should be noted, that experience with various woodflours has definitely demonstrated the superiority of one of a fine granular nature over any other form.

It has been suggested that creosote, being an excellent preservative of wood, and a distillate of coal tar, would be an equally good preservative for burlap. The objection to this lies in the fact that creosote evaporates very quickly, leaving the fabric stiff and unprotected against mechanical injury.

Tests for Acceptance

Experience has shown that the following inspection methods reveal whatever is good or bad in waterproofing fabric:

1. Observe the surface of the fabric through a magnifying glass and note whether the individual strands are merely stained or actually coated with the saturant, the former being entirely insufficient.

2. Hold a large piece of the fabric before a light and note the percentage of open mesh, which should be approximately 50% of the untreated burlap. This percentage of open mesh insures good coating, but not necessarily good saturation.

3. Cut off a piece of fabric about 1 ft. square from a roll selected at random, and with a sharp knife cut it parallel to the warp, parallel to the woof and diagonal to both. This will not always reveal insufficient saturation, but by tapping the fabric along the line of these cuts, the defect will become visible and show the fabric to be unsatisfactory.

4. Flexibility and a certain degree of softness of the fabric are essential properties. These may be discovered by crushing the fabric in the hand held close to the ear. If a crackling sound is heard, or flakes peel off, it shows that the asphalt is too hard or the coal-tar pitch is of too high a melting point. The fabric will also feel stiff if either is the case.

5. A square foot of the fabric should be cut from any portion of the roll and carefully weighed to determine the amount of saturation; this should equal the weight of the raw burlap, thus making the finished product twice the weight of the raw, and this should be a minimum.

6. Since an excessive coating of woodflour is undesirable, and even injurious, the finished roll should be examined, and if its appearance is distinctly white, as it is when too heavily covered with white pine woodflour, it should be rejected; the amount of woodflour permissible being 2½ lb. per square, that is, per 100 sq.ft. of surface, uniformly spread on one side only. In hot weather, 3½ lb. per square is permissible.

7. To determine the effect of the saturant on the burlap, for it is sometimes injurious to its tensile strength, the fabric should be tested in a tension machine; a well saturated fabric will always show an increase in strength over the raw burlap, but when tested in strips 1 in. in width, it should show not less than 80 lb.

8. A sample of the saturating flux should show on chemical analysis the following:

Solubility in carbon tetrachloride, not less than 98%.
Solubility in [illegible] not less than 66%.
Physical tests should show:
Softening point not less than 75° F.
Melting point, not less than 140° F.
Penetration, not less than 0.75 cm.
Penetration of coating, not less than 0.15 cm.
Ductility of saturant, not less than 20 cm.
Ductility of coating, not less than 3 cm. when elongated at the rate of 5 cm. per minute in water at 77° F.

9. The woodflour should be preferably a fine granular color applied as a thin, even film on one surface only, yet if sawdust is used, it should be sparsely applied.

10. When the fabric is brought on the work, it should be stored in a dry and cool place, piled no more than three or four rolls high, protected against rain and other weather conditions, as well as from injury by resting or falling weights.

It should be noted that in hot weather a saturating flux with a higher melting point should be used than that employed during the winter, but the former should not exceed 160°, and the latter should not fall below 140°; that the amount of woodflour should be reduced as the weather grows colder, and all quantities lying loose should be swept off.

An open-mesh saturated fabric is now recognized by most engineers to be superior to the saturated felt for waterproofing purposes, as it is now employed in what is known as the membrane method of waterproofing. The reason for this conclusion is found in the fact that an open-mesh fabric permits a more thorough bonding of the successive plies of fabric with the binder, and permits the escape of air from pockets formed underneath the layer of fabric on and before the application of the binder to the surface. A substitute has been suggested in the form of perforated felt, saturated in the same way as fabric. This is simply recognizing the efficacy of open-mesh fabric which is free from the disadvantages inherent in the perforated felt, viz.: distinct layers in the form of alternate strata; lack of tensile strength, lack of amalgamation of materials and a tendency to "creep," especially on vertical walls; while the fabric possesses the advantage of acting as a reinforcement and body-giver to the membrane, being more elastic and capable of yielding over a considerable area.

Tie Treating Plant, Louisville & Nashville R. R.

SYNOPSIS—A [illegible] plant of [illegible] construction, [illegible] treatment [illegible] treatment for [illegible]. [illegible] The plant [illegible]

[illegible]

... may seriously impair the economic value of treated ties.

The Louisville & Nashville R.R. has for many years been treating piles and bridge timbers by the creosoting process at its West Pascagoula plant, near Gautier, Miss., but this was largely as protection against the teredo and other destructive organisms in salt water. The railway had an ample source of supply for its ties (the standard material being white oak), but with the outlook for a decreasing supply and increasing cost of first-class untreated ties, it began to consider the possible economies due to the use of ties of inferior timber treated by preservative processes, and about a year ago it was decided to undertake the treating of ties.

The question of the location of the plant was one of the first points to be considered. For a railway obtaining all its ties from one district, a single large treating plant may be economical, but this railway obtains its ties all

along the various lines of its system and it was easily shown that one large plant would not be economical, in view of the fact that cost of transportation is a large proportion of the cost incidental to treatment. The cost of haul per tie was estimated at 4c. per 100 miles, while the cost of treatment (exclusive of chemicals) was about 5c. per tie, so that it would not pay to haul the ties much more than 150 miles. It was considered the better policy, therefore, to establish two or three plants at different points so as to economically serve the different portions of the railway system.

The first of these tie-treating plants is that now in operation at Guthrie, Ky. This place was selected as being at the intersection of two important divisions, one extending from Nashville north to Henderson (on the Ohio River) and St. Louis, and the other extending from Memphis to Louisville. Thus ties are readily received and distributed, and the plant will serve the entire northwestern portion of the system.

The special features of the plant may be noted as follows: (1) The use of two preservatives, creosote oil for ties on curves (with tie plates) and zinc-chloride for ties on tangents (without tie plates). (2) The compact arrangement of the plant, with low cost of construction and operation, and special facilities for inspection of the intricate piping systems. (3) The fireproof construction of the buildings. (4) The use of cast-iron flanged pipe for all lines handling oil or zinc. (5) The steam-heating systems for the cylinders and tanks, avoiding the use of coils and pipe joints. (6) The economy in fuel consumption, due to compact arrangement of the plant and to the use of exhaust steam for heating feed water.

The plant was put in operation in March, 1911, and is treating about 60,000 ties per month. Its total cost was about $161,000, including $15,000 for the yard. The plant was designed by the railway company's engineers, and all parts were built and furnished to specifications. The buildings were erected by contract, and the equipment was supplied by various manufacturers. The grading was done by contract, and tracklaying was done by the railway company. The design and construction were under the direction of W. H. Courtenay, Chief Engineer of the Louisville & Nashville R.R., and J. B. Lindsey, Superintendent of Timber Treating Plants; H. G. Laird is Assistant Superintendent in charge of operation.

General Plan

The plant is located near the station at Guthrie, and is served by tracks connecting with both of the intersecting divisions. It occupies a tract of about 30 acres, giving ample yard room for the storage of ties for seasoning. There is room for about 500,000 ties in the yard, which is well equipped with water mains and hydrants for fire protection. The water pressure, about 25 lb., is maintained by an elevated tank of 50,000 gal. capacity.

The soil is a stiff red clay, and the foundations simply require footings in this; no piles are used. A creek running diagonally across the site has been filled up, and its course diverted to two 20-ft. drainage ditches, paralleling the longer sides of the yard and discharging through culverts in the railway embankment at the north end. The excavated material was used to fill low places in the yard. The site has a slope toward the east, and open drains are cut across the yard to drain surface and subsurface water to the ditch on the east side.

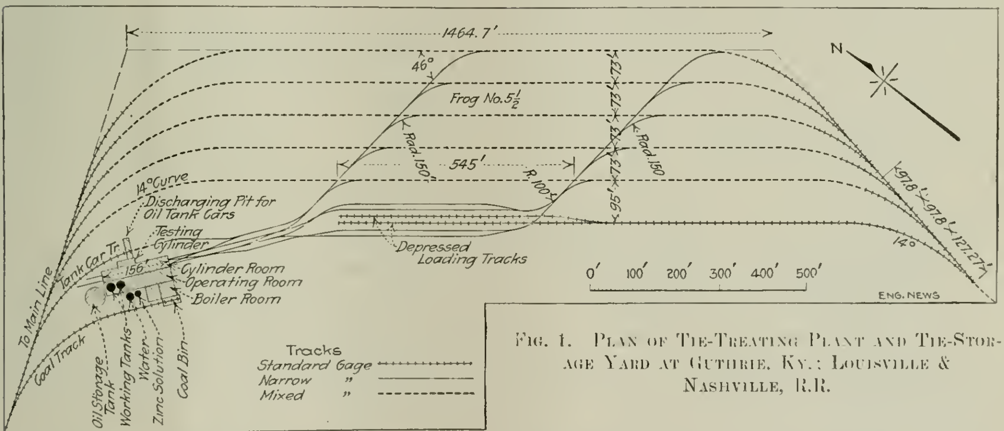


Fig. 1. Plan of Tie-Treating Plant and Tie-Storage Yard at Guthrie, Ky.; Louisville & Nashville, R.R.

The layout of the plant and yard is shown in Fig. 1. The connection at the north end is with the Louisville-Memphis main line, while that at the south end is with the St. Louis-Nashville main line. The standard-gage and mixed-gage tracks are laid with 70-lb. rails (Am. Soc. C. E. section), and the narrow-gage (30-in.) tracks with 58¼-lb. rails. The standard-gage tracks have 12-ft. switches and No. 7 frogs. There are several intersections of narrow-gage with mixed-gage tracks, and these are built of 70-lb. rails.

A locomotive is used for handling the railway coal cars, tank cars and carloads of ties, as well as for handling the tie trains on and out of the cylinders. This machine is available for general use and is considered more satisfactory and economical than a cable haulage plant for the cylinder trains. It is a four-wheeled engine, weighing 65,000 lb., and while this is not at all too powerful for the work, it represents about the maximum weight for a four-wheel engine of 30-in. gage. A six-wheel engine could not well be used on account of the sharp curves in the yard tracks. The front end of the

frame is fitted with a heavy bumper for pushing the cars. It pushes the rear end of the tie trains into the cylinder by means of a pole, so that the engine does not run onto the transfer table. It hauls the train out by a cable extending the full length of the train. A notable feature is the use of the Walschaerts valve-gear on a narrow-gage industrial locomotive of this size.

The tie cars are of structural steel, with pressed-steel ribs forming the lower part of the hoops, which hold the ties in place. They run on 12-in. wheels. Each tie train consists of 17 cars, with about 45 ties per car.

The railway cars for shipping the treated ties are placed on two standard-gage tracks, which are depressed so as to bring the car floors about level with the yard surface. This is considered preferable to running the tie cars on an elevated loading platform. This loading pit, Fig. 2, is 28 ft. wide and 4 ft. deep (to rail level). It has 6-in. reinforced-concrete walls, 7 ft. high, with counterforts 10 ft. apart and expansion joints at intervals of 55 ft.

Treating Plant

The treating plant is located at the northwest corner of the site, and has two cylinders or retorts, with provision for a third in the position now occupied by the testing cylinder. The general arrangement is shown in

Fig. 2. Section of Loading Pit

Fig. 3. The cylinders are housed in one side of a building, which contains also the boiler room, the valve or operating room and a repair shop.

The building also encloses the working tanks, but is not carried up high enough to roof over these tanks, as this would have made an expensive construction. Instead, the upper part of each tank, above the roof, is enclosed by a steel jacket, whose lower end opens into the building, while the upper end carries a hood just above the tank roof. Thus the hot air of the building passes up through the 4-in. space around the tank and roof.

The storage tanks are outside the building, but very close to it, so that the outside pipe connections are very short. These pipes are in concrete trenches, protected from the weather and readily accessible.

One of the special features of the plant, as noted above, is the use of cast-iron flanged pipe for all lines handling oil and zinc solution. This is in order to avoid the trouble of leakage at threaded joints, due to the liquid working along the threads or causing their corrosion, while the cast-iron pipe also gives better resistance to the action of the zinc and creosote. The additional cost was slight, but the pipe system had to be very carefully laid out in advance, since the parts had to be cast to specified lengths and could not be cut and adjusted like steel or wrought-iron piping. The piping is arranged with a view to accessibility and to convenient location of all valves and fittings.

The two cylinders, 7 ft. in diameter and 130 ft. long, are fitted with a single sap drum for drainage. They were shipped from the maker's shops in two lengths. Both ends have doors, but that at the south end is used as the charging door. Each of these doors is carried entirely by its two heavy hinges, no overhead or bottom support being used, and is secured by 36 hinged bolts 2¼ in. diameter. The cylinders (which are heavily lagged) rest on saddles on concrete piers 12 to 16 ft. apart. The central saddle is anchored, but the others are fitted with rollers to allow for expansion movements. In front of the two cylinders is a pit for a short transfer

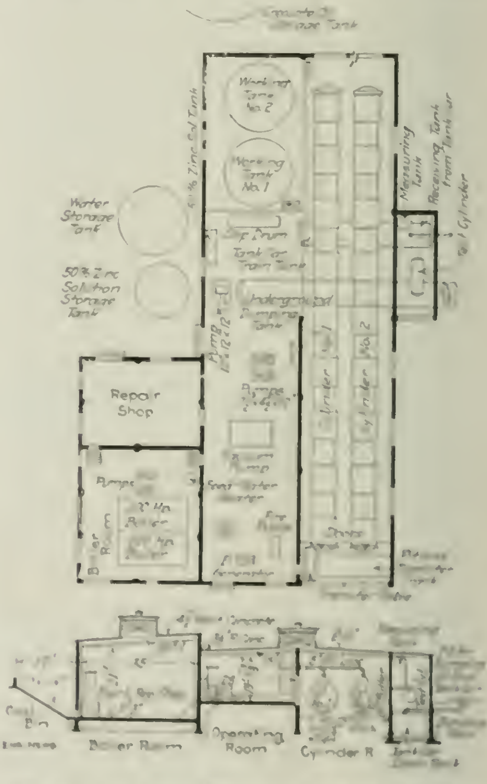


Fig. 3. Plan and Sectional Elevation of Tie Treating Plant, Louisville & Nashville R.R.

table, which connects the yard tracks with the cylinder track when the door is open. This end of the building is open, but a partition is built across it at the rear of the pit, so as to exclude cold air from the cylinder room.

The creosote oil is delivered in tank cars, and each car is spotted over a concrete pit or hopper, having an 8-in. pipe leading to a receiving cylinder in the basement. From this the oil is pumped to the storage tank. The oil for the cylinders is fed from the working tanks, and after a charge has been treated the oil is drawn off into

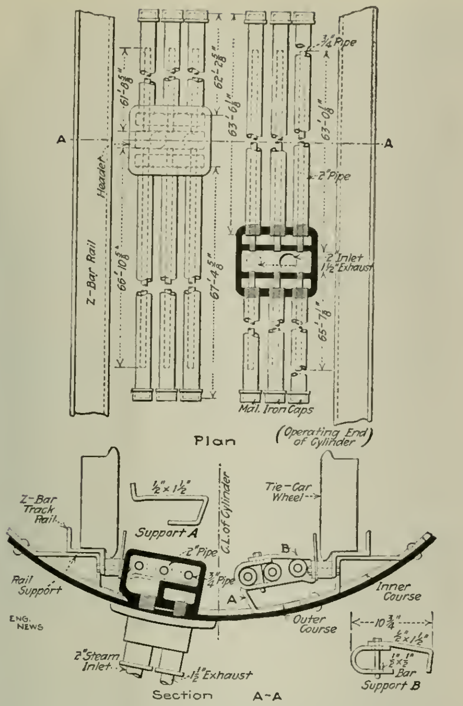


FIG. 4. TRACK AND STEAM-HEATING EQUIPMENT FOR TIE-TREATING CYLINDERS

a dumping tank in the basement, from which it is pumped to the storage or working tanks as required.

The zinc solution (50%) is also delivered in tank cars, but these have no bottom discharge. A portable pipe connection is made to the top manhole, and the solution pumped to the zinc-storage tank. The measuring of the oil and zinc solution is done by means of float gages.

For experimental work there is a cylinder 11 ft. 6½ in. x 3 ft. 7½ in., served by a measuring tank, as shown.

The heating system of the treating cylinders is of novel design, and is one of the special features of the plant. It eliminates the use of pipe coils, with the troubles incidental to keeping the joints tight, which result in oil leaking into the pipes and water getting into the oil. As shown by Fig. 4, the steam is delivered to cast-iron headers bolted to the shell of the cylinder near the bottom, and from these ¾-in. pipes extend in both directions; these pipes are inclosed in 2-in. pipes of slightly greater length, through which the steam returns to the header. The end of the larger pipe is closed with a heavy cap.

The pipes are supported and held at intervals by saddles of steel bars. The headers are placed on opposite sides of the center of the cylinder, thus leaving the bottom unobstructed for draining out the cylinder. The tie-car track in the cylinder is composed of Z-bars, with plate guard rails. The storage tanks are heated by steam pipes in the same way as described for the treating cylinders, but the larger pipes have the ends closed with heavy plugs welded to the pipe and made convex in order to resist the cutting action of the steam. Each tank has two sets of pipes, placed at right angles to each other, and attached to headers or manifolds bolted to manhole openings, as shown in Fig. 5.

The pump equipment includes the following: One duplex crank and flywheel pump, 10x16x12 in. for vacuum, one duplex piston pump 12x12x12 in. for pumping the preservative, one 7½x8½x10-in. duplex pump for pumping oil and 50% zinc solution, two 7½x4½x12-in. pressure pumps for the solution, and two boiler-feed pumps. No compressed air is used either in the treatment or for handling material. A small steam generator set supplies current for electric light in the building. On the gage board in the operating room are vacuum, steam-pressure and recording gages for each cylinder. An electric bell is rung by a float when the cylinder is full.

Steam is supplied by two horizontal water-tube boilers of 200 hp., one of these being held in reserve. A large feed-water heater is placed in the boiler room. Coal is delivered in cars which are run over a concrete trestle to a 100-ton concrete bin. This is alongside the boiler house, and the bottom slopes toward openings in the wall, so that the firemen can handle the coal direct from the bin to the boilers. Coal costs about $1 per ton. The fuel cost per tie is only about 0.18c. per tie, this very low figure being due largely to the use of exhaust steam for feed-water heating and to the compactness of the plant.

TREATMENT

The tie-treating policy on this railway is somewhat unique, in that it provides for the regular use of two

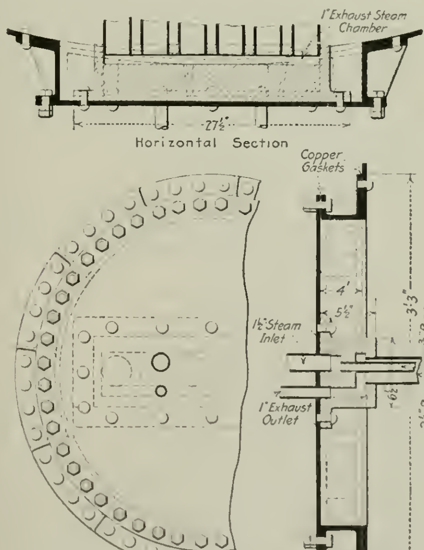


FIG. 5. STEAM-HEATING EQUIPMENT FOR OIL TANKS

distinct processes. Ties for tangents, on which no tie plates are used, will be treated by the straight zinc process. Ties for curves, all of which have tie plates, will be creosoted. The zinc process is by far the cheaper, and

a consideration of the use of creosoted ties on tangents, with metal tie plates, showed no economy over untreated white-oak ties without tie plates.

The reasons of the case may be explained as follows: For ties on tangents the cheaper zinc process will make their resistance to decay about equal to their resistance to mechanical wear. In other words, when the ties need renewal, it will be on account of both decay and wear, and they will thus have given their full service life. On curves, however, the treated ties would be worn out by the rails long before their decay, unless protected by tie plates. But with this protection the effect of the zinc preservative would have disappeared long before the tie was worn out, and in order to equalize the resistance to wear and decay under curve conditions it is economical to use the creosoting process, which is higher in first cost but gives a longer life than the zinc treatment. To apply creosoting and tie plates for all ties (on tangents as well as curves) would be too expensive under the conditions existing on this road, and advantage is taken of the economies made possible by the use of the zinc process.

The wood used is red oak, having a life of about four years untreated. The ties are 7x9 in., 8½ ft. long. The metal tie plates are 7x8½ in., ½ in. thick, with a shoulder on top and with two shallow ribs (across the tie) on the bottom. The latter are just large enough to give the plate a hold on the tie without injuring the wood.

The creosoting is done by the full-cell process, and is designed to impregnate the timber with 8 lb. of creosote oil per cu.ft. A 24-in. vacuum is obtained in about 30 min., and is then held for 2 hr.; the creosote is then admitted and a pressure of 150 lb. maintained for about 3 hr., after which 15 min. is allowed for the timber to drain, before the cylinder is opened and the charge withdrawn. The zinc process is very similar, and is designed to give ½ lb. of dry zinc per cubic foot of timber. The zinc chloride is purchased as a 50% solution, and a [illegible]% solution is used in the treatment.

The oil is required to be a coal tar creosote (free from any other oil or tar) having a specific gravity at [illegible]° C. of at least 1.0[illegible], and containing not more than 2% of water. An average of the test analyses from five tank cars show a distillate as follows:

	Per Cent.		Per Cent.
[illegible]	2.2	Total [illegible]	[illegible]
[illegible]	22.[illegible]	Residue [illegible]	[illegible]
[illegible]	[illegible]		
[illegible]	1[illegible]	Total	[illegible]
[illegible]	[illegible]		

The ties are inspected at the points of shipment by special inspectors of the Tie and Timber Department (instead of by the various roadmasters), and when stacked in the storage yard they are marked with the [illegible] and year. They are arranged in consecutive or chronological order as far as possible, thus facilitating the work and reducing the cost of yard switching in making up the cylinder trains. The ties remain in the yard for [illegible] months before treatment. The zinc-treated ties are shipped promptly after treatment, and the creosoted ties are shipped out at once, as holding them would only result in allowing some of the lighter oils to escape.

The ties for seasoning are stacked in piles of [illegible] each, with [illegible] ties at the bottom and [illegible] layers of [illegible] ties each, the adjacent layers being in contact at one end and separated at the other end (alternate ends) by a single cross-tie. This gives a comparatively low pile, with plenty of air space.

All loading, unloading and handling is done by manual labor at piece-work. There is no difficulty in getting men (colored), and they make good pay while the company gets its work done at a low rate. The average untreated tie weighs about 220 lb., and a man will readily pull out a tie, tilt it on end and so get it across his shoulder and walk off with it with little apparent effort. In handling zinc-treated ties the men sometimes wear gloves, but in general they handle the ties with bare hands and appear to suffer no discomfort from the zinc-chloride or the creosoted oil.

Records of Treated Ties

All treated ties will have dating nails, having the last two figures of the year stamped on the head. These nails will be driven in the ties when they are placed in the track, and the position of the nails in the tie will also show in what year the tie was placed, so that if the figures on the nail become obliterated the age of the tie will still be known. To determine the life of treated ties, stretches of track will be laid with 500 treated ties each. Records of the treatment of the ties in these stretches will be preserved at the tie plant, while a careful record of the location of the test tracks on the various divisions (as well as record of removals of these treated ties) will be kept by the roadmaster of each division.

Tests of Electrolysis Mitigation by the U. S. Bureau of Standards [illegible], the second of its "special studies" is reported in Bulletin 32 on tests of systems of insulated negative return feeders in St. Louis, Mo. The engineers of the Bureau secured the cooperation of the United Rys. Co. for the use of the track network supplied by the [illegible] St. substation. Eight 1,000,000-circ. mil negative-feeder lines were run in three directions, north, east and southwest, each feeder being 1[illegible] to [illegible] ft. long. They were arranged to be used, for tests, into tracks and water and gas mains as either insulated or uninsulated negative feeders according to the scheme described in "Engineering News," Feb. 26, and Apr. 2, 1914. They were designed to reduce the track potential gradient to one volt per 1000 ft. average for one-hour peak load, which would correspond to a 24-hour average of 0.[illegible] volt. Measurements were made of rail gradients, current in pipes, potential between pipes and rails, over-all potential and feeder current. Under the insulated-feeder system, but one point was found with greater than 1 volt per 1000 ft., and the 24-hour average of all was 0.[illegible] volt (corresponding to one volt at peak). Under connection as an uninsulated-feeder system, several points ran above 1 volt per 1000 ft., the 24-hour maximum being [illegible] (corresponding to [illegible] volts at peak load) and the average [illegible] (corresponding to 2 volts at peak). The current flow in gas and water pipes under the insulated-feed system, varied from 0.[illegible] to 1[illegible] amp. with a total of [illegible]; corresponding figures for same points under the insulated-feeder system were [illegible] and [illegible] amp. with a total of [illegible]. Taking in the pipe systems as feeders gave total current values of [illegible] and [illegible] amp. respectively.

The potential differences between pipes and rails, at places where, before, were above 1 volt positive, averaged [illegible] under the uninsulated and [illegible] under the insulated-feeder system. At points where the initial potential differences were below 1 volt positive, the new figures were [illegible] and 0.[illegible]. Where the initial potentials were negative there was a mean value of [illegible] volt under the uninsulated-feeder system, with the insulated feeders this became [illegible] volt positive. This is taken as showing that the extension of positive areas by the insulated negative feeders is not large enough and where it is greatly overbalanced by reduction of positive potentials, so the [illegible] diminishes more rapidly than the [illegible]. The over-all potentials on feeders between the several outlying [illegible] points and the substation were 2 volts per 1000 ft. average under the uninsulated system and 0.[illegible] insulated. The data as a whole are considered to show that under the insulated negative-feeder system currents on underground structures are so reduced as probably to cause no trouble before replacement for other reasons.

New Railway Station at Memphis

SYNOPSIS—The new Central Station at Memphis, completed in 1914, was built in connection with the Illinois Central R.R. track-elevation work, and has both stub and through tracks. The through tracks are arranged singly, the alternate platforms being for passengers and trucking, while the stub tracks are in pairs. The subways are of different types of construction to meet the conditions, and are partly of steel and partly of concrete, but all steelwork is incased with concrete. One of the retaining-walls has a 4-ft. cantilever slab for a walk overhanging the street sidewalk. The subway construction and track elevation had to be done under traffic in most cases, and the plant and methods employed are described. The headhouse includes station facilities and several floors for railway offices.

The Central Station at Memphis

The city of Memphis, Tenn., with a population of 135,000, is served by nine railway systems, the passenger traffic of which is accommodated by two new union stations, with a third station maintained under franchise conditions which require the Illinois Central R.R. to have two stations. The two union stations are about a block apart, on Calhoun St., as shown in Fig. 1. A single station was at one time proposed, but unfortunately the coöperation of all the railways concerned could not be obtained.

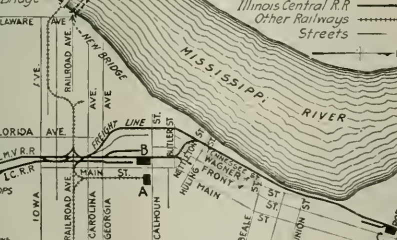


Fig. 1. Map of Central Part of Memphis, Tenn., Showing the Railways and Railway Stations

Union Station—This is owned by the Memphis Union Station Co., and was opened in 1912. It is used by the following railways: the Louisville & Nashville, the Nashville, Chattanooga & St. Louis, the St. Louis, Iron Mountain & Southern, the St. Louis Southwestern and the Southern. It is a terminal or stub-end station, with Y-approaches to a line running (east and west) at right angles to the station and leading west to the Memphis Bridge over the Mississippi River. It is shown at A in Fig. 1.

Central Station—This is owned by the Illinois Central R.R. and is a through station on its line. It is used also by the Rock Island Lines and the St. Louis & San Francisco Ry., as well as the Yazoo & Mississippi R.R. (a part of the Illinois Central System), but these make it a terminal point, and do not run further north. The station is under construction and is expected to be completed by August, 1914. It is this station, marked B in Fig. 1, which is described in the accompanying article. When opened it will have a traffic of about 46 trains daily, four of which are through trains. There are four other through trains, but these back in and pull out again at the south end of the station.

Illinois Central R.R. Improvements

The Illinois Central R.R. line entering from the north runs parallel with and west of Main St., the tracks being at the foot of a bluff along the river front and on this part of the line is the Poplar St. station C. At Beale St. the tracks leave the river bluff and run in Tennessee St. at the street level to Huling Ave., where the passenger tracks make a sharp diversion to the east by a reverse curve to the station at Calhoun and Main St., beyond which they run approximately southward. The freight tracks continue south from Huling St., running around the industrial district and connecting with the main line again at Carolina Ave. The improvements include the elevation of the former surface passenger tracks from Huling to Iowa Ave. (with a maximum elevation of 15 ft.), the removal of the tracks in Nettleton St. (on the reverse curve) to an elevated structure on private right-of-way, and the construction of a new passenger station, power house and express building.

The old line had a grade of 2.4% from Huling Ave. down to Wagner Place and then 1% into the station, which made an unfavorable condition for heavy trains pulling out to the north. The new line rises from Huling St. on a grade of 1% to the new elevation, runs through the station on grades of 0.1 to 0.3% and then falls on a 1% grade to the grade crossing of the other railways (now elevated) at Railroad Ave. Beyond this it continues practically level till it meets the old elevation south of Iowa Ave.

A direct line eliminating the reverse curve approach at the north was desirable and was considered, but the cost of property to be acquired was considered prohibitive. The north end of this curve is about 20° and the south end 15°. To reach industry tracks on Nettleton St. there is a short spur track of 4½% grade down from the new elevation at Butler St., and another with a grade of 3.8% on a 30° curve at Wagner Place. South of the station are curves connecting the main line (north and south) with the east and west main line on Railroad Ave.

The Passenger Station

The station site extends from Calhoun Ave. to Georgia Ave., along the west side of Main St., a distance of 1200 ft. It has a width of 200 ft. between the retaining-walls along Main St. and along the freighthouse driveway (which is at the street level), and this is increased to 204 ft. by a 4-ft. overhang on the Main St. side. A plan of the track layout of the station is shown in Fig. 2.

While the station is used by four lines the Illinois Central R.R. is the only one which operates its trains through the station and north of Memphis, as noted above. Consequently the track layout includes both through and stub tracks. The double-track line from the north widens into a three-track approach which again opens out into five through tracks at the station. These tracks are not in pairs (as is the more usual plan), but are spaced alternately 23 ft. and 22 ft. c. to c., with 13-ft. passenger plat-

forms and 16-ft. trucking platforms at the wider and narrower spacing, respectively. This arrangement will keep the passenger platforms free from baggage trucks.

Parallel with the through tracks there are five stub tracks entering from the south and terminating at the headhouse. These are in pairs with alternate spacing of [illegible] ft. and 21½ ft. Their platforms will be used for both passengers and trucking, but the provision of baggage elevators at both ends of the platforms will reduce to a minimum the amount of trucking along the platforms. The length of the platforms is about 800 ft. at the through tracks and 600 ft. at the stub tracks, the latter having a 50-ft. cross platform at the end of the tracks. All of the platforms will be of concrete, but the temporary wooden platforms will remain until the new fill has settled thoroughly. They are covered with steel frame canopy shelters of the butterfly type, having a wood roof.

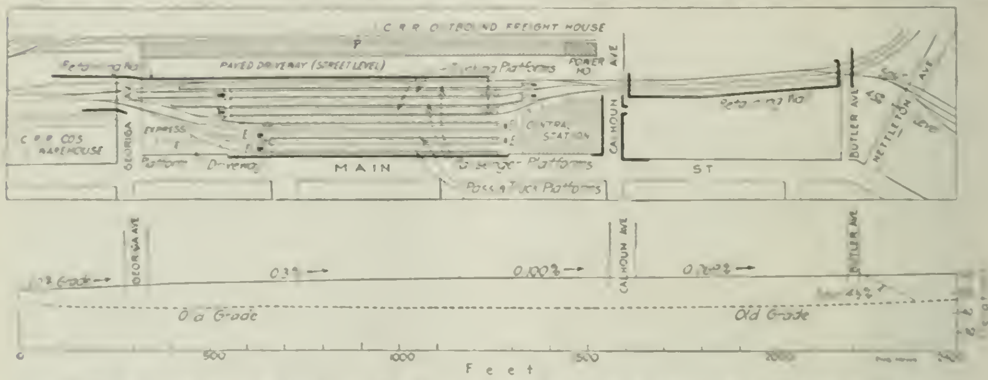


FIG. 2. PLAN OF THE NEW CENTRAL STATION AND ELEVATED APPROACHES AT MEMPHIS, TENN.; ILLINOIS CENTRAL R.R.

The canopies are 11 ft. high and about 13 ft. wide.

At the south end the ten station tracks converge into the double-track main line. The frogs throughout the terminal are Nos. 8 and 10, with No. 10 slip switches in the double crossover connections between the main tracks at each end of the station. These crossovers enable trains to be routed from either main track to any one of the station tracks. The through tracks and all turnouts are laid with 90-lb. rails in stone ballast, while 75-lb. rails are used in the elevated portions of the stub tracks.

The station building or headhouse is [illegible]×160 ft. at the street level and is eight stories high, or 100 ft. from sidewalk to roof. A rather unusual feature is that the upper portion (five stories) is smaller in plan than the lower portion, which contains the station facilities. The lower part of the building, or the station proper, is in the Roman Doric style of architecture, and built of Bedford stone. The upper part is of red brick and terra cotta. The structural frame is of steel. The street level plan is shown in Fig. 3.

The upper floors contain the railway division offices, station offices and various facilities. The Illinois Central R.R. division hospital and medical service is installed here, and a doctor will be in constant attendance for the service of employees and passengers.

In this station the street entrance is at the lower level and the track floor is at the upper level, 15 ft. above. An unusual feature has been introduced to break up the flight of stairs, and that is the location of the concourse at an intermediate elevation, as will be seen by the cross-section in Fig. 3. Passengers entering from the street will find at hand the ticket office, baggage-checking counter, parcels-checking room, restaurant and lunchroom. A short flight of steps, only 8 ft. in height, gives access to the concourse, which serves as a general waiting room. Passengers going direct to the trains will pass across this to the gates leading to the stairways which give access to the several platforms. Passengers having to wait any length of time, can ascend a short flight of steps leading from the concourse to a waiting room which is at the side of the building and retired from the concourse. In connection with this are the toilet rooms, a nursery, and rest rooms for women.

As Tennessee is one of the Southern states having laws requiring separate accommodations for whites and colored people, there are special waiting, dining, lunch and toilet rooms for colored people, and these are arranged so as to be as independent as possible, the races meeting together only at the concourse and the approaches to the trains. In addition to this, independent rooms and accommodations are provided for immigrants. A rather novel feature will be a telephone train-announcing system (to be installed later), having loud-speaking "trumpets" or announcers fitted in the concourse, waiting room, etc. A pneumatic-tube system for messages will afford means of communication between the several offices and departments.

From the baggage room a rectangular concrete subway or tunnel extends southward through the station fill for nearly 700 ft., and connects with cross tunnels to the elevators at the south end of the platforms. This subway extends also to the express buildings at the southeast corner of the station. It has walls of concrete, heavily reinforced with steel, and a waterproofing compound was added with the water. The floor is finished with "granitic" to render it both hard and waterproof.

TRACK ELEVATION AND SUBWAYS

The track elevation eliminates the former six grade crossings at Carolina, Calhoun, Butler, Front, Wagner and Nettleton Aves., all of which streets carry heavy hauling traffic for warehouses and industries. At most of these crossings there was little change in the street

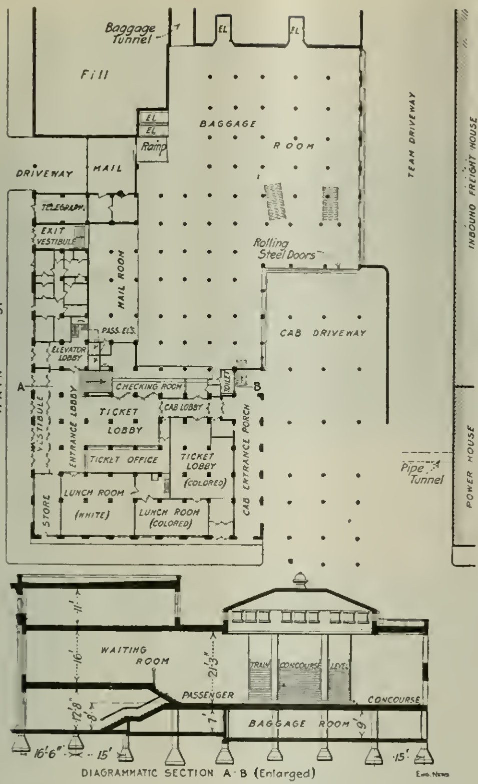


FIG. 3. PLAN AND CROSS-SECTION OF STATION BUILDING

grades, but Carolina Ave. was lowered considerably in order to give the required 12-ft. headway, as the elevation of the tracks here was governed by the approach to the railway grade crossing at Railroad Ave. The street approaches in this case are 4% at one end and 2.85% at the other. Both gravity and reinforced-concrete retaining-walls are used in different parts of the work, and all steelwork of the subways is incased in concrete.

The Carolina Ave. subway, Fig. 4, is 65 ft. wide between the abutments, and is 215 ft. long, carrying ten tracks. It has heavy gravity abutments at the street lines, and three intermediate supports or bents, spaced 23 ft. 9 in. c. to c. These intermediate supports consist of heavily reinforced footings, 18-in. circular columns (with spiral reinforcement), and a top or cap girder with semicircular arches between the columns, which are spaced 6 ft. c. to c. The deck is made of reinforced-concrete slabs, cast in a temporary yard and set in place by a wrecking crane.

At the ends of the subway, the grades of the approach and the tracks made a shallower floor necessary. For the two tracks at the east end, there are three lines of 36-in. plate-girders (parallel with the tracks) having 12-in. I-beams across the lower flanges and a solid concrete filling between and over the I-beams and incasing the girders, as shown in Figs. 4 and 6. The deck is 19 in. thick at the middle and 15 in. at the abutment ends, covered with a 2-in. waterproofing course. For one track at the west end the deck is of longitudinal I-beams embedded in concrete. The concrete is 1½ in. thick beneath the I-beams and there is a sheet of expanded metal beneath the beams and embedded in the concrete. The exposed surfaces of the concrete, facing the street, are 40 in. deep and are relieved by panels recessed 2 in.

The Calhoun Ave. subway, in front of the station has two roadway spans 24 ft. 3 in. c. to c. of columns, a sidewalk span of 15 ft. 3 in. on the station side, and a similar span of 10 ft. 9 in. on the opposite side. It carries three tracks (14 ft. c. to c.) and is 44 ft. 2 in. long over all, with 14-ft. headway for the street spans, as there is an electric railway on this street. The three bents have steel columns supporting box girders parallel with the street line, all the steelwork being incased with concrete.

Longitudinal I-beams are framed between the webs of the box girders, the tops of the beams and girders being at approximately the same level, and the I-beams being embedded in a concrete deck which is 30 in. thick in the roadway spans. The concrete is shaped at the sides to form 18-in. curb walls (with iron railings), and the exposed faces represent fascia girders with paneled faces. For 300 ft. south of this subway, which is the space occupied by the baggage room and the cab and baggage driveway, there are steel columns incased in concrete and carrying a steel floor framing of girders and stringers, with a 6-in. deck slab reinforced with wire mesh.

The Front St. subway, Fig. 5, is 60 ft. between abutments. It is similar to the one at Carolina Ave., except that the floor over the roadway is of longitudinal I-beams (embedded in concrete) resting on the reinforced-con-

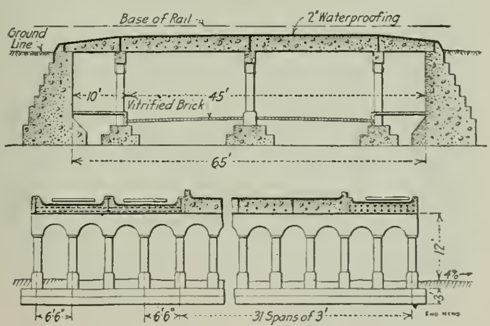


FIG. 4. THE CAROLINA AVE. SUBWAY AT MEMPHIS, TENN.; ILLINOIS CENTRAL R.R.

(Note the three different types of construction shown in the cross-section.)

crete bents, while concrete slabs form the sidewalk spans. The Butler Ave. subway (only 30 ft. between abutments) has gravity concrete abutments with a single 30-ft. span of the I-beam and concrete deck. This same construction, with 20-ft. span, is used at Wagner Place, where it forms a part of the skew bridge across Nettleton Ave.

The Nettleton Ave. subway is a complicated structure, due to its skew location (at an angle of about 30° with the center line of the street), the sharp curve of the tracks, and the fact that it extends across the intersection of Wagner Place. In this case the intermediate bents have columns 17 ft. c. to c. carrying heavy steel girders embedded in concrete. Upon these and the abutments are

[illegible] girders for the [illegible] ballast, and the I-beams of the floor rest upon the lower flanges of these girders. These I-beams are placed at right angles to the street line, so that, owing to the skew, many of them have one end carried by the lower flange of the main girder and [illegible] projection overhanging the sidewalk and carried by cantilever brackets, as shown in Fig. 7. The wall was built in sections 40 ft. long. No expansion filling was placed at the joints, but tarred paper and burlap were laid behind them to prevent leakage of water in the fill.

FIG. 5. CONCRETE ABUTMENTS AND BENTS FOR THE SOUTH FRONT ST. SUBWAY

[illegible] and resting on the abutment or on the top of the cross-girder of the intermediate bent.

All the steelwork in the structure is wrapped with wire mesh and [illegible] in concrete. The street faces of the girders are [illegible], and are rubbed down with carborundum blocks to remove form marks. The decks are formed with curb walls to retain the ballast, and upon these are erected iron railings. The standards for these railings are set in cast-iron bases so shaped that the sockets for the posts are over the inner line of the parapet, thus giving the maximum clearance between cars and railings.

The decks of the subways have a waterproofing course of [illegible] felt and [illegible] pitch [illegible] with $1\frac{1}{2}$ in. of [illegible] and sand, making a total thickness of nearly 2 in. This is turned up against the sides, where it is protected with a concrete [illegible]. The construction is shown in Fig. 6, which represents the girder span of the Carolina Ave. subway. The [illegible] of the retaining-walls and platform-

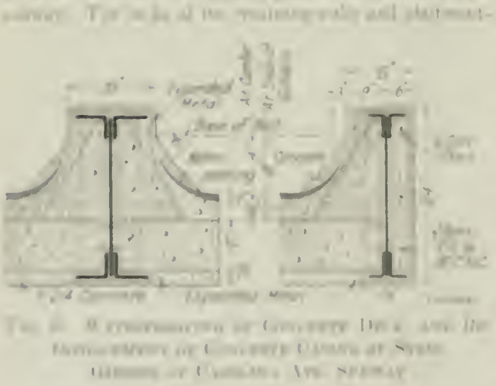


FIG. 6. WATERPROOFING OF CONCRETE DECK AND [illegible] OF CONCRETE [illegible] AT [illegible] GIRDERS OF CAROLINA AVE. SUBWAY

[illegible] coated with a bituminous preparation. Nearly all this waterproofing work was done by the railway company.

The fill at the station site, between Carolina and [illegible] Aves., has a retaining-wall on either side. On the east, or [illegible] side, this is a [illegible] wall 18 ft. high, with counterforts. At the top this has a [illegible]

On the west side is a heavy gravity retaining-wall along the driveway of the freighthouse (at the street level). This is shown in Fig. 8, which shows also the temporary track left in the driveway (but now removed) and the temporary platforms for the first tracks on the new elevation. The elevator tower beyond the platform shelter indicates the position of the station building. Similar walls (but without the cantilever slab on the reinforced walls) are used at other streets. Near the [illegible] Ave. subway the retaining-wall is surmounted by an open-work parapet wall, having concrete panels cast separately and set in place.

The construction of the retaining-walls and subway [illegible]

CONSTRUCTION WORK

The construction of the retaining-walls and subway bridges was hampered by the necessity of providing for traffic. There were about [illegible] trains daily, the heaviest traffic being from 7 a.m. to noon, and 5 to 6 p.m. The only freight movements over this part of the line were in [illegible] service. The great difficulties encountered were the limited space available, the handling of concrete while keeping clear of trains, and the inability of the contractors to get certain parts of the site delivered to them for work at the time desired. For all the work (except at Carolina Ave.) the storage space for materials was very limited, and it was necessary to regulate shipments of all kinds so as to be able to use the material upon arrival.

The concrete was delivered in place by spouting from elevator towers, using self-supporting trussed chutes. Two stationary plants with [illegible] towers and one portable plant with a [illegible] tower were used, each of the former being set up twice (in different locations) and the latter being shifted as required. Each had its mixer, and in order to work to full capacity a two-compartment material bin or hopper was erected over the mixer, holding about [illegible] cu.yd. of stone and 15 cu.yd. of sand. The materials were brought in railway cars and unloaded direct to the mixer bin or to small storage piles, there being little room for storage. A derrick with clamshell bucket took the material from the car or storage pile and dumped it into [illegible] cars which were hauled up a cable incline and dumped into the material hopper. The in-

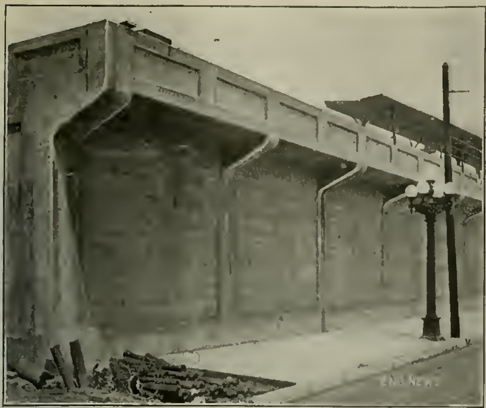


FIG. 7. REINFORCED-CONCRETE RETAINING WALL (COUNTERFORT TYPE) WITH CANTILEVER SLAB FOR WALK

(Main St. side of new Central Station at Memphis, Tenn., Illinois Central R.R.)

located in the freighthouse driveway at Calhoun Ave., was kept open until Apr. 24, when it was put on the elevation. At the station this ran through the freighthouse driveway, at the foot of the retaining-wall on the west side of the station (Fig. 8). A temporary ticket office and other facilities were maintained at Calhoun St.

ENGINEERS AND CONTRACTORS

The design and construction of the whole work was under the direction of A. S. Baldwin, Chief Engineer of the Illinois Central R.R., and F. L. Thompson, Assistant Chief Engineer (then Engineer of Bridges and Buildings). F. R. Judd was assistant engineer in charge.

The retaining-walls and subways were built by the Bates & Rogers Construction Co., of Chicago, whose superintendent was R. Rasmussen. The station building was erected by the James Alexander Construction Co., of Memphis. All steelwork supporting the tracks and for the platform shelters and express building was erected by the Strobel Steel Construction Co., of Chicago. The power house, express building and the roofs of the platform shelters were built by Geo. B. Swift & Co., also of Chicago. The filling and track work, also the waterproofing of bridge floors, was all done by the railway

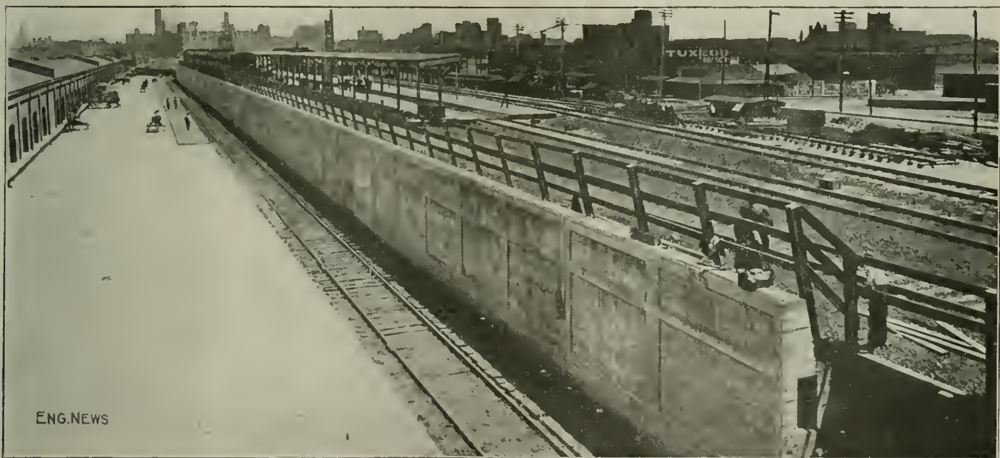


FIG. 8. CONCRETE RETAINING WALL (GRAVITY TYPE) AT THE NEW CENTRAL STATION AT MEMPHIS, TENN.

(At the left are the freight house and team driveway. The old running track at street level has now been removed. It was used during the elevation of the tracks.)

cline had a four-rail track in the lower portion and a three-rail track at the top.

Steel forms were used for the subway columns and arches. The concrete was made with stone and river sand. The proportions were 1 : 3 : 6 for gravity concrete, 1 : 2 : 4 for reinforced concrete and 1 : 1½ : 3 for the ornamental parapet panels, the 18-in. columns and the casing of steel girders.

The maximum output per day was about 550 yd. The entire elevation work, covering a distance of about 3000 ft., included about 30,000 yd. of concrete, 500 tons of reinforcing steel and 50,000 yd. of excavation. The crew varied from 100 to 600 men, depending upon the work that could be given to the contractors and the railway forces at one time.

One running track of the old line at street level, and

company. The architects for the station were D. H. Burnham & Co., of Chicago, who made the design to conform to general plans and requirements submitted by the railway company.

Is Public Office a Public Trust or a Private Snap?—The modern tendency among men who are trying to promote efficiency in the public service is to get the best man for the job—at home, if possible, otherwise abroad. And in every city where the new idea has taken hold there is the same shout to "keep the jobs at home."

It all depends upon the point of view. If the municipality is more interested in providing jobs for its home people than in developing efficient government, of course the proposition to hire out-of-town experts is wholly unjustifiable. But if efficient and satisfactory service is to be taken as the chief end of municipal government, it is quite obvious that when the right kind of a man is not available at home, he should be looked for wherever he is to be found—Cincinnati "Times-Star."

Reinforced-Concrete Flat-Slab Floors; New Chicago Building Ordinance

By J. Norman Jensen*

On Aug. 18, the Commissioner of Buildings of Chicago signed a ruling on the design and testing of reinforced-concrete flat-slab or girderless floor systems which is the result of nearly four years' study and testing. In the complication of methods of design prevalent for such systems, this one should prove both rational and simple.

In the early part of 1911, the necessity for a careful analysis and rational method of design of the flat-slab type of reinforced-concrete construction was felt in the Building Department. Plans showing the details of this recent advance in building construction were submitted to the department for approval, and it was desirable to have more information on the subject. In June, 1911, the Cantilever Flat Slab System controlled by the Concrete Steel Products Co., of Chicago, applied for a permit to use their type of construction. The Commissioner of Buildings, Henry Ericsson, appointed a commission of three engineers to investigate this system, and make a report recommending rational methods of design. This was the first flat-slab investigated.

From time to time other systems of flat-slab construction were reported on in the same way. In each case the report was made by a commission appointed as in the first case. The personnel was not always the same, but the greater proportion of the reports submitted bore the names of Prof. A. N. Talbot, of the University of Illinois, Prof. W. K. Hatt, of Purdue University, and Ernest McCullough, consulting engineer of Chicago.

Sources of Information

It is impossible to enumerate all the sources of information which were drawn upon in these reports, but a few typical ones will illustrate the thoroughness of these investigations. Whatever information obtained in the tests on reinforced-concrete footings made in the Engineering Experiment Station of the University of Illinois, which would have any bearing on the subject, was used. In some respects, the flat slab may be considered an inverted footing. The rubber panel tests conducted by the Corrugated Bar Co., and their extensometer tests in Minneapolis, Detroit, Niagara Falls and other cities were [illegible]. Theoretical analyses based on assumptions which appeared to be sound were also used insofar as they seemed applicable. The great source of information was [illegible] tests on full size structures, such as the tests which were conducted on the Deere & Webber building in Minneapolis, the [illegible] Printing Co., A. J. [illegible], Larkin, Schulz Baking Co., and other buildings in Chicago and elsewhere. [illegible]

By the middle of 1914, a great mass of information had accumulated in the office of the Chicago Building Department. Various tests had brought out certain facts which were not contemplated in the earlier reports. Using the accepted reports as a basis the department drew up a ruling in the following form:

THE DESIGN OF FLAT SLABS SHALL BE IN ACCORDANCE WITH THE FOLLOWING RULING

Definitions—Flat-slabs as understood by this ruling are reinforced-concrete slabs supported directly on reinforced-concrete columns with or without plates or capitals at the top, the whole construction being hingeless and monolithic without any visible beams or girders. The construction may be such as to admit the use of hollow panels in the ceiling or smooth ceiling with depressed panels in the floor.

The column capital shall be defined as the gradual flaring out of the top of the column without any marked offset.

The drop panel shall be defined as a square or rectangular depression around the column capital extending below the slab adjacent to it.

The panel length shall be defined as the distance center to center of columns of the side of a square panel, or the average distance center to center of columns of the long and short sides of a rectangular panel.

Columns—The least dimension of any concrete column shall be not less than one-twelfth the panel length, or one-twelfth the clear height of the column.

Slab Thickness—The minimum total thickness of the slab in inches shall be determined by the formula.

$$t = 0.[illegible] L \sqrt{w}$$

In the formula hereinabove given,

t = Total thickness of slab in [illegible]

L = Panel length in ft.,

w = Total live and dead load in lb. per sq. ft.

In no case shall the slab thickness be less than one-thirty-second of the panel length for floors, and one-fortieth of the panel length for roofs, and also not less than 6 in.

Column Capital—The diameter of the column capital shall be measured where its vertical thickness is at least $1\frac{1}{2}$ in. and shall be at least 0.22[illegible] of the panel length.

The slope of the column capital shall nowhere make an angle with the vertical of more than 45°. Special attention shall be given to the design of the column capital in considering eccentric loads, and the effect of wind upon the structure.

Drop Panel—The depth of the drop panel shall be determined by computing it as a beam, using the negative bending moment specified elsewhere in this ruling. The width and length shall be determined by the allowable unit shearing stresses on the perimeter given below.

Shearing Stresses—The allowable unit punching shear on the perimeter of the column capital shall be three-fiftieths of the ultimate compressive strength of the concrete as given in section [illegible] of the building ordinance. The allowable unit shear on the perimeter of the drop panel shall be [illegible] of the ultimate compressive strength of the concrete. In computing shearing stress for the purpose of determining the resistance to diagonal tension, the method specified by the ordinance shall be used.

Panel Strips—For purposes of establishing the bending moments and the resisting moments of a square panel, the panel shall be divided into strips known as strip A and strip B. Strip A shall include the reinforcement and slab in a width extending from the center line of the columns for a distance each side of this center line equal to one-quarter of the panel length. Strip B shall include the reinforcement and slab in the half width remaining in the center of the panel. At right angles to these strips, the panel shall be divided into similar strips A and B having the same widths and reference to the center line of the columns as the above strips. These strips shall be for designating purposes only, and are not intended as [illegible].

[illegible]

Bending Moment Coefficients, Interior Panel, Two-Way System—The negative bending moment taken at a cross-section of slab strip A at the edge of a column capital [illegible] shall be taken as [illegible]. The positive bending moment [illegible] strip A [illegible] shall be taken as [illegible]. The positive bending [illegible]

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moment taken at a cross-section of each strip B in the middle of the panel shall be taken at $WL^2/60$. The negative bending moment taken at a cross-section of each strip B on the center line of the column shall be taken at $WL^2/60$. In the formulas hereinabove given

W = Total live and dead load per lin.ft. of each strip,
L = Panel length in ft.

Bending Moment Coefficients, Interior Panel, Four-Way System—The negative bending moment taken at a cross-section of each strip A at the edge of the column capital or over it, shall be taken as $WL^2/15$. The positive bending moment taken at a cross-section of each strip A, midway between column centers shall be taken as $WL^2/40$. The positive bending moment taken at a cross-section of each strip B in the middle of the panel shall be taken at $WL^2/60$. The negative bending moment taken at a cross-section of each strip B on the center line of the column shall be taken at $WL^2/60$.

Bending Moment Coefficients, Wall Panels—Wherever the coefficients $^1/_{15}$, $^1/_{30}$, $^1/_{40}$ or $^1/_{60}$ appear in the moments given for interior panels in either the two-way or the four-way systems, the coefficients $^1/_{12}$, $^1/_{25}$, $^1/_{33}$ and $^1/_{50}$, respectively, shall be used in the moments for wall panels supported on concrete columns and girders.

When brick walls are used to partly support wall panels, these walls shall be stiffened by pilasters or piers as directed by the Commissioner of Buildings. Wherever the coefficients $^1/_{15}$, $^1/_{30}$, $^1/_{10}$ or $^1/_{60}$ appear in the moments given for interior panels in either the two-way or the four-way systems, the coefficients $^1/_{10}$, $^1/_{20}$, $^1/_{27}$ and $^1/_{40}$, respectively, shall be used in the moments for such panels resting on brick walls.

Point of Inflection—For the purpose of making the calculations of the bending moment at the sections away from the column capital, the point of inflection shall be considered as being one-quarter the distance center to center of columns, both crosswise and diagonally, from the center of the column.

The Tensile Stress in Steel and Compressive Stress in Concrete—The tensile stress in steel and the compressive stress in the concrete to resist the bending moment shall be calculated on the basis of the reinforcement and slab in the width included in a given strip, and according to the assumptions and requirements given in sections 545 to 548, inclusive, of the building ordinance.*

The steel shall be considered as being concentrated at the center of gravity of all the bands of steel in a given strip.

For the four-way system of reinforcement, the amount of steel to resist the negative bending moment over the support in each strip A shall be taken as the sum of the areas of steel in one cross band and one diagonal band. The amount of steel to resist the positive bending moment of each strip B shall be considered as the area of the steel in a diagonal band. The amount of steel to resist the positive bending moment in each strip A shall be considered as the area of the steel in a crossband, and the amount of steel to resist the negative moment in each strip B shall be the steel included in the width of strip B.

For the two-way system of reinforcement, the amount of steel to resist the bending moment in any stirp that shall be considered as the area of steel included in the width of the strip.

In both systems of reinforcement the compressive stress in the concrete in any strip shall be calculated by taking the area of steel considered for each strip and applying it in a beam formula based on the principles of Sect. 548 of the building ordinance.

Rectangular Panels—When the length of a panel does not exceed the breadth by more than 5%, all computations shall be made on the basis of a square with sides equal to the mean of the length and breadth. In no rectangular panel shall the length exceed four-thirds the breadth.

For panels with length more than 5% in excess of the breadth, the slab shall first be designated for a bending moment based on an assumed square panel with sides equal to the mean of the length and breadth of the rectangular panel.

For the four-way system of reinforcement, the amount of steel found for the positive moment of each strip B by designing in this manner shall be that used in the diagonal band. For the positive moment in each strip A, the required amount of steel in the crossband shall be obtained by multiplying the steel used in the design of the assumed square panel by the cube of the ratio found by dividing the length or breadth of the rectangular panel by the side of the assumed square panel, for the long and short sides of the panel, respectively. The compressive stresses shall be calculated on the basis of a width equal to one-half of the side of the assumed square panel, and on the assumptions used in the calculations of compressive stresses in square panels. In no case shall the amount of steel in the short side be less than two-thirds of that required for the long side.

For the two-way system of reinforcement, the amount of steel found for the positive and negative moment of each strip B by designing in this manner shall be obtained by multiplying the steel used in the design of the assumed square panel by the cube of the ratio found by dividing the length or breadth of the rectangular panel by the side of the assumed square panel, for the short and long sides of the panel, respectively. The method of obtaining the amount of steel required for each strip A shall be the same as that given above for the four-way system.

Walls and Openings—Girders or beams shall be constructed under walls and around openings, and to carry concentrated loads.

Computations—Complete computations of interior and wall panels and such other portions of the building as may be required by the Commissioners of Buildings shall be left in the office of the Commissioner of Buildings when plans are presented for approval.

Placing of Steel—In order that the slab bars shall be maintained in the position shown in the design during the work of pouring the slab, spacers and supports shall be provided satisfactory to the Commissioner of Buildings. All bars shall be secured in place at intersections by wire or other metal fastenings. In no case shall the spacing of the bars exceed 9 in. The steel to resist the negative moment in each strip B shall extend one-quarter of the panel length beyond the center line of the columns in both directions.

All splices in bars shall be made over the column head. The length of the splice beyond the center line of the column in both directions shall be at least 2 ft., nor less than that necessary for the full development of the strength of the bar as limited by the unit bond stresses given by the ordinance. The splicing of adjacent bars shall be avoided as far as possible.

Slab bars which are lapped over the column, the sectional area of both being included in the calculations for negative moment, shall extend not less than 0.25 of the panel length for crossbands, and 0.35 of the panel length for diagonal bands, beyond the column center.

Test of Workmanship—The Commissioner of Buildings or his representative may choose any two adjacent panels in the building for the purpose of ascertaining the character of workmanship. The test shall not be made sooner than the time required for the cement to set thoroughly, nor less than six weeks after the concrete had been poured.

All deflections under test load shall be taken at the center of the slab, and shall be measured from the normal unloaded position of the slab. The two panels selected shall be uniformly loaded over their entire area with a load equal to the dead load plus twice the live load, thus obtaining twice the total design load. The load shall remain in place not less than 24 hr. If the total deflection in the center of the panel under the test load does not exceed 1/[illegible] of the panel length, the slab may be placarded to carry the full design live load If it exceeds this amount of deflection, and recovers not less

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*Footnote herewith gives unit stresses allowable.

546. **Ratio of Moduli of Elasticity—Adhesion—Bond.** (a) The calculations for the strength of reinforced concrete shall be based on the assumed ultimate compressive strength per square inch designated by the letter "U" given in the table below for the mixture to be used.

(b) The ratio designated by the letter "R" of the modulus of elasticity of steel to that of the different grades of concrete shall be taken in accordance with the following table:

	U	R
1 cement, 1 sand, 2 broken stone, gravel or slag..	2900	10
1 cement, 1½ sand, 3 broken stone, gravel or slag	2400	12
1 cement, 2 sand, 4 broken stone, gravel or slag..	2000	15

547. **Unit Stresses for Steel and Concrete.** (a) The stresses in the concrete and the steel shall not exceed the following limits:

(b) Tensile stress in steel shall not exceed one-third of its elastic limits and shall not exceed 18,000 lb. per sq.in.

(e) Direct compression in concrete shall be one-fifth of its ultimate strength. Bending in extreme fiber of concrete shall be 0.35 of the ultimate strength.

(f) Tension in concrete on diagonal plane shall be one-fiftieth of the ultimate compressive strength.

(g) For a concrete composed of one part of cement, two parts of sand and four parts of broken stone, the allowable unit stress for adhesion per square inch of surface of imbedment shall not exceed the following:

	Pounds per sq.in.
On plain round or square bars of structural steel......	70
On plain round or square bars of high-carbon steel...	50
On plain flat bars, in which the ratio of the sides is not more than 2 to 1......................................	50
On twisted bars when the twisting is not less than one complete twist in eight diameters................. ..	100

than 80% of the total deflection within seven days after the load is removed the slab may be placarded to carry the full design live load. If the deflection exceeds the allowable amount above specified, and the recovery is less than 80% in seven days after the removal of the test load, other tests shall be made on the same or other panels, the results of which will determine the amount of live load the slabs will be permitted to carry.

General—The design and execution of the work shall conform to the provisions of the Chicago building ordinances and to correct principles of construction.

Discussion of Ruling

Certain phases of this ruling may require further explanation. Fig. 1 shows a plan and section of a typical interior panel contemplated in the ruling. The general arrangement of steel is not shown, as it varies somewhat with the ideas of the designers. As a rule, the reinforcement consists of belts of steel placed on rectangular and diagonal lines with respect to the center line of the column. In the middle of the panel, the steel is in the bottom. Over the column heads and at right angles to the rectangular bands, most of the steel is in the top of the slab.

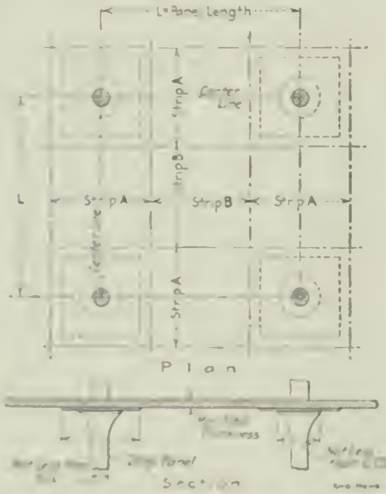


Fig. 1. Typical Flat-Slab Floor as Described in New Chicago Building Ruling

As a preliminary step, it was necessary to define the terms used. The first step was the determination of the minimum width of the column. Test after test has shown that the column head, and that the stresses on the extreme fiber of the column may be even greater than in the slab itself. So it is that the column is an essential part of the whole construction, and they should not be [illegible] in any flat-slab design.

The thickness of the slab has been a much discussed point. This thickness should be a function of both the span and the load, so the formula given was adopted. The formula controls for heavy loads, and the other requirements for light loads.

The minimum diameter of the column capital is given because the capital performs a valuable function in stiffening the entire construction, and also because the bending moments given were based on such a width. The function of the drop panel is to provide a greater depth for negative moment for the slab, and also to provide additional concrete for shear.

Referring to Fig. 1, it will be seen that the slab is divided into imaginary strips *A* and *B* as defined in the ruling. In any slab, the bending moment varies from point to point, being least in the middle and increasing as the center line of the columns is approached. To be strictly correct, therefore, the slab should be divided into a great many strips so that the values for these varying moments could be expressed. For practical reasons, the slab was divided into the two strips shown.

Although the spacing of the steel may vary within the width of the strip to resist the varying bending moment, still these strips are a convenient way of expressing the bending moment for the full width of the strip. The product WL, appearing in the formulas used for each strip, is really one-half the total load on the whole panel measuring center to center of columns, as it will be seen by inspection of Fig. 1 that $W = wL/2$, where w is the total live- and dead-load in lb. per sq.ft.

The bending moment for the middle of the panel seems very small. When one considers that the flat slab is essentially a cantilever, the moment does not seem so strange. It will also be noticed that the same bending moment is given for the strip at right angles to strip *A* on the center line of the columns. The cracking in the top of the slab and various tests have shown that tensile stresses exist in this part of the slab, and for that reason a small amount of steel is required to take care of these stresses.

For the same span and load more steel or concrete or both are required in wall panels than in interior panels. The coefficients for panels supported on brick walls are given in the ruling. The reason for the larger moments for the latter support is the fact that a brick wall is a poor type of construction to take the bending that usually exists in columns carrying flat slabs. The results of some flat-slab jobs resting on brick walls are not as satisfactory as they might have been.

The subject of the point of inflection has been an open argument for some time. The results of tests are not entirely concordant, but the method used represents good practice.

As far as the ruling is concerned, the flat slab is a beam, and nothing else. Knowing the moments and loads, the design resolves itself into ordinary reinforced-concrete design. The tensile stress in the steel and the compressive stress in the concrete can be computed on that basis.

The distribution of load in rectangular panels is given by some authorities as a function of the fourth power of the span, and by others as a function of the cube. The method of the values given by the ruling represents the present knowledge on this subject.

No matter how carefully a slab is designed, if no provision is made to keep the steel in the position where it belongs, the design is valueless. There are a great many ways of accomplishing this purpose, but especial attention must be paid to the steel over the column capital.

While the ruling states that splices should be made over the column head, still all the laps should not be in a line. Such an arrangement would create a plane of weakness, and for this reason it is advisable to distribute the laps so as to occur at different column capitals.

After the work is up it is required to be tested. The

TABLE GIVING TEST DATA. REINFORCED CONCRETE FLAT SLABS IN CHICAGO

No.	Name of Building	Age of concrete weeks	Drop panel size	Total thk. slab in.	Load per sq.ft. Lbs. design	test	Size of panel b	l	Total Deflection, 100 in. A	B	C	D	E	F	G	H	I
1	Lyon & Healy	[illegible]	7′ 0″	7½	150	400	21′ 0″	18′ 6″	14	36	35	36	18	4	5	6	5
2	Illinois Wall Paper Mills	11	4′ 6″	8½	200	506	16′ 0″	21′ 0″	8	28	19	29	8	14	13	14	14
3	Edward Katzinger	12	6′ 0′	8	350	830	14′ 11″	15′ 5″	4	13	10	11	2	1	4	4	4
4	Sears, Roebuck & Co	9	4′ 0″	8	200	500	18′ 0″	18′ 0″	16	44	40	40	11	10	12	14	13
5	Adam Schaaf Piano Co	13	4′ 0″	8	200	525	18′ 0″	18′ 0″	7	35	26	32	12	8	12	10	10
6	Hollander Express & Van Co	14	4′ 6″	6½	150	400	15′ C″	12′ 7″	6	17	13	19		1	8	5	1
7	American Book Co	13	4′ 6″	10	300	740	19′ 5″	19′ 3¼″	7	30	26	28	10	4	5	5	4
8	International Register Co	10	4′ 0″	7½	150	400	18′ 6′	17′ 10″	19	47	30	40	13	10	10	16	11
9	R. R. Donnelly	13	9′ 0″	11	300	750	24′ 4″	24′ 10″	8	32	8				12	8	
10	Ford Motor Co	11	7′ 0″	11	150	420	28′ 0″	25′ 0″	11	37	17				6	8	

deflection is used as a measure of the workmanship. It has been found by experience that the deflection requirement as given is not excessive, as any well designed and carefully built job will test to comply with this portion of the ruling, if the concrete has had a sufficient time to set.

All buildings used for the manufacture and storage of goods in the City of Chicago are required to be placarded. Each floor of each such building is required to have a card on which is stated the safe live-load per square foot to which the floor can be loaded. These cards are prepared by engineers and architects, and if correct, are

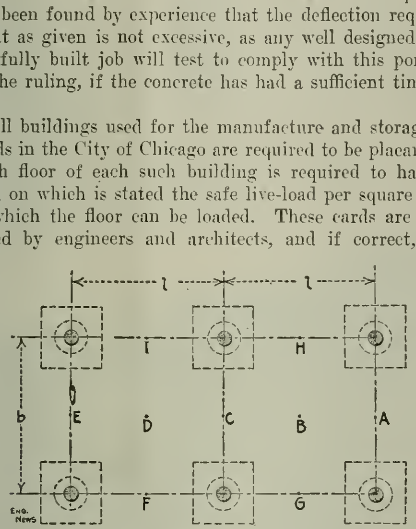


Fig. 2. Diagram Showing Location of Deflection Measurements in Chicago Building Tests of Flat-Slab Floors

approved with the official stamp of the Commissioner of Buildings. In case the design is correct, but the workmanship poor, the department has a means of preventing the loading of the floor to its full designed capacity.

Results of Tests

No matter how carefully a ruling may be drawn up, verification of such a ruling is desirable. During the last three years, 60 buildings designed in general in accordance with the ruling given above have been built. None of the buildings were more than six stories in height, but some of them covered great areas of ground.

In the accompanying table is given the results of the tests of ten buildings taken at random from the records of the department. None of these are extensometer tests. On the left-hand side of the table is given general data in regard to the panel. The total thickness of slab refers to the thickness in the middle of the panel. The designing and tests loads are given in lb. per sq.ft.

The location of the points used in measuring the deflection is given in Fig. 2. This same general method of lettering the points was maintained throughout. On the right of the table is given the total deflections of these points in $^1/_{100}$ in.

The readings of deflection were taken with great care. In some cases light poles were hung from the ceiling of the panels tested from the points shown. On these poles were glued paper targets, which were read with an engineer's level. In such cases, readings were also taken on fixed points on the columns, as there was usually a small settlement in these columns when under load. The readings thus obtained were corrected for the settlement, the corrected readings being the ones appearing in the table. Sometimes other methods were used such as fixing points in the floor and the ceiling, and reading the distances between these points with great precision. Multiplying levers were occasionally used.

It will be observed that the table covers a wide range, the test load varying from about 400 to 800 lb., and the span from 15 to 28 ft. Inspection of this table shows in some cases that points under identical conditions had the same deflection while in other cases there was a wide discrepancy. As a general rule, there was a very close agreement between the deflections of the center of the two adjoining panels.

Tests No. 4 and 5 bring out the fact that the deflection is a function of the age of the concrete. In these two buildings the conditions were identical in that the size of the panel, design, method of reinforcement, supervision and contractors were the same in both. The last two tests were on single panels as the size of the panels and the tests loads were so large that a double-panel test was waived. All the ten tests complied with the test of workmanship given above.

The statement is sometimes made that under continuous load a flat-slab panel would become fatigued, and ultimately break down. In order to determine whether there is any changes in stress or not, the department has required that a panel be tested with the test load continuously for one year. This extensometer test is under the direction of A. R. Lord, consulting engineer of Chicago, who has taken preliminary readings, and will take readings at regular intervals throughout the year.

Conclusion

The ruling as given above may not be theoretically correct according to the conception of some. It may be decidedly empirical. Information obtained in the future may necessitate a revision in some parts of the ruling. With the information available to date, however, it is known that designs prepared in accordance with this ruling will be safe, and that buildings constructed in accordance with the design in a workmanlike manner will abundantly carry the loads for which they were designed.

The Production of Natural Gas in the United States in 1913 surpassed that of any previous year in both quantity and value. Total gas production in 1913 is estimated at 581,898,239,000 cu.ft., valued at $87,847,000, an average price of 15.10c. per M. cu.ft., an increase of 19,797,787,000 cu.ft. and $3,282,720 in value over 1912. Of this total product, about 32% was utilized for domestic and 68% was utilized for industrial purposes.

West Virginia led in 1913 in quantity produced. Pennsylvania was second. Pennsylvania led in quantity consumed, and Ohio was second.—U. S. Geological Survey.

Winter Construction of a Reinforced-Concrete Building

It is not so long since contractors hesitated to undertake extensive reinforced-concrete construction in the low temperatures of winter because of the fear that the concrete could not be sufficiently protected against freezing. Under the most modern conditions of construction, however, and with proper precautions, it is now quite possible to build concrete buildings in the winter time [illegible] as in the summer. Such a construction was completed during the past winter in the erection of the concrete factory building for the New York Consolidated Card Co., at 12th St. and Webster Ave., Long Island City, in the City of New York.

This building is five stories high and covers in plan an area of [illegible] ft., in addition to the various exten-

TEMPERATURES IN DEGREES FAHRENHEIT IN NEW YORK CITY, NOVEMBER, 1913-MARCH, 1914

	Nov.	Dec.	Jan.	Feb.	Mar.
Mean	46.9	38.8	31.4	25.3	[illegible]
Maximum	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Minimum	28	19	−5	−2	11

While construction for the north end of the building was going on, materials were ordered, shipped and received and stored in the vicinity of the mixing plant, which was located on the center of the north part of the building. In this way, there was stored enough sand and gravel inside the building to complete the job, and at one time 36,000 bags of cement were stored, covered with tarpaulin, ready for use. This precaution insured the quick completion of the job independent of slow winter delivery. Inside of the completed part were installed arrangements for heating the sand and gravel, water barrel, steel reinforcement and the forms.

Fig. 1. Tarpaulins over Wall Openings during Winter Concreting; New York Consolidated Card Co. Building, Long Island City

sions for power house, garage and [illegible]. The plant called for about 10,000 cu.yd. of concrete. [illegible] of the north part of the building, [illegible] it was decided to push the work [illegible]. Excavation for the [illegible] of the north part was started on Oct. [illegible], 1912, and [illegible] at that end of the building on Dec. [illegible], 1912. Construction on the south end started Nov. [illegible], 1913, and the roof was completed Jan. [illegible], 1914. For the five months from November, 1913, to March, 1914, the range of temperature at New York City was as shown in the following table. It will be seen that particularly in January and February, when the south end of the building was under construction, extremely cold weather prevailed.

The precautions taken comprised the heating of the sand and gravel on griddles of steam coils, connecting the water barrel to a steam jet and running a steam pipe to the mixing floor, so that the reinforcing rods could be sprayed with steam immediately before placing to prevent any ice particles adhering thereto. Then each floor, immediately after concreting, was completely protected by tarpaulins, above and on the outside, and salamanders (open stoves burning coke) were placed on the floor beneath, and holes left in the floor forms to allow the heat to find its way up to the floor.

The three accompanying photographs show various views of the concreting work in the cold weather. Fig. 1 shows the tarpaulin hung over the side of the building and fastened, completely enclosing the portion of the structure to be concreted. This precaution was necessary to prevent the coldness and to hold the heat for the pro-

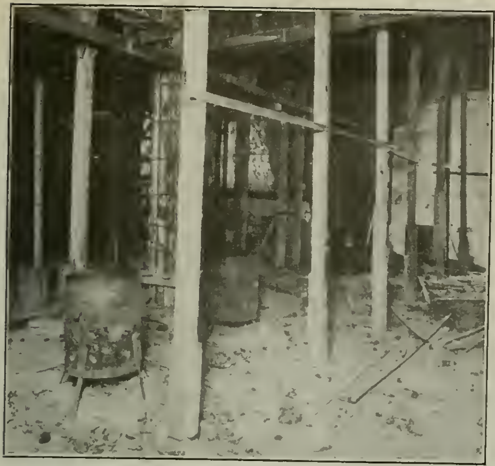


FIG. 2. INTERIOR OF BUILDING, SHOWING SALAMANDERS HEATING NEW CONCRETE FLOOR ABOVE

tection of the floor above. Fig. 2 shows the interior of the same floor with the tarpaulin on the outside wall and the salamanders, one of which was placed for every 300 sq.ft. of floor area, in action heating up the floor in the wooden tower. Forms were made up for about 75% of the building, this work being greatly facilitated by the use of a small circular saw run by a 5-hp. motor.

In hoisting steel and material to the working floor, a tower similar to the concrete tower was used and located at the side of the building with one leg of the tower equipped with a derrick. The advantage of the tower over the derrick mounted on the working floor is that construction of part of the floor does not have to be held up while erecting and handling material. For pulling and setting forms, a small A-frame equipped with block and tackle was used. Stone was dumped in the depressed bins in the street, from which it fed by gravity to a bucket conveyor, and by this means was deposited to the center of the building adjacent to the mixing plant, thereby greatly reducing the cost of its handling. All of these conveyors and hoists were operated by electricity.

To insure the heating of the material, 765,000 lb. of coke, 50,000 sq.ft. of canvas and 71 salamanders were used in the construction of the building. The contractor states that there was a slight increased cost for the winter weather construction over summer weather construction, but that a complete and careful organization served to offset some of this extra cost, and the increased profit due to earlier completion should be taken into consideration.

Ballinger & Perrot, Philadelphia and New York, were

FIG. 3. TARPAULINS COVERING FLOOR JUST LAID, JAN. 16, 1914
(Minimum temperature record: Jan. 13, 5°; Jan. 14, 5°; Jan. 15, 15°; Jan. 16, 29°.)

inclosure. Fig. 3 shows a view of a finished floor with the tarpaulin, which was hung on scantlings 12 in. above the floor, immediately after the placing of the concrete.

For the construction of the building only one mixing plant was used. This plant was located about in the center of the north end of the building, which made it necessary to leave a small opening in each floor in which to operate the hoist. The mixer was sunk about 5 ft. below the first floor level, thereby making a charging operation merely one of dumping and not of pushing a heavy load up an incline. The mixer was run by a small motor, which also operated an automatic dumping bucket the architects and engineers for the building, and the Turner Construction Co., of New York City, the general contractor. To the latter was due the method of winter construction described above.

⁂

Production of Slate in the United States, in 1913, was valued at $6,175,456, an increase over 1912 of $132,158, or 2.19%. This advance, according to A. T. Coons, of the U. S. Geological Survey, was caused by an increase in the average price and not due to increased production. The average price per square (100 sq.ft.) of roofing slate has fluctuated but little in the past 10 years; it was $3.78 in 1904, $3.87 in 1912, and $4 in 1913. About 72% of the 1913 figure was for roofing slate.

Field and Office

Contractor's Scows for the Fraser River

In the construction of the Grand Trunk Pacific Ry. along the Fraser River, in British Columbia, the river afforded the only means of transportation for distributing plant and material to different points at which work was to be commenced. This was a dangerous service, as at high water (the only navigable condition) the river has a swift current with numerous bends and rapids. From Tete Jaune Cache some of the material was carried in small stern-wheel river steamers built for the work by

FIG. 1. FORWARDING CONTRACTOR'S PLANT AND SUPPLIES BY SCOWS ON THE FRASER RIVER, GRAND TRUNK PACIFIC RY.

(A rock at this point, located just to the left of the boat in the [illegible] currents [illegible] the current tended to throw the scows against it.)

Foley, Welch & Stewart (of Winnipeg), contractors for the grading. But the great bulk of the machinery, material and supplies was transported in large scows, carried down by the current and controlled by a long oar or sweep at each end. Steam shovels, dump cars, cement, [illegible] piling, food supplies, etc., were handled in this way, and freighted for distances of 150 to 300 miles. Fig. 1 gives an idea of the character of this transportation.

Fig. 2 shows the construction of the scow, of which over 200 were built by the Bates & Rogers Construction Co. (of Chicago), contractors for all the bridge substructure work. The hull is 36 ft. long on the bottom, 44 ft. on top, 12 ft. wide and 4 ft. deep, with a carrying capacity of 20 tons. At each end is a V-shaped outrigger, with a notch in the end forming a guide for the sweep. All joints are calked. The sides can be raised 12 in. by a line of 12-in. splash boards, but these are used only in rough water or for cargoes liable to be damaged by spray. For the drawing we are indebted to W. C. Ruegnitz, Superintendent for the Bates & Rogers Construction Co.

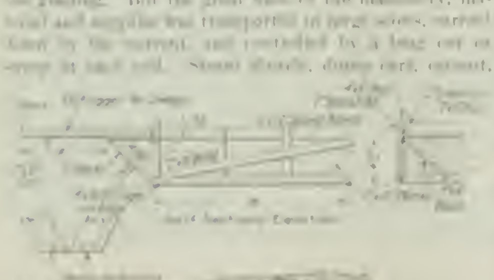


FIG. 2. SCOW FOR CARRYING [illegible] ON FRASER RIVER FOR THE BATES & ROGERS CONSTRUCTION CO.

A Few Motor-Truck Novelties for Contractors

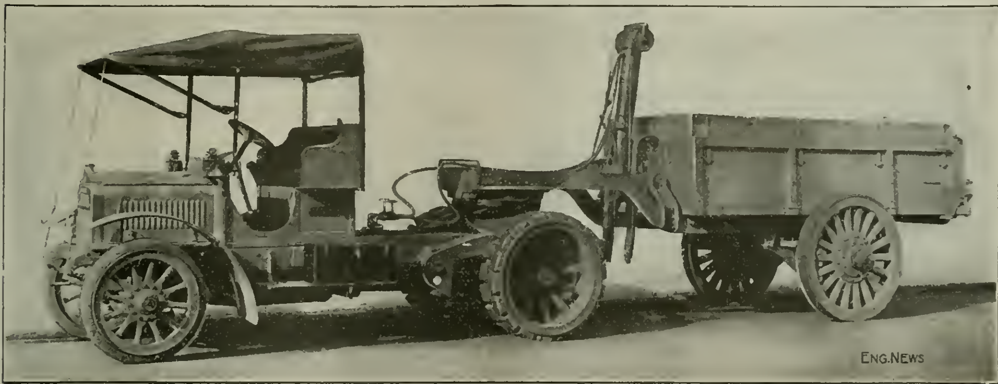
A TRACTOR-TRAILER OUTFIT FOR CARRYING HOT ASPHALT

An interesting and novel motor vehicle, in use by the Borough Asphalt Co., Brooklyn, New York, is shown in the accompanying figure. It is a truck with trailer body of 5 ton (100-cu.ft.) capacity, equipped with a hydraulic-hoist dump. Such trailer outfits are claimed to give greater flexibility of operation, permitting heavy loads to be handled in rough service where an ordinary truck could not pull out. In this case, the trailer body is of wood, $10\frac{1}{2}$ ft. long, $4\frac{1}{2}$ ft. wide at the front, 5 ft. wide at the rear and 2 ft. high. There is a sheet-steel lining, laid over $\frac{1}{2}$ in. of asbestos board and made tight for carrying hot asphalt-pavement materials—though it should be as serviceable as any truck for hauling sand and gravel.

The body dumps at the rear end, being raised [illegible] by mechanism controlled from the driver's seat. The tilting device comprises a cylinder and piston on the trailer and an oil pump on the tractor, with hose connections. The pump is driven from the [illegible] shaft by sprocket and chain with a disengaging clutch. Oil is forced into the bottom of the cylinder under pressure up to 800 lb. per sq.in. On the piston end at its exposed end is a crosshead and this in turn carries a pair of sheaves over each of which runs a cable connecting [illegible] along the front of the body to an equalizing bar on the trailer frame. A pipe leading to the pump [illegible] connects with a cylinder port near the upper end and when the limit of travel is reached, pressure under the piston is relieved through this. The return is by gravity, valves at the pump allowing the oil to flow in reverse [illegible] beneath the pump.

The connection between truck and trailer is by a [illegible] universal joint. A flat steel ring is fastened to the rear of the truck frame. This supports, in a recess, the lower half of the universal joint, allowing free horizontal

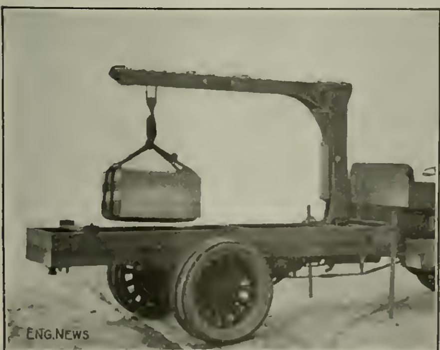
rotation of it. A long, horizontal pin is held in heavy trunnions on the lower half and engages, at right angles, a removable horizontal pin which passes through the trunnions of the inverted third or upper part of the joint. This last further bears a toothed plate engaging with a duplicate on the trailer frame but easily disengaged by pulling a horizontal bolt. A couple of spiral springs between the upper and lower parts of the joint stiffen it against sidewise rocking. The tractor and trailer shown (Saurer type) were made by the International Motor Co., New York City; the dumping hoist was made by the Wood Hydraulic Hoist Co., St. Paul, Minn.

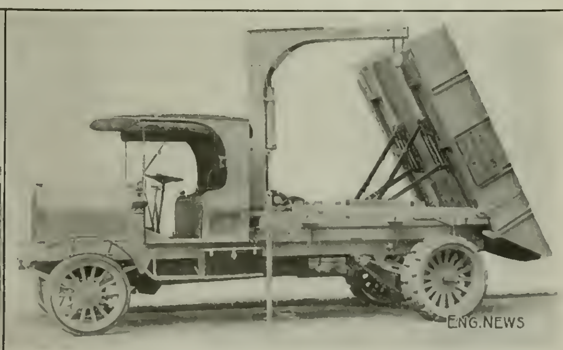


A Tractor-Trailer Outfit for Hot Asphalt

A Crane for Motor Trucks

The wider use of heavy motor tracks has brought an increasing number of instances of trouble in unloading at destinations where there is no particular handling equipment. To meet this difficulty, in some cases special cranes have been installed on the truck chassis, one example (used by the Pullman Co., at Chicago) being shown at the left in the accompanying figure—a pillar-and-jib crane of one ton capacity. A structural-steel mast with jib rotates (on a roller thrust bearing) about a steel casting bolted to the chassis frame. A vertical hoist shaft extends from the head of the pillar through the chassis and is geared to a horizontal shaft below. This last in turn is driven through chains and sprockets (and an idler shaft to reduce speed) from the main transmission. The horizontal hoisting shaft has a double jaw clutch worked by raising or lowering a lever behind the driver's seat; this throws one or the other of two bevel gears into mesh with a gear on the vertical shaft, according as the crane has to hoist or lower. This vertical shaft is bevelgeared to a short horizontal shaft, at the top of the pillar, bearing a chain sprocket, over which the dead-ended hoist chain passes. The cylinder on the mast holds the excess length of chain when the hook is up. The jib arm is formed by two channels with flanges turned in. The crane trolley, running on the bottom flanges, is moved in and out by a hand chain and sprocket. Swinging is done by hand. Outrigger supports, made of iron pipe, are provided to prevent overturning the truck, and the chassis is reinforced by a steel top frame. The outfit shown was built by the Brown Hoisting Machinery Co., and the Peerless Motor Co., of Cleveland.





A Power Crane for Motor Trucks

The 7½-ton dumping truck with crane shown at the right was recently delivered to the Bureau of Sewers, Borough of the Bronx, New York City. It was intended to facilitate hoisting sediment from sewer manholes and loading it, which work has previously been done by hand or with a small tripod derrick. The crane has a capacity of 1½ tons; the body is water-tight and has a capacity of 3½ cu.yd. The dumping is at the rear end, the body being raised through 60° angle by a hand hoist, the

ments an arrangement of arms, cables, drums and gears. The body is lowered by gravity and is controlled by a hand brake on the drums. The truck is a Mack type made by the International Motor Co., New York.

THE HYDRAULIC HOIST ON MOTOR TRUCKS*

The modern hydraulic hoist for dumping motor trucks, in which a rotary oil pump is mounted with hoist cyl-

HYDRAULIC MOTOR-TRUCK HOIST IN OPERATION, (JULY, 1911)

inder carrying the oil reservoir in the head of the cylinder, was successfully applied by the Pierce-Arrow Motor Co., Buffalo, N. Y., in August, 1912. The pump is started by lifting a lever located in front of the cab seat. A three-way valve is provided for raising or lowering the hoist. Experience has shown that it is best that the driver get down from the seat to operate the valve, or that his helper operate it, as it is safer and more satisfactory to see exactly where the load is dumped. This cannot be accomplished from the driver's seat as the truck body obscures the view. Fig. 1 shows the details of the hoist and its arrangement on the truck chassis.

The pump is operated through chain sprockets, one situated in front of the cab and another behind. The sprocket at the back of the driver's seat, which connects through a chain directly to the pump, makes a maximum of [illegible] r.p.m. and is controlled by a governor on the motor. The pump itself turns at 800 r.p.m.

The hydraulic cylinder is made from weldless steel tubing, machined and then reamed to a bore of 5 in. The end flanges are screwed on and a seal of iron (melted in blast furnace) run in a groove between the flange and the tube, preventing any leakage. The joint at the head and base is made oiltight by a copper gasket, as shown in Fig. 2. The piston rod is of nickel steel 1⅝ in. in diameter.

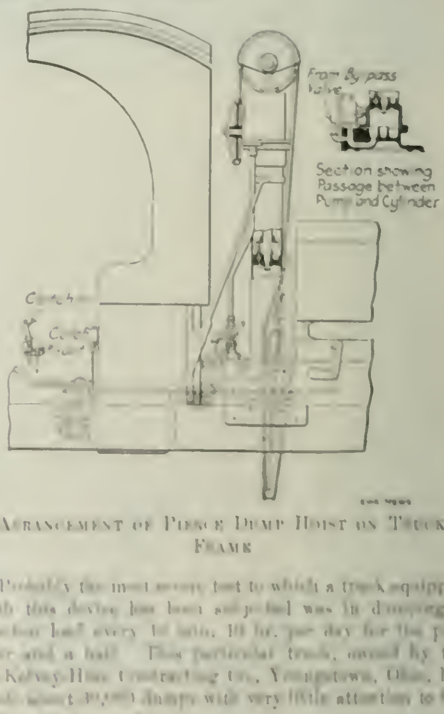
The piston has the usual cup leather. In earlier stages of the development, grooves were cut in the top of the cylinder, so that when the piston reached the limit of its travel the oil bypassed along these grooves. This was found to wear the leather and was abandoned in favor of the present method wherein three small valves in the piston open when in contact with a spacer. By this means the travel of the body can be readily varied.

The piston carries a crosshead at its upper end with two sheaves over which the load-lifting cable passes. A third sheave is placed at right angles to these two on the cylinder head and acts as a compensating sheave for distributing the stresses equally throughout the cable. It incidentally acts for simplicity, in limiting the cable to only two ends. Where a compensating lever is used instead of a sheave, two cables are necessary.

The ends of the cable are connected by yokes to substantial brackets on the front of the body, as shown in Fig. 1. In operation, oil is drawn from the cylinder head, through the three-way valve, through the pump and then under pressure to the bottom of the piston. If it is desired to hold the body in any position, the valve is turned round shutting off the intake pipe. To lower the body the valve is turned round so that the oil is bypassed around the pump from the lower part of the cylinder to the upper. The weight of the body is sufficient to lower the piston.

The oil used is preferably a good grade of ice-machine oil in the winter and a somewhat heavier oil in summer. In fact, the best oil to use depends to some extent upon climatic conditions.

The oil pressure required to lift a full five-ton load plus the body is more than 400 lb. per sq.in. The body can be lifted in 8 sec.



ARRANGEMENT OF PIERCE DUMP HOIST ON TRUCK FRAME

Probably the most severe test to which a truck equipped with this device has been subjected was in dumping a five-ton load every 10 min. 10 hr. per day for the past year and a half. This particular truck, owned by the McKelvey-Hine Contracting Co., Youngstown, Ohio, has made about 30,000 dumps with very little attention to the hoisting equipment.

*By [illegible], Engineer, Truck Department, Pierce-Arrow Motor Car Co., Buffalo, N. Y.

Cutting Out a Large Concrete Turbine Foundation

The removal of large portions of a reinforced-concrete foundation about [illegible] ft. in plan by 12 ft. deep, in the Gold St. Generating Station of the Edison Electric Illuminating Co. of Brooklyn, without interference with the operation of the plant, is being accomplished at the present time, to make way for a new concrete and steel

grillage and steel superstructure for a large horizontal turbo-generator. The concrete foundation was built in 1911 when it was proposed to install a 12,000-kw. vertical unit. It was decided, however, to install a larger unit,

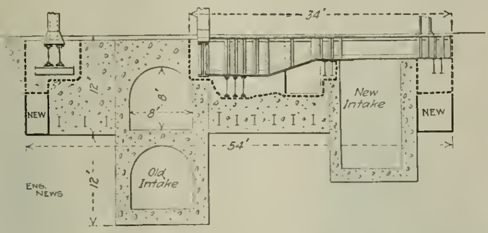


Fig. 1. Reconstructed Turbine Foundation

and because such units are available in the horizontal type at less cost per kilowatt, on account of greater speed, a 22,000-kw. horizontal unit was selected.

The amount of cutting required is indicated on the drawing, which also shows the grillages set for the proposed steel structure. The method employed was to drill a series of 2-in. holes about 6 in. c. to c., 6 in. back of the face, and break down by plug and feathers the material between holes and face. The cutting started along the line of the 30-in. atmospheric exhaust (Fig. 2), situated about 10 in. below the surface, and proceeded in 3- to 4-ft. stages to a maximum depth of 12 ft.

The first step in the whole work was to build a substantial wood screen from the top of the foundation (basement-floor level) to an elevation 6 ft. above the turbine-room floor, through the opening left in the latter floor, for the future unit. This screen or partition served to isolate the concrete-cutting from the various station operations. It was commenced on Aug. 6, by a force of 4 carpenters and 2 laborers.

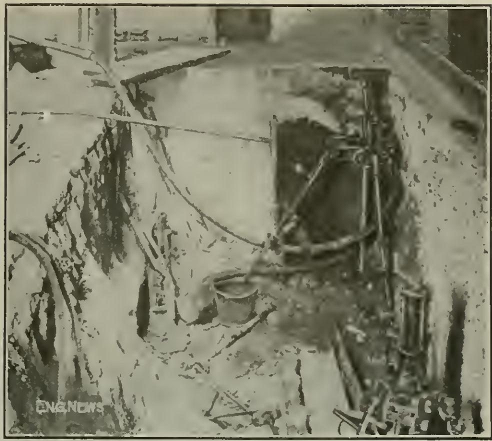


Fig. 3. Opening for Corner Grillages

(For grillages shown at right of Fig. 1. Two drills in place. Gravel concrete at left, broken-stone concrete at right.)

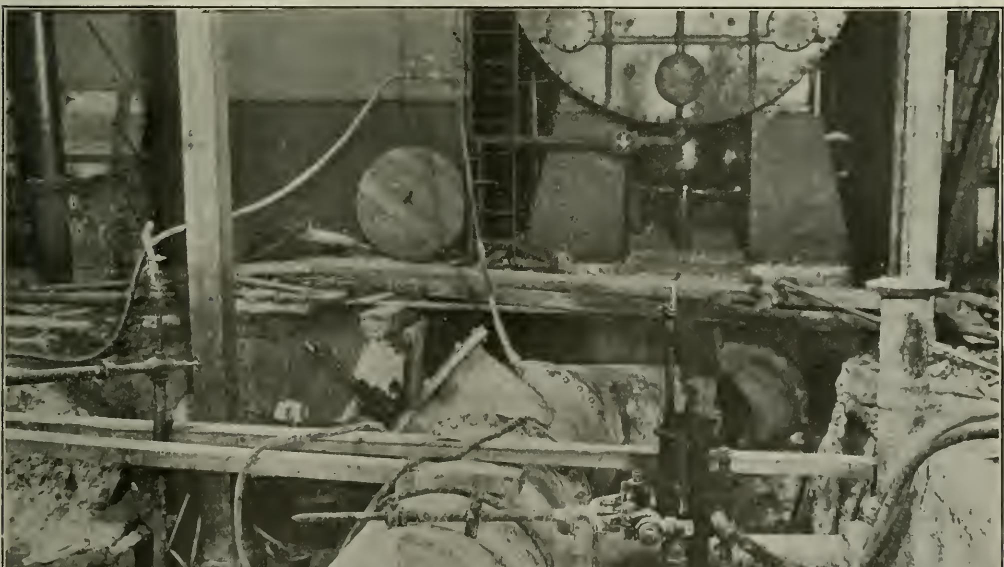


Fig. 2. Main Cut, Showing Atmospheric Exhaust Exposed

(Condenser of adjacent turbine, at top of view. Wood forms at left separated concrete wall of old condensing water tunnels from the concrete turbine foundation. Face at right is gravel concrete.)

FIG. 1. LAND-CLEARING MACHINE

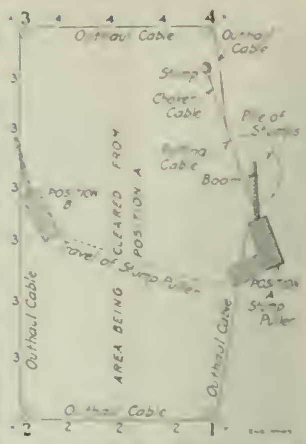


FIG. 2. WORKING ARRANGEMENT IN CLEARING LAND BY MACHINE

To obtain sufficient width it was necessary to cut a slice from an abandoned engine foundation built in 1897. This concrete was a mix of cement, sand and broken stone, while gravel was used in the 1913 structure in place of the stone. The work developed that the older material broke away in chunks under the action of the plug and feathers, but the gravel concrete crumbled, running up the cost of its removal (see Fig. 3, in this connection).

The cutting is carried on by two shifts. The first works from 7 a.m. to 6 p.m. and comprises about 45 men; the night force works from 6 p.m. to 5 a.m. and averages 20 men. A total of 6 drills (both steam and air) were used. The work is scheduled for completion by Oct. 1.

The work is being done by Barth S. Cronin & Co., under the supervision of G. L. Knight, Designing Engineer of the Edison Co.; H. B. Morrow, Chief Inspector.

Stump-Pulling Machine for Clearing Land

In the clearing of timbered land, extensive use is made of machines for hauling, skidding and loading the logs and trees; but there is less general use of machines for the usually slow and heavy work of removing the stumps. The machine here described is intended for the entire work of clearing; it first hauls in and stacks or loads the trees and logs, then it pulls up the stumps, hauls them in, and stacks them ready to be burned. A portable machine, moving from stump to stump and pulling them vertically, was described in ENGINEERING NEWS, Aug. 27, 1914; but the machine described below will clear a tract of 5 or more acres (about [illegible] sq.ft.) at one setting, and it pulls the stumps with a horizontal cable.

The machine, shown in Fig. 1, consists of a frame of three steel I-beams mounted on a pair of longitudinal 9-in. I-beams which form the runners. Each runner is turned upward to enable the machine to ride over obstructions, and is shod with a steel plate 20 in. wide. Steel sheets are riveted to the bottom of the framework of the frame to protect the machinery from dirt and to give additional support on very soft ground. At the front end is a steel A-frame, 16 ft. high, to which are attached the guy lines of the 36-ft. boom. At the rear end is the hoisting engine and a vertical boiler, and over it may be a canopy roof for the protection of the operator. The frame is 32x9 ft., and the machine (with its cables and all equipment complete) weighs about 35 tons. Lighter machines of the same type are built.

A double-cylinder three-drum engine is used, with cylinders 10x12 in. for the larger machines. The front drum carries the pulling cable, and is geared for two speeds; for pulling the stump it exerts a pull of 145,000 lb. with a speed of 30 ft. per min., while for skidding or hauling in the stump it has a speed of 350 ft. per min. The rear drum carries the outhaul cable for running out the pulling cable after it has brought in a stump, giving a speed of 800 ft. per min. The middle drum carries the piling line which is led over the boom and is used for stacking the stumps in piles ready for burning. The hoisting capacity is 10 tons.

When the machine is in position it is anchored by steel spuds driven into the ground through holes in the runners, or by chains attached to trees or stumps at the rear. The outhaul cable is then led around the area to be cleared, being passed through snatch blocks, as shown at 1, 2, 3 and 4, in Fig. 2, and led back to the machine, where its end is attached to the pulling cable.

The drum then hauls on the outhaul cable, thus running out the pulling cable to the first stump (Fig. 2). A choker line or short steel cable, having a hook at one end and a loop at the other, is then wrapped around the stump, and the loop is slipped over the hook on the pulling cable. The drum of this cable then hauls in on the slow gear until the stump is pulled from the ground, and then on the high gear until the stump is deposited at the machine. The choker line is released automatically and taken back by the outhaul cable.

When the machine has pulled all the stumps between it and point 4, the snatch block is shifted successively to points in the line 4-3, as shown. Then snatch block No. 4 is dispensed with, and the cable led directly to block No. 3. This in turn is shifted toward No. 2, and is

then removed, and No. 2 is then shifted in the same way. As the positions of the snatch block are changed, the machine swings so that it is always in the line of the direct pull.

The entire area having been cleared, the pulling line is run out and anchored at the next position (shown at *B*, Fig. 2) and by hauling on this cable the machine pulls itself forward to that position. The outhaul cable is then led around the new area and work proceeds as before.

One piece of clearing done in Texas was on heavy clay land with pine stumps 10 to 40 in. diameter averaging 44 per acre. The machine pulled, skidded and piled about 110 stumps per day, at a cost of about 28c. per stump, or $12.32 per acre, clearing about 2½ acres per day. The working force was as follows, with a total daily cost of $30:

1 Foreman	$5.00	2 Hookers (each)	$2.00
1 Engineman	3.50	1 Tongman	2.00
1 Leverman	2.00	1 Stump grubber	1.50
1 Fireman	2.00	1 Water team	4.00
1 Helper	2.00	1 Fuel team	4.00

The machine is built by the Clyde Iron Works, of Duluth, Minn.

General Points on Moving Large Structures*

In preparing a building or structure of any kind for raising and moving it will be necessary to make a careful study of the structure. The weight should be carefully estimated, the general construction of the building should be understood, in order to know the distribution of loads on present foundations. The character of ground over which the structure is to be moved should be considered, especially if the building is of a heavy type.

After the above points have been carefully considered, a layout is made showing the manner of picking up the structure, which is done in the case of a brick or stone structure by inserting either beams or heavy cross timbers at proper places to take the load without causing strains in the main structure, when the building is raised. The main principle in raising structures is to keep conditions as nearly as they were, when on original foundations.

*From a paper by Geo. W. Nichols, Engineer, John Eichlacy, Jr., Co., Pittsburgh, Penn., "Principles and Details Involved in the Moving of Large Structures," "Proceedings" of the Engineers' Society of Western Pennsylvania, April, 1914.

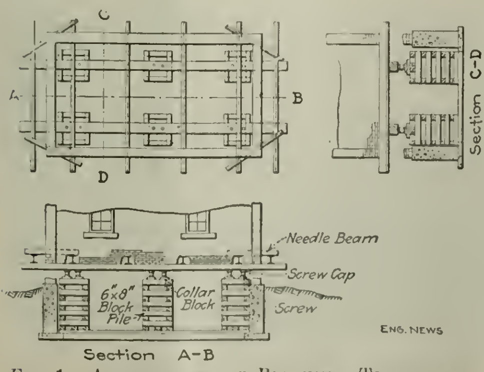


FIG. 1. ARRANGEMENT OF BLOCKING, TIMBERS AND SCREWS FOR RAISING A BUILDING

In the case of steel structures, special consideration is given to each individual case and no set method can be laid down for the work, however, the general principles are applicable to all structures.

The following sketch, Fig. 1, shows the manner of building a blocking and the setting of timbers and arrangement of screws for raising a structure. Regularity and care must be used in building the blocking and in the manner of setting the screws and locating cross-timbers for taking up the building.

After the building has been raised the required height and it is desired to move it, oak runs are built and the building lowered on rollers which bear on 6x8-in. oak runs below and on roller planks above, after which the jackscrews are removed. This is shown by the sketch, Fig. 2.

In case it is desired to turn the building slightly, the rollers can be "cut," that is, set at a slight angle to the general direction and gradually brought over to proper line. Cutting the rollers is a term used for knocking one end of the roller slightly with a hammer to change the general direction of the structure being moved. However, it is sometimes necessary to actually cut the rollers with a saw. Where the building is to be given a quarter or half turn, or a complete turn, a pivot point is selected and runs laid and rollers set to operate about this point (Fig. 3).

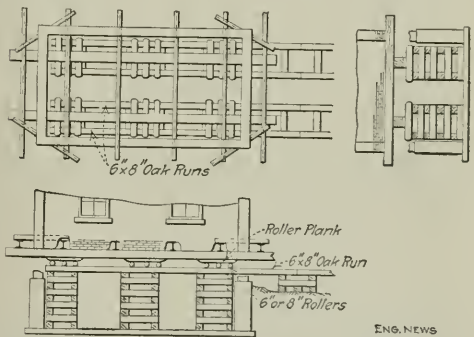


FIG. 2. ARRANGEMENT OF RUNS AND ROLLERS FOR MOVING A BUILDING

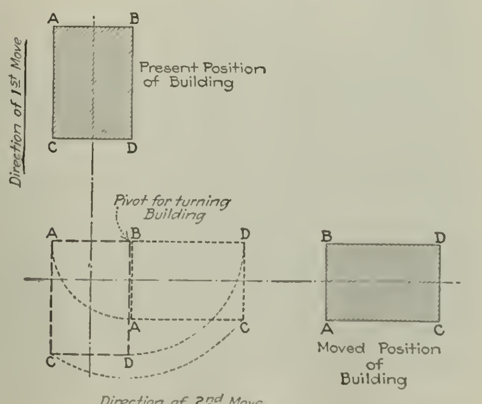


FIG. 3. PLAN FOR MOVING A BUILDING AND MAKING A QUARTER TURN

In the [illegible] of buildings, such as the change in [illegible] or [illegible] of floors or the [illegible] of heavy structures where [illegible] blocking would be required, pump-logs or drums are used. Pump-logs are timbers, usually [illegible] in size, but often larger, one end of which is bored to a [illegible]-in. diameter about 18 in. deep. In this hole operates the screw, the lower part of nut sets in the [illegible]-in. hole in the timber and the flange of nut bears directly on the bottom of timber—more often a collar block is used to form a bearing for the nut. Drums are usually set in position with the screw at the lower end, so that the screw may be more easily operated.

In the raising of brick structures great care is required to keep the building level and the movement uniform. It is usually customary to run cables entirely around the building and tighten by means of ratchets. In attaching the ropes to take the blocks for moving a brick structure, these are not connected directly to any part of the brick building, but to the timber or steel grillage upon which the building sets.

The building is watched carefully by all the men to assure raising in a level position. These levels are [illegible] by means of ordinary carpenters' spirit levels, which are placed on rails and timbers which support the structure and these kept as near level as possible. In raising the building a number of screws are divided among the men. Each man may have ten screws to turn. Each man takes his screws and makes two rounds at a given signal. He starts at one end and makes a quarter turn and goes through to the end of his screws, and then returns and stops until every one else is through and until the signal to turn is given again.

An Erection Economy: Marking Structural Members for their Connections

By [illegible]*

[illegible]

The writer proposed (1) that every shipping member of a structure be marked with the [illegible] of the connecting members at the points where they connect and (2) that each end of each member be marked with its [illegible], e.g., the top with "Top," the end toward the [illegible] "Water End," and so on. Then the erector will [illegible] have to look at the end of the member for the connection symbol, [illegible] the marking on the piece would [illegible] back for [illegible] and send it up.

*[illegible]

Now [illegible] diagram, Fig. 1, and suppose $EG2$ is already in position. The detailing of $EG2$ and its connecting members $TL9$ and $TL10$ is shown in Fig. 2. If, when this girder is assembled in the shop, the marks of the connecting pieces are painted on the gusset plates, the erector will know without the detail drawings how to place these members in the structure, which he otherwise would not know.

The system would work out the same as match-marking. The erector would note the symbol of a connection and call it down to the men on the ground; the latter, in looking onto it to send it up, would be governed by the marking found on the piece as to which end goes which way. The foreman would not have to get the detail drawing and check up a piece to see which is the top or water end, his men waiting for instructions in the meantime. It is hard to work with drawings out in the open, where the wind and possibly rain can get at them; in cold weather it becomes doubly hard.

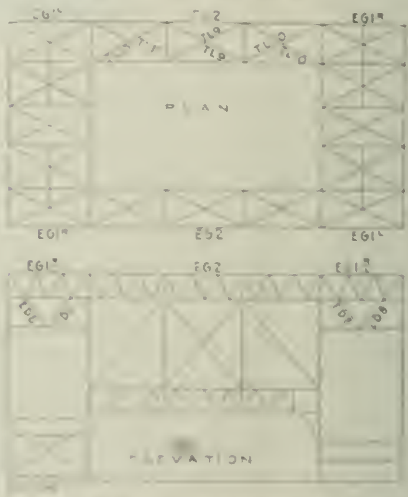


Fig. 1. [illegible] Marking of Members on Erection Diagrams

[illegible]

I have [illegible] jobs where there have been [illegible] and [illegible] Fig. 2 gives a good example of such a case. [illegible] handled by one [illegible] two sets of falsework were used, and on each bridge a raising gang worked at either end, making four gangs to begin with. As soon as one bridge span was complete, the bridge was run off the falsework and another one started, and another gang set to work putting in track stringers and [illegible]. Thus finally [illegible] gangs were raising [illegible].

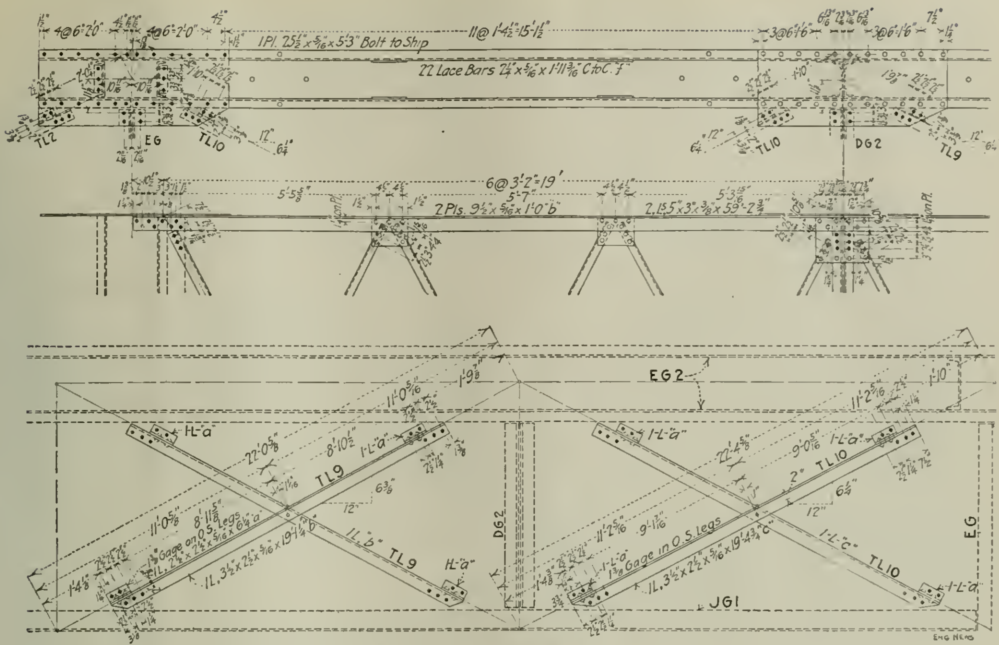


FIG. 2. DETAILS OF THREE MEMBERS OF FIG. 1

and in addition there were machinists and electricians. Since in most cases a blueprint is Greek to the pusher or foreman of the gang, it is necessary that he have someone at work to pick the iron out and mark it as to its location in each bridge. In this case two men were kept busy on such work, and even then mistakes were made, sometimes a piece being put up wrong and taken down again, because they did not have sufficient time to study out the details.

There is no doubt that a great deal of time can be saved and mistakes forestalled by designating in the shop the position a member occupies in the finished structure. To enable the shop to do this properly, the marking should be noted on the detail drawing. The draftsman would need but very little more time to put this information on the drawing, so that the shop can use it on sight.

An argument against adding more information to a detail drawing is that it clutters up the drawing. But the more information is placed on a drawing, the less the

FIG. 3. A GROUP OF ORE BRIDGES ERECTED BY ONE FIELD ORGANIZATION

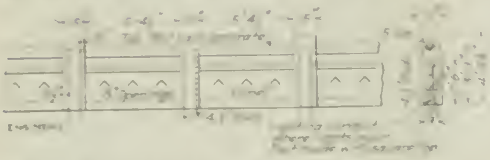
Part of ore-handling plant at Edgar Thompson Steel Works, Bessemer, Penn. Built by Brown Hoisting Machinery Co. Two of the five bridges are at right angles to the three shown, and cannot be seen in the picture.

deep seam grid sections will have to be wired [illegible].

As far as increasing the shop expense, this method would only add to one man's duties, the shop inspector or checker. When he is going over a member for its final inspection, he can perform the necessary marking as called for on the drawing.

A Special Reinforced-Concrete Bridge Railing

A partially precast concrete hand-railing was placed on the Pleasant St. Viaduct of the Delaware, Lackawanna & Western R.R., at Utica, N. Y., by Peters & Kiehm, contractors for the bridge. The accompanying drawing shows the detail of the construction. The railing was divided so that a large 15-in. square post was placed every 13 ft. Midway between these posts was set a smaller 12-in. post, which extended in height only to the center of the top rail and acted as a support to that rail. Between



Railing for Pleasant St. Viaduct, D. L. & W. R.R. Utica, N. Y.

these posts were 5-in. vertical slabs acting as panels and paneled with 8-in. square diamond-shape openings as ornaments.

In building the rail the small intermediate post and the two adjacent panels were first cast in place and were made long enough to extend 2 in. into the main post. After a number of these sections had been cast and the forms removed, the top railing, which was a square section set with a diagonal vertical, and which had been previously cast on the ground was put in place resting in the groove left in the top of the short mid-post. Then forms for the main post were placed and filled, the ends of the panel and of the top rail having been covered with grease and wrapped with paper to provide a slip joint at each of these main posts.

A Rough Wood Suspension Footbridge*

A suspension footbridge 273 ft. long was recently built across the Gila River near Kelvin, Ariz., by the Kelvin-Sultana Copper Co., to connect their mine and power plant and to accommodate miners living in Kelvin. Although designed only for pedestrians, single pieces of machinery weighing 1800 lb. have been taken across. The maximum load placed upon it to date was 3000 lb. The bridge carries a 4-in. pipe line which conveys boiler water from the mine to the power plant.

The general design is shown in the accompanying view. At the center the roadway is 15 ft. above mean high water. The wooden towers are carried on concrete foundations. On the west side of the river (the far side in the view) the former river bottom, now about 8 ft. above mean high water, forms a flat several hundred feet wide which affords poor bearing. The concrete foundations on this side are 14 ft. deep x 6 ft. wide at the base. On the opposite side the piers are about 3 ft. high. The towers, constructed of 10x10-in. Oregon pine posts with 3x8

*Data furnished by Arthur L. Flagg, Kelvin, Ariz., who built the bridge.

General View of 273-Ft. Suspension Bridge

in. bracing, are 21 ft. square at the base and 31 ft. 5 in. high.

The two cables are made each of two 3/4-in. plowsteel ropes, which had seen about six months' service in hoisting. The floor, 4 ft. wide in the clear, is attached by 5/8-in. Ernst patent hangers passing through 4x6-in. cross-bars, on which rest two 4x8-in. and one 3x8-in. stringer. The floor of 2x12 is nailed directly to the stringers. Directly over each side stringer is a 4x6-in. guard timber, bolted through plank and stringer to the cross-bars.

The anchorages are concrete blocks. The cable ends are passed around several 16-ft. lengths of 90-lb. rail embedded in the concrete. On the power-plant side, turnbuckles are provided.

From the center of the bridge there are four guys to the bank, making an angle of 30° with the center line of the bridge. There is very slight sway to the bridge under ordinary loads.

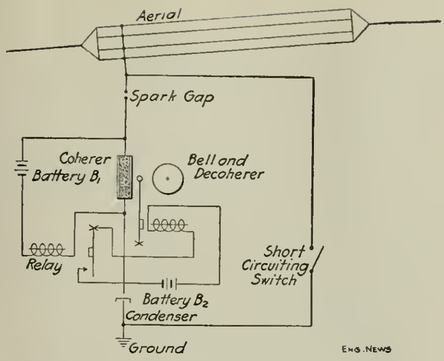
In building the bridge, as soon as the towers were completed the cables were hung and roughly adjusted to nearly the proper deflection. The hangers were then put on, beginning with the longest and working from both ends toward the center simultaneously. When the hangers were all placed, the deflection was adjusted (27.2 ft.), the floor laid, and the handrail put on.

A Detector of Approaching Storms

The storm detector recently developed by the engineers of the New York Edison Co. gives them warning of storms 2 to 7 hours before the actual clouds and darkness arrive and they are enabled to prepare for heavy drafts of lighting currents. The apparatus is very simple and should be of broad application wherever there is work under way which it is advisable to protect in advance from storms and darkness. A few detector stations scattered over the area served by a large electric-transmission network should give advance warning of impending local loads and line disturbances—helping the new art of load dispatching.

Practically all summer storms are accompanied by electrical disturbances, and these are detected by what is virtually a wireless-telegraph receiving circuit. Winter storms have but weak electrical manifestations, and are not yet as well detected.

As shown in the accompanying figure there is an aërial frame, a spark gap, a coherer, a condenser, a ground connection, a combined bell and decoherer, a relay, two batteries and a short-circuiting switch. The spark gap is to shut out radiations from radio-telegraph stations; the spherical terminals are about 1/64 in. apart and storm surges will jump this distance. The coherer is like the earlier ones of wireless telegraphy—a short glass tube of small bore filled with nickel-silver filings between german-silver plugs. The bell is one of single-stroke connection mounted so that the clapper will back-strike the coherer tube. On passage of a storm impulse the coherer loses its high resistance so that steady current flows through it from its battery and causes the bell to tap. The return of the clapper jars the filings and restores the high resistance ready to report another storm impulse. The condenser was inserted in the Edison Company apparatus to prevent direct current from flowing; in many cases it could be omitted. The short-circuiting arrangement is needed to prevent damage to the set when the storm begins to break.



Connection Diagram of Storm Detector

At the New York station, it has been found that the bell begins to tap every 15 to 5 minutes when a storm is a few hours away. If it approaches nearer, then about two hours before it breaks the bell taps every minute or half minute. The bell rings continually an hour or a half-hour before the crux and then the set is short-circuited since no other warning is possible or needed.

Arrangements for Soil-Loading Tests

That the rather uncommon operation of testing the bearing capacity of foundation soil involves a number of troubles and complications was commented upon editorially in our issue of September 3, 1914. The following two descriptions of test arrangements which have proved satisfactory in actual use, received in response to our comments, may be instructive.

UNBRACED LOAD BALANCED ON SINGLE POST

Wm. P. Snow, Lewiston, Me., several years ago made soil tests with load balanced on a single post, as follows:

A large chimney was to be built close to a river bank and the bearing capacity of the subsoil had to be determined before designing the foundation. A test-pit was excavated to the proposed foundation depth, and showed a good coarse gravel, which was capable of carrying a heavy loading. While this gravel did not seem to call for the proposed test nevertheless the test was carried out for the information of outside parties.

A 12x12-in. iron plate was set level on the bottom of the pit and on it was placed a 10x12-in. post with top about 2 ft. above ground. When this post was carefully plumbed the hole was backfilled around it. A 12x16-in. timber 20 ft. long was laid over the top of the post as a loading beam. Under each end of it a timber crib was built to within a few inches of the beam, as a stop in case it got out of balance. Bricks were piled on the loading beam until the required intensity of loading was reached. There was no trouble in keeping the load balanced, the bricks being added with reasonable uniformity on either side of the post.

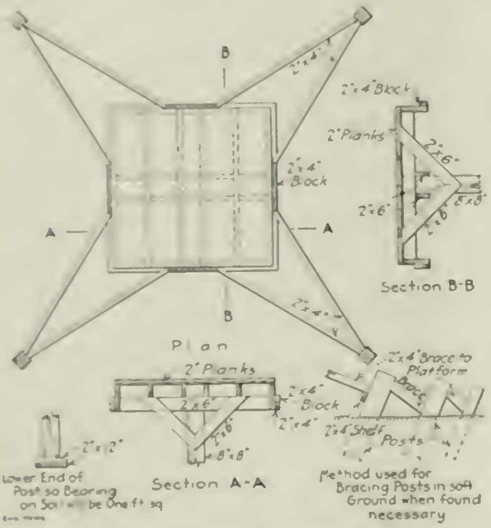
There was a slight compression under the first thousand pounds of load, but thereafter little or no settlement was perceptible up to the maximum applied loading of four or five tons per sq.ft. This test was carried out for Lockwood Greene & Co.

A similar test was made some time later on top of the ground, without backfill around the loading post, and there was no trouble in maintaining balance of the load on the post

BRACED PLATFORM ON SINGLE POST

The [illegible] arrangement described and shown in the [illegible] been used by E. McCullough, Chicago, in a number of [illegible] tests for building foundations.

The platform, of at least [illegible] tons capacity, is 6x6 ft., made of 2-in. planks resting on an outer frame of 2x12-in. plank and stiffened by four 2x6 joists below. Two additional 2x6's underneath these joists support the platform and are spiked to the middle post. The post is 8x8 or larger. The platform is braced to it by inclined 2x6 knees. The bearing area at the bottom of the post should be 1 sq. ft. This is



Braced Loading Platform Used by E. McCullough

obtained by spiking to the foot of the post two thicknesses of 2-in. plank with the fibers crossed. There is no necessity of using a 12x12 post. It is much simpler to make a shoe as thus described than to build up the post of plank to get the proper bearing area at the bottom.

To receive the ends of props on the four sides of the platform a 2x4 strip is nailed around the outside of the frame along the lower edge of the 2x12 frame support, and at the middle of each side a piece of 2x4 about [illegible] ft. long is spiked on top of this strip, forming a lug against which props can be located.

About five or six feet away from each corner of the platform a large post is driven, and if necessary it is braced. [illegible]

[illegible]

[illegible]

[illegible]

Concussion Effects in Pavements; Information on Tests Wanted

There is a good deal of difference of opinion as to whether 6 in. of cement-concrete foundation is sufficient for heavy-traffic street pavements. One of the arguments for heavier foundations is that thin foundation slabs may be fractured by vibrations produced by heavy vehicles passing at high speed. But no experimental study has been made of this phase of the pavement problem, so far as we are able to find.

Several important practical questions come up in this connection. Two fundamental questions are:

1. *Is one kind of pavement surfacing as hard on the foundation as another?*

2. *Does asphalt or wood-block surface have a cushioning effect, as compared with brick or stone block? Which results in longer life of the foundation?*

Answers to these questions are solicited. Further, if any tests or measurements have been made of vibration (concussion) effects in pavements, we would be glad to hear of it.

NOTES

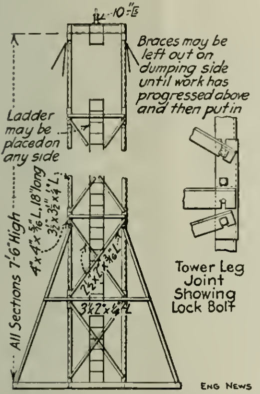
Selfcomputing Leveling Rod—A new leveling rod has the number face on an endless steel tape instead of on the fixed material of the rod, and, the tape being carried on two end rollers, the graduations can be set to match the elevation of the benchmark. Thus the level-reading on any stake gives its elevation direct, without any addition, subtraction or other of the usual level-record computations. In construction the rod is simple, the tape roller at either end is the chief addition to the ordinary rod. The tape is joined by a hook joint in the rear half, and it can be taken off and replaced with

[illegible] Rod, Tape Roller and Clamp; Selfcomputing Leveling Rod

very little trouble. A winding reel may be attached near the bottom end of the rod, for use in putting the ribbon on the rod and taking it off. Of course, the graduations on the tape increase from top to bottom, as on an inverted rod, though the figures themselves are right side up.

The rod itself is made in three sections with telescope joints, so that for transportation it can be brought down to a length of 4½ ft. An oval target sliding on the rod in the usual way enables the rod to be used as target rod, although with suitable graduations it is probably best adapted for self-reading work. The face of the rod is made wider than that of the usual target rod, and this helps in reading from the instrument. The rod can be made with any desired graduations. The Chicago Steel Tape Co., 6231 Cottage Grove Ave., Chicago, makes and sells the new rod. The present list price is in the neighborhood of $17.

Steel Concreting Tower Designed for Rapid Erection—Slots in place of bolt-holes are the essential feature of a steel concreting tower which the Yorke Derrick Co., Washington, Penn., has just begun to manufacture. The parts of the tower are put together or dismantled without removing nuts or bolts, but slip apart as soon as the nuts are slacked off. This applies to the splices of the tower legs as well as to the attachment of the horizontal struts and diagonals. The leg splices are made by means of a piece of angle 18 in. long riveted to the end of one of the leg sections and projecting to engage the other; its end is slotted, and two bolts in the engaged leg section enter the slot, while similarly two slots in that section receive two bolts in the splice angle. Thus the two leg sections go together by a simple telescope joint, which is held firm by tightening the four bolts.



STEEL CONCRETING TOWER WITH SLOTTED BOLT-HOLES

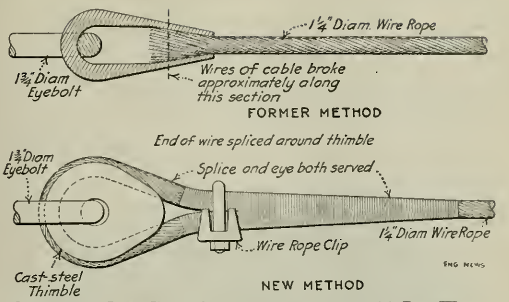
This principle of construction has been used by the same company for a long time in building oil derricks, but only recently has been applied to a concreting tower. The new tower is being made in sizes of 4 ft. to 5 ft. clear width of hoistway, and in any height. The sections are 7½ ft. high, except that guides and ladder are put on in 15-ft. lengths. The adjoining sketch shows the construction clearly. At the top of the tower a 10-in. channel on each of two opposite faces of the tower, taking the place of the regular strut, furnishes a support for the sheave beams. The top frame can be connected at the end of any tower section in place of the horizontal struts and the succeeding tower section.

A single tower section weighs about 500 lb. and the base section (base spread to 15-ft. length) weighs 800 lb.

Cable Socket Break and New Type of Cable Connection—The breaking of a 1¼-in. wire rope cable socket on the U. S. seagoing suction dredge "New Orleans" a year ago, as described by Maj. E. H. Schulz in "Professional Memoirs," Sept.-Oct., 1914, led to the design of a new cable attachment which is now used. Two 1¼-in. ropes hold up the dredge arm. On Sept. 23, 1913, while at work on the outer bar of Southwest Pass, both these ropes broke at the sockets, dropping the dredge arm. In attempting to lift the arm there was a series of breaks of cables and of hoisting tackle as a result of which it was ten days before the arm was finally raised and secured again.

Two similar socket connections were tested at Tulane University. They broke at loads of 53,000 and 58,000 lb., although the initial stages of fracture occurred at 44,000 and 38,000 lb. respectively. The cable itself is advertised to have a breaking strength of 100,000 lb., but a piece tested with leaded end connections broke at 89,000 lb., the first stages of fracture occurring at 63,000 lb.

As a result of the accident to the dredge and the tests, the socket connection was concluded to be undesirable and a spliced-in eye connection was employed. (See sketch). The cable is spliced around a thimble, the splice served with wire, and the end of the loop close to the thimble held by

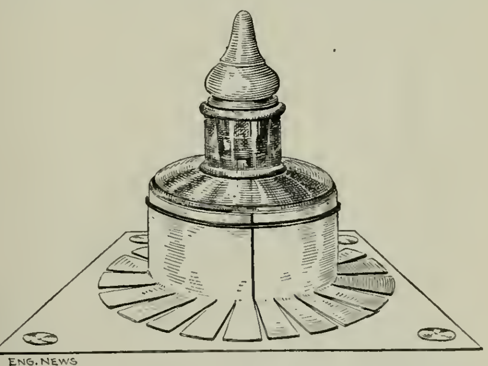


OLD AND NEW END CONNECTIONS FOR 1¼-IN. WIRE ROPES HOLDING DREDGE ARM, U. S. SUCTION DREDGE "NEW ORLEANS"

a Crosby clip. The old method of connection is described as follows: The ends of the wire were passed through the socket; served inside the socket with wire; end unlaced; heart taken out; ends of wire bent over into the socket; and spike driven into the heart. The ends were then seized together and pulled into the socket with the tackle. After the end was pulled in, the socket was poured full of Magnolia white metal and allowed to cool. The new eye connection has not been tested so far as reported.

A Simple Ink-Bottle Holder—An even simpler ink-bottle holder than that described in this department on May 28, been called to mind by a correspondent.

First wrap a piece of drawing paper around the bottle and hold in place by means of rubber bands. Then cut the projecting portion into strips. Next, bend the strips over



ANOTHER INK-BOTTLE HOLDER

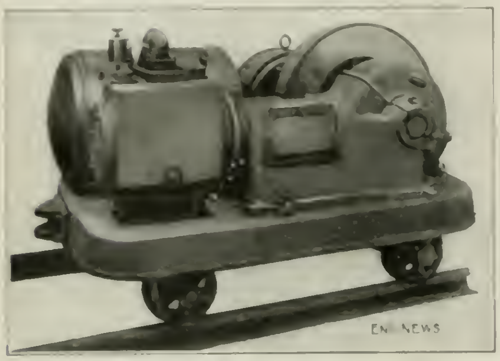
and paste on another piece of drawing paper, and fasten to the drawing board or drawing table with thumb tacks, as illustrated in the cut.

The disadvantage of immovability could be overcome by fastening to a block of wood ,instead of to the drafting table.

How to Turn a Revolving Shovel in a Small Space—The ordinary method of turning a revolving shovel around in a cut is generally a rather lengthy process of backing and filing. A much quicker and simpler method is given below, but we do not recommend this unless the operator is pretty sure of himself. Suppose it is desired to make a right angle turn to the right. Swing the shovel until the boom is over the steering axle wheel, the opposite way from the direction in which it is desired to move. Drop the dipper to the ground, then thrust down with the crowding engines and at the same time propel ahead. This will raise the front wheels off the ground. The hog rods will probably be slack at this time. Then swing. This will slue the rear wheels. By repeating this two or three times, a right angle turn may be effected. Another method which is often practiced when it does not seem advisable to slue because of the condition of the ground or other reasons, is to slip fishplates under the front wheels, with the flanges pointing in the direction in which it is de-

[illegible] to turn the shovel. Propelling the shovel against these flanges will cause the wheels to slip on the plates and turn in the proper direction. [The "Excavating Engineer" for July, 1914.]

A Portable Electric Compressor Unit for mines and industrial plants where tracks are laid is shown in the accompanying figure, as developed by the Sullivan Machinery Co., of Chicago. A rugged design of compressor is mounted on a bedplate casting together with a 1?-hp. motor, storage tank and starting rheostat. The bedplate forms the truck.



A PORTABLE ELECTRIC COMPRESSOR UNIT

Storage Battery Emergency and Construction Car—The accompanying figure shows one of four emergency, wrecking and construction cars built by the Field Omnibus Co., of New York, for the Havana Central R.R. The cars will operate from the overhead trolley on certain sections of the line and from storage batteries where there is no overhead construction. The battery (a 2?0-cell Edison nickel-iron) may be charged directly at trolley voltage. The speed on trolley current is ?? miles per hour, and 20 on the batteries; 70 miles run per charge was guaranteed and reported exceeded by [illegible]. A hoist motor and air compressor are operated by

STORAGE BATTERY EMERGENCY AND CONSTRUCTION CAR

battery current. For propulsion, there are two [illegible]-hp. motors, [illegible] [illegible] [illegible] the Pennsylvania R.R. The car is not intended as a locomotive, [illegible] grade, running [illegible].

A Special Pipe Cutter and Die Stock is [illegible]

A Rivet Buster, to be used in place of a rivet set with a pneumatic riveting hammer, has recently been brought out by the Ingersoll-Rand Co., of New York City. This is a small chisel with the socket end shaped, as with the rivet set, to be held in place by a safety spring.

Highway Notes

Kinds of Road Construction in New York State—Since May, 1913, the New York State Highway Department has placed under contract a total of 1003.12 miles of highways. These contracts are made up of the following mileage under different types of construction:

Waterbound macadam	266.90
Waterbound macadam, hot oil	10.87
Waterbound macadam, cold oil	10.[illegible]6
Bituminous macadam	3[illegible]2.31
Concrete	217.13
Concrete, bituminous top	8.31
Brick	90.[illegible]3
Asphalt block	6.83
Stone block	1.[illegible]3
Other types	19.22

Combination Concrete Storm Drain and Road—A method of taking care of the semi-annual runoff of large volumes of water by building a concrete trough 24 ft. wide and 12 in. deep, which serves as a drainage ditch in wet weather and as road in dry weather, has proved both economical and efficient, in a ranch section about 15 miles from Los Angeles, Calif. The pavement surface is a flat slab 24 ft. wide and 4 in. thick. The concrete curb is 12 in. high, 12 in. wide at the base and 5 in. wide at the top. At road intersections the curb flares out like the edge of a saucer. Transverse expansion joints are placed every 25 ft. The pavement surface is covered with Ott 95% wood oil spread ½ gal. per sq.yd., over which is sprinkled sand and crushed stone. The combined road and drain is 4500 ft. long and cost $1.05 per sq.yd. for the pavement and 30c. per lin.ft. for the curb. F. H. Joyner was engineer and the Davidson Construction Co., of Los Angeles, the contractor. [Information from the September issue of "Western Engineering."]

The Economy of Road Machinery—Many townships in Illinois have chosen to do all road grading and leveling with a heavy power machine and leveler. Such equipment has proven quite satisfactory for heavy grading work, but a little expensive for leveling work. Experience shows that the cost of running a tractor and leveler, including helpers, is from $12 to $1? per day, exclusive of the heavy depreciation and interest on the investment, which may vary from $?00 to $700 annually. Assuming that the tractor outfit will cover 15 miles per day, and that it is used by the average township 40 days out of the year, it would cost between $2 and $3 per mile for maintenance work, which is about double the cost of maintenance work with the ordinary drag. However, if the same equipment could be used for six months in each year, the outfit would be much more efficient and would probably not have as high an annual depreciation, as a more competent operator could be secured for this length of service. This, therefore, would indicate that such equipment should be owned by the counties, and leased to the townships and districts at actual cost, rather than all individual townships buying such equipment. [R. H. [illegible], Assistant Engineer, Illinois State Highway Department, in July issue of "Illinois Highways."]

Some New York State Experience with Tar-Covered Concrete Roads—Many miles of concrete road construction exist in the vicinity of Syracuse. These roads are of more than local interest and are being observed by road builders in different parts of the country. It is worth while here to explain that the wearing surface of these roads is a [illegible] of tar and stone screenings, sand or fine gravel. This cover has not as yet yielded perfect results. The idea in placing it is to obtain an economical wearing surface which can be easily repaired at a low expense, while the real body and foundation of the road remain practically permanent. Experience in the past two years has shown that it is difficult to get this cover to adhere perfectly to the concrete. It wears off in spots and in others is unable to take the wear [illegible]. During the present summer several miles of these [illegible] have been repaired, and if the appearance of the work is any criterion, it seems that the patches will give good service. It also seems probable on account of the [illegible] of [illegible] that the first cover can be applied with the expectation that about one-half of it will come off the first season, requiring patching the following year and still be an economical proposition. The aim of our experiments, however, is to be able to apply this cover so that the first application will require only occasional repairs.—Chas. I. [illegible], Assistant Engineer, New York State Highway Department, in August issue of the "New York Highway News."

Editorials

The River and Harbor Bill

The searching criticism of the River and Harbor Bill by Senator Burton, of Ohio, referred to in our last issue, finally caused the Senate on Sept. 21, to refer the $53,000,000 bill back to the committee with instructions to report a new bill carrying appropriations of not more than $20,000,000, thus saving on this one appropriation bill alone substantially a third of the amount necessary to offset the deficit in the government's revenues due to the war abroad.

There need be no alarm that the interests of the country are to suffer and that necessary river and harbor work is to be suspended because of this sweeping cut in the River and Harbor Bill, for as Senator Burton showed, in his masterly review before the Senate, there is a large amount of money still available from previous years' appropriations with which river and harbor work can be prosecuted.

The unexpended appropriations for river and harbor work on June 30 last amounted to the sum of $45,338,000. In addition to that, the sundry civil appropriation bill, approved on Aug. 1, provided $7,000,000 additional. Thus there is over $52,000,000 of money available for river and harbor work this year without passing any appropriation bill at all. This is far more than the amount which has been expended in any year on river and harbor work. In 1912, the total expenditure on rivers and harbors was in the neighborhood of $33,000,000. In 1913, it was about $38,000,000. If then, the River and Harbor Bill of this session passes carrying appropriations of $20,000,000, there will be $72,000,000 available for river and harbor work in the treasury, or enough to carry the work onward for two years at the same rate of progress as in the year 1913. On the face of these figures there can be no question that the government is providing sufficient money for river and harbor improvement to carry on all works that can be justified on the ground that they render a public benefit proportionate to their cost.

Bringing Spanish-American Students to United States Engineering Schools

A correspondent in last week's issue., discussing the prospects for American engineers and manufacturers in South America, suggests that a large proportion of the young men from the wealthy families of Argentine finish their education in the schools and colleges of France and traced to this influence the tendency in Buenos Aires to give preference to French styles of architecture and French methods of engineering work.

It is well known that South America has been always more closely in touch with Europe than with the United States. The similarity in language and in customs has something to do, doubtless, in attracting South Americans going abroad for an education to the Continent, rather than to the United States. To those who are to study engineering, however, there can be little doubt that the training they could obtain at a first-class engineering school in the United States would be much more valuable than that given in European schools. These naturally follow European practice and methods which are not as well adapted to American conditions as practice in the United States. Besides this, the advantage to Spanish-American students in studying engineering and acquiring a command of the English language is an advantage of great importance, since it makes available to them the largest volume of professional literature.

It would seem well worth while for American engineering schools to make a distinct effort at this time to attract students from South and Central America. Engineers who obtain their education here and become familiar with American methods and commercial customs, will be much more apt to use American methods, materials and machinery on their return to their native land to take up actual work, than they would had they been educated in Europe. It is true that in the past a considerable number of Spanish-American students have come to some of the American engineering schools, notably to Rensselaer and to Cornell. As far as we are aware, however, no special effort to bring students from foreign countries to the United States has ever been made, and it would seem well worth while for some of our leading schools to seek coöperation with the newly organized Bureau of Foregn Trade, in order to make their facilities and the advantages they offer more widely known in the countries to the south. Nor need this effort to obtain foregn students, with a far look to the future of American trade, be confined to the New World. With the difficult conditions which may continue in Europe for some time to come, it should be possible to divert to the United States numerous students from Russia, China, South Africa, and other lands. China, indeed, is already sending large numbers of students here. The great favor in which the United States is held in China is partly the result of the work of our missionaries there, and also of our fair treatment of the Chinese nation in connection with the Boxer war indemnity. The latter especially has a most favorable influence upon the development of our future commercial relations with that vast country.

The Winnipeg Municipal Electric Plant

The valuable article published elsewhere in this issue describing the results obtained by the City of Winnipeg with its new municipal electric-lighting plant deserves the careful study of engineers interested in the current discussion concerning the possibility of American municipalities supplying their own citizens with electric current for lighting and power purposes.

The City of Winnipeg has built a hydro-electric plant which now develops 22,500 hp. and will eventually be increased to 100,000 hp., transmitting the current gener

ried 77 miles and distributing it to consumers at a maximum price of substantially 4c. per kw.-hr. Large consumers of power can obtain current at as low a rate as 1½c. per kw.-hr. One can imagine the popularity of the municipal plant with the citizens and the commercial interests of Winnipeg from the statement that no longer ago than 1905 the base rate per kw.-hr. for electric current furnished by a private company was 20c.

It is of interest to observe the financial situation of Winnipeg's great experiment in municipal electric generation and distribution. While the plant has the great advantage of generating electric-current from water power so that the item of fuel is eliminated, it has to stand the heavy capital cost due to the investment in the long-distance transmission line and also due to the fact that a large part of its plant has been constructed for the ultimate development of 100,000 hp. eventually to be furnished, while it has so far been operating with a maximum capacity of less than one-fourth this. Added to this is the necessity the plant has been under of building up and organizing its business to make it a going concern.

Notwithstanding these heavy handicaps, the Winnipeg plant for the fiscal year ending Apr. 30, 1914, showed a profit of something over $60,000, after paying all operating expenses and fixed charges. It has now reduced the accumulated deficit from the first two years of partial operation to only $82,000. The city is now enlarging its hydro-electric plant to develop 50,000 hp. If it can sell a fair proportion of this additional capacity, the enterprise should be placed on a very lucrative basis with the present rates to consumers.

Winnipeg experience is not without a certain bearing on the probabilities of success of the Cleveland municipal electric plant described in our issue of July 30 last. If Winnipeg can carry on this municipal plant at a profit, there seems good reason to believe that Cleveland can do the same. Reference to our description of the Cleveland plant will show that with the high fuel economy which the Cleveland plant is designed to secure, the cost of the coal burned per kilowatt of output is after all a very small proportion of the operating expenses and would be nearly offset, it is probable, by the much higher fixed charges on the Winnipeg plant due to the cost of the long transmission line and the water-power development.

The Harlem River Tunnel

The successful sinking last week of the last section of the tubes for the Harlem River Tunnel, on the line of the Lexington Avenue Subway, New York City, is an event of especial interest to engineers. As most of our readers are aware, this tunnel is being built by substantially the same process that was adopted in building the Michigan Central Tunnel under the Detroit River five years ago, and which was fully described in ENGINEERING NEWS at the time.

The process consists, in brief, of building successive sections of steel tubes somewhat larger in diameter than the completed tunnel, bracing them together, closing the ends of the tubes by temporary bulkheads so that they will float, sinking the sections one after the other in a trench dredged along the line of the completed tunnel, and filling with concrete, deposited under water through a tremie, the space below, around and over these steel tubes. The final step of the process is to pump out from the interior of the tubes the water which had been admitted when the tubes were sunk, and place a concrete lining inside.

The various details of the process were worked out with great care at Detroit, and the work was considered entirely successful from the point of view of practical construction. In building the Harlem River Tunnel, however, the contractors and engineers have had the advantage of the experience gained at Detroit and have facilitated the work by improvements in numerous particulars. The work at the Harlem River is easier than that at Detroit on some accounts as the depth of water is less and there is no current in the river at slack tides. There are, however, four parallel tunnels necessary for the Harlem River, as compared with the two at Detroit. The Harlem River Tunnel is much shorter than the Detroit tunnel, the width of the Harlem River between bulkheads being only 600 ft. Nevertheless, the successful completion of this second tunnel will give engineers renewed confidence in this system of constructing under-river tunnels.

One very important advantage of this system from the operating point of view over a tunnel driven with hydraulic shields is that the roof of the tunnel can be placed much closer to the bed of the river, thereby reducing the vertical distance which the train must descend in order to make the under-river crossing. The top of the Harlem River Tunnel structure is only 7 ft. lower than the original river bed.

Another consideration which appeals very strongly to engineers and contractors is the comparative security and certainty of the process. There is always more or less risk in driving tunnels under rivers with the hydraulic shield. The use of compressed air is almost invariably essential, and the pressures are apt to be carried so high that more or less cases of injury to workmen occur, which under the present Employers' Liability Laws mean a very heavy bill of expense to the contractor. The rapid work possible with the system is illustrated by the fact that while the Harlem River contract was signed July 23, 1912, the contractors, the Arthur McMullen & Hoff Co., have sunk the last section, as noted above, have encased in concrete the four sections previously sunk and are placing the inside lining; the contract date for completion is early in 1916; but the work is already more than two-thirds done.

When the system was first proposed for the Detroit tunnel, there was much skepticism as to the possible risk in sinking the successive sections of the tubes, and as to other features in connection with the work. Experience at Detroit and at the Harlem, however, has now fully established that the claims of the able engineers who originated and developed this process were sound; and where the local conditions are such as to favor its use it will probably be largely adopted in the future in preference to work with the hydraulic shield.

The Wood-Preserving Industry and the Supply of Creosote Oil

The sudden reduction in the supply of creosote oil from Europe as a result of the war is a matter of much importance to the wood-preserving industry. A special report upon the situation has just been prepared by

Clyde H. Teesdale, of the forest products laboratory at Madison, Wis., under the Department of Agriculture. According to Dr. Teesdale's figures, there are in the United States 94 wood-preserving plants, with an aggregate annual capacity of over 300,000,000 cu.ft. of timber. These plants actually treated 153,000,000 cu.ft. of timber in 1913. About two-thirds of this timber was treated with créosote, and most of the remainder with zinc chloride. In round numbers, these plants used a total of over 108,000,000 gal. of creosote oil, of which about 42,000,000 gal. were produced in the United States, and about 67,000,000 gal. were imported, principally from Germany and England. The supply from Germany has been entirely cut off, and for a time the English supply was also interrupted. It is likely, however, that the English supply will be reëstablished, and it may even be increased, since the English producers will lose a part of their market elsewhere.

On the assumption that the foreign supply of creosote to the United States will be seriously curtailed, Dr. Teesdale points out that the output of the timber-preserving works can be maintained either by adopting the zinc chloride instead of the creosote process of treatment, or by using the so called "empty-cell" process of creosoting, by which the consumption of creosote oil per cu.ft. is reduced to 5 to 7 lb. instead of 10 or 12 lb. It is also possible to use a mixture of creosote and zinc chloride, for which only about 3 lb. of creosote per cu.ft. of timber is required, and in fact, 8,000,000 cu.ft. of timber were treated by this combined process in 1913.

Other possibilities suggested by Dr. Teesdale are the use of creosote made from water-gas tar (most of which has hitherto been either burned or thrown away), the use of creosote and crude petroleum, the use of creosote made from wood tar, and the use of sodium fluoride. The last process has been experimented with successfully in Europe, and tests of ties treated with it are under way in the United States.

Another possible source of economy in creosote is reviewed by F. R. Church in an article published on another page of this issue, consisting in mixing refined tar with the creosote. This process, in fact, is already widely used.

Another factor which will tend to help out the wood-preserving situation is likely to be a falling off in the amount of timber creosoted. This will certainly happen should there be any large increase in the price of wood-preserving materials, but apart from that there will be probably in the coming year a comparative slackening in the demand for timber of all classes, on account of the falling off in construction work which is already apparent. Further, as we have already pointed out, the tendency of engineers will be to carry on their construction work at the lowest possible first cost, on account of the high interest rates likely to prevail, so that timber construction will be used in many cases without going to the expense of wood preservation.

The American railway-tie-preserving plants will probably continue with little slackening, as the work they are engaged on is necessary for regular railway maintenance. It is probable, however, that from English sources a considerable part of the deficit produced by the stoppage of German imports of creosote oil can be made up; and a falling off in the demand for preserving other classes of timber, with the use of some of the other processes suggested by Mr. Teesdale, will probably be sufficient to bring about an equilibrium in the industry.

Letters to the Editor

Graphite and Boiler Scale

Sir—Your issue of July 30, '14, contains an article on "Graphite Treatment for Boiler Scale" in which a good many claims are made for this method of removal of scale. The one which attracted my attention is that the graphite is noncorrosive and harmless. In this connection, I would like to refer you to the tests of boiler compounds made by the U. S. Government, under the direction of Lieut. Commander Frank Lyon. In the *Journal* of the American Society of Naval Engineers, November, 1911, p. 1080, he states: "Graphite is a scale remover for the same reason that hydrochloric acid is. That is, it corrodes the metal underneath the scale and frees the scale from the metallic surfaces." The tests referred to above extended over a period of years and should be authoratative.

The use of boiler compounds is at best a makeshift method and in permanent steam plants seems to be due to the false conception of many that eleventh hour cures are cheaper than other apparently more expensive installations for treating water outside the boiler. The waste of fuel is well known and the harmfulness of scale to the structural condition of the boiler does not need repetition here, but it seems a little strange that we have so little discussion of the scientific management of boilers. The ordinary boiler is designed to generate steam and is not intended to be used as a retort for chemical experiment.

P. M. LaBach.

Assistant Engineer, Chicago, Rock Island & Pacific Ry.

803 La Salle Station, Chicago, Aug. 30, 1914.

[Commander Lyon's tests were chemical-laboratory studies of certain chemical reagents which were being introduced to make boiler water alkaline or to render insoluble under heat the scale-forming constituents in feed water. The same experiments were applied to graphite though obviously it cannot act in either of these ways, being entirely a mechanical assistant. For instance, pieces of boiler plate were filed bright and immersed 2 in. for one and for 30 days in distilled water (200 c.c.) containing divers amounts of the various reagents—the latter being varied to find the anticorrosive concentrations. The tops of jars were left open for natural absorption of air and CO_2. Graphite not acting as a regeant, in spite of Commander Lyon's assertion that its nature is that of hydrochloric acid, yields no significant data under this experi-

[illegible]. Optimum conditions were present for stimulating corrosion of the iron samples. In a boiler there would prevail vastly different conditions, the lack of air, the changed chemical equilibria due to new temperature and pressure, the loss of initial bright iron surface to [illegible] contact with the carbon, etc., make it unsafe to prophesy from these studies as to what would happen in a boiler. Similar studies have "proved" that graphite and lampblack would be unmitigated evils in paint—but they continue to give at least fair protection where any oil paint would serve.

Commander Lyon made further accelerated and intensified tests of boiler compounds under more natural conditions in boiler tubes, but nothing was reported about graphite and indeed little vital information was to be expected if the action of graphite is mechanical and slow.

In regard to the general use of compounds in boilers referred to in the last paragraph of the above letter, we venture to suggest that it may be a question of economics. There is nothing holy about the inside of a boiler to forbid chemical action, and if it is cheaper to combine boiler and chemical tank it will be done. Experience seems to show that where there is present in the supply only 5 to 10 grains per gallon of scale-forming constituents, the separate water-treating plant can show no economy.—Ed.]

Bridges over the New York Barge Canal

Sir—In your issue of Sept. 10, 1914, you published a letter from Mr. John Reid, 17 Battery Place, New York City, with the heading "Boat Design Difficulties on the New York State Barge Canal."

In this letter, Mr. Reid criticizes J. A. Bensel, State Engineer and Surveyor, for not providing greater headroom under the fixed bridges that have been constructed over the Barge Canal under the authority given to him principally by Chapter 147, Laws of 1903.

It has been the privilege of the writer to serve under Mr. Bensel for the past three years, and I feel it my duty to explain to Mr. Reid that the above mentioned chapter provides: "All fixed bridges and lift bridges when raised shall give a clear passageway of not less than 15½ ft. between the bridge and the water at its highest ordinary navigable stage."

The funds available for this work do not provide a sufficient amount to place as many fixed bridges as are necessary. The cost of [illegible] bridges is therefore prohibitive.

The above mentioned law also provides a bottom width of 75 ft. and a depth of channel of 12 ft., where a new location has been made or where the old location was enlarged. These dimensions, however, apply only to the land line and affect about [illegible] of the total length of canal, the remaining part of the line being located in several river or lake channels where a width of channel of 200 ft. or more will be available for navigation.

The State of New York has authorized an expenditure of [illegible] for the improvement of the Erie, Oswego, [illegible] and Cayuga Canals, to accommodate barges of 1000 tons capacity. The canal that is now nearing completion under the able leadership of the present State Engineer and Surveyor will accommodate vessels of about 2000 tons capacity and it seems to me that this fact should be better known and appreciated by the public in general and by all naval architects in particular.

W. H. YATES.

Albany, N. Y., Sept. 17, 1914.

Lessons from Difficulties in Initial Operation of High-Tension Transmission Lines

Sir—Referring to the article by F. G. Allen on "Difficulties in Initial Operation of 110,000-Volt Transmission Line," in your issue of Aug. 20, the author is entitled to the thanks of the profession for furnishing information on details too frequently omitted from the published accounts of such construction. It would be of great assistance to the designers of transmission lines if more publicity were given to the actual results obtained in service.

Although the relative value of some of the details of construction is difficult to ascertain, such information is very greatly to be desired. A detail which gives entire satisfaction in service is well worth an excess of cost over that of a somewhat unsatisfactory detail. This feature was evidently given consideration, since it is stated by the author that two ground wires were used, and that the structures were heavier than many of those heretofore installed. Further, it would appear, from the lack of insulator failures, that the two ground wires have presumably given adequate protection to the line. However, it would be of interest to know whether, other conditions being equal, the line with two ground wires has had less failures during a given period than neighboring lines with but one ground wire.

In case the power conductors are copper wires, with, in most localities, an indefinitely long life, it is possible that a greater ultimate benefit would be obtained for about the same original expenditure if one copper cable or a copper-covered cable were used as a ground wire, instead of, as has sometimes been the case, two galvanized steel cables.

It was probably not so intended by the author, but the inference might be made that suspension-type insulators were, per se, more desirable than pin insulators for the telephone wires. It would seem that the telephone wires could have been carried successfully on high-tension pin insulators, and by transposing them in every span, or in every few spans, that the inductive troubles should have been considerably reduced.

R. D. COOMBS,
Consulting Engineer.

[illegible] Church St., New York City, Aug. 21, 1914.

Sir—Answering R. D. Coombs' letter of Aug. 21, we beg to advise as follows:

It would hardly be logical to state that two ground wires afford better protection than one wire, as there is no other high-tension line paralleling the [illegible] line, and to compare the results of operation of this line with some other line would not be proper because of different local conditions. It might be interesting to note, however, that the [illegible] line has been struck by lightning three times, and the lightning in each case tripped the

insulators of their skirts, but when voltage was again placed on the line, the insulators stood up O. K. without puncturing. This would lead one to believe that the ground wires are not a perfect protection. However, we do not feel that we have compiled, as yet, sufficient data to speak of the absolute efficiency of overhead ground wires.

As to the question of using copper-clad cable for ground wires, or one copper-clad cable instead of two steel ground wires, such construction has been contemplated in view of the fact that the life of the ground wire should be the equal of that of the power conductors. On the other hand, the steel in the towers is only galvanized. There is no question about the life of the ordinary steel ground wire being greater than that of the towers themselves, and it is probable that during the life of any steel towers now constructed, more definite information will have been learned regarding the merits of overhead ground wires for lightning protection, the result of which may be the discontinuance of their use.

As to the last paragraph of Mr. Coombs' letter regarding the use of suspension insulators on the telephone lines, the suspension type of insulator was decided upon instead of a higher-voltage pin-type because the method of construction made it easier to make a change of this kind, and the additional advantage was obtained of being easily able to add a second suspension insulator should it be necessary to further raise the insulation of the line.

The telephone lines are transposed at each and every tower, but this only keeps down the voltage between the two wires and prevents unbalanced potential, and does not reduce the voltage induced between the telephone wires and the ground by the voltage on the power conductors. This induced voltage to ground under normal operating conditions is about 5600 volts, but is considerably reduced by the installation of drainage coils, specially designed for the purpose, between the telephone lines and ground. Tests made on the telephone lines under special conditions showed an induced voltage to ground of some 18,000 volts, and under surges set up by lightning or switching on the proper conductors, insulators on the telephone lines which were tested to 70,000 volts have punctured, as the drainage coils do not protect the equipment from steep-front oscillating waves.

CHAS. O. LENZ, Chief Engineer.
BY FRANK G. ALLEN, Secretary.

Georgia Ry. & Power Co.,
71 Broadway, New York City, Sept. 2, 1914.

NOTES AND QUERIES

Track Layouts at Stations (Correction)—In this article in our issue of July 9 there was an error in the 14th line of second column, page 57. Tracks (A) and (C) are kept clear, and not (A) and (B), as stated.

In the article on the "Irrigation Operations of Imperial Water Co. No. 1 for the Year 1913," published in our issue of Sept. 3, 1914, p. 495, the full address of Ray S. Carberry, Superintendent of the company, was not given. As many of our readers may be interested in securing from Mr. Carberry a copy of his complete report, we would advise that he is located at Imperial, Calif.

The Mountain Parks of Denver, Colo., are to be increased by the addition of 30,040 acres ceded to the city by the Federal government without cost to the city by a recent act of Congress which has just been signed by President Wilson.

Another Municipal Electric Plant Supplying Lighting Current at 3 cents per Kw.-Hr.

BY R. A. SARA*

In ENGINEERING NEWS, July 30, 1914, an article on "Cleveland's New Municipal Electric Plant," states that

Cleveland is the only city in the United States or anywhere else, for that matter, as far as we are aware, where a municipal electric plant furnishes electric current at a maximum rate of 3c. per kw.-hr.

Charles F. Roland, Industrial Commissioner of Winnipeg, population 210,000, has asked me to forward details of the Winnipeg municipal plant which, since October, 1911, has been selling electric current in Winnipeg at a maximum net rate of 3c. per kw.-hr. Large consumers buy power as low as ½c. net and commercial lighting is as low as 1¼c. net. The rate system may be outlined as follows:

SCHEDULE B: Residence Lighting, 3⅓c. per kw.-hr., subject to a net minimum monthly payment of 50c. per meter.

The city allows a discount of 10% on all bills paid within ten days.

SCHEDULE A: Commercial lighting, 3⅓c. per kw.-hr., subject to a net minimum monthly payment of $1 per kw. of total connected load, but in no case less than $1 net per month per meter. Prompt payment discounts: One year contract, 10%; three-year contract, 15%; five-year contract, 20%. Wholesale discounts on gross bills over $25 per month:

	Per cent. discount
For the first $25	None
For the second $25	20
For the next $50	25
For the next $50	30
For the next $50	35
For the next $50	40
From $250 to $500	50
Excess over $500	60

SCHEDULE E: Heating, 1c. per kw.-hr., subject to a net minimum monthly payment of 75c. per kw. total connected load, but in no case less than 75c. net per month per meter. (Where connected load is greatly in excess of maximum demand the city will install an automatic cutoff and base the monthly minimum charge on specified load at which the cutoff is set.)

Prompt payment discount, one-year contract 10%.

SCHEDULE C: Alternating-current power.

	Cents per kw.-hr.
First 50 hours per month use of total connected load	3⅓
Next 50 hours per month use of total connected load	2.5
Next 50 hours per month use of total connected load	1.9
Next 50 hours per month use of total connected load	1.4
Next 50 hours per month use of total connected load	1.1
Excess over 250 hours per month use of total connected load	0.8

Subject to minimum monthly payment of 75c. per hp. of total connected load but in no case less than $1 net per month per meter. Prompt-payment discounts: One-year contract, 10%; three-year contract, 15%; five-year contract, 20%.

Wholesale discounts apply on gross bills of over $100 per month.

	Per cent. discount
For the first $100	None
For the second $100	10
For the third $100	20
For the fourth $100	30
For the fifth $100	40
From $500 to $1000	50
Excess over $1000	60

SCHEDULE F. Direct-current power.

	Cents per kw.-hr.
First 50 hours' use per month of total connected load	3⅓
Next 50 hours' use per month of total connected load	2.5
Next 50 hours' use per month of total connected load	1.9
Next 50 hours' use per month of total connected load	1.4
Next 50 hours' use per month of total connected load	1.1
Excess over 250 hours' use per month of total connected load	0.8

*Sales Manager, City Light and Power Department, Winnipeg, Man.

[illegible] to a [illegible] monthly payment of [illegible] per hp. of [illegible] load [illegible] $1 net per month per [illegible].

Prompt payment discounts [illegible] contract [illegible] contract [illegible]

Schedule E applies where separate circuits are provided. The low rate, [illegible] ct., has encouraged electric cooking to such an extent that over 1000 electric stoves are in use.

The effect of the municipal service on electric rates in Winnipeg is thus shown:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Construction commenced in 1909 and operation in October, 1911. The generating station is situated at Point du Bois on the Winnipeg River, 77 miles from Winnipeg, where a 46-ft. head is available.* The total power available at the site is 100,000 hp. The original development included dams, forebay, head-gates, etc., for the full amount, but only 22,500 hp. capacity was installed. This is now being increased to 50,000 hp., and the remainder may be developed at any time by extending the power-house building and installing water-wheels, generators and transformers.

Current is transmitted to Winnipeg at 60,000 volts over a double-circuit aluminum-conductor steel-tower transmission line situated on a 100-ft. right-of-way. It is stepped down at the terminal receiving station to 12,000 volts and distributed underground to the substations located conveniently around the city.

The expenditure on the original development was as follows:

(1) Hydro-electric plant and generating station	$2,336,19[illegible] 60
(2) Transmission line and terminal receiving station	1,390,[illegible] 30
(3) Distributing system	2,012,7[illegible] 79
Total	$5,739,[illegible] 09

This has since been increased to $6,721,372.58 (April 30, 1914) by additions to the plant and extensions of the distribution system. Progress made may be summarized in part as follows:

Period	[illegible]	Kw.-hr. generated	Gross earnings	Net profit or loss
[illegible]	[illegible]	[illegible]		$[illegible] loss
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]			[illegible]

The plant was operated at a loss during the first year and a half because during that period the business connected up was not sufficient, at the rates prevailing, to pay all charges although 21,791 meters were connected at that time. The present low rates were made at the commencement of operation as it was realized that the lower the rates, consistent with cost, the quicker the load would be secured. It is safe to say that the deficit will be entirely wiped out of profits early in 1915.

The accounts are kept according to forms prescribed by the Public Utility Commission of the Province of Manitoba, which periodically audits the books and stipulates what provision shall be made for depreciation, etc. The financial statements have been approved by this Commission.

*Described in "Engineering News," [illegible] 1914.

INCOME AND EXPENSE ACCOUNTS WINNIPEG MUNICIPAL ELECTRIC PLANT FISCAL YEARS ENDING APR. 30, 1913, AND 1914

	1913	1914
Operating Revenues		
Domestic and commercial lighting and heating	$[illegible] 50	$512,[illegible]
Commercial power	71,[illegible] 59	218,643 [illegible]
Municipal street lighting	[illegible]	58,777 [illegible]
Municipal building lighting	[illegible] 35	6,[illegible]
Municipal power, water-works	61,[illegible] 27	59,[illegible]
Municipal power—miscellaneous	[illegible] 62	1,[illegible]
Tramway earnings	6,619.13	7,961.47
Accounts receivable	70,111.43	....
Total	$[illegible],736.03	$565,[illegible] 19
Operating Expenses		
Power	$2[illegible],616.7[illegible]	$28,732 36
Transmission and transformation	37,[illegible]73 81	45,[illegible] 34
Distribution	41,[illegible]69 76	37,861 [illegible]
Consumption	6,[illegible]17 14	9,[illegible]
Commercial	61,7[illegible]1 51	67,3[illegible]
General	17,[illegible] 15	22,7[illegible]
Tramway	17,[illegible]35 58	21,161 [illegible]
Undistributed	31,0[illegible] 47	2[illegible]
Contingencies, extraordinary		2,[illegible]
Depreciation	99,662 32	2[illegible]
Taxes	3,[illegible] 93	3,5[illegible]
Total	$347,717 40	$490,[illegible] 06
Net operating revenues	$197,01[illegible] 63	$37[illegible] 11
Nonoperating revenues	[illegible] 15	1,816 28
Income	$197,926.78	$377,039 41
Deductions from income:		
Interest on founded debt	$210,619 55	$270,681 08
Interest on floating debt	[illegible] 19	21,460 37
Deficit for year	$53,297.96	....
Surplus for year	....	$81,[illegible] 96
Applied to equipment and stores	....	21,675 35
Deficit, beginning of year	58,841.74	112,139 7[illegible]
Deficit, end of year	$112,139.70	$81,917.09

Annual Convention of the National Paving Brick Manufacturers Association; Inspection Tour of Brick Roads*

Two days of the annual convention of the National Paving Brick Manufacturers Association, held in Buffalo, Sept. 9-11, were devoted to automobile inspection tours over brick roads, both completed and in various stages of construction. As guests on these trips the Association had many city and highway engineers and professors of civil engineering from the Eastern States, where as a general thing brick country roads are rather the exception.

On leaving Buffalo to the southwest many brick-paved streets were inspected which had several years' service to their credit. From city streets the trip was continued on over brick country roads almost without a break.

Having seen several brick roads three and four years old, the party disembarked at State Road No. 5407, where a brick pavement 5.92 miles long is in the process of construction. This road is a good example of the highest class of New York State road work. This piece of construction includes several thousand feet of new alignment. The pavement is made 16 ft. wide on a 5-in. (minimum 5-in., 7-in. at center) concrete base, mixed 1:2½:5. The contractor is the Louis H. Gipp Construction Co., of Buffalo, and the brick used are of the wire-cut lug variety.

The accompanying illustrations show all phases of the pavement work but laying and rolling the brick. After the subgrade is prepared and rolled the stone and sand for the concrete are piled directly on it. Just the right quantities are distributed either side of the paver so

*For report of annual meeting see "Engineering News," Sept. 17, 1914, p. 600.

Construction Views of a First-Class Brick Road, New York State Highway Department. Hamburg, N. Y.

that the passage of the mixer uses up all the material, leaving the subgrade ready to receive the concrete.

The forms to support the concrete base and edging* consist of 10-in. channels, properly aligned and held in place by ½-in. round iron rods driven through holes in the flanges about every 3 ft. Between these 10-in. channels the concrete foundation is laid 5 in. deep, and then a 2x6-in. plank is laid on edge on the base, separated from the channel by 6-in. wood struts, which are knocked out as the work of filling progresses (Fig. 3). The plank and channel are held together by strap irons or brackets, which are quickly lifted off and the forms removed as soon as the concrete has sufficiently set.

Figs. 2 and 4 show the concreting in progress. After the base is struck off and given its proper crown by means of a board screed or float, it is smoothed with the implement shown in Fig. 5, which is a device worked up by the contractor. This consists of a sheet-iron disk, about 18 in. in diameter, with upturned or beaded edge. To the disk, about halfway between its center and its edge, is fastened a handle 8 or 10 ft. long by means of a universal joint. On the same diameter of the disk opposite the handle is a counterweight. Pushing the disk back and forth gives it a revolving as well as a sliding motion, which answers admirably for troweling.

Longitudinal expansion joints along the edging are provided, but no transverse joints. Each longitudinal expansion joint is 1 in. wide and is made by placing alongside each edging, wood strips with metal wedge pieces dropped over the tops of the boards, and between the board and the edging, every 3 ft.

Fig. 6 shows a steel sand spreader for smoothing and crowning the sand cushion; and Fig. 7 shows the first filling of the joints with a very wet grout, after which the pavement is gone over with a thicker grout, having the consistency of cream (Fig. 8), which is spread and worked into the joints with squeegees.

After the grouting has been completed and the joints filled flush with the tops of the brick and the grout sufficiently hardened so that the sand will not absorb moisture from the grout, a ½-in. layer of sand or gravel is spread over the pavement and kept moist for at least 10 days, to insure a proper curing of the grout. The bituminous filler for expansion joints is placed as soon as the grout has set, and within 36 hr. of the time when the grout was applied.

Leaving this piece of work the inspection party continued to Hamburg, where an opportunity was given to examine the [illegible] effects of transverse expansion joints in a brick pavement built in 1910. Further on, the resurfacing of a water-bound macadam road, built in 1907, was in progress. Here wire-cut-lug brick are being laid on a 5-in. concrete base, which is built on top of the old macadam.

The first day's trip was completed after a luncheon at the Roycroft Inn, East Aurora, by returning to Buffalo over a different route, which presented several excellent examples of recent brick-road construction.

The second day's trip was to the north, through Delaware Ave., Buffalo, to Niagara Falls. On this trip, also, much of the traveling was over brick pavements which had been in place from a few months to 20 years. In one continuous strip on the famous Niagara Boulevard is 17 miles of brick road, from the city line of Buffalo to the city line of Niagara Falls. This road cost $375,000 and is a splendid example of both repressed and wire-cut-lug brick pavement.

From the city of Niagara Falls the party continued to Lewiston and old Fort Niagara, returning to the International Hotel at Niagara Falls for lunch. Much of this road follows the famous old portage road of the French and Indian War period and is replete with historical associations. Long stretches of this road are also brick paved.

While the above itinerary probably would contain little new to city and highway engineers of the Middle West, where brick roads and street pavements have long been so favorably known, it was quite an education to many of the Eastern visitors. Buffalo and vicinity is probably as far east as brick country roads have yet been built on any very extensive scale.

*This [illegible] is illustrated in "Engineering News," July 9, [illegible]

The Creosote Oil Situation and the Treatment of Crossties*

By S. R. Church†

Statistics compiled by the Forest Service of the United States Department of Agriculture in cooperation with the American Wood Preservers' Association, show that approximately 40 million crossties were treated during 1913, an increase of about 20% over 1912, and an increase of 100% over 1908. Of these, approximately 25 million were treated with creosote oil. Those thus treated probably required between 60,000,000 and 70,000,000 gal. of oil, or approximately two-thirds of the total creosote oil consumed during 1913.

The production of creosote oil in the United States for 1913 was, roughly, 40,000,000 gal., or less than 40% of the total consumption; and the balance of the oil, over 66,000,000 gal., was imported from Europe, principally from Germany and England. It is evident that no imports of oil from Germany can be expected for some time, particularly as a specific embargo has been laid upon such shipments by the German Government, and shipments from England are by no means to be counted upon.

This situation lends peculiar significance to the discussion on wood preservation that occurred at the meeting of the American Railway Engineering Association, when the report of the Committee on Wood Preservation was presented. This committee has realized for some time that the supply of high-grade creosote oil such as they have recommended and specified as "No. 1 Creosote Oil" was limited and inadequate, and they have for a number of years been investigating the merits of the use of refined coal tar in creosote oil.

Prior to the publication of this report, definite information was difficult to obtain, although it was recognized that many roads had adopted this practice. It was estimated by von Schrenk and Kammerer‡ that 40% of all the creosote oil used at present in the United States was a combination of coal tar and distillate oil. In addition

*This statement of the war's effect on the supply, with special reference to the treatment of railway crossties, was furnished by the Barrett Manufacturing Co. at our request.—Ed.

†Manager, Research Department, Barrett Manufacturing Co., 17 Battery Place, New York City.

‡"Use of Refined Coal Tar in the Creosoting Industry," Proc. A. R. E. A., 191[illegible]

to this summary of von Schrenk and Kammerer, a report was presented and printed in the *Proceedings* of the American Railway Engineering Association, p. 1074, by the writer, on tests made in December, 1913, at the plant of the Pittsburgh Wood Preserving Co. In these tests a direct comparison was made on eight different kinds of wood, of ordinary coal-tar creosote oil of No. 2 grade and a special grade of creosote oil containing filtered coal tar, prepared to meet the following specification:

The oil shall be a pure coal-tar product, containing no crude tar.
Water shall not exceed 2%.
Specific gravity at 38° C. 1.06 to 1.10.
Insoluble in hot benzol, not over 2%.
Distillation by standard method:
Not more than 1% at 170° C.;
" " " 5% " 210° C.;
" " " 30% " 235° C.;
" less " 40 nor more than 60% at 300° C.;
" " " 60% at 355° C.
Viscosity at 100° C., not more than 25 sec. for 100 c.c

Analyses of average samples of the oils used throughout the tests were given as follows:

	Regular Oil	Special Oil
Specific gravity at 38° C.	1.049	1.078
Water, per cent	0.30	0.30
Free carbon, per cent	0.31	1.00
Viscosity (100 c.c. Engler)		
at 60° C. (140° F.) sec.	25.5	28.6
at 100° C. (212° F.) sec.	23.8	24.4
Retort distillation:		
Total to 170° C., per cent	0.0	0.0
" " 200° "	1.7	1.5
" " 210° "	4.8	4.3
" " 235° "	37.8	28.7
" " 270° "	62.9	49.5
" " 315° "	76.3	59.4
" " 355° "	91.8	73.2

From the results of these tests it was determined that equally good penetration could be obtained with the special oil as with the regular oil under the same conditions of treatment, both by full-cell and empty-cell processes; the only difference was that the oil in the cylinder was maintained at an average of 15 to 20° higher during the treatment with the special oil.

If this discussion was pertinent and interesting to the railroads when presented, it certainly becomes of much greater importance in the light of the present shortage of creosote oil. It is recognized that the oil used in the Pittsburgh experiments contained approximately 30% of filtered coal tar, yet. owing to the care with which it was prepared and the elimination of free carbon by filtration, the oil was scarcely more viscous at the temperature of treatment than a straight distillate oil, and not only penetrated the ties equally well, but left a perfectly dry and unobjectionable surface of the timber employed.

These results could not, of course, be duplicated by indiscriminately mixing crude tar with creosote oil; but as Earl Stimson, Chairman of the Committee on Wood Preservation, indicated in presenting his report, the committee may be expected before very long to prepare definite specifications for such a product, under which the railways may use such oil with economy.

In view of the urgency of the present situation, and particularly in view of the natural increase in the price of high-grade creosote oil, the railways operating treating plants might well consider anticipating such a recommendation from the committee, and we have no doubt that the committee's experts, such as Dr. von Schrenk and Mr. Sterling, would be glad to recommend tentative specifications which might safely be used for all the work the roads might have.

Even should all the railways adopt this grade of oil there would still be a shortage; but conditions would certainly be very much relieved by such practice.

Sidelights on the Salem Conflagration *

The burning of 1600 buildings in Salem, Mass., in 13 hr. (June 25-26), devastating 253 acres of the business district at a loss of $14,000,000, is too important and too typical of like possibilities in other American cities to be passed over with a mere description of the damage, published immediately after the fire. No investigation was needed to discover that frame buildings are a continual invitation for this sort of disaster. One of the important recommendations in the bulletin is that the use of wood shingles be prohibilted in all districts of a city.

Knowledge that the old wrought-iron and cement water mains were weak restricted the manipulation of the water-supply, although these mains did not burst until after the fire had spent its force. The abundant water-supplies of Peabody, Danvers and Beverly were gingerly tied into the Salem system, resulting in a hydrant pressure of 10 to 20 lb.

It would seem that the long campaign for standard fire hose and hydrant connections throughout the country, so logically based, would have met success ere now; but, as usual, in a conflagration of this character, the fire apparatus of some of the surrounding towns was rendered impotent through inability to connect to the water system.

The gasoline-driven fire engine was shown to be more mobile than the horse-drawn apparatus, and to be able to carry sufficient fuel for such a demand, instead of having to requisition wood fences and box boards.

The second recommendation made in this bulletin is for the establishment of a modern and reliable water-supply under adequate pressure, and well distributed post hydrants with standard connections.

The final recommendation bears upon the out-of-date fire department of Salem, which maintained no adequate inspection bureau. It states the need for proper municipal housekeeping under the administration of a commissioner or a fire chief possessing modern ideas and with authority to maintain cleanliness; regulating the storage and use of inflammables; and compelling the proper automatic fire protection of all buildings endangering the public safety.

A Flood from a 7-In. Rainfall at Kansas City†

A local rainfall of 7 in. in 10 hours on Sept. 8 caused heavy damage at Kansas City, Mo. The storm sewers were entirely inadequate to handle the rainfall and many basements were flooded. Far greater damage, however, was done in Rosedale, Kan., and Armourdale, Mo., which were inundated by the rise in Turkey Creek. The damage is estimated at $1,500,000.

The drainage area of upper Turkey Creek comprises about 14,000 acres; lower Turkey Creek has a drainage area of 1088 acres. The discharge of Turkey Creek at flood stage is about 28,000 sec.ft. It is practically the only outlet for the district and overflows at a low stage

*Notes from a recent bulletin of the National Fire Protection Association, 87 Milk St., Boston, Mass., by Franklin H. Wentworth. The bulletin may be purchased from the Association for 10c. per copy.

†Information furnished by Murray & Hamilton, Consulting Engineers, 920 Walnut St., Kansas City, Mo.

because the channel is small and crooked and has been further restricted by the construction of overhanging buildings resting on piles, and by the erection of numerous low, narrow railway bridges. Probably four-fifths of its drainage area is steep rocky hillsides.

Some of the bridges crossing the creek are of steel and some of reinforced concrete, but many are timber trestles, with bents spaced 16 ft. c. to c., which prevents the passage of any driftwood coming down the creek at flood stage. Most of the buildings which encroach upon the creek channel were carried away by the first rush of water or collapsed when their supports were washed out, adding to the wreckage in the channel and tending to dam it. Lumber from a lumber yard and wood poles from a supply yard of the Kansas Home Telephone Co. were added to the wreckage in the creek.

At the Terminal yards, just east of the Kaw River, the miscellaneous drift piled up against the bridges crossing the stream at that point, carrying away some and shifting others out of alignment.

The wide timber trestle at the mouth of Turkey Creek, which carried the Santa Fé feed tracks to the stock yards, was wrecked, leaving only a couple of tracks spanning a gap approximately 150 ft. wide.

Neither the machinery nor the settling basin of the pumping station, which lies in a bend of Turkey Creek and back about 1000 ft. from the Kaw River, was damaged.

The levees also were damaged. The first break occurred about 400 ft. upstream from the Kansas Belt bridge, and was 110 ft. across and about 35 ft. deep, extending into the Santa Fe yards approximately 200 ft. This break occurred where the Santa Fe had placed a 3-ft. storm sewer through the levee, and had evidently not tamped the back fill properly. Several strings of box cars standing on the track at this hole were washed downstream.

A hole, about 60 ft. wide and 30 ft. deep, was washed at each side of an abutment of the Belt bridge, which is $4\frac{1}{2}$ ft. lower than the levee grade. About 200 ft. downstream from the bridge another break occurred, where a 12-in. sewer extended through the levee. The hole washed here was about 200 ft. wide and 35 ft. deep. Several cattle cars were washed away and the cattle drowned.

F. H. McNeel, Chief Engineer of the Kaw Valley Drainage District, estimates that more than 35,000 cu.yd. of earth will be required to repair the damaged levee, exclusive of the filling required for the holes back of the levee. The levee was not designed to withstand any [illegible] from the rear.

The Kaw River rose more than 10 ft., and had an estimated velocity of 7 ft. per sec. All railways from the southwest entering Kansas City were tied up, except the Chicago, Milwaukee & St. Paul Ry., and the Strang Electric line. The Chicago, Burlington & Quincy R.R., and the Atchison, Topeka & Santa Fe Ry., both had several miles of track washed out about Kansas City.

Turkey Creek has long been subject to destructive floods. There are three solutions to the problem: (1) Straightening the channel and diking along the creek; (2) constructing a reservoir for the excess water; (3) re-routing the creek to a cut-off at the lower end of the upper district, through Gladstone Heights, and extending [illegible] Creek sewer to the Kaw River, and diverting the lower Turkey Creek basin into this sewer by means of a large storm sewer.

The crookedness of the present channel, the value of the adjoining land, the necessity of raising the Terminal yard through which the creek flows, and the lack of a site for a reservoir, make the first two solutions impracticable. The third was suggested by L. R. Ash, a former City Engineer of Kansas City, who recommended the diverting of a part of Turkey Creek through a tunnel which emptied into the Kaw River, approximately 100 ft. south, or upstream from the Fifth St. Bridge. The distance from the mouth of the natural course of the creek, measured up the river, is 6200 ft.; measured down along the natural course of Turkey Creek, it is 10,000 ft.

NEWS NOTES

Washouts at Eagle, Stoughton, Hanover, Broadhead and Gratiot, Wis., from heavy rains on Sept. 14 interrupted traffic on the Chicago, Milwaukee & St. Paul R.R.

A Scaffolding Collapse in the Cross Keys Moving Picture Theatre, under construction in Philadelphia, Penn., on Sept. 9, injured five workmen who fell to the basement, 65 ft. below.

Lightning Struck Steel Oil Tanks near Ringling, Okla., recently. The subsequent fire destroyed 20 tanks, of which seven were of 55,000-bbl. capacity. About 600,000 bbl. of crude oil were stored in the tanks, accumulated in great part since the European war.

A Water-Supply Conduit Failed in a Los Angeles water tunnel near Hollywood, Calif., on Sept. 8, killing one workman and injuring another. The accident occurred on the line between the San Fernando Valley at the lower end of the Los Angeles Aqueduct, and Hollywood, where the water-supply enters Los Angeles.

Broken Axle Caused Collapse of a Steel Railway Bridge—A train of six cars, traveling at high speed, was derailed by the breaking of an axle, at a steel bridge over Crum Creek, west of Woodlyn, Penn., on the Baltimore & Ohio R.R. on Sept. 21. The train plunged through the bridge. One passenger was seriously injured.

The Collapse of a Concrete Span of the Twelfth St. Viaduct being constructed over Mill Creek Valley, St. Louis, Mo., on Sept. 13, injured the superintendent of construction, two steel workers and two concrete workers. It is stated that the forms were being removed when the accident occurred. The collapsed section was [illegible] ft. long and it fell [illegible] ft.

A Freight Train Smashed a Street Car at a grade crossing five miles from Memphis, Tenn., on Sept. 1[illegible], killing nine persons and injuring 1[illegible] others. Just preceding the accident a freight train had cleared the street railway tracks and the crew of the car failed to observe that another train was following. The street car struck was being drawn by another car which escaped damage.

Air-Brake Trouble on a Train in the Phoenixville Tunnel of the Philadelphia & Reading Ry., near Philadelphia, on Sept. 21, stalled the train and filled the tunnel with gas and smoke. The enginemen and conductor of the Pottsville express were killed and [illegible] passengers were overcome by the gas. The train had been stopped about [illegible] yd. inside the tunnel on account of striking a workman on the tracks near the portal.

Collision with a Carload of Slag [illegible] caused the death of [illegible] persons and the injury of [illegible] on a Queen & Crescent passenger train, near Livingston, Ala., on Sept. 18. The engineman, who was killed, is said to have [illegible] the [illegible] signal at the block just preceding the [illegible] where the wreck occurred. It is thought that the switch had been tampered with. The train, composed of six [illegible], [illegible] day coaches, mail, baggage and express cars, left [illegible] shortly after midnight last night, a half hour late.

Two Sections of a Large Water Main Broke, in [illegible], Ohio, on Sept. [illegible], badly damaging the pavement and cutting off the water supply in the district for at least 12 hr. and flooding cellars and the Pennsylvania R.R. tracks in the vicinity. Superintendent [illegible] stated that three or four days would be required to repair the damage. The situation was said to be further complicated by the fact that only one

f the reservoirs in Eden Park was available. Three reserve pumps were started almost as s en as the accident occurred and were of great assistance.

A Washout Caused a Severe Train Wreck on the St. Louis & San Francisco R.R., 2 miles west of Lebanon, Mo., on Sept. 15; 21 persons were killed and 18 injured. Heavy rains of the preceding week had swollen the streams in this vicinity to flood stages. In the heavy rain of the night before the accident, a 12-ft. fill crossing a gulley, on a curve, was washed out. Although it is stated that the train was not moving rapidly, it could not be stopped in time to save the locomotive, chair car and smoker from going over the structure. The four sleeping cars remained on the track.

Steamship Damaged by Fire While at Dock—A fire was discovered in the forward part of the Mall ry steamship "Neuces," at 8 p.m., Sept. 18, at Pier 9 of the Tietj n and Lang Dry Dock Co., Hoboken, N. J. Considerable wood was used in some reconstruction work involving th addition of a number of staterooms and it was this woodwork which burned fiercely. There had been no fire in the ship engine room for several days, and it is believed that the blaze started in the reconstructed section. Tugs towed adjacent ships beyond the danger zone. Water was poured into the ship until she settled several feet. The fire, however, was gotten under control. The "Neuces" was built in 1887.

A Ship Collision on the St. Lawrence River caused the loss of 14 persons on the Government steamer "Montmagny," which was rammed by the Black Diamond collier "Lingan," at 5 a.m., Sept. 18, in a fog at the Beaujeu Banks, 1 mi. below Crane Island, and 26 mi. from Quebec. The "Montmagny" sank in 3 min. The "Lingan" backed off leaking badly. She is of the same type as the "Storstad," which sank the "Empress of Ireland" in the St. Lawrence last spring. She is of 4338 tons burden and was laden for Montreal. The sunken vessel is a steel, twin-screw steamer of 1269 registered tonnage, owned by the Canadian Government and employed by the Department of Marine and Fisheries. She was built in 1909.

A Heavy Explosion in a 6-ft. Brick Sewer, on East 42d St., New York City, at 5:30 p.m., Sept. 22, blew off some 30 manhole covers, injuring fiv persons and causing damage to several b ildings by breaking windows. The heaviest explosion appeared to be in the vicinity of Third Ave., where three manhole frames and several square feet of the surrounding pavement were demolished. A trolley car standing near one of these manholes was badly splintered and three or four passengers injured. The manhole frames in at least two instances were entirely wrecked, and sections of asphalt pavement several feet square were thrown a number of feet away. The manholes are between the trolley tracks and next to the rails granite blocks were laid; these were thrown considerable distance and broke windows in nearby buildings. Flames followed the explosion, showing considerable quantities of gas. The sewer at this point is a brick-lined rock tunnel and to this fact is attributed the little apparent damage to the street. The bricklined manholes appeared badly cracked but at this writing an examination of the interior of the sewer had not been made. There were heavy explosions in this same sewer last July and again in August.

Divers Working on the "Empress of Ireland," in the St. Lawrence River, have recovered all the silver bullion and mails on the vessel. The mail sacks were sent to the Post Office Department, Ottawa. Diving work on this job has closed for the season.

The Pratt Bequest to the Massachusetts Institute of Technology, providing $750,000 for a school of naval architecture, practically has been allowed by the Massachusetts Supreme Court in indicating the way to be followed out of the technicalities upon which attempts to break the will were based.

The Three-Cent Fare Ordinance imposed by the city of Toledo on the Toled S reet-railway system (and resulting in a controversy noted in "Engineering News," April 16, 1914, p. 868) was d clared confiscatory and unconstitutional on Sept. 12, by Judge J. M. Killits in the U. S. Circuit Court. The city's expert accountants are reported to have admitted reduction of earnings below reasonable return. Pending n gotiations the 3c. rate will prevail during "workingmen's" hours, according to an earlier agreement.

The Substitute River and Harbor Appropriation Bill, passed by the Senate on Sept. 22, provides a lump sum of $20,-000,000 "to be expend d under the direction of the Secretary of War and the supervision of the Chief of Engineers for the preservation and maintenance of existing riv r and harbor works and for the prosecution of such projects heretofore authorized as may be most desirable in the interests of commerce and navigation and most economical and advantageous in the execution of the work."

The allotments to various works from the appropriations are to be made by the Secretary of War under direction of the Chief of Engineers and the amount allotted to work on the Mississippi below Cairo is to be expended under direction of the Mississippi River Commission.

Statistics of Accidents to Workmen in Ohio are made public by the Ohio Industrial Commission, reporting on the accident claims filed under the State Workm n's Compensation Act for the period from Mar. 1, 1912, to Dec 31, 1913. Referring to the number of employees covered by state insurance, 110,000 in number, the report states that during the year 1913, 13 industrial accidents occurred for every 100 employees exposed to risk, or one employee was injured for every eight exposed to risk. Of course, most of these were minor injuries, for which medical and hospital expenses are paid, but no compensation is allowed unless a loss of time of more than sev n days ccurs. During the year, four employees out of every 100 insured received compensation for loss of time on account of accid nts, or one in every 25 exposed to risk.

During the year, 16,544 accident claims were filed, of which 13,408 were allowed and 938 were disallowed, while 2198 were pending at the close of the year. Of the claims allowed, 40 were death claims, 2 were for permanent total disability, 302 were for permanent partial disability, 4787 were for temporary disability involving loss of time of more than seven days; 8277, or nearly two-thirds of the whole number, involved loss of time of less than seven days, and only medical and hospital expenses, not to exceed $200, were allowed. The total compensation allowed amounted to $378,-000, of which nearly $100,000 was for death benefits. The average death benefit awarded was $2510.

The Negative-Head Mechanical Water-Filter Patent Decision against Harrisburg, Penn., noted on p. 528 of our issue of Sept. 11, 1913, has been reversed by the United States Circuit Court of Appeals of the Third Circuit. The court declares that Harrisburg has not infringed either of the two patents involved: No. 644,137, dated Feb. 27, 1900, and Reissue No. 11,672, dated Jan. 28, 1898 (original No. 546,738, dated Sept. 24, 1895.) In its summing up the court said:

> However, it is probably enough to say that (at the best) the evidence in behalf of the company leaves us in much uncertainty whether the theories of the patents are sound. We do not feel bound to go the length of declaring the patents invalid—the re-issue patent, indeed, has already expired, leaving the patentee only a claim for royalties—but we are prepared to say that while the subject is so surrounded by uncertainty the company cannot reasonably object to the application of a test that tries the Harrisburg filters by the theories of the patents.

The suit was originally brought in 1908 by the New York Continental Jewell Filtration Co., 15 Broad St., New York City. There appeared as expert engineers in behalf of Harrisburg, James H. Fuertes, Geo. W. Fuller and Allen Hazen, of New York City, and in behalf of the plaintiff filter company Geo. A. Johnson, of New York City, and Profs. Wm. P. Mason and James M. Caird, of Troy, N. Y. Various filter-manufacturing companies (licensees of the plaintiff) assisted in the suit against Harrisburg and that city was aided by a number of water-works having mechanical filter plants, as stated in more detail in our issue of Sept. 11, 1913.

PERSONALS

Mr. W. D. Jones, formerly of Pittsburgh, Penn., is now Designer for the Broken Hill Proprietary Co.'s steel works at Newcastle, Australia.

Mr. Satoru Nishioeda, Chief Engineer of the municipal water-works of Tokio, Japan, is visiting in this country for the purpose of inspecting and studying water-filtration plants. Last week he was in Philadelphia.

Mr. Fred W. Johnson has been appointed Engineer of the Springfield (Mo.) Special Road District. All the work in the district is to be done by county labor under the supervision of the three Commissioners of the district.

Mr. Alex. E. Kastl, M. Am. Soc. C. E., Consulting Engineer, formerly Special Deputy State Engineer, New York State Barge Canal, Albany, N. Y., has moved to Nolan, Mora County, N. M., in connection with the development of land in that vicinity.

Mr. W. F. Monfort has resigned as Chemist of the supply and purification division of the St. Louis, Mo., water-works, in order to devote his whole time to private practice as Consulting Chemist and Bacteriologist, with offices at 706 North Van Zenter Ave., St. Louis.

Mr. C. E. Knickerbocker, M. Am. Soc. C. E., former Chief Engineer of the New York, Ontario & Western Ry. and re-

[illegible] Chief Engineer of the MacDonald Construction Co., New York City, has been appointed Cost Engineer, Division of Valuation, Interstate Commerce Commission, Washington, D. C.

Mr. David Van Alstyne has been appointed Assistant to the Vice-President of Operation of the New York, New Haven & Hartford R.R., with headquarters in New York City. Mr. Van Alstyne will be in charge of the test and store departments and of the handling of scrap, and he will have supervisory authority over the mechanical department in regard to organization, shop practice, approval of design, standards and requisitions.

Mr. Robert E. Kremers, Consulting Engineer, of Portland, Ore., has been appointed Chief of Highways and Bridges of the city of Portland, Ore., under Mr. Philip H. Dater, Assoc. M. Am. Soc. C. E., City Engineer. Mr. Kremers is a graduate of the civil engineering department of the University of Michigan, class of 1900, and for several years was Engineer of Bridges and Buildings of the Oregon Short Line R.R. at Salt Lake City, Utah.

Mr. J. H. Sanford, formerly Purchasing Agent of the New York, New Haven & Hartford R.R., has been appointed Purchasing Agent of the Connecticut Co., the Housatonic Power Co., the Berkshire Street Railway Co., the New York & Stamford Street Railroad Co. and the Westport Water Co. Mr. H. A. Fabian, Director of Purchases of the New York, New Haven & Hartford R.R. will have sole charge of that company's purchases. The appointment of an independent purchasing agent for the trolley companies is officially stated to be the last step in giving those companies a complete organization of their own, entirely independent of the management of the New York, New Haven & Hartford R.R. Mr. Sanford will make his headquarters in New Haven, Conn.

OBITUARY

J. A. McCague, Assistant Engineer, of Joseph T. Ryerson & Son, Chicago, Ill., was drowned while bathing on Aug. 16.

Prof. Charles Laden Adams, of the department of drawing of the Massachusetts Institute of Technology, died Sept. 17, at Antwerp, Belgium.

Henry Bratnober, a mining engineer, who prospected in many countries for the Rothschilds and Guggenheims, died Sept. 14, at his home in California.

Samuel McMurtie, a railway civil engineer of Denver, Colo., died Sept. 16, aged 57 years. He was born in Summit Hill, Penn., and was educated at Lehigh University. He was at various times a member of the engineering staff of the Denver & Rio Grande R.R., the Colorado Midland Ry. and the Southern Pacific Ry.

Edward Julius Hall, Assoc. Am. Inst. E. E., Vice-President of the American Telephone & Telegraph Co., died at Watkins, N. Y., Sept. 18. He was born at Perth Amboy, N. J., in October, 1853. Later his parents moved to Buffalo, N. Y., where he was educated in the public schools and at Sheffield Scientific School, Yale University, where he was graduated in 1873. He was identified with the telephone industry almost from the beginning and was the organizer of the local operating company in Buffalo, holding the offices of Vice-President and Manager. When the Buffalo company was taken over by the American Telephone & Telegraph Co. Mr. Hall became Manager of Traffic of the whole organization and devoted a large portion of his energies to the development of the long distance telephone business.

ENGINEERING SOCIETIES

COMING MEETINGS

INTERNATIONAL IRRIGATION CONGRESS.
[illegible]

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
[illegible] New York City.

NATIONAL COUNCIL FOR INDUSTRIAL SAFETY.
[illegible] Continental Bank Building, Chicago.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
[illegible] Convention at Los Angeles, Calif. [illegible] Chicago, Ill.

INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS.
[illegible] Annual convention at New Orleans. [illegible]

AMERICAN GAS INSTITUTE.
Oct. 20-23. Annual meeting in New York. Secy., George G. Ramsdell, 29 W. 39th St., New York City.

AMERICAN ROAD CONGRESS.
Nov. 9-14. Atlanta, Ga. Permanent headquarters, American Highway Association, Colorado Building, Washington, D. C.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 6-9. Annual meeting at Boston, Mass. Secy., Charles Carroll Brown, Indianapolis, Ind.

NATIONAL MUNICIPAL LEAGUE.
Nov. 17-21. Annual meeting at Baltimore, Md. Secy., Clinton Rogers Woodruff, North American Building, Philadelphia, Penn.

AMERICAN PUBLIC HEALTH ASSOCIATION.
Nov. 30-Dec. 5. Annual meeting at Jacksonville, Fla. Secy., Prof. Selskar M. Gunn, Massachusetts Institute of Technology, Boston, Mass.

Northwestern Road Congress—The states participating in the 1914 Congress to be held in Milwaukee, Wis., Oct. 28-31, are Wisconsin, Illinois, Michigan, Iowa, Minnesota, North Dakota and South Dakota. A brief review of the status of the highway problem in each state represented will be presented by the highway commissioner of that state. Among the subjects for discussion are the following: "What Responsibilities Should be Placed on the County Engineer or Commissioner?" "What Should be the Salary and Tenure of Office of the County Engineer?" "When Should Highway Work be Let by Contract and When be Done by Day Labor?" "What is the Best System of Inspection for Contract Road and Pavement Construction?" One of the sessions will be devoted to the characteristics of types of roads, and here brick, concrete, bituminous, gravel and macadam roads will be discussed. At another session, the relation of good roads to the health and prosperity of a community will be considered. Further information may be obtained at 71 Sentinel Bldg., Milwaukee, Wis.

American Society of Municipal Improvements—The 21st annual convention of the Society will be held at the Hotel Somerset, Boston, Mass., Oct. 6-9. On the opening day, the Committee on Standard Specifications will meet with the various subcommittees, wood-block, brick, bituminous, asphalt, concrete, stone-block, broken-stone and gravel roads, and sewers. Among the papers to be read are the following:

"The High-Temperature Incinerating Plant at Savannah, Ga.," E. R. Conant, Chief Engineer, Savannah, Ga.; "Sewage Disposal, Preliminary Investigations Required," E. A. Fisher, Rochester, N. Y.; "Converting an Old Septic Tank into a Modern Two-Story Tank," Alexander Potter, New York City; "Economics of Sewage Filters," George W. Fuller, New York City; "Experimental Sewage-Disposal Plant of Brooklyn," George T. Hammond, Engineer-in-Charge; "Permanent Sediment Records of Water and Sewage," George C. Whipple, New York City; "Limitations of Water Filters," George W. Fuller; "Street Paving and Repairs," J. H. Sullivan, Boston, Mass.; "Sidewalks and Curbs," Harry S. Harris, Trenton, N. J.; "Sewer Construction and Maintenance," E. S. Rankin, Newark, N. J.; "Bleeding and Swelling and Longleaf Pine Paving Blocks," C. H. Teesdale, Madison, Wis.; "The Effect of Leaking Illuminating Gas on Bituminous Pavements," George C. Warren, Boston, Mass.; "Concrete Highways," George W. Meyers, Columbus, Ohio; "Napped, Recut and Grouted Granite-Block Pavements," William A. Howell, Newark, N. J.

The Secretary is Charles Carroll Brown, 702 Wilson Bldg., Indianapolis, Ind.

Western Society of Engineers—The first meeting of the season was held at the Society's rooms in Chicago, Sept. 14, with President E. H. Lee (C. & W. I. R.R.) in the chair. A paper on "Permeability Tests on Gravel Concrete" was presented by Morton O. Withey (University of Wisconsin). The use of rich mixtures and fine cement gave best results, and a very wet consistency increases the rate of leaking in a lean mixture. The proportioning and grading are important and a 1 : 1½ : 3 mix is very impervious. By grading the sand and gravel in accordance with Fuller's curve, it was possible to obtain watertight concrete of 1 : 9 proportions under pressures up to 40 lb. The tests related to gravel concrete, and did not cover the use of waterproofing compounds. In the discussion, F. H. Wilson (American Bureau of Inspection) mentioned tests of waterproofing floor slabs in which the best results were obtained without such compounds.

A paper on "Reactions in a Three-Leg Stiff Frame with Hinged Column Bases" was presented by N. H. Stineman (C. M. & St. P. Ry.). It included special formulas, the special application of which is in the design of reinforced-concrete frames of the type [illegible] such as bridge abutments which are now being built by some railways. The paper was of a mathematical character.

Engineering News

VOLUME 72 OCTOBER 1, 1914 NUMBER 14

An Ice-Breaking Train Ferry for Quebec

In the accompanying figures are shown the steamer "Leonard" just completed at Birkenhead, England, for the special service of transporting standard passenger railway trains or freight cars across the St. Lawrence River between Quebec and Levis at all seasons of the year. The weight of train to be carried is 1285 tons. The ferry has been designed so that the time taken in running the train upon the ferry, traversing the river (a distance of 2½ miles), and landing and coupling up the train will not occupy more than three-quarters of an hour. The particular features of interest in the design are: (1) the car deck which is raised or lowered through 18 ft., according to the stage of the tide; (2) the attachment of landing bridges to the ferry instead of to the shore houses; (3) the joints between bridges and car deck. The vessel is of the twin-screw type with a third ice-breaking propeller at the forward end. The principal dimensions are as follows:

Length overall	326 ft.
Breadth molded	65 ft.
Breadth over fenders	66 ft. 9½ in.
Depth molded	23 ft.
Mean draft	15 ft.
Speed (statute miles per hour)	15
I.hp., main engines	3200
I.hp., engines for ice propeller	420

The tidal deck is arranged above the main deck of the vessel and has 10 transverse girders, each end of which rests on a large nut which works up and down on a vertical screw, giving the deck the necessary range of action to suit the various conditions of tide. Three 272-ft. lengths of track are fitted on the tidal deck, each supported on lattice girders. The deck-lifting screws are hung from ball bearings supported on strong columns. These columns are stayed by lattice buttresses against fore-and-aft and transverse thrusts, while below the main deck a strongbraced strut is built, in way of each column, to distribute the load to the keel of the ship. The main deck and hull are strengthened by additional intercostals, etc., to insure sufficient strength to resist the stresses induced by the heavy loads on the tidal deck. The braced columns below the main deck also serve to carry the worm gearing for the deck-lifting screws.

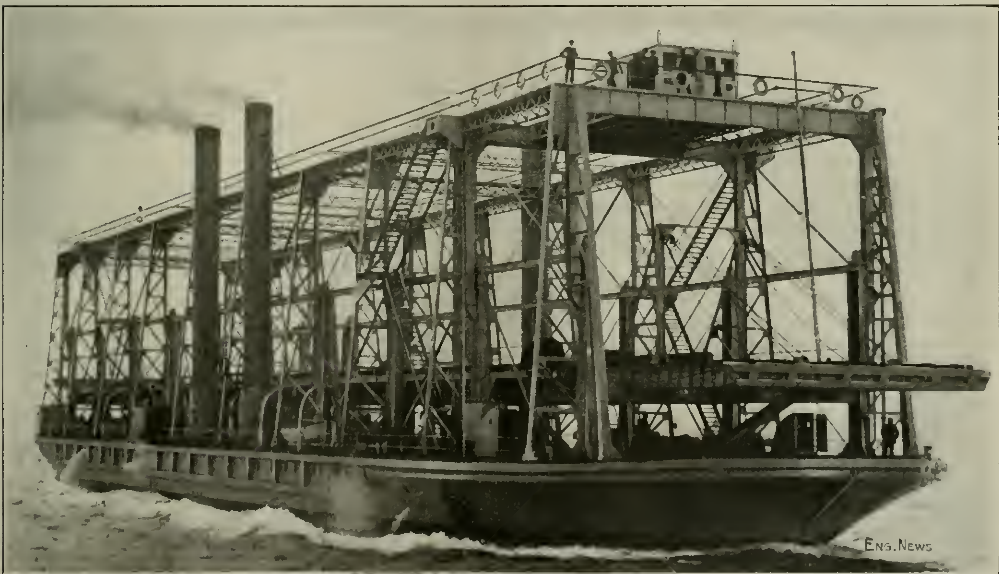


Fig. 1. Quebec Car Ferry "Leonard"

At each end of the tidal deck, an adjustable hinged gangway is suspended by means of treble purchases from struts fixed on the deck. These gangways are arranged, with ball-and-socket joints at the ends of each of the girders carrying the rails, to allow for any heel of ship or change of trim which takes place while loading or unloading the ferry. A special motor controls each gangway.

Above the highest position of coaches on the tidal deck,

Fig. 2. Longitudinal Elevation of Quebec Car Ferry "Leonard"

A promenade is arranged all round the vessel with a bridge platform, at the forward end, carrying a pilot house and chart room. The promenade and bridge are carried on lattice girders supported by the buttresses. Special arrangements are made to prevent any stress which would result from the bending moment on the hull being taken by the girders supporting the promenade.

The boiler rooms are arranged in wing compartments alongside with coal bunkers and tidal deck engine room between them. The main propelling engines are situated abaft the boiler rooms and the engines for the ice propeller are placed in the hold just abaft the fore-peak bulkhead. A special feed-water tank is built in the double bottom extending from bilge to bilge for a length of [illegible] frame spaces.

Accommodation is arranged for officers and crew on a flat below the main deck forward on both sides of the ship. Everything necessary for full day and night crews is provided.

The propelling machinery comprises two sets of triple-expansion engines. The shafts and propellers are made strong enough to withstand any stresses imposed by striking solid ice. The propellers are of nickel steel. The forward (ice) propelling engine is [illegible]. This pro-

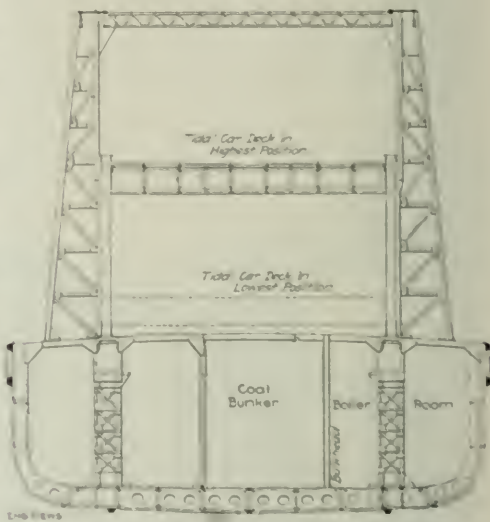


Fig. 5. Midship Section of Ferry "Leonard"

Fig. 4. Lift Screw and Nut [illegible] Train Deck Girder

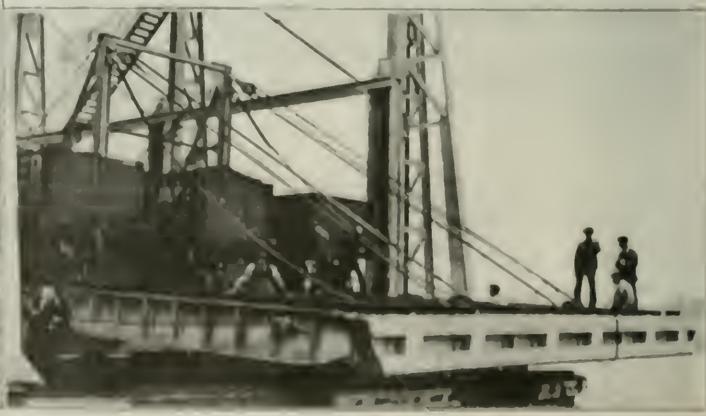


Fig. 3. Track Gangway of Train Deck; Car Ferry "Leonard"

peller runs idle in summer. The deck-lifting engine is a heavy high-pressure type driving a shaft athwartship through double helical spur gears. At each end of this second shaft, miter gears engage a fore-and-aft shaft on either side of the ship. These long shafts in turn work the deck-lifting screws by worm-gear connections. There is interposed between wheel and screw, however, a loose forged sleeve with sliding key. The lifting nuts in which the screws work are of heavy gunmetal, fitted into the train-deck structure.

The steamer is electric lighted. There is an electric winch with two winding drums fitted between girders of the tidal deck for hauling the carriages on or off the ship. Two powerful steam windlasses, one on each side of the ship, are fitted with slip drums for mooring.

This ferry was built to the order of the Commissioners of the Transcontinental Ry. of Canada, by Cammell Laird & Co., of Birkenhead. These details are presented by courtesy of the American agents, John Reid & Co., New York City.

The New York Rapid Transit Railway Extensions

By F. Lavis*

SYNOPSIS—The greatest engineering work in the world, measured by the amount of expenditure involved, is the extension of the rapid transit railway system of New York City. More engineers are now working on this great enterprise than on any other single work anywhere. The work is of interest not only in connection with the development of a vast transportation system; but because the tasks of construction involved are instructive to engineers engaged in a great variety of work. In order to present adequately the important features of this work for the benefit of the engineering profession, we have arranged with Fred Lavis, one of the highest authorities on tunnel construction in this country, to make a careful study of the entire work. Mr. Lavis has given much time to this task and has had the hearty coöperation of the members of the engineering staff of the Public Service Commission, whose courtesies and aid are freely acknowledged. The first of Mr. Lavis's articles is printed below and will be followed in succeeding issues with additional articles, each dealing with some special feature of this great work.

I—History and Extent

Extensions to the existing systems of rapid transit in the City of New York have been planned which will involve an estimated expenditure of \$366,000,000. The construction of these lines is now well under way and is being rapidly pushed forward at a rate which, it is hoped, will insure their completion by the end of the year 1917. The length of new line is altogether 110 miles, comprising 325 miles of single main-line track. These additions will make the total length of the completed system of rapid-transit railways in the city 230 miles, with 621 miles of single main-line track. The mileage of main-line track will thus be approximately doubled, though it is expected that the capacity for handling passengers will be increased threefold or fourfold.

The magnitude of this work may be at least partly realized by comparison of its cost with that of the Panama Canal, which, including the \$50,000,000 paid to the French, is to cost about \$375,000,000. This vast enterprise in the City of New York is progressing literally under the feet of its five million inhabitants and the other several millions of the adjacent territory whose business brings them frequently to the city, with hardly any notice or disturbance of the regular routine of business.

The cost is to be borne in approximately the following proportions partly by the city and partly by the two operating companies which will divide the territory between them.

City of New York	\$200,000,000
Interborough Rapid Transit Co.	105,000,000
New York Municipal Railway Corporation	61,000,000

The first of these two operating companies, The Interborough Rapid Transit Co., generally spoken of as "The Interborough," operates the present subway which traverses the length of Manhattan Island, reaching into the Borough of Bronx at one end and a short distance into Brooklyn at the other. It also operates the four lines of elevated railway in Manhattan and the Bronx, as well as the surface lines in those boroughs. The so called Steinway or Belmont Tunnel, running from 42nd St., New York, under the East River to Long Island City, was built about five years ago by interests closely associated with the Interborough but has never yet been utilized. It is now, however, to be finished, equipped and operated by that company, in conjunction with the other lines of its system.

The New York Municipal Railway Corporation is a company formed by the Brooklyn Rapid Transit Co. to finance and operate that part of this new system of railways which falls to its share. The Brooklyn Rapid Transit Co. is familiarly known as the "B. R. T." and both it and the New York Municipal Railway Corporation will be generally so referred to hereafter. It controls all the elevated and surface lines in Brooklyn including those which reach the famous ocean summer resort at Coney Island.

Heretofore, the operations of these two systems, the Interborough and B. R. T., have been almost exclusively confined to territories divided by the East River, the former to Manhattan and the Bronx on its west side, and the latter to Brooklyn and the Borough of Queens on the other side.

By the new arrangement, the B. R. T. gains an entrance into Manhattan by a new tunnel from the business center of Brooklyn to the lower end of New York, thence via Broadway and 7th Ave. through the center of the business and amusement districts to 59th St. Thence it turns eastward and crosses the East River on the Queensborough

*Consulting Engineer, 50 Church St., New York City.

Bridge to a connection with the proposed lines to Astoria and Flushing. It then reaches lower New York by a series of underground loops connecting the three lower East River bridges and the new tunnel just referred to, which will permit also continuous circulation of its trains instead of bringing them in as at present to stub-end terminals at the New York ends of the bridges.

The Interborough, besides a new north and south line in Manhattan, will reach the Borough of Queens and will have two lines to Astoria and Flushing from 42nd St., via the Steinway Tunnel. Its present line to Brooklyn is to be extended by two branches, each to a point some five or six miles beyond its present terminus at Atlantic Ave. into the residential section of that borough.

The Borough of Queens, comprising Long Island City, Astoria, Jamaica, Flushing, etc., which up to the present, has never been served by any so called Rapid Transit Lines, will now have the two elevated lines referred to which are to be operated jointly by the two companies, linked up to both the Queensborough Bridge, the Steinway Tunnel and the 2nd Ave. elevated, and thus connecting directly with all lines in Manhattan and other boroughs.

It is of some interest perhaps to note that many of the routes in Queens through Roosevelt Ave. is through

Fig. 1. Route of an Elevated Railway through a Cabbage Field in Queens Borough

a street not yet constructed and marked on the ground only by monuments, being now actually used for market garden purposes, as may be seen by the accompanying photographs, Figs. 1 and 2, which were taken looking along the center line of the street.

The Borough of Richmond (Staten Island) is eventually to be connected with the B. R. T. system by a tunnel under the "Narrows," the tidal channel connecting the outer bay with New York Harbor. This, however, does not form part of the present (proposed) scheme of construction.

As part of its system of records the Commission has had taken hundreds of photographs showing clearly the character of the streets and of each building adjacent to or near the proposed route, which might be expected to be affected in any way by the construction. This series of photographs is not only of great value for reference in case of litigation or claims for damages which might be due to the work in hand, but forms a unique and interesting historical record of the appearance of the city at this time.

Earlier History

The adoption of the present scheme and the consummation of the contracts under which the work is now going forward are the result of negotiations which have been carried on continuously almost ever since the completion of the present subway in 1904.

Almost as soon as operation of that line was started it was seen that the profits from operation were going to be much greater than had been expected. The public lost sight of the fact that when the contracts had been first proposed it was with considerable difficulty that anyone had been induced to accept them, and there was a great outcry, especially by the sensational newspapers, against the so called monopoly of the Interborough, and the alleged one-sided bargain with the city, and the demand arose that any future subways be operated as well as owned by the city.

Various forms of contract were therefore proposed, but none of them which required the use of private capital for construction was acceptable to bidders (see Eng. News, Mar. 10, 1910, p. 288 for a discussion of the so called Triborough route). Finally it was determined to start to build certain sections with the City's money, and contracts were let for the construction of part of the Fourth Ave. subway in Brooklyn, and the Centre St. loop in Manhattan, but no arrangement was made for their operation, nor was any made until the final agreement arrived at between the Public Service Commission, the City and the two operating Companies on Mar. 19, 1913.

The Public Service Commission, which succeeded the old Rapid Transit Commission, was appointed and took office in July, 1907. A new city administration under Mayor Gaynor, and including among its members Messrs. Mitchel (now Mayor), Prendergast and McAneny, came into office Jan. 1, 1910.

The bids for the Triborough were called for in October of that year. As noted there were no bids for construction by private capital, but numerous bids were received for construction alone with city funds. The awards for the latter were, however, held up for various reasons in spite of strenuous protests from that section of the press and public which allowed the large profits of the Interborough and the alleged monopoly of this latter to obscure their judgment as to the best interests of the city and the traveling public, which many competent authorities considered were not best served by the proposed scheme for the Triborough route.

Fig. 2. A Street in Queens Borough on Which an Elevated Railway Will Run

The objections to the Triborough were principally because it was proposed to build the lines without any arrangement for their operation, because it was felt that the new lines should be linked up to, and form a part of the present system (the Triborough as laid out would not have permitted transfer except on payment of an extra fare), because the route was not considered well laid out, and because it was inadequate to meet the growing needs of the city and to properly provide for all the boroughs, and, above all, because at the time the amount of city money available for railway construction

was very limited (not more than 60 to 70 million dollars).

From the beginning, Mayor Gaynor's administration, through the Board of Estimate (the approval of which is required on all expenditures of the city's money) adopted an attitude of coöperation with the Public Service Commission, and the present contracts are the result of nearly three years of very hard work and the most persistent, patient and diplomatic negotiation between these bodies and the companies which have now finally undertaken the operation. It was necessary that the city's credit be strengthened and its borrowing capacity be enlarged, and this in itself was no small part of the task.

During all this period, certain sections of the public press were very bitter in urging their own views, and there were many committees of citizens, public meetings, etc. At one time the Interborough entirely withdrew and everything was to be given to the B. R. T. The delay was well nigh intolerable owing to the congested and crowded condition of the present lines of transport; but it is felt now that the delay has been more than justified by the comprehensiveness of the scheme evolved, the consolidation of the lines into two large systems, either of which can be traversed throughout its length for a single fare, and the conclusion of equitable contracts by which not only will the city own the lines free of cost at the end of 49 years, but will have shared in such profits as there may be beyond a certain stated amount.

It may not be out of place to emphasize the advantage to the city from the perpetuation of the virtual monopoly of these two companies under fair and efficient regulation. The public is not only allowed a ride for a single five-cent fare over the lines of a complete system reaching almost to every part of the City of Greater New York, but the city shares in such profits as there may be from the consolidation of the management and its own contribution of credit in obtaining the greater part of the money at low rates of interest. A most important consideration is also that which provides complete arrangements for the operation of all routes in advance of design and construction, so that these latter can proceed with an intelligent conception of the operating requirements.

Character of the Lines

The 325 miles of new lines already decided on will be built underground in the more thickly populated sections of Manhattan and Brooklyn and elevated in the outlying districts. The subway will embrace various types of structures, both for two, three and four tracks, the latter in some cases all at the same level; in others as a double-deck structure, each level having two tracks. There are to be subaqueous tunnels under the rivers, some sunk from the surface by methods similar to those developed at the Detroit tunnel, and others probably to be driven by the shield method. The elevated will be mostly a steel structure of the familiar type, though of modern construction, but in some cases where parkways or boulevards are crossed or traversed it is being built of reinforced concrete with special attention to artistic architectural design, as illustrated in Fig. 3.

Fig. 3. Design for Ornamental Reinforced-Concrete Viaduct on Queens Boulevard

Improvements in Design

On all the new lines a special effort will be made to locate all the stations on tangents so as to avoid the inconvenience and possibility of danger from the space between the car and the platform on curves, which occurs at some places on the existing subway lines. An endeavor has also been made in so designing the structure at the junctions and connections of main lines and branches, etc., to avoid grade crossings of the various tracks. With the abnormal density of traffic during the rush hours this is very desirable, as the slightest delay at any one point may be, and generally is, reflected over the whole system. Footpaths at the sides of the tunnels at the level of the car platforms, similar to those built in the Pennsylvania R.R.'s New York tunnels, are to be constructed so as to provide a walk for passengers in case a train should meet with an accident and be stalled.

The new subway will be divided by partitions so as to separate the trains going in different directions, with the expectation of thereby so improving the ventilation by utilizing the piston-like action of the trains to change the air, that the accumulation of excessive heat so noticeable in the summer in the present subway may be avoided.

In furtherance of this also, waterproofing will be omitted when it is possible to do so, as it is thought that the practical inclosure of the existing subway in a waterproof envelope materially helps to prevent the diffusion of the generated heat through the walls of the structure. As is well known, locally at least, this accumulation of heat in the subway in the summer time, due to the heating of the motors, the friction of brakeshoes on wheels, the wheels on the tracks, etc., has made traveling very uncomfortable at times, the installation of expensive ventilating apparatus having only partially alleviated the trouble. In the present subway there are no division walls between the tracks, and while the trains stir up the air in passing, they do not change it very much, and not nearly to the extent so noticeable in all the single-track tube tunnels already built under the waters of New York Harbor and on all the lines of the Hudson & Manhattan Co.

Another point of interest is the provision of or for three tracks on the lines in the outlying districts where the density of travel does not require four tracks for

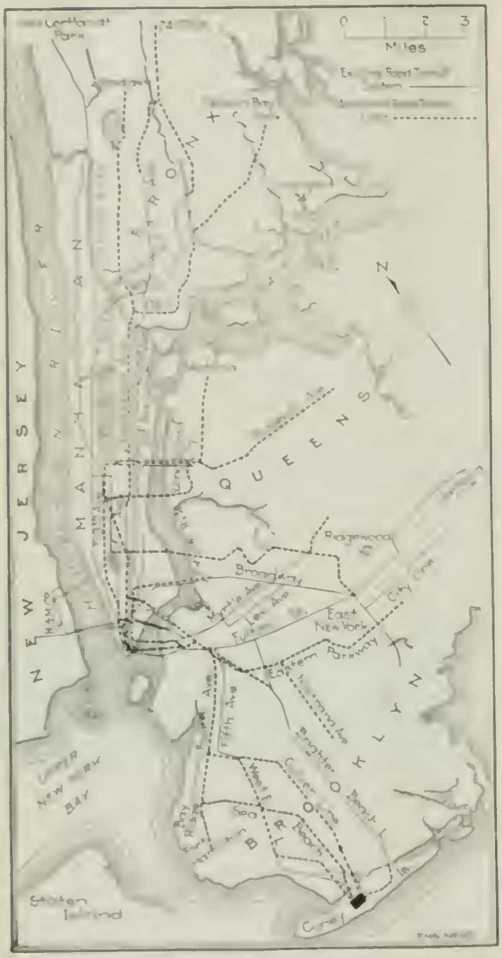


FIG. 4. THE OLDER NEW YORK RAPID TRANSIT SYSTEM AND THE NEW LINES NOW UNDER CONSTRUCTION AND PLANNED

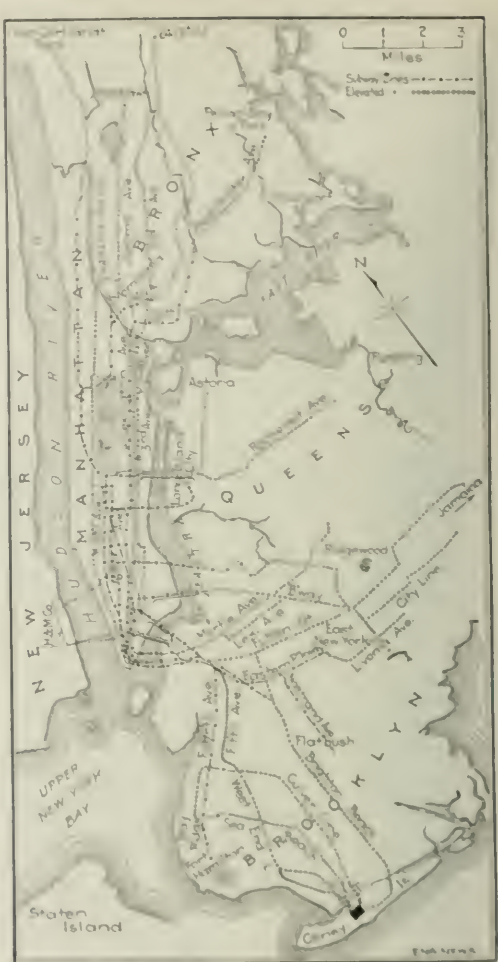


FIG. 5. SUBWAY LINES AND ELEVATED LINES IN THE COMPLETED RAPID TRANSIT SYSTEM

continuous express service. This allows express service one way during the rush hours.

EXISTING LINES

The principal features of the rapid transit lines now in operation in Manhattan are the four elevated lines running north and south through Second, Third, Sixth and Ninth Aves., the principal parts of which were built between 1870 and 1880, and the original subway, built between 1900 and 1904.* In Brooklyn the principal elevated lines, which were built soon after those in Manhattan, radiate from the old Brooklyn Bridge, one group eastward toward Jamaica and the other toward Coney Island. Some of these last-mentioned lines, after reaching a point some five or six miles from the bridge, drop to the surface and remain there for the rest of the way to Coney Island, and all these are to be elevated (or depressed in open cuttings), and are shown on the map as now elevated lines of the B. R. T., although through trains from the bridge to Coney Island are operated over them now.

TRAFFIC

Almost ever since the Brooklyn Bridge was first put into operation it has been recognized that the congestion and crowding of the transportation lines of New York has been unequaled in any other transportation system in the world. The opening of the present subway in 1904, although it had then a capacity of 400,000 passengers per day, afforded little relief. By the lengthening of the express platforms to accommodate 10 instead of eight cars, the installation of the most modern and improved types of automatic block signals, brakes, car

*[illegible]

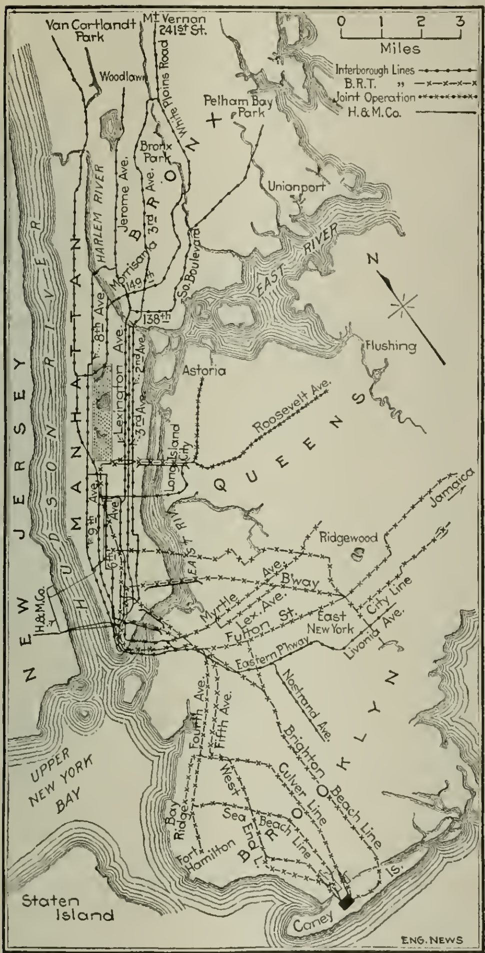


Fig. 6. The Systems of the Two Operating Companies, the Interborough and the Brooklyn Rapid Transit

and air-line couplings, center side doors, etc., its capacity was increased so that 1,250,000 passengers can be and have been handled in 24 hours, but the crowding during the rush hours is as bad as ever on all lines.

The following figures, condensed from a table given in the last report of the Public Service Commission, with the addition of the figures for 1913, show the great and greatly increasing amount of travel, and justify the attempt to meet the requirements by the system now proposed, enormous though its cost will be:

NUMBER OF FARES COLLECTED (MILLIONS)

	Subway	Manhattan and Bronx Elev.	Manhattan and Bronx Surface	Brooklyn All lines	Queens Surface	Total
1898......	...	184	321	221	9	735
1903......	...	246	427	304	16	993
1908......	200	202	411	419	30	1342
1913......	327	307	494	484	47	1659

(Note—In 1905, its first year of operation, the Subway carried 75,000,000 passengers. In 1914 it carried 340,400,000 passengers.)

Ever since the opening of the present subway in 1904, plans for extensions have been under consideration, first by the old Rapid Transit Commission and since then by its successor, the Public Service Commission for the First District of New York, but for the reasons already given there were various delays until the present comprehensive scheme of routes was developed to give so far as possible and, as may be seen by the maps, fair and equitable service to all parts of the greater city. There had been for some time a feeling that Manhattan had been unduly favored at the expense of the other boroughs, and while this to some extent is reasonable, both that it had, and that it should be, there can be little fault found with the scheme now laid out.

The routes of the various extensions and their character are shown on the maps, Figs. 4, 5 and 6, but for the benefit of those not entirely familiar with the situation it may be well to briefly enumerate their salient features and some of the details of the scheme.

New Lines

The Interborough—In Manhattan the Second, Third and Ninth elevated lines will complete the installation of third tracks from the down-town business section to above 125th St., thus enabling express trains to be run down-town in the morning and up-town at night.

The present subway will be divided at 42d St., the lower part being connected with the new Lexington Ave. subway, giving a four-track line all the way up the East Side, splitting into two three-track branches in the Bronx after it crosses under the Harlem River; the upper part will be connected to the new Seventh Ave.-Varick St. line, thus giving a through route up and down the West Side, and placing the Pennsylvania Terminal at 33d St. on a main line of the Rapid Transit system. The present West Farms branch of this line in the Bronx will be extended some five miles farther to the Mount Vernon line at the northerly boundary of the city.

The Brooklyn end of the present subway will be extended from Atlantic Ave. by two branches via Flatbush Ave. and Eastern Parkway into the residential sections of Brooklyn.

The part of the present subway on 42d St. between the Grand Central Station and Times Square will be operated by a shuttle service between the main lines on the East and West Sides.

The Steinway tunnel will be extended back to Times Square and forward to the east end of the Queensborough Bridge, where it will connect with the two lines to Astoria and Flushing, over which both systems are to have trackage rights. The Second Ave. elevated will be connected to the Queensborough Bridge and so to these same two lines.

There will be certain other small extensions and connections to allow the proper linking up of the various lines and permit desirable or convenient combinations in the operation of trains, all of which are shown on the maps.

The Interborough will thus have, besides its four elevated lines, four double- or three-track branches in the Bronx leading to two main trunk lines (four-track) throughout the length of Manhattan on Fourth and Seventh Aves. to two tunnel routes under the East River, joining under Fulton St., the main business street of Brooklyn, and then spreading out again into two branches into the residential section of that borough. The distance from the upper end of the Bronx to the

ends of the lines in Brooklyn is about 26 miles. From the center of this system there will be the offshoot at 42nd St. via the Steinway tunnels to the lines in the Borough of Queens to Astoria and Flushing.

THE BROOKLYN RAPID TRANSIT.—Besides certain extensions of various lines in Brooklyn and the construction of the elevated structures in South Brooklyn on the Coney Island lines, as already referred to, the main features of the contract of this company with the city are those which provide for its entrance into New York and the linking up of the four bridges across the East River into lines of through travel instead of establishing terminals at their ends. There is one important new line in Brooklyn, the Fourth Ave. subway, which was started some five years ago, a considerable part of which is now nearly completed; this route extends from the Manhattan Bridge through Fourth Ave. to Fort Hamilton, and will be part of an important new route to Coney Island.

The principal line of the B. R. T. in New York will be that already described, running from the center of Brooklyn under the East River and via Broadway and Seventh Ave. to 59th St., the Queensborough Bridge and to Astoria and Flushing. This will be a four-track line in Manhattan above City Hall (Park Place).

From a certain point of view, the linking up of the New York end of the three down-town East River bridges, the old Brooklyn Bridge, the Manhattan just above it, and the Williamsburg Bridge, a mile farther up the river, is one of the most interesting features of the whole scheme. For years the crowding and congestion at the ends of the Brooklyn Bridge were worse than even on the elevated and subway lines. Nearly all the travel from the lines of the B. R. T. was concentrated at this one bridge and brought over to a stub-end terminal at the New York end. In an attempt to provide better means of communication between Brooklyn and New York, the Williamsburg Bridge was built and opened in 1903 and the Manhattan Bridge in 1909. No provision was made, however, for the operation of these bridges or their proper connection with any of the existing lines of communication, and the people from Brooklyn have been brought over to the New York ends and dumped there, to make the best of their way to their destination. The travel between Brooklyn and New York is mostly all toward New York in the mornings and toward Brooklyn at night, all four of the East River bridges providing for lines of rapid transit (two to four tracks) as well as for street cars, ordinary vehicular traffic and pedestrians.

To eliminate the stub-end terminals the so called Centre St. loop was planned to connect up the New York Ends of these three bridges, and its construction was started in 1907, though no arrangement was made for its use. Now, however, it is to be completed and further extended down along the New York side to a connection with the new tunnel which is to connect the B. R. T. with its Broadway line. This will enable all the trains to circulate, coming over on one bridge, continuing and returning via another instead of coming into a terminal in the congested district and having to back out.

There will be also another new route established under 14th St., New York, and the East River to the easterly section of Brooklyn (East New York).

FARES

The contracts between the city and the two operating companies provide for a single fare of five cents on each system, with free transfers at intersecting points for a continuous ride in the same general direction. On the Brooklyn system, transfers will be exchanged between the elevated lines and the subway lines, but on the Interborough only such transfers as are now given will be provided between the elevated railroads and the subway. On the existing lines, as they stand today, the longest ride obtainable for five cents is through the subway from Atlantic Ave., Brooklyn, to Van Cortlandt Park or 242nd St. on the Broadway branch, a distance of $17\frac{1}{2}$ miles. Under the dual system, as the new system has been commonly called, it will be possible to travel over the Interborough subway from the terminus of the White Plains Road line, near the northern city boundary, the whole length of the Bronx and Manhattan, under the East River to Brooklyn, and through the Eastern Parkway subway and its extensions to New Lots Ave.—a distance of about 26 miles—for one fare and without change of cars.

The longest ride on the Brooklyn system will be from Flushing, at the end of the Corona branch, to and across the Queensborough Bridge, through the Broadway subway in Manhattan, under the East River to Brooklyn and through the Fourth Ave. subway and its connections to Coney Island, about 21 miles, for five cents.

The fare from the center of Brooklyn to Coney Island had always been 10 cents (15 cents from New York) up to within the last few years, when a general agitation for its reduction was started.

As soon as the connections of the Fourth Ave. subway in Brooklyn with the elevated lines are made and through-train operation is possible from Manhattan to Coney Island, the five-cent fare between these points will apply. This, it is estimated, will take about 18 months.

CHANGES IN METHODS OF COMMUNICATION IN NEW YORK

Before leaving the general subject of routes, it may not be amiss to call attention to the radical change in the character of the means of communication between New York City proper (Manhattan) and the surrounding territory, which has taken place in the last six or eight years. Direct land communication has never been possible except to the north, while the most densely populated of the surrounding districts have been to the east in Brooklyn and the west in New Jersey, with which communication was only possible by means of boats of one kind or another, and from both of which districts enormous numbers of people come to Manhattan daily.

Brooklyn was connected with Manhattan by means of the famous Brooklyn Bridge as long ago as 1883, but with the completion of that structure progress along these lines stopped for almost a quarter of a century. Within the last eight years, however, three more bridges have spanned the East River and six pairs of railway tunnels have been put into service under the rivers; one pair more has been built, three pairs are to be built under the present scheme, making four bridges and ten pairs of tunnels for railways, besides which there have been built two tunnels for gas and one for water supply, and thus making practical the direct physical connection of Manhattan by land lines of communication with the populous districts to the east and west.

Collection and Disposal of City Refuse, Washington, D. C.

By J. W. Paxton*

SYNOPSIS—This is the fourth and last article describing the method of operation of the Washington Street Cleaning Department. Previous articles appeared in Engineering News *of July 9, Aug. 6 and Aug. 27, 1914. The present article describes the collection and handling of garbage and refuse, which is done by contract, from the point of view of the city inspectors and supervisors.*

The collection and disposal of city refuse for the District of Columbia is done by contract, under the supervision of the Street Cleaning Department. Five contracts are let; namely, for the collection and disposal of garbage, ashes, miscellaneous refuse, dead animals and night soil.

The main features of the contracts are as follows:

Garbage—(1) Collections and disposal of garbage are made daily, including Sundays, from such hotels, apartment houses, markets, and other like places within the City of Washington and such of its suburban sections as may be designated, from time to time, by the Commissioners of the District of Columbia.

(2) Collections and disposal of garbage are made daily, excluding Sundays, from May 16 to Oct. 15, both days inclusive, and three times a week from Oct. 16 to May 15, both days inclusive, from all places not embraced in the preceding paragraph within the existing fire limits of the District of Columbia and certain of the more thickly populated sections on the outside of and adjacent to the fire limits.

(3) Collections and disposal of garbage are made three times a week from May 16 to Oct. 15, both days inclusive, and semiweekly from Oct. 16 to May 15, both days inclusive, from all places not included in the preceding paragraphs, in the City of Washington and its suburbs, as such suburbs may, from time to time, be designated by the Commissioners of the District of Columbia.

(4) The collection of garbage is made in wagons carrying a covered iron box which is lifted from the wagons and loaded on cars at the transfer station. This box containing the garbage is then shipped by rail to the disposal plant owned by the contractor, located about 32 miles from Washington, and the garbage is there disposed of by the reduction process.

Ashes—(1) Collections and disposal of ashes within the existing fire limits of the District of Columbia and certain of the more thickly populated sections outside of and adjacent to the fire-limits, are made weekly, from Apr. 16 to Oct. 31, inclusive, and semiweekly from Nov. 1 to Apr. 15, inclusive, from private residences, boarding houses, lodging houses not exceeding 25 rooms, and apartment houses containing not more than four families, and other like places, as may be designated by the Commissioners of the District of Columbia.

(2) Collections and disposal of ashes are made from all private residences and such other like places corresponding to those included in the preceding paragraph from the remainder of the City of Washington and its suburban sections, as said suburban sections may from time to time be designated by the Commissioners of the District of Columbia, weekly, throughout the entire year.

(3) The collections are made in wagons with canvas covers and disposed of by filling low ground on the outskirts of the city.

Refuse—(1) Collections and disposal of miscellaneous refuse in the City of Washington and its more densely populated suburbs, as such suburbs may from time to time be designated by the Commissioners of the District of Columbia, are made once a week from all private residences, boarding houses, and lodging houses with not to exceed 25 rooms, and apartment houses containing not to exceed four families, and other like places, as may be designated by the Commissioners of the District of Columbia, and from such public waste boxes as may be established by the street-cleaning division in the machine-swept section of the City and District.

(2) The collections are made in wagons suitable for this purpose and what is not salable is disposed of at an incinerating plant owned by the contractor.

Dead Animals—(1) The collection and disposal of dead animals daily, including Sundays, throughout the year, from every part of the District of Columbia, is required upon notification to the contractor of the existence of said dead animals.

(2) The collections are made in vehicles suitable for the purpose, and the disposal is accomplished by the reduction process at a plant owned by the contractor located about 4 miles from the city.

Night Soil—(1) The collection and disposal of night soil from all privies, and from all streets, avenues, alleys, roads and open lots in the District of Columbia is required upon receipt of notice from the Superintendent of Street Cleaning.

(2) The collections are made in air-tight receptacles designed for that purpose and transported therein on barges about 8 miles from the city and there used as fertilizer on a farm.

Ashes from Public Buildings—(1) The collection and disposal of ashes and refuse from buildings under the control of the Commissioners of the District of Columbia is required as such may accumulate.

(2) This work is done by contract under the direction of this division but paid for from the appropriation for the maintenance of each building in proportion to the quantity removed.

Collection

Householders' Instructions—The householders are required to conform to the police regulations as to receptacles, separation of material and accessibility. Cards of instructions to householders containing extracts from the police regulations are distributed on request or to those who show evidence of the need of instruction.

The contractor is required to call on the same days each week, collections to be made at any time between

*Superintendent of Street Cleaning, Washington, D. C.

7 a.m. and 6 p.m.], and he is to make free use of horn or gong as a signal of his presence. Failure of the contractor to promptly and properly collect material lawfully offered costs him a fine of from $1 to $2 for each neglect.

The supervision of this work is in charge of one man, reporting directly to the Superintendent. He has under him a force of five inspectors and a complaint clerk.

INSPECTION—It is manifestly impossible, and it is not considered necessary, for this force to supervise the collection of every mass of material from every house. Inspection can be made in a general way, information obtained as to whether each wagon is on its regular route on the schedule day, special attention being given to

DISTRICT OF COLUMBIA
STREET CLEANING DIVISION

WASHINGTON, Oct. 15th 1913

Mr. M. R. Ready

CONTRACTOR for COLLECTION OF Misc. Refuse.

THE FOLLOWING COMPLAINTS HAVE BEEN RECEIVED AT THIS OFFICE. YOU ARE REQUESTED TO IMMEDIATELY REMOVE THE MATERIAL FROM THE PREMISES SPECIFIED AND TO RENDER A REGULAR COLLECTION SERVICE HEREAFTER, IN ACCORDANCE WITH THE TERMS OF YOUR CONTRACT.

COMPLAINT NUMBER	LOCATION
10,014	452 - 2nd [illegible]
10,015	304 - M
10,016	919 - Jefferson
10,017	702 - L NE
10,018	545 - Eye SE

Delivered to Contractor 10/17 [illegible]

Superintendent per [illegible]

FIG. 1. DAILY LIST OF COMPLAINTS AS SUPPLIED TO CONTRACTORS

those which are or likely to be [illegible], and all complaints are investigated.

The investigation, however, being after the cause of the complaint, it is sometimes difficult to ascertain whether the fault was the householder's, in not making the proper separation or the waste accessible, or the collector's.

COMPLAINTS—In spite of this fact, the work of holding the contractor to the specifications depends to a large extent on complaints received from householders, each acting on his own premises as an inspector. Unfortunately, complaints received cannot be accepted as an absolute criterion of conditions. The householders often do not conform to the regulations, and service is refused for that reason.

During the year ending June 30, 1912, 693 garbage, 1198 ash, and 2983 refuse complaints were investigated. Of the total garbage complaints, but 36 or 5¼% were found on investigation to be the fault of the contractor; [illegible] or 38.3% were found to be the result of violation on the part of the householder of the police regulations regarding the disposal of refuse, while in 390 cases, or 56.3%, the fault could not be definitely placed.

In the case of ashes but 115 complaints, or 9.6%, proved to be the fault of the contractor; 802 or 67% are chargeable to the failure on the part of the householder to observe the regulations, principally regarding accessibility, while 279 or 23.4% are classed as doubtful. In the refuse service, 730 complaints, or 24.5%, were found to be the fault of the contractor, 836 or 28%, the fault of the householder, while 1419, or 47.5%, were classed as doubtful.

ACTING ON COMPLAINTS—Upon receipt of either a garbage, ash or refuse complaint, the papers referring to the case are placed in an open-sided envelope, 4x9½ in., which is given a complaint number, and the blanks for location and date filled in. These envelopes are then turned over to the inspector in whose district the complaint originated. The information suggested on the face of the envelope (including a description of premises, how collections are made, date of last collection, etc.) is obtained and any additional observations written under remarks on the back, together with the inspector's conclusion as to the location of the fault. When fines are fixed, they are considered as liquidated damages and not as penalties. The envelopes are filed according to location of the complaint and cross-indexed by number and date.

COMPLAINT RECORD—A monthly record of such complaints is also kept on a Complaint Record, 35¾x8½ in., which gives a summary of requests and complaints received each day, the results of the investigations as to fault and fines imposed.

The form shown in Fig. 1 is a list supplied each day to the contractor of complaints received at the office, which also serves as an order to collect the material immediately and as a warning against such failure in the future. The actual size of the card is just twice the reproduction.

COLLECTIONS—The form shown in Fig. 2 is a notice issued by contractors, in accordance with specifications, to householders previous to any change in collection days. Fig. 3 is a summary of daily reports from contractors showing the working force and the amount collected. The actual size is 35¾x8¼ in.

GARBAGE WILL BE COLLECTED
From October 16 to May 15, between 7 A. M. and 6 P. M.
MONDAY, WEDNESDAY & FRIDAY

GARBAGE consists of the refuse of animal and vegetable matter which has been used or was intended to be used as food. Cans, glass, broken crockery, paper, ashes and other refuse are removed free by other than the garbage collectors, and if mixed with the garbage, it is a violation of the Police Regulations. Such mixture will be refused by the collectors.

RECEPTACLES. Garbage must be placed in water-tight metal receptacles, provided with a tight cover and a handle, with a capacity of not less than 3 nor more than 10 gallons. More than one receptacle containing less than 10 gallons is not allowed. Garbage must be kept dry.

ACCESSIBILITY. Receptacles must be placed by the householder at the rear entrance to the premises, or in case there is no rear entrance, in the areaway or other convenient place in front of the premises, and gates or doors must be left unfastened on collection day. The collector will give notice of his approach by the blowing of a horn. No receptacle will be allowed on the sidewalk, street or public alley.

If service is not rendered promptly on collection day, notify by mail or phone

STREET CLEANING DIVISION, DISTRICT BUILDING
PHONES, MAIN 6000 OR MAIN 2410

FIG. 2. CARD SENT TO HOUSEHOLDERS BY CONTRACTOR PREVIOUS TO ANY CHANGE IN COLLECTION DAYS

Collections of night soil and dead animals are made only on request for such service. The contractor is supplied with a list of requests received, in the form of an order to make the collections, which he is required to return with a statement that the collections have been made, giving the date, or a reason for failure.

INSPECTORS' REPORT—The form, Fig. 4, is a daily report, 11¾x7¼ in., turned in by each inspector and shows

STREET CLEANING DIVISION

Service Record

RECORD OF *Garbage* SERVICE

FOR MONTH OF *September* 1913.

DATE	WORKING VEH	WORKING MEN	WORKING HORS	LOADS	COLLECTIONS TONS	POUNDS.
1	98	115	120	254	305	450
2	86	104	114	167	192	700
3	86	105	113	166	197	1600
4	85	104	114	161	194	400
28	11	14	18	17	23	850
29	86	102	110	193	235	250
30	73	90	102	132	146	400
31						
TOTAL					5068	1550

FIG. 3. SUMMARY OF REPORTS FROM CONTRACTORS

complaints investigated, general inspection, and whether or not contractors' wagons are behind the schedule. Districts having been set by the contractor to be collected on certain days, the inspector reports whether the wagon is O. K., ¼ day late or ½ day late, etc.

SCHEDULE PROFILES—This record is plotted on profile paper (Fig. 5). If any wagon driver shows a continued tendency to be behind and the contractor does not upon request supply assistance, assistance is furnished by the Superintendent of Street Cleaning and charged to the contractor.

GRAPHICAL RECORDS—From the Complaint Record and the Service Record (Fig. 3), a profile (Fig. 6) is made up giving graphically the information recorded on

#6-cw

STREET CLEANING DIVISION

WASHINGTON, D. C.

REFUSE INSPECTOR'S REPORT,

DATE *Oct. 14th, 1913*

ARR	DEP	LOCATION	
$8^{[illegible]}$	8^{30}	#7 Garbage	
8^{35}	8^{50}	#3 Refuse	
9^{00}	9^{20}	#25 Refuse	
9^{31}	9^{50}	#22 [illegible]	
11^{00}			
	$3^{[illegible]}$	#12 Refuse	O.K.
$3^{[illegible]}$	4^{05}	#22 Refuse	1/4 day late
4^{15}	4^{35}	#25 Refuse	O.K.
4^{55}	5^{00}	#3 Refuse	O.K.

INSPECTOR *B. W. Connelly.*

FIG. 4. REPORT FROM INSPECTOR, SHOWING PLACES VISITED AND CONDITION OF COLLECTION

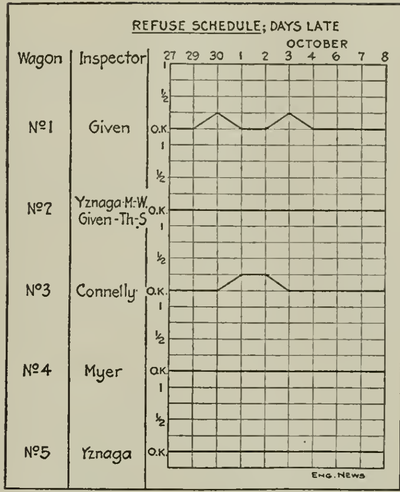


FIG. 5. PROFILE SHOWING CONDITION OF REFUSE WAGONS AS TO THEIR WORKING SCHEDULE

these two records. This profile might well be considered a barometer of the collection service. Thus at certain seasons, a large number of complaints may always be expected, but so long as collections increase and the number of complaints charged to the contractor does not materially increase, the service is probably at a high standard.

In October, 1912, the total ash complaints show a considerable increase on account of cold weather over September, while the collections show an increase of about 5000 cu.yd. The complaints which found the fault with the contractor, however, show only a nominal increase over September.

The refuse profile shows, in May, 1912, the other condition, collections being only slightly more than in April, while complaints increased about 66%, those charged against the contractor, however, increasing about 125%. This indicates the service was at fault, the additional accumulation, due to spring house cleaning, overtaxing the resources of the contractor.

The general upward trend of the collection curve of the refuse profile and the corresponding downward movement of the line of total complaints shows that better service is being rendered.

PROPOSED MUNICIPAL COLLECTION—With a view to obtaining less objectionable, more efficient and more economical services than rendered by contractors, the Commissioners have recommended to Congress that an appropriation of $10,000 be made for the purpose of investigating and reporting on the collection and disposal of city waste, including the preparation of plans and specifications for the construction of disposal plants. Congress has not, as yet, seen fit to make this appropriation.

ADVANTAGES OF MUNICIPAL DISPOSAL WORKS—It is estimated that the contractors for the disposal of city waste have invested in collecting equipment and disposal plants, several hundred thousand dollars, which they must have figured on recovering from the amounts received from the District of Columbia, for the services rendered during the five-year term of their contracts, as these in-

[illegible] will be practically valueless on the expiration of the contracts, if they are not successful in obtaining the same contracts for the next term of five years.

In other words, the District of Columbia is probably paying to the contractors, in addition to the cost of the work and the contractors' profit, the cost of complete disposal plants and collection equipment every five years,

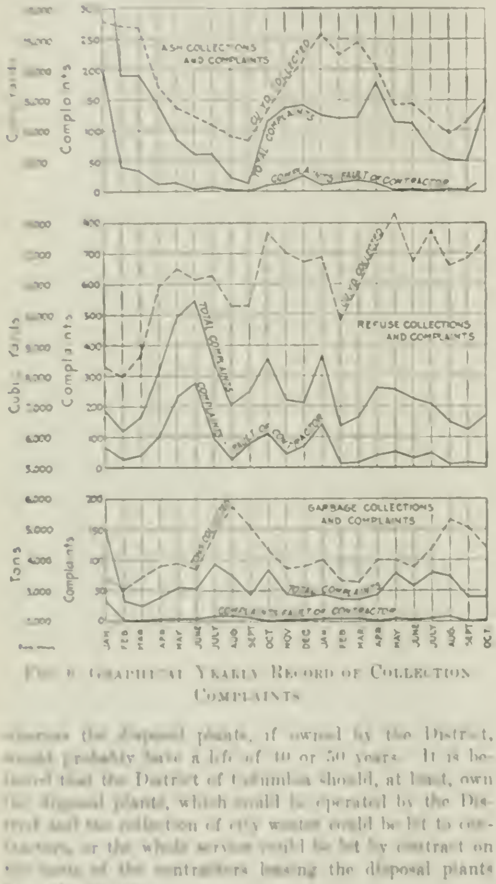


FIG. [illegible] GRAPHICAL YEARLY RECORD OF COLLECTION COMPLAINTS

whereas the disposal plants, if owned by the District, would probably have a life of 40 or 50 years. It is believed that the District of Columbia should, at least, own the disposal plants, which could be operated by the District and the collection of city wastes could be let to contractors, or the whole service could be let by contract on the basis of the contractors leasing the disposal plants from the District.

Electricity in the Anthracite Industry—The introduction of electricity in any great quantity into the mines is not more than [illegible] decades old. The first electrical installation was made in [illegible] by the Lehigh Valley R.R. In 1889 the Thompson-Houston Co. installed a locomotive and a generating station in the [illegible] of the [illegible] Coal & Iron Co. and this locomotive was in continuous service until 1911. The first electric pump was installed in [illegible] and it has been in continuous operation ever since.

The present total capacity of electric generators or [illegible] is [illegible] kw. [illegible] with [illegible] hp. [illegible] by steam [illegible]. Today there are [illegible] miles of wooden pole lines above ground and [illegible] miles of [illegible] lines below ground in the anthracite mines. There are 9[illegible] electric locomotives using an estimated amount of over [illegible] hp. The other electrically operated equipment requires [illegible] hp. for [illegible] and [illegible] machinery, [illegible] hp. for electric hoists, [illegible] for electrically driven pumps, [illegible] for ventilating machinery, [illegible] for lighting and about [illegible] for heating. There are [illegible] [illegible] with individual [illegible] [illegible] [illegible].

Computing Maximum Bridge Stresses by a Maximum-Moment Table

BY J. P. J. WILLIAMS*

The accompanying table has been devised to save a large amount of the labor required to compute live-load stresses in beams and trusses due to Cooper's standard loadings. It gives directly, or by interpolation, the *maximum bending moment per rail produced by E-50 loading* at intermediate points of spans of various lengths. The *number of the critical wheel* which gives the greatest bending moment is also indicated, by black-face figure placed at the upper left when the shorter segment l_1 is the left segment, and at the upper right when l_1 is the right segment (the engines are always assumed to be headed toward the left). The moments are given for every 5-ft. interval along the span, and for span lengths varying by 5 ft. To aid in the work of interpolating, the *change of bending moment per foot change* of distance (l_1) from the nearer support is given by a figure above the moment.

The results can be relied upon as accurate within 1%, and are, of course, available for any specified Cooper's loading by simply multiplying by the ratio of the given loading to E-50. All figures in both table and examples are given in 1000-lb. units.

The well known relation between floor-beam load and two-panel bending moment makes it possible to compute maximum *floor-beam loads* from the values in the table. It will also be proved that there is a definite relation between *maximum shears* in truss panels and maximum bending moments in certain equivalent spans, also between the latter and maximum moments for computing *web stresses* in trusses with inclined chords. The field of usefulness of such a table is thus greatly extended, and includes short methods of computing not only maximum chord stresses but also maximum web stresses in all ordinary trusses in addition to the usual applications to girders and beams.

The method of using the table and applications to definite practical problems will be detailed, and the new relations and formulas fully developed. Incidentally, it will be shown that the limiting value for l_1, the shorter segment of the span, is 11.5 ft. because a constant position of loading and a simple formula will give maximum bending moments when l_1 exceeds that value.

MAXIMUM BENDING MOMENTS

Example 1. What are the maximum E-50 live-load bending moments at 5-ft. intervals in a 50-ft. girder? By entering the table for the known values of segments l_1 and l_2, which for this case are found in the table without interpolation, these results:

Point	l_1 ft.	l_2 ft.	Max. mom. (ft.-kips)
1	5	45	[illegible]
2	10	40	[illegible]
3	15	35	1014
4	20	30	1152
5 (center)	25	25	1150

The value of 1150 for the center section is practically equal to the absolute maximum bending moment near the center. For all spans greater than about 25 ft. in length, the center bending moment is within a small percentage of the absolute maximum bending moment.

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TABLE OF MAXIMUM BENDING MOMENTS FOR E 50 LOADING

Values given in thousand pound-foot units for one rail. Upper figures are differences per foot change in l_1 for interpolation. Blackface figures denote number of critical wheel.

Shorter Segment l_1 (columns); Longer Segment $l_2 = l - l_1$ (rows)

l_2	5	10	15	20	25	30	35	40	45	50	55	60
250		2	3 364 5660	3 357 7480	4 350 9270	4 343 11020	5 347 12740	5 316 14470	6 334 16200	7 342 17870	8 332 19580	8 338 21240
225		2	3 332 5160	3 326 6820	4 314 8450	4 318 10020	5 306 11610	5 312 13140	6 300 14700	7 316 16200	8 312 17780	8 298 19340
200		2	3 300 4660	3 292 6160	4 288 7620	4 282 9060	5 272 10470	5 273 11830	6 280 13200	7 284 14600	8 262 16020	9 280 17330
175		2	3 266 4160	3 260 5490	4 256 6790	4 244 8070	5 240 9290	5 248 10490	6 240 11730	7 244 12930	8 240 14150	9 236 15350
160		2	3 244 3860	3 242 5080	4 232 6290	4 232 7450	5 218 8610	5 226 9700	6 218 10830	7 224 11920	8 224 13040	9 220 14160
150		2	3 232 3650	3 226 4810	4 218 5940	4 218 7030	5 208 8120	5 210 9160	6 208 10210	7 214 11250	8 202 12320	9 214 13330
140		3	3 216 3440	3 216 4520	4 206 5600	4 200 6630	5 196 7630	5 192 8610	6 206 9570	7 196 10600	8 200 11580	9 194 12580
130		3	3 203 3230	3 204 4250	4 188 5260	4 188 6200	5 178 7140	5 184 8030	6 190 8950	7 188 9900	8 178 10840	9 176 11730
120		3	3 190 3012	3 188 3960	4 172 4900	4 180 5760	5 160 6660	5 178 7460	6 170 8350	7 174 9200	8 162 10070	9 172 10880
110		3	3 172 2800	3 174 3660	4 162 4530	4 160 5340	5 152 6140	6 158 6900	7 158 7690	7 158 8480	8 158 9270	9 170 10060
100		3 165 1744	3 160 2570	3 156 3370	4 150 4150	5 148 4900	5 138 5640	152 13 6330	142 14 7090	144 14 7800	142 14 8520	156 13 9230
95		3 158 1660	3 152 2450	4 152 3210	4 140 3970	5 148 4670	140 13 5410	140 13 6110	136 13 6810	144 13 7490	134 13 8210	142 13 8880
90		3 150 1580	3 142 2330	4 146 3040	4 134 3770	5 144 4440	130 13 5160	138 13 5810	138 13 6500	130 13 7190	128 13 7840	136 13 8480
85		3 144 1498	3 136 2210	4 136 2890	4 124 3570	5 146 4190	134 13 4920	126 13 5590	124 12 6220	128 13 6840	124 13 7480	122 12 8100
80		3 134 1417	3 129 2085	4 127 2733	4 121 3365	140 13 3970	124 13 4670	126 13 5290	116 12 5920	120 12 6500	118 12 7100	110 12 7690
75	2 130 690	3 125 1337	3 120 1965	4 119 2565	4 110 3163	140 13 3710	118 13 4110	110 12 5000	116 12 5550	116 12 6120	108 12 6700	110 12 7240
70	2 122 645	3 117 1255	3 112 1842	4 112 2400	4 110 2960	118 13 3510	110 13 4100	112 12 4655	100 12 5215	109 12 5715	104 12 6240	100 11 6760
65	2 113 602	3 109 1167	3 106 1710	4 102 2240	4 102 2750	102 12 3260	110 12 3770	96 12 4320	100 12 4800	98 12 5300	96 11 5790	94 11 6270
60	11 103 566	3 101 4079	3 96 1582	4 94 2063	4 90 2535	5 97 2983	94 13 3470	92 13 3940	98 11 4400	86 11 4890	86 11 5320	11 5750
55	11 95 532	12 92 1005	12 86 1467	12 85 1895	4 84 2320	12 86 2740	90 13 3170	80 12 3620	72 12 4020	96 13 4380	11 4860	
50	11 88 496	12 85 938	12 79 1362	12 77 1755	12 78 2140	12 80 2530	74 13 2930	72 13 3300	72 13 3660	12 4020		
45	2 81 160	3 78 865	12 71 1255	12 70 1610	12 70 1960	12 72 2310	70 13 2670	64 13 3020	13 3340			
40	2 75 420	3 70 795	3 64 1144	12 63 1462	12 62 1780	12 63 2090	59 13 2405	13 2700				
35	2 67 378	3 62 715	3 57 1024	4 56 1310	4 54 1590	13 55 1860	13 2135					
30	2 58 339	3 54 631	3 50 899	4 48 1150	4 45 1390	13 1615						
25	2 52 294	3 45 555	3 10 782	4 40 982	4 1180							
20	2 44 250	35 4 469	3 36 645	4 823								
15	2 37 188	3 27 375	3 512									
10	2 25 125	3 250										

l_2	65	70	75	80	85	90	95	100	110	120	130	140
250	9 334 22930	10 340 24600	11 340 26300	11 364 28000	12 316 29800	12 324 31400	12 316 33020	13 330 34600	14 300 37900	15 310 40900	17 310 44000	18 47100
225	9 294 20830	10 320 22300	11 300 23900	11 320 25400	12 300 27000	12 300 28500	12 280 30000	13 280 31400	14 270 34200	15 290 36900	17 280 39800	18 42600
200	9 274 18730	10 270 20100	11 278 21450	11 276 22840	12 276 24220	12 250 25600	12 250 26850	13 250 28100	14 250 30600	15 250 33100	17 240 35600	18 38000
175	9 254 16530	11 240 17800	11 244 19000	12 240 20220	12 236 21420	12 220 22600	12 220 23700	13 220 24800	14 220 27000	15 200 29200	17 210 31200	18 33300
160	9 226 15260	11 222 16390	11 230 17500	12 230 18650	12 200 19800	12 200 20800	12 200 21800	13 200 22900	14 190 24900	15 180 26800	17 210 28600	18 30700
150	9 214 14400	11 203 15470	12 210 16530	12 208 17580	12 196 18620	12 180 19600	12 180 20500	13 200 21400	14 180 23400	15 180 25200	17 180 27000	18 28800
140	10 194 13550	11 198 14520	12 200 15500	12 200 16500	12 180 17500	12 190 18400	12 170 19350	13 170 20200	14 180 21900	15 160 23700	17 170 25300	18 27000
130	10 202 12610	11 176 13620	12 200 14500	12 180 15500	12 160 16400	12 172 17200	12 168 18060	13 160 18900	14 150 20500	15 155 22000	17 23550	130
120	10 182 11740	11 168 12650	12 176 13500	12 164 14380	12 156 15200	13 174 15980	13 150 16850	13 147 17600	14 134 19070	15 20410	120	
110	10 152 10910	11 166 11670	12 160 12500	12 160 13300	12 140 14100	13 136 14800	13 144 15480	13 131 16200	14 17510	110		
100	140 13 10010	11 148 10710	12 144 11450	12 146 12170	12 142 12900	13 128 13610	13 114 14250	13 14820	100			
95	142 13 9590	130 13 10300	12 150 10950	12 120 11700	12 122 12300	13 130 12910	13 13560	95				
90	130 13 9160	142 13 9810	12 124 10520	12 116 11140	12 116 11720	13 12300	90					
85	126 13 8710	106 13 9340	126 12 9870	12 124 10500	12 11120							
80	124 12 8240	112 12 8860	104 12 9420	12 9940								
75	106 12 7790	100 12 8320	12 8820									
70	96 11 7260	11 7740										
65	11 6740											

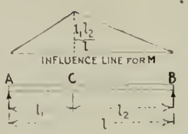


FIG 1

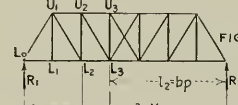


FIG. 2

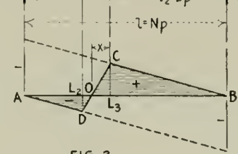


FIG. 3

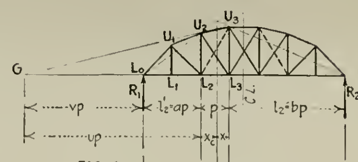


FIG. 4

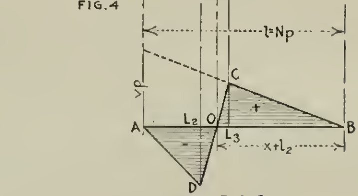


FIG. 5

FORMULAS FOR USE OF TABLE

Max. Moment at C in Beam AB. Fig 1 = M given by table direct

Max. Floorbeam Reaction = $M \frac{l_1 + l_2}{l_1 l_2}$, M taken for l_1 and l_2 equal to the adjoining stringer spans

Max Shear in Truss Panel = $\frac{M}{p}$, M taken for $l_1 = x = \frac{bp}{N-1}$ and $l_2 = bp$, Fig 2

Max. Mom. for Main Web Stress = vM, M taken for $l_1 = x = \frac{bpv}{Nu-v}$, Fig. 4, and $l_2 = bp$

Max. Mom. for Counter Stress = $(u+1)M$, M taken for $l_1 = x_c = p - x$, Fig. 4, and $l_2 = ap$

Example 2. What is the maximum E-50 live-load bending moment at the center of a 76-ft. span? For this case

$$l_1 = l_2 = 38\ ft$$

For $l_1 = l_2 = 35$ *ft.*, $M = 2135$

Add for change in l_1, $3 \times 58 = 174$

Add for change in l_2, $3/_5 \times 270 = 162$

$M = 2471$ *per girder.*

The value of 58 for the difference per foot change in l_1 was obtained from the upper figure 59 found when $l_1 = 35$ ft. and $l_2 = 40$ ft. by allowing for the small difference due to the fact that l_2 is less than 40 ft. The value 270 was easily found by subtracting the two values in the vertical column $l_1 = 35$ ft. for $l_2 = 35$ ft. and $l_2 = 40$ ft. An estimated increase might have been made in this quantity, since l_1 is really 38 ft. instead of 35 ft., but this is generally unnecessary.

LIMITING VALUE OF LEFT SEGMENT—The table was not carried beyond the value $l_1 = 110$ ft. because when the shorter segment l_1 becomes 112 ft. or more the bending moment is maximum for a fixed position of the loading, i.e., engines on shorter segment and head of uniform load 112 ft. from nearer support, as will now be proved. Let

W_e = total weight per rail of the two engines;
= 355 for E-50 loading;
w = uniform train load per rail, per ft.;
= 2.5 for E-50 loading;
W = total load on span l;
y = length of uniform train load on span;
$k = 57.6$ ft. = distance from center of gravity of the two engines to the head of uniform load.

The equation for bending moment M can be written by considering the right segment l_2, the uniform train load covering that segment completely:

$$M = R_2 l_2 - \tfrac{1}{2} w l_2^2 = l_2 (R_2 - \tfrac{1}{2} w l_2)$$

Thus the bending moment is evidently maximum when R_2 is maximum, and

$$R_2 = W - R_1 = W_e + wy - \left(\frac{W_e (k + y) + \frac{1}{2} w y^2}{l}\right)$$

By placing the first derivative with respect to the variable y equal to zero to find the maximum, there is obtained

$$l - y = \frac{W_e}{w} = \frac{355}{2.5} = 142\ ft. \qquad \text{Q.E.D.}$$

Thus whenever l_1 is greater than 142 ft., the bending moments are maximum for a fixed position of the loading, and the value of reaction R_2 due to E-50 loading will be:

$$R_2 = \frac{355 (142 - 57.6) + 2.5 (l - 142) \left(\frac{l}{2} + 71\right)}{l}$$

$$= \frac{[illegible]}{l} + 1.25\, l$$

Therefore

$$M = l_2 \left(R_2 - \frac{2.5}{2} l_2\right) = l_2 \left(\frac{[illegible]}{l} + 1.25\, l_1\right) \quad (1)$$

Example 3. What is the maximum E-50 live-load bending moment at the center of a 300-ft. span? For this case, using Eq. (1),

$$l_1 = l_2 = \frac{300}{2} = 150\ ft. \text{ and } l = 300\ ft.$$

$$M = 150 \left(\frac{[illegible]}{300} + 1.25 \times 150\right) = [illegible]$$

MAXIMUM FLOOR-BEAM REACTIONS

The maximum floor-beam reaction R is obtained from the value of M for l_1 = length of one stringer span and l_2 = length of the adjacent stringer span by the usual well known formula

$$R = M \frac{l_1 + l_2}{l_1 l_2} \qquad (2)*$$

Or, for equal spans,

$$l_1 = l_2 = p$$

$$R = \frac{2\,M}{p} \qquad (2a)*$$

Example 4. Compute the maximum E-50 live-load floor-beam reaction for equal adjacent stringer spans of 25 ft. Read M directly from table with $l_1 = l_2 = 25$ ft. Then, by eq. (2a),

$$R_2 = \frac{2\,M}{p} = 2 \times \frac{1180}{25} = 94.4$$

Example 5. Compute the maximum E-50 live-load column concentration for adjacent viaduct spans of 30 ft. and 60 ft. Read M directly from table with $l_1 = 30$ ft., $l_2 = 60$ ft. By eq. (2),

$$R_2 = M \left(\frac{l_1 + l_2}{l_1 l_2}\right) = 2983 \left(\frac{30 + 60}{30 \times 60}\right) = 149.2$$

SHEARS AND WEB STRESSES (HORIZONTAL CHORDS)

Consider a simple truss span, Fig. 2, of N equal panels, i.e., length $l = Np$, and let

$l_2 = bp$ = distance from right end of critical panel p to right end of span;
x = distance from right end of panel p to the neutral point of no shear in the panel.
$M_s = M$ from the table for $l_1 = x$, $l_2 = bp$;
S = desired maximum E-50 live-load shear in the panel.

The value x can be found either analytically or graphically. By equating to zero the shear in the given panel produced by a single load in that panel, x is found to be:

$$x = \frac{l}{N - 1} \qquad (3)$$

Or the graphical construction of the influence line as in Fig. 3 locates this point of zero shear and the value of x can be scaled.

The influence line for shear in panel $L_2 L_3$ of the truss of Fig. 2 is drawn in the usual way in Fig. 3. The triangular portion OCB would be used to give maximum positive shear, and it is found that for practically all cases the maximum will occur for Cooper's loadings with [illegible] wheels in advance of the point O. Therefore, since this [illegible] shear influence line OCB is exactly similar to a triangular influence line for bending moment at L_3 of a beam $OB = x + l_2$ in length, the ratio of the desired maximum shear S to the maximum bending moment M_s (obtainable from the table) is the same as the ratio of the ordinates to these influence lines. These ordinates at L_3 are:

Shear in panel, $L_3 C = \dfrac{l_2}{l}$

Bending moment at L_3 of OB

$$L_3 C' = \frac{x\, l_2}{x + l_2} = \frac{l_2}{1 + \frac{l_2}{x}} = \frac{l_2}{1 + \frac{l_2 (N - 1)}{l}} = \frac{l_2}{N}$$

*See Johnson, Bryan & Turneaure's "Modern Framed Structures," Part I, p. [illegible].

Since the ratio of these ordinates is $\frac{N}{l}$, the shear S will be:

$$S = \frac{N}{l} M_s = \frac{M_s}{p} \qquad (4)$$

This equation will evidently give results always on the side of safety. For the case of a short through plate-girder with short panels, wheel 1 may be in advance of the neutral point O for panels near the center, but the error is negligible.

Example 6. Compute the maximum E-50 live-load web stresses in a 150-ft. Pratt truss of 6 panels, 28 ft. deep, with horizontal chords. Using the bending-moment table for values M_s and eq. (3)

$$x = \frac{l_2}{N-1} = \frac{l_2}{5}, \text{ and eq. (4) } S = \frac{M_s}{p} = \frac{M_s}{25}$$

the following tabular form of computation can be adopted, noting that i = inclined length of diagonals = 37.5 ft.:

Panel No.	$l_2 = bp$	$l_1 = x = \frac{l_2}{5}$	Ms (from table)	$S = \frac{Ms}{25}$	Stress $= \frac{Si}{h}$ $\frac{37.5}{28} S$	Member
1	125 ft.	25′	5080	203.2	—272	L_0U_1
2	100	20	3370	134.8	+181	U_1L_2
3	75	15	1965	78.6	+105	U_2L_3
4	50	10	938	37.5	+ 50	L_3U_3
		Maximum floor-beam reaction			+ 94.4	$U_1\ L_1$
		Shear in panel 3			— 78.6	$U_2\ L_2$
		Shear in panel 4			— 37.5	$U_3\ L_3$

Main Web Stresses (Inclined Chords)

By an exactly similar analysis a very simple relation between the maximum moment about the moment center for any web member of a truss with inclined chords, and the maximum bending moment at a point of an equivalent beam, can be derived as follows:

Let

M_G = maximum E-50 live-load moment about moment center G of the forces to the left of the section for given web member; (U_2L_3, Fig. 4.)

v = distance in panels from G to end Lo (Fig. 4);

u = distance in panels from G to left end of the critical panel p considered;

x = distance in feet from the right end of critical panel to the neutral point of no stress;

z = lever arm of web member in feet;

M_b = maximum bending moment at L_3 for a span $OB = x + l_2$ in length, i.e., for $l_2 = bp$ as above (Fig. 4) and $l_1 = x$.

The value of x is obtained in the usual way either analytically or graphically. By equating to zero the expression for the moment about moment center G when a single load is in the critical panel, the neutral point is located and the following value for x is obtained:

$$x = \frac{l_2 v}{Nu - v} \qquad (5)^*$$

If preferred, a simple graphical construction as shown in Fig. 4 will give the value of x.*

The influence line for the moment M_G, by which stress in diagonal U_2L_3 of Fig. 4 is determined, is drawn in Fig. 5. As in the case of shear no wheels are found to left of O when maximum stress occurs, and it is evident that the positive area OCB of this influence line is exactly similar to the triangular bending-moment influence line for point L_3 of a span $OB = x + l_2$ in length. For this case, however, the ordinates at L_3 have the new values:

Moment about G, $L_3C = \frac{l_2 vp}{l} = \frac{l_2 v}{N}$

Bending moment at L_3 of OB, $L_3C = \frac{xl_2}{x + l_2}$

$$= \frac{l_2}{1 + \frac{l_2}{x}} = \frac{l_2}{1 + \frac{l_2 (Nu - v)}{l_2 v}} = \frac{l_2 v}{Nu}$$

The ratio of these ordinates is seen to be simply u, therefore to find M_G from the tabular value of M_b and then the main web stress:

$$M_G = u M_b \qquad (6)$$

$$\textit{main web stress } (U_2L_3) = \frac{M_G}{z} = \frac{u M_b}{z} \qquad (7)$$

Example 7. Compute the maximum E-60 live-load stress in diagonal U_2L_3 of a through truss of 7 panels at 28.57 ft. = 200 ft., the truss being 30 ft. deep at U_1, 34 ft. at U_2 and 36 ft. at U_3. Length U_2L_3 = 44.4 ft.

$u = \frac{34}{2} = 17$; $v = 17 - 2 = 15$; $l_2 = bp = 4 \times 28.57 = 114.3$ ft.; $z = 18 \times \frac{34}{44.4} \times 28.57 = 394$ ft.

Then, using eq. (5),

$$x = \frac{l_2 v}{Nu - v} = \frac{114.3 \times 15}{(7 \times 17) - 15} = 16.5 \textit{ ft.}$$

Find M_b from table for $l_1 = x = 16.5$ and $l_2 = 114.3$ by interpolation:

For $l_1 = 15$ and $l_2 = 110$,		2800
Add for l_1	$1.5 \times 180 =$	270
Add for l_2	$\frac{4.3}{10} \times 230 =$	100
	$M_b =$	3170

Then, by eq. (7), stress U_2L_3 for E-50 equals

$$\frac{u M_b}{z} = \frac{17 \times 3170}{394} = +137$$

and for E-60,

$$137 \times \tfrac{6}{5} = +164$$

Example 8. Compute the maximum E-60 live-load stress in the vertical post U_2L_2 of Ex. 7 (Fig. 4). For this member the moment center G is at the intersection of U_1U_2 and L_2L_3, therefore the values of u and v are not the same as in the preceding example although the critical panel remains the same (L_2L_3).

$u = \frac{34}{4} = 8.5$; $v = u - 2 = 8.5 - 2 = 6.5$; $l_2 = bp = 114.3$ ft. as before; $z = 8.5 \times 28.57 = 242.5$ ft. By eq. (5),

$$x = \frac{l_2 v}{Nu - v} = \frac{114.3 \times 6.5}{(7 \times 8.5) - 6.5} = 14.03 \textit{ ft}$$

Compute M_b from the table by interpolation:

For $l_1 = 15$ and $l_2 = 110$		2800
Add for l_2,	$\frac{4.3}{10} \times 212 = 90$	
Subtract for l_1	$0.97 \times 172 = 170$	— 80
	$M_b =$	2720

Then, by eq. (7), stress U_2L_2 for E-50 equals

$$\frac{u M_b}{z} = \frac{8.5 \times 2720}{242.5} = 95.5$$

and for E-60,

$$95.5 \times \tfrac{6}{5} = -115$$

*See Marburg, "Framed Structures and Girders," Art. 138, p. 282 and Art. 194, p. 392.

COUNTER STRESSES (INCLINED CHORDS)

The influence line (Fig. 5) for moment about moment center G to give stresses in the diagonals of panel $L_3 L_4$ (Fig. 4) indicates that the maximum counter stress $L_3 U_4$, which occurs when the negative moment is maximum, is obtained when the engines enter from the left and cover segment AO. It is found that when the criterion for maximum is satisfied no wheels of Cooper's loadings will be in advance of O. Thus the triangular influence line AOD can be used exactly as in the preceding case, noting that the value n now becomes $n + 1$ for the distance in panels from moment center G to *forward* panel load at end of critical panel. Using the same notation as in the preceding case, and, in addition,

$x_c = p - x$ (compute x by eq. (5) or use graphic method).

z_c = lever arm of counter, in ft.,

$l_2' = np = L_0 L_3$ for panel $L_3 L_4$ considered.

M_c = maximum bending moment (from table) at L_3 of span $AO = x_c + l_2'$, for $l_1 = x_c$ and $l_2 = l_2' = np$.

Then by analogy with eq. (6) and (7),

$$(-) M_G = (n + 1) M_c \qquad (8)$$

$$\text{counter stress } (L_3 U_4) = \frac{(-) M_G}{z_c} = \frac{(n + 1) M_c}{z_c} \qquad (9)$$

Example 9. Compute the maximum E-60 live-load stress in counter $L_3 U_4$ of Ex. 7 (Fig. 4). Length $L_3 U_4$ = 16 ft., n = 17 as before, $l_2' = np = 2 \times 28.57 = 57.14$ ft., $z_c = 17 \times \frac{16}{15} \times 28.57 = 388.5$ ft.

$$x_c = p - x = 28.57 - 16.5 = 12.07 \ ft$$

Compute M_c from table for $l_1 = 12.07$ and $l_2 = 57.14$ by interpolation as follows:

For l_2 = 55 ft. and l_1 = 10 ft.,		1005
Add for l_1	$2.07 \times 100 =$	207
Add for l_2	$\frac{2.14}{5} \times 86 =$	37
	$M_c =$	1249

Then by Eq. (9), stress $L_3 U_4$ for E-50 equals

$$\frac{(n + 1) M_c}{z_c} = \frac{18 \times 1249}{388.5} = 458$$

and for E-60,

$$58 \times \frac{6}{5} = 470$$

MAXIMUM CHORD STRESSES

Whenever the moment center for a given chord member lies at or vertically in line with one of the loaded panel points at the ends of the critical panel, the table can be used exactly as for the case of maximum bending moment of a beam to obtain the maximum moment desired. The maximum stress is then found as usual by dividing by the lever arm of the chord member.

Example 10. Compute the maximum E-60 live-load stresses in chords $L_3 L_4$, $L_5 L_6$, and $U_5 U_6$ of Ex. 7 (Fig. 4). Length $U_5 U_6$ = 28.9 ft.

For chord $L_3 L_4$ (moment center U_3), l_1 = 28.57 ft. and l_2 = 171.43 ft. From the table, M is:

For l_1 = 25 and l_2 = 170,		6990
Add for l_1	$3.57 \times 130 =$	460
Add for l_2	$\frac{1.43}{15} \times 1680 =$	160
	$M =$	7610

stress $L_3 L_4$ for E-50 equals

$$\frac{7610}{30} = 254$$

and for E-60,

$$254 \times \frac{6}{5} = 304$$

For chord $L_5 L_6$ (moment center U_5), l_1 = 57.14 ft. and l_2 = 142.86 ft. From the table, M is

For l_1 = 55 and l_2 = 140,		11,580
Add for l_1	$2.14 \times 200 =$	430
Add for l_2	$\frac{2.86}{10} \times 715 =$	210
	$M =$	12,220

stress $L_5 L_6$ for E-50 equals

$$\frac{12,220}{34} = 359$$

and for E-60,

$$359 \times \frac{6}{5} = 431$$

Since this stress $L_5 L_6$ is the horizontal component of stress $U_5 U_6$, we get,

$$\textit{stress}\ U_5 U_6 = 431 \times \frac{28.9}{28.57} = 436$$

Engineering and Temporary Structures for the St. Louis Pageant

Theatrical engineering is a rather limited branch of the profession, the work of which consists largely in the design of special structures and machinery for movable stages, special scenic effects, etc. A class of work which may be included in this branch is the design of the temporary structures for the open-air historical pageant given

FIG. 1. THE STAGE AND AMPHITHEATER FOR THE ST. LOUIS PAGEANT

[illegible]

recently at St. Louis, Mo., the conditions of use and the necessity of ample safety making it desirable to design these structures on engineering principles rather than by rule of thumb. The pageant was given on four days, before great crowds of spectators. The location was in Forest Park, at the slopes beneath the hill occupied by the Art Gallery (the Art Building of the exhibition of 1904), and the seats for spectators were arranged upon the slope of this hill.

The design and construction of the several structures were under the direction of Nelson Cunliff, Superintendent of Construction of the Park Department, and the construction was done by employees of the park department. The work cost about $125,000 and after the closing of the pageant all the structures had to be removed and the park restored to its original condition. The work had to be planned, therefore, with a view to strength, safety and economy.

Timber Stage or Platform

The temporary stage on which the pageant scenes were enacted was built over the water of the lagoon, and was about 520 ft. long by 200 ft. wide. It is shown in Fig. 1. It was supported on piles spaced 7 ft. 9 in. by 8 ft., having a penetration of 7 to 14 ft. and calculated for 7-ton loads by the Engineering News formula. The piles were driven by an improvised piledriver scow with a gasoline engine and 1650-lb. ram (Engineering News, June 11). The same machine was used to pull the piles after the close of the pageant.

On the pile heads (over the 8-ft. spacing) were caps composed of pairs of 3x12-in. planks, across which were laid 2x8-in. joists, 16 in. apart, with a row of 1x3-in. cross bridging in each span (Fig. 2). Upon these was nailed the 2x10-in. floor planking, covered with roofing felt. The sides and rear were protected by hand rails. It was originally considered sufficient to design this for a load of 100 lb. per sq.ft., but Mr. Cunliff raised this to 250 lb. in view of the chances of concentrated loads, the vibration due to the movement of the crowds of performers, and the still heavier vibration due to the passage of artillery and cavalry in certain scenes. A roadway across the stage was covered with tan bark for these latter movements.

At each front corner of the stage was a tower or pylon 45 ft. high, and about 12 ft. square, having four concealed floors for switchboards, telephones (for the stage directors), and for singers. The stage manager considered that it would be necessary to design the floors to carry only a few people, but as a matter of fact it was found that 25 or more people would be on the several floors at one time.

Trussed Timber Wall

In order to render the voices of the performers and singers audible to the spectators a vertical wall or sounding board was erected along the back of the stage, and was painted to form an appropriate background. This is shown in Fig. 2. The central part, 165 ft. long, rose to a height of 40 ft. above the stage (or 50 ft. above the water), and the side section of about 55 ft. rose to a height of 35 ft. above the stage. These great flat surfaces were designed to withstand a wind pressure of 60 lb. per sq.ft., as high winds were liable to occur, and the supporting trusses were designed for 30 lb. wind pressure. At the back of the structure and supported by it were dressing rooms and gangways, so that ample provision had to be made for stresses due to vibration and irregular loading.

The central portion was supported by triangular trusses, resting on the floor, and each having the rear inclined member extended to an anchor pile beyond the stage (Fig. 2). These trusses were spaced $15\frac{1}{2}$ ft. apart, and their inclined members were connected by horizontal struts and three sets of diagonal bracing. Between the vertical front posts were fitted horizontal sticks 2x6 in., 30 in. apart, to which were nailed the 1x10-in. planks forming the face of the sounding board. The truss members were put together with ¼-in. steel connection plates

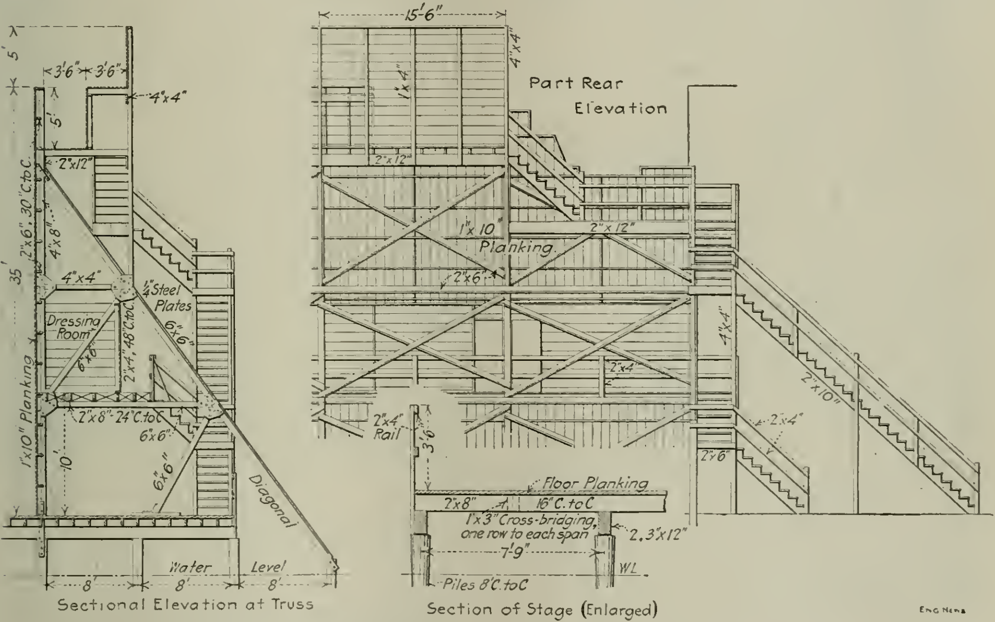


Fig. 2. The 50-Ft. Timber Wall or Sounding Board, with its Truss Supports

punched with 13/16-in. holes for bolts, the burrs being removed.

The side or wing portions of the sounding board were of similar construction, but the trusses carried no floors. They rested entirely on the stage, a 3x12-in. plank spiked

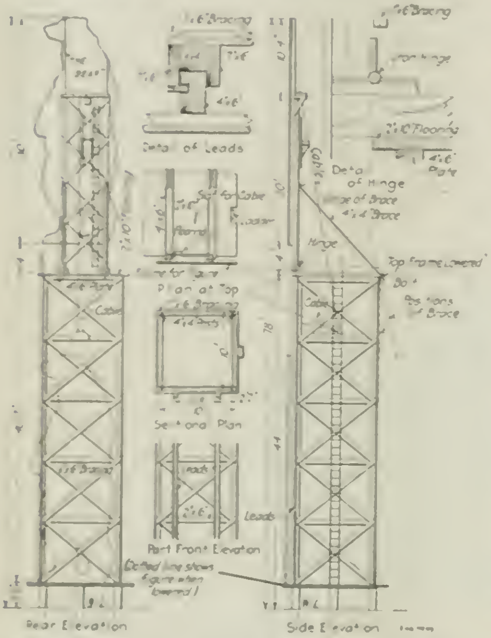


FIG. 3. TOWER AND MOVING FRAME FOR THE "GREAT BEAR" CONSTELLATION

to the joists serving as a sill to carry the rear post of the truss and its bottom strut. These trusses were 17½ ft. apart, connected in the same way as the others.

Timber Tower for the "Great Bear"

One of the illuminated effects was the constellation of the Great Bear, appearing high above the background, the stars being represented by electric lights. The figure of the bear was 30 ft. high, and in its displayed position the top was 78 ft. above the water. As this illumination was to appear only during a part of the performance, the figure had to be made movable or disappearing, and at the same time the possible difficulties due to high winds had to be considered in the handling and supporting of the figure. The figure appears at the right in Fig. 1, and the method of support is shown in Fig. 3.

Behind the stage was built a tower 44 ft. high and 10 ft. square, having four posts 4x4 in., with struts and double bracing of 2x6-in. and 1x6-in. planks on each side. On the front side were two additional posts or leads, with side pieces spiked on to form grooves for the two vertical sticks or runners at the back of the sliding frame of the "bear."

Extending 34 ft. above the top of the tower was a framed panel hinged at the base and having leads connecting with those on the face of the tower (and extending 10 ft. below the top of the tower to form a brace). This frame was supported by four braces, and at its top was a pulley for the cable by which the figure was raised from the base of the tower.

The figure stood normally at the base of the tower. Before the performance it was raised to the full height of the frame, above the tower, and this frame was then revolved backward to a horizontal position. At the proper time it was swung up by block and tackle, the end of the rope being attached to the foot of the hinged frame.

Timber Pyramids

The first scene of the pageant was in the days of the Indian mound builders, and the mounds built by this race were represented by structures forming sections of truncated pyramids (vertical on the rear side). These were of timber framing covered with painted canvas.

The largest of these, shown in the center of Fig. 1, was 32x35 ft. on the base, and 25 ft. high, to a top platform 12x16 ft. surmounted by a temple. The posts were 4x4 in., with inclined corner struts 2x10 in., and stubbing 2x4 in. In this largest structure an elevator was rigged for certain spectacular effects, and this was operated by block and tackle. After this part of the performance the mounds had to be removed from the scene, and for this purpose they were mounted on timber dollies or rollers. These structures had to be of ample strength to support a number of people, and to stand the vibration due to the performers moving about on the top and on the steps on the front slope.

To mask the entrance of the performers from each side of the stage there were wing sections of appropriate scenery, one of which appears between the two rear mounds in Fig. 1. These were large framed panels, supported by braces at the rear, and mounted on large casters with 4-in. wheels to enable the attendants to place and remove them readily.

Wood Bridge

For the service of the pageant a wood bridge having four spans of 15 ft. 6 in. was built across the lagoon, and

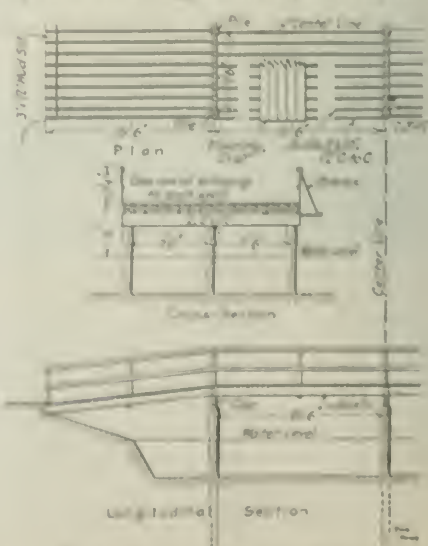


FIG. 4. TEMPORARY TIMBER BRIDGE

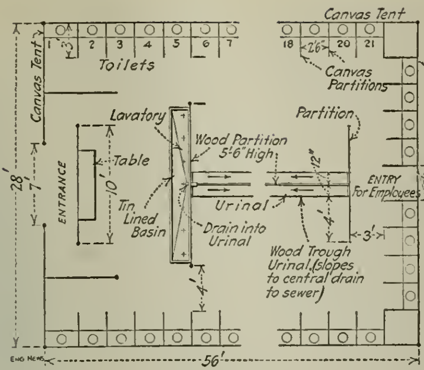


FIG. 5. TEMPORARY PUBLIC-COMFORT STATION IN TENT, ST. LOUIS PAGEANT

was designed for a live-load of 250 lb. per sq.ft. This bridge, Fig. 4, had three bents of three piles each, with caps composed of pairs of 3x12-in. planks. On these were the 2x10-in. joists, 12 in. c. to c., with a line of double bridging between them in the middle of each span. The shore ends of the joists rested on mudsills 3x12 in. The floor was of 2x10-in. planks, and uprights spiked to the outer joists carried the hand railing, the upright in the middle of the span having diagonal braces.

The bridge was built in 2½ days, at a cost of about $200. The materials used were as follows:

Piles (9)	15 ft. long
Floor beams and mud sills, 8 pieces, 3x12 in.	16 ft. long
Joists and flooring, 155 pieces, 2x10 in.	16 ft. long
Bridging, 10 pieces, 1x3 in.	16 ft. long
Hand railing, 28 pieces, 2x4 in.	16 ft. long
Nails, 20d	1 keg

PUBLIC-COMFORT STATIONS IN TENTS

Toilet accommodation for the performers and the crowds of spectators were provided in tents, a dry-pail system being used, as there were no sufficient sewer connections. The urinals, however, were connected to the park sewers. The pails were removed at night by the park department, and were emptied and cleaned at a city sewer about a mile from the site of the pageant.

There were two public-comfort stations (one for men and the other for women) in tents 28x56 ft., arranged as shown in Fig. 5. The arrangement of the women's tent was similar, but in the center were two additional rows of toilet rooms, set back to back, with a 3-ft. passageway between them for the use of the attendants.

For the performers there were four tents 11x21 ft., with a similar arrangement, except that the women's tents (two) had a single row of toilets in the center.

Temporary water mains were laid to serve a number of bubbling fountains and hydrants were provided for fire service.

The American River Irrigation District, to be formed under what is known as the Wright Irrigation District Act of California, has been recommended by a Citizens Investigating Committee headed by J. B. Wrangham, chairman, Fair Oaks, Calif. A report on the project has been made by Stephen E. Kieffer, Consulting Engineer, Mechanics Institute Building, San Francisco. The proposed district would have an area of 18,115 acres located between Sacramento and Folsom, on the north and west side of the American River. The source of water-supply would be the ditch of the existing North Fork Ditch Co. The system of this company includes 25 mi., to quote from Mr. Kieffer's report, "of well-constructed ditch and a system of pressure pipe lines. The ditch would be enlarged and cemented and the pipe lines rebuilt, enlarged and extended." The estimated cost of the "ultimate planned development" is placed by Mr. Kieffer at $687,000, or $37.90 per acre, but this does not include the purchase price of the North Fork Ditch Co. Excluding charges for water rights the estimated annual charge upon irrigated land for water tolls and taxes would be $2.65 in 1915, increasing to $4.59 in 1919, and then gradually increasing. The committee states in its report that adding the cost of water rights and physical properties, which, as we understand, it is proposed to purchase from the ditch company, the total cost of the project would be to $1,087,000, or $58.89 per acre. Taking everything into account, the annual charges for water tolls and taxes and for water rights would be $3.73 per acre in 1915, increasing to $5.11 in 1919. The reports of the committee named and of Mr. Kieffer, including an analysis of the Wright Irrigation District Act, were published as a supplement to "The Fair Oaks Citizen," of Fair Oaks, Calif., for Aug. 20, 1914. Mr. Kieffer informs us that the report was accepted by a mass meeting of the citizens of the district held on Sept. 5 and steps for the organization of the proposed district are to be taken.

Fire and Water Tests of a Metal-Lathe Wall*

A 2½-in. solid metal-lath wall of construction shown in the accompanying cut was erected in a fire-test house at Columbia University, New York City, and subjected to an average temperature of 1700° F., for 2½ hr., as measured by three thermo couples connected to a Le Chatlier pyrometer. At the end of this period a 1⅛-in. stream of cold water at hydrant pressure (25 to 30 lb.) was directed against the partition for 2½ min. Neither the fire nor the water did sufficient injury to the wall to destroy its stability or fire-resisting quality.

The partition wall tested was 14.5x9.5 ft. high, and the studding was of 1-in. channel-iron weighing 0.76 lb. per lin.ft. and set 12 in. c. to c. The lath was 24-gage expanded metal lath painted on both sides, and weighing 3¼ lb. per sq.yd. It was sewed to the studding with No. 18 annealed galvanized tie-wire.

The first, or scratch, coat of plastering was 1 part portland cement, $\frac{1}{10}$ hydrated lime and 2½ sand, by volume. About 1 lb. of long cattle hair per 1 cu.ft. of cement was used. Two similar coats, with the omission of the hair, were then applied; and finally a coat of 1:2½ mix was put on.

The heat developed a number of cracks in the exterior face of the wall within the first 10 min. of the test. No cracks were noted on the inside during the first 1½ hr., when four cracks averaging about 2 ft. in length appeared. After a total period of 2 hr. 40 min., the inner surface of the wall became crazed with innumerable hair cracks extending in all directions. The maximum opening was only $\frac{1}{16}$ in. deep.

The partition started to deflect inward almost immediately after the test was started; the maximum deflection was $4\frac{3}{16}$ in. After cooling the wall with water, the deflection was $2\frac{7}{16}$ in. The application of water washed away a large portion of the finish coat of plaster, and considerable of the second coat. No metal was exposed.

No fire, smoke or water penetrated the partition and after it had dried out, it was firm and gave a good ring when struck with a hammer.

*From a report of a fire and water test upon a fireproof partition, made at the Columbia Fire Testing Station, New York City, on July 17, for the Associated Metal Lath Manufacturers.

Methods and Equipment for Applying Lime Water at the Columbus Water-Purification Works

By Charles P. Hoover*

In the use of lime for water treatment at Columbus, Ohio, various methods for applying the lime water have been tried, and improved methods and apparatus have been adopted. This article, which is supplementary to one on "The Use of Lime in Water Purification," published by the present authors in ENGINEERING NEWS of [illegible] 1914, outlines earlier experiences and describes present methods and apparatus employed at Columbus.

It may be explained in passing that the water of the Scioto River is treated with lime, soda ash and sulphate of alumina to soften and purify it, and after the various chemicals have been given an opportunity to react the water is passed through mechanical filters. This article is concerned only with the methods and apparatus used in applying the lime.

Methods of Applying Lime Water

The following methods of applying lime to water have received considerable attention:

(1) Treating the water with a saturated solution of lime water (64 grains CaO per gal.).

(2) A continuous feed of standard strength solution of milk of lime.

(3) Adding weighed amounts of lime at definite intervals of time.

SATURATED LIME WATER—When the Columbus plant was first started it was thought advisable to apply lime to the water as saturated lime water, for the following reasons:

(1) Lime water being a true solution could be more readily applied in uniform quantities than milk of lime.

(2) The feasibility of thoroughly mixing raw water with milk of lime in large quantities was questioned. It was thought that the raw water and the milk of lime would not be adequately mixed, resulting in a marked loss in softening efficiency, owing to the fact that the suspended particles of lime (calcium oxide) would become coated with precipitated carbonate of calcium and magnesium hydrate, thereby lessening [illegible].

According to this theory, the plant was equipped with lime saturators and an attempt was made to apply the lime as saturated lime water. After being pumped into the [illegible] of the head house, the water was divided. One portion passed over a weir, milk of lime was added and it was then passed into the lime saturators, designed to make a saturated lime water carrying about 76 grains $Ca(OH)_2$ in solution and about 15 grains in suspension [illegible].

[illegible] and adjustable weirs were provided, regulating the flow of raw water to the saturators from a minimum of [illegible]% to a maximum of [illegible]%. More than [illegible] [illegible] was [illegible]. Considerable lime ([illegible]) was lost in the sludge which collected in the bottom of the saturators. Sludge taken from these deposits contained as much as 70% CaO, hence, after a short time, the attempt to make saturated lime water was abandoned.

STANDARD SOLUTION OF MILK OF LIME—Since abandoning the procedure of treating with saturated lime water, milk of lime has been added to the raw water, either at the entrance of the saturators which are now used as mixing tanks or at the entrance of the baffled mixing tanks. It is fed automatically in proportion to the quantity of water pumped. This is accomplished by means of an automatic chemical feed regulator.

The method of handling lime in bags was abandoned in February, 1913, and an entirely new equipment was installed for storing and handling the material. In this new method of procedure, as now practiced at the Columbus water-softening and purification plant, crushed lime is elevated into storage bins, and from the storage bins the lime drops into automatic weighing scales, definite amounts of lime being discharged from the scales into the slacking tanks at predetermined intervals of time. (The storage bins and weighing apparatus are described in some detail further on.) The slacked lime is discharged from the slacking tanks into the chemical solution tanks below, and milk of lime of required strength (3 or 4% solution) is made by the addition of water. The paddles installed for the purpose of keeping the milk of lime thoroughly stirred have proven inadequate, and jets of compressed air have been supplemented at three points near the bottom of each solution tank. Tests made upon portions at 15-minute intervals, from the time the solution tank first begins to discharge until it is empty, show that the solution varies in strength from about 2 or 3% each side of the mean.

ADDING WEIGHED AMOUNTS OF LIME AT DEFINITE INTERVALS OF TIME—At the St. Louis water-purification works, lime is weighed by automatic weighing scales into slacking tanks, and discharged from the slacking tanks directly into the water. This plan may very easily be adopted at Columbus by simply bypassing the present lime-solution tanks.

The advantages of this plan are:

(1) No chemical feed regulator is required other than the automatic weighing scales.

(2) No chemical solution tanks are needed, thus the paddles and air necessary to keep the milk of lime in good suspension may be dispensed with.

But in order for this plan to work out successfully it is necessary that the quantity of water to be treated with lime be delivered to the plant at a uniform rate.

PIPING MILK OF LIME—Much trouble was experienced at Columbus in transporting the lime milk from the orifice box to the point of application to the water. Heavy deposits of lime formed in the pipes and stopped them up. This was overcome by connecting an ejector into the pipes just below the chemical feed regulators.

HYDRATED VS. QUICKLIME—The work of sacking lime [illegible] proved to be a very disagreeable job, especially in hot weather, on account of the lime dust sticking on the sweaty hands and faces of the men. The sticking of lime dust often resulted in severe burns and sores. It was thought that the disagreeable feature attending the use of quicklime might be overcome by using hydrated lime in its place.

Several carload lots of hydrated lime packed in [illegible] valve-type paper bags were received and used. This material was easily stored because the bags were square and could be closely packed, and as the lime had its affinity for water satisfied there was no trouble from swelling and [illegible]

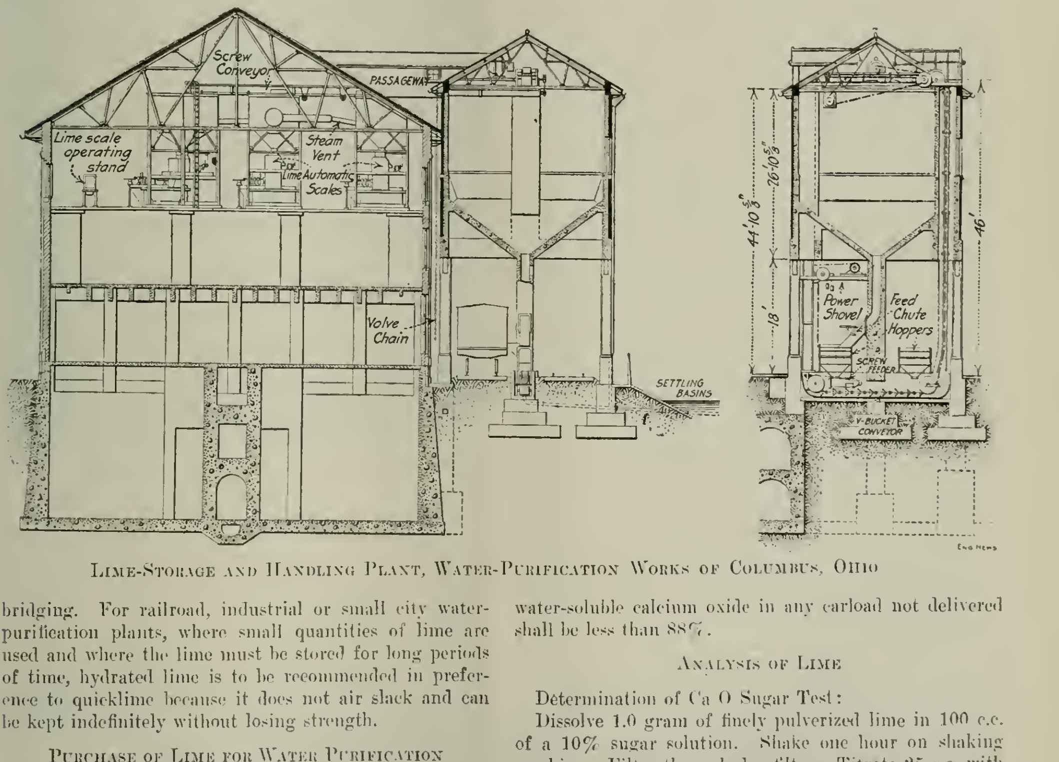
*[illegible] Water-Softening and Purification [illegible] Columbus, Ohio. [illegible]

bursting of bags. The material could be kept indefinitely without losing strength because it packs into a dense mass, rendering the penetration of carbon dioxide very difficult. However, it did not prove economical or satisfactory to handle, and its use was abandoned for the following reasons: Hydrated lime costs more than quicklime. If the hydrated lime is shipped to the plant where it is to be used the consumer must pay freight on a large per cent. of water, aproximately 30%. It is very difficult to apply hydrated lime to water on a large scale. One of the disagreeable features of using hydrated lime in large quantities is that it "flies" badly, scattering dust through the plant The dust gets into the eyes, noses and throats of the men handling it. Hydrated lime, according to Monfort, cannot be successfully fed through an orifice, and if fed into automatic scales there is trouble due to more frequent cleaning of the sedimentation basins.

In paying for lime the contractor should be paid a bonus when the calcium-oxide content of the lime exceeds the guarantee, and a penalty should be extracted when the percentage of the calcium oxide is below the guarantee.

Specifications for Lime Used at Columbus

For any carload of lime containing 88% of water-soluble calcium oxide, the city will pay to the contractor the price per ton stated in the proposal. It is hereby agreed that the city shall pay a bonus of 1½% of the contract price per ton for each 1%, by which the water-soluble calcium oxide in any carload lot delivered shall exceed 88%, and shall exact a penalty of 1½% of the contract price per ton for each one per cent. by which the



Lime-Storage and Handling Plant, Water-Purification Works of Columbus, Ohio

water-soluble calcium oxide in any carload not delivered shall be less than 88%.

bridging. For railroad, industrial or small city water-purification plants, where small quantities of lime are used and where the lime must be stored for long periods of time, hydrated lime is to be recommended in preference to quicklime because it does not air slack and can be kept indefinitely without losing strength.

Purchase of Lime for Water Purification

The value of lime for water-purification purposes depends upon its percentage of water-soluble calcium oxide. The reactions already given show that it is the calcium oxide in the lime that absorbs the carbonic acid in the water and precipitates the magnesium. The percentage of inert material, such as carbonate of lime, cinders, unburned and overburned lime, magnesium, alumina and silica, increase or decrease in the same proportion as the calcium-oxide content increases or decreases, and the presence of this inert material detracts from the value of the lime because it increases the bulk, thus increasing the cost of handling and storing it. The inert material being insoluble in water, causes trouble by clogging the slacking tanks and orifice boxes and necessitates

Analysis of Lime

Determination of Ca O Sugar Test:

Dissolve 1.0 gram of finely pulverized lime in 100 c.c. of a 10% sugar solution. Shake one hour on shaking machine. Filter through dry filter. Titrate 25 c.c. with N/10 H_2SO_4, using Phenolphthalein as indicator. The burette reading multiplied by 1.122 = % Cao. (The 10% sugar solution should be made with cool, freshly boiled distilled water.)

Lime-Storage Bins, Conveying and Weighing Apparatus

As has been explained, the lime used at the Columbus plant was at first handled and stored in canvas bags. Finding this unsatisfactory, the lime was bought in bulk in carload lots, bagged at the purification works and used shortly after bagging, the lime contractor varying his weekly deliveries to suit the demand as determined by the changes in the character of the water. Regulation of the

supply proving difficult, and the operations also proving troublesome and expensive, the writer and C. J. Clarke, engineer in the water-works department, were instructed to devise new means for handling the lime. Their plans and specifications were adopted, after having been checked by R. S. Jones, of Columbus, who suggested some changes. The storage-bin, conveying equipment and automatic weighing scales were described by the writer in the annual report of the Columbus Division of Water for 1913, from which the remainder of this article is reprinted.

STORAGE BIN—This consists (see sections of hopper and building) of a concrete hopper, 25½ ft. square, with bottom slopes of approximately 38 degrees with the horizontal, heavily reinforced to take the direct pull due to the weight of the lime and the horizontal thrust due to the bulging effect. The main weight is carried on four reinforced-concrete beams, supported in turn by eight columns with flared footings, which take bearings on the solid gravel under the track bed. The center column takes part of the load of the hopper and is cored inside with an 18-in. square opening used as a chute to reclaim lime from the storage bin and deliver it by means of the elevator and conveyor to the tanks in the headhouse.

The lime may be taken directly from the cars to the tanks without passing into the storage bin. The storage bin has a capacity of 220 tons of lime, or about 22 days' supply, which gives ample storage for any emergency.

CONVEYING EQUIPMENT—The conveying equipment consists of a continuous V-bucket conveyor and elevator with a capacity of 50 tons per hr., running in a concrete trough between the tracks and through chutes each side of the bin, so that it is inclosed throughout its entire length. The lime is discharged from this elevator into a 12-in. screw conveyor which extends into the roof of the head house and discharges into the top of three tanks which are supported on the third floor of the head house on angle columns and extend through the ceiling into the roof space above.

The V-bucket conveyor and the screw conveyor are operated by an [illegible] Westinghouse direct current, 220-volt motor, situated in the roof of the storage bin. The tanks are constructed of ¼-in. steel plate, are 8 ft. square, with hopper bottoms, and have a combined capacity of approximately [illegible] tons, or about two days' supply.

Lump lime, averaging about 2 in. in size, is fed from the tanks into automatic weighing scales, which automatically weighs the lime into the slacking tanks. The slaked lime discharges from the slacking tanks into the lime-solution tanks below. Milk lime, of required strength, is made by the addition of water. The milk of lime is kept well stirred by means of paddles and jets of compressed air and is measured into the water by a chemical feed apparatus. Later it is planned to pipe the slacked lime directly from the slacking tanks into the water, thus bypassing the lime-solution tanks and the chemical feed regulator.

The writer is indebted to W. N. Goodman for the following description of the automatic scales:

AUTOMATIC SCALES—The three automatic scales are [illegible]

charged is placed in the weight box, or the excess of weight over 75 lb. can be added by a sliding counterpoise working on the graduated lever.

The lime is fed to the weigh hopper of the scale down a sloping chute in which is placed a reciprocating plate feeder to keep the lime from blocking. This feeder is in action only while the scale is filling. It is motor-driven by an electric motor, and as soon as the scale has received its load the motor automatically stops.

After being fed down the inlet chute the lime passes through a gate of the undercut type. When the weigh hopper has received four-fifths of its load the gate partially closes, the last one-fifth being dribbled into the hopper. When the exact amount has been received into the hopper, the gate closes and is locked by a toggle mechanism. The scale hopper holds the load until it is time to discharge it.

The time of discharge of the three scales is governed by a very ingenious electric clock device specially designed for this job. The scales are connected electrically to the clock and so arranged that one, two or three scales may be discharged as desired merely by throwing in the corresponding switches. Supposing Scale No. 1 is required to discharge 100 lb. every minute, it is set to weigh exactly 100 lb. and a minute disk is placed on the clock face. At every one minute interval the clock movement closes a switch which is connected to the scale by means of a solenoid; this solenoid discharges the scale by allowing the weigh hopper door to open. After discharging the load the hopper door closes again and locks itself. In doing so it opens up the inlet gate and automatically starts another weighing, which will be discharged at the right time. The clock can be set to weigh any number of discharges, from 60 per hr. down to 1 per hr.

Each scale is equipped with an automatic stop-counter device, so that when a certain quantity of lime is required to be weighed into the slacking tank the counter is set to the number of drafts required, and when that quantity has been weighed the scale will stop automatically. The scales are very accurate, much more so than any hand-weighing methods.

In order to get rid of the steam arising from the water in the slacking tanks, pipes are connected to a suction fan, which draws nearly all the steam away from the scales. To prevent dust and steam from clogging the operating levers of the scales, all of the levers are placed outside of the scale proper, which is inclosed in a heavy cast-iron dust-proof casting. All of the pins in the scales are made of phosphor bronze and the bearings in which these pins work are bronze bushed, so there is no chance for corrosion to affect accurate and continuous work. The clock device is arranged in a dust-proof lock-up casing, with glass doors, thus preventing tampering.

UNLOADING LIME FROM CARS—A power shovel for unloading lime from cars into the hopper of the conveyor is located just under the storage bin and supported on the columns. It is operated by a separate 5-hp., 220-volt Westinghouse motor, and has unloaded a [illegible]-ton car in about three hours, two men being necessary to do the unloading. The total contract price for the bin and equipment complete was $17,[illegible]. Extras were $1303.

The new installation was put in service Feb. 5, 1913, and it has operated successfully from the start.

COST OF OPERATION—A cost system is kept at the plant and the cost of every job or operation is known. A comparison of the cost of unloading, sacking and handling chemicals during the year 1912, the year before the new equipment was installed, and the cost of handling chemicals during year 1913 is of interest.

In 1912, 5774 tons of chemicals were used and 28,[illegible] hr. of labor are charged against the handling of this material or 4 hr. and 54 min. for each ton handled.

In 1913, 7701 tons of chemical were used and [illegible] hr. of labor are charged, or 3 hr. and 23 min. per ton.

This represents a saving of 1 hr. and 31 min. on each ton of chemical handled. At the present time the labor cost of handling chemicals amounts to approximately [illegible] per hour, so that the saving of 1 hr. and 31 min. is equivalent to approximately [illegible] per ton.

Figured on this basis the saving effected during the year 1913 by the introduction of this new equipment amounted to $[illegible].

Methods of Construction of the Grand Mere Hydro-Electric Plant, Quebec

One of the largest hydro-electric plants in Canada is now nearing completion at Grand Mere, Quebec, 90 miles northeast of Montreal. At this point, the St. Maurice River which drains an area of some 17,000 sq.mi. lying

Fig. 1. The Rocky Island Which Gave Grand Mere Falls Its Name

north of the St. Lawrence, crosses a barrier of hard Laurentian rock and falls about 45 ft.

The Laurentide Co. has for years had in operation at this point one of the largest pulp and paper manufacturing plants in Canada, utilizing, however, only a part of the available power. Two years ago, the company determined to proceed with the work of power development at this point on a large scale, and plans for the work were prepared by Geo. F. Hardy, Consulting Engineer, 309 Broadway, New York. On Jan. 16, 1913, a contract for the construction of the entire work was made with the H. E. Talbott Co., Engineers and Contractors of Dayton, Ohio.

At Grand Mere Falls, the St. Maurice River is divided into two channels by a large island of hard rock covered with a heavy growth of trees.

On the western channel the original power plant and paper mill were constructed. In the project for utilizing the entire flow of the river, it was necessary to cut this rocky island down to water level to obtain a sufficient length of spillway for controlling the water level above the falls in the flood season.

It was a detached pinnacle of this island whose rugged profile gave Grand Mere its name, as may be understood by reference to Fig. 1, showing a winter view of the "Grandmother." While this ancient landmark had also to be removed in building the new power plant, the directors of the Laurentide Co. desired that it should be preserved, and the contractor was required to take it down piece by piece and reërect it on a pedestal near the company's office. The total mass moved represented five or six hundred tons of rock.

While the natural fall was about 45 ft., the dam now under construction will so raise the level of the water above the falls as to give a total head of 76 ft. The still water, navigable by motor boats, will extend about 75 miles upstream to La Tuque.

The advantage to the power plant of the great storage thus created for carrying peak loads will be obvious. It may be noted in addition, that the Provincial Government of Quebec has made plans for transforming a labyrinth of lakes on the upper reaches of the St. Maurice into great storage reservoirs, which will enable the spring floods to be impounded and released during low-water periods.

The designs for the hydro-electric plant at Grand Mere provide for the development of 180,000 hp. by nine turbine-generator units of 20,000 hp. each. These turbine-generators are to be located in a power house which will form a barrier across the west channel of the river.

Fig. 2. Beginning Work at Grand Mere Falls, July 20, 1913.
(Old paper mill at left. Upper coffer-dam completed on top of old paper-mill dam. Work started on coffer-dam across tail race.)

The east channel of the river is to be closed by a concrete spillway dam, which will extend across the island.

The construction work had to be carried out without interrupting the operation of the present power plant and paper mills located close to the west bank of the river. This was not wholly disadvantageous, however, since the large proportion of the river's flow diverted through the turbines of the present paper mill, made so much less water to be taken care of in construction.

To lay dry the power-house site, the water was shut off from above by a low coffer-dam on top of the paper company's old wooden crib dam. This was comparatively easy. Then a coffer-dam about 600 ft. long was carried across the tailrace in an average depth of some 20 ft. of water. This dam was made up of wooden cribs with 12x20-ft. pockets filled with stone, the outside covered with sheet piling and canvased to make it water-tight. The rock bottom on which this coffer-dam was placed was very irregular and was covered with a deep deposit of bark, logs, gravel and boulders, which had to be dredged out before sinking the cribs.

As stated above, the contract for the work was signed on Jan. 16, 1913. The early months of the year were spent by the contractor in getting his force and plant onto the ground and organized. The coffer-dams could not be built until after the spring floods in May, when the melting snow pours into the upper reaches of the river. Between that time and the latter part of August, however, the coffer-dams were completed and pumped out. By the end of December, the rock excavation had been completed over the whole power-house area, about 400x160 ft., and in the tailrace below the power-house area, as shown in the accompanying figure. The draft-tube forms had been placed and the concrete had been poured for the entire lower portion of the power house and the section of dam adjoining, bringing the structure to the elevation of the scroll case and above the normal level of water in the tailrace. The pumping plant and lower coffer-dam had also been removed.

Work on concrete laying could not be resumed in the spring till after the flood season in May. Fig. 5 shows the

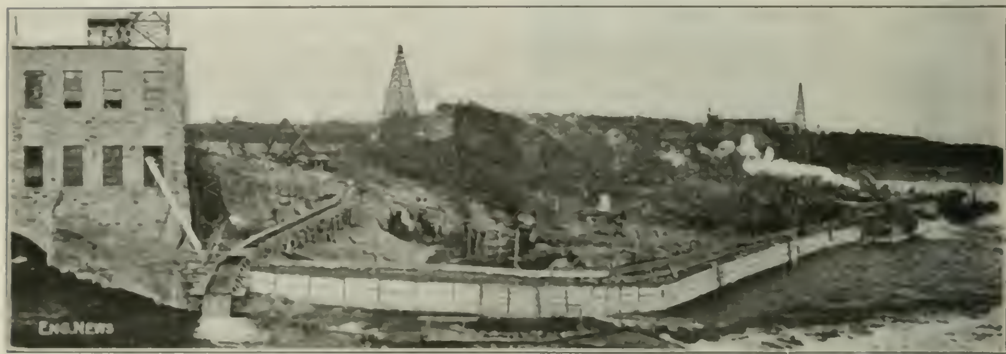


FIG. 3. TAIL RACE COFFER-DAM, COMPLETED AND PUMPED OUT, AUGUST 15, 1913

flood pouring over the power-house foundation on May 27, 1914. Fig. 6 shows the power-house foundation on June 11, after most of the flood had subsided.

Work was now pushed with the utmost rapidity. Hoisting towers and concrete distributing spouts were erected and the placing of forms and of reinforcement previously made ready and the pouring of concrete went on night and day. Fig. 7 is reproduced from a photograph of the power-house work taken on July 24. A month later, the steel frame of the power house was nearly completed and the concrete had been carried up to the floor level of the generator room, while the work of concreting the partitions between the gate chambers was far advanced. Besides the work on the west channel, the dam across the east channel had been completed for about half its length and most of the island had been excavated down to water level, the rock removed being used for concrete.

It will be of interest to note the plant, methods and organization by which the work has been carried forward with such rapidity. The accompanying general plan of the work, Fig. 8, will assist in making the operation clear.

In the first place, it is well to emphasize that the problem of chief magnitude on such a work is the problem of rapid and economical conveying and placing of material. The entire work involves the excavation of 110,000 cu.yd. of rock and 810,000 cu.yd. of earth, placing 170,000 cu.yd. of concrete with 1000 tons of reinforcing steel and erecting 3000 tons of structural steel. The lumber, cement and steel which have to be brought to the work aggregate over 2000 carloads.

FIG. 4. DRAFT TUBES COMPLETED AND ROCK EXCAVATION IN TAIL RACE IN PROGRESS, NOVEMBER, 1913

The river at the falls flows in a narrow gorge with steep banks, and available room on the west side was already occupied by the paper company's plant. Material had to be received and stored on the banks of the river therefore high above the site where it was to be finally used. The cableway system was adopted to transport the material from this point to its place in the works, and it is difficult to see how any other system could have compared with it for economy or speed.

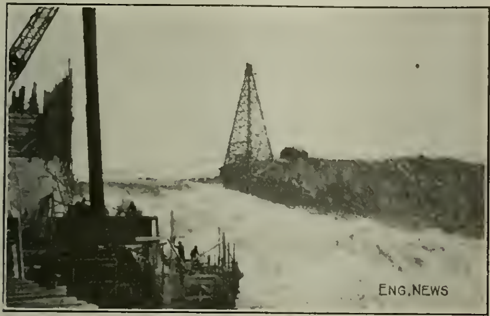


Fig. 5. Spring Flood Going over Completed Lower Section of Power House, May 27, 1914

Fig. 6. Lower Part of Power House after Partial Subsidence of Flood, June 11, 1914

(Inclines are the lower parts of the penstocks above the turbines.)

Sidings were built from the railway to the site on both sides of the river, one on the west side reached a sand deposit on the west bank below the falls from which sand for the work was obtained. The sand was loaded on railway cars by a clam-shell bucket handled by a locomotive crane. A clam-shell bucket and crane was also used to transfer the sand from the cars to storage bins, from which it is drawn for use as required.

On the immediate site of the work, the materials were hoisted and conveyed by four Lidgerwood cableways. One of 7 tons capacity and 1650-ft. span extends from the main concrete mixing plant over the power house and part of the dam, and is used chiefly for transporting concrete from the main mixing plant to the work. A smaller cableway of 3 tons capacity and 600-ft. span, on the west side of the river, carries materials for concrete to an auxiliary mixing plant on the roof of the paper-mill building on the west bank of the river close to the power-house site from which mixer the concrete is chuted where desired. Another 7-ton cableway of 1125-ft. span is stretched over the island. Skips of rock loaded by the excavating force on the island are carried on cars running on transverse tracks to a point beneath the cableway, and are then hoisted by the cableway, carried to the east bank and dumped on an inclined platform from which the rock slides into the crushers. A fourth cableway will handle concrete for the completion of the spillway over the east channel.

All but one of these cableways are operated by electric motors. Current for these and other motors on the work and for lighting the entire plant is supplied from the hydro-electric plant at Shawinigan Falls, four miles below on the St. Maurice River. The 50,000-volt current is received at Grand Mere in a transformer station where it is stepped down to 2210 volts by a bank of three 1000-kv.-a. transformers. Part of this 2240-volt current goes to a bank of three 100-kw. transformers which reduce it to 370 volts at which pressure it goes to a rotary converter for reduction to 600-volt direct-current for operting d.c. motors.

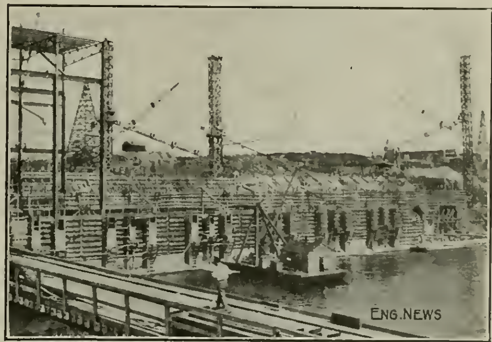


Fig. 7. Progress of Concreting and Steel Superstructure Erection, July 21, 1914

Another part goes to three 75-kw. transformers which deliver 450-volt current for a.c. motors. The current for lighting passes through a 25-kw. transformer and is delivered at 230-115 volts.

The concrete bucket used on the long span cableway is shown in Fig. 9. The bucket is dumped by letting the two overlapping hinged leaves which form the bottom of the bucket swing apart. These leaves are held closed by the tension on the ropes by which the bucket is traversed on the cable, and by slacking on these ropes the cableway operator can dump the bucket at any point.

This system gives very rapid operation, and the bucket empties itself clean. With the bucket traversing a distance of 1100 ft., 187 buckets of 2.4 cu.yd. each were poured in a ten-hour shift.

For distributing concrete in the power-house construction, extensive use is made of hoisting towers with chutes and gates, as may be seen in the accompanying figures. Small electric trolley hopper cars are used for carrying the concrete from the hopper into which the cableway deposits it to the foot of the hoisting towers. Portable mixers are used on parts of the work not easily reached by the cableways. During the month of July about 21,000 cu.yd. of concrete were placed in the work.

In order that the rate of progress of the work might be carefully watched, a large diagram was plotted at the outset with lines showing the expected rate of progress on ex-

eration, concrete laying, steel erection, and other principal items of work. This diagram is posted on the wall of the main office and upon it is plotted daily the amount of work accomplished. By comparison of the lines of expected and of actual progress, it is seen at a glance whether the work is proceeding faster or slower than is necessary to reach completion at the time originally planned. Daily reports are also filed, showing the output of each principal piece of plant, bucket of concrete handled, skips of rock transported, cars of sand delivered, etc.; also the hours of time during each of the machines was shut down, with the reason why the shutdown was necessary.

The main stone-crushing plant, to which the stone ex[illegible]

concrete was carried up, the forms were ready for setting.

Besides the work on the dam and power-house construction, a large tract of land next the river bank above the dam had to be raised some 12 to 15 ft. to bring it above high-water level when the dam is completed. This tract is used by the paper company for storing its year's supply of pulp-wood. It may be explained that the wood used for pulp is floated down the St. Maurice River from various lumbering operations on the head waters. Most of this wood comes down the river during the season of high water in the spring, and is cut into 2-ft. lengths, barked and put into storage to be used as needed. Two lofty steel towers, 180 ft. high, carry by light suspension members, a latticed truss, 600 ft. long. There is also a head tower 90 ft. high and an inclined truss 600 ft. long. These trusses carry an endless-chain conveyor, which transports the barked pieces of pulp wood and drops them on the storage pile.

This structure was erected last winter by the Talbot Co., which also raised the level of the wood-storage yard around these towers, bringing in for that purpose some 200,000 cu.yd. of earth on dump cars loaded by steam shovel.

The contractors have had, at times, a force of some 1100 men on the work, and the care of this force was as important a feature in securing rapid and efficient work as the provision of efficient machinery. Nearly all the foremen and even some of the workmen have been employed more or less continuously by the contracting company on various construction jobs since 18[illegible].

As is usual on large construction operations, the working force is made up of a mixture of many nationalities, mostly brought in from outside. The local French Canadians were little used in construction work of this sort and comparatively few were employed. A medical service was maintained on the work and gave a careful physical examination to every applicant for employment. A considerable number, found to be infected with dangerous or infectious diseases, were rejected and only those were accepted who were found physically fit for their jobs. The physicians had also to care for those hurt by accident or attacked by disease.

The water of the St. Maurice River is polluted by drainage from settlements above, and cases of typhoid in the locality are common. The entire working force, therefore, was supplied with water carried from large springs in the vicinity. To reduce the risk of accident to water boys

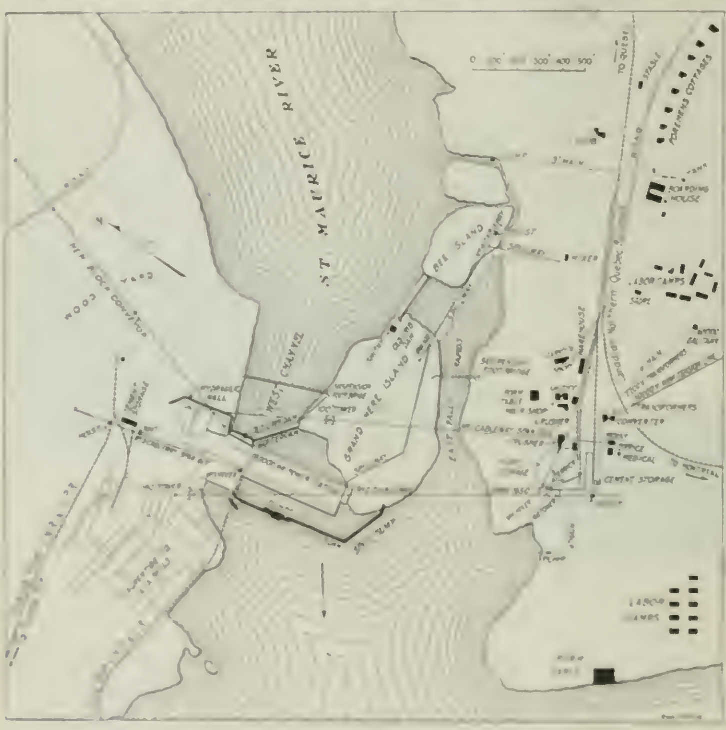


FIG. 3. GENERAL PLAN OF WORKS FOR CONSTRUCTION, GRAND MERE HYDRO-ELECTRIC PLANT

[illegible] from the island is delivered, crushed, in a large gyratory crusher, with a small [illegible] crusher taking care of [illegible] pieces rejected by the screen below the main crusher. Belt conveyors are used for carrying the crushed stone and also for the bags of cement from the cement storehouse (75,000 bbl. capacity) to the mixer. A conveyor is operated at the sand and gravel pit for taking cobbles and stones rejected by the screens through which the gravel is passed.

A carpenter shop, with band-saw, [illegible] and other woodworking tools, was installed to carry out the form work; and to facilitate the laying out of the large and complicated forms necessary for the draft tubes, scroll cases, etc., a large [illegible] form table was built outdoors. The form work, of course, was done in advance so that as fast as the

Fig. 9. Bottom Dumping Bucket for Carrying Concrete

on the power-house work, the spring water was piped to several drinking fountains.

There being no suitable housing accommodations in the village of Grand Mere for the working force, a workmen's camp was built on the east side of the river. Fig. 10 shows a street in a section of this camp for the foreign workmen. About 40 of these bunk houses were built, and a system of discipline was put in force to keep the camps in sanitary condition, occupants of the camps who did not keep their houses clean or who did not use the sanitary closets provided for them, being fined.

For the foremen and English-speaking workmen, a boarding house was built for those without families and a row of neat cottages was erected which were rented to married men. Adjoining the boarding house was erected

Fig. 10. Workmen's Camp at Grand Mere Falls

a bath house with showers and tubs for the free use of all employees. A club house was also built and equipped with pool tables, cigar stand, reading room and a barber shop. A nominal charge of 50c. per month was made for all club privileges.

These various provisions were effective in attracting to and retaining on the work an efficient force of contented employees.

In the organization of the H. E. Talbott Co., by which this work has been carried forward, H. E. Talbott, Jr., is general manager, and has resided at Grand Mere in general charge of all operations.

The progress made on the work this season has been so rapid that the entire plant would probably have been substantially completed by Jan. 1. The sudden financial stringency due to the European war, however, has made necessary a temporary curtailment of work, and, therefore, the date of completion is uncertain.

Snow Removal by Melting with Artificial Heat

By S. Whinery*

The opinion is quite general among engineers and others that, while theoretically it should be possible to melt snow on the streets by artificial heat at a reasonable cost, the method is impracticable and uneconomical in actual practice. Such experiments as have been made seem to confirm this conclusion. But the thoughtful enquirer is likely to reason that where a process appears to be practicable and economical in theory, failure to secure satisfactory results in practice may be due to a lack of knowledge or skill in applying it, and that the whole subject may be worth further investigation. The fact that, in burning, 1 lb. of coal gives off sufficient heat to melt from 70 to 90 lb. of snow, looks attractive at first thought to one who is not familiar with the difficulties of converting heat into useful work.

Snow removal in our Northern cities is one of the important municipal problems that has not yet been satisfactorily solved, though it has attracted much attention and has been the subject of no little unintelligent inventive skill. Many schemes and devices for disposing of snow by melting have been proposed and a number of them tried, only to prove failures because the basic scientific principles involved and their practical application were unknown or disregarded by the inventors.

There is not much available literature on the subject, and it may be worth while to review the scientific and practical elements of the problem, which are not so obstruse and complicated as those who have not investigated them are likely to imagine. The purpose of this article is to do this briefly, using for illustration a project for melting snow by the application to it of water, taken from the fire-hydrants, heated to a temperature just below the boiling point in an ordinary steam boiler and applied to the snow on the street by means of a hose and nozzle.

Assume that a standard 60-hp. portable boiler is used; i.e., a boiler capable of evaporating 30 lb. of water per hp. per hr., from a feed-water temperature of 100° F. to steam at a gage pressure of 70 lb., equivalent to about $29\frac{1}{2}$ lb. from a feed-water temperature of 50° F. The quantity of water evaporated in an 8-hr. day would be $29.5 \times 60 \times 8 = 14{,}160$ lb. To convert 1 lb. of water into steam under the conditions named, requires, we know, the absorption of about 1165 B.t.u. and the quantity of heat necessary to so convert 14,160 lb. of water is

$$14{,}160 \times 1165 = 16{,}496{,}400 \text{ } B.t.u.$$

The quantity of heat required to melt 1 lb. of snow from a temperature of 20° F. is:

	B.t.u.
To raise the temperature to 32°	12
Heat absorbed in fusion	142
Total	154

*Consulting Engineer, 95 Liberty St., New York City.

If the snow weighs 8½ lb. per cu.ft., the net quantity of heat required to melt 1 cu.ft. of snow would be:

$$151 \times 8\tfrac{1}{2} = 1283 \text{ B.t.u.}$$

But a part of the heat contained in the hot water would be lost in passing through the discharge hose, and in its application to the snow. If we assume that only two-thirds of the heat leaving the boiler would be made actually available for melting snow then the gross quantity of heat necessary to melt 1 cu.ft. of snow would be 1925 B.t.u., and the 8-hr. product of heat from the boiler should melt:

$$\frac{16,496,400}{1925} = 8569 \text{ cu.ft.} = 317 \text{ cu.yd. of snow}$$

To heat 1 lb. of water from 50° F. (the assumed temperature of the hydrant water) up to a temperature of 210° requires 210° − 50° = 160 B.t.u., and since the boiler is capable of developing 16,496,400 B.t.u. per 8-hr. day, the quantity of water so heated would be:

$$\frac{16,496,400}{160} = 103,102 \text{ lb.} = 12,363 \text{ gal.}$$

What would be the cost?

We may safely estimate that in a portable locomotive-type boiler of 60 hp. capacity, 1 lb. of anthracite coal would evaporate 6 lb. of water, and as the evaporating capacity of the boiler is 14,160 lb. per 8-hr. day, the quantity of coal required would be:

$$\frac{14,160}{6} = 2360 \text{ lb.} = 1.18 \text{ tons}$$

The complete plant necessary would be the portable boiler equipped with a gasoline engine to propel it on the street, sufficient hose to connect the boiler to a fire-hydrant, and a short discharge hose and nozzle.

As the pressure would be that in the water mains only, a cheap second-hand boiler could be used, and condemned fire hose would answer the purpose. The cost of the plant would probably not exceed:

One second-hand 60-hp. portable boiler	$[illegible]
Hose, nozzle and connections	[illegible]
Gasoline engine attached to boiler truck	[illegible]
Total	$[illegible]
The yearly charges on the plant would be:	
Interest, depreciation and repairs, say 15%	[illegible]
Storage [illegible]	[illegible]
Total	[illegible]
If we assume that the plant would be used [illegible]	
[illegible]	[illegible]
The total operating expenses per day would be about:	
Plant expense	$[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Total	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Total per cu. yd.	[illegible]

The cost of hydrant water used is not charged in the estimate; in cities like New York, having an abundant gravity supply during the winter season this item may be neglected.

The above statements and figures seem to be conservative on the side of safety, and if so, the results ought to be attainable in practice. The figures seem sufficiently promising to warrant a fair trial of the project under working conditions.

We have in the above figured on melting all the snow on the street. It is probable, however, that more or less unmelted, or partly melted snow would be carried into the sewers with the current of water, thus tending to reduce the cost.

Recent experience in New York City seems to favor the method of disposing of snow by collecting and forcing it into the sewer-inlets and manholes by the use of a jet of cold hydrant water. By the hot-water method, no handling of the snow would be necessary. It would be melted as it lies on the street, and the resulting water would flow into the sewer inlets. There would probably be no question of the capacity of the sewers to handle all the water produced.

It is not intended to here discuss the probable merits or demerits of artificial snow melting, nor the practical difficulties and objections to be encountered. The purpose is only to outline the technical problems involved, for the use of practical men or inventors who may wish to give the matter further consideration.

The hot-water project was taken for illustration not only because it includes most of the technical elements involved, but because water is a good absorbent and conveyor of heat, and by its rapid penetration into the snow should transmit its heat to the snow with comparatively little loss. The plant used for illustration is crude, for it is to be remembered that in steam boilers only from 50 to 80% of the heat yielded by the fuel is actually taken up by the water. It is quite possible that a more efficient type of heater for the purpose could be devised.

At first thought, it would seem that a project for the application of the heat from the coal directly to the snow would be more economical and less complicated, but as this seems to involve the application of the heat to the surface only of the snow, the heat losses would be much greater than from the penetrating hot water.

Concrete Steps and Retaining Wall

A recent feature of park construction work at St. Louis is a long flight of steps on the slope of Government Hill, in Forest Park. It is about 115 ft. long, with a total rise of 35 ft., the steps being interrupted by two platforms. It was designed originally as a monolithic structure throughout, but Nelson Cunliff, Superintendent of Construction of the Park Department, thought that this would result in unsightly cracks and that continuous expansion and contraction movements might result in the entire structure shifting downhill.

The design was therefore modified by putting an expansion joint through each platform, and designing each section as a beam with three pier supports. This is shown by the longitudinal section in Fig. 1. The middle pier serves as anchor, so that expansion and contraction movements take place in both directions from it. There is no longitudinal joint, but the steps are divided into two sections by a central [illegible] space. The steps are of rather unusual shape, 19½-in. tread and only 4-in. rise, so that it will be easy to wheel baby carriages up and down the steps. Each step has a pitch of ½ in.

The reinforcement in the beam along each side of the steps consisted of four [illegible] longitudinal bars at the bottom, three [illegible] of these being bent up to come to the top of the beam at the piers, as shown in Fig. 2.

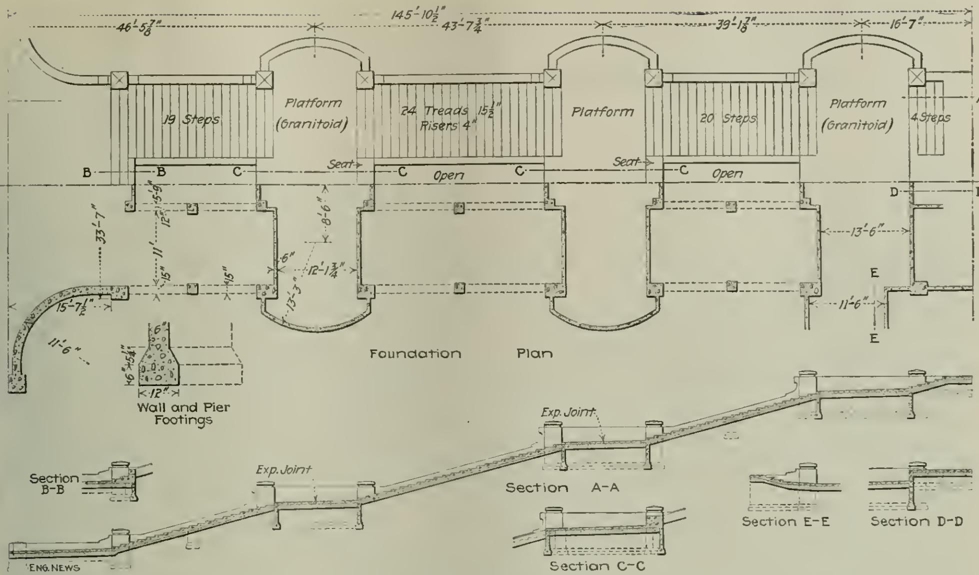


FIG. 1. PLAN AND CROSS-SECTION OF CONCRETE STAIRWAY ON THE SLOPE OF GOVERNMENT HILL IN FOREST PARK, ST. LOUIS, MO.

The structure is divided into sections by transverse expansion joints, and each section is anchored in position by a transverse pier at the middle.

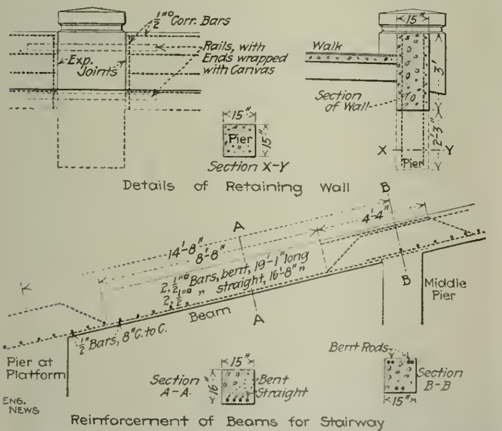


FIG. 2. DETAILS OF LOW RETAINING WALL AND THE REINFORCEMENT OF THE BEAMS OF THE STAIRWAY

Across the bottom bars were laid ½-in. transverse bars spaced 8 in. c. to c. Over the transverse bars were laid longitudinal bars 2 ft. c. to c. to prevent surface cracking. All bars were embedded at least 1 in. in the concrete.

The concrete is made with 1½-in. stone, the mixture being 1:2:4, and a granolithic surface is given to the steps. Wood forms were used. The construction was done by the park department force.

From the top platform of the flight of steps a concrete walk, at *E*, Fig. 1, will extend along the top of the slope of the hill in front of a pavilion. This will be supported by a retaining wall, which forms also a low parapet and has piers at intervals of 9 ft. 9 in. and 10 ft. 6 in. The wall is 13 in. thick and 3 ft. deep, or 5 ft. 3 in. deep at the piers. In front of the entrance to the building the walk is widened, and there the wall is made 5 ft. deep (7 ft. 3 in. at the piers). At each third pier (30 ft. c. to c.) the wall has an expansion joint on each side of the pier, made as shown in Fig. 2. In the pier are embedded old rails with the ends projecting to be built into the wall, these ends being wrapped with canvas to form a slip joint.

A Panama Canal Veteran Dredge Retired—The seagoing suction dredge "Culebra" has been retired from service, moored alongside the wharf at Paraiso, Panama, and dismantled. The retirement of the "Culebra" follows the practical completion of the work it is best suited to do, in the Pacific entrance and at the lake level. Its sister ship, the "Caribbean," now at work in the Atlantic entrance, will be able, it is thought, to handle the maintenance work of removing silt, in both entrances. The remainder of the heavy work in the Pacific entrance will be done by ladder, dipper and pipeline suction dredges. Construction work in the Atlantic entrance was completed in December, 1913, and subsequent work has been confined to the removal of silt.

The "Culebra" was built by the Maryland Steel Co., and sailed from its yards at Sparrows Point on Oct. 9, 1907, for Balboa, by way of the Strait of Magellan. The vessel arrived at Balboa on Dec. 28, and was placed in commission on Jan. 21, 1908. It worked in the Pacific entrance channel and in the slips alongside the wharves at the Pacific terminus until Jan. 20, 1914, when it was transferred to the Gatun Lake level and put at work removing gravel washed into the canal channel near Gamboa by the Chagres River. It was transferred to the dry dock at Mount Hope for overhauling early in June, and on June 14, was returned to Balboa, where it was engaged alongside the steel pier and in the entrance channel until the time of its retirement. The "Culebra's" output up to July 1, 1914, amounted to very nearly 19,000,000 cu.yd. The yearly output varied from 1,785,166 cu.yd. in 1912-'13, when it was out of commission 70 days, to 3,960,153 cu.yd. in 1908-'09, with 21 days out of commission. —"Canal Record," Sept. 2, 1914.

The Calaveras Dam, California, the Highest Earth Dam

By A. J. Cleary*

SYNOPSIS—The highest earth dam yet on record is the Necaxa No. 2 at Necaxa, Mexico, which has a finished height of 192 ft. The Calaveras Dam, now under construction, is to be 240 ft. high. It is to retain the waters of a new reservoir for the Spring Valley Water Co. of San Francisco.

San Francisco's rapid growth has created a demand for a more adequate water-supply. The construction of the Hetch Hetchy System, recently begun by the municipality, will require some eight years to complete. Meanwhile, the Spring Valley Water Co., which now supplies practically the entire city, is increasing its resources by the erection of the largest earth dam ever built. The completion of this structure will add to the company's system a reservoir with a storage capacity of 53,000 million gallons. This reservoir site is located in the wide level valley of Calaveras Creek, Alameda County, 30 miles southeast of San Francisco.

The watershed tributary to the reservoir extends southerly from the dam site for a distance of 25 miles, and has an area of 98.3 sq.mi. By the construction of a diverting dam on Upper Alameda Creek and a short tunnel through an intervening ridge, 33.3 sq.mi. additional may be included in the catchment area. The mountains that form the boundary of the drainage basin are precipitous, yielding a large percentage of the rainfall as available runoff. The elevation of the highest peak is 1200 and the lowest ground elevation in the reservoir is 560 ft. above sea level. The slopes of the entire watershed are partly thickly wooded, the ground elsewhere [illegible], except in the valley proper, fit only for grazing. There are few [illegible] in

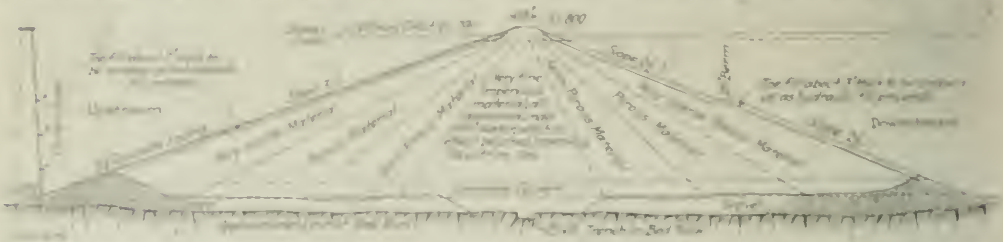


Fig. 1. Drainage of Calaveras Reservoir [illegible] San Francisco, Calif.

the drainage area not owned or controlled by the Spring Valley Water Co., and the water is thus insured from contamination.

Precipitation is principally in the form of rain, but occasionally snow [illegible] the upper reaches. This varies considerably from year to year, 27.7 in. being the normal seasonal rainfall for a period of 37 years. The maximum for one season was 47.1 in. or 70% above the normal, and the minimum 14.2 or about 51% of the normal.

After very extensive explorations, consisting of shafts, borings, tunnels and stripping over a considerable length of the outlet gorge of Calaveras Valley and the study of plans of various types of dam, the present site was finally chosen as the best for the type of dam it was decided to build, by reason of the quantity of material required, the location of borrow pits, and the position and character of bedrock. The type chosen was that of an earth dam with slope dimensions. The method of construction adopted was the hydraulic-fill method.

Design

Calaveras dam, as now being erected, will have a maximum height of 240 ft. above bedrock. In sectional thickness at the base it [illegible] ft., and at the top will be 25 ft., while the crest will be 1200 ft. in length. No core wall will be separately constructed, but great care is being taken in handling the sluicing material so that only fine, impervious clay will be deposited in the center, flanked on either side with porous material grading from sandy material next to the clay to heavy coarse gravel near the faces. On the upstream side the 3 to 1 slope will be

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Fig. 2. Upstream View of Calaveras Dam Site, Showing Culvert to Be Afterward Covered

faced with concrete as a protection from scouring wave action. The downstream face will have a slope of $2\frac{1}{2}$ to 1, with a 20-ft. berm 100 ft. vertically below the crest.

A trapezoidal spillway of ample capacity will be constructed 10 ft. below the crest of the dam. Additional drainage is provided by means of a concrete culvert which rests on bedrock for its entire length beneath the dam. This has a 15-ft. drop between the toe and heel of the dam, and a net sectional area equivalent to a 20-ft. diameter circle.

Connected to the outlet culvert by a circular concrete tunnel is a reinforced-concrete gate tower of interesting design. It is founded on bedrock adjacent to the upstream end of the culvert, and will be 229 ft. in height above the rock foundation. The shell is 4 ft. thick at the base and 1 ft. at the top, with an inside diameter decreasing from 20 ft. to 10 ft. The concrete foundation is octagonal in shape, 50 ft. in diameter, 9 ft. thick and heavily reinforced. It is of the "open" type, with outlet pipe, gate valves and stairway on the interior. A sluice gate on the outside admits water to the valves. Being located in a district generally subject to seismic disturbances, the tower has been designed especially to withstand severe earthquake shock, and the assumptions and stress analysis are of much interest.

Fig. 3. Laying culvert.

Fig. 4. Turning Arch.

Figs. 3-4. Culvert under Construction

Construction

Like most Western streams, the Calaveras is of a torrential nature, varying from a few second-feet in summer to a raging torrent in winter and to provide for handling the waters of any floods that might occur while the dam was being erected, the 20-ft. culvert which will later contain the outlet pipes, was first constructed on the underlying bedrock. For this, a suitable foundation was prepared, with a $1\frac{1}{4}$-yd. steam shovel and hand work. Gravel for the concrete was conveyed by Fresno scrapers and a drag-line scraper from the gravel deposits in the creek channel 2000 ft. below the dam to an elevated platform. There it was washed down an inclined chute into hoppers, all silt and soluble material thus being removed. After the washing process, the aggregate in the bins below the hoppers was a clean mixture of graded sand and gravel, in which the voids averaged from 12 to 15%. From the bins, gravel was conveyed to three concrete mixers in 1-yd. cars. A 1 to 6 mixture was used throughout the structure, all joints being reinforced. A portable tower with elevator skip and hopper shown in Fig. [illegible], was used to place the concrete in part of the [illegible] of the culvert. In the central portion of the dam, five large concrete collars extending into the [illegible] and bedrock for a distance of about 10 ft. were built [illegible] the culvert. These are shown in Fig. 4. The purpose of these collars is to interrupt any tendency to seepage along the surface of the culvert.

Material to be incorporated into the dam is sluiced from borrow pits down an open channel having grades varying from 3% to 5%, to an 8x8-ft. concrete-lined sump. Two monitors similar to those used in placer mining, each having a discharge that can be fitted with nozzles varying in diameter from 1 to 5 in., loosen and wash the material from the borrow pits. These are operated at a discharge rate of 7 sec.-ft. with a nozzle pressure of from 80 lb. to 120 lb. per sq. in. (For very soft material a series of $2\frac{1}{2}$-in. hose jets are used instead of

Fig. 3. Giant Monitor Starting Material from Borrow Pit; Calaveras Dam

monitors.) The clay content of the aggregate at the borrow pit varies from 10% to 30%, with the remainder gravel and sand. In the open channel near the sump is a screen by which all boulders larger than 5 in. in diameter are removed. Water is supplied to the monitors by two [illegible] 10-in. pumps, operated at a speed of [illegible] r.p.m. by 200-hp. electric motors. The consistency of the mixture arriving at the sump is usually about 20% solids and 80% water. At the sump this is additionally diluted when necessary, an average of about 15% material in suspension being carried to the dam.

From the sump the mixture is raised to the dam by two 10-in. [illegible] pumps, which are driven by 300-hp. motors at such a speed that the velocity of the mixture in the

discharge pipes will be from 10 to 12 sec.-ft., according to the character of the sluiced material. It is essential to secure at least this velocity in order that no heavy gravel will deposit in the pipes. To insure a steady flow at this speed a booster pump is necessary when the material is being deposited at portions of the dam most remote from the sump. As the distance to borrow pits and the height of the dam increases, other booster pumps will be added. Slip-joint riveted-steel pipe, 14 in. in diameter, No. 16 gage, is used for the discharge line. To distribute the material properly and to raise the pipe line as the height of the dam increases, it is necessary frequently to disconnect and rejoin the pipe lengths. That the pipe may stand up under the ramming necessary with each change, a tip of No. 12 gage pipe 18 in. long was riveted to each end of each joint of pipe. This simple expedient has proved very satisfactory.

Fig. 6. Depositing Hydraulic Fill

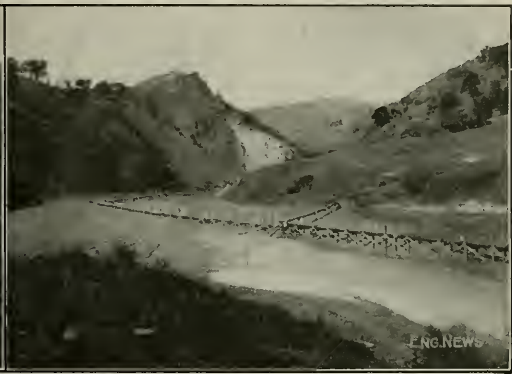


Fig. 7. The Sluiced Material in Place

Fig. 8. Collars on the Culvert under the Calaveras Dam

The sluiced material is discharged at the upper and lower faces of the dam and allowed to run on natural grades toward the center of the dam, where a pool of still water is constantly kept at the desired elevation. All porous material is deposited on the slopes approaching the pool, but only clay enters that portion of the dam covered by the central pool. By natural selection the porous material gradually changes from large rocks and boulders at the face of the dam to fine sand at the edge of the central pool. By regulating the elevation of the water in the pool the limits of the clay core are readily regulated. No water is wasted during the process, as the drainage from the center is conveyed through a 22-in. pipe back to the sump and thus used repeatedly.

Current for construction operations is supplied by the Pacific Gas & Electric Co. at 60,000 volts. This is transformed on the work to 2200 volts.

For the hydraulicking process fifteen men are required in each shift—one on each of the two monitors and one helper for both of these; three to operate the pumps; two to keep the 5-in. screens free from boulders; two to move the discharge pipes; one blacksmith; one electrician and three general helpers. Scraper teams are employed in smoothing the slopes of the dam and carrying up small levees along each face to divert the sluiced material toward the center of the dam. A steam shovel was used to excavate a central area 150 ft. wide to bedrock along the longitudinal center line of the dam. Directly under the crest line and through this central area, a cutoff trench has been excavated in bedrock. Over 3,000,000 cu. yd. of fill will be placed by the hydraulic process.

The concrete culvert to pass flood waters was taxed to its capacity on Jan. 1, 1914, 40 days after its completion. At this time Calaveras Creek changed from a small stream to a raging torrent, following a downpour of about 4 in. in 24 hr. over most of the tributary catchment area. Water rose in the pond above the dam to a height of 9 ft. above the roof of the entrance to the culvert, making it necessary to remove a short stretch of the culvert roof during the flood. It is estimated that 6000 sec.-ft. of water passed through the culvert for a period of 10 hr. By rapid work at the levee no damage was done by this flood. Subsequently several similar floods were passed through the culvert all without mishap.

All the construction is being done by day's work. The only contracts on the job are those for hauling material, supplies and equipment, and for boarding the men.

Design and construction of the dam are under the direction of F. C. Herrmann, Chief Engineer of the Spring Valley Water Co., and Wm. Mulholland, consulting engineer. T. W. Espy is Construction Engineer in direct charge of the work.

CONTRACT DREDGING BY HYDRAULIC DREDGES, ENGINEER DEPARTMENT, U. S. ARMY, YEAR ENDING JUNE 30, 1913

Locality of improvement	[illegible]	Name of contractor	Date of contract	Cu yd of material	Price per cu yd, cents	Amount of contract	Character of material	Pumped per month, cu yd	Pipe line Length, Ft	Pipe line Dia, in	Brief description of dredge and attending plant
[illegible]	[illegible]	[illegible]	Nov. 18, 1911	300,000	17.7	[illegible]	Mud, [illegible]	20,000	300	12	12-in. hydraulic dredge, [illegible] and pumping engine
[illegible]	[illegible]	[illegible]	Jan. 30, 1912	8,378,000	7.20	[illegible]	Clay	130,000	500	20-22	Dredge "No. 7," 1400 hp, [illegible] 750 hp, 20-in. suction
[illegible]	[illegible]	[illegible]	Aug. 13, 1912	3,350,000	6.90	231,000	Sand, clay	185,000	600	15	Dredge, 250 hp, [illegible]
[illegible]	[illegible]	[illegible]	Nov. [illegible], 1912	1,607,000	8.81	275,000	Clay	125,000	450	20	Dredge, 250 hp, 20-in. suction, [illegible]
[illegible]	[illegible]	[illegible]	May 9, 1911	3,982,192	17.0	661,580	Clay, sand	121,300	900	20	Dredge "Enterprise," hull 128x40 ft, 540 hp; "[illegible]gara," hull, 14[illegible]x43 ft, 1000 hp
[illegible]	[illegible]	[illegible]	Apr. 18, 1911	4,000,000	6.7	281,000	Sand, mud, clay	260,492	400	20	
[illegible]	[illegible]	[illegible]	Feb. 14, 1912	188,800	11.5	60,001	Mud, sand, clay	60,252	800	20	Dredge, hull, 122x36 ft
[illegible]	[illegible]	[illegible]	Jan. 13, 1912	20,000,000		2,400,701	Sand, clay, mud-silt	125,000	800	22	*6.95, 11.9 and 18 cents, 3 dredges
[illegible]	[illegible]	[illegible]	Dec. 20, 1910	1,000,440	14.74	137,400	Shell, sand, clay	40,000	1000	20	Dredges Nos. "4" and "10"
[illegible]	[illegible]	[illegible]	Aug. 11, 1911	1,284,000	11.0	141,441	Sand, shell, clay	85,000	1200	20	Dredges Nos. "4" and "10"
[illegible]	[illegible]	[illegible]	Apr. 1, 1911	1,100,800			Shell, sand, clay	100,000	800	16	*8.74 and 10.2 cents, 2 dredges
[illegible]	[illegible]	[illegible]	Aug. 14, 1911	1,600,000		137,800	Sand, clay, loose rock	138,000	2000	22	*7.45 and 3.725 cents, dredge [illegible] steel
[illegible]	[illegible]	[illegible]	June 8, 1911	3,500,000		300,000	Sand, clay	75,000	1200	18	*10.4 and 5.2 cents, dredges "[illegible]" and "No. 9"
								185,000	1300	20	
[illegible]	[illegible]	[illegible]	Nov. 15, 1910	2,000,710	8.072	181,000	Fine sand, shell, clay	108,387	1200	20	2 dredges, 750 and 150 hp
[illegible]	[illegible]	[illegible]	July 17, 1911	611,200	11.90	72,750	Sand	39,229	1100	12	
[illegible]	[illegible]	[illegible]	Nov. 18, 1912	1,513,701	7.4	112,178	Mud and sand	192,974	None	22	Nonpropelling hopper dredge, [illegible], capacity 1013 cu yd
[illegible]	[illegible]	[illegible]	Aug. [illegible], 1911	5,283,[illegible]	[illegible]	173,274	Mud	273,612	None	22	Nonpropelling hopper dredge, [illegible] cu yd
[illegible]	[illegible]	[illegible]	June 3, 1912	155,270	27.0	42,000	Mud, sand, clay, shells	14,400	1200	15	Dredge, "Irving T.," hull, 90.5x27x11 ft, [illegible]
[illegible]	[illegible]	[illegible]	Oct. 17, 1912	81,401	18.7	15,080	Sand, mud, gravel	14,400	300	15	Hull, 90.6x27x7 ft, 400 hp
[illegible]	[illegible]	[illegible]	Mar. 1, 1909	208,000	14.33	29,800	Sand, clay, gravel	12,330	300	15	Hull, 84x25x8 ft, 175 hp, 15 [illegible] engine, [illegible] in. x 18 in.
[illegible]	[illegible]	[illegible]	May 22, 1913	450,000	17.3	77,850	Sand			20	Not begun, seagoing dredge, [illegible]
[illegible]	[illegible]	[illegible]	Aug. 28, 1911	620,418	11.3	70,712	Mud, sand	161,900	1000	20	Dredge, 12[illegible]x35 ft
[illegible]	[illegible]	[illegible]	Nov. 28, 1910	[illegible]	13.3	221,333	Sand	60,400		20	Seagoing dredge, capacity of [illegible], 700 [illegible]
[illegible]	[illegible]	[illegible]	Oct. 13, 1911	774,919	6.0	46,497	Sand, gravel, mud	30,634	1875	15	Dredge "Potomac," hull, 92x[illegible] ft, engine, [illegible]x32x18 in., 250 hp
Columbia River	[illegible]	The Port of Portland	Dec. 30, 1912	1,062,000	4.30	47,000	Sand	206,470	1500	30	Dredge, "Columbia"
[illegible]	[illegible]	[illegible]	Nov. 8, 1911	904,285	11.0	[illegible]	Sediment, mud, hardpan	17,043	3000	20	
[illegible]	[illegible]	[illegible]	Nov. 15, 1910	2,101,182	11.1	230,000	Sediment, mud, hardpan	51,400	3000	20	Hull, 115x40x10 ft
[illegible]	[illegible]	[illegible]	Aug. 15, 1911	2,400,000	18.88	474,000	Sandy clay, sediment	117,400	10,500	22	Hull, 138x38x12 ft, dredge, "James McMullen"
[illegible]	[illegible]	[illegible]	May 15, 1913	837,000	12.8	120,000	Sediment, mud, hardpan	80,000	3000	20	Hull, 115x40x10 ft
[illegible]	[illegible]	[illegible]	Apr. 26, 1912	800,000	10.15	88,825	Sand, clay	40,000	1000	20	600 hp
[illegible]	[illegible]	[illegible]	July 3, 1911	1,161,812	11.6	200,193	Sand, clay, mud, snags	100,000	1000	20	Remodeled steamship hull, 700 hp
[illegible]	[illegible]	[illegible]	Oct. 27, 1910	[illegible]	10.33	138,716	Sand, clay, mud	100,000	1000	20	600 hp
[illegible]	[illegible]	[illegible]	Dec. [illegible], 1912	722,000	14.8	106,856	Sand, stiff clay	100,000	1200	20	Remodeled steamship hull, 700 hp
[illegible]	[illegible]	[illegible]	Apr. 1, 1912	180,264	11.0	20,403	Mud, sand	78,130	1200	20	
[illegible]	[illegible]	[illegible]	Aug. 29, 1911	1,279,181	12.1	115,111	Silt, sand, clay	100,000	1400	20	
[illegible]	[illegible]	[illegible]	Jan. 21, 1912	807,271	14.1	111,203	Sand, mud, hard clay	115,325	1000	20	
[illegible]	[illegible]	[illegible]	Oct. 23, 1911	520,700	11.2	58,118	Silt, sand	17,225	800	12	
[illegible]	[illegible]	[illegible]	Dec. 12, 1911	121,568		23,250	Sand	5,000	1200	12	*Mattaponi, 19½; Pamunkey R., 18½ cents. Dredge, "Mary," 67x23x6 ft
[illegible]	[illegible]	[illegible]	Mar. 9, 1912	35,000	23.0	8,250	Mud, sand	10,500	1200	12	Dredge, "Grey Eagle"
[illegible]	[illegible]	Sanford & Brooks Co.	Jan. [illegible], 1912	1,076,175	3.40	30,082	Mud	120,575	1000	20	Dredge, "Dewey," hull, 97x34x9.5 ft
[illegible]	7	[illegible]	Nov. 26, 1912	151,000	10.7	16,178	Mud	9,202	920	12	Dredge, "Mary," hull, 67x23x6 ft
[illegible]	[illegible]	[illegible]	Feb. 25, 1911	100,000	14.5	14,950	Sand, gravel	23,814	250	15	Dredge, "No. 5," 90x32x9 ft, engine, 15x18x18 in.
[illegible]	[illegible]	[illegible]	Feb. 27, 1911	380,000	10.5	39,140	Mud, sand, oyster shells	35,000	300	12	Dredge, "Black Diamond," hull, 70x25x6 ft
[illegible]	[illegible]	[illegible]	Mar. 18, 1912	811,000	8.8	67,800	Mud, sand	67,400	1000	20	Dredge, "New Jersey"
[illegible]	[illegible]	[illegible]	May [illegible], 1912	1,460,000	8.3	120,000	Sand, mud, gravel, clay	120,687	7920	15	Dredge, "Maryland," hull, 110 ft long, engine, 150 hp
[illegible]	[illegible]	[illegible]	Dec. 18, 1912	201,198	10.[illegible]	16,427	Sand, mud	78,200	500	20	
[illegible]	[illegible]	[illegible]	Dec. 18, 1912	[illegible]	10.[illegible]	13,900	Sand, mud	90,300	400	20	
[illegible]	[illegible]	[illegible]	Dec. 18, 1912	120,000	10.5	11,000	Sand, mud	72,000	500	20	
[illegible]	[illegible]	[illegible]	Dec. 20, 1912	1,300,000	10.35	140,000	Sand, mud, roots, stumps	105,045	1400	*	

*[illegible] and [illegible] dredge.

Contract Hydraulic Dredging for United States Government

In addition to the extensive dredging plant operated under the direction of the Engineer Dept., U. S. Army, a great amount of dredging is done by contract. The contract dredging for 1913 is shown in the accompanying tabulation compiled from the official report of the Chief of Engineers. As a rule, the major portion of this class of dredging is done in coast harbors along the Atlantic and Pacific Oceans and the Gulf of Mexico; an exception is the hydraulic dredging in the Saginaw River, Mich. The table is arranged by districts, alphabetically.

Dust Used Instead of Cement; Packed in Cement Bags—Defective concrete said to exist in a piece of public work in Los Angeles, Calif., is explained in a novel and [illegible] manner. What was thought to be cement was only dust! And this dust was packed in cement bags, came from a cement mill, and had been used accidentally, in good faith, by the contractors. A local newspaper gives the facts as follows:

Early yesterday the board of public works learned that the [illegible] with the concrete was caused by the accidental use of dust instead of cement in [illegible] the [illegible]. The [illegible] [illegible] that [illegible] [illegible] [illegible] the [illegible] [illegible] the [illegible] [illegible] the dust in [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] cement. This dust is used [illegible] [illegible] [illegible] [illegible] [illegible].

The board of public works accordingly [illegible] [illegible] that in future [illegible] [illegible] [illegible] [illegible] [illegible] for this purpose must be packed in sacks of a different appearance from those used for cement sacks.

Further news is to the effect that the board has ordered all cement and sand to be tested before use instead of afterward.

Editorials

Clams and Hope on the New Haven

In these times of business storm and stress, it is well worthy of record when one finds in a railway financial report a note of hope and optimism. Still more remarkable is it when such a thing is found in a report issued by the New Haven Co. It is surely of interest to repeat, therefore, from the report of the net corporate income of the New York, New Haven & Hartford R.R. for the month of July, just made public, the following twang of a cheerful lyre:

An interesting incident in New England commerce is the discovery of a very large deposit of clams between Martha's Vineyard and Nantucket. These are being moved in large quantities, principally to the New York markets, and the deposit appears to be large enough to insure a business for several years at least.

If the Stock Exchange were only open, this news ought to be worth a two-point rise in New Haven stock. If the retiring clam can aid in hoisting the New Haven out of the financial mire, and at the same time reduce the high cost of living in the metropolis by adding a durable article of diet to its food supply, the tale of its achievements may well be spread abroad. Perhaps some member of the talented literary staff who served under the former New Haven regime, writing "Prayers from the Hills" and other masterpieces, might celebrate the achievements of this gentle shellfish in lyric song.

The one disquieting note in the above quotation is the suggestion that this colony of clams is being treated like a mineral vein, and that in a few years is likely to be worked out. It is to be hoped that the compiler of this financial report has made some mistake and merely used the language to which he was accustomed in connection with copper, or iron, or coal mines in some previous railroad service. To exhaust a deposit of clams on the Rhode Island coast would be a calamity not lightly to be borne. Not even the financial exigencies of the New Haven Co. could justify such extremes of exploitation. The public will earnestly hope that so long as the New Haven Railroad continues to run, the deposits of Rhode Island clams will not be exhausted.

Injuries from Nails

To step on the point of a nail causes a direct loss of money. Somebody has to pay for the resulting injury, which is often a serious one. Unfortunately, the man who leaves the nail sticking up is seldom the one to step on it. But in the long run, if A steps on the nail that B left, and B steps on C's nail, C on A's, or otherwise around the circle of events, the situation is much the same as if every man that left a projecting nail point where somebody could step on it or catch on it was likely to suffer the injury himself. This is a clear argument for more care in dealing with projecting nails.

Two concerns state that injuries from nails form 3 to 6% of their total casualties, according to George Gilmore, Chief Engineer of the Travelers Insurance Co. "The Travelers' Standard" in an article on the nail hazard points out further that clinching a nail may make it more dangerous than the straight projecting point, if the clinching is not thorough. A nail point bent over so that it is nearly flat on the face of the board but yet clear of it a few sixteenths of an inch may catch the foot or hand to worse effect than an unclinched point, while at the same time it seems safe and thus invites the accident. The safe clinch shows the point is buried in the wood.

Under the workmen's compensation law now in force in many states, injuries to workmen from projecting nails may easily transform the profit on a contract into loss.

A Series of Papers on the New York Rapid Transit Railway Construction

We begin the publication in this issue of one of the most important and valuable contributions to engineering literature that Engineering News has ever had the pleasure of laying before its readers. We refer to the articles on the New York Rapid Transit Ry. extensions by Fred Lavis. Mr. Lavis' high reputation as an expert in connection with railway and tunnel construction is well known to many of our readers. He has made a special study of the New York subway construction in all its phases, and is to present the results of this study to the profession through our columns in a series of articles. Each of these will take up some special part of the work, so that each article will be complete in itself, and the entire series will make a complete technical account of the greatest piece of engineering work, figured by total expenditure, that has been undertaken in the world, almost without exception.

This series of papers will be of value not merely to engineers engaged in city rapid-transit subway construction in the future, for there is no doubt that other large cities will adopt this system of rapid transit to a great extent during the next quarter century. They will be of value also to engineers and contractors engaged in a great variety of construction work.

Take, for example, the underpinning of buildings affected by deep excavations, a class of work that has to be done at times in almost every city of the country. It is safe to say that nowhere in the world has building underpinning been carried out on such an enormous scale and under such difficult conditions as has been the case on the subway construction. The same thing may be said of deep tunneling under navigable rivers, of deep trenching through city streets, of provision for gas pipes and water mains, electric wires, and other underground street furniture in connection with large street excavations, of the transport of excavated material in crowded city streets, and of a number of other important primary operations in connection with the New York subway construction.

It must be remembered, moreover, that the engineering problems in connection with the New York Rapid Transit Ry. system, including the design of the completed

structure and the methods of construction, have been thoroughly studied by the largest staff of engineers, probably, that has ever been brought together in connection with any great public work. Speaking broadly, therefore, it may be fairly presumed that the New York rapid transit railway construction represents as good work as the engineering profession of the present day is capable of producing, while the methods adopted by the contractors on the various sections can safely be assumed to typify the best construction practice at the present day.

It may readily be understood that the difficult task of the author of these articles was to judge what to omit as well as what to include. The rigid limitations as to the space which could be spared in the crowded columns of ENGINEERING NEWS for the description of even so noted a work made it necessary to select only the features of greatest technical importance.

In describing a work of such magnitude, spread over such a wide area and involving so many features of difficulty and unusual practice at various points, it would have been easier to have made a description four times as voluminous as the present series of articles. The critical reader who follows these articles in detail will perceive that what has been presented in them are the technical facts of greatest interest and usefulness to the working engineer, while preserving enough of the general features to be interesting to the general reader.

A word of appreciation and acknowledgment is also proper here to the numerous members of the engineering staff of the Public Service Commission who have courteously aided Mr. Lavis in his work of collecting this information, as well as to the contractors and their engineers on the various sections, who have likewise extended to him much valuable aid.

Broken Rails and Derailment Accidents

In commenting on the causes of railway derailments in our issue of Aug. 13, we reviewed the statistics given in the accident bulletin of the Interstate Commerce Commission for the last quarter of 1913. It showed that only 128 derailments occurred in the three months on railways in the United States which were traced to broken rails. At this rate the total in a year would be 512.

A well known railway engineer, writing us to comment on these statistics, states that on his own road alone with about 1500 miles of track, about 500 broken rails occur per annum. There are, he estimates, judging from his own experience, at least 100 cases of broken rails to one derailment caused thereby. At this rate the actual number of rail breakages in a year for the mileage of the United States would be in the neighborhood of 45,000. Actually the number is likely three times as great.

The explanation of the seeming discrepancy is that the Interstate Commerce Commission's statistics of accidents include only those accidents which are reported to it, and its rules require the reporting only of accidents which either cause loss of life or serious injury, or which do damage to property exceeding a certain minimum amount. There are probably somewhere from three to four to a dozen derailments which cause no damage of consequence to every derailment which is serious.

Our correspondent makes the further point, however, that the deductions in the latter part of our editorial as to the general character of the rails now in service were not warranted. As to that, there may be two opinions. The statistics which we quoted certainly indicated that the danger from broken rails is not the appalling menace to the safety of railroad travel that might be supposed from some of the published matter on the subject of rail breakage. It is entirely true, on the other hand, that the great number of rail breakages in comparison with the derailments due to broken rails make statistics of the latter an unsafe basis for forming conclusions as to the character of the rails in service.

Inspecting Injured Bridges After Train Wrecks

An unusual bridge wreck on the Wabash R.R., at Attica, Ind., on Apr. 5 last, has just been reported upon by the Interstate Commerce Commission. As our readers will recall, this accident was described by Prof. Albert Smith of Purdue University, in our issue of Apr. 16. A derailed freight car struck the end post of a Pratt truss bridge, partially shattering it and bending it 6 in. out of line. It still had strength enough, however, so that the bridge stood up without collapsing. The engineer of the freight train pulled the front portion of the train to a siding and then came back, ran his locomotive onto the bridge, pushed the derailed car across it, and the car was then thrown down the bank to clear the tracks for a fast passenger train which had been held up. That train was then allowed to come over the bridge at a speed of not more than 3 or 4 miles an hour, and under its weight the bridge collapsed.

The technical features in connection with the stresses in the injured end post were reviewed in our issues of Apr. 16 and 23. The feature of chief interest in the Interstate Commerce Commission Inspector's report is the attempt to fix the responsibility for permitting trains to pass onto the bridge span in its dangerous condition.

It is clearly evident that none of the trainmen or trackmen at the site of the wreck had any idea that the injury to the bridge's end post, which was, of course, in plain sight to everyone, was a matter involving any serious danger. In fact, the whole matter of clearing up the freight wreck and moving cars and locomotives over the bridge was handled by the company train crew with the aid of a wrecking crew from Lafayette. The only man representing the Maintenance-of-Way Department, higher than a section foreman, was a track supervisor, who said frankly in his examination by the Inspector that he did not know much about such bridges and that he did not talk over the condition of the bridge with anyone except the section foreman. He said the bridge looked all right to him.

The only man who seemed to have any idea that the bridge had received serious injury and should have expert examination before trains were allowed to go upon it was the telegraph operator at the station nearest the bridge. He was, in fact, directed by the train dispatcher after the wreck occurred, to go to the bridge and see what damage had been done, and after inspecting he wired the dispatcher that the end post had been knocked out of line and that a bridge man should be summoned. The dispatcher consulted with the chief dispatcher, and they decided to have a bridge man go to the site of the wreck, but the only one they could secure was the track supervisor above referred to. The fatal mistake of relying

on the judgment of a track supervisor as to the safety of an important bridge structure under such conditions was very shortly demonstrated.

It is not to be expected, of course, that the ordinary train crew, or track foremen or supervisors would be competent to pass expert judgment upon the strength of an injured bridge. The important thing is that these men should not rely on their own judgment in cases of doubt.

The possibility of just such an accident as this on the Wabash exists on many another railway. It would seem well to add to the rules for trainmen and foremen of wrecking crews some rule reading somewhat as follows:

If any car or locomotive is derailed on a bridge or runs onto a bridge after derailment, examine the structure carefully, and if any parts of it other than the rails, ties, and guard timbers, have been struck and injured, report conditions fully to train dispatcher, who will notify Bridge Department and secure authorization therefrom before permitting any locomotive or car to cross the bridge.

The Responsibility for River and Harbor Appropriations

As briefly reported in our last week's issue, the U. S. Senate, on Sept. 22, passed the shortest river and harbor appropriation bill on record, and in doing so established a precedent which may possibly bring about a sweeping reform in the method of conducting our public works.

The bill simply provides a lump sum of $20,000,000 to be expended on the preservation and maintenance of river and harbor works already completed, and the prosecution of other river and harbor works already authorized by Congress. The entire responsibility for the expenditure of this appropriation and its distribution among the different works is placed upon the Corps of Engineers and their official head, the Secretary of War. In the apportionment of the money to various projects, the engineers are merely directed to favor those which are most desirable in the interest of commerce and navigation and which can be most economically and advantageously carried on.

It is seldom indeed that such sound common sense and businesslike procedure characterizes a piece of Congressional legislation. It is fair to say that the Senate passed this model river and harbor bill not by any means because of statesmanlike ambition to effect a reform in legislative procedure, but because the bill appeared to be a last resort if any appropriation for rivers and harbors was to be made at this session.

As already recorded in these columns, the bill as it was originally reported to the Senate from the Committee on Commerce carried appropriations of over $57,000,000 and was substantially the House Bill, with numerous changes and additions to suit the ideas of various Senators as to what should be provided for expenditure in the different States and districts.

The unanswerable criticism of this bill made by Senator Burton of Ohio, ably assisted by a number of other Senators, showed so fully the criminal wastefulness of the measure that the Senate eventually awoke to the fact that the enactment of the bill as originally reported would be political suicide. To revise the law, however, and include only meritorious appropriations meant that the amended measure would incur the hostility of every Senator whose pet appropriation was eliminated. The only way out of the difficulty, therefore, appeared to be for the Senate to abandon all responsibility for the apportionment of the money to the different localities and place that responsibility where in our opinion it properly belongs—with the engineer officers in charge of the work.

It still remains to be determined, of course, whether the House of Representatives will consent, like the Senate, to abrogate its powers heretofore exercised. That there will be violent protest against this is not to be doubted; but those who protest are likely to consider also that if they do not accept the Senate bill, there is little chance that any river and harbor appropriation bill of any sort can be passed at this session. There seems good ground for hoping, therefore, that the House will finally determine to accept the Senate bill with such grace as it may; and that the country may witness the remarkable spectacle of Congress providing a lump sum appropriation to be spent on public works, not for the purpose of enabling the Congressman from this or that or the other district to retain his seat in the House, but purely for the benefit of commerce and navigation.

It is understood, of course, that this handing over of responsibility by Congress is only temporary and also that it is not complete, since the responsibility of the engineers is confined to distributing the appropriation among the projects already authorized by Congress. Distinguished Senators and their colleagues in the House are, of course, firm in their intention to retain the say as to what new works shall be taken up; and they doubtless intend next year to resume their old plan of parcelling out the money for maintenance to each different item of work.

Notwithstanding this, a most important precedent has been established and it seems not too much to hope that in the light of this precedent public opinion may yet compel Congress to relinquish the responsibilities that do not properly belong to it at all and allow the public works of the country to be planned by experts with regard solely to their merits and usefulness.

It may be argued, of course, that the Corps of Engineers is fitted to pass on technical questions only and is incompetent to pass upon the complicated matters of commerce and economics involved in the decision as to whether or not a particular navigation improvement is worthy of being undertaken in view of its cost and its promise of commercial importance.

We may admit, for the sake of argument, that the Army Engineers are not infallible judges in these matters; but experience has demonstrated that Congress is not only still farther from the ideal in this respect but that as a matter of fact it does not attempt to judge. A large proportion of the projects to which it allots appropriations are only ostensibly for the benefit of navigation. Their real purpose is to secure the expenditure of money in a particular Congressional district. Surely the time is past when the waste of government funds in this way can be successfully defended. In fact, a large proportion of the Congressmen who take part in this annual pork-barrel distribution frankly condemn the system and accept it merely because it is a part of an established political custom which they deem themselves powerless to change.

It should not be overlooked, either, that this long established practice of distributing river and harbor appropriations among different Congressmen practically destroys the possibility of any intelligent systematic effort to improve our systems of inland navigation on a sound

and well considered engineering plan. It has been frequently pointed out to the public by the Inland Waterway Commission and other official bodies during the last few years that what is needed most of all in our river and harbor work is systematic and intelligent planning, so that the work may be concentrated where it will be of real public benefit instead of frittering away appropriations on unrelated projects and doling out the money for important works over such long periods of time that the whole scheme is obsolete before it is completed.

If Congress a dozen years ago, for example, had had the wisdom to place the entire work of navigation improvement in the hands of an able commission appointed by the President, made up largely of expert engineers of the highest standing and had provided for the use of that commission an annual sum no greater than has been expended on river and harbor works during that time, such a body would have been able to concentrate expenditures on works of real commercial value. By this time there might have been completed some of the large and important works that really promise enough benefit to navigation to be worth their cost.

And it is worth while, in connection with the above discussion, to point out that the principle involved is really far broader than the matter of river and harbor appropriations. There would be a vast improvement in legislative procedure and an immense public benefit if Congress would relinquish its long-established habit of framing appropriation bills to provide specific sums for each specific object, even going down so far as to fix the salaries of individual employees which the bill provides for. Such work does not belong at all to the legislative department of government. So far as Congress undertakes it, it does so to the neglect of other and far greater responsibilities.

Furthermore, this distribution of appropriations is actually not the voice of Congress at all, and often not even of the subcommittees of Congress, but is carried out by some clerical assistant to whose work a perfunctory approval is given. It would be vastly better to wipe out this absurdity altogether and provide in all cases lump-sum appropriations for general purposes, leaving to the executive officers in charge the apportionment and distribution of the appropriation in the manner which will be most to the public interest.

While the river and harbor bill which passed the Senate on Sept. 22 is a long step in this direction, it would be too much of an approach to millennial perfection to hope that any such principle will be carried into effect in the general conduct of our National legislation.

Letters to the Editor

Bridge Rerailing Frogs

Sir—I have noticed on p. 408 of your issue of Aug. 20, a reference to rerailing frogs, placed in the inner guard rails on the approach to a bridge, to eliminate danger by catching derailed wheels and guiding them back on the rails. Will you kindly inform me where I can obtain a sketch and description of this device?

F. GAMBLE, Chief Engineer,
Department of Railways, B. C.

Victoria, B. C., Canada, Sept. 2, 1914.

[Inquiry of a large number of frog and switch companies shows that five make or are prepared to make rerailing frogs. Three of these refer to the Childs-Latimer frog (the patents on which expired long ago); the Weir Frog Co., Cincinnati, Ohio, the Morden Frog & Crossing Works, Chicago, and the American Frog & Switch Co., Hamilton, Ohio. The Pennsylvania Steel Co. has made rerailing frogs to the designs of the Pittsburgh & Lake Erie R.R., and the Pettibone, Mulliken Co., of Chicago, has made them to the designs of the Morgan's Louisiana & Texas R.R. The Southern Pacific Ry. also has a design of its own.—Editor.]

Still More about Teredo-Proof Piles of Australian Woods

Sir—The letter in your issue of May 21, entitled "More about Teredo-proof Wood Piles," states that turpentine and ironbark are identical. Actually, they are far different both in appearance and strength.

Ironbark is practically never driven with the bark on while turpentine always is, and the bark is its protection. The latter timber is not very much used here as we have other borers which attack it. For temporary use, or in fenders, we often use swamp mahogany with bark on; but the regularly accepted pile (where not exposed to fretting) is ironbark (Eucalyptus creba by preference) sheathed with muntz metal.

Ironbark is one of the strongest and most durable timbers known. I have sample ties of it as sound as a bell after 45 years, and the average life of such a tie is at least 25 years.

W. PAGAN,
Recently Chief Engineer, Queensland Rys.

Brisbane, Australia.

On the Necessity (?) for Heavier Pavement Foundations

Sir—In ENGINEERING NEWS of July 23, 1914, p. 176, there appears an article on concrete foundations for pavements, in which the experience of the English engineers does not seem to be duplicated here.

In the operation of removing many thousand square yards of streets in New York I have had occasion to examine carefully the old concrete foundations. In many cases these were made with Rosendale (natural) cement. I have yet to see any evidence of crushing of the concrete foundation from excessive loads.

The foundations on some streets did not exceed 4 in., and averaged 6 in., and, while being removed, came up in large cakes 3 to 4 ft. wide, requiring several blows from

sledges to break the cakes. Cracks found in the concrete plainly seemed to be due to the settlement of the earth foundation, as the distance between the cracks was considerable.

Where cave-ins occur it is often found that the concrete foundation apparently had for some time been spanning a hole 3 to 4 ft. across and finally gave way when the span became too great. A cavity as large as 30x12 ft. has been discovered by a hole about a foot square finally being broken in by a truck. The concrete here was only 6 in., the usual thickness.

Much of the area paved with asphalt blocks in New York City has a foundation of only 4½ in. thick, as the ½-in. mortar bed cannot properly be considered concrete foundation. In the Borough of Manhattan the standard thickness of concrete foundation is now 6 in., increased occasionally where required over bad material.

Unless provision is to be made for spanning such large cavities as are mentioned above, it would appear that the present thickness of 6 in. of 1 : 3 : 6 concrete of the quality now being laid is quite sufficient.

R. A. MacGregor.

2428 Lorillard Pl., New York City, Sept. 8, 1914.

Need of a Home Export Manager for South American Trade

Sir—One important point is apparently overlooked in the present movement toward developing better American business relations and trade with the countries of South America—that is, the need of an Export Manager in the home office, who has been trained in those countries and appreciates their needs.

The obstacle that presents itself is that the United States is not prepared to meet the conditions and requirements of the South American trade. In fact, American firms, except a very few, know nothing about these requirements; but doggedly insist upon the foreign trade accepting what the American firms presume in their ignorance to offer them.

The fact has been that the representative, engineer, contractor or merchant of the South cannot obtain what he wants when he places his order in the United States. Cabled orders are not given due notice, and it is not uncommon after giving an explicit order for timed delivery, followed up by cables, to find on the ship on which the goods are expected, a letter proposing to send something different than ordered, under the excuse that the purchaser was ignorant of what he wanted, whereas in fact the ignorance was on the part of the American firm.

Troubles in packing and labeling are met in ordering steel, mill work and almost every constructive material, whereas orders to Europe will bring the article just as ordered without delay or question on the set time and with the advantages of low freight rates in European bottoms. The high American shipping rates in American colonies such as Porto Rico were partly offset by the former high tariff, but even there the Europeans met the American prices C. I. F. in spite of the American customs duty. This condition must be attributed to the ignorance on part of the Americans at home and the knowledge on the part of Europeans of the requirements of the South American trade. The manufacturers of the United States are just awakening to the necessity of adjusting themselves to the requirements of this trade.

The banking system is being extended by large banking houses, and there is no doubt but what the American banker will meet the demands as he sees the value of the business. The Canadian banks are there in full strength, have studied the requirements and are pushing themselves in wherever there is an opening.

The American steamship companies now have their opportunity while the war is on to get fully into the field. By the time that European ships come again into the field, the steamship companies may win a subsidy from the government; or if not, they can at least take advantage of the situation now and foreign bottoms can be used again after the war to carry American goods.

The manufacturers and supply people in the States, however, are complaining about the man in the field. They fail to see that they need an experienced Export Manager at home to understand the orders from the representative in the field and see that the orders are properly handled. The American representative resident in the foreign country soon learns to conform to the new condition by necessity; but his hands are tied if he is not understood in the home office.

American supply houses require Export Managers who have graduated through years of experience in the field. They should be drawn from men who have been trained in South American countries and probably have been promoted to Managers in their fields. The Export Manager at home should be the next step; but the supply house has failed to see the necessity of that important position.

Frederick O. Lewis.

130 Peterboro St., Detroit, Mich.,
Aug. 31, 1914.

NOTES AND QUERIES

Notes and Queries—"Subscriber" is informed that anonymous communications cannot receive attention from the editors.

Girard Point Elevator—The following corrections are to be noted in the article by S. H. Ingberg in "Engineering News," Sept. 17, 1914. On p. 573, fifth paragraph, is the statement "Each band is made up of two lengths lapping 3½ in." etc. This should read 3½ ft. In Section AA, Fig. 4, p. 575, the lower first floor should be 7 in. instead of the 4 in. shown.

The Code of Ethics of the American Society of Civil Engineers has been adopted by a letter ballot vote of 1997 to 107. This code of ethics was printed in "Engineering News" of Apr. 30, 1914, previous to its discussion at the annual convention of the Society at Baltimore, Md. It is reprinted below, together with the result of the canvass of ballots:

It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Society of Civil Engineers:

(1) To act for his clients in professional matters otherwise than as a faithful agent or trustee, or to accept any remuneration other than his stated charges for services rendered his clients.

(2) To attempt to injure falsely or maliciously, directly or indirectly, the professional reputation, prospects or business of another engineer.

(3) To attempt to supplant another engineer after definite steps have been taken toward his employment.

(4) To compete with another engineer for employment on the basis of professional charges, by reducing his usual charges and in this manner attempting to underbid after being informed of the charges named by another.

(5) To review the work of another engineer for the same client, except with the knowledge or consent of such engineer, or unless the connection of such engineer with the work has been terminated.

(6) To advertise in self-laudatory language, or in any other manner derogatory to the dignity of the profession.

Total number of ballots received	2316
Ballots irregular	154
Ballots to be canvassed	2162

Total affirmative votes, 1997
Negative votes, 107.

Pavement Records to Determine an Economical Policy in Repairs and Reconstruction

The Bureau of Highways of Philadelphia, Penna., of which William H. Connell is Chief, has devised and put into operation a system of pavement records which is designed to furnish not only a complete history of each city block of street pavement, but the data upon which to determine the proper policy to pursue with regard to continuing repairs to a street, repaving it, or changing the kind of pavement for one more suitable to the prevailing conditions. In other words, the information contained on these cards can be used to determine the economical life of the existing pavement and the type of

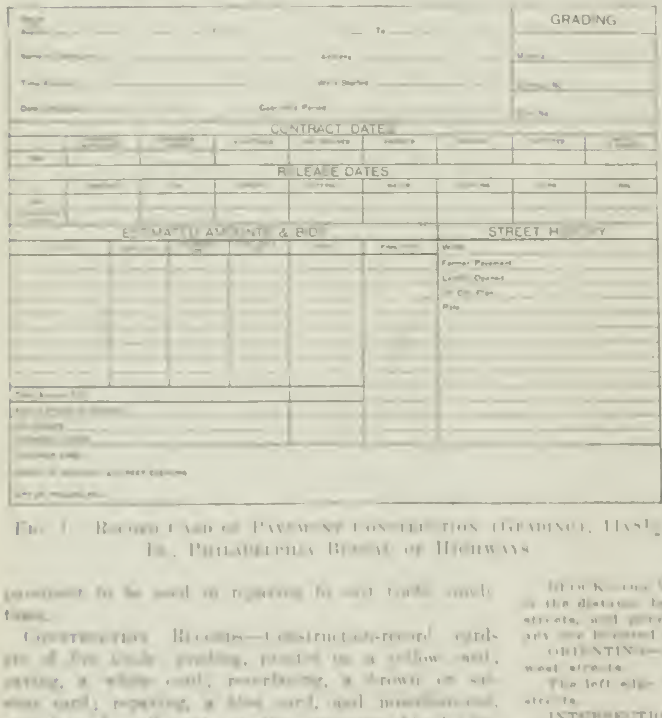


FIG. 1. RECORD CARD OF PAVEMENT CONSTRUCTION (GRADING), HASTINGS, PHILADELPHIA BUREAU OF HIGHWAYS

pavement to be used in repaving [illegible] traffic conditions.

CONSTRUCTION RECORDS—Construction-record cards are of five kinds: grading, printed on a yellow card; paving, a white card; resurfacing, a brown or salmon card; repaving, a blue card; and miscellaneous, a pink card. All cards are the same size, [illegible] in., and identically the same except in color and filing title. Fig. 1 shows the face of one of these cards, and Fig. 2 the reverse side of one.

It is readily seen by an examination of these reproductions, that [illegible] all the [illegible] information in regard to construction of the pavement [illegible] and [illegible]. The reverse of the cards, Fig. 2, shows the method of [illegible] the [illegible] plan, so that the progress of the work may be followed in the office. The record plan and following [illegible] are for [illegible] of [illegible] [illegible]. [illegible] to [illegible] these cards [illegible] [illegible] as cost data records, and [illegible] of the efficiency of the various contractors.

MAINTENANCE RECORDS—These cards [illegible] [illegible] the history of the [illegible] portion of each block and street intersection, together with the maintenance data of pavements laid since Jan. 1, 1912. The reverse side of each card is used for a stereotyped sketch of the block or street intersection, and, where practicable, shows the approximate location of each patch or section repaired. The cards for blocks of pavements are white, and for street intersections are green.

Many of the streets in the older portions of the city are narrow and are paved with asphalt on a broken-stone base. They are subjected to very heavy traffic which is concentrated largely on the shoulders, because of the street-railway track, and patching is done in the same places every year. Chestnut St. and Walnut St., between the Delaware and Schuylkill Rivers, are examples of this kind of street. The plotting of the patching done on these streets show that patching is in the same places each year, and brings out the high cost of maintenance required and serves as a powerful argument for replacing the old paving with a new one on a suitable base.

Another matter which these cards will control is the cost of restoration of the pavement over cuts made by plumbers and others having permission to open the streets. The data thus obtained will be used as a basis for obtaining equitable rates to be charged in cases of this kind.

The accompanying directions to engineers of the Bureau of Highways explain more fully the use of the street-maintenance record cards, which bid fair to become a most essential part of the Bureau's records.

DIRECTIONS FOR MAKING SKETCHES ON CARDS FOR HIGHWAY RECORDS

STREET—A street is a highway [illegible] for vehicular traffic, as defined in Street Cleaning Specifications, and the [illegible] will be found in the street-cleaning reports of the highway district [illegible].

BLOCK—One block will be shown on one card. One block is the distance between adjacent curb lines of the boundary streets, and generally includes the house numbers between [illegible] [illegible] numbers.

ORIENTING—The top of the card is north for all east and west streets.

The left edge of the card is north for all north and south streets.

INTERSECTIONS—Intersection cards [illegible] will be made out for all intersections of streets which are [illegible] [illegible] and for intersections of [illegible] streets which are [illegible] [illegible] boundary streets with block boundary streets and with [illegible]. The intersections of the small streets with the [illegible] streets and of the small streets with each other will not be shown on intersection cards.

BLOCK AREA—The block area will include the area [illegible] within the limits shown on the card, after deducting the areas of any intersections which may be shown on [illegible] other cards and any portion not paved. Generally the block area will be measured between the curb lines of the block and the adjacent [illegible] lines of the streets at each end of the block.

[illegible]—When a street is [illegible] to the property line at the intersections of streets which are not graded or paved, the [illegible] intersections outside of the curb lines shall be [illegible] to the block area.

[illegible] care must be exercised to avoid any duplication of [illegible] [illegible] or of the areas of the several kinds of paving [illegible] on the block [illegible].

[illegible] of the street [illegible] shown on the card which is [illegible] [illegible] or where for any other reason

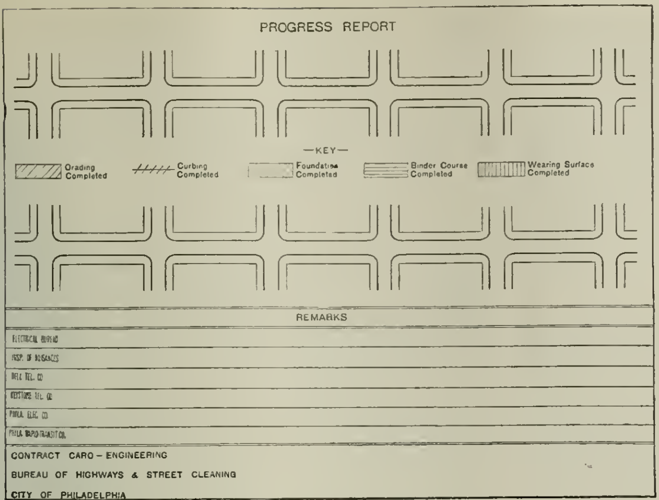


Fig. 2. Record Card of Pavement Construction (Paving, Reverse Side), 11x8½ In., Philadelphia, Bureau of Highways

is not to be included in the block area shall be plainly marked and with directions for reference if necessary.

Block areas will include areas comprised between the extensions of the curb lines and the radius corners.

LETTERING, ETC.—The name of the street and of the boundary streets shall be printed in CAPITALS. The remainder of the card above "Maintenance Data" on one side and above "Remarks" on the other shall be printed in script. As far as possible the space between the curbs shall be reserved for future entries and only street and curb widths and street grades shall be entered between curbs at this time, and such entries shall be made as small as possible. Grades shall be shown by the percentage of fall per foot, and the direction of the fall by an arrow point at the word "Grades." (Lengths of property lines between adjacent streets shall be noted on the footway opposite and in small figures.) The block length comprising the distance between the adjacent curb lines of the end streets shall be entered in its place below the lower property line.

If the block length of the upper side of the block is different from the lower block length, it shall be so entered above the upper property line. If both property lines are the same, the lower entry will be sufficient. All property lines and block lengths shall be to the nearest tenth of a foot. Street, curb and footway widths shall be entered according to the city survey plans.

INTERSECTING STREETS—All intersecting streets shall be drawn to scale, showing footways, roadways and radius of corner. The footway and roadway widths shall be entered at the right end of the card under "Remarks," one entry on each line, and shall be marked by letters, as "A," "B," etc., referring to similar code letters on the sketch

The space back of the house lines shall be kept for the future sketching of house and property lines. The space after "Square Yards" shall be kept free for the entry of the areas of the several pavements comprising the block area.

DIAGONAL STREETS—Owing to the difference of the longitudinal and transverse scales of these sketches, as printed on the cards, the direction of the diagonal streets will be shown by lines drawn through the corners of the property lines when plotted to the horizontal scale on the sketch. This applies to both intersecting streets and end streets.

ANGULAR AND CURVED STREETS—All angular, curved and other irregular streets and straight streets intersected by diagonal streets running in two or more different directions, shall be plotted on the special blank cards and to such scale as will best fill the card. The roadway and footway widths to be exaggerated as on the printed form when possible.

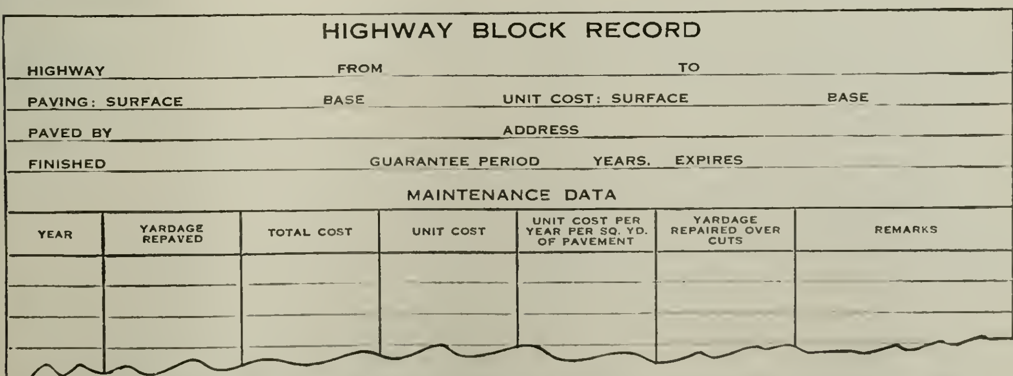
INTERSECTION CARDS—The highway intersection record cards (green) shall be filled out in the same manner as the highway block record cards. Special and irregular intersection cards will be used for all intersections which are not rectangular.

When plotting offset intersections where the line of one street is offset, the intersection will be located in the straight street opposite that portion of the offset street which divides the through street at the point where the numbering changes.

HOUSE AND PROPERTY LINES—House and property lines shall be plotted on the highway block cards so that the distance from the block corner to the nearest property line of the property so plotted, or the distance between the adjacent property lines of the properties so plotted shall not extend 100 ft. The frontage of the plotted properties and the distance of the property lines from block corners or from each other will not be plotted.

RECTANGULAR INTERSECTION CARDS—The upper edge of the highway intersection cards will be north; not true north, but the north used when plotting the streets between the intersections.

A Tar Macadam Pavement was laid on Margate Pier, London, England, as far back as 1820, or very shortly after the introduction of gas lighting. More than that, it was constructed by the "penetration method." This method of treatment was recommended for macadam roads by a correspondent of the "Mechanics' Magazine" in 1824.



HIGHWAY BLOCK RECORD

HIGHWAY FROM TO

PAVING: SURFACE BASE UNIT COST: SURFACE BASE

PAVED BY ADDRESS

FINISHED GUARANTEE PERIOD YEARS. EXPIRES

MAINTENANCE DATA

YEAR	YARDAGE REPAVED	TOTAL COST	UNIT COST	UNIT COST PER YEAR PER SQ. YD. OF PAVEMENT	YARDAGE REPAIRED OVER CUTS	REMARKS

Fig. 3. Pavement Maintenance Record Card, Philadelphia Bureau of Highways; Actual Size 8x5 In.

Soil Loading Test for Foundation Design, Michigan Central Detroit Terminal

Difficult foundation conditions at the site of the Michigan Central Terminal, Detroit, in dense blue clay subsoil 100 ft. deep, led to extensive tests of piles and of direct soil footings. On the results of these tests was based the design of the remarkable reinforced-concrete mat footing already described*. While the tests were made 2½ years ago, their results have not been published. The

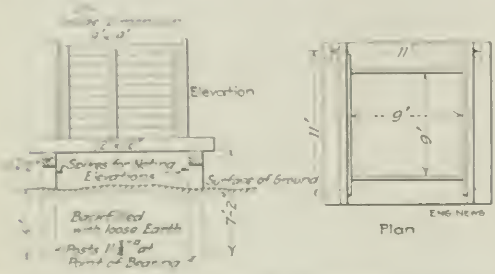


FIG. 1. TEST AND LOADING ARRANGEMENT FOR FOUR-POST SOIL TEST

following summary of the methods and results is abstracted from a copy of the official record.

FOUR-POST BOX TEST

Four vertical 12x12-in. posts, Fig. 1, were set in holes or narrow pits about 5 ft. deep, arranged in a square 11 ft. on a side. On the posts was built a platform supporting a square box. *The pits were backfilled with loose earth around the posts;* this evidently tended to maintain the original soil surcharge at the level of post bottom, and acted to prevent any direct squeezing out of the soil under the loading posts, such as might occur if there were a free surface nearby.

For the loading, the bin or box was filled with sand, carefully dumping the sand in the middle of the box and distributing it evenly to keep the load symmetrical. The posts were a little scant of 12 in. on a side, but the units of loading were adjusted to give integral values of load per square foot of bearing area.

COLD-WEATHER SETTLEMENT—Loading was begun Nov. 14, 1911, and continued until Jan. 25, 1912. Levels were taken daily to determine the settlements. The highest loading was 4 tons per sq.ft., which was reached Nov. 28, and remained unchanged from that date to the end of the test, two months.

The settlement of the posts during the period of increasing load was quite regular. Also during the following month, December, practically no movement took place under the 4-ton loading. But beginning with Jan. 2, 1912, in a time of zero weather, settlement recommenced and continued, with no letup, at a very uniform rate, until the end of the test period. The settlement during these three weeks was somewhat greater than the total settlement up to Jan. 2. The final settlement averaged 0.088 ft. for the two northerly posts and 0.059 ft. for the other two.

Evidently the load of 4 tons per sq.ft. exceeded the

*See "Engineering News," [illegible]

bearing power of the soil under particular conditions of moisture and temperature, or under variable conditions.

SINGLE-POST PLATFORM TEST

A second test, using a single-post platform, was carried to only two-thirds as high a loading, namely, 5500 lb. per sq.ft. Its special purpose was to verify the observations under low loadings. The post, 12x12 in., was set in a pit 5 ft. deep, backfilled with loose, dry dirt. Load was applied by I-beams and pieces of rail laid on top of the post, 2 ft. above ground level. Loading began Nov. 15, 1911, and the full load of 5500 lb. per sq.ft. was reached Dec. 15. The settlements were normal until after Jan. 2, 1912, at which time the settlement was about 0.02 ft. On Jan. 3, more rapid settlement began, and by Jan. 25, the end of the test period, the settlement had increased by 50%, to a total of 0.030 ft.

SILL TEST IN WELL

A third test was made in a well 19 ft. deep, on a bearing plate 2x2 ft., giving 4 sq.ft. bearing area. The well was *not backfilled.* The well and the arrangement for getting a measurement of the depression are sketched in Fig. 3. The load was run up to a maximum value of 6000 lb. per sq.ft. The test was begun practically at the same time as the preceding tests, but continued much longer, until Apr. 1, 1912, or 4½ months.

The load of 6000 lb. per sq.ft. was reached by Nov. 28, and the settlements up to this time and for four days following were normal. Between Dec. 2 and 4, a sudden settlement of 0.026 ft. occurred. There was no further settlement for 26 days. But beginning on Dec. 30, new settlement was noted, and as the curve in Fig. 3 shows, it increased steadily and rapidly, with no indication that the load came to a final bearing, even up to the end of the test on Apr. 1. The final settlement was

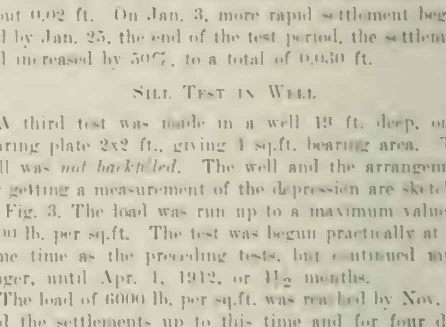


FIG. 2. SINGLE-POST TEST FOR CHECK ON EFFECT OF LOW LOADING

over 0.300 ft., and at this time the load was beginning to tip. This stopped the test in fact, as on Apr. 2 the load tipped against the wall of the well.

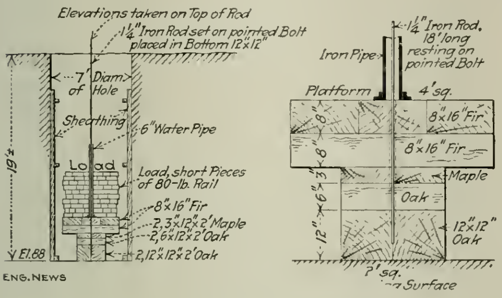
An important difference between the first two tests and the third (besides the absence of backfill in the latter) is that the former were open to the weather, while the well was covered by a wooden shed, and a drain trench was built around the well about 2 ft. distant to divert the surface water. In spite of this, the general phenomena of the settlement were the same as in the other tests. Water was not kept away from the loaded area

entirely, for at the end of the test there were 3 in. of water in the well.

The result of the test of the 2-ft. square sill in the well are shown in Fig. 3 by a curve, plotted on time as a base and settlements as downward ordinates. The temperature curve is plotted below, to show the influence of cold weather on the progress of this test.

Pier Test

A much larger bearing area and different conditions of loaded surface were tested by means of a pier test,



Test Arrangement for Sill Test

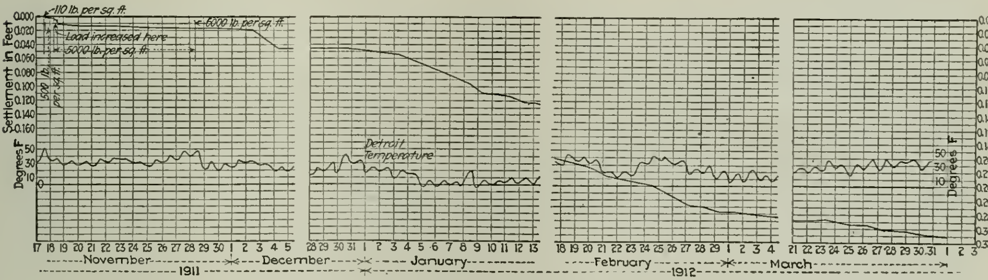
within the bearing capacity of the soil; whereas the preceding test showed that under somewhat different loading conditions a loading only 500 lb. higher exceeded the capacity of the soil and produced continuous settlement.

Use of the Data

It had been assumed in advance of the test that a load not greatly exceeding 2 tons per sq.ft. ought to be safe for the clay in question, and it was known that a satisfactory foundation could be designed within this loading. The results of the test were interpreted as confirming the belief that 2 tons per sq.ft. was safe.

Pile-Loading Tests

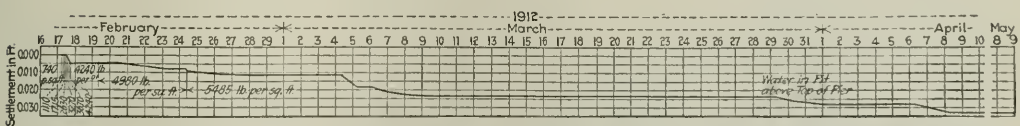
Simultaneous with the soil tests, test piles of various kinds were put down and loaded. In all, there were 36 such piles, comprising wooden piles and four kinds of concrete pile. At the start, it was decided that 20 tons safe loading per pile would probably justify the use of piles for the foundation. But the tests did not support the belief that 20 tons loading would be safe; on the contrary, all but two or three individual piles had what might be called their yield-point at or below 10 tons. On this showing, and the proof (by the soil-loading tests) that direct footings with 2 tons per sq.ft. would be safe, the direct footings were adopted; and, on the



Curves of Settlement and Temperature, for Sill Test

Fig. 3. Sill Test in Well

(Soil, blue clay just moist enough to be molded in the hand. Bottom of well carefully leveled. No indication of soil cracking or sliding in completed well; sheeting placed as precaution. Load, 1-ft. lengths of 80-lb. rail. Bottom of well, El. 88, Detroit datum.)



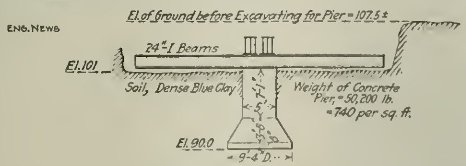


Fig. 4. Pier Test, and Settlement Curve

(Soil, dense blue clay.)

Fig. 4, begun in February, 1912, and continued until May. Here the loading was carried up to 5500 lb. per sq.ft., and while the settlement started and stopped somewhat irregularly at different times, the final result was a practically stable condition. It was concluded that this load, on a pier completely imbedded in the earth, was idea of Geo. H. Webb, Chief Engineer, and Olaf Hoff, called in consultation, the reinforced-concrete mat was used under the footings to equalize conditions.

The pile tests, also, showed very great variations between different piles, whether of the same or different types. No conclusions were drawn as to the advantage of one type over another.

Drainage Construction on United States Reclamation Service Projects to Dec. 31, 1913, had cost a total of $1,339,404 and it was estimated that by the close of 1914 the total outlay for this purpose would be about $2,500,000.

A Bridge Wrecked by a Derailed Passenger Train

A passenger train on the Baltimore & Ohio R.R. broke down a steel bridge at Woodlyn, Penn., near Philadelphia, on Saturday, Sept. 19, as was briefly noted in our last issue. This unusual accident is shown in the two views herewith, from photographs taken by the Philadelphia *Public Ledger*.

F. L. Stuart, Chief Engineer of the B. & O. System, describes the collapse of the bridge as being caused by damage to the end-post by the derailed train:

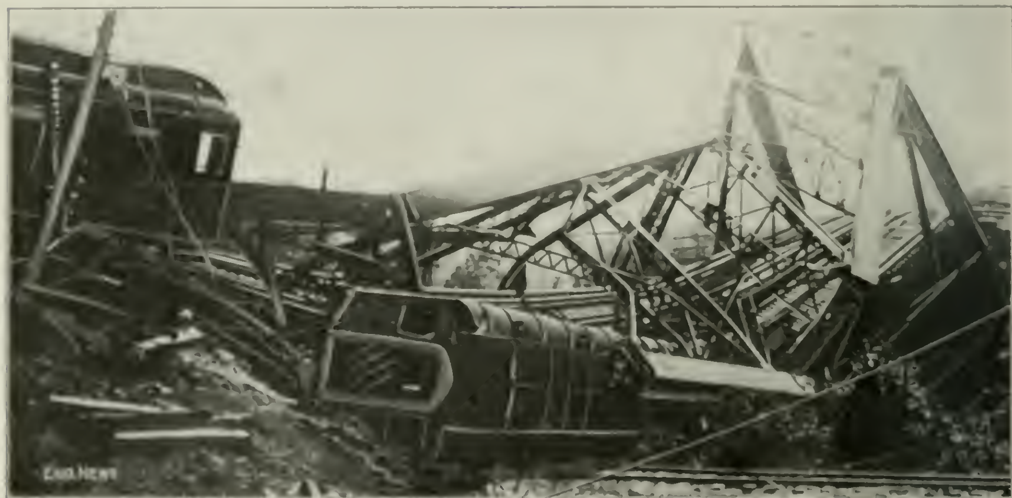
The train was westbound, and was derailed a few hundred feet east of the bridge, due to a broken axle in the forward truck of the tender on the north or right-hand side of the train. The engine and the first few cars passed over the structure, but apparently the first sleeping-car rammed the east end-post of the north truss, and damaged it to such an extent that the span collapsed in a gradual manner. After the wreck, the end-post was found broken in two.

Two of the floor-beam hangers and some of the other members of the structure were broken, but apparently the primary cause of the failure was the destruction of the end-post. There was no damage to the floor system proper which would have caused the collapse of the span.

The bridge is a double-track through span of Warren web with verticals; 163 ft. long c. to c. pins, six panels; trusses 34 ft. deep c. to c., and spaced $28\frac{1}{2}$ ft. apart. The floor has four stringers, i.e., two per track 7 ft. apart. The portals are open webbed trusswork; the remnants of the east portal may be seen indistinctly in Fig. 2.

Failure of Falsework under 12th Street Viaduct, St. Louis, Mo.

Later advices from St. Louis report that the partial failure of the 12th St. Viaduct noted on p. 661 of last week's issue, was not a collapse of the span during the removal of the forms, but a failure of some wooden falsework timbers during the laying of the concrete.



WRECK OF 163-FT. TRUSS BRIDGE BY A DERAILED TRAIN ON THE B. & O. R.R. AT WOODLYN, PENN.

(Both views are from the east end of the bridge. The right-hand or north end-post was broken, presumably by being struck by the first sleeping-car of the train.)

The 12th St. Viaduct consists of a number of deck-span units of reinforced concrete girder-and-slab construction, varying in span from 28 to 54 ft., which together make up a bridge structure 80 ft. wide and [illegible] ft. long, between abutments. The west half of spans 16 and 17, each [illegible] ft. long, and extending between expansion joints, were poured from each end simultaneously on Sept. 17. Span 16, the north span, extended over two through tracks of the Missouri & Pacific Ry., on which there is very heavy traffic. The newer por-

tion of the centering for both spans consisted of a 33-ft. span of old 24-in. 100-lb. steel I-beams, supported by 8-in. timber posts with 8x8-in. caps, and resting on grilled mud sills, the arrangement being such that two I-beams with two posts receive the weight of a concrete stringer and its slab portion. These posts were so braced that the ratio of slenderness amounted to about 15. They were intended to be proportioned for a load of from 800 to 1000 lb. per sq.in. A similar construction had been used successfully on all that part of the bridge which had already been built.

The pouring of the concrete was completed about 8 p.m., and the levels for the top of a coping along the west side of the bridge had been run, and the settlement was measured and found to be about 2 in. This coping is capped by a 3½-in. finishing surfacing, which is put on after the settlement has taken place. This was being put on at 8:20 p.m., when the centering collapsed under the west 20 ft. of the span 16—that is, the span over the railroad tracks—and the wet concrete fell to the tracks below, carrying five men, including the city's engineer and an inspector for the city, the superintendent for the contractor, and two concrete laborers. Two outside stringers, together with their slab portions, dropped the 30 ft. to the tracks below, leaving the inner three stringers and their slab portions in place. The men were more or less seriously injured, but are now recovering. The accident occurred immediately after the passage of a switching engine under the span.

The condition of the wreckage indicated that the failure of the wooden columns was probably the cardinal factor in the collapse. These posts should have been strong enough to take the loading, but some of them were spliced out of three pieces, and in addition possibly had insufficient lateral bracing. The accident may have been brought about by a variety of causes, such as the overloading of some of the posts by unequal settlement, the improper placing or fastening of slabs where some of the 8x8-in. posts were spliced, the unsymmetrical placing of the footings or sills for the posts with reference to the posts, the lack of square bearing on the spliced posts, etc.

A railway wrecking crew cleared up the débris in six hours. The cost of the accident to the contractor, including the removal of the débris and the reconstructing of the collapsed portion, will probably amount to about $2000.

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A Temporary Bulkhead at Seabright—The citizens of Seabright have raised funds for the erection of a temporary bulkhead to replace in part the one demolished by the terrific ocean storms of Dec. 25-26 and Jan. 3-4. Jesse A. Howland is repairing the jetty in front of the Octagon Hotel property, and building a bulkhead 550 ft. long. Thomas J. Scully has a bill before Congress to build a breakwater at Seabright; but its passage is doubtful at the present time

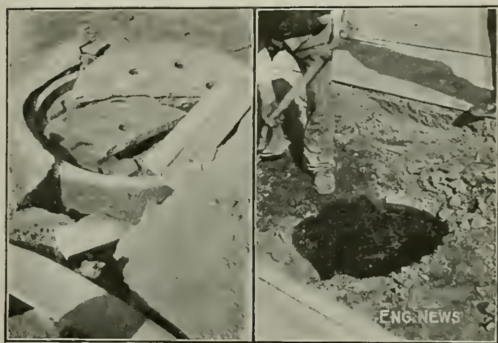
※

Studies of Mine Caving and Surface Support—Following the studies of mine-caving conditions and surface subsidence at Scranton, Penn., and the more general study of the mine-cave problem by the Pennsylvania State Anthracite Mine Cave Commission, further work will be done in this field by the U. S. Bureau of Mines in coöperation with the U. S. Geological Survey. Mining engineers and geologists of these two bureaus will make detailed studies of the extensive open-cut and underground mining operations of western New Mexico. Earth pressures and surface subsidence as related to geological formation and mining efficiency, and as affected by the mine equipment, will be studied. Charles Enzian, mining engineer, under the direction of Chief Mining Engineer George S. Rice, will represent the Bureau of Mines in the investigation.

Recent New York City Sewer Explosion

The accompanying views from photographs taken the morning following the sewer explosion in East 42nd St., New York City, described on p. 661 of Engineering News of Sept. 24, give some conception of the violence of the explosion.

Tests of the sewer air made in the same sewer subsequent to the explosion, by the Division of Combustibles of the New York City Fire Department, revealed very appreciable quantities of gasoline vapor. By search it was determined that certain garages were allowing considerable quantities of gasoline and oil to find a way into the sewer.



Manholes on New York Sewer after Explosion of Sept. 22

Notes from Engineering Schools

University of Pittsburgh—The School of Engineering will give evening graduate courses for men who hold a B. S. degree. This has been arranged to accommodate a large number of engineers in this district who desire to undertake further study but cannot devote any of the working hours to it. Courses will be offered in the mechanical, civil and electrical fields generally; among the special subjects are mentioned sanitation, concrete construction and railway mechanical work. Prominent engineers in the district will coöperate.

Ohio State University—A short course in industrial arts and science has been arranged for those who have been unable to take a regular technical course but who need preparation for advanced positions and added responsibilities. The studies will require two years, from about Sept. 15 to June 15. The entrance requirements are ability to read, write and compute; if an applicant is under 21 years of age, he should have had two years' practical experience in manufacturing. During the first year, the subjects covered are mathematics, drawing and shopwork; in the second year are given mathematics, drawing, mechanism, physics, materials, shopwork. Men proficient in any studies scheduled may substitute others.

A Department of Agricultural Engineering has been established. At first, instruction will largely be confined to building construction and management of machinery.

NEWS NOTES

Mt. Lassen's 18th Eruption Since May occurred on Sept. 21. [illegible] from the explosion which opened a new crater was felt at Macomber Flat, 3 mi. distant. The volcano now has four craters.

Heavy Blasts Brought down Plaster Ceilings in the Royal Victoria Hospital, Montreal, Que., recently. The hospital authorities have applied for an injunction restraining the contractors from blasting in the immediate vicinity of the institution. The work is in connection with the leveling of McGill campus. The ground was partly rock.

A Cylinder of Hydrochloric Acid Was Broken Open in the Jersey City station of the Erie R.R. and Hudson Tubes, during the rush hour, on the morning of Sept. 24. A steel-cylinder tank about 4 ft. long slipped and fell while being loaded on a car by employees of the Wells-Fargo Co., and the top of the tank was broken off. The accident occurred about 15 ft. from the stairways leading to the underground ticket office of the Hudson & Manhattan Tube Ry. The fumes were drawn into the long tunnel leading to the tracks of the Hudson Tubes. In 15 minutes, 25 persons had been overcome by the liberated gas, and many others were more or less affected.

A Break in a 48-In. Force Main at Cincinnati, Ohio, was noted in our issue of Sept. 24, 1914. At our request, J. A. Hiller, General Superintendent of Water-Works, Cincinnati, Ohio, has sent us the following note on the break:

The break was in a 48-in. pump main, wherein the pressure was about 185 lb. The break was about 4 ft. around the hub of the pipe, and extended about 10 ft. toward the spigot end. The pipe thickness was 2 in., was of even thickness throughout, and showed no flaw or defect. The main was laid in a stratified formation, and there was no settlement or movement of the pipe in any direction. The main has been subjected to the same pressure many times since its construction seven years ago. A check valve at the top of the hill closed, thus conserving the water in the tanks and in the mains above. This main was the only supply to a very large territory, and during the time repairs were being made a large number of people were without water. The break was repaired and pumping resumed in 44 hr.

A Partial Failure of the Stark Lyman Building in Cedar Rapids, Iowa, occurred in November last while the building was in process of construction. Full accounts of the failure were published in "Engineering News" at the time and it will be remembered that there was some controversy as to whether the failure was due to the designs on which the structure was erected or to the freezing weather that prevailed previous to the collapse while concrete was being placed. We are informed that the building has now been completed according to the original plans. Before undertaking to reconstruct the portion of the building which failed an official test was made of the standing part of the building which had been built before freezing weather, and the designs for the structure were submitted to several engineers [illegible]. On the approval of these engineers the reconstruction was carried out according to the original plans.

A City University for Cleveland, Ohio, is being studied by [illegible] [illegible] of the Cleveland [illegible] [illegible] The [illegible] the possible amalgamation of [illegible] University, Case School of Applied Science, and the Cleveland School of Art, as well as the city health, charity, welfare and [illegible] departments.

The Panama-Pacific Exposition Will Not Be Postponed, [illegible]

[illegible]

The Records for Placing Concrete Masonry [illegible]

of masonry of all kinds placed in the dam was 84,450 cu.yd., of this 1310 cu.yd. was placed by a second shift—deducting this the record for the month on a one-shift basis is as follows:

Number of working days (8 hr.)	$26\frac{1}{2}$ days
Total masonry placed in dam, all kinds	83140 cu.yd.
Average amount of masonry per day	3137 cu.yd.
Best day's work	3772 cu.yd.

The dam is now completed to Elev. 3[illegible] in one section, 314 in eight sections and 286 in seven sections. The top of the dam is Elev. 370. Seventy-six per cent. of the masonry is now completed.

This month's work will probably stand as the record on this structure, as the cross-section of the dam in the upper portions is so much smaller than below that it will not be possible to maintain the recent rate of progress.

During the five months, April to August, inclusive, 348,830 cu.yd. of masonry were placed in 128 working days, or a daily average of 2725 cu.yd.

An Exhibition of Street-Cleaning Appliances will be held in New York City, from Nov. 23 to 28, by the Department of Street Cleaning of New York City, according to a notice just sent out to manufacturers by Commissioner J. T. Fetherston (Municipal Building, Borough of Manhattan, New York City). The exhibit will be at Department Stable "A," 17th St. and Ave. C, Borough of Manhattan. Manufacturers and others are invited to show either working apparatus or models, illustrations of various sorts or other material. It is hoped that the exhibition will attract manufacturers and inventors from all over the country. Commissioner Fetherston's statement regarding the purpose, nature and object of the exhibit is as follows:

The purpose of this exhibition is threefold: (1) To show the people of the City of New York the types of equipment now in service. (2) To give manufacturers of modern street-cleaning apparatus an opportunity of exhibiting their various appliances, not only to the citizens of New York, but also to officials of surrounding communities who will be invited to attend. (3) To provide an opportunity for practical tests or demonstrations of street-cleaning appliances under such conditions as will be acceptable to the city and manufacturers.

The street-cleaning apparatus proposed for exhibition will cover all sorts of brooms, brushes, sweeping machines, flushing machines and other equipment or appliances used in cleaning streets and removing snow; garbage, ash and rubbish cans or receptacles used by householders; carts, wagons, motor trucks or other vehicles used for collecting garbage, ashes, rubbish and street sweepings; conveyances for transporting refuse by water or by rail; methods used for the disposal of garbage, ashes, rubbish and street sweepings, including garbage-reduction works, garbage crematories, incinerators, destructors, etc.

The City of New York is considering the adoption of improved methods and appliances for street cleaning, refuse storage, refuse collection and refuse disposal. An appropriation amounting to $1[illegible],000 has been made for the purchase of apparatus to be installed in a "Model District" of the Borough of Manhattan. The object of the exhibit will be to give every manufacturer or inventor an opportunity of bringing to the attention of the city officials their various appliances, likewise providing a chance for examining and testing these appliances during the period while the exhibit is being held. The city cannot guarantee expenses nor sales of apparatus, nor can it assume any responsibility further than the care of the equipment while stored at the city stable. All expenses and risks in connection with the exhibit must be borne by the exhibitors.

PERSONALS

Mr. S. L. Schoonmaker, of New York City, has been elected Chairman of the Board of Directors of the American Locomotive Co.

Mr. W. H. [illegible] has been appointed Assistant Engineer of the Chicago, Burlington & Quincy R.R., with office at St. Joseph, Mo., succeeding Mr. E. H. [illegible]

Mr. J. A. [illegible], of [illegible], Me., has been appointed County [illegible] and [illegible] County Highway Engineer of [illegible] County, Me., succeeding Mr. A. M. [illegible], who has resigned to engage in the contracting business.

Mr. Alfred C. [illegible], recently Architectural Engineer, Department of Buildings, Milwaukee, Wis., has been appointed Engineer of Construction of the new State [illegible] House buildings at North Milwaukee, Wis.

Mr. M. T. [illegible], Engineer with the [illegible] Railroad Commission, has been appointed [illegible] Inspector of [illegible] Division of Valuation, Interstate Commerce Commission, Southern District, with headquarters at Chattanooga, Tenn.

Mr. Thomas F. [illegible], a public school teacher of Long Island City, N. Y., has been appointed [illegible] Commissioner

of the Department of Water Supply, Gas and Electricity, for the Borough of Queens, New York City, at a salary of $4000 per annum.

Mr. Andrew W. Woodman, M. Am. Soc. C. E., Consulting Engineer, of Chicago, Ill., has been elected President of the Joliet Bridge & Iron Works, Joliet, Ill. Mr. Raymond Morrison has been elected Vice-President and Mr. Ernest Rollinson, Secretary.

Maj. C. O. Sherrill, Corps of Engineers, U. S. A., has been relieved of duty as Engineer in Charge of the Fourth District of the Mississippi River and the New Orleans Harbor improvement and will sail on Nov. 5 to take charge of fortification construction at Manila, P. I.

Mr. Augustus Griffin, Assoc. M. Am. Soc. C. E., Superintendent of Irrigation, U. S. Reclamation Service, Truckee-Carson Project, Fallon, Nev., has resigned to accept the position of Chief Engineer and Superintendent of the South San Joaquin Irrigation District, with offices at Manteca, Calif.

Mr. Alfred C. Callen, recently Assistant Manager and Draftsman of the Pottstown Machine Co., Pottstown, Penn., has been appointed Instructor in mining engineering at the University of Illinois. Mr. Callen is a graduate of Lehigh University, class of 1909, and was an instructor there until 1911.

Mr. A. H. Ayers, Assoc. M. Am. Soc. C. E., Superintendent of Construction, U. S. Reclamation Service, Great Falls, Mont., has been promoted to be Engineer on the Sun River Project at Fort Shaw, Mont. Mr. Ayers was formerly Division Engineer of the irrigation project of the Southern Alberta Land Co., Alberta, Canada.

Mr. Frank M. Patterson, for 27 years with the engineering department of the Chicago, Burlington & Qunicy R.R., has been appointed Field Engineer, Division of Valuation, Interstate Commerce Commission, Central district, with headquarters at Chicago, Ill. He was recently Engineer of the Missouri district of the C. B. & Q. R.R.

Mr. John Williams Davis, Assoc. Am. Inst. E. E., has been appointed Instructor in electrical engineering at the University of Illinois. Mr. Davis is a graduate in mechanical engineering of Cornell University, class of 1910, and has been an instructor in electrical engineering at Vanderbilt University and Leland Stanford, Jr., University.

Mr. F. R. Schanck, for several years in charge of the mechanical and engineering parts of the power and irrigation work on Indian Reservations for the United States Indian Service, has been promoted to be Assistant Chief Engineer of the Indian Service. He will have charge of the same branches of engineering, but his headquarters have been moved from Los Angeles, Calif., to Washington, D. C.

Mr. Horatio S. McDewell, Jr. Am. Soc. M. E., for the past year Assistant to Prof. L. S. Marks, of Harvard University, in his work as Editor-in-Chief of a new Mechanical Engineers' Handbook, has been appointed Instructor in mechanical engineering at the University of Illinois. Mr. McDewell is a mechanical engineering graduate of Harvard University, class of 1907. From 1908 to 1913 he was with the Allis-Chalmers Co., Milwaukee, Wis., first as an apprentice, and finally as Gas Engine Erecting Engineer.

Mr. F. L. Stuart, M. Am. Soc. C. E., Chief Engineer of the Baltimore & Ohio R.R., has been appointed by Mayor John Purroy Mitchel of New York City, a member of the advisory committee on port development at New York. Messrs. Ralph Peters, President of the Long Island R.R. and P. J. Flynn, Vice-President of the Delaware, Lackawanna & Western R. R., have also been named as members of the committee. The New York City Department of Docks and Ferries intends to work out a comprehensive plan for enlarging the shipping facilities of the harbor, and the coöperation of the large railway systems is sought.

Mr. Charles A. Ellis, Assoc. M. Am. Soc. C. E., former Resident Engineer, Dominion Bridge Co., Winnipeg, Man., has been appointed Assistant Professor of civil engineering at the University of Illinois. Prof. Ellis graduated from Wesleyan University, Middletown, Conn., in 1900. For a year he was Assistant City Engineer of Middletown, and for seven years Structural Engineer with the American Bridge Co. at Berlin, Conn., New York City and Ambridge, Penn. He was Assistant Professor of structural engineering at the University of Michigan from 1907 to 1912, and since then has been with the Dominion Bridge Co. of Canada.

Mr. H. C. Grant, former Superintendent of the Canadian Pacific Ry. at Brownville Jc., Maine, and recently Assistant General Superintendent of the Atlantic division at St. Johns, N. S., has been promoted to be General Superintendent of the Atlantic division, succeeding Mr. William Downie, who has retired after a service with Canadian Pacific Ry. extending over 27 years. Mr. Grout is a graduate of the engineering staff of the railway. He was in the construction and maintenance-of-way departments from 1898 to 1910, rising from the position of Rodman to that of Assistant Division Engineer at Toronto, Ont. Since 1910 he has been in the operating department.

Mr. Edwin Frank, Jr. Am. Soc. M. E., recently a draftsman in the centrifugal pump department of the Allis-Chalmers Co., Milwaukee, Wis., has been appointed Instructor in mechanical engineering at the University of Illinois. He graduated in mechanical engineering at the Massachusetts Institute of Technology in 1906, served a two years' apprenticeship with the Allis-Chalmers Co., Milwaukee, Wis., and then spent two years in Germany, where he was Draftsman and Engineer in the centrifugal, pump and steam departments of the Maffei-Schwartskopff Werke, of Berlin, at the same time attending the Konigliche Technische Hochschule zu Aachen. Since 1911 he has been with the centrifugal pump department of the Allis-Chalmers Co.

The Department of Architecture of the University of Illinois announces the following new appointments to the faculty: Mr. William D. Foster has been appointed Instructor in architectural design. He is a graduate of the Massachusetts Institute of Technology, class of 1911, and since June, 1913, has been Head Draftsman for Lour & Bollenbacher, Chicago, Ill. Mr. Ralph S. Fanning has been appointed Instructor in architectural design. He graduated from Cornell University in 1912 and for the past year has been a designer with F. J. Hughes & Co., Dayton, Ohio. Mr. William M. Stanton, a 1913 graduate of the University of Pennsylvania, has been appointed Instructor in architecture; and Mr. William S. Wolfe, a 1913 graduate of the University of Illinois, has been appointed Instructor in architectural engineering.

OBITUARY

Joseph F. Weekes, a retired Consulting Engineer, of Salem, Mass., died Sept. 20, aged 77 years.

John G. Haun, Supervisor of Bridges and Buildings of the Virginia & Southwestern Ry., of Bristol, Tenn., was killed, Sept. 14, when the motor car in which he was traveling was derailed in crossing a trestle.

John B. Carter, President of the Carter Construction Co. and the John B. Carter Co., New York City, died Sept. 10, at his home in that city, from nephritis. He is survived by a widow, a daughter and a son, John B. Carter, Jr. Mr. Carter was born Jan. 4, 1861, at Louisville, Ky. His father, Van Buren Carter, who was a newspaper man, died when the son was 18 months of age. His infancy was spent in Harrodsburg, Ky., where he received a common-school education. At the age of 15 years, he entered the employ of Tabler, Rosser & Co. as commissary clerk, and he remained with them several years. His next employment was with Mason, Hogue & Co., with whom he remained until he was 22 years of age, when he received a subcontract from that firm. His rise in the construction world was steady. It was a habit in his early career, which he followed to the time of his death, to remain personally upon any work which he undertook, or to be in constant touch with it. Some of his most noted achievements were the extension of the Bangor & Aroostook Ry., in Aroostook County, Maine; the construction of the Washington County R.R., along the east coast of Maine; an extensive system of government highways in Porto Rico; the construction of the Green Tree Tunnel and work for the Wabash R.R. entrance into Pittsburgh; the Indianapolis Southern R.R. from Indianapolis to Switz City, Ind.; the organization and construction of the Lake Erie & Pittsburgh Ry. from Cleveland to Ravenna, Ohio, which he sold to the New York Central and Pennsylvania systems; the Burlington extension from Herrin to Metropolis, Ill. The Western Maryland extension from Cumberland, Md., to Connellsville, Penn., will stand as an enduring monument to his genius and energy and capacity for the rapid accomplishment of gigantic undertakings, as this work involved the construction of 87 miles of very heavy work and included the removal of 6,000,000 cu.yd. of excavation, nearly all of which was rock; the construction of five tunnels and very heavy concrete masonry for bridges. The work necessitated the use of 47 steam shovels, and was completed in the record time of 15 months. Mr. Carter lived on this work, and the strain which resulted from the constant efforts to beat all previous records wrecked his health. Three weeks before his death he secured the contracts for the construction of the Mill Creek Joint District Sewer in St. Louis, at a price of $3,200,000. He left an estate in excess of $3,000,000 [Contributed by S. F. Cohen, Carter Construction Co.]

Henry Harbinson Sinclair, M. Am. Inst. E. E., whose death, on Sept. 1, was noted in these columns of Sept. 10, was a pioneer in long-distance electric power transmission. Mr. Sinclair was born in Brooklyn, N. Y., Dec. 22, 18[illegible]. He was educated in the public schools and academies of that city. When 1[illegible] years of age, he went to sea for three years, and in 18[illegible] entered Cornell University. Later he was engaged in the [illegible] business for several years in New York, following which he studied law at Columbia University. During [illegible] legal experience, his health failed, and he went to [illegible], Calif., in 1887, where he finally recovered. In 18[illegible], Mr. Sinclair, as one of the organizers of the Southern California Power Co., undertook the development of power in Santa Ana Cañon, near Redlands, and its transmission to Los Angeles, a distance of 83 miles, at 33,000 volts. The voltage and distance proposed were twice as great as in any long-distance line then existing or contemplated. Foremost electrical authorities refused indorsement, and thus his undertaking was heroic, both technically and financially. However, he succeeded in obtaining capital, and work was begun. During construction, the company's property was purchased by the Edison Electric Co., of Los Angeles, and the entire system (the largest hydro-electric project of its time) was made a success, under the management of Mr. Sinclair and superintendence of Mr. O. H. Ensign, now Chief Electrical Engineer of the U. S. Reclamation Service. During this period, under Mr. Sinclair's management, the Mill Creek Plant with 1960-ft. head, was built. This was for many years the highest head in the world. Under the active supervision of Mr. Sinclair, the Edison Electric Co. installed on its system the first oil-break switches, revolving field generators, 12,000-volt generators, high potential measuring instruments, steel towers and steam turbines ever brought west of Chicago. After the completion of the Kern River plant of the Edison Electric Co., Mr. Sinclair maintained a consulting engineering office in Los Angeles until 1909, when he went to San Francisco to assume management of the Great Western Power Co., which position he occupied for [illegible]. During that time the company carried on the construction of two monumental dams and developed an extensive power market. After severing his connection with Great Western Power Co., although because of failing health an [illegible] rest seemed imperative, his many interests in [illegible] and Lower California necessitated his maintaining an office in Los Angeles until 1911. During this time, under his management, the industrial city of Torrance was built, [illegible] another example of his wonderful executive ability.

ENGINEERING SOCIETIES

COMING MEETINGS

INTERNATIONAL IRRIGATION CONGRESS.
[illegible]

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
[illegible]

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
[illegible]

NATIONAL COUNCIL FOR INDUSTRIAL SAFETY.
[illegible]

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
[illegible]

INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS.
[illegible]

AMERICAN GAS INSTITUTE.
[illegible]

[illegible] ROAD CONGRESS.
[illegible]

AMERICAN ROAD CONGRESS.
[illegible]

INDUSTRIAL WELFARE AND EFFICIENCY CONFERENCE.
[illegible]

NATIONAL MUNICIPAL LEAGUE.
[illegible]

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.
Nov. 19-2[illegible]. Annual meeting at Columbus, Ohio. Secy., F. E. Sanborn, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Nov. 30—Dec. 1. Annual meeting at New York. Secy., W. H. Ross, 1[illegible] Nassau St., New York City.

AMERICAN PUBLIC HEALTH ASSOCIATION.
Nov. 30-Dec. [illegible]. Annual meeting at Jacksonville, Fla. Secy., Prof. Selskar M. Gunn, Massachusetts Institute of Technology, Boston, Mass.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 2-4. Convention at Washington, D. C. Secy., D. Knickerbacker Boyd, The Octagon, Washington, D. C.

AMERICAN MINING CONGRESS.
Dec. 7-11. Annual meeting at Phoenix, Ariz. Secy., J. F. Callbreath, Denver, Col.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.
Dec. 9-12. Convention at Richmond, Va. Secy., C. A. Prosser, 140 W. 42d St., New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Dec. 10-11. Annual meeting at New York City. Secy., D. H. Cox, 29 W. 39th St., New York City.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Dec. 2[illegible]-30. Annual meeting at Madison, Wis. Secy., F. M. White, Madison, Wis.

American Institute of Architects—The 1914 convention will be held in Washington, D. C., Dec. 2-4. The Secretary is D. Knickerbacker Boyd, Washington, D. C.

American Civic Association—The annual convention will be held in Washington, D. C., Dec. 2-4. The Secretary is Richard D. Watrous, 913 Union Trust Bldg., Washington, D. C.

National Society for the Promotion of Industrial Education—The annual convention will be held at Richmond, Va., Dec. 9-12. The Secretary is C. A. Prosser, 140 West 42d St., New York City.

American Society of Refrigerating Engineers—The annual meeting will be held in the Engineering Societies' Building, New York City, Nov. 30-Dec. 1. The Secretary is W. H. Ross, 1[illegible] Nassau St., New York City.

American Association for the Advancement of Science—The next convocation-week meeting will be held in Philadelphia, Penn., Dec. 28 to Jan. 2 under the presidency of Dr. Chas. Wm. Eliott. The Secretary is L. O. Howard, Smithsonian Institution, Washington, D. C.

Society of Naval Architects and Marine Engineers—The next annual meeting of the society will be held Dec. 10-11, at the Engineering Societies' Building, New York City. The usual banquet will be held at the Waldorf-Astoria on Dec. 11. The Secretary is D. H. Cox, 29 West 39th St., New York City.

National Conservation Congress—The secretary of the National Conservation Congress states that the 6th annual convention, which was to have been held at New Orleans, Nov. [illegible] will [illegible] on account of the war conditions [illegible]. The Secretary is Thomas R. [illegible], Washington, D. C.

American Public Health Association—In connection with the [illegible] annual meeting [illegible] Nov. 30 to Dec. 5, in Jacksonville, Fla., a [illegible] Health [illegible] will be held [illegible] Jacksonville, Fla. [illegible] will be [illegible].

Electric Vehicle Association of America—The program for the [illegible] annual convention has [illegible]. Among the items [illegible] are the following: [illegible] F. Walker; "Design and Performance of [illegible] Motors," [illegible]; "The [illegible]"; "[illegible] Development of the [illegible] Vehicle Industry," [illegible]; "The Motor Truck in [illegible]," [illegible]. The general office of the Association is at [illegible] West [illegible] St., New York City.

American Railway Bridge and Building Association—The [illegible] annual convention will be held in Los Angeles, Oct. 2[illegible] [illegible] with [illegible]. The following are the committees which will report and their chairmen: [illegible] C. E. Smith; [illegible] and Side [illegible]; [illegible] O. F. [illegible] M. [illegible] Cunningham; [illegible] Knowles; [illegible] F. L. [illegible]; Heating, Lighting and Ventilating [illegible] W. M. [illegible] G. E. [illegible]. The [illegible] will be held on Thursday evening, Oct. 22. The Secretary is [illegible] N. Waller St., Chicago, Ill.

Engineering News

VOLUME 72 OCTOBER 8, 1914 NUMBER 15

Building Bridge Substructures on the Grand Trunk Pacific Ry.

By W. C. Ruegnitz*

One of the most interesting features of construction on the Pacific Coast section of the new transcontinental line of the Grand Trunk Pacific Ry. is the bridge foundation work along the Fraser River between Tete Jaune Cache and Fort George, in British Columbia. For 185 miles between these points the railway follows the Fraser River through several ranges of mountains, the distance by river being 300 miles. The country is wild and rugged, and inhabited mainly by Indians and trappers.

In the summer the melting glaciers and snow turn the streams into deep, swift rivers, and because of the scour and swift current exceptionally good foundations are required. Temporary bridges could not be maintained over the larger and more dangerous rivers, and it was necessary to complete the substructures in advance of track in order to allow the quick erection of the superstructure when tracklaying reached the various bridge sites.

There are ten permanent bridges, from 2658 ft. in length to single-girder spans, and the three longest bridges cross the Fraser River. The substructure work of these bridges was commenced by some small individual contracts, but it was soon evident that it could not be carried on satisfactorily or with the necessary speed. In July, 1912, the contract for all the bridge substructure work from Tete Jaune Cache westward for some 450 miles or to within about 200 miles of Prince Rupert (the Pacific terminal) was awarded to the Bates & Rogers Construction Co., of Chicago. The writer was superintendent of construction for this company on the division between Tete Jaune Cache and Fort George, and work on this division was completed in May, 1914.

Fig. 1. Taking Construction Material and Supplies Down the Fraser River on Scows

Supplies and Camps

To complete the difficult foundations in the short time allotted and under the conditions described, necessitated very careful preparation. Markets for labor, plant and material were far away. Men were often shipped from Montreal and Boston, a trip of 10 to 14 days. Cement and steel from eastern Canada and Pennsylvania, requiring a lake and rail shipment, were often weeks in getting to destination. The base of supplies was at Tete Jaune Cache, at the end of the track. Here it was necessary to assemble all requirements to be freighted to the bridge sites.

The nature of the country was such that wagon roads were impossible, and the only means of delivering material was by boat or scow on the Fraser River, which is navigable only during the high-water period. Actual construction had to be carried on during the low-water period, which begins usually in October or November and

*Superintendent, Bates & Rogers Construction Co. (of Chicago), Prince George, B. C., Canada.

[illegible] until April or May. Thus the high-water period was a time of preparation. Camps had to be established quickly, and plant, supplies and material had to be transferred and stored at the various sites. The smaller details had to be carefully worked out in advance, as [illegible] would be without freight communication during [illegible] of the construction period.

[illegible] telephone system serving all the camps provided a wonderful help, although the line was not as good as the ordinary party line of the rural settlements. Most of the camps were located in heavily wooded districts, and fuel for all uses was cut during the summer months. Foundation piling and round timbers for construction purposes were cut in the fall and delivered to the sites

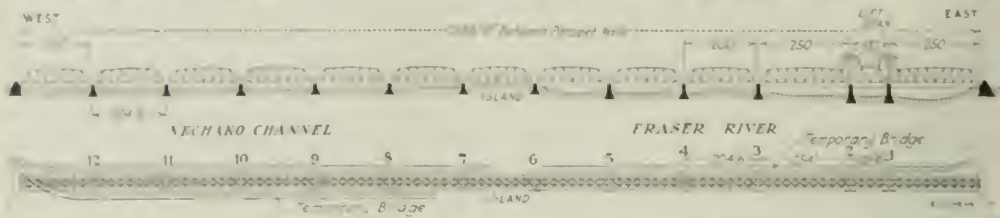


FIG. 2. BRIDGE AT THE FOURTH CROSSING OF THE FRASER RIVER, GRAND TRUNK PACIFIC RY.

[illegible] steamers of the usual river type were built to handle the freight but they could not begin to deliver all the enormous tonnage. Hence hundreds of scows 36 to 40 ft. long, 12 to 14 ft. wide, and carrying 12 to 25 tons each were floated to the jobs. They were handled by sweeps at both ends, each sweep being manned by two men. In the more dangerous cañons and rapids, pilots and extra men were put on to assist the regular crews, but even with this protection entire cargoes were frequently lost. The average mileage per day for a scow was 50 miles, while one would frequently make 70 miles. Their progress was augmented by the swift currents and the long summer days of the North. Fig. 1 shows the character of this transportation.

Nearly all cement was delivered by scows that were from 5 to 10 days on the way. False bottoms, covered with straw to absorb the moisture, served as a floor to [illegible] the cement. The sides and [illegible] of the barge were also protected [illegible] while the top was covered with a heavy [illegible] Rise boards were provided to protect the cargo from the [illegible] the river. [illegible] the cement [illegible] on the job it was [illegible].

The camps presented exceptional requirements. Ample storage room was necessary to accommodate the material and supplies that had to be delivered in advance of construction. Preparation for the long cold winter had to be made, and bunkhouses of logs well "banked" were used when lumber could not be easily procured. Sanitary conditions had to meet the requirements of the British Columbia Government. During the fall, when it was impossible to deliver fresh meat from the [illegible] supplies, [illegible] the [illegible] construction with [illegible].

When navigation was closed, the only means of [illegible] the camps was by [illegible]. [illegible] During the winter months dog teams [illegible] and sleighs [illegible] when the ice permitted. A

by water before ice closed the river. Square timbers were hewed on the job, there being many expert broad-axe men available.

SUBSTRUCTURE OF THE FRASER RIVER BRIDGE

All the bridges presented special difficulties but the largest and most interesting is that at Fourth Crossing, one mile east of the old Hudson's Bay Co. Post known as Fort George. It is just below the confluence of the Fraser and Nechaco Rivers. Here the line crosses an island, with the deep-water channel, known as the Fraser, on the east side, while the Nechaco, an overflow channel during high water, is on the west side. The length of the bridge is 2658 ft. As shown in Fig. 2, there are ten spans of 200 ft. and two of 250 ft., one at either end of the 100-ft. lift span. The base-of-rail elevation at pier No. 1 is 1867 above sea level, and the elevation of the river bed

FIG. 3. STAGES OF WORK ON THE PIERS FOR THE FOURTH CROSSING BRIDGE, FRASER RIVER

[illegible] 1871. High-water level is assumed as 1838 and the low water as 1822.

The west [illegible] of the island was selected by the contractors for their camp, accommodating 400 men. This was [illegible] purposes. The buildings were frame

buildings covered with prepared roofing. The storehouses for cement and material were large frame buildings covered with heavy oiled tarpaulins or "tarps," an exceptionally fine canvas made in Scotland. Tarps that had protected the cement on the river trip were used to cover the buildings. An auxiliary camp to accommodate 100 men was established on the east bank, on account of the great danger in taking laborers across the main channel during the ice floes before the contractors temporary bridge was completed. This proved very fortunate, for in the spring, when the ice took out all temporary structures, the work on the east bank was carried on without interruption.

A complete day and night organization was maintained for the entire work, each pier having a complete plant layout as well as an individual crew. A night and day foreman for each pier worked together, shifting their crews every two weeks. Each foreman reported to the general foreman, there being one general foreman for each shift. The general foremen reported to the superintendent in charge, who was located on the work. Fig. 3 shows the condition of work in December, 1913, and April, 1914.

Construction Work

The substructure consists of 12 concrete piers and two abutments, all resting on pile foundations, as shown. The deepest foundations are at piers Nos. 1 and 2, which were carried 25 ft. below low water, requiring 40-ft. steel sheeting. An ice jam which raised the water several feet above the top of the sheeting delayed all operations for several days. Careful soundings were taken before the work was started and showed a gravel bed with an underlying strata of very stiff sandy clay with layers of quicksand. The depth of gravel varied at different pier sites.

An exhaustive study of the individual pier and abutment sites was made by the contractors, and coffer-dams were designed both as to kind and strength to suit the local conditions. Three types of coffer-dams were used; crib, steel sheeting and a single row of Wakefield wood sheeting. The size of coffer-dams was designed to allow ample room for the necessary coffer-dam piles, bracing and timbers. The braces were spaced in order to allow of dredging with grab buckets and to permit the placing of pumping equipment.

Actual work on the shore was commenced in September, 1913, on the east abutment and pier No. 6, the only units then accessible. The temporary bridge from which all work was directed was started at this time and carried out as far as navigation laws permitted. Later, when floating ice stopped navigation, it was found a very difficult task to drive the remainder of the bridge and it was not until January that it was entirely completed. The river, with a current of 4½ to 5 m.p.h. and filled with ice, presented a formidable obstacle not only against the temporary bridge but it seriously hindered the placing of the coffer-dams.

The general program of construction for each pier was as follows:

1. Open dredging was carried down as far as possible.

2. The coffer-dams were then built. The crib coffer-dams were built and sunk in the ordinary way. For the steel coffer-dams, wood piles spaced about 8 ft. c. to c. were driven around the space to be inclosed; these were carefully lined up and two sets of timbers 4 ft. apart bolted on the inside piles (above the water) to act as guides for the steel sheeting. In Fig. 4 is shown a complete set of the steel sheeting in place and ready to be driven. Three or four complete sets of waling and bracing were then sunk into position and set as deep as possible. The steel sheeting was then set inside the guide timbers and around the waling, care being taken to get a locked dam. After closure the steel was driven the full depth required, usually 6 ft. below the elevation required for the bottom of the foundation.

3. Excavation inside the coffer-dam was continued with dredges (Fig. 5), teeth being used on clam-shell buckets when clay was encountered. The waling and bracing was sunk as the excavation proceeded. The excavation was usually carried 1 to 2 ft. below the bottom

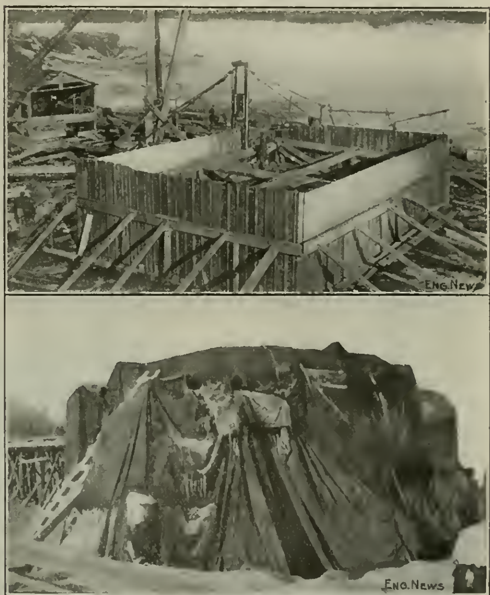


Fig. 4. Substructure Work on the Fourth Crossing Bridge

(Top view, steel sheeting for coffer-dam erected in place and ready to be driven. Bottom view, completed form and concrete pier incased with canvas, inside of which are steam pipes. (Temperature, 50° below zero.)

elevation required, in order to allow for swell caused by driving the foundation piles.

4. When excavation was completed, the foundation piles were driven and cut off under water at the elevation required by means of a saw (Fig. 5). The penetration of this piling usually averaged over 20 ft. below cutoff. The driving was very hard.

5. Concrete was then placed under water by means of bottom-dump buckets, using a 1 : 2 : 4 mixture. The amount of sealing used was carefully figured to prevent floating or "blow-in." The sealing was allowed to set from two to six days, depending upon the depth of water and temperature.

6. When the concrete was properly set the coffer-dam was pumped out. As the water was lowered, the bracing was examined and strengthened or repaired if necessary.

EXAMPLE OF CONTRACTOR'S WEEKLY PROGRESS REPORT ON BRIDGE SUBSTRUCTURE WORK
FRASER RIVER BRIDGE

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The results in all cases showed exceptionally good ma[illegible]

(7) Forms were built (Fig. 3) and the pier concreted, using 1:3:5 mixture. The necessary precautions being taken (as described later) to protect it against [illegible]

CONCRETE WORK

For the Fraser [illegible], two concrete plants were used, one on the island and one on the east bank. Gravel was [illegible] at each pier; the only material to be loaded being cement.

To prevent freezing, the gravel was heated as mentioned above. Water was also heated, the mixed concrete coming to the forms very warm. The forms were entirely covered by heavy oiled canvas tarps, these extending from the top of the coffer-dams to the top of the forms, completely enclosing the pier, as shown in Fig. 3. Between the forms and canvas covering, fires were kept in small stoves, or steam heat was furnished in radiators built on

FIG. 3. WORK ON THE PIERS OF THE FRASER CROSSING BRIDGE, FRASER RIVER; GRAND TRUNK PACIFIC RY.

[illegible]

[illegible]

[illegible]

The forms had to be well built and braced with more than ordinary care before placing concrete, because the canvas covering did not leave an opportunity to examine the forms to determine if they were being kept in line.

Progress Records

The weekly progress report used by the contractor was a white print 28 in. long showing an elevation and plan of the bridge (on which the concrete progress was marked) and a profile of the river bed on which the progress of cotfer-dams and pile foundations was marked. On the print was a table for the excavation, cotfer-dam, piling and concrete at each pier, the table being filled in each week. The accompanying table gives one of these weekly reports of work of the main channel of the Fraser River for the Fourth Crossing bridge, shown in Fig. 2. In addition to this, a monthly report was made for each pier or abutment, showing the progress, materials used, etc., and the condition of the work. These graphic reports were made up at the superintendent's office and forwarded to the main office of the contractors, in Chicago.

Concrete Retaining-Wall for Flood Protection at Schenectady

A low concrete retaining-wall more than a mile in length was completed Sept. 1 by the General Electric Co., at Schenectady, N. Y., to protect its works from freshets in the Mohawk River. The property of the company is located a few hundred feet south of this winding river and adjacent bottom lands. Between the river road upon which the plant buildings front and the river channels, is the Erie Canal.

Previous to the spring of 1914, the banks of the canal prevented overflow into the works. The towpath of the canal is 6 ft. higher than the floor level of the works and permits a rise of 23 ft. of the Mohawk River before water can overflow the top of the canal and flood the plant.

This stage was exceeded in March, 1914, when the towpath of the Erie Canal was overflowed, closing navigation. Fortunately, at this juncture the ice gorges in the river broke, preventing a general inundation of the works. Water overflowed many of the principal streets in the lower sections of Schenectady, to a depth of 2 to 5 ft. The normal flow of the river in this vicinity is from 5000 to 7000 cu.ft. per sec.; but in the spring of 1913, reached 105,000 to 110,000 sec.-ft.

*Information furnished by General Electric Co.

Utilizing the Mohawk River for the Barge Canal made it necessary to create a pool 11 miles long with a dam 30 ft. high at Visschers Ferry, 3 mi. below Schenectady. This raised the general water level about 2 ft., which accounts largely for the high stage this year. Engineers of the General Electric Co., last January investigated the situation and recommended raising the present heelpath masonry walls of the Erie Canal about 3 ft. and increasing the height of the old dike extending around the southwest end of the company's property.

Work started on July 13 and was completed in six weeks by a gang of 25 men. The new flood-protection wall extends west from the Washington Ave. bridge to the earth dike. It is 5400 ft. long and about 2 ft. 6 in. high. It is 24 in. thick at the base and 14 in. at the top. It is dovetailed to the rubble-concrete canal wall. Thirty tie-rods of $1\frac{1}{4}$-in. steel 24 ft. long embedded in concrete and anchored to concrete deadmen, backbrace the heelpath wall to the embankment, where the old wall was out of plumb. Blaw steel forms were employed and all material was transported and mixed on scows. The wall contains more than 1000 cu.yd. of concrete.

A short section of the wall 225 ft. long will be run on the heelpath of the canal, starting just east of the Washington Ave. bridge and extending to a point where it can be directed across along the side of the illuminating laboratory, onto and abutting the New York Central railway embankment.

The work was done under the direction of Carl G. Hulth, Engineer and Superintendent of Grounds and Buildings for the company, and Chas. H. Benedict, Assistant Superintendent for the Eastern Division of the State Department of Public Works.

A Highway Crossing Signal now in use on the Lehigh Valley R.R. and other lines comprises a disk, lamp and gong in its indications. The signal is of the banjo type, with circular box mounted on a post as in an old form of automatic block signal. The signal is held at the "clear" position by magnetic attraction, but when the control circuit is broken by the approach of a train the magnet coils are demagnetized and the mechanism goes to the "stop" position by gravity, showing a large red disk at the larger opening in the box and bringing a red glass opposite the lamp opening. The gong is housed at the lower end of the banjo box. One design of the signal shows indications in both directions, so that only one signal is required for the crossing. This crossing signal is a development of the old Hall automatic block type.

Low Concrete Retaining Wall on Heelpath of Erie Canal

Experimental Levees with Concrete Paving and Sheet-Pile Cutoff, Mississippi River

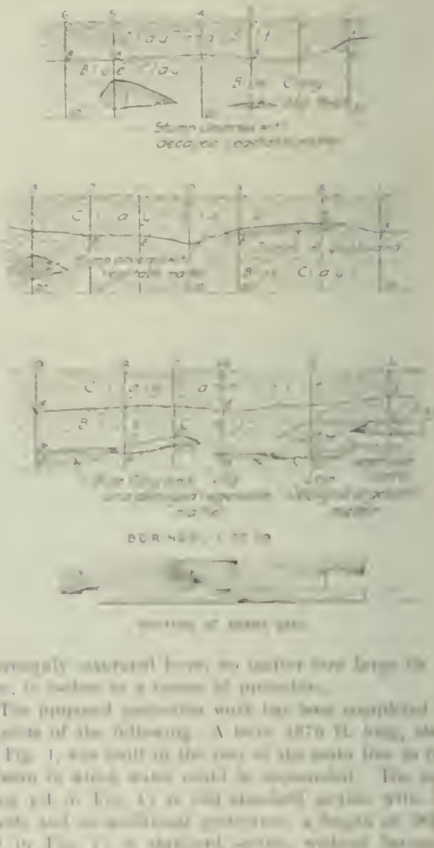
By C. O. SHERRILL*

The years 1912 and 1913 were characterized by the greatest floods ever known on the Mississippi River, and efforts of the United States Government and the local engineers to hold these floods between the levees are well known to all. These efforts, in effect, were directed against 2,200,000 cu.ft. per sec. of water flowing down the river between levees constructed to grade for 1,750,000 cu.ft. per sec. As a result, all the levees were strained to the utmost and many proved unsafe, or sloughed and had to be reinforced.

It was found that in certain classes of soil excessive seepage and sand boils occurred, even in the most carefully built levees. To determine the effectiveness of various types of protection, the Fourth District, Mississippi River Commission, undertook certain experimental work, described below, with a view to determining whether a standard-section levee protected with granite concrete, [illegible] and with interlocking sheet piling, extending 20 to 30 ft. deep, on the land or the flood side, will decrease the percolation of water through the levee so as to keep it dry for the long period of highest flood, usually 30 to 60 days.

FIG. 1. EXPERIMENTAL LEVEE WITH PAVE PROTECTION AND PILE CUTOFF AT UPPER LATTERMAN, MISSISSIPPI RIVER

The writer undertook these experiments with the idea that the protection of levees in this way would add greatly to the resistance of the water passing through the levee, due to the necessity of its passing over the longer path around the bottom of the sheet piling and upward toward the surface against gravity and frictional resistance of the soil, and that for the period during which levees are subjected to the pressure of flood water this increased resistance to percolation would probably delay the rise of the seepage plane sufficiently to allow the levee to remain dry until the danger was passed. It has been thoroughly demonstrated, however, that a dry levee of any size practicable to build is a safe levee, and that any



thoroughly saturated levee, no matter how large its section, is liable to a failure of protection.

The proposed protection work has been completed and consists of the following: A levee 1870 ft. long, shown in Fig. 1, was built in the rear of the main line to form a basin in which water could be impounded. The upper wing [illegible] is a standard section with [illegible] and no additional protection; a length of [illegible] ft. [illegible] is standard section without [illegible], and has [illegible] concrete slabs for flow protection and 20-ft. sheet-pile protection; the remainder [illegible] has a [illegible] crown, and slopes of 1 on 3, with a [illegible] granite face protection and 29-ft. wood interlocking sheet piles.

A length of [illegible] ft. [illegible] has concrete and interlocking steel-pile protection, placed at the expense of the Lackawanna Steel Company to test their new [illegible] steel interlocking piling. [illegible] ft. of steel piling, [illegible] lb. per sq.ft., was of Lackawanna beam type [illegible], driven 20 ft. deep. This piling proved easy to drive, as there was no tendency for the piles to twist, either at top or bottom, due to the construction

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FIGS. 2-5. VIEWS OF EXPERIMENTAL LEVEE BEFORE FILLING

(Fig. 2. General view of basin. Fig. 3. Small section levee, one on two slopes, 5-ft. crown, 2-in. Gunite face protection, wood sheet piles. ("C" in Fig. 1.) Fig. 4. Levee with one on three slopes, 8-ft. crown, 4-in. concrete slab protection. ("B" in Fig. 1.) Fig. 5. Standard Levee, 8-ft. crown, one on three slopes and 20-ft. banquette. No protection. ("A" in Fig. 1.)

Practically all the piles were driven full 20-ft. penetration with an average of 20 blows per double pile. A drop hammer weighing 2350 lb., with a fall of 12 ft., was used.

There had been previously used by the Fourth District office various types of wood piles for levee protection, including Wakefield, dovetail-interlock, spline and groove, and tongue and groove, but none of these can compare with the standard interlocking type, patented by Alexandria Lumber Co., Alexandria, La., and shown in Fig. 1, as to ease of driving and water-tightness. The steel piling gives a good interlock, but on account of its light section was difficult to drive in the hard soil found at Fairfield; and it costs considerably more than wood. The Lackawanna Steel Co., however, is experimenting further with this piling, and it is believed that with a properly designed steam hammer and driving cap it can be satisfactorily driven in the hard soil at this locality. The writer saw some of it driven with success at the Lackawanna plant in comparatively soft ground. There is some doubt whether it will last for any great length of time unless made of special nonrusting composition.

Upon the surface of the protected portions of the levee was placed either ordinary concrete (1:3:5) 4 in. thick, or gunite, 2 in. thick. The gunite was placed on a levee of small sections, namely: 5-ft. crown, with slopes 1 on 2, to give it as severe a test as possible in comparison with the ordinary concrete. The 4-in. monolithic concrete was placed on a levee having 8-ft. crown and slopes 1 on 3. The largest section levee, which is the standard Mississippi River Commission type, was left unprotected in order to have a direct comparison between this levee's efficiency and that of the smaller protected sections.

Gunite was placed on the levee in several different

FIG. 6. SECTION OF THE INTERLOCKING WOOD PILING COVERED WITH CONCRETE

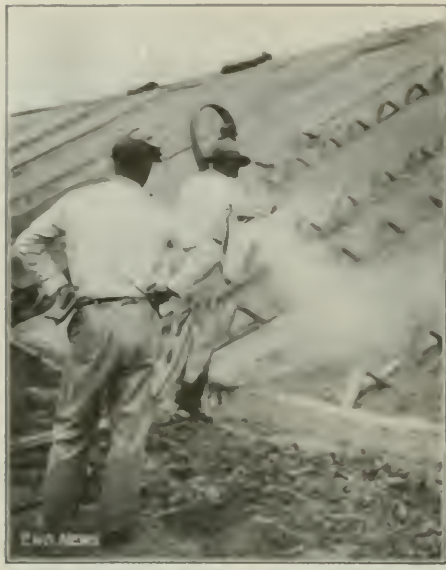


Fig. 7. Placing Gunite on Face

Fig. 8. Gunite in Place

Figs. 7-8. Gunite Protection of Levee Face

ways: (a) Directly on the levee itself; (b) on the levee with light reinforcement; (c) on gravel spread on the levee with reinforcement on the top; (d) on gravel with no reinforcement. In each case, the top of the sheet piling was covered for one foot down with gunite reinforced by light wire mesh. The last method named, that is, gravel with no reinforcement, having proved most satisfactory, it was adopted for the bulk of the work. The gravel was spread 2 in. thick on the levee and was then treated with gunite to cement it in place. This was found to give a dense concrete practically impervious to water, as was shown by a basin constructed by this effort.

Fig. 9. Top of Gunite Slab

Fig. 10. Bottom of Gunite Slab

This basin was hopper shaped, 4 ft. square at the top, 2 ft. square at the bottom and 2 ft. deep, and was constructed with a 2-in. layer of gravel treated with gunite. After this gunite had set, the basin was removed from its earth form, and being placed on timber supports and filled with water, it was tested as to percolation, with the result that it was found to be practically water-tight after a week's test. This mixture consisted of one part cement to 3 of sand and 3 of gravel.

After experiments in placing the gunite by the various methods mentioned above had been made, it was found that the products secured by spreading a layer of 2-in. gravel ranging from ½ to 2 in. in diameter and treating with very wet gunite of one part cement and three parts sand gave an impervious dense mixture 2 to 3 in. thick at a cost of about 33⅓% less than the ordinary 1:3:5 concrete mixture 4 in. thick.

Four sets of test wells, four wells in each set (Fig. 1), were driven and lined with porous terra cotta pipe, in order to determine the rate and amount of rise of the plane of percolation of water through the levee under the head caused by the filled basin. On account of the saturation of the levee by heavy rains previous to the filling, it was found that water in the wells driven through the center of the levee rose about 12 ft. above the natural ground surface before any water was pumped into the basin. It is proposed to continue the test during the dry fall months, in order to definitely measure the effect of protection work on the surface of percolation as compared with that in the unprotected portions.

The U. S. dredge "The Ram" pumped the basin full of water up to 41.8 ft., Cairo datum, 0.6 ft. below the 1912 high water, between July 18 and 25. On July 27, a slough occurred 80 ft. long at its base which took out 3 ft. of the crown at the point marked X (Fig. 1). It had been the intention to raise the water about 1½ ft. higher, but due to this dangerous slough of the old main levee, which threatened to cause a crevasse toward the river, the pumping was discontinued. At this time, the landside of the threatened main levee was blanketed with earth and the entire length of this main levee between the ends of the experimental levee was thoroughly drained on the river side to carry off the seepage as fast as possible, in order that a crevasse might not occur in this levee before the experimental sections should have had a thorough test.

On Aug. 5-6, the water was further raised to 0.4 ft. above the 1912 high water. Two days later a slough occurred at Y (Fig. 1), taking out 1½ ft. of the crown, and but for prompt protective work a crevasse would have occurred on this date.

The first seepage in the new experimental levee began July 23, in the standard full section unprotected levee near its junction with the main levee and has continued increasing to date. The second seepage began July 29 at the landside toe of the levee at Station 3693 behind the concrete-protected levee. The third seepage began Aug. 8 on the landside slope opposite Station 3690 + 60, about 15 ft. up from the toe. The seepage at these two places covers small areas about 6 to 8 ft. in diameter and of small amount. No seepage whatever has occurred in the small section levee itself or in the fields behind the small section levee protected with interlocking sheet piling and 2-in. gunite facing. The basin has been filled with water more than a month at this time, which is a considerably longer period than the levees are usually subjected to the strain of the highest water of the Mississippi River floods, as the extreme height is reached gradually and the water at once begins to subside. The behavior of the protected sections as compared with those unprotected indicates the superiority of protected levees of small section over the larger standard sections of earth alone.

The old main levee, although subjected to a much lower head, and though having a larger section than the protected portions, began to seep throughout its entire length shortly after the basin was filled and continued to grow worse from that time onward. The new standard section has also shown considerable seepage in its upper portion; the concrete-protected levee has seeped at only two small places. The smaller section gunite and sheet-pile protected levee has shown no seepage. The levee itself and the fields in the rear remain dry. The two seepage areas behind the concrete protection can probably be explained by the fact that in driving the sheet piling two logs, buried from 10 to 15 ft., were struck by the piles, which were badly shattered and probably did not make a tight cutoff wall at those points. It is also possible that the seepage at these points was caused by cracking of the concrete, due to the excessive subsidence of the levee where extensive slides had previously occurred and had been replaced in the construction of the levee. In localities where levees are subjected to wave-wash or where the land on which to build the levee is expensive the protection is especially valuable.

Tables have been compiled showing that for heights over 16 ft. the smaller levee with gunite and interlocking wood sheet piling with 10-ft. penetration costs less than the standard large unprotected levee. For the heights up to 16 ft., the standard small levee costs more than the large unprotected one.

Payment for Construction Charges of Irrigation Projects carried out by the Reclamation Service will hereafter be distributed over a period of twenty years, instead of ten years, as heretofore. This change is the result of a recent Act of Congress. Under the act, 5% of the construction charges against any land owner will be paid as an initial installment, and the remainder due will be paid in 15 annual installments, but the first of the 15 installments will not be due until Dec. 1 of the fifth calendar year after the initial installment. The first five of the 15 installments will be at the rate of 5% of the construction charge, and the last ten at the rate of 7%. The change in the period allowed for payment will apply to land owners under existing projects, so far as balances due are concerned; but such balances would be payable in 20 instead of 15 annual installments, the first four installments at the rate of 2% per annum, the next two installments at 4%, and the next 14 at 6% of the total construction charges unpaid when the law goes into effect. The act also prohibits any increase in the construction charges after these have once been established, except on agreement between the Secretary of the Interior and a majority of the land owners affected. The Act further provides for "an operation and maintenance charge based upon the total cost of operation and maintenance of the project, or each separate unit thereof and such charge shall be made for each acre-foot of water delivered; but each acre of irrigable land, whether irrigated or not, shall be charged the minimum operation and maintenance charge based upon the charge for delivery of not less than one acre-foot of water." The Act authorizes the Secretary of the Interior to make general rules and regulations regarding the use of water in any project, and also authorizes him to "require the reclamation for agricultural purposes and the cultivation of one-fourth the irrigable area under each water-right application or entry within three full irrigation seasons after the filing of water right application or entry, and the reclamation for agricultural purposes and the cultivation of one-half the irrigable area within five full irrigation seasons after the filing of the water-right application or entry."

Tests of a Deep-Well Irrigation Pumping Plant

By Geo. S. Knapp*

While most of western Kansas consists of semiarid plains having an altitude of 2000 to 3000 ft., it has an almost unlimited supply of underground water suitable for irrigation. At a depth of 10 to 60 ft. in the Arkansas Valley, and 80 to 150 ft. on the uplands, is a water-bearing gravel extending to a depth of several hundred feet. The gravel is coarse so that the water flows to the wells very rapidly. Most of the wells furnish 2000 to 3000 gal. per min., and will supply this amount continuously without any apparent decrease in the supply.

The richness of the land and of the climate, combined with the cheapness of the land and the abundance of water, have led homeseekers and capitalists to buy up these lands and convert the great ranches of a decade ago into productive fields. The United States Sugar & Land Co. has about 5000 acres, nearly all irrigated by pumping and used for growing sugar beets and alfalfa. The company is constructing a large electric power plant to supply power to the farmers for pumping.

The field of irrigation by pumping from deep wells is a comparatively new one, and is yet in the experimental stage. The question of economical pumping is a large one and the development of efficient machinery to handle large quantities of water at the high heads will go far toward solving the problem.

There are at the present time three distinct types of pumping plants: (1) the plunger pump operated by a windmill; (2) the common horizontal centrifugal pump used where large quantities of water are required and the head is not too great; (3) the deep-well turbine centrifugal pump. The chief advantage of the windmill plant is the low cost of operation. But in order to make use of the power whenever the wind is blowing, and to have a ready supply of water whenever it is desired to irrigate, a large and ofttimes expensive reservoir must be built. To get a sufficient supply of water, several wells may be put down around the reservoir and a windmill erected over each. It is not uncommon to see five to ten windmills pumping into one reservoir.

With the horizontal centrifugal pump, it is possible to pump water enough to irrigate directly from the pump, the plant being run only while irrigating. This saves the expense of a reservoir and eliminates the loss of water by seepage and evaporation from the reservoir. The pump is placed usually in a pit about 10 ft. below the surface to reduce the suction head, and is driven by a belt from above. With this type of plant, it is usually better to put down several small wells rather than one large one, and pipe all to one pump. Near Garden City, Kan., is a plant of this kind with five wells about 50 ft. apart, connected to one pump driven by an oil tractor. This plant has a capacity of 3000 gal. per min.

The deep-well pumping plant differs from the others principally in the type of pump used. The pump (consisting of several stages) is placed near the bottom of the well and is supported entirely by the piping, as shown in Fig. 1. The driving shaft is vertical and is enclosed in a protecting pipe inside of the discharge pipe, which serves the double purpose of protecting it and keeping it in alignment. A thrust bearing in the head carries the weight of the shaft and the revolving parts. The entire weight of the pump is carried by the head, which rests on the well casing. The pump is driven either by an engine (with a quarter-twist belt) or by a direct-connected motor.

For the purpose of investigating the success of pumping, the cost of equipment, the duty of water, and the methods of applying it, a pumping plant of this last type has been installed near Garden City, Kan., to irrigate 80 to 160 acres, and is operated by the cooperation of the U. S. Department of Agriculture and the Division of Agriculture of the Kansas State Agricultural College. In the spring of 1913, the writer spent three months at the plant and during that time made a number of tests.

*Superintendent, Experiment Station, Kansas State Agricultural College, Garden City, Kan.

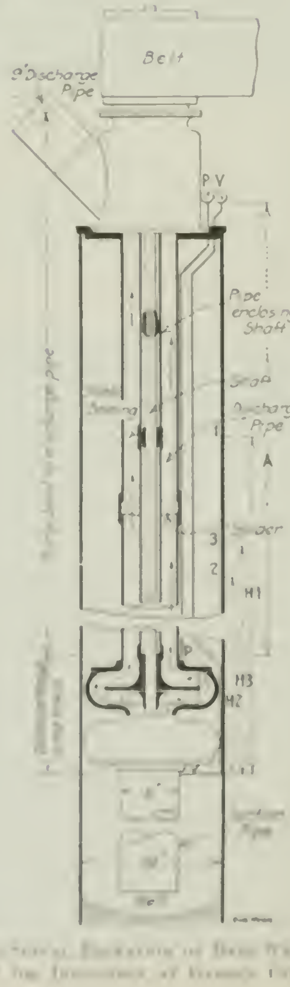


Fig. 1. Sectional Elevation of Deep-Well Pumping Plant for Irrigation at Garden City, Kan.

Description of the Plant

The well is 24 in. diameter, 100 ft. deep, cased with No. 8 steel (U. S. gage). The lower 30 ft. of this is a perforated strainer. A log of the well shows 47 ft. soil, 7 ft.

soft limestone, 6 ft. gravel, 2 ft. sandstone, 35 ft. No. 8 sand, 30 ft. No. 9 sand, 16 ft. No. 10 sand, balance fine sand and soft limestone. The water stands at 71 ft. in the well when the pump is not in operation, and draws down to about 110 ft. when supplying 650 gal. per min.

A two-stage pump with 8-in. suction and 9-in. discharge, has its shaft belted to a fuel-oil engine. The pump bowls are 120 ft. below the surface. Below this is 40 ft. of wrought-iron suction pipe without foot valve or strainer, this pipe being for the purpose of keeping the well free from sand. The shaft and moving parts of the pump are carried on a ball thrust-bearing in the pump head. The protecting pipe incloses babbited bearings placed 6 ft. apart to keep the shaft in alignment, and this pipe in turn is supported at 20-ft. intervals by spiders fastened in the couplings of the discharge pipe. The shaft is lubricated by the overflow from the main bearing at the top flowing down around the shaft. The discharge from the pump is into a concrete weir box, shown in Fig. 2, from which the water flows over a Cippoletti weir (with 24-in. crest) to the ditches.

The oil engine is horizontal, single cylinder 16x24 in., single-acting, throttle governed, and rated at 75 hp. It operates on fuel oil of about 39° Baumé and about 17,-200 B.t.u. per lb. The fuel is pumped by the engine from a 10,000-gal. supply tank outside of the building and passes through coils in the exhaust pipe which heat it nearly to the boiling point before entering the carburetor. To facilitate starting, a 60-gal. tank is provided for gasoline which is used until the engine becomes warm enough to vaporize the distillate. Three-way cocks on the engine make possible an instantaneous change from one fuel to another. An additional fuel tank is provided for measuring the fuel during a test. Compressed air for starting is stored at 150 lb. pressure in two tanks having a capacity each of 4 cu.ft. of compressed air. These are charged by a small compressor driven by the engine.

The engine is housed by a concrete building, and the pump and belt way by a frame structure covered with corrugated steel. The large fuel tank is of steel and is set in a concrete-lined pit and covered with a shingled roof. A derrick over the well to assist in pulling the pump, and a few necessary tools complete the equipment of the plant. The cost of the plant is as follows:

Engine, complete on foundation		$1705
Pump, complete in well		764
Well:		
Drilling well and setting pit and strainer	$1136	
90 ft. of 24-in. strainer	900	
90 ft. of 24-in. steel pit	315	
Hauling supplies, etc.	382	
Total cost of well		2733
Building		446
Storage tank		202
Belt, weir box, labor, etc.		375
Grand total		$6225

Tests

A number of tests were made during the summer, but many of them either did not give results of any value or were not continued enough to warrant publishing the results. Several attempts were made to obtain curves of the pump, since its efficiency was low and the curves would have been of considerable value in studying the causes of the low efficiency. Nothing of any value was obtained, however, because of the limited range through which the conditions could be varied. The head could not be reduced below about 80 ft. and as there was no means of regulating it, it increased in proportion to the quantity of water pumped, due to the lowering of the water in the well. The pump speed also could not be varied, as the speed of the engine could not be changed more than about 5% above or below normal, and there was not power enough to admit of putting smaller pulleys on the pump to get higher speeds.

The two tests in the accompanying table best show the operation of the plant. The first represents the ordinary working conditions, and in the second, the conditions are improved somewhat. After the first test the valves on the engine were carefully ground and timed, and the piston rings (which were leaking badly) were turned and fitted. This resulted in such an increase in

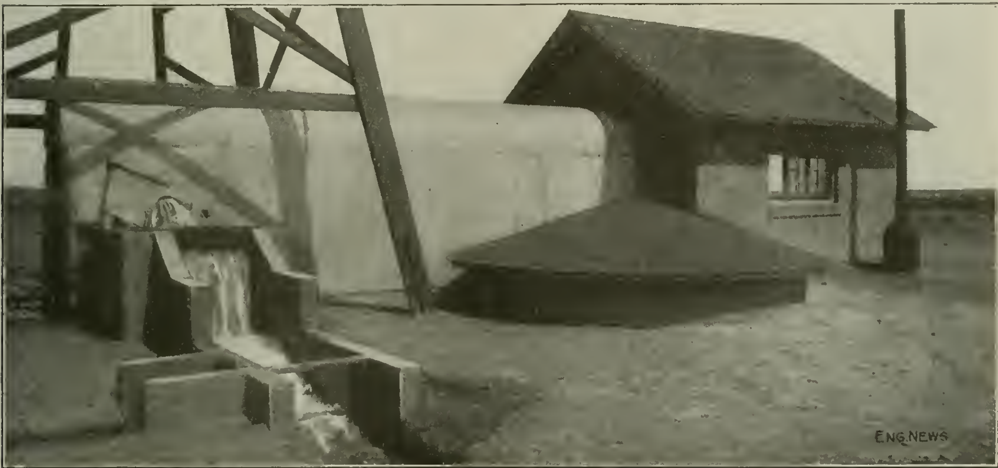


Fig. 2. Deep-Well Pumping Plant for Irrigation at Garden City, Kan.

(The oil engine is in the small house, with inclosed belt gallery to the well. The discharge from the pump flows to the concrete weir box. Adjacent to the pump house is the top of the tank for fuel oil. The derrick over the well is for handling the pump.)

power than it was possible to use a pulley of [illegible] smaller diameter on the pump, thus getting an increase in pump speed.

As the conditions remained practically constant during the tests, readings were taken only at 30-min. intervals, the averages of which being taken in the final computations. The horsepower was found by indicating the engine, and the power delivered to the pump was obtained by multiplying this by the mechanical efficiency of the engine and making a correction for belt slip. A subsequent test on the engine by loading it with a rope brake gave a mechanical efficiency of 82% at the load required by the pump. The belt slip was 4.8% in the first test and 6.5% in the second. The fuel was weighed each time the small tank was refilled. The discharge over the weir was determined by measuring the head and referring to a previously prepared head-discharge curve for that weir.

TESTS OF DEEP-WELL IRRIGATION PUMPING PLANTS

	No. 1		No. 2
[illegible]	[illegible]		[illegible]
Engine speed, r.p.m.	[illegible]		17[illegible]
[illegible]	[illegible]		[illegible]
[illegible]	[illegible]		[illegible]
[illegible]	[illegible]		[illegible]
Pump speed, r.p.m.	[illegible]		[illegible]
[illegible]	[illegible]		[illegible]
[illegible]	[illegible]		[illegible]
[illegible]	1[illegible]		18.[illegible]
[illegible]	[illegible]		[illegible]
Total water pumped, gal.	[illegible]		115,[illegible]
Total water pumped, [illegible]	[illegible]		6.[illegible]
Cost of pumping:			
[illegible]	$[illegible]	[illegible]	$3.00
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2.[illegible]		1.[illegible]
Total	[illegible]		$[illegible]
Cost per [illegible]	[illegible]		5.1[illegible]

The prices given do not include labor to spread the water in the field, nor interest and depreciation on the plant. The cost of pumping was reduced considerably in the second test. This must be due to a better pump efficiency at the increased speed, since the fuel consumption of the engine was the same. From the fact that a [illegible]% increase in power in the second test resulted in a [illegible]% increase in pump speed and a 16.6% increase in discharge at a slightly increased head, we may conclude that the pump is operating below the most efficient speed for that head. No better speed could be obtained, however, as the engine was loaded to its maximum capacity in both tests. From the results of these tests it appears that the engine does not deliver its rated power in the belt. Probably much of this deficiency is due to the rarefied air at this altitude (4000 ft.), which reduces the volumetric efficiency of the engine. The engine comes within the manufacturer's guarantee, however, as the specifications only required the engine to deliver [illegible] b.hp. at this altitude.

Testing the Pump

A test of this type of pump presents some features not met with in the more common types. Gages were connected above and below the pump bowls to determine the head, the pressure gage being [illegible] ft. and the vacuum gage [illegible] ft. below the ground level. If any readings were taken separately on the gages, they were not used in computing the total head on the pump, for reasons which follow.

It is much more difficult to determine the suction head with a pump of this type than with an ordinary centrifugal pump, because the height of the water in the pipe P (Fig. 1) leading to the vacuum gage cannot be determined with any certainty. This must be known to determine the suction head. This is due to the following causes: When the pump is not running, the water in the well stands at some point 1, and there is a static head H-1 at the entrance to the pump. When the pump is in operation, the water draws down to 2, and the static head at entrance is H-2. The water in the small pipe P will not remain at 1, neither will it fall to 2, but as the pressure is reduced at the pump entrance as the pump is started, the column of water will fall and the air above it will expand until a condition of equilibrium has been obtained. This will allow the water to fall to some point 3 and the static head will be H-3, the actual head at entrance being the algebraic sum of the head H-3, and the gage reading reduced to feet.

It yet remains to find the value of H-3. This can be done by considering the expansion of the air column as isothermal and applying the law $PV = pv$ where P and p are the initial and final absolute pressures, and V and v are the initial and final lengths of the air column above the water level in the small pipe. In the second test: $V = 71$ ft.; $P = 26.7$ in. of mercury, $p = 26.7 - 7.8 = 18.9$ in. mercury. Then $v = (71 \times 26.7) \div 18.9 = 100$ ft. And H-3 $= 124 - 100 = 24$ ft. The average gage reading during the run was 7.8[illegible] in. of mercury = 8.8 ft. of water. The head at the pump entrance then is $24 - 8.8 = 15.2$ ft.

In this plant the pump is submerged until there is a positive head at entrance. This method will give the true head only if no air has leaked into the pipe, for if there is any leakage, H-3 may drop until the gage will read zero even though there is a considerable suction head. This possibility of leakage makes this method very uncertain.

Another method of determining the head at the pump entrance is to find the loss of head below the pump and subtract such loss from H-2. This loss consists of the friction head in the suction pipe and the velocity head. Since there was neither foot valve nor strainer on the suction pipe, we can allow the usual friction for iron pipe for the friction head. Merriman's "Hydraulics" gives 0.[illegible] ft. as the friction head for 10 ft. of 8-in. iron pipe with a velocity of [illegible] ft. per sec. The velocity in the suction pipe was [illegible] ft. per sec., from which the velocity head [illegible] = 0.2 ft. Dropping a float to the surface of the water showed that H-2 was 16.[illegible] ft. The head at entrance then is 16.[illegible] − [illegible] = 15.[illegible]

The head is 0.5 ft. more by this method. While there is always some uncertainty in regard to the friction head, it is always small, and the liability of error will probably be less by the latter method. This was the method used to compute the suction head in the foregoing tests.

There is no difficulty in determining the head above the pump by the use of the pressure gage. If a cock is opened at the top of the pipe when the pump is started the water will rise and expel the air; thus the head in the pressure-gage pipe is be added to the pressure-gage reading is known. It is readily seen, however, that in a pump of this type the loss of head between the pump bowls and the discharge is governed largely by the manufacturer's design. Obstructions, such as the spiders to hold the protecting pipe in place, as well as the pipe itself, may cause a considerable friction head.

In a test to determine the performance of the pump proper at various heads it is desirable to have a gage [illegible]

mediately above the pump bowls. But in a test where the object is to find the efficiency of the installation, any losses between the pump bowls and the discharge pipe should, in the opinion of the writer, be charged to the pump. Then a gage should be placed in the discharge pipe above the pump head if there is any head above that point. On this pump the discharge pipe was less than 2 ft. long, and the friction is negligible; and as there was no pressure head the velocity head can be taken as the total head at that point.

Under the former method the head is 110.8 ft., but if computed by using the pressure gage it will be 120.1 ft. This is 9.3 ft. greater, the difference representing the head lost between the pump bowls and the discharge pipe. If this were not charged to the pump the efficiency would be 36% instead of 33%, as given in the table.

Piles of Unusual Length are to be driven to support the falsework of the Mississippi River Bridge which is under construction for the Rock Island R.R. at Memphis, Tenn. An order for 120,000 lineal feet of piling is being filled in the coast forests of Oregon. Some of the piles are 111 ft. in length. The felling and handling of these very long slender timbers is a task of no small difficulty. The piles are shipped out of the woods on a logging railroad with 15° curves, which is about the limit of curvature over which such long piles could be handled. For shipment east, the piles are loaded on flat cars with an intermediate idler car.

Trainshed of the Kansas City Union Station

The trainshed of the new station of the Kansas City Terminal Ry., Kansas City, Mo., is of the low-roof multiple-span type now very generally used in preference to the lofty single-span arch roofs that were largely favored at one time. It has a very unique feature, however, in the use of one wide opening over each pair of tracks instead of a narrow opening or smoke slot over the center of each track. Fig. 1 is a view of the completed steel work of one span, showing the skylight covering

FIG. 1. TRAINSHED OF THE NEW UNION STATION OF THE KANSAS CITY TERMINAL RY., KANSAS CITY, MO.

and (at the right) the vertical concrete slabs forming one side of the wide ventilating opening. The slabs on the left side had not been placed. The roof and window which appear through the open top of the trainshed are part of the waiting room, which occupies a one-story building spanning the tracks.

The roof framing consists of a row of steel columns along the center of each platform, supporting longitudinal trusses of 34 ft. span and main trusses of 44 ft. span. The columns are spaced 34 ft. apart longitudinally and the main trusses 17 ft., the intermediate trusses being carried by the longitudinal trusses. Over the outer platform there is an extension of the roof supported by cantilever trusses. The main trusses have in-

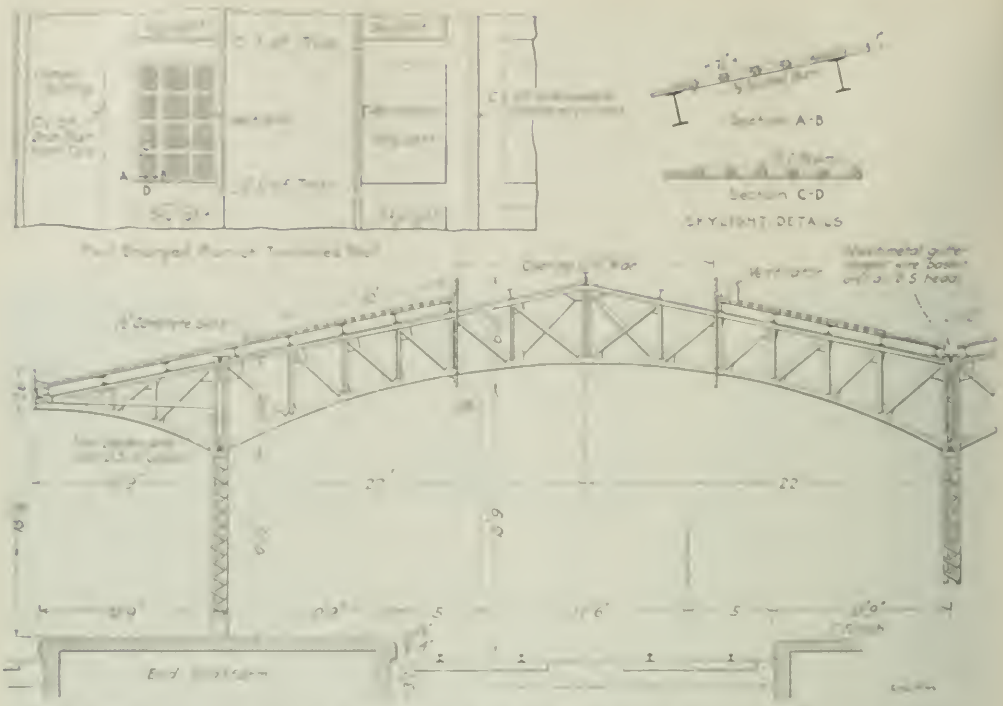


Fig. 2. Sectional Elevation of the Trainshed of the New Union Station at Kansas City, Mo.

A Tight Job of Water-Main Laying at Akron, Ohio*

By E. G. Bradbury†

In designing the extensive improvements to the water-works of Akron, Ohio, F. A. Barbour [Boston, Mass.] and the writer specified, after much consideration, a maximum permissible leakage of 200 gal. per inch-mile daily—equivalent to about 1.6 gal. per ft. of lead joint.

The pipe laid at Akron comprises new supply lines, lines paralleling and reinforcing old mains of insufficient capacity, and extensions into streets not heretofore furnished with water. The new supply lines and reinforcing mains are laid by contract under the supervision of the designing engineers, E. A. Kemmler, Department Engineer, being in immediate charge, while the extensions are laid by employees of the city under H. H. Frost, Superintendent of Water-Works. All pipe is purchased by contract and is inspected at the foundry by experienced men. The depth of lead specified is $2\frac{1}{4}$ in.

The method used in all tests was as follows: After completion of laying, the pipe was filled with water and usually allowed to stand for about 24 hr. to permit the yarn in the joints to become saturated. The pipe having been tapped for a $\frac{3}{4}$-in. connection, a small hand pump was connected by wrought-iron pipe and fittings, on which a gage was set, the suction being placed in a barrel of water. All gates were then closed and a hydrant valve opened to determine whether gate leakage existed in amount sufficient to flow. The depth of water in the barrel and its diameter at water level were then measured and pumping begun. If the pressure was readily raised to the required amount the time was noted, and the amount of water required to hold the gage stationary for a period of from 10 to 30 minutes carefully observed. The leakage was computed from the quantity so used. If too great difficulty was found in raising the pressure, or if the leakage was found to exceed the allowed quantity, pumping was stopped and the gage observed to see it if would remain stationary after dropping to city pressure, thus indicating gate leakage; if such leakage was not demonstrated, effort was made to find defects in the pipe. In one or two instances pipe which could not be pumped up to pressure on the first trial were successfully tested on the following day, no satisfactory explanation being found. In a considerable number of cases the contractor was required to locate leaks and recalk joints, sometimes causing the reopening of the trench for considerable distances. In two cases, cracked pipe were located and removed.

The final results of the tests have been very gratifying. A total of 100 tests have been made of pipe laid by contract, of which 86 are included in the accompanying table. Of the remaining 14, there were eight in which all joints were visible and no leakage existed, but on account of loss through gates, no measurement was made; three in which the measured loss somewhat exceeded the specified maximum but evidence of gate leakage was such as to satisfy the engineers that the specifications were complied with; and three in which the leakage was above the specified amount and the work not accepted. Of 40 tests made by the superintendent of water-works of pipe laid by his department employees, 38 have been tabulated, the remaining two exceeding the permissible loss; these are to be dug up if necessary to locate and repair the leaks.

TABLE I. SUMMARIZED RESULT OF TESTS OF PIPE LAID BY CONTRACT AND BY THE SUPERINTENDENT OF WATER WORKS, AKRON OHIO

Size, in.	Length, ft.	Leakage, gal. daily per in.-mi.	Number of tests
86 TESTS OF PIPE LAID BY CONTRACT*			
4	717	23	1
6	31,066	66	34
8	6,882	42	6
10	5,123	81	5
12	9,704	102	8
16	8,792	135	11
20	8,389	69	10
24	3,358	69	3
30	14,445	82	8
	88,476 (16.76 mi.)	83.4	86
38 TESTS OF PIPE LAID BY SUPERINTENDENT OF WATER-WORKS			
6	37,524	59	32
8	6,509	63	5
10	2,859	133	1
	46,883 (8.9 mi.)	61.7	38

*Pressure from 66 to 152 lb.—35 greater than static head when improvements are complete.

All the above figures are probably high, as they include whatever leakage may have occurred through gates, as well as actual loss. Such leakage was known to exist in many cases, and in 20 of the tests of pipe laid by contract and included in the above summary, every joint was visible and tight, although usually some water was required to keep up the pressure. The amount pumped also covers any contraction or absorption of air contained in the pipe. The presence of any considerable amount of air makes the tests unsatisfactory and occasionally it becomes necessary to tap the pipe to release it.

Check tests of 24- and 30-in. pipe, made several months after the original test in two districts of about one mile each, verified closely the previous work, showing losses of 55 and 79 gal. per in.-mi., respectively.

Assuming the average diameter of pipe in a complete system to be 9 in., each 100 gal. daily per in.-mi. saved or lost has a value of $3.28 per year for each mile of pipe at a production cost of $10 per million gallons, or, capitalized at 7%, is worth $46.86. Applying these figures to a concrete example, a city of 100,000 population with a production cost of $25 per million gallons, and 160 miles of mains, would gain $5626 per year by a saving of 400 gal. per in.-mi., and figuring interest and sinking fund at 7%, could afford to have spent $75,100, or about $470 per mile more on construction to accomplish this result, and the same amount lost per inch-mile would cost a city of 200,000 population with 300 miles of mains and a production cost of $50 per million gallons $19,700 per year—equal to an investment of $281,430.

The expense of testing in the manner described is not heavy, averaging about $50 per mile. Occasionally, where careless work has been done and the pipe covered, the contractor foots a rather heavy bill of expense, but the knowledge that the work is to be tested discourages carelessness and most of the tests are made quickly and without trouble.

In view of all the above facts the writer proposes as a standard for allowable leakage in new cast-iron water pipe, an average of 100 gal. per mi. per in. of diameter for each complete contract or district, with a maximum limit of 200 gal. per mi. per in. of diameter not to be exceeded in any single test. The recommendation

*Extracts from a paper, "Allowable Leakage from Water Mains," read before the New England Water Works Association, September, 1914.

†Civil Engineer, Columbus, Ohio.

[illegible]

A Reinforced-Concrete Pile with Special Provisions for Jetting

[illegible]

Water is supplied at a pressure of 100 to 150 lb. per sq.in. [illegible]

The average time to sink a 50-ft. pile is about 12 [illegible]

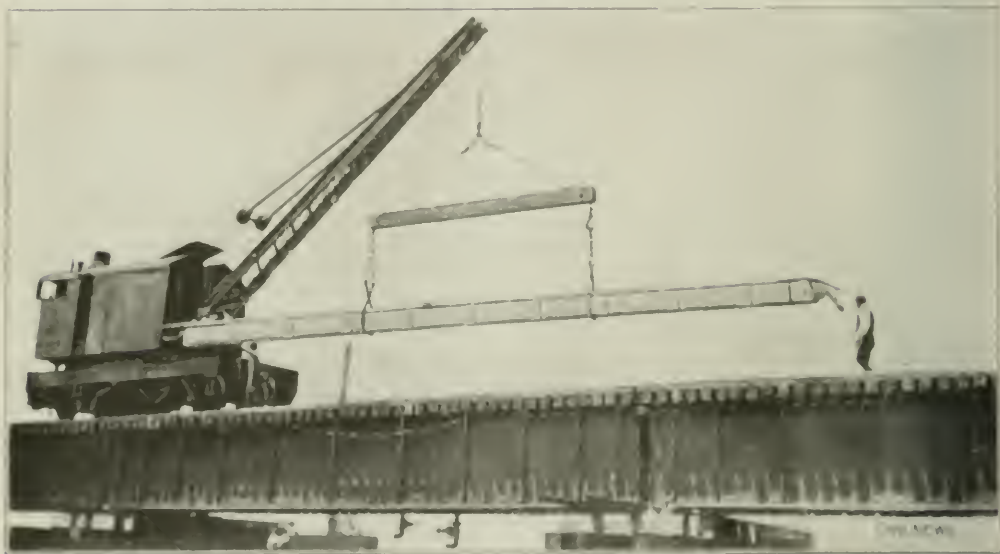


Fig. 1. [illegible] Pile Into Place

[illegible]

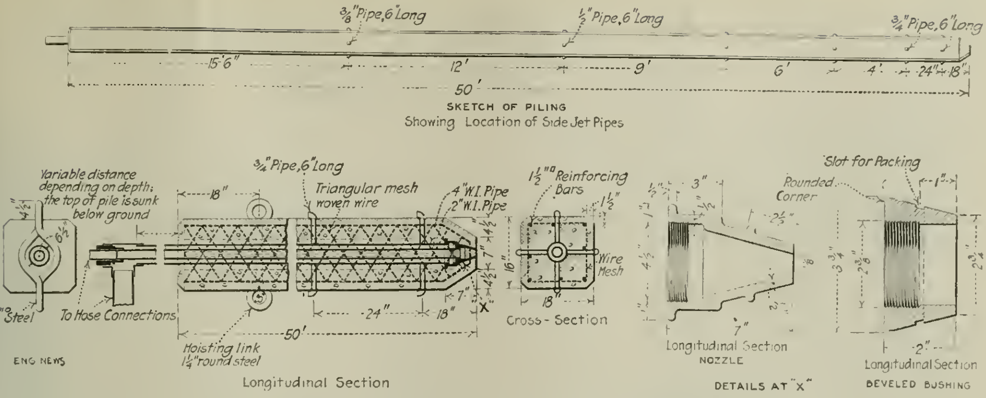


FIG. 2. DETAILS OF THE BIGNELL REINFORCED-CONCRETE PILE

The cost of manufacturing piles used on the Platte River Bridge was 53c. per lin.ft., excluding the cost of freight on the material. The piles were cast at Havelock, Neb., for convenience in using the yard equipment and were brought some 24 mi. on flat-cars to the job. The cost of sinking the whole is not known since the cost statement for work at the bridge includes work and material not charged for the sinking of piling. An estimate based on labor amounting to $40 per day and a liberal amount for the use of equipment and overhead charges gives the cost of sinking not to exceed 15c. per lin.ft., where the job amounts to not less than 10,000 ft. of piling. For a small job the total cost of piling in place is estimated to be about $1 per ft. up to lengths of 50 ft.; $1.07 for piling 80 ft. long, and 59c. per sq.ft. for sheet piling, which is of similar general design as the square piling shown, but which is provided with tongue-and-groove sides for the joints.

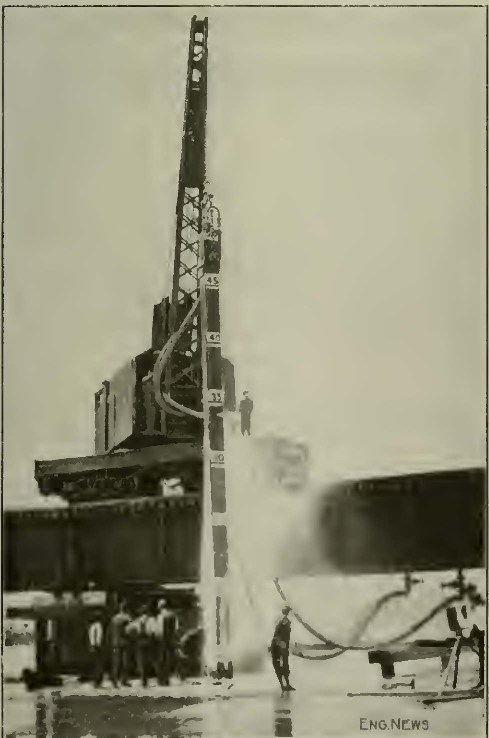


FIG. 3. A BIGNELL PILE BEING WATER-JETTED INTO PLACE

(Note water spurting from side nozzles).

Water Storage in the Naugatuck Valley, Conn., for the benefit of manufacturers and others, has been under consideration for some time past by a committee representing the manufacturers. Continuing the information given in a note published on p. 1221 of our issue of May 28, 1914, it may be stated that Charles H. Preston, Jr., consulting engineer, of Waterbury, Conn., has been engaged to make surveys, maps, borings and soundings for the project. Of several schemes available for storage purposes, Lead Mine Brook has been chosen for possible development, and the surveys will be conducted at three possible sites chosen on this stream. Preliminary estimates indicate that three reservoirs could be provided by the construction of dams at a total cost of about $1,000,000. These reservoirs would have a combined storage capacity of about 23,000,000,000 gal. Lead Mine Brook enters the Naugatuck River near Thomaston.

The Malleable Iron Industry dates from a patent obtained in 1804 by an Englishman, Samuel Lucas. In the United States, Seth Boyden first made malleable castings in Newark, N. J., in 1826. About 250 firms in this country now produce malleable castings, the total output being about 1,000,000 tons per year. The industry is almost exclusively an American one, malleable iron being made in Europe only on a very limited scale. The most rapid growth in the industry has occurred during the past twenty years. In that time malleable iron has almost entirely replaced cast iron in freight car construction and in agricultural implement manufacture. A good malleable iron should have a tensile strength of 35,000 to 55,000 or even 60,000 lb. per sq.in., with an elongation of 3% to 8% in 2 in. The above statements are taken from a paper on malleable iron read by J. P. Pero at the Chicago meeting of the American Foundrymen's Association on Sept. 7. Mr. Pero further says:

Its greatest advantage is the fact that the metal is not subject to crystallization or fatigue, but will stand as severe a test after twenty or twenty-five years of use as it will when originally made, no matter how great the vibration may have been to which it has been subjected.

If proper care is used in its manufacture, it should also be quite free from internal flaws, such as blow holes or shrinkage flaws, and the metal, while it will stand considerable abuse and distortion before breaking, is much more rigid and will resist the tendency to become distorted to a greater extent than either drop forgings or steel castings of the same sections.

Malleable iron also resists rusting or corrosion very much better than either wrought iron and steel, running only slightly below cast iron in its resisting qualities to oxidation

The New York Rapid Transit Railway Extensions

II--Organization and Personnel of the Engineering Staff*

[illegible] in New York City, [illegible] of constructing [illegible] miles of rapid-transit [illegible] and through the heart of the most congested districts of New York City—a system of elevated and underground electric railways of far greater mileage and more complete in every respect than any similar system in the world. This work is being carried on under the direction of the Public Service Commission of the First District of the State of New York, which besides having direct charge of the construction of these new Rapid Transit lines also supervises the operation of all Public Utilities companies, [illegible] and passes upon equipment, services and rates of all existing transportation lines, whether Surface, Rapid Transit, Interurban or regular steam railroads, etc., as well as gas, electric light, power and telephone companies.

ORGANIZATION

The chart, p. [illegible], shows [illegible] the organization of the engineering staff engaged in subway and rapid-transit design and construction and incidental work. [illegible]

[illegible]

PROMOTION EXAMINATIONS—An example of such an examination was one held a year ago for the position of Assistant Division Engineer. This was open only to Assistant Engineers and Designers of Grade 10. The subjects of the examination and the relative weights were: (a) A paper on some subject relevant to the work of the applicant, weight 1; (b) efficiency, weight [illegible]. The paper was to be typewritten and illustrated with drawings or photographs, and accompanied by an affidavit to the effect that it was an original composition of the applicant. The practicability of such a test is readily appreciated and illustrates how an enthusiastic, loyal and efficient staff may be built up and maintained, while still keeping strictly both to the letter and the spirit of the civil-service laws.

DUTIES OF EACH RANK—The specific duties of the members of each rank (in the subordinate positions there are several grades in each rank according to salary) are given below.

CHIEF ENGINEER—In general charge over all work under the Engineering Department, including the preparation of plans for and the construction of subway and elevated work by the City, and the approval of plans for and supervision over the construction and equipment of subway and elevated lines by the operating companies [illegible]

ENGINEER OF SUBWAY CONSTRUCTION—[illegible]

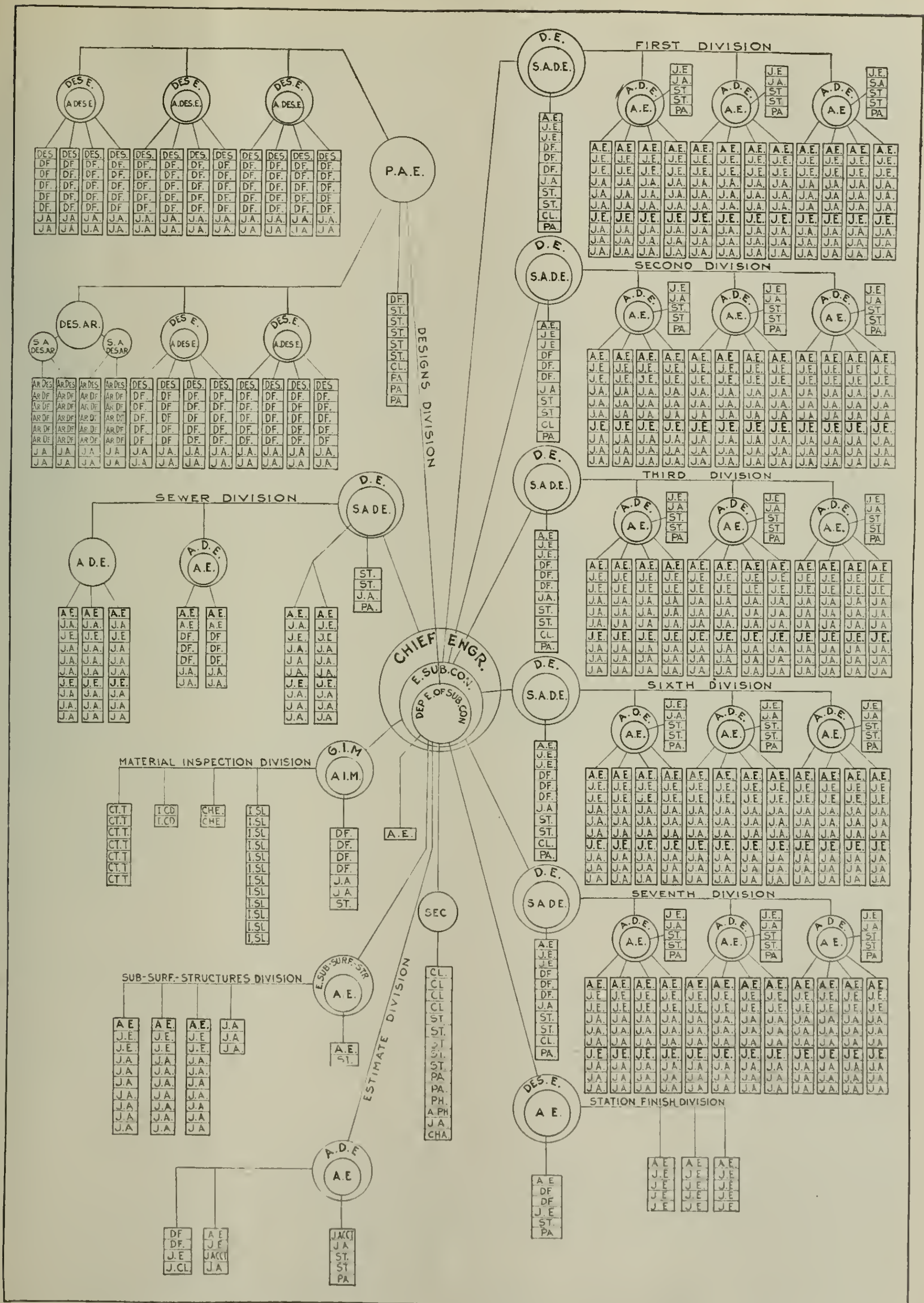
DEPUTY ENGINEER OF SUBWAY CONSTRUCTION—[illegible]

PRINCIPAL ASSISTANT ENGINEER—In charge of the Division of Designs. [illegible]

ABBREVIATIONS USED ON ORGANIZATION CHART ON OPPOSITE PAGE

Abbreviation	Title	Salary
[illegible]	[illegible]	[illegible]

[illegible]



Organization Chart of the Engineering Staff of the Public Service Commission

[illegible] plans [illegible] and also [illegible] for work [illegible] to the [illegible] companies.

DIVISION ENGINEER—In direct charge of a division of construction work in the field covering subway and elevated construction. Has charge of construction work amounting to from [illegible] to [illegible].

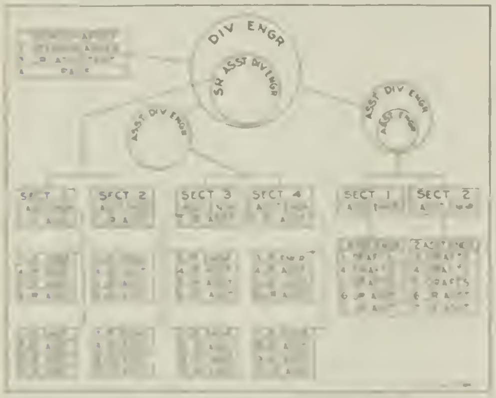
DIVISION ENGINEER OF SEWERS—In charge of Sewer [illegible] direct charge of the preparation of designs and plans and supervision in the field over all sewer reconstruction work resulting from subway or elevated construction.

ENGINEER OF SUBSURFACE STRUCTURES—In charge of the Division of Subsurface Structures. In direct charge of the preparation of all designs and plans covering the reconstruction and [illegible] of all sub-surface structure work in connection with the construction of subway and elevated lines.

GENERAL INSPECTOR OF MATERIAL—Has direct charge over the [illegible] of all materials of construction.

SENIOR ASSISTANT DIVISION ENGINEER—In charge of administrative work of a field division, under the Division Engineer. Acts as Division Engineer in the absence of Division Engineer.

ASSISTANT DIVISION ENGINEER—In direct charge of a subdivision of field work under the Division Engineer, consisting of four contract sections of subway or elevated construction covering work amounting to from $1[illegible] to [illegible].



[illegible]

[illegible]

ASSISTANT ENGINEER—In direct charge in the field of the details of construction of one contract section of subway or elevated work, under the Assistant Division Engineer, approximating $1,[illegible] to $[illegible] in cost.

JUNIOR ENGINEER—Has charge of the administrative work of a contract section or of a field party giving lines and grades, under Assistant Engineer.

DESIGNER—In charge of a squad of Draftsmen and Junior Assistants in computing and preparing designs and plans, under Assistant Designing Engineer.

DRAFTSMAN—Does detail work in preparing designs and plans, under Designer.

ARCHITECTURAL DESIGNER—In charge of a squad of Architectural Draftsmen and Junior Assistants in computing and preparing architectural designs and plans, under Assistant Designing Architect.

ARCHITECTURAL DRAFTSMAN—Does detail work in preparing architectural designs and plans, under Architectural Designer.

JUNIOR ASSISTANT—Acts as a member of field party giving lines and grades, under Junior Engineer, or does detail work on tracings, plans, etc., under Draftsman or Architectural Draftsman.

CHEMIST—Makes chemical analyses of materials under the General Inspector of Material.

CEMENT TESTER—Tests cements under the General Inspector of Material.

INSPECTOR OF STEEL—Inspects the manufacture and fabrication of steel at the mills and shops and the erection of the steel in the field, under the General Inspector of Material.

INSPECTOR OF CONDUITS—Inspects the manufacture of conduits, under the General Inspector of Material.

CHIEF CLERK—Secretary to Chief Engineer. Has direct supervision over Engineering Department general files and clerical and stenographic work in the general office, under the Deputy Engineer of Subway Construction.

ASSISTANT CHIEF CLERK—Has charge of filing and clerical work under Chief Clerk.

The lowest [illegible] grade is that of Junior Assistant, with an [illegible] salary of $[illegible], with [illegible] to $1,[illegible] [illegible] of rank. By passing the [illegible] examinations and fulfilling the [illegible], the Junior Assistant is eligible to the position of Junior Engineer at a salary of $[illegible] to $1,[illegible], or the [illegible] rank in the drafting-room force, and so on; so that a capable man is assured of reasonable progress as he [illegible]. The Junior Assistant corresponds to the rank of [illegible], [illegible], etc., in other city work, but is better paid.

DIVISION ORGANIZATION—Each field division is itself [illegible] as shown in the [illegible], p. [illegible], the organization chart for the sewer division [illegible] as an example to illustrate how the [illegible] is [illegible] out in [illegible] detail. There are at present [illegible] field Division Engineers, each with such a [illegible] independent organization [illegible]. Each field division [illegible] approximately $[illegible] to $[illegible] in work, the division being so [illegible] to [illegible] a [illegible] or a geographical district.

The field divisions are subdivided as follows: three subdivisions, each in direct charge of an Assistant Division Engineer; [illegible] four sections, each comprising a normal contract of from $[illegible] to $[illegible], each section being in charge of an Assistant Engineer. The sections, like the divisions and subdivisions, are groups of construction work of approximately the same character [illegible] rather than divisions of length. Each Assistant Engineer has, under the full [illegible], [illegible] Junior Engineer assistants, and the [illegible] Junior Engineers have [illegible] Junior Assistants, the lowest engineering grade on the staff. A section usually covers a distance of from [illegible] to [illegible] lin. ft. of trackway.

Besides the salaried engineering staff of each division, there are [illegible] and [illegible] inspectors of construction [illegible]

to each section, who are paid $4.50 to $5.50 per day, and who are not included in the organization scheme. The inspectors report to the Assistant Engineers in charge of their respective sections.

A similar scheme of subdivision exists in the office divisions of inspection of material, subsurface structures, station finish and estimates, and the divisions of design and of sewers. The various designers and draftsmen are divided into groups and squads in charge of Division Engineers, Assistant Division Engineers, Designers, etc., with ranks, grades and salaries corresponding to the field positions. Positions such as the one previously noted for Assistant Division Engineer are usually open to both field and office men, so it is possible for a man to be promoted from office to field, or *vice versa*.

Work of the Engineering Staff

It is almost impossible within a brief space to give an adequate idea of the breadth and scope of the engineering work the Public Service Commission's engineers are called upon to perform. The rapid-transit work alone requires careful surveys of the streets and subsurface structures, the examination of buildings before and during the construction of subways on account of the possibility of damages, the preparation of contract and detail plans, the examination of steel plans, the testing and inspection of materials such as cement and steel at the mills where they are manufactured, the close supervision of the construction work as it progresses, the preparation of the estimates upon which the payments to contractors are made, the redesign and construction of sewers and other subsurface structures, the passing upon all the equipment for the operation of the new railways, and other problems too numerous to mention. Besides these there are the disposition of complaints, the maintenance of existing subsurface structures and street traffic to be looked after during the period of construction.

The rapid-transit construction work has been outlined in 15 steps, as follows:

(1) Preliminary survey of streets to be traversed.
(2) Preparation of route maps and resolutions.
(3) Application to and approval by the Board of Estimate and the Mayor.
(4) Consent of property owners or of the Appellate Division.
(5) Survey of surface and subsurface structures.
(6) Preparation of contract plans.
(7) Preparation of form of contract.
(8) Public hearing on form of contract.
(9) Approval of form of contract by Corporation Counsel.
(10) Advertisement for and receipt of bids.
(11) Acceptance of bids and submission to Board of Estimate for approval and appropriation.
(12) Execution of contract and commencement of work.
(13) Preparation of working plans and examination of the working steel plans.
(14) Preparation of record plans.
(15) Arbitration of disputed items of cost.

The rapid-transit construction work cannot be compared with the work of any other commission in this country except the Boston Rapid Transit Commission, but it must be remembered that besides construction work, the Public Service Commission of the First District also performs the regulatory work of supervising all the public services of the Greater New York District, the transportation, gas and electric businesses of which amounts to about 20% of the total for the entire United States. The number of passengers carried annually on the existing transportation lines in the city is some 60% more than the number carried by all the steam railways of the country.

Electrical Engineer—The Electrical Engineer, Clifton W. Wilder, maintains a bureau, not shown on the organization chart, employing about 60 engineering assistants. His work is divided into four main divisions as follows: (1) Passing on all plans for the electrical equipment; (2) cost accounting of equipment; (3) supervision of operation of the existing lines; (4) valuation of public-utility corporation properties. On the first two divisions, as a part of the new subway construction, he reports to the Chief Engineer, but on the supervision of operation and valuation work he reports directly to the Public Service Commission as its Electrical Engineer. He has one Principal Assistant Engineer and six Assistant Engineers. The supervision of operation includes such work as investigating complaints of equipment, accidents, regular inspection of equipment, special investigations, etc.

Personnel

The scheme of an engineering organization plays only a small part in its successful operation. Much depends on the men who are at the head of it. The Chief Engineer of the Public Service Commission is himself the kind of man to appreciate the importance of personality in the efficient working of the splendid organization he has achieved; and he not only takes a kindly interest in his many subordinates and makes himself accessible to them, but has so designed the working of the entire organization as to promote individual effort, enthusiasm and loyalty.

Alfred Craven

The Chief Engineer of this great organization, which at present includes approximately 1000 engineering employees—and it is growing—is a descendant of a distinguished family of naval officers and engineers. He was the son of Rear-Admiral Thomas T. Craven, who served throughout the Civil War and was afterward Commandant of the Mare Island Navy Yard. He is a nephew of Alfred W. Craven, Chief Engineer of the old Croton Aqueduct, builder of much of the original sewer system of lower Manhattan, the Central Park Reservoir, and many other historic engineering works in and about New York City.

Alfred Craven was born at Bound Brook, N. J., Sept 16, 1846. At 17 years of age, at the height of the Civil War period, he was appointed to the United States Naval Academy, then conducted at Newport, R. I. Later, after the coming of peace, the Academy returned to Annapolis, Md., where Mr. Craven was graduated in 1867. After a few years' service, and while on the Pacific Coast, he retired from the Navy with the rank of Master, to devote his life to engineering.

In 1871, he joined the California Geological Survey. Later, he was engaged in irrigation work in the Sacramento and San Joaquin Valleys, and then began private practice in Virginia City, where he established a reputation as a mining engineer in connection with the development of the famous Comstock lode. On this work he was associated with Adolph Sutro in the construction of the well known Sutro tunnel.

Mr. Craven returned East in 1881 to become Division Engineer of the new Croton Aqueduct for the additional

water supply for the City of New York, where he was in charge of a construction division and later of the Croton and Titicus Dams and reservoirs. On this work he established an enviable reputation for rugged honesty in the midst of graft and corruption on the part of contractors and politicians. After some straightforward and uncompromising testimony before a legislative committee, an incensed politician is said to have told Mr. Craven, "You've done the last stroke of work you ever will do on this job." Whereat, Mr. Craven is said to have quietly replied, "I'll be here when you're all gone!"—which proved correct, for the Aqueduct Commission was subsequently reorganized by Mayor Hewitt, and men of a

St. and Park Ave. through Forty-second St. and up Broadway to 104th St., the section through Forty-second St. and under the Times Building being one of the most difficult and delicate pieces of the whole work. He succeeded George S. Rice as Deputy Chief Engineer of the Rapid Transit Commission in 1904, when Mr. Rice became Chief Engineer, and succeeded to the office of Deputy Engineer of Subway Construction under Mr. Rice, when the Public Service Commission was organized in 1907. In 1910, Mr. Craven succeeded H. B. Seaman as Chief Engineer of the Commission.

Mr. Craven has not only distinguished himself in his 44 years of varied experience as a great engineer and

D. L. Turner Alfred Craven Robt. Ridgway

[illegible]

[illegible]

[illegible]

Robert Ridgway

[illegible]

Brooklyn and on a New Jersey farm until he was 19 years of age. He never attended a college or technical school.

In May, 1882, he went West and joined the engineer corps of the Northern Pacific Ry., serving as chainman, rodman and leveler on preliminary surveys in Montana, and on location and construction in Wisconsin. Mr. Ridgway returned to the East in the summer of 1884 to accept a position as a leveler with the Croton Aqueduct Commission, New York City.

For 16 years he was a member of the Commission's engineering staff. His first important assignment was as Assistant Engineer in charge of the construction of the gate-house and appurtenances at the Croton dam and the northerly 1½ miles of the new Croton Aqueduct, from 1886 to 1890. On the practical completion of this work he was made Assistant Engineer of Construction of Reservoir M and appurtenances, on the Titicus River, which included the construction of a masonry dam having a maximum height of 130 ft., with earth wings 100 ft. in height. Subsequently, he was Assistant Engineer in charge of the construction of the Jerome Park reservoir, serving there under his present chief, Mr. Craven, who was Division Engineer.

He followed his chief to the Rapid Transit Commission in 1900 as his Senior Assistant Engineer on the Second division. In March, 1903, Mr. Ridgway was promoted to be Division Engineer and was placed in charge of the Fifth division, including the construction of the South Ferry loop, the tunnels under the East River from the Battery to Brooklyn and the Brooklyn subway.

When the Board of Water Supply was organized in 1905 for the construction of an additional system for the water-supply of New York City, he joined the staff of its Chief Engineer, J. Waldo Smith, as Division Engineer, and was promoted the following spring to the position of Department Engineer in charge of the Northern Aqueduct Department, which included the location and construction of the upper 60 miles of the Catskill Aqueduct. The Hudson River crossing at Storm King mountain was in his department. Here he continued until the practical completion of most of the work under construction, in January, 1912, when he was again called to serve under his former chief, Mr. Craven, with the Public Service Commission.

Daniel Lawrence Turner

Daniel Lawrence Turner was born in 1869. He graduated from Rensselaer Polytechnic Institute with the degree of C. E. in 1891.

For a year he was assistant in mathematics at the Institute, and then for three years he was Assistant Engineer in charge of the location and construction of a standard-gage switchback railway near Middletown, Conn., for the Columbia Granite Co.

In 1893, he was engaged in railway location work and as Engineer for Ernest Flagg, Architect, New York City. For nine years following, Mr. Turner was Instructor in surveying, railway engineering and hydraulics at Harvard University. While at Harvard he inaugurated the Harvard engineering camp and established and conducted for a number of years the present camp at Squam Lake, N. H. During this period, he was also engaged in private practice with special reference to hydraulic engineering.

Mr. Turner, like his chief and Mr. Ridgway, is also a pioneer New York City subway engineer. His experience in this work dates from the beginning of the subway work in 1900 when he became a member of the engineering staff of the Rapid Transit Commission. During the life of the Rapid Transit Commission 1900-1907, he served in various capacities, first on the preparation of drainage plans, as Assistant Engineer in charge of stations and in charge of surveys for subway extension to Brooklyn, including the East River triangulation. Later he was Division Engineer in charge of stations.

Upon the establishment of the Public Service Commission, First District, in 1907, Mr. Turner became Division Engineer of Stations and Chief of the Bureau of Transit Inspection, in which latter position he originated and formulated the methods of supervising the operation of the various street railways coming under the Public Service Commission's jurisdiction. For a year he was Division Engineer of the Seventh division of the new subways, and since 1912 he has been Deputy Engineer of Subway Construction.

Division Engineers

Sverre Dahm, Principal Assistant Engineer in charge of the Division of Design, was born in Norway, in 1858. His technical education was received at the Polytechnicum, Munich, Bavaria. He began his engineering experience as an Assistant Engineer on the Norwegian Government railways. His first work in America was as Assistant Engineer for Theodore Cooper, Consulting Engineer, New York City. Subsequently he was in bridge and structural work with the Long Island R.R., and with contractors in Chicago and New York City, until June, 1900, when he was appointed Assistant Engineer of the Rapid Transit Commission. Since then he has passed through various grades in the Rapid Transit Commission and its successor, the Public Service Commission, and since 1909, has been Principal Assistant Engineer.

Frederick W. Carpenter, Division Engineer of construction, was born in 1859, and graduated from Cornell University in 1881. For 10 years he was in railway construction and municipal work in the East and Middle West. In 1895 he was appointed Assistant Engineer, Bureau of Highways, Brooklyn, N. Y., where he remained until 1900, when he became Assistant Engineer of the Rapid Transit Commission. He continued as Assistant Engineer of the Public Service Commission, and in 1910 was promoted to be Senior Assistant Division Engineer, and Division Engineer in 1913.

John H. Myers, Division Engineer of construction, was born in 1869 and graduated from Rensselaer Polytechnic Institute in 1893. After a few years' experience in general surveying and engineering work in and about New York City, he spent six years as Assistant Engineer with the Department of Water Supply of Brooklyn, N. Y. In 1900 he joined the engineering staff of the Rapid Transit Commission as Assistant Engineer, and in 1906 he was promoted to be Division Engineer, which office he continued to hold under the Public Service Commission.

Frederick C. Noble, Division Engineer of construction, is a son of the late Alfred Noble. He was born in 1872 and graduated in civil engineering at the University of Michigan in 1894. Most of his experience until 1900 was in bridge and structural work. He

[illegible] the service of the Rapid Transit Commission as [illegible] from 1901 to June, 1900. He was promoted to be Assistant Engineer the following summer and to be Division Engineer in 1905. Mr. Noble has had immediate supervision of the design and preparation of contracts and specifications for the four East River tunnels for which contracts have recently been awarded.*

[illegible] A. Pierce, Division Engineer of construction, was born in 1860. He is a graduate of the [illegible] University School of Mines and his first experience was as Chemist and Metallurgist for a smelting company. His civil engineering experience began as a laborer with the New Croton Aqueduct Commission in 1885. He was successively promoted through subordinate positions to be Assistant Engineer. In 1900 he joined the staff of the Rapid Transit Commission as Assistant Engineer. He was promoted to be Division Engineer in 1903.

Jesse O. [illegible], Division Engineer of construction, was born in 1868. He graduated from Bucknell University, Pennsylvania, in 1890. The first 10 years of his engineering experience were spent mostly in railway survey and construction work. In June, 1900, he was appointed transitman with the Rapid Transit Commission and a year later Assistant Engineer. In April, 1910, he was promoted to be Senior Assistant Division Engineer and in October, 1911, Division Engineer.

[illegible] D. [illegible], Division Engineer of Sewers, was born in 1867. He was in railway work in the East. From 1901 to 1908, he was Assistant Engineer of the New York, New Haven & Hartford R.R., and had charge of construction of two large Scherzer rolling lift draw bridges, one four-track and the other six-track. He joined the staff of the Public Service Commission in 1908 as Division Engineer.

The Division Engineer in charge of Subsurface Structures is C. N. Green, and George L. Lucas is Division Engineer in charge of Inspection of Materials and Construction.

ELECTRICAL ENGINEER

The Electrical Engineer of the Public Service Commission, Clifford W. Wilder, was born in Leominster, Mass., in 1876, and graduated from the Massachusetts Institute of Technology in 1898. For several years he was engaged in various kinds of electrical and mechanical engineering in and about Boston and New York City. He first became connected with New York City electric railway work in April 1903, as Assistant Engineer of Construction with the New York City Interborough Railway Co. He joined the staff of the Public Service Commission in November, 1907, as Assistant Electrical Engineer, becoming the head of the department in 1909. This position requires not only wide technical knowledge and experience in electrical engineering, but also the ability to appear as an advocate and expert at public hearings of the Commission.

*[illegible]

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Train-Stops On the Chicago & Eastern Illinois R.R.

While automatic train stops as auxiliary to block signals are in extensive use on electric, elevated and underground railways, we believe the Chicago & Eastern Illinois R.R. is the only surface steam railway in this country which has a train-stop system in regular use. The system is the invention of H. B. Miller, of Staunton, Va., and for information concerning its use we are indebted to L. C. Hartley, Chief Engineer of the Chicago & Eastern Illinois R.R.

The equipment is on a stretch of double-track line between Hoopeston and Danville, Ill., 24 miles, having 35 blocks (with automatic block signals), each block equipped with the track-contact device for the train-stop. About 90 locomotives in passenger and freight service are equipped with the contact shoe and brake-control apparatus. The traffic is from 18 to 20 trains daily on each track, but not all the locomotives on these runs are equipped with the train-stop apparatus. It is expected to extend the equipment north from Hoopeston to Dolton, an additional 82 miles of double track. The apparatus has been installed also on 20 miles of double track between Findley and Arthur (10 miles of automatic block signals and 10 miles of manual block), but this is not yet in service.

The track contact is a T-bar 180 ft. long, placed outside of the track, 22 in. from the rail, as shown in Fig. 1. It has a maximum height of 5 in. above the rail, and the ends are inclined, the contact shoe on the engine engaging the contact bar or ramp at about 3 in. above the rail. The contact apparatus on the engine, shown in Fig. 2,

FIG. 1. TRACK CONTACT DEVICE FOR THE MILLER TRAIN-STOP SYSTEM, CHICAGO & EASTERN ILLINOIS R.R.

consists of a shoe on a vertically sliding bar; this is raised when it engages the track device and its movement makes the necessary electrical connections to apply the air brakes and to close the throttle. The ramp or track contact is placed at such a distance from the signal as to enable a train to be stopped before reaching the signal; this distance varies with local conditions, but averages about 1500 ft.

The equipment was installed for a service test under regular traffic, and has been in use for about nine months. This included a part of the winter, but the apparatus worked successfully in spite of snow and sleet storms. We are informed that on different occasions its operation has stopped regular trains running at various speeds. As a matter of record of the test, each engineman (on the equipped engines) marks on a report card the position of each signal on the 24-mile stretch of track so governed.

The apparatus complies with the requirements of the American Railway Association, except that it will not correct the signal indication providing the track relay is held up, with block occupied. It is not equipped with the speed-control feature specified in the above requirements, but it is possible to add this when desired. There is no cab signal, either audible or visual, and no indication is given on the engine when passing a "clear" signal.

The following description is an abstract of an article in the *Signal Engineer*, by H. H. Orr, Chief Signal Inspector of the Chicago & Eastern Illinois Ry.

The train control is installed as an adjunct to the automatic block signals, and operated through the track relay and circuit controller. The first engines to be equipped were those used in the local freight service. It was thought that if there were any defects in the system they would develop on these runs, as here the most complicated conditions are met with. Many tests have been made on trains of various lengths with loaded and empty cars, and in each case the control has been effective in applying the air-brakes and closing the throttle simultaneously, making a smooth stop without unnecessary shock to the equipment of the engine or train.

The principle of the system is as follows: A stationary ramp, placed beside the track at braking distance back of each automatic signal (or the block station), is in the path of a contact shoe on the engine. This shoe, as it travels over the ramp, is raised vertically. If the block about to be entered is unoccupied and the signal ahead indicates "proceed," the vertical lift of the shoe does not affect the operation of the train. If the block ahead is occupied or the governing signal indicates "stop," this vertical lift of the shoe closes the throttle and applies the air-brakes, bringing the train to a stop.

The engine equipment consists of the control mechanism placed in a small steel box in the cab; the contact shoe, carried by a bracket on the crosshead guide, and air cylinders and connections for transmitting the motion of the shoe to the throttle and brake valve through the control mechanism. The track equipment consists of the ramp, a relay and battery located at the ramp, and a circuit controller at the signal ahead. The control mechanism is, in effect, a bell crank whose two arms are locked rigidly with respect to each other by the plunger of an electro-magnet normally deënergized. The upward motion of the shoe is transmitted to one arm of this crank through an air cylinder. The other arm of the crank is connected through an air cylinder to the throttle and brake valve. When the control magnet is energized, the crank arms are disengaged, thereby breaking the connection between the engine shoe and the brake valve.

Energy for operating the control magnet is supplied by a battery located at the ramp and so connected through the track relay and automatic signal that when the block about to be entered is unoccupied and the signal indicates "proceed," the battery is connected, one terminal to the facing end of the ramp and the other to the adjacent running rail. Under these conditions, the control will be energized the instant the engine shoe engages the ramp, and the train will pass over the ramp without interruption. When the block ahead is occupied or the governing signal indicates "stop," the battery is disconnected from the ramp; the control magnet of the engine passing over it will receive no current and the brakes will be applied and the throttle closed.

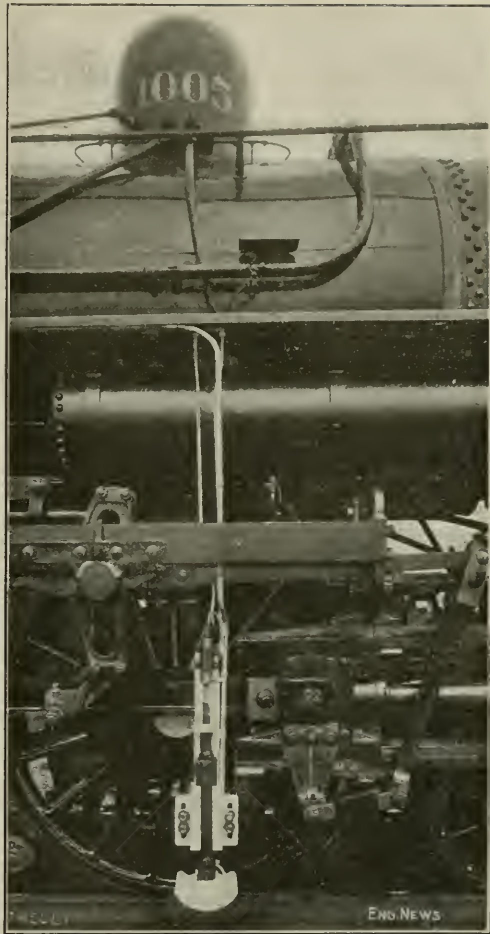


Fig. 2. Contact Shoe of Train-Stop System on a Locomotive of the Chicago & Eastern Illinois R.R.

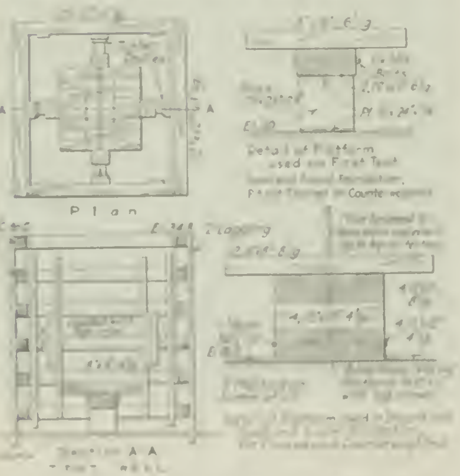
The ramp is divided by two insulated joints in the middle, the trailing end being supplied with energy for the purpose of energizing the control and preventing stop of an engine making a back-up move. As now applied, the breaks may be released and the throttle opened by the engineman in the usual way, at any time after being operated by the automatic-control system. This has proved satisfactory, but if thought desirable, a speedometer may be so locked as to necessitate the full stop of a train and release from the ground by the engineman. Due to the simplicity of the apparatus and its similarity to other signal and engine equipment, the maintenance can be cared for by the men employed in the maintenance of the signal and mechanical departments.

The records of this service show instances of "safety failure" or unnecessary stops due in general to such causes as commonly affect automatic signal operation, but in no case has the control failed to bring the train to a stop with the block ahead already occupied or the signal at "stop" position.

Field and Office

Soil-Bearing Tests for New Railroad Building, St. Paul, Minn.

Tests of material beneath ground filled in about 10 yr. ago in St. Paul were recently carried out to determine the feasibility of its holding up a new 12-story office building under a load of 4 tons per sq.ft. The structure is being erected on a [illegible] space at Jackson and Sibley Sts. between Fourth and Fifth Sts., jointly by the Northern Pacific Ry. Co., the Great Northern Ry. and the First National Bank. Considerable doubt was felt as to the bearing value of the material under the filled area on the Fourth St. side, so that tests up to 8 tons per sq.ft. were initiated. The material under the footings, about 15 ft. below the surface, was a mixture of



Test Arrangement for Soil-Bearing Tests at Railroad Building, St. Paul

coarse sand and comparatively small gravel with about [illegible] of clay. Possibly [illegible] of gravel would not pass a [illegible] ring but the remainder was graded down to fine gravel.

Tests were carried out in [illegible] excavated [illegible] down to the [illegible] elevation of the footing, the pit being sheet-piled [illegible].

First Test—The bottom of the pit was leveled and a block [illegible] square placed on the [illegible] with a [illegible] pipe extended to the top of the pit to provide a hand [illegible]. The [illegible] was loaded [illegible]. [illegible] The [illegible] are given in Table I.

Second Test—A second test was then carried out with a block 4 ft. square, the remainder of the pit being cov-

TABLE I. TEST WITH 2-FT. BLOCK. UNFLOORED PIT

Time 1914	Load, tons per sq.ft.	Settlement, in.
May [illegible] a.m.	No load	
May [illegible] a.m.	1	[illegible]
May [illegible] p.m.	[illegible]	[illegible]
May [illegible] p.m.	[illegible]	[illegible]
	Total settlement	[illegible]

ered with 2-in. planks counterweighted to 175 lb. per sq. ft. to meet as nearly as possible the actual conditions that would exist were the building completed. To obviate any danger of the pig iron shifting or tipping over, planks were placed on the four sides of the load and the timber dollies attached to the sides of the pit, leaving ½-in. clearance.

But ¼-in. total settlement was noted (Table II), which was considered due to the block reaching its proper bearing. Inspection of the material under the block after the test showed no indication of displacements. A ½-in. layer of cement which had been placed to level the block was cracked only in a few places.

TABLE II. TEST WITH 4-FT. BLOCK. PIT FLOORED AND COUNTER-WEIGHTED

Time 1914	Load, tons per sq.ft.	Settlement, in.
May [illegible] p.m.	No load	[illegible]
May [illegible] p.m.	1	[illegible]
June 1, 7:00 a.m.	2	[illegible]
June 2, 8:00 a.m.	4	[illegible]
June 3, 7:00 a.m.	4	[illegible]
June 4, 8:00 a.m.	6	0
June 5, 7:30 a.m.	6	[illegible]
June 6, 7:00 a.m.	8	[illegible]
	Total settlement	[illegible]

Third Test—A test similar to the second one was repeated on the opposite side of the building site, where the material was all clean coarse sand. A total settlement of ½ in. occurred during the first part of the loading, the later readings up to 8 tons per sq.ft. showing no further settlement.

The tests were carried out under the direction of E. B. [illegible], Superintendent of Construction. Grant Smith & Co. are contractors for the Railroad Building. Chas. A. Frost is the Architect.

Three Short-Cuts in Surveyors' Computations

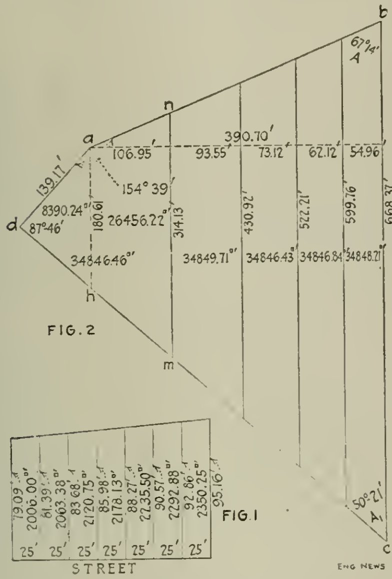
By P. H. [illegible]*

1. In computations such as those affecting suburban property, where an error of 0.02 or 0.01 ft. is in itself unobjectionable, the margin of accuracy may be converted into time saved, by a very simple process.

A case that arises frequently is that shown in Fig. 1, where the rear line is a number of adjacent lots of equal frontage F taken at oblique angle A with the street. If [illegible] the lengths of the first and last side lines are known or may be computed. The intermediate lot lines may be determined by adding a [illegible] successively to the smaller lot line, checking on the last lot line. But as [illegible] may not be expressed exactly in hundredths and as the lot lines are given to the nearest 0.01 ft., it fol-

*[illegible], Washington, D. C.

lows that there can be no common difference in length for all the lots, the difference between any two successive lot lines possibly varying by 0.01 from the difference immediately preceding or following. Hence it is necessary to compute the area of each lot separately, since an error of 0.01 in the length of the lot line makes an error of 0.005 a in area—a discrepancy easily detected, and giv-



ing an appearance of inaccuracy. If, however, the areas of the lots could be obtained by adding a common difference, checking exactly with lot lengths also obtained by adding a common difference, much time could be saved. This may be accomplished as follows:

Dividing the difference between the two outer lot lines, in this case 16.08, by the number of equal lots, 7, and carrying the result out to the nearest 0.005, we obtain 2.295, which we multiply by the number of lots, 7, giving 16.065, which we express to the next higher 0.01, giving 16.07. This we add to the smaller lot line, 79.09, giving 95.16. *The larger lot line is changed,* then, from 95.17 to 95.16, and the common difference for the lot lengths is 2.295, which we add successively to the smaller lot line, expressing the result always to the nearest higher hundredth.

When the above procedure calls for a difference of 0.02 between adopted length and actual length of the last side line, we may reduce one of the outer lines by 0.01 and increase the other by 0.01; that is, the change is to be divided as nearly equally as possible between the two outer lines.

The common difference of the areas is evidently the common difference of the lot lines, 2.295, multiplied by the lot width, 25, or 57.375. This difference we add successively to the area of the smaller lot, 2006, checking on the area of the larger lot, 2350.25.

Equal Lots in an Irregular Tract

2. A computation that sometimes arises for which a simple formula is desirable, is that shown in Fig. 2—where a trapezium or other irregular rectilinear figure is to be divided into a given number of lots of equal area by lines of a given direction. The first step is, of course, to determine the area of the entire figure $abcd$ = 174,240, which we divide by the number of lots required, 5, giving 34,848 as the common area of the resulting lots. Where the direction of the required lot lines is not parallel to an exterior line of the figure ad, the next step is to drop a line ah, of the required direction, to intersect cd, and determine the area of the figure adh, 8390.24, which we subtract from the common area 34,848, giving 26,457.76 as the area of the trapezoid $ahmn$.

To determine the width of $ahmn$, we have the formula

$$mn = \sqrt{(ah)^2 \pm 2F(\cot A \pm \cot A_1)}$$

where F = the area required, 26,457.76. Care must be taken to use the correct algebraic signs: if the angles A and A_1 are in the same quadrant we take the sum of $\cot A$ and $\cot A_1$; if in different quadrants, we take their difference; and the term containing this sum or difference is added to $(ah)^2$ when the lines bc and cd diverge toward mn, that is, when $A + A_1$ is less than 180°, and subtracted when greater.

Having obtained the length mn, we may either divide $mn - ah$ by $\cot A \pm \cot A_1$ to determine the width of the trapezoid, or we divide the area 26,457.76, by ½ $(ah + mn)$. The latter gives a greater degree of accuracy. As the lot depths are given only to the nearest hundredth, the areas computed from these depths will not quite tally with the required areas.

To obtain the lengths of the following lot lines, we add successively to $(mn)^2$, or 98,680.77, the amount $2F(\cot A \pm \cot A_1)$, or 87,009.88, giving 185,690.65, 272,700.53, etc. The square roots of these sums are the lengths of the lot lines required. The widths may be obtained by either of the methods described above. We may check the work by adding the width of each lot multiplied by $(\cot A \pm \cot A_1)$ successively to mn.

Saving a Line in Solving Triangles

3. Where a large number of right triangles is to be worked out by logs, as for instance in obtaining the coordinates for a traverse, we may effect a noticeable saving of time by writing the log of the course between log sin bearing and log cos bearing, posting the sum of log course and log sin bearing above, and the sum of the log course and log cos bearing below, thus:

(1)	log	242.51	= 2.3847367
(2)		sin 22° 19′ 30″	= 9.5796234
(3)		638.13	= 2.8051133
(4)		cos	= 9.9661624
(5)		590.58	= 2.7712757

Here line (1) is the sum of (2) and (3), and (5) is the sum of (3) and (4). Only five lines are written, as against the usual six, a saving of one line in six, or nearly 17% of the work of writing the quantities.

Similarly, where an oblique triangle is to be solved by the sine formula, we may write the work thus:

(1)	log	a	= 255.04	= 2.4066082
(2)		sin A	= 42° 11′	= 9.8270493
(3)		c	= 379.18	= 2.5788454
(4)	colog	sin C	= 93° 17′	= 0.0007135
(5)		sin B	= 44° 32′	= 9.8459188
(6)		b	= 266.37	= 2.4254777

Line (1) is the sum of (2), (3) and (4), and (6) is the sum of (3), (4) and (5); six lines are written, against the usual seven. With a little practice this may be done mechanically, with no increased chance of error, and without effort.

Converting a Pin-Connected Bridge into a Riveted Structure

The conversion of a pin-connected bridge span into a riveted span is an interesting and very exceptional piece of bridge work recently carried out. The bridge is a single-track swing span on a branch of the Pennsylvania Lines, crossing the Grand Calumet River, at [illegible], Ill., and was built by A. [illegible] & Co., in 1886. It is [illegible] ft. long, c. to c., having two [illegible]-ft. arms and a central [illegible]-ft. panel. It was necessary to adapt the bridge to carry heavy loading (Cooper's E-60), and investigation showed that this could be done more rapidly and at much less cost by strengthening the old structure than by replacing it by a new bridge.

Figs. 1 and 2 show the original design and the alterations, and Fig. 3 shows some details of the resulting riveted trusses. The work in general was as follows: (1) Reinforcing the main trusses; (2) adding an additional pair of stringers for each rail; (3) placing new top and bottom cover plates and additional end

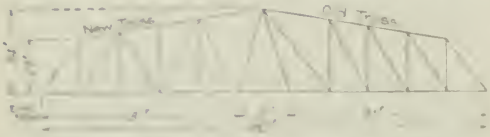


FIG. 1. DIAGRAM SHOWING DRAWBRIDGE WITH TRUSSES OF ORIGINAL PIN-CONNECTED TYPE AND AS ALTERED TO RIVETED TYPE

gusset plates on the floor-beams; (4) strengthening the circular girder of the turntable drum.

Trusses

The work on the trusses comprised the following changes (see Fig. 1): (1) Replacing posts B-b, C-c and E-e by new members. (2) Replacing the stiff web members b-C and c-D by new stiff members b-C and C-d. (3) replacing tension web members d-E and e-F by new stiff members d-F and E-f. (4) cutting the battens and lacing bars from the channels forming post D-d, shifting the channels inward (to clear the new gusset plates) and applying new battens and lacing bars; (5) applying new top cover plate and two new bottom flange angles to the end posts a-B. The old web members c-D and e-F are eliminated, and f-F has new battens at the bottom while the flanges of its channels are trimmed to clear the gusset plates.

In the bottom chord, gusset plates were applied for new riveted connections to the end posts and web members, new holes being drilled as required and battens removed where necessary to clear the gusset plates. The gusset plates at d were trimmed to clear the pin plates, and those at f were trimmed to clear rivets. In the top chord, similar work was done. The composition of the members is shown in the accompanying table.

MAKE-UP OF TRUSS MEMBERS OF BRIDGE CONVERTED FROM PIN-CONNECTED TO RIVETED. PENNSYLVANIA LINES

Member		Original	Altered
Bottom chord	a to c	2 channels, 10 in., [illegible] lb.	[illegible]
	c to f	2 channels, 1[illegible] in., [illegible] lb. 2 plates, 9x[illegible] in.	[illegible]
	f to [illegible]	2 channels, 1[illegible] in., [illegible] lb.	[illegible]
Top chord	B to F	2 channels, 1[illegible] in., [illegible] lb.	[illegible]
Verticals	B-b	2 channels, 8 in., 13 lb., removed	4 L's, [illegible]
	C-c	2 channels, 7 in., [illegible] lb. (removed)	4 L's, [illegible]
	D-d	2 channels, 9 in., [illegible] lb. (retained)	Channels moved over
	E-e	2 channels, 10 in., [illegible] lb. (removed)	4 L's, [illegible]
End Posts	a-B	2 channels, 1[illegible] in., 73 lb.	1 plate, 1[illegible] in. 2 L's, 3[illegible] in.
Diagonals	b-C	2 channels, 7 in., [illegible] lb., removed	4 L's, 3[illegible] in. 2 plates, 1[illegible] in.
	C-d	(In place of c-D removed)	4 L's, 3[illegible] in. 2 plates, 1[illegible] in.
	d-F	2 [illegible] bars, removed	4 L's, [illegible] in. 2 plates, 1[illegible] in.
"	E-f	(In place of e-F removed)	4 L's, [illegible] in. 2 plates, 1[illegible] in.
"	f-F	2 channels, 1[illegible] in., 112 lb.	Flanges trimmed, new battens

Erection Work

Under the railway company's instructions, the first work was confined to the half of the bridge west of the pivot, and this was completed before beginning work on the other half of the bridge. The blocking and shoring used are shown in Fig. 2.

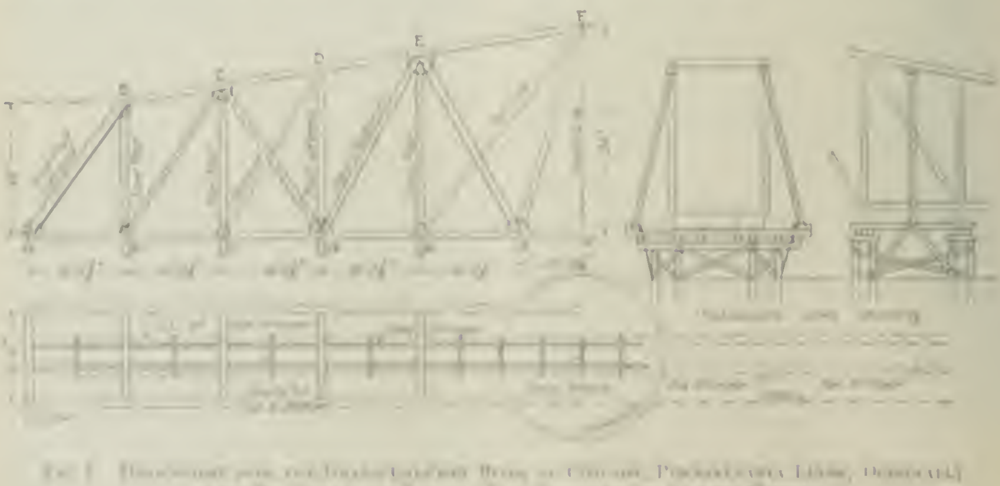


FIG. 2. [illegible] WITH PIN-CONNECTED TRUSSES, NOW CONVERTED TO RIVETED TRUSSES

(The heavy lines show the new work)

It was required that all floor-beams must have full bearing on the pile bents before any truss members were disturbed. For the half of the bridge on which work was done the top-chord members of both trusses were supported at the center of each panel by shoring timbers, as shown. And in the other half of the bridge, opposite that which was being prepared for reinforcement, the member *d-E* was stiffened by fitting a 6x12-in. timber (in one piece) between the eye-bars, and fastening it to these bars, its ends bearing against oak blocks fitted and secured at the top and bottom panel points.

The bridge being thus supported on falsework, all members to be removed were cut away; this included the batten plates and lacing bars on *d-D*, the pins, floor-beam hangers, etc., except that the temporary removal of battens and lacing bars on *f-F* was deferred until it became necessary. In the top and bottom chords, the batten plates and lacing bars were cut away where necessary to admit of placing the new truss members. No drilling of holes between the gusset plates and the webs of top or plates on the outside of the chords. In riveting diagonal *b-C* to the gussets at *b*, the post *b-B* had to be swung clear at the bottom, after which the post was replaced in position, with the hanger *FB*-1 and the pin replaced at *b*.

The final riveting of the new members in place was then proceeded with. It was necessary to draw the channels of old member *d-D* first to one side and then to the other in order to allow of driving rivets through the diagonal and gusset plates at *d*. The same had to be done with old member *f-F* for the riveting at *f*, but with special care, as this member might take stress when trains were crossing the bridge. Care had to be used in making the splice near the end of the bottom chord, so as to obtain the proper panel length, as shown on the drawings.

Other Work

Stringers—For placing the additional line of stringers under each rail, holes were drilled in the floor-beams for the end connections, using the filler plates as templates. Holes were cut in the webs for the bottom lateral

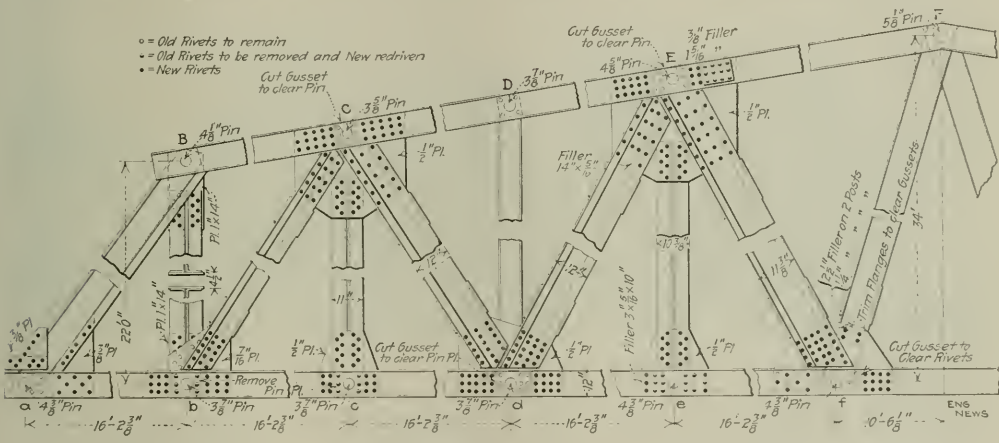


Fig. 3. Details of Truss as Converted from Pin-Connected to Riveted Truss

bottom chords was permitted until all new members were assembled and field-bolted in position.

The placing of new members was specified to be done in the following order: Diagonal *E-f* must be swung over the old member *f-F* in such a manner that the gusset plates at *E* could be put in position, and also so that the post *e-E* might be placed in approximate position, but with its upper part against the diagonal *E-f*, so as to permit of swinging the diagonal *d-E* in place after the gusset plates at *d* were in position. Then the post *e-E* was set, followed in the order named by the gussets *f*, diagonal *E-f*, gussets *C*, diagonal *C-d*, post *C-c*, gussets *b*, and diagonal *b-C*.

Then the new floor-beam pin plates were placed in position at points *c*, *d* and *e*, and the pins at these points were replaced. The work on the end post was allowed to be done at any convenient time, except that the reinforcement of its bottom flange was required to be riveted up completely before placing the post *b B* in position. This post being placed in position temporarily, all members were then bolted together and holes drilled through the webs of the top and bottom chords to correspond with the holes in the gusset plates, using templates. rods, these rods being removed and replaced by passing them through the stringers. Before riveting the new stringers in place, all the filler plates, diaphragms, cross-frames, struts and lateral rods were fitted into place.

Floor-Beams—The new cover plates had $\frac{3}{4}$-in. punched holes reamed to $\frac{15}{16}$ in., and these plates were used as templates for drilling the old flange angles (in place). Before riveting up these plates all parts were adjusted to position; these included the stringers, operating-rod castings on intermediate floor-beams, rail-joint castings, diaphragms, and the stiffener angles on the end floor-beams.

The new hanger plates on the ends of the floor-beams being set in place, the old ones were replaced outside of them. The two plates were fastened together by the top five rivets (with flattened heads) before being put in final position. The new plates had been punched with $\frac{7}{8}$-in. rivet holes and bored to fit the pins. The holes in the new and old plates and end angles were reamed to $1\frac{1}{16}$ in. in the field, for new 1-in. rivets. The truss pins were removed and replaced as part of the operation.

Drum Girder—The new top and bottom cover plates were added in the same way as described for the floor-

ceeded. New inclined stiffeners were run from the struts [illegible] to the center support.

CLEANING AND PAINTING.—Where the old metal would be [illegible] inaccessible by the application of the new parts, the old surface was cleaned and given a coat of paint. All new metal was given a shop coat, and its contact surfaces were given an additional coat before assembling. After the completion of the work, all the metal was cleaned and given two coats of paint.

ERECTION OF WORK.—One arm of the bridge is over shallow water and the other over the navigable channel. The plan of reconstruction adopted was to build falsework under the former arm and make all the alterations to it, each truss part being removed from it as was necessary to make way for the new parts. The bridge was then reversed, and the other arm treated in the same way. This falsework (which was built by the contractors) is shown in Fig. 2. The traffic averaged 20 trains daily.

As the work was done before the navigation season opened, the bridge was not required to be swung for river traffic. When reversed for the reconstruction work, it was swung by means of its hand-operated machinery in the regular manner. A locomotive crane standing on the bridge was used to take out the old members and put the new members in place, while the use of oxyacetylene torches in cutting away old rivets considerably reduced the time and cost of the work.

In all, about 29 tons of metal were removed and 80 tons of new metal placed, the bridge as now completed having a weight of about 170 tons.

The necessary alterations to the bridge and the methods of carrying them out were planned under the direction of J. C. Bland, Engineer of Bridges of the Pennsylvania Lines. The contract for the erection of the work was awarded Dec. 2, 1913, to the Great Lakes Dredge & Dock Co., of Chicago. This company also furnished detail and shop drawings for the approval of the railway engineers. Work was commenced Jan. 23, 1914, and completed Mar. 17, 1914. The cost was approximately $18,500, while it is estimated that a new bridge to meet the same conditions would have cost about $75,000.

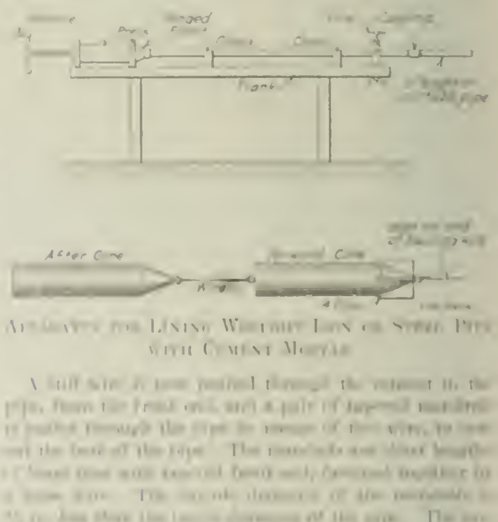
It is of interest to note that the Pennsylvania Lines strengthened the draw span over the Maumee River, at Toledo, in a similar manner in 1903, this being a span 182 ft. 9 in. long. Not long after the work was completed, the bridge was considerably damaged by a collision from a boat, but had the original unreconstructed structure still been in place, no doubt it would have been damaged much more seriously. The bridge was then repaired and carried traffic in good shape until recently when it was taken out of service.

Form-Spacer Bolt with Adjustable Head—[illegible]

Lining Pipe with Cement

Cement-lined wrought-iron service pipes, because of their freedom from interior corrosion and stoppage, have been used in New England and probably to a lesser extent elsewhere for many years. As a rule, it appears that each water-works department lines its own pipe. Recently, a company has been organized in Boston* to line pipe on order, either taking pipe supplied to it or furnishing the pipe itself. The procedure in lining the pipe is as follows:

A screw-piston press 5 in. in diameter and about 18 in. long, mounted on one end of an 18-ft. plank, is used to force the mortar into the pipe. The forward head of the press cylinder is hinged to swing open; it has a central hole threaded for 2-in. pipe (other sizes are accommodated by use of bushings). The cylinder head is swung open, the cylinder filled with mortar, and the head closed and locked. The pipe to be lined is then screwed into the hole in the cylinder head. By forcing the piston ahead, the cement is then shoved out into the pipe. After this the pipe is unscrewed and moved ahead onto a vise at the front end of the plank. A coupling is set up on the forward end, with a portable length of pipe about 15 in. long screwed into it as far as another pipe would be fitted, usually about six threads; this keeps the threads clear of mortar for connecting the length of pipe to another length.



APPARATUS FOR LINING WROUGHT IRON OR STEEL PIPE WITH CEMENT MORTAR

A stiff wire is now pushed through the cement in the pipe, from the front end, and a pair of tapered mandrels is pulled through the pipe by means of the wire, to form out the bore of the pipe. The mandrels are short lengths of [illegible] with tapered [illegible] ends, fastened together by a short wire. The outside diameter of the mandrels is ½ in. less than the inside diameter of the pipe. The forward mandrel has four longitudinal fins at 90 deg. intervals to center it in the pipe, while the rear mandrel is smooth and, following through the bore made by the first mandrel, finishes it to shape and surface. The result is a smooth ¼-in. lining of cement mortar. After [illegible] the pipe is laid away for the mortar to harden. The short length of pipe at the front is unscrewed and the coupling is left on.

All tees, elbows and other fittings are also lined with cement mortar, so applied as to give an interior surface continuous with that of the lined pipe and having [illegible] [illegible] to the flow.

*[illegible] Cement Lined Pipe Co., [illegible], Boston, Mass.

Emergency Work in Drainage-Ditch Excavation

The contractor on the construction of the Storm Creek ditch in Carroll County, Iowa, met with the misfortune of losing his 3-yd. oil-power dredge by fire when the work was 93% completed, and had to find some way of doing the remaining work quickly and economically.

The contract amounted to 2,300,000 cu.yd., the main ditch being about 25 miles long. The laterals and all small work were completed, and when the large dredge was burned there was 8400 ft. of the main ditch to be dug, crossing the old channel at several points. This was a difficult proposition: The amount involved was only about $8500, and as the work was nine miles from a railway (at Glidden), it was a problem to get out a machine that could be handled within reasonable cost. It was estimated that to do the work by an ordinary large dredge would cost $20,000. Contractors owning dragline machines were invited to submit proposals but the conditions were too severe for them to bid. The contract prices on this part of the work were $5\frac{1}{4}$ and 7c. per yd., with no deductions made for the old channel. The specifications required a ditch of 35-ft. bottom width, 8 to 12 ft. deep, with 1 : 1 slopes.

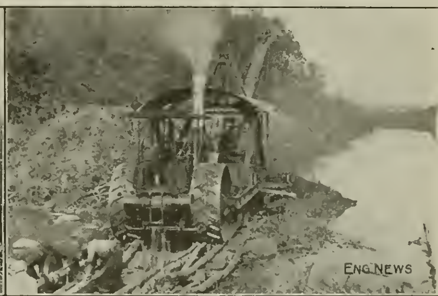
The features required in a machine to do the work within reasonable cost were quick delivery, low cost of transporting nine miles over land and installing on the work, low fuel consumption and small payroll expense. To meet the conditions, the contractor purchased a Turner dragline excavator, built by the United Iron Works Co., of Springfield, Mo. The machine was set up at the railway station, and traveled under its own power and on its own wheels to the work, making several turns at corners, and crossing two highway bridges. It required two days to move nine miles and cross the fields to the work. The machine has a steel frame, a 40-ft. boom and a $1\frac{1}{2}$-yd. scraper bucket. It is driven by a 60-hp. oil tractor, the front wheels of the tractor being removed, and the front end of its frame resting on a cross-beam of the dragline machinery frame. The extending side beams connect to an extension hub that is bolted to the driving wheel of the tractor. These removable hubs and the addition of a spur wheel on the main engine shaft were the only changes made to the tractor. The power is conveyed from the engine shaft to pinion shaft of the dragline machinery through a sprocket chain. The machine can handle two scraper loads per minute.

On account of the wide ditch and amount of material to handle, the machine was operated double cutting, with material cast on both sides. Fig. 2 shows the machine finishing a cut, and shows the approximate width taken at each cut. It shows also the method of crossing the old channel, brush and logs being laid in the creek bed, with poles on top to form runways for the wheels.

The machine started June 27, 1914. The first 18 days' work cost for labor $322.62, including one extra man dynamiting a ditch through a short cut. Fuel cost, $3 per 10-hr. work, being for 60 gal. of distillate. The 18 days', or 360 hours', work amounted to 42,913 cu.yd.

A considerable amount of work on the old channel figured in this estimate, but the machine met the conditions of moving from one cut to another and maneuvering to handle the material and open up into the old channel; such items being delays against actual digging. Part of the work is through heavy timber, and the banks were generally high and entirely of earth, although at the lower end of the stream there was good gravel bottom. For the crossings, places were selected where the material could be handled to the best advantage, and in going from one cut to another the machine would travel out around the bends or be moved to a place where a crossing could be put in to get across the old channel. It has excavated as high as 100 cu.yd. per hour, but the average seems to be about 65 or 70 yd. as there was so much maneuvering at the end of the cuts where the machine came up against the old channel.

A Combined Dragline Excavator and Oil-Engine Tractor for Ditch Work



Ditch Excavated by Oil-Engine Dragline Excavator

(The machine is shown crossing one of the numerous bends of the old channel intersected by the ditch.)

On the cut which the machine is shown finishing, in Fig. 2, the work included 15 hours making bridge and crossing it, 133 hours making the complete cut, 8772 cu. yd. actual cutting, or 66 cu.yd. per hr., no deductions made for time of turning machine and finishing cut at upstream end. The labor cost is 77c. per hour and fuel 30c. per hour.

Two men can operate the machine; three were used here because of the extra amount of labor necessary on the crossings. Two short cutoffs were handled by blasting a ditch through them and then damming the stream by using the machine to build an earth dam and turning the water through the blasted ditch.

The engineer in charge is I. W. Hoffmann, of Carroll, Iowa. The contractor is D. C. Stephens, of Buffalo, N. Y., the work being handled by his western office (815 Hippee Bldg., Des Moines, Iowa), of which H. B. Whitney is Manager. For information we are indebted to Mr. Whitney.

Cross-Section Measurements by a System of Polar Co-ordinates

BY EDWARD L. VERPLANCK*

When steam-shovel excavation began on the Cape Cod Canal, direct tape measurements for obtaining the cross-sections of the cuts became greatly impeded. To facilitate the work, the writer developed a method of surveying in which the center line offset distances were obtained by trigonometric computation from observed angles, instead of by direct measurements.

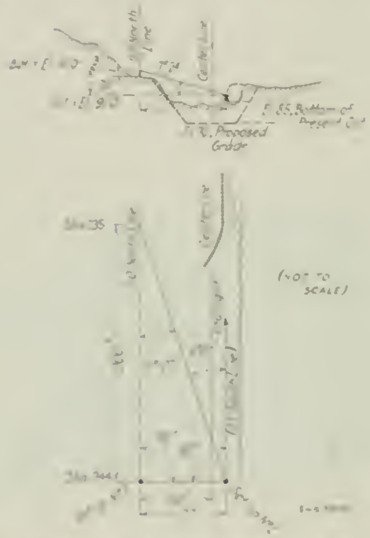


FIG. 1. CROSS-SECTION MEASUREMENTS, CAPE COD CANAL

FIELD OPERATIONS—Referring to Fig. 1, the transit was set up on the permanent reference line 150 ft. north of the center line and a point was established [illegible] near the center line on the cross-section line. The transit was moved to this point and the offset distance from the center line determined by triangulation and the transit [illegible]

[illegible]

[illegible]

*[illegible]

TABLE I. SAMPLE FIELD NOTES

Sta.	Left of	Sight	Rod reading	Angle	Base	Base computed	Offset from center	Elev.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE II. SAMPLE FIELD NOTES OF CURVED CENTER LINE

Sta.	Rectangle or tan-gle radius with ver. constant	Sight	Rod Reading	Angle	Base	Base comp.	Offset	From	Elev.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CURVED CENTER LINE—This method, with certain modifications, was applied with equal success to the 0° 30' curves of the Cape Cod canal. Fig. 2 shows the layout of such a survey.

The transit was set up on the 150-ft. north reference line and a point established near the center line on the radial section line through the transit station, and the transit was set up over this point and oriented parallel to a tangent of the curve at the station of the cross-section to be taken. A study of Fig. 2 will show the angles necessary to be turned in order to get this orientation.

FIG. 2. CROSS-SECTION MEASUREMENTS ON CURVED CENTER LINE

[illegible]

[illegible]

procedure, besides its extreme rapidity, was the fact that only two men were required to make the survey, a transitman (keeping his own notes) and a rodman. By the direct-tape-measurement method, three men are indispensable.

The work was done under the direction of C. T. Waring, Resident Engineer of the Cape Cod Construction Co., of Sandwich, Mass., of which Wm. Barclay Parsons, of New York City, is Chief Engineer.

Increasing the Height of a Chimney While in Service

An interesting piece of work carried out recently was that of increasing the height of a chimney by 30 ft., and doing this while the chimney was in use. This was at the plant of the Northwestern Malt & Grain Co., Kenton and Cortland Sts., Chicago.

The original stack was 129 ft. high, of square section, 6x6 ft. square inside at the top, and built of common sewer brick. It was desired to increase the height by 30 ft., and this extension is of circular section, 6 ft. diameter, built of radial brick. The top of the old stack (including its cap or cornice) was torn down for 6 ft., and replaced by a connection changing from square to octagonal, this part being built of sewer brick. Above this is the 30-ft. circular extension.

The work was done from an outside scaffold supported on triangular frames. The upper end of each vertical leg was fitted with a hook, engaging a steel cable drawn around the chimney and tightened by a turnbuckle. When the men had laid the brick as high as they could reach, another cable was placed around this new section, with a second set of frames, the lower scaffold and cable being later removed and shifted above the other. An L-shaped builders' derrick on the chimney carried the cable for hoisting men and material. To protect the men from the direct attack of smoke and gases a steel shield, nearly semi-circular in plan, was fitted inside the flue, extending several feet above the brickwork, but on very windy days the men did not work.

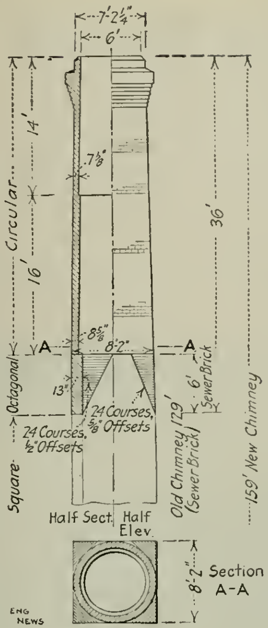


Fig. 2. A 30-Ft. Circular Extension on a 129-Ft. Square Brick Chimney

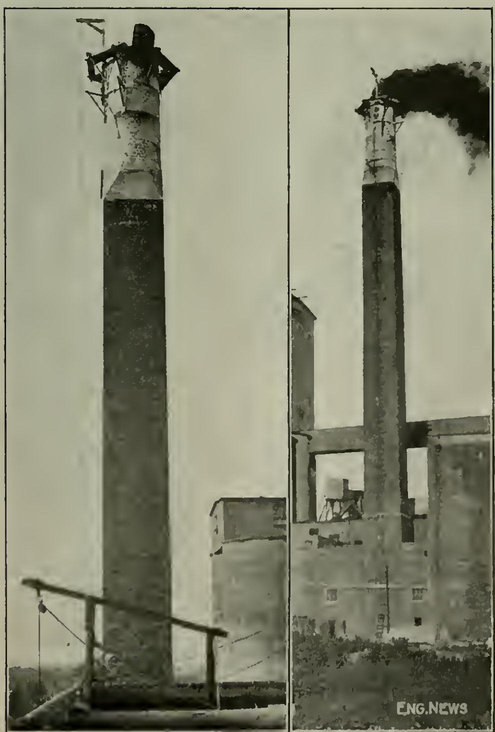


Fig. 1. Building a 30-Ft. Extension to a Brick Chimney

Fig. 1 shows the work very clearly. In the left-hand view may be seen the working platform on its brackets, and two of the brackets at a low level still hooked to the cable around the chimney. At the top are seen the steel shield (at the right) and the hoisting derrick. The derrick near the bottom of the view is for repair work on an adjacent building. The right-hand view shows the entire chimney and shows it during heavy emission of smoke.

This work is being done by the Alphons Custodis Chimney Construction Co., of Chicago. This company has done similar work on a number of chimneys, the extension in one case having been 60 ft. high.

Impact Formula for City Street Bridges—In designing the Bloomfield cantilever bridge, Pittsburgh, Penn., which is just being completed, an impact formula was used, the live-load stresses being increased by a variable percentage to allow for vibration and other traffic effects. The formula used is:

$$I = S \frac{100}{L + 300}$$

where I = impact addition, S = live-load stress, and L = loaded length of bridge in feet. The formula gives an impact addition one-third as great as that applied to railway bridges under a commonly used formula. T. J. Wilkerson is Engineer of Bridges of the City of Pittsburgh.

A Metallic Tape Detachable from the Reel Box by a new device called a "threader" has been patented and placed on the market by the Lufkin Rule Co., of Saginaw, Mich., and will hereafter be furnished with this company's "metallic" woven tapes without extra charge. The "threader" is a loop and stud arrangement, by means of which the tape is securely fastened to the winding drum of the reel, when the tape is in use, but which permits an old worn out tape to be readily detached and replaced by a new one. The life of the tape is generally much shorter than that of the leather case or reel box, so that the latter, which represents about half the first cost of the instrument, may be used as long as it is fit for service.

Patching Concrete Retaining-Walls by a Concrete-Spraying Machine

Extensive patching of surface defects on concrete retaining walls is being done by the Delaware, Lackawanna & Western Ry., at Newark, N. J., where its Morris & Essex division runs through a retained cut a mile long and up to 25 ft. deep. An interesting new concrete-spraying machine is used for the work.

The retaining walls were built about ten years ago. After a few years they began to show serious deterioration on the face—mainly horizontal cracking and spalling at the day's-work planes, but also superficial scaling or sloughing on more extended areas. These defects spread gradually. Finally, during the present year the work of patching the wall was started.

Before patching, the bad spots were cleaned out. The repair gang went through the cut and chiseled out the poor concrete at the points of deterioration, down to solid concrete, usually an inch or so, leaving the wall pretty thoroughly marked up with "holes" ranging in size up to two or three feet wide and up to six feet long, ready for plaster patching.

The first part of the patching, just west of Newark station, was done by hand troweling, using 1:3 cement mortar. Then a concrete-spraying machine, called "Concrete Atomizer," was put on the job, and the rest of the work has been done with it.

The Machine—The "Atomizer," of [illegible] construction [illegible] can be used as [illegible], consists of a closed cylindrical tank with central shaft carrying baffles or paddles and valve [illegible], and a discharge hose [illegible] end of the tank. Mortar materials are fed into the front of the tank, the end opposite the hose outlet. The machine can be operated by steam or by compressed air. Its mechanical construction allows of using large-sized aggregate in the concrete.*

Plant Used—In the Newark work steam at 65 lb. is used to run the "Atomizer," being more conveniently available than air. A switching locomotive furnishes the steam and at the same time hauls the work train, comprising the car carrying the machine and sand, and a caboose or tool car.

Operation—A batch for the machine consists of two pails cement and six pails sand. These materials and the required amount of water are charged in through the front door of the tank, and after closing the door are mixed by turning on steam, which revolves the paddles. Then the outlet valve is opened and the steam pressure forces the mortar out through the hose.

The discharge hose is 2-in. rubber hose, with a nozzle consisting of a short piece of $1\frac{1}{2}$-in. rubber hose choked down by an elliptical band. It can be handled by one man, but in the present work two men are used, as one is needed to carry the pipe to follow the nozzle.

The stream issuing from the nozzle is simply played across the area to be plastered (or concreted), the mortar deposited on the wall is very dense and hardens rapidly (perhaps due to the accelerating effect of the steam). The stream of mortar is surrounded by a cloud of steam so that the nozzle-man cannot always see the surface on which he is working. Little cement or sand drops out of the stream or off the work, however.

Trimming and screeding or smoothing is done by hand after the machine has placed the mortar.

The working force on the Lackawanna wall patching comprises: 2 men feeding, 1 man operating machine, 2 men at nozzle, 1 laborer, 3 or 4 cleaners smoothing up the patches, 1 foreman. The locomotive crew takes care of the steam control.

The "Concrete Atomizer" is controlled by Harold P. Brown, 120 Liberty St., New York, and was leased by him for the Lackawanna work, the railway company furnishing the labor.

Concrete-Spraying Machine Patching the Walls of the Lackawanna Cut, Newark, N. J.

(This machine is operated by a steam jet. A piece of $1\frac{1}{2}$-in. rubber hose serves as sprayer nozzle. The cloud of steam issuing from the nozzle sometimes obscures the work. The applied concrete seems to set very rapidly, perhaps due to the action of the steam.)

Handling Excavation for the William Penn Hotel, Pittsburgh

The large cellar excavation for the new 20-story William Penn Hotel, in Pittsburgh, Penn., called for exceptional methods for handling the dirt, if speed and low cost were to be secured. The contractor met this requirement by installing a highly organized mechanical equipment.

The site is at Sixth and Oliver Aves. and Cherry Way, and measures 216x130 ft.; the depth to be excavated ranges from 40 to 60 ft., with a volume of 50,000 to 60,000 cu.yd. place measurement, including shale and some harder rock. The digging is done by a 1-yd. Thew steam shovel, loading 1½-yd. Koppel steel dump-cars hauled by mules along a narrow-gage track on the floor of the excavation (Fig. 1). At the lower edge of the lot is built a timber hoisting-tower with inclined hoistway in which a 5-yd. dumping skip travels. The skip is patterned after mine or furnace hoist models, though built of timber. The bottom of the hoist is in a pit below the bottom of the excavation, and the narrow-gage cars thus are able to dump directly into the skip. At the top of the hoistway, above the street, the skip tips its load into motor-car trucks (Fig. 2). Three trucks and three trailers are in use, each of about 5 cu.yd. capacity. The haul to the dumping-board is about 1 mi., and some 400 trips are made in 24 hr., nearly three-quarters of the total being handled in the night hours, on account of the clearer streets.

The dumping-board is located on the Allegheny River above the Ninth St. bridge. It is a sort of pontoon bridge, consisting of a planked roadway carried on a pair

Equipment for Handling Excavation for William Penn Hotel, Pittsburgh; James L. Stuart, Contractor

(Dump cars loaded by steam shovel; dumping-skip hoist to lift spoil to street and load the wagons.)

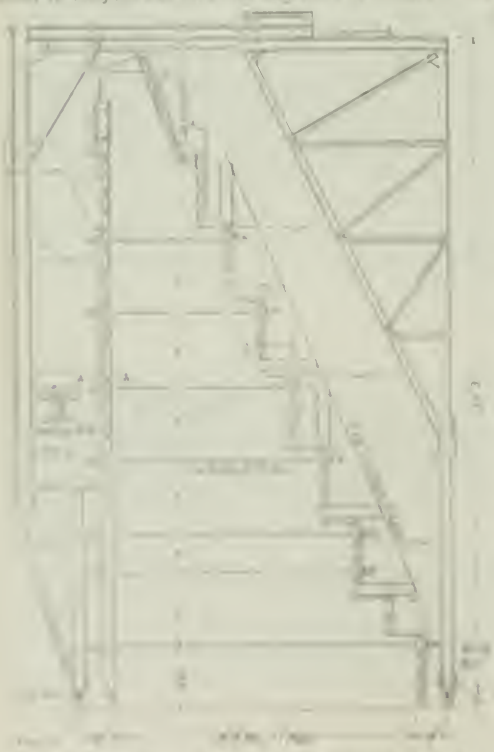
of girders whose outer ends each is supported by two scows. Under the bridge is a bin, into which the trucks dump through a trap in the roadway planking. At the end of the bridge a turntable is built up on the scows. The truck after dumping is turned here and returns to shore running forward. The spoil is taken away on barges carrying 2-yd. boxes, filled from the bin; at the dump the boxes are lifted off by a derrick.

Steel Traveling Forms for Retaining Walls

In the construction of the reinforced-concrete retaining walls for track-elevation work at Chicago, the Rock Island Lines are using traveling forms, some of timber and some of steel. The walls are built in 35-ft. sections.

The accompanying cut is a sectional elevation of the steel form. It consists of a gallows frame traveling on double-flanged wheels on a pair of rails, the width of form (and gage of track) varying from 13 to 21 ft., according to the size of the wall. The width is varied by sliding the rear part of the frame inward or outward, each top cross-beam of the frame being made in two overlapping sections, as shown. The faceplate rests on a longitudinal sill and steel channel and is attached to the cross-beam of the gallows frame, while it is tied back to the rear of the form by a series of tie rods.

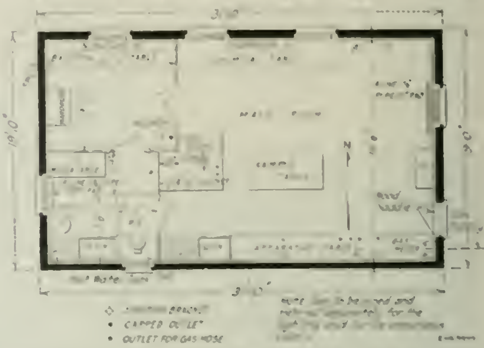
The steel forms were built by the Blaw Steel Construction Co., of Pittsburgh, Penn., and were designed by them in conjunction with the engineers in charge of the work, which is being done by the railway company under the direction of R. H. Ford, Engineer of Track Elevation.



Steel Traveling Forms for Retaining Walls

A Compact Laboratory for Sewage-Purification Experiments

An experiment laboratory built by the Bureau of Sewers of the Borough of Brooklyn, New York City, is shown in the accompanying plan. The laboratory is designed to handle a large number of samples daily from the various units of the sewage-experiment plant, located at the 26th Ward pumping station, near Jamaica Bay. E. J. Fort is Chief Engineer and George T. Hammond is Engineer of Design of the Brooklyn Sewer Bureau, and William T. Carpenter is chemist in charge of the laboratory.



Sewage-Purification Experiment Laboratory, Brooklyn, N. Y.

Moving an Old Stone Church with Screw Jacks

The Mott Haven Church, New York City, an old brownstone structure built in 1855, was recently moved to a new position on the same lot. The building formerly fronted on Third Ave.; it was moved back 50 ft. and swung around to face 146th St.

The first procedure was to tie across inside the building with steel cables fastened to beams spanning the outside of the windows. Holes were broken in the foundation to permit the placing of longitudinal or rolling sticks. Cross-timbers were placed under these, running in some instances the entire width of the building and in others only through the wall, being supported by cribwork on the inside. Screwing sticks were then placed longitudinally under the cross-timbers and [illegible] jacks placed under the screwing sticks. The weight was then taken off the old foundation and the latter demolished.

About 15 [illegible] were placed under the building, extending in the direction of proposed movement. The jacks were then removed and dropped on their sides on the rails, so that their heads pointed in the direction of movement and pressed against the screwing sticks (the other timbering had been removed). The screw jacks, acting horizontally, moved the building as desired.

The church was moved by the [illegible] House Moving Co., [illegible] E. 146th St., New York City, in about a month. The work required 15 men and a foreman.

A Useful but Inexpensive Boat for Surveyors

By F. W. Salmon*

The boat shown in the accompanying figure can easily be made in two working days by any two men having a little handiness with tools. If pine pitch is used for the outside, instead of paint, and "enamel" or paint mixed with a good proportion of quick-drying varnish for the inside, it can be put in the water and used the evening of the second day—provided that the material is roughed out to size in a sash-and-door factory or similar mill.

To get the proper shape of the sideboards, I carefully made a small model of the outer surface to scale and drew a piece of strong paper over this tightly and marked the edges; on removing the paper of course there was a plain template of the outside of the skin, from which the figures are given to enable anyone readily to reproduce it. I have made several boats from "sawn stuff" by such templates and find that they come out amply close to the intended dimensions for general use and it saves a lot of time, labor and money.

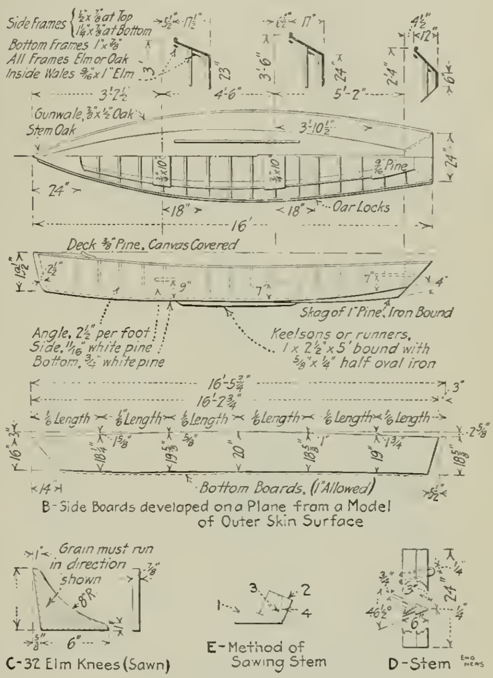
The boat handles well in choppy water. As the stern is undercut, the bow rises quickly to waves, keeping the boat dry. There being no deck, there is ample room for poles and tents. On ordinary waters, four men can be carried safely and well, or two men and a camp outfit.

If made of pine or basswood, the boat weighs about 250 lb. with four 8-ft. ash oars and rowlocks. The material costs some $12, where one man goes to the mill and lays out the pieces for cutting. As these millmen do not often get out material for boats, I have shown in *E* the scheme of sawing the stem. Generally, for a boat of this style and size it is made out of a piece of 6x6-in. timber. Tack on two wedges, 1, cut at 23¼° angle; then on a circular ripsaw cut off the piece 2, and after lowering the saw (or raising the saw-table) make the cut 3; after this the timber can be reversed end for end on the wedges and the other side cut so as to give the general outline desired and the second cut 3. Remove the wedges and make the cuts 4 from each side. To set up the boat, first the frames at the seats are rigidly put together with eight-penny iron-wire nails on form boards secured to a stiff plank, or a 4x4 in. Then the two sides, sawn as shown, are drawn down on these with ropes and the stem carefully fitted and nailed. Care must be taken that the distance from the stem to the seat on the right is exactly the same as on the left, measured along the top edge of the side, to insure having the seats at right angles to the center line of the boat when finished. Fit the stern carefully and secure all parts well. Dress off the bottom edges of the side planking, after turning the boat bottom up, so that the bottom boards will be tight. Put these on lengthwise after trimming the stem.

The boat can next be turned right side up, the bottom and side frames fitted and secured, the elm knees marked and cut at the angle to fit each place and all nailed, the inside wales and outside gunwale fitted and well nailed, and the stern seat and front deck put in.

When assembling the parts, surfaces that come in contact should be given a coat of paint, such as thick white lead ground in oil and thinned with spar varnish and turpentine. This is not very often done in the cheaper boats, but adds to their tightness and durability. The seams may be calked lightly with cotton where necessary. The boat should be painted inside, turned over and pitched with hot pine pitch if wanted for immediate use and at the least expense. The outside may be painted if more time can be allowed and more expense incurred.

An iron U-bolt should be put through the stem post, as shown in *D*, for the painter—which is usually a ⅝-in.



Plans of a Surveyor's Boat

hemp rope. The rowlocks should be secured to the boat by a cord or small chain. Some people like a floor inside on the frames; two boards 10 in. wide, of ⅜- to ½-in. stuff, can be laid loose or secured.

Few tools are required if the material is roughed out at the mill—a hammer, hatchet, smoothing plane, firmer chisel, brace and bits, including a screwdriver, and a crosscut saw, cover everything.

*607 N. 20th St., Birmingham, Ala.

NOTES

A Real Novelty in Stadia Methods—J. Zwicky, of St Gallen, Switzerland, has brought out a radical novelty in the field of stadia measurement. Instead of using two horizontal crosswires in the telescope reticule as stadia interval, he forms a horizontal stadia interval by using two telescopes whose horizontal axes make a small angle with each other In the instrument as practically constructed, one of the telescopes is mounted immediately above the other, and a link connection causes the two telescopes to rotate together vertically. Since both telescopes revolve in vertical planes, the intercept which they cut off on a horizontally held stadia rod is proportional to the horizontal distance between instrument and rod, instead of being proportional to the slope distance (as with upright rod held normal to the line of sight, or with horizontal rod and ordinary stadia wires), or proper

tional to a function of the slope distance, as with ordinary vertical stadia rod.

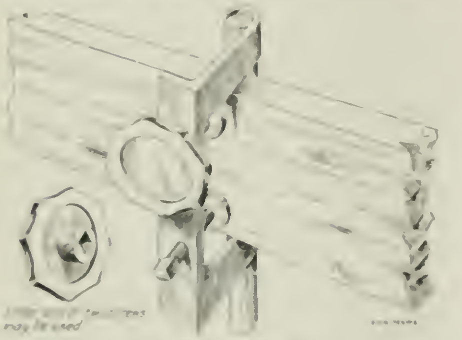
The two [illegible] advantages of this instrument and stadia method are claimed to be: (1) the possibility of using a much smaller stadia ratio than 1:100, thus permitting the attainment of much greater accuracy on ordinary lengths of sight; (2) the elimination of [illegible] calculations to get horizontal distances. The former advantage permits of getting a precision of better than 1 : 1000. In a survey of an [illegible]-acre tract, where all measurements (except those in woodland, where the tape was used) were made by the stadia method (with interval 1 : 2[illegible]), a precision of about 1 in 3000 was obtained.

Holding the rod in horizontal position needs two rodmen instead of one, which is a counterbalancing disadvantage.

To eliminate calculation for obtaining elevations also, a reduction chart is attached to the side of the transit standards and a pointer fixed to the horizontal axis of rotation moves over this chart as the telescope is revolved.

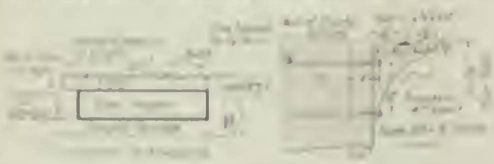
The inventor describes the new method and instrument in the "Schweizerische Bauzeitung" of Sept. 5, 1914.

A Reusable Batter Board—The accompanying drawing shows the details of a batter board device, patent for which has been applied for by R. H. Peck, an engineer of New York City. The device may be used in any kind of work requiring the batter boards, but by the diagram it is illustrated in use on a sewer trench. It consists of two iron rods which are driven into the ground and for each rod a [illegible] which clamps the iron rod and at the same time allows between the rod and the spring yoke, for a plank anywhere from [illegible] to [illegible] in. thick. This plank, which is used for the batter board, is then clamped tight against the [illegible] by a screw with a large flat plate head.



A PATENT BATTER BOARD

A 100-Ft. Length-Standard Bar has been installed in a [illegible] of the city hall at [illegible] for standardizing tapes and other measures. [illegible]



[illegible]

1 meter, 1 ft., 25 ft., 50 ft., 66 ft., 25 meters, 30 meters and 100 ft. At the zero end of the rod there is provided a clamp for holding the end of a tape line to be tested. At the other end there is provided a spring balance. The rod was graduated in October, 1913, by Prof. L. A. Fischer, of the U. S. Bureau of Standards. It was officially accepted by ordinance of the City Council on Mar. 30, 1914. It is put under the charge of the superintendent of [illegible], and a set of rules has been drawn up governing its use. A bronze tablet on the wall sets forth that this standard was presented to the city by the Western Society of Engineers and installed by Peter [illegible]. The society's committee which has had the matter in charge is composed of G. A. M. Liljencrantz (chairman), C. D. Hill and A. C. Schrader.

A New Steel Sheetpile of Very Light Weight has just been brought out by the Lackawanna Steel Co. It is of the section shown in the cut herewith, and is intended to be used for core walls and cutoff walls of dams or levees, protective cutoffs in difficult excavation work, etc.

The pile is 8 in. wide [illegible] of interlocks, and is curved transversely to a versed sine of 1¼ in. Alternate piles are turned in opposite directions, and thus produce a wall thickness of 2½ in. out to out. The metal thickness is [illegible] in.; the pile weighs 7.66 lb. per lin.ft. or 11.[illegible] lb. per sq.ft. of wall.

NEW LACKAWANNA SHEETPILE

The resisting moment of the pile section (taken singly) at 16,000 lb. stress in the extreme fiber, is 11,810 in.-lb.

This pile has been used recently in some levee work on the Mississippi River, and a large amount is to be used shortly in subway construction in New York City, for protecting existing foundations against soil movement.

Filling a Park Area with Spoil; Transportation Difficulties—In Cleveland, Ohio, some 85,000 cu.yd. of excavation from the site of the W. Bingham Co.'s new building on West Ninth St., near St. Clair Ave., is being used for filling low-lying park area some 1½ mi. away. Herstein Park, a newly created playground on waste low land alongside a congested district, near East 27th St. and the Nickel Plate tracks, is being filled. The city pays 1[illegible] per yd. for unloading and spreading, and the contract price for the excavation is $7[illegible], so that the contractor receives in all $1.62 per cu.yd. Apparently he is handling it at a fair profit in spite of quite unfavorable conditions. The material is a moist sand and clay mixture. It is handled from the excavation directly into Western air-dump cars on the Big Four tracks near the excavation site, and is transported by the contractor's own locomotives (with railway company crews) to the park via Big Four and Nickel Plate. There is considerable delay at the transfer point, and also at the Nickel Plate viaduct over the Cuyahoga River, which is being reconstructed, and is operated single-track under slow orders. The biggest day's handling has been 2[illegible] cars averaging [illegible] cu.yd. The Fred R. Jones Co., Inc., of Chicago, is the contractor.

Rules for Setting and Starting Water Meters—Before cutting the service pipe, flush it thoroughly to remove the sediment, sand and gravel which are liable to make trouble if washed into the meter. After cutting and threading the pipe remove thread-cutting chips from inside the end of the pipe.

[illegible]

Editorials

Heavy Construction Work on the Grand Trunk Pacific Ry.

While the Grand Trunk Pacific Ry. has secured a specially favorable location for the Rocky Mountain section of its transcontinental line as far as grades and a low summit elevation go, the construction of this part of the line has been attended with exceptional difficulties. These difficulties arise from three causes: the severe winter climate, the topography and almost inaccessible character of the country, and the character of the streams which had to be utilized for transportation of material.

The necessity for expediting the progress of the work made it necessary to commence construction at various points, and this, in turn, made necessary the transportation of men, machinery and supplies to points not only difficult of access but often cut off entirely from any means of communication. These conditions of carrying on the work are illustrated in an article published elsewhere in this issue describing some of the bridge substructure work, and written by one of the men in direct charge of this construction.

In ordinary railway construction it is usual practice to build temporary bridges in advance and thus to have a line of communication open with the base of supplies. But in the case of the Grand Trunk Pacific Ry. there were many cases where temporary bridges could not be built or would be constantly liable to destruction, and it was desired to have the substructures for permanent bridges built in advance, so as to be ready for the steel superstructures when the tracklaying reached them. This necessitated establishing construction camps in distant mountain regions, where the means of communication were very limited and were liable to be interrupted entirely for considerable periods. Under such conditions ample supply of provisions, equipment and machinery parts was essential. Still more essential was the placing of the work in the hands of resourceful men who could turn emergencies into opportunities and could keep the work in progress whatever might happen.

Where the line follows the general course of the Fraser River, the river was adopted as a means of distributing material to the construction points, including the three long bridges which cross it. The river is navigable only at high-water period, which is during the summer, and is then too high and turbulent for construction work in the stream. The low-water period available for bridge construction occurs during the winter, which is very severe, the temperature continuing at 40 to 50° below zero for considerable lengths of time. Under these conditions, much of the heavy material and supplies had to be taken to the sites in summer, by means of scows floating down a dangerous channel with a wild current and numerous rapids. In winter, with everything frozen solid, the coffer-dams were built, excavations made, and concrete deposited for the foundations and piers. But the work was planned to meet these conditions and was carried out successfully, while the concrete proved to be of excellent character, indicating once more that proper precaution and expense can make winter concreting quite practicable.

In winter there was communication by sled on the river, except when the snow was too deep, and this was the most favorable time to deliver material, owing to the dangers of navigation in summer. During some winters, there is comparatively little snow, and in the hope of experiencing this condition the bridge contractors purchased and delivered a large motor truck with trailer wagons. Their hopes were not fulfilled, however, and the heavy snow made this costly equipment quite ineffective. In one case, materials and plant were hauled by sleds about 150 miles over the frozen river, between points about 100 miles distant by the future railway but quite inaccessible by land. For another of the bridges, a considerable part of the material was carried on scows for nearly 300 miles.

Ben Franklin Vindicated

The decline in popularity of lightning rods, following the pernicious activity of rascally agents, left a stain on the scientific reputation of the great and wise Ben Franklin, who developed this protection against thunder bolts. Scientists have stoutly defended the value of such equipment, if well put up, but, nevertheless, practical men, often speaking from bitter experience, have maintained continuously for generations that the rods have proved worse than useless.

Two valiant defenders of the faith, Professors J. B. Reynolds and W. H. Day, of the Ontario Agricultural College, not contented with the inconclusive deadlock of theory and claimed fact, set out to find the truth—in practicable demonstrable form. For ten years, first one and then the other industriously collected all possible information about buildings reported struck by lightning in Ontario. At the end of this time (1910), they had data on 599 buildings struck by lightning. Of this number struck, 317, or 53.6%, were burned, but only 18 of the buildings struck, or 3%, had rods and only three of these, or 16.6%, of the protected buildings were burned. Having these interesting but incomplete figures, the investigators desired to know further the number and experience with unrodded buildings in the province, so that they might complete their case—reasoning that if rods neither prevented nor induced strokes the ratio of damaged to undamaged structures in the unprotected risks would be of the same order of magnitude as in the rodded.

Great difficulty was found in securing the desired data. Eventually, however, the Provincial mutual insurance companies were interested in the studies and reports covering about a fourth of the province were secured after some delay. These showed that 21% of insured farm buildings were rodded and that of all those struck only 1½% were rodded. Out of 7000 unprotected buildings, 37 were struck; out of 7000 protected ones only two

were struck. [illegible] 57 were saved out of 67 expected to be struck, or a probable protection of 91.5%, and that with uninspected rod construction.

Prof. Day visited Iowa and Michigan to inspect the insurance records and evidences of protection there. In Iowa, he found that the total claims paid for lightning losses in eight years amounted to $1081 on rodded buildings and $70,000 on unprotected ones. Apparently then, for each dollar paid on rodded risks $70 was paid on unrodded. The rods were not inspected and some of the losses probably were due to poor construction. Even so, the protection shown was 98.7%. In Michigan, one mutual company insuring only rodded and inspected buildings, in four years paid $72 claims on $55,172,075 risk. Another mutual company taking both protected and unprotected risks paid $82,294 in claims on a total of $58,[illegible] in the same period. The loss was practically all on unprotected buildings aggregating $17,553,818 in value of risks. Comparing the two companies, for each $1 damage on protected buildings there seemed to be paid $[illegible] on unprotected ones—an obvious protection of 99.9%. All this and more is set forth at length in a recent bulletin of the Ontario Department of Agriculture.

Regarding the technique of the rod construction so successfully employed in these states, it is of interest to know that, where knowledge was available, there appeared to have been used more or less of an approach to a cage of conductors about the building. The rods were fastened both close to and away from buildings but without insulators. Poorly buried ground plates and rods were found and where these groundings proved defective there invariably developed disaster.

The worthlessness of the old lightning rods, of course, was the fault of the ignorant fly-by-night agent who carelessly put up his cheap affairs, gathered his money and disappeared, leaving disaster and ruin for many a farmer in the approach of the first heavy electrical storm. A deliberate attempt to discredit the great American philosopher and patriot could not have worked as well. It is a source of much satisfaction to see definite figures which substantiate the soundness of his scientific knowledge as well as that of a long line of later physicists.

The Submarine Vessel as a Factor in Naval Warfare

The destruction wrought upon United States wooden war vessels by the Confederate ironclad "Merrimac" in Hampton Roads during the Civil War, closely followed by the conflict between the "Merrimac" and the "Monitor," changed the entire trend of naval construction. It is quite within the possibilities that the recent sinking of three British cruisers in the North Sea by a German submarine boat will constitute equally profound change in the world's navies. The control of the seas has hitherto belonged to the power able to build and to man the largest number of fighting ships, with armor and armament sufficient to enable them to vanquish their antagonists. But of what use to build these huge floating fortresses at enormous expense if they had their very act at any time likely to meet destruction by an insignificant antagonist hidden in the ocean depth?

It was the course of the development of the submarine boats to accomplish this very thing. During the fifteen years or so since the first submarine boats were built there has been no war between nations owning sufficient submarines to test the possibilities of their action. Yet an eminent British admiral, only a few weeks before the outbreak of the war, expressed his belief that the development of the submarine boat had reached a stage that rendered battleships obsolete. This prediction is recalled in connection with the news of the recent serious disaster to the British fleet.

Of great significance is the detailed account of the circumstances under which the British cruisers were sunk. As has been fully reported in the newspapers, it appears that the doomed cruisers were in the open ocean far from the coast with no thought of an enemy being near. It may never be positively known whether anyone on the first cruiser sunk saw even the periscope of the attacking submarine before its torpedo exploded. At any rate, the attacking vessel, if seen at all, was seen too late to make any effective defense. The two other cruisers, a mile or two distant, saw the plight of their sister vessel and supposing it to have struck a floating mine came near to rescue the crews struggling in the water, when the submarine torpedoed these cruisers also. The number of men lost in this brief and inglorious battle, if battle it can be called, equalled the losses in some of the most famous naval battles in history.

Another significant outcome of the loss of these three cruisers is the issue of orders by the British Admiralty that in case one vessel of a fleet is torpedoed by a submarine boat, other vessels in the fleet must look to their own safety and not run the harmful attendant of rescuing the crew of the stricken vessel. It is difficult to read any other interpretation from this order than that the proper tactics for a naval vessel, as soon as it learns that a submarine boat of the enemy is near, is ignominious flight. It may be the most powerful cruiser or the latest super-dreadnought battleship, yet its fighting power is of so little avail for defense against this hidden foe that its only refuge is to seek safety through superior speed.

It is fair to say, on the other hand, that the submarine boat, while it has reached a high degree of mechanical perfection, is still subject to serious limitations. Were it not for these limitations, the losses of naval vessels torpedoed by submarines since the beginning of hostilities would already have been far more numerous. The submarine can carry only a limited amount of supplies; it must operate either within a definite radius of a shore station or else it is dependent on a supply ship. Its speed is limited, and what is most important of all is its inability to locate its adversary when running submerged.

The modern submarine boat is more properly termed a submersible boat. In normal operation a considerable part of its hull is above the surface. On sighting and identifying an enemy's vessel the boat sinks in the water leaving only its periscope above the water. From this point of observation, the course of the submarine is directed until it is near enough to the enemy so that there is danger of discovery. From that point onward the journey must be entirely under water, coming to the surface only when absolutely necessary to verify the course and distance. If at such a time some lookout on the threatened vessel discovers the submarine, instant efforts will be made to discharge a machine-gun volley at the periscope. If successful, the blinded submarine will probably come to the surface where its thin hull will be quickly pierced by shots.

The tactics of the submarine, therefore, are to seek an enemy's vessel when darkness or storm or fog makes observation difficult, so that its approach may be undiscovered.

The difficulty of navigating a submarine vessel under the conditions of attack and of effectively discharging its torpedoes are well known and have caused many naval authorities to regard the submarine boat with skepticism and to continue to pin their faith to big battleships and cruisers.

Nevertheless, the mere possibilities of submarine attack have already revolutionized the naval blockade. The close blockading, which was the ordinary practice in warfare a generation ago, is now too hazardous. It is even an open question, which the present war may settle, whether such a blockade with the vessels perhaps 200 miles off the coast at times can be considered an effective blockade in international law.

It would be indeed a marvelous event in the progress of invention and discovery if the development of submarine navigation should render obsolete the enormously expensive cruisers and battleships on which the great powers of the world have chiefly relied for naval supremacy. It is quite possible that the submarine boat may so greatly increase the defensive power of the smaller nations that they may make themselves invulnerable from an attack by sea on the part of even the most powerful nations by the possession of even a small fleet of comparatively inexpensive submarine boats.

Standard Specifications for Steam-Boiler Construction and Operation

Of all the work done by engineering societies, probably the most valuable and important is the establishment of standard practice on matters with which the members of the Society have to deal. A task of this sort which is just now attracting much attention is the work which a committee of the American Society of Mechanical Engineers is doing in framing a standard specification for boiler construction and operation suitable for enactment by State legislatures.

The first appeal to the Society to take up this task came from the boiler manufacturers. The State of Massachusetts a number of years ago passed a law governing the construction and inspection of steam boilers, which has without a doubt been a great factor in reducing the risk to life and property from steam-boiler explosions in that state. In recent years, a half-dozen other states have followed Massachusetts' example and while they have generally taken the Massachusetts law as a foundation, they have made various minor changes which have become the source of a vast deal of trouble to the boiler manufacturer.

Slight differences in the quality and character of the material, acceptable in one state and not acceptable in another, make it necessary for the boiler manufacturer to keep materials for use in boilers for different states separate as they pass through the shop. The difficulties and expense involved in this in a large establishment can readily be understood. Besides this, there is the risk that through some unintentional error, material intended for use in one state may be accidentally used in a boiler intended for use in another state.

This legislation is already a most serious matter to the boiler manufacturers, when only half a dozen states or so have laws in force regarding steam-boiler construction. One can well imagine the situation, therefore, if instead of a half-dozen states, thirty or forty states had each laws governing boiler construction differing in various details and requirements. Such a condition, however, has actually been threatened. The very fact that some states have laws specifying what boiler materials will be accepted operates to give them the better class of steel and of boilers, and the boiler makers sell the material which would be refused in states which have no such legislation.

It is a realization of this condition, as well as a general movement toward more stringent protection of public safety, that has caused the authorities of a dozen or more states to draft laws upon the subject which are likely to be presented to the legislatures when in session next winter. It is, in fact, authoritatively stated that a number of states would have passed laws a year ago save for the urgent appeals of engineers that action should be delayed until a model law had been framed by the American Society of Mechanical Engineers which could be generally adopted.

The Mechanical Engineers' committee which has been at work upon the proposed standard code completed a preliminary draft last spring which was printed and sent to 2000 engineers representative of all the different interests connected with boiler construction, operation, inspection, etc., with requests for detailed study and criticism. While some preliminary discussion of this tentative draft took place at the St. Paul meeting of the Society in June, the main discussion took place at a special meeting of the committee held in the Engineering Societies' Building, New York City, on Sept. 15, at which nearly 150 engineers were present. The discussion was most active and in some instances heated. Eventually, however, a spirit of harmony and willingness to compromise prevailed.

The discussion made clear that a specification for steam boilers to be embodied in a statute should be general rather than specific. It should embody only the most essential features necessary to safety in boiler construction. It was clearly brought out that to embody in such a code certain specific requirements which might be advantageous for certain classes of boilers would operate as a serious handicap in the construction and operation of other classes of boilers widely different in their design.

The committee is now engaged in the large task of analyzing and studying the large amount of written and oral discussion and criticism it has received and will, it is expected, present its final report for adoption by the Society at the December meeting. Doubtless there will be further active discussion there on some controverted points in the specifications. It seems likely, however, that the report will be finally adopted at that meeting and made available for such state legislatures as choose to act upon it, since further delay, as has been already pointed out, would mean a still worse chaos in state legislation on boiler construction.

It is of interest to note that this voluntary action by a technical society seems to have been practically the only way to save a very important branch of industry from an impossible situation. The desirability of protecting the

public safety or making boiler construction and operation a matter governed by law will be almost universally conceded, but while the Federal Government under the Constitution may and does control the construction of steam boilers used on vessels navigating waters over which the United States Government has jurisdiction and also controls the boilers of railway locomotives employed in interstate traffic, the construction of other classes of boilers has been held to be a matter purely within the police power of the several states and not subject to Federal regulation.

If, however, each state were to independently draft a law regulating steam-boiler construction and inspection, it would be almost as great a barrier upon interstate commerce in this industry as would exist if the several states erected tariff walls around their borders and collected customs on all imports. It is, therefore, the highest kind of public service to have a national engineering society step forward in this difficult situation and take the lead in framing a law which will have the professional prestige of the society behind it and can be accepted by the various state legislatures, therefore, as a safer and more intelligent guide to their work than they could hope to secure from any experts within their own boundaries.

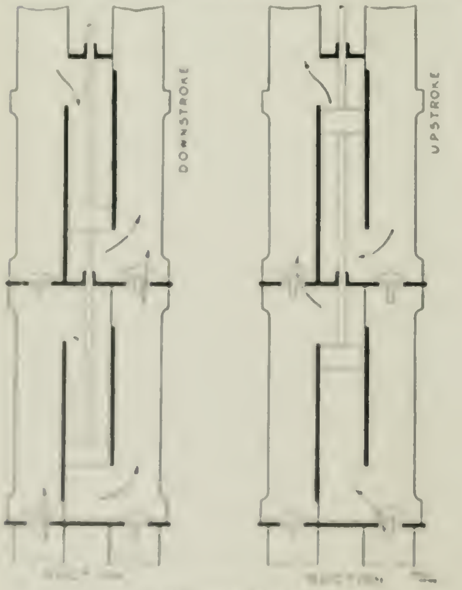
It is worth emphasis, too, that the American Society of Mechanical Engineers is probably the only technical society which could have successfully undertaken this work. Were any commercial organization to take it up, representing any special trade or interest, such as the boiler manufacturers or the steel manufacturers, for example, legislators would naturally be suspicious that the legislation offered was framed to protect some commercial interest, and however unjust or unfair such a suspicion might be, it would have undoubted weight in hindering the adoption of such legislation in many states.

The model law to be framed by the American Society of Mechanical Engineers, however, should be free from any such handicap. There is every indication, moreover, that by the time the law is finally perfected all the interests concerned will be satisfied that they have had a fair hearing and that their representatives have received impartial consideration and they should therefore be counted on for its support. The Society in this task, therefore, is rendering a service not only to the public but to the entire engineering industry.

Letters to the Editor

Another Wonder Pump

Sir—About three years ago the writer was called upon to analyze the working of a pump, which, while evidently similar to the one described in the letter of L. M. H. in the issue of Aug. 27, is far ahead of it in the matter of efficiency—in the mind of the inventor. The accompanying sketch shows the operation of the pump, explained as follows:



A Wonder Pump

DOWN STROKE—The two pistons force water up the right hand pipe, the lower piston draws water into the left hand lower cylinder, the upper valve on left hand side is closed so the weight of water in left hand pipe is forced against the top of the upper piston thereby balancing the same amount of water in the right hand pipe.

UP STROKE—The upper valve on the right closes, forcing the weight of the right hand water column against the bottom of the upper piston and thereby lifting the water in the left hand pipe, while the lower piston draws water into the lower right hand cylinder. We thereby get a complete balance on all water above the pump in each pipe, making it possible to lift the water any distance by the use of just enough power to push the water the length of the stroke plus friction in the pipe. The pump requires two pipes of the same size the full height the water is to be raised.

The 200% efficiency of the pump mentioned by L. M. H. pales into insignificance beside the performance of this prodigy. Conceive of the ease and low cost by which water could be raised 500 ft. by the expenditure of merely enough energy to raise it one foot (plus a little friction) on a 12-in. stroke!

E. J. C.

Moscow, Idaho, Sept. 2, 1914.

A Problem in Mechanics

Sir—The problem stated takes [illegible] readers of Engineering News. While the principles involved are simple, the writer found it difficult to demonstrate them to five or six intelligent people, after a week of intermittent discussion followed by an experiment carried out with all conditions exactly as in the problem. Among those interested was a professor of physics, who was not

convinced, even after the experiment! Here is the problem:

A man on shore is exerting himself to his utmost in pulling a boat toward him by means of a long rope. The off-shore end of the rope is not made fast to the boat, but is held in the hands of a man in the boat. If the man in the boat exerts himself by pulling the rope into the boat, will the boat move faster than if he does not so exert himself, and why?

There is no "catch" in the problem and no question of accelerated motion. Those to whom the problem is a puzzle reason as follows: How can the boat move faster without an increase of tension in the rope; and if the shore man is already pulling his best upon the rope, how can the tension be increased by the mere fact of the man in the boat going to work?

The answer to the problem is that the boat will move faster when both men haul in the rope. The fallacy in the statement above which makes the problem a puzzle to many is that the maximum force a man can exert is a constant quantity. It is not a constant quantity, but is a function of the speed of application. To express it in simpler terms: The force exerted by the man on shore is not so great as he might exert were he pulling on a rope anchored to an immovable object. The man in the boat is therefore capable of exerting a greater force on the rope than he does when merely acting as an anchor. When he attempts to do this, the increased pull checks the speed of the shore man with a concomitant increase in the force which he exerts, forming the increased reaction to the increased pull from the boat. Hence the tension in the rope increases, and therefore the speed of the boat increases, even though the rope goes ashore more slowly, bcause the speed of the boat is now the sum of the speed of the rope going ashore plus the speed of the rope entering the boat.

In an experiment carried out with a rowboat, the shore man acting alone was able to pull the boat over a given course in 21 to 23 seconds. When the boatman applied himself also, the boat covered the same course in 14 to 16 seconds.

The resistance to a boat moving through the water is roughly proportionate to the square of the speed. If we assume that the maximum force exerted by a man is inversely proportional to the speed of application, it is easy to make the problem quantitative, and to show the speed with two men as against one to be an increase of $\sqrt[3]{2}$ times.

While the men are supposed to apply themselves in the same way, it makes no difference what that way is. They may take in the rope hand over hand, they may run bodily back with it or they may turn a windless. The same conditions would hold if we substituted steam winches or electric winches.

Chas. A. Gilchrist.

2401 Le Conte Ave., Berkeley, Calif., Sept. 11, 1914.

Creeping of Asphalt Block Pavements

Sir—In Engineering News of July 16, 1914, p. 130, there are some notes on the creeping of asphalt-block pavements. Though the instances given show more movement of the courses than commonly found, practically all asphalt-block pavements show this creeping.

The first case noted by the writer was in 1907 or 1908 on the Southern Boulevard, south of Freeman St., New York City, a year or 18 months after the completion of the pavement. The east roadway carrying uptown traffic has a down grade of about 4% in the direction of travel, and the courses of blocks showed a movement of 18 or 20 in. then. Blocks, which as laid were 12x5x3 in. thick have been found squeezed by the traffic to 16 in. long, 6 in. wide and 1½ in. thick, and in other cases to 5 in. thick and proportionately narrow.

In the writer's opinion the creeping is due to the traffic crowding the blocks closer together, a small movement at each joint amounting to a considerable distance in a city block. As there are about 240 joints in 100 ft., ⅛ in. on each joint would amount to 30 in. This space is filled by the spreading of individual blocks, most of which show slight spreading, at least on top.

The irregularity on asphalt-block pavements is also due in the writer's opinion to the spreading of the blocks permitted by the open joints. These will usually average about ¼ in. when the pavement is laid, but soon the blocks show absolutely close joints, only a skin of dirt separating adjacent blocks. This spreading of the block allows it to be gradually rolled out to a thickness of 1½ to 2 in., making a decided hollow, which rapidly increases in size, as it holds water and has to sustain blows of wheels as they drop from the higher blocks.

The creeping of the courses in wood-block pavement is also noticeable, but from a different cause. It is usually due to the swelling of the blocks at cuts or openings where the pressure has been relieved and the pavement is free to swell, thus allowing the courses to assume a curved line where originally they were straight.

R. A. MacGregor.

2428 Lorillard Pl., New York City, Sept. 8, 1914.

Record Season of Pavement Construction in Montreal, Que.—To the first of September about 25 miles of new pavements had been laid on Montreal streets since the present season's work began. This is about 250,000 sq.yd.

The Progress of Work on the New York Barge Canal is summarized by State Engineer John A. Bensel in the "Barge Canal Bulletin" for August. On the Champlain Canal from Whiteball, the southern end of navigation on Lake Champlain, south to Northumberland, a distance of 30 miles, the canal is finished. The completion of the entire Champlain Canal awaits the completion of the Troy Dam by the United States Government. A branch from the main line of the barge canal to Oswego on Lake Ontario will be finished next season, ready for the opening of the new waterway in 1916. Federal Government work will be necessary to deepen the harbor at Oswego to 12 ft.

Of the 346 miles of canal between Albany and Buffalo, about 70% has been completed and turned over to the state. At the western end the work is all completed from Tonawanda to a point about 6 miles west of Rochester. Work has been delayed east of Rochester by litigation over six railway crossings. This litigation has now ended, and the work will proceed rapidly, so that next year should see the completion of the work all the way from Rochester to Fox Ridge, near Syracuse, and between Fox Ridge and Utica.

The work on the canal terminals, which is being done under a separate bond issue, is also making rapid progress, and will be ready when the barge canal is completed. The Whiteball terminal is already finished, and the terminal at Albany has already received lumber vessels from Florida. The Troy terminal is under contract, and work has begun at Buffalo and Oswego.

A table in the report shows that on completed contracts for the barge canal work, $37,266,000 has been expended, and on contracts now in force, $31,600,000 has been expended, a total of $68,806,000 worth of work completed to Aug. 1. The total work completed to July 1 includes 87,690,000 yd. of excavation, 1,200,000 yd. of embankment, 2,416,000 cu.yd. of concrete, 1,408,000 cu.yd. of rough stone work of all classes, 22,000,000 ft. B. M. of lumber, and 82,000,000 lb. of metal work.

The Prismatic Astrolabe, A New Instrument for Determining Latitude and Time by Equal Altitudes

By David Binns*

The method of equal altitudes for the astronomic determination of the observer's position upon the earth's surface leads to results of such surprising accuracy that it has been termed incontestably superior to any other. As the name suggests, this method calls for the observation of celestial bodies in various portions of the heavens,

Fig. 1. Elements of the Prismatic Astrolabe

but always at the same altitude, the observation consisting merely in noting the time when this altitude is attained.

As the altitude itself is entirely eliminated from the results in the course of the computation, its exact value, affected by constant errors of graduation, eccentricity, level, collimation, azimuth, flexure, etc., is of no consequence, provided only that it is the same for all stars observed. The local time and the latitude thus obtained, free from systematic error due to these sources, are remarkably precise.

The method itself was introduced by Gauss, who first pointed out its advantages a century ago. Employing a sextant and artificial horizon, this illustrious mathematician, even with such crude apparatus, and with only three stars, obtained a value for latitude which excited wonder. After Gauss, others experimented with the sextant; but only the brightest stars can be observed with this little instrument. Very few of these can be found at a given altitude within a reasonably short period of time, and the small magnification necessarily employed to permit keeping the star in the field of view is not conducive to sharp observation. Sextant work cannot be relied upon for work of extreme precision.

Experiments were accordingly made with theodolites and other instruments rotatable around a stable vertical axis, and very good results were obtained by careful manipulation; but the artificial horizon was here replaced by some device like the spirit level, and this reintroduced the elements of systematic error. The method of equal altitudes, therefore, despite its advantages, though employed extensively at sea, was long neglected on land.

Recently, the French took hold of the problem, and, as their persistent way called for, by inventing and improving a new instrument, "L'astrolabe à prisme," "the astrolabe with a prism" or the prismatic astrolabe. Of this, there are several forms, but the principle in all is the same. Like the sextant, the astrolabe involves the use of an artificial horizon, but it replaces the two separate sextant mirrors by a single equilateral glass prism. The prism is mounted, edges horizontal, with rear face vertical, in front of the object glass of a horizontal telescope rotatable on a vertical axis in a horizontal plane, and the whole—prism, telescope, mercury basin and other appliances—is supported on a tripod like a theodolite.

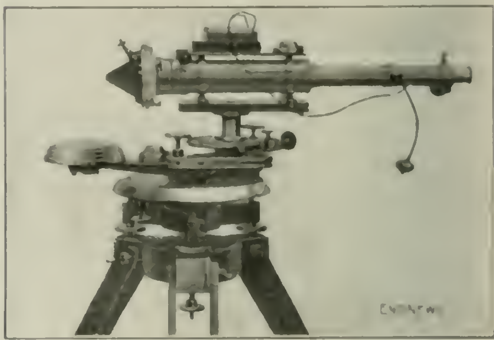


Fig. 2. Prismatic Astrolabe for Determining Latitude and Time by the Method of Equal Altitudes

One face of the prism receives light directly from the star, another from the star's image reflected in the mercury, and the two light rays, after internal reflection, pass through the rear face of the prism to the object glass. Stars are thus observed at a constant altitude of 60°.

For time determination, observations are made in the neighborhood of the prime vertical, where the altitude changes most rapidly; for latitude, near the meridian. As it is easily possible without field illumination to observe stars as faint as the seventh magnitude, a skillful observer may secure 30 to 40 stars in less than an hour, and this number is sufficient to give very good values for both time and latitude.

An interesting feature of the astrolabe is that, unlike other instruments, the results obtained, if the prism be well constructed and by employing reasonable care, are almost entirely independent of errors due to maladjustment. The telescope should be perfectly horizontal; so also should the prism edges; and the rear face of the prism should be vertical. If, however, the prism edges, for example, are not horizontal, the skilled observer will recognize this fact when he perceives the motion of the star in the field of view and a slight touch of a screw eliminates the inconvenience; indeed, this adjustment is generally effected on every star.

The one important adjustment—and even that is not absolutely essential—is the perpendicularity of the rear face of the prism to the axis of the telescope, which is easily effected by aid of a simple accessory device. If the adjustments are not perfect, the only error involved is in the observed altitude which, instead of being 60°, may be some larger or smaller quantity; but if care is taken to make all observations in the same portion of the field and in the same way, this quantity will be the same in all positions of the instrument. All stars will be observed at the same altitude, and the resulting latitude

* [illegible]

and local time will be unaffected. With the newer type of prismatic astrolabe, permitting temporary field illumination, this condition is easily fulfilled.

There are no instrumental constants to be determined, and consequently there are no systematic errors introduced by such constants. There are no circle measures, with the danger of reading and recording them incorrectly. There are no errors of nadir, pointing, thread inclination, pivots, etc., such as affect observations with other instruments. In fact, nearly all constant errors, affecting all observations alike, are eliminated. There is danger of systematic error introduced by the personal equation in noting the times of observation, but almost all other errors are of the accidental class, and may be eliminated by increasing sufficiently the number of observed stars.

The manipulation of the instrument is simple, rapid and easy. The French employ one or two assistants, but a single observer can work just as easily and quickly without aid. Guided by a previously prepared list of stars containing approximate times and azimuths, the observer first sets the telescope in azimuth, then seating himself at the eye end, watches the star and its reflected image enter the field of view from opposite directions. He touches a screw, perhaps, to cause the images to change slightly their relative positions, or to bring their vertical line nearer the center of the field. As the images draw closer in their approach toward each other, he concentrates his attention and at the moment of coincidence makes a record of the time, either by the eye and ear method, or by the chronograph and key. In this record is comprised the whole observation.

The computations both preliminary to and succeeding the observations are long and tedious. An hour's observing list requires many hours of preparation and subsequent computation. The labor of preparing the observing list may be considerably shortened by tables and other aids; and the final computations, too, may be made more easy by tables and graphic processes. The fact, nevertheless, remains that the computations are time consuming. In view of the high precision attainable, this objection should carry but little weight, particularly when it is remembered that the computations may be made at one's leisure, long after the observations have been completed.

The instrument is comparatively inexpensive, it is light and portable, and requires no previously established stable foundation, but may be set up in a few minutes. These considerations should recommend it particularly to geographers, explorers, surveyors and other travelers who seek accuracy, yet do not wish to encumber themselves with the comparatively heavy portable transit and accompanying chronograph. For the very finest kinds of longitude work, however, owing to the personal equation, the astrolabe should be looked upon with suspicion. Yet it should be remarked that it has been used side by side with portable astonomic transits of the best known types, and the results obtained by the two different kinds of instrument have been wonderfully close.

The prismatic astrolabe has been employed by the French on boundary and other survey work in their colonies, in the measurement of a meridian arc in Ecuador, and more recently in important wireless longitude determinations. It was used last spring in the preliminary operations attending the determination of the difference of longitude between Washington and Paris.

The astrolabe may be employed for absolute longitudes by observing equal altitudes of stars and of the moon. It can advantageously replace the portable transit in much of the longitude work now carried on in this country, and would result in considerable saving. Among other applications, it may be employed at fixed observatories to determine star positions. Our astronomers and engineers should give it a trial.

For an exhaustive discussion, the reader is recommended to A. Claude et L. Dueneourt, "Description et Usage de L' Astrolabe à Prisme."

The Twelfth St. Viaduct Accident, St. Louis

Supplementing the account in our last issue (p. 706) of the accident at the Twelfth Street Viaduct in St. Louis, we reproduce herewith a general view of the span affected by the wreck. The span crosses two tracks of the Missouri Pacific Ry., and is 54 ft. long. It consists of reinforced-concrete main beams and transverse slab (the slab reinforcing rods show in the view). Each main beam was supported by 24-in. I-beams resting on pairs of 8x8-in. wooden posts. It is believed that failure of one or more of these posts, possibly from lack of bracing, caused the collapse. Three main beams went down. At the time the photograph was taken, the wreckage had practically all been cleared away. Practically no delay will result. This was the last span of the viaduct to be concreted.

Partial Wreck of Span 16 of Twelfth Street Viaduct, St. Louis, Mo.

(This span crosses Missouri Pacific tracks. Three main beams or stringers of 54-ft. span went down, shortly after being poured, due to failure of the posts supporting the steel centering beams.)

Notes from Engineering Schools

HARVARD UNIVERSITY.—The half course in administration of municipal sanitation given last year has been expanded to a full course to be given three times a week throughout the coming year. The course will not be confined to sanitation but will include city administration, vital statistics, city planning, housing, fire protection, police, lighting and paving. Special outside lecturers will have charge of six exercises each—in order to give adequate treatment of their subjects. The topics are essentially of engineering nature but are to be presented for those who desire to fit themselves for municipal executive and legislative effort.

MICHIGAN COLLEGE OF MINES.—This institution has opened its doors to the practical mining man. Announcement has been made of the introduction this year of a series of special short courses in mining, metallurgy, mapping, drawing, concrete construction and like subjects that will be open to ambitious workingmen. This step has been under consideration for many years and is now introduced as a permanent extension of the college work, designed to broaden its usefulness.

The admission requirements for the new courses are simple. It is required first that a man be able to read and write the English language to a fair degree of proficiency. The second demand is that a man be of good character and have had experience in the mine, mill, smelter, shop, etc.

The courses will run from five to twelve weeks, probably coincident with the regular college work. The same teachers and equipment will be used in this work as in the regular college courses. Every course will be given under the head of the department to which the subject belongs. There has been no attempt to place definite limits on the number of courses or the ground to be covered by them. They are to be arranged to suit the demand. It is intended also to pay particular attention to men who come for special work—whether with previous technical training or not.

NEWS NOTES

Recent Floods in Polk County, Iowa, [illegible]

An Explosion of Natural Gas in a Building Basement [illegible]

A Mine Explosion [illegible]

An Explosion in a Fireworks Factory [illegible]

A Boiler Explosion [illegible]

An Explosion in the Fireworks Factory [illegible]

... the death of the President of the company, H. L. Thearle, and three of the other employees. The explosion took place in the steel and concrete vault in the office building. The explosion is supposed to have been caused by a spark from the electric wiring on which an electrician was at work at the time of the explosion.

A 36-in. Water Main Was Broken by a dredge excavating for the foundations of the Wellington bridge over the Mystic River, in the suburbs of Boston, Mass., on Oct. 3. Reports state that the break was caused by driving a spud through the submerged main. A large quantity of water was lost before the gates could be closed, which required nearly an hour. Soon after the gates were closed the pressure in other parallel mains increased and nearly normal conditions in the suburbs of Charlestown, East Boston, Cambridge, Chelsea and other towns were restored. The main is a part of the Metropolitan Water Board's distribution system.

The New Boylston St. Subway, Boston, Mass., was opened to the public Oct. 3. The new subway cost approximately $4,500,000 and will give rapid transit service to Brookline, Brighton and Allston. Construction was begun in March, 1912.

Statistics of Foreign Trade of the United States for August show an increase in imports of $[illegible] over the same month in 1914, while the exports decreased $[illegible],000. The falling off in exports was entirely in manufactured goods and raw materials for manufacturers' use. The exports of foods remained substantially the same. Much more radical changes will doubtless be shown by the returns for September.

Installation of a 50 Million-Gal. Chlorinating Plant was recently made in 28 minutes at the Watts Pond pumping station, Brooklyn, N. Y. It was desired to disinfect the water supply from this station without delay, and a telephone order was placed with Wallace & Tiernan of New York, makers of treating apparatus for use with liquid chlorine. Two sets were sent out with a set mounted ready for use on a panel board and calibrated so that it had only to be fastened to the station wall and connected to the chlorine tank and water-supply lines.

Improvements on the Chicago, Milwaukee & St. Paul R.R.—During the year 43 steel bridges, aggregating [illegible] ft. in length and 6 masonry bridges, aggregating 676 ft. in length, were built—replacing 3130 ft. of wooden bridges, [illegible]13 ft. of iron bridges and 212 ft. of embankment, and 12,[illegible] ft. of wooden culverts were replaced with iron and concrete pipe. About 3[illegible] miles of pile bridges were filled with earth, 9[illegible] bridges having been completely filled and 7[illegible] reduced in length by filling.—From the company's annual report for the year ending June 30, 1914.

Grade Crossing Elimination on the Chicago, Milwaukee & St. Paul Ry. system is summarized as follows in the annual report of the company. In Minneapolis 37 grade crossings are being removed and the work is about [illegible] completed. In Chicago along the Bloomingdale Road for a distance of 2.[illegible] miles 45 grade crossings are being removed. On the Evanston division work was begun last February on the elimination of 36 grade crossings, a distance of [illegible] miles. In Milwaukee [illegible] grade crossings are being removed. The work will require about two years.

Impulse Wheel for 5412-Ft. Head.—Among the exhibits of the firm of Piccard, Pictet & Co., Geneva, Switzerland, at the Swiss National Exposition being held at Berne, Switzerland, is an impulse wheel built for the Fully high head plant of the [illegible], a French company. This is a horizontal shaft wheel which will develop [illegible] hp. at [illegible] r.p.m. Its wheel diameter is [illegible] ft. and the jet diameter is [illegible] in. The Fully plant (as noted in Engineering News, May [illegible], 1912, p. [illegible]) will be the highest head water power plant in the world by a considerable margin. No [illegible] [illegible] prior to this one.

The Organization of Fraudulent Engineering and Drafting Companies, [illegible]

A Street Extension by Subway or Open Cut [illegible]

West Side Park Commission objects to having the car tracks extended through the park, and in order to meet this objection the Northwest Side Commercial Association has had plans prepared for carrying the tracks either in a covered subway or an open cut, with inclined approaches. These plans, prepared by Wm. W. Marr, have been submitted to the park commission, and the estimated cost is $65,000 for the open cut and $110,000 for the subway.

Elimination of Traffic Congestion at the foot of Market St., San Francisco, is being considered by the city in a plan which contemplates the acquisition of six parcels of land from two city blocks to create a new street two blocks long, 91½ ft wide, parallel to and 137½ ft. south of Market St. The present ferry-bound cars on Market St. would be rerouted through this new avenue of approach to the Embarcadero to prevent the procession of cars there in opposite directions due to the present ferry-loop tracks. The terminals of the Mission, Howard and Fulsom St. lines could be shortened 100 ft. Two foot bridges of structural steel and reinforced concrete would be built, running from the second story of the ferry building over the Embarcadero in the general line of and on either side of Market St., with entrances and exits to give best access to various street-railway lines, sidewalks and ferries. The estimated cost is placed at $380,000 for land, $49,000 for street-railway changes, $59,000 for foot bridges, $15,000 for changes to Ferry Building.

The Railways of Great Britain were taken over for operation by the British Government at the outbreak of the war and are operated as a single system under control of a committee made up of the General Managers of all the principal railway companies. The operation of the railways proceeds as usual, except that the military requirements of the government are paramount to all other traffic considerations. The compensation to be paid to the companies owning the roads for their use will be the net receipts from operations increased by the amount by which the net receipts during the period of government operation may fall short of the net receipts during the corresponding period in 1913. It is provided, however, that where the net receipts of any railway were less in the first half of 1914 than in the corresponding half of 1913 the basis on which compensation is to be computed shall be decreased in like proportion. Under this arrangement the government makes no special payment for transportation of troops or any other service performed for the government, this being paid for under the arrangmeent above noted.

Grade Crossing Elimination in Paterson, N. J. has been investigated by the City Engineer, H. J. Harder. He estimates, in a report to the Finance Commission of the City, on Oct. 1, that to depress the tracks of the New York, Susquehanna & Western would cost $2,772,000, while to elevate the tracks of the Erie would cost $2,587,000. Land damages have not been included in either estimate. The work of depressing the Susquehanna tracks may be divided into four independent sections, any of which may be completed without the others and without the duplication of any work when the other sections are constructed. The average estimated cost is $139 per lin.ft. for the Susquehanna against $142 for the Erie.

The bridges over the streets would be of the through plate girder type with waterproof trough floors. Those carrying the streets over the railroad would be of a similar type, except that where street intersections come on the railroad right-of-way the bridges would probably consist of concrete arches thrown between heavy I-beams extending from one abutment to the other. The Susquehanna right-of-way in most places is wider than that of the Erie, and it will be possible to allow the cuts and fills to run out on natural slopes part of the way. Retaining walls will be required, however, along the greater part of the line. These will be of concrete backed by dry rubble to carry off the drainage.

Street grades on approaches to crossings have in nearly all cases been kept below 4%, in only two or three places reaching 5% and in one instance 6%.

PERSONALS

Mr. Frank M. Williams, M. Am. Soc. C. E., former State Engineer of New York, has been nominated for that office by the Republican Party at the recent primaries.

Mr. Jesse C. Bader has been appointed Manager of the Western Sales Branch of the McMyler Interstate Co., of Cleveland, Ohio, with headquarters at 1503 Fisher Bldg., Chicago, Ill.

Mr. Leslie Warren Goddard, M. Am. Soc. C. E., Principal Assistant Engineer, U. S. Engineer Office, Grand Rapids, Mich., was married Sept. 26 to Miss Mina Etta Bordine, of Saline, Mich.

Mr. Patrick Kierman, for 30 years Superintendent of the Fall River, Mass., water-works, has resigned. He has been a member of the New England Water Works Association for 28 years.

Mr. John A. Bensel, Past-President, Am. Soc. C. E., State Engineer of New York, has been renominated as a candidate for the same office by the Democratic Party at the recent primaries.

Mr. F. J. McKee, who has been Acting Superintendent of Terminals of the Grand Trunk Ry. at Port Huron, Mich., has been promoted to be Superintendent, succeeding Mr. J. F. Jones, resigned on account of ill health.

Mr. Alfred E. Kornfeld, who relinquished his connection with "Engineering News" in 1912 after 18 years' service, has again become identified with it and as a member of its business staff, with headquarters in New York City.

Mr. George P. Johnson has resigned as General Manager of the Chesapeake & Ohio Ry., Richmond, Va., and for the present no successor will be appointed. Mr. Johnson was formerly Receiver for the Detroit, Toledo & Ironton Ry.

Mr. R. F. Peters, M. Am. Soc. M. E., recently Mechanical Engineer of the San Antonio & Aransas Pass Ry., has been appointed Senior Mechanical Engineer, Division of Valuation, Interstate Commerce Commission, with headquarters at Kansas City, Mo.

Mr. T. B. Van Dorn, Vice-President and Engineer of the Van Dorn Iron Works of Cleveland, Ohio, has been elected President, to fill the vacancy caused by the death of his father, the late J. H. Van Dorn, who was the head of the company for 35 years.

Mr. C. M. Cott, formerly with the engineering staff of the McClintic-Marshall Co., of Pittsburgh, Penn., and recently Chief Engineer of the Champion Iron Co., Cleveland, Ohio, has been appointed Manager of the new Cleveland office of the Trussed Concrete Steel Co., of Youngstown, Ohio.

Mr. E. M. Mohrman, recently Superintendent of Construction and Division Engineer of the Twin Falls Land & Water Co., Twin Falls, Idaho, has accepted a position with the Trussed Concrete Steel Co., of Youngstown, Ohio, with headquarters at the newly established offices of the company in Cleveland, Ohio.

Edward J. Kunze, M. Am. Soc. M. E., who for the past four years has been Assistant Professor of Mechanical Engineering in charge of machine design and construction at the Michigan Agricultural College, has been appointed Professor of Mechanical Engineering in charge of the department of mechanical engineering at the Oklahoma Agricultural and Mechanical College.

Mr. T. Coleman du Pont is reported to have abandoned his plans to build a $2,000,000 highway for the state of Delaware because of the opposition which developed against the acquisition of land for right-of-way. The engineering force gathered to build the road, the organization of which was described in "Engineering News" of Jan. 25, 1912, has been disbanded. Mr. du Pont has already spent about $100,000 on the project.

Mr. Thomas D. Pierce, Assoc. M. Am. Soc. C. E., recently Assistant Engineer, Valuation Department, Toledo & Ohio Central Ry., has been appointed Appraisal Engineer of the Public Utilities Commission of Ohio. The appointment was received through a civil service examination, in which Mr. Pierce ranked high. He is a graduate of Case School of Applied Science, Cleveland, Ohio, and has had about ten years experience in railway location and construction, and in appraisal work.

Messrs. J. C. McGormley and J. J. King, formerly of Toledo, Ohio, have formed the McGormley-King Co., with offices at 641 Engineers' Bldg., Cleveland, Ohio. Mr. McGormley was Secretary and Treasurer of the De Vare-McGormley Co., Industrial Engineers of Toledo; and Mr. King was employed in a similar capacity with the Henehan-King Co., General Contractors, also of Toledo. The new firm will specialize in industrial engineering, particularly the design and construction of factory buildings.

Messrs. John Garretson Eadie, Mortimer Freund and James Kenneth Campbell announce that they have established the firm of Eadie, Freund & Campbell, Consulting Engineers, 7 W. 45th St., New York City. The new firm will specialize in the design and supervision of installations for the heating, ventilation, lighting, plumbing, water supply, refrigeration and automatic sprinkling of all classes of build-

[illegible] industrial establishments.

The New York State College of Forestry at Syracuse, N. Y., has added [illegible] Prof. J. Fred [illegible] of the Department of Forestry at [illegible] College, is to take charge of ex[illegible] work in forestry. Mr. [illegible] W. Allen, Deputy [illegible] U. S. Forest Service, a graduate in forestry [illegible] State College, will [illegible] extension [illegible] forestry. Mr. [illegible] C. Adams, recently at the University of Illinois, has been appointed Forest Zoologist. [illegible] L. H. [illegible] University of Michigan, has been appointed [illegible] and Dr. H. [illegible] of Cornell University, has been appointed Forest [illegible]

Mr. [illegible] Whitham, Assoc. M. Am. Soc. C. E., has [illegible] as Chief Engineer of the Port of Seattle to engage in [illegible] practice with offices in the New York Bldg., Seattle, Wash. The Seattle harbor improvements which have cost [illegible] are now practically completed. Mr. Whitham will be associated with Mr. George W. Evans, M. Am. [illegible] Chief of Coal [illegible] U. S. Geological Survey. Mr. Whitham as Chief Engineer of the Seattle Port Commission has [illegible] of the design and construction of [illegible] terminals in the [illegible] Waterway, Central [illegible] and warehouse, the Smith Cove Pier, Salmon Bay [illegible] and the East Waterway [illegible] basin and improvements including a very large grain elevator and cold storage warehouse. Mr. Whitham has previously been Chief Engineer of the Seattle Public Utilities Department, and also Engineer of the [illegible] Port Commission.

Dr. [illegible] J. McLaughlin, Surgeon, United States Public Health Service, has been appointed Commissioner of Health of Massachusetts at a salary [illegible] per annum for a term of [illegible] years. The position is a new one created by a law which went into effect Aug. 6, 1914, abolishing the old State Board of Health, whose executive officer was the Secretary, and establishing a State Department of Health, of which the newly appointed Commissioner is the Chief. The law creating the new department was reprinted in our issue of July [illegible] and commented upon in the editorial columns of [illegible] issue, July [illegible]. Dr. McLaughlin was born in [illegible] June [illegible] 1872. He graduated at the [illegible] in [illegible] and at the [illegible] College of [illegible] in [illegible]. In [illegible] he was appointed Acting Assistant Surgeon [illegible] Public Health and Marine Hospital and was promoted through successive grades to be Surgeon in 1912. He served both in this country and abroad and from 1898 to [illegible] was Acting Director of Health for the Philippine Islands. In [illegible] and [illegible] he was in charge of the federal investigation of sewage pollution of the Great Lakes and the [illegible] and since [illegible] has been Chief Sanitary Expert and Director of [illegible] for the International Joint Commission.

OBITUARY

[illegible]

[illegible]

[illegible]

[illegible]

...served with the Lighthouse Service, and during this period he had charge of construction of several large lighthouses on the Gulf Coast, among them the [illegible] Light, which is a difficult structure some [illegible] miles from shore, presenting many difficulties in construction.

A. Considère, Inspector General, retired, of the Ponts et Chaussées of France, has just died at the age of 72. M. Considère was probably better known in America than any other continental European engineer, particularly in the field of testing materials and of concrete. A large part of his professional career was spent at Quimper, where, while serving as an engineer in his corps, he devoted so much attention to the testing of materials. He was one of the earliest of modern engineers to investigate thoroughly the properties of concrete, and particularly of reinforced concrete. In 18[illegible] Considère published the results of his researches on mortars, concretes and reinforcement, a book which immediately took its place as the foremost exposition of the subject. It was as a result of his investigation published at this time that he announced the well known theory that the conjunction of steel and concrete gave to each of the two materials certain properties which separately they did not possess. This theory was accepted by the scientific world for a number of years but was later disproved by the famous [illegible] tests at the University of Wisconsin. Considère's name is also connected with another radical development in reinforced concrete, namely, the hooped column, which he devised some years ago. He was a prominent member of the International Association for Testing Materials and was prominently spoken of for the presidency of the International Commission on reinforced concrete established in 190[illegible]. Since his retirement, some years ago, M. Considère has been at the head of a bureau for testing materials which he established in Paris.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 12-16. Annual convention at Atlantic City, N. J. Secy., E. B. Burritt, 29 West 39th St., New York City.

NATIONAL COUNCIL FOR INDUSTRIAL SAFETY.
Oct. 13-15. Annual Safety Congress at Chicago, Ill. Secy., W. H. Cameron, Continental [illegible] Building, Chicago.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
Oct. 20-22. Convention at Los Angeles, Calif. Secy., C. A. Lichty, 319 North Waller Ave., Chicago, Ill.

INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS.
Oct. [illegible] Annual convention at New Orleans. Secy., James McFall, Roanoke, Va.

AMERICAN GAS INSTITUTE.
Oct. [illegible] Annual meeting in New York. Secy., George G. Ramsdell, [illegible] W. [illegible] St., New York City.

NORTHWESTERN ROAD CONGRESS.
Oct. [illegible] Congress at Milwaukee, Wis. Headquarters [illegible], Milwaukee, Wis.

AMERICAN ROAD CONGRESS.
Nov. 9-13. Atlanta, Ga. Permanent headquarters, American Highway Association, Colorado Building, Washington, D. C.

INDUSTRIAL WELFARE AND EFFICIENCY CONFERENCE.
Nov. [illegible] Conference at Harrisburg, Penn. Secy., R. M. [illegible], Harrisburg, Penn.

NATIONAL MUNICIPAL LEAGUE.
[illegible] Annual meeting at Baltimore, Md. Secy., Clinton Rogers Woodruff, North American Building, Philadelphia, Penn.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.
[illegible] Annual meeting at Columbus, Ohio. Secy., F. [illegible], Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
[illegible] Annual meeting at New York. Secy., W. H. Ross, [illegible], New York City.

AMERICAN PUBLIC HEALTH ASSOCIATION.
[illegible] Annual meeting at Jacksonville, Fla. [illegible] Prof. Selskar M. Gunn, Massachusetts Institute of Technology, Boston, Mass.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. [illegible] Convention at Washington, D. C. Secy., [illegible] Washington, D. C.

AMERICAN MINING CONGRESS.
Dec. [illegible] Annual meeting at Phoenix, Ariz. Secy., J. F. Callbreath, Denver, Col.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.
Dec. [illegible] Convention at Richmond, Va. Secy., [illegible] W. [illegible] St., New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Dec. [illegible] Annual meeting at New York City. Secy., [illegible] W. [illegible] St., New York City.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Dec. [illegible] Annual meeting at Madison, Wis. Secy., F. M. [illegible], Madison, Wis.

Engineering News

VOLUME 72 | OCTOBER 15, 1914 | NUMBER 16

Palace of Horticulture and Dome, Panama Pacific Exposition

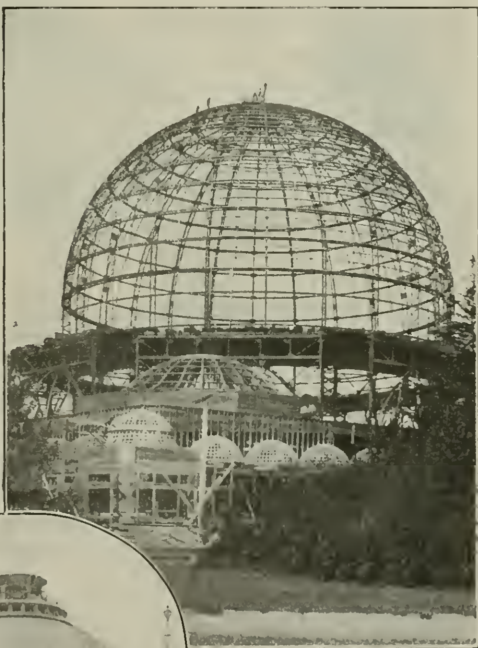
By A. W. Earl and Thomas F. Chace*

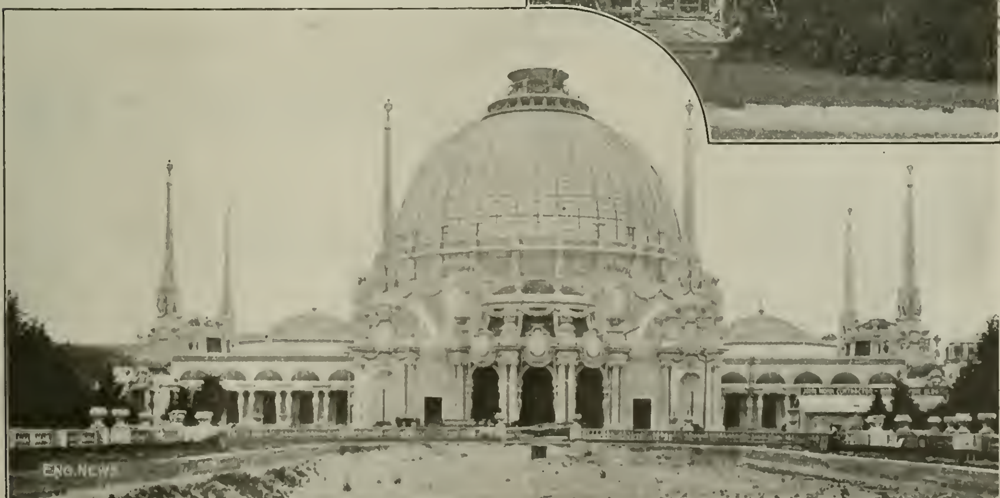
The recently completed Palace of Horticulture at the Panama-Pacific Exposition has a dome that ranks among the largest steel domes and in fact among the largest domes of any kind in the world. The size of this structure, coupled with a desire to keep the framework light and airy in conformity with the character of the building, made a careful study of the design well worth while. Many interesting problems arose in the course of this study. The character of the framing and the methods of analysis by which the designs were worked out will be set forth in future articles by the authors. For the present a brief description of the building is given.

The Palace of Horticulture is rectangular in plan, approximately 660x300 ft., and covers an area of 4½ acres.

The eastern or main portion is square in plan and forms the base for the imposing glass-covered dome, the salient feature of the design. The dome is a hemisphere 152 ft. in diameter, resting upon a cylinder of the same diameter and 25 ft. high. It is surmounted by an architectural staff motive in the form of an immense flower basket. The extreme height from the ground to the top of the basket is 186 ft. Rising from the low roof and intersecting the large dome are eight small glazed half-domes, and at the four corners of the square are four octagonal domes of timber construction. The main entrances on the north, east and south sides are accentuated by elliptical domes built of wooden lattice-work. On either

*Asst. Structural Engineers, Panama-Pacific International Exposition, San Francisco, Calif.



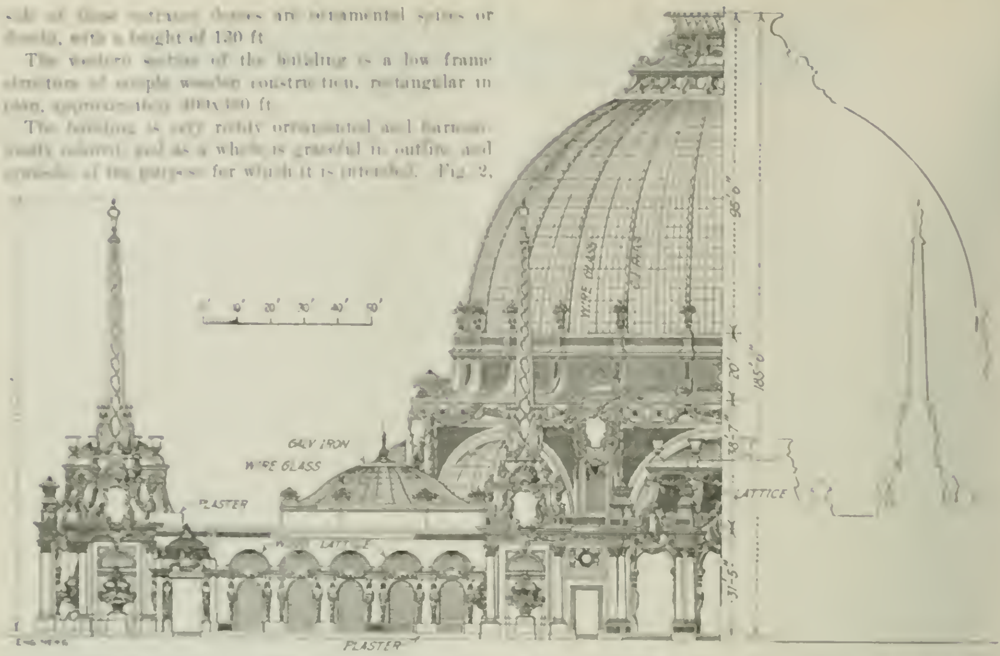


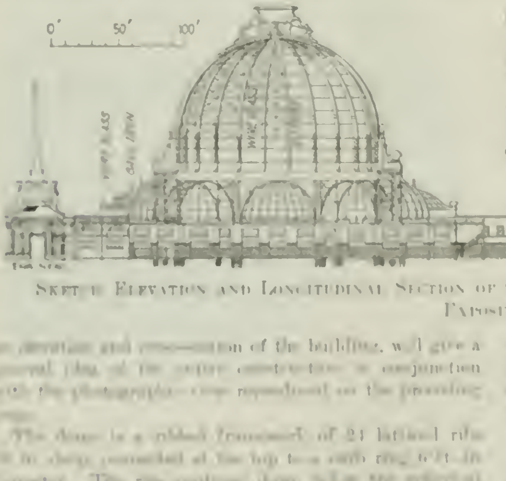
The Palace of Horticulture of the Panama-Pacific International Exposition at San Francisco
(The great glass-covered dome, 152 ft. in diameter, has a steel frame, but the rest of the building is largely wood-framed.)

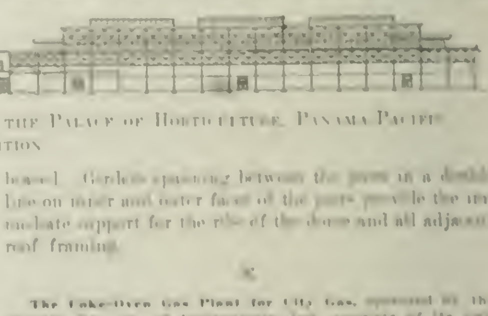
side of these entrance domes are ornamental spires or domes, with a height of 130 ft.

The western section of the building is a low frame structure of simple wooden construction, rectangular in plan, approximately 400x180 ft.

The building is very richly ornamented and harmoniously colored, and as a whole is graceful in outline and symbolic of the purpose for which it is intended. Fig. 2, an elevation and cross-section of the building, will give a general idea of the entire construction in conjunction with the photographs reproduced on the preceding page.







SKETCH ELEVATION AND LONGITUDINAL SECTION OF THE PALACE OF HORTICULTURE, PANAMA-PACIFIC EXPOSITION

The dome is a ribbed framework of 24 latticed ribs 36 in. deep, connected at the top to a crown ring 6 ft. in diameter. The ribs continue down below the spherical part as straight vertical members a distance of 23 ft. The dome is, however, [illegible] at the springing line of the dome by a [illegible] horizontal tie ring. At the foot of the vertical portion of the rib no thrust is taken; the ribs rest simply on girders.

The main ribs are connected by 11 horizontal lattice girder rings. These act both as tension rings and as main purlins, carrying secondary ribs or rafters of 4-in. I-beams, on which rest wooden purlins supporting the skylight bars. Adjustable diagonal rods brace all panels between ribs and rings.

The total weight of steel in the dome, above the plate-girder supports of the ribs is 300 tons.

The dome is carried by eight piers 65 ft. high above ground level. Each of these consist of four columns braced in trapezoidal arrangement, 4 ft. 6 in. apart on the inner face, sides diverging at an angle of 45°, and 15 ft. 10 in. deep in a direction radial to the dome. On the diverging side the pier bracing extends only down to a height of 14 ft. 7 in. from the floor, where a passageway occupies the clearance. Except for this the pier is fully braced. Girders spanning between the piers in a double line on inner and outer faces of the piers provide the immediate support for the ribs of the dome and all adjacent roof framing.

The Coke-Oven Gas Plant for City Gas, operated by the Citizens Gas Co., of Indianapolis, Ind., consists of its new plant of 100 by-product coke ovens [illegible] and a second plant [illegible]. The total carbonizing capacity is [illegible] tons per day respectively. The old water-gas and coal gas plants of the Indianapolis Gas Co. (now controlled by the Citizens Gas Co.) were operated for a time, but since March, 1914, only coke-oven gas has been produced. During the first half of 1914, the total coal carbonized was [illegible] tons, with a production of [illegible] tons of coke, all of which has been sold, while the output for the remainder of the year has been sold also. The sale of the by-products has been satisfactory. The production of gas (exclusive of that used for oven heating) was as follows: Coke-oven gas, [illegible] cu.ft.; water-gas, [illegible] cu.ft. and coal gas, [illegible] cu.ft. Of the total [illegible] cu.ft., about [illegible] cu.ft. were used under boilers and [illegible] cu.ft. were sold to consumers. The average heat value was [illegible] B.t.u. for the gas from the [illegible] plant and [illegible] B.t.u. for that from the [illegible] plant.

Gravel-Road Construction in Wisconsin

Wisconsin is one of the states in which gravel is plentiful and has been used extensively for road construction, and under the present system of state aid and supervision in highway work a considerable amount of work is being done in the construction and improvement of gravel roads. For information as to this work we are indebted to A. R. Hirst, State Highway Engineer (at Madison), and W. M. de Berard, District Engineer (at Milwaukee).

The old practice in building such roads was to dump loose gravel, to be consolidated and worn down by traffic. The road was then neglected entirely until certain parts were practically destroyed, when holes and low spots would be filled with loose gravel deposited in the same way and usually in excessive quantities. Traffic would keep to the sides of these mounds of gravel, gradually forming a new roadbed and making eventually a very irregular line of road. One of the lines of work of the Wisconsin Highway Commission is to secure the proper use of this excellent material, and the proper maintenance of the roads built with it. The old road makes an excellent foundation for the new surface.

It is not always easy to secure the necessary coöperation of the local authorities or to make them realize that they are spending much more in this ineffective repair work than would be required for the proper reconstruction of the roads.

There has been a little difficulty also in initiating the construction and improvement of gravel roads by the Highway Commission, due to a general feeling in the rural districts that they needed no instruction in making roads of gravel. There was an impression also, that as Wisconsin has an abundance of limestone quarries the state authorities would substitute stone for gravel and thus greatly increase the cost, to the benefit of the stone companies. However, these latent suspicions are disappearing, as it is now being realized that it is the endeavor of the Commission to use local material where possible, and to combine strict economy and good work in all its road work.

Use of Varying Qualities of Gravel

While gravel exists in large quantities and over a large area of the state, it is of very varying character, requiring different methods of treatment to adapt it for making good roads. Practically no two gravels are alike, even though obtained from neighboring pits. For this reason it is required that deposits proposed to be used by local authorities on state-aid roads must be examined and approved by the engineers of the Commission.

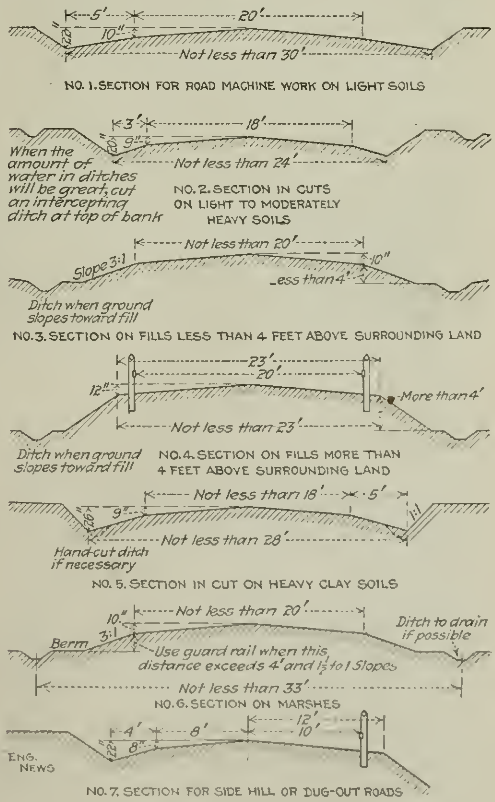
In certain cases the material is of such size and of such cementing character that the pit-run gravel can be put directly into the road. As a rule, however, it contains stones too large for use in the surface course, so that crushing and screening are necessary. Many deposits have too large a proportion of sand, while the sand is of a non-cementing character. In such cases the addition of clay as a binder may easily make the material suitable for use. In some locations washed gravel (prepared for concrete use) is available, and may be rendered satisfactory by the addition of clay and limestone screenings.

The gravel stones are usually very hard, and a gravel road is, therefore, more durable than one built with limestone or shaly stone, although local authorities may be inclined to prefer the latter on the general assumption that a "stone road" is a "hard road." Another favorable property of the gravel road is that it tends to wear evenly, and is much less liable to develop the holes and low spots which give a very rough riding surface to a partly worn road of soft stone. At the same time the gravel road is much less dusty. It is also less costly, even from the point of maintenance, as ordinary traffic suffices to compact loose gravel used to repair ruts and holes, if care is taken to select gravel having a percentage of clay or being of a cementing quality.

The width of road surface is 18 to 20 ft., with a 9-ft. graveled surface and 5 ft. shoulder on each side. On main roads with heavy traffic the graveled width is 18 ft. The form of roadbed used under different conditions is shown in the accompanying cut; these sections apply to finished gravel and macadam roads with 9-ft. surface, and also to earth roads. It will be noticed that with fills of over 4 ft. in height a post-and-rail fence is used for the protection of traffic. In some cases deviations or cutoffs are made to eliminate steep grades. Land may be condemned for these purposes, and the abandoned roadbed then reverts to the owner of the adjacent land.

Road Construction with Crushed Gravel

A majority of the gravel road work is done with



Standard Cross-Sections for Gravel, Macadam and Earth Roads in Wisconsin (with Gravel or Macadam Surface 9 Ft. Wide)

crushed gravel. The crushing and screening are done at the pit, which is selected as near as possible to the work, and a portable plant is used, since the jobs are usually short ($1\frac{1}{2}$ miles to 2 miles). One plant, which in many respects is typical, may be described as follows.

The gravel formed a small hill, with practically no stripping beyond the removal of sod, and was excavated by two or three wheeled scrapers working over a circular surface on the slope. At the lower side of the path the gravel was deposited beside a platform, beneath which was the portable crusher, of jaw type, adjusted for a product of $\frac{1}{2}$ to $3\frac{1}{2}$-in. size. A team at the lower level, on which the crusher stood, moved to and fro, pulling a slip scraper crosswise of the pile of material dumped from the wheel scrapers, and delivering it to the hopper of the crusher. A length of cable led from the team to the scraper.

An elevating conveyor raised the product to a three-size revolving screen, grading the material into screenings, $\frac{1}{2}$- to 2-in. stone, and 2- to $3\frac{1}{2}$-in. stone. In order to have a proper proportion of fine material, a part of the "screenings" section of the screen was wrapped with felt or sheet iron, so that both fine and coarse material would travel along to the coarse end of the screen. The crusher, elevator and screen were driven from a 20-hp. traction engine. The screen was over a three-compartment storage bin, with side chutes for loading the wagons.

From two to four drop-bottom dump wagons were used to convey the material to the road, according to the length of haul. The coarse material for the lower layer was dumped on a carefully prepared subgrade and was spread with rakes to a thickness of from 5 to 6 in. (seldom less than 4 in.), depending on the character of base soil or subgrade. Screenings or clay was then applied to prevent creeping under the roller and to secure good compaction, as the binding of the second course takes place over the same, and with much better ease. This latter course was placed in the same way, to a depth of from 4 to 5 in. (seldom less than 3 in.), rolled dry, meanwhile screenings were spread until all the stone was covered. Then it was sprinkled and rolled thoroughly, giving the road a finished thickness of from 6 to 8 in., dependent on the depth of [illegible] placed.

An average force for such a job as described above would be about as given in the accompanying list: One foreman, one engineman, one helper, two or three men with wheeled-scraper teams (or wheelbarrows), two men with slip-scraper team, [illegible], two to four men with dump wagons, one team [illegible] screenings, one roller driver, one tank wagon driver, and water boy.

In another case, no scrapers were used, but three men at the pit [illegible] the gravel into wheelbarrows which an equal number of men wheeled to the crusher on planks [illegible]. These crews work six 10-hour days per week.

Such a force as [illegible] will build about [illegible] ft. of road per week, depending upon the amount of grading and finishing work to be done. The cost of the gravel at the pit is usually about [illegible] per cu.yd. The cost of gravel roads built in this way averages [illegible] per sq.yd., which includes the grading of [illegible] and [illegible] culverts (all of which are of concrete).

In some localities good bonding gravels are scarce, but sandy gravels are available. These latter may be adapted for the purpose by the application of clay binder, suitable clay being generally found near the site. The best clay is that which breaks up into almost granular form, so that it mixes thoroughly with the gravel. The lower course is deposited, the clay spread and worked in as evenly as possible, and rolled. A manure spreader has been used to advantage in cutting and spreading the clay, and a farm drag or pulverizer in working it upon the road surface. The top course is then applied, rolled dry and covered with screenings; then thoroughly wetted and rolled until the clay is brought to the surface, after which it is left to dry out. At times a light application of sand or limestone screenings is applied to prevent the surface from picking up in case of rerolling and future travel.

It is considered advisable to oil the gravel roads when funds permit, and to do this the first year on roads subject to heavy traffic or those built early in the season, instead of allowing the road to wear for a year before this treatment.

Machinery

Each county has its own equipment, purchased usually by a committee of the county board, and generally in accordance with the advice or suggestion of the district engineer. The outfit includes road plows and graders, wheel and slip scrapers, water-sprinkling wagons, steam or gasoline rollers (10-ton usually), crushing and screening plant, and sometimes an oil-sprinkling wagon. In some cases farm dump wagons with flat bottoms are used, but where the money can be afforded the drop-bottom wagons are preferred. There is a tendency to use small water wagons with the result that there is often difficulty in keeping the work well sprinkled at the proper time. A 400-gal. tank is very generally used, but a 600-gal. tank is considered preferable and could be handled as easily on the work.

Organization

A brief description of the organization of the Wisconsin State-aid road work was given in ENGINEERING NEWS, June 25, p. 1319. The State Highway Commission has nothing to do with roads outside of this system. A township desiring the improvement of a road within its boundaries, with State aid, must vote an appropriation (not less than $400), the county and state then appropriate equal amounts, making a minimum of $1200 for the work in the township. The state-aid system of roads throughout the state is divided into seven districts, each of which is in charge of a district engineer of the Commission. These men spend most of their time visiting the various jobs, keeping in close touch with the county highway commissioners and with the foremen in direct charge of the work.

This system of organization, whereby the local authorities initiate a piece of work and the local county highway commissioner takes the responsibility for its successful completion under the general supervision and advice of the State Highway Engineer and his assistants, has the advantage of establishing close and friendly relations between the local authorities and the State Highway Commission, avoiding jealousy or antagonism which may arise where the local authorities or the men on the work get the idea that the Commission is simply a set of officials issuing orders from an office in the capital.

An exact and reliable record of cost is essential, so that the local authorities may be informed as to the detailed

of their money. The foreman makes daily report on a printed blank as to his force and work, and makes also a weekly report which shows his payroll. In this way he sees how his money is holding out in relation to the work to be done. These reports are given to the road commissioner, and at the end of the season a summarized cost report is made to the district (state) engineer, who measures up the work and (if it has been done according to the prescribed plans and methods) accepts the road for the state, with recommendation as to whether it should be turned over to the county for maintenance.

This being done, the county is required (under the law) to provide a continuing fund for the inspection and maintenance of the road. This maintenance then comes under the supervision of the district engineer, so that the new road will not be subject to injury by neglect or by the dumping of wagon loads of loose material for "repairs."

The system has worked very well in the short time it has been in operation, and the rural public generally has recognized its value. Thus there is a decline from the old sentiment that while the state should provide money the local authorities should have the spending of it, free from any state supervision.

Most of the road work is done by day labor, as the individual jobs are too small to pay a contractor to put his plant on them, and he could not be sure of getting a sufficient number of jobs to make the work worth while. The concrete road work, however, is done mainly by contract, although in Milwaukee County the county board has its own equipment and builds a large amount of concrete roads.

A New Medal to be awarded to those workers in physical science or technology, whose efforts have done most to advance the knowledge of physical science or its applications, has been established by the Franklin Institute through the gift of $6000 by Samuel Insull, of Chicago. The medal is to be known as "The Franklin Medal" and is to be made of gold of an intrinsic value of about $75. In case the income from the endowment creating the medal should be more than sufficient for the purchase of the medals, the medal may be accompanied by a premium to the recipient.

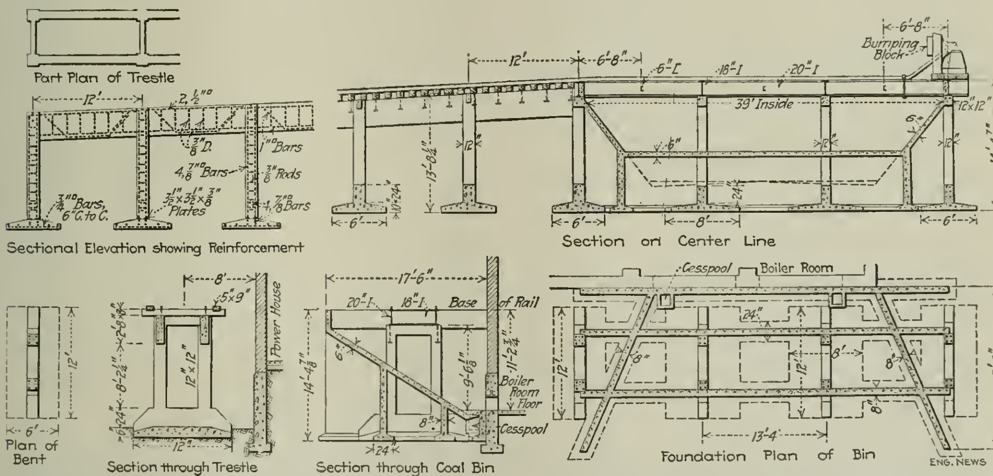
Concrete Trestle and Coal Bin

A coal bin and inclined trestle approach of reinforced concrete is an interesting feature of the new tie-treating plant of the Louisville & Nashville R.R. at Guthrie, Ky. The construction is shown in the accompanying cut.

The bin is alongside the boiler house, and is of hopper shape, with the ends and one side inclined. The other side is open to the boiler house, and the bottom slopes to the level of the floor so that coal is handled directly to the boilers. Its sides and ends are supported by a framing of longitudinal and transverse concrete walls, having broad footings on the red clay soil. The ends and two intermediate concrete bents support a pair of track stringers of 20-in. I-beams, between which are framed 18-in. I-beams and 6-in. channels. Upon the stringers are bolted the track rails. This open construction provides for free flow of the coal from hopper cars. The bin has a capacity of about 100 tons.

The approach trestle is on a grade of 4%. It is composed of a pair of 10x32-in. girders in 12-ft. spans between concrete bents. Each bent has a broad footing 12x6 ft., with two 12x12-in. posts, the posts being connected by a cross wall at the bottom and a strut at the top. All of this is a monolithic concrete structure, as shown at the left of the cut. Anchor bolts embedded in the girders for securing alternate ties provide against movement of the track on the incline. The ties are 8x8 in., 9 ft. long, laid directly upon the girders, and carry outside guard timbers 5x9 in.

The work was done under the direction of W. H. Courtenay, Chief Engineer, and J. B. Lindsey, Superintendent of Timber Treating Plants.



Reinforced-Concrete Coal Bin and Trestle at Guthrie, Ky.; Louisville & Nashville R.R.

The Natural-Gas Gasoline Industry in this country has become of importance in the last three years. The production in 1913 amounted to 24,060,817 gal. valued at $2,458,443, an average price of 10.22c. per gal. as compared with a production of 12,081,179 gal. valued at $1,157,476, in 1912, and 7,425,839 gallons, valued at $531,704, in 1911. In 1913, West Virginia produced 7,662,493 gal., Oklahoma, 6,462,968; Pennsylvania, 3,680,096; California, 3,460,747; Ohio, 2,072,687; the balance was produced by Illinois, Colorado, New York, Kentucky, and Kansas.

Protecting Steelwork Against Locomotive Blasts

One of the greatest problems in the design of steel grade-crossing bridges is the protection of the floor systems and lower chords against the sand blast action of the locomotive exhaust and the corrosive effect of the locomotive gases. The requirements of grade are practically always such that the clearance above the locomotive stack is very small (in some well known instances less than 12 in.), so that the locomotive blast plays directly on the lower part of the bridge, and if it be not thoroughly protected, causes its very early destruction. In the cities of Buffalo and Cleveland, a great amount

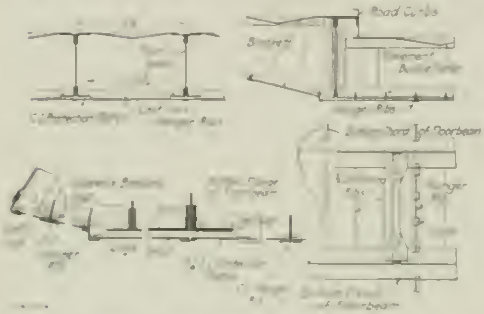


Fig. 1. Methods of Protecting the Under Side of Street Bridges against Locomotive Blasts

([illegible] Robert J. Reidpath & Son for the [illegible] Viaduct, Buffalo, N. Y.)

of grade-crossing work has been done, and a number of different methods of protecting the lower parts of the steel bridges have been tried.

In 1913, Robert J. Reidpath & Son, consulting engineers, made a report to the city of Buffalo on the condition of a number of the steel overhead grade-crossing bridges in that city. They found that a great number had been seriously affected by the locomotive blast and described their condition in the following paragraphs, which indicate the extent of such action:

[illegible]

where the locomotives are operated most frequently in switching, etc.

The trusses and floor-beams are eaten away in places where the [illegible] protection has been forced off by the action of the blast from the locomotives exhausting and by [illegible] chunks of this concrete varying in weight up to twenty-five pounds are [illegible] daily and endangering the lives of the [illegible] working below.

In the [illegible] St. Bridges, over the Pennsylvania, New York Central and Lake Shore tracks and the Hamburg St. Bridge over the same, the steelwork above the lower chords and the floor system is in fairly good condition although there is quite an accumulation of rust that should be removed and the steel painted.

The floor systems are in a very bad condition. The most important members, those supporting the ends of the floor-beams and their loads, will not last but a little while longer and are liable to fail at any time under an unusual load suddenly applied. Originally the steel in the flanges in these girders was [illegible]-in. thick. In some places nothing is left; in other places where it is not entirely gone it varies in thickness from [illegible]-in. up to [illegible] original thickness according to location. The webs of these girders were [illegible]-in. thick; they are now only [illegible] in. thick.

Many of the steel cantilever brackets that support the sidewalks are eaten away to such an extent that in places there is no steel left and what remains is only [illegible]-in. thick.

The flange angles of the floor-beams when built were [illegible] in. thick, many of them have been eaten away until there is only [illegible]-in. of metal left and in some places only [illegible]-in.

The short plate girders between the floor-beams over which the tracks of the street car [illegible] are laid, are in many instances almost eaten away. The web plates were originally [illegible]-in. thick, they are now less than [illegible]-in. thick. In some places one-half [illegible] of the flange angles are gone.

The [illegible] bottom chords of these structures were cleaned and painted in 1911-12; previous to that they suffered severely from corrosion and the effects of gas and smoke from the locomotives. Where they are subjected to the direct action of the exhaust from the locomotives, the paint is [illegible] and they are again badly rusted.

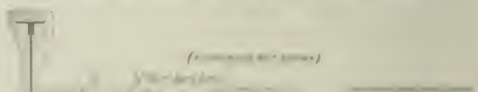


Fig. 2. Cast-Iron Plate Protection, Quincy Ave. Grade Crossing, Cleveland, Ohio

[illegible]

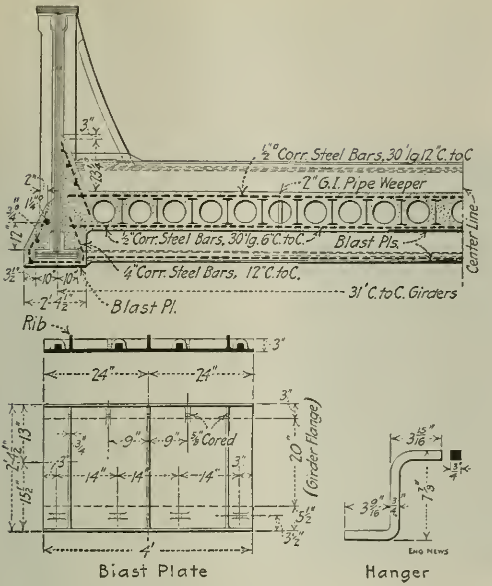


Fig. 3. Cast-Iron Blast Plate on Cleveland Short Line-Nickel Plate Grade Crossing, Cleveland, O.

many years, but the floor systems and parts of the lower chords and several of the piers and abutments must be rebuilt. In doing so, proper precautions should be taken to prevent the gases and smoke from the locomotives injuring them. The natural corrosion can be almost entirely prevented by properly and frequently painting them after they are once more cleaned.

This report indicates that there was a deplorable lack of inspection and maintenance in all of the structures mentioned, which accounts for the serious deterioration they suffered, but at the same time it is evident that the lower parts of the bridges, subjected to the locomotive blast, were affected more than the remainder of the structure.

To guard against this action, the several methods noted below have been tried:

Cast-Iron Plates—It is generally conceded that cast-iron plates withstand the sand-blast action of the exhaust as well as, or better than, any other material, but they are needed only in the path of the locomotive stack. A durable coating, light in weight, which possesses qualities of protecting portions of the structure adjacent to the tracks and between them against injury from steam and gas must be found if the cost of separating grades by carrying the streets over the railroads on long viaducts is to be kept down to what the city and railroads can afford to pay. The method of encasing or embedding the steel-floor system in concrete with cast-iron plates to take the sand-blast action is positive, but it adds considerably to the cost.

A very good example of the cast-iron plate protection is shown in Fig. 1, which is the viaduct across the New York Central, West Shore, and Erie railroads at Chicago St., Buffalo, one of the first crossings to be eliminated. This was closed to all traffic a shore time ago because of its dangerous condition, and to permit extensive repairs, consisting of reinforcing or replacing members damaged principally by locomotive exhaust. Reconstruction plans include the placing of a ceiling of cast-iron plates over the tracks according to design by Robert J. Reidpath & Son. It will be noticed that the lugs and hanger ribs as well as the plates are of cast-iron. Inasmuch as it will be difficult to inspect the steel after the plates are up, penetration of the gases through the interstices between them will be prevented by plastering them on the back with cement mortar. One thought was to fill the interstices with lead and oil.

Fig. 2 shows the method of applying cast-iron plates to the base of the concrete incasement of the girders in the Quincy Ave. grade crossing of the Nickel Plate R.R. in Cleveland. Here the minimum clearance is 16 ft. 3

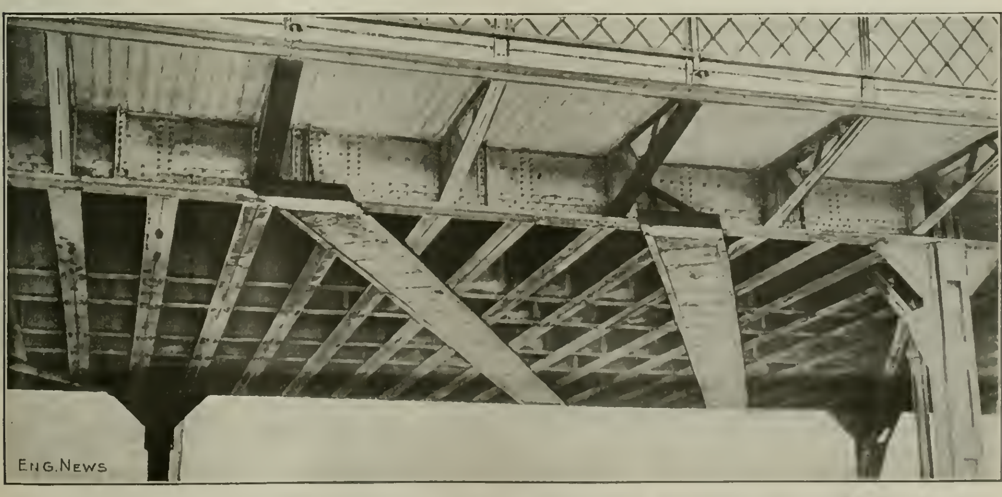


Fig. 4. Under Floor of Hamburg Turnpike Viaduct, Buffalo, N. Y., Showing Cast-Iron Blast Plates and Cement Grout over Red-Lead Oil Paint

in. To incase in concrete each floor-beam, which are about 3 ft. c. to c., on this bridge, required expensive forms and great care in placing concrete. The mix was quite wet in order that it would run from above and completely fill the form around the lower flange. Silica gravel, such as is used to finish parkways, was used instead of crushed stone for the aggregate.

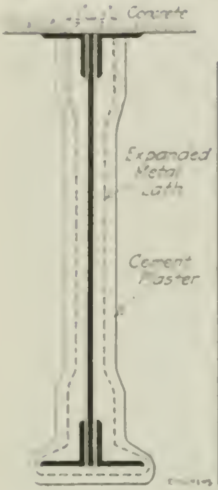


Fig. 5 Fig. 6

Figs. 5-6. Elk St. Viaduct over Railways, Buffalo, N. Y.

Fig. 5. Detail of floor beam showing concrete protection. Fig. 6. Underside of floor after concrete was removed. Cement mortar fell from dark spots. Light areas where concrete was taken off for safety.

Fig. 9 gives the details of the cast-iron protection plates on the Nickel Plate-Cleveland Short Line crossing at Cleveland.

Another instance of this cast-iron locomotive protection plate is shown in Fig. 4, which is the Hamburg Turnpike viaduct over the Buffalo Creek R.R., at Buffalo. Here, cast-iron plates carried by cast-iron hangers resting on the lower flanges of the floor-beams take the blast from the locomotive exhaust.

CONCRETE COATING.—One of the most popular methods of protection is to plaster a cement mortar coat directly onto the lower part of the floor girders, generally holding it on with a wire mesh or expanded metal reinforcement. This gives fair protection under certain circumstances, when the concrete is thick enough or the reinforcement far enough from the surface, but there have been some places where it has failed. Figs. 5-6, which show the Elk St. viaduct over a number of railways in Buffalo, illustrate one such case. About six years ago, floor-beams and stringers of this structure were incased in thick cement mortar plastered on expanded metal lath. It served its purpose fairly well for a time except over the center line of tracks, where it was rapidly cut away. Recently, the concrete protection began to fall in chunks from the lower flanges of the floor beams, endangering traffic and men passing beneath, and, at the request of the railroads, the city removed the portion from beneath the lower flanges.

The weak point was at the outer edge of the lower flange of the floor-beams, with which the metal lath was left in contact during construction. No space was left between the lath and the edges of the angles, with the result that rusting set up and destroyed the lath. Vibration, due to trains passing beneath and traffic overhead, broke the plaster at these lines of contact. The gases appeared to have no effect on the plaster other than to darken it about 1/4 in. deep. If the reinforcement were a little sturdier, and care were exercised to have it bedded in the mortar, this method of protection, in combination with cast-iron plates over the center of the tracks, would give satisfaction.

PAINT AND CEMENT COATING.—As noted above, that part of the floor not directly subjected to the sand blast usually requires some minor protection. A novel method of thus coating steel, applicable both to new structures and to old ones where no protection has been attempted other than painting, has been in use in Buffalo for a number of years. In principle, it combines in an inexpensive manner the properties of protection belonging to both paint and cement.

After the steel is erected, a coat of red lead and oil is applied, mixed in the proportions of 25 lb. of red lead to each gallon of linseed oil. While the paint is still wet, lake sand is thrown against it, so that the grains are embedded about half their diameter in the paint. After it is thoroughly dried, two coats of cement grout, creamy in consistency, and mixed in the proportions of one part of lake sand to one part of cement, are applied with brushes. The Hamburg Turnpike viaduct, shown in Fig. 4, has been treated in this fashion, outside of the cast iron plates over the track centers.

Costs of applying the sand blast and cement grout coats to the paint have not been kept separately, as the

Fig. 7

Fig. 8

Fig. 7. [illegible] Viaduct over Railways, Buffalo, N. Y. Fig. 8. [illegible] Beam Locomotive Blast Protection, [illegible] St. [illegible] Crossing, Buffalo, N. Y.

work was included in general specifications covering an entire job. Thus, at the Hamburg Turnpike, the contractor erecting the steel painted it and applied the cement grout. It is probable that the cement gun could be used to advantage to apply both the sand binder and the grout, guarding against getting the latter too thick.

On the Hamburg St. viaduct (distinct from Hamburg Turnpike), over the Erie, Pennsylvania, and New York Central railroads at Buffalo, the grout has been doing service for four years and is in good condition except over the tracks, no special provision being made to care for the sand-blast action. The method of combining paint and grout in a protective coating was originated by Capt. George H. Norton, deputy engineer commissioner.

Wood and Asbestos Boards—Another method of protection tried out was to ceil the underside of the viaduct with tongue and grooved boards nailed to 1x3-in. strips bolted to wood 3x3-in. hanger ribs resting on the lower floor-beam angles (Fig. 7). The boards shrunk in the dry summer months, admitting gases through the cracks. During the rest of the year they swelled so that the ceiling bulged and had to be taken down to keep it from falling on trains and men.

Still another method was to attach 1/4-in. asbestos lumber by means of 3/4-in. oak plugs to the under side of concrete encasing girders or floor beams. This method was first designed for the Amherst St. bridge over the New York Central R.R., at Buffalo, in 1908. A detail is shown in Fig. 8. This has been satisfactory except after several years the oak plugs become loose.

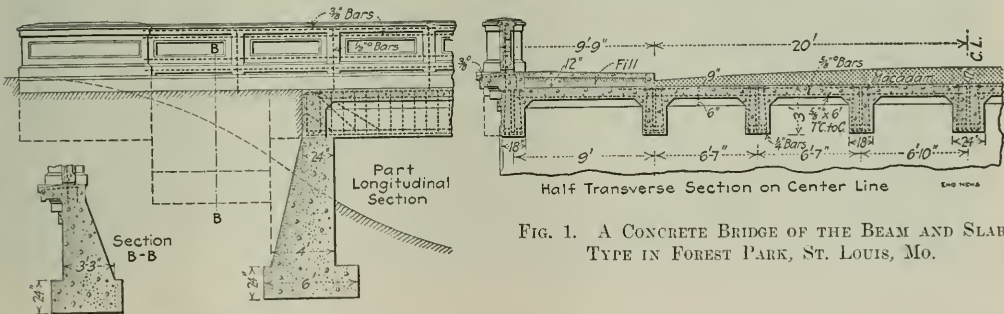


Fig. 1. A Concrete Bridge of the Beam and Slab Type in Forest Park, St. Louis, Mo.

A Park Bridge of Reinforced Concrete

Among the various engineering works for the improvement of Forest Park, at St. Louis, is a reinforced-concrete bridge carrying a main driveway over a storm-water channel. The clear span is 30 ft. and the length over parapet walls is 60 ft. The bridge has a 40-ft. roadway and two 9-ft. sidewalks. It is designed to carry a 10-ton steam roller and a load of 100 lb. per sq.ft. The bridge is of the beam and slab type, with nine beams 3 ft. deep (including the 9-in. slab). The concrete is a 1 : 3 : 4 mixture, made with broken stone, and the reinforcement is of deformed bars. The abutments and the side walls of the approaches are of gravity section.

A rough stucco finish was applied to the exterior, the forms being removed 14 days after the concrete was poured and the stucco coat (1 : 2) then plastered on a scratch coat over the concrete. This surface is relieved by a smooth brush finish for the concrete of the coping, string course, the panel moldings on the end pedestals, and the moldings of the open panels in the parapet wall. The contrast of the rough gray stucco with the smooth and lighter-colored concrete is very effective.

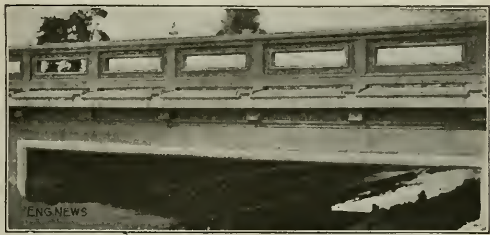


Fig. 2. Exterior Finish of the Park Bridge

(The darker part of the surface is a rough stucco; the coping, paneling, etc., are of smooth brush-finished concrete.)

The architectural details for the bridge were prepared by Geo. E. Kessler & Co., landscape architects, and the structural details by W. S. Will, of the Park Department of St. Louis. The bridge was built by the park forces under Nelson Cunliff, Superintendent of Construction, at a total cost of $4300.

The policy of the department is to do all its varied work by its own force rather than by contract. The force numbers some 125 men, engaged on concrete work of various kinds, paving and the multifarious items of work required in park improvement and maintenance. This force is under the direction of Mr. Cunliff. Dwight Davis is Park Commissioner.

Interior Fire Walls for safeguarding lives in hospitals and other public institutions, according to the plan developed by H. F. J. Porter, of New York City, have been adopted by the Department of Charities, New York City, and are to be installed in a number of the principal buildings. The department had requested from the Board of Estimate an appropriation of $200,000 to install on certain hospital buildings fire escapes and cylindrical chutes down which patients were to be slid in case of fire. Before action was taken by the Board of Estimate on this request, President McAneny had his attention called to the horizontal division fire-wall system described by Mr. Porter at the Baltimore meeting of the Society of Mechanical Engineers and in "Engineering News" of July 31, 1913. Expert investigation was made, and it was decided to install this system in place of fire escapes. The Department of Correction has also asked appropriations to construct similar walls in its institutions, which contain large numbers of inmates whose lives would be in peril in case of fire.

Flood Prevention Reservoirs in Bohemia

By Kenneth C. Grant*

Two [illegible] reservoirs for flood control are now nearly completed on the Elbe River, near its headwaters, in northern Bohemia. They are being built by the Commission for River Regulation in Bohemia. The Austrian government will pay 60% of their cost and the Bohemian government 40%.

Konigreich-Walde Reservoir

This project was begun in 1910, and in 1912 had reached the stage shown in Fig. 3, which was taken by

FIG. 1. GENERAL PLAN OF THE KONIGREICH-WALDE FLOOD-PREVENTION DAM, BOHEMIA

the writer in July, 1912. The dam is located on the Elbe River, just above Konigrinhof.

The annual rainfall over the entire drainage area above the dam averages 39.4 in. and varies between [illegible] in. and [illegible] in. The maximum 24-hr. rainfall occurred on July [illegible], 1897, and at one station, [illegible], reached 7.9 in., or 20.6% of the mean annual over the catchment area. The total rainfall at this station for this storm, July 27-31, was 11.1 in., or [illegible]% of the mean annual over the catchment area.

The maximum recorded discharge at the dam site, which occurred July [illegible], 1897, is [illegible] sec.-ft., or [illegible] sec.-ft. per sq.mi. The peak of the flood lasted for only [illegible] hr. The minimum discharge is [illegible] sec.-ft., or [illegible] sec.-ft. per square mile. The average low-water discharge is [illegible] sec.-ft., or [illegible] sec.-ft. per square mile.

The reservoir has a capacity of [illegible] cu.ft. and controls a drainage area of [illegible] sq.mi. [illegible] cu.ft., or [illegible]% of the capacity, will be kept empty for flood control. When full the reservoir extends 1.43 miles upstream from the dam and covers an area of [illegible] acres to a maximum depth of [illegible] ft.

The dam contains [illegible] cu.yd. of [illegible] masonry, and is [illegible] ft. high, [illegible] ft. wide on top, 184 ft. wide at the base and [illegible] ft. long on the crest. It is curved upstream with a radius of 656 ft. The great width of the base (91% of the height) is due to the fact that the dam is designed to take care of full uplift pressure. This was felt to be wise in view of the important towns, Konigrinhof, [illegible], etc., and the large industrial and other interests lying not far downstream. At the same time, every precaution has been taken to prevent any upward pressure due to the penetration of water into or under the dam. The upstream side has been provided with a watertight coating from the foundation up, and the interior of the dam has a complete drainage system. The maximum pressure at the toe of the dam, with full uplift pressure, is estimated to be about 12.8 tons per sq.ft. The borings and tests made of the sandstone upon which the dam is founded show that it will carry from 510 to 920 tons per sq.ft.

During construction, the river is being carried around the dam site in two tunnels, 19.7 ft. in diameter, bored through the solid rock of the hillsides. About 200 ft. above the main dam, and just below the upstream portals of the tunnels, is a low earthen diversion dam, 262 ft. long and 15 ft. high, with a masonry core wall. The tunnels empty into the river channel about 540 ft. below the main dam.

When the dam is completed, these tunnels will be closed by bulkheads, and through each bulkhead will pass three $15\frac{1}{4}$-in. pipes, provided with gates operated by spindles through a vertical shaft from a gate house above. With the reservoir full, these six pipes will discharge 3180 sec.-ft., which is the capacity of the channel below the dam. There are also two $13\frac{1}{4}$-in. pipes through the dam, provided with double gates, to supply water to the power house below the dam, where from 150 to 600 hp. will be developed by three turbines.

There are two circular spillways above the dam, one on each side of the valley, emptying into the tunnels below the bulkheads through downfall shafts. The crest of the spillway on the left bank is 853 ft. long, and is set at such an elevation that, with the reservoir full, or a quantity of 320,887,000 cu.ft., the discharge will be [illegible] sec.-ft. The spillway on the right bank (Fig. 3)

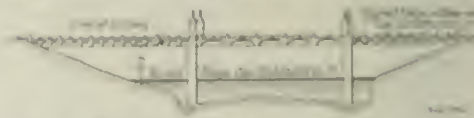


FIG. 2. ELEVATION OF KONIGREICH-WALDE DAM

is [illegible] ft. long and discharges [illegible] sec.-ft. with the reservoir full.

There is also a spillway 177 ft. long near the middle of the dam, consisting of five arched openings under the roadway across the dam, each [illegible] ft. long. The crest is [illegible] ft. below the crest of the dam proper, and [illegible] ft. below the level where the capacity is [illegible] cu.ft. The discharge over this spillway, with a depth of [illegible] ft., is [illegible] sec.-ft. With a depth of [illegible] ft., which will leave a freeboard of [illegible] ft., [illegible] sec.-ft. will discharge over this spillway. Thus if all the other outlets are out of order, the entire maximum discharge can be safely taken care of by this spillway.

Water passing over this spillway is received on a water cushion formed by a low masonry dam about [illegible] ft. below the foot of the main dam. A second water

*[illegible] Engineer [illegible], [illegible]

cushion, to receive the flow from the tunnels, is formed by a low masonry weir directly below their downstream portals. The bed of the stream is carefully paved for about 440 ft. below the dam.

Discharge Control

The discharging apparatus of the dam will be manipulated during a flood as follows: During the first part of the flood, as the reservoir is filling, the six tunnel pipes will be kept discharging at full capacity. When the reservoir is full these pipes will discharge 3180 sec.-ft., which is the capacity of the channel below the dam. If the inflow should still exceed this amount, the water would begin to flow over the spillways above described, and the maximum discharge would be taken care of as follows:

Through the six tunnel pipes	3,180 sec.-ft.
Over the left circular spillway	2,470 sec.-ft.
Over the right circular spillway	3,880 sec.-ft.
Over the dam spillway	2,120 sec.-ft.
Total	11,650 sec.-ft.

If the tunnel pipes were out of commission, the total maximum discharge could pass over the three spillways with an increased depth of only 0.75 ft., leaving a freeboard of 7.13 ft. If the two downfall shafts were also out of commission, as noted above, the dam spillway could carry the maximum discharge and still leave a freeboard of 4.7 ft. All the provisions for discharging more than 3180 sec.-ft. are considered by the designers of the dam to provide a very large factor of safety, because records show that the peaks of the floods last but a short time and will always have passed before the reservoir is full.

The total cost of the reservoir, including land, damages, etc., will be $965,000, or $3000 per mill. cu.ft. of storage.

Krausebauden Reservoir

The construction of this project was begun in 1910 and is now practically completed. The dam is located near the headwaters of the Elbe River, a short distance below the town of Spindelmühle, and 21.4 mi. above the Königreich-Walde dam.

The annual rainfall over the entire drainage area above the dam averages 47.2 in., and varies between 35.4 in. and 55 in. The maximum 24-hr. rainfall and the maximum rainstorm are as noted above for Friedrichsthal, which is near the dam site.

The maximum recorded discharge at the dam site, which occurred in July, 1897, is 7060 sec.-ft., or 315 sec.-ft. per sq.mi. The minimum discharge is 10.6 sec.-ft., or 0.472 sec.-ft. per sq.mi. The minimum low-water flow of long duration lasted for 100 days, and averaged 35.3 sec.-ft., or 1.58 sec.-ft. per square mile.

The reservoir controls a drainage area of 22.4 sq.mi. and has a capacity of 119,191,400 cu.ft., 105,900,000 cu. ft., or 88.5% of which will be kept empty for flood storage. When full, the reservoir is 1.12 miles long and covers an area of 71.7 acres to a maximum depth of 107 feet.

The dam contains 65,450 cu.yd. of broken-stone masonry and is 136 ft. high, 16.4 ft. wide on top and 118.2 ft. (87% of the height) wide on the base. It is arched upstream and has a crest length of 492 ft. The dam is designed for full uplift pressure. The greatest pressure

Fig. 3. Looking Upstream at the Site of the Königreich-Walde Dam during Construction

at the downstream toe of the dam with the reservoir full is 12.4 tons per sq.ft. With the reservoir empty, the pressure at the toe of the dam is 1.28 tons per sq.ft., and at the heel is 8.25 tons per sq.ft. The dam is founded on a hard gneiss, rich in quartz, which was reached at a

Fig. 4. Konigsreich-Walde Dam. Spillway above Dam on Right Side of Valley

depth of from 13 to 16 ft. in the bed of the stream and of about 3 to 4 ft. on the sides of the valley.

The foundation for the dam was prepared, after excavation, by filling all cracks in the rock surface with cement mortar. Twenty-three small springs which had been encountered were enclosed in vitrified clay pipe, from 6 to 8 in. in diameter, so that they could be safely conducted out of the dam by the drainage system. The whole bed of the stream was then leveled up with concrete of a 1:2:4 mixture in a terraced form to give a uniform footing for the dam.

To prevent the entrance of water into the dam it is provided with a reinforced-concrete facing on the upstream side. The Hennebique system was used in the construction of this facing. In addition, the upstream face has been given two waterproof coatings. The interior of the dam is provided with a complete drainage system.

The water was carried around the dam site during construction in a tunnel 13 ft. in diameter and 475 ft. long, bored through the solid rock of the hillside around the left end of the dam. The flow was diverted into this tunnel by a concrete dam 21.6 ft. high, about 210 ft. upstream from the main dam. This diversion dam is arched upstream and is faced with masonry about 20 in. thick on the downstream side.

The diversion tunnel is now closed by a bulkhead through which pass five [illegible]-in. pipes with gates operated by spindles through a vertical shaft from a gate house above. With the water 31.2 ft. below the spillway, at which level the flood-storage capacity of the reservoir is empty, these five pipes will discharge 2470 sec.-ft., which is the capacity of the channel below the dam. With the reservoir full these pipes will discharge [illegible] sec.-ft.

On the left side of the valley above the dam there is a circular spillway 197 ft. long, with its crest 9.52 ft. below the crest of the dam. This spillway discharges through a downfall shaft 16.4 ft. in diameter into the tunnel below the bulkhead. With a depth of 1.92 ft. on the crest, the discharge over this spillway is 1235 sec.-ft. With a depth of 3.61 ft., the discharge is 3530 sec.-ft.

There is also a spillway 131.2 ft. long over the main dam at the right end, consisting of four arches, each 32.8 ft. wide in the clear. The crest of this spillway is at the same level as that of the circular spillway above the dam, i.e. 9.52 ft. below the crest of the dam. With a depth of 1.92 ft. on the crest, this spillway will discharge 1235 sec.-ft.; with a depth of 3.61 ft., 3530 sec.-ft.; and with a depth of 5.58 ft., 7060 sec.-ft. The discharge from this spillway is conducted between training walls over a paved cascade on the rocky side of the valley to the paved stream-bed below the dam, where it falls into a water cushion, later described.

There are also two $13\frac{3}{4}$-in. pipes through the dam, with gates above and below the dam. These furnish water to a small power house below the dam where 120 to 150 hp. will be developed. They are not reckoned as a part of the equipment for flood-control manipulation.

Discharge Control

The manipulation of the reservoir during a flood takes place in this manner. During the early part of the flood, the five tunnel pipes are kept discharging at the rate of 2470 sec.-ft., the capacity of the channel below the dam. As soon as the inflow exceeds this amount, and the flood-storage capacity begins to fill, the gates are gradually

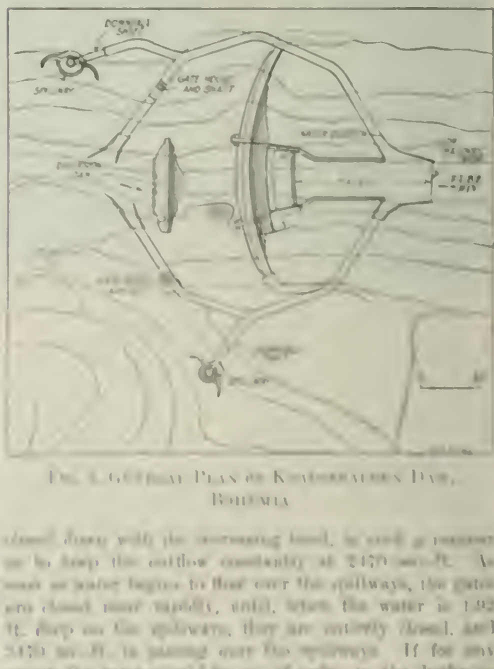


Fig. 5. General Plan of Konigsreichwalde Dam, Bohemia

closed down with the increasing head, in such a manner as to keep the outflow constantly at 2470 sec.-ft. As soon as water begins to flow over the spillways, the gates are closed more rapidly, until, when the water is 1.92 ft. deep on the spillways, they are entirely closed, and 2470 sec.-ft. is passing over the spillways. If for any reason the gates should be out of order, or the discharge pipes blocked, the maximum recorded discharge, 7060 sec.-ft., can be accommodated by the two spillways with a depth of 3.61 ft. on their crests. Further, if the circular spillway or downfall shaft or tunnel should for

any reason be out of commission, the entire 7060 sec.-ft. could be taken care of over the main spillway alone, with a depth of 5.58 ft., and still leave a freeboard of 3.94 ft. below the crest of the dam proper.

About 250 ft. downstream from the toe of the dam, a concrete weir, 4.3 ft. high, has been built to provide a

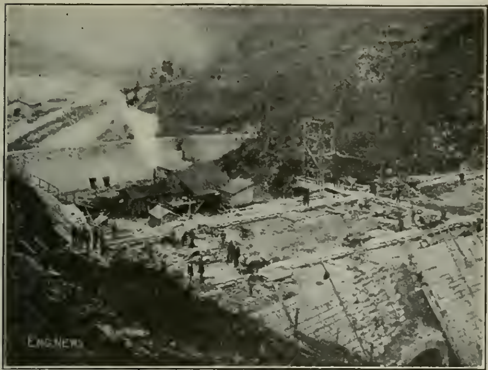


Fig. 6. Krausebauden Dam in Course of Construction (Looking Upstream, Showing Diversion Dam.)

water cushion to receive the discharge from the tunnel and the cascades leading from the dam spillway. The upstream training wall of the cascades is extended across the stream bed about 130 ft. above this weir, and joins the upstream side of the tunnel portal. With 2470 sec.-ft. discharging from the reservoir, a water cushion about 8 ft. deep is provided in the space between the training wall and the weir. This space and the streambed for about 25 ft. below the weir is carefully paved with masonry 3 ft. thick.

The Work of the River-Regulation Commission

The Commission for River Regulation in Bohemia has been in existence since 1903. Since that time it has been carrying out a well defined plan of river improvement, including reforestation, improvement of mountain torrents, regulation of stream channels and construction of flood-prevention reservoirs.

The Commission has investigated 103 sites for storage reservoirs on the Elbe Basin in Bohemia. These reservoirs would have a total capacity of about 20,000,000,000 cu.ft. and would control a drainage area of abut 5840 sq.mi., or about 30% of the Bohemian Elbe Basin, which has an area of about 19,800 square miles.

It is calculated that this system of reservoirs would have stored one-quarter the total flood run-off of the Bohemian Elbe in the flood of 1890. The maximum discharge of 158,800 sec.-ft. would have been reduced by 56,500 sec.-ft., or to 102,300 sec.-ft., a reduction of 35.6 %. The maximum stage of 26.2 ft. would have been reduced to 19.7 ft., a reduction of 6.5 ft. A stage of 19.7 ft. is not usual, and does little damage. Ordinary floods of 19.7 ft. would be reduced to 11.5 feet.

Of these 103 projects, 23 have been decided upon, and six have been built or are under construction, including the two above described. These 23 projects will have a total capacity of about 5,000,000,000 cu.ft., and will control a total drainage area of 1730 sq.mi. Comparing the greater rainfall over their catchment areas with the average over the entire basin, their controlled area is equal to 2420 sq.mi., or to 12.2% of the entire Bohemian Elbe Basin.

It is estimated that these 23 reservoirs will reduce maximum floods on the main Elbe, above the German border, by about 1.3 ft. The reduction further upstream will, of course, be considerably greater.

The total cost of the 23 projects is $12,100,000. The cost of the six now built or under construction is $2,503,000; leaving $9,597,000 to be expended for the other 17, which will be built in the next few years, as money is made available by the government.

About 20% of the total capacity will be used to retain flood water for the increase of low-water flow. The other 80% will be kept empty for flood control.

The studies of the Commission show that a total storage capacity of about one-quarter the total capacity of the 103 projects above mentioned would, if used for that purpose, raise the low-water stage of the lower Bohemian Elbe to navigable stage for a month.

The South American Field

By Cyrus T. Brady, Jr.*

SYNOPSIS—Many manufacturers and engineers in the United States are looking for opportunities to develop business in South America. The difficulties which must be met and overcome in order to do this are set forth by Mr. Brady from knowledge based on a personal experience of some years on engineering construction in various South American countries. He shows that while labor is cheap, materials are dear and the engineer from the United States must radically revise his standards of design and in many respects learn his business over again if he would succeed in South America.

There exists a widespread belief that South America is a continent of vast wealth in a sadly undeveloped condition, which awaits only the magic touch of the American engineer, or man of commerce, to pour forth streams of this wealth for their enrichment. This idea is very erroneous, at least in regard to the Argentine, Uruguay and Brazil, with the first of which this article is mainly concerned. The general conclusions deduced will, however, apply directly to the whole East Coast and in a less degree to Chile; or, in other words, to the great majority of the area and population of the continent. The information given will supplement the writer's letters published in Engineering News of Apr. 30 and Sept. 3 of this year.

As was stated in his last letter, the cost of living is very high in Buenos Aires. James Bryce, in his book on South America, has stated that he found it higher there than in

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St. Petersburg itself (or to be in fashion "Petrograd")—long known as the world's most expensive city. The cost is only slightly less in Montevideo and Rio. In some of the other cities of the three countries, the cost of food and lodging is lower, but clothing, amusements, books and other general expenses are on a par in all. The writer's personal experience extends to Salta, Tucuman, Santa Fe, Corrientes and Rosario, as well as Buenos Aires in the Argentine, to Montevideo in Uruguay, to Santos, Sao Paolo, Bahia and Rio de Janeiro in Brazil, and he has had many opportunities of conversing with men familiar with other cities.

Of course, in parts remote from the great cities, lodging and simple articles of food are cheaper; but all other expenses are greatly increased so that on the whole the cost of living with even a very modest amount of comfort is about a third higher than in the United States. The cost of living is but one factor which must be reckoned with. Accompanied by high custom duties, high rents, high wages of employees and the expenses attendant upon the giving of long-term credits, the cost of doing business is so high that only companies with large capital and with the most intelligent administrative ability are able to bear the burden of the development of their business. South America is slow to adopt new articles of commerce, and competition has been so keen that only the very best, considering both cost and quality, have established themselves. Yet, once established, it is difficult to dislodge them from favor. Many persons are apt to forget that there are already several American importing firms operating in South America in a more or less healthy economic condition and that they are much more likely to profit by our present lack of competition from Germany and Belgium than are newer organizations or representatives of manufacturers.

The average American engineer probably is not aware that some of the ablest European engineers have devoted much of their time to our sister continent and that many of their works will bear the closest scrutiny. To mention only one name: the Argentine Province of Mendoza years ago employed the famous Italian engineer, Cippoletti, to design a large number of irrigation works. Some of these works have since failed but the works which replaced them have profited by the dearly acquired experience. In this connection it should be noted that there are many irrigation systems built or building in Argentina, which, while not comparing in size with some of our gigantic Reclamation Service projects, will compare very favorably for detail.

The writer was employed by the Argentine Government on the design of the headworks for an irrigation system in the Province of Salta and was amazed at the thoroughness [illegible] in the well made topographical surveys of the irrigable lands, the general survey of the entire drainage area, the careful investigation and solution of the complicated problem of the [illegible] of the existing irrigation water rights and other details, legal or technical. Some of the existing irrigation systems have been in use for hundreds of years and [illegible].

In all the [illegible] cities the street railways are of the most improved types. Buenos Aires has a two-track subway line [illegible] miles long, provided with a station where electric trains of one of the railroads carrying much [illegible] traffic [illegible] passengers with the subway trains. Directly underneath the subway runs a single-track tunnel by which the freight trains of the same railroad reach the port. The construction of this tunnel is being carried out in the most satisfactory manner by C. H. Walker & Co., the great English contractors, while the engineers of the subway were German and the work was done by Philipp Holzmann & Co., also of Germany.

Of the ports it is unnecessary to speak at length as they have recently been described in ENGINEERING NEWS.* The port equipment is in general much superior to that of New York. Santos, Rio and Montevideo all have, in service or building, ports of the same excellence as those of the Argentine. Although much lighterage is done, especially in transporting goods from the steamers directly to factories or warehouses situated on water fronts, the great bulk of the freight is transferred by the most modern cargo-handling machinery. The ships tie up to massive masonry quay walls which are lined with extensive bonded warehouses, grain elevators, cattle pens and the like.

In the Argentine a type of river quay wharf which has given much satisfaction has been developed in timber or reinforced concrete. The accompanying sketch (Fig. 1) is merely diagrammatic but indicates the new type of construction in the Riachuelo of Buenos Aires, which is a [illegible] river with these quays facing the banks. The sketch also shows a part of one of the three large transporter bridges across this stream. The caisson was made in place as it was being lowered, advantage having been taken of the [illegible] to form a working stage. The piles were then driven and the caissons filled with a lean concrete. The work was designed and constructed by Messrs. Wayss & Freytag.

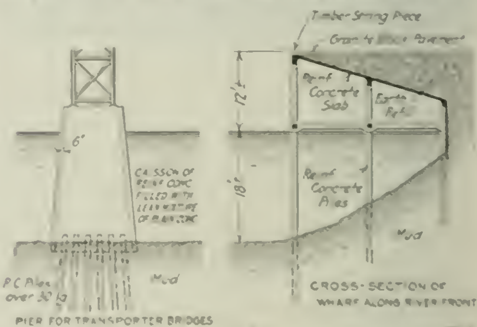


FIG. 1

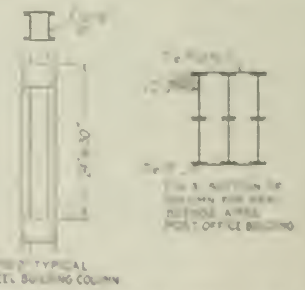


FIG. 2. TYPICAL STEEL BUILDING COLUMN

In reinforced-concrete building construction several bold projects have been accomplished, largely due to the initiative of the German contractors just mentioned and Philipp Holzmann & Co. In Buenos Aires, the latter firm has built an [illegible] building the general [illegible]

*[illegible] "Engineering News" [illegible]

of which rises to sixteen stories. There are three or four concrete buildings in service, eight to ten stories high.

Steel building construction is carried out by European companies and by the export branch of the United States Steel Corporation. In addition there are two large and several small structural shops in Buenos Aires where fairly good work is turned out (from German or Belgian material), at a slightly higher cost than for imported steelwork. The writer remembers that on one occasion when 250 tons of grillage beams, cut to length and part of them punched for separators, were required, both companies agreed to deliver the work within 48 hr. This was, of course, sooner than the material was needed, as the bidders may have known, but the job was never held up an instant waiting for delivery; whereas the shipments arriving irregularly from foreign countries often cause delays on the work.

These delays and similar unavoidable annoyances are of constant occurrence in the export field and the greatest energy and tact are necessary in dealing with them. Americans as a race are well endowed with the former quality but are often criticized for their comparative lack of the latter, and this is much to be regretted as it is the quality above all others necessary in dealing with the Latin-American temperament. The importance of tact, or better, of understanding of and consideration for the customer, is felt not only in personal relations but in all forms of commercial activity.

To present this point more clearly a specific example will aid. It is a matter of almost common knowledge that the invoices, packing lists and so on, which accompany export shipments, are prepared by many American manufacturers in the most slovenly manner. Sometimes they are quite unintelligible to the customs broker in South America whose knowledge of American technical terms is always weak. An item like

1 Cr. Mark 312. Containing one Type A Former with No. 3 reverse bar hoop spider

means absolutely nothing to anyone except to the manufacturer who supplied it. This should be billed on the manifest as "Repair part for barrel-making machine" or something of the sort. In one instance, an experienced customs broker called upon the writer to explain whether the item

40,000 ft. 2 in. ammonia piping, with screwed fittings

should be declared as wrought iron or as cast iron, this classification being compulsory in the formal declaration to the customs officers. Doubtless to anyone familiar with the pipe trade the answer is self-evident, but it is not so to a customs broker. Another very embarrassing experience of no infrequent happening is that a box, which has been declared through a misunderstanding of the invoice to contain iron screws, may be found full of copper bolts, or other articles equally difficult of explanation to the customs officer.

The same principles apply to technical matters. Thus in bidding on a steel bridge it is not sufficient to inclose a blueprint stress sheet in a letter offering to furnish the fabricated steel only, for a certain lump sum, c.i.f. South American engineers are not accustomed to receive designs or to prepare them in this manner, nor do they care to let the contract for steelwork to one contractor, the erection to another, masonry and foundations to a third, surfacing to a fourth, etc. What is desired is a price for the bridge complete and ready to be opened to the public, thus including every cost connected with the work. Even were they disposed to contract for the steel as a separate item, the stress sheet with its usual scale in inches to the foot and its meager detail would fail to satisfy them.

Engineers in Europe and South America know very little of the practically standard details which any American structural shop turns out, as a rule, so satisfactorily. "American Railway Engineering Association Specifications" naturally means next to nothing to them. When they prepare designs of their own, large scale general drawings are furnished and amplified by details of particular points. A thesis invariably accompanies the drawings. This will contain a general description of the whole work and will discuss in detail the loads and stresses to be used. Methods of computation and design will be described and what amounts to an elaborate specification for materials, workmanship and construction will be given, followed by carefully estimated weights and other quantities. All the drawings and the thesis are usually bound together in a portfolio.

The cost of preparing designs in this style is, of course, considerable; but if competition of other enterprising contractors is to be met, it must be borne without reluctance. In passing it might be mentioned that, in one way, the theses often seem rather child-like. They always assume, tacitly, that the work being described is the first of its type ever conceived, and many self-evident details and even the commonest engineering formulas are developed at great length.

In competitive bidding with European firms a point of some difficulty concerning the columns often arises. In the first place, the sections used are wofully deficient from our point of view. The sketch (Fig. 2) shows the type usually employed in buildings. Fig. 3 is one proposed for the new post office of Buenos Aires, and the engineer of the American company which furnished the steel had great trouble in securing approval for his substituted design which was more in conformity with our standards. A second difficulty is the constant European use of Euler's formula. This formula does not reduce the stress below the allowable value in pure compression, for bridge or even building members of ordinary length. In Europe itself the building ordinances specify loads and stresses which are safe when used in connection with it. In South America where the stresses are commonly taken much higher, it allows loads which are too great; and it is useless to object as European practice is instantly referred to as final; the differences in the allowed stresses in pure compression are dismissed as being of little importance.

It should be evident from the examples cited that in placing any new engineering materials, or types of construction, or machinery, or other manufactured commodity on the South American market, much study must be given to types already in use, which are in any way similar to the one proposed, and to the desires and habits of the customer. What he wants and how he wants it should be the aim of every investigation. Only by following this method will success attend the effort to win his trade.

We have discussed the methods to be adopted more from the viewpoint of the American exporter than from that of the engineer or capitalist interested in engineering works. One of the topics of most interest to these two classes is,

of course, the labor situation. It has been said epigrammatically that in the Argentine the labor of the country is Italian, the shopkeepers Spanish, the commerce English and German, the culture French, and that the only occupation of the natives is selling land to foreigners or borrowing money on what remains in their possession. Were this statement perfectly true, it would be a simple matter for engineering companies to carry on their work, for there seems no part of the earth where Italian labor is not familiar and appreciated.

Unfortunately, the situation is much more complicated since the laborers in fact come from all the nations, from Scandinavia to Asia Minor. A personal experience will indicate the complexity of the situations which must be met daily by an engineer on construction work. On a certain reinforced-concrete, steel-frame building, the foundation contractor was a Frenchman and his foreman an Italian; the concrete work was done by a German firm with German and Italian foremen; the structural steel was supplied by an English company and erected by a superintendent hailing from Gibralter, assisted by Spanish foremen; the electrical equipment was installed by an American concern under that great rarity, an Argentine foreman, and this variety of nationality extended to the other subcontractors.

Constant friction arose between the Germans and the Spaniards, and most of the writer's time was taken in smoothing out the differences and in trying to induce the disputants to apply the energy used in their quarrels to the furtherance of the job. This is a task which permits a man to make use of all the tact and knowledge of human nature which he chances to possess; and, in so far as he is successful, returns to him the greatest reward the engineering profession offers—the keen pleasure of the management of men.

It will be profitable to enlarge on the labor question and the following approximate list of the wages prevailing in Buenos Aires may be useful. All are given in American cents per hour. The common day's work on construction is 10 hours, although stevedores and some other trades work but eight.

[illegible]

In rural districts, where labor is largely agricultural, the day's wage is [illegible] $1.25 with food, or $1.75 without. In undeveloped districts, such as the province of La Rioja, the figures shrink to about [illegible] to $1.10.

[illegible]

tractor, without profit, of ordinary reinforced-concrete building work in Buenos Aires. The table is an average of several buildings and is rather low than high.

Cement, 1.5 bbl. @ [illegible]	$[illegible]
Gravel, 0.9 cu.yd. @ 3.50	3.15
Sand, 0.45 cu.yd. @ 1.[illegible]	0.7[illegible]
Labor mixing and placing	1.80
Superintendence	0.4[illegible]
Forms, labor and material	3.[illegible]
Reinforcement in place, [illegible] lb. @ [illegible]	3.[illegible]
Power, light, water [illegible]	1.[illegible]
Plant, development and depreciation [illegible]	1.[illegible]
Interest, insurance, clerical expenses	1.[illegible]
Cost, without profit, per cubic yard	$21.70

It will be noticed that the labor costs are much lower than those of materials, and this will explain why many of the devices and methods used in other countries to dispense with extra labor have not come into general use here. The lessons drawn from the two tables may be extended to other fields of engineering work. Hand labor and horses are so cheap that, regardless of their rather low efficiency, machinery must be of a very exceptional usefulness to supplant them.

Even in the field of railroad construction, hand labor and horse-drawn vehicles or equipment are the rule. The vast plains of Argentine are broken by so few hills or elevations that large cuts and fills are far apart and steam shovels would soon "eat off their heads" in general charges while moving long distances to excavate but small yardages in any one spot.

On the other hand an enterprising American contracting engineer has had much more work offered him in Santa Fé province than he is able to carry out with his American ditch-digging machine. There are enormous tracts of semi-swamp lands along the Rivers Plate and Parana, which only require drainage to be most productive, and here this type of machine has proved more economical than hand labor.

One or two makes of concrete mixers are already in use, and their sale and that of other good types can be extended. Concrete distributing machinery could also be introduced with profit to replace the present method of heavy $\frac{1}{2}$-yd. skips running on 24 or 36-in. gage track. Large automobile trucks are rapidly increasing in number in cities, for there the cost of maintenance of horses is greater. A few road rollers are to be seen, naturally only in the cities, as the country roads are almost entirely unsurfaced. Scrapers and drags might be introduced to care for these. Small pumping plants could be installed in many places where the omnipresent windmill does not render sufficient supply. Taking advantage of the present cessation of German and British competition, our trade in electrical supplies and in light, power and street-railway plants and equipment can be increased. Many inquiries for structural steel and cement have already been received. We have developed a healthy commerce in steam-railway equipment, and it can be increased. The [illegible]

[illegible]

omy of labor, rather than of material, and we have seen that practically the reverse is true in Latin-America. Still it is patent that where engineering competition is so keen, any saving in labor would be of value. A few months since, shortly after the writer's return home, he was privileged to inspect closely a concrete warehouse being built by the Turner Construction Co. His instant remark was, "If you chaps were to go to South America, you could put every other contractor there out of business." Whether such a prophecy could be realized would depend very largely on the successful solution of many of the administrative matters mentioned in this discussion and on others, such as ability to play politics, or to keep out of them, when necessary.

The North American product which will prove of greatest value in South America is not some special type of machinery, but rather the type of man who can understand the character of its people.

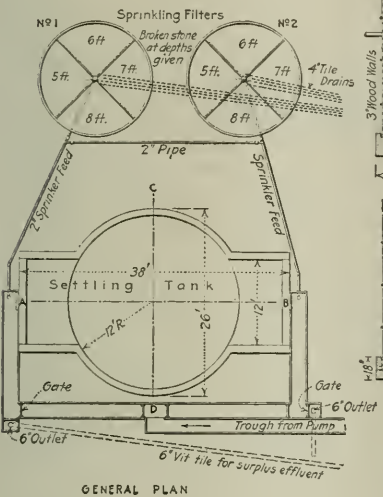


Fig. 1

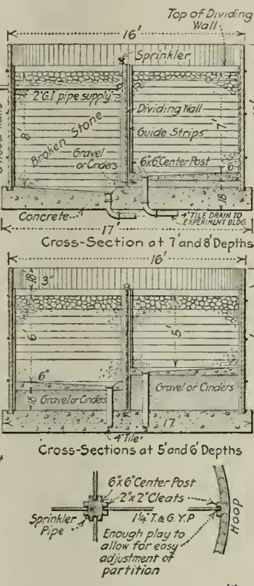


Fig. 2

EXPERIMENTAL SEWAGE-TREATMENT PLANT, INDIANAPOLIS, IND.

Experimental Sewage Treatment Plant at Indianapolis

The city of Indianapolis, Ind., has for some time been considering the question of sewage treatment in order to avoid the present pollution of White River, and during 1913 an experimental plant was built. This consists of an Imhoff settling tank, two sprinkling filters, an electrolytic tank, and a laboratory building. This plant is located near a 6-ft. sewer, from which the sewage is taken as required, and to which the effluent is returned. The electrolytic process was found unsuitable to the character of the effluent and has been abandoned.

The city, with a population of 250,000, has an average total daily discharge of 11,000,000 gal. of sewage and trade wastes (into White River), and the experimental plant has a capacity for treating 240,000 gal. daily. It was put in service in March and will be operated for about 12 months, after which the question of a permanent plant will be considered. The fact that the sewage contains a rather high percentage of trade wastes is a special factor in determining the most satisfactory treatment.

A plan of the plant is shown in Fig. 1. The 6-ft. circular sewer is divided into two rectangular channels 3 ft. wide. One of these has a double set of inclined bar screens to remove the solids, and from this the sewage is pumped. This channel can be shut off by a gate, and the other channel serves as a bypass. The sewage is pumped to a wood trough fitted with gates, and is delivered first to a settling tank of the Imhoff type, rectangular on top (36x24 ft.) and having a circular sludge chamber 24 ft. diameter. The total depth is about 33 ft. An 8-in. pipe extends to the bottom of the chamber. The tank is of reinforced concrete, but considerable trouble was experienced with leaks, and extra time and work was necessary to get it watertight. The upper portion is fitted with steel baffle plates.

The effluent from the settling tank flows by gravity through 2-in. galvanized pipes to the sprinkling filters, 8 ft. diameter, shown in detail in Fig. 2. They are of wood construction, each divided into four compartments filled with broken limestone of 1½-in. size in one filler and 2-in. in the other. The depth of stone varies from 5 ft. to 8 ft., to determine the effects of different depths. The bottom is of concrete with gravel fill and concrete floor for the shallower compartments. The two tanks are identical in construction and are used alternately. The 2-in. supply pipe ends in a sprinkler head, and each compartment has a 4-in. vitrified tile drain leading the effluent to a sampling tank in the laboratory building, which is built over the sewer.

A typical analysis of the sewage is as follows: organic nitrogen, 21.4 parts per million; free ammonia, 6.6; nitrite-nitrate, 1.0; oxygen, 34.0; chlorine, 122.0; suspended matter, 200.

The plant was designed and built under the direction of H. W. Klausmann, then City Engineer, but has been modified by B. J. T. Jeup, the present City Engineer. When put in operation it was inspected by Geo. W. Fuller, as consulting engineer for the city, and he will make the necessary study of the results in relation to the design of the permanent plant. The operation is under the charge of H. C. Underwood, City Chemist.

A Wireless Telephone System is being installed by the Union Pacific R.R. for communication with its overland trains. There will be stations at Grand Island and North Platte, Neb., Cheyenne and Green River, Wyo., and Ogden, Utah. High towers and heavy sending equipment (5- and 10-kw.) will be used to overcome communication difficulties in the Rocky Mountains.

The Relation of Geology to Railway-Tunnel Location*

By Edwin C. Eckel†

Most railway tunnels are so located as to pass through a barrier range at some relatively low point. The railroad was headed for a gap or pass through the range in order to secure as low a crossing point as possible, and the tunnel represents an effort to make a little farther reduction in the elevation of the crossing point.

The fact that a gap or pass exists at a certain point in a mountain range is not a matter of accident; there is always a cause for its location at that particular point.

Fig. 1. Gap Caused by Erosion of Softer Rock

Fig. 2. Gap Caused by Erosion of Weak Crest of Arch or Anticlinal Fold

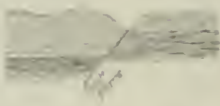


Fig. 3. Gap Caused by Erosion along Weakened Fault Plane

Fig. 4. Gap Due to Overlapping Folds

In most cases, it is possible to say, after study of the case in the field, that the pass owes its location to some peculiarity in the structure or composition of the rocks at that point.

Other things being equal, depressions along a mountain ridge are likely to occur where soft or soluble rocks reach the ground surface. If the rocks of the range are so placed that a depression of this kind extends at right angles to the range, it may in time be extended entirely across it, giving rise to a gap. Fig. 1 illustrates a hypothetical case of this kind, where a series of limestones, inclosed by harder rocks, have been worn down below the general crest level. On a small scale, gaps owing their origin to this cause are fairly common.

A second cause is erosion of the crest of an arch or anticline. Fracturing is common at this point during the folding of the rocks, and the weakness thus induced may at a later date give rise to deep erosion along the weakened zone, and the ultimate formation of a gap across a ridge. This is illustrated in Fig. 2, showing a condition which could be readily duplicated in many parts of the South.

Faulting on a large scale also causes zones of weakness and easy erosion, and gaps may arise from this cause as shown in Fig. 3. In many cases, where a gap or pass is located along a fault zone, we have to deal not only with such weakness as may have been the direct result of faulting, but with the fact that the fault may have brought into contact at the surface two sets of beds differing widely in hardness and resistance to weathering. In such cases, the gap is due to the indirect effects of the fault, rather than to the direct structural weakness.

Another very common type of gap, particularly in certain portions of the southern Appalachian region, is that caused by the arrangement of the rock folds and, consequently, of the mountain masses. This can be seen best along the line of the Chesapeake & Ohio R.R. in the section near the Virginia-West Virginia state boundary, where examples are encountered at frequent intervals. The rocks of this area are arranged in steep folds, and in most cases the mountain ridges represent actual arches or anticlines in the underlying rocks. Cross folding at intervals causes an echelon arrangement of the ridges, and the roads and streams follow through around the ends of these ridges at relatively low crossings. Fig. 4 is an attempt to suggest the main features of this sort of topography.

If the entire ridge which has to be tunneled were composed of one kind of rock, if the structure of this rock were everywhere uniform, and if no faults or other dislocations existed, it would, of course, make little difference where the tunnel was driven. Such homogeneous rock-masses are frequently found in textbooks, but they are really quite rare in the outside world. Usually the engineer will find, on examining the ridge which faces him, that it is made up of several distinct kinds of rock, that these kinds of rock differ in hardness and other physical characters, and that different portions of the ridge probably show differences in the formation of the rocks. All of these facts will have some bearing on the cost of driving and operating the proposed tunnel; and it will be well to get some idea in advance as to how the ground conditions can be made to fit in best with the other requirements of the line. If a relatively slight shift in alignment is going to give cheaper work, either in construction or operating, without bringing in any serious new difficulties, it will certainly pay to make the change.

Shale—Cutting through shale usually means fast driving and cheap extraction, for the material breaks so readily that the quantity extracted per man or per pound of powder is commonly far higher than in any other rock. But when this is said, all the advantages have been mentioned. The final completion of the tunnel may be dangerous and expensive, and the cost of maintenance may turn out very high unless it is completely lined at once. In some cases, timbering must follow up close behind the heading, in order to prevent falling fragments and to retain the roof lines. Shale is ordinarily full of closely set joint planes. On a freshly exposed surface, these may not show markedly, but exposure to the air induces "slaking," the joints open, and the shale breaks into fragments. Further than this, water is apt to be carried in quantity along some of the more strongly marked joint planes.

Slate—The material reported as slate in the progress of the work may be a real roofing slate, but it is more apt to be a dense shale, breaking out in tabular masses instead of irregular fragments. In either case the driving is easy if the bedding or cleavage are at such an attitude that advantage can be taken of them, but easily becomes difficult and expensive. There is less frequency of falls of roof during working than in dealing with other shales, but on the other hand the use of the

*Abstract from a forthcoming book on "Geology as Applied to Engineering Work."

†Geologist, [illegible], Washington, D. C.

falling masses makes the matter more serious when it does happen. If the bedding is vertical or nearly so, lining will usually be unnecessary; if the bedding is horizontal, falls may be expected to occur at intervals. The importance of the tunnel will then have to determine whether all of these should be guarded against from the outset.

Sandstone—Sandstones vary widely in physical properties, from thin-bedded fragile materials that can be readily broken with a pick up to dense vitreous quartzites that will wreck all the tool steel on the job.

Quartzites are sandstones in which the original quartz grains have been cemented together by infiltrating silica. They are dense, resistant to physical and chemical changes, difficult and expensive to excavate. Fortunately, they occur principally in regions of extreme metamorphism, and are therefore common only in certain mountainous portions near the eastern and western coasts, and in the Lake Superior region. In steeply folded regions, the quartzites may be barely jointed. In this case their excavation is easier, but at the same time the joint planes give access to water.

Throughout most of the central and eastern United States, the sandstones found are reasonably dense, varying from stones like the Berea stone up to the much denser and tougher bluestones or flagstones. They give fairly cheap driving, especially where the bedding is in a favorable attitude, and make excellent roofs and sides. Taken as a group, sandstones of this intermediate type probably furnish the cheapest tunnel work, when construction and maintenance both are considered.

West of the 95th meridian, most of the sandstones encountered in the plains region and along the immediate Pacific coast are fragile, thin-bedded materials, readily excavated and yet commonly strong enough to hold position after the cut is driven.

Gneiss—The banded metamorphic rocks, such as gneiss, schist, etc., will differ greatly in difficulty of treatment, the variations being due not so much to differences in mineral or chemical composition, as to the attitude of their banding or apparent bedding planes, the thickness of the plates or beds into which they are separated, and the presence and relative importance of joints. A gneiss lying horizontally or nearly so, and without frequent joints or thin banding, is perhaps more expensive to handle than any granite. On the other hand, a gneiss or schist whose banding is at right angles to the course of the heading will commonly break almost as readily as flagstone. In any case, except where joints are very numerous and open, the roof and sides will be secure. Water softening with lime and then allowing the turbidity to settle out, along with the precipitated carbonates. Turbid water has never been successfully disinfected with hypochlorite, because the bacteria imbedded in the suspended matter are not destroyed.

(7) The sterilizing action persists indefinitely. In a paper on water disinfection by chemical methods, Samuel Rideal states the advantages of using chemicals that persist in their disinfecting action, in the following words: may enter either along the apparent bedding planes, or along joint planes; but ordinarily the quantity will not be serious.

Granite—For convenience, all of the massive igneous rocks may be included here under this heading, and as a matter of fact most of them will be true granites or closely allied. Under ordinary circumstances, rock of this type will afford very expensive excavation, but good sound roofs and sides, and practically no water troubles. One point is worth bearing in mind. Granites do not have any bedding planes, and ordinarily show little banding or foliation. But even the densest and most massive looking granite will break with considerably greater ease in one direction than in another. This direction can only be found by experiment in each case, but it is worth going to this trouble early in the work in order to secure extra efficiency in drilling and blasting operations later.

Limestone—Limestones differ from all the roofs which have heretofore been mentioned, in a very striking and important way. The other rocks, from shales to granites, weather chiefly or entirely from an exposed surface, so that if the rocks exposed on the ground above the tunnel alignment seem fresh, there need be little fear of striking decayed rock in the headings. But limestone acts differently. It is very soluble, and water penetrating along joint planes or through the mass of the rock itself will gradually work out large channels or cavities to a great depth. These may remain open, or be partly filled up by "clay seams."

Limestone is an easily handled rock, and a sound thick-bedded limestone will make for cheap driving and good roofs and sides. But in driving a limestone tunnel there is always the chance that the next blast will play havoc with all calculations by opening up a clay seam, a cave, or a water channel. The difficulty is not so much the increased expense, as the fact that the interruptions are unexpected and so hard to guard against in advance.

Owing to differences in composition, texture, bedding, position and climate, limestones show wide differences in solubility and cavity formation. Other things being equal, caves and large water channels are most likely to occur in a limestone lying horizontally or nearly so. On the other hand, steeply dipping limestones will frequently show clay seams extending from the surface downward for 50 ft. or more.

These facts may be used for guidance. If the ridge consists partly or entirely of flat-lying limestone beds, the presence of known caves in the same general region, or the existence of exceptionally large springs breaking out along the flanks of the ridge, should serve as a warning. On the other hand, if the beds dip at angles of 35° or more, attention should be paid to their appearance along a line across the ridge over the tunnel alignment. The occurrence of bands of red or deep yellow clay, apparently interbedded with sound limestone, will in that case suggest that these seams may go deep enough to be encountered in the tunnel work.

Rock Folds—It is but rarely that a tunnel passes through rock beds lying flat or nearly so, because low points in ridges do not usually occur in areas of horizontal and undisturbed rocks. Normally, the rocks will be dipping at fairly high angles, which may indeed approach the vertical. Normally, also, the strike or trend of the rocks will be more nearly at right angles to the course of the tunnel than parallel to it. These conditions arise from the general modes of origin of mountain ranges and passes

Whatever the angle of dip, the rocks will break most readily from a bedding plane, slips and falls will commonly originate on such planes, and the chief water flows may be expected along them. The presence of numerous

or very open joints may, however, operate to modify these conditions. So far as work is concerned, if the rock beds dip parallel to the axis of the range, the blasting will be less effective, and the water troubles greatest; if the beds on the contrary dip into the mountain, the excavating work will be cheapest, though perhaps more dangerous, while the chance of heavy water flows will usually be slight. The chance of falls or slips will be least with horizontal or vertical rocks, and greatest with rocks dipping between 35 and 70° or thereabout. Of course, allowances must be made, in reaching conclusions, for variations in the thickness of the individual beds, and for differences in the tightness or openness of the bedding planes.

CONTACT PLANES.—All of the features which characterize ordinary bedding planes are emphasized on those planes where two different kinds of rock are brought into contact. The chance of slipping and the possibility of water troubles are both present at such points. This is true even where the contact is an ordinary conformable one, both rocks having the same dip; it becomes still more important where the contact plane is marked by faulting.

FAULT PLANES.—Since the existence of a fault implies that there has been movement along its plane, the rocks on one side having been raised or lowered relatively to those on the other side, it can be seen that the fault plane and the zone of rock in its immediate vicinity are likely to offer engineering difficulties. When fracturing or brecciation of the rocks has accompanied the faulting, the effects may extend over a considerable zone, and their technical importance may be heavily increased. But even where there is no serious rock fracturing, the fault plane itself offers opportunities for easy rock movement, which may vary in intensity from simple roof falls to serious slips. And, in addition, the plane of the fault is likely to offer an easy passage for surface and subsurface waters.

For these reasons, a faulted zone is not likely to give cheap and safe tunnel driving, or cheap maintenance, and if it is possible to detect the presence of fault in advance, and locate its position on the ground, it will pay to go to considerable trouble to avoid its neighborhood, by shifts in either alignment or level.

The Reclamation of the Zuider Zee

By J. M. [illegible]*

The long contemplated reclamation of the Zuider Zee, the inland sea reaching into the north coast of Holland, was just about to be started when the present European War broke out. Whether it is to be carried out now or whether it is to wait for another 20 years while Europe regains its balance, it remains a most interesting engineering problem. The first complete plan for the project was made in 1866, and this was supported by the government to the extent of appointing investigating committees in 1870. There followed then a series of plans culminating in those of 1877 and 1891,[1] since which time the project has been constantly growing in favor until on September, 1913, the Government announced its intention to begin the work along the plans suggested in the 1891 report, with the necessary modifications of detail. This final scheme will be described below.

*[illegible]

[1]See "Engineering News," [illegible]

Details of Scheme

The Zuider Zee (Fig. 1) covers a total area of 2600 sq.mi. The plans approved by the Government provide for a main dike across the mouth of the sea, with a number of subsidiary dikes inclosing 770 sq.mi. of "polders,"* which will be drained and used for agricultural purposes. Between the polders and the main dike is to be formed a fresh-water lake of 800 sq.mi., to serve as a reservoir for the Yssel River.

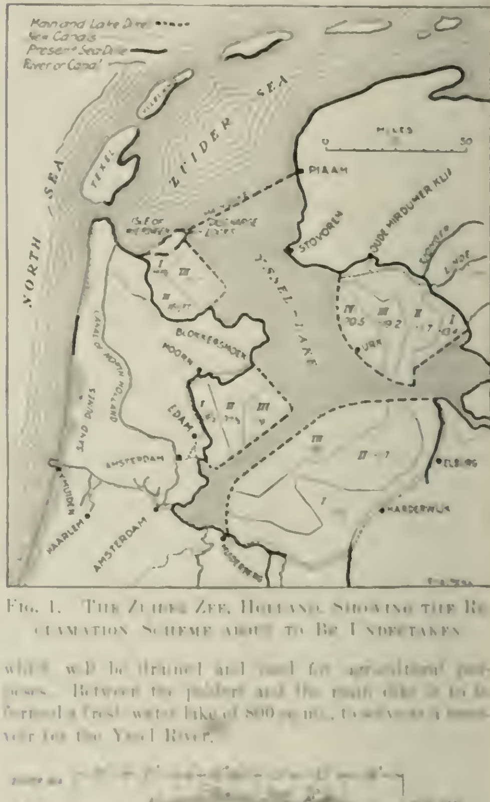


Fig. 1. The Zuider Zee, Holland, Showing the Reclamation Scheme About to Be Undertaken

Fig. 2. Section through Main Dike across Mouth of Zuider Zee

The main dike, separating the lake from the sea, will have a length of 18 mi. and an average width of [illegible] ft., with a height of 17 ft. above the Amsterdam water mark (Fig. 2). This dike will be in water of an average depth of 16½ ft. below Amsterdam water mark, while the deepest place will be as much as 20 ft. below that datum.

Thirty-three years will be required to complete the work, at a cost of $[illegible], not including the interest, or $[illegible], including the interest. Instead of the present annual revenue of $[illegible] derived from the Zuider Zee fishing industry, it is estimated that agriculture will yield a revenue of about $[illegible] annually.

*Polder, a Dutch word which has been anglicized and which is defined as "a tract of low land reclaimed from the sea by dikes."

Main Dike

The main dike will connect Ewykslnis, in the province of North Holland, with the Island of Wieringen, and from there will go northeast to the little city of Piaam, in the province of Friesland. The deepest channel is 35 ft., between Wieringen and North Holland, while the deepest place between Wieringen and Friesland is 20 ft. It is planned to construct a little island of brushwood, revetment, and stone half-way between Wieringen and Friesland on the sandbank Breezand, with a berm of 250 ft. The connection of this island with the coasts of Wieringen will be the next undertaking.

The dike is to be constructed with its toe against a dam (Fig. 2), a necessary means to assure the best possible footing for so long a dike. This dam, which will be built in layers, will have its crest at low-water mark. The toe will assure a solid footing for the main dike, which, with the layer of stones and the anchoring with piles, makes it impossible for it to wash away.

The base of the toe dam will be approximately 100 ft. On and against this dam will be built the actual dike, with sand which will probably be dredged from the Zuider Zee. The outer slope, 1 on 4, will have a solid stone paving up to a height of +15½ ft. A. P.; then a layer of clay 3½ ft. thick to the top of the dike, which will have a width of 7 ft. Then will follow the first inner slope, 1 on 2½ (no stone covering), a driveway of 23 ft., a double-track railroad requiring a width of 33 ft. and a second inner slope 1 on 3, having a heavy stone paving and a 3½-ft. layer of clay to 1 ft. 4 in. below A. P., the adopted water level of the Yssel Lake.

In building the main dike, it is proposed to first fill up all the lower part; which preparatory work of evening up the bed of the dike should be accomplished without any difficulty. The sand being dumped out in large quantity at several places at the same time, will fall with its natural slope forming a very wide base, which certainly will increase the solidity of the foot of the dike. Two continuous layers, forming a so called sinkplate, will anchor the base permanently. Then while the dike is being built up on top of this anchored base, the outside scope will be protected against the onrushing waters of the sea with large stones.

The most difficult part will be in the meeting of the four dikes, built from the temporary island half-way between Piaam and Wieringen, to either side, and also from Wieringen and Piaam toward that island. When a certain opening is reached, the head ends of these dikes will be protected by a massive concrete block. The next problem will be the placing of a number of concrete boxes measuring 160 ft. long by 16 ft. wide and 16 ft. high, about 115 ft. apart. These boxes, which will be made with partitions, will be towed to the proper place, then filled with sand, and in this way lowered to the bottom. Sand will be deposited on both sides. The weight of each will be approximately 2000 tons. In this way the opening will be reduced by about 50%. A second row of concrete boxes of the same dimensions will be deposited beside the first ones, but in such a way that they cover the open spaces of 115 ft. left by the other row of boxes, and also overlap about 7 ft. on each side. In this way, by means of this massive row of concrete boxes, the opening between the dikes will close up.

In order to prevent the forming of dangerous rapids when closing the last few openings, it will be necessary to wait for a very quiet day to close up the last twenty or so openings, and even then it is very doubtful if the remaining opening between the dikes can be filled up in one season. A great many concrete boxes will have to be used, and there is a possibility that the closing up of the opening will not be completed before fall and winter set in, which may result in the wrecking of some of the work. But once the concrete blocks are all set in their right place, the completion of the remainder of the dike is merely a matter of time.

Polders

There will be four polders within the dike. They will be known as the Northwestern Drainage or the Wieringer Lake, with an area of 80 sq.mi.; the Southwestern Drainage or Hoornsche Hop (120 sq.mi.); the Southeastern Drainage (405 sq.mi.); and last the Northeastern Drainage (195 sq.mi.). Each will be subdivided into smaller areas, as shown in Fig. 1, with varying depths for each subdivision. These subpolders, as one might call them, will be separated by dikes or quays, with locks where various canals intersect these quays. This division has a great advantage, in that it will be possible to first drain the most shallow subpolders and get them properly treated and prepared.

Each subpolder will have its own steam pump, the capacity of each being calculated as follows: 12 hp. per 1000 hectares (2470 acres) for each meter (3.28 ft.) lift (approximately 1.15 hp. per 1000 acres for each foot lift). Considering the fact that the water must be pumped up to 16 in. above the normal water mark of the new lake, the combined power of the various steam pumps for the four main polders will be approximately 17,000 hp. These pumps will have to be kept in perfect condition at all times, owing to the fact that they must do continuous duty, especially during the rainy season in spring, in order to keep the level of the various canals of the subpolders up to the proper height. The total area drained will be 800 sq.mi., of which 725 sq.mi. is first-class clay ground. Fifteen steam pumps will be required, one for each subpolder.

A fresh-water lake will be formed within the dike, known as the Yssel Lake, thus solving the hard problem of what disposition to make of the River Yssel, which will flow into this lake. Thirty discharging sluices, each having a width of 33 ft., will form the connection between the lake and the Zuider Zee. It is proposed to build a discharging canal, 3200 ft. wide, at the east end of the Island of Wieringen, increasing to 3930 ft. at the Zuider Zee side, with a depth of 16 ft., while near the Yssel Lake, the width will be 1875 ft. At the Zuider Zee end, there will be located five groups of six discharging sluices each, with lock sills at a depth of 13 ft. below the water mark of the lake. Besides this discharging canal, there will be a canal 500 ft. wide, with two locks, one 35 ft. wide, and the other 20 ft. wide. The size of the lake is calculated to give ample storage room for Yssel water even if high seas and a high river level render it impossible to open the discharging sluices, for three days, a combination of circumstances which is not likely to occur.

The dikes along the lake, which will not be of such massive construction as the main dike, will have their crests at from +8 ft. A. P. to +11½ ft. A. P.

A very careful examination of the water level of the

Zuider Zee was necessary before it was possible to place the proposed normal level of the Yssel Lake at −16 in. A. P. Of course, it will not be possible to always keep the water level to the normal mark, because of various natural conditions, such as high winds or unexpected high water in the River Yssel, but the variation will never amount to much. It will always be possible to prevent a lower level than the proposed by a well regulated valve system in the discharging locks.

New Canals

On account of the location of the main dike and the four main polders, it is necessary to provide for new discharge canals in a few provinces. These are shown on the map in Fig. 1.

Benefits of Scheme

Navigation on the Zuider Zee will be greatly benefited by the diking, as the proposed water level will insure a level high enough to make navigation safe. It will also be a great benefit by facilitating the discharge of most of the rivers and polders, which in some depends entirely on a low level of the Zuider Zee, with the result that these are overflowed during high water, and are damaged by the Zuider Zee water which is harmful to grass land. Then again, in the course of a few years, the Yssel Lake will have fresh water, which will mean that the small streams and canals will also contain fresh water, especially in Friesland. Furthermore, there will be a short railroad connection between the northern part of North Holland and Friesland.

The main gain will be a very fertile piece of ground with an area of approximately 8[illegible] sq.mi. Figuring about ¼ sq.mi. for one farmer and his family, this new province will give homes to not less than 10,000 families, or about [illegible] people. To this can be added about [illegible]% to take care of the tradespeople of various classes, doctors, teachers, etc., who will make this new province their home. In all, this reclaimed land should furnish homes for between [illegible] and 100,000 people.

It is calculated that the main dike will be completed in 9 years. From the fifth to the ninth year, improvements will be made on several harbors, and the Zuiderzee dikes with the two draining locks, as well as the canal from [illegible] to Harlingen in the province of Friesland will be completed.

In the 15th year, the Northwestern Drainage will be completed, in the 2[illegible] year, the Southeastern Drainage, some years later the Southwestern Drainage, and in the 32nd year, the final work on this great project will be finished. The government, however, will hold the reclaimed land for two or three years before leasing it out to farmers.

A Large Hand-Built Earth Dam, "Mammoth Reservoir," Price, Utah.

By [illegible]*

Mammoth Reservoir, which supplies the [illegible] water for the Price River Irrigation Co.'s [illegible] in Carbon and Emery counties, Utah, is situated in San Pete County, 3[illegible] miles east of the town of [illegible], and is up in the mountains at an elevation of [illegible] ft. above sea level. The basin in which the waters are impounded, lies in the apex of the Wasatch mountains, at a point where this range forms the divide between the Great Salt Lake basin and the Great Colorado River watershed, and of which stream the Price River is a tributary. The waters released from this reservoir travel down Gooseberry Creek 24 miles to the town of Colton, on the Denver & Rio Grande R.R., and thence down Price River to the diversion dam, some five miles above the city of Price.

Dam Site—The dam, which is being constructed to impound the waters of Upper Gooseberry Creek, is located in a cañon, the side slopes of which are composed of a glacial flow. The clay and rocks seem to have moved but a short distance as the rocks are worn but little and ledges of some extent are almost intact. The clay and fine gravel have formed a soil covering on the cañon slopes and is of fine quality for use in the construction of an earthen dam. The bed rock is found only a few feet below the bed of the creek and upon this the discharge tunnel, 5x7 ft. in section, was built, connecting the feeding tower in the reservoir with the creek on the downstream side of the dam.

General Design—The dam is designed to be 125 ft. in height, eventually, and is built of earth on both sides of a concrete center core wall. The core has buttresses on both sides opposite each other, starting 20 ft. wide at bed rock and tapering on a batter to zero at the top of the dam, and spaced 20 ft. apart along the wall. The dam is being built only so fast as the irrigation demands of the farming district require; it has been six years under construction; and, is now at the 67-ft. level. The present area of the dam covers [illegible] of an acre.

Peep Wells—Two peep wells, composed of 7[illegible]-in. casing pipe, are carried up through the dam, one on the upstream side of the core wall and one on the downstream side, each about 6 ft. from the core and near the center of the dam. The bottom end of each starts at about the 30-ft. level. They were started by placing a pad of sand and gravel of the proportions for concrete but without the cement or water. This pad was made 1 ft. thick by 6 ft. square on the earth dam. A grillage of ½-in. rods, 3 ft. long, was laid on this pad, the rods being set 2 in. apart. Upon this grillage, the open end of a section of pipe was set, the top being braced in a vertical position; then, as the earth was spread up the next lift, the pipe was filled with the sand and gravel to about 1 ft. above the lower end. From this point on, the earth was tamped up to the outside of the pipe the same as on any other portion of the work. These wells will be carried to the top of the dam, and each will be fitted with cap and float. These wells are designed to indicate the line of saturation in the interior of the dam.

Springs—Several springs were encountered during construction. Those in the bottom of the gulch were tapped with concrete and the water conducted to the outlet tunnel in tile pipe, while those encountered up the hill slopes were excavated so the cavity could be filled up with gravel, capped with concrete and conducted in [illegible] drains laid in trenches in the natural hill ground and carried out below the area covered by the dam. Those springs which developed on the upstream side of the core wall were conducted to and through the core wall in a concrete-covered gravel filter, and thence to the outlets, as above described.

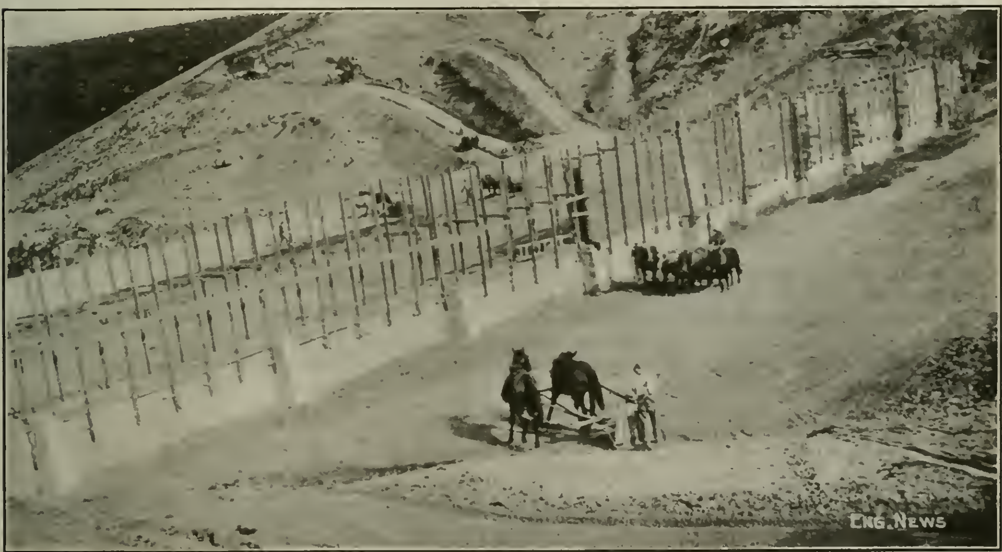
*[illegible]

EARTH FILL—The first work on the earthen fill was carried to the 15-ft. level by dump wagons, the earth being rolled with a corrugated roller of eight tons weight, drawn by four horses. The next 25 ft. was carried on by water. A ditch carried water along the brow of the hillside 150 ft. higher than the work. Teams and plows would make furrows straight down the hill slope from the ditch to the work level on the dam. A small quantity of water released from the ditch into the furrow washed the entire furrow upon the dam, while the teams were coming back up the hill to engage another furrow. The free water was carried off the work in an improvised culvert through a dike at the extreme up- and downstream faces of the dam, which was carried a few feet higher than the puddled lobe and thus impounded it. This method was found objectionable because the heavy and coarser material, weighing 2100 lb. per cu.yd., dry, would repose next to the hillside, while the very fine clay, weighing 1500 lb. per cu.yd., dry, would carry in suspension to the center lobe of the work. It was found so difficult to extract the water from this fine clay that the sluicing process was abandoned and rock and gravel were thrown into this puddled and bottomless mass from the edges until men and teams could travel over it. The work is being finished by the use of scrapers and wagons.

CORE WALL—The core wall is built up in 10-ft. levels ahead of the earth work. First the materials are brought upon the work and are distributed along a strip of the dam about 20 ft. wide next to the wall. Then the forms are erected, a steam concrete mixer is brought on and a platform is built at intervals of 100 ft. The concrete is pulled up an inclined plane, by horses working on a block and tackle system. Three-wheeled cars are used, holding 1 cu.yd. of concrete, and these are dumped over the edge of the forms into place.

OUTLET TOWER—The circular tower, or valve pit, is erected at the upper end of the outlet tunnel and is made of concrete reinforced with heavy steel bars and rods. The tower is 6 ft. in diameter inside of a 24-in. wall. A system of valves, 28 in number, is being built into this tower spaced vertically and horizontally to give a helical course up from the bottom of the tower and in order that every one can be operated from the top of the structure when this is completed.

The tower is up to the 67-ft. level now, and has been constructed by the use of a trestle work extending from the hillside at the regular 10-ft. levels. At this level the trestle was so high that when the reservoir is filled, each spring, the timber work attempted to float. This work therefore has been taken down and built into a circular barge. The tower will be erected to the yearly 10-ft. levels from this barge while the reservoir is full in the spring. The barge will lower with the surface of the water as the same is drawn out and will rise to the upper level the next spring when another 10-ft. level will be built.



CONSTRUCTION WORK UNDER WAY AT "MAMMOTH RESERVOIR" DAM, PRICE, UTAH

ORGANIZATION, ETC.—This is an example of doing work under difficulties, yet the work does not suffer in consequence. The dam should be of interest as one of the largest earthen dams in the United States, and as it is being built without any modern machinery, except the smallest steam concrete mixer made. A 12-mile dug-way through a precipitous cañon renders the hauling of heavy freight very difficult. The roller was cast in seven sections so that, with the frame, eight loads could be made of it.

The earth fill is costing 38c. per cu.yd., and the concrete $9.87 per cu.yd. The overhead charges are very nominal.

The work is visited annually by the State Engineer and the State Land Board. The report of the State Land Board after a recent visit to this dam went so far as to say that this work was, without question, the best of its kind in the State of Utah.

The New York Rapid Transit Railway Extensions*

By F. Lavis†

III--General Arrangements for Construction

The Operating Contracts

[illegible] the original contract‡ for the present subway provided for its construction by the city or with the city's money, its equipment of power stations, electrical apparatus, signals, telephones, rolling stock, etc., being furnished by the operating company, which had a lease for 50 years, with privilege of renewal for 25 years. Contract 2, Brooklyn extension, 35 years and 25 years. These two contracts with the renewals would, therefore, run to 19[illegible] and 1965, respectively. The operating company was to pay a rental sufficient to cover the interest and amortization on the bonds issued by the city in payment of the cost of construction. At the end of the lease, the city to own the structure free and clear, with the right to purchase the equipment.

The elevated lines in Manhattan have a perpetual franchise, so that under the new arrangement, the lease for the extensions to these lines and the third tracks was made to run for 85 years, and is not included in the agreement covering the other lines, which is as follows:

By the terms of the new contracts, the leases of all the *new* lines as well as those of the existing subway are to run for 49 years from Jan. 1, 1917, and provide that the city shall share in the profits of operation, which are to be determined in the following manner:

The revenues of all operated lines of each system will be pooled, the two companies will be allowed to retain all the earnings (after payment of rentals, interest, amortization, etc.) on the lines they now operate, and the city will share in the profits of the rest. The contracts provide for quarterly settlements, which will provide for the following payments:§

1. To the city (in the Interborough contract only) rentals now received [illegible]

2. Taxes and governmental charges of every description [illegible] with the system.

3. All [illegible] in the operation of its system.

4. Twelve per cent. of the quarter's revenue for maintenance exclusive of depreciation. "Maintenance" shall include repairs and replacement of [illegible], but not the replacement of [illegible] equipment. If the maintenance cost in any quarter [illegible] shall be less than 12 per cent. of the revenue the unexpended balance shall go into the depreciation funds and if [illegible] excess occurs, it may be withdrawn from such funds.

5. (Interborough Contract). For the first year of operation an amount equal to 5 per cent. of the revenue for depreciation of such portions as are not repaired or replaced through expenditures for maintenance. Two depreciation funds are established—one for the existing subway, and one for the new lines, and they will be under the control of the Depreciation Fund Board. Depreciation for future years to be agreed upon.

5. (Brooklyn Contract). For the first year of temporary operation an amount equal to 3 per cent. of the year's revenue for depreciation of such portion of roads and equipment as are not repaired or replaced through expenditures for maintenance. This amount for each year will be paid into three depreciation funds—"Depreciation fund for the railroad and equipment," "Depreciation fund for the plant and property of the extensions and additional tracks," and "Depreciation fund for existing railroads." Such funds shall be under the control of the Depreciation Fund Board. Depreciation for future years to be agreed upon.

The Depreciation Fund Board is to consist of three members—one to be chosen by the company, one by the Commission and the third by both jointly, or in case of failure to agree, by the Chief Judge or an Associate Judge of the Court of Appeals, or by the President of the Chamber of Commerce.

6. (Interborough Contract). One-quarter of the sum of $6,335,000 to be retained by the company as representing the average annual income from the operation of the existing railroads.

6. (Brooklyn Contract). One-quarter of the sum of $3,500,000 to go to the company as representing the average annual income from the operation of the existing railroads during the two years prior to the beginning of [illegible]

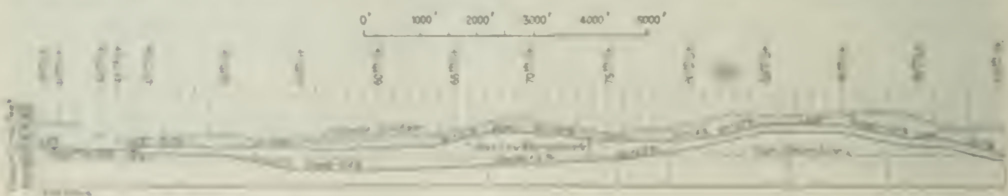


Fig. 7. Profile of [illegible]

[illegible] out of which the lessee shall pay interest charges on obligations representing the capital investment [illegible] the date of this contract) on the existing [illegible]."

7. One-quarter of an amount equal to 6 per cent. of the company's contribution toward the cost of construction and equipment for initial operation. Out of this payment the company [illegible] sufficient, with interest and [illegible], to [illegible] within the terms of the lease such [illegible] cost.

8. If additional equipment is provided an amount to be retained by the company equal to one-quarter of the annual interest payable by it upon the cost of such additional equipment together with a sum equal to ¼ of 1 per cent. for the amortization of such cost.

9. (Interborough Contract). If the company shall share the cost of construction of additions to the [illegible] system, an amount equal to one-quarter of the annual interest payable by the company upon its share of such cost, together with ¼ of 1 per cent. for amortization.

9. (Brooklyn Contract). To be paid to the city an amount equal to one-quarter of the annual interest payable by the city upon its share of the cost of construction and ¼ of 1 per cent. of the city's share of such cost.

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†Consulting Engineer, [illegible], New York City.

[illegible]

[illegible]

CONTRACT PRICES FOR VARIOUS SECTIONS OF SUBWAY CONSTRUCTION

Location	Route	Section	Contract price Total	Per lin. ft. Structure	Per lin. ft. Track	% completed on Mar. 1, 1914	Contractor
Broadway Line.			$	$	$	%	
Morris to Dey	5	1	1,222,269	607	303	51	F. L. Cranford, Inc.
to Park Place	5	1a	982,741	954	472	31	"
to Walker St	5	2	2,355,829	841	201	82	Degnon Contr. Co.
to Howard	5	2a	912,352	1721	430	56	O'Rourke Constr. Co.
to Bleeker	5	3	2,295,086	879	.	82	Und. & Found'n Co.
to Union Sq.	5	4	2,578,078	658	165	20	Dock Contr. Co.
to 26th St	4 & 36	1	2,056,703	. .	. . .	12	E. E. Smith Co.
Varick St.-7th Ave.							
Vesey to Beach	4 & 38	2	3,059,522	910	268	..	Degnon
to Commerce	4 & 38	3	2,185,064	503	126	1	"
to 16th St	4 & 38	4	1,837,927	536	134	..	U. S. Realty Co.
to 30th St	4 & 38	5	2,401,307	673	168	1	U. S. Realty Co.
to 42nd St	4 & 38	6	2,292,944	717	161	..	Rapid Transit Constr. Co.
Lexington Ave.							
53rd to 67th St	5	8	3,369,484	913	215	66	Bradley Contr. Co.
to 79th St	5	9	1,961,997	633	158	79	Patrick McGovern Co.
to 93rd St	5	10	3,253,073	865	134	80	Bradley Contr. Co.
to 106th St	5	11	3,132,195	911	226	83	"
to 118th St	5	12	2,825,740	895	224	86	Oscar Daniels.
to 129th St.	5	13	4,071,417	1397	228	60	McMullen, Snare & Triest.
to 135th St. (Harlem River)	5	14	3,889,775	1238	361	41	McMullen & Hoff.
to 157th St	5	15	3,820,130	458	183	81	Rogers & Hagerty.
138th to 147th St	19 & 22	1	2,253,282	312	105	12	Richard Carvel Co.
to Bancroft	19 & 22	1a	2,253,159	. .	. . .	..	Rogers & Hagerty.
Completion Steinway Tunnel	50	...	557,857	. . .	. . . .	2	Degnon
Jerome Ave.							
157th to 182nd St.	16	1	1,077,978	81	27	..	Oscar Daniels Co.
to Woodlawn Road	....	2	1,076,831	82	27	..	Cooper & Evans
White Plains Road.							
to Burke Ave	18	1	914,400	71	24	..	Oscar Daniels Co.
to 241st St	....	2	958,480	76	25	..	Alfred P. Roth
Queensborough							
Bridge Plaza	36 & 37	1	884,859	. .	.	.	Snare & Triest Co.
Beebe Ave. to Ditmars Ave	....	2	860,744	80		97	Cooper & Evans Co.
Van Dam St. to Syracuse Ave.	....	3	2,063,588	93* 116†	....	22	E. E. Smith Co.
Brooklyn, 4th Ave.							
Man. Bridge to 43rd St.	...	...	16,014,388	....	....	..	6 sections completed.
43rd to 61st St	11b	1	1,930,259	346	91	36	Carpenter & Boxley & Herrick
61st to 89th St.	....	2	1,904,171	240	109	28	" " "
New Utrecht Ave.							
39th to Ave. Y	39	2	1,672,190	71	24	..	Post & McCord

*Steel †Reinforced Concrete.

10. (Interborough Contract). An amount to be paid to the city equal to ¼ of 8.76 per cent. of that portion of the cost of construction paid by the city.

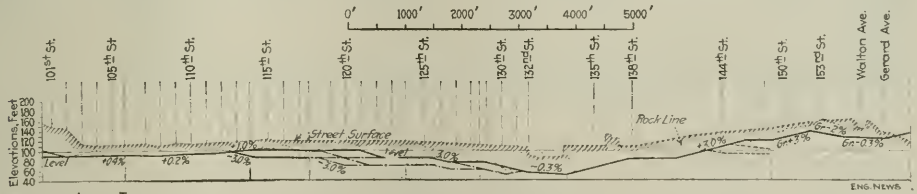
11. An amount to be paid to the city equal to one-quarter of the annual interest actually payable by it upon its share of the cost of construction of additional lines, together with ¼ of 1 per cent. for amortization.

12. One per cent. of the revenue to be paid into a separate fund under control of the Depreciation Fund Board to be invested and reinvested to provide a contingent reserve fund. When such fund equals 1 per cent. of the cost of construction and equipment, payments to it shall be suspended and interest on it shall be included in the revenue. If it falls below 1 per cent., payments shall be resumed until it again equals 1 per cent. This fund shall be used to meet deficits in operation and other purposes.

13. The amount remaining after making the foregoing deductions, shall be divided equally between the city and the company.

Route and Section Numbers

The custom was established in the days of the old Rapid Transit Commission of assigning a number to the various different routes proposed from time to time for new lines, and this has been perpetuated, as, for instance, the Lexington Ave. route is Route 5, etc. It seems hardly necessary, however, for the purpose of these articles to enumerate these in detail.



LEXINGTON AVE. LINE

For construction purposes, each route is divided into sections, numbered consecutively from the beginning and usually from the south toward the north in Manhattan and the Bronx, from west to east in Brooklyn. The sections vary considerably in length, but are generally about half a mile, and the bids so far obtained range from about $800,000 to $1,000,000 per section. The cost of structure and per foot of track is shown in the accompanying table, which also shows the per cent. of work completed on each section on Mar. 1, 1914, and the names of the contractors. The prices given in this table do not include station finish, such as tiling, stairways, ticket offices, railing, etc., or any track or equipment.

There is very little comment which can be made on these figures. The work is so varied that there is, as will be seen, a wide variation in the prices either per lin.ft. of track or per lin.ft. of structure. The Lexington Ave. line is perhaps fairly typical of normal conditions. (See profile, Fig. 7.) From 53rd St. to 129th St. the price is fairly uniform at about $225 per lin.ft. of track. Sections 9 and 10, however, have two tracks in tunnel which can be built with little or no interference with subsurface structures and no street

[illegible], and this is included in the lower price. Section 12 has a high price per lin.ft. of structure, as this, as will be noted later, provides for a very elaborate system of track crossings. Section 14 is the Harlem River crossing. The sections north of the Harlem, Route 5, Section 15, Routes 19 and 22, Sections 1 and 1a, where only part of the street is proposed to be decked and where the street cars are operated on the overhead trolley, show a considerable decrease in the cost per lin.ft., as do also the elevated structures on Jerome Ave. and White Plains Road.

On the down-town lines, Route 5 (Broadway), Section 1 involves the support of the elevated railroad structure; Section 1a the two reversed curves driven in tunnel; Section 2a the crossing of Canal St., where the underground conditions are very bad. The other sections, which are perhaps more nearly normal, show approximately an approach to the commonly accepted rough estimate figure of $1,000,000 per mile of track, built in subway.

Equipment

There has been no announcement so far of any change in type of rolling stock of the Interborough, but the B. R. T. has had a larger type of car designed, Fig. 9, providing considerably greater capacity, which will, it is thought, owing to the arrangement of the doors, permit

There have been many difficulties to overcome in connection with the design of these larger cars. Axle loads of 51,000 lb. cannot be exceeded, as this is fixed by the bridge department for the East River bridges. The motors are arranged one on each truck, instead of both on one truck, as on the present Interborough car, thus, of course, giving a better distribution of the weight and taking care of some of the increase in the weight of the body and number of passengers. The limitation as to the axle loadings could not be overcome by the adoption of six-wheeled trucks, even though their use were not prohibited by the sharp curvature, as this would only involve a heavier truck with practically the same concentration of load so far as the bridge structures are concerned.

Some important improvements are to be introduced in the equipment of the cars. The combined car and air-line couplers (described in Engineering News, Feb. 29, 1912) have proven very satisfactory, and in addition to these couplers a device is to be installed in the new equipment which will also permit the automatic coupling of the electrical connections (10 in all). The coupling and uncoupling will be entirely under the control of the motorman in the cab and be governed by an interlocking device so that the electrical connection cannot be made until the air-line coupling is complete and the

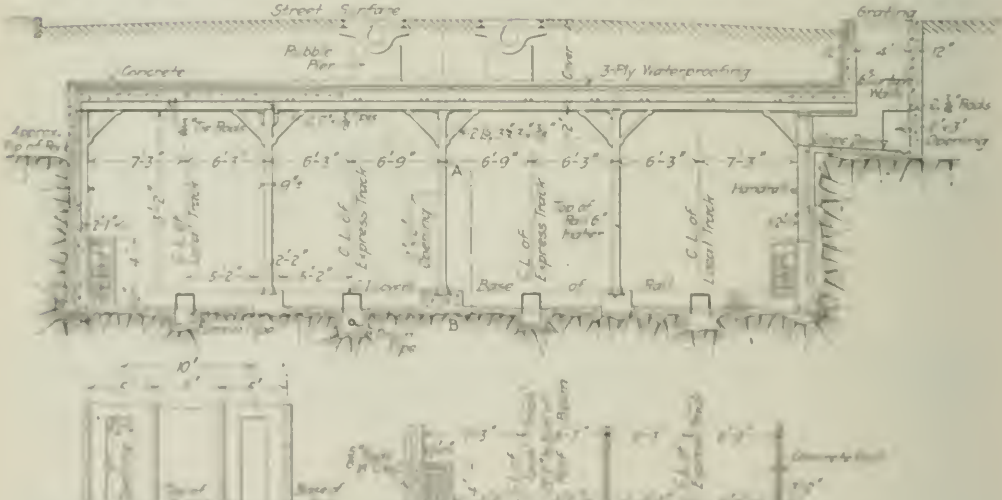


Fig. [illegible] Typical Section of Rapid Transit Subway on Seventh Ave. at [illegible] St.

[illegible] passengers and [illegible] that there will be no more delay in loading and unloading than there is with the small [illegible] now in use. The principal dimensions of these two cars are as follows:

	Interborough	B. R. T.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]

brakes are under control. Similarly, to uncouple, the release of the electrical connection by the motorman permits him to release the devices so that the air and train couplings will part. It is hoped by these devices to materially decrease the number of accidents to men in coupling cars, and also to reduce the time and expense of making up trains.

Before the introduction of this automatic coupler the link-and-pin type had been in general use, but even with eight-car trains on the Interborough, the breaking in

two of the trains was frequent enough to show that the limit had been reached for this type of couplings. Automatic stops in connection with the signals are in use in the present subway, and the sudden setting of the brakes produces heavy stresses on the couplings. The new coupler has satisfactorily stood all the strains due to these causes, and the introduction of 10-car trains made it almost an absolute necessity. Electric pneumatic brake control will be used on the new equipment, insuring more nearly simultaneous action of the brakes on all the cars.

The signal to the motorman is given by the closing of an electric circuit when all the doors of the train are closed. This has been in use successfully for some little time already, and not only saves the delay due to transmitting the signal from car to car by hand, but also acts as a safety device in preventing the starting of the train while any door is open.

A species of weighing device has been introduced in connection with the air-brake system to maintain the same ratio of braking power on loaded and empty cars. As the car is stopped at the station, the variation in the load due to the discharge or receipt of passengers, actuates a piston in an auxiliary air cylinder, directly connected to the jam-cylinder. The variation in the position of this piston in the auxiliary cylinder regulates the volume of the jam cylinder, thereby regulating the effective pressure obtained from a given amount of air; thus when the car is fully loaded the volume of the auxiliary cylinder is at its minimum, and when the car is empty it is at its maximum. When the doors are closed it is automatically locked in this position until they are opened at the next station, thus preventing any change from variations in the loading due to the vibration and oscillation of the moving train.

A similar device is to be applied to the accelerating system. At present this has to be adjusted so that it will not slip the wheels of an unloaded car. With the proposed device, however, it will be so adjusted that it will be increased under load.

By these various devices it is expected to save six minutes in time between 59th St. and Coney Island. Deceleration from 50 miles per hour will be accomplished at the rate of 3 mi. per hr. per sec. (on the emergency) as compared with the present maximum of 2 mi. per hr. per sec., and from the lower rates of speed at higher rates of deceleration, while acceleration will be at the rate of 1½ mi. per hr. per sec.

Comparison of this with some comparatively recent practice on electrified steam railroads is of interest.

N. Y., N. H. & H. R.R.—Multiple unit trains 1 motor 2 trailers acceleration 0.5 mi. per hr. per sec. Schedule speed from Grand Central Station to Mt. Vernon, 13½ miles, with 1 stop in 23 minutes.

Lancashire & Yorkshire R.R., England—Acceleration to 30 mi. per hr. in 30 sec. Schedule speed, 18½ miles with 14 stops in 37 minutes.

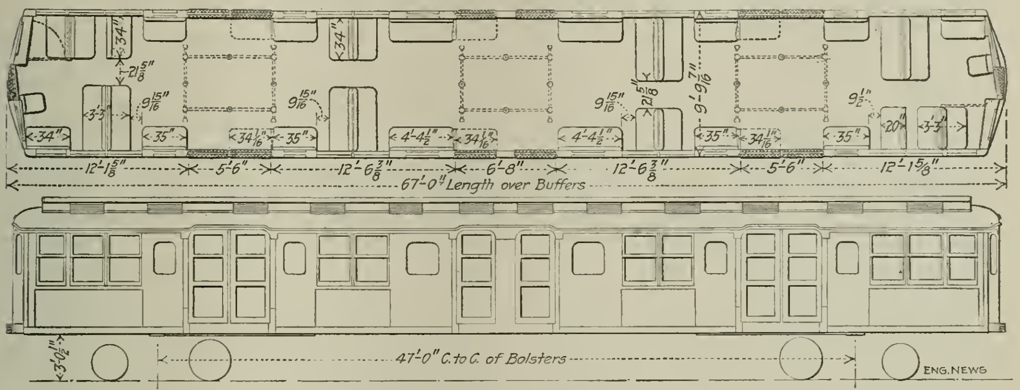


FIG. 9. DESIGN FOR STEEL CAR; BROOKLYN RAPID TRANSIT SYSTEM

POWER

Power for the Interborough system is to be furnished from the power houses at 59th St. and the North River and at 74th St. and the East River. The former, built to furnish power for the present subway, was originally equipped with nine reciprocating units with a total normal capacity of 7500 kw. each. This was increased later by the addition of five low-pressure turbines each having an additional capacity of 7500 kw. and using exhaust steam from the original units to a total of 105,000 kw. This plant is now to be enlarged by the addition of two 30,000-kw. turbine units, each unit consisting of a high-pressure high-speed set exhausting into a low-pressure low-speed turbine, making the total normal capacity about 165,000 kw.

The 74th St. power house was built only 13 years ago when the elevated lines were electrified, but owing to the rapid change and improvement which is continually taking place in electrical machinery and apparatus, part of this plant is to be replaced. The old equipment consisted of eight units (reciprocating) and one turbine unit of 7500 kw. each. Four of these are to be taken out and three turbine generators of 30,000 kw. each are to be installed, which, with the five old units remaining, will make a total normal capacity of 127,500 kw.

The contracts between the operating companies and the city call for an average speed on express tracks between main-line terminals of 25 miles per hour, including stops of 30 seconds at each intermediate station, and an average speed on local tracks between terminals of 15 miles per hour, including stops of 20 seconds at each intermediate station.

GRADIENTS AND ALIGNMENT

Unlike the location of steam railroads, the location of such lines as those under consideration is governed only to a comparatively small extent by questions of gradient or alignment as they affect economy of operation. The primary consideration, of course, is the general location of the lines through or under streets in those sections of the city where the service is needed. The second consideration is the location of the various stations, which, in the lower part of Manhattan (below 42d St.) are about five or six blocks (1000 to 1500 ft.), and in the outlying sections about 2500 ft. apart, and which is generally arbitrarily fixed by local conditions. Then the grades and alignment (within certain fairly wide limits) are made to fit these conditions. At present, owing to the fact that some sections of the line are not definitely designed, it is not possible to make an exact and complete statement covering the gradients and alignments of the whole system, but the following is approximately correct.

GRADIENTS—Gradients up to 3% may be considered normal, this upper limit being used with considerable frequency, though generally in comparatively short stretches. Some of the longest are nearly 1500 ft. in length, and in a very few cases 3% grades, as long as this occur as ascending grades immediately beyond a station stop on the local lines. There are gradients in excess of this up to 4.5%, and in one case where the Centre St. loop connects to the old Brooklyn Bridge it has been necessary to use 5.4%. The higher rates of gradient occur mostly in connection with the approaches to the East River Bridges or the tunnels under the rivers, the grades on the former being 3.4% on the three newer bridges and 3.75% on the old Brooklyn Bridge.

With electrical operation and especially with the dense traffic conditions which exist or which will exist on the Rapid Transit lines in New York, the question of gradients is not so important as it is in connection with the locations of railroad lines for operation by steam locomotives, or where continuous sustained effort is required on long supported gradients.

For short sections of heavy grade, extra power is supplied through an additional feed wire, or wires to the points where it is needed. The electric motor as is known can stand a heavy overload of as much as 100%, or even more for short periods, the amount of the load and the time which it can be carried being limited by the heating which takes place under these conditions. Short stretches of steep gradient are not, therefore, limiting or so important as longer ones would be. Considering the requirements for some reserve power for ordinary operation (which have to be fairly liberal on account of the great carrying capacity of the lines as well as the short distance between stations), it may be seen that the limits controlling the gradients which may be used are rather wide.

In the operation of self-contained motor cars also, there is the advantage over trains hauled by locomotives that all additional load increases the adhesion and, therefore, permits application of the power necessary to haul it. It must also be noted that the new motors are to be [illegible].

The general procedure has been that the gradients are fixed by local conditions within the limits given above, then the motors are designed to carry the load. Momentum is availed of whenever possible, where under normal conditions trains may be expected to utilize it in overcoming ascending gradients, and this can be quite safely done, because in case a train is stopped on an up grade, the motors can be relied to start it and move it along, even though at low speed, on account of their great capacity for overload. The original subway equipment was designed on a basis of about 60% motors and 40% trailers, but the tendency is toward the equipment of all cars with motors.

On the underground lines so far as possible, stations have been located at summits of gradients, both in order to get them as near the surface as possible and also that the ascending gradient may be utilized in braking, and the descending grade to help acceleration. While, however, these two purposes mutually help each other on the subway lines, and the rise and fall involved is, therefore, not an operating expense, this is not the case on the elevated lines. These latter, of course, must maintain a certain minimum elevation over summits, but the comparatively slight additional cost of longer columns is so little, that there is every inducement to avoid dipping down into depressions even, or perhaps especially, if stations happen to be located at such points, and it has seemed better to put in escalators or elevators than to drop the track grade down, involving braking on a descending grade and acceleration against an opposing grade.

In one instance at least, on the original subway (at 33d St. and Park Ave.) on the four-track section, the two center tracks, which are used for the expresses, are carried through on an even grade, while the outer two local tracks are raised up at the station. On the new lines the tracks generally all follow the same grade except on Lexington Ave., where the express tracks are located on a lower grade in tunnel through the hill; but here, on account of the necessity of having an express stop at some point as nearly as possible midway between 42d St. and 125th St., it was necessary to bring the express tracks up near the surface at 86th St., as shown in the profile, Fig. 7, which is very typical of the way local conditions absolutely control the profile. From an operating standpoint, of course, it would have been much better to have run all the way through the hill on the lower grade.

On account of the capacity of the electric motor for overload also, there is little necessity for, or benefit to be derived from, the compensation of grades for curvature, although it is not uncommon to find the heavier rates of gradient combined with quite sharp curvature, as for instance, at Vesey St. and Broadway, where there is a 4% grade on a curve of 200 ft. radius.

By reference to the profile of the original subway line (Eng. News, Feb. 25, 1904) it will be seen that much steeper gradients have been found necessary on the new routes than are used on the present line, but this, as is explained above, has virtually been forced by the conditions which have had to be met, which are more onerous in many cases on the new routes than on the old.

On the old line, the Broadway section had no gradient in excess of 1.5%, and the Bronx branch has 3% grades only at the crossing of the Harlem River and 3.3% just beyond where the line comes out on to the elevated structure.

In a way the profile given, Fig. 7, of the Lexington Ave. line from 86th St. to 138th St. may be considered fairly typical, though on the other hand, the Varick St.-Seventh Ave. line from the Battery to 42d St. has light grades

throughout its length, comparing favorably with the old line, with which it will connect at 42d St.

ALIGNMENT—The alignment, of course, is governed by the same considerations of the necessity of following the streets, and so far as possible, avoiding encroachment on private property. This is especially difficult in the lower part of Manhattan where the streets are narrow and crooked, and where it is especially difficult to turn the curves, so that in some instances, notably at St. Paul's Churchyard, at Vesey St. and Broadway, and also at 42d St. and Lexington Ave., it has been necessary to acquire easements under private property at considerable expense. On the new lines all stations are to be located on tangents, to avoid the difficulties found on the original subways with stations on curves.

On the present subway in which cars 51 ft. long and 9 ft. 0½ in. wide are operated, there are the following sharp curves:

	Ft. rad.
City Hall loop	147¼
Forty-second St. and Park Ave	180
South Ferry loop	191
Main express tracks	225

The outer rails on curves were elevated for speeds of 30 mi. per hr. with a maximum of 6½ in., and this practice is followed in designing the new lines, though in some cases the operating company has increased the elevation in the old subway to permit speeds of 40 mi. per hr., on some of the curves of large radius.

On the new lines 500 ft. has been considered the minimum radius for ordinary cases, 200 ft. the absolute minimum, except that there is one curve of 150 ft. radius. On the B. R. T. lines additional clearance has to be provided on curves to provide for the extra overhang of the larger cars, 67 ft. long and 10 ft. wide, which that company proposes to use.

Transition curves of a uniform length of 150 ft., irrespective of the degree of curvature are used, wherever it is possible to get them in. Crandall's formulas and tables are used. It may be noted that curves are usually laid out with radii of even feet instead of with even degrees of curvature.

CONTRACTS AND SPECIFICATIONS

GENERAL CLAUSES—The clauses of the specifications indicating the character of the work to be performed under each item or type of construction, will be discussed or quoted under each separate heading, together with the descriptions of the work. The general clauses of the contract and specifications where they differ from ordinary practice, or where they have particular applications on this work are briefly noted below.

The contracts are printed in pamphlet form, letter-size sheet (8x11). There is a table of contents at the beginning and a complete index at the end. Plans were published originally on large sheets about 22x30, lithographed and bound together, but this has been changed for smaller-sized plans which are lithographed on thin paper uniformly 11 in. wide, and bound into letter size (8x11) pamphlets the same as the contracts, thus making them very easy and convenient to handle.

The contracts for the general construction do not include any station finish of any kind, nor the track, ballast, or electrical equipment except such parts as necessarily have to be incorporated in the main structure, such as conduits for electric wiring, power cables, etc., and the ducts or pipes for lighting wires at the stations. The automatic pumps at the pumping stations are included as, of course, the drainage has to be taken care of from the beginning. The contract drawings usually include enough plans showing the general scheme of station finish, so that the contractor may have this as a guide in carrying out his work and that he may make due allowances for it. All necessary changes in location of sewers, water and gas pipes, electrical conduits, etc., required by the construction of the subway are included in the contract, the principal changes of the larger structures are shown on the plans, but exact details of smaller pipes, conduits, etc., are left until the existing pipes are uncovered, and all subsurface structures definitely and exactly located.

Approximate quantities of each item are given for the purpose of comparing the bids on a basis of total cost. The time may be extended or diminished if there is any material change in total quantities.

There are provisions calling special attention to the necessity of compliance with state and city laws, especially the eight-hour law and the requirement that contractors shall pay the union scale of wages.

As the work is to a large extent to be carried out in residential districts, there are provisions which give the engineers adequate control of night work of any kind which might disturb people living near the line. Blasting is not permitted between the hours of 11 p.m. and 7 a.m. There are strict provisions (regular city ordinance) for the storage of explosives, the maximum capacity in any magazine being 250 lb., and in most of them not over 100 lb.

BOND—A certified check for a stated sum, varying from \$10,000 to \$25,000, according to the size of the contract, is required with all proposals and a bond of a stated sum of approximately 10% of the amount of the contract from the accepted contractor, 15% is retained from the monthly payments up to a total of about 10% of the amount of the contract, after which only 10% is deducted.

TIME—The following clause is of interest in the provision for completion within the specified time:

> In the event of delay . . . . . the city . . . . . shall be paid damages for such delay. Inasmuch as the amount of such damages will be extremely difficult to ascertain, especially in view of the fact that the railroad herein contracted for is only a part of a complete system, the remainder of which is to be constructed under other contracts, it is hereby expressly agreed that damages shall be liquidated and paid by reducing the price to be paid the contractor as follows:

The provision then is for the retention of 1% of the amount due for the work done in the first month, after the time elapses, 2% for the second month, and so on.

The following "blanket" clause is of interest in connection with works of large magnitude, where the subsurface conditions are as uncertain as they may be in a city:

> The specifications and contract drawings hereinafter mentioned and taken in connection with the other provisions of this contract, are intended by the Commission to be full and comprehensive, and to show all the work required to be done. But in a work of this magnitude it is impossible either in advance to show all details, or precisely to forecast all exigencies. The specifications and contract drawings are to be taken, therefore, as indicating the amount of work, its nature and the method of construction so far as the same are now distinctly apprehended. The railroad is intended to be constructed for actual use and operation as an intraurban railroad of the highest class, adapted to the necessities of the people of New York, in the best manner, according to the best rules and usages of railroad construction, and in the event of any doubt as to the meaning of any portion or portions of the specifications or contract drawings, or of the

[illegible] of the contract, the same shall be interpreted as calling for the best construction, both as to materials and workmanship, [illegible] under the then [illegible] conditions. All the [illegible] of the specifications and all the terms of the contract [illegible] are therefore to be [illegible], construed and interpreted as [illegible] to [illegible] the [illegible].

MONTHLY ESTIMATES—The engineer shall make an estimate of the amount and value of the work done as [illegible] shall be just and [illegible], but shall not necessarily be [illegible] by the unit prices contained in the contractors' proposal, and provided that such estimate shall be withheld [illegible] if in the opinion of the engineer the work is not proceeding in accordance with the contract.

An allowance is made for structural steel delivered, at the rate of $40 per ton.

The contracts provide that the city shall make payments on estimates within 30 days after a certificate is issued by the commissioner. As a matter of fact, payments are usually made within 30 days of the end of the period covered by each estimate. Final payments are to be made 30 days after the filing of a certificate of completion.

SHAFTS AND OPENINGS—Plans showing the location of all shafts, plant to be erected in the streets, supports of street decking, openings in decking, etc., must be submitted to the engineers, and receive their approval before work is commenced. This, of course, in addition to the regular permits to be obtained from the city.

LIABILITY—The contractor admits (under the form of contract) that if the work be done without fault or negligence on his part that the plans, etc., do not involve any danger of foundations, walls, or other parts of adjacent buildings, etc.

Soldiers of Peace

BY LESTER C. G[illegible]*

[illegible]

In the heart of the sunny Southland
  Where the sultry breezes sigh,
The song of their panting dredges
  Flings [illegible] against the sky,
And the lazy water gurgles
  As it [illegible] at its earthen chains,
As the levee walls rise [illegible]
  A guard for the sheltered plains.

Through the everlasting mountains
  Their pounding rock drills bite,
And the yawning tunnels open
  To the smash of their dynamite,
Or a water pathway lengthens
  O'er the brink of a great divide,
Where their huge locks [illegible]
  Up the frowning mountain side!

On the floors of the [illegible] waters
  Through the [illegible]
Seeking their steel-shod [illegible]
  To the yieldless rock beneath,
Digging down through the [illegible],
  Fighting the flood [illegible]
Till the bridge piers [illegible] the torrent
  And carry a pathway there!

When the flickering shadows lengthen,
  And the glowing embers [illegible]
Their toil-scarred veterans gather
  On many a lonesome trail,
Snatching a moment's freedom,
  Ere break of [illegible] dawn,
With a thought of the deeds of [illegible],
  A sigh for their comrades gone.

On the stretches of far Alaska,
  On isles of the restless deep,
On the prairies of Central [illegible],
  Their unknown heroes sleep,
Where the Congo seeks the ocean,
  By the Orinoco's [illegible],
'Neath the skies of a hundred nations,
  Slumber their nameless dead.

By a boiler's wild explosion,
  By the [illegible] feathered dart,
'Mid the [illegible] of twisted girders
  When the great bridge trusses part,
By the burn of the [illegible] fever,
  With a [illegible] on the pale lips [illegible],
A curse that their work is finished,
  A prayer that the job goes through!

[illegible]

Eastward across the [illegible]
  Where the Old World [illegible] lie,
Westward [illegible] the mountains
  That [illegible] the sky,
[illegible]
  In the [illegible] light,
The Soldiers of Peace are fighting
  Their never ending fight.

[illegible]

A Dry-Pipe Sprinkler Installation [illegible]

* [illegible]

Editorials

Opportunities for Engineers

Those of our readers who find themselves open for professional engagements on account of the war and its backfire in American financial circles, might move to Detroit. If their experience has been along mechanical lines, with an effective disguise in speech and appearance, they should be able to get from $5 a day up as a cog in the Ford machine. If, on the other hand, their training has been structural, a few weeks' study and labor should make them eligible for membership in the local bricklayers' union and then their fortunes would be made. Just now ordinary bricklayers in Detroit are being paid $1 per hour and on one sewer job—a good clear free-air 10-ft. tunnel —bricklayers are drawing $10 per shift, which rarely exceeds 8 hours and is sometimes much less.

Safety First at the Elevator Door

In our last issue we commented on the excellent work being done in the promotion of general public safety by the American Society of Mechanical Engineers through its efforts to draw up standard specifications for the construction and operation of steam boilers and to formulate a model state boiler law. It seems worth while to point out another field where concerted action by some equally disinterested association would be productive of almost as great public benefit. We suggest that provision for increased safety in the construction and operation of elevators be similarly studied—though not necessarily by this same society, for there may be others in even better positions to take up such a work.

Our attention is repeatedly called to the needs in this field by various insurance bulletins on industrial accidents, where the comparatively large number of elevator accidents are noteworthy. For instance, a statement before us of the Fidelity & Casualty Co., gives statistics of individual accidents during July, 1914. There were 66 elevator accidents during the month, but only 16 boiler explosions and 5 flywheel mishaps. Thirteen falling elevators caused the death of 3 persons and the injury of 31; 12 people were killed by falling down elevator shafts and 12 were injured; there were 31 accidents in which 9 persons were crushed to death and 22 were injured by moving elevators.

Study of such figures confirms the opinion that a comparatively high degree of protection has been secured against serious accidents due to the fall of elevators, since the number of cases is small and the casualties not severe. The figures do show, however, that great risks still prevail at elevator-shaft doors and elevator gates. In a year, upward of 200 people are killed at these danger points and upward of 300 are injured. Any engineer who has attentively observed elevator operation in New York City, which offers a good chance of intensive experience, must have been impressed with innumerable cases of unlatched and unguarded shaft doors and failures to provide or use safety gates on the car openings. Here then seems to be an important field for the "Safety-First" enthusiasts.

A Chance for Economy in Public-Utility Service

Why should gas-, electricity- and water-supply and even telephone-service companies continue to send out bills every month, or twelve times a year, when quarterly meter reading and billing, or only four times a year, would save from 25 to 40% of the amounts of the smallest bills rendered and from 10 to 15% of the annual cost of serving a very considerable proportion of its patrons? This question is naturally raised by the letter published elsewhere in this issue, criticizing the Cleveland Municipal electric plant and our recent analysis of its probable operating results. The writer of the letter calls attention to the small consumers who do not use enough current at times to make their bill equal the minimum charge imposed, and argues that they do not really have the advantage of the low rate advertised. This effect has been incidentally noted by commissions and courts, and in one case the Ohio Supreme Court held that minimum charges were illegal because they brought unit prices to small consumers above the limit fixed by franchise.

That such a large saving as we have noted above is possible on much of the business of gas, water and electric companies may be shown by a few figures. In 1909, the Massachusetts Board of Gas & Electric Light Commissioners inquired into the minimum monthly charges of the Boston Edison Co., and the company submitted the following as its actual cost per month of supplying each consumer paying the minimum rate:

Meter interest and depreciation	$0.232
Testing and repair	0.064
Meter reading	0.035
Accounting, billing, postage and stationery	0.245
Energy supplied (4.5 kw.-hr. at 3c.)	0.135
	$0.711

In 1912, the New Jersey Public Service Commission inquired into the monthly minimum rates of the Public Service Corporation and made up from the books of the company the following table of monthly costs per customer:

Meter and connection interest and depreciation	$0.295
Meter and connection maintenance	0.112
Distribution expense	0.090
Indexing meters	0.023
Office salaries and expenses	0.225
Expense collection	0.055
Expense	0.065
Energy loss in transformers	0.090
Energy supplied (6 kw.-hr. at 3c.)	0.180
	$1,135

In both tables the last item has been added from data accompanying the tabulation and assuming a total cost of energy alone at the customer's premises of 3c.

In the case of the Boston company 28c., and in the case of the New Jersey company 37c. represents the actual cost per month of meter reading, billing, etc. These items could be reduced to one-third this amount by reading the meters and rendering the bills quarterly instead of

monthly. The total annual saving per customer in these cases would range from $2.25 to $5. Besides this saving to the company, there would be an additional saving to the customers in postage and time in paying bills, which would add a considerable amount to this total.

It is argued that the companies must make monthly collections to meet their current expenses. But labor is the one important item which is really paid for in cash. Fuel and other supplies going into operation and maintenance are generally purchased on credit, running as high as 90 days. It would seem quite fair if the payments from the customers could justly be made to correspond with the payments which the company has to make—semi-annually in the case of interest and up to quarterly on supplies, especially if rate-basis valuations carry a certain amount of working capital to cover payments between quarterly collections.

By cutting down the cost of collection, the minimum charges and effective rate prices can be lowered to attract the small customers who are desirable additions if they pay their cost, since they increase the diversity of load and the popularity of service. It is a matter of recorded experience that the generating capacity needed to carry the small electric-light customers' load may be only about a third that indicated by the sum of their maximum demands and a fifth that shown by their installed fixtures.

It cannot be said that reading meters and rendering bills quarterly instead of monthly is impracticable, nor that it would impair the finances of the companies, since many prosperous water companies follow this plan and have always followed it.

There is, however, a large opportunity for saving in the waterworks field also, for we have been surprised to find that even here a considerable number of the works are incurring the expense of rendering monthly bills. A committee of the American Water-Works Association, which compiled data on American waterworks rate [illegible], secured information on 447 plants out of the 5000 odd probably in existence. The committee's tables show that of 276 of these works operating on a meter basis, 111 render accounts for the most part quarterly and 165 monthly. The figures for the quarterly and monthly arrangements, respectively, are proportioned as [illegible] for the New England and North Atlantic States, 54 and 51 for the Central and Middle West, 7 and 20 for the Far West, 11 and 39 for the Southern and South Atlantic. Probably in a majority of the remaining waterworks, which are the smaller ones of the country and in which presumably meters are the exception rather than the rule, the payment takes the form of an annual assessment or "tax," so that the actual proportion of monthly bills to quarterly or less frequent ones for the whole waterworks industry is insignificant.

The Prospects for South American Trade

The number of engineers and business men who on account of the current depression of industry in the United States are looking for openings in South America [illegible] the article by Cyrus Townsend Brady, Jr., published elsewhere in this issue, is particularly timely. Mr. Brady writes with an intimate knowledge of South American conditions and his statements are corroborated also by other well known engineers who have had experience there.

It is to be borne in mind, however, that Mr. Brady writes of South America as he has known it during the past dozen years, while during the past two months the most revolutionary change that history records has swept over the financial and industrial world. The question what effect this change is to have on the commercial relations of the United States with South America is an exceedingly difficult one.

Broadly speaking, South America imports all its manufactured goods. In 1913, its total imports were valued at $1,304,000,000, of which $417,000,000 came from the United States. The exports of France, Germany and Belgium to South America were valued at $568,000,000, and Great Britain's, $322,000,000. The great bulk of the exports from France, Germany and Belgium are now cut off and if South America were to continue to purchase at the same rate as in 1913 it would probably tax the surplus capacity of the factories in both England and the United States to supply the demand.

At present, however, all accounts agree that the European war and its accompanying financial stringency has paralyzed commerce and industry in South America. Business conditions appear to be worse there even than in the countries of Europe outside the immediate zone of military operations.

South America has long been accustomed to do business on very long credit. It is claimed that one of the methods by which Germany has secured so large a portion of South American trade is by the cooperation of the German banks and trading companies with German manufacturers, so that orders have been secured in competition with manufacturers of other nations largely on the basis of the long period of credit extended. Very few American manufacturers are willing to do business under such conditions, nor are their banking facilities such as would permit them to do so.

Traders in South America, while they would be glad to purchase American goods when their supply from Europe is cut off, have not the money to pay for the goods and have, moreover, no way of obtaining the money. They can no longer borrow from their European connections, and, worst of all, the exports of raw materials to Europe, on which in the end South America relies to finance its imports of manufactured goods, have been cut down to very small proportions by the paralysis of European industry. The whole situation furnishes in fact an object lesson of the economic truth that international trade after all rests on the basis finally of barter. The transfer of gold is only a means of settling trade balances. In the long run a country can only import large quantities of manufactured goods by sending abroad a volume of exports of substantially equal value.

That was a most interesting incident in international trade that occurred last month when a vessel arrived in the port of New York from Iceland, commissioned by the government of Iceland to purchase wheat and other foodstuffs required by the inhabitants of that far northern land for their winter consumption and bringing to pay for them not gold coin or bullion, or drafts on European bankers for gold, but a shipload of fine wool, [illegible] fish, and other marketable products of the far north.

In order to increase our export trade to South America, therefore, the first step will be to increase our imports of South American products, the European market for which has failed. This can be done to some extent without doubt; but we are already South America's largest customer, buying over $500,000,000 worth from her last year. But South America exports to other countries over a billion dollars worth per annum. Any increase in our purchases would be only a drop in the bucket compared with the vast amount that Europe normally draws from South America.

Much of the South American export trade to Europe, however, must be soon reëstablished. The meat and grain of Argentine are essential to Europe's food supply; the nitrates of Chile are essential to maintain the production of European farms. It is equally true, however, that with the resumption of South America's export trade to Europe will come the reëstablishment in large part of the supply of European manufactured goods. British manufacturers are eager to recapture the world's markets which they have lost under stress of German competition.

At present, on account of the enormous number of men withdrawn from active production for military service, industry is stagnant in all European countries, except in industries directly connected with the supply of articles for military use. This worldwide paralysis of trade and industry cannot long continue. While the destruction of capital and the consequent financial stringency the world over resulting from the war are indeed of prime importance, it is to be remembered that the area over which actual military operations have extended is after all of trifling extent. Were hostilities to cease tomorrow, practically all of Europe's factories would be ready for operation for the world's supply of goods. The shortage of capital and of employees will have a certain effect it is true; but there is a large surplus population available to draw upon, the lines of trade are already established, and with the absolute necessity of the export trade to prosperity, it may well be believed that Germany will again be a strong competitor in the export trade not long after peace is declared.

While, therefore, the European war does unquestionably offer certain opportunities never before presented to American manufacturers and exporters, the business will have to be conducted with intelligence of a high order in order to win and hold the customers.

It must be said with great regret that the immediate opportunities for employment in South America of engineers who seek employment solely and have to live on their salaries are anything but encouraging. In fact, while steamers are taking from the United States to South America certain hustling manufacturers' agents and fortune seekers, returning steamers are bringing back to the United States engineers and skilled workmen who were engaged on South American enterprises a few months ago and were thrown out of their positions by the suspension of all industry when the war broke out.

It has been often and truly said that South America is a land of enormously valuable natural resources. There are without doubt a great number of opportunities for men with capital and brains and a knowledge of the country to build up various lines of profitable industry. The drawback to such ventures is the uncertainties as to governmental stability in the various Spanish-American countries. The losses suffered during the past three or four years by Americans who had money invested in Mexico have been extremely discouraging to those promoting investments in the countries farther south. With the high rates which capital can command in the United States on perfectly safe investments under conditions which are likely to prevail for some time, it must take very dazzling promises of profit to induce American capitalists to venture upon South American enterprises.

The Progress of the Steam Turbine Driven Centrifugal Pumping Engine

The City of Philadelphia was recently awarded a contract for two 20,000,000-gal. steam-turbine driven, geared centrifugal pumps to operate against a total head of 330 ft., under a duty guarantee of 145,000,000 ft.-lb. per thousand pounds of steam. The firm which is to build these machines, the De Laval Steam Turbine Co., Trenton, N. J., has also orders on hand for two 24,000,000-Imperial gal. pumps of similar design for the Toronto water-works, operating against a 268-ft. head, and two 6,500,000-gal. pumps operating against a 273-ft. head, for the water-works of San Antonio, Tex. A half dozen other machines of similar large power and capacity, built by the same company, are already in operation in a number of city water-works. These installations are of much interest, as indicating the strong position which the centrifugal pumping engine has already attained as a competitor of the reciprocating pumping engine. The probabilities seem strong that the centrifugal pump is destined to triumph over the reciprocating pump, just as the steam turbine has triumphed over the reciprocating steam engine and well nigh driven it from the market.

It seems no very long time ago that the centrifugal pump was first developed for use against high heads. At the Paris Exposition of 1900, Sulzer Bros., of Zurich, Switzerland, had a notable exhibit of multi-stage centrifugal pumps designed to operate against heads of several hundred feet. The claims for high efficiency made for these pumps were received at the time with a good deal of skepticism. The centrifugal pump was at that time a well known machine, but it had always been designed by rule of thumb, its use was confined to low heads and it was never expected to give high efficiency. The European designers applied scientific principles to the construction of centrifugal pumps, and revolutionized the machine. Pump builders in the United States promptly followed the lead of the Swiss and German designers, and high-speed high-head centrifugal pumps were shortly attainable in the American market.

It was not, however, until the steam turbine was developed to be a machine of high efficiency as well as high speed that the possibilities of the centrifugal pump began to be realized. Development in the steam-turbine field has been so rapid in the past seven years that it has been difficult to keep pace with it. The steam turbine is a machine demanding high-class workmanship and most careful and scientific design. The early steam turbines were prone to serious trouble from stripping of the blades, and were very apt to be extravagant in steam consumption. The steam turbine of the present day has attained

a very creditable degree of economy, and what is still more important, it retains its original economy in service very much better than does the average reciprocating engine. From the commercial point of view, the centrifugal pump is aided in taking the lead because steam-turbine construction has now been reduced to such a system that high-speed machines can be turned out at a cost far below the cost of building a reciprocating engine of the same power. Such high-speed machines are not only peculiarly adapted to driving electric generators of low cost, but also to the driving of high-head centrifugal pumps.

The high-duty reciprocating pumping engines of large size may well be called a monumental triumph of mechanical engineering. Its full efficiency is still materially higher than the best that the turbine-driven centrifugal pump can show, but a high-duty reciprocating engine of large power is an enormous machine, which requires a costly foundation and a huge building to house it. The steam-driven centrifugal pump of the same capacity is a machine with hardly a tenth part of the weight and size of its giant competitor. All the progress in mechanical engineering in numerous fields during the past half century has been toward the adoption of high-speed rotary motion and the abandonment of slow-speed reciprocating motion. There seems good reason to believe that the steam turbine will eventually win out over the reciprocating steam engine in the pumping-engine field as it has in so many other fields where the reciprocating engine was formerly the only type of prime mover.

Letters to the Editor

On Engineering Opportunities in South America

Sir—I have just read the letter of Cyrus T. Brady, Jr., published in ENGINEERING NEWS of Sept. 3. For some time I have had in mind the desirability of writing something very similar, but owing to press of other work have put the matter off. The case is stated so well in the letter referred to, that there is little to add to it, but I have had so many letters from engineers and others who think there are great opportunities in South America, that I think it is worth while to ask you to publish this, in confirmation of what Mr. Brady has said.

I do not mean to say there are no opportunities at all, but that they are comparatively few, whether for the professions or for commercial enterprise and require trained and experienced men to take advantage of them. It seems particularly necessary at this time to warn against too much optimism in regard to any great expansion of American trade with South America, which it is entirely improbable will take place, though we may be able to lay the foundations for expansion along certain lines of industry, if the situation is properly handled.

F. LAVIS.

New York City, Sept. 16, 1914.

Sir—The two letters of Cyrus T. Brady, Jr., in your issues of Apr. 30 and Sept. 3 are so inexplicably carried on all the [illegible] contained therein that the writer did not feel the necessity of commenting on them, [illegible] E. L. Verveer's letter in your issue of Sept. 17, criticizing Mr. Brady, the writer has thought that the testimony of an engineer who lived 15 years in Argentina would be welcome to Mr. Brady and interesting to your readers [illegible].

Mr. Brady has given a short [illegible] account of conditions in Argentina and the cost of the various articles he mentions are given undoubtedly in U. S. dollars and cents. The writer never wore a pair of boots while in Argentina that cost less than 14 or 16 paper dollars, or about 7 or 8 U. S. dollars, nor a suit of clothes that cost less than 60 paper dollars, or 30 U. S. dollars. The same quality of goods would cost in this country just about half those prices.

It is true that food stuffs raised in the country are not very dear—Mr. Brady didn't say anything to the contrary—but, what sort of a house would Mr. Verveer get in Buenos Aires for, say, \$70 U. S. currency per month?

Mr. Verveer seems to have an exaggerated idea of the role the French have played in Argentina. With the exception of a short narrow-gage railway in the north of the province of Santa Fe and the port of Rosario, which, curiously enough, is also in the same province, the writer does not recollect any other big engineering enterprise carried out by the French.

As pointed out by Mr. Brady, most of the engineering enterprises are English, while the Germans have also a good share. The fact of the matter is that Argentina, with true business instinct, always tries to secure the best talent regardless of nationality. And so it happens that when the magnificent port at Bahia Blanca was constructed the job was put in the hands of Senor Luiggi, an Italian engineer of international reputation.

That "so many Argentines have [illegible] sent their sons to France to study engineering" is far from being the case. If Mr. Verveer goes into statistics he will probably find that there are at Cornell more Argentine students than at any engineering college in France, and that by far the largest number of students go to Britain, Germany and Belgium, in normal times, of course. In the latter country, it may be remarked en passant, the University of the unfortunate Louvain granted degrees [illegible], that is to say, which were of no use whatever in Belgium itself.

British influence has been infinitely more powerful than that of the French. In spite of the difference in religion, there are several British schools in and around Buenos Aires which are largely attended by the natives. British sports have become all the rage and in the comparatively short time of 20 years Association Football—thanks chiefly to the efforts of A. W. Hutton, Esq.-

tor of the English High School—has become a national pastime.

Apart from his ideas as to the cost of living and as to French influence in Argentina, Mr. Verveer is quite correct in his assertions, and any engineer intending to go to that country would do well to read his interesting letter.

M. J. LORENTE.

Stone & Webster Engineering Corporation,
Cambridge, Mass.

The Cleveland Municipal Electric Plant

Sir—I have read, in your issue of July 30, the editorial article on Cleveland's new municipal electric plant. I have much interest and complete sympathy for some of the general observations contained therein on relations between electric central stations and the public which they are supplying. I am disposed to believe, however, that the editorial in question falls into error by comparing a utility having a restricted supply with one supplying, and under obligation to supply, an entire community.

It will be conceded generally that an electric central station which is privileged to limit the scope of its operations and to select its territory and customers can show more favorable results than one which is under obligation to supply an entire community. The Cleveland municipal plant is not embarking on the business of supplying the entire people of Cleveland with electricity. It is undertaking to supply a few people and it is in a position to pick its own territory and its own customers. From all that appears, the problem of the management is not to limit the number of customers whose rates will be less than the assumed average cost of 1.96c. but to prevent an influx of customers who will pay the maximum rate of three cents.

The editorial states (p. 261) that "the new municipal electric plant can serve only a small part of Cleveland's great area and seven hundred thousand population." The maximum station capacity is stated to be 25,000 kw. This plant is compared with a company having 100,000 hp. in station capacity and a "distribution system covering nearly the entire city." It does not appear that the municipal plant will reach any considerable proportion of the consumers in Cleveland who, because of their small lighting loads would be confined to the 3-c. maximum rate. Consequently the 3-c. rate is of little if any advantage to the residence lighting consumer.

Your criticism of private company rates, be it noted, extends not to rates afforded power consumers but to what you would have considered a traditional 10-c. maximum for residence lighting. In a city the size of Cleveland, the actual cost of reading and maintaining the average consumer's meter, of keeping his account and of collecting his bill is probably no less than 50c. per month. At the 3-c. rate it would require a consumption of 16⅔ kw.-hr. per month to pay the consumer's cost alone, not to speak of direct and fixed charges on the current consumed and its distribution. A company supplying the entire city at a maximum rate of 3c. would have thousands of customers whose monthly bills would range between 25 and 30c. and $1 at the outside. The company could better afford to give its service gratis to many of these than attempt to collect the small bills resulting from a reading of meters. As originally announced, the rate schedule for the Cleveland municipal plant contained no minimum charge. If a fair minimum is applied, the maximum actual charge in the case of those for whom the greatest solicitude is shown would greatly exceed 3c. The fact seem to be that the 3-c. maximum rate is a fiction in that its application is to be restricted by limiting the customers to whom service is rendered; some selective device must be employed as admittedly there is not enough capacity for the entire city.

The editorial carries its own refutation in the extracts previously quoted therefrom of its characterization of the Cleveland enterprise as "businesslike municipal competition." It is not competition for a municipality to set up an electric plant to take the cream of the business of a private company. Rather is it a modern form of highway robbery. The average railroad rates in the densely populated trunk-line territory are much lower than average rates in the sparsely settled Western classification territory. British tramways have lower nominal rates of fare than American street railways but the miles of track per unit of population are far less. The duty to serve entire communities is a heavy responsibility resting on central-station companies which must inevitably affect the rate so long as there are material differences in the use made of the facilities by different classes of consumers. Your editorial says: "If, however, a city like Cleveland can supply its citizens with electric current produced at lowest cost from an uptodate plant there is no need of interference by commission or courts." By your own admission the city of Cleveland is attempting to do nothing of the kind. On the contrary, it is imposing a heavy responsibility on all of its citizens for the supposed benefit of a favored few in an enterprise which will redound ultimately to the disadvantage of all through the violation of an economic law that monopoly most advantageously can conduct a business characterized by increasing returns.

As your editorial states, the Cleveland experiment is one of national importance. If it were conducted under laboratory methods, and with supervision not tinged with the suspicion of political motives, one would be obliged to accord it full and complete approbation—but for the fact that it does not attempt to solve the really important problem of furnishing electricity to all of the people of the city, including those residing in outlying and sparsely settled sections as well as those affording the best load conditions. As it is, however, Cleveland's experiment deserves nothing but severe condemnation, for, even if experience demonstrates that this small plant can be operated under ideal conditions at extremely low rates, the world will be no wiser as to the exact cost of caring for the needs of entire communities and Cleveland will be paying in the aggregate more for an inferior divided service than it would be required to pay under conditions of closely regulated monopoly.

WILLIAM D. KERR.

Director, Bureau of Public Service Economics.
17 East 38th St., New York City.
Aug. 29, 1914.

[Opportunity was extended to F. W. Ballard, Commissioner of the Cleveland Division of Light and Heat, to

comment on the foregoing criticisms. This he has done in the following letter.—Ed.]

Sir: I have read with much interest the letter of the Director of the Bureau of Public Service Economies of New York City in reply to your editorial on the Cleveland Municipal Electric Plant.

It is quite evident that he is not well informed in regard to the conditions in Cleveland, particularly as to the amount of territory which is being served by the municipal light plants. He draws some very odious comparisons tending to show the small and restricted area which is to be furnished by the new municipal plant as compared with the territory which is furnished by the privately owned plant in Cleveland. As a matter of fact, the amount of territory covered by the distribution system of the municipal plants is very much greater than that furnished by the privately owned plant, when considering the relative size of the stations. The small Brooklyn station, which has been in operation for about ten years, and which has only a capacity of 150 kw., or 1½% of the capacity of the large privately owned station, has a distribution system covering some ten square miles of territory. Instead of being the "cream" of the business, this territory is almost entirely the residence sections of the city, and largely consists of the suburbs. The privately owned company's distribution system covers the business part of the city, and has all the large customers, and in reality has had the "cream" of the business, or in other words, that part of the business which really pays the best profit. This small plant is the one which secured the good results set forth by the figures in the editorial of the Engineering News referred to.

Also I note that in Mr. Kerr's letter he states that the rate schedule for the Cleveland Municipal Plant contains no minimum charge. He seems to be misinformed on this point, as there is a minimum charge of $.50 for each customer, intended to cover the cost of billing and collecting.

As all the arguments set forth in his letter are based upon these two assumptions, which are entirely erroneous, very few will agree with him in his conclusion that "Cleveland's experiment deserves nothing but severe condemnation."

F. W. Ballard, Commissioner and Chief Engineer,
Division of Light & Heat.

Cleveland, Ohio, Sept. 26, 1914.

A New Harbor Map of Philadelphia has been prepared by the Department of Wharves, Docks and Ferries, and is now ready for distribution. It is [illegible] in. and shows the Delaware River and the navigable section of the Schuylkill within the city limits with all wharves, bulkhead and pierhead lines and channel and [illegible], as well as the present depth of water in the channels and at the docks.

A Bill Requiring Engineers in Pennsylvania to be [illegible] [illegible] in order to practice their profession has been drafted by a committee of which Prof. John P. Jackson, of State College, Penn., is the chairman, and the other members are [illegible] A. Taylor, George S. Webster, F. Herbert [illegible] and J. [illegible]. The bill requires every [illegible] [illegible] of the engineering profession other than [illegible] engineers [illegible] after June 30, 1914, to be registered as a professional engineer, and provides for examinations by a [illegible] board of [illegible]. A fee of $[illegible] is [illegible]. [illegible] on the proposed bill were held by the [illegible] of the [illegible] Society in Pittsburgh, Oct. 15 and [illegible] the Engineers' Club of Philadelphia, on [illegible] [illegible] and [illegible] at the Engineers' Club on Oct. [illegible]

A Humphrey Direct-Acting Explosion Pump for Irrigation Service at Del Rio, Texas

The first installation in this country of a large-size Humphrey direct-acting explosion pump, now being made on a Texas irrigation project, is of unusual interest. It will be used by the G. Bedell Moore Estate, which has planned for some time the irrigation of a tract along the Rio Grande, of twelve thousand acres, between Del Rio and Eagle Pass.

Alexander Potter, Consulting Engineer of New York City, was retained to pass upon the most economic plan of development and recommended pumping, preferably by Humphrey pumps, instead of a long and hazardous gravity canal. The Moore Estate commissioned Mr. Potter to study the European installations of this type and the detail plants of the immense Mix (Egypt) plant now under construction. As a result of these investigations, together with a study of the original research work done by the American company, the Moore Estate has purchased Humphrey pumps and Akerlund-type producers for wood and coal burning.

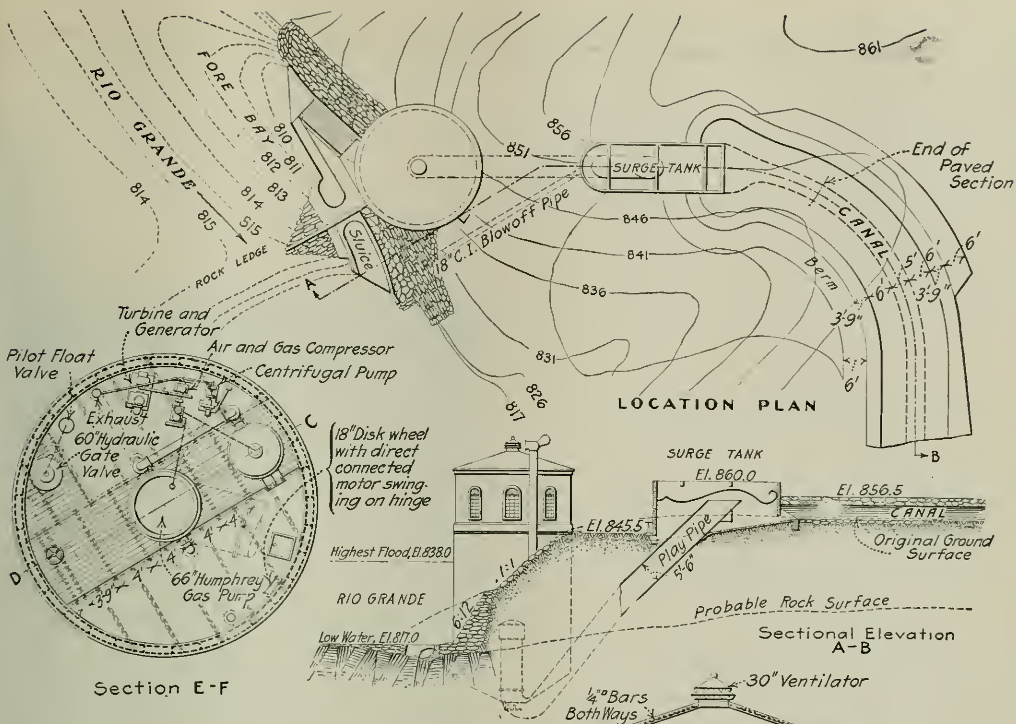
Use of Humphrey Pump.—In designing the pumping plant, two types of machinery units were studied: (1) A centrifugal pump driven by an internal-combustion engine; and (2) a Humphrey direct-acting explosion pump. In the decision to use the latter, the kind of fuel that could be obtained at the pumping station played an important part.

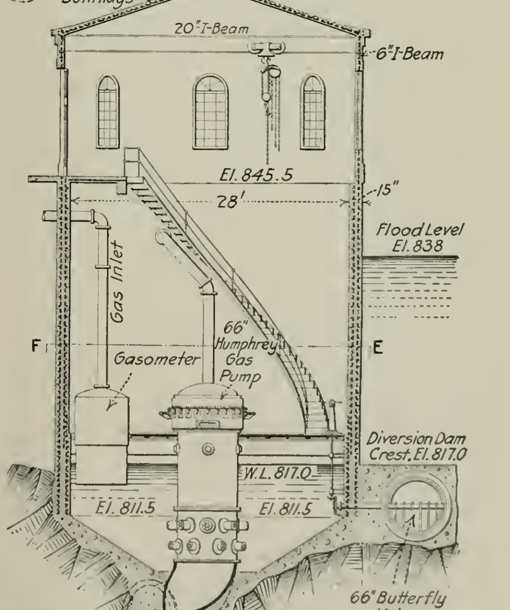
The pumping station is located some 15 miles by road from Del Rio, the nearest railroad station; Eagle Pass bituminous coal could be delivered at the plant for $4 per ton, while fuel oil would cost some $2 per bbl. Much of the land is covered with mesquite wood and will have to be cleared before cultivation. Therefore, the use of this wood as fuel until clearing was completed seemed attractive and its possibilities in gas producers has been fully investigated with highly satisfactory results to the purchasers. The estimated fuel consumption per 24 hours and fuel cost per acre-foot for a plant of 67 sec.-ft. capacity under 37 ft. lift, was as follows:

	Fuel	Consumption per 24 hr	Fuel cost per acre-ft.
Humphrey pump and gas producer	wood	[illegible] cords	$[illegible]
	coal	[illegible] tons	$.1[illegible]
Centrifugal pump and Diesel engine	oil	11 bbl	0.311
Centrifugal pump, gas engine and producer	wood	11.[illegible] cords	0.1[illegible]
	coal	[illegible] tons	0.1[illegible]

Thermal efficiencies: Humphrey pump [illegible], gas engine, [illegible]; Diesel engine, 32%; gas producer on lignite fuel, [illegible]; gas producer on wood fuel, [illegible]. Mechanical efficiency of centrifugal pump, 65%. Coal of [illegible] B.t.u. per pound at $4 per ton. Fuel oil of 19,000 B.t.u. per pound at $2 per barrel. Mesquite wood at $1.50 per cord ([illegible] lb.), [illegible] B.t.u. per pound.

Pumping Station.—The pumping station, as shown in the accompanying general plan is located directly upon the banks of the Rio Grande River at a point where a rock ledge extends entirely across and creates a slight fall. A forebay is being excavated in the river bed adjacent to the pumping station and just above the ledge. At the downstream end, the forebay is being closed by a small concrete dam and in this is placed a 66-in. circular sluiceway which can be closed by a [illegible]-in. butterfly valve operated from the interior of the station. Normally, this valve will be kept open so as to keep the forebay free of silt deposits, as the river is very muddy. The intake to the pumping station is 5 ft. in diameter. At its outer





Irrigation Pumping Station of Moore Estate, Del Rio, Texas

end it is protected by a screen inclined at a slope of 1 on 3. It has been assumed that no trouble will be experienced in keeping the screen free of floating débris as this will have a tendency, because of the flat slope, to work upward and gradually clear itself.

The Humphrey pump is now nearing completion by the owners of the American patents, the Humphrey Gas Pump Co., of Syracuse, N. Y. It is guaranteed to pump a minimum of 28,000 gal. per min. against 37 ft., though the designers are confident of showing 30,000 gal. on test and the hydraulic works have been designed for the latter figure. The guaranteed thermal efficiency is 20% when using producer gas of over 100 B.t.u. per cu.ft. The pump and play-pipe are 66 in. in diameter, the latter being 100 ft. long.

The pump is housed in a reinforced-concrete well, 34 ft. deep, shown in the accompanying figure, designed to resist the full hydrostatic pressure of flood waters. The operating floor is 3 ft. above the lowest river level. The water level in the pump well is maintained at constant elevation, irrespective of the river stage, by a float-controlled hydraulic gate valve operated by pressure from the high canal.

A gasometer is placed in the gas main leading from the producer to the pump. This, for safety in case of backfires, is a steel tank with the lower end open but sealed by the water in the pump pit.

The following accessories are also to be installed in the pump pit: (1) a 1-kw. electric generator direct connected to a small turbine operated by water from the canal; (2) a two-cylinder air compressor which can be driven either by the turbine or by an explosion engine operated

or producer gas or gasoline, and a small centrifugal pump belted to the gas engine of the air compressor for draining the pump well.

Special attention has been given to ventilating the pump house. The top of the conical roof of the superstructure is provided with a 30-in. exhaust cowl. Fresh air is admitted to the pump pit at the operating floor level through a 24-in. pipe with a top cap designed to force air down by wind action. The pipe opening into the pit carries an 18-in. motor-driven blower on hinges so as to be swung into place for service when the wind velocity is too low to secure sufficient natural ventilation.

The play-pipe discharges into a reinforced-concrete surge tank 36x12 ft. The discharge pipe extends 9 in. above the normal water level in the canal. The guaranteed lift of the pump is fixed at 37 ft., as this is not sufficient to irrigate a tract of some 500 acres in the immediate vicinity of the pumping station, it is intended to use the wave action in the surge tank to raise a small quantity of water 4 or 5 ft. above the elevation in the supply canal. The arrangement for this is not shown on the accompanying figure. The surge tank is also designed to act as a grit chamber, the grit to be washed in to the river through an 18-in. cast-iron pipe.

PUMP OPERATION—The operation of the Humphrey-type pump has been noted in ENGINEERING NEWS from time to time (particularly in the issues of Dec. 2, 1909, p. 601; Apr. 17, 1913, p. 764; Dec. 25, 1913, p. 1331) so that it will be but briefly noted here. A charge of gas-air mixture is exploded in a chamber above the water surface, no piston being used. The explosion drives the water downward, closes the water inlet valves and sets the whole water column in the play-pipe in motion. The inertia of the moving column of water permits the burned gases to expand below atmospheric pressure when both exhaust and water valves open. There follows a return surge of the liquid column until the water reaches the exhaust valves and closes them by impact. There is a second forward surge set up by the trapped and compressed gases and when the pressure again falls below atmospheric a fresh charge of gas and air is drawn in. This is finally compressed by the second return surge and exploded, when the cycle repeats. The inlet and exhaust valves are interlocked so that the proper sequence of operation is maintained.

In the American adaptation of the Humphrey design, the complicated arrangement of rods and bell cranks by which the interlocking is accomplished on the large Chingford pumps in England, has been superseded by a simple eccentric chain [illegible] around the valve belt engaging ratcheting studs and moving a short distance first in one direction and then in another to shift the lock from one set of valves to the other. The period of oscillation is about proportional to the square root of water column length; in this case the pump will have approximately 18 cycles per minute.

There will be two types of ignition equipment: (1) Jump-spark (high tension) from storage batteries and coils, and (2) "wipe-spark" or arc ignition taking current from the [illegible] generator. To start, an initial charge of gas and air will be forced in by compressed air, all the valves being held shut. After explosion the play-pipe oscillations thus initiated are strong enough to work the valves and make the pump begin regular operation.

GAS-PRODUCER PLANT—The producer house will be located very close to the pump house on higher ground.

The producer system is that of the Standard Gas Power Co., of New York. It comprises a vertical down-draft generator with a water pan on top and a vapor ring around the combustion belt; air is admitted to the vapor ring and the mixture of air and steam enters the fuel chamber above the green charge. The gas is led off through a spray-cooler, a wet scrubber, exhauster, dry purifier and delivery pipe. The following figures were obtained on trial runs of the producer with mesquite wood:

Average wood burned per hour	416 lb.
Average gas made per hour	[illegible] cu.ft.
Average gas made per lb. of wood	[illegible] cu.ft.
Average B.t.u. per cu.ft. of gas	111.5
Average lb. of wood per sq.ft. of fire area	[illegible]
Lb. of wood per horsepower-hour	1.76

The pumping plant will be completed by Jan. 1, 1915. The construction of the pumping station, intake works and canal is being executed by company forces. Mr. J. H. Savage is General Manager of the Moore Estate. Whiteaker & Washington, Engineers, San Antonio, designed and are in charge of the canal work.

Water Disinfection by Liquid Chlorine at Wakefield, Mass.

BY EDWARD C. SHERMAN*

The water-supply of Wakefield, Mass., is taken from Crystal Lake, in the outskirts of the town, and pumped directly into the mains, a stand-pipe serving to take the excess and to afford a night supply. The lake, although fed by many springs, receives considerable surface water which, with increase of population on the watershed, caused the quality of the supply to become unsatisfactory at times.

The amount of water available is limited and a new source will have to be found before many years if the town continues to grow as it has in the past, the population having nearly doubled in the last 25 years. As Wakefield is only about ten miles from Boston, it is probable that it will increase in size and also that it may be found desirable to enter the Metropolitan Water Works system with which a physical connection for emergency use now exists.

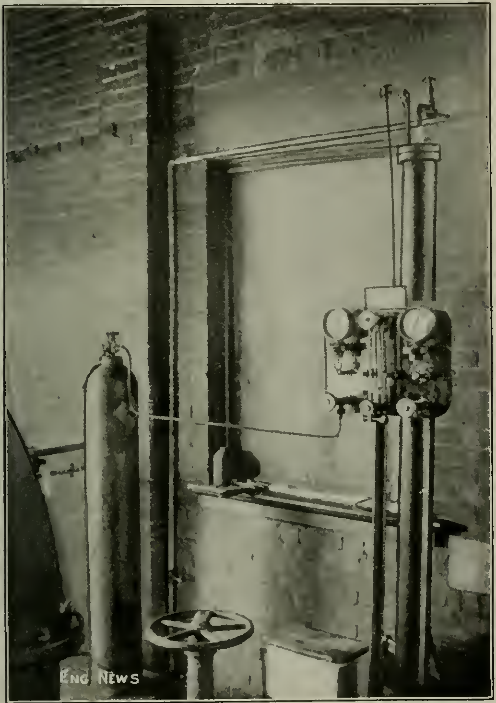
For this reason, and as the water of Crystal Lake is satisfactory in appearance, the town did not feel justified in constructing a filter plant, but the Water Board decided to continue its use provided it could be made safe at all times at not too great a cost. Upon the recommendation of the writer, it was decided to disinfect the water by chlorine gas and the necessary apparatus was installed.

The apparatus, which is shown in the illustration, consists of a gas tank, control board and absorption tower. The chlorine is received in liquefied form in steel cylinders containing about 100 lb. Opening the valves on the tank and the control board permits the chlorine to vaporize and the gas passes through the copper tube to the high-pressure gage on the right of the control board. It then passes through a pressure-reducing valve, the low pressure then being shown by the gage at the left side of the board, and after flowing through a rate-control valve, or

*Consulting Engineer, Boston.

ters the tower, behind the control board, where it is absorbed by a small spray of water. The chlorine solution is then allowed to flow into the pump suction, where it mixes with the supply and sterilizes it.

The rate of pumping is very nearly constant, the standpipe taking care of fluctuations in the rate of consumption, so that the rate of application of the gas is satisfactorily controlled by hand, by a tangent screw on the valve, the gage showing the amount being used in ounces per hour. The rate-control gage consists of a glass tube, ground on the inside to form a truncated cone, and a peculiarly



Liquid-Chlorine Installation for Water Disinfection at Wakefield, Mass.

shaped platinum float, which can move up and down in the tube. The gas, in passing upward through the tube, flows through the annular space around the float and raises it to the point where the area of the opening is sufficient. With a small flow the float remains near the bottom of the tube, while a larger flow raises it. Graduations on the glass make it possible to read directly the rate at which the gas is passing.

As a check on the rate of using the gas, the tank is placed on platform scales and the weight is read and recorded every morning when the gas is turned on and the pumps started.

The small tank near the base of the absorption tower is directly connected with it by a pipe and serves to maintain a supply of water at a fixed depth in the bottom of the tower, the tank being provided with a float valve. The water for absorbing the chlorine is supplied through a small pipe leading to the top of the tower.

During the first month of operation of the plant, chlorine was used at the average rate of 5.8 lb. per million gallons of water, analyses showing this amount to be required to effectually sterilize the water. This amount cannot be detected in the water by taste or smell. The results have been very satisfactory, the number of bacteria in the treated water being from 1 to 12 per c.c., except for a period of five days, when a reduced rate of application of the chlorine was tried, at which time the number of bacteria rose to an average of 22 per c.c.

The apparatus was installed by the Electro Bleaching Gas Co., of New York, and its operation is under the direction of the writer. The Wakefield Water Board consists of Charles A. Dean, Chairman, Dr. J. H. Kimball and T. G. O'Connell.

Annual Convention of the American Society of Municipal Improvements

The twenty-first annual convention of the American Society of Municipal Improvements was held in Boston, on Oct. 6 to 9. There was a good attendance, a full program of papers and committee reports, a number of interesting exhibits, a harbor excursion tendered by the City of Boston and a long automobile ride, the latter provided by the local committee.

By far the greater part of the program was devoted to roads and pavements. Next stood sewers and sewage treatment, and third came garbage and refuse collection and disposal and street cleaning. Fire protection and some general municipal problems were considered and there was one paper and a written discussion on bacterial limits for raw and filtered city water-supplies.

The notable achievement of the meeting was the adoption of a large number of standard paving specifications.

The papers and committee reports were too numerous for more than a wearisome categorical summary here, and will all appear in the annual proceedings of the Society. We shall therefore confine our report of the convention to the business proceedings, and chiefly to the action on standard specifications and forms.

In his brief presidential address, Edward H. Christ, of Grand Rapids, Mich., remarked that the convention then being opened was the first one since amalgamation with the Association for Standardizing Paving Specifications. Without doubt, he said, the greatest work of the society has been on standardizing specifications and report forms.

The report of C. C. Brown, Secretary of the society, showed an excess of about $740 in receipts over expenditures and a total membership of nearly 500. There were 239 active and 9 affiliated members; 30 municipal members, with 67 delegates; and 68 associate members, with 81 representatives.

Dayton, Ohio, was chosen as the next meeting place by a vote of 39, against 19 for New Orleans and 5 for Buffalo.

The president chosen for 1915 was Wm. A. Howell, Engineer of Streets, Newark, N. J. Charles Carroll Brown, Editor of "Municipal Engineering," Indianapolis, Ind., was reëlected Secretary.

Adoption of Standard Paving Specifications

For some years past the society has had a general committee and various sub-committees on paving specifica-

[illegible]. As a result, a number of paving specifications were submitted to previous meetings and some of them adopted by the Society. Working along the same general lines and to a considerable extent through the same men, the Association for Standardizing Paving Specifications, which held its last meeting in 1913, also adopted standard paving specifications. Since amalgamation, the paving specification committee and sub-committees of the American Society of Municipal Improvements have harmonized the two sets of specifications, made some revisions in them, and added others.

The general committee (Geo. W. Tillson, Consulting Engineer to the Borough President of Brooklyn, N. Y., Chairman) recommended the adoption of the following specifications, as submitted by sub-committees, with chairmen as stated in parentheses: Stone Block (H. H. Schmidt); Brick (E. H. Christ); Concrete (C. E. P. Babcock); Broken Stone and Gravel, the same with Bituminous Surface, and Bituminous Macadam (Prof. A. H. Blanchard); and Ashphalt (Francis P. Smith). This recommendation was adopted.

The general committee recommended and the meeting voted that the Wood Block specifications (Ellis R. Dutton, Chairman sub-committee) be printed; that the sub-committee be authorized to confer with the lumber and wood preservers' associations and that the specifications come up for action next year.

As to Bituminous [Concrete] Pavement specifications (Linn White, Chairman sub-committee) the general committee [illegible] and the meeting approved the recommendation of the sub-committee that the latter be allowed three months' time to draft and submit to the general committee two sets of specifications: one to follow the [illegible] patents and one to avoid infringement of these patents. The understanding was that if these specifications meet with the approval of the general committee, then they shall be accepted tentatively until the next meeting and come up for adoption at that time.

STANDARD SEWER SPECIFICATIONS

The same general committee (which is really one on Standard Specifications for all classes of municipal engineering work) also recommended the adoption of Sewer Specifications (F. J. Fort, Chairman of sub-committee) except that two sections shall be left open and alternates provided. This recommendation was adopted.

The reports of the general committee and the eight sub-committees on Specifications were presented and adopted in perhaps an hour and a half. A few questions were asked, to get explanations, but there was no discussion. In fact, Mr. Tillson stated, in effect, that discussion with the idea of changes from the convention at large, would not be fitting, since the various committees had given hearings for the very purpose of general discussion. The proper course, Mr. Tillson urged, would be to adopt the specifications and then for individual members to submit suggestions for changes during the year, if they so desired. [illegible] before many of the reports had been submitted, a resolution had been introduced which, if carried, would have postponed any action on the reports for a year, except [illegible] and printing them.

The society voted to print the specifications adopted, [illegible] to each member, and sell the remainder at [illegible].

REPORT OF COMMITTEE ON STANDARD FORMS

The chief progress made by this committee (J. C. Hallock, Deputy Chief Engineer, Newark, N. J., Chairman) was the submission through a sub-committee (E. S. Rankin, Chairman) of some forms for reporting sewerage operations. In accordance with the recommendations of both committees, a tabular form for reporting new construction was adopted and several other forms were ordered printed for consideration. Suggestions for conference with the Sanitary Section of the Boston Society of Civil Engineers, which adopted standard report forms some years ago, were not acted upon; but the one form actually adopted has no parallel in the Boston Society forms.

A sub-committee on Street Cleaning and Disposal (J. T. Fetherston, Chairman) reported that the poor success of the American Public Health Association in collecting statistics in accordance with the form devised by a committee of its Sanitary Engineering Section indicated that detailed data on street cleaning and refuse disposal are not available. The sub-committee presented a list of questions which it proposed to send out asking for information. Answers to these questions may be of immediate use as data, besides aiding in making up forms in the future.

NEWS NOTES

The Panama Canal Toll Receipts for September are reported to have been $117,[illegible]

Asphalt Pavement Contracts to the amount of $17[illegible] have recently been awarded in Richmond, Va.

A Highway Bridge collapsed under the weight of a heavily loaded furniture van, at Roxbury Mills, Md., Sept. 2[illegible]. The load is said to have exceeded that for which the bridge was designed. The bridge was about [illegible] years old.

A Collision between a passenger train on the Chicago & Eastern Illinois R.R. and a [illegible] truck loaded with [illegible] of nitroglycerin occurred at a grade crossing in [illegible], Ind., Sept. 21. One of the front wheels of the motor truck was torn off, but the nitroglycerin did not explode.

Ground Was Broken for the New East River Tunnels of the New York City subways from the Battery to [illegible] on [illegible] 11. The ceremonies took place at the foot of Whitehall St., and were attended by the Mayor, the members of the Public Service Commission and invited guests. The contractors are the [illegible] Engineering Construction Co. and [illegible] Flinn. The contract price is nearly $[illegible].

The Lakes-to-the-Gulf Deep Waterway proposed by the State of Illinois has been reported upon by the board of [illegible] engineers. [illegible] by which a [illegible]-ft. waterway may be built from Chicago to the Illinois River at La Salle. The recommended plan provides for the use of the Chicago Drainage Canal to Joliet, then of 15 miles of the Illinois & Michigan Canal to Illinois River. The estimated cost of this project is $[illegible].

Free Moving Picture Exhibits were given in the city parks of St. Louis during the summer months. Two wagons were sufficient to transport the entire outfit, including the [illegible] chairs used for the audience, from park to park. In this way 56 exhibitions [illegible] were given during the summer in [illegible] different parks. The expenses were within the appropriation of $[illegible]. It is proposed to continue the exhibit in the city school buildings during the winter months.

Paving Progress in Baltimore, Md.—It is reported that the Paving Commission will ask the board of Estimate for another appropriation of $[illegible] next year from the [illegible] loan. At the end of the present season, it is stated, the commission will have paved about [illegible] miles of streets since the new paving program was commenced in 1911. There is [illegible] part of the original $[illegible] which it was estimated would pay about half the cost of repaving the entire city. Another $[illegible] is [illegible] having the [illegible] the next [illegible] years.

New York Subway Construction Work continues to make satisfactory progress. There are now about 17,000 men engaged in construction work on the new subway and elevated lines. Contracts have been awarded for 59 of the 83 sections to be built. On some of the older contracts awarded in 1911 and 1912 the work is nearing completion and there are several stretches of completed structure in Lexington Ave., lower Broadway and Fourth Ave., Brooklyn. The Centre St. loop has been in operation some months. Work has recently been begun on the two-track Whitehall St. line, connecting the Broadway subway with the proposed new East River tunnels to Montague St., Brooklyn. Work has also been begun recently on both the new East River tunnels.

The Purchase of the Water-Works of the Spring Valley Water Co., San Francisco, Calif., will be submitted to popular vote next December, in accordance with action taken on Sept. 29 by the Board of Supervisors of San Francisco. The purchase is strongly advocated by City Engineer M. M. O'Shaughnessy, Mayor Rolph and the Advisory Water Committee.

The following estimates of values were arrived at after careful examination by City Engineer O'Shaughnessy and other experts in the employ of the city:

Physical properties	$13,922,534
Real estate in San Francisco	1,100,000
Lake Merced, 823 acres	1,647,340
Outside lands, 67,348 acres	6,734,800
Rights-of-way	520,000
Reservoir sites	5,022,072
Water rights	3,350,000
"Going concern"	2,500,000
Total	$34,796,746

The water company has agreed to accept $34,500,000 for its holdings. The acquisition of the water company's holdings by the municipality would end protracted litigation between the city and the company.

The Interstate Irrigation Commission held a preliminary meeting for organization at Helena, Mont., Oct. 1 and 2. Of the 16 arid and semi-arid states, nine were represented by delegates appointed by the respective governors. An organization was perfected with Ira P. Englehart, of North Yakima, Wash., as President; W. D. Beers, State Engineer of Utah, as Vice-President, and A. W. Mahon, State Engineer of Montana, as Secretary. It was agreed that the first regular meeting should be held in the City of Washington in December Various resolutions were introduced and discussed, but are to be acted upon at the next meeting, time being thus allowed for their full consideration. The most important of these resolutions looks toward the strengthening and unification of state laws regarding irrigation districts with a view to entering into contracts with the National government by which the present irrigation works built by the U. S. Reclamation Service may be turned over to the districts at the earliest practicable date and the funds thus released be used as soon as possible in building other works, and in completing some of the meritorious schemes begun and partly finished under the terms of the Carey Act, the state district and other laws. It is hoped by some such action to relieve the distress of the settlers on these projects and to overcome the general stagnation in the development of the resources of the arid West.

PERSONALS

Mr. E. B. Patterson has resigned as Engineer of the City Park Board of Dallas, Tex.

Mr. C. H. Blackman has been appointed Principal Assistant Engineer of the Louisville & Nashville R.R., with offices at Louisville, Ky., succeeding the late J. Werness.

Mr. L. E. Marshall has resigned as General Superintendent of the Illinois Northern Utilities Co., to become General Manager of the properties of the Missouri Gas & Electric Co., Lexington, Mo.

Mr. Harold Knight, former Division Engineer of the Erie R.R. at Jersey City, N. J., has been appointed Signal Engineer, with headquarters at Jersey City, succeeding Mr. W. H. Willis, resigned.

Mr. A. M. Acheson, recently Chief Engineer of the Missouri, Kansas & Texas Ry., at Dallas, Tex., has been appointed Superintendent of the Trinity district, with headquarters at Trinity, Tex. The office of Chief Engineer is abolished.

Mr. C. A. Thanheiser, Assoc. M. Am. Soc. C. E., recently Engineer of Maintenance-of-Way of the Missouri, Kansas & Texas Ry. of Texas, at Dallas, Tex., has been appointed Superintendent of the Smithville district, with headquarters at Smithville, Tex.

Mr. Charles F. Lacombe, F. Am. Inst. E. E., has resigned as Chief Engineer of the Bureau of Gas and Electricity of the Department of Water Supply, Gas and Electricity, New York City, effective Nov. 12. Mr. Lacombe has been connected with the department since 1903.

Mr. Harry Edward Prindle, formerly Canadian representative of Messrs. Palmer, Hornbostel & Jones, Architects, has opened an office at 915 New Birks Bldg., Montreal, Que., for the general practice of architecture. The Montreal office of Palmer, Hornbostel & Jones has been discontinued.

Mr. D. W. Chamberlain, for the past two years Resident Engineer of the California Highway Commission, has been promoted to be Assistant Division Engineer with headquarters at Fresno, Calif. Mr. Chamberlain was connected with the New York State Highway Department before going to California.

Mr. Frank Ringer, recently Superintendent of the Missouri, Kansas & Texas Ry., at Muskogee, Okla., has been appointed Engineer of Maintenance-of-Way, with headquarters at Parsons, Kan., to succeed Mr. L. F. Lonnbladh, promoted, as noted elsewhere. Mr. Ringer was Engineer of Maintenance-of-Way until a short time ago.

Mr. L. F. Lonnbladh, Engineer of Maintenance-of-Way of the Missouri, Kansas & Texas Ry., at Parsons, Kan., has been appointed Engineer of Maintenance-of-Way of the Missouri, Kansas & Texas Ry. of Texas, wtih headquarters at Dallas, Tex., succeeding Mr. C. A. Thanheiser, Assoc. M. Am. Soc. C. E., promoted, as noted elsewhere.

Mr. H. S. R. McCurdy, M. Am. Soc. C. E., Division Engineer in charge of the construction of the Ashokan Reservoir, Catskill Water Supply, has resigned as a member of the engineering staff of the Board of Water Supply, New York City, to go to Dayton, Ohio, with the Morgan Engineering Co., on the Miami River flood prevention work.

Mr. John P. Newton, Assoc. M. Am. Soc. C. E., Assistant Engineer, formerly in charge of the Bureau of Hydraulics, New York State Barge Canal, Albany, N. Y., has been granted leave of absence to become Engineer in charge of water supply investigations for the proposed new Pennsylvania canal system, with headquarters in Pittsburgh, Penn.

Mr. Elmer E. Bernard, Assoc. M. Am. Soc. C. E., formerly Assistant City Engineer of Lynchburg, Va., has resigned, effective Oct. 1, to become Engineer of Roadways of the Lynchburg Traction & Light Co. and the Roanoke Ry. & Electric Co. Mr. Bernard will divide his time between Lynchburg and Roanoke, Va., but will make his headquarters in Lynchburg.

J. H. Dockweiler, Consulting Engineer for the City Attorney of San Francisco, has been appointed by the City Council of Oakland, Calif., Municipal Water Expert, at a salary of $4000 per year. The appointment will not interfere with Mr. Dockweiler's consulting practice. He will be in direct charge of collecting data for rate suits and will represent the city in all water litigation.

Mr. John J. Long, for the past four years a member of the engineering faculty of Brown University, has been appointed Instructor in Civil Engineering in the University of Cincinnati, where he will teach sanitary and highway engineering. Mr. Long is a graduate of the Sheffield Scientific School, Yale University, and has been connected at various times with the Pennsylvania Lines West of Pittsburgh, the City Engineer's Office of Woonsocket, R. I.; the Bronx Bureau of Design, New York City, and more recently was Assistant Engineer in the Bureau of Highways, Borough of Queens, New York City.

Mr. A. B. Nichols, Office Engineer, under the Engineer of Maintenance, Panama Canal, has resigned and has returned to his old home in Philadelphia, Penn. Mr. Nichols was the oldest employee, in point of service, of the Panama Canal engineering staff. He was appointed to the canal service in May, 1904, and until June, 1905, was Assistant Engineer at Gatun. He was promoted to be Resident Engineer in the Culebra division, and in July, 1906, was made Office Engineer at Culebra, which position he has held ever since. Mr. Nichols was Division Engineer from 1899 to 1901 of the old Isthmian Canal Commission, and he had charge of the surveys for the Nicaraugua canal route.

Mr. C. J. Reilly, formerly General Superintendent of the Sandusky Portland Cement Co., and for the past year Consulting Engineer for the design, construction and operation of portland cement plants, with offices at Syracuse, Ind., has been appointed General Superintendent of the Sterling Portland Cement Corporation, a concern organized to take over and complete the plant started by the Seaboard Portland Cement Co., near Catskill, N. Y. This plant uses limestone

[illegible] shale and [illegible] originally designed and partly completed [illegible] the dry process. Mr Reilly proposes to redesign the entire plant to use the wet process, for the purpose of [illegible] [illegible] dust in the vicinity of the mill, and to make other [illegible].

Mr Frank W [illegible] M Am Soc C E, for many years Senior Associate Editor of "The Engineering Record" has opened consulting offices at [illegible] Broadway, New York City, and in the [illegible] St George Staten Island. Mr [illegible] is associated with Mr C F Fowler, M Am Soc C E, of Seattle Wash, and will specialize in bridge and structural steel work, foundations and general civil engineering and construction methods. He will also specialize in the preparation of engineering cases for litigation, expert witness reports and testimony preparation and mediation of cases in controversy and in the preparation of technical [illegible], popular and miscellaneous descriptions of engineering construction.

Mr Dwight B La Du, Assoc M Am Soc C E, former Division Engineer, Department of the State Engineer of New York, has been promoted to be Special Deputy State Engineer in charge of the Barge Canal work, to succeed Mr Alex F Kast M Am Soc C E, whose resignation was noted in these columns of Sept 24. Mr La Du has been connected with the Barge Canal work since its beginning with the running of precise levels in the Mohawk Valley in [illegible]. Later he was Assistant Engineer in charge of the construction of locks and canal in the vicinity of Whitehall, N. Y., and on the Champlain division of the Barge Canal. More recently he has been Division Engineer of the Eastern division, with headquarters at Albany, N. Y.

OBITUARY

Michael V Kennedy, a well known public-works contractor of Des Moines Iowa died Sept 2[illegible]. He was born in Ireland in 18[illegible].

Henry N Hamilton, a retired civil engineer, died Oct 7, at his home in Yonkers N. Y., aged 6[illegible] years. He was a great-grandson of Alexander Hamilton, of Revolutionary fame.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN ELECTRIC RAILWAY ASSOCIATION
Oct 12-16. Annual convention at Atlantic City, N J. Secy, E B Burritt, [illegible] West [illegible] St, New York City.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION
Oct [illegible]. Convention at Los Angeles, Calif. Secy, C A Lichty, [illegible] North [illegible] Ave, Chicago, Ill.

INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS
Oct [illegible]. Annual convention at New Orleans. Secy, James McFall, Roanoke, Va.

AMERICAN GAS INSTITUTE
Oct [illegible]. Annual meeting in New York. Secy, George G. Ramsdell, [illegible] W [illegible] St, New York City.

[illegible] ROAD CONGRESS
Oct [illegible]. Congress at Milwaukee, Wis. [illegible], Milwaukee, Wis.

[illegible]

[illegible]

NATIONAL MUNICIPAL LEAGUE
[illegible]

[illegible] SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS
[illegible]

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS
[illegible]

AMERICAN PUBLIC HEALTH ASSOCIATION
[illegible]

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
[illegible]

AMERICAN INSTITUTE OF ARCHITECTS
[illegible] Convention at Washington, D. C. Secy, [illegible] Washington, D. C.

AMERICAN MINING CONGRESS
Dec 7-11. Annual meeting at Phoenix, Ariz. Secy, J F Callbreath, Denver, Col.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION
Dec 9-12. Convention at Richmond, Va. Secy, C A Prosser, 1[illegible] W [illegible] St, New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS
Dec 10-11. Annual meeting at New York City. Secy, D H Cox, 2[illegible] W 3[illegible]th St, New York City.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS
Dec 2[illegible]-30. Annual meeting at Madison, Wis. Secy, F M White, Madison, Wis.

Engineers' Club of Jefferson City, Mo.—This club was recently organized with 31 charter members. H F Shaw, a member of the Missouri Public Service Commission, is President.

Indiana Electric Light Association—The annual convention was held in Indianapolis Sept 24 and 25. The following officers were elected: President, T E Grover, Terre Haute, Ind; Secretary, Thomas Donahue, Lafayette, Ind; Treasurer, Fred L Dennis, South Bend, Ind.

Conference of Mayors on the Regulation and Control of Public Utilities—Mayor Blankenburg, of Philadelphia, has invited the mayors of 75 large cities to meet in Philadelphia Nov 12, 13 and 14 to discuss public policies in regard to the municipal regulation and control of public utilities. The scheme has the indorsement of the mayors of New York City, Chicago, Cleveland and Dayton. The American Academy of Political and Social Science is coöperating with Mayor Blankenburg.

American Society of Mechanical Engineers—The nominating committee consisting of John E. Sweet, Charles Whiting Baker, John H Barr, A M Hunt and F W Gates have made the following nomination of officers for the coming year: For President, Dr. John A Brashear, of Pittsburgh, Penn; for Vice-Presidents, Henry Hess, of Philadelphia, Penn, George W Dickie, of San Francisco, Calif, and James E Sague, of Poughkeepsie, N Y; for Managers, Charles T Main, of Boston, Mass, Spencer Miller, of New York City, and Max Toltz, of St Paul, Minn, to fill the unexpired term of the late Alfred Noble, Morris L Cooke, of Philadelphia; for Treasurer, Wm H Wiley, of New York City.

Philadelphia Association of Members of the American Society of Civil Engineers—The [illegible] meeting was held Oct 5 with Hunter McDonald, President of the American Society of Civil Engineers, was a guest. The fundamental principles of the proposed federation of engineering activities in Philadelphia were approved by the meeting. The tentative draft of an act prepared by the Engineers' Commission of Pennsylvania for licensing engineers in that state was discussed. The Philadelphia Association was formally organized less than a year ago with 2[illegible] members. The membership has now reached 1[illegible] and the interest shown in the meetings indicates that it fulfills the purpose for which the association was organized.

The following officers have been elected for the ensuing year: President, Richard L Humphrey; Treasurer, [illegible] M Smith; Secretary, W L Stevens.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., [illegible] 1914

Of Engineering News, published weekly at New York, N. Y., required by the Act of August 24, 1912.

Editor, Charles Whiting Baker, [illegible] Ave at [illegible] St, New York, N. Y.

Managing Editor, Frank C. Wight, [illegible] Ave at [illegible] St, New York, N. Y.

Business Manager, [illegible], [illegible] Ave at [illegible] St, New York, N. Y.

Publisher, Hill Publishing Company, [illegible] Ave at [illegible] St, New York, N. Y.

Owners: Hill Publishing Company, [illegible] Ave at [illegible] St, New York, N. Y.

[illegible]

[illegible]

C W [illegible], Vice President,
HILL PUBLISHING COMPANY

[illegible]

RICHARD L MURPHY
Notary Public
[illegible]

Engineering Literature

CONTENTS

REVIEWS AND NOTES

How Can Engineers Best Utilize the Technical Journals?*

By John W. Alvord†

That we cannot keep abreast of the times without reading the engineering journals is obvious. That if we carefully read all the engineering journals in our chosen specialty we would have no time left to earn a living is easily capable of demonstration. What, then, is the proper attitude to adopt toward this ever increasing flood of information that pours in upon us so relentlessly?

The problem of the engineer with his technical paper is much affected by his age, station, and aim in life. To the man who is in engineering only to get money and more money, the engineering journal is a newspaper, in which he may notice mainly where there are better jobs than his own that may be sought after and perhaps obtained. To the man who is anxious to fit himself every year of his life for something better, it is an opportunity, quite unequaled many years ago, for a great variety of study. To the young engineer, the engineering journal, properly read and noted, is part of a post-graduate course in engineering. To the middle-aged man, it is a mine of data, bearing in all sorts of ways on his work, and to the mature specialist only does it begin to become burdensome by its repetition of experience, and its volume of matter on subject which has already, to him at least, been well digested.

Let us see if we can outline how each of these classes can get more profit out of the matter contained in the engineering journals than do the careless or the indifferent who, after their journal is once looked over, let it go to waste or idleness.

The young engineer should, as early as possible, take at least one good first-class engineering journal, and own it himself; bind it, if he can afford to, but lay it away in an orderly manner, in any event. If he can afford two journals, so much the better, especially if they are selected so as to widen his outlook. If one might advise, it would be to suggest enforced systematic reading of all articles particularly bearing on the line of work the reader is immediately engaged upon, and the optional reading only of such other articles as interest him.

It is probably not wise for the young engineer to indulge extensively in card indexes, filing systems, and the like, for topically arranging his available engineering journal articles. Few men know very early in life where fate and interest will land their future attention, and filing systems and special indexes are expensive and time consuming, and when indulged in without definite aim nearly always quickly become too voluminous and thereby useless. Many a young engineer has spent many weary hours filing and indexing only to abandon his system later or in despair at the quantity of material he early collects and the difficulties of making it quickly available.

If any suggestions are made along this line, it would be to start a loose-leaf letter-size (8½x11-in. page) notebook, and note in it (separate pages for separate subjects) only what appears to be extremely useful, either in exceedingly brief abstracts from engineering articles or diagrams, costs, etc. These notes will be most useful if they are confined to that kind of work in which the compiler is immediately engaged, and has on his mind at the time, or at the most, work very similar to his own, which has perhaps had his personal inspection.

If any such book is started, it is highly desirable that it be of letter size, because that is nowadays the working size to which all sorts of documents, engineering reports, and estimate work are approximating. Pocket notebooks, card indexes and odd sizes of notebooks should be avoided, if possible, as likely to be finally abandoned. The letter size fitting the stock office furniture and ordinary typewriter is much more likely to endure with the average man as a permanent system.

We next come to the man in early middle life, actively engaged in his profession, and note at once that his problem with the technical journal is the absence of "time." If he is largely engaged in administrative work, or is a salaried officer in a large enterprise with a comparatively limited range of problem, or a limited call for miscellaneous data, he may generally be content with a cursory examination of the engineering journal such as will keep him qualified on his undertaking, and the preservation of such journals in bound form, with the standard published indexes. If, however, he is entering upon novel work, or work presenting a great variety of problems, overlapping into a great variety of fields, ambition will compel him to do more than this, and some form of special indexing will appeal to him more or less strongly as he feels the need more often for research in uptodate material.

There are several methods of classifying and indexing selections from engineering literature which such an engineer may adopt.

(1) He may rely on his memory and the published index to his bound volumes.

*Extracts from a paper read at the meeting of the Federation of Trade Press Associations, at Chicago, Sept. 25, 1914.
†Consulting Engineer, Chicago, Ill.

It is safe to say, however, that few engineers really make much practical use of this method. The intervening index and the bother of a search following, prove to be discouraging to that degree that a proposed reference search is abandoned in about one-half the suggested attempts. The ideal filing system is the one in which with the least amount of effort one can put his hand immediately and accurately on the thing itself, be it a book, a pamphlet, or a data sheet.

(2) He may keep a special card index of important data, and reference to valuable articles.

This at once involves labor and attention, which few busy men can give, and which, if done by assistants or librarians, largely loses its personal value to the one who needs it. The same objection as to the discouraging effect of intervening indexes holds good here, too, and it is further safe to say that of all the contrivances for indexing, the most difficult to readily handle and rapidly examine is the card-index system.

(3) He may abstract important data in a limited way on loose-leaf transparent paper, standard letter size, and he may remove or detach articles of special value from out his journals, to be filed in regular office file system, like correspondence.

The writer has tried all of the above methods at considerable cost in time and patience, and has, for many years, settled upon the third method above outlined. With all its admitted limitations it seems to be the best for an office which is expected to find out information on a great variety of subjects in a limited time, and with the least amount of effort.

Some description of its practical workings may be of interest.

All the technical papers of the office pass on to the desk of the head of the office and are at least looked over (not read) by him. Articles important to his particular specialty are checked with pencil, and articles of especial interest are looked over with care and double-checked. Once in a long while data important enough to go to the data file are noted. This is either especially abstracted by the stenographer, or, if a diagram or road data, perhaps traced in the drafting room, all on transparent paper for copying purposes. Special data of this kind on standard-size sheets are filed in the office data file in separate but common standard correspondence size. From the data file loose-leaf working notebooks are made up from blueprints for office or travel purposes. They are altered, refilled, discarded, and sorted back from time to time as needed to keep them of usable volume and usefully up to date.

The technical journals with checked articles, go to the office clerk or the stenographer at odd hours, or the librarian if one can be afforded, and the useful articles are removed by tearing them out with a ruler. They are folded, usually once, to standard size, with one edge lap left for binding, and are then filed in a subject index file, like current correspondence. The Dewey decimal system, especially arranged for the office, is used, but only as a general subject plan. When the file is full, portions of its contents, especially that which is most useful, are simply bound in plain pasteboard covers and placed in the library shelves, with titles. Such a book for many subjects would contain all the recent articles thought to be of special value on a given single subject. The remaining portions of the technical paper are thrown away, but in a large office warranting the expense duplicate bound copies can be kept as well, with the general published index as their key.

The objections to this system are as follows:

1. It is too expensive for any but the most important offices doing specialized work.

2. [illegible] unless rigidly kept down to a minimum.

3. It requires some personal attention of the head of the office, a competent assistant or the employment of a regular librarian.

The advantages are:

1. It compels the office head to know all the time what is being published in current engineering literature, if only in [illegible].

2. It removes all intervening indexes between the searcher and the final repository in the bound volume.

3. It keeps [illegible] up to date on all lines in which one should be especially interested.

4. It is economical of [illegible] and thinking cost.

We come finally to the mature and experienced engineer of advancing years. How can he make engineering and technical literature of use?

It is safe to say that when an engineer has much passed fifty or sixty years of age, and has led an active life, in constant touch with affairs, he feels less need for accumulated data or particular description. Probably no one enjoys engineering reading as does the mature engineer, for he can read between the lines and find much to instruct as well as interest.

If his acquaintance is wide, he reads with interest the accomplishments of his friends, and the addresses of society presidents, and articles on the ethics of the profession. Of failures he is the keen student. The personal column appeals to him, and if he is of right-mindedness he is conscious of more pleasure than formerly in the accomplishments of those who have succeeded and succeeded well in dire and burdensome responsibility.

The engineering journal again becomes for him a technical newspaper of great personal interest and deep satisfaction, for no longer is he keen for jobs, or eager for data, but the human, personal, and ethical side of the life work of the engineer is uppermost in his mind, and he realizes that though he may have seemed to others, and even may have seemed to himself to have been striving all these years for emolument, as a matter of fact the deep and abiding motive of his life work has been the pleasure of being *needed* and the joy of being useful.

In conclusion, I would remark that technical papers, along with the technical societies and their proceedings, form the repository of the profession; they are the interchange of experience, the common store upon which we all draw. Without them we would be strangely helpless. We are indebted to everyone more or less who records his experience for the common use, and that debt we should endeavor to helpfully repay in kind, but wisely, concisely and thoughtfully.

Translation of Melan's Arches and Suspension Bridges

REVIEWED BY PROF. J. P. J. WILLIAMS*

THEORY OF ARCHES AND SUSPENSION BRIDGES—By J. Melan, Professor of Bridge Design, German Technical School at Prague. Authorized Translation by D. B. Steinman, Professor of Civil Engineering, University of Idaho; author of "Suspension Bridges and Cantilevers." Chicago: The Myron C. Clark Publishing Co. London: E. & F. N. Spon, Ltd., 57 Haymarket. Cloth; 6x9 in.; pp. x+303; 119 illustrations. $3.

This book is a complete literal translation of J. Melan's mathematical treatment of the elastic theory of arches and suspension bridges, as published in 1906, in Vol. 2, Part 5, of the German "Handbuch der Ingenieurwissenschaften." The translator states in the preface that admiration of the work of Melan and a desire to fill a gap in our own engineering literature on this subject were the impelling motives for the translation, and that he believes it will prove useful to practicing engineers and to teachers as a textbook for graduate work. He says: "The book will prove a liberal education in itself, rendering clear the fundamental principles of the analysis of structures, familiarizing the student with many helpful analytical and graphical devices of general application, training him in the independent derivation of formulas, and preparing him to do original work in structural theory and design."

Even after making full allowance for the natural en-

*[illegible], N. Y.; lately Assistant Professor of Structural Engineering, University of Minnesota.

thusiasm of an admirer, such a statement of the value of this book is quite evidently unwarranted. In order to justify such claims, a book on this subject should possess two definite characteristics: clear statement of notation and completeness in mathematical derivations. The book is defective in both. In order to be easily and effectively useful to both practicing engineer and student, the notation used in the many complicated formulas should be completely and clearly defined. In this book it is generally quite difficult to find the meaning of the symbols used because in nearly all cases they are defined in the body of the text, and no complete tabulated standard notation is given. In fact, in at least one case (Equation 416) the same symbol (A) is used in two entirely different ways, and often the symbols in a formula are defined after the formula is given.

The second noticeable defect is the incompleteness of the explanation and detail of the mathematical derivations. In a handbook, it is only necessary to give a concise statement of general processes and the final forms of working formulas. But for the engineer or student who really desires definite understanding of all formulas and completeness and certainty in their derivation, the book will be found to be quite unsatisfactory. Many hours of time would be required to check the mathematical formulas independently and repeat the author's omitted operations in order to confirm the accuracy of the formulas given. If mathematical gymnastics with the object of attaining a given result be the best training for engineering students, then the translator's claims for the advantages of this book as a text for graduate students are fully justified. In too many cases simple explanatory sentences stating the logical reasoning processes in detail are conspicuous by their absence, making the intelligent understanding of the mathematics unnecessarily difficult.

Aside from the defect of notation already mentioned, the book will be found most complete and useful as a reference work for formulas and both analytical and graphical methods of analysis of nearly all forms of both framed and solid arches and braced chain and cable suspension bridges. The author has undoubtedly accomplished an excellent piece of work requiring an immense amount of time and labor and great mathematical ability. It is by far the most extensive theoretical study of this subject known to the reviewer. The only incompleteness of treatment is in the theory of the continuous arch, which is not extended to include fixed ended continuous arches so extensively used in this country.

Although it has been impossible to find the time to study fully the accuracy of the translation, it appears to be both complete and exact with the exception of the translation of the word "berechnung." For example, Article 2 is headed "General Method of Design," and should be "General Method of Analysis." With this exception, the work of translation seems to be very well done.

The contents of the book are divided into five well defined sections: A—The Flexible Arch and Unstiffened Cable; B—The Stiffened Suspension Bridge; C—The Arched Rib; D—Arch and Suspension Systems with Braced Web; and E—Combined Systems. The Appendix discusses the application of the elastic theory to masonry and concrete arches, and contains short remarks on the temperature variation in steel and masonry bridges.

Section A contains two articles, one on the funicular polygon for vertical concentrated loads, continuously distributed loading and uniform loading, the other on the unstiffened suspension bridge. The latter (Art. 4) is divided into five parts, treating: (1) Form of cable and value of horizontal tension for chain (or eye-bar) cables and wire cables, and values of cross-sections required; (2) maximum attainable span, with table for various cases; (3) economic ratio of rise to span, including an example; (4) deformations and deflections under uniform loading, also effects of elongation of cable, displacement of saddles, and an example in metric units; and (5) secondary stresses due to friction at pins of eye-bar chain cable and example.

Section B, on the stiffened suspension bridge, contains five articles. The first of these, Article 5, contains the formulas for bending moments and shears in stiffening trusses, for the horizontal tension, and discusses influence lines and gives an example; this analysis being by the approximate method which neglects the effect of the deflection of the cable. Article 6 contains the expressions for values of horizontal reactions, and Article 7 the discussion of stresses in the stiffening trusses, including reaction locus, influence lines and graphical equilibrium polygon methods, effect of temperature and secondary stresses. Article 8 gives values of deflections due to loading and to temperature changes, and Article 9 contains the development of the more exact theory of the stiffened suspension bridge, with examples in metric units showing that the error resulting from the approximate theory might be a high percentage on the side of safety when light stiffening trusses are used.

Section C, on the Arched Rib with Solid Web, contains 19 articles fully developing the elastic theory of arch analysis. The first five articles discuss internal stresses in curved ribs, conditions for stability, line of resistance, core-points, graphic determination of normal fiber stresses, determination of deformations, external forces on arched rib, the reaction locus, tangent curves, and critical loading for maximum normal stresses and shears. These general formulas are then extended to apply to five different types of arch: (1) Three-Hinged Arch; (2) Arch with End Hinges; (3) Arch without Hinges; (4) Cantilever Arch; and (5) Continuous Arch. The last two articles then discuss the more exact theory of the arch, including the effect of deformation, and formulas for proportioning the section of plate-girder types of arch ribs.

In section D, the subject of framed arches and suspension systems is discussed in six articles. The treatment includes the determination of maximum stresses in members, the drawing of influence lines for three hinged and two-hinged arch frames, arch frame with tie rod, the free-ended cantilever arch, cantilever arch with ends fixed on horizontal rollers, framed arch with fixed ends, and the continuous-framed arch and braced-suspension bridge of multiple span. The example given as an illustration of the last mentioned analysis is Lindenthal's project for the Quebec Bridge, which is really an inverted two-hinged braced arch of three spans swung from rocker arms and anchored at the ends. All maximum stresses are determined, but using metric units.

Section E, on Combined Systems, contains two articles, one on the combination of an arch with a straight truss, and the other on the combination of the arched rib with a cable. The Appendix, already described, the very com-

[illegible] bibliographic and a rather meager index complete the volume.

On the whole, the typography and figures are perfectly satisfactory. In some formulas the Greek letter alpha looks almost exactly like "a," and sometimes the bold-faced symbols are not sufficiently distinct. In at least one formula there is an evident typographical error (Formula 175, "a" should be "A"). In a few figures the lines are crowded, and in Plate 1 some of the German notes and letters were not translated, but otherwise the publishers have done excellent work.

Rock Tunneling

Reviewed by F. Lavis*

MODERN TUNNELING, with Special Reference to Mine and Water-Supply Tunnels—By David W. Brunton and John A. Davis. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. vi + 450; 80 text figures. $3.50, net.

Recently in conversation with a group of well known and quite prominent engineers, the question was raised as to the utility of books dealing with such phases of practical work as, for instance, that of tunneling, and the opinion was expressed that as far as tunneling or work of a similar character was concerned, they would rather take the opinion of an experienced foreman or superintendent, that is of the practical workman, than anything to be found in books.

The writer has had enough practical experience to have a good deal of respect for the opinion of the intelligent, practical man, but he has felt for many years that in regard to tunneling this had been carried rather too far in the United States. This may be one of the reasons why, up to within, say, six or seven years ago, the Europeans were so far ahead of us in this class of work, which has there been almost entirely directed by engineers and here by foremen. Since engineers in this country have taken an active part in the analysis of the causes which make for rapid progress and low costs and in the active direction of the work, we have done much better here and in many respects equaled or bettered European records.

Some seven or eight years ago, the writer was asked to review the book on tunneling, written by the late David McN. Stauffer. This was really a compilation of a number of descriptive articles previously published and scattered through a number of technical papers and periodicals, and while the reviewer admitted the fact that such compilation had a certain value, he expressed the opinion that there was a great need of a book on tunneling which would thoroughly discuss the relative value of modern appliances and the reasons for the (at that time) very poor showing (of progress) in American tunnels (as compared with European).

The introductory chapter of the book under review, which set forth its scope, warranted the expectation that this need had now been met, and it is a pleasure to say at once that this expectation has been realized. The introduction states that descriptions of work done are interesting historically, but that in very few of the published descriptions "do the writers attempt to criticise the methods [illegible] [illegible] [illegible] methods and [illegible]." In this volume, on the contrary, the authors state that the "[illegible] of each method will be a primary consideration" and that constructive rather than destructive criticism will be their object. "For that reason emphasis will be placed upon safe, efficient and economical methods and upon good points of equipment, while bad practice and obsolete machinery will be ignored except, perhaps, as examples of the inadvisable or as they have some bearing historically. Thus the authors hope to set forth a guide for future work rather than an unilluminated record of past or present achievement."

The authors have confined themselves entirely to descriptions of and the discussion of methods, applicable to mine adits and small tunnels, "where the entire cross-section is excavated in one operation," and practically entirely to excavation in solid rock. This, of course, limits the scope of their work and it would seem that the book might appropriately have been entitled, Modern Rock Tunneling as Applied to Mining and Small Water-Supply Tunnels.

The first three chapters, pp. 1 to 53, are devoted first to an introduction and a statement of the purpose of the authors, second to a brief history of tunneling from the earliest beginning to modern times, and which rather strangely includes the only reference and data in the book referring to railroad tunnels, and the third, contains some data of modern mining and water tunnels, including, of course, the tunnels of the Catskill and Los Angeles aqueducts (though the former are larger than those to which the subsequent discussions refer), the Newhouse, Laramie Poudre, Carter and others well known to those who keep in touch with this subject.

Chapters 4 to 14, however, contain the matter of greatest interest. Chapters 4 to 10, pp. 53 to 207, contain descriptions of and discussions of the value of various types of machinery, power plants, compressors, tunneling machines, drills, cars, ventilation methods, etc., etc. There are many tables and the advantages and disadvantages of the many different varieties of equipment, and their particular application to various conditions are very fully and intelligently analysed.

In chapters 11 to 14, pp. 208 to 274, the various methods of drilling, blasting, mucking and timbering are treated in the same analytical manner and the discussion is so exhaustive and complete within the limits of the class of tunnels to which the authors confine it as to be of undoubted value and interest to anyone interested in the practical side of tunneling, whether engineer or foreman.

There is a chapter on Safety, one on Costs, and a Bibliography. The latter is arranged for convenient reference under some 30 different headings such as for instance, Steam Power, Water Power, Tunneling Machines, Drilling Methods, Speed Records, etc., etc. There is an index at the end which is well arranged and seemingly quite complete.

Speaking generally, this book is a distinct and quite valuable acquisition to the literature of tunneling. There is nothing at all in English which the writer knows of which has attempted to cover the same field, and the authors are to be congratulated on having accomplished a difficult task so well.

They have, however, in their discussions of methods practically entirely ignored the field of railway tunnels, or any tunnels of larger cross-section than that in which the entire excavation is made at one operation, and practically nothing is said regarding methods of tunneling in soft ground except in the chapter on timbering.

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and this is rather brief and like the rest confined only to tunnels of small cross-section.

So far as rock tunnels of large cross-section are concerned, of course, the methods described are quite as applicable to the heading work as they are to the class of small tunnels discussed, but there are many factors controlling the operation of the excavation of rock tunnels of large cross-section which need the same kind of analysis as has been here given to the small tunnels; such, for instance, as the economies of shaft sinking, the relation of the heading to the enlargement, the questions of top and bottom headings, the use of steam shovels for mucking, the clearance of the heading operations from those of the enlargement, etc., etc.

The Bibliography occupies some sixty pages, but it is doubtful if its value is as great as that of the rest of the book, as it is far from complete. In the first section, for instance, covering "Tunnel Description," there is no reference to the two volumes of the Transactions of the American Society of Civil Engineers, describing the New York Tunnels of the Pennsylvania Railroad, or to many other articles of seemingly equal importance to those quoted, although there are included references to such works as the "The Blackwell Tunnel in London and the Tunnels of the Hudson & Manhattan Company in New York," both subaqueous, shield driven, and therefore, apparently outside of the scope of the book. It is true that there is a note to the effect that this is a "selected" bibliography, but the value of anything of this kind is largely in its completeness. Many references are duplicated under the various headings and for future consideration it might be suggested that the bibliography be made complete in one section with an index to the various subjects covered.

How to Operate Sewage Works: A German View

REVIEWED BY EMIL KUICHLING*

ABWASSERREINIGUNGSANLAGEN IHRE LEISTUNGEN UND IHRE KONTROLLE VOM CHEMISCH-PRAKTISCHEN STANDPUNKT—Von Prof. Dr. K. Thumm, Abteilungsvorsteher an der Königl. Landesanstalt für Wasserhygiene in Berlin-Dahlem. Berlin: August Hirschwald. Paper, 6x9 in.; pp. 92. 2.80 Marks.

This monograph deals mainly with the scientific management of sewage-disposal works, and emphasizes the obligation to conserve the purity of the outfall waters into which the effluent is discharged. It frequently happens that well designed works fail to be efficient when skilled supervision is neglected, and the operation is carried on chiefly with the view of avoiding complaints about offensive odors. In such cases, a serious pollution of the outfall is often the natural consequence, and hence a careful manager must give due attention to both the plant and the outfall.

The subjects considered embrace the physical and chemical analyses of water, sewage and effluents and the operation of disposal works of every description, embracing screens, sedimentation tanks, chemical treatment, septic tanks, natural and artificial filters or biological purification processes, final purification of the effluent in fish-ponds, treatment of sludge, and the scientific supervision of the outfall; and in conclusion, a brief review of the preceding chapters is given with some general remarks about the treatment of industrial wastes. Numerous analytical data and descriptions of methods of examination are presented, together with the results attained by the various modes of treating sewage of different strength or quality.

The book is well written and contains much valuable information in condensed form. Its keynote is that the secret of a successful result in operating sewage-disposal works is careful management, guided by scientific knowledge and practical experience in securing the utmost efficiency of every available appliance.

*Consulting Engineer, 52 Broadway, New York.

Multiplication by Addition, Subtraction and Division

REVIEWED BY ROSSITER R. POTTER*

COX'S COMMERCIAL CALCULATOR; A Novel and Easy Method of Multiplication, One Formula for all Calculations, Range of Results from a Single Unit to Over Ten Billions, Automatic Index to Tables—By Edward L. Cox, Southport, Lancashire, England. New York: Funk & Wagnalls Co., and the Remington Typewriter Co. Linen; 7x11 in.; pp. 101. $10.

The tables of figures making up this book may be used to find the product of any two whole numbers whose sum does not exceed 202,000. In other words, they may be used for multiplying together any two numbers having up to five digits apiece and they cover besides a limited range of six-place multiplications. The products are not obtained directly from the tables, but indirectly from "key numbers" obtained by a simple manipulation of the multiplier and multiplicand. The lesser of the two numbers to be multiplied is first subtracted from the greater. Dividing the difference by two gives the first key number.

$$\frac{A - B}{2} = \textit{first key number} \qquad (1)$$

The second key number is then obtained by adding the smaller of the numbers to be multiplied to the first key number.

$$\frac{A - B}{2} + B = \textit{second key number} \qquad (2)$$

The number in the tables corresponding to the first key number is then subtracted from that for the second key number and the resulting difference is the desired product.

The explanatory text and instructions occupying the first three pages do not tell the secret of the book's operation. A moment's consideration, however, of the algebraic form of the key numbers, as given above, shows that the book is simply a table of squares.

$$\left(\frac{A - B}{2} + B\right)^2 - \left(\frac{A - B}{2}\right)^2 = AB \qquad (3)$$

The difference of the squares of the key numbers gives the product of the principals. Besides the explanatory text telling how to use the book for multiplying, it differs from ordinary tables of squares in being ingeniously arranged to be self-indexing. The proper page can be turned to at once and the desired number very quickly located. It gives the squares of all numbers up to 100,999.

The chief use of these tables as a means for multiplying is with numbers of five and six places. Even here it is necessary to actually write down more figures than in long-hand multiplication and the time required is about the same. For smaller numbers than five places,

*Assistant Manager and Production Engineer, Blood Bros Machine Co., Kalamazoo, Mich

the long-hand method is quicker, though perhaps more liable to error. The Cox method requires less mental exertion and not such close attention, since the chief operations involved are addition and subtraction. In this respect the Cox tables are comparable to a table of logarithms. They are about equal in scope to a table of six-place logs, with the advantage that the products obtained are exact to the last digit without the need of interpolation.

NEW PUBLICATIONS

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

ANALYSIS OF A THREE-LEGGED STIFF FRAME, Stressed by a Horizontal Load—By N. M. Stineman (4923 Winthrop Ave., Chicago, Ill.) [Reprint of paper presented to Western Society of Engineers, Sept. 14, 1914.] Paper, 6x9 in., pp. [illegible], 11 illustrations. 25c., postpaid.

ANALYTIC GEOMETRY.—By L. Wayland Dowling, Associate Professor of Mathematics, and F. E. Turneaure, Dean of the College of Engineering, University of Wisconsin. New York: Henry Holt & Co. [American Mathematical Series.] Cloth, 6x9 in., pp. xii + 266, 110 text figures. $1.[illegible] net.

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Engineering News

VOLUME 72 | OCTOBER 22, 1914 | NUMBER 17

The Spokane River and Hangman Creek Viaduct of the O. W. R. R. & N. Co.

By J. O. Baar*

Where the Oregon Washington R.R. & Navigation Co. gains entrance to the City of Spokane, Wash., over its new line from the west, it crosses the valleys of the Spokane River and Hangman Creek on a single-track steel viaduct 3003 ft. long and 187 ft. high above low water. At the site of the bridge, the Hangman or Latah Creek is nearing the end of its course, and is separated from the Spokane River, which it parallels at that point, by a low ridge only a few hundred feet wide. The bridge traverses the valleys at right angles and at the narrowest point.

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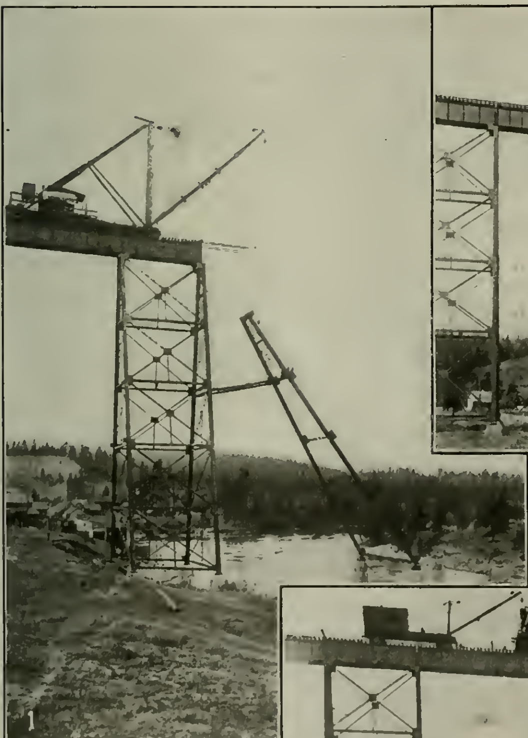
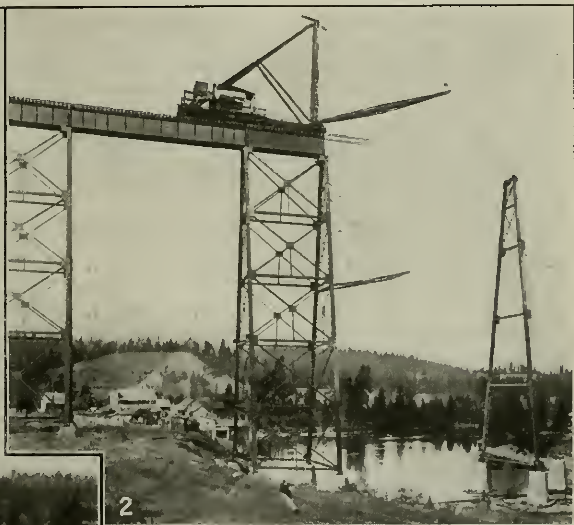
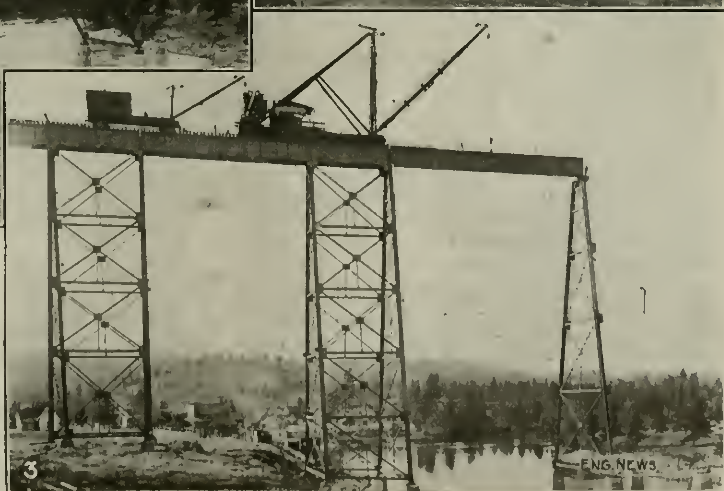






Figs. 1-3. Erecting Bent 12, for 105-Ft. Span, by Tripping up into Vertical; Hangman Creek Viaduct

Fig. 1. Temporary bent lashed to bent 13, and bent 12 ready to be raised.
Fig. 2. Bent 12 in vertical position. Note the lines used in raising.
Fig. 3. Setting 105-ft girder, 38 tons, between bents 12 and 13. Rear of derrick car heavily counterweighted with steel members.

Description of the Viaduct

Design—The alignment of the bridge is tangent for 2700 ft., terminating in a spiraled 5° curve on the west end. The grade is 0.6% [illegible], downward to the east.

Several preliminary studies were made in connection with this structure. The design finally decided upon contains two spans of 105 ft., 17 of 80 ft., four of 70 ft., one of 60 ft., three of 50 ft., 20 of 40 ft., one of 45 ft. and three of 35 ft., all deck plate-girder spans. The main portion consists of 80-ft. spans between 40-ft. towers, with two 105-ft. river spans.

The design of the superstructure was based on the O. W. R.R. & N. standard wheel-loading, which practically corresponds to Cooper's E55. The specifications used allowed a stress of 8000 $\left(1+\frac{min.}{max.}\right)$, reduced by [illegible] for compression. A rather low bearing value on concrete masonry was used, 250 lb. per sq.in. This necessitated the use of large cast-steel column bases, those for the river piers being 4 ft. 2 in. square.

The tower columns are of built-up channel section, having 18-in. webs, 4x4- and 6x6-in. angles and 22-in. cover plates. The maximum cross-section (at bents 11 and 12) is 67 sq.in. The struts are made up of 12-in. channels placed back to back and latticed, those over 27 ft. in length being supported in the center by vertical hangers riveted to the gusset-plates at the intersection of the diagonal braces in the panel above. Two 4x3- to 5x4-in. angles with batten plates were used for diagonal bracing.

The girders are spaced 8 ft. c. to c. and are of uniform depth of 8 ft. 9 in. throughout the entire bridge, except in the 105-ft. river spans and the 50-ft. span between, where they are spaced 10 ft. center to center, with the long girders 9 ft. 8 in. deep. They were designed with clear [illegible] flanges built up of 6x6-in. angles and 8-in. side plates, allowing all ties to be of the same depth and without daps for cover plates at river bents.

All 70-ft. and 80-ft. girders were designed with simple sliding expansion at the down-grade end. The 105-ft. girders, however, have rocker bearings and segmental expansion rollers [illegible] between [illegible] surfaces.

The design of the masonry foundations was based on a safe bearing value of the soil of 4 tons per sq.ft. For the dry-land foundations, pedestals 3 to 6 ft. square on top were used, ranging in height from 6 to 31 ft., with the sides battered from 1 : 12 to $1\frac{1}{2}$: 12, the batter varying inversely as the height. Two anchor bolts of 2 in. to $2\frac{1}{4}$ in. diameter, ranging in length from [illegible] ft. to 11 ft., and connected at the lower end by a steel plate, were embedded in the concrete at a depth where the weight of the concrete above the plate would resist the uplift. The pedestals are of 1 : 3 : 5 concrete, resting on footings of 1 : 3 : 6 mixture.

Open-Caisson Piers

The depth of excavation for the dry-land work varied from 5 ft. to 22 ft., for the Spokane River piers inside the high-water line from 9 to 22 ft., and for the Hangman Creek piers 14 to 21 ft. All dry excavation was done by hand, a force of from 10 to 25 men keeping [illegible] well in advance of the concreting crew.

The Spokane River piers were constructed by the open-caisson process. These piers are diamond shaped 6 ft. wide on top and 12 ft. from point to point, with the sides battered $1\frac{1}{4}$: 12. They rest on from 22 to 26 timber piles.

The formation quite uniformly encountered was a deep bed of well packed coarse gravel and sand with embedded boulders, overlaid with from 2 to 4 ft. of sandy soil. Occasionally, pockets of volcanic ash were met with. Test-borings carried to considerable depth in the river beds revealed no change in the general formation.

For the river work, a temporary pile trestle was first built on the center-line of the bridge, with the deck at an elevation of 8 ft. above low water, which was sufficiently high to take care of such floods as might reasonably be expected during the period of construction. Extensions of this trestle at right angles were built at the center of the river towers, so that all piers could be reached. The caissons, averaging 22 ft. in depth, with inside dimensions 2 ft. larger all around than the footings of the piers, were built up of 3x10-in. plank laid on the 10-in. face and spiked together with 60d. nails. Sections 6 ft. high were put together on the trestle, a V-shaped cutting edge of timber drift-bolted to the bottom, and towed out to their location, where they were anchored to guy piles, previously driven. The caissons were then completed in the river and weighted down with rails distributed in such a manner that any part of the interior could be reached with an excavating bucket.

The excavation was done with a clamshell bucket of 1 cu.yd. capacity, operated from a stiffleg [illegible] derrick placed on the trestle at the intersection of the wings. The excavated material was deposited around the caissons. In excavating, the cutting edge was first evenly undermined to insure a uniform settling of the caisson. Occasionally, a caisson would list rapidly to one side, then the opposite side would be additionally counter-weighted and undermined until it righted itself again. After the excavation was completed, 4x8-in. t. & g. sheetpiling was driven snugly against the outside of the caisson, from leads suspended from the derrick. Where the sheetpiling did not drive up tight, the intervening space was filled with [illegible], rammed to shut out the water.

The foundation piles, 22 to 26 under each pier, were driven next, with a 2200-lb. drop-hammer piledriver equipped with 20-ft. leads and 15-ft. extension leads, and 7x10-in. hoisting engine using a [illegible]-in. steel cable for the hammer line and a [illegible]-in. steel cable for the pile line. The piles were driven to refusal at an average penetration of 18 ft.

Before attempting to pump the caissons dry, the bottom was sealed with a 5-ft. layer of 1 : 3 : 5 concrete, deposited with a tremie, a 10-in. steel pipe slightly flared at the lower end and a [illegible] receiving funnel riveted to the upper end, operated from a scaffold set on the caisson. It was found that the best concrete resulted by starting with a dry batch and following it with semi-fluid concrete. The dry concrete would keep the water out of the tremie and the thin concrete would come out slowly and spread itself evenly.

Leakage Troubles—Much difficulty was encountered in pumping out the caissons. For this purpose, one 6-in. and one 4-in. centrifugal pump were installed. The many joints in the caissons, almost every one of them allowing leaks, led to so much water that both pumps working together never lowered the water more than 7 ft. To make the joints watertight, cedar shingles sharpened to

a thin edge were driven into the larger cracks of the pumped-out section, after which the water could be lowered a few feet farther, and the process repeated; afterwards, the small leaks were stopped with waste. The piles were then cut off 2 ft. above the concrete, and the remaining portion of the footings completed with 1 : 3 : 5 concrete.

For the construction of the Hangman Creek piers, it was not necessary to build a temporary trestle. At the time the work was commenced, the creek was practically dry. However, Hangman Creek is subject to severe and sudden floods, so it was decided to use caissons for the top of the forms and one or two lanterns in the space between the canvas and the concrete kept the frost out successfully. The cost of heating the aggregate, etc., was 12½c. per cu.yd. concrete.

Erecting the Superstructure

The steel for the superstructure, shipped from the East to Hooper, on the O. W. R.R. & N. Co.'s cutoff, about 83 miles southwest of Spokane, was brought to the site over the new line. The west approach of the bridge being an embankment over 3000 ft. long and an average of 20 ft. high, followed by a series of short and com-

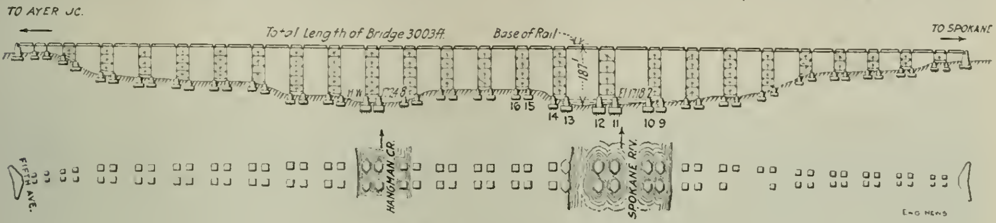


Fig. 4. Diagram of the O. W. R.R. & N. Co.'s Viaduct over Spokane River and Hangman Creek at Spokane, Wash.

six piers, similar to those employed on the Spokane River foundations. It was well that such provision had been made; the creek rose rapidly while excavating, but no damage was done to the foundations. The work of excavating was done by hand, using buckets operated from a small hoist to dispose of the muck. The foundation piles were driven and cut off before placing concrete, one 6-in. centrifugal pump keeping the pits dry.

The forms for piers and pedestals were built of 2x8-in. t. & g. fir and tamarack, with four 2x8-in. studs on the north and south faces and three 2x8-in. studs on the others. The two center studs on the north and south sides were spaced 6 in. center to center and cut off 2 ft. above the top of masonry. These were used to support a 4x8-in. plate, provided with two 2-in. or 2½-in. holes through which the anchor-bolts were hung. Around the anchor-bolts were placed tapered boxes made of half-inch lumber, 4 ft. long, 6 in. square at the upper end and 3 in. square at the lower end, the top flush with the top of the pier. Before concreting, the boxes were covered with grease, and upon completion of the pedestal they were removed, thus leaving sufficient space to correctly realign anchor-bolts which might have been displaced. It was found best to loosen the boxes about one hour after the last of the concrete was poured, and then no difficulty was experienced in removing them entirely when the forms were taken down. Occasionally, this would be neglected and the boxes were so tight that they had to be burned out.

Perhaps 60% of the concrete was placed in freezing weather, with temperatures as low as 18° below zero; then proper precautions had to be taken to insure satisfactory results. The sand and crushed rock were heated by turning steam into perforated wooden boxes 8 in. square and 20 ft. long, on top of which the aggregate was dumped to a depth of 3 ft. directly from the wagons. This proved sufficient at all times to keep the frost out of the material. The water was heated to a temperature of about 70° and the exhaust steam of the mixer engine was discharged into the drum. Canvas placed over the paratively high cuts and fills, the storage facilities were not the best. The steel was therefore distributed along the roadbed for a mile and a half west of the bridge. A blind siding in a borrowpit served to store and switch derrick cars and steel cars awaiting unloading. For unloading, two small self-propelling derrick cars, equipped with a two-drum, three-spool hoisting engine, 40-ft. timber boom hinged to a revolving center post in the A-frame, rigged for a capacity of 25 tons, were used. For the erection, a stiffleg A-frame derrick-car was specially designed. The body of the car, consisting of six 9x18-in. by 70-ft. timbers, cross-braced and so spaced that the width of the car was made 11 ft., was carried on one eight-wheeled truck in front and two sets of wheels placed 6 ft. and 20 ft. respectively, from the rear end of the car. The derrick was run on four rails spaced standard and 8-ft. gage. The A-frame, 50 ft. high, 5 ft. wide on top and 11 ft. at the base, was framed of two 12x14-in. batter posts and one 18x19-in. center post, cross-braced in the manner of a trestle bent. Two rear stifflegs of 14x14-in. by 80-ft. timbers extended from the top of A-frame to the rear of the car. The boom consisted of one 18x18-in. by 81-ft. Oregon fir timber, trussed on all four sides with a 4x18-in. plank. The fixed end was hinged to a bullwheel placed directly in front of the A-frame, a special engine operating the swing cable. Power was supplied by a double-drum, four-spool American hoisting engine. The drums carried ⅝-in. steel cable rove through six-sheave blocks on the mast and boom. From the spools were operated two runners or side lines running through single sheaves placed at the end of the boom, one on each side of the load line.

This car never left the bridge. The steel was brought to it by the small derrick cars and placed on outriggers consisting of 12x12 timbers 22 ft. long, put under the track and projecting 6 ft. beyond the ends of ties, braced by struts resting on the bottom flanges of the girders. As the erection progressed, these outriggers were moved ahead so that the main car never had to back up more than 500 ft. to get the material.

Before placing the cast column bases, the piers were carefully gone over and, where the shrinkage of the concrete was less than provided for, bush-hammered to the proper elevations. The work of erection was carried on from the west end only. After the bents reached a certain height, it was found most economical to bolt up two column sections in the yard, thereby lessening the work in the field. The columns and struts were placed with the head wire, the transverse and longitudinal beams with the side lines or runners. Where the ground was suited, the top section would be completely assembled on the ground and then raised. Temporary erecting struts were used to stay the bents forming the east supports of tower spans. The longitudinal or tower bracing was filled in as the erection of the farther bent progressed. [...] of bent 13. The bent was held in a position slightly inclined from the horizontal by two lines fastened to bent 13 at the second strut from the top (see Fig. 2). The three lower column sections of the bent to be erected were completely riveted in the yard and the cast bases bolted on. A temporary timber blocking was put around the anchor-bolts in the piers, and the columns were so placed thereon that when the bent was vertical, the anchor-bolts would match the corresponding holes in the column bases.

These preparations being completed, the columns were moved to the outriggers. In placing these long members, the movement of the lower end had to be guided by one of the small derrick-cars until the column was in a ver- [illegible]

Fig. 5. The Completed Spokane-Hangman Viaduct

ing was filled in as the erection of the farther bent progressed.

Erecting the [illegible]

The most interesting feature was the erection of bents 13 and 12, forming the east supports for the [illegible] girders. With the equipment on hand, two methods were open: (1) to erect the bent vertical, necessitating the [illegible] of every member a distance of 90 ft., or (2) to erect it in an inclined position on a temporary support. The latter method was employed.

For this purpose, a temporary timber bent 42 ft. high, consisting of four 12x12 posts and caps braced with 8x12 timbers, was framed. The center-to-center distance of the posts at one end corresponded with the column distance of the columns of bent 12 at a point just below the fourth transverse strut, and on the other end with the column spacing of bent 13 at the third transverse strut. One end of the bent was lashed to the columns

that position, after which it had to be anchored to the pier and was finally placed with the upper end resting on the temporary bent. After both columns were properly aligned, the transverse struts were connected up, the bottom section was assembled on the ground and [illegible] into place.

[illegible] the Bent

With the bent in the inclined position, a double-chain was swung around the columns immediately above the third transverse strut, and to this one of a set of 12-in. [illegible] blocks was attached, the other block being made fast to a guy line carried out to a post on the east side of the river. The line from through the set of blocks [illegible] was carried upward and over the top of the bent and thence to a snatch-block as well as the double-engine. In order to keep the line from fouling the top strut, the [illegible] was passed through a snatch-block made fast to the end of one of the runners. This block

is seen in the illustration immediately back of the diamond block at the end of the boom. The second runner line passed from its sheave through a snatchblock made fast to the top transverse strut, thence it led and was made fast to a pier on the east bank of the river. In order to prevent the bent from falling forward as it assumed a vertical position, should anything happen to the load line, two snublines were attached to the columns of the bent being erected, leading to bent 13 and made fast thereto.

Power was applied simultaneously to the load line, the line leading from the set of blocks guyed to the east side of the river and to the second runner line described above. The bent then assumed a vertical position, resting on blocking placed around the anchor-bolts, as previously described. With the bent in this position, a slight strain was taken on all the lines, holding the bent as rigidly as possible, while two 35-ton Norton jacks were placed under the lower transverse strut immediately adjacent to the columns, and the entire bent was lifted sufficiently to release the blocking. The blocking was then removed and the bent uniformly lowered over the anchor-bolts. The outhaul line was snubbed around the top transverse strut, and all other lines attached to the derrick car let go.

In the meantime, the 105-ft. girders were placed on the outriggers by the small derrick cars working boom to boom. The main car then backed up, and, picking up one of the girders, moved forward and landed it in position, after which it was bolted down. The other girder was then placed and the braces filled in.

Bent 10, the east support of the other 105-ft. span, was erected in a similar manner.

The riveting was done by compressed air, a plant of 250 cu.ft. per min. capacity being installed for that purpose at the west end of the bridge, from which a pipe line was extended to the front on the deck of the structure. From six to eight riveting crews riveted the steel as fast as it was erected. All field rivets were given one coat of black graphite paint.

Engineering

No difficult features presented themselves in establishing the center line. After the line was definitely located, substantial hubs were driven at intervals not exceeding 100 ft., projecting far enough above the ground surface to allow the tape to be suspended between points. In these, wire brads were set to serve as chaining points, the tops of hubs being trimmed to an apex at the brad. These hubs were numbered in succession from the east end, and the distance between them measured with a standard tested tape, graduated to feet and hundredths. Readings were taken to the nearest thousandth of a foot, the pull being measured with spring balances and the temperature read to the nearest half degree. Levels were then run carefully over the hubs, and, with the measured distance and the difference of elevation between points, the horizontal distance was computed, and checked in the field by horizontal chaining. At the center line of each bent, a substantial hub was driven 3 ft. into the ground, with the top flush with the surface. At every fourth bent, a concrete hub was placed. The Spokane River was triangulated first, and after the temporary trestle was built, the distance was checked by actual chaining. Great care was taken in setting the anchor-bolts, with very gratifying results throughout. After the bridge was completed, its length was measured on the deck, and checking the original chaining within 0.02 ft.

The construction of the substructure for this bridge was commenced in August, 1911, and rushed to completion by March, 1912. The quantities involved were: 8250 cu.yd. excavation, 14,400 lin.ft. piling, 1110 cu.yd. 1 : 3 : 6 concrete, 4155 cu.yd. 1 : 3 : 5 concrete, and 285 cu.yd. 1 : 2 : 4 concrete. For the superstructure, 3822 tons of structural steel were used.

A change in the plans for delivery of the steel caused the erection of the superstructure to be delayed until June, 1913. The bridge was completed in November, 1913, and opened for traffic the same month.

Chaugren, Boynton & Co., of Spokane, had the contract for the substructure. The superstructure was fabricated by the American Bridge Co. and erected by the Kelly-Atkinson Co., of Chicago. G. Schennewerk and E. Baggs acted as superintendents. The writer was engineer-in-charge for the Oregon-Washington R.R. & Navigation Co.

Permeability Tests on Gravel Concrete are being made at the University of Wisconsin. A progress report by Prof. Morton O. Withey, read before the Western Society of Engineers, Sept. 14, 1914, gave the following summary of the tests so far made.

1. None of the concretes tested were absolutely watertight if we consider continuous flow into the specimen as proof of permeability, but the majority of the mixes [varying from 1:1 to 1:3:6] were so impervious that no visible evidence of flow appeared. For most purposes such mixes can be considered water-tight.

2. The visibility of dampness on the bottom of the specimens increased with the humidity of the air and the nonhomogeneity of the concrete. The minimum rate of flow for which leakage was indicated was 0.00011 gal. per sq.ft. per hr.

3. In tests of nearly all of the properly made mixes of 1:7 proportions, or richer, the rate of flow for a 50-hr. period was less than 0.0001 gal. per sq.ft. per hr. under a pressure of 40 lb. per sq.in.

4. Through increasing the fineness of the cement a reduction in the rate of flow and a considerable increase in the strength of a 1:9 mix were secured.

5. By grading the sand and gravel in accordance with Fuller's curve it was possible to obtain practically watertight concrete of 1:9 proportions under pressures less than 40 lb. per sq.in. To secure such results, however, requires great care and careful supervision in mixing, in determining the proper consistency, in placing, and in curing the concrete.

6. In the proportioning of such materials as these, volumetric analysis coupled with a determination of the density and air voids yields very valuable information concerning the best proportions of sand and gravel for a given proportion of cement. If proportions must be selected arbitrarily a 1:1½:3 mix, by volume, is very impervious.

7. The use of the proper amount of water necessary to produce a medium or mushy consistency is one of the most important conditions in securing impervious concrete, especially when lean mixtures are used. Dry mixtures cannot be sufficiently compacted in the molds and are more difficult to cure properly than the mushy mixtures. Although the use of a wet consistency does not materially affect the imperviousness of very rich mixes, such as 1:1½:3, it greatly increases the flow through a lean mix.

8. For lean mixes made from damp sand it seems advisable to mix longer than is now common practice. These tests would indicate that for a mixer running at 30 r.p.m., a period of one and one-half to two minutes is required to secure thorough mixing of a 1:9 concrete. For a rich 1:1½:3 mix a one-minute period appears to be sufficient. The method of mixing in which water is first admitted to the mixer is to be condemned. A preliminary period of dry mixing lasting from 15 to 30 sec. seems desirable.

9. No stage or process in the making of impervious concrete is of more importance than curing. The results of these tests clearly demonstrate that premature drying destroys the imperviousness of 1:9 mixes, seriously impairs that of the 1:2:4 mixes and somewhat diminishes that of the 1:1½:3 mixes. For thin sections, not over six or eight inches thick, the curing conditions should be such that a lean concrete will be kept damp for a period of one month and a rich concrete for at least two weeks. Even after a month of proper curing, complete desiccation of a lean mix composed of these materials produces an increase in permeability, but the effect on a rich mix is not marked.

10. In these tests the imperviousness of the concrete increased rapidly with the age of the specimens for the first month; thereafter the change was not marked.

11. From the tests thus far made it seems probable that the permeability of lean concrete in a direction normal to the pouring is greater than in the direction of pouring.

Pipe-Laying Methods on the Narrows Siphon of the Catskill Aqueduct, New York City

The general features of the Narrows siphon of the Catskill Aqueduct were described and illustrated in Engineering News of Apr. 30, 1914, pp. 916-918. The present article and illustrations give some additional points, developed in the construction work, which are taken from a recent description of the project prepared by the engineers of the Board of Water Supply of the City of New York.*

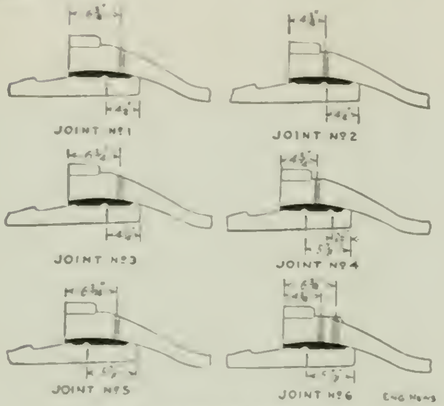


Fig. 1. Evolution of Joint

The Narrows pipe line, which is being constructed to supply Staten Island with water from the Catskill Aqueduct, will consist of a 36-in. cast-iron flexible-jointed submarine pipe, about 10,000 ft. long, containing in all approximately 4000 tons of pipe.

Before deciding on this type of construction, many schemes were investigated. A pressure tunnel, such as has been used on the main line of the Catskill Aqueduct, was not well adapted to the conditions on account of the comparatively small quantity of water to be delivered, the length of the crossing, the great depth of the underlying rock, the difficulty of making additional borings, and the long time required for exploration and construction. The estimated cost of construction of a [illegible] tunnel was very much greater than for this pipe line.

The crossing has many of the usual difficulties encountered in laying submarine pipe, and in an exaggerated degree. The Narrows is the main entrance to New York harbor from the ocean; through the channels pass the largest steamships afloat and very many craft of all kinds, making it one of the busiest channels in the world.

The pipe line will cross the anchorage grounds for [illegible] and lines of [illegible]. Across the anchorage ground [illegible] about 50 ft., [illegible] to about [illegible] ft. below [illegible] for a length of nearly [illegible] ft. is required.

Government regulations require that no refill shall be placed above [illegible] ft. below mean low water, and protection of the pipe requires about 3 ft. of refill, so that the bottom of the pipe must be at least 56 ft. below mean low water. This great depth made it advisable to do as much of the work on the surface as possible, and therefore the continuous method of laying pipe by means of a cradle was preferred to any method of lowering the pipe in sections and joining them together on the bottom.

The modified Ward joint, known as the Doane joint, was selected as the highest development of the flexible joint to date. Experiments were made with a view of adapting it to the excessively rigorous conditions met in the Narrows. This joint is essentially a ball-and-socket joint, the socket being the bell of one pipe, and the ball the lead-covered spigot of the adjoining pipe.

On account of the shrinkage of the lead, all poured joints leaked excessively until calked at the face. The effect of the calking penetrates only ¾ in. into the lead, and as the pipe is deflected while laying at least 5°, corresponding to a horizontal movement of 2 in. along the line of the joint, the effect of any face calking done on the scow would be destroyed while laying. To obtain a tight joint, calking would therefore have to be done by divers after the pipe had reached the bottom. This would be extremely laborious and expensive on account of the great depth and strong tidal currents which limit the hours divers can work.

Experiments were conducted prior to letting the contract with a view to developing a joint which would not require calking under water. Various alloys of lead with tin and antimony were tried with a view to developing

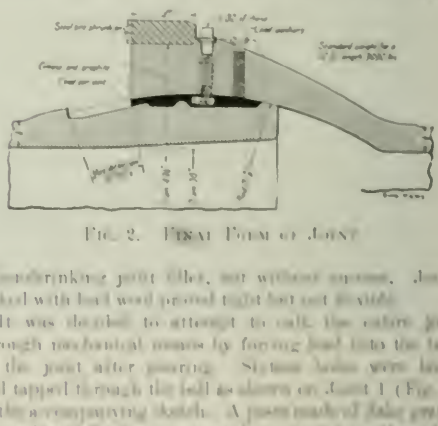


Fig. 2. Final Form of Joint

a nonshrinking joint filler, but without success. Joints calked with lead wool proved tight but not flexible.

It was decided to attempt to calk the entire joint through mechanical means by forcing lead into the back of the joint after pouring. Sixteen holes were bored and tapped through the bell as shown on Joint 1 (Fig. 1) in the accompanying sketch. A [illegible] flake graphite and anti-friction compound was put into these [illegible] holes and forced into the joint by screwing in [illegible] or pit screws. Lead plugs ½ in. in diameter and 1 in. long were then screwed down, about seven pellets per hole being used, amounting to nine pounds of lead for the whole joint.

The joint proved to be tight and flexible under ordinary conditions and the promise of ultimate success was sufficient to proceed with the letting of the contract. The contract was awarded May 7, 1914, to the Merritt & Chapman Derrick & Wrecking Co., at an estimated total cost of nearly $1,000,000.

There were still extraordinary conditions to be met and many details to be worked out. Accordingly, through the cooperation of the contractor, experiments were resumed after the letting.

In addition to tightness and flexibility it was desired

*From an account [illegible] prepared [illegible] the work by the [illegible] of the City of New York and [illegible]

Fig. 3. Type of Joint Used on Narrows Subaqueous Pipe-Line

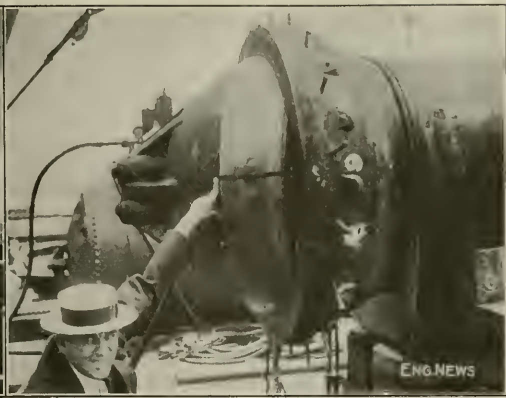


Fig. 4. Bulkhead for Closing Pipe to Make Pressure Tests of Joints

to get a joint which would have the greatest possible strength against longitudinal pull. The ordinary joint, even though uncalked, becomes tight when subjected to a longitudinal strain, but when the strain is released the leakage is worse than before. On account of the length of the Narrows siphon, sag could not be relied upon to tighten the joints, and in addition the stress and movements due to changes of temperature had to be considered.

It was with a view to increasing the longitudinal strength that the gib-screw hole was moved to the position shown in Joint 2 (Fig. 1), with the idea of concentrating the lead at the great diameter of the bell. This was not successful as the lead tended to flow freely out of the face of the joint instead of filling it up.

Joint No. 3 (Fig. 1) was a repetition of the preliminary experiments on Joint 1, using a larger quantity of lead in order to gain strength. Though this joint was satisfactory in many respects it still failed to give the desired longitudinal strength, because after a certain amount of lead had been forced in, further injection drove the spigot out faster than it filled up the space in the joint.

Accordingly Joint 4 (Fig. 1) was tried, which proved to be very tight and to have a great deal of longitudinal strength; but is was not flexible, for it tended to

Fig. 5. Pipe-Laying Cradle Used on the Narrows Siphon, Catskill Aqueduct, New York City

ing, instead of the grease. Joint 5 (Fig. 10) was then tried; it proved flexible and strong longitudinally, but showed a slight tendency to leak between the spigot and the lead. Finally the second set of gib-screw holes were added, as in Joint 6 (Fig. 11); this joint proved a complete success and is the one being used.

The procedure of pipe jointing on the deck of the scow is as follows. The inside of the bell is coated

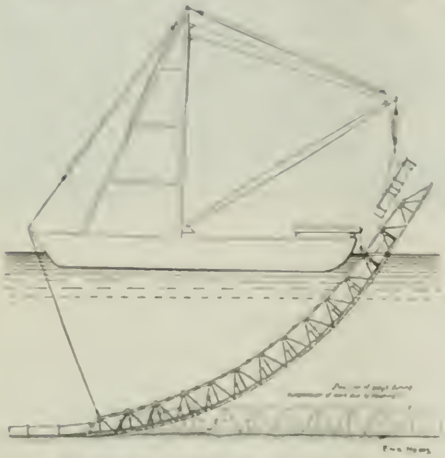


Fig. 6. Detail of Pipe-Laying Cradle

with graphite. The spigot of the next pipe is inserted and properly centered and the joint poured, using about 200 lb. of lead. Lead pellets 5/8 in. in diameter by 1¾ in. long are forced in by compressed air, three each in the [illegible] holes, three each in the front holes, and then one each in the back holes, using from 20 to 22 lb. of lead in all.

A mixture of grease with about 10% graphite is forced in each hole, and the holes are plugged with tap bolts and lead washers. The joint is deflected 5° and tested under a hydrostatic pressure of 100 lb. per sq. in. before launching from the scow, as described in the specifications (reprinted in the previous article above referred to).

The pipe-laying scow measures 40 ft. by 125 ft. It is held in position by 10 anchors. It carries the 20-ton derrick which is used for handling pipe and for auxiliary operating. At the beginning of the work it supported the pipe-laying cradle or skidway. The latter is now carried by cables running over a framework in the front of the scow. The cradle, or skidway, is made of structural steel and resembles a through truss, curved in the vertical plane. It is 100 ft. long, 8 ft. wide and 10 ft. deep and weighs nearly 60 tons. The pipe is held in place on the skidway by chain stops.

As soon as a joint has been completed and passed the derrick or scow moves ahead one length and the pipe at the lower end slips off to the bottom of the dredged trench. The skidway is then ready to receive another length of pipe at the top.

The work described is being done by the Board of Water Supply, of which J. Waldo Smith is Chief Engineer; Alfred D. Flinn, Deputy Chief Engineer; Thaddeus Merriman, Department Engineer; and Thomas H. Wiggin, Senior Designing Engineer. The work is under the city department, of which Walter E. Spear is Department Engineer; John P. Hogan, Division Engineer; James F. Murphy, Section Engineer, and E. P. Hopson, Section Engineer, in charge of Narrows siphon laying. W. L. Chapman is Secretary of the Merritt-Chapman Derrick & Wrecking Co., in charge of the Narrows siphon work for the contractor, for whom Ralph Chapman is Mechanical Engineer.

Wheel Pit and Elevator for Coach-Repair Yard; Michigan Central R.R.

The convenient handling of wheels and axles is one of the essentials in the design of a coach-repair yard, and the removal of wheels of passenger cars in the new coach yard of the Michigan Central R.R., at Detroit, Mich., is effected by means of a wheel pit and two elevators. Fig. 1 shows the deck framing of the pit, and Fig. 2 shows the elevator construction.

The pit is about 36x58 ft., and 7½ ft. deep, with a deck framing of I-beams 18 in. apart, arranged in two

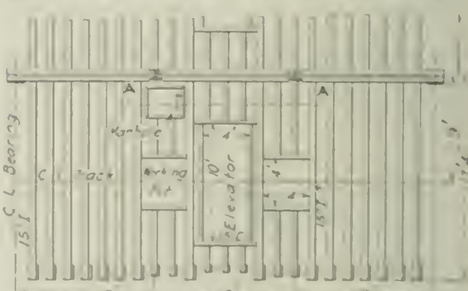


Fig. 1. Plan of Track Deck of Wheel Pit in the Coach Yard of the Michigan Central R.R. at Detroit, Mich.

spans. Their outer ends rest on bearing plates on the concrete walls and their inner ends are framed against a girder supported on columns and the side walls. In each span is an elevator opening 10x4 ft., closed by a repair track, and the elevator platform has a section of track about 4 ft. long, which forms a part of the repair track when raised and part of the wheel track in the pit when lowered. The elevators are operated by pneumatic cylinders, as shown in Fig. 2. Compressed air is taken from the pipes of the air-cleaning system in the coach yard, being supplied from compressors located in the basement of the station building.

At each side and end of the elevator opening is a pit about 4 ft. square. The floors of these pits are suspended about 4 ft. below the track and form platforms for the men working under the car, while they are high enough to allow wheels on the pit track to pass under them. These shallow working pits are covered by movable deck sections when not in use, as shown in Fig. 2. There is also a manhole opening about 36x30 in., having a hinged cover with segmental guides. This gives access to an iron ladder.

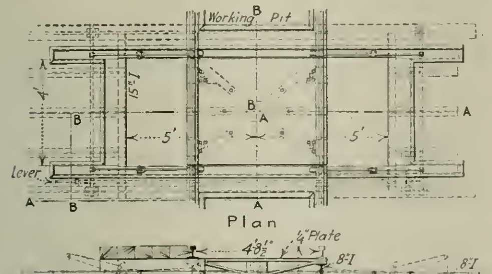


FIG. 2. SECTION OF WHEEL PIT AND ELEVATOR

The operation will be understood from the plan, Fig. 3. The team-track yard has a general elevation about 4 ft. lower than the repair yard. The wheel-loading track leads out from this yard, so that the floor of a flat-car in the wheel dock is just about level with the tracks in the repair yard, enabling wheels to be loaded or unloaded directly onto the track lying across the end of the repair tracks. Thence the wheels are placed in the storage yard, or if one of the repair tracks is empty they may be rolled directly to the elevator and taken down into the wheel pit under the repair tracks. A capacity of about four pairs of wheels is provided on either side of the elevator on this low-level track. New wheels are stored on one side and the other side is reserved for the removed wheels.

Coaches on the repair track are placed with the wheels to be removed directly on the elevator, so that they can be lowered as soon as released from the boxes. The elevator takes the wheels down, and they are rolled off and the new wheels rolled on. The elevator then ascends, bringing the axles with their journals in the bearings. When the repair track is again clear, the removed wheels are brought up on the elevator and rolled away into the storage yard. The principle of this wheel pit was taken from one in use in the Mott Haven yard of the New York Central R.R. At that yard, however, the wheels are stored on the lower level, to which they are brought by

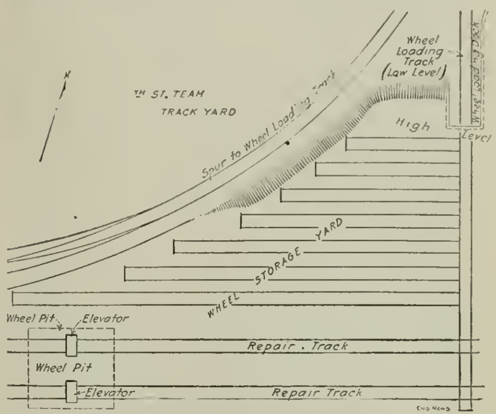


FIG. 3. PLAN OF WHEEL-STORAGE TRACKS AND COACH-REPAIR TRACKS WITH WHEEL PIT

an inclined plane, and are taken in and out from the side of the pit instead of being taken up and down on the elevators, the latter being reserved exclusively for removing and replacing the wheels under the cars.

The Export Trade in Iron and Steel and the relative prospects of Great Britain and the United States in securing the trade heretofore held by iron and steel producers on the continent of Europe are discussed by London "Engineering" of Sept. 18. The world's total export trade in iron and steel is about 20,000,000 tons per annum, of which about half has been supplied by the European continental countries now at war; 6,000,000 tons by Germany alone. Were the war to end shortly, it is assumed that financial and other losses would prevent Germany and Belgium from playing a large figure in the iron and steel export trade for some years to come. At present the financial stringency the world over has cut down the demand for export iron and steel to very small proportions. It is assumed, however, that this condition will gradually disappear and that the normal demand for iron and steel and its products from non-manufacturing countries will be reëstablished. "Engineering" concedes that in the competition for this business the United States firms will have the great advantage over the British firms of surplus capacity able to turn out the material required. It estimates the total capacity of American steel producing concerns at 30,000,000 tons of steel ingots a year, and the normal demand in the United States at 20,000,000 tons, leaving a margin of 10,000,000 tons available for export trade. Great Britain, on the other hand, has little surplus capacity, and when its home demands and the export trade it holds are normal, it can provide only a small part of the necessities of the remainder of the world. As to the relative cheapness of production in the two countries, "Engineering" thinks that Great Britain now has the advantage. In the past fifteen years the cost of iron and steel-making in the United States has materially increased, due to increases in ore royalties, cost of mining, cost of coal and coke, and falling off in the quality of ore. It is now estimated that the cost of iron and steel production in the United States has increased in the neighborhood of \$6 per ton since 1899. No similar increase has taken place in England, and "Engineering" therefore believes that with the advantage the English iron and steel works have of location near tidewater, they can export at prices as low at least as their American competitors.

A Method for Constructing a Tunnel under the East River at New York City

By Emil Diebitsch*

The construction of the four tunnels for the Pennsylvania Railroad under the East River at New York City showed the uncertainty of progress by the shield method of tunneling in this location. Sometimes the heading was lost during a blowout and it required weeks of labor to recover it. At other times several headings had to be shut down in order to turn all available air into the headings under operation. At all times enormous volumes of air had to be pumped into the headings and finally portions of the river bed had to be covered with clay in order to make any progress at all possible.

Similar difficulties were encountered in building the present subway tunnels to Brooklyn and in both instances the cost of the work was very high.

The fundamental cause of most of these troubles is found in the difference in hydrostatic pressure at the bottom and the top of a tunnel heading. Air pressure sufficient to keep the floor of a tunnel dry will be enough greater than the hydrostatic head at the roof of the tunnel to allow the air to escape in great volume; and when the cover is not sufficiently heavy, may even blow a hole through the river bottom and by thus suddenly reducing the air pressure in the tunnel allow the water and sand to enter the tunnel, resulting in a "blow-out."

In practice this difference in pressure is kept as small as possible by keeping the air pressure in the tunnel about equal to the hydrostatic head at the middle of the tunnel section; but it is still greater than the hydrostatic pressure at the roof of the tunnel, and this difference in pressure is the chief cause of the delays and expense in building tunnels by the shield method.

In the shield method, then, the work of excavation and construction is carried forward in a vertical plane or heading under a condition of unbalanced pressures. In the method herein proposed the work is carried on in a horizontal plane under a condition of balanced pressures. For this reason this new method permits of building tunnels more expeditiously and economically and consequently also the tunnels can be built at easier grades and [illegible].

The method in general consists of building successive lengths of the tunnel under the protection of a large movable pneumatic caisson which rests on the river bottom and extends above the surface of the water like a dock or pier.

When a section of the tunnel has been completed, the caisson is moved forward along the line of the proposed tunnel, so that another section of tunnel immediately adjoining the finished section and connecting with it can be constructed. By repetition of this process the entire tunnel between terminal shafts can be built.

This caisson is really a large steel box with double walls enclosing ballast chambers and forming a working chamber closed over the top but open at the river bottom. Water is excluded from this working chamber by means of compressed air and access to it for men and materials is gained by means of shafts and air locks in the usual way.

*Consulting Engineer, [illegible]

The word caisson is used to designate this steel box but it should be noted that this structure differs in design and function from the caissons used for foundations of bridges and buildings. It does not form the bottom of the finished structure as ordinary caissons do but is used as a temporary protective covering placed over the portion of the tunnel under construction and is moved to a new position as soon as the tunnel section is completed.

This caisson rests on the river bottom above and at the edge of the excavation within which the tunnel is built. It therefore has no cutting edge but a broad base, giving ample bearing surface for stability and to prevent the caisson from sinking too deeply into the mud of the river bottom.

To facilitate the handling of the caisson, it is provided with ballast chambers which can be readily filled or emptied of water by means of valves and pumps. These ballast chambers must be large enough to contain sufficient weight to hold the caisson securely on the river bottom when the tunnel construction is proceeding. Enough of the ballast should be water for easy handling which, when pumped out of the chambers, will permit the caisson to float.

Reference to the accompanying drawings will show that the caisson under consideration has the following principal dimensions: Length 120 ft.; width 50 ft.; depth 62 ft. Length of working chamber 100 ft.; width 40 ft.; height 25 ft. The estimated weight without machinery or ballast is 2500 tons.

This structure is large enough and strong enough to form when resting on the river bottom, a pier to which scows, lighters, tow boats, etc., may be moored and on which materials and supplies may be landed. The main deck of the caisson will be equipped with derricks, hoisting engines, concrete mixers and such other machines and appliances as may be needed for expeditiously and economically handling the excavated materials from the working chamber to the scows and the structural materials such as sand, gravel, cement, steel and lumber from the lighters to the air locks.

The machinery deck, located about 12 ft. below the main deck, will contain boilers, air compressors, steam engines, electric generators, pumps and such other machinery as may be needed in constructing the tunnel or handling the caisson.

The walls of the working chamber are provided with interlocking tongued and grooved poling boards or [illegible] which resemble steel piling. These steel poles are shown in the drawing as constructed of steel I-beams with grooved timbers bolted on each side of the webs of the beams. These steel poles are used as vertical poling boards and are carried down a little in advance of the general excavation and serve to keep the air within the excavation from escaping too freely. They also support the banks of the trench within which the tunnel is built. It should be noted that each steel pole is attached to the wall of the working chamber by means of bent steel plates forming a groove within which the steel pole can readily be moved vertically up or down but which prevents lateral displacement of the steel pole.

Having constructed the caisson as above described with all necessary men and material locks, ballast chambers, etc., and equipped it with air compressors, boilers, pumps, dynamos and other necessary machinery, the procedure is as follows:

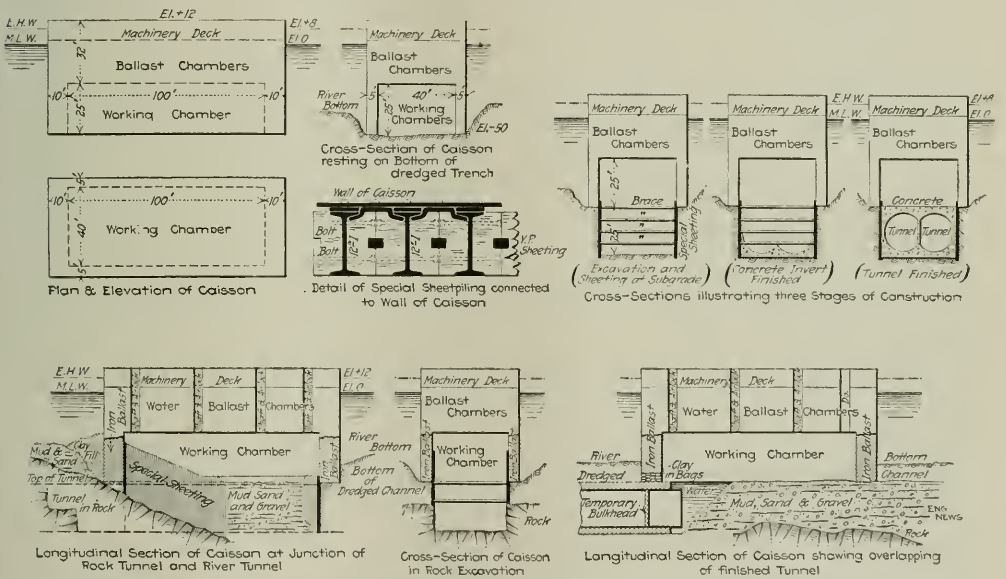
A trench is dredged along the line of the proposed tunnel, wide enough to hold the caisson when resting on the bottom of the channel and at least 45 feet below extreme low water, as the harbor regulations require the top of the tunnel to be below that depth.

The caisson is towed to a point selected for beginning work and sunk by flooding the ballast tanks until it rests on the bottom of the channel. Compressed air is forced into the working chamber until all of the water is excluded, some of the water being pumped out if deemed more expedient, and more ballast is added in order to hold the caisson in place.

Workmen now enter the working chamber and begin excavating, taking care to keep the sheeting below the excavation, and cross bracing the sheeting if necessary, as the excavation proceeds. When the bottom of the excavation is reached, concrete is placed to form the foundation and invert for the tunnel lining.

The tunnel can now be built as designed—whether of tion of the tunnel under the river, but provision must be made for connecting the river tunnels with the tunnels on the Manhattan and Brooklyn shores.

A study of the boring sheet made by the engineers of the Public Service Commission for the new subway tunnels from Whitehall St., Manhattan, to Montague St., Brooklyn, for which contracts were recently let, show that approaching the Manhattan shore the rock in the river apparently rises sufficiently above the top of the tunnel to permit of driving a tunnel in the rock in the ordinary way. In this case the caisson could be located near the point where the tunnel enters the rock from the sand and mud in the river and a heading could be started into the rock from the working chamber of the caisson. If the rock is of such a character as to require compressed air to keep the excavation dry, or compressed air and a shield, the air could be furnished from the plant on the caisson and the tunnel driven toward the shore, using the caisson as a shaft.



SKETCHES ILLUSTRATING A PROPOSED CAISSON METHOD FOR CONSTRUCTING SUBAQUEOUS TUNNELS

massive or reinforced concrete with waterproofing of fabric and pitch or asphalt or brick laid in asphalt. Should it be found desirable to surround the tunnel with a metal casing to act as waterproofing, this can be made of thin steel plates or of sheet copper.

When a section of the tunnel has been completed, the sheet piling must be drawn and secured to the walls of the working chamber after which the caisson is to be moved ahead.

The next step is to float the caisson by discharging ballast and to move it along the line until the rear end just overlaps the finished portion of the tunnel, thus allowing the end of the finished section to project into the working chamber. The caisson must now be sunk to the bottom of the channel in this position by flooding the ballast chambers, after which the work now proceeds as before.

These operations would serve for constructing the por-

If on the other hand the rock is solid and the tunnel can be driven without air, it might be advisable to bulkhead the tunnel after it has been well advanced into the rock and drive the rest of the tunnel under normal air pressure from a shaft on the Manhattan shore.

On the Brooklyn shore, where the tunnel enters earth and sand below mean high water, it may be advisable to use a shield. The shield could be set up in the working chamber of the caisson and operated with the plant on the caisson, using the caisson as a shaft for men and materials.

In considering the operations involved in this method of constructing tunnels, the following questions suggest themselves:

(1) The construction of a caisson of the magnitude indicated and the character of the stresses to be taken care of.

(2) The facility of handling a caisson of the dimen-

some [illegible] floating it, resting it [illegible], sinking it to the bottom of the river and subsequently raising it again. In this connection the force of the currents on the caisson must be considered.

(3) The stresses in the special sheathing which is used to carry the excavation below the bottom of caisson. The possibility of constructing this sheathing so that it will stand the strain and also be practically air-tight.

(4) Leakage of air from working chamber and trench.

(5) The advantages which this method of tunnel construction has under the existing conditions over the method of using compressed air and shields.

CONSTRUCTION OF CAISSON

In considering the first question, we will assume the following dimensions of the caisson: Length over all 120 ft., width 50 ft., depth from top to bottom 62 ft., length of working chamber, 100 ft., width 40 ft., height above bottom of caisson 25 ft.

When such a caisson is resting on the bottom of the river in 50 ft. of water, and a trench 25 ft. deep has been excavated below the edge of the caisson, the air pressure in the working chamber and trench necessary to keep water out of the bottom of the trench must be equal theoretically to the hydrostatic head of 75 ft. which is the distance from the surface of the water to the bottom of the trench. This hydrostatic head of 75 ft. is equal to a pressure of 32.55 lb. per sq.in. or 4687 lb. per sq.ft. This pressure produces a very heavy load on the walls and roof of the working chamber.

The stresses will not be discussed in detail here but they have been sufficiently developed to show that they can easily be taken care of with a steel structure weighing 3000 tons.

The working chamber is made 25 ft. high so that the sheet piles can be made in one piece and drawn up clear of the bottom of caisson when the latter is to be moved. The height of the working chamber and the fact that no cross braces are shown in the chamber increases the stresses in the walls but these increased stresses have been considered and the 3000-ton structure will take care of them.

The high working chamber offers several advantages in the economical handling of excavated materials, timbering, [illegible], etc., which do not, however, affect the principles of the method of construction and hence will not be discussed in detail here. These [illegible] the cost of the [illegible] steel due to [illegible] of beams in working chamber.

HANDLING CAISSON

Considering first the problem of handling the caisson in the water, we will assume that the caisson weighs 3000 tons and that the machinery placed upon it will weigh 200 tons. The caisson is 120 ft. long by 50 ft. wide and therefore displaces 6000 cu.ft. of water for every foot that it sinks into the water. This 6000 cu.ft. of water weighs 6000 × 62.5 lb. or 187.5 tons. Since the caisson [illegible] weighs 3200 tons it will sink 17 ft. [illegible] and by adding ballast can be sunk to any desired depth.

As it is proposed to seat the caisson on the bottom of a trench in 50 ft. of water, and [illegible] it [illegible] and sink it to the bottom again, it will be advisable to ballast with some heavy material such as pig iron so that the caisson will float at a depth of 45 ft. and can be sunk lower by adding water ballast. This will require 45×187.5 tons or 8437.5 tons less 3000 or 5437.5 tons of pig iron.

The space available for ballast is equal to the volume of the caisson below the machinery deck less the space occupied by the working chamber. The machinery deck is to be 12 ft. below the top deck and the volume of the caisson below that deck is equal to 120 × 50 × 50 = 300,000 cu.ft. From this deduct the volume of the working chamber 100 × 40 × 25 = 100,000 cu.ft. The space available for ballast is therefore 300,000 less 100,000 or 200,000 cu.ft. less the space occupied by structural members, shafts, etc.

Assuming that pig iron stacked as ballast will weigh 300 lb. per cu.ft., one ton will occupy 6.67 cu.ft. and 5437.5 tons will occupy 36,268 cu.ft. This leaves 200,000 less 36,268 or 163,732 cu.ft. of space for other ballast, when the caisson is floating at a depth of 45 ft.

This other ballast is required to sink the caisson to the bottom in fifty feet of water and hold it there, and as it has to be easily handled in order to sink or raise the caisson readily it will consist of water.

The maximum amount of ballast will be required when the trench under the caisson has been excavated to the subgrade of the tunnel, for there it will be necessary to have a pressure of air in the working chamber equal to a hydrostatic head of 75 ft.; this is 32.55 lb. per sq.in. or 4687 lb. per sq.ft. Under these conditions the uplift due to air will equal area of working chamber 100 × 40 or 4000 sq.ft. times 4687 lb. or 18,748,000 lb. or 9374 tons. To this must be added the uplift due to pressure of water on bearing area of caisson, the bottom being 50 ft. below the surface of the water and the bearing surface having an area of 2000 sq.ft.; the pressure per sq.ft. at depth of 50 ft. is 3125 lb.; total pressure equals 2000 × 3125 or 6,250,000 lb. or 3125 tons.

The total uplifting pressure is therefore 9374 tons plus 3125 or 12,499 tons. Against this we have weight of caisson, machinery and pig-iron ballast a total of 8437.5 tons leaving 4061.5 tons to be taken care of by water ballast.

Ballasted as above and with 32.55 lb. of air in the working chamber, the caisson will theoretically touch the bottom but not bear upon it. As it may be desirable to have the caisson press firmly on the bottom under these conditions it will be necessary to consider the total space available for additional water ballast.

It has been shown that the space available for ballast is about 200,000 cu.ft. The pig iron occupies 36,268 cu.ft. and 4061.5 tons of water will occupy 129,968 cu.ft. Total space occupied by iron and water ballast is 166,236 cu.ft. which amount deducted from 200,000 leaves 33,764 cu.ft. of space to be occupied by structural members, shafts, etc., and additional water ballast.

From these figures it appears that additional water can be admitted to ballast chambers to hold caisson firmly on the river bottom under the heaviest air pressure needed for the conduct of the work.

In order to sink and raise the caisson readily the ballast chambers will be provided with valves for the ready admission of water and with pumps for the discharge of ballast water with reasonable dispatch.

It has been shown that the maximum amount of ballast will be in the caisson when the trench has been ex-

cavated to subgrade and there is 32.55 lb. per sq.ft. air pressure in the working chamber. Under these conditions it has been shown that there will be at least 4061.5 tons of water equal to 162,236 cu.ft. or 1,216,770 gal. in the ballast chambers. Four 6-in. centrifugal pumps, each with a capacity of 3000 gal. per min., will empty all of this water in 102 min. But with all of the water out of the ballast chambers the caisson will float at a depth of 45 ft. and as it is only necessary to clear the caisson of the trench bottom in 50 ft. of water, it will theoretically be necessary to pump out only about 80% the above quantity of water for the caisson will float in 50 ft. of water with 937.5 tons or 300,000 cu.ft. or 225,000 gal. of water in the ballast chambers. From these calculations it can be readily seen that the ballast chambers can be emptied entirely in less than 1 hr. 42 min. and sufficient for manipulating the caisson in 1 hr. 23 min.

The flooding either ballast chambers or working space, it will only be necessary to furnish a sufficient number of flooding valves of proper size to fill these spaces in a very short time.

The space to be occupied by water ballast is to be divided and subdivided by longitudinal and transverse bulkheads so as to form separate ballast chambers. These chambers are to be so connected with the pumps and so interconnected with each other that any ballast chamber or any group of chambers can be emptied or flooded independent of all others. This arrangement facilitates very much the handling of the caisson.

The operation of sinking and floating a structure similar to the caisson under consideration is neither novel nor untried as is evidenced by the ease and rapidity with which the floating gates of the dry-docks in our Navy Yards are manipulated in docking and undocking vessels. The great floating dry-docks at New Orleans, Manila and elsewhere are operated in exactly this principle and battleships weighing ten thousand tons or more are lifted out of the water in a few hours.

There is, however, one condition in connection with this tunnel construction that is different from those existing in the operation of floating dry-docks and that is the possible interference caused by currents.

Inspection of the tide tables published by the U. S. Coast & Geodetic Survey shows that the currents at the site of the proposed tunnels run in opposite directions at different stages of the tide and that every six hours there is a period of slack water when no currents exist.

The maximum velocity is given at 3.1 miles per hour and the pressure exerted by such a current against a caisson 120 ft. long and 50 ft. deep is 127.6 tons. Tendency to displace the caisson is resisted by the pressure of the caisson on river bottom and by the sheathing driven below bottom of caisson as well as by the spuds which will be operated from the main deck.

The end of the caisson which rests over the finished portion of the tunnel is made about 4 ft. less in depth than the forward end and the long side walls. This shortening of the rear wall prevents the weight of the caisson from bearing too heavily on the unyielding masonry of the finished tunnel while the other portions of the caisson bottom bear more or less on the compressible river bottom.

This notch in the rear end of the caisson also permits the caisson to ride a finished portion of the tunnel when the caisson is being moved forward. The finished tunnel will thus serve as a guide for the caisson and also resist the action of the currents toward moving the caisson laterally.

The space which occurs between the bottom of rear wall of caisson and the roof of the finished tunnel where it projects under the rear end of the caisson into the working chamber after the caisson has been settled in place for a new tunnel section can be filled with bags of clay carefully packed to prevent air leakage and further protected by lowering the sheet piling on the rear wall until it rests on the tunnel roof.

Operations for moving and sinking caisson would be conducted as nearly as possible during periods of slack water when the currents are of low velocity or nonexistent.

The difficulty of moving caisson and resetting it in a current of the velocity of 3.1 miles per hour is evidently not very great for in constructing the Detroit River tunnels, sections of the lining of two tunnels 23 ft. in diameter and 260 ft. long were sunk in two hours in a current of about 3.4 ft. per sec. or 2.3 miles per hour.

In considering the remote possibility of the caisson escaping from its moorings and being carried away by the currents, it should be remembered that the caisson draws 45 ft. of water even when all the water ballast has been pumped out, consequently it cannot float beyond the confines of the dredged trench as it would run aground.

Sheathing

In considering the sheathing which is used in carrying the excavation 25 ft. below the bottom of the caisson, it should be borne in mind that the plan of procedure contemplates driving the sheet piling in advance of the excavation to a greater or less extent. The distance driven will be determined by the character of material penetrated, the absence or presence of boulders and the ease of penetration.

It will be necessary to increase the air pressure in the working chamber so as to exclude the water from the bottom of the excavation as the trench is deepened. As a result of this increase in air pressure there will be a pressure on the sheeting tending to force it against the material in the river bed back of the sheeting.

The maximum pressure will be exerted when the bottom of the trench has been reached 75 ft. below the surface of the water, for then the air pressure in the trench and working chamber will be 32.55 lb. per sq.in. or 4687.5 lb. per sq.ft., sufficient to resist the hydrostatic head of 75 ft. which exists outside of sheeting at the level of the trench bottom.

Considering the stresses in the sheet piling under these conditions of maximum air pressure, it is found that on a level with the bottom of the excavation the air pressure in the trench tending to push the sheeting against the banks is just equal to the 75 ft. of hydrostatic pressure which exists outside of the sheeting and tends to push the sheeting into the trench. These two equal and opposing forces counteract each other and there is no strain on the sheeting at the bottom of the trench.

As the air pressure within the trench and working chamber is uniform throughout, while the pressure against the outside of the sheeting decreases as the surface of the water is approached, the resultant pressure is from the trench outward and increases as the upper end of the sheeting is approached.

At the upper end of the sheeting, on a level with the bottom of the caisson 50 ft. below the surface of the water there is a hydrostatic head of fifty feet against the outside of the sheeting while within the trench at the same level the air pressure is equal to the hydrostatic head of 75 ft. The resultant pressure equal to a hydrostatic head of 25 ft., is the equivalent of 1562.5 lb. per sq.ft.

A sheet pile 12 in. wide and extending from the bottom of the caisson downward 25 ft. to the bottom of the trench would therefore be subjected to a pressure varying from nothing at the bottom to 1562.5 lb. per sq.ft. at the top. The tendency to force a sheet pile under such pressure outward is resisted by the material in the river bottom outside of the sheeting, and as ordinary soils have a safe bearing capacity of $1\frac{1}{2}$ tons per sq.ft., even the maximum pressure of 1562.5 lb. at the top of the sheeting is not sufficient to push it out of place.

As a matter of fact, the wall of sheet piling separating the air pressure within the trench from the hydrostatic pressure on the outside merely acts as a diaphragm to neutralize the comparatively small inequalities of pressure between the two opposing forces.

In designing this sheeting it should be made stiff enough and strong enough to take with safety the maximum pressure of 1562.5 lb. per sq.ft. for a span of from six to ten feet to take care of soft spots, or holes, cavities made by dredging which may exist in the banks of mud, sand and gravel against which the sheeting will bear.

Furthermore, when the caisson is located over a rock bottom it may be necessary to drive sheeting to rock, make a tight connection with the rock, brace the sheeting across the trench and then reduce the air pressure in the trench to normal. In such a case the pressure will be from nothing at top and the maximum pressure would be at the bottom of the sheeting. The sheeting should be sufficiently strong to resist this pressure for a span of about ten feet between waling pieces and braces.

To make a practically air-tight sheeting a tongued-and-grooved sheeting of yellow pine, such as is ordinarily used on deep trench work, suggests itself. As such a material, [illegible] might not be strong enough for all conditions. A strong but tight sheet pile can be made by bolting [illegible] timbers to each side of a steel I-beam, thus giving the composite beam or sheet pile. The timber members are to be tongued and grooved in the usual manner, thus securing a sliding joint with the adjoining sheet piles which can be maintained practically air-tight.

Each sheet pile will be attached to a wall of the working chamber by means of a guide built of steel in which the sheet piles are readily slid up or down. This sliding connection will be so constructed that the sheeting cannot be displaced laterally at any location without removing the steel portion of which the guide is attached.

Sheeting constructed in this manner will be prevented from drifting when driven into the river bottom, thus insuring [illegible] with the bracing [illegible] and bracing [illegible].

Air Leakage

There will be practically no excessive air leakage at the bottom of the excavation, for here the outer and inner pressures are equal. But when the excavation has been carried down to subgrade there is a difference of about 11 lb. per sq.in. between the pressure within the work chamber and on the outside at the level of the bottom of the caisson.

Under these conditions the air tends to escape between the back of the sheeting and the walls of the caisson and thence under the bottom of the caisson and through the water into the free air. To reduce this leakage it will be advisable before starting to drive the sheeting to pack bags of clay under the inner edge of caisson and fill all cavities which may exist between caisson bottom and river bottom with clay. These bags of clay are to be so placed that the sheet piles, as they descend, will press firmly against the clay and make a close contact.

After the sheet piles have been carried to the full depth, the space between sheet pile and caisson wall can be calked with oakum or other suitable materials or the space may be "mudded up" with clay in the usual way.

Advantages of This Method of Construction

From the foregoing description and discussion it is evident that this method of tunnel construction offers the following advantages over the shield method:

1. Safety from Blowouts—The balanced pressures in the "horizontal heading" or place of operations removes all danger from blowouts and flooding of working chamber and thus assures (a) the safety of the workmen, (b) steady progress in the work of construction.

2. Easier Grades—As no cover other than the caisson is required the tunnels need not dip as far below the river bottom as shields necessitate and hence easier grades can be followed.

3. Exact Line and Grade—The tunnel may be built to exact line and grade, results which are approximated in the shield method by making the diameter of the tube larger and correcting deflections from line and grade in the inner concrete lining of the tube.

4. Foundations—The river bottom may be reinforced with piles or by other methods should conditions demand it, before the tunnel is built.

5. Better Construction—As the tunnel is accessible from all sides the work of construction is open to thorough inspection and the tunnel may be built of riveted steel plates surrounded with impervious concrete. This gives a tighter, less flexible and more permanent structure than one built of cast-iron plates bolted together and placed directly against the river mud. The expensive operation of pumping grout blindly into the mud in the hope that eventually it will fill all cavities back of the tunnel lining is also obviated.

6. Materials Handled More Economically and Expeditiously—The caisson resting firmly on the river bottom forms a stable dock of ample area, equipped with derricks and hoists for the handling of excavated materials direct to scows and lighters and for the receiving of materials of construction such as sand, gravel, cement, steel, timber, etc., from lighters and barges moored alongside the caisson.

By this arrangement the cost of conveying excavated material through the finished portion of the tunnel to the shaft, hoisting it at the shaft, dumping it into wagons, carting it through the streets and dumping it on barges at the dock is avoided. Similar operations in bringing materials of construction to the heading are dispensed with.

7 WORK DONE MORE ECONOMICALLY AND EXPEDITIOUSLY—It is evident that with an area 100 ft. long and 40 ft. wide uncovered for work and protected from interruption from "blowouts" more men can be employed and the work finished more quickly and economically than by working through shield doors against a tunnel face 20 ft. in diameter.

There is also less labor involved in hoisting or lowering materials through shafts directly overhead than there is in conveying them through the finished tunnel to a shaft on shore.

8 GENERALLY MORE ECONOMICAL—In addition to handling materials and labor more economically there is a considerable saving in the amount of plant and in the operation of the same, in the amount of piping, cost of building shafts, cost of pushing shields through rock tunnels on the Manhattan side of the river from the shaft on shore to where the rock dips below the tunnel line in the river deposit, cost of property where plants are located, cost of covering part of river bed with clay and cost of pumping great quantities of compressed air which escapes through the river bed. The balanced pressures in the heading, the tightness and comparatively small volume of space under air pressure reduce the requirements for air to a minimum and hence reduce the number of compressor units required.

The location of the plant on the caisson directly above the "heading" reduces the amount of piping required, while the location of shafts and air locks directly over the operations does away with the necessity of tracks and cars used in the shield method to convey materials from the heading to the shaft on shore and *vice versa.*

The setting up of shields in the working chamber of the caisson as the river tunnel approaches the shore and the subsequent use of the caisson as a shaft for handling materials does away with the necessity of sinking a shaft on shore. This is a great saving as the cost of such a shaft is large.

As the caisson covers the section of the tunnel under construction there is no occasion to cover the river bottom with a blanket of clay for there is no excessive air leakage.

ESTIMATED COST

An estimate carefully made in detail shows the following costs exclusive of contractors' profit:

Caisson with machinery complete	$400,000
Operating caisson	118 per day
Interest charges	66 per day
Supervision, office and field	183 per day
Tow boat for men	75 per day

With the above overhead charges and the actual labor and materials estimated at present market prices, a tunnel 18 ft. in diameter made of ⅜-in. steel plates and surrounded by 3 ft. of concrete would cost if constructed by this "caisson" method $245 per lin.ft. through mud, sand and river deposit and $370 per lin.ft. through rock.

The estimated cost of such a tunnel built on the location shown for the new subway tunnels from Whitehall St., Manhattan, to Montague St. Brooklyn, would be $3,176,330. If to this cost 25% be added for contingencies and the profit of the contractor, a reasonable contract price for the tunnel would be $3,975,412 or practically $4,000,000.

The lowest bid received by the Public Service Commission for the construction of a tunnel to be built on the same route, but according to the plans and specifications of the Public Service Commission, was $6,368,550 if built alone, and $5,974,809 if built in conjunction with the tunnel from Old Slip Manhattan to Clarke St.,

The Explosibility of Grain Dust

A number of disastrous grain-dust explosions in elevators and mills have occurred during the past few years and have attracted general attention from engineers. An arrangement was made between the U. S. Bureau of Mines and representatives of various milling interests for a scientific study of the explosibility of grain dust and of methods to prevent such explosions. Work was started late in 1913 under direction of G. A. Hulett, Chief Chemist of the Bureau of Mines, with D. S. Price in charge of field investigations and H. H. Brown in charge of laboratory work. A preliminary report has been issued from which the following data are abstracted.

An investigation was made of 13 explosions which have occurred since 1905; of these, three were in Iowa, three in New York, two in Illinois and one each in Vermont, Indiana, Kansas, Ohio and Texas. The explosions were distributed among various lines of milling as follows: cereal mills 4, elevators 3, feed mills 2, starch factories 2, glucose factory 1, flour mill 1. In these 13 explosions 78 men were killed and 119 injured; the total property damage was in excess of $2,000,000. The relative freedom of flour mills from explosions compared with the magnitude of the industry is noteworthy; this has been attributed by millers to the elimination of the old dust bin, which took place after the disastrous explosions in the great flour mills of Minneapolis a quarter century ago.

Various wheat, corn and oat dusts from different parts of mills and elevators were analyzed and their ignition temperatures and explosion pressures were determined. As the basis of comparison, Pittsburgh standard coal dust was used in accordance with the Bureau of Mines practice.

In general, it was found that the grain dusts are more inflammable than coal dust, higher explosion pressures being developed in most cases and especially at the lower temperatures (between a range of 900° to 1300° C). Dusts from oats and yellow corn appeared to be more inflammable than dust from wheat. The explosion pressures with dried dusts were some 16 times greater than with the undried.

The investigators found several causes generally assigned to the explosions noted: open-flame lights, conflagrations, foreign materials in grinding machines, sparks from electric motors, switches and circuits, and static electric discharges from belts. It was found that many of the mill explosions and fires originated from foreign materials in the grinding machines and it is recommended that some means be found of removing such materials before the grain reaches the mills. It is also recommended that only a completely guarded electric lighting system be used, that portable electric lanterns be used in place of flame types, and that receiving bins from grinders be kept as small as practicable to decrease the space for dust clouds.

Granite-Block Pavement as Smooth as Asphalt

A granite-block pavement as smooth as one of sheet asphalt seems an anomaly, yet engineer visitors to Worcester, Mass., may satisfy themselves of the truth of this statement, that the granite-block pavements of Main and Front Streets, which have been down ten or more years, are as smooth as ordinary sheet-asphalt pavements which have been down two or three years. Fig. 1 is from a photograph of Main St. just after a street-sprinkling car had passed, so that the wet surface reflected the light and brings out all the imperfections.

A NEW YORK ENGINEER'S OPINION—Worcester, Mass., was probably the first city to make use of the cement-grout joint. The spaces between the blocks were filled with stone screenings and then poured full of the grout. The result was very satisfactory.

There are advantages and disadvantages in a joint of this kind. It makes a smooth, even pavement, and one that is easily cleaned. It presents little resistance to traffic, and brings the wear of traffic vertically on top of the blocks so that the pavement is very durable, but becomes smooth and slippery under wear.

It is extremely necessary that the grout should become thoroughly hard before any traffic is allowed on the pavement, otherwise the blocks will be loosened and the [illegible] so that the filling becomes little, if any, better than sand.

Pavements thus laid become practically continuous, giving off a metallic sound under traffic. The hardened grout, being a good conductor of sound, transmits the noise readily from block to block. Where the grout is [illegible], however, and the street is kept free from traffic until the grout has thoroughly set, the pavement will be very satisfactory. It is the smoothest form of stone pavement that has been laid in the United States.—Geo. W. Tillson, "Transactions," Am. Soc. C. E., LXXV, pp. 327-29.

FIG. 1. [illegible] GRANITE-BLOCK PAVEMENT, [illegible] MASS.

These extraordinarily smooth granite-block pavements are due to several reasons: (1) a fine-grained, uniform granite, which is not so hard as that ordinarily specified or used; (2) experience and skill of the municipal laborers, acquired by many years' continuous experience in laying stone-block pavement; (3) a rich portland-cement grout and stone screenings for joint filling, and the method and care in application; (4) a fairly heavy traffic, which wears off the original roughness and irregularity.

The Blocks

A digest of the Worcester specifications follows:

SPECIFICATIONS AND CONDITIONS—The stone blocks are of granite of a durable, sound and uniform quality, each measuring on its face or upper surface not less than 7 nor more than 12 in. in length, and not less than 3½ in. nor more than 4½ in. in width and not less than 6 nor more than 6½ in. in depth for the larger size blocks, and not less than 4 nor more than 4½ in. in depth for the smaller size blocks.

The blocks used on each piece of work are uniform in depth and are of the same quality as to hardness, color and grain. All edges are sharp and straight, and at approximately right angles with each other, and dressed so as to form, when laid, close end and side joints, with fair and true surfaces on top, bottom and ends, and are to be in all respects equal to the specimen blocks furnished by the contractor.

All blocks delivered must be satisfactory to the Street Commissioner, and any block which does not in his opinion conform strictly to these specifications may be either rejected or caused to conform to the requirements of the contract at the expense of the contractor. The blocks are delivered as ordered, upon [illegible] at such times and in such quantities as the Street Commissioner may direct, and no liability attaches to the city until their acceptance is made in writing.

The Pavement

The pavements are laid by the Street Department with municipal day labor, according to specifications of the City Engineer, a digest of which follows:

FOUNDATION—The foundation is 4, 5 or 6 in. of 1:3:6 portland-cement concrete.

CUSHION—Upon the concrete foundation is a layer of clean sharp screened dry sand, not less than 1½ in. thick, evenly spread to the finished crown. If the sand is not dry it must be made so by artificial heat before being spread. The sand cushion is prepared at least 25 ft. ahead of the laying.

LAYING THE BLOCKS—The blocks are laid with their longest dimension perpendicular to the center line of the street, except at street intersections where the blocks are laid diagonally. Each course of blocks is of uniform width and so laid that all longitudinal joints are broken by a lap of at least [illegible] [illegible] [illegible]

FILLING JOINTS—[illegible]

[illegible]

[illegible]

FIG. 2. CLOSE VIEW OF FRONT ST. GRANITE BLOCK

applying the grout. After completion the pavement is kept damp and is protected from traffic until the grout has thoroughly set and hardened. [This is one of the most important provisions, for it insures that grout is given a chance to stick to the surface of the blocks.]

COST DATA—These pavements cost, complete with 1:3:6 portland-cement concrete foundation, from $2.75 to $3.25 per sq.yd. The blocks cost about $54 per 1000 for 4-in. size and $60 for 5-in.

CONCLUSIONS—THE SECRET OF SMOOTH GRANITE-BLOCK PAVEMENTS—Fig. 2 is a close view of the Front Street pavement. Although the blocks are a bluish-white granite (Fig. 3) when placed, they wear a slaty color. The joints wear with the same uniformity as the granite itself so that the surface is smooth and free from depressions. The pavement is not slippery like sheet asphalt, but has a gritty feeling.

The pavement when first placed is comparatively rough, but the grout is broomed into the surface depressions and granite bumps wear smooth; so that, if not disturbed for subsurface construction, the pavement is actually in much better condition after ten years' use than when put down; and absolutely nothing has been spent for maintenance.

The secret is not so much the method of construction, perhaps, as in the character of the granite itself. The granite used in Worcester and Lowell, Mass., where pavements of the same remarkable smoothness have been attained, all comes from New Hampshire quarries of the Hildreth Granite Co., which are within a radius of 25 mi., including the towns of Concord, Marlborough and Milford. While varying much in color and appearance, these granites all have the same general physical characteristics.

Typical of all is the so called "Concord granite" described as follows:

Concord granite is a muscovite-biotite granite of medium bluish-gray color. The texture is fine to medium, somewhat porphyritic, with sparse, slender, isolated feldspars up to 0.5 in. Although the micas occur in very minute particles, especially the biotite, they measure up to 0.2 in. and exceptionally 0.4 in.

Its constituents in descending order of abundance are: Slightly bluish, translucent potash feldspar inclosing particles of quartz and of soda-lime feldspar; clear to pale amethystine quartz with hair-line crystals, probably of rutile, and with cavities in sheets which in some sections are parallel; milk white striated soda-lime feldspar, more or less kaolinized and centrally micaized; with white potash mica (muscovite); and black mica (biotite), some of it chloritized, generally in smaller scales than the muscovite. In some cases the mica plates have their flat sides parallel to the rift direction; in some the biotite appears to predominate over the muscovite, possibly owing to the alignment of its scales.

The accessory minerals are: magnetite, apatite, zircon and rutile. Purple and white fluorite occurs here and there on and near joint planes. Calcite and quartz are associated with it on these joints. Secondary minerals are: kaolin, muscovite, in veinlets, a white mica without potash, chlorite and calcite.

FIG. 3. CHARACTER OF BLOCK USED IN WORCESTER

The specific gravity is 2.64-.65 or 165.6 lb. per cu.ft. The polish is fair, but the abundant mica plates and size of some of them do not favor the durability of the polish under long-continued outdoor exposure.*

These granites contain a relatively large quantity of finely divided mica. The quarry men believe that to this is due the tenacity with which the grout clings to these blocks, the lean grout following the mica filaments into the interior of the blocks. These and the soda-lime felspars, more or less kaolinized, must make the porosity relatively high for granite. The crushing strength is from 18,000 to 23,000 lb. per sq.in. The fact that as a polished stone this granite weathers considerably is probably proof of its porosity, and possible lack of durability as a building stone; but nevertheless tends to make it an ideal paving material.

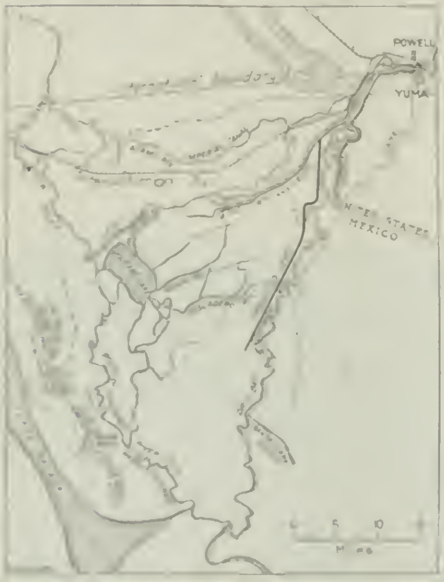
The city engineer of Worcester is F. A. McClure, to whom we are indebted for much of this information.

*Dale, U. S. Geological Survey Bulletin No. 354.

A Suggested Plan for Developing the Lower Colorado River*

By Walter D. Smith†

As irrigation engineer, United States Reclamation Service, and the first to be stationed on the lower Colorado River, the writer has had very exceptional opportunities to study the hydrography of that river. From 1902 to 1906 he had charge of the hydrographic measurements on the lower Colorado made by the Reclamation Service and the Geological Survey, including observation and official reports of all that occurred at the Imperial Canal heading, in the United States and in Mexico, the diversion of the river to the Salton Sink, and the work done in returning it to its old channel.



Map of the Lower Colorado Delta and Imperial Valley, California-Mexico

([illegible] from "Engineering News," [illegible])

In 1909 he was a member of the first party to make a [illegible] of reconnaissance into Mexico for the Reclamation Service. Further study and a trip over the region in June, 1914, has confirmed him in his opinion as to the [illegible] methods of controlling the floods.

Importance of the Project.—At a recent meeting of the Engineers and Architects' Association of Southern California, A. P. Davis, Chief Engineer of the United States Reclamation Service, expressed the opinion that the Colorado River Development is a bigger project than the Panama Canal. Mr. Davis has been connected with both projects.

There is enough water, if properly stored, to irrigate more than [illegible] acres, and that amount of land is available. Estimating the cost of putting the water on land at $[illegible] per acre, and the value of land with water at $[illegible] per acre, the net profit would be $[illegible]. Estimating the value at $[illegible], the direct net profit would be $[illegible]. With the opening of the Panama Canal and the flood of commerce which will pour through, there will be on the Pacific Coast a plentiful supply of labor for construction work and an enormous demand for land. Our products will have access to the markets of the world through the harbors at Los Angeles and San Diego; also perhaps over perfect railway grades through a harbor on the Gulf of California. The Colorado River country cannot be developed too rapidly.

Rapid development, however, may be attended with certain weakness. Rapid as has been the development up to the present time, it could have been more rapid and more secure if there had been a central organization with a single comprehensive plan. An illustration of this is found in the disaster of 1905. Today the situation is more complicated than it was in 1905 and there is more at stake. There should be some way of uniting the efforts of all who are concerned—private corporations, mutual water companies, reclamation service projects, War Department, individual landowners in Mexico and in five states of this country.

Fortunately in 1905 the only cost was retarding development of the Imperial Valley about two years and $[illegible] in tangible damage and expense. It might be much worse another time. Today the Colorado River floods are not being watched and guarded against as carefully as they should be. Everybody's business is nobody's business.

A Plan to Fit the Case.—The writer suggests the organization of a permanent commission composed of five members, to be known as the International Colorado River Commission, to have full responsibility and authority subject to the approval of the legislative bodies of the two countries, as follows:

1. To adopt a general plan of development to use the natural resources regardless of international boundary lines.

2. Apportion cost of same, decide method of financing and order of construction.

3. Determine by whom the work shall be done, what portion by the United States and by Mexico, what portion by private corporations, mutual companies, Reclamation Service, War Department, and what if any directly by the Commission; by whom controlled and operated when completed.

4. To review and report annually on the progress of the work and to have direct charge of all completed [illegible], [illegible], reservoirs and dams on the river itself.

5. To adjust rights, national, state and individual.

Each commissioner to serve five years subject to recall at any time, the term of one member to expire each year. Two to be chosen by a water users' association composed of all irrigators using Colorado River water, and by landowners in the districts where Colorado River water is to be provided, the water district to be [illegible] at first by the [illegible] of the Reclamation Service; one to be appointed by the President of the United States; and one by the President of Mexico.

By such a plan all interests will have due representation and all causes, either individual and national, will be protected. The landowners who have most at stake and who will pay much of the cost will have sufficient

*[illegible] of the [illegible] "Engineering News," [illegible]

†[illegible], U. S. Reclamation Service, [illegible]

direct authority to get results promptly and efficiently. In this way the two countries can agree upon progressive methods of development and land ownership.

ENGINEERING PROBLEMS—The engineering problems to be solved in the accomplishment of this work are:

(1) Store flood waters; (2) separate water from silt; (3) put water on land for irrigation; (4) keep flood water off the land; (5) drain irrigated land and use water again; (6) dispose of surplus flood water; (7) dispose of surplus silt; (8) develop electric power; (9) perhaps build land with silt.

The remainder of this article will deal primarily with points 6 and 7. The other points have already been considered by others and can be accomplished by proved methods. The most urgent problem now is flood control. It is even more important to protect and insure the territory already developed than to develop new territory. Insurance is worth while. Land in the Imperial Valley sells for $150 per acre which in the San Bernard-

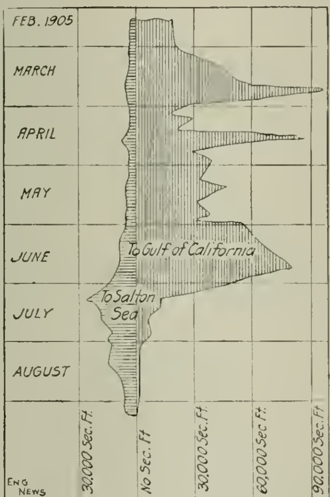


DIAGRAM SHOWING RATE OF DIVERSION OF COLORADO BY IMPERIAL CANAL, 1905

(Amount of water diverted to the Imperial Valley and Salton Sink from February to June, 1905, was only 10 to 13%; from July 1 to 15 it increased to 70%.)

ino, San Gabriel and Los Angeles valleys would bring $500 per acre. Also in most of the territory yet to be developed the flood problem is the most important, the most difficult and the most liable to be neglected. It probably will be impossible to control the floods completely by storage reservoirs alone.

To keep the river out of the Salton Basin by a levee along the high land north of Bee River and Volcano Lake is not entirely satisfactory. It will be expensive and there is danger of the river breaking through. Also the water cannot reach the ocean without using a very large tract of land as a settling basin.

To force the river into its old channel, the shortest route to the ocean, gives a better grade but no satisfactory settling area. With its load of silt amounting each year to 75 sq.mi. one foot deep, this will be increasingly expensive and insecure. If the silt could be removed this expense and danger could be eliminated.

WHERE TO PUT THE SILT—The writer suggests that the proper place to put the troublesome part of the silt is in the Salton Basin. In this way the Imperial Valley, the delta in Mexico, and the Yuma Valley can be insured against flood as they never can be by levees alone. As an additional insurance device the controlling gates might be made large enough to take a considerable portion of the flow at flood, using them as a safety valve.

When the system of storage reservoirs on the headwaters is completed, the Salton Sea may be sufficient to take all the remaining floods, and the channels to the ocean can be used as canals.

With all the power of the federal government the lands along the Mississippi have never been insured against flood, perhaps never will be by levees alone, and only at great expense otherwise. The same would be true of the Colorado if there were no Salton Sink.

The possible incidental advantages of this plan are:

1. Drainage for the Imperial Valley, of all land on north slope of the delta, and lands of the Yuma Project.

2. Eliminating expense of removing silt from canals. Sink where surplus drainage from the Imperial Valley can be used for irrigation.

7. Straightening and making permanent the Alamo Channel below Sharp's or Holt Heading.

8. Shifting of Alamo above Sharp's Heading to a permanent location closer to the mesa, increasing area of delta land easily available for irrigation.

9. Increased opportunities for development of electric power.

The details of this plan are simple. The cost will be moderate. The plan is to sluice the silt into the Alamo Channel by controlling gates on bed rock at Pilot Knob. With the heavier silt removed the old channel below Pilot Knob will scour deeper and straighter. All that is necessary is to scour deep enough to carry the flood waters without levees. Some bank revetment may be required. At 200 ft. below sea level, the elevation which the Salton Sea attained in 1907, the evaporation amounts to 2,000,000 acre-ft. per year. This amount minus the drainage from the Imperial Valley would be available for the work of sluicing. The larger the gates at Pilot Knob, the less the total amount of water required for that purpose, because: (First) the greater the discharge the greater the percentage of silt possible to carry; (second) the more the gates can be depended upon as a regulating safety device at crests of floods, the less the amount of silt necessary to remove.

CONCLUSION—The piecemeal methods which necessarily have been used up to this time have proved expensive and dangerous. The development of the Colorado River country is a case where prompt and comprehensive work is more economical than slow and partial development. With the knowledge and experience gained in the past such action is now possible. Construction can go forward rapidly and surely as soon as a practical permanent organization is effected.

Sewage Disposal by a Public Service Company is not entirely out of date yet, it appears from recent press reports from Collingswood, N. J. The Collingswood Sewerage Co. is petitioning the New Jersey State Public Utilities Commission for permission to increase its rates from $9 to an average of $20 per house. The sewerage company alleges that it has lost $92,000 in its operations of a sewerage system and disposal plant. Oct. 20, has been set for a final hearing on the case. Collingwood is in Camden County and has a population of about 5000.

Brooklyn Sewage-Experiment Plant

By George T. Hammond*

SYNOPSIS—A notable addition to the list of municipal experiment plants for the treatment of sewage has been made by the Borough of Brooklyn. This plant [illegible] for [illegible] sedimentation in Dortmund and Imhoff tanks, a special [illegible] tank and Imhoff sludge beds, a [illegible] tank and [illegible] siphon, sprinkling filters, both ordinary and [illegible] by means of compressed air, and "[illegible]" sedimentation tanks. [illegible] studies are proposed, as also tests of a [illegible] screen and a [illegible] filter. The sewage flow to all units is measured by calibrated orifices in connection with [illegible] and [illegible]

[illegible] station and sewage-treatment plant, on Jamaica Bay. The studies there being made are intended to assist in designing new sewage works for the 26th Ward, in place of the present outgrown plant, and also to assist in designing works for other portions of Brooklyn. Part of the plant was put in operation on Oct. 1, 1913, and most of the rest on Jan. 1, 1914.

At the 26th Ward site and also at other available sites for disposal works for Brooklyn the problem is to provide works which will produce an effluent suitable to be discharged into tidewater, which works must be located on marsh land with a surface only slightly above sea level.

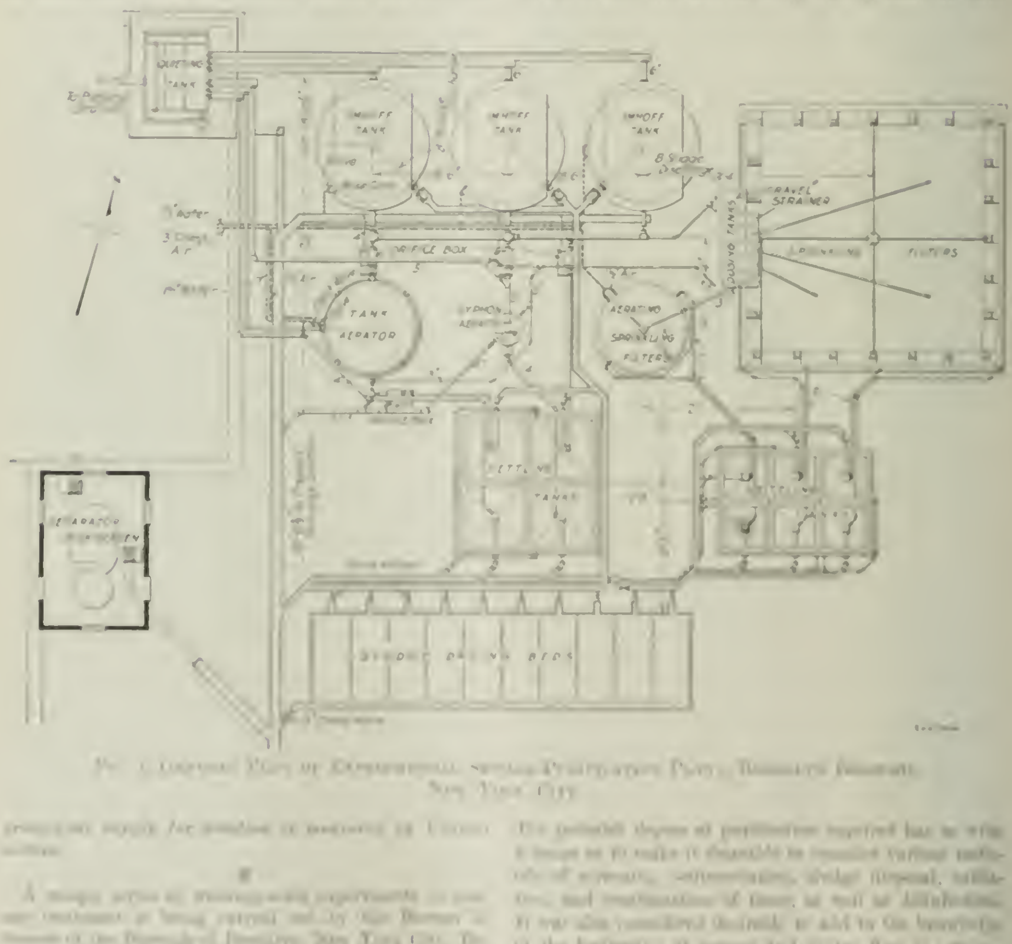


Fig. 1. General Plan of Experimental Sewage-Purification Plant, Brooklyn Borough, New York City

[illegible] for [illegible] in [illegible]

A [illegible] series of [illegible] experiments in sewage treatment is being carried out by the Bureau of Sewers of the Borough of Brooklyn, New York City. The experimental plant is located at the 26th Ward pumping

The [illegible] degree of purification required has to [illegible] [illegible] so as to make it desirable to consider various methods of screening, sedimentation, sludge disposal, filtration, and combinations of these, as well as disinfection. It was also considered desirable to add to the knowledge of the hydraulics of sewage and sludge flow in sewage-treatment plants and the effect of very cold weather on exposed sprinkling filters. The opportunity to study the effect of shape and direction on the operation of the various experimental units was also seized.

For the foregoing and other reasons all parts of the experimental plant were placed above [illegible] and [illegible]

*[illegible] Engineer, Bureau of Sewers, [illegible] Brooklyn, N. Y. [illegible]

accessible for observations on sewage and sludge and on the structures themselves. For study there were selected a Reinsch-Wurl screen and a Moore vacuum filter (or strainer); a Dortmund tank for plain sedimentation,

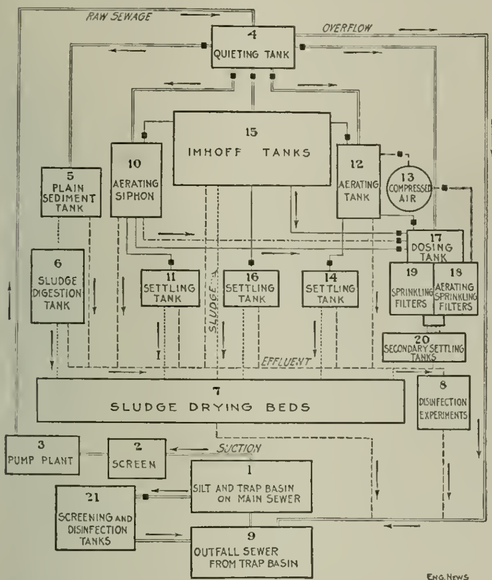


FIG. 2. DIAGRAM SHOWING RELATION OF APPARATUS IN VARIOUS STAGES OF OPERATION AND EFFECT ON SEWAGE, BROOKLYN SEWAGE-EXPERIMENT STATION

coupled with an independent sludge-digestion tank, and also three Imhoff tanks of different depths, coupled with sludge beds (the latter also being available for sludge from other units); an aërating siphon and an aërating tank, each supplied with compressed air, ordinary sprinkling filters and sprinkling filters supplied with compressed air; secondary Dortmund settling tanks receiving effluent from the aërating siphon, aërating tank and Imhoff tanks; and disinfecting apparatus. To aid in the hydraulic studies and in keeping accurate quantity records there were provided a knife-edge weir 25.84 ft. in length (ENG. NEWS, Apr. 9, 1914), in the outfall sewer; a quieting tank to receive the sewage from the pumps and distribute it by gravity to the various primary elements of the experimental plant; various orifice boxes and calibrated orifices to measure the flow of sewage to each unit; and Venturi meters to determine the volume of air used for aëration.

Fig. 1 shows the actual layout of the plant. The sequential relations of the various parts and processes are shown by the diagram, Fig. 2. A general view of the plant is shown by Fig. 3.

The large district from which the sewage used in the experiments comes is sewered on the combined plan. The sewage reaches the 26th Ward station in two 12½-ft. twin sewers, which terminate in a silt chamber. The latter is continued, in turn, by an outfall flume to tidewater. A 48-in. bypass conveys the dry-weather flow from the silt chamber to the old treatment works, from which it is pumped back into the flume.

The sewage for the experimental plant is drawn through a 12-in. suction pipe to a 1,200,000- and a 650,-000-gal. direct-acting steam pump, and is discharged through an 8-in. pipe 180 ft. long into the quieting tank already mentioned. The maximum lift is 40 ft. After supplying the quieting tank for some time with unscreened sewage it is proposed to try, successively, screens of different mesh on the 12-in. suction pipe. The Reinsch-Wurl screen will be tested with raw sewage, which has not gone to the quieting tank. The air for aëration purposes is supplied by a duplex air compressor, automatic in stopping, starting and speed. The compressor has a rated displacement capacity of 228 cu.

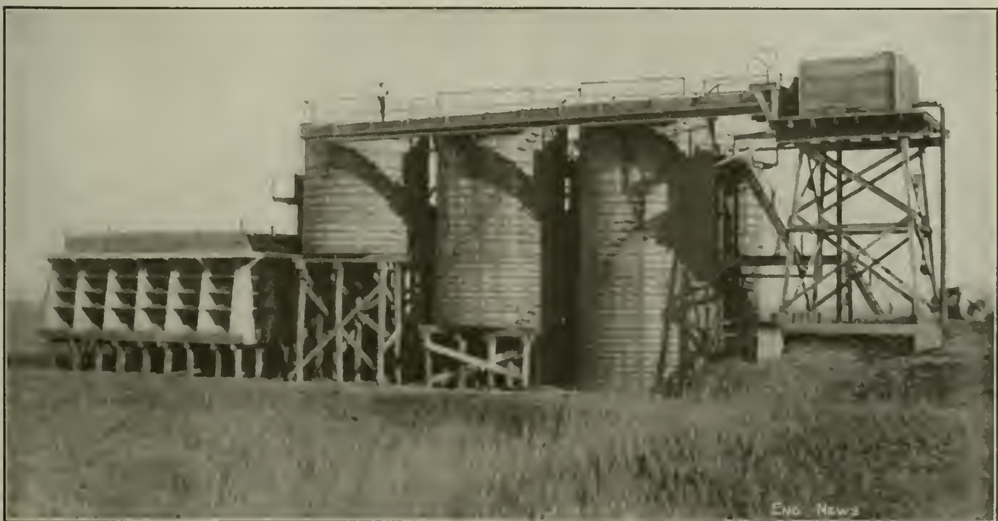


FIG. 3. GENERAL VIEW OF BROOKLYN SEWAGE-EXPERIMENT PLANT

[illegible] of air per min. and discharges into a receiver 24 in. in diameter and 72 in. high.

The maximum elevation of the land at the site of the experimental plant is 1.5 ft. above high water. The sludge beds were made the governing elevation of the experimental plant, with their surfaces at 2.67 ft. above mean high water. The elevation of the quieting tank was fixed so as to give a gravity flow throughout the plant. For this purpose the constant level of the sewage was set at 16.12 ft. above datum, or 12.92 ft. above the invert of the main outlet of the sludge-bed underdrainage system.

In general, the structural elements of the plant are of wood, but concrete was used for the Dortmund settling tanks, and for the ordinary sprinkling filters, and steel for the special sludge-digestion tank.

QUIETING TANK—By referring to Figs. 1 to 3, it will be seen that the center of operations is the quieting tank, which occupies the commanding elevation already noted. This tank is 5 ft. deep and 12 ft. 3 in. by 8 ft. 10 in. in plan. In its interior, each end is divided off by a partition, forming overflow chambers, which are connected with the waste pipe; the main chamber is between these internal partitions, and is 9 ft. in length by 8 ft. in width. Each end partition is cut down to the water line a horizontal distance of 3 ft. from the outlet side of the tank, forming an overflow weir, designed to maintain a constant hydraulic head over the outlet orifices. Two baffles are placed lengthwise of the tank, normal to the line of flow. The baffle nearest to the entrance of the sewage extends 3 ft. upward from the bottom, and is 2 ft. 6 in. from the entrance side of the tank. The other baffle extends downward from the top of the tank to within 1 ft. of the bottom, and is 2 ft. 6 in. from the first baffle, parallel with it, toward the outlet side. Thus the sewage, which enters submerged, rises over the first baffle, and then passes downward under the second, before entering the constant-level part of the chamber, from which it is fed to the various units through adjustable orifices.

ORIFICES—In the side of the main chamber of the tank, opposite to the entrance of the sewage, are placed six outlet orifices, each provided with an adjustable opening having a calibrated scale, which may be set to any rate of discharge within its range of capacity.* These orifices discharge directly into flumes that lead to the various experimental units, each orifice into a flume which it serves. The orifice boxes installed throughout the plant, with their weirs, are designed upon the same principle as the quieting tank. They were included in the general contract for the experimental plant.

A separate contract was made with the Wallace & Tiernan Co., Inc., of 136 Liberty St., New York City, for supplying, installing and adjusting in place the air [illegible] fixtures and also the compressed-air [illegible] to the [illegible] devices. The specified capacity of the [illegible] ranged from 150,- and to 500,000 gal. per 24 hours. As already stated, [illegible] are used to control the flow to each unit of the plant.

SEWAGE CLARIFICATION AND SLUDGE DISPOSAL

A considerable amount of the [illegible] was devoted to sewage clarification and to sludge reduction and disposal. For these purposes tanks, Dortmund and Imhoff tanks were used, as well as a separate sludge-digestion tank and sludge-drying beds.

DORTMUND TANKS—Of a group of four Dortmund tanks, one is used for primary sedimentation and three for secondary sedimentation, the latter receiving the effluents from the aerating siphon, aerating tank and the Imhoff tanks. Each Dortmund tank is of concrete, 8×8 ft. in interior plan, and 8 ft. deep from the water line to the lowest point in the pyramidal bottom. The inflow is through a 4-in. central down-pipe and the outflow through V-notches, two on each side. The sludge from the primary tanks goes to the sludge-digestion tank and that from the secondary tanks to the sludge-drying beds, in all cases without pumping.

IMHOFF TANKS—The three Imhoff tanks, which differ only in depth and cubical capacity, supply settled sewage or effluent to seven experimental units, all of which may be in action at the same time: (1) The ordinary sprinkling filters; (2) aerating tank; (3) aerating siphon; (4) the special sprinkling filters, with compressed-air aeration; (5) a secondary settling tank; (6) disinfection tanks; (7) Moore mechanical vacuum filter tanks.* Sewage discharged to the various sprinkling filters may be passed through a gravel roughing filter. Sludge for testing and drying goes to the drying beds and surplus sludge is discharged into the sewer.

The only parts of the Imhoff tanks which are of the same depth in all three tanks are the scum or baffling boards, which dip 18 in. into the sewage. Later on, different baffling arrangements will be studied. Each tank is 15 ft. in diameter, with depths from the water line downward as follows:

	Total depth, ft.	Sedimentation-chamber depths, ft.	
		Vertical side	Center
Tank 1	[illegible]	[illegible]	12.97
Tank 2	[illegible]	[illegible]	10.6[illegible]
Tank 3	[illegible]	[illegible]	7.[illegible]

The floors of the upper sewers or sedimentation chambers have a slope of about 45°. The floors do not lap, as is usually the case, but below them there is a timber shield, with upper slopes of 45°. In the [illegible] no collection of settlings has remained upon the slopes. The tanks are covered with a flat removable roof. The tanks have been in satisfactory operation since [illegible] 1, 1914.

SLUDGE DIGESTION TANK—This tank (the location not shown on the accompanying plan) is of steel, made to be water-tight and air-tight. It is 5 ft. in diameter and 15 ft. in depth, set vertically in the ground so that the most of it is above the water line of the [illegible] sedimentation tank, from which it receives sludge. The effect of varying temperature or of chilling from ground water is minimized by providing a double shell, with a closed air space between the shells. The sludge is drawn from the primary Dortmund tank through an [illegible] line to the digestion tank. The digested sludge is passed to the sludge-drying beds.

SLUDGE-DRYING BEDS—There are [illegible] beds of [illegible] half [illegible], each [illegible] ft. in plan. The [illegible] is [illegible] of "[illegible]" [illegible], surfaced [illegible] of coarse sand, the whole supported on a [illegible] platform.

AERATION DEVICES

[illegible] raw sewage from the quieting tank or Imhoff tank effluent may be subjected to aeration in (1) an aerating [illegible]

*See [illegible] detailed description, with illustrations, in the [illegible] and [illegible] of this issue.—Ed.

*The last items are not yet in use.

ing siphon, (2) an aërating tank, (3) sprinkling filters equipped with a compressed-air grid, or (4) ordinary sprinkling filters. The two first named aërating devices will here be briefly described, and the third and fourth will be taken up under Sprinkling Filters.

Aërating Siphon—This was adapted from a design used on a working scale, but under unfavorable conditions, at Millville and at Riverside, N. J. It is an application to sewage of the siphon air compressor, proposed by the late C. C. Beddoes, who obtained a patent covering the use of the siphon for sewage aëration, and the process. It may be operated with raw sewage or Imhoff effluent.

The flow of sewage is led by gravity to the bell, or enlargement at the top of the siphon pipe, into which the sewage falls, sucking the air in with it, and passing vertically downward with considerable velocity to such a depth that the entrained air becomes compressed, and the sewage exposed to it absorbs a greater proportion of air in consequence of the pressure: as the volume of air absorbed will be in proportion to the head or height of the volume above it.

The apparatus consists of a 4-in. pipe, extending vertically downward 130 ft., first through the center of a vertical tank, specially designed for this experiment, 30 ft. deep and 4 ft. in internal diameter, which rests on piles. The remaining 100 ft. of the 4-in. pipe passes downward inside of an 8-in. pipe, from the bottom of the 4-ft. diameter tank to below the bottom of the 4-in. pipe, which it inclosed. This leaves an annular space, through which the sewage returns from the bottom of the 4-in. pipe to the vertical tank, in which the sewage is retained for a period of time in proportion to the quantity of flow and capacity of the tank. The sewage leaves near the top of the vertical tank by means of a waste pipe and measuring-orifice box, from which a portion of the flow is piped for observation to one of the four secondary settling tanks.

Aërating Tank—This tank was developed from experiments made at the 26th Ward sewage works in 1911 by Col. Wm. M. Black and Prof. Earle B. Phelps. The tank is 12 ft. in diameter and 25 ft. 8 in. in height. The sewage enters at the top of the tank by gravity from the quieting tank, or the Imhoff tank, as the case may be, through a pipe surrounding the top. The sewage may fill the tank so that the points of entrance are submerged, or the tank may be operated at lesser depths of content. The tank effluent is taken off at the bottom.

A grid for supplying compressed air is placed on the bottom of the tank, 7½ in. of broken stone passing a 2-in. ring and retained by a 1-in. ring being provided to support it, and the same depth of broken stone being placed over it. The grid consists of two 1½-in. pipes at right angles, forming a cross connected in the center, the arms of the cross being connected with quarter circles of ¾-in. pipe forming concentric rings, of which there are five. Each ring is perforated at 6-in. intervals with $\frac{1}{16}$-in. holes. The air enters through the 1½-in. pipes and is distributed thereby to the rings and is discharged into the broken stone surrounding the grid, which tends to break up any upward streaming effect. The main outlets for the tank effluent are 1 ft. above this grid. Through the central axis of the tank is placed a vertical 4-in. pipe, which serves to center and support the deflector disks, of which there are nine, placed longitudinally, provided for the purpose of deflecting the downward flow of sewage and upward flow of air bubbles, so as to obtain even distribution of both air and sewage.

The deflectors are designed in the form of a wheel with a hub, which is of iron. Six radial arms are provided, between which slats are placed. The slats are set in grooves in the arms at an angle of about 45° with the horizontal; the slats in each alternate deflector being set at angles alternating from and toward the center.

Ordinary and Extra-Aërated Sprinkling Filters

Much of the interest in the plant centers in two sets of sprinkling or percolating filters, one set of four beds being of the ordinary type and the other set of two beds being equipped with a compressed-air aërating device, so arranged that one bed may be tested with and one without special aëration at the same time. Before the sewage reaches the filters, it may be passed through a gravel roughing filter and must pass through dosing tanks. The filters may be supplied with: (1) Crude sewage from the quieting tank; (2) aërated sewage from the siphon aërator; (3) aërated sewage from the aërating tank; (4) Imhoff-tank effluent; (5) any of the foregoing after having been passed through the gravel-roughing filter; (6) sewage passed through the Reinsch-Wurl screens. All the sewage is applied by gravity, except that from the screens, which will have to be pumped. The screens referred to are not yet installed.

Gravel Roughing Filter—This is a 12-in. bed of gravel passing a ¾-in. ring and retained on a ½-in. ring, supported on a wire screen of ¼-in. mesh.

Dosing Tanks—There is a dosing tank for each filter, equipped with calibrated orifices and constant-head overflow. Each dosing tank is also equipped with counters that record the number of discharges. The dosing tanks discharge into pyramidal feeding tanks.

The elevation of the water line in the dosing tanks at the instant of siphon discharge is 26.74 ft., which is 9.40 ft. above the surface of the filter beds. The elevation of the same line in the reversed pyramidal feeding tanks is 23.5 ft., which is 6 ft. 2 in. above the beds.

Ordinary Sprinkling Filters—There are four of these, square in plan, and each 0.005 acre in effective area, separated by 4-in. wooden partition walls and inclosed outwardly by reinforced-concrete piers, cast with slots for receiving 3-in. wood shutters sloping inward at an angle of 45°. The piers carry a reinforced-concrete coping, level with the top of the filter bed. The beds have concrete floors, on which rest 6-in. half-tile underdrains, convex side up. The filter medium consists of 10 ft. of broken trap rock. The size of stone in each bed is different, as follows: No. 1, passed a 1½-in. ring and retained on a ¾-in. ring; No. 2, 2 to 1 in.; No. 3, 2½ to 1¼ in.; No. 4, 2½ to 1¾ in. Provision is made for taking samples at depths of 6, 7¼, 8½ and 10 ft.

Extra-Aërated Sprinkling Filters—A tank 12 ft. in diameter and 16 ft. high is divided vertically into two equal parts, alike in every respect, with independent 6-in. half-tile underdrainage systems, resting on concrete. The beds are filled to a depth of 10 ft. with 2½ to 1¼-in. stone. This depth may be increased to 11 ft. if desired. Each bed is provided with a grid near its bottom, formed of ¾-in. iron pipe, perforated every 6 in. with ⅛-in. holes, through which metered compressed air is supplied. As already stated, one bed is operated with, and the other without, extra aëration, for comparative purposes.

SPRINKLER NOZZLES.—Various types of these will be tried. The initial installation is of the Taylor type. A board laid around and between each bed of each set serves as a wind shield to prevent unequal distribution.

SECONDARY SETTLING TANKS.—The secondary settling tanks provided for these filters are six in number, placed in a group, each tank being a reversed truncated pyramid 10 ft. deep from the water line. The flow enters through a 2-in. pipe carried down to a point 2 ft. above the bottom. A 6-in. sludge pipe acts under the hydraulic head of the tank. The tank effluent is taken off by means of troughs passing entirely around the top of each tank, two V-shaped openings being provided on each side of each tank. The effluent passes to the main sewer. The sludge removed may be studied upon drying beds.

The experimental plant was designed and constructed and is operated by the Bureau of Sewers, Brooklyn Borough, New York City. E. J. Fort is Chief Engineer of the Bureau of Sewers.

The Salem Water-Works and the Salem Fire*

BY FRANK A. MCINNES† AND CLARENCE GOLDSMITH‡

The point of origin of the Salem fire (June 25, 1914) on Boston St., between Pope and Proctor streets, was immediately adjacent to a 20-in. main having a normal pressure of a little more than 50 lb. The building in which the fire started, and those surrounding it, were of frame construction and mutually exposed each other, thus enabling the fire to spread with such rapidity that the adjoining buildings were almost immediately involved. Two of these were protected by automatic sprinklers. Before the first hour had lapsed, 10 engines were at work, and a conservative estimate based on a careful study of lengths of hose lines, sizes of nozzles, and water pressures maintained at the engines, shows that at no time during this period was more than 2500 gal. of water per min. pumped from the distribution system, yet the recording pressure gage maintained by the Water Department on Church St. registered a drop in pressure from its normal of 42 lb. to 20 lb. at the end of the hour.

At the beginning of the fire the 30,000,000-gal. reservoir was practically full, the two 5,000,000-gal. pumping engines were in operation under a full head of steam, the 30-in. and 20-in. supply mains were in service. No breaks occurred in the street mains during the progress of the fire.

A test of the carrying capacity of the distribution system was made on Aug. [illegible], 1914, as follows:

[illegible] were set on hydrants near the point of origin of the fire. These hydrants were opened, two discharging through three 2½-in. outlets and two through four 2½-in. outlets. In addition, a post hydrant in an adjacent alley was discharging through two 2½-in. outlets. The flow from each of the [illegible] outlets was measured by Pitot tubes and showed a total of [illegible] gal. per min. The drop in pressure in the 20-in. main at the point where the test was made was observed on the pressure gage attached to a hydrant which was not discharging. The gage showed a pressure of 54 lb. prior to opening the hydrants and 22 lb. while they were discharging, giving a drop of 32 lb. The recording gage on Church St. showed a pressure of 47 lb. before the test and a pressure of 27 lb. while the hydrants were discharging. The quantity of water obtained shows an abundant supply at this point, an amount in excess of the combined capacity of the engines working at the end of the first hour.

A draft from the mains equal to the previously estimated quantity pumped by the engines, namely, 2500 gal. per min., would cause a local drop in pressure of less than 4 lb. On the date of the fire, the recording gage on Church St. showed 42 lb. pressure when the first alarm was received. In 30 minutes the pressure had dropped to 33 lb., and at the end of the hour to 20 lb.

From this record it is evident that a quantity of water approximately equal to the quantity obtained at the flow test was being withdrawn from the system and the principal object of the investigation here recorded was to account for this large rate of flow. The 8-in. and two 6-in. connections supplying the two sprinkler risks already referred to must bear the blame. The 8-in. connection from the 20-in. main was through 25 ft. of pipe to the sprinkler equipment in the Charles H. Kettle plant. The two 6-in. connections supplying the sprinkler equipment in the Carr Leather Co.'s plant was fed through 200 ft. of 8-in. main connected to the 20-in. pipe. These buildings ignited immediately and a large number of sprinkler heads opened in a very short time but were powerless to check the fire. The collapse of the buildings resulted in the breaking of the sprinkler pipes, allowing the capacity of the three large connections to be wasted from the 20-in. main. To determine the actual effect of these three broken pipes they were opened shortly after the flow test above referred to was made, with the following result:

A gage on a hydrant on the 20-in. main showed a normal pressure of 54 lb., and when the connections were open and flowing, a pressure of 31 lb., which, from the previous flow test, enabled the discharge from these pipes to be accurately determined at 3200 gal. per min., a quantity of water in excess of the entire supply required for the fire protection of a city the size of Salem according to the best modern practice. The Church St. gage fell during this test from 46 to 35 lb. The effect of these broken connections is further evidenced by the record of this gage which continued to drop during the fire until it registered 15 lb. about 3 p.m., at which time a supply at the rate of 8,000,000 gal. per day was obtained from the Peabody system without improving the pressure. At about [illegible] o'clock, the [illegible] so that these connections, together with a post hydrant, which had been discharging through two 2½-in. outlets, were closed and the pressure immediately rose to a little over 21 lb. in spite of the fact that many service pipes were broken at this time.

The lesson to be learned from the experience in Salem is that the existence of connections from a distribution system of such size that their failure destroys the pressure at the hydrant is a mistake that surely invites disaster to a water-works system and [illegible].

The record of fires occurring in sprinkler risks during the past 18 years shows that in a total of 11,359 fires

*[illegible]

†[illegible]

‡[illegible]

13,691 were controlled by the opening of less than 51 sprinklers, and only 662, or 4.6%, were not controlled by this number of sprinklers, which number can be supplied by a 4-in. connection.

In most closely built-up sections the first piece of apparatus will be on the ground within three minutes of the alarm of fire and additional water may be immediately delivered to the sprinklers through outside siamese connections with which all sprinkler equipments should be provided. The fire department would then have the supply under its control and be able to deliver the water at the seat of the fire rather than use it with little effect, as is so often done. Such a method of operation would preclude the possibility of a single large connection menacing the entire community.

Some Notes on Street Cleaning

Among the many papers read last week before the annual convention of the American Society of Municipal Improvements, at Boston, Mass., there was one on street cleaning in general and a second, a very brief one on special practice with one kind of pavement at Providence. Those portions of the former having to do with machine cleaning are presented below in condensed form, and here is also given the substance of the notes from Providence.

Machine Street Cleaning

By Edward D. Very*

New York has 2173 miles of paved streets, Chicago 1899, Philadelphia 1371, and the other large cities have from 100 to 500 miles. Under average conditions a man can hand clean but about one-half mile per day. Even could he perform the work with thoroughness, the cost of such an army of labor for this work would be prohibitive. Machines at present used can do from two to four miles each and this work is done with a good degree of thoroughness, making daily work on the same area unnecessary. The patrol man then merely polices the streets as a litter gatherer and can cover a very considerably larger route.

The machine broom as today operated leaves much to be desired; purely, I think, because the action of the broom is dependent upon the speed of traction, whereas should a motor vehicle be substituted, power may be transmitted to the axis of the broom independent of the tractive power of the machine, a proper rate of revolution of the broom may be found and maintained irrespective of the speed of progress of the machine. At present if you find a particular filthy spot and endeavor to slow up to give it more careful attention, the speed of the broom lessens and the effect is loss, whereas were the power independent the result would be that required.

A mechanical device attached to the sweeping machine to pick up the stroke of sweepings from the broom and empty into a receptacle or receptacles would avoid a considerable amount of extra work now performed because the materials are spread by the wind or tracked by vehicle tires. Such machines are in evolution now but most of the devices are complicated or otherwise ill adapted to the performance of this work.

Flushing machines and squeegees are now constructed which do effective work but their adoption has been greatly retarded by the claims that the water has an adverse effect upon paving materials. My judgment is that the paving engineer should design his exposed surfaces to resist water action for the great benefit to be derived from water cleansing. In flushing machines there is a distinct advantage in having an attached pump to press the water so as to get a positive action continuously and on all the water which the storage tank may carry. A motor flushing machine has the advantage of carrying larger quantities of water with a consequent conservation of the time now lost in frequent filling of small tanks.

The machine squeegee or rubber scrubber is effective on smooth pavements where not too filthy, but the present method of delivery of water so close to the scrubber renders the work imperfect through the ineffective action of the water on the filth before the scrubbing is applied. This may be remedied by preceding the squeegee machines by a sprinkling cart sufficiently in advance to give the water action full effect. And here let me say that the sprinkling wagon should not be used, in my opinion, except as an adjunct to other cleansing devices, as by itself it is but a temporary makeshift and ineffective for good result. There is no reason for the filth removed by washing machines being deposited in sewer basins. The machine should be so operated as to leave the dirt near the curb, to be picked and carted away, as soon as it becomes sufficiently dry.

Dry-cleaning machines are greatly to be desired and good progress is being made in the development of such. I know of two types of vacuum cleaners which are doing good work and need but little to make them practical and effective. These, of course, should be designed to pick up and place in receptacles the filth removed. When dry cleaning machine work is adopted there must still be periodical wet cleaning and such a combination should insure the best results.

*Sanitary Engineer, 17 Battery Place, New York City; formerly of the New York Street Cleaning Department.

Clean Bituminous Pavements without Sprinkling

By Walter F. Slade*

In Providence we keep bituminous pavements clean by the patrol system, and reasonably free from dust. We believe that the use of water has an injurious effect upon the durability of the pavement. It emphasizes every slight depression and gathers and retains the fine particles that collect on a street, creating an unsightly appearance and a muddy, slippery condition. This results in the skidding of automobiles and a vast increase in the number of accidents.

By keeping the pavements free from water we escape another prolific source of complaint. Upon the best of pavements there will be depressions sufficient to retain a thin sheet of water. The rubber tires of the swiftly-moving auto, and especially the auto truck, will force the muddy water in a small stream upon the clothing of any one passing along the sidewalk, and even across the sidewalk, covering windows and buildings with muddy spots.

The Garbage of St. Louis is being dumped into the Mississippi River below the city. The Indiana Reduction Co. has a five-year contract for the treatment of the garbage but its plant was closed in July on account of objectionable odors. Another company has taken over the plant and will reopen it shortly, but the city is said to be planning to build its own garbage-reduction plant.

*Commissioner of Public Works, Providence, R. I.

Field and Office

Reinforcing the Winona Bridge, C. & N. W. Ry.

The Chicago & Northwestern Ry. crosses the Mississippi River at Winona, Minn., by a long bridge consisting of a series of through-truss spans. The bridge consists of 16 spans, with design and loading as follows:

(A) Twelve riveted lattice through-truss spans, built in 1891: five of 159 ft. 8 in., six of 142 ft. 2 in. and one (shore) of 104 ft. 6 in. Designed for a load of 3000 lb.

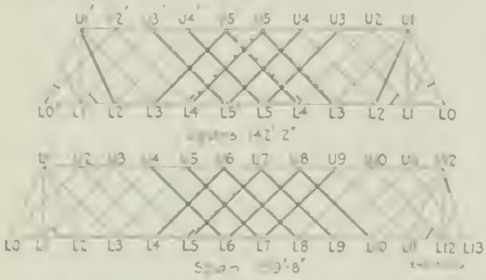


Fig. 1. Riveted Lattice Trusses of the Winona Bridge; C. & N. W. Ry.

(The heavy lines show the reinforcement.)

per lin.ft. with engine excess of 10,000 lb. Iron in tension, 8000 lb.; in compression, 8000 lb. for 159-ft. spans and 7000 lb. for shorter spans, reduced by Gordon's formula.

(B) Two pin-connected through-truss spans of 2[illegible] ft., built in 1895. Live-load, two 107-ton engines (2-8-0) followed by train load of 3000 lb. per lin.ft. Iron in tension, 10,000 lb. live-load, 20,000 lb. dead-load; in compression, 7500 and 15,000 lb.

(C) One pin-connected draw span of 456 ft., built in 1898. Live-load, two 141½-ton engines (2-8-0) followed by 4000 lb. per lin.ft. Iron in tension, 9000 lb. for riveted members and 11,000 lb. for eye-bars; in compression, 8000 lb. reduced by Gordon's formula.

(D) One deck plate-girder span of 85 ft., built in 1898 for the same loading as the draw span.

With the increase in weight of locomotives and trains it became necessary to strengthen the 12 lattice spans to adapt them to the new conditions, and these spans have been reinforced to carry two 202-ton locomotives (2-8-0) followed by 4000 lb. per lin.ft. of train load. The other four spans, being designed for much heavier loading than the older lattice spans, and with low unit stresses, were found not stressed to excess by the modern engine loading.

A careful study was made of the composition and stresses in each span, and the reinforcement designed accordingly. This consisted mainly of additions to the web members of the trusses and the floor members of the riveted spans.

The trusses, Fig. 1, have some web members composed of only a pair of angles, and the principal reinforcement consisted in applying two additional angles to each overstressed member, attaching these to the original angles with tie plates. Additional connections to the chords were applied also, and in some cases struts were fitted to connect the end post with the first web member

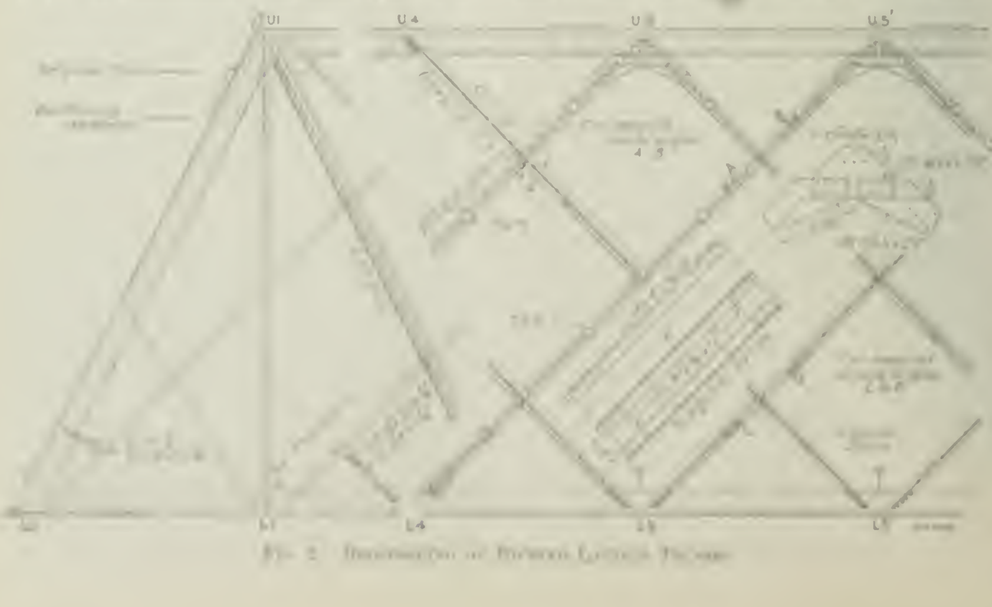


Fig. 2. Reinforcement of Riveted Lattice Trusses

Fig. 1 shows the general design and the location of the reinforcement, while Fig. 2 shows further details of the work on the trusses.

In planning the reinforcement of the floor-beams, it was recognized that to strengthen them by adding cover-plates and other riveted work would be very expensive.

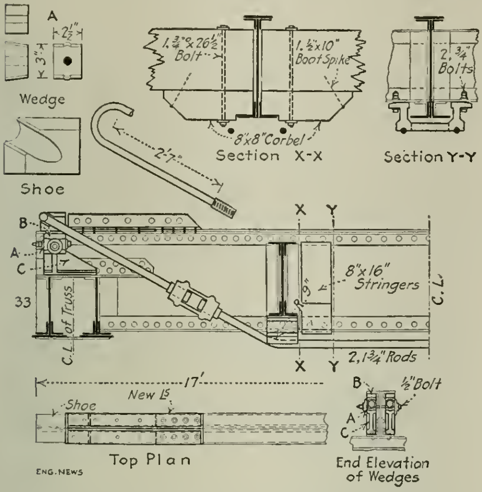


Fig. 3. Reinforcement of Floor-Beams by Truss Rods; Winona Bridge, C. & N. W. Ry.

A method of securing the necessary additional strength by means of tie-rods was devised, therefore, and special aim was made to reduce to the minimum the amount of field drilling required for applying these rods. To reinforce the stringers and floor system a line of 8x16-in. fir stringers is placed inside of each of the original track stringers, their ends resting on corbels fitted to the bottom flange angles of the floor-beams.

The floor-beam reinforcement is shown in Fig. 3, and consists of a pair of 1¾-in. truss rods to each beam. Their ends are attached by turnbuckles to the legs of stirrups whose loop ends rest on shoes riveted to the top of the floor-beam at each end. The truss rods pass under cast-steel saddles located at the bottom flange of the floor-beam but bearing against the bottom flanges of the steel stringers. The bearings of the floor-beams on the trusses were strengthened by means of a set of cast wedges placed between the top and bottom angles of the floor-beams and driven to a bearing by means of a bolt. The device consists of the two opposite wedge pieces (A) between the cap (B) and pedestal (C). This arrangement was found to be much more economical and much more effective than riveting on short end stiffeners.

The method of carrying on the work under traffic was not difficult, as there was no occasion to obstruct the tracks, and the reinforcing of the trusses consisted only in light members which were easily hoisted into place. A gasoline air-compressor plant was installed at the east end of the bridge, and air pipes were carried on the floor to the various spans.

The work was done by the railway company's bridge department during 1913 and 1914. It was designed and executed under the direction of W. C. Armstrong, Engineer of Bridges, Chicago & Northwestern Ry., to whom we are indebted for our information.

Pile-Testing as Practiced with "Pedestal" Piles

Further discussion of the proper way to carry on a pile test or a soil bearing test* is contained in the following description of the MacArthur Concrete Pile & Foundation Co.'s practice in testing "Pedestal" piles (concrete piles with enlarged foot, formed in the ground). The so called pile formulas which are used for guessing at the capacity of a driven pile are altogether useless in the case of Pedestal piles, and therefore pile tests became almost indispensable. Hunley Abbott, chief engineer of the company, says that over 100 such pile tests have been made up to the present, and that, as these furnish experience and figures for almost every conceivable soil condition, tests are now not made usually except where the owner wishes them for his own satisfaction.

In preparing for a test the top of the pile is cleaned off and a concrete cap molded on it (see drawing, Fig. 1 herewith), the pile projecting a few inches into the cap. A steel bolt molded in the top of the cap furnishes a footing point for the leveling rod in measuring settlement.

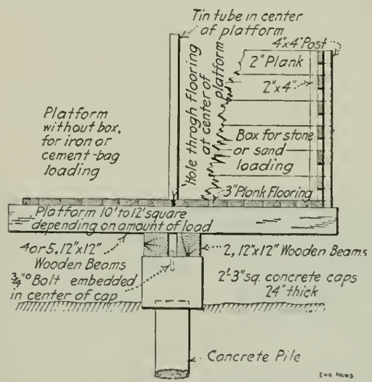


Fig. 1. Sketch of Pile-Testing Rig Used in Tests of Pedestal Piles

On the cap is built up a platform composed of two tiers of 12x12 grillage covered with a 3-in. plank floor. If the loading material is sand or broken stone, a box must be built on the platform, but for pig iron or cement in sacks the simple platform will do. A tin tube passing through a hole in the middle of the floor enables the leveling rod to reach the bolt in the pile top.

Blocking near the ends of the 12x12 timbers keeps the platform from tipping while the load is being placed; but by the time the full load is on the load should have been brought to a balance, so that the blocking can be removed.

A level reading on the bolt should be taken before any weight is placed on the platform. Further readings

*For previous data on these two subjects see May 7, 1914, p. 1024 (Erie R.R.); July 23, 1914, p. 203; July 30, 1914, p. 250 (Panama-Pacific); Aug. 6, 1914, p. 310 (Pittsburgh); Sept. 3, 1914, p. 510; Sept. 24, 1914, p. 647; Oct. 1, 1914, p. 704 (Michigan Central).

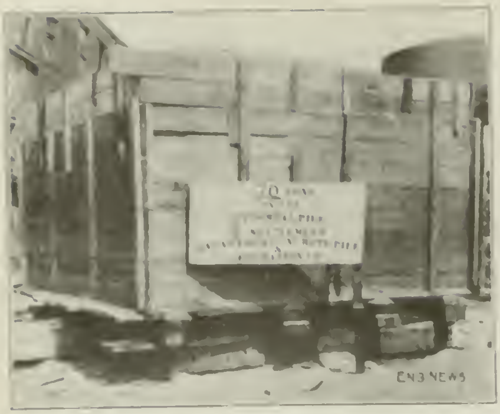


FIG. 2. A 70-TON TEST LOAD ON A PEDESTAL PILE FOR A GAS-HOLDER FOUNDATION, NEW BEDFORD, MASS.

should be taken at various stages of the loading and a final reading when the load is all on. The total load should be allowed to remain on for several hours and readings taken to ascertain whether any further settlement occurs. Mr. Abbott's experience indicates that if the pile shows any settling tendency at all after receiving the final load, this tendency is relatively small, and the pile will come to a complete stop in a very few hours after ending the application of the load (24 hr. ample in all cases).

Pedestal-base piles should be allowed at least three weeks for curing of the concrete before load is placed on the pile, even under the most favorable conditions; better four weeks.

Fig. 2 shows a test made according to the procedure above described on a Pedestal pile installed for the foundations of a large gas-holder at New Bedford, Mass. The test pile was chosen at random by the engineers and all level readings were taken by them. No settlement was observed up to 40 tons loading; from 40 to 70 tons a small settlement developed, the total at 70 tons being less than [illegible] in. after the load had been on for 24 hr.

Another interesting series of tests was made on Pedestal piles for the foundations of the Canadian Vickers plant at Montreal. Out of 2000 piles driven for the works, 19 were tested. Each was loaded to 42 tons standing for 24 hr. The total settlement ranged from [illegible] to a scant ¼ in. In this case the loading was done with pig iron on a flat platform. In testing four piles in the foundations of the Subtreasury building, San Francisco, Calif., the maximum loading was 72 tons. No settlement was observed. These piles were tested with a cement-bag loading on a platform (without box).

Lining Large Coal Bunkers by the Cement-Gun Process

The new plant of the Minnesota Steel Co. at Duluth, Minn., has 53 coal bunkers for the gas-producers and a large circular storage bin for the coke ovens. It was decided to line these with cement mortar for protection against rusting. The lining was applied by the cement-gun process. It was intended originally to use a 6-in. lining of concrete placed by hand, but the cement-gun work was not only done at greatly reduced cost, but it also gave a lining of greater density and (owing to the impelling force) it insured closer contact and adhesion with the steel.

FIG. 3. LINING A [illegible] COAL TANK WITH CONCRETE BY THE CEMENT-GUN PROCESS

([illegible])

FIG. 4. LINING A COAL BUNKER BY THE CEMENT-GUN PROCESS

([illegible])

The coal-storage bin which serves the coke ovens is 55 ft. diameter and 40 ft. high, with a capacity of 2100 tons, and is supported on a framing of steel girders and columns. It is fed at the top by a conveyor, while the coal is drawn off at the bottom by 20 hoppers 7 ft. square and 9 ft. deep, through which the coal is delivered to the charging cars. The capacity is equal to about one day's supply, so that the coal in the tank is practically in continual motion.

To the steel shell were riveted Z-bar lugs to which were fastened ½-in. vertical rods, and to these was wired a layer of triangular-mesh wire netting, about ¾ in. from the shell. The mortar is a 1:4 mixture of cement and sand; the dry mixture, forced through hose by the cement-gun, receives the mixing water at the nozzle from a separate pipe. In the impact upon the steel a portion of the sand is liberated, so that the actual mixture as placed is about 1:3½. The air-pressure in the cement-

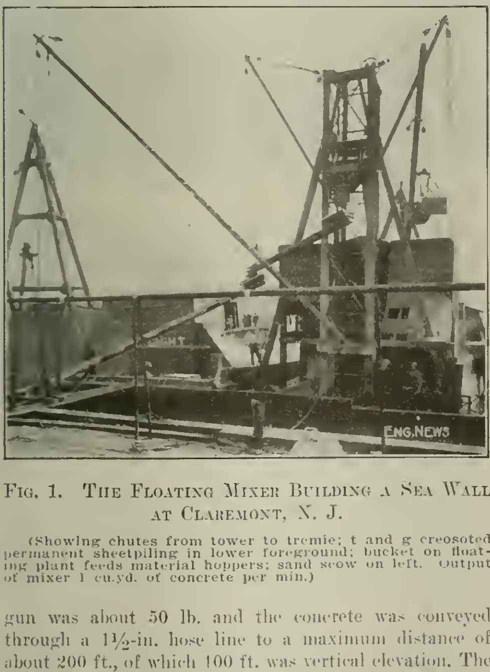


Fig. 1. The Floating Mixer Building a Sea Wall at Claremont, N. J.

(Showing chutes from tower to tremie; t and g creosoted permanent sheetpiling in lower foreground; bucket on floating plant feeds material hoppers; sand scow on left. Output of mixer 1 cu.yd. of concrete per min.)

gun was about 50 lb. and the concrete was conveyed through a 1½-in. hose line to a maximum distance of about 200 ft., of which 100 ft. was vertical elevation. The concrete was applied in two coats, the first or stiffener coat filling behind the reinforcement and the second forming the finish. The total thickness is 5 in.

The working crew consisted of a foreman and nine men, three of the men working on the scaffold in the tank; as shown in Fig. 1. The work occupied about six weeks working time for the application of the reinforcement and the lining.

The same lining, but with a thickness of only 2 in., was used for the 33 parabolic bins serving the gas producers. These bins are 19 ft. square and 12 ft. deep. Fig. 2 shows the work being done in one of these bins.

The work was executed under the direction of K. C. Hoxie, Chief Engineer of the Minnesota Steel Co. The Cement-Gun Construction Co., of Chicago, had the contract for the work of lining all the bins and bunkers.

Building a Concrete Sea Wall with a Special Floating Mixer

A rock-filled crib bulkhead at the Standard Oil Co.'s Eagle Works at Claremont, N. J., is being reinforced, practically replaced, by the construction of a heavy concrete wall in front. The crib is about 20 years old and has deteriorated to such an extent that the rocks were falling out at the face. The bulkhead is about 700 ft. long by 23 ft. high. The concrete wall, 10 ft. thick, was placed in water, by means of a tremie. A specially laid-out floating concrete-mixing plant was used.

Floating Concrete-Mixing Plant

A concreting tower was erected on a scow, with mixer adjoining and arranged so that the concrete moved by gravity into the 1-cu.yd. hoisting bucket, as shown in

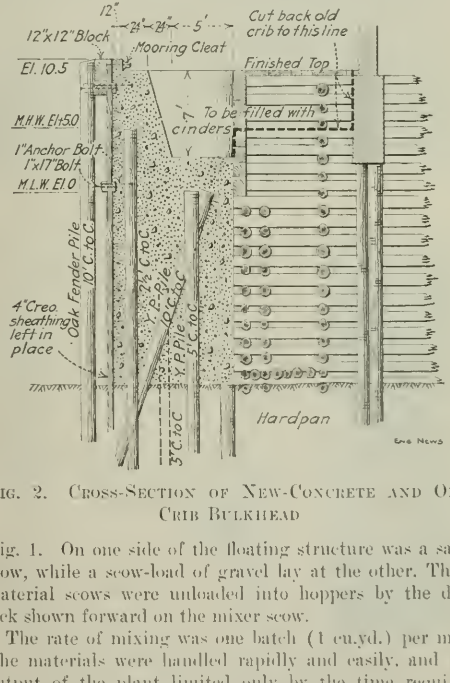


Fig. 2. Cross-Section of New-Concrete and Old-Crib Bulkhead

Fig. 1. On one side of the floating structure was a sand scow, while a scow-load of gravel lay at the other. These material scows were unloaded into hoppers by the derrick shown forward on the mixer scow.

The rate of mixing was one batch (1 cu.yd.) per min. The materials were handled rapidly and easily, and the output of the plant limited only by the time required to mix. The first two lengths of chute were supported by booms extending from the tower. The third length was held by an A-frame placed on the new wall. The concrete passed from the chute into a hopper which fed the tremie. A pump supplied salt water for the mixer.

Method of Procedure

The site was first dredged to hard bottom, about 15 ft. below low water. Bearing and brace piles, 35 ft. long, were driven and cut off at low water. A line of 4-in. t & g creosoted sheetpiling to serve as face form was then put down, and the concrete deposited. The work was carried on in 100-ft. sections, one section being completed before another was commenced, so that the finished portion was available for commercial use.

The concrete was carried up full width to half-tide level (2 ft. 6 in. above low water) and above this the rear face battered as shown in Fig. 2. A 12x12-in. concrete backing log was placed along the top of the wall and provided with cleats for tying up boats. The timber crib was cut off 5 ft. from the top, and the space thus made as well as that back of the curb wall, filled with cinders. A plank floor was then laid over both the wall and the crib.

The creosoted sheetpiling will be left in place to protect the concrete against deterioration from tide action and temperature variations.

The work is being done by Geo. B. Spearin, 90 West St., New York City.

Calibrated Orifices at the Brooklyn Sewage-Experiment Station

By Geo. T. Hammond*

A considerable number of graduated adjustable orifices are being used to control the flow to the settling tanks, filters and other elements of the experimental

Fig. 1. View of Orifice

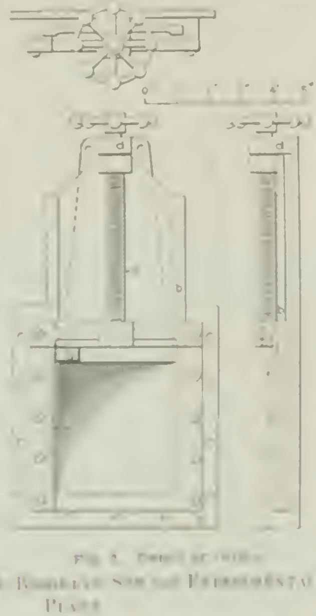


Fig. 2. Detail of Orifice

Calibrated Orifice, Brooklyn Sewage Experimental Plant

sewage-treatment plant at the 26th Ward pumping station, Brooklyn, N. Y. Before installation, each orifice was calibrated in place by actual measurement of the discharge from one of the large tanks at the experiment plant.

The sewage at the experiment station is first pumped to a receiving tank and is then passed through one or the other of two orifices to a flume leading to a tank of the plant. When the effluent from one of these units receives further treatment it is again passed through an orifice, placed in an orifice box, to control the rate of flow.

The orifices were supplied, installed and calibrated by the Wallace & Tiernan Co., Inc., of 136 Liberty St., New York City. The smallest of the orifices called for by the specifications was required to measure flows ranging up to 150,000 gal. per 24 hr. and the largest up to 600,000 gal.

Fig. 1 shows one of the orifices in use and Fig. 2 shows one in detail. In the drawing a is a back plate, screwed to the outside of the constant-level box; b is a sliding gate moved by screw c, which turns in the threaded part d. The scale e is made by obtaining points by actual measurements of the sewage discharged through the orifice at different openings into the tanks of the plant; several points on the scale were thus obtained and the others interpolated.

The orifices are of bronze. All sliding parts are machined so as to work easily and yet fit tightly. They are made according to the principle of hydraulic discharge; but the discharge as actually measured varied somewhat, owing probably to the velocity of approach through the 2-in. planking of the wall of the constant-level boxes on the outside of which they are placed.

E. J. Fort is Chief Engineer of the Brooklyn Bureau of Sewers.

*Engineer in Charge, Bureau of Sewers, 215 Montague St., Brooklyn, N. Y.

Oil-Engine Excavator with Detachable Tractor

The Turner Excavator, used in the emergency ditching job described on p. 711 of the Oct. 8 issue of Engineering News, is a strikingly new type of machine. The excavator and tractor parts are made separate, each with two wheels, their frames being coupled together somewhat like the coupling of motor-truck tractors and trailers. Moreover, the forward part of the machine, i.e., the excavator portion, can be coupled up with any other tractor or traction engine. The machine is built by the United Iron Works Co., Springfield, Mo.

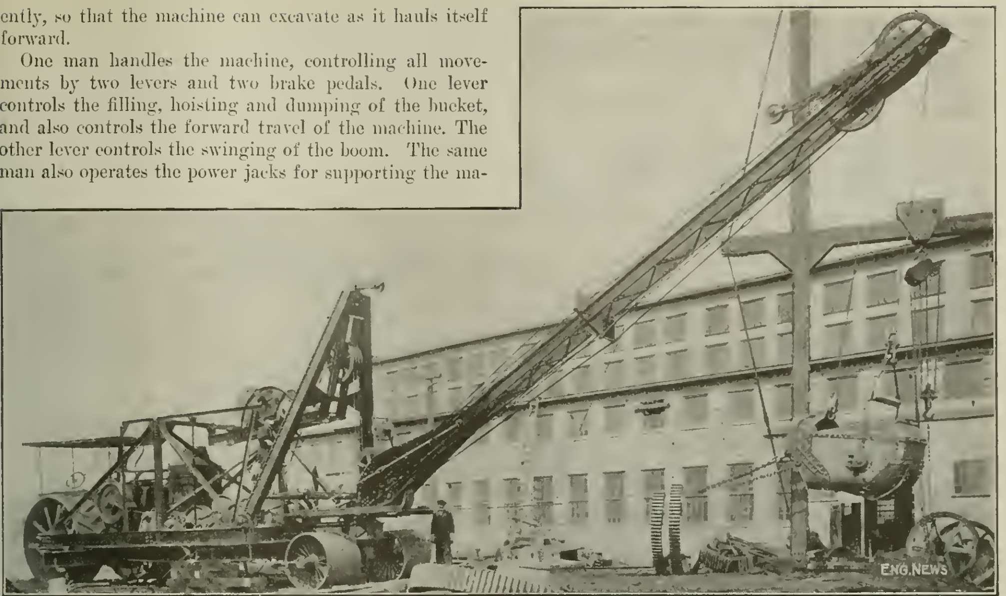
The machine is primarily a drag-line machine, but it can be converted into a steam shovel by some changes: replacing the long boom (see view) by a shorter (dustergirder) boom with dipper handle and bucket.

The excavator machinery is mounted on a trussed-steel frame, with a pair of wide-tread wheels under the front end. The rear end of the frame is forked, and embraces the forward part of the tractor, the latter resting upon a crossframe of the frame. The sills extend back far enough to form outboard bearings for extension hubs which are bolted to the centers of the rear (driving) wheels. In adapting the excavator to an existing tractor, the front axle and wheels of the latter are removed and its front end is supported on and attached to the crossframe, as noted above. Any kind of tractor may be used (steam, oil or gasoline) and any kind of grab or scraper bucket can be handled.

The machine shown in the cut is 28 ft. long, with 40-ft. boom, 1½-yd. scraper bucket, an A-frame 15 ft. 6 in. high, and front wheels 18 in. diameter. It is driven by a 60-hp. oil tractor and weighs complete about 10 tons. In addition to the propelling gear it has a rudder-steering drum which enables the machine to be steered readily over wet ground. The towing rig is driven independ-

ently, so that the machine can excavate as it hauls itself forward.

One man handles the machine, controlling all movements by two levers and two brake pedals. One lever controls the filling, hoisting and dumping of the bucket, and also controls the forward travel of the machine. The other lever controls the swinging of the boom. The same man also operates the power jacks for supporting the machine on either side, and shifts the platform tracks used on soft ground. These platforms are 18 ft. long, and much wider than the wheels.



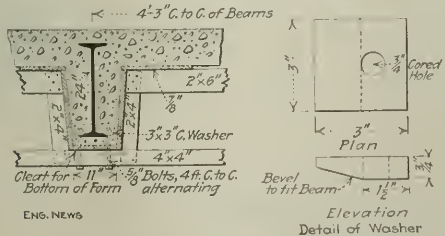
Drag-Line Excavator Operated by an Oil Tractor of 60 Hp.
(Union Iron Works Co., Springfield, Mo., builders.)

NOTES

A Beveled Washer as the main detail of a form support for forms for placing concrete incasement around steel beams was used by Peters & Kiehm, the contractors for the Pleasant St. viaduct of the Delaware, Lackawanna & Western R.R. at Utica, N. Y. The detail of the construction is given in the accompanying cut. This part of the bridge consisted of 24-in. longitudinal I-beams spaced 4 ft. 3 in. center to center, completely incased with 2 in. of concrete and carrying the roadway on a reinforced-concrete superposed slab.

The form consisted of 4x4-in. stringers hung 1 ft. on center from the lower flange of the main I-beam, carrying the concrete form as shown in the drawing.

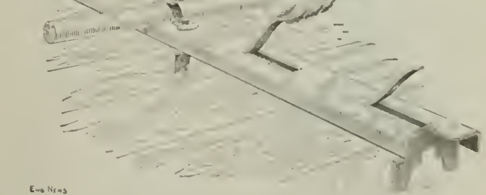
The hanger bolts had their head at the lower end and were hung from the lower flanges of the I-beam by specially made washers beveled as shown in the detail on the drawing to fit the lower flange of the beam. In erection, the 4x4-in. sticks were hung on one set of bolts, from one flange of the beam, and the bottom of the beam box placed on the opposite side, the bolts being put through holes bored for that purpose. Then the first placed bolts were removed, allowing the beam box to be hung by the second set of holts, while the first line of hanger bolts was replaced and the beam box sides and floor forms were set.



Beveled Washers to Carry Beam Box for Concrete Incasement

The bolts and nuts were well greased and after the concrete was placed the forms were taken down by unscrewing the heads of the bolts, leaving the washers and the nuts in the concrete; the holes in the concrete were plugged up with cement mortar.

A Patented Spacing Bar for holding and spacing reinforcing rods in concrete slabs has just been put on the market by the Electric Welding Co., of Pittsburgh, Penn. The accompanying sketch gives a view of the bar and the method of its use. It is known as the "Efficiency Spacing Bar." The bar consists of a 3/4-in. channel pierced at proper intervals for floor rod spacing (say 3 or 4 in.) with openings the metal strip from which is bent up at an angle sufficient to admit the floor rod. At every other one of these openings a chair is welded so as to carry the spacing bar (and the reinforcing rods) the proper distance above the bottom of the slab. The floor rods are clamped solidly into place by a hammer blow, which easily bends the projecting metal strip tight over the rod.



"Efficiency Spacing Bar"

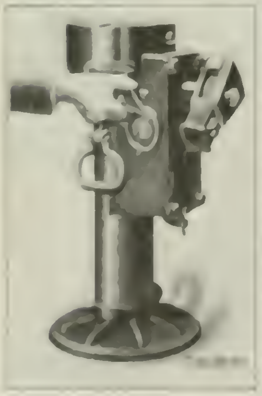
The section of the bar is about 3/8 sq.in. so that it serves also as a transverse stiffening or reinforcing rod.

Dumping a Wagonload of Old Brick—The accompanying view taken in the new Western Yard of the Department of Public Works of Detroit, Mich., shows the method used there [illegible] dumping [illegible] brick into the pile from which they are passed into the crusher to be used for fill and for concrete aggregate. The wagons holding about one [illegible] yard each, are driven into the yard, the horses unhitched, the

Lifting a Two-Horse Wagon over a Brick Dump

wagon [illegible] by [illegible] shown and lifted [illegible] the bottom [illegible] and the wagon is [illegible] to the waiting horses in [illegible]. The method [illegible] the dump pile because it [illegible] higher piling than would be possible by the ordinary [illegible] methods.

Screw Jacks With a Friction-Brake Lowering Device [illegible] by A. O. Norton, Inc., of Boston, Mass. The friction-brake device makes it safe to [illegible] the [illegible] under all conditions. It consists of [illegible] [illegible] when [illegible], a friction [illegible] at the outer end of this [illegible], and a [illegible] the spring [illegible] of this [illegible]. When the jack is to lower the lifting [illegible] [illegible]

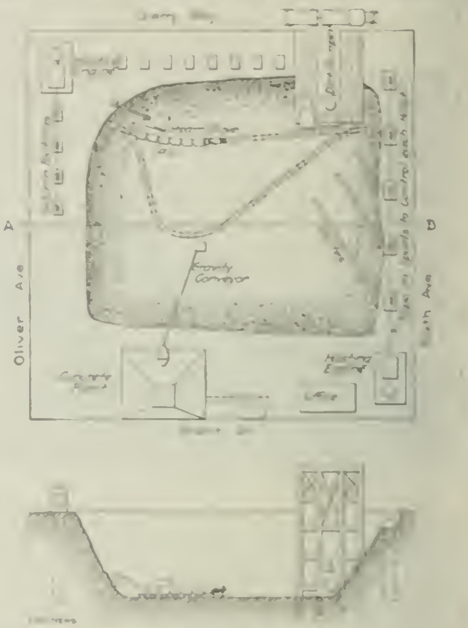


[illegible]

[illegible]

The Excavation Plan of the William Penn Hotel, at [illegible] [illegible]

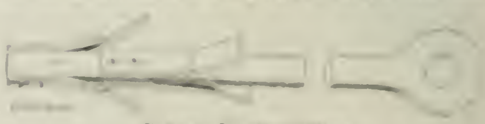
narrow-gage cars drawn by horses to the dumping elevator where the cars are emptied into [illegible] deep below the track level. These skips are pulled up the [illegible] and dumped into automobile trucks [illegible] which empty onto barges at the river front. The footings for the [illegible] of columns next to the streets are being sunk in [illegible] open pits from the high level, as shown in the section. These pits are [illegible]



Layout of Plant for Excavating, Wm. Penn Hotel

and [illegible] each street is [illegible] over each pit. The [illegible] [illegible] to lower or elevate [illegible] by throwing in a clutch. The [illegible] from a gravity tower, fed from the mixing plant on the Grant St. side of the lot. The contractor is [illegible]

A Guy Anchor Without Loose Parts—[illegible] trials were made of a [illegible] and the [illegible] Louisville, Ky. [illegible] point. [illegible]



Barbed Drive Anchor

[illegible]

Editorials

Status of the Proposed International Congresses at San Francisco in 1915

The first positive action regarding the International Congresses, scheduled to be held in San Francisco next year during the Panama-Pacific Exposition, is the announcement that the Electrical Congress will be indefinitely postponed. The Executive Committee has been continued, its records preserved, and the bills will be settled by the American Institute of Electrical Engineers. It is intended to hold the congress eventually, and in America.

In view of the absolute impossibility of holding a truly international meeting, on account of the European War, this action is entirely wise. Those organizations which carry through their previous plans for holding congresses may possibly secure a fair American attendance, although even that is problematical in view of the decreased interest which will result from the scanty foreign representation, and because many American engineers will be deterred by business conditions from taking the time and money necessary to attend a congress at San Francisco next year.

Ethics and Compensation of Engineers Again

In our issue of May 7 last, we published a letter entitled, "Ethics and Compensation of Engineers from the Standpoint of a Lawyer." The second paragraph of this letter read as follows:

> An active writer on engineering ethics, prominent in the American Society of Civil Engineers, who would unquestionably consider it unethical for an engineer to guarantee or assume the financial responsibility for the commercial success of a new design in practice, had no scruples about reporting under his signature, on the same day, that the same railroad project would cost $17,000 per mile in his report to the promoting company, and $25,000 per mile in his report to the Provincial Ministry, for the purpose of securing a subsidy for the promoting company of $20,000 per mile.

The fact that no names were mentioned in the above quotation or in the letter of which it formed a part is probably the reason why it passed editorial scrutiny, although our scrutiny ought to have been particularly strict since the letter purported to be written by a lawyer! It is part of a lawyer's business to state facts in such a manner that they will produce a desired impression. Since the letter was published, statements have been laid before us which show that the statement above quoted was entirely unwarranted.

The papers in the case show that the engineer in question did present two different estimates of cost for a projected railroad, and in fact presented more than two different estimates; *but the different estimates were based on widely different specifications.* One estimate, for example, was based on entirely different requirements as to maximum grade and curvature, weight of rails, etc., from the other. It should be further stated that both reports were made to the promoting company, the engineer's client, and that no report was made to the Provincial Ministry, save that the engineer in question represented his client in negotiations over the railway project, which later became the subject of a bitter political controversy in the Provincial Parliament; and as those familiar with Canadian politics are aware, professional and personal and business reputations are often sacrificed to the necessities of partisan political squabbles.

In the present case, however, the papers submitted to us indicate that even the attorneys of the opposition conceded at the end that the action of the engineer in question was that of a high-minded professional man discharging his duty toward his client. It was very likely some distorted newspaper report of the squabbles in the Provincial Parliament which led to the unfounded accusation in our issue of May 7, referred to above.

We deem it worth while, even at this late date, to set forth the facts in this case in order that at least one unjust and unwarranted attack upon the honor of the engineering profession, as represented by one of its prominent members, may be rendered of no effect.

Military Engineering Training for the Engineering Student

We believe that engineers who were educated at a "land-grant" college generally look back upon their compulsory military training there (which is the federal government's compensation for financial assistance) as a period of drudgery. While the young male is essentially a military creature and the tin soldier a plaything *par excellence* to the boy, the soldier's life, or at least that part of a soldier's life which involves two hours' drill inside of a dusty and ill-ventilated armory, does not as a rule appeal to the more mature boy at college. However, an all-wise government considers that even this limited military experience is a desirable part of the education of young men; and furthermore it is constantly trying to make this enforced military drill somewhat more interesting to the students. It is worthy of note in this connection that special instruction is now being given in military engineering in some of the land-grant colleges.

Under the American system of army development, the United States must depend for its armed forces in time of war upon a small nucleus formed of the regular army, distributed as a leaven through the great mass of volunteer troops. In order that those who may have to make up this volunteer army should not be entirely ignorant of the work which they may be called upon to perform, certain of the youth of the country are trained in the elements of military science either in school, in college or in the National Guard. In the National Guard, there are sections devoted to the practice of military engineering, which perform the functions of the engineer-companies of the regular army. These sections, however, are much too small and the time given to their work much

not fitted to take up all of the duties which naturally devolve upon an engineer corps in time of war. In fact, in the Spanish-American War there were formed some volunteer engineer companies.

In the event of any extensive war, such companies must be formed and their efficiency will naturally be greater if they are made up of men whose ordinary occupation has to do with engineering. Yet while such civilian engineers are eminently more fitted for the practice of military engineering than would be a civilian who knew nothing of engineering, the entirely novel features of military engineering are so many as to require considerable time and labor on the part of a civilian engineer if he is to be capable of performing the work of his military brother.

It seems eminently fitting, therefore, that boys engaged in the study of civil engineering, who are required by the government to devote some time to military studies, should devote that time to the study of military engineering. Thus in the event of a war where their services would be required, they would be able to bring to the very important engineering corps of the army not only a training in civil engineering but some elementary knowledge, at least, of the military engineer's work. At the same time it adds to the student engineer's curriculum a study which should be much more interesting than the routine drilling of the infantry branch.

At Cornell University during the coming year an engineer corps is to be added to the student "army," and is to be not only under the direction of the U. S. Army officer who is in charge of military instruction there, but is also to have instruction by a retired sergeant of engineers of the U. S. Army, a man who can undoubtedly bring to the instruction of the student more practical experience than the line officer who is commandant.

The Design of the New York Barge Canal

We quoted in our issue of Aug. 27, 1914, a statement by John A. Bensel, State Engineer of New York, to the effect that a Western manufacturing concern which desired to use the New York Barge Canal when completed and investigated the relative cost of rail and water transportation found that for economical transportation freight should be shipped through without transfer. The ship designers, however, Mr. Bensel stated, have not yet been able to design a vessel which could navigate both the Lakes and the barge canal with the limited depth and overhead clearance prevailing on the canal.

This statement of Mr. Bensel's was discussed in a later issue (Sept. 10) by John Reid, the well known marine architect, and he raised the very natural question why the barge canal was not designed in the first place so that it would accommodate vessels capable of Lake navigation. Mr. Reid said:

It has always seemed extraordinary to naval architects and shipbuilders that all the efforts [illegible] made in designing the New York Barge Canal [illegible] Mr. Bensel in his statement declares that shipbuilders have found it [illegible] Canal [illegible] the Barge Canal engineers designed so as to be adapted for the passage of vessels which could navigate the Great Lakes?

It is proper that this question should be brought up and answered in these columns since it is a question which will doubtless receive wide public attention as soon as the canal is ready for traffic. The commercial interests of the State of New York when they acquire what benefit they are to receive from the enormous expenditure which the State of New York has made in the construction of this waterway will be very likely to jump at the conclusion that a stupid blunder was made by the engineers who planned the canal in not adapting it to vessels which could navigate Lake Erie at least, so that cargoes could go through without breaking bulk from any of the Lake Erie ports to tidewater.

It was not, however, by a blunder that the canal was built in this manner. On the contrary, strange though it may seem, the New York Barge Canal was actually designed with a distinct purpose to prevent its navigation by vessels capable of traversing the Lakes and so that all cargoes would have to be transferred at Buffalo.

To explain how this came about it will be necessary to review briefly the history of the Barge Canal project.

Twenty-five years ago, in the late '80's and early '90's, great interest was aroused in the States bordering on the Great Lakes over the project to extend Lake navigation to the Atlantic seaboard. At that time the grain and flour trade on the Lakes was the largest item of traffic. The iron ore and coal business was of small proportions compared with what it has since become. Railway rates from the Central States to tidewater, on the huge volume of export grain which was then moved to the seaboard were comparatively high. The Erie Canal had lost its former commercial importance and it was clearly recognized would soon become obsolete as a traffic route. Commercial interests were agreed that a water route to take the place of the Erie Canal and designed in accordance with modern traffic requirements was a necessity of the future.

In 1884, the late Elnathan Sweet, a former State Engineer of New York, read a paper before the American Society of Civil Engineers outlining a project for the rebuilding of the Erie Canal as a ship canal capable of carrying vessels of 18-ft. draught. Interest in the Lake cities became more and more active and various conventions were held to further the survey and construction by the United States of a deep waterway from the Lakes to the Atlantic.

In 1895, in response to this agitation in the Lake states, an International Commission was created by joint action of the United States and Canada to study the best route for a deep waterway between the Lakes and the Atlantic. The American members of the Commission were James B. Angell, then President of the University of Michigan, John E. Russell, of Massachusetts, and Lyman E. Cooley, the well known engineer of Chicago.

This Commission was given only a small appropriation and was able to make only a preliminary investigation, but it reported that such a waterway was feasible and recommended a large appropriation sufficient to make complete surveys and estimates. Congress therefore made appropriations for such surveys aggregating nearly half a million dollars and President McKinley appointed as a Commission to conduct these surveys, Major Chas. W. Raymond of the Corps of Engineers, Alfred Noble and George Y. Wisner.

As most of our readers will know these three engineers, all of whom have now passed away, were among the most eminent men in the profession, and their conclusions and recommendations were entitled to great weight. The

Commission spent three years in its work and made complete surveys and estimates for both a 21-ft. deep waterway and a 30-ft. deep waterway from Duluth and from Chicago to tidewater by various routes. It recommended the 21-ft. channel as the most advantageous commercially. The estimated cost of its construction was in round numbers $200,000,000, of which $155,000,000 was the cost of the section from Lake Ontario to tidewater, across the State of New York.

But the commercial interests in the Lake cities which six or seven years earlier had agitated so vigorously for government construction of a deep waterway between the Lakes and the Atlantic paid no attention whatever to this report, when it was presented in 1900. A partial explanation is that the Lake carriers who had a few years earlier been anxious to have an outlet to the Atlantic for their fleet now found themselves taxed to their capacity in caring for the ore and coal traffic to the head of the Lakes. But the more important reason, doubtless, for the shelving of the report and abandonment of the project was that the State of New York had by this time determined to provide its own waterway to the Great Lakes by enlarging the Erie Canal.

While the Board of Engineers for Deep Waterways was at work on its surveys, Theodore Roosevelt, who was then Governor of New York, appointed a commission in 1898 to advise what New York should do with its canal system. The Erie Canal, as has been stated above, was rapidly becoming obsolete and was no longer an important commercial factor. In 1895, the State had made an absurd attempt to do something for the canal by borrowing $9,000,000 to enlarge some of the locks and dredge to greater depth some of the canal levels. The expenditure of this $9,000,000 appropriation was accompanied by scandals which nearly wrecked the administration. It was evident, however, that even if the money had been honestly and efficiently expended, the outlay of any such trifling amount on this shallow old canal was practically wasted.

The Commission which Governor Roosevelt appointed was headed by General Francis V. Greene, a well known engineer. The report of this Commission, presented in 1899, practically ignored the Federal project for a deep waterway from the Lakes to the Atlantic, then under survey and recommended that New York should with its own funds undertake the construction of a waterway to supersede the Erie Canal. The Commission advised that such a waterway should be made large enough to accommodate barges of 1000 tons capacity; and the canal which was afterward undertaken has been generally known as the 1000-ton barge canal. The work has been carried out to a large extent on the lines laid down by that Commission's report, save that the dimensions have been increased so that, in theory at least, barges of a capacity of as much as 3000 tons, will be able to pass through the canal.

The interesting point, however, is the consideration which caused the Commission and the legislature which acted upon its recommendations to fix upon a canal of this type. It should be understood that the only two sections of the State which took any great interest in the canal project were New York City and Buffalo. Other sections of the State, even along the canal line, were either lukewarm or strongly opposed to the assumption of a huge debt by the State for this purpose. New York City, clinging to the old tradition that her greatness was due to her location at the mouth of a waterway from the West, would have been satisfied with any waterway of large capacity, that projected by the Federal Government commission, for example. Buffalo, however, which had really fathered the project for enlarging the Erie Canal, was insistent upon one thing: that the waterway built should not be of such capacity that the lake traffic could pass her docks without stopping. What Buffalo wanted was a waterway across the State which would move traffic at the lowest possible cost and yet would not be large enough to admit vessels capable of navigating the lake!

It seems strange indeed, as we look back upon it now, that this huge engineering work—the greatest piece of waterway construction ever undertaken in the United States and probably the largest piece of public work ever undertaken as a State enterprise—should have been deliberately planned, not with a view to give the greatest public benefit, or even the greatest benefit to the State itself which paid for the work, but with the distinct object of protecting the commercial interests of a single city of that State.

Such, however, is the absolute fact. Buffalo's interest in the Barge Canal was as a means of building up her commerce and increasing the value of her real estate. Any proposal for permitting the Lake commerce to pass her doors without paying tribute, she would not hear of for an instant.

The mistake New York was making in adopting plans for a canal which would accommodate nothing but barges, instead of a channel which could be used by lake and coastwise vessels also without transferring cargoes at the terminals, was pointed out again and again in the columns of ENGINEERING NEWS. Attention was called to the fact that in view of the interest which had been taken by the Lake States in the project for a deep waterway between the Lakes and tidewater, New York could easily secure their coöperation and probably have the entire work undertaken by the Federal government or that it could at least do so if New York would offer to bear half of the expense, which would have made a much smaller burden for her than that which she shouldered in constructing the barge canal. At one time, as our older readers may recall, we published a symposium presenting the opinions of a dozen engineers standing at the head of the profession, all agreeing as to the unwisdom of the project which New York was entering upon.

We deem it proper to review this past history here, because it will undoubtedly be said that the engineers were to blame in not designing the New York Barge Canal for economic transportation. It is well to have on record the fact that it was not lack of engineering foresight or knowledge but the desire to further special interests which determined the type of New York's $100,000,000 waterway.

It is fair to add, however, that some economic facts which bear upon the problem were less widely known fifteen years ago than they are today. If those who represented Buffalo, for example, in furthering the canal enterprise, had understood as they would today the enormous expense involved in transferring freight compared with the cost of hauling it, they might have been less insistent that the canal must be so built as to compel transfers at Buffalo, since they would have realized the danger that a traffic route thus handicapped would very

likely prove unable to attract any large volume of traffic in competition with other routes.

Further than this, as was shown in these columns some weeks ago (Eng. News, July 9, p. 90), the passage of commerce through a city, even where a transfer is involved, is nowadays a very small factor in the city's growth and prosperity. Galveston has after New York the largest foreign trade of any port in the United States, yet Galveston has only 37,000 population, while Buffalo is a city of over 400,000. Buffalo's commerce would benefit far more from a canal able to pass the Lake freighters than from the present canal which requires a transfer of cargo.

Subject to the limitation above noted it was endeavored to design the barge canal as an economic waterway. The canal locks were made phenomenally large for a barge canal because at that time towing of a fleet of barges by a single power boat was in great favor as an economical system of transport, especially on the Lakes. The evolution of the past fifteen years has been away from that system and toward the practice of giving each vessel its own motive power.

Probably the most serious handicap of all to the use of the new canal by vessels which could also navigate the lakes, is the numerous fixed bridges across the canal with a clear headway of only 15½ ft. This is an even more serious restriction to the boat designer than the limiting depth of 12 ft. If movable bridges instead of fixed bridges had been built over the canal, it would be possible to design a roomy freight carrier with shallow draft and very broad beam and to obtain a fair degree of longitudinal strength in its hull notwithstanding its shallow draft, by giving it a very high freeboard. Such a boat would be only fitted for slow speed, it is true; but it would be seaworthy enough to operate with reasonable safety on the lower Lakes during most of the season. The low headway under the fixed bridges, however, seems to shut off any possibility of the use of such vessels and restricts the use of the canal to low barges and tugs.

Of course, it will be freely admitted that to interpose possible interruptions to railway and highway traffic by a line of drawbridges over the canal extending from east to west clear across the State of New York would be a very serious matter. If, however, New York desired a great commercial waterway to extend across its territory, that is part of the price it would have had to pay.

As an alternative, a deep waterway could have been built at no greater cost by the St. Lawrence River and Lake Champlain route; and now that Canada with commendable enterprise is enlarging the Welland Canal to accommodate the largest lake steamers and is likely to enlarge the St. Lawrence canals eventually, either that or the route wholly through Canadian territory to the Gulf of St. Lawrence, is the probable future outlet for the Lake shipping to the Atlantic.

That the New York Barge Canal with its compulsory transfers at each end could not compete as a through traffic route with such a waterway is obvious.

Letters to the Editor

Trade Catalogs Wanted by South American Engineers

Sir—I should be glad if you would insert a paragraph in your widely read journal to the effect that The Institution of Engineers of the River Plate, of which I have the honor to be President, would be glad to receive and file for reference of members catalogs of engineering materials which manufacturers may desire to introduce to this market. The address of the Institution is 25 de Mayo 195, Buenos Aires, S. A.

Bertram C. Hume.

Field Test Values for Concrete

Sir—The article entitled "Field Tests of Concrete for Municipal Work at Kansas City, Mo.," in Engineering News, Sept. 10, 1914, p. 536, has just come to my attention.

I regret that these otherwise interesting tests are practically valueless because rubber pads were used for cushioning the ends of specimens in the testing machine. When the rubber is under pressure it spreads laterally and outwardly ... which split the end of the test specimen before the true compressive strength of the concrete is attained. The illustration accompanying the article in question shows that this happened to the specimens there reported. So far as can be determined from the illustration, all the cylinders are fractured through one of the ends. In properly manipulated tests the fracture either occurs in the middle of the cylinder, leaving the ends intact, or it originates in the middle and spreads to the ends, the fracture of the ends being a secondary result.

Your editorial on the subject is excellent, but in view of what has just been stated you have shown no satisfactory reason for reducing to a lower value Mr. Aiken's figure of 1500 lb. per sq.in. for 1:2:4 concrete at 30 days. The experience of the writer with a large number of field tests in New York City agrees very well with that figure.

Ralph F. Goodwin.

Public Service Commission Testing Laboratory,
55 Park Place, New York City.

On Living Conditions and Commercial Opportunities in the Argentine

Sir—Replying to M. J. Laronde's letter in your issue of Oct. 15, 1914, I will say that while in Buenos Aires I bought several pairs of shoes for less than 14 or 16 paper dollars a pair, and being intimately acquainted with the representative of the United Shoe Machinery Co. who was installing many shoe-making machines in the

Argentine Republic, I can safely assert that at that time first-class native-made shoes could be bought for less than 7 or 8 U. S. dollars. Also I bought suits made to order for 85 and 90 paper dollars, which is equivalent to 36 and 38 U. S. dollars, respectively, and these suits were equal to those costing the same price in New York City.

I do not wish it to be understood to mean that French influence predominates in every enterprise in the country; and if Mr. Lorente will read again my letter of Sept. 5, 1914, he will find the statement that, "South America has in the past secured its capital in Europe . . . and for this reason the English have large interests there."

It is true that in business circles the "British influence has been infinitely more powerful than that of the French," but not so in the matters of tastes, culture, methods of living and the like.

British enterprises are quite naturally managed in accordance with British customs and their structures built according to British standards. This is also true of other nationalities having holdings in the republic, and I do not dispute the fact that British holdings in the country are very large and numerous. Neither do I wish to belittle the vast interests held by the Germans, for the writer has referred to the German "aggressiveness" and its result.

It must be borne in mind that Buenos Aires is a cosmopolitan city and that practically one-half the population is of foreign birth, and about one-fifth are Italians. It is therefore to be expected that to a certain degree the Italian influence is felt. Engineers of various nationalities are to be found in the republic and in the employ of the government.

In the matter of sports, many English games have become popular with the Argentines, among which are football, rowing and wrestling; but it is equally true that sports and amusements of other nations are enjoyed by the people.

It is not the writer's purpose to enter into a lengthy discussion as to the merits of the various views expressed by different ones who have lived in the Argentine, as individual impressions will naturally differ; but the opportunities and conditions existing in a foreign country must be considered from other points of view besides that of engineering to be fairly judged.

E. L. Verveer.

518 West 111th St., New York City,
Oct. 17, 1914.

The Largest Installations of Cooling Towers, it is claimed, are those being made for the Texas Power Co. at Waco, Tex. There is a steel shell 100 ft. long, 18 ft. wide and 40 ft. high, with six pairs of fans 10 ft. in diameter operating at 250 r.p.m., belt driven by motors located above each pair of fans in small motor houses. The fan-housings are extended from the shell and are provided with doors so that they may be opened to permit unobstructed entrance of air for winter operation under natural draft. There is a platform serving the three motor houses and reached by a ladder from the ground. An upper gallery is built on the level of the water distributor and regulating valves which control the discharge to each compartment of the shell. Any section may be cut off for inspection or cleaning without interfering with the operation of the others. Plans are made for an additional installation of equal capacity at one side of the present outfit, which is designed to cool 600,000 gal. per hour. These towers were made by the Wheeler Condenser & Engineering Co., of Cartaret, N. J., at the direction of Sargent & Lundy, Consulting Engineers, Chicago.

The Twenty-First International Irrigation Congress

By F. H. Newell*

The restoration of confidence in irrigation and the continuation of developments in the arid West were the underlying thoughts at the twenty-first International Irrigation Congress at Calgary, Canada, Oct. 5 to 8.

The confidence which is so essential to further irrigation development must come through achieved success in the work already undertaken. In other words, the settler now on the ground, who is producing crops from the irrigation works already built, must be in a prosperous condition before other settlers and other works can be had. If the average irrigator is contented and prosperous, he will attract new men to the opportunities offered. It must, therefore, be seen that the man on the ground is making good, and when this is done there will be little to fear for the future.

These and similar ideas were developed at the Congress. It was shown that the construction of irrigation works and the reclamation of arid land are still in advance of the problem of settlement. There are now millions of acres of good land provided with water at a cost of upward of fifty dollars an acre which are not being tilled. The settlers on these lands are achieving a certain degree of success, but the great need is for more money, or cheaper money, in order to make it practicable for the settler to utilize his opportunities to the largest degree. He needs more livestock, more machinery, better tilling of the soil. Although the security which he can offer is fairly good, his opportunity to borrow money is limited, and the rates charged him are from 8 to 12%, or even more—enough to destroy any less prosperous business.

It was urged that while the reservoirs should be retained by the Government under careful supervision, the irrigation works themselves should be turned over to the people benefitted at the earliest practicable moment, under some form of organization such as the irrigation district, created under state law and having power of taxation. The present voluntary irrigation associations are found to be largely powerless to enforce the will of the majority, but the irrigation district, with powers comparable to those of a municipality, can and will enforce proper rules, and will deal effectively with present evils, such as those of the "water hog" who is wasting water to the detriment of the community. While the Government may be practically powerless in these matters, local public sentiment, enforced by a strong organization, can reach the desired end.

No new projects should be undertaken until the present schemes initiated under the Carey Act or by private enterprise have been thoroughly investigated. If, as a result of such investigation, some of these schemes appear to be meritorious, effort should be centered on completing them, but with the understanding that no work should be approved, either for Government or private investment, unless it appears that it can bear an interest charge of at least 3%. During the first three or four years, however, no interest should be paid, but an equivalent amount should be added to the construction cost and distributed over annual installments to be paid in the future.

*Director, U. S. Reclamation Service, Washington, D. C.

The majority of large irrigation projects initiated under the provisions of the Carey Act or of irrigation districts so far have not been financially successful. The General Land Office has presented figures showing that of the 3,700,000 acres segregated at the request of various states, under the law of 1894, there have been reclaimed and patented about 438,000 acres, as follows:

State	Acres	State	Acres
Idaho	217,000	Montana	15,000
Oregon	45,000	Wyoming	131,000

In addition to the above, there are pending 384,000 acres, so that there is reasonable probability of patents issuing to about 822,000 acres of lands reclaimed under the terms of this Act. Possibly, other projects may be completed so that we may expect that ultimately there will be reclaimed nearly a million acres. There are 31 projects which are at a standstill, involving 1,500,000 acres, and these may be considered to be wholly, or in part, failures. The difficulties are about as follows:

No. of projects	Conditions	Areas involved, acres
9	Financial troubles	350,000
6	Difficulties unknown	180,000
5	No water	125,000
4	Defective engineering	200,000
3	Defective titles	145,000
3	Accidents after construction	65,000
1	Bad management	70,000

Eleven projects, involving 500,000 acres, have succeeded fairly well.

The irrigation districts organized under state law have had a somewhat similar history, but as a result of the experience gained the laws are being improved, so that now we have every reason to hope that districts can be successfully organized and operated under state law. The advantage which this plan possesses is that the irrigation district has behind it, with possibility of taxation, all of the real estate and other values within the confines of the district. Even if disaster comes, there is possibility of renewing effort through wise exercise of the taxing power.

As the outcome of the discussion of the above mentioned and other topics, the congress was convinced that it still has a mission to perform and continued its permanent organization with a view to meeting probably in California in 1915, future activities to be concentrated largely on the problems of settlement and of securing the prosperity of the irrigator.

A Simplified Solution for Some Statically Indeterminate Problems in Building Construction

By G. A. Maney*

Two properties of the bending-moment curve for beams are used in this article to simplify the solution of all problems involving statically indeterminate bending moments. These properties are:

(1) The area under the M/EI curve, between any two points on the elastic curve, measures the change of the slope of the elastic curve between these points. M, E and I represent the bending moment, the modulus of elasticity of the material and the moment of inertia of the beam section, respectively.

(2) The statical moment of the area under the M/EI curve between any two points on the elastic curve, about one of these points, measures the deflection at this point from the tangent to the elastic curve at the other point.

These properties have long been well known among authorities on the subject of mechanics, but their great possibilities for indeterminate problems have been neglected. Their simplicity and ease of application to such problems, as compared with applications of the principle of least work and of the differential equation of the elastic curve (generally used at the present time), makes this method of solution a desirable one.

By the use of the two properties mentioned, we are enabled to write directly, from simple inspection of the M/EI curve, as many simple linear equations between the bending moments as are necessary for a complete solution.

The method here described has been used to advantage by the Illinois Experiment Station. It simplified the analysis of the results of tests of reinforced-concrete construction with reference to combined slab (beam) and column action in resisting bending moments due to loads applied on only one panel, or eccentric loading.

Two specific problems will be worked through by this method to demonstrate its ease and simplicity of application.

A proof of the above-cited properties, which are probably not very widely recognized among engineers, will be given, after which the problem of the elevated slab for the Soo Line Chicago freight terminal will be solved.

An excellent illustration of the application of these properties is found in the extremely short and direct derivation of the theorem of three moments, given at the end of this article.

Proof of Properties

Let

M = bending moment;

I = moment of inertia of the sectional area of the beam;

E = modulus of elasticity of the material;

c = distance from the neutral axis to the extreme fiber;

ds = element of length along the neutral axis;

$d\theta$ = increment of slope in the distance ds due to bending.

1. At any point on the extreme fiber of a beam, Fig. 1, we have the unit-stress Mc/I and the corresponding stretch or compression for length ds is, therefore,

$$\frac{Mc}{EI}\,ds$$

We obtain the change of slope in the distance ds by dividing the deformation for a distance ds along the extreme fiber by c, the distance from the extreme fiber to the neutral axis.

The slope increment in the distance ds is, therefore,

$$d\theta = \frac{M}{EI}\,ds$$

A glance at the M/EI curve, Fig. 2, makes it evident that the quantity $(M/EI)\,ds$ equals the area under that curve for a distance ds along it. The sum of the changes of angle in lengths ds equals the total change of

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the slope; in other words, the sum of all the elementary areas $(M/EI)\ dS$ between any two points of the beam equals the area of the (M/EI) curve between these two points. Therefore, the area under the M/EI curve between any two points is an exact measure of the change in angle between the two tangents to the elastic curve at these points, due to bending.

II. Suppose we desire the deflection of the point N' from the tangent MN.

We will assume here that the displacements of the neutral axis due to bending are so small that the projection of the neutral axis after bending upon the neutral axis before bending has practically the same length as the neutral axis before bending. This is the assumption commonly made in deriving the differential equation of the elastic curve.

Let S, Fig. 1, be the distance from the middle of ele-

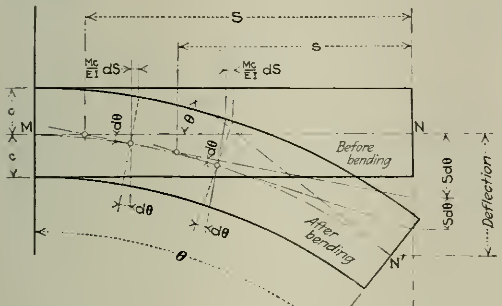


FIG. 1

FIG. 2

FIG. 1. PORTION OF BEAM, ORIGINAL AND BENT POSITIONS

FIG. 2. MOMENT DIAGRAM OR $\frac{M}{EI}$ DIAGRAM

mentary portion dS to the point N whose deflection is desired. The effect of the elastic curvature $d\theta$ of the portion dS upon the deflection at N is measured by the product $S\,d\theta$. But $d\theta$, as previously proved, is equal to the area of the $\frac{M}{EI}$ diagram corresponding to the portion dS; therefore, the product $S\,d\theta$ is the statical moment of this area about the point N'' corresponding to N, whose deflection is desired. It follows that the total deflection at N, being due to the bending in all the elementary portions dS, is equal to the statical moment of the entire M/EI curve about point N''.

APPLICATION TO ONE-STORY BENT, SOO TERMINAL

In load tests of the reinforced-concrete Soo line freight terminal at Chicago, made under the direction of Prof. A. N. Talbot, a question of statically indeterminate bending moments came up. An attempt was made to analyze the action of the structure with one panel loaded and all the adjacent panels empty. The object of the analysis was to determine what effect the relative moments of inertia and lengths of the sections of the floor and the columns would have upon the bending moments.

The conditions which were assumed as being approximately true in one of the analyses made are represented in Fig. 3. For the heavy elevated-track floor slab a condition of approximate fixity was assumed for the outside edges of the panels surrounding the loaded area, and also for the bottom or base of the columns. The column and slab moments were to be determined.

The problem was first solved by the method of least work, and values for the various moments were obtained which checked themselves in all the limiting cases. Then the method here described was used, and an exact check was obtained for every value. The amount of detailed analysis necessitated was only about 10% of that required by the analysis based on the principle of least work.

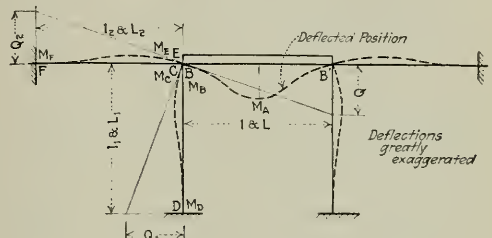


FIG. 3

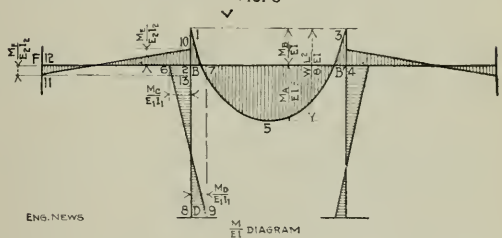


FIG. 4

FIG. 3. ONE-STORY BENT ANALYZED FOR SOO TERMINAL TESTS

FIG. 4. MOMENT DIAGRAM FOR SOO BENT

As sketched in Fig. 3, there are six unknown bending moments, M_A, M_B, M_C, M_D, M_E and M_F. Between these six unknowns, we can only set up two equations from the conditions of statics. These are

$$M_B = M_E + M_C \qquad (1)$$

$$M_A + M_B = \tfrac{1}{8}\,w\,L^2 \qquad (2)$$

The remaining four equations can be written with the aid of the two moment-curve principles above demonstrated. The distribution of the M/EI values is indicated by the curves of the diagram Fig. 4.

The condition of rigidity of the joint at B means that the two tangents at this point are always perpendicular to each other. From this condition we get two independent equations:

$$\frac{Q}{L} = \frac{Q_2}{L_2}, \text{ and } \frac{Q_1}{L_1} = \frac{Q_2}{L_2}$$

Here Q, Q_1 and Q_2 are the deflections of the points B', D and F. The deflection Q is measured by the statical moment of the area 1-5-3-1-2, Fig. 4, about B', or the

moment of the area 1-5-3 minus the moment of the area 1-2-1-3.

Therefore

$$Q = \frac{\frac{1}{3} w L^2 \times \frac{2}{3} L \times \frac{1}{2} L - M_B \times \frac{1}{2} L \times L}{E I}$$

The deflection Q_2 is measured by the statical moment of the area 12-2-10-11 about the point F, equal to the moment of the area 11-13-10 minus the moment of the area 12-11-13-2.

Therefore

$$Q_2 = \frac{(M_F + M_F) \frac{1}{2} L_2 \times \frac{2}{3} L_2 - M_F \times L_2 \times \frac{1}{2} L_2}{E_2 I_2}$$

And knowing that Q/L equals Q_2/L_2 we get

$$\frac{\frac{w L^3}{3 \times 8} - \frac{M_B L}{2}}{E I} = \frac{\frac{(M_F + M_F) L_2}{3} - \frac{M_F L_2}{2}}{E_2 I_2}$$

Also since Q_1/L_1 equals Q_2/L_2 we get

$$\frac{\frac{(M_C + M_D) L_1}{3} - \frac{M_D L_1}{2}}{E_1 I_1} = \frac{\frac{(M_F + M_F) L_2}{3} - \frac{M_F L_2}{2}}{E_2 I_2}$$

The deflection of the point B from the tangent to the elastic curve at D is zero since the point B remains unchanged and the tangent at D is fixed by the conditions of the problem. Therefore, the statical moment of the area 8-2-6-9 about the point B is zero, or, what is the same, the moment of the area 6-9-7 about the point B minus the moment of the area 2-7-9-8 about the point B is equal to zero. From this we get

$$\frac{(M_C + M_D)\left(\frac{L_1}{2}\right)\left(\frac{L_1}{3}\right) - M_D L_1 \left(\frac{L_1}{2}\right)}{E_1 I_1} = 0$$

or

$$M_C = 2 M_D$$

The same thing being true with regard to the tangent at the point F we may immediately write

$$M_E = 2 M_F$$

The relations indicated in these two equations may be also derived [illegible] of the elastic curve for these end conditions.

Assuming that the modulus of elasticity is the same in [illegible] and simplifying we get

$$M_B = M_C + M_E \tag{1}$$

$$M_A - M_B = \frac{w L^2}{8} \tag{2}$$

$$\left(\frac{w L^2}{8} - \ldots M_B\right)\frac{I}{I} = (2 M_C - M_D)\frac{I}{I_1}$$

or

$$\frac{w L^2}{8} - 3 M_B = K_1 (2 M_F - M_F) \tag{3}$$

where

$$K_1 = \frac{L_1 I}{L I_1}$$

$$2 M_C - M_D = K_2 (2 M_E - M_F) \tag{4}$$

where

$$K_2 = \frac{L_1 I_2}{L_2 I_1}$$

$$M_C = 2 M_D \tag{5}$$

$$M_F = \frac{1}{2} M_E \tag{6}$$

Substituting (5) and (6) in (4) we get,

$$M_C = K_2 M_E \tag{a}$$

Substituting (a) in (1) we get,

$$M_B = (1 + K_2)\, M_E \tag{b}$$

Substituting (b) and (6) in (3) we get,

$$\frac{w L^2}{4} - 3\,(1 + K_2)\, M_E = \frac{3\, K_1}{2}\, M_E$$

Therefore

$$M_F = \frac{w L^2}{12}\left(\frac{2}{K_1 + 2 K_2 + 2}\right)$$

$$= \frac{w L^2}{12}\left(\frac{2 I L_1 I_2}{L_1 L_2 I + 2 L L_2 I_1 + 2 L L_1 I_2}\right)$$

$$\therefore M_F = C \frac{w L^2}{12}$$

and

$$C = \frac{2 L L_1 I_2}{L_1 L_2 I + 2 L L_2 I_1 + 2 L L_1 I_2}$$

From (6)

$$M_F = \frac{C}{2}\left(\frac{w L^2}{12}\right) = \frac{w L^2}{12}\left(\frac{L L_1 I_2}{L_1 L_2 I + 2 L L_2 I_1 + 2 L L_1 I_2}\right)$$

From (a)

$$M_C = C K_2\left(\frac{w L^2}{12}\right) = \frac{w L^2}{12}\left(\frac{2 L L_2 I_1}{L_1 L_2 I + 2 L L_2 I_1 + 2 L L_1 I_2}\right)$$

From (5)

$$M_D = \frac{C K_2}{2}\left(\frac{w L^2}{12}\right) = \frac{w L^2}{12}\left(\frac{L L_2 I_1}{L_1 L_2 I + 2 L L_2 I_1 + 2 L L_1 I_2}\right)$$

From (1)

$$M_B = C\,(1 + K_2)\,\frac{w L^2}{12}$$

$$= \frac{w L^2}{12}\left(\frac{2 L L_1 I_2 + 2 L L_2 I_1}{L_1 L_2 I + 2 L L_2 I_1 + 2 L L_1 I_2}\right)$$

From (2)

$$M_A = \frac{w L^2}{8} - M_B$$

It is an easy matter to test some of these values for the limiting cases. Take for instance the value for M_B. There are four conditions of the members BD and BE which would produce a condition of fixed ends for the central span BC. If I_1 or I_2 become very large in comparison with the remaining values of I, or if L_1 or L_2 become very short in comparison with the remaining values of L, we will get a condition approaching fixed ends for the central span. In all four of these cases it is seen that the value of M_B approaches $w L^2/12$, which is the value of the end moment for a fixed span with a uniform load. When these same mentioned values of I and L approach the other extreme we have a condition of a freely supported simple span, where M_B approaches zero, as a substitution will show.

When I_1 equals [illegible], I equals I_2, and L equals L_2, we have the solution of a beam of uniform section with three equal spans fixed at the two end supports and supported freely on the two intermediate supports. Here again the values of M_B and M_E [illegible] themselves by becoming $w L^2/18$, while M_A becomes $w L^2/[illegible]$. For this last case see Fig. 5.

The Theorem of Three Moments

From a theoretical point of view it is interesting to find how simple a derivation of the theorem of three moments becomes when the moment-area method is applied.

Take the case where the two adjacent spans have different lengths and different uniform loads, and the beam section for each span has a different moment of inertia, as indicated in Fig. 6. By the use of the theorem of three moments we obtain $n - 2$ equations between n unknown moments at n supports. The remaining two equations can be written from a knowledge of the degree of fixity of the two end supports.

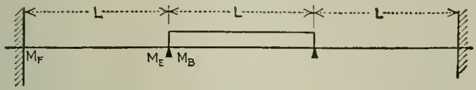


Fig. 5. A Limiting Case for the One-Story-Bent Formulas. ($I_1 = 0$)

For each support except the two end ones we have a condition which determines the relation between the moment at the support considered and the moments at the two adjoining supports. The determining condition is that of continuity at the support considered, which means that the two adjacent spans have a common tangent at this support.

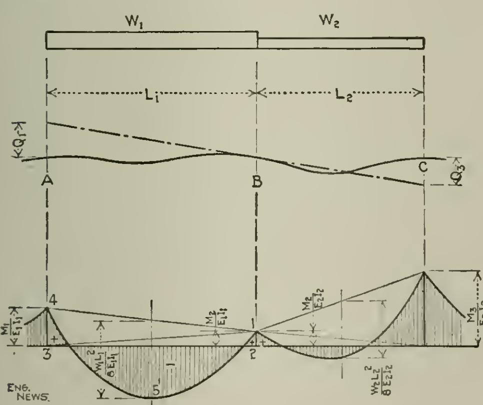


Fig. 6. Portion of Continuous Beam, and Moment Diagram

Let Q_1 and Q_3 be the deflections at A and C, Fig. 6, from the common tangent to the beam at B, the middle support of the three. Let L_1, w_1, I_1 be the lengths, load per lineal foot, and moment of inertia of beam cross-section in the left-hand span, and L_2, w_2, I_2, the corresponding quantities for the right-hand span.

The deflection Q_1 is measured by the statical moment of the M/EI area 3-4-5-1-2 about support A. This again is equal to the moment of the area 4-5-1 minus the moment of the triangle 1-2-3 minus the moment of the triangle 1-3-4, so that

$$Q_1 = \frac{w_1 L_1^2}{8 E_1 I_1}\left(\frac{2 L_1}{3}\right)\left(\frac{L_1}{2}\right) - \frac{M_1}{E_1 I_1}\left(\frac{L_1}{2}\right)\left(\frac{L_1}{3}\right) - \frac{M_2}{E_1 I_1}\left(\frac{L_1}{2}\right)\left(\frac{2 L_1}{3}\right)$$

Similarly,

$$Q_3 = \frac{w_2 L_2^2}{8 E_2 I_2}\left(\frac{2 L_2}{3}\right)\left(\frac{L_2}{2}\right) - \frac{M_3}{E_2 I_2}\left(\frac{L_2}{2}\right)\left(\frac{L_2}{3}\right) - \frac{M_2}{E_2 I_2}\left(\frac{L_2}{2}\right)\left(\frac{2 L_2}{3}\right)$$

Since $Q_1/L_1 = -Q_3/L_2$ on account of the common tangent over the middle support, we can immediately write the theorem of three moments by substituting and reducing. Giving the moments at the support the minus sign we finally get

$$\frac{w_1 L_1^3}{24 E_1 I_1} + \frac{w_2 L_2^3}{24 E_2 I_2} + \frac{M_1 L_1}{6 E_1 I_1} + \frac{M_2}{3}\left(\frac{L_1}{E_1 I_1} + \frac{L_2}{E_2 I_2}\right) + \frac{M_2 L_2}{6 E_2 I_2} = 0$$

Now, assuming that $E_1 = E_2$ and $I_1 = I_2$, we get the familiar form

$$M_1 L_1 + 2 M_2 (L_1 + L_2) + M_3 L_2 = -\left(\frac{w_1 L_1^3}{4} + \frac{w_2 L_2^3}{4}\right)$$

Annual Convention of the American Electric Railway Association

Th 33d annual convention of the American Electric Railway Association and meetings of the allied bodies of engineers, traffic men, accountants, and claim agents were held in Atlantic City, N. J., Oct. 12 to 16. There was the usual huge exhibition of the affiliated manufacturers and supply dealers; in this were prominent novel developments in track-signal systems, automatic "flagmen," illuminated car signs, vitreous-enamel interior fittings, ventilated and pressed-steel motors, headlights, etc. There was perhaps a falling off in the number of cars shown, in the amount of overhead and track work, in wheels and trucks, and in construction, shop and power-plant apparatus—though the amount of equipment, large and small, was not meager.

The very satisfactory plan was followed of having parallel sessions of the special associations in the mornings and meetings of the present body in the afternoon for consideration of the matters of general interest. In addition to the serious work noted below, an extensive entertainment program was arranged to fill the spare hours of all in attendance. The registration was about 2400—a falling off of some 20% generally attributed to the demands for economy throughout the industry.

American Association

Addresses—Under the title, "Mooted Principles in Valuation," F. W. Stevens, Chairman Valuation Committee New York Central Lines, discussed a single matter—the meaning of "value." It appeared to him very plain in economics and in law that the word had but one true use. This covered the worth of anything, expressed in money, to a willing purchaser. He discussed the rate cases of the U. S. Supreme Court to support his opinion (1) that there was only this one worth and that it applied alike in ratemaking, taxation and condemnation; (2) that it was immaterial whether property was paid for by money from stocks and bonds, or by excess earn-

ings, or was donated, (3) that all property had to be protected alike under the constitutional guarantees and therefore appreciation in worth had to be included; (4) that reproduction cost was not value, though often a means of approach.

Mr. H. C. Donecker, Public Service Ry., Newark, N. J., in a paper "Organization and Functions of a Valuation Staff," quoted extensively from the writings of experienced appraisers to show the cost of appraisals, the methods of procedure, the qualifications of the staff and the use of the valuation results. He recited arguments for having the valuation carried on by company forces, for making it convincing, and for the economy of a committee in charge with divided responsibility.

In the discussion, Philander Betts, Chief Engineer New Jersey Board of Utility Commissioners, advanced the opinion that the purpose of the valuation should affect the make-up of the staff. He favored having the inventory made by a joint force of company and commission employees. Henry Floy, Consulting Engineer, New York, commended Mr. Betts' idea, but called attention to the unfitness of the ordinary construction or operating engineer to prepare a valuation for court or commission scrutiny. He criticized an existing lack of that full cooperation of companies and commissions which was needed for best results.

In "Aspects of Workmen's Compensation Laws," H. A. Bullock, Brooklyn, N. Y., briefly reviewed the economic, social and political conditions which made compensation laws a live issue in so many states. The haste in which the laws were being prepared and the disagreement among expert advisors tended to result in provisions burdensome on both employee and employer; the electric railway industry was advised not to stand by and let unfair measures go to unchallenged enactment.

In the paper, "Electric Railway Securities from the Company Standpoint," Calvert Townley, of New York, called on railway men to stop apologizing for early sins which, he claimed, the public had condoned and in spite of which the public had profited from the utilities as much as the promoters. The large sums needed to develop traction lines to meet the demands made on them could not come from earnings and would come from private investors only when adequate returns could be secured—all of which he claimed should be made evident in the exercise of public control.

"A Zone System of Fares," by R. B. Stearns, of Milwaukee, described the system worked out for Milwaukee to apportion fares equitably according to length of ride. Data on zone operation abroad was also presented. It was voted to reprint the report in pamphlet form for distribution.

Reports—The address of the President, C. N. Black, of San Francisco, was a review of the year's work and a demand for larger rate of return on capital. The annual report of the Secretary-Treasurer, E. B. Burritt, New York, showed that the [illegible] member companies now represented [illegible] of the [illegible] miles of electric-railway track and [illegible] million of the 550 million dollars revenue reported. There are 3000 individual members. Some $75,000 income was received and about $71,000 spent.

The Committee on Education, Chairman, H. H. Norris, New York, reported that it had canvassed the member companies, and had found practically none having apprentice systems, and regular courses of lectures. No instruction of a school nature was found, little cooperation with outside schools, and no system of encouraging educational progress in employees. However, a favorable attitude was noted toward a correspondence-school course under the auspices of the Association. Such courses, arranged for mechanical-shop, electrical-shop, line, track, power-house and substation men were outlined.

The Electrolysis Committee, Chairman, Calvert Townley, New York, reported the formation of a joint national committee on electrolysis and advised discontinuing independent study.

The Committees on Insurance and Fire Protection, Chairman, H. J. Davies, Cleveland, gave statistics of the member companies' experience during the year. The fire losses were the highest of any year but one, and the rate the lowest; the average rate of 56c., it was held, could not be decreased unless present hazards were reduced.

The Joint Committee on Joint Use of Poles, Chairman, W. J. Harvie, of Syracuse, presented revised specifications, which had been worked out by the several interests involved, together with a model agreement. On account of protests that various practices were not universally applicable and, if broadly recommended, would constitute evidence of negligence when not followed, the convention received the report merely as guiding information.

The Committees on Ways and Means and Changes in Constitution recommended raising the company dues from the present range of $15 to $600 (depending on gross earnings) to $25-$750 so that the activities of the association need not be curtailed. This plan is expected to increase the annual revenues by some $16,000 and was unanimously accepted.

A Committee on Compensation for Carrying Mail, Chairman, M. C. Brush, Boston, described the consideration given by the Senate Committee revising mail pay and showed high hopes of fair treatment if proper facts could be presented. A Committee on Federal Relations, Chairman, A. W. Brady, Anderson, Ind., reported efforts to have electric roads recognized as a distinct class from steam roads and, on account of local regulation, exempt from provisions of drastic bills requiring steel cars, block signals, etc.

The work of the new Bureau of Fare Research in securing up-to-date information was presented by the Committee on Cost of Passenger Transportation, Chairman, J. D. Mortimer, New York.

The Public Relations Committee, Chairman, T. N. McCarter, Newark, N. J., transmitted the report of a subcommittee which recommended the establishment of a bureau of public relations to disseminate reliable information and to cooperate with similar bureaus. The report also presented a plan of publicity through Chautauqua lectures, technical education, technical, trade, and economic societies, popular magazines, and newspaper advertising. Eventually, some $50,000 per year was to be sought, but for the present, a start would be made by asking certain leaders of the industry to deliver addresses. A code of utility principles was enunciated, such as follows: (1) Adequate service is the first obligation; ample fares are necessary to provide it and yield a fair return; (2) regulated private ownership is preferable to government ownership or operation; (3) local transportation should be a monopoly; (4) short-term

franchises discourage good service and check growth; (5) capitalization should be authorized on terms which will produce needed funds; and securities previously issued in accordance with law should be valid obligations; (7) adequate wages should be recognized but utilities should be protected against strikes and excessive demands; (8) holding companies are economically sound; (9) in appraisal, all methods of valuation should have due consideration; (10) full and frank publicity should furnish public and investor with proper information.

Engineering Association

Reports—After many routine and organization matters, various techincal reports were presented. The Power Distribution Committee submitted specifications for rubber-insulated wire and cable, for round and grooved copper trolley wire, for high-voltage paper-insulated lead-covered cables, for 600-volt overhead construction and for galvanizing iron and steel. In an appendix, the design of reinforced-concrete poles was briefly outlined.

A Board of Accident Prevention described how greater safety was actually being secured by improved equipment and special devices, by education of general public, of school children and employees, by traffic regulation, etc. A paper on "Accident Prevention," by F. C. Henderschott, New York, gave statistics of the improvement secured by a few of the thousand odd concerns which have instituted safety systems.

The Block Signal Committee, Chairman, J. M. Waldron, New York, supplemented its 1913 report with a new digest of state laws, a bibliography, descriptions of light signals for interurban roads, a summary of new installations, standard rules for operation of trolley-contact signals, a summary of contemplated signal installations, a description of a new automatic train stop (Horne-Crane type), and a paper by Gaylord Thompson on "Braking Distances." A standard spectacle and a standard clearance diagram were offered; the former was accepted by the meeting but the latter was returned for further study in connection with other committees. The operating rules presented, but slightly modified, were accepted as standards. The recommendation was adopted that signal lenses of not less than 8⅜ in. and 5⅜ in. diameter, respectively, should be considered good practice for high-speed and moderate-speed operation.

A Committee on Transportation Engineering gave figures for a single-phase line in the Middle West where trains had secured 158% increase in seating capacity and 122% in ton miles with 76% increase in power consumption. A tendency was reported in freight and express service to use a motor car or locomotive with trailers instead of multiple-unit trains. Several favorable car designs were shown.

The Equipment Committee, Chairman, F. R. Phillips, Pittsburgh, recommended further investigation of the standard specifications for heat-treated axles, of possible standard specifications for gears and pinions, troubles with M.C.B. journal brasses, and car wiring in relation to fire-protection. Standard specifications were presented and adopted for solid wrought-steel wheels; specifications of "recommended practice" were accepted for air-brake hose. As an appendix, a paper by L. M. Clark, of Indianapolis, outlined the existing common faults of car-lighting and the proper use of reflectors and lamps for improvement. Data from a large number of tests were given for guidance in fixing size and character of new equipment.

The Buildings and Structures Committee, Chairman, C. F. Bedwell, Newark, N. J., reported approval by the National Fire Protection Association of last year's protection rules for electric-railway properties. General specifications and a form of contract for building construction were presented for consideration as eventual standards. A synopsis of power-house design was submitted for criticism as a part of proposed study of modern practice.

The Committee on Engineering Accounting, Chairman, J. P. Barnes, Brooklyn, N. Y., showed the need of greater attention to applying overhead interdepartmental charges to cost figures of construction that there be no self deception and false economy. A scheme of account analysis was presented so that engineering and executive departments could compare in detail, the original estimates and final costs, etc.

The report of the Power Generation Committee, Chairman, B. F. Wood, New York, was a collection of papers on (1) status of machine stokers (in which it was held that the field was narrowing down to chain grates for high-ash high-volatile fuels and the underfeed type for other coals); (2) use of special reactance coils to protect power apparatus and feeder circuits; (3) advantages and disadvantages in the use of 60-cycle rotary converters.

At some of the sessions of other allied groups, a few papers of more or less engineering interest were presented; one was particularly notable—"The Accounting Treatment of Depreciation," by Robert Sealy, New York. In this it was urged that many of the difficulties in comprehending the subject would be overcome if so called "depreciation" be treated as a replacement insurance. An insurance scheme of computing annual depreciation contributions was offered, but with the remark that life limits due to wear, accident, obsolescence, inadequacy and public demand were all so uncertain that close computations of annual amounts for reserves were useless.

The Committee on Way Matters, Chairman, C. S. Kimball, Washington, D. C., discussed track foundations for paved streets, T-rails and alloy-steel rails. In regard to foundations, it was stated that permanency was the main object. Many soils considered unfit as a foundation, without concrete, could be made serviceable by drainage. Good foundation drainage hindered stray currents and electrolysis. Practice of rolling subgrade and ballast was increasing and was recommended. Current practice seemed to be away from solid concrete construction. Four types of foundation were recommended. The advantages and disadvantages of T-rail construction in streets were recited and conclusions given from data secured that (1) diverse opinions still excited, (2) granite or brick headers are generally used along gage lines and under heads, (3) portland-cement or asphaltic-cement grout is best for filling the space next to rails, (4) tendency of vehicles to follow rails is about the same with all rails. It was recommended that T-rails in permanent pavements should be 7 in. high. The tonnage of alloy-steel rails rolled continued to decrease; the production of bessemer rails also decreased, but use of open-hearth steel correspondingly increased.

The Heavy Electric Traction Committee, Chairman, E. R. Hill, New York, presented a revised diagram of recom-

[illegible] clearances for overhead conductors, allowing 15 ft. [illegible] in. for direct-current rails, and advised continuing the study of third-rail clearances and electric locomotives.

NEW OFFICERS

The following officers were elected for the parent association: President, C. Loomis Allen, President of the Newport News & Hampton Ry., Gas & Electric Co., Syracuse, N. Y.; Vice-presidents, C. L. Henry, President of the Indianapolis & Cincinnati Traction Co., Indianapolis; J. A. Beeler, Vice-president of the Denver Tramway Co., Denver; L. S. Storrs, President of the Connecticut Co., New Haven; T. S. Williams, President of the Brooklyn Rapid Transit Co., New York.

The Engineering Association elected the following: President, L. P. Crecelius, Electrical Engineer of the Cleveland Ry.; Vice-presidents, John Lindall, Superintendent of Rolling Stock and Shops, Boston Elevated Ry.; B. F. Wood, Chief Engineer, United Gas & Engineering Co., New York; F. R. Phillips, Superintendent of Equipment, Pittsburgh Rys.

The new presidents of the other associations are: M. C. Brush, second Vice-president of the Boston Elevated Ry. (Transportation and Traffic); C. S. Mitchell, Auditor of the Pittsburgh Rys. (Accountants); William Tichenor, Claim Agent of the Terre Haute, Indianapolis & Eastern Traction Co. (Claim Agents); E. H. Baker, Second Vice-president of the Galena Signal Oil Co., New York (Manufacturers). The Secretary-Treasurer is appointed and not elected. The present incumbent, E. B. Burritt, continues in office and serves in similar capacity for the allied associations, except that M. R. Boylan, Public Service Ry., Newark, N. J., serves for the accountants and H. G. McConnaughy, Dearborn Chemical Co., New York, for the manufacturers.

Should Members of the Engineering Profession in Pennsylvania Be Subject to State Examination and License?

The Pennsylvania legislature a year ago created a Commission of engineers which was instructed "to investigate the advisability of licensing engineers, within this Commonwealth, who are engaged upon the construction, maintenance and operation of works, public or private, within this Commonwealth, where criminal hazards are offered to the lives, health and property of the citizens of this Commonwealth; and to recommend to the Governor such measures as, in their judgment, should be enacted into law."

Governor Tener appointed as this Commission John Price Jackson, Samuel A. Taylor, [illegible] S. Webster, [illegible] Herbert Stone and J. Murray Africa. The Commission held public hearings at Pittsburgh on Oct. 15 and 16, at Philadelphia on Oct. 19 and will hold a further hearing at Harrisburg on Oct. 30 at the headquarters of the Engineers' Society of Pennsylvania, which has called a special meeting for that date.

In order to stimulate discussion the Commission has [illegible] a draft of a bill which would require engineers engaged in any sort of professional engineering work, whether civil, mechanical, mining, electrical or marine, to be registered as professional engineers by a State Engineering Board, the practice of engineering of any sort without such registration being made a misdemeanor, punishable by fine and imprisonment.

The hearings at Pittsburgh and at Philadelphia were well attended by leading men in the profession. The sentiment expressed was well nigh unanimous against the proposed bill and in most cases the opinions were adverse to any state interference whatever with the practice of engineering.

A number of those attending the sessions represented engineering societies in Pennsylvania or engineering schools in the state. The Philadelphia Association of Members of the American Society of Civil Engineers held a special meeting at which the proposed legislation was discussed at great length; the final vote was nearly unanimous against the proposed bill.

A committee was appointed to represent the Association before the Commission and prepared a report which is so admirable a summary of the principal arguments against engineers license legislation that we print it in full below.

The State Commission, after conclusion of the hearings, will formulate its findings in a preliminary report to the Governor by Nov. 1 and its final report before the end of the year. The Commission is pursuing a judicial attitude in its inquiry and by its questions of those who appeared before it appeared anxious to obtain constructive criticism as well as destructive criticism. In other words, the Commission appeared anxious to ascertain not merely what were the defects and dangers of the particular bill offered for discussion, but what legislation, if any, is desirable in connection with the practice of engineering to safeguard the public welfare.

The Committee's report above referred to is as follows:

ARGUMENTS IN OPPOSITION TO THE PROPOSED ACT FOR LICENSING PROFESSIONAL ENGINEERS IN THE STATE OF PENNSYLVANIA

The Committee appointed to [illegible] arguments against the proposed Act for licensing professional engineers in the State of Pennsylvania [illegible] to present certain general considerations and then to treat the subject under the following headings:

A. Objections to any plan looking to the licensing of engineers in the State of Pennsylvania.

B. Specific objections to the terms of the particular Act proposed by the Engineers' Commission.

C. A [illegible] plan for accomplishing the avowed purposes of this Act in a more direct and effective manner.

GENERAL CONSIDERATIONS

1. [illegible] for licensing engineers in a given [illegible] that there is the same need of licensing engineers as of licensing lawyers and physicians, whereas the conditions in engineering are, in fact, wholly different from those in law and medicine. In the latter professions the public interests cannot be measurably protected against [illegible] and quacks except through licensing on the basis of individual examinations, although experience has shown that even that safeguard is inadequate for the purpose [illegible]. It may, in fact, be confidently affirmed that no plan of licensing can serve to eliminate unscrupulous, though technically competent men, who will not hesitate to resort to unprofessional practices in so far as that may be possible within [illegible].

In engineering, unlike law and medicine, the public may be protected against incompetent or unscrupulous practice, not by the licensing of engineers, but by state approval of plans before execution, by state inspection during construction and by other means to be set forth in more detail hereafter.

2. The fact that the licensing of lawyers and physicians is required in every state of the Union, whereas provisions for the licensing of engineers is made in only two states (Louisiana and Wyoming), indicates that the fundamental differences, from the standpoint of public interests, between the professions of law and medicine on the one hand, and that of

engineering on the other, are widely recognized. The burden of proof in justification of an Act designed to license engineers in the State of Pennsylvania rests, therefore, upon the sponsors of such an Act.

3 In support of a plan for licensing professional engineers it may be claimed that it is necessary for the promotion of safety and the protection of life, health and property. It will be shown, however, that these ends cannot be attained through such an Act, and that other measures would be far more effective toward their accomplishment.

A Objections to any Plan Looking to the Licensing of Engineers in the State of Pennsylvania

I. The licensing of independently established consulting engineers is objectionable on the following grounds:

(a) That the plan would afford no reliable guarantee that those who pass prescribed examinations will not design unsafe work through incompetency, carelessness, or under pressure of economical restrictions.

(b) It is a well known fact that the test of examination becomes increasingly inadequate as the value to be set upon experience, and sound judgment based on such experience, becomes increasingly important. It is easy, for example, to determine by examination a candidate's qualifications for such minor positions as rodman, draftsman, etc., but difficult to ascertain by such a test a candidate's fitness for an engineering position involving large and varied responsibilities.

It is impossible to carry in one's head the many data which a seasoned engineer would readily command in his normal office environment, where he has access to reference books, filing cases, personal notes, etc., which would readily enable him to find the desired data; whereas such accessories would be of comparatively little value to an inexperienced man. On the other hand, it is easily conceivable that the latter would outstrip the seasoned man in an examination, since it is almost impossible, in an examination, to set the proper value upon ability and experience as distinguished from mere book knowledge.

(c) The field of engineering is so highly specialized, and the various specialties overlap to such a degree, that no individual can reasonably be expected to qualify in a full sense in more than a single specialty and, in a modified sense, in closely related specialties. The term "professional engineer" is therefore meaningless, except in an inclusive way as covering many specialized titles. Such a speciality as railroad engineering, for example, is properly sub-classified under "Design, Construction, Maintenance and Operation." A given individual may deservedly have attained to the highest rank in Construction, although he may command little or no knowledge of Designing. A fair examination in such a case should be limited to Construction; or better still, the personal record of the individual concerned should be accepted as a far better criterion of his qualifications than any form of examination.

(d) That the licensing of engineers will not serve to avert disaster through improper design or construction is attested by the calamitous failures that have at times attended engineering operations under the direction of engineers deservedly recognized as among the ablest members of the profession—men who would unquestionably have qualified under a proper examination.

II. The licensing of salaried engineers, as distinguished from independent consulting engineers, is objectionable on the following grounds:

(a) The great majority of engineers (probably not less than 90%) hold salaried positions, and the legal and moral responsibility for their professional work should fall on the employing municipalities, corporations or firms, by whom their competency can also be far better determined than through the operation of any legislative Act. The licensing of such engineers would therefore serve no useful purpose, and would be an unnecessary source of expense and annoyance to those affected.

(b) No scheme of examination that can be devised is as effective for determining the degree of professional competency as the principles ordinarily governing the employment, promotion and discharge of salaried men.

(c) Every salaried engineer upon merited promotion to a position of a certain higher responsibility would have to pass an examination prescribed by the state. His rejection upon such an examination would work an undeserved professional injury to the individual concerned, and would justly tend to bring ridicule upon the examining system.

(d) In the promotion of engineers to positions of higher responsibility by corporations whose activities extend beyond the state, such as railroad companies, public-service corporations, etc., the transfer of an individual from another state to Pennsylvania could not take place without subjecting him to an examination involving the contingencies just mentioned.

B Specific Objections to the Terms of the Particular Act Proposed by the Engineers' Commission

I The indefiniteness of certain important features in the proposed Act.

In Section 1, Paragraph 1, the Act is made applicable to those charged with "the designing or general supervision of the operation and maintenance to a greater or less extent of public or private works, etc." The term "greater or less extent" is so indefinite that it may well be asked whether such officers, for example, as railroad supervisors would come under the provisions of the Act.

On the other hand, according to Section 20, Paragraph 2, one of the classes under "Limitation and Scope of Act" is described as "any professional engineer employed as an assistant to a registered professional engineer." This may fairly be assumed to mean that the chief engineer of a railroad company or the chief of a municipal bureau would be required to register as a "Professional Engineer," whereas the innumerable engineers of subordinate rank would be exempt. It is evident that an engineer of subordinate rank on an engineering operation of first magnitude may be charged with much heavier responsibilities than the chief engineer of an engineering operation of minor importance. Again, engineers in subordinate positions on important engineering works may command specialized knowledge not possessed by the chief engineer.

II Certain features of the proposed Act are apparently contradictory.

Thus, in Section 3, Paragraph 3, it is stated among the requirements for eligibility to examinations that the candidate must have "had charge of engineering work as principal or assistant for at least one year." whereas by Section 1, Paragraph 1, only "Professional Engineers" can be "in charge" of engineering work. If these terms were enforced it would apparently mean that an engineer in order to qualify for an examination as "Professional Engineer" in Pennsylvania must have had charge of engineering work in another state for at least one year.

III The proposed Act is incomplete in failing to provide for certain important features, as, for example, the following:

(a) The professional complexion of the examining board. Modern engineering is so highly specialized that it may be confidently affirmed that an examining board consisting of only nine members, no matter how otherwise constituted, would be incompetent to supervise examinations in every important engineering speciality.

(b) Since no individual can possibly qualify as a "Professional Engineer" in the inclusive sense, the act should indicate by title, and define as to scope, the various divisions of professional engineering in which candidates may qualify by examination. The difficulty of doing this is manifest, and this only serves to indicate the futility of determining the competency of engineers for high professional services through examination.

(c) The progress in engineering, especially in certain lines, is so rapid that an engineer who may readily pass a fair examination at a given period, may be utterly unable to qualify under an uptodate examination five or ten years later, unless he has kept well abreast of progress. Therefore, if examinations are to be applied as a test of competency, they should be reapplied at suitable intervals, as is the practice, for example, in the U. S. Army and Navy.

(d) It should be explicitly stated in the Act that the engagement of a professional engineer will not serve to absolve the employer of such an engineer from legal responsibility for his acts and their consequences; that is to say, that it will not shift such legal responsibility either upon the professional engineer or upon the State.

IV The terms of the Act fail to make adequate provision for its application, in that an examining board of nine members, assisted by one secretary and one stenographer, cannot possibly meet the practical requirements entailed.

V The proposed terms of the Act are objectionable in that:

(a) The members of the examining board (Section 3, Paragraph 6) "shall serve without compensation" and shall only be allowed "expenses actually and necessarily incurred in the performance of their duties." If under the head "necessary expenses" the act is intended to provide for the engagement of a corps of examining specialists, membership on the examining board without compensation would be apt to be viewed as an honorary appointment involving comparatively slight demands on time and energy. If, on the other hand, the examining board should be expected personally to prepare the examination questions and to examine the examination papers, it is wholly unreasonable to expect engineers of high professional standing to render such service to the state without liberal remuneration. Moreover, it is both undignified and unfair for a great state to expect individuals

to render professional services of such a high grade and such great value at their personal sacrifice. In this respect, [illegible] tions in engineering under an adequate interpretation of the purposes of this Act differ radically from those in law and medicine. The examinations for licenses to practice the latter professions are designed to test inexperienced graduates of law and medical colleges as to their knowledge of such fundamental principles as they may fairly be expected to [illegible]. The conduct of such examinations is a comparatively simple matter. In engineering, on the other hand, examinations designed to accomplish the expressed purposes of this Act would have to be of a specialized kind and of advanced grade to test the fitness of the candidates for high professional responsibilities.

(b) No exemption is given to those members of the profession who hold responsible teaching positions, as is the practice of leading national engineering societies. This paragraph should be amended by adding the following sentence, quoted from the Constitution of the American Society of Civil Engineers:

The performance of the duties of a professor of engineering in a technical school of a high grade shall be taken as an equivalent to an equal number of years of actual practice.

VI. Other features of the proposed Act are fairly open to question and criticism, but it is thought best to limit this report to what may be regarded as its most vital features.

C. A Proposed Plan for Accomplishing the Avowed Purpose of the Act in a More Direct and Effective Manner

Assuming that the proposed Act is designed solely as a protection to public interests, as stated in its title, and is not designed to elevate professional standards or to promote the pecuniary interests of the members of the engineering profession, its purpose may be accomplished much more directly and effectively through legislation to the following ends:

(a) To create a State Engineering Department, Board or Commission by which engineering designs which may involve public safety would have to be approved before execution. This Department, Board or Commission should also be charged with the inspection of engineering works during construction at such intervals and to such extent as may be deemed proper.

(b) To exempt from the supervision of this Department, Board or Commission, work designed and constructed by municipalities and approved corporations, such as railroad companies, etc., which are not only legally responsible for, but have an immediate and lasting interest in engineering operations conducted on their behalf and under their supervision.

(c) To require the licensing of county surveyors and other surveyors in independent practice. Fair examinations for surveyors can easily be set, which would serve to exclude incompetent men whose incompetency would be likely to entail property losses and expensive litigation.

(d) To license other classes of technical men whose duties are of a definite and restricted nature in fields where incompetence would be attended by results similar to those just mentioned in connection with surveyors, and in which competency may readily be determined by examinations.

[illegible]

First: That laws under which engineering designs must be [illegible] examined before their execution are in satisfactory operation in certain European countries.

Second: That such laws tend to deter incompetent engineers from preparing designs without competent assistance.

Third: That the Act under review is inadequate as a measure of protection to public interests.

Fourth: That this Act is objectionable in that it will [illegible] as "Professional Engineers" men who, [illegible] the professional [illegible], can safely be entrusted with the responsible direction of engineering works. The [illegible] will tend to [illegible] confidence [illegible] of the public to a degree [illegible].

Fifth: That in so far as this Act may tend to deter the [illegible] its effect would be [illegible] to public interests.

Respectfully submitted,

[illegible], Chief Engineer, [illegible]; John W. [illegible], [illegible] Engineer, American [illegible] Co.; H. [illegible] Engineer of Bridges & Buildings, Pennsylvania R.R. Co.; [illegible], Chief Engineer, Dept. of City Transit; [illegible], Chief Engineer, [illegible] State Construction [illegible]; [illegible], Asst. Chief Engineer, Pennsylvania R.R. Co.; Samuel [illegible], Asst. Engineer, Philadelphia & Reading Ry. Co.; [illegible] (Chairman), Professor of Civil Engineering, University of Pennsylvania.

Committee of the Philadelphia Association of Members of the American Society of Civil Engineers appointed to represent that Association in opposition to legislation for licensing professional engineers in the State of Pennsylvania.

NEWS NOTES

A Cave-In in a Sewer Trench in South Bend, Ind., on Oct. 13, caused the death of three men.

Earthquakes Are Reported in Greece, where considerable damage has been done at Thebes, Chalcis and Athens.

A 20-In. Water Main Burst, on Oct. 16, at the corner of Second and Market St., Philadelphia, Penn. Water flooded the basements of several business establishments, and for a time threatened to tie up traffic in the subway.

A Collision Occurred in the New York City Subway on Oct. 17, at the 116th St. station of the Lenox Ave. line. Failure of the brakes of a northbound train caused it to collide with the rear of the train ahead just as the latter was leaving the station. No one was seriously injured, but the insulation of one of the motors was so damaged as to set fire to the car.

Two Sewer Cave-Ins occurred in Toronto, Ont., Oct. [illegible]. A wagon loaded with coal and drawn by a team of horses went through an apparently sound pavement on Marguerretta St., falling into a cavity 10 ft. deep over a sewer cave-in. The driver was uninjured but one of the horses was killed. A cave-in during the construction of a new sewer on [illegible] Ave. buried three men on the same day. No one was seriously injured.

A Slide in Culebra Cut, Panama Canal, on Oct. 1[illegible], entirely closed the channel about 1500 ft. north of Gold Hill for a distance of several hundred feet. The slide was on the east bank of the canal. It is also reported the bottom of the channel is being forced up on the west side. Dredges were at once set to work, and on Oct. 20 the canal was again opened for traffic, a new channel 1[illegible]0 ft. wide and [illegible] ft. deep being dredged at record speed.

The 5000-ton Steamship "Metapan" Was Sunk by a collision with the 8000-ton steamship "Iowan," at the entrance to Ambrose Channel, New York Harbor, Oct. 1[illegible]. The "Metapan" of the United Fruit Co. was inbound from Colon and the West Indies, and the "Iowan" of the Hawaiian-American Line was outbound. The passengers and crew of the wrecked steamship were saved. The "Metapan" was headed for shore and was beached in 1[illegible] ft. of water a few minutes after the collision.

A Boulder Fell on a Passenger Train on the Denver & Rio Grande R.R., [illegible] miles east of Grand Junction, Colo., on Oct. 1[illegible]. The accident occurred at a point where the railway tracks closely parallel the Rio Grande with cliffs rising high above the river bank. The train was running at high speed when a rock falling from the cliffs struck the coupling between the tender and the smoking car, which parted the train. Before the cars came to a stop a large boulder fell on the smoking car and day coach following, smashing in the roofs and [illegible] the steel [illegible]. [illegible] passengers in the two cars escaped injury, while three were killed and 11 were injured. Much of the wreckage was swept into the river.

A Pier Fire on the Delaware River waterfront at Philadelphia, on Oct. 1[illegible], destroyed a new pier shed just being completed for the Philadelphia & Reading R.R., causing a loss of about $1[illegible]. The floor of the pier and its foundation were of substantial concrete construction and were uninjured by the fire. The pier shed was a steel structure with [illegible] floors and roof. A small quantity of freight had been placed on the pier, but except for the burning of a few barrels of whiskey the heat of the fire was furnished chiefly by the wooden flooring and roof. The steel structure promptly collapsed on exposure to the flames. The front of the pier facing on the street was of reinforced concrete pierced by large openings. This was not quite completed when the fire occurred, but remained standing, and except for some cracking and spalling was little injured by the flames. Part of the windows in this front wall were of wire glass in steel frames, and this remained intact, no [illegible] through it being made.

The heat of the fire through which this reinforced concrete passed with so little injury was so great as to start fires in storage warehouses protected by fireproof shutters on the opposite side of a 1[illegible] ft. street. The heavy granite piers in the front of the building exposed to a much lower degree of heat than the concrete were badly spalled.

An Industrial Welfare Conference is to be held at Harrisburg, Penn., in the State Capitol, Nov. 17-19, under the auspices of the Engineers Society of Pennsylvania and the State Labor Department. A call for the conference has been issued by Dr. John Price Jackson, Dean of Pennsylvania State College and Commissioner of Labor. The conference held a year ago was attended by over 2000 persons. A safety and efficiency exhibition will be held in connection with the conference.

The Rapid Transit Traffic of New York City in the year ending June 30, 1911, has been reported by the Public Service Commission for the first district. The existing subway lines carried 340,413,103 passengers or 1,001,215 per working day. All of the elevated lines together carried 311,473,568. The Second and Ninth Ave. lines made moderate gains; the Third Ave. line gained heavily and reached its limit of carrying capacity. The Sixth Ave. line, including the west-side line above 53d St., showed a slight decrease.

The First Generating Station owned by the Ontario Hydro-Electric Commission was placed in service Oct. 6. This is at Wasdell's Falls on the Severn River, and has 1200 hp. capacity. It is one of several Severn projects, other sites having been purchased from private owners at Big Chute, Swift Current, Port Severn and Eugenia Falls. When they are connected, the system will have an output of 25,000 hp Heretofore, the Commission has purchased power (notably at Niagara Falls, and transmitted it for distribution and resale by municipalities.

Economies in the Boston, Mass., Health Department—Rather than pay \$5000 per annum rent for a more convenient milk laboratory, the city of Boston has increased the salaries of three milk sample collectors \$100 per annum, and forced them to walk upstairs to the 11th floor of the new City Hall Annex every night. It is the duty of these collectors to go about the city every night and get samples of milk from delivery wagons. The elevator service to the laboratory ceases at 11 p.m., and legal complications prevent the leaving of the milk samples temporarily in some other place. It was proposed to hire the quarters formerly used on Huntington Ave. for \$5000 per annum, so the city fathers figure they have made a saving of \$4700 per annum.

Petty Thieving by Drivers of Garbage Wagons is said to be costing the Boston Development & Sanitary Co., which has a 10-year contract to dispose of the wastes of the city of Boston, hundreds of dollars. When depositing the contents of barrels in their wagons, the men take time to pick out such articles as bottles, old metal and shoes and place them in a corner of the wagon. On the way to the receiving station they transfer these articles to bags and dispose of them to junk dealers. The drivers are, in many cases, adding several dollars a week to their incomes in this way, and the company, rightfully claiming that it is entitled to everything in the wastes, is objecting. The Commissioner of Public Works, L. K. Rourke, has suspended a number of drivers for from one to three days as punishment.

The Street Railway Situation at Detroit—In April, 1913, the city voted for municipal ownership of traction lines and the Mayor appointed a board of street-railway commissioners consisting of wealthy automobile manufacturers. They were charged to report on the best methods for building up a new street-railway system or the purchase and development of the old one. This commission appointed E. W. Bemis to make an appraisal of the existing system and he placed a large force at the task. The local company is reported willing to sell. The Bemis report was due Oct. 15 and probably will be made sometime during the month. Pending receipt of this, the commission called in Wm. Barclay Parsons for advice and subsequently retained the firm of Barclay Parsons & Klapp to report on a comprehensive rapid-transit system. The firm's local investigations are going forward under the direction of H. M. Brinkerhoff and this report is expected in February, 1914.

The Production of Explosives in the United States during 1913 has just been published by the U. S. Bureau of Mines. The total was 463,511,881 lb., compared with 489,393,131 lb. for 1912. This production is seggregated as follows: Black powder, 194,116,717 lb.; "high" explosives other than permissible explosives, 241,682,364 lb.; permissible explosives, 27,685,-770 lb. These figures represent a decrease of 36,146,622 lb. of black powder and an increase of 7,212,872 lb. of high explosives and 3,055,500 lb. of permissible explosives. In 1902 only 11,300 lb. of permissible explosive was used in coal mining, whereas in 1913 the quantity so used was 21,804,285 lb. The quantity of permissible explosives used in the United States is larger than in a number of foreign countries. In 1912 it represented about 5% of the total quantity of explosives produced, and in 1913 6%. The total amount of explosives used for the production of coal in 1913 was 209,352,938 lb., of which about 10% was of the permissible class as compared with 8% in 1912.

Work on the Austin-San Antonio Post Road, in Texas, was begun Oct. 20. The road is being improved under the supervision of the U. S. Office of Public Roads in accordance with the Act of Congress of Aug. 24, 1912. The total length is nearly 83 miles. Parts of the road have previously been surfaced with gravel. It is proposed to rebuild the road 24 ft. wide between shoulders with a surfaced roadway 15 ft. wide. On portions which have not been graveled before the surfacing is to be 12 in. deep. On the best portions of the old graveled sections the surfacing is to be scarified, reshaped and topped with a new 5-in. (loose measure) wearing course. Other sections will have new wearing courses of from 5 to 12 in. thick. The foundation course may be either adobe rock, or gravel, or any rough gravel which will properly compact. The wearing course will be of selected hard gravel, screened to exclude stones over 2 in. in diameter. All large openings in the roadbed will be bridged with reinforced-concrete structures of not less than 20 ft. clear roadway. Smaller culverts will be of vitrified clay pipe or ingot-iron pipe with concrete headwalls. All wooden structures will be replaced. The estimated cost is nearly \$250,000. Local newspapers are rejoicing because the road "will afford employment to hundreds of farmers who will welcome this opportunity to increase their incomes, following a disastrous cotton season."

A Partial Sanitary Reconnaissance Survey of Ohio is being made by the Ohio State Board of Health under the direction of W. H. Dittoe, Chief Engineer. As many of our readers will remember, the board named made an extended investigation of the water-supplies of the state some fifteen years ago, a special investigation of water- and sewage-treatment plants about six years ago and a special study of garbage and refuse disposal some four years ago. The board has also regularly made examinations of the water-supplies and sewerage systems of the state. Mr. Dittoe informs us that these earlier investigations have not taken into account the conditions existing in communities which have not yet provided themselves with the sort of improvements mentioned. Representatives of the board have therefore begun to visit every incorporated community and every public and private institution in the state with a view of determining the existing conditions as regard water-supply, sewerage, and sewage and waste disposal. The work is being done rapidly in order to cover the state in a reasonable length of time, and it is not expected that a complete report based on the information immediately obtained will be published. What is expected is that the board will be able to tabulate for its own information, as well as for the information of those interested, the essential facts relating to all the public and private water-supplies of the incorporated communities and institutions of the state, as well as like information for sewerage and sewage disposal and refuse collection and disposal. It is believed that with this information in a compact form the board will be able to direct an attack upon those conditions in Ohio which are most prejudicial to the health of the state.

The Longest Recorded Drought in Massachusetts was ended when rain began to fall on Oct. 16. The dry period, which began with Aug. 30, lasted for 47 days, during which time the total precipitation amounted to only 0.21 in. at Boston.

The average rainfall at stations on the watershed of the Wachusett River during September, 1914, was 0.15 in. The lowest previous record for any month was 0.48 in. for June, 1912. On the Sudbury River watershed the average rainfall for September, 1914, was 0.29 in., and the lowest previous record was 0.32 in. for September, 1877. At Lake Cochituate the rainfall was 0.27 in. for September, 1914, the lowest previous record having been 0.38 in. for June, 1873. The records have been kept on the Wachusett watershed for 17 years and on the Sudbury watershed and at Lake Cochituate for 50 years.

As no rain fell during the last two days of August and the first 15 days of October, the precipitation record for the month of September is the rainfall for the entire period. It is said that private records show no such long continued drought since 1817.

Unless there are heavy rains during the remainder of the year, 1914 will take its place in the list of exceedingly dry years which began with 1908. The Committee of the New England Water Works Association, which reported on the "Yield of Drainage Areas" at the recent convention in Boston, presented figures on the Wachusett Watershed and called attention to the remarkable fact that the highest yield of any year since 1907 was less than the lowest yield of any one of the preceding 11 years. The importance of this to engineers attempting to estimate the available yield of a watershed is obvious.

PERSONALS

Mr. [illegible] Blackstone, M. Am. Inst. M. E., Chief Engineer of the Homestake Mining Co., Lead, S. D., has been promoted to be Superintendent, succeeding the late T. J. Grier. Mr. Blackstone is a native of Pennsylvania, where he was born 71 years ago.

Mr. W. Cameron Forbes, of Dedham, Mass., former Governor General of the Philippine Islands, has been appointed Receiver of the Brazil Railway Co. and its subsidiary the Madeira-Mamoré Railway Co., both incorporated under the laws of the State of Maine. Mr. Forbes is a graduate of Harvard University, class of 189[illegible], and from 1897 to 190[illegible] was chief of the financial department of Stone & Webster, Electrical Engineers, Boston, Mass.

Mr. [illegible] L. Havens, M. Am. Soc. C. E., has been appointed Special Commercial Attaché of the United States Department of Commerce at Santiago, Chile. Mr. Havens was formerly Chief Engineer of the Mexico City Tramways and more recently has been engaged as Consulting Engineer for various Latin-American enterprises. He is the first civil engineer to be appointed Commercial Attaché. The appointment of three other attachés was also made during the past week.

The following city officials have been appointed under the new charter of St. Louis, Mo., which was outlined in our issue of July 9, 1914, p. 104: Messrs. Edward E. Wall, M. Am. Soc. C. E., Water Commissioner of the Department of Public Utilities; A. L. Jacobs, Supervisor of City Lighting of the Department of Public Utilities; Charles M. Talbert, Director of the Department of Streets and Sewers; J. M. Slater, M. Am. Soc. C. E., former Principal Assistant Engineer of the Wabash R.R., Street Commissioner.

Mr. C. Loomis Allen, M. Am. Soc. C. E., President of the Newport News & Old Point Ry. & Electric Co., Vice-President of the Maryland Electric Rys., and President of the Syracuse & Suburban R.R., of Syracuse, N. Y., has been elected President of the American Electric Railway Association. Mr. Allen was born in Syracuse 41 years ago. He attended Alfred and Syracuse Universities and began his engineering experience as an axman with the engineering corps of the Norfolk & Western Ry. As a member of the firm of Mather & Allen, he had charge of much of the civil engineering work in the electrification of the railways in Syracuse from 1892 to 1895; later he was Chief Engineer and General Manager of the Syracuse street railways.

OBITUARY

William W. Lobdell, President of the Lobdell Car Wheel Co., of Wilmington, Del., died Oct. 10. He was 70 years old.

George A. [illegible], a prominent contractor of Chicago, Ill., died at his home in that city, Oct. 10. He was born in [illegible] in 1811.

[illegible] H. [illegible], Superintendent of Buildings of the [illegible] Service Corporation, Newark, N. J., died Oct. 13, at his home in Flushing, N. Y.

[illegible], a civil engineer for many years with the [illegible] Works, of Brooklyn, N. Y., died at his home in [illegible], Oct. 9.

[illegible], M. Am. Soc. C. E., Civil Engineer and Contractor of San [illegible], Calif., committed suicide at his office at [illegible] St., Oct. 7, by shooting himself [illegible]. He was [illegible] years old and had for some time suffered from heart trouble. He was a [illegible] [illegible]. He is survived by a widow and one son.

[illegible], M. Am. Inst. M. E., [illegible] of the [illegible] Mining Co., San [illegible], Calif., died at his home there Oct. [illegible]. He was born in Trenton, N. J., [illegible] years ago. He was educated in the public schools of Trenton and Philadelphia, and in 18[illegible] graduated in mining engineering from the Polytechnic College of Pennsylvania. For several years he was in [illegible] work in [illegible]. Returning to the East he was for a number of years a prominent consulting mining engineer of Philadelphia and New York City. Since 18[illegible] he had lived in California.

[illegible] S. Lyford, former Vice-President of the Chicago & Eastern Illinois R.R., whose railway experience dated back to 1846, died Oct. 12, at the home of his son in Chicago, Ill. He was born in Maine, June 19, 1823. At 23 years of age he entered the service of the old Boston & Lowell R.R. as a watchman and assistant baggage master. In 1851 he was a passenger conductor. He then left the Boston & Lowell R.R. for the Erie Ry., being for a few months shop clerk at Dunkirk, N. Y., and then a passenger conductor. In 1863 Mr. Lyford became Division Superintendent of the Atlantic & Great Western Ry., and later held the same position with the Erie Ry. Subsequently he was General Superintendent of the Hannibal & St. Joseph R.R., of the Kansas Pacific Ry., and in 1878 first became connected with the Chicago & Eastern Illinois as Superintendent. He was Vice-President from 18[illegible] until about a year ago, when he retired at the age of 90 years, after a total railway service of 67 years.

ENGINEERING SOCIETIES

COMING MEETINGS

NORTHWESTERN ROAD CONGRESS.
Oct. 28-31. Congress at Milwaukee, Wis. Headquarters, 71, Sentinel Bldg., Milwaukee, Wis.

AMERICAN ROAD CONGRESS.
Nov. 9-11. Atlanta, Ga. Permanent headquarters American Highway Association, Colorado Building, Washington, D. C.

INDUSTRIAL WELFARE AND EFFICIENCY CONFERENCE.
Nov. 16-20. Conference at Harrisburg, Penn. Secy., R. M. Pennock, Harrisburg, Penn.

NATIONAL MUNICIPAL LEAGUE.
Nov. 17-21. Annual meeting at Baltimore, Md. Secy., Clinton Rogers Woodruff, North American Building, Philadelphia, Penn.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.
Nov. 19-20. Annual meeting at Columbus, Ohio. Secy., F. E. Sanborn, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Nov. 30-Dec. 1. Annual meeting at New York. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN PUBLIC HEALTH ASSOCIATION.
Nov. 30-Dec. 5. Annual meeting at Jacksonville, Fla. Secy., Prof. Selskar M. Gunn, Massachusetts Institute of Technology, Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 1-4. Annual meeting at New York City. Secy., Calvin W. Rice, 29 W. 39th St., New York City.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 2-4. Convention at Washington, D. C. Secy., D. Knickerbacker Boyd, The Octagon, Washington, D. C.

AMERICAN MINING CONGRESS.
Dec. 7-11. Annual meeting at Phoenix, Ariz. Secy., J. F. Callbreath, Denver, Colo.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.
Dec. 9-12. Convention at Richmond, Va. Secy., C. A. Prosser, 140 W. 42d St., New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Dec. 10-11. Annual meeting at New York City. Secy., D. H. Cox, 29 W. 39th St., New York City.

AMERICAN ROAD BUILDERS' ASSOCIATION.
Dec. 14-18. Convention at Chicago, Ill. Secy., E. L. Powers, 150 Nassau St., New York City.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Dec. [illegible]. Annual meeting at Madison, Wis. Secy., F. M. White, Madison, Wis.

Society for the Promotion of Engineering Education—The council of the society has decided to hold the 1915 meeting at Iowa State College, Ames, Iowa, June [illegible]. Dean Marston, of Iowa State College, is President of the society.

Albany Society of Civil Engineers—The regular annual meeting and election of officers will be held in Albany, Oct. [illegible]. Richard W. [illegible] will address the society on "Engineering from the Contractor's View Point." The secretary is [illegible] at [illegible], Albany, N. Y.

American Society of Civil Engineers—The nominations of officers for 1915 are [illegible] as follows: For President, Charles D. Marx, Professor of civil engineering at Leland Stanford, Jr., University; for Vice-Presidents, [illegible], Consulting Engineer, New York City; [illegible], Consulting Engineer, Kansas City, Mo.; [illegible], Consulting Engineer, New York City; for Directors, [illegible], Consulting Engineer, New York City; John V. [illegible], Consulting Engineer, New York City; J. E. Greiner, Consulting Engineer, Baltimore, Md.; [illegible], Consulting Engineer, Fort Worth, Tex.; John F. Coleman, Consulting Engineer, New Orleans, La.; Herbert S. Crocker, Consulting Engineer, Denver, Colo.

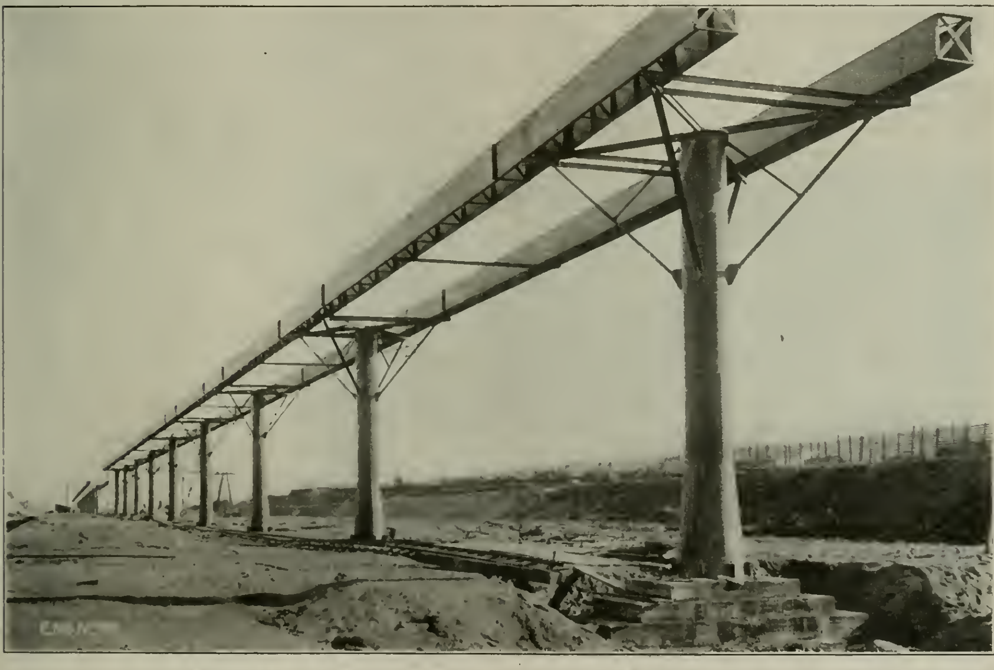
Engineering News

VOLUME 72 OCTOBER 29, 1914 NUMBER 18

A Noteworthy Steel Trestle: Stock-Pile Trestle at Negaunee Mine

Trestles for dumping ore into stock piles at the iron mines are usually wooden trestles of the simplest construction; these trestles are taken down when material is shipped from the pile, to give room for working the steam shovel, which loads the ore into railway cars, and re-erected when the ore is again to be stocked. The Negaunee mine, Negaunee, Mich., five years ago started a new shaft (No. 3), which promised sufficient permanence to justify a better type of stock trestle, one which would save the cost of frequently demolishing and re-erecting and of complete renewal every five or six years, as necessitated by timber trestles. On the suggestions of Stuart R. Elliott*, superintendent of the mine, a center-column steel trestle (allowing steam shovels to work along the ground without interference) was designed by the Wisconsin Bridge & Iron Co., and this trestle has been in service now for two years with satisfactory results. It presents several radical novelties in steel construction.

The trestle is a double-track plate-girder structure of 20-ft. track spacing with a single central line of columns. It is 42 ft. high from ground to rail. The plate-girder portion of the structure, the columns, and the method of supporting the girders on the columns are quite unusual. The single-column construction allows of running the steam shovels along the ground so close to the columns that they can clean up the whole ore pile except a small amount of material just at the foot of each column. Thus the trestle is permanent and its length of life should be equal to that of bridges and other steel structures.



PERMANENT STOCK-PILE TRESTLE AT NEGAUNEE MINE SHAFT NO. 3

(Columns, 4-ft. reinforced-concrete cylinders in 1/4-in. steel shells. Girders, cantilever system of 114-ft. spans with 76-ft. suspended spans, 42-in. plate-girders, for 36-in. track gage. Trestle 2591 ft. long, 42 ft. high rail to rail, tracks 20 ft. c. to c. Designed for 10-ton load.)

The columns are 4-ft. cylindrical reinforced-concrete columns with the base enlarged on a taper to a bottom diameter of 6 ft.; they are inclosed in 1/4-in. steel shells, which serve as forms for the concreting as protection to the shaft against damage by the ore and the steam shovel.

*Mr. Elliott recently read a paper describing the trestle, before the Lake Superior Mining Institute. The present article is based on data given in that paper.

Each column rests on an independent base, which is a [illegible] concrete footing [illegible] ft. deep, 12x26 ft., the long dimension transverse to the track. Footing and column are reinforced [illegible] fifty-two [illegible]-in. steel rods, which rise from the base into the shell and are tied at the bottom to [illegible] old rails, running in the long direction of the footing. The rods, [illegible] 20 ft. above ground, and spaced by several rings, continue to the top, [illegible] ft. above ground. The shells are strongly anchor-bolted to the footing. At the top the concrete of the column is rounded and smoothed off with a rich mixture to prevent entrance of water between concrete and shell.

The columns are 114 ft. apart, center to center. This great length of span for the light load (10 tons moving load) and the correspondingly shallow girders is made feasible by the use of cantilever span construction. A [illegible]-ft. girder section at the column is connected with bracket support to the column and forms the fixed span, while the [illegible]-ft. intermediate portion forms the suspended span. Each girder is a latticed box section, 30 in. wide, of which each half is a [illegible] channel 12 in. deep, with [illegible]-in. web-plate, flanges turned in.

The construction for supporting the girders on the columns is a framework in the shape of an inverted square pyramid, comprising four bracket struts extending out at angle of 45° from the columns and transverse and diagonal top ties of [illegible]-in. channel. There is also a cross-tie in the middle of each suspended span.

The girders carry 5 in. sawed ties [illegible] ft. long, on which is laid the 40-lb. rail. Bolted to the under side of the ties, and immediately outside of the two girder web-plates, are two 4x4-in. longitudinal timbers, which prevent transverse shifting of the track.

The cost of the entire trestle (2591 ft. long) was $51,[illegible] or $[illegible] per lin. ft. erected, including decking, ties, walks, rails, etc. Of this total, the steel girder construction and the column shells (and trestle [illegible] in the middle portion, which is of more normal construction) amounted to $[illegible],100, or $[illegible] per ft.

Comparing the trestle with a wooden trestle in point of cost, including maintenance and accumulated interest, the following facts are discovered: The greater first cost of the steel trestle is paid back [illegible] (by the saving in maintenance, i.e., annual demolition and renewal and repairs) in [illegible] years, the average life of the wooden trestle. For any longer period than [illegible] years, the steel trestle shows a marked financial advantage, because of the renewal cost of the wooden structure, so that at the end of 20 years a saving of $[illegible] is realized. Should the mine continue productive beyond the 20 years and the steel trestle still be in good shape, the saving would continue to grow.

Quarry Accidents in the United States during 1913 [illegible] [illegible]

An Instance of Lightning on a Steel Dome and Reinforced-Concrete Walls

Numerous requests have been received for specific information as to the performance of reinforced-concrete structures subjected to the play of lightning, but below are the first complete and accurate observations that have been put on record. They are reported in a letter of C. D. Perrine, of the Argentine National Observatory, at Cordoba, published in *Science*, Oct. 9, 1914. It is evident that the domes and reinforcing were carefully grounded to lead lightning discharges safely to ground. Freedom from disturbances within the domes was expected as the construction was most favorable for such protection.

The center of the storm, judging from the clouds and their motions, was not over [illegible] mile south [illegible] of the observatory. In nearly all the storms which I had seen here previously the discharges were nearly all between clouds. (Perhaps because most of them occur at night?) In this storm nearly all of the discharges were between the clouds and earth.

The direction of motion of this storm, as is usually the case, was from south to north. After some half dozen discharges close to the south there was a heavy one to the northwest about three hundred meters away, then another to the northeast about the same distance.

On account of this being a heavy storm and apparently passing directly over us, I was interested to see what the effect would be on our two new reinforced-concrete walls and steel domes sheathed with galvanized iron, and was outside among the central group of buildings [illegible] ft. from the domes in question, one of them in full sight.

A minute or two after the flash to the northeast, mentioned above, there was a general illumination close by, followed almost instantly by the ripping sound of a very close stroke. The interval between the flash and the sound was certainly not over [illegible] second. To me the sound appeared to be made up of three or four separate discharges [illegible] not consecutive.

The power and light currents were cut off until about [illegible] p.m., when it was found that fuses had been blown on our lines (which were special lines) just outside the [illegible] station, some [illegible] meters away. No other effects of the [illegible] were noticed in or near this station.

The dome which had just been completed was largely out of sight from where I stood and no one at the observatory seems to have seen the actual flash. A [illegible], however, in the grounds of the Meteorological office about [illegible] meters away, had a full view of both domes and buildings, was facing them and saw the flash just over and about the new dome. This [illegible] well with the direction and distance from the point of observation.

After hearing of this observation I made a careful examination of the dome and in particular the connection of the copper cable with the track upon which the dome revolves, which forms the connection between the metal dome and one of the vertical I-beams embedded in the concrete for grounding the circuit. The lightning rod proper extends about [illegible] meters above the highest part of the dome and terminates in a bunch of brass wires. No signs whatever of any [illegible] have been found at any point about the dome.

[illegible]

[illegible]

the lightning rod and then the whole surface of the metallic dome appeared to be covered with sparks or flashes.

It seems certain, therefore, that the dome was actually the principal point of discharge for a fairly heavy flash of lightning. (It is uncertain how much of the discharge was taken by the derrick, but it would appear to have been relatively small.) Also the induced currents in the light and power lines were sufficiently heavy to blow the fuses in both.

At the time the bolt struck, there was a peon inside the closed dome, cleaning the running-gear. When questioned he said he had felt nothing nor had he noticed anything unusual beyond the heavy noise.

This experience seems to be a fairly severe test for such a construction—a metallic dome surmounting concrete walls which are heavily reinforced with iron—the metal in the walls having a good ground connection and being connected also with the dome.

Failure of the Reinforced-Concrete Customs House at La Ceiba, Honduras, C. A.

In Engineering News, Sept. 17, 1914, p. 607, there was printed a brief note recounting the failure of a roof slab in the reinforced-concrete Customs House under construction at La Ceiba, Honduras, in which five men were killed, including the designer of the building, who was an American. Since then we have received from F. J. Parmele, Assistant Engineer, Vaccaro Bros., of La Ceiba, an account of the failure.

The building was being erected for the Honduras government by a contracting firm, which was also the designer of the structure, plans for which were accepted without verification by the government, and the construction for which was carried on without governmental inspection. The building was an extremely simple structure, 124x108 ft. in plan, with one story over the whole area 20 ft. high, and a second story over part of the area 12 ft. high. The main structural elements in the design were square columns 12x12 in. in section, reinforced with corner rods, and spaced on the corner of the bays 20x24 ft. $3\frac{1}{2}$ in. The long dimension of the bay was spanned by 9x12-in. beams reinforced with five $\frac{1}{2}$-in. and two $\frac{3}{8}$-in. rods bent up over the columns and lightly stirruped. The roof of the first floor, which also formed the floor for the second floor in the two-story portion, was a 6-in. floor slab spanning the 20-ft. bay between beams, reinforced with $\frac{1}{2}$-in. bars 12 in. c. to c., 2 in. from the bottom of the slab. The second-story portion was disposed as to columns or partitions without apparent regard to the supporting columns beneath, a decidedly poor feature of design, but one which apparently did not cause failure, as the collapse occurred in the one-story portion of the building.

The failure took place immediately after the removal of the forms under the roof of the one-story portion, and covered an area of about 50x60 ft. It was found after the failure occurred that the plans had not been followed in several respects, notably in the thickness of the roof slabs and in the design of the columns. As is shown by one of the columns, in the accompanying view, which is taken from the second story looking down into the hole made by the collapse, the columns were built in a very curious fashion. Instead of the straight 12x12-in. section through their entire height of 20 ft., they were made 24x24 in. in section for a height of 15 ft., and then were off-set to a 12-in. square for the remaining height of 5 ft. to the beams. The reinforcement throughout was of the designed $4\frac{1}{2}$-in. twisted steel bars, wired together by 12-in. spacers.

The roof, which was intended to act as a floor at a future date, as stated above, was supposed to be 6 in. deep. The contractor had no roofing material to bring the surface of the roof up to the proper draining grade, so he added 7 in. of concrete at the high end of the roof; then covered the whole with a light metal lath, and added a top dressing 1 in. thick, making a total depth of 14 in. at one end of the roof, reducing to 6 in. at the corner. The reinforcing, however, was the same as though it had been a 6-in. roof. The initial failure occurred under the thickest section of the roof slab.

In addition to the poor design, the method of construction was not up to standard. The mix was very lean, being about 1 part of cement to 8 parts sea sand, which carried about 10% gravel. In portions of the débris, Mr. Parmele states that he discovered charcoal, broken glass, machetes and nails, all of which was part of débris left from the burning of a building which had previously occupied the site. The method of placing the forms was neither good nor economical. They were, for the most part, made of lap siding, very poorly put together, so the great portion of cement and water escaped. The centering had buckled in several places, causing sags and cracks.

Looking Down into Hole Left by Collapse of Roof of Customs House at La Ceiba, Honduras

(Note column in right foreground.)

The government has placed an embargo on seven other contracts held by the same contractor. Investigation has shown that other buildings under construction by the contractor were equally bad in design and construction.

The New York Rapid Transit Railway Extensions*

By F. Lavis[1]

IV--Design of Structure and Track

Loadings—The subway and elevated structures are all designed in accordance with the specifications for assumed loadings, and strengths of materials and methods of calculation, as given in detail in a paper presented to the American Society of Civil Engineers by Henry B. Seaman, formerly Chief Engineer of the Public Service Commission, and under whose direction they were worked out (Trans. Am. Soc. C. E., Vol. LXXV, p. 313). The principal provisions governing the design for steel structures are given below:

The railroad trains on bridges shall be estimated as required by specifications of railroad company.

Elevated or subway trains shall be estimated as a continuous load of [illegible] lb. ([illegible]k) per lineal foot of each track, or a single local concentration of two adjacent motor trucks with axle loads spaced as follows:

Trolley cars shall be estimated as continuous at 1500 lb. ([illegible]) per lineal foot of each track, or as a local concentration of one [illegible] car with axle loads spaced as follows: (Note: the [illegible] cars are special cars used by the B. R. T. for [illegible].)

The roadway for trolley cars on bridges shall be assumed to be 12 ft. wide and shall be capable of carrying the loads specified for roadway of bridges.

The roadway load for bridges shall consist of a uniform load of 12[illegible] lb. per sq.ft. of surface, or a local concentration of [illegible] on one axle with a wheel gage of [illegible] ft. This load may be assumed to cover a space of 12 ft. wide by 1[illegible] ft. long.

The roadway load over subways shall consist of a uniform load of [illegible] lb. per sq.ft. of surface, or a single local concentration of [illegible] on four wheels, 12 ft. between axles and [illegible] ft. wide. These concentrated loads shall be assumed to be distributed over an area of 2x2 ft. on the pavement and thence through the earth at a slope of [illegible] to [illegible]. [illegible] shall be assumed to be loaded at [illegible] lb. per sq.ft.

[illegible] shall be estimated as loaded at [illegible] lb. per sq.ft. of surface. [illegible] platforms shall be estimated as loaded at [illegible] lb. per sq.ft. of surface.

[illegible]

[illegible]

*[illegible]

[1][illegible]

No increase shall be made for impact to horizontal loading (centrifugal or traction forces).

Wind—Provision shall be made for wind pressure acting in either direction, horizontally, of 3[illegible] lb. per sq.ft.

Traction—Provision shall be made for the sudden starting or stopping of a train [illegible] ft. in length, estimating the coefficient of sliding friction at [illegible].

Temperature—Provision shall be made on bridges for a variation in temperature at 1[illegible]° F. [illegible] difference of [illegible]° in the temperature of the chords of the same truss, or in that of adjacent trusses of the same structure shall be considered in spans of more than 3[illegible] ft.

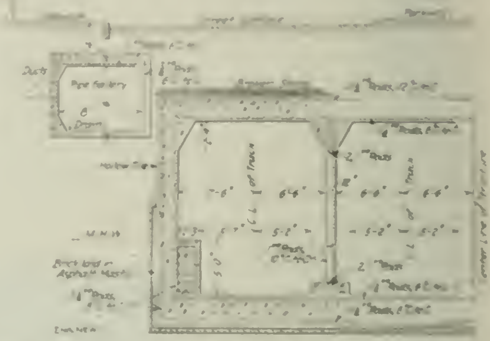


Fig. 10. Half Section of B. R. T. Subway on Fourth Ave., Brooklyn, Built in Reinforced Concrete with Pipe Gallery under Sidewalk

The following table shows the unit stresses (1 k = 1000 lb.) allowed for steel used in the structure taken in conjunction with the foregoing loadings.

Nature of stress	Steel Medium Structural	Cast
Tension (Net)	20k	[illegible]
Compression (l/D [illegible]) [illegible]	2[illegible]	[illegible]
Compression (12 D[illegible]) [illegible]	16.5k	
Compression [illegible]	$\frac{20k^*}{1 + \frac{[illegible]}{[illegible]}}$	
Bending [illegible]	[illegible]	
Bending [illegible] Rivets and [illegible]	[illegible]	
Shear [illegible] (Net)	[illegible]	[illegible]
Bearing [illegible]	[illegible]	
Bearing [illegible] per lineal in.	[illegible]	

l = Length of [illegible] in inches.
r = Least radius of gyration [illegible] in inches.
D = Diameter [illegible] in inches.

*Note: Compression members in steel [illegible] shall not receive greater unit stress than that allowed for 1[illegible] [illegible].

When [illegible] are [illegible] the [illegible] will be assumed to take 2[illegible] of the loading.

[illegible] excess will be added [illegible] number of rivets required [illegible] [illegible].

Preliminary Investigations

Extensive borings, [illegible], were taken before construction to determine as nearly as possible the character of the subsoil, depth to rock, etc., although the latter is extremely irregular. All existing structures both above and below ground, were located as well as possible so that proper provision might be made for taking care of them, though the actual final disposition of [illegible] of the small pipes, etc., was not determined until they

were all uncovered by the excavation and accurately located.

General Design

Speaking generally, the present designs are based on the use of structural-steel frames with concrete jack arches between. The use of reinforced concrete is very limited. It seems to be generally considered that the use of the structural-steel frame greatly facilitates the support of the street decking during construction, because just as soon as a bent is set up and riveted, the load may be transferred to it.

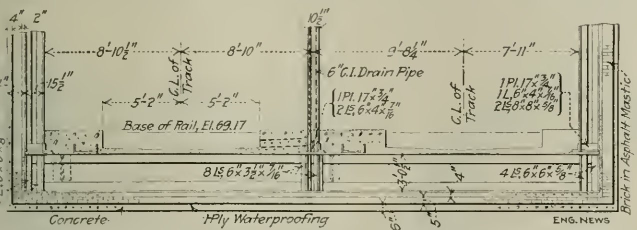


Fig. 11. B. R. T. Subway on Broadway at Canal St., Showing Very Heavy Floor to Resist Upward Pressure of Water

Under the requirement, that the street surfaces shall be maintained and their use for vehicular and other traffic be uninterrupted, it is generally necessary, on account of the width of the excavation, to carry this decking on timber supports, which, as will be seen later, fill up a large part of the excavated space. The construction of reinforced-concrete structures under these conditions is, therefore, somewhat difficult and liable to be patchy, but by proper care in arranging the timbering, the steel-framed bents can be erected easily.

The usual members employed in the steel-frame type of construction in these subways are small enough to be easily handled, so that reinforced concrete has little advantage in the use of small construction units. The ease of construction of the steel-frame structure, and advantages of support more than outweigh any disadvantage in the necessity of using skilled steel erectors, as against the supposed ability to use unskilled labor for reinforced concrete, even though the form work for the concrete with the steel structure is little less than it would be for ordinary reinforced concrete. Fig. 10 shows the reinforced-concrete design adopted in 1908 for the 4th Ave., Brooklyn, lines, which, however, were built mostly in open cut.

The use of the specially rolled "bulb" angles, used on the original subway, has been abandoned and only standard steel shapes are used. Usually the columns rest directly on the concrete, as shown in in the normal sections, Fig. 8, but in certain places I-beam grillages are provided. No stone-block footings are used. Where the ground is soft or where water pressure exists, specially designed floors are necessary. One of the most important of these places is at Canal St., where the subgrade of the lower level is 40 ft. below M. H. W. or normal ground-water level. The heavy girders and thick concrete floor required at this point is shown in Fig. 11. A typical floor to meet conditions below ground-water level is shown in Fig. 15, which is a cross-section of part of the Lexington Ave. subway, where the line passes over what seems to have been an old swamp. This special type was designed principally for the purpose of carrying the structure on the soft ground. Just north of this, at Lexington Ave. and 128th St., where the subgrade is considerably below the water level, a typical design (Fig. 16) of reinforced concrete, for resistance to water pressure in rock, is used.

On account of the fact that the New York rock, a micaceous gneiss, is well known to present difficulties of support, that is, on account of bad seams, etc., to be "heavy" in places, it was decided to use a reinforced-concrete lining for the deep-level tunnels under Lexington Ave. It was found on opening up the work, however, that the necessary temporary supports of timber made this type of construction difficult to execute satisfactorily, and a change was, therefore, made to the design shown in Fig. 13. This, as will be seen, permits the construction of the center wall and the haunches with the steel columns and longitudinal I-beams, so that a direct center support can be built to the roof, which is generally sufficient for

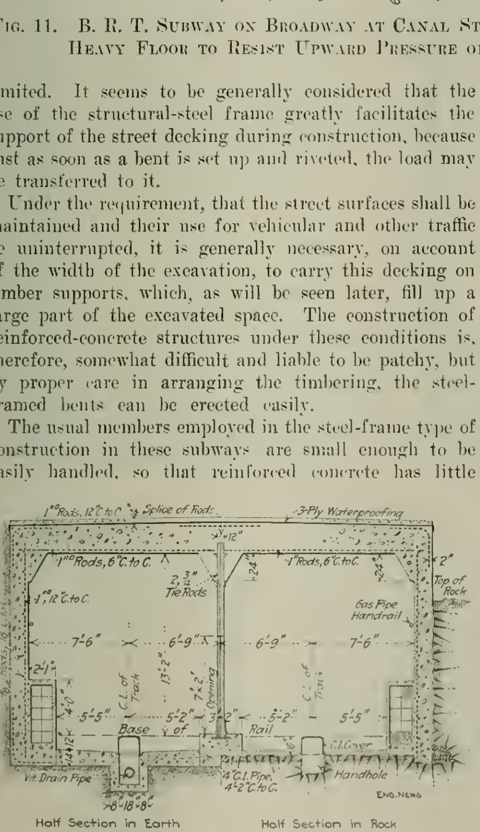


Fig. 12. Reinforced-Concrete Subway on Lexington Ave.

(This shows the upper level. The tracks on the lower level are in tunnel with a roof of two arches supported on a center wall and the sidewalls.)

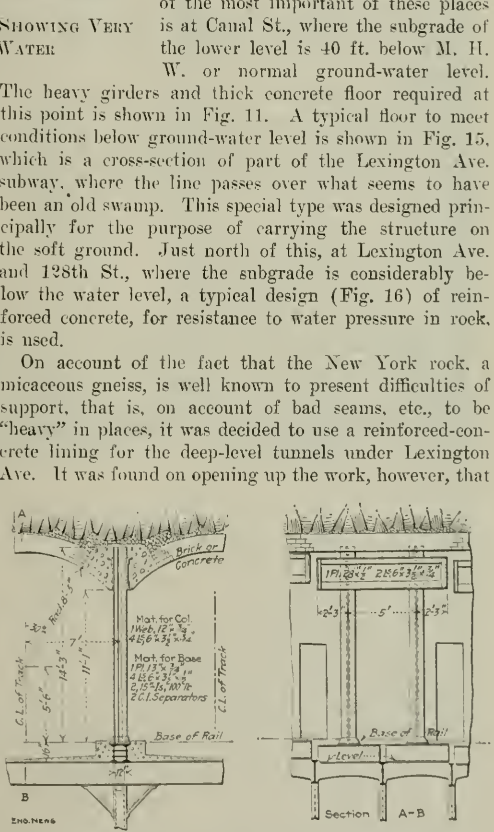


Fig. 13. Alternative Design for Center Wall Using Structural Steel Instead of Reinforced Concrete

[illegible] the construction of the concrete arches.

The [illegible] character of the rock and the variation [illegible] changes in the [illegible] necessary to shift [illegible]

[illegible] of operation, a third party might be found, and as there then seemed to be a possibility that this might be one of the existing steam railroad lines, it was decided to provide clearance for standard railroad equipment and the designs of these two sections were modified accordingly to provide this. As all doubt in regard to the future operation has, however, been eliminated, it has not been thought necessary in the design of the new

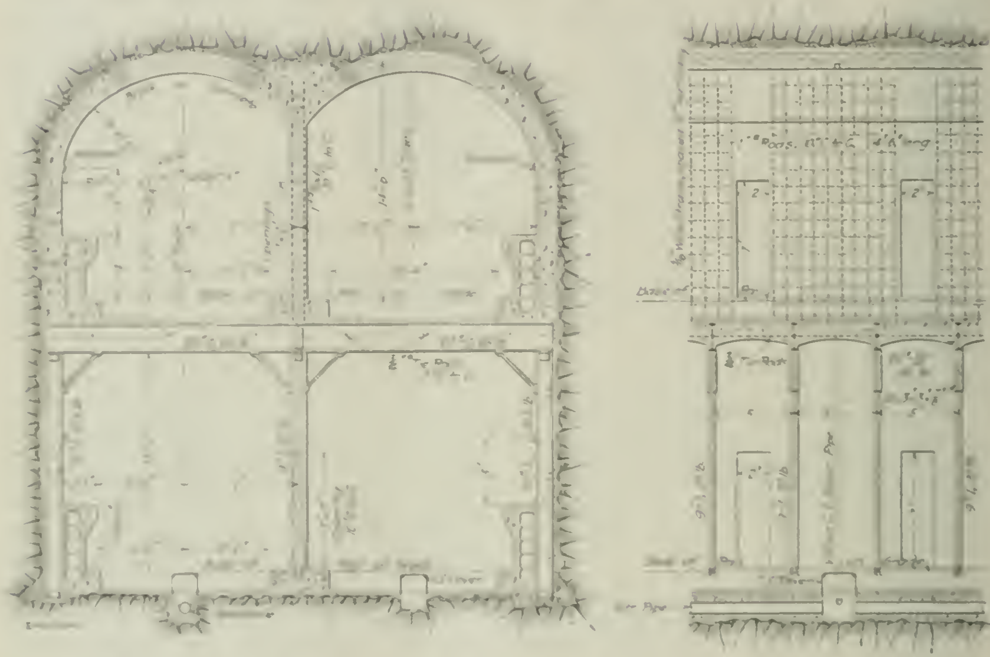


FIG. 11. DOUBLE-DECK SUBWAY ON LEXINGTON AVENUE BUILT WHOLLY IN TUNNEL

[illegible] The heavy ground [illegible] Lexington Ave. [illegible] Fig. [illegible]

[illegible] such as the Harlem River Tubes, [illegible]

[illegible] During the early days of the Public Service Commission [illegible]

lines now to be built to provide for larger equipment than it is known will be used, and the clearances decided on for the new lines are only slightly larger than those provided in the present subway, as is shown in the following table, and in more detail in the typical cross-sections which are shown.

In Fig. 8 (of the previous article) is shown a cross-section of the 7th Ave. line of the Interborough, which is the minimum section for the new lines. Figs. 12 and

FIG. 13. [illegible] SECTION 12 OF [illegible]

14 show the Lexington Ave. line, which is to be operated by the Interborough, but which was designed before the question of operation was definitely decided. Fig. 11 shows the cross-section of the Broadway 59th St. route of the B. R. T. The following table shows a general comparison of the dimensions of the original subway and those since adopted.

	Height above top of rail	Width*
Original subway	12 ft. 4 in.	12 ft. 6 in.
Fourth Ave. Brooklyn and Centre St. loop	14 ft. 6 in.	14 ft. 0 in.
New subways:		
B. R. T.	12 ft. 8 in.	14 ft. 3 in. & 13 ft. 6 in.
Interborough	12 ft. 3 in.	13 ft. 6 in. & 13 ft. 0 in.

*From center of columns between tracks to face of side wall. (Columns about 8 in.)

Note—These are dimensions on tangents and are increased on curves to provide equivalent clearance.

Cross-sectional dimensions of other rapid transit subways in the United States are approximately as follows, there being many minor variations:

	Height above top of rail	Clear width
Boston, Tremont St., 1898	13 ft. 10 in.	12 ft.
Boston, Washington St., 1905	14 ft. 5 in.	12 ft. 2 in.
Cambridge, 1910	14 ft. 9 in.	12 ft. 6 in. (a)
Philadelphia, 1907	14 ft.	12 ft.
H. & M., 6th Ave., 1908	12 ft. 10 in.	13 ft. (b)

Note (a)—The Cambridge subway is large enough to take standard steam railway equipment, the tracks are 12 ft. on centers.

Note (b)—Sidewalk over duct bench at side.

The question of cross-section is one of considerable importance. It is determined largely by the size of the cars, the economic limit of which is controlled largely

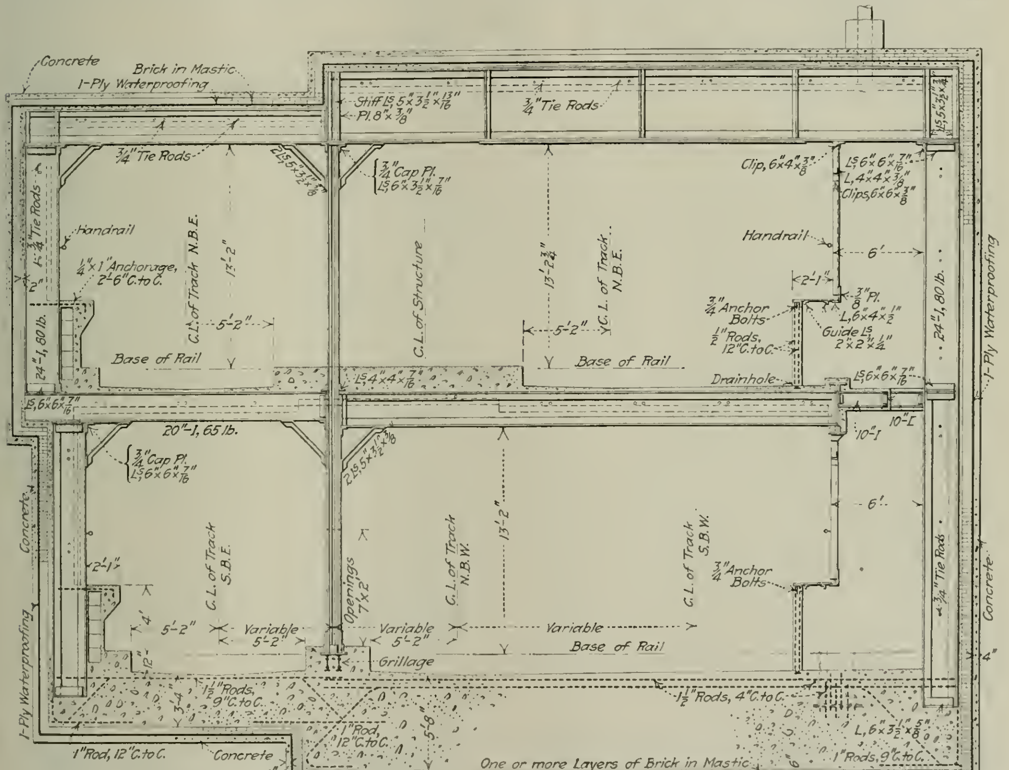


FIG. 16. LEXINGTON AVE. SUBWAY AT 129TH ST. DOUBLE-DECK STEEL-FRAME CONSTRUCTION WITH HEAVY REINFORCED-CONCRETE FLOOR

As is shown on the various cross-sections, provision is made for building the conduits for the electric wires, in a side-bench wall with a walk on the top, instead of placing them in the sidewalls, as in the old subway.

The standard track spacing for four-track subways finally adopted is as follows; from the center line of the four tracks to face of sidewalls:

INTERBOROUGH 6'-9" 12'-6" 7'-3"

B.R.T. 6'-9" 13'-6" 7'-6"

Center line Sidewall

by the time necessary to load and unload them at express stations during the rush hours. Under present operating conditions, the spacing of trains is determined probably as much by the length of station stops as by ability to run the trains more closely together between stations. It is probably difficult to determine the exact economic dimensions of a car which will hold the maximum number of people and at the same time permit the minimum time of stopping. As has already been pointed out, the B. R. T. has decided to use a larger car, but the Interborough will probably of necessity be obliged to

[illegible] the use of equipment interchangeable with that [illegible], and therefore all new lines which are to be [illegible] to this latter company, are designed [illegible] slightly larger than that now in use.

FIG. 17. HEAVY STEEL SECTIONS IN CENTER WALL LEXINGTON AVE. LINE AT 59TH ST.

The cross-section has also, of course, an important bearing on the question of ventilation. This, however, is discussed more fully under that heading.

On some of the routes when the designs were made and construction started, it was uncertain whether they were to be operated by the B. R. T. or the Interborough; provision was, therefore, made as is shown in the sketch, Fig. 18, for an adjustable edge to the platforms, so that either the 9-ft. Interborough or 10-ft. B. R. T. cars could be used.

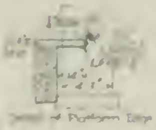


FIG. 18. DETAIL OF ADJUSTABLE PLATFORM EDGE

TRACK CONSTRUCTION—A standard track construction has been adopted for all the new lines, by conference and agreement between the two operating companies and the Public Service Commission. Rails are to be 100-lb. [illegible] sections of the Am. Ry. Eng. Assoc. [illegible]

[illegible]

[illegible]

high cost of track work under the extremely heavy traffic and in the confined space in the subways.

At stations, in order to facilitate cleanliness and sanitation, a special type of track construction similar to that used in the Pennsylvania terminal station in New York* and the Detroit River tunnels† is to be used. A cross-section is shown in Fig. 19.

The track material is to be bought by the Public Service Commission under contracts and at unit prices to be bid for the various items required; it is to be stored and issued on requisition to the operating companies who will install the track as part of the "equipment."

TRACK LAYOUTS—The arrangement of tracks at junction points, so as to avoid crossings at grade, with the consequent delay, as well as danger, has been the subject of considerable thought and study. In the present subway there are three junction points, at Bowling Green, City Hall, and at 96th St. The first two being merely junctions of double-track lines, where only one class of trains, either local or express, has to be cared for on each route, did not present any particular difficulty, it being only necessary to depress one track under the other two. At 96th St., however, where two double-track lines come together into a four-track section, and where express and local trains have to be directed from any one line to any of the others (in the same direction), the problem is more complicated.

The present layout at 96th St. is shown diagrammatically at D, Fig. 20. It will be noted that the switches and slip-crossings are all on the north side of the station, and that as trains from either branch [illegible]

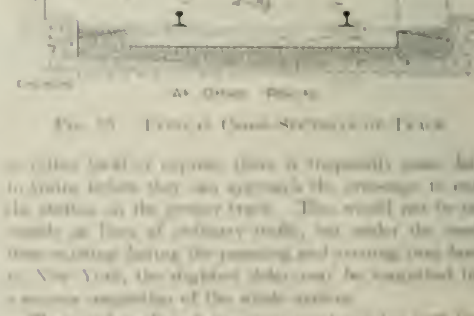


FIG. 19. TYPICAL CROSS-SECTIONS OF TRACK

as either local or express, there is frequently some delay to trains before they can approach the crossings to enter the station on the proper track. This would not be [illegible] on lines of ordinary traffic, but under the conditions existing during the morning and evening rush hours in New York, the slightest delay may be magnified into a serious congestion of the whole system.

The number of such junction points on the new lines has been considerably increased and typical methods of

*"Eng. News," [illegible] Vol. LXIII, p. [illegible]
†"Eng. News," [illegible] Vol. LXXIV, p. [illegible]

overcoming the difficulties are shown in the three diagrams *A*, *B* and *C* of Fig. 20.

So far as possible in all the designs for the new lines the engineers have tried to avoid any slow points, such as switches, crossings, etc., at places other than close to stations where trains must stop, and to locate them on the *farther side* rather than on the near side where they would be reached before the train enters the station, and where in case the line is not clear the train would have to make a signal stop before reaching the switch as well as the station stop after.

The diagram at A shows the track layout at 125th St. on the Lexington Ave. line. It will be noted that coming from the north, trains from either branch reach the station without crossing any switches, are both on the

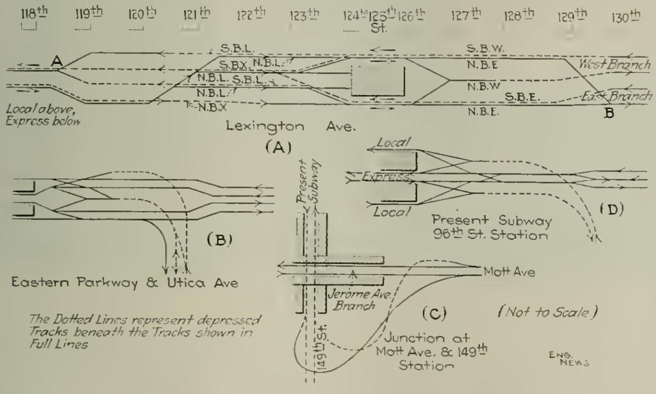


FIG. 20. VARIOUS TRACK INTERSECTIONS

same level and on their same respective sides of the station. Continuing south, those trains which become expresses from this point, pass the required switches within 300 or 400 ft., while the locals have a switch, which is, of course, a slow point, at 119th St. (about 1500 ft. beyond the station). This, however, is of little importance, so far as causing any delay in the south bound movement of the local trains is concerned, as their next station stop is at 116th St.

Coming from the south the expresses reach the upper level in the east side over practically a straight line with no switches, with just enough ascending grade to slow them down. Leaving, they take one or two switches as they are diverted to either the east or west branch, but both within 300 ft. of the station. The locals coming from the south have one or more switches to pass before they reach the station; this, however, is not of importance especially as they do not anywhere come in contact with the expresses. As may be seen these latter switches are not necessary for the operation of through trains, as trains from either side of the station going north reach either branch without a crossing of tracks of trains going in the opposite direction, but are put in for convenience, to provide two extra side tracks for any emergencies of operation at this junction.

The other two diagrams are self-explanatory, except to say that at Eastern Parkway and Utica Ave., diagram *B*, the arrangement is not quite so elaborate as there is not expected to be such heavy travel on this section as to warrant large expenditures to prevent short delays.

Effect of Creosoting on Strength of Oregon Fir Piling

The August, 1914, bulletin of the American Railway Engineering Association is entirely given up to a paper by H. B. Macfarland, Engineer of Tests, Atchison, Topeka & Santa Fé Ry., entitled "Tests of Oregon Fir Piling." The object of the tests was to determine the effect of the steaming process of creosoting as practiced on the Pacific coast upon the physical properties of the piling. Mr. Macfarland states that tests have been made demonstrating that the physical structure of Oregon fir piling is decreased considerably by the boiling process of creosoting, but claims have been made that the steam creosoting plant did not deteriorate the physical strength of the material except possibly on the outer surface. These statements have been based on a small number of small-size tests, so the railway decided to make a large number of tests on both full-size piles and on small pieces cut from piles. The piles to be tested were selected and treated under the observation of the office, and were tested for transverse strength, compression parallel to grain, compression perpendicular to grain, shearing parallel to grain, moisture and creosote absorption. The minor specimens, cut from the creosoted piling, were tested in transverse strength and compression.

The material in treating is subjected to three processes, namely, steaming, removing the moisture and filling with creosote.

When introduced into the tank the logs are thoroughly wet as they come from salt water. They are brought to a temperature of about 330° in a period of one and one-half hours by the introduction of steam. The temperature is maintained for one and one-half hours. A vacuum of about 28 in. is then produced and the temperature reduced to a minimum of 190°. The vacuum process is maintained for 10 hours. The tanks are then filled with oil at 190° temperature and an average pressure of 75 lb. is maintained for a period of five hours, until the piles have taken up the proper quantity of oil. The oil is then transferred from the treating tank to the general storage tank, after which the timbers are removed.

The general conclusions are as follows:

In every case the treated material shows a decided loss of strength as compared to untreated. The greatest loss is in transverse strength due to the influence of treated sap-wood. The loss of compression strength is considerable. The result of the tests indicates the following conclusions relative to the effect of steaming process of creosoted Oregon fir piling: (1) Depth of penetration of creosote was mainly dependent upon the depth of sap-wood; (2) heart-wood of Oregon fir piling was almost impervious to treatment; (3) depth of penetration of creosote was the same in the butts as in the top; (4) depth of penetration of creosote should be interpreted as to mean the depth of active penetration; (5) tests of minor specimens show that injury to fiber through method of treatment is not localized to treated fiber alone, but extends throughout the whole specimen; (6) transverse strength of Oregon fir piling was decreased 42% due to steaming process of creosoting; (7) compressive strength perpendicular to the grain was decreased 32% through the steaming process; (8) compressive strength parallel to the grain was decreased 27%, due to steaming process; (9) in general average, the strength of Oregon fir piling subjected to steaming process of creosoting was only two-thirds its original strength.

Snow Disposal Experiments in Manhattan Borough Sewers

By William Goldsmith*

SYNOPSIS—Besides disposing of [illegible] *of snow by means of the sewers in 1914, the Borough of Manhattan, New York City, made a hundred detailed observations on the sewers receiving the snow. These are presented in tabular form, arranged by size of sewers and giving theoretical velocity of sewage and actual velocity of snow, besides other data.*

The sewers of Manhattan Borough were used to a greater extent for the disposal of snow during the winter of 1914 than in any previous year. Approximately 800,000 cu.yd. of snow were dumped by carts into sewer manholes instead of being hauled to the river front, as is the usual method. [See accompanying views of (1) hauling, (2) shoveling and (3) dumping snow into sewer manhole and (4) dumping at waterfront.]. Every facility of the Manhattan Bureau of Sewers was offered to the Street Cleaning Department in order to expedite the removal of snow.

In order to determine to what extent the sewers of Manhattan Borough could be used for snow removal, a series of experiments were conducted during the winter of 1914. The experiments may be divided into five parts:

(1) Obtaining the actual weight of snow.
(2) Noting the effect of sewer water on snow.
(3) Noting the effect of dumping snow into sewer siphons.
(4) Noting the effect of dumping snow into sewers of different sizes and velocities.
(5) Costs.

Weight of Snow

From the "American Engineer's Handbook" we find that freshly fallen snow weighs from 5 to 12 lb. per cu.ft. Compacted or wet snow weighs from 15 to 50 lb. per cu.ft.

By an actual test it was found that compacted snow as carried in wagon loads during 1914 weighed 36 lb. per cu.ft. This last weight was obtained by test on an average sized New York wagon into which snow was shoveled. This does not give the actual weight of a compacted cubic foot, but is the cubic foot which includes voids as they exist in the average wagon load. The test [illegible] this weight was made on March 2 [illegible] average wagon load being weighed on an ordinary coal scale. The snow which was shoveled into the wagon consisted of chunks about [illegible] in. and weighed from [illegible] lb. per piece. The atmospheric temperature was about [illegible]° F. The weight of the wagon and snow was [illegible] lb.; of the wagon empty, [illegible]; of the snow, therefore, [illegible]. The cart carried [illegible] cu.yd. of snow, thus giving [illegible] lb. as the weight of a cubic yard of snow in the wagon. This weight is used as a basis in what follows.

Effect of Sewer Water on Snow

In order to determine how quickly snow melts when it comes into contact with sewer water, an actual test was made in the Manhattan Ave. sewer between [illegible] and [illegible] streets. A cake of snow well compacted was weighed, dropped into one sewer manhole, picked up by a man at the next manhole and re-weighed. The temperature of the water in the sewer was 60° F.; depth of water, 12 in.; size of sewer, 5x4 ft.; velocity, approximately 3 ft. per sec.; distance between manholes, 250 ft.; time for snow to travel from one manhole to the next, 85 sec. Three separate cakes of snow were dropped at intervals of approximately five minutes, the test resulting as follows:

Weight of snow before being dropped into manhole	Weight of snow when picked up at second manhole
8 lb. 7 oz.	6 oz.
9 lb. 8 oz.	11 oz.
13 lb.	1 lb. 1 oz.

By a simple proportion we have:

Actual distance between manholes : distance necessary to melt snow :: lost weight : total weight.

This gives 262 ft. as the point where the first piece of snow would be entirely melted; 269 ft. for the second, and 272 ft. for the third. From this, it may be safely assumed that within 300 ft. no snow would be left.

There is a possible inaccuracy in the above simple proportion for the reason that as the snow is melted the mass becomes smaller and the area in contact with the sewer water is diminished.

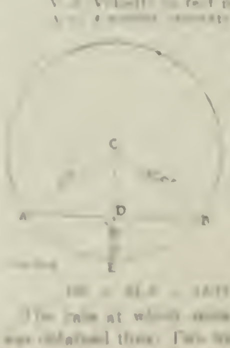
The compacted snow used in this test was the largest which could be obtained, it having laid on the streets for nearly a month, and was more like ice than snow. Thus, this was a more severe test than would have been the case had freshly fallen snow been used.

Lenox Avenue Sewer Experiment—To determine to what extent the temperature of sewer water was affected by the continual dumping of snow therein, and whether, theoretically, there was sufficient heat present to melt the snow, an experiment was tried on the Lenox Avenue sewer between 114th and 115th streets, thus:

Size of sewer, [illegible] ft. circular.
Depth of water, 9 [illegible] in.
Velocity (actual), 2.4 ft. per sec.
Temperature of sewer water, [illegible]° F.
Temperature of sewer water below point of snow dumping, [illegible]° F.

$$Q = AV$$

Q = Cu.ft. of water passing [illegible] per sec.
A = Area of water section in sq.ft.
V = Velocity in feet per sec.
A = [illegible]



[illegible]

The rate at which snow was dumped into this sewer was obtained thus: Two wagon loads were dumped beside the manhole; [illegible] took just eight minutes to

*[illegible]

Figs. 1-4. Snow Disposal into Sewers and at Water Front, New York City

(1) Hauling the snow to a sewer manhole. (2) Shoveling snow into manhole. (3) Dumping snow directly into sewer manhole. (4) How snow is dumped at the water front.

shovel it all into the sewer. So we have two wagon loads $\times$ 3550 lb. (previous test) = 7100 lb. shoveled into the sewer in eight minutes, giving a rate of 888 lb. of snow entering the sewer per min.

It takes 144 B.t.u. to change 1 lb. of snow or ice into water; therefore, $888 \times 144 = 127{,}782$ B.t.u. would be required for these 888 lb. per min.

The temperature of snow is approximately 32° F.; the sewer water was 60° F., which is 28° above that of the snow.

Since 18,750 lb. of water passes per min., we get $18{,}750 \times 28 = 525{,}000$ B.t.u. available to melt this snow; whereas, it is shown above that only 127,872 B.t.u. are necessary.

A man standing in the sewer 127 ft. from where the snow was dumped, found the sewer-water temperature to be an average of 54° F., giving a drop of 6° from the normal temperature of the water. This gives a theoretical expenditure of $18{,}750$ lb. $\times$ 6° = 112,500 B.t.u., which is slightly less than the theoretical 127,872 B.t.u. necessary for the entire melting of the snow. It was observed, however, that a few small pieces of snow were still intact at this point, which explains the reason for this theoretical figure.

At a manhole 261 ft. from the dumping point no snow remained, but the temperature of the water was normal; i.e., 60° F. This experiment shows that there was almost four times as much heat in this sewer as is needed to melt all the snow dumped therein, within 200 ft., and the theoretical amount of heat used in melting the snow checks up the actual amount very closely, showing that gases and chemical combinations must not be considered in this connection.

Eighty-First Street Sewer Experiment — More snow was dumped into the 81st St. sewer between Broadway and West End Ave., during March, 1914, than into any other sewer. This is a 6-ft. circular sewer and had 16 in. of water flowing in it on March 15, with a velocity of 4 ft. per sec. On this day 640 loads of snow were dumped into three manholes within this block during eight hours. This gives 5 cu.yd. per min. of snow dumped into the sewer. Five men were used at each manhole to shovel the snow dumped from the carts. A quick test at one of these holes showed that it took 30 sec. to empty a load containing 4 cu.yd. into the sewer, this giving 32 sec. per cu.yd., which is the quickest record obtained throughout these experiments and indicates a probable limit with which it is possible to empty snow into the sewer manholes.

This sewer turns south on Riverside Drive and enters the Hudson River at 80th St., a distance of approximately 1000 ft. Observations made at this outlet while the snow was being dumped into the manhole at the maximum rate showed no indication of snow at this point.

Tidal Sewer Experiments—Many sewers in Manhattan Borough are affected by the tides; that is, the water rises in them with the incoming tide and is entirely clear of tidal water when the tides are low. Some of these were used for snow removal, but it was found that some clogged up and that the snow did not melt, but would come out at the outlet in large chunks. This was probably due to the low temperature of the tide water bringing the sewage temperature much lower than is ordinarily the case. These observations would indicate that sewers affected by the tides cannot be used to advantage at all times.

Tests of Siphon Sewers

At 106th and 110th Sts. are sewers which are interrupted by the Lexington Ave. subway. At these points siphons were constructed by the Public Service Commission, and it was thought that these might clog up if snow was dumped into the sewers above the siphon points.

At 110th St., 117 ft. west of the west curb line of Lexington Ave., there is a manhole which is practically the start of the siphon underneath the subway. At this point 23 men dumped snow into the sewer as quickly as possible. (This is a more severe test than a wagon dumped directly into a manhole.) Most of the snow consisted of large chunks. Observations at a manhole 274 ft. from this point at the other end of the siphon showed practically no trace of snow. Some of the large chunks appeared reduced approximately to one-quarter of their size, but no trouble was found with the working of these siphons. Practically the same results were obtained at the 106th St. siphon, from which may be deduced that sewer siphons of this type, when other conditions are favorable, can be used with perfect safety for the disposal of snow.

Actual Tests on Sewers of Various Sizes and with Different Velocities

In order to lay down some general rules to determine which sewers can be used for the removal of snow, experiments were made on different sized sewers with different velocities at various locations. In making these tests, the following method was used:

One intelligent man with three laborers, with hooks, shovels, electric light, thermometer and rule, was the experimental outfit. Two manhole covers were removed, a man went down one manhole, noted the depth of water, kept his thermometer in the water for approximately one minute, and with an electric light read the temperature. The distance between manholes was then measured and the time recorded which it took a float (small piece of wood) to travel from one manhole to the next. A quantity of snow was then [illegible] quickly shoveled into the manhole and observations made to see whether the sewer clogged or whether the snow was easily carried away. At locations which might be used for dumping wagon loads of snow into the sewer, a wagon load was ordered and a dump test made. If no wagons were available an [illegible] heap of snow was gathered about the manhole by the laborers and quickly shoveled in, so that the conditions obtaining when a wagon load was dumped were secured.

In the table on p. 897, under the heading "Remarks," these expressions are used: shoveling, panning, dumping.

"Shoveling" means the process of shoveling freshly fallen or small pieces of snow into a sewer with care, large lumps not being used, as with these the sewer would clog.

"Panning" means the process of using drag scrapers with a laborer shoving the snow into the manhole, or the drag scrapers with horses attached dumping directly into the sewer.

"Dumping" means the process of dumping wagon loads directly into the sewer manhole.

A statement, as "O. K. for shoveling, panning or dumping" means that it is possible to so use these sewers.

"N. G. for shoveling, panning or dumping" means that it is not possible to so use these sewers.

The experiments shown by the accompanying table were plotted. The results as shown by the accompanying curve (Fig. 5) indicate: (1) that snow can be dumped by wagon loads into sewers carrying 10 cu.ft. per sec. or more; (2) that panning can be employed where sewers have 3 cu.ft. per sec. or more flowing in them

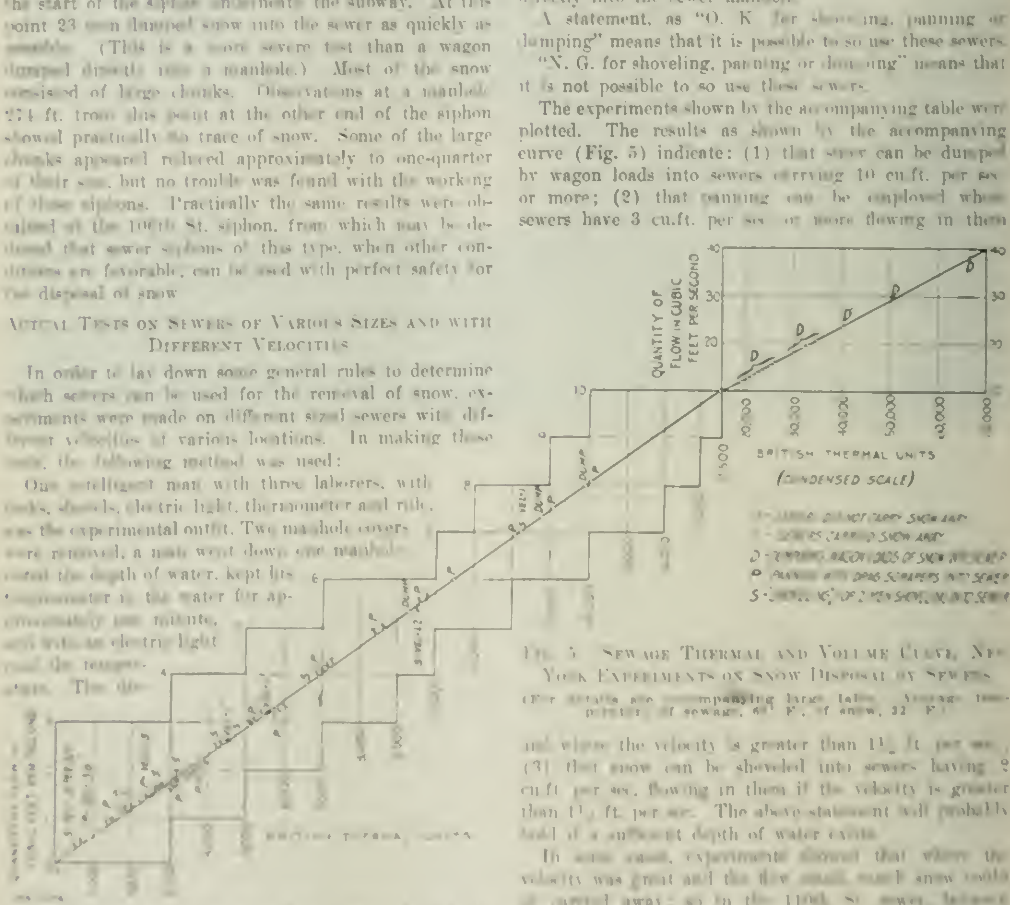


Fig. 5. Sewage Thermal and Volume Curve, New York Experiments on Snow Disposal by Sewers

(For details see accompanying large table. Average temperature of sewage, 60° F., of snow, 32° F.)

and where the velocity is greater than $1\frac{1}{2}$ ft. per sec.; (3) that snow can be shoveled into sewers having 2 cu.ft. per sec. flowing in them if the velocity is greater than $1\frac{1}{2}$ ft. per sec. The above statement will probably hold if a sufficient depth of water exists.

In some cases, experiments showed that where the velocity was great and the flow small, much snow could be carried away; so in the 110th St. sewer, between Madison and Columbus Avenues, we have a flow of 5.2 cu.ft. per sec., the velocity being [illegible] ft. per sec. Yet with this slight flow this sewer makes an excellent dump.

A study of the curve (Fig. 5) will show that the above conclusions are conservative and that sewers outside of these limits may be used, but it is recommended that they should not be unless tried out by actual test in each case.

Costs

Very important items to consider when it is proposed to use sewers for snow disposal are:

(a) Cost of necessary [illegible].

(b) Removal of all [illegible] which are dumped in with the snow.

(c) [illegible] damage [illegible] arising from clogged-up sewers.

OBSERVATIONS TO DETERMINE WHETHER SEWERS COULD BE USED TO REMOVE SNOW IN NEW YORK CITY.

Location	Size of sewer, ft. and in.	Depth of sewage, in.	Discharge, cu.ft. per sec.	Temp. sewage, deg. F.	Distance, ft.	Time sec.	Velocity, ft. per sec. Theoretical	Velocity, ft. per sec. Actual	Remarks
Lenox Ave., 114th to 115th St., W. S.	5 cir.	9½	15.6	60	264	100	2.9	2.6	O.K. dumping
81st St., B'way to West End Ave..	6x6	16	19.7	60	220	60	4.8	4.0	Excel. dump
75th St., Amst. to Col. Ave.........	5x4 ell	18	10.1	52	?	?	2.8	?	O.K. panning
B'way, E. S., 96th to 102d St.......	5-6x5 4x2-8	3½	5.8	58	200	90	3.1	2.0	O.K. panning
98th St., Col. to Amst. Ave........	5-6x5	11	14.2	54	150	55	3.9	2.7	Good dump
98th St., Amst. to B'way...........	5-6x5	10	14.8	54	125	60	3.6	2.1	Good dump
83d St., Col. to Amst. Ave...........	5-7¼x5	10	12.3	49	250	80	3.2	3.1	Good dump
96th St., Amst. to B'way...........	5-6x5	5	36.5	57	120	10	12.0	12.0	Excel. dump
124th St., 7th to 8th Ave...........	5-7½x5	8½	16.0	62	150	110	2.3	1.4	O.K. dumping
Manhattan Ave., 116th to 124th St..	5x4	14	19.2	57	200	70	3.8	2.9	O.K. dumping
1st Ave., E. S., 100th St. to 106th St..	4-6x5	16½	12.0	64	125	Slow	3.1	...	O.K. dumping
106th St., Lex. to 2d Ave...........	5-7½x5	6	29.7	60	160	30	2.7	5.3	O.K. dumping
110th St., Lex. to 2d Ave...........	8x12	16	57.0	60	280	45	2.6	6.2	O.K. dumping
110th St., Lenox to 5th Ave........	6-6 cir.	16	21.6	60	200	40	4.4	5.0	O.K. dumping
110th St., Madison to Park Ave....	8x12	16	46.0	60	200	40	2.6	5.0	O.K. dumping
75th St., Amst. to Col. Ave.........	5x4 ell	12	11.1	51	150	100	3.2	1.5	O.K. dumping
70th St., West End to Amst. Ave...	5x4	14	23.6	61	100	35	3.5	2.8	O.K. dumping
			Sewers between 4 and 5 ft.						
118th St., 3d to 2d Ave.............	4x2-8	6	7.0	55	100	100	1.7	1.0	O.K. shovel
Cent. Pk. W., 100th to 103d St......	4x2-8	3½	3.2	48	250	150	1.05	1.6	O.K. panning
Amst. Ave., 96th to 104th St. (2)...	3x4	6	E. S. 9.5 W S. 5.4	56	100	65	3.1	1.2	O.K. panning
98th St., Cent. Pk. W. to Col. Ave...	4x2-8	4	4.9	60	120	30	3.4	4.0	O.K. panning
100th St., Cent. Pk. W. to Col. Ave...	4x3 5x4	10	5.4	65	175	155	2.4	1.2	O.K. shovel
110th St., Manhattan to Col. Ave...	4x2-8	3½	5.3	64	200	20	5.3	10.0	Excel. dump
West End Ave., 87th to 88th St.....	4x2-8	5	2.7	61	125	75	4.1	1.7	O.K. panning
88th St., Cent. Pk. W. to Col. Ave...	4 cir.	11	3.3	59	100	50	3.2	2.0	O.K. panning
Lenox Ave., E. S., 116th to 121st St..	4x2-8	6½	6.0	44	125	75	2.3	1.6	O.K. panning
Lenox Ave., W. S., 116th to 121st St..	4-6x4	7	7.5	57	125	70	2.5	1.7	O.K. panning
121st St., Lenox to 7th Ave.........	4-6x4	5½	4.8	53	175	100	2.15	1.7	O.K. panning
5th Ave., 125th to 135th St.........	4x2-8	5	16.5	52	100	45	1.65	2.2	O.K. panning
109th St., 1st to 2d Ave............	4x2-8	4	1.4	62	200	165	1.6	1.3	O.K. shovel
108th St., 1st to 2d Ave.............	4x2-8	4	1.8	45	100	95	1.6	1.0	O.K. panning
2d Ave., W. S., 100th to 106th St.. ..	3-6x2-4 4x2-8 4x3	11	3.3	50	125	200	2.65	0.6	O.K. dumping
95th St., 2d Ave. to East River.....	4 cir.	16	7.3	60	100	75	2.8	1.2	O.K. dumping
106th St., Mad. to Park Ave........	4-6x4	4	0.8	60	100	100	1.6	1.0	O.K. panning
87th St., Lex. to 3d Ave...........	4x2-8	3	1.1	51	100	110	2.6	1.0	O.K. shovel
86th St., 2d Ave. to East River.....	4x2-8 4 cir.	8	16.5	62	100	34	8.5	2.9	O.K. dumping
85th St., Lex. and 3d Ave...........	4x2-8	3	1.4	53	100	Slow	3.2	...	N.G. shovel
65th St., B'way to Amst. Ave.......	4x2-8	9	13.3	60	200	?	5.0	?	O.K. dumping
			Sewers between 2 and 3 ft.						
94th St., Cent. Pk. W. to Col. Ave..	3-6x2	2½	0.7	62	100	...	1.5	?	N.G. panning
175th St., Amst. to Audubon Ave. (2)	3-6x2-4	3	N. S. 1.8 S. S. 3.9	55	100	20	4.0	5.0	O.K. panning
92d St., Amst. Ave. to Broadway....	3-6x2	1½	0.3	61	125	55	2.6	2.0	N.G. panning
91st St., Col. to Amst. Ave..........	15 pipe	3	0.6	58	100	40	3.5	2.5	N.G. panning
82d St., Cent. Pk. W. to Col. Ave....	3-6x2	2	0.7	85	...	...	2.3	?	N.G. panning
110th St., Lenox to 8th Ave.........	3-7¼x2-4¾	8	4.1	53	300	120	3.75	2.5	O.K. panning
101st St., Cent. Pk. W. to Col. Ave..	3-6x2 15 pipe	1	0.3	54	...	..	1.9	1.5	O.K. shovel
Manhattan Ave., 105th to 107th St..	3-6x2-6	1½	2.7	56	50	10	4.7	5.0	O.K. shovel
B'way, E. S., 110th St. to 112th St..	18 & 15 pipe	3½	2.7	63	110	20	5.5	5.0	O.K. panning
Cent. Pk. W., 96th to 98th St.......	3-6x2-4	6	4.1	64	200	50	4.8	4.0	O.K. panning
Amst. Ave., 79th to 81st St........	3-6x2	6½	4.4	64	150	50	3.1	3.0	Bet. tracks bad
West End Ave., 78th to 80th St	3-6x2	1¾	1.1	63	120	35	1.7	3.4	N.G. shovel
81st St., Cent. Pk. W. to Col. Ave...	3-6x2-4	2½	1.8	81	100	52	1.75	2.0	O.K. panning
82d St., Col. to Amst. Ave..........	3-6x2	5	1.8	79	120	45	3.1	2.7	O.K. panning
86th St., Col. to Amst. Ave..........	3-6x2	2½	1.8	55	100	?	1.5	1.0	N.G. panning
Col. Ave., 88th to 91st St...........	3-6x2	5½	0.4	55	200	56	6.4	3.6	O.K. panning
96th St., Col. to Amst. Ave..........	3-6x2-4	5½	2.9	54	100	75	4.2	1.2	O.K. panning
81st., Col. to Amst. Ave......... ...	3-6x2	1¼	0.6	69	100	24	2.7	4.0	N.G. shovel
7th Ave., E. S., 112th to 115th St...	3-7¼x2-4¾	3½	0.6	55	125	120	0.2	1.0	N.G. shovel
7th Ave., W. S., 112th to 115th St. .	3-7¼x2-4¾	9	4.0	61	130	90	2.9	1.4	O.K. panning
120th St., Lenox to Mt. Morris Pk. W.	3-6x2	2½	1.2	54	125		1.5	1.0	N.G. shovel
8th Ave., 127th to 131st St., W. S....	3-6x2								
8th Ave., 127th to 131st St., E. S.....	18 pipe	4	2.9	42	125	125	1.8	1.0	O.K. panning
125th St., Lenox to 5th Ave........	3 cir.	3	1.4	53	100	...	2.5	?	N.G. shovel
119th St., 5th to Park Ave..........	3-6x2-4	3½	2.6	55	100	120	2.0	1.0	N.G. shovel
114th St., 1st to 2d Ave............	3-6x2-4	2¼	1.5	45	100	100	1.45	1.0	O.K. shovel
113th St., 1st to 2d Ave............	3-7¼x2-4¾	4	1.7	53	100	90	1.9	1.1	O.K. panning
107th St., Park to Madison Ave.....	3-6x2	5½	0.8	55	200	Slow	1.65	?	N.G. panning
105th St., Park to Madison Ave.....	3-6x2	4	1.0	50	125	65	2.8	2.0	O.K. shovel
103d St., Park to Madison Ave......	3-6x2-4	15	8.1	67	100	40	4.8	2.5	O.K. panning
Park Ave., E. S., 96th to 106th St.	3x2 3-7¼x2-4¾	2	4.0	56	100	20	3.5	5.0	O.K. shovel
Madison Ave., 91st. to 103d St.....	3-6x2	4	6.9	60	100	12	5.8	8.0	O.K. panning
5th Ave., 91st to 107th St..........	3-6x2-4 3 cir. 2-6 cir.	4½	6.9	43	125	33	5.5	4.0	O.K. panning
97th St., Lexington to 3d Ave......	3-6x2	3½	2.5	53	225	...	4.0	?	O.K. shovel
98th St., Lexington to 3d Ave......	3-6x2	3	0.8	50	125	22	4.9	5.0	O.K. panning
3d Ave., E. S., 98th to 100th St.. ...	3 cir.	8	8.0	50	125	25	8.3	5.0	O.K. dumping
3d Ave., W. S., 100th to 106th St.....	3x2 12 pipe	4	2.4	43	125	50	2.9	2.1	O.K. shovel
93d St., 3d to 2d Ave............. ..	3-6x2-4	9	1.7	52	75	25	13.0	3.0	O.K. dumping
73d St., Amst. to Col. Ave...........	3-6x2	3	1.7	45	100	22	2.8	1.6	O.K. panning
72d St., Amst. to Col. Ave..........	3-6x2-4	6	1.84	65	100	25	4.8	4.0	O.K. panning
			Sewers smaller than 2 ft.						
89th St., Cent. Pk. W. to Col. Ave...	12 pipe	2	0.45	59	100	..	1.7	?	N.G. panning
87th St., Cent. Pk. W. to Col. Ave....	15 pipe	1½	0.70	55	100	75	2.3	1.2	N.G. panning
84th St., Cent. Pk. W. to Col. Ave . .	15 pipe	2	0.70	59	100	95	1.6	1.0	N.G. panning
Columbus Ave., 92d to 96th St.. ..	18 pipe	2	1.4	56	..	.	1.0	?	N.G. shovel
3d Ave. 116th to 118th St..........	18 pipe	2	3.2	43	75	90	1.5	1.0	N.G. shovel
117th St., 1st to 2d Ave...........	15 pipe	3½	1.40	72	75	48	1.8	1.6	O.K. panning
115th St., 1st to 2d Ave......	18 pipe	5¼	1.60	37	100	45	2.4	2.2	O.K. panning
115th St., 2d to 3d Ave........... .	15 pipe	1½	0.65	45	100	100	1.2	1.0	N.G. shovel
111th St., 1st to 2d Ave............	15 & 18 pipe	3¼	1.3	42	100	100	1.6	1.0	O.K. shovel
91st St., 3d and 2d Ave.............	18 pipe	3	2.1	60	100	20	5.6	5.0	O.K. panning
90th St., 3d and 2d Ave........... .	15 pipe	3	2.0	58	100	15	5.5	5.6	O.K. panning
89th St., 2d and 2d Ave.............	18 pipe	2	2.2	51	100	15	4.3	6.6	O.K. panning
88th St., 3d and 2d Ave.............	15 pipe	1¼	0.6	42	125	55	3.2	2.3	N.G. shovel
77th St., Broadway and Amst. Ave..	15 pipe	2½	0.25	60	100	Slow	1.9		N.G. shovel
66th St . Broadway and Amst. Ave	18 pipe	7	1.0	80	100	60	7.0	1.4	O.K. panning

Approximately [illegible] was spent for snow removal from sewers in Manhattan Borough. The inspection cost at sewer manholes was [illegible], approximately, making about [illegible] per cu.yd. of snow dumped. Then, if we assume that [illegible] of snow is dirt or other débris which remains in the sewer or must be removed, we add an additional [illegible] per cu.yd. to the cost, since the removal of dirt in sewers costs approximately [illegible] a cu.yd. in Manhattan Borough. An estimate of damage suits which may result from the use of sewers for disposal of snow is very difficult. This damage would arise from a clogged-up sewer backing sewage into houses, and possible damage caused thereby.

Conclusions

The results and possible deductions from these experiments may be summarized as follows:

(1) Under ordinary conditions, if the flow in a sewer is sufficient to carry the snow away, snow will melt in a sewer within [illegible] ft. from the point where it is dumped (average temperature, [illegible] F.).

(2) The theoretical number of B.t.u. necessary to melt snow is checked by the tests, showing that gases and chemical combinations have little effect and need not be considered.

(3) The maximum rate at which it is possible to dump snow into a sewer manhole 24 in. in diameter is [illegible] cu.yd. per min.

(4) Sewers affected by the tides can only be used to advantage (if other conditions are favorable) when the tide is low.

(5) When other conditions are favorable, siphon sewers will carry snow away just as well as others.

(6) Inspection at each manhole where snow is being dumped is necessary in order that the sewers shall not clog.

(7) Cost of inspection, removal of silt and possible damage suits to be considered before determining whether a sewer should be used for snow disposal.

The consulting engineer of Manhattan Borough is E. P. Goodrich; the engineer in charge of sewers, [illegible]. The experiments described in this article were conducted by the writer, under the supervision of the engineers just named.

A Working Formula for Eccentric Riveted Connections

By [illegible]*

The writer has long felt the lack of a simple formula for the number of rivets required in an eccentric connection, expressed in terms of working quantities. The following is the derivation of such a formula for connections having any number of equal rivet lines.

In Fig. 1, let S_m be the bending stress on the extreme rivet due to the moment WL, S_d the stress on the rivet due to the direct load W, and S_r their resultant, equal to the allowable rivet stress. Resolving [illegible] we have

[illegible]

$$S_m^2 + 2\,S_y S_d + S_d^2 = S_r^2 \qquad (1)$$

If now in Eq. (1) expressions be found for S_m, S_d and S_y involving the number of rivets as an unknown, it can be solved for the unknown. Thus we would have a general expression for the number of rivets required in an eccentrically loaded connection of any number of equal rivet-lines.

The bending stress in the extreme rivet is:

$$S_m = \frac{W\,L\,c}{I_p} \qquad (2)$$

where c is the distance of the extreme rivet from the center of gravity of the rivet-group O, and I_p is the polar moment of inertia of the rivets about O.

To derive I_p directly in terms of the squares of the rivet distances from O is a process both tedious and unnecessary for our final results. But it is a principle of

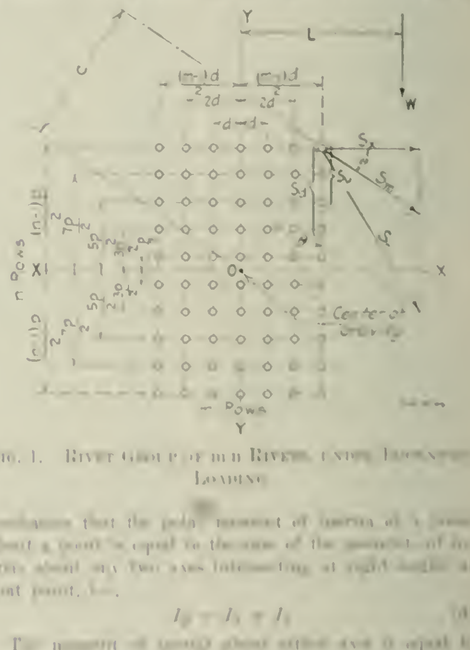


Fig. 1. Rivet Group of mn Rivets, under Eccentric Loading

mechanics that the polar moment of inertia of a plane about a point is equal to the sum of the moments of inertia about any two axes intersecting at right angles at that point, i.e.,

$$I_p = I_x + I_y \qquad (3)$$

The moment of inertia about either axis is equal to the moment of inertia of one of the lines running normal to it times the number of such lines in the group. If n is the number of rivets in a vertical line, p their vertical spacing and m the number of such lines in the group, then (see Note at end of article):

$$I_x = \frac{mn}{12}(n^2 - 1)\,p^2 \qquad (4)$$

Similarly, if d is the distance between vertical rivet lines, or the horizontal rivet spacing, then:

$$I_y = \frac{mn}{12}(m^2 - 1)\,d^2 \qquad (5)$$

Hence Eq. (3) becomes:

$$I_p = \frac{mn}{12}\left[(n^2 - 1)\,p^2 + (m^2 - 1)\,d^2\right] \qquad (6)$$

which is a true formula for the polar moment of inertia of any group of equal rivet lines about their center of gravity.

*[illegible]

If now in the above equation we substitute for $(n^2 - 1)$ its closely approximate value n^2, and similarly m^2 for $(m^2 - 1)$, the modified value of n will not differ from the true value by more than a fraction. Since the value of n is sought to the nearest integer such substitution is valid for all practical purposes. This is also sustained by the satisfactory results obtained from the final formula. The change gives:

$$I_p = \frac{mn}{12}(n^2p^2 + m^2d^2) \qquad (7)$$

Similarly, the true value of c, which is

$$\tfrac{1}{2}\sqrt{(n-1)^2p^2 + (m-1)^2d^2}$$

becomes modified to

$$c = \tfrac{1}{2}\sqrt{n^2p^2 + m^2d^2} \qquad (8)$$

Hence the expression for S_m becomes:

$$S_m = \frac{6WL}{mn\sqrt{n^2p^2 + m^2d^2}} \qquad (9)$$

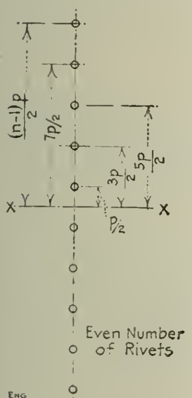


FIG. 2

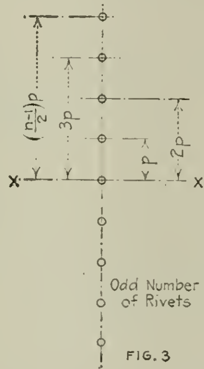


FIG. 3

Since the direction of S_m is normal to c, we have the relation:

$$\frac{S_y}{S_m} = \frac{(m-1)d}{\sqrt{(m-1)^2d^2 + (n-1)^2p^2}}$$

or approximately

$$\frac{md}{\sqrt{n^2p^2 + m^2d^2}}$$

Hence

$$S_y = \frac{6WLd}{n(n^2p^2 + m^2d^2)} \qquad (10)$$

Since the total number of rivets (Fig. 1) equals mn, the direct stress S_d is:

$$S_d = \frac{W}{mn} \qquad (11)$$

Now substituting in Eq. (1) the values for S_m, S_y and S_d, and putting $W/S_r = k$, a coefficient, and reducing it to a most convenient quadratic form, we get:

$$\left[\frac{m^2p^2}{m^4d^2 - k^2p^2}\right]n^4 + n^2 = \frac{(6L + md)^2k^2}{m^4d^2 - k^2p^2} \qquad (12)$$

Solving the above equation first for n^2, then for n, and eliminating in the resulting expression the terms unity (1) under each radical sign, which may be done without affecting the final value of n by more than a fraction as reasoned above, and by proper cancellation, the following convenient working formula is obtained:

$$n = \sqrt{\frac{k(6L + md)}{mp}} \qquad (13)$$

where as a recapitulation:

- n = number of rivets required in each line for any group of equal rivet lines;
- m = number of rivet-lines employed; group of equal rivet-lines;
- L = eccentricity of load;
- p = vertical rivet spacing;
- d = horizontal rivet spacing, and
- k = ratio of load to the allowable rivet stress, or $k = W/Sr$.

The following is a comparison of results obtained by using formula (13) with the actual required values of n as obtained by directly computing the squares of the rivet distances in each case.

$k = W/S_r$	L, in.	m	p, in.	d, in.	Required number of rivets by computation	n, by eq (13)
3.00	6.0	1	3	0	6	6.00
8.00	18.0	2	3	3	12	12.32
10.00	21.0	3	3	3	12	12.24
9.5	18.0	4	3	3	9	9.74
22.72	10.0	5	4	3	9	9.23

NOTE—The expression for moment of inertia of one rivet-line, about a central axis normal to the rivet-line, is the same for even as for odd number of rivets.

For *even* number of rivets, n, Fig. 2, the moment of inertia I_x is:

$$I_x = 2p^2\left[(\tfrac{1}{2})^2 + (\tfrac{1}{2}+1)^2 + (\tfrac{1}{2}+2)^2 + \ldots\left(\tfrac{1}{2} + \frac{n}{2} - 1\right)^2\right]$$

$$= 2p^2 [\tfrac{1}{4}$$
$$+ \tfrac{1}{4} + 1 + 1^2$$
$$+ \tfrac{1}{4} + 2 + 2^2$$
$$+ \tfrac{1}{4} + 3 + 3^2$$
$$+ \tfrac{1}{4} + \left(\frac{n}{2} - 1\right) + \left(\frac{n}{2} - 1\right)^2]$$

For $\frac{n}{2}$ terms the sum $\Sigma\frac{1}{4}$ is $\frac{n}{8}$; the sum of the arithmetical progression $1 + 2 + \ldots\left(\frac{n}{2} - 1\right)$ is $\frac{n}{8}(n - 2)$; the sum of the series of squares $1^2 + 2^2 + 3^2 \ldots \left(\frac{n}{2} - 1\right)^2$ is, calling N^2 the last term, $\frac{N}{6}(N + 1)(2N + 1)$, and substituting $\left(\frac{n}{2} - 1\right)$ for N, the sum is $\frac{n}{24}(n - 1)(n - 2)$.

Hence,

$$I_x = 2p^2\left[\frac{n}{8} + \frac{n}{8}(n - 2) + \frac{n}{24}(n - 1)(n - 2)\right]$$
$$= \frac{n(n^2 - 1)p^2}{12}$$

For an *odd* number of rivets, Fig. 3, if we still denote the number of rivets by n, we have:

$$I_x = \left[1^2 + 2^2 + 3^2 + \ldots\left(\frac{n-1}{2}\right)^2\right]$$

which, by the summation formula $\frac{N}{6}(N + 1)(2N + 1)$, becomes

$$I_x = 2p^2\left[\frac{(n - 1)(n + 1)n}{24}\right] = \frac{n(n^2 - 1)p^2}{12}$$

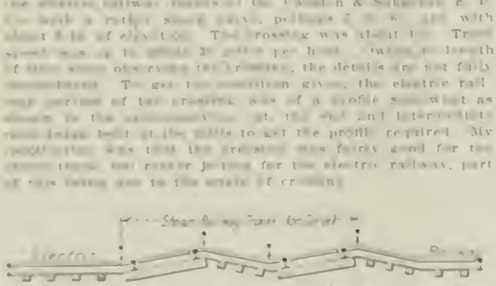
Thus the expressions for I_x are identical for odd and even number of rivets.

Track Crossings on Curves, with Superelevation

A special problem in track-crossing construction is involved in carrying an electric railway at grade across a steam-railway track when the latter is on a curve and has superelevation of the outer rails to provide for fast trains. This problem was suggested in our issue of May 21, by a correspondent who inquired as to a means by which superelevation may be introduced where one of the intersecting tracks is on a curve, so that trains may pass the crossing at high speed.

An arrangement to meet this condition seems to have been introduced in a number of cases where a steam railway (on curve) had to be crossed by an electric railway. Mr. Hare, Superintendent of Construction of the Altoona & Logan Valley Electric Ry., wrote us as follows on the subject:

About 13 or 14 years ago, the Atlantic City R.R. crossed the electric railway tracks of the Camden & Suburban E. R. Co. with a rather sharp curve, perhaps 6° or 8°, and with about 6 in. of elevation. The crossing was about [illegible]. Train speed was up to about 30 miles per hour. Owing to length of time since observing the crossing, the details are not fully remembered. To get the condition given, the electric railway portion of the crossing was of a profile somewhat as shown in the accompanying cut, the end and intermediate rails being bent at the mills to get the profile required. My recollection was that the crossing was fairly good for the steam track, but rather jerking for the electric railway, part of this being due to the angle of crossing.



Profiles of Electric Railway Tracks at Grade Crossings of Steam Railways on Curves, with Superelevation of Outer Rails. (Not Drawn to Scale.)

[illegible] crossing in question appears to have been [illegible] by [illegible] as [illegible] of the railways [illegible] have failed to [illegible] any information concerning it. But William Wharton, Jr., & Co., of Philadelphia, advise us that they have furnished crossings of this type for other locations where the steam track is on a curve, the electric rails being bent to conform to the [illegible] of the [illegible] track (with superelevation of outer rails). The construction is [illegible] to the accompanying cut.

One of these cases is the [illegible] crossing of a [illegible] track of the [illegible] with the [illegible] track of the [illegible] Division of the Boston & Maine R.R. at [illegible] Ave. St., Worcester, Mass. The electric line is on a curve of [illegible]-ft. radius and the steam line on a curve of [illegible]-ft. radius. The crossing was built of 90-lb. rails connecting with [illegible] rails of the steam track and [illegible] girder rail on the electric track. This crossing was built in 1907.

Here the profile is as shown in the upper drawing, the maximum superelevation being about 7 in. The rails are bent at four points as shown. The tread is rounded and the baseplates under the rail intersections are bent to fit the rails. The total length of crossing on the electric track is about 50 ft. The flangeways are 2 in. deep, 2 in. wide for the steam tracks and $1\frac{1}{2}$ in. wide for the electric track.

Another case is the $71\frac{1}{2}°$ crossing of the Schuylkill Valley Traction Co. (single track) over the four-track line of the Philadelphia & Reading R.R. at DeKalb St., Bridgeport, Penn. The steam railway is on a curve of about 3137-ft. radius on center line, with elevations as shown by the lower drawing. The electric railway is on tangent, with a length of about 54 ft. over the crossing. The entire crossing is built of 90-lb. rails, connecting with 6-in. 60-lb. step-head rails of the electric railway.

The rails are given a rounded bend as shown; the two outer bends give a difference in elevation of $\frac{5}{16}$ in. in a length of 19 in.; the two inner bends give $1\frac{3}{4}$ in. in the same distance. This crossing had no baseplates under the rail intersections. It may be noted that the electric line (like several others in Pennsylvania) has a gage of 5 ft. $2\frac{1}{2}$ in.

The Use of Electric Energy in the Construction of the Sun River Irrigation Project

By H. N. Savage*

The Sun River Irrigation Project, which is being constructed by the U. S. Reclamation Service, is located in Teton, Lewis and Clark, Chouteau, and Cascade Counties, Montana. Over 300,000 acres of land can be irrigated under this project, provided adequate water-supply can be developed and extension of the project to its ultimate limits is found to be justifiable from an economic standpoint.

Present development of the project (see Fig. 1) includes only the Fort Shaw unit, covering 17,000 acres of land on the south side of Sun River, mainly on the abandoned Fort Shaw military reservation, and about 90,000 acres on the north side of the river in Spring Valley and on the Greenfields bench. These lands will be irrigated by the flow of Sun River, supplemented by stored water released from Pishkun and Willow Creek reservoirs. The canal system for the Fort Shaw unit was completed in 1908 and has been in operation since that date. The first enlargement of Willow Creek reservoir to impound 19,000 acre-feet has also been completed.

The Sun River diversion dam, 180 ft. in length, located in the canyon of Sun River, will divert water to both Pishkun and Willow Creek reservoirs. The dam and the [illegible] tunnel leading from the dam to the head of the Pishkun reservoir supply canal are now under construction by government forces. Contract work is also well under way on the Pishkun reservoir supply canal, which has a length of 11 miles and a capacity for the first development of 1200 sec.-ft., and on the Sun River slope canal with a length of [illegible] miles and a capacity for the first development of 900 sec.-ft. The contracts provide for the construction of the canals complete including all structures. Location of the distribution system for the Greenfields unit is completed and plans are well advanced toward the construction stage.

*Supervising Engineer, U. S. Reclamation Service, [illegible]

The complete irrigation plan of the Sun River project provides for the storage of water (1) in a reservoir on the North Fork of Sun River, which is to have a capacity of about 350,000 acre-ft., requiring a masonry dam over 300 ft. high; (2) in the Willow Creek reservoir, capacity at final development, 86,000 acre-ft., and (3) in Pishkun reservoir, 46,000 acre-ft. There is also a possibility of storage in connection with further development in Muddy Creek reservoir near Power, and in Benton Lake reservoir 8 miles north of Great Falls. Diamond-drill borings have been completed at the site of the Sun River storage dam, but its construction has not yet been authorized as the Pishkun and Willow Creek reservoirs will furnish sufficient storage for the units of the project now built and under construction.

Adequate transportation facilities were a necessary preliminary to construction and a controlling factor in the project's feasibility. These have recently been provided in the construction of several new railway lines through the project. The Great Northern Ry. has completed a branch line from Vaughn station running westerly 10 miles up the Sun River valley to Gilman. The same company has completed and established train service upon a branch line from Power station northwesterly through the project to Chouteau and continuing northwesterly. The Chicago, Milwaukee & St. Paul Ry. has also completed a roadbed northwesterly across the project to Chouteau and beyond, and train service will soon be inaugurated.

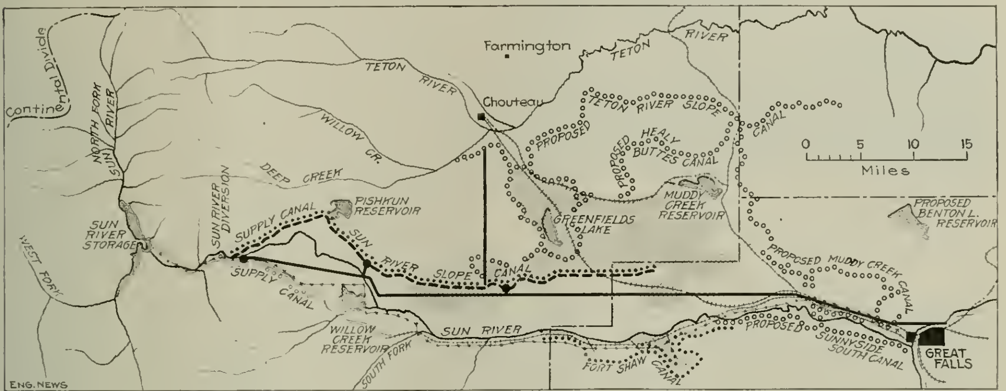


Fig. 1. General Map of the Sun River Project Works

As a further prerequisite to the largest success of the project settlers and the most economical construction of the project works, contract was entered into between the United States and the Great Falls Power Co. for electrical energy to be used primarily in constructing the irrigation system, including dams, canals and tunnels and all canal structures, and, ultimately, to insure the availability of electrical energy for the 12 small towns now scattered through the project (which were in existence before the project was put under construction) as well as for about as many more new towns projected along the new lines of railway.

This contract provides for the construction, by the power company, of over 100 miles of trunk transmission line. Starting from the company's Rainbow Falls hydro-

Fig. 2. Sun River Substation No. 2 of the Great Falls Power Co.

Fig. 3. Substation No. 3, Sun River Project

(Pole at right carries the 48,600-volt circuit.)

electric plant located on the Missouri River about 5 miles below the city of Great Falls, the main transmission line extends westerly through the project for a distance

FIG. 1. SWITCHES AND 15-KW. TRANSFORMER (16,500 TO 2300 VOLTS), HAYDEN BROS., SUN RIVER CONSTRUCTION WORK

of 73 miles to the Sun River diversion dam where the Willow Creek reservoir supply canal and the Pishkun reservoir supply canal divert from the river. A right-angle branch trunk-transmission line, 30 miles in length, will be extended from a point 40 miles west of Great Falls across the project to Choteau.

The Great Falls Power Co.'s transmission line is strung on wooden poles 35 ft. in length, spaced 200 ft. The energy is delivered to the substation at 18,600 volts, three-phase, 60-cycles. The transmission-line wires consist of three strands of No. 8 B. & S. hard copper. The insulators are of a suspension type. Two wires are suspended from the lower crossarm and one from the upper crossarm. A 1/4-in. stranded-steel ground wire is strung on one end of the upper crossarm and is grounded at every pole. A telephone circuit, consisting of No. 8 B. & S. copper wire, is placed on the same poles. The transmission line is transposed three times in its total length, and the telephone line is transposed at every 5th pole.

The electrical energy is delivered to the Reclamation

pacity of 900 kw. in three transformers of 300 kw. each. The transformers at the substation reduce the voltage from 18,600 to 16,500 for local distribution. Substation No. 3 also contains two transformers stepping down from 16,500 to 2500 volts for local use at the diversion dam and tunnels at the upper end of the canal system, where it is used for driving air compressors, hoisting engines, pumps, concrete mixers, ventilating fans, and for lighting and general purposes. Substation No. 3 is equipped with electrolytic lightning arresters on the 18,600-volt side; substations Nos. 1 and 2 have no lightning arresters on the high-tension side. All of the substations are of the outdoor type; but small corrugated-iron buildings are provided at each substation, in which are installed on the low-tension side of the transformers, oil switches and graphic and integrating watt meters.

The government has constructed a 16,500-volt distribution-transmission line the entire length of and adjacent to the Pishkun reservoir supply canal and Sun River slope canal, a distance of 45 miles. The line is strung on wooden poles 30 ft. in length, spaced 150 ft. The distribution-transmission line consists of No. 6 B. & S. copper wire placed on glass insulators. In order to keep this line, throughout its length, convenient to the canal work, the line as constructed is very crooked and required an unusual number of guys and double crossarms. A great number of ravines are crossed, with spans varying from 150 to 450 ft. No ground wire is used on this line. A telephone line is placed on the same poles. At points where the energy is used along the canals and tunnels, portable transformers mounted on skids or on wagons are used to step the voltage down to that required by the contractors. For the dragline-scraper work, the voltage is first stepped down to 2300 and is transmitted through a three-conductor armored cable about 1000 ft. long to the dragline, where it is again stepped down to 440 volts. At the tunnels, direct current at 250 volts is used for drills and is obtained from a 250-volt direct-current generator driven by a 440-volt induction motor.

FIG. 2. [illegible] ELECTRIC DRAGLINE EXCAVATOR; [illegible] TRANSFORMERS AND SWITCH WAGONS

Service at three substations; additional substations are to be provided when required. Substation No. 1, located at Mile 35, has a capacity of 200 kw. in two transformers of 100 kw. each; substation No. 2, located at Mile 50, has a capacity of 200 kw. in two transformers of 100 kw. each. Substation No. 3, located at the terminus of the company's transmission line, Mile 73, has a total ca-

The contract specifications for the main canals, Pishkun reservoir supply canal and Sun River slope canal, and for the structures, including tunnels, require that electrical energy shall be used by the contractors for the operation of excavating machinery and wherever else power is used in the construction work covered by the specifications. The United States is to maintain a trans-

mission line adjacent to the canal and furnish the contractor with electrical energy for the operation of the excavating machinery, all power and lighting and other purposes required under the contract.

The contract between the United States and the power company continues over a period of six years and is renewable at the option of the Government. The power company obligates itself to furnish, not to exceed a maximum of 2600 kw., continuous delivery, the United States guaranteeing to pay the company a fixed minimum sum for the total period. Electrical energy is delivered to the contractors at 16,500 volts (measured on the high-tension side of the transformers) at 1c. per kw.-hr., at the substation on the distribution line or at 1.1c., if measured at other points, and there is no service charge. The contractors supply the transformers for stepping down from 16,500 volts and for all lower voltages.

The work covered by the first contract for the construction of the Pishkun reservoir supply canal and Sun River slope canal and Tunnels Nos. 2 and 3, involving the excavation of about 2,400,000 cu.yd. of material and the construction of about 3260 lin.ft. of concrete-lined tunnel, was secured by the MacArthur Bros. Co., of New York and Chicago.

The construction of structures for these same two canals involves about 82,000 cu.yd. of excavation, 14,000 cu.yd. of concrete, the placing of about 664,000 lb. of reinforcing steel, the erection of about 10,000 lb. of structural steel, the placing in wooden structures of about 66,000 ft. b.m. of lumber and the laying of about 24,000 lin.ft. of drain pipe. This contract was awarded to the Hayden Bros. Co., of Portland, Ore. The contractors are now actively engaged in carrying out the construction of the work, utilizing electrical energy wherever power is required.

Excavating Machines—Two dragline scrapers were made for the contractors and have been in successful operation for several weeks. The first machine (Class 24 Bucyrus) has a 24-ft.-diameter swing circle, 100-ft. boom and a 3½-yd. extra heavy bucket (Page). The main motor is of 225 hp., and the swinging motor 115 hp. These motors are of a slip-ring induction type, intended for severe intermittent variable-speed reversing service. They are operated by automatic solenoid control, so designed as to make it impossible for the operator to injure the motors by improper handling of his levers, and to make the handling of the electric machines the same as the steam. The excavator is mounted on skids and wooden rollers. The current, which is brought to the machine in a three-wire armored cable at 2200 volts, is transformed in the base of the machine to 440 volts; the motors operate on the three-phase 60-cycle 440-volt current thus supplied.

The second machine (Class 20 Bucyrus) has a turntable of 20-ft. diameter, a boom 85 ft. long and a 2½-yd. extra heavy bucket (Bucyrus). The main motor is of 135 hp. and the swinging motor of 75 hp. The motors and control are of the same design as used on the other machine. This machine is also mounted on skids and rollers, and the current is similarly supplied.

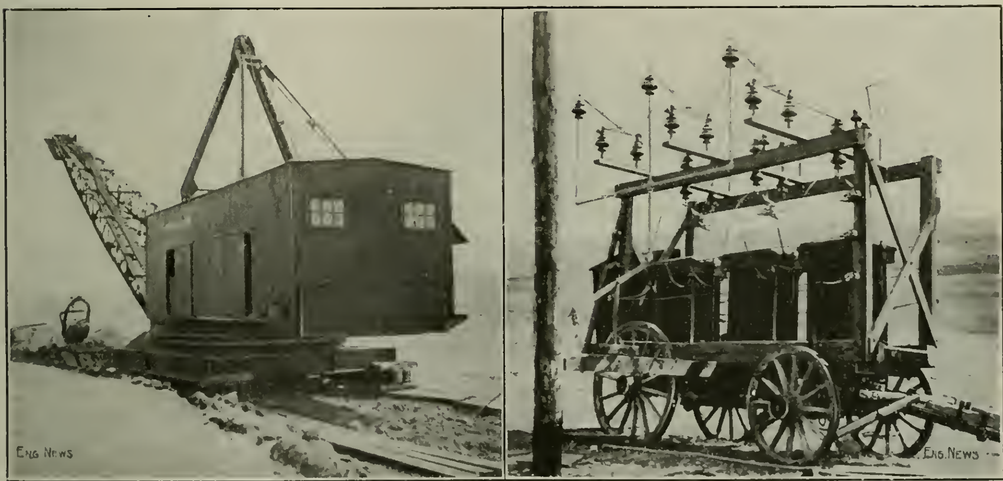


Fig. 6. Class 20 Electric Dragline Excavator and the Transformer and Switch Wagon

The cost of the energy used by the dragline scrapers has averaged about $0.85 per cu.yd. of material moved.

The Reclamation Service is constructing the diversion dam (which is concrete masonry and is to have a total height of 140 ft.) and Tunnel No. 1, with Government forces, using electrical energy wherever power is required.

A Year's Progress on the Lincoln Highway, from New York to San Francisco, gives reason to believe that the undertaking will be carried out successfully without federal aid. About 2500 miles of the total 3400 miles have been marked by the Lincoln Highway Association, and the association has supplied local communities with $40,000 worth of cement to be used in road improvement. In Ohio over three-fourths of the whole has been paved. In Indiana local communities have issued bonds to the amount of $350,000 for improvements not previously contemplated. Sections in Illinois are in the new state-aid road system. In the West much improvement work has been done, particularly in Nebraska, Colorado and Wyoming. The whole highway is in such shape that the transcontinental trip by motor car may easily be made in less than a month.

A Tunneling Machine for Clay or Stiff Sand Formations

A tunneling machine of the boring type, for use in clay or stiff sand and gravel formations, has been in use for some time on a section of the Mount Elliott Ave. sewer in Detroit, Mich., and is now about to be put in operation on the new water tunnel for the City of Cleveland under Lake Erie. The machine was designed by [illegible] of Port Huron, Michigan, a practical tunnel worker who is foreman for the Mount Elliott Ave. sewer work, and is controlled by Carpenter & Anderson, general contractors and engineers, [illegible] Widdicomb Bldg., Grand Rapids, Mich., and 508 [illegible] Trust Bldg., Detroit. This firm has the contract for Section 2 of the Mount Elliott Ave. sewer, most of which is being excavated with the tunneling machine. The City of Cleveland has leased two of the machines for work on its new waterworks intake, and is to pay a small [illegible] royalty to Car-

[illegible] cutting tool makes a spiral cut in the tunnel heading. The machine carriage is further provided with a traveling belt mounted beneath the shaft, leading back to another traveling belt which can be elevated so as to dump into a car.

The operation of the machine is as follows. A full section is first made, by ordinary mining methods, a sufficient distance to allow the entrance of the tunneling machine, which is either mounted on a track or upon some bearings sufficiently elevated to center the main shaft. The [illegible] knife is then centered in the tunnel heading and the machine started. The shaft is so geared that an advance for the full length of the knife, that is, about 15 in., is automatically made, the knife making a conical cut of that depth. The boring knife is then thrown out of gear and the [illegible] thrown into gear, and the cutting tool set to work on the [illegible] in the cut made by the knife. The cutting tool is 6 in. deep and 6 in. wide in the diameter of the tun-

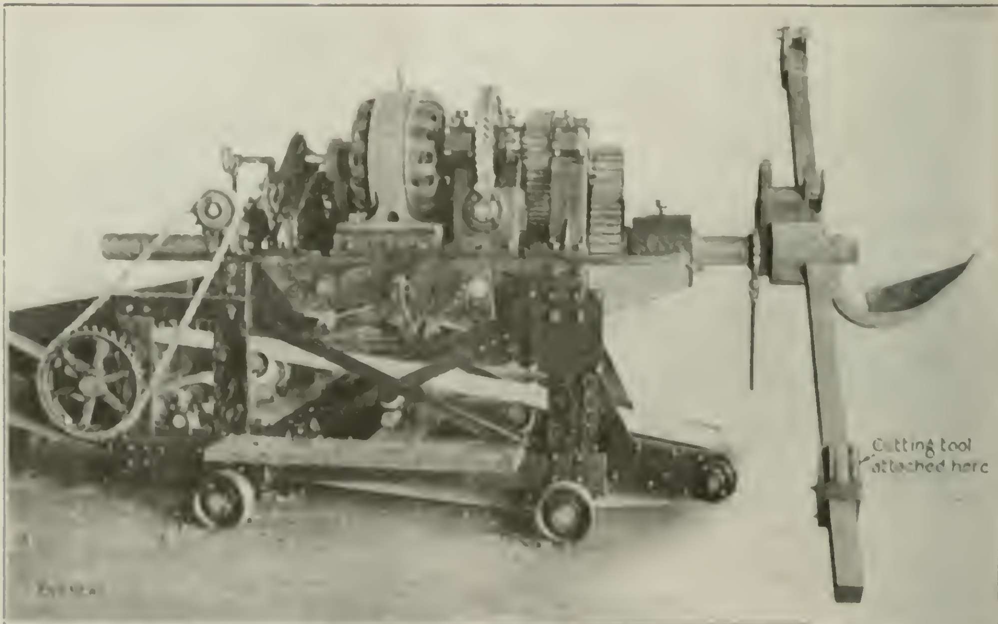


Fig. 1. [illegible] Tunneling Machine [illegible] Water Works Intake

[illegible]

[illegible]

[illegible]

In the Detroit work, the weight of the machine, [illegible]

that unless the machine is held it will pull forward toward the tunnel heading.

The section of the Mount Elliott Ave. sewer bored by the machine is about 5000 ft. long. The cut made by the machine is an 11-ft. 2-in. circle and the finished section inside the brick lining has a 9-ft. clear diameter. This tunnel was dug from three shafts; in the first one the heading for a short distance in one direction was driven by ordinary mining methods and in the other by the machine. The formation here was of a stiff blue clay, which stood up very easily and cut very readily. The following figures show the comparative costs of driving the tunnel by the machine and by ordinary mining methods, the conditions, except for the method of driving, being precisely similar.

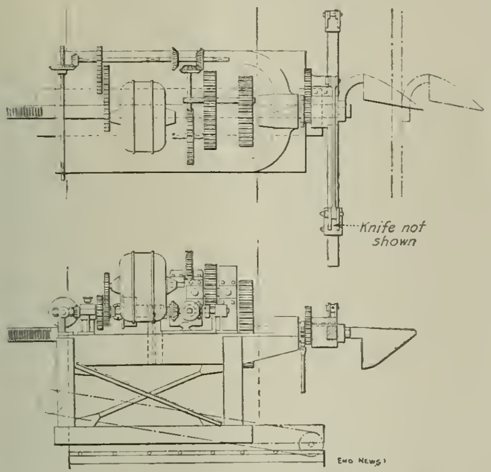


Fig. 2. General Details of the Bonnett Tunneling Machine

In the hand method, the labor charge was as follows: 6 miners at \$5.50 ea., 3 muckers at \$2.75 ea., 1 to 4 car pushers at \$2.75 ea. This force averaged 8 ft. per day of 8 hr.

With the machine there were two operators, one on the machine at \$4 per day and one on the knife at \$3 per day; two muckers in front at \$2.75 per day; two handy men at \$2.75 per day. This force averaged 12 ft. per day of 8 hr.

Behind both of these forces bricklayers were laying the brick lining. These men had to be paid \$10 per shift, no matter how long the shift was. With the ordinary mining method, the cut made during the shift previous to the bricklaying shift was often not long enough to keep the bricklayers busy, whereas with the machine the cut was always sufficient to keep them throughout their regular 8-hr. period. In addition, the miners made a much greater overrun than did the machine, which cut true to line and did not require any extra backing. With the hand method sometimes the extra brick backing was as much as 500 bricks per shift.

In some places in the tunnel some rather unsatisfactory sand was met with, and in these places the roof of the tunnel had to be timbered. It is stated, however, by the engineers on the work that the machine did very well in this formation. In a number of places quite large boulders were encountered, but these were picked out by the muckers and gotten out of the way without injuring the machine or impeding its progress.

In the Cleveland tunnel work the two machines are to be used in a shield, with a concrete-block lining machine directly behind them. For a while, at least, they will have to be under air, but it is hoped that the ground will be tight enough to allow open-air driving to proceed.

Figs. 3-4 show the comparative appearance of the machine and hand work in the Mt. Elliott Ave. sewer.

Fig. 3. Cut Made by Tunneling Machine

Fig. 4. Cut Made by Ordinary Mining Methods

Figs. 3-4. In the Mt. Elliott Ave. Sewer, Detroit, Mich.

Economics of Sewage Filters*

By [illegible]†

[illegible] OF FILTERS.—The output of a filter of any type [illegible] at any suitable [illegible] unit, is largely a question of local conditions. It depends upon the nature of the sewage, the nature and fineness or coarseness of the filtering material, the method of application of the sewage to the filtering material, temperature, atmospheric conditions, and many other factors.

Not considering special conditions and just taking fair figures, we can safely state the following:

Intermittent sand filters, 5 ft. bed of sand, loading [illegible] population per acre; contact filters, 4-ft. depth of stone, loading [illegible] population per acre; sprinkling filters, 7 ft. depth of stone, loading [illegible] population per acre.

The ratio, then, for these three types of filters are in the ratio 1, [illegible] and 10 [illegible].

COST OF SEWAGE FILTERS.—Costs of construction are so much affected by local conditions, such as the amount of excavation necessary, the cost of various classes of materials, the distance from which various classes of materials must be obtained, details of local construction conditions, such as competition, class of work required, and classes, that comparative costs for different localities are only to be used with great discretion, and individual cost and even averages are only a guide to comparative costs in various places. Having this limitation in mind, we will examine in a rough way the cost of various types of sewage filters on the per capita basis.

The average cost of [illegible] Massachusetts intermittent sand filters is $[illegible] per acre, as reported in the Massachusetts State Board of Health Report of 1903. This gives a cost per person connected to the filters of $3.50.

The 1906 Baltimore Sewerage Commission estimates that the cost per acre of filters at $[illegible], these filters being suitable for a connected population of 1200 per acre. This corresponds to a per capita cost of $[illegible].

The cost of contact filters, varying, of course, with the degree of the fineness of the [illegible], may be taken, for filters equipped with suitable convenient appurtenances, at $[illegible] per acre for a 4-ft. deep bed. This corresponds with a loading of [illegible] population per acre to a per capita cost of $[illegible].

For sprinkling filters 7 ft. deep the cost will be about $[illegible] per acre. On the basis of a loading of 19,000 population per acre, the cost per capita will be $2.[illegible].

When considering the relatively low cost of the Massachusetts sand filters compared with the estimate made from the Baltimore sand filters, it is to be borne in mind that the conditions in Massachusetts for the construction of sand filters were generally favorable and the cost represented average conditions through the country. In most places the costs would approximate more nearly those estimated for Baltimore.

Taken on a broad basis, sprinkling filters are by far more economical to construct on the basis of first cost. Intermittent sand filters and contact filters do not stand far apart in this particular.

RELATIVE COST OF DIFFERENT DEPTHS.—There is but very small known about the relative advantages of filters of shallow or deep construction. The choice of depth is usually made for entirely different reasons from those of considering the most economical construction to obtain the desired amount of purification. Very few tests of a comparative kind have been made to give convincing information, and the interpretation of the tests has not been uniform. In some places the conclusion has been made to make filters, say 10 ft., at other places 6 ft., and accordingly is worth while to determine what if any difference there be in the cost of such construction at different depths, and which would appear to be the better. It is to be assumed in such comparisons that sufficient head would be available in any case for the greatest depth to be considered and that pumping would not be necessitated by building filters of the greater depth.

For intermittent sand filters questions of depth do not arise. The filters are generally made as shallow as is consistent with getting proper results and sand beds are not usually made more than 4 or 5 ft. deep as a maximum. Shallower beds, even, will give about the same output as the deeper beds, and beds are made deep only so that sand may be removed for cleaning without removing the sand for a considerable period.

With contact filters it is recognized that from the nature of the action of the contact filters, where the amount of air that is drawn in between fillings of sewage is practically equal to the volume of the sewage, and where surface clogging cannot be a serious factor and may even be no factor at all, each unit of volume of the stone forming the filter, say each cubic yard, will give the same output of sewage purification, no matter what may be the depth of the filter.

From this it follows that it is economical to build a sewage filter on the contact principle as deep as local conditions of construction will permit, and the limitation of depth which it is economical to use is therefore made by the factors of earth excavation or fill and the possible head available without pumping.

When it comes to sprinkling filters, the problem becomes a little more complicated. The English experience, as recited in the Report to the Royal Commission, seems to indicate that the output per unit of volume of sprinkling filters is the same, no matter what the depth. Our experience in work in this country does not wholly corroborate this information. Our best knowledge seems to indicate that the output per unit of volume of sprinkling filters is somewhat less for deep filters than for shallow filters. For such conditions, with a relatively decreasing efficiency of the stone of the filter beds for greater depths and at the same time a relatively decreasing cost per unit volume of the stone for deep beds, there must come some point where the greatest output per unit of cost will be obtained.

The Report of the Baltimore Sewerage Commission in 1911, gives some information obtained from tests made in Baltimore as to the relative efficiency of various depths of [illegible] stone of [illegible] in [illegible] filters, which is the one most commonly used. Figures obtained from that source show the following:

	[illegible] ft.	[illegible] ft.	10 ft.
Relative [illegible]	[illegible]	[illegible]	[illegible]
Per cent. reduction of [illegible] consumed	[illegible]	[illegible]	[illegible]

Giving equal weight to the relative stability and per cent. reduction of oxygen consumed, we get the following:

	[illegible] ft.	[illegible] ft.	10 ft.
Relative stability	1	1.[illegible]	1.[illegible]
Per cent. reduction of oxygen consumed	1	1.[illegible]	1.[illegible]
Average of the two	1	1.[illegible]	1.[illegible]
Relative depths	1	1.[illegible]	2.[illegible]
Relative value of [illegible] per [illegible]	1	.[illegible]	.[illegible]

*From a paper [illegible] before the [illegible] Society of [illegible] [illegible], [illegible].

†Consulting Engineer, [illegible] Broadway, New York City.

Assuming this depth varies at a uniform rate from one end of the curve to the other, we get the following for the relative value of stone per cubic yard:

Depth of bed	6 ft.	7 ft.	8 ft.	9 ft.	10 ft.	12 ft.
Relative value of stone per cu.yd.	1.0	0.97	0.94	0.92	0.82	0.63

To get comparative figures, then, between the 6-, 8- and 10-ft. beds, the cost figures for the 8-ft. beds must be divided by 0.94, and the cost for the 10-ft. beds by 0.82, putting them all on the basis of the 6-ft. beds.

For comparative cost a number of factors, such as excavation, etc., are naturally omitted, as they are not affected in all places the same way by the depth of the filter. Comparing, then, only those particular costs which are affected per unit of output by the depth of the filter, we get the following costs per effective cubic yard for depths of 6, 7 and 8 ft.:

	Depths, ft. 6	7	8
Floor	$0.40	$0.35	$0.32
Tile	.49	.44	.40
Walls	.17	.17	.18
Galleries and Collectors	.25	.22	.20
Distribution	.50	.50	.50
Stone	1.50	1.55	1.60
Total	$3.31	$3.23	$3.20

Outside factors will depend on quantity only and not on depth.

It appears, then, that there is some slight saving of cost, which, on the figures given in the table, amount to about 3%, in favor of the 8-ft. deep bed, as compared with the 6-ft. deep bed. On the other hand, it is to be recognized that a deep bed will give a good deal more trouble with pooling and freezing than a shallow bed, and the advantages in favor of a shallow bed due to this lesser amount of pooling will be considerably more than this 3% difference in cost. Taking everything into account, the writer believes that a sprinkling filter of bed of not less than 6 ft. and not more than 7 ft. will, in the greater number of cases, prove the most economical to use.

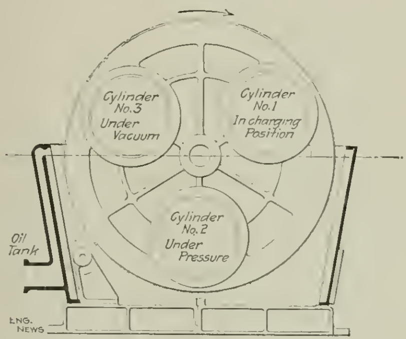
A New Type of Creosoting Plant

A creosoting plant of novel type now being tried in Scotland has as its special features an entirely new design of the treating plant, a very short period of impregnation, and a very high pressure for this impregnation. The retort consists of three horizontal cylinders 33 in. diameter and 28½ ft. long, mounted between two end plates or disks which have openings to receive the cylinders and are carried by a central longitudinal shaft. The entire machine is immersed in an oil tank which is kept filled to the level of the shaft. The general arrangement is shown in the accompanying cut. The end plates are driven intermittently by gearing in such a way that every four minutes the retort revolves through an angle of 120°. The movement occupies 18 sec., the retort being then at rest for 3 min. 12 sec.

In the first position, with two of the cylinders above the level of the tank, the cylinder at the right is in line with the feed trough (above the end of the tank) and a charge of 24 ties is pushed in by a ram. The frame then revolves (clockwise) 120°, immersing the cylinder in the tank. After 60 sec. (to allow the fluid to completely fill the cylinder), sealing pistons move out and close the ends of the cylinder in 12 sec. A pressure of 400 to 500 lb. in the cylinder is then raised by pumps in 12 sec. and maintained for 2 min. 6 sec., followed by a release in 12 sec., completing the 4-min. period.

The frame then revolves 120° bringing the cylinder out of the tank (and immersing the second cylinder). Other sealing pistons again close the ends while a vacuum is created to withdraw a proportion of the creosote. The frame then revolves through 120°, completing its revolution, when the charging ram pushes in a new charge of ties, thus pushing out the treated ties at the other end. The operations are the same with each of the three cylinders, so that at each 4-min. interval a charge of 24 treated ties is ejected.

The partial recovery of oil from the wood is one of the



Sectional Elevation of Revolving Triple Retort for Creosoting Ties

features of the system (which is termed the "save-oil" system), and a series of tests of this process and the full-cell process showed results as follows:

	Save-oil process	Full-cell process
Average increase in weight per tie.	21.22%	30.05%
Average creosote per cu.ft.	7.04 lb.	9.97 lb.
Average creosote per tie	2.18 gal.	3.09 gal.

The plant can be adapted, however, for the full-cell creosoting process or for the zinc-chloride process, the vacuum treatment being then omitted. The operation is continuous and rapid, and gives an output of 360 ties per hour. The plant is compact and occupies comparatively little space, but has considerably more machinery than a plant of the ordinary type. It works also on the principle of high pressure maintained for a short period, the actual pressure period being but a few minutes instead of several hours. However, the amount of oil forced into the wood is said to be greater than by the ordinary process. Ties, poles, bridge timbers and paving blocks can be treated in the same way.

The new process and plant are owned by the Saveoil Creosoting Co., Dickson, St., Glasgow, Scotland. Experiments were made first at the Royal Technical College, Glasgow, and as a result of these a complete plant has been erected at the creosoting works of the Glasgow & Southwestern Ry. Our information is taken from an article in *The Engineer*, of London.

The Pavements of Guayaquil, Ecuador, consist of large blocks of stone averaging 12x12 in. on top. They are laid directly on the soil. About 15 miles of a total of 45 miles of streets are so paved.

The Volumetric Measurement of Liquids on a Large Scale

By Geo. Jacob Davis, Jr.*

It is the purpose of this article to point out some of the causes of error in the volumetric measurement of liquids on large scale and the magnitudes of the errors, together with a method of gaging measuring basins to avoid errors, in so far as possible.

Gaging the Measuring Basin.—In many cases it is desirable to measure liquids in calibrated tanks or basins. A tank for this purpose is usually provided with a glass gage or other device for showing the depth of contained liquid, and on the gage scale is marked the weight or volume of liquid contained in the tank at various heights. In gaging the tank or basin a definite amount of the liquid is weighed into the tank and a mark is made on the gage scale, and the operation is repeated until the tank is full.

Before beginning the calibration the weighing scales should be tested under various loads by standardized weights. Scales are subject to a number of errors which may be summarized as: (1) erroneous graduation of the scale arm; (2) poise of wrong weight; (3) weights inaccurate; (4) shifting of knife edges in the link bearings. On account of the last mentioned errors the scales should be placed in their final position before calibrating and should thereafter be protected from jars or vibrations which might shift the positions of the knife edges. A variation of over 0.2% has been found in scales before and after moving them from one part of a room to another. (The accompanying data sheet shows a convenient form for tabulation of data.)

If the tank has practically vertical plane walls, the average cross-sectional area may be determined, from which, with the initial and final gage heights, the contents may be computed. Usually, however, there are projecting gates, etc., and irregularities in the side walls which make this method impracticable. In six gagings of a [illegible] tank by a number of senior students, the computed average horizontal cross-section ranged from 164.8 sq.ft. to 168.2 sq.ft., a variation of over 2%. With the following method, devised by the writer, the maximum variation from the mean capacity of the tank, as determined by half a dozen calibrations by different parties of students, is not more than 1/10 of 1%.

The volume of each tankful of water weighed into the basin was calculated by dividing the observed weight by the density of pure water at the observed temperature, careful observations having shown that the density of the lake water was the same as that of pure water, out to the fifth decimal place. The volume of water in the basin at various depths could not be conveniently plotted, against gage heights, to a sufficiently large scale to show the discrepancies in the various calibrations, so the following method was adopted. Since the smallest horizontal area of the basin was a little above 160 sq.ft., the volume of contained water above the zero of the tank gage is given by

$$V = 160\,G + X$$

in which G is the tank-gage reading and X may be called the excess. It was not possible to read lower than about 0.3 ft. on the gage scale, owing to its being placed too low, so the absolute quantity of water in the basin above the zero of the gage could not be determined by the above formula, but the excess volume, x, between any two gage heights, g_1 and g_2 is given by the formula

$$v = 160\,(g_2 - g_1) + x$$

in which v is the actual volume of the tank between gage heights g_1 and g_2. In gaging the basin the elementary excesses, for each tankful of about 1800 lb. of water were calculated, and these were summed as shown (accompanying data sheet) in the column headed cumulative excess, which shows the total excess between any observed gage height and the initial gage height of that particular gaging.

In order to compare the results of different gagings of the basin, it was necessary to determine what the excess would have been had all the initial gage readings been the same. This was done by dividing the data of each gaging into two groups of observations and determining the average gage reading and the average value

*[illegible] College of Engineering, University of [illegible]

TABULATION FOR LARGE-SCALE VOLUMETRIC MEASUREMENT

Experiment on calibration of tank No. [illegible]
Made by [illegible]
Date of experiment, [illegible]
[illegible] Density of water [illegible]

Computed by [illegible]

Tankful No.	[illegible]	[illegible]	Gage reading	[illegible]	Weights Gross	Tare	Net	Corrected weight	Temp.	[illegible]	Excess	[illegible]	Cumulative excess
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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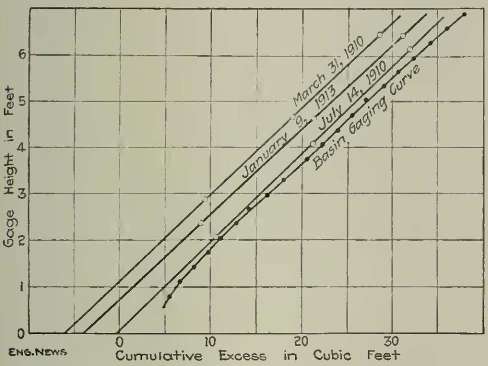
of the elementary excesses for each group and also for the entire gaging. These values when plotted on cross-section paper will lie on a straight line if the calculation is correctly done. The average lines for three gagings have been plotted in the accompanying figure. The intercepts of these lines on the X axis were added to the values of the cumulative excess and the resulting values were plotted as abscissas against gage heights as ordinates. The corrected cumulative excess for the January, 1913, gaging only has been plotted to avoid confusion. An irregular line has been drawn through the points, which shows the variation in the horizontal cross-section of the tank due to projections and other irregularities in the walls. The results of any number of gagings may thus be put on a comparative basis. If the plotted values deviate much from a straight line this method will



Comparison of Basin Gagings at University of Alabama

not give satisfactory results unless the gagings cover practically the same range of elevations in the basin.

To compute the quantity of water V in the basin between gage heights G_1 and G_2 the following formula is used:

$$V = 160\ (G_2 - G_1) + (X_2 - X_1)$$

In this formula X_1 and X_2 are the corrected cumulative excess for gage heights G_1 and G_2, respectively, and are taken from a curve similar to that shown but plotted to a large scale. The constant 160 applies to the particular tank used in the above experiments only.

Temperature Errors—In case the liquid to be measured is at a different temperature from that used in gaging the tank an error will be introduced on account of the variation of the specific volume of the liquid at different temperatures. For example, suppose a measuring tank is graduated at 60° F. to show the weight of water, in 100-lb. units, contained in it when filled to certain elevations, and water at 100° F. is afterwards measured in it. The volume of 100 lb. of water at 60° is 1.6031 cu.ft. and the weight of 1.6031 cu.ft. of water at 100° is 99.383 lb. Therefore an error of 0.617% would be introduced into the measurements, assuming the volume of the tank to remain constant. If the tank is made of thin steel which would have practically the same temperature as the contained water, the tank, as well as the water would expand with the increase in temperature, but not at the same rate. Assuming a coefficient of linear expansion of steel of 0.0000065, the new volume at 100° of the portion of the tank formerly occupied by 100 lb. of 60° water would be 1.60425 cu.ft., which would contain 99.460 lb. of 100° water, giving an error of 0.54%. On account of the shape of the expansion curve of water the error will rapidly increase with the temperature. For example, if the tank is gaged at 75° and water at 180° is measured in it, an error of 2¾% will be introduced into the readings.

In the case of a large concrete measuring basin where the gage was located some distance away in an engine room the temperature of the gage and its contained water was at times quite different from that in the basin. In the winter when the water in the tank was at a temperature of 4° C., the gage temperature was found to be 20° C. When the gage indicated a depth of 8.000 ft. at 20°, it was balanced by a depth of 7.986 ft. of heavier water at 4°. The gage readings were, therefore, in error 0.175%. This error is small as compared with those permissible in commercial work, but such constant errors should not be allowed in experimental work. The data shown in the tabulation sheet were taken in the summer when the temperature of the water in the gage and in the basin were the same and hence in this case there was no correction to apply to the gage heights. In the diagram, however, it may be seen that the average line for the January gaging has a flatter slope than those taken in the summer, which is fully accounted for by the fact that the correction for gage temperature was not applied.

Absorption—There is a possibility of the masonry wall of measuring basins absorbing an appreciable amount of water if they are dry at the time of filling. The effect of such absorption was investigated by Fteley and Stearns* in their experiments on weirs. It was found that the dry brick of the walls absorbed 12% of their volume, while brick taken out of the water and left standing on end in a damp place when again immersed absorbed 1½%. If the cross-section of the measuring basin is small in comparison with the thickness of the walls the percentage of error due to neglecting the absorption may be relatively large.

Leakage—In the operation of sluice gates various amounts of leakage are likely to occur, due to chips preventing the gates shutting tightly. In the attempt to shut the gate sufficient force is sometimes applied to buckle he gates slightly, thereby causing an increase in the leakage. After shutting the gate tightly the hand wheel should be reversed so as to relieve the gate and stem of all strain. The gates should be so placed that it will be easy to inspect them during each experiment, to detect leakage.

Large leaks through the walls may be stopped by calking, or pointing up the cracks, and small leaks can be reduced by putting bran and other sediment in the water, or by the use of a waterproof paint. The rate of leakage should be determined by filling the tank to various heights and noting the drop in the water surface in, say, ten hours, making due allowance for evaporation.

Yielding of Walls—Rectangular basins of wood or metal are likely to become distorted due to the weight of the liquid. The practice of computing the capacity of such basins from contours of the side walls when empty would therefore be inaccurate. The method outlined above would give correct results.

*Trans., Am. Soc. C. E., Vol. 12, p. 71 (1883).

Field and Office

Novel Stop for Gantry Cranes

The recent wrecking by a high wind of a large gantry crane used for handling coal in storage, directs attention to the extent to which such structures are menaced by violent storms. Included in the coal-handling equipment at the Astoria, L. I., plant of the Consolidated Gas Co., of New York, is the largest such gantry crane ever built. It is 600 ft. long, with a span of 250 ft. c. to c. of tracks. It weighs 320 tons and runs on a track about 1000 ft. long. A wind of sufficiently high and sustained velocity

FIG. 1. ARRANGEMENT OF STOP LOGS ALONG RAILS

to move a 320-ton gantry crane is not a frequent occurrence, but only one such gale is required to send several hundred thousand dollars to the scrap heap.

At the time this structure was built the engineers of the gas company recognized the seriousness of this matter and undertook to provide safety devices for preventing the gantry being driven off the tracks by the wind. The last 50 ft. of the rails at each end of the track were inclined upward 1 ft., and 8x8-in. wood stringers were bolted to each side of the rails of the last 25 ft., as shown in the sketch, Fig. 1. The top of the rail head is 2 in. below the upper face of the stringers, or stop logs as they are called.

FIG. 2. THE 600-FT., 320-TON, COAL-HANDLING GANTRY CRANE AT ASTORIA, L. I.

([illegible] See Fig. 1.)

A consideration leads us to the value of this device because as an extreme condition that the gantry was caught in the [illegible] gust of a gale and given a velocity of 15 ft. per sec.

Should a runaway occur, when the forward trucks of the gantry ran up on the inclined rails gravity would tend to bring the crane to a stop. The main resistance, however, is introduced when the double-flanged wheels mount the stop logs. The flanges would, of course, crush into the timbers, developing a high tractive resistance.

The Astoria gantry crane was built by the Brown Hoisting Machinery Co., Cleveland, Ohio, in 1908. The tracks, including the safety device, were designed and constructed by the Engineering Department of the Consolidated Gas Co.

Lining a Railway Tunnel with Concrete by Compressed Air

A recent application of the method of delivering concrete in place by means of compressed air is the lining of the Alkali Summit tunnel on the new line of the Chicago, Burlington & Quincy R.R., between Thermopolis and Orrin Junction, Wyo. The tunnel is 800 ft. long, in sandstone which required timbering throughout. It was completed in 1913, and is now being lined with concrete. The tunnel has vertical sides and arch roof.

The timbering is removed in advance, as it does not leave sufficient room for the new lining. It is pulled down by fastening to the feet of the posts a cable which is led through a snatch-block at the middle of the track and attached to a dinky locomotive. Any loose rock in the roof is removed. To protect the men erecting the forms, roofing planks are laid from the completed concrete to the next set of timbering. These planks would catch small pieces of rock, while larger rocks would be impeded and would give sufficient warning to enable the men to get out of the way. The length of timbering removed at one time varies from 5 to 20 ft., according to the apparent safety of the rock roof.

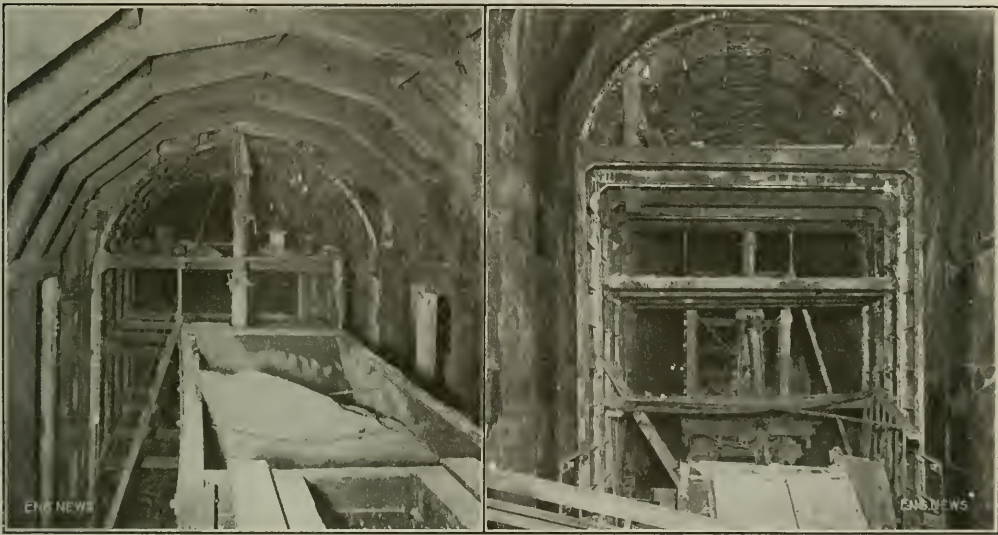
The forms are of steel, consisting of channel ribs (shaped to the tunnel section) placed 4 ft. apart and carrying a lagging of steel plates 4 ft. long and 8 in. high. This lagging is built up to the top of the arch, as forcing the concrete into place by compressed air permits the forms to be built complete before concreting begins. From one to five lengths of the forms are set up at a time, depending upon the character of the rock.

The mixing and placing outfit consists of a pneumatic concrete mixer and conveyor mounted upon a 40-ft. flat car, equipped with bins holding 26 cu.yd. of material. The cement is stored in bags under one of the bins, and discharged toward the center of the car through chutes into a measuring hopper, which is tilted automatically by a 6-in. air cylinder to discharge into the mixer. The 8-in. delivery pipe leads from the mixer under the car and vertically up at the end to the crown of the arch, where a 90° elbow enters through the bulkhead of the form and forms the delivery nozzle. The top section of the pipe, with the elbow or nozzle, is slung from the roof by tackle, and has a screw-joint connection with the vertical pipe at the end of the car. It can be swiveled horizontally so as to direct the stream of concrete to all parts of the form. Air is supplied from a compressor at the mouth of the tunnel by a 4-in. main, with hose connections to the receiver on the car.*

This portable concreting plant requires for proper working a compressor with a capacity of about 300 cu.ft. free air per minute, at 80 to 100 lb. pressure. In beginning the work, however, the only compressor available was one in poor condition and furnishing only about 80 cu.ft. per minute. It was driven by a gasoline engine.

The sand and gravel, dredged near Casper, is hauled in gondola cars and delivered along the track near the tunnel. Cement is stored in a small shed. The bins on the car are loaded by a portable derrick with a wooden skip which is filled by shoveling, as a clam-shell bucket was not available. The car was taken into the tunnel by means of the dinky engine and spotted at a point next to the forms, and its delivery pipe connected to the upper section was suspended in place. The air connection was then made and concreting immediately commenced.

For the first 20 ft. of the lining the work was as follows: Tearing down the timbers, 128 man-hours; erecting forms, 229½ man-hours; loading gravel and cement onto the car, 140 man-hours; mixing and placing concrete in the forms, 204 man-hours. The total yardage placed was 132 cu.yd. The number of man-hours required per yard of concrete was 0.97 for tearing down and clearing timbers, 1.74 for erecting forms, 1.5 for mixing and placing concrete and 1.06 for loading gravel and cement. The delays were 3½ hours on account of blowing off an 8-in. nipple, and 2 hours on account of a derailment of the derrick car.



PLACING CONCRETE LINING BY COMPRESSED AIR IN THE ALKALI SUMMIT TUNNEL; CHICAGO, BURLINGTON & QUINCY R.R.

(The view at the left shows the head of the concreting car, with its material bins and vertical concreting pipe. The top section of this pipe, with elbow entering the end bulkhead of the form, is suspended from the roof by tackle, and has a swivel joint with the pipe on the car. The timbering is removed as the concrete lining advances. The view at the right shows the concrete lining and the steel forms, the latter consisting of ribs and panel plates.)

The substitution of a clam-shell bucket is expected to cut the cost of loading the car to about 0.3 man-hour (or, say 10c. labor cost) per cu.yd. The substitution of a 300-ft. compressor will make it possible to mix and place one batch per minute. The number of batches made with one loading of the car varies between 112 and 118. The time required for placing this amount of concrete, including time of transporting and for connecting and disconnecting the delivery pipe, is about 210 to 240 min.

This portable outfit was designed by the Concrete Mixing & Placing Co., of Chicago, Ill., which also furnished the pneumatic mixer and conveyor apparatus.

*This concreting car was described and illustrated in "Engineering News," March 26, 1914. At that time, however, the delivery pipe was inclined, while the vertical pipe has been found much more satisfactory.

Fish in Chicago Water Mains—During the past year 153 fish traps were installed where complaints were continually received of meters filling up with fish. These traps were so constructed that consumers could clean them without calling on the Water Department

Rod for both Stadia and Direct Leveling

BY [illegible]*

Fig. 1 shows a pattern for a combined stadia and level rod which has proved by long experience to be of great practical value. It is substantially the design of Harold Van De Zee[illegible], consulting engineer of Philadelphia, Penn. [illegible]

[illegible]

[illegible] 0.02 allows a more [illegible] marking than into 0.01, while there is no difficulty in estimating to 0.005; that after an hour's practice, one can almost instantly and automatically take an accurate reading; that it can be read at considerably greater distances than the usual [illegible] patterns; and that it may be adapted to a rod of permissible weight.

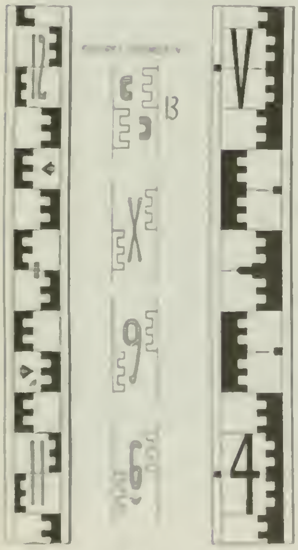


FIG. 1 FIG. 2 FIG. 3

[illegible] LEVEL ROD

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

*[illegible]

[illegible] alternate tenths, so that the paint is not rubbed [illegible].

Fig. 3 illustrates another pattern, also a design of Mr. Van De Zee's, which allows a longer range, though not so easily adaptable to a rod of as light weight as is the first.

※

Steel Tank for Coal Storage

The proprietor of a [illegible] coal yard at North East, Penn., stores his stock, except the large lump varieties of coal, in a circular steel bin, fashioned somewhat after the manner of a circular grain bin. The dimensions of the bin are, height and diameter, each about 40 ft. It rests on a brick foundation about [illegible] ft. high.

The coal which is to be unloaded into the bin is allowed to run from hopper-bottom cars into a pit under the [illegible]. A [illegible] conveyor, inclosed in a [illegible]

STEEL TANK FOR COAL STORAGE, NORTH EAST, PENN.

[illegible]

[illegible]

[illegible]

suddenly remember that they forgot to order coal. No insurance is carried on the bin shown in the accompanying view. The builder is the VonWald Engineering Co., of Buffalo, N. Y.

A High-Speed Valveless Displacement Pump

An unique design of valveless pump, giving large capacities for small sizes and weights is shown in the accompanying figures. The type is adaptable for wide ranges of service and a standardized line is available. It is reported that satisfactory service has been secured (with single-stage units) for hot and cold water, gasoline and volatiles, heavy fuel oils, molasses, soaps, sludges, tar and asphalt; vacuum pumps and compressors have been built in one-, two- and three-stage units. The principle is familiar but has not before been commercialized for miscellaneous small services or in such multistage single-impeller units.

The relative sizes and capacities may thus be shown: For general water-supply, boiler feed, etc., a small unit, 17x12¾x12¾ in. with 1½-in. suction and discharge runs from 50 to 800 r.p.m. and discharges 0.035 gal. per revolution; the maximum designed pressure is 200 lb. per sq. in. and the maximum capacity 25 gal. per min. The largest unit for this service is 26x20x22 in., runs at from 50 to 700 r.p.m., and has a maximum capacity of 300 gal. per min.

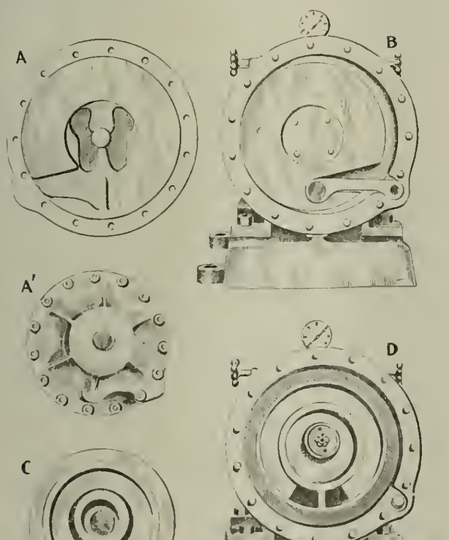


FIG. 1. THE MAY-NELSON PUMP TAKEN APART
(A, A', cover removed; B, impeller and back link in place; C, D, impeller removed.)

The same pump may be used for vacuum service working at 24 in. wet or dry, and giving an air displacement of 0.0017 cu.ft. per revolution or 10 cu.ft. per min. at maximum capacity. A special design (three-stage) of high-vacuum pump supplements the general line noted, holding a vacuum of 0.05 mm. pressure; the same pump may be used to furnish both suction and blast if desired. Another special pump, 4x4¾ in. and weighing 4 lb., has a blast displacement of 0.7 cu.in. per revolution and gives a vacuum of 29¾ in. at 800 r.p.m.

The design, shown in the accompanying figures, comprises a flat cup-shaped casing finished with two or more concentric annular ridges cross-connected by a stop partition with inlet and discharge ports on either side. Into the casing grooves thus formed fit rings cast on an impeller plate properly cut to straddle the casing-groove bridges. This impeller is mounted eccentric with the casing and rocks but does not revolve, being restrained by a back link to the casing. The shaft carries the impeller on an eccentric end pin working in either plain or roller bearings.

The net result is that the rings on the impeller plate roll and slide on the adjacent rings of the casing, as shown in Fig. 2. In *A* the pump is discharging through the right-hand port and drawing through the left: the exterior space is filled. In *B* (90° later) the inner space is completing both discharge and fill while the outer space is beginning both. In *C* (another 90°) the interior space is filled and the exterior one is ready to discharge. In *D* (270°) the inner space is discharging well and beginning suction: the outer space is filling well and completing discharge.

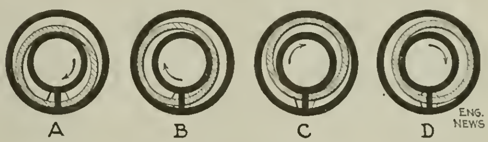


FIG. 2. DIAGRAM SHOWING OPERATION OF MAY-NELSON DISPLACEMENT PUMP

In those designs employing multiples of the simplest arrangement shown, the ports may be connected for multiple or series effect, or they may be used independently as for vacuum and blast simultaneously.

In pumping it is necessary to balance the impeller plate to prevent leakage and friction; as the back of the plate has more effective surface than the grooves, about one-third the operating pressure is admitted to the rear chamber, *A* and *B*, Fig. 1. This is done by adjusting opening of valves in balancing lines run from rear chamber to suction and discharge lines.

High volumetric and mechanical efficiency is claimed though figures are not published. The most of the pumps now in use are in laboratory service but definite operating data seem not to have been secured.

This pump is designed and built by the May-Nelson Manufacturing Co., Washington, D. C.

Traction Engines Are Causing Serious Damage to Maryland Roads, according to a recent newspaper report. The State Roads Commission cannot get local authorities to enforce the law regarding the use of traction engines with cleated wheels; because the farming communities are just now threshing their grain. An injunction to prevent the use of traction engines on state roads without covering the wheel cleats has been refused in Frederick County. The Roads Commission now proposes to equip a traction engine with filler blocks for the wheels, and exhibit it at the county fairs as an object lesson of how damage to the roads may be prevented.

Traveling Cranes for Bridge Wrecking and Erection

In the reconstruction of the Southwark Bridge over the Thames, at London, overhead traveling cranes were used for the removal of the old cast-iron arch ribs and the erection of the new steel arch ribs.

The old bridge (built in 1819) had a center span of 240 ft. and two side spans of 210 ft., each composed of six ribs, and each rib composed of 13 segments or panels weighing 6 to 8 tons each. The ribs were 8 ft. deep at the springing and 6 ft. at the haunches, and were connected by cross frames and diagonal bracing. In the original erection of the ribs, the crown segments were placed first and then the adjacent segments on each side, the segments at the springing being placed last. The bridge was 42 ft. 6 in. wide, with a 28-ft. roadway, and the approach grades were severe. The new bridge will have five arch spans, 240 ft. 6 in. for the center, 131 ft. 9 in. for the intermediate, and 126 ft. 9 in. for the shore spans. It will be 55 ft. wide, with a 35-ft. roadway.

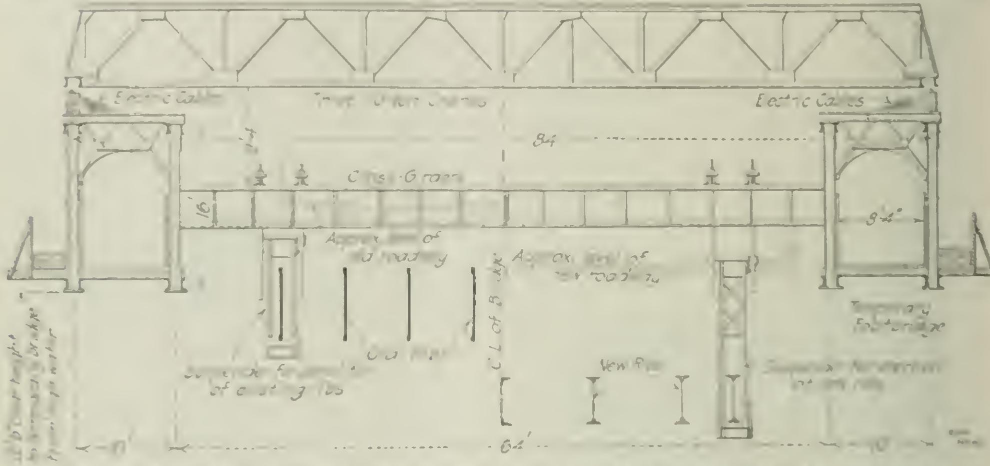


Fig. 1. Temporary Footbridges Carrying Traveling Cranes for Wrecking and Reerecting the Southwark Bridge over the Thames at London

Fig. 2. Method of Supporting the Old Arch Ribs Before Cutting Segments for Their Removal

Along each side of the bridge was erected a [illegible] footbridge, consisting of Warren trusses [illegible] in two parts. These were built on the old bridge and [illegible] out laterally upon the temporary [illegible]. A deck on the footbridge carried the roadway [illegible] and [illegible] the electric cables and water and gas mains. Over the top chord of each outer truss was built a runway beam of two 12x12-in. timbers surmounted by a 70-lb. rail. The two rails were 84 ft. c. to c., and on these ran the grooved wheels of three 10-ton traveling cranes, the girders of which were parallel-chord trusses 7 ft. 9 in. deep.

Posts in the inner truss of each footbridge supported transverse girders, to which were attached hangers holding the arch ribs during the removal of the segments. These girders were 19 ft. 6 in. apart, and connected by diagonal bracing. Across them were laid pairs of 10-in. channels, with washer plates on top for the nuts of the threaded stems of the hangers for the ribs.

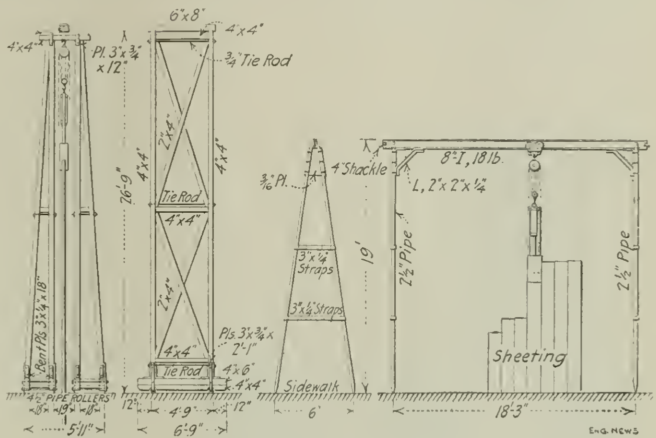
Fig. 1 is a cross-section showing the temporary footbridges, the erecting cranes and the position of the old and new arch ribs. Fig. 2 shows the method of supporting the ribs by hangers and struts. The dotted line on the crown segment (Fig. 2) shows the row of holes drilled to split this segment in two. The other segments were then removed by breaking out the joints. The consulting engineers are Mott & Hay, and Wm. Arrol & Co. have the contract for removing the old and building the new bridge. Our information is condensed from an article in The Engineer, of London, from which also our illustrations are reproduced.

A New Exterior Finish for Surveying Instruments [illegible]

Gantry Frames for Sheetpile Drives

On a section of the new Seventh Ave. subway in New York City the U. S. Realty & Improvement Co. is using a simple gantry frame to support the hammer for driving the sheetpiling along the side of the main trench. The gantry originally used was made up of 4x4-in. timber, as shown in the left-hand sketch herewith. It was a short frame or tower adapted to run on wheels to move it along the trench, the sheetpile hammer being suspended through a chain block from a fixed hook in the top of the top of the frame. After this had been in use a short time a different type of frame, of steel construction, was built. This is shown by the right-hand sketch. Here the hammer is suspended from a trolley running on a longitudinal I-beam which forms the cap of two triangular bents; the frame is not mounted on wheels, but remains in place while the driver is moved along the 16- or 17-ft. length of beam. When this length has been covered the whole frame is picked up and shifted ahead.

The sketch shows the construction of both frames quite clearly and the manner of using them will be apparent. R. K. Smith, superintendent for the contractor on this job, supplied sketches of these rigs.



Gantry Frames for Supporting Sheetpile Hammer

Steel Bridgework in a Severe Fire

A graphic reminder of how destructive is the action of intense fire on structural steelwork is furnished by some views of wreckage of the Central Viaduct and the Nickel Plate railway viaduct at Cleveland. These two viaducts were wrecked on May 25, 1914, by a fire in a lumber yard beneath. A description of the fire and the damage done to the viaducts was published in Engineering News, June 4, 1914, p. 1269, in an article by C. E. Drayer.

Fig. 1 shows a crumpled leg of tower 29-30 of the Central Viaduct. This was pulled out of the ground by the wrecking gang after the iron which had fallen on top of it had been cleared away. Its appearance tends to support the theory that an overheated tower leg initiated the collapse of the viaduct.

Fig. 2 is a view on the deck of the Nickel Plate Viaduct at tower 5. Here the heat was at its greatest intensity. The extreme distortion of girders and bracing shows strikingly.

NOTES

A New Pile Formula which takes into account the relation between the weight of the pile and of the pile hammer, has recently been adopted by R. A. Cummings, Pittsburgh, Penn., in some concrete-pile work in Pitsburgh. The formula is purely empirical and is a development of the "Engineering News" formula, substituting the ratio between weight of pile and weight of hammer for unity in the denominator of that formula. The Cummings formula thus stands:

$$P = \frac{2\,Wh}{s\left(1 + \frac{w}{W}\right)}$$

where

P = Safe load in lb.;
W = Weight of hammer in lb.;
h = Drop of hammer in ft.;
s = Final penetration in in.;
w = Weight of pile in lb.

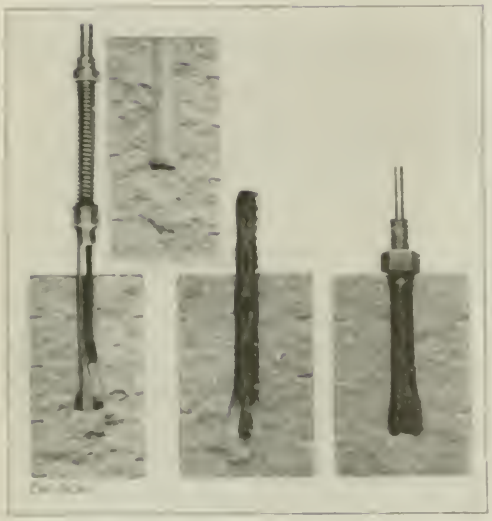
Fig. 1. Tower Leg of Central Viaduct

Fig. 2. Deck of Nickel Plate Viaduct

Effects of Fire on Steel Bridgework

(Photographs by G. H. Tinker, Bridge Engineer, N. Y. C. & St. L. Ry.)

Chambering Tool for Anchor-Bolt Holes [illegible]



CHAMBERING TOOL INVENTED BY A. [illegible]

[illegible]

A Record in Precise Leveling—[illegible]

[illegible] level, which is described in detail as Appendix 3 of the Report of the Coast & Geodetic Survey for [illegible]

[illegible] Assistant J. B. [illegible] Its total length of single line was 242 mi. [illegible] F. W. [illegible] Coast & Geodetic Survey.]

The Need of Heavier Pavement Foundations—I think on the streets that will be subjected to the heavy traffic, it will undoubtedly be necessary in the future, if motor trucks are to be continued with heavy loads, as they undoubtedly will, to lay heavier foundations on streets that will be subjected to that traffic. [illegible] certain streets assigned for those heavy trucks. I do not think it is fair to [illegible] or the property owners to be compelled to lay pavements with a strength sufficient to hold up those heavy loads. I was surprised to find [illegible] that even under the heaviest traffic conditions, they did not use more than 6 in. of concrete foundations [illegible] the heavy traffic streets [illegible]. If we are going to have these enormous loads, as we undoubtedly are, some special provisions must be made for them.—George W. Tillson, Consulting Engineer of the Borough of Brooklyn, New York City, in a discussion before the [illegible] May 16, 1914.

Automobile Attachment for Opening Water-Main Valves—There has been a demand for the [illegible] of water-main valves in [illegible] could be [illegible] by hand. One of the first [illegible] for this service, designed to be attached to one of the rear wheels of a motor vehicle, was shown in "Engineering News," Feb. [illegible], 1914. A different arrangement is shown in the accompanying figure. It was devised by G. H. [illegible], Superintendent of Distribution, [illegible] Water Department, and built by the White Co., of Cleveland, Ohio, to be used on an [illegible] supplied by them to the City of Boston. A [illegible] with vertical [illegible] connected to a universal joint, to a [illegible] valve operated from the main transmission shaft. [illegible] is used for closing the valve and reverse motion for opening. Control is by a special lever on the

AUTOMOBILE ATTACHMENT FOR OPENING STREET MAIN VALVES

[illegible]

*See "Engineering News," [illegible]

Editorials

Evil of Exempting Municipal Utilities from Commission Regulation

We have referred in these columns at various times to the need of placing municipally owned utilities on the same basis as privately owned plants under the supervision of public-utility commissions. One of the latest illustrations of economic loss from duplication of plants, is seen underlying the recent decision of the New York Commission for the Second District, granting the village of Bath authority to construct a municipal electric-light plant. The application to the commission was opposed by the local company, but the report of the commission shows that the authority of the commission was needed only when the village plant should do other than purely public business. The work of constructing the plant had been largely completed and all the commission could do would be to prevent the town from supplying private customers. But the service of the local company was unsatisfactory and could be made only worse without the village's business. The commission was faced with the unfortunate alternative of either having a private company for the private consumers and a public utility for the public load, with inferior service to both, or allowing the municipality to take on the private customers and compel it to give them good service. Had the commission full jurisdiction over the municipal plant from the start, it would have prevented the duplication of work and compelled the private company to give adequate service. The commission recommended that the town purchase the plant of the private company, but the temper of the people is not such as to make that outcome probable.

A Superficially Fireproof Pier

The Philadelphia & Reading Ry. pier fire at Philadelphia, described on another page in this issue, is the fifth destructive pier fire of the year. Already during 1914 the ports of Seattle and Portland on the Pacific, and Glasgow and Portsmouth in Great Britain have suffered considerable loss from the burning up of the structure and contents of wharves. The inflammable contents of the usual warehouse pier, the wide open spaces and the difficulties in fire-fighting, all seem to join together to make particularly destructive any fire which gets a fair start. The four previous fires were in structures which laid no especial claim to being fireproof, so they made particularly good texts from which to preach the necessity for a fireproof construction in all pier and harbor work. The lesson from the Philadelphia fire is somewhat different.

To the untrained eye the Philadelphia pier appeared to be fireproof. It was of steel structure and it had a concrete facade showing from the street. In reality in the condition in which it was last week it was anything but fireproof. The surrounding of the steel columns by concrete had not reached above the floor, and the steel and concrete shell was made practically useless as fireproofing by the presence of a wooden interior balcony and an inflammable, or at least burnable, roof. Finally, there did not appear to have been any attempt to install a sprinkler system of protection.

The fire emphasized the fact that a fireproof building is not a building in which some of the units or members are fire-resisting. It is rather a well designed whole, consisting of individual fire-resisting members so placed as to make extremely difficult the starting of a fire, so built as to succumb but slowly to the attacks of the fire once started, and so protected as to put out the beginning at least of any fire which may evade the first line of protection in arrangement and construction.

The Philadelphia pier was not complete, so any criticism of its construction must be withheld. It should be widely recognized, however, that the building was not a fireproof building in any sense of the word and that its destruction by the fire is no reflection on fireproof buildings or on the quality of concrete and properly protected steel in fireproof structures.

Elevator Gate Accidents in New York City

In remarking, in our issue of Oct. 15, upon the grave dangers to life and limb that lurk at unguarded elevator entrances, we called attention to the multitude of very obvious examples in New York City. This has been strikingly confirmed by figures secured by the Department of Buildings for Rudolph P. Miller, Engineer in Charge of Building-Code Revision for the Board of Aldermen. In the five years 1907-1911, for which records were available, there were 207 fatal accidents—119 on passenger elevators and 88 on freight lifts. Of these, 80% were at shaftings and were preventable. These preventable accidents are well distributed—three in private houses, 19 in apartments, 12 in hotels and clubs, 30 in office buildings, 8 in stores and 23 in factories or lofts. Looked at from another angle, 36 were in buildings six stories high or less; 39 were in buildings of seven to twelve stories, and 20 were where the height was over twenty stories. These are accidents in which fatalities occurred and are not the actual number of deaths, which is somewhat larger. If the same ratios of death to injury prevail here as throughout the country, there were probably nearly two times as many persons injured as were killed.

This situation we should note, however, is one that is being heeded by the present city administration. If the efforts now underway are successfully completed, New York should become a great model of safety in this regard instead of the notorious example of danger.

In the revision of the building code, under the direction of Mr. Miller, it is aimed to incorporate provisions requiring the interlocking of elevator cars and shaft doors so that no shaft gate or door can be opened until the elevator has come to stop at the landing and so that the

car cannot be moved when the door is open. There are some 10,000 elevators in Manhattan alone, with about 100,000 openings. It is planned to spread the required installation of safety interlocks from Jan. 1, 1915, to Apr. 1, 1917, high-lift and high-speed elevators being attended to first.

As proposed up to the present, the use of safety gates inside the cars is not to be made a part of the statute, but is to be covered by rules and regulations of the superintendents of buildings. The most rigid requirements are directed against elevators used for the carrying of persons other than those necessary for safe operation; this includes the majority of so-called freight elevators in the city.

The code provisions, however, as proposed, will go even further. Before the elevators can be installed, erected or altered they must be inspected and licensed. It is also proposed to have them inspected at least once in each three months though, to prevent duplicated effort and to lessen the burden of cost to the city, the certificates of inspection by casualty insurance companies are to be accepted in lieu city inspection. The operator must be competent, experienced and licensed. All accidents are to be promptly reported to the superintendent of buildings, with penalties for failure.

Government Operations at the Panama Canal

Engineers who visited the Panama Canal during its construction were particularly impressed by the fact that the United States, through its engineers, was not only carrying on the actual work of digging the canal by the direct employment of labor without the intervention of any contractor, and was carrying on the civil government of the Canal Zone, but was also carrying on practically all the commercial work required for the supply of the Zone's population.

The commissary stores where the canal employees bought their food, clothing and other supplies were conducted by the army quartermasters and effected an enormous saving to the employees over what would have been necessary had the private enterprise of the Republic of Panama been the sole reliance for supplying the workmen's needs.

Now that the canal has been completed and put into operation, however, it has been found to be necessary that the United States shall continue this work for the benefit of the vessels making use of the canal, as well as for the permanent population of the Zone. Thus, at Panama, the United States is not only operating its canal for the use of the world's shipping, but is keeping store, keeping hotel, running laundries, ice plants, coal depots, oil depots, machine shops and various other commercial enterprises. The government buys coal from the fields of Virginia and West Virginia, transports it to the Isthmus, and sells it at Cristobal at from $5.[illegible] to $5.90 per ton, according to the manner in which it is delivered to the ships, whether from a lighter or alongside the wharf. At Balboa, on the Pacific side of the Isthmus, the price is $1 per ton higher, which is stated to be on account of the cost of transportation of the coal across the Isthmus. This would be at the rate of 2c. per ton per mile for the 50-mile haul—a very liberal figure for transportation cost. Probably this high differential is fixed so that ships passing through the canal will take their supply at Cristobal instead of Balboa, but it brings the coal to rather a high figure for vessels sailing north or south on the Pacific and putting into Balboa for coal without passing through the canal.

Vessels desiring fuel oil can get it at Balboa at present from the Union Oil Co. at $1.30 per barrel, but the government itself will handle the business as soon as its oil-handling plant is completed in January next.

The commissary department of the Panama Canal is now supplying regularly most of the food and wearing apparel used by a population of 50,000 people. These commissary stores are available for the use of ships passing through the canal. The prices charged are generally lower than retail prices in the United States. A large stock of fresh meat, vegetables, fruits, canned groceries, etc., is always kept on hand; and by making advance arrangements, ships can obtain supplies of any article obtainable in the markets of the world. The government laundries are equipped to handle the entire laundry work of a ship in one day's time, so that by forwarding the laundry work by rail from one terminal of the canal to the opposite terminal as soon as the ship arrives in port, the laundry will be ready by the time the ship is ready to clear from the opposite end. The canal repair shops are equipped to do any sort of ship-repair work, and the permanent dry dock, now under construction at Balboa, is large enough to take any vessel that can pass through the canal. Prices of repair work are made on the basis of actual cost plus a percentage to cover overhead expenses.

This remarkable development at Panama, by which the government has undertaken the carrying on of industries and commerce on a large scale which are commonly carried on by private enterprise, has been found to be necessary at Panama to the business-like operation of the canal.

The United States has invested nearly $400,000,000 in a great transportation enterprise. In order to earn as much income as possible on this huge investment, it is necessary that the canal should be made as attractive as possible to the world's shipping. The ability to procure supplies, fuel and repairs for shipping at a reasonable price and to be sure of good service will be as important a factor in encouraging traffic to pass through the canal in preference to other possible routes as will be the safety of transit through the canal and the maintenance of toll rates at moderate figures.

It would, of course, have been possible for the government to have left wholly to private enterprise the care of vessels of fuel, food, water, ice, laundry service and other essentials; but in this limited field it would have been doubtless but a short time before one concern would have secured a monopoly in these respective fields, and it would then have been necessary for the government to undertake the difficult work of regulating prices. It would have involved serious difficulties in dealing with merchants of various nationalities, and the regulation of the character of service rendered in the repair shops, for example, would have been as necessary as the regulation of prices.

This remarkable entrance of the government into the field of commerce and industry at Panama, therefore, has been undertaken as a matter of logical necessity. It is particularly noteworthy that it has been undertaken with

out a hint of public criticism in the United States. The remarkable efficiency attained by Colonel Goethals and his associates in carrying on the canal work has in fact disarmed all criticism. We believe it is an aspect of the engineering work at Panama which deserves even more notice than it has received, and one in which the profession as a whole may take just pride.

Licensing Engineers in Pennsylvania

As reported in our last week's issue, the storm center of agitation concerning state legislation to restrict the practice of engineering appears to have removed from New York to Pennsylvania. A state commission of engineers was appointed by the Governor of Pennsylvania a year ago to consider the question whether state legislation regulating the practice of engineering was advisable in the public interest and this Commission is holding hearings in various cities. It may be of interest at this time briefly to review the agitation of this question in New York and elsewhere, and to indicate the present status of the movement.

In the Western States, legislation to restrict engineering practice has been under discussion for several years in the state engineering societies. A large proportion of the members of these state societies are chiefly interested in land-surveying work; and many of them have been impressed with the poor quality of the work done by many of the men who engage in land surveying and the laying out of drainage and irrigation ditches.

Many who have given careful study to this subject and who oppose any project to subject the entire engineering profession to a license law have freely recognized that there is something to be said for the proposal to subject engineers engaged in some specific branch of work, such as land surveying, to examination and registration. Those who employ surveyors to run farm boundaries, lay out drainage and irrigation ditches, etc., are not well qualified to determine whether a man is or is not competent to perform his work. There is, therefore, some reason for the state stepping in and requiring that those engaging in such tasks should have some minimum degree of qualification for their work. It is, moreover, practicable to determine the qualifications of men to engage in such work as surveying, which requires only a comparatively elementary knowledge of engineering and no very long period of practical experience.

The strongest impetus toward state legislation on this subject, however, came from an organization of engineering employees in New York known as the Technical League. The members of this organization were impressed with the idea that their positions might be bettered and their chances for promotion increased by restricting the practice of engineering to those having a certain minimum degree of education and experience. This organization employed counsel and had bills drafted and introduced in the New York Legislature. These bills, however, related to civil-engineering work solely. As the news went abroad of the introduction of these bills in the legislature, there was a general movement among the engineers of New York to protest against their enactment. Year after year delegations of engineers, including some of the most eminent men in the profession, went to Albany and appeared before the committee in charge of these bills to point out the injury that would result from their enactment. In every case these delegations were successful in having the bills killed by the committee. Not one was ever reported to the legislature.

There were, however, a certain number of engineers who felt that some legislation to regulate the practice of engineering, framed on proper lines, might be desirable There was a larger number who, while they believed that any such legislation would be injurious, felt nevertheless that the pressure to enact such laws would prove in the end too strong to be resisted and that it was better therefore to undertake to frame a bill which would do as little injury as possible.

The first move in this direction was made by the American Society of Civil Engineers. At the annual meeting of this Society, in January, 1911, the members present by almost a unanimous vote, declared that any legislation restricting the practice of engineering was inadvisable. The meeting also, however, adopted the report of a committee of the society's Board of Direction containing a draft of a proposed model engineer's license law which required the licensing not merely of civil engineers but of every man who should undertake to practice professionally any branch of engineering whatsoever, outside of military engineering.

No progress was made, however, in New York or elsewhere toward the enactment of such a law, and in the New York legislature of 1911, 1912 and 1913 bills introduced for this purpose were killed in Committee.

There was organized, in 1913, a joint committee, made up of representatives from each of five of the national engineering societies, for the purpose of investigating the question of state legislation with reference to the practice of enginering, and determining whether an unobjectionable act could be drafted.

Radical differences of opinion developed in the committee as the work proceeded; and notwithstanding more or less mutual concessions, no final agreement on a completed report was ever reached. The principal work in connection with the committee was done by its chairman, the late Alfred Noble. After Mr. Noble's death, the whole matter was dropped.

Meanwhile, however, the changed situation in New York put quite a different face upon the movement to draft a model bill. It had been urged that the joint committee above referred to should complete its work in 1913 so that its bill might be ready for the legislature of 1914, to prevent the enactment of some bill of more injurious character. It developed, however, that the legislature of 1914 took no interest in the project to legislate on engineering practice. No bill on the subject was introduced in the legislature, and apparently the organization which had been so industrious in preparing and pushing bills in previous years had disappeared or had ceased to be active.

While the bill drafted by the joint committee above referred to was supposed to be in theory a model bill applicable to the conditions in any state, it was actually drafted with the conditions existing in New York as the controlling motive.

A copy of this bill was, however, placed in the hands of the Pennsylvania commission above referred to; and this commission, in order to draw discussion from the engineers of the state and have something tangible on which to base discussion, took this bill, redrafted it on

somewhat different form, had it further revised by the bill-drafting experts employed by the State of Pennsylvania, and circulated it among the engineers of that state to obtain their opinions.

The result has been an expression of sentiment from leaders of the profession throughout Pennsylvania, which is, we understand, overwhelmingly against the proposed bill and for the most part against any legislation whatever restricting the practice of engineering. We printed in our last issue a statement by a committee of Philadelphia members of the American Society of Civil Engineers, headed by Prof. Edgar Marburg, giving in detail the reasons why such legislation is opposed.

Space does not permit us to print the numerous other strong letters and statements made by prominent engineers and by committees representing engineering societies in Pennsylvania. These statements, however, will doubtless be printed in full in the report of the Pennsylvania Commission, when that is made up.

The work of this Commission, therefore, will be exceedingly useful. It will doubtless again and again be necessary, in various states, for representative engineers to oppose legislation which seeks to hamper the profession with impracticable restrictions. Again and again in the past the question has arisen, where could a systematic presentation of the arguments against such legislation be found? It will be of great benefit to the profession to have the proceedings of the Pennsylvania State Commission and the testimony before it printed and made available for the use of engineers in other states.

As to the general question of the advantage or disadvantage of legislation restricting the practice of engineering, this has been so fully discussed editorially in past volumes of this journal that it seems unnecessary to take further space at this time. However, it may be said that any attempt to draft a blanket law which will cover the entire work of the engineering profession will result in an unworkable scheme which would break down of its own weight, if it were placed on the statute book. If the practice of engineering is to be regulated by law it must be done by specifying some distinct branch of engineering work, which can be defined in the law, and for which the competency of an engineer can be determined.

In most departments of engineering work, however, it is wholly impracticable to safeguard the public by conducting state examinations of the engineers engaged in it. It is, for example, highly desirable that the public should be guarded from such disasters as boiler explosions. It would be impossible, however, to examine every engineer in the state who might design or construct a steam boiler, and determine his competency for the work, nor could such an examination reach the engineers designing and building boilers elsewhere for sale within the state. The only way the state can secure safe boilers within its borders is to pass such a law as that now being drafted by a committee of the American Society of Mechanical Engineers, specifying how boilers must be designed and built, operated and inspected.

Letters to the Editor

A Vagrant Steam Shovel

Sir—On a recent morning, while walking down Division St. near Ashland Ave., Chicago, I saw a steam shovel trying to cross Division St. The man operating the steam shovel ran the shovel right into a live trolley wire, which burnt off and fell sizzling and spitting to the street. Without losing any time, a helper grabbed a long pole, something like a clothesline pole, and held up the other trolley wire so that the steam shovel could go under it.

Lifting a Trolley Wire Out of Reach of Steam Shovel Boom in a Chicago Street

The whole thing was rather a nervy operation. In the first place the steam shovel ran into the trolley wire without any care at all, just as though no trolley wire was there. In the second place the way that fellow held up the trolley wire with the clothespole and let the steam shovel go under with not more than 2 in. clearance, was rather daring. If the steam shovel had caught the wire it would have burned off and dropped off right near him, and had it touched him it would have put him out of business. I got my camera out of my suitcase and snapped some views, one of which is shown herewith. When the steam shovel was out from under the second or northerly trolley wire it went up the street.

The one thing that impressed me more than anything else was the rank disregard these steam-shovel operators have for the trolley wires. There ought to be a severe penalty for such careless work.

R. A.

Chicago, Ill., Oct. 15, 1914.

Snow Removal by Artificial Heat

Sir—The method of removing snow by artificial heat suggested in the issue of the Engineering News of Oct. 1, 1914, by Samuel Whinery, is timely and novel, but it

seems to me the same results could be accomplished more readily by the use of direct heat and at much less cost per cubic yard.

Having given a little thought to this subject, I suggest the use of a kind of inverted muffle, mounted on wheels very similar to the apparatus which is used for local heating in making repairs to asphalt pavements. On the muffle could be mounted a tank for fuel oil, and an oil-driven pump could also be mounted on the truck for putting pressure on the tank.

With oil as fuel and directly applied heat, it is probable that 80% of the heat would be available, hence using Mr. Whinery's figures, 1600 B.t.u. would be sufficient to melt 1 cu.ft. of snow, or 13,550,000 B.t.u. would melt 317 cu.yd. At 19,000 B.t.u. per lb., there would be required 713 lb. of fuel, or about 96 gal., which, say, at 5c. per gal., would cost $4.80.

Now, as such a machine would probably be too large for a man to handle efficiently, suppose we consider one of twice that capacity drawn by a single horse; and further, suppose that such an apparatus would cost the same as the boiler, pump, etc., mentioned by Mr. Whinery, viz., $1300; then the cost per cu.yd. would figure out about as follows:

Fixed charges per day	$29.58
Fuel, 192 gal. at 5c. (delivered)	9.60
Driver and horse	6.00
Stoker or engineer	3.00
Laborer or trimmer	2.50
Miscellaneous	2.00
	$52.68

If 634 cu.ft. of snow were melted, the cost per cu.yd. would be	8.30c.
To cover contingencies, add 10%	.83c.
	9.13c.

Or, if we consider the heat efficiency at ⅝ as Mr. Whinery did, the cost would be 8.42 c. per cu.yd.

Of course, the idea might easily be expanded to a number of large machines drawn by a traction engine, or a number of large units each operated by oil or gas engines.

E. L. Broome, Mechanical Engineer.
General Reduction, Gas and By-Products Co.
49 Wall St., New York City, Oct. 21, 1914.

NOTES AND QUERIES

In the article entitled "Pipe Laying Methods on the Narrows Siphon of the Catskill Aqueduct," "Engineering News," Oct. 22, 1914, p. 812, mention was not made of the fact that Long & Miller, 172 Fulton St., New York City, are Consulting Engineers for the contractor, the Merritt-Chapman Derrick & Wrecking Co.

Building Levees with the Hydraulic Dredge

By Jean M. Allen*

In view of the large amount of levee work now contemplated and under construction, and the low cost claimed for the hydraulic fill system, a description of plant and methods used in building levees with hydraulic dredges may be of interest.†

*Consulting engineer, 1139 First National Bank Building, Chicago.

†A previous article on work of this character, by D. C. Yarnell, was published in "Engineering News," June 11, 1914. —Editor.

Discharge Pipe with Bottom Openings

Sand or gravel dredged by the hydraulic process is not carried entirely in suspension by the water in the discharge pipe, but the heavier material settles and flows along the bottom at a velocity much lower than the impelling water. This is specially true if the pipe line is long or the velocity of the discharge water is low. This action can be utilized to build embankments of as steep a slope as 1 on 1, directly from the discharge pipe.

This is accomplished by what are called "shutter pipes," which are lengths of ordinary slip-joint discharge pipe, generally made of No. 10 to 14 sheet steel and in lengths of from 16 to 18 ft., with openings in the bottom, as shown in Fig. 1. These openings are controlled by steel plates or shutters and may be opened or closed at will. A stretch of these pipes is laid on a trestle and the discharge pipe from the dredge is connected to them. When the shutters are opened the sand flows at about the consistency of thick mortar, building up into a steep embankment.

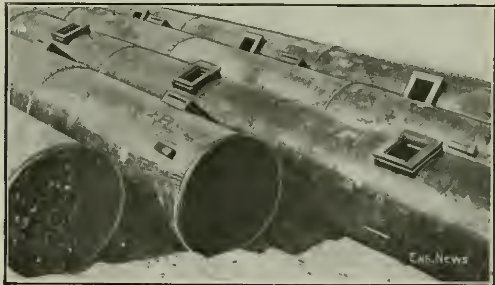


Fig. 1. 20-In. Shore Pipes for Hydraulic Dredge, with Bottom Discharge Openings for Building Levees

The discharge pipe is continued beyond the shutter pipe in order to carry away the surplus water and avoid washing down the levee which has been built. Fig. 2 shows this work and Fig. 3 shows a shutter for a 14-in. pipe. The shutters should be spaced 3 to 4 ft. apart, and should be attached to the pipe with chain or wire, otherwise many will be dropped into the fill and lost.

Dredging Plant for Levees

Many sizes and types of dredges have been used, with discharge pipes 12 to 20 in. diameter, and the cost of the complete plant is from $15,000 to $100,000. Both steam and electrically driven dredges are being used. Some have revolving cutters or water jets to disintegrate the material, but many have neither apparatus. This depends on the compactness of the material to be excavated. In general, any attempt to economize in first cost at the expense of construction or equipment of the dredge will be paid for dearly in subsequent breakdowns and loss of time.

California Dredges—Two powerful and efficient dredges for this class of work on the Sacramento River, are identical except that the "Natoma" is driven by steam and the "West Sacramento" by electricity. Both are built entirely of steel, having hulls 104x35x9 ft. The structural-steel ladder carrying the suction pipe is 50 ft. long, and is equipped with a rotary cutter.

Fig. 2. Dredge Discharge Pipes with Bottom Openings, and Fill Made in This Way for a Levee

The dredging pumps have 20-in. suction and discharge openings and are of nickel-chrome steel. The "Natoma" has a 74-in. runner, driven at 190 r.p.m. by a triple-expansion engine of about 600 hp. Steam at 160 lb. pressure is furnished by two water-tube boilers having a total heating surface of 1500 sq.ft. A double-cylinder 10x12-in. engine drives the cutter, and the winding machinery which handles the spuds and ladder and swings the dredge is operated by a double-cylinder [illegible]-in. engine. A surface condenser receives the exhaust steam from all engines.

The 20-in. pump of the "West Sacramento" has a 50-in. runner and is driven by a 750-hp. motor whose speed may be varied between 300 and 350 r.p.m. The winding machinery has a 75-hp. motor, and the cutter a 150-hp. motor. Three-phase, 60-cycle, alternating current, at 13,000 volts, is brought aboard by a submarine cable and stepped down to 2300 volts.

The cost of the "Natoma" was $[illegible], including [illegible] feet of [illegible] pipe, and the cost of the "West Sacramento" was $[illegible]. The former has deposited several million yards at an average cost of [illegible]c. per cu.yd. After the work was thoroughly organized the average monthly output was about [illegible] cu.yd. per month, and [illegible] for one month [illegible] cu.yd. The dredge was operated 24 hr. a day and 6 days a week, with [illegible] men per shift on the dredge and about 10 men per shift to handle the pipe line.

Mississippi and Missouri River Dredges.—On these rivers, [illegible] and [illegible]-in. dredges are used. The [illegible] to the reluctance of the contractor to build an expensive plant for the small yardage in the contracts offered. Larger machines will hardly be built until projects of greater magnitude are brought forward or unless a great amount of filling is to be done in connection with the levee work.

For a 12-in. dredge, a hull about 80x24x4½ ft. is ample, as the character of the material does not require rotary cutters or heavy suction ladders. The pump is generally belt driven. The ordinary sand and gravel pump of cast-iron construction is not satisfactory, as the abrasive character of the river sand wears cast-iron pump parts with great rapidity; and with pumps having renewable liners there is loss of time in keeping the liners in place and renewing them. The best pump for this kind of dredging is of special design and massive construction, with the shell and runner made of manganese or other special steel. While its first cost is greater, it effects a great saving of operating time, thus increasing the output.

A steam-driven dredge with 12-in. pump should have an engine of 150 to 250 hp. The power for any particular installation is a matter for calculation, taking into consideration the height of discharge, length of line, number of elbows, etc.; also the character of the material to be pumped, which determines the requisite velocity of the water in the discharge pipe. The transmission may be either a leather or a rubber belt or a rope drive, the latter having been found very satisfactory for this duty.

The boilers should be of the externally fired type with large mud drums, both the cylindrical and the Mississippi River types being in general use. The locomotive boiler is not particularly adapted to this work on account of the general turbidity of the feed water. Even boilers of the river type with large mud drums, and frequently blown down, must be washed out every few days. Few of

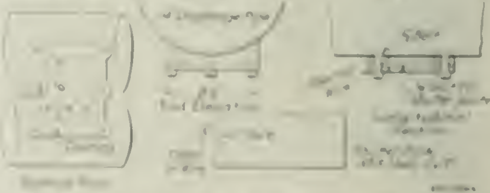


Fig. 3. Bottom Discharge Gates for Suction Pipes of Hydraulic Dredges

these dredges have been equipped with surface condensers, but their use would result in a large saving of time in boiler washing and repairs.

These dredges, working in swift rivers, are held in position by anchors and cables rather than spuds, and [illegible] [illegible] little [illegible] [illegible] to maintain an adequate

supply of sand to the suction pipe. The current keeps the bottom of the river constantly in motion and the material excavated is rapidly replaced by this movement. Instances are common where dredges have pumped for weeks without moving the suction pipe. Thus little winding machinery is required. A double-cylinder single-drum hoist of about 20 hp. is used to raise and lower the suction pipe while the dredge is maneuvered by taking the anchor cables to the winch heads.

The total cost of a 12-in. plant, complete with pipe line, is between $15,000 and $25,000, depending upon the class of machinery and the refinement of construction. Between 25,000 and 50,000 cu.yd. per month would be the probable output, depending upon the length of the pipe line, the layout of the work, river conditions and the skill of the operators.

The dredge with 15-in. pump is built along the same lines as the 12-in., though frequently the pump is directly connected rather than belt driven. In either case, the engine should be compound, to save fuel. Between 250 and 300 hp. is required for a plant of this size, depending upon the conditions mentioned. An efficient engine for medium power is a cross-compound of either the horizontal or marine type. The boilers should have about 2500 sq.ft. of heating surface. If surface condensers are installed, water-tube boilers may be used, otherwise the Mississippi River type is to be preferred. A donkey boiler should be provided for washing the main battery. A hoisting engine handles the suction pipe, but it is desirable to have a deck capstan with independent engines for handling the boat.

The suction pipe is articulated at the end of the dredge either by a swivel elbow or merely by a length of suction hose, and is raised and lowered by tackle suspended from an A-frame over the bow. Its lower end is provided with a suction nozzle, consisting of a cone-shaped head with cross-bars to prevent the entrance of large stones and pieces of wood that would clog the pump. The hull will be about 110x30x5 ft. The 15-in. dredge, complete with all equipment, will cost between $25,000 and $45,000 and its output will be from 60,000 to 125,000 cu.yd. per month. To attain the latter figure, the conditions must be very favorable and the dredge must be operated continuously (24 hr. a day) and with very few delays.

Levee Construction with Dredge

The maximum monthly output of which a dredge is capable is rarely attained in levee work, on account of the large percentage of time lost in shifting pipe, and it is of great importance that experienced men be employed, to reduce this loss to a minimum. As the shutter pipes have to be shifted ahead as each section of the levee is completed, it is advisable to so plan the work that operations can be conducted on two sections simultaneously. The main discharge pipe is provided with a Y-branch and gate valves so that the filling can progress on each section alternately, thus reducing the idle time of the dredge. If this is not possible, sometimes the levee is brought up to the full height but not to full width at the first operation, and then widened with the branch line while extending the main line.

Some contractors use a discharge pipe of larger size than the pump and suction; for instance, an 18-in. discharge pipe for a 15-in. pump, with 15-in. suction pipe. The purpose is to save power by reducing the velocity of water in the line and thus the friction head pumped against. But it is the velocity rather than the quantity of the water that is instrumental in keeping in suspension and transporting such heavy material as coarse sand and gravel. Enlarging the discharge pipe reduces the velocity and causes the sand to settle until the cross-section is reduced and the velocity thus increased to a point where it will again carry the material.

It is better practice to use a discharge pipe of the same size as the pump as far as it connects with the shutter pipe. There it may be enlarged, as it is desired that the sand should settle so that it may be discharged through the shutters. In a high-powered 20-in. dredge on the New York Barge Canal, difficulty was experienced in pumping gravel and small boulders through a long 20-in. discharge line, but upon replacing this with a 16-in. line the material was discharged with ease and the output greatly increased.

Shields or slope-boards, consisting of plates of No. 16 steel about 10 ft. long and 18 in. wide, are frequently used to facilitate the formation of the desired slope. A number of these are inserted, end to end, in the partly formed slope. They prevent the sand from flowing downward until it fills to the top of the plates, when they are pulled out and moved further up the slope.

The hydraulic construction of levees requires considerable skill. The suction-pipe operator must keep a steady and uniform flow of sand in the discharge pipe, and the pipe men must use judgment in opening and closing the shutters to build the embankment to the proper slope; closing some of them if the percentage of sand in the pipe decreases and opening enough of them to discharge water if the slopes need to be flattened out. The handling of the slope boards also requires practice. With a good reliable plant, properly designed to meet local conditions, some remarkable results have been obtained, not only in the low cost per yard but in the character and appearance of the fill.

The operating costs given in the accompanying table are typical for a 15-in. dredge on the Mississippi River,

MONTHLY OPERATING COST—15-IN. HYDRAULIC DREDGE

1 foreman	$150
1 engineman	125
1 engineman	100
2 suction operators, at $100	200
2 oilers, at $60	120
2 firemen, at $70	140
2 coal passers, at $60	120
3 deck hands, at $60	180
1 levee foreman (day)	90
1 levee foreman (night)	70
10 levee laborers, at $60	600
26 Total labor cost per month	$1895
Coal (18 tons per day)	1200
Supplies (rope, oil, packing)	150
Repairs and renewals	200
Office and overhead expenses	200
Insurance (fire and liability)	100
Interest and depreciation (2% on $35,000)	700
Total operating cost per month	$4445

working two 12-hr. shifts. The wages given do not include subsistence. Assuming an output of 75,000 yd. per month the cost is about 6c. per yd.

Division Engineers of the New York State Highway Department have been directed in submitting estimates for construction to include hereafter an approximation of the number of working days required to complete each contract. This, it is expected will enable the Highway Department to specify time limits on contracts more accurately, as the local engineers who work up the field notes are unquestionably in a better position to weigh carefully the elements which enter into the building of a piece of road than the office force are.

Failure of a Basement Retaining Wall During Construction

By Henry Blood*

On Oct. 7, a portion of the Morrison St. retaining wall of the new Meier & Frank department store, in Portland, Ore., collapsed, causing the street to cave in for a length of 62 ft. and flooding the excavation with water.

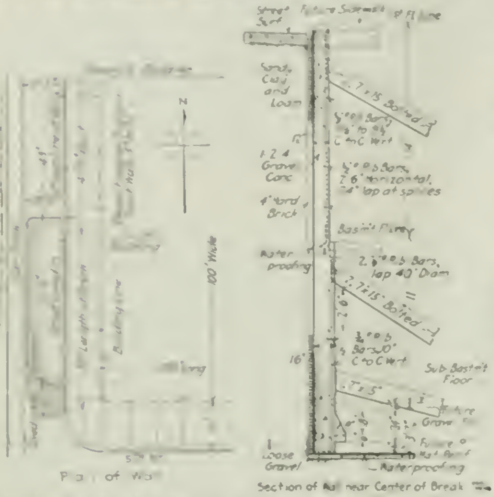


Fig. 1. Plan and Section of Retaining Wall Which Failed at Portland, Ore.

The building is under construction. It will be 100x200 ft. in plan, of steel-frame construction, with reinforced-concrete floor slabs, and will have a basement and sub-basement, both to be used for mercantile purposes. The basement space is 115x224 ft. outside dimensions. The height of the sub-basement is 11 ft., that of the basement is 14 ft. The sub-basement floor is laid directly on the soil, which consists of good gravel. It is to be composed of a 4-in. plain slab laid on the soil, and carefully leveled on top for the waterproofing, a 9-in. reinforced mat on the waterproofing, 2 ft. of gravel fill, and finally 6 in. of concrete with wood sleepers and a wood floor. Only the 4-in. slab on the earth had been laid at the time of the collapse.

The wall was designed as a vertical slab with vertical reinforcing, to be held against the lateral pressure of the street fill by the sub-basement, basement floors, and sidewalk. It varies from 16 in. in thickness below the basement floor to 12 in. at the top, the reinforcing varying as shown in the section through the wall in Fig. 1. The concrete is a 1 : 2 : 4 mix. It was about six weeks old at the bottom and four weeks at the top, at the time of accident. On the outside of the walls there is a layer of waterproofing membrane and 4 in. of hard brick. This may be seen in the view taken from the street (Fig. 4).

The wall is 27 ft. high at the east building line, on Morrison St., 33 ft. at the west end and about 28 ft. at the center of the break. It was braced with three lines of shores, one above the other, spaced about 12 ft. apart horizontally. The upper two rows consist of two 7x15-in. seasoned Douglas-fir sticks, bolted together and well braced laterally. They show clearly in the views in Figs. 2 and 3. The upper end is set into the concrete about an inch, and the lower end firmly held. The center of the upper shores is from 3 to 4 ft. below the top of wall, the middle row hardly half way up the wall. The lower set of braces was made of single 7x15-in. timbers and simply placed to bear against the wall with thin pieces of plank between them and the wall, relying on friction to hold them in place. They are from 4 ft. 9 in. to 5 ft. above the bottom of wall still standing, and inclined at an angle of approximately 15° to the horizontal. It could not be ascertained whether there were any at the point where the break occurred, but the superintendent states that there were.

There is a 6-in. water main and a 20-in. glazed tile sewer

*Bureau of Buildings, City Hall, Portland, Ore.

Fig. 2. Near View from the Inside, Showing Bracing and the Bottom of Wall Which Failed

Fig. 3. View Taken Day after Failure, Showing Broken Wall at Bottom

on this side of the street. The sewer is about 11 ft. below the street opposite the break.

The inspector for the architects stated that the wall had moved in $1\frac{1}{2}$ to 2 in. at the point of failure about Sept. 18. The pavement began to settle slightly, and readings were taken by the Department of Public Works on the 25th and 28th, showing a maximum settlement of

Fig. 4. Looking Alongside Morrison St. after Collapse

(Brick outside facing of concrete wall on right; sewer trench cut on left.)

$1\frac{3}{4}$ in. Later it was reported that the sewer was leaking, and a crew was sent on Oct. 2 to uncover and repair it. A trench was made close to the outer rail of the car track, as the sewer lies in this position. It was found that a settlement of about 9 in. had occurred at the worst point. The trench had not been refilled and its vertical side may be seen in Fig. 4.

Water coming over the wall, according to the superintendent's statement, and cracks opening in its lower portion, gave the workmen sufficient warning to escape. An irregular piece of wall about 55 ft. long and 17 ft. high at the highest point was torn loose and forced inward, the movement beginning at the bottom of the wall (Fig. 3); it lay on a heap of earth and timber with the bottom edge about 20 ft. from the wall. The reinforcing rods pulled out where they were lapped at the basement-floor line, and large cracks were formed in the surrounding wall. The street caved in from the wall to nearer car track for a length of 62 ft., beginning 43 ft. from the west end of building, leaving a deep hole. The pavement dropped in for 51 ft. 6 in. (Fig. 4). Before the water main could be shut off it had let 2 ft. of water into the excavation. Car service in front of the site had to be discontinued, and cannot be resumed for some time yet.

At the time of accident no floor framing or any steelwork was in place; the sub-basement floor, gravel fill, and 9-in. mat had not been placed; and the wall simply stood on the waterproofiing, with nothing on the lot side to resist pressure from the street fill except the struts. It can be seen by reference to the wall section that there was no steel to resist stresses due to cantilever action. The wall was not designed for such action; but was entirely safe as a slab for a heavy earth pressure, even at the age it had reached. The concrete was good and steel accurately placed. It will also be noted that there were no horizontal timbers along the wall.

A large portion of the wall will have to be rebuilt. It is quite probable that the entire Morrison St. end will be replaced. The new wall will be made somewhat heavier. It will not be put in until the mat is all in place, and of sufficient age to be used for support. The bottom will then be held with horizontal shores. The bracing will probably be set closer together, and the lower ends will have a firmer seat in the mat than was the case when the accident occurred.

The accompanying photographs were made by the Department of Public Works. In connection with the drawing they illustrate the conditions quite clearly.

The Savings of Electric Traction over steam on the Butte, Anaconda & Pacific Ry. (described in "Engineering News," Aug. 15, 1912, Mar. 19, Apr. 2, and June 2, 1914), were reported at a meeting of the American Institute of Electrical Engineers in Spokane, Sept. 9, 1914, by J. B. Cox. The number of trains had decreased 25% but 35% more tonnage was hauled per train. Repairs had dropped 26% and engine-house expenses 38%. For energy alone \$150,727 was saved. The reduction in trainmen's wages was \$31,146. The total cost of conversion to electric traction was \$1,201,000, making the total savings some 20% on the cost.

A Storm on Lake Michigan, Oct. 24, marooned 11 workmen on the intake crib of the new water-works intake for the city of Milwaukee. They were rescued by a member of the United States Life Saving crew, who swam out to them from a motorboat with a life line. On Apr. 20, 1893, 21 men lost their lives on a water-works crib under construction on the Milwaukee waterfront. Information regarding the recent storm came to us after the note by Mr. Warren printed on p. 897

How Fire Wrecks Unprotected Structural Steel

We briefly described on p. 862 of our last week's issue the burning of a new pier shed of the Philadelphia & Reading Ry. on the Delaware River at Philadelphia on the evening of Oct. 15. The accompanying upper view shows a photograph of the interior of the wrecked pier, looking toward the street, and the lower view shows the reinforced-concrete front from the street side. The lesson has been many times impressed on the engineering profession that steel structural members, unless protected by fireproofing material, are much more vulnerable to the attack of flames than are heavy wooden posts and beams. The wreck of this pier shed is simply another illustration of the same fact.

Below the floor level the pier was a substantial concrete structure with a concrete floor, and the fire left it practically uninjured. The entire steel superstructure, however, was in a very few minutes converted into a mass of tangled scrap exceedingly difficult and expensive to cut up and remove. The work is being accomplished with the aid of oxy-acetylene torches.

The fact that a solid wooden post resists fire far better than bare steel is again well illustrated at one point of this pier where a short wooden post about 10 in. square, used as some temporary support, was in place at the time of the fire. The outside of this post was charred only to the depth of half to three-quarters of an inch, and the balance of the post cross-section was sound and uninjured. As most of our readers are aware, it was this substantial resistance to fire of solid wooden posts and beams which brought the New England factory slow-burning method of construction into being.

While the steel pier shed had been completed and a small amount of freight had been stored on the pier at

Interior and Exterior Views of Burned Philadelphia & Reading R.R. Pier, Philadelphia

the time the fire occurred, the reinforced-concrete front of the pier, facing on Delaware Ave., still lacked a few days' work of completion. At one end, some of the forms were still in place, while the concrete protection of the steelwork at the central arch portal had not yet been poured. This reinforced concrete withstood the exposure in admirable fashion, as may be judged from the accompanying photograph. It is noteworthy also that the row of small windows above the projecting canopy roof framework on the left-hand side, seen in the background in Fig. 2, had been filled with wired glass. This glass had been heated so intensely as to render it opaque, but every pane remained intact throughout the fire.

Difficulties Being Met in Constructing the New Intake Tunnel at Milwaukee

By Lee G. Warren*

In the prosecution of the construction of the Linwood Avenue Intake Tunnel, under Lake Michigan, at Milwaukee, Wis., which was described in Engineering News, June 18, 1914, p. 1364, two recent and very serious collapses of the unlined roof have occurred. This tunnel, which is being built to give an increased water-supply for the city, has a circular cross-section, 12 ft. inside diameter, 15 ft. outside diameter. The lining is reinforced concrete having 1 : 2 : 4 proportion, the reinforcing being ¾-in. round steel bars. The tunnel when completed will have a length of 4000 ft.

Since June 1 of this year, or at Sta. 18+00, the contractor had encountered firm shale, having little difficulty in holding the roof, while advancing the heading on a daily average of 10 ft. But on Sept. 27, the unlined roof collapsed at Sta. 27+95 to 28+04, carrying down four 12x12-in. roof timbers, set at 4-ft. intervals. The hole resulting was 15x9 ft. at the bottom, 7x8 ft. at the top, and 15 ft. high, above the roof timbers. The material coming from the hole consisted of gravel, boulders, saturated clay and disintegrated shale, the quantity of water being very small. None of the workmen was injured, as a preliminary warning was given by the cracking and scaling off from the roof, and the settling of the timbers. The fall was caused, no doubt, by the saturated condition of this pocket and by the consequent overloading of the timbers. The nearest borings, 1100 ft. distant, showed shale at the depth at which the collapse occurred, 38 ft. below the lake bottom. The depth of the lake at this point is 30 ft. The roof timbers were replaced and the hole at the point of collapse was tightly packed with cribbing, after a 36-hr. battle to install them. An examination of the strata of the hole showed 14 ft. and 6 in. of mixed and soft shale, lying in thin layers, above the roof line. The roof of the hole consisted of hardpan, which held its position. Between the hardpan and the shale, there was a water course about 6 in. in depth and extending the width of the tunnel. Water, in a small volume was flowing from both sides parallel to the tunnel axis into the hole from this water course.

On Oct. 12, another roof collapse occurred at Sta. 29+09, bringing down a mixture of gravel, sand, clay, boulders and broken shale. With the fall came a 3-in. stream of water which continued for 2 hr. The same kind of preliminary warnings as given prior to the roof collapse on Sept. 27, were given for this collapse. This hole measured 6 ft. long and 12 ft. wide at the bottom, 3 ft. long and 10 ft. wide at the top and 18 ft. high above the normal timber line. The lower 14 ft. of the hole consisted of mixed and soft shale. Above this shale, there was 1 ft. of hardpan, the hardpan having collapsed after it had become water-soaked and softened. As soon as the collapse occurred, the tunnel was placed under air pressure, which was gradually increased to 26 lb. per sq. in. A pressure of 10 lb. per sq.in. was secured within 2 hr. and 10 min., two compressors operating, the air locks being located at Sta. 0+85. Thirty hours after the pressure was applied the compressors were stopped, the pressure then being 26 lb. per sq.in. Eleven hours after the compressors were stopped, the pressure gage showed 17½ lb. per sq.in., indicating that the tunnel was reasonably air-tight. No one was injured by this fall.

The hole caused by this roof collapse was firmly cribbed after a 30-hr. struggle. The tunnel was entirely released from air pressure 42 hr. after the collapse. Mining and concreting operations were then resumed, light charges being used in blasting.

Orders were issued to the contractor to install a safety bulkhead within 200 ft. of the heading. Plans and preparations have been completed for installing a safety bulkhead composed of 10x10-in. tongue-and-grooved timbers, reinforced with one 20-lb. 6-in. I-beam and two 35-lb. 10-in. I-beams. It will have a 4x6-ft. material door composed of ¾-in. steel and will also have a 3x3-ft. man door composed of ¾-in. steel. The former door will hang on rollers and close by sliding. The latter door will be hinged. The bulkhead will have its outside perimeter resting in a 6-in. groove in the concrete lining. The present air lock will be used in conjunction with the bulkhead.

Joseph Hanreddy & Co., of Chicago, Ill., is constructing the tunnel. Geo. F. Staal is City Engineer, under whose charge the work is being done. The writer is Resident Engineer for the city, supervising construction.

*Resident Engineer, Linwood Ave. Tunnel, Milwaukee, Wis.

Automobile Exports in the year ending June 30, 1914, are reported by the U. S. Department of Commerce to have been distributed as follows:

	Commercial		Passenger		Ports
England.......	203	189,099	6,992	5,615,487	1,282,388
Germany.. ..	24	18,462	1,411	1,040,787	213,351
France.....	2	5,070	1,427	919,060	179,351
Russia...	2	5,322	926	898,458	14,079
Sweden..	1	900	324	253,588	6,140
Italy....	1	1,229	342	241,466	50,580
Austria-Hungary...	3	7,455	314	190,199	5,498
Rest of Europe...	13	21,179	1,372	1,009,173	79,473
Canada.	217	174,724	1,377	5,445,052	3,663,879
Cuba...	19	33,500	297	254,128	48,217
Mexico.	12	17,509	155	239,166	41,508
Central Am. Reps. ..	13	17,814	118	123,155	28,390
Rest of North America	7	14,866	243	218,241	65,622
Argentina.	18	65,225	940	963,586	92,633
Brazil ...	13	20,449	299	264,992	84,602
Chile..	2	10,743	195	160,194	22,105
Uruguay.	1	865	183	167,269	21,401
Venezuela	12	28,228	126	102,073	36,286
Colombia.			79	69,620	19,970
Peru.	3	5,301	36	31,362	5,982
Rest of South America			48	49,305	13,027
China...	7	12,700	144	143,619	5,825
Japan...	1	900	96	101,195	35,637
Rest of Asia .	22	42,058	1,168	961,217	102,555
South Africa..	12	11,539	1,618	1,437,883	157,246
Rest of Africa .	3	5,067	243	153,411	13,531
Australia and Tasmania	32	37,378	3,099	2,615,896	202,363
New Zealand .	39	61,599	1,065	974,708	53,644
Phillippine Islands..	38	64,805	611	697,175	69,933
Rest of Oceania	4	7,625	55	51,198	9,016
Grand total.	784	1,181,611	28,306	25,392,963	6,624,232

A New Process of Metal Coating

A remarkable new process of coating metal, which was brought out by a Swiss inventor, Schoop, some two years ago, has now been reduced to commercial form, and promises to have industrial applications of great importance. The novel character of this new process may be realized, when it is stated that it is possible by it to apply a metal coating not merely to another metal surface, but to articles of wood, plaster, cement, paper, leather, glass, porcelain and even cloth. What is still more important is that a great variety of metals and alloys can be thus applied. The coating may be extremely thin or as thick as desired; the process is applicable either for delicate decorative work or for the rough work of coating iron and steel articles or sheets with some non-corrosive covering, such as lead, zinc, tin or copper.

According to the present outlook, it should be possible to treat many articles of steel and iron now protected by paint, which requires frequent renewal, with a coating of lead or zinc or brass applied by the Schoop process at a cost which will be less than the ultimate cost of repeated applications of paint.

There are only two metal-coating processes now in extensive commercial use—electroplating and dipping.* The electroplating process is chiefly used for coating metal articles with gold, silver or nickel. Iron sheets and pipes are coated with zinc by dipping (the so-called galvanizing process), and also with tin. A very serious drawback of the electroplating process is that the film of metal which is deposited is chemically pure, and therefore comparatively soft, so that it rapidly wears away. Were it possible to apply a coating of gold or silver or nickel alloy instead of the pure metal, the plating would wear several times as long. Further than this, the electroplating process is an expensive one to operate, and is, therefore, confined to articles of considerable value.

The Schoop process of metal coating, now to be described, operates in a manner entirely different from anything ever tried in the art. Briefly described, a thin wire composed of the metal of which a coating is to be applied is melted in the flame of an oxy-hydrogen blowpipe, and at the instant of melting is subjected to a powerful blast of compressed air. The article to be coated is held in this air blast a few inches away from the oxyhydrogen flame; the minute particles of metal carried by the blast build up a coating that adheres as firmly as a coat of tin or zinc to a plate of steel dipped in a molten bath. It is, of course, necessary that the surface to be coated shall be perfectly clean. Even the slightest film of grease prevents adherence. In this, of course, this process is similar to other metal-coating processes in which it is common practice to pickle the metal to be coated before it is treated.

The amazing and well nigh incredible thing about the Schoop process is that the particles of metal discharged in the air blast should adhere and form a dense, smooth coating, instead of flying off as dust. While the wire is melted in the oxy-hydrogen jet, the molten metal is instantly congealed by the blast of compressed air, and the particles of metal, as they strike the object to be coated, are at so low a temperature that they can be received on the hand for a moment without injury. In fact, the metal coating can be applied to such inflammable materials as cloth, paper, wood and even celluloid, or the phosphorus-coated end of a match. It is evident, therefore, that the particles of metal on the surface to be coated are in the solid and not in the molten state. They are, however, moving with an enormous velocity, some 3000 ft. per sec.

The invention, as now developed, is radically changed from its original form. At first, the metal to be used for coating was melted and held in a reservoir. A fine jet of this molten metal was atomized by air pressure and directed against the surface to be coated. In that form the apparatus was clumsy, and the process was only adapted to spraying lead and tin. In a later apparatus, fine metallic dust was simultaneously acted upon by heat and air pressure. Some success was attained with this form of apparatus, but the high cost of manufactured metallic dust and its tendency to oxidize rapidly, restricted the use of this form of apparatus chiefly to zinc.

The present form of apparatus is termed a spraying pistol. While it has been used in Europe for some time, it was introduced into this country only six months ago. It is a portable hand tool, weighing only 7½ lb. The pistol is connected by small tubes with reservoirs supply

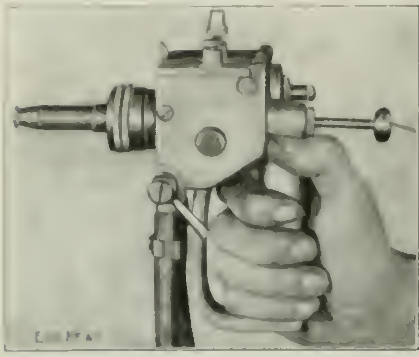


Fig. 1 The Schoop Metal Spraying Pistol

Fig. 2 Coating an Iron Casting with Copper with the Schoop Pistol

*The [illegible] process for coating [illegible] with [illegible] [illegible] [illegible] [illegible] [illegible]

ing oxygen, hydrogen and compressed air. The compressed-air blast nozzle is concentric with the oxy-hydrogen burner. The issuing compressed air drives a tiny turbine which propels friction wheels that feed the wire into the flame.

In a paper on the Schoop process*, by R. K. Morcom, before the Institute of Metals†, the process is thus described:

The essential parts of the machine, or "pistol," as it is called, are a combined melting and spraying jet and a feed mechanism. The metal, in the form of rod or wire, is fed to the melting-flame. The flame can be formed by coal-gas, water-gas, acetylene, hydrogen, etc., burning in air or oxygen according to the metal used. The gases are supplied at such pressures as to prevent blowing out and to insure a highly deoxidizing flame. The spraying-jet can be of carbon dioxide, nitrogen, air, steam, etc.; it is fed at such a pressure as to produce a sufficiently high velocity for successful coating.

To obtain the best adhesion, the surface on to which the metal is sprayed must be thoroughly clean and of an open nature to give a key for the deposit. Sand-blasting with sharp sand has been found best. Shot gives too polished a surface. Such surfaces as fabrics, wood, unglazed earthenware, and asbestos require only freedom from grease, as their surfaces give a natural key.

As at present constructed, the standard pistol uses about 0.55 to 0.6 cu.ft. per minute for every 1 lb. per sq.in. air pressure, so that with an air supply at 80 lb. per sq.in., which is a very suitable figure for ordinary spraying, the air consumption will be from 45 to 50 cu.ft. per minute. The mass of this will be from 830 to 920 grams, and the mass of metal sprayed by this air will be from about 8 grams in the case of iron to about 200 grams in the case of lead.

The action of deposition is probably a complex one. The minute particles of solid metal are driven with such force against the object that, in some cases, they fuse, but, owing to their small relative size, are promptly chilled by the object to which they adhere. If any of the particles are molten or gaseous, they will adhere. In addition, the suddenly chilled particles are possibly, or even probably, in the state of unstable equilibrium found in "Prince Rupert's Drops," and act like so many minute bombs, bursting on impact into almost molecular dimensions, and penetrating the smallest cracks and fissures of the object.

The process requires some care in manipulation, as, by varying the conditions, it is possible to spray porous or non-

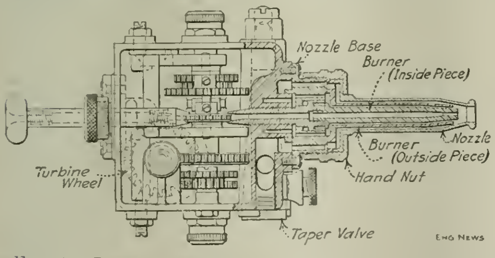


Fig. 3. Longitudinal Section through Spraying Pistol

porous coatings, and, with some metals anything from a pure metal to a pure oxide. With care, however, nonporous, oxide-free, adherent coatings can be produced of almost any metal on almost any solid.

In addition to metals it is possible to spray fusible nonmetals, or, by stranded wires, alloys of metals or mixture of metals with nonmetals.

The possibilities of the Schoop metal-coating process are so many that time has only permitted a few of them to be commercially investigated. So far, three principal lines have been followed: First, to preserve from corrosion, moisture or chemical action, various objects of wood, paper, stone, cement, iron and steel; second, to use the process for decorative purposes; third, to use the process for copying. As already noted, a thin film of grease on a surface prevents the adherence of the coating. It is possible in this way to make, very quickly and cheaply, perfect replicas of a coin, medal or other object in relief. Of great interest to engineers is the use of the process for covering iron and steel with some non-corrodible metal. We are informed that it is possible to carry out this work at very moderate cost. Those controlling the process say, "The cost of operating the Schoop process in the United States has been carefully ascertained, through experience with the appliance during the last six months. The seven metals most commonly used for protecting or decorating surfaces are lead, zinc, aluminum, brass, German silver, bronze and copper. When the oxygen and hydrogen used are purchased in small quantities in usual containers, the cost of spraying lead, including the cost of wire, compressed air and labor, is between 1 and 2c. per sq.ft., and one pound of lead can be sprayed in less than a minute. The other metal coatings vary with the initial price of raw material and its relative hardness. When the process is used on a large scale and the oxygen and hydrogen are either generated on the premises or purchased at wholesale, a considerable saving from the above figures can be effected."

The use of the Schoop process in the United States is controlled by the Metal Coating Co. of America, with offices in the People's Gas Bldg., Chicago. The president of the company is John Calder, formerly associate manager of the Cadillac Motor Car Co., of Detroit.

*"Engineering," Sept. 25.

†See British patent to Schoop, 1910, No. 5712, 1911, No. 21,066; and to Morf, 1912, No. 2801.

NEWS NOTES

Floods Resulting From a Rainfall of 5 In. In 3 Hr. caused the death by drowning of about 20 persons in San Antonio, Tex., Oct. 23. The property loss is estimated at $150,000.

A 24-In. Water Main Burst in Jackson, Miss., Oct. 13. The main had been installed but about two weeks as a part of the new water-works. The failure is laid to a defect in the pipe

The Derailment of a Passenger Train on the Missouri, Kansas & Texas Ry., Oct. 19, near Bartlett, Tex., caused the death of the engineman and fireman, and injuries to 15 passengers.

A Fall of Rock and Earth at the quarry of the R. F. Baker Rock Crushing Co., at Bluefield, W. Va., Oct. 19, killed six workmen. The fall came without warning and the men were so deeply buried that blasting had to be resorted to in recovering the bodies.

The Serious Accident at Tiptonford, Mo., Aug. 5, 1914, in which a gasoline motor car on the Missouri & North Arkansas Ry. ran head on into a passenger train on the Kansas City Southern R.R., resulting in the death of 45 persons was caused by a poor signal system and an apparent misunderstanding of orders, according to the recently issued report of the Interstate Commerce Commission.

A Fast Express Train Was Derailed on the Pennsylvania R.R., 38 miles west of Glen Union, Penn., Oct. 18. The train is known as No. 52, or the Buffalo-Philadelphia express. The derailment was caused by the breaking of an axle on the tender, while the train was running at a speed of 45 mi. per hr. The entire train of three coaches, three Pullman cars, a dining car and a baggage car left the rails, and the engine, tender and baggage car rolled down a 6-ft. embankment. The train was composed of all steel cars and no one of the 100 or more passengers was seriously injured.

Extensive Highway Construction in California—The California State Highway Commission announces that 202 miles of road have been completed and accepted, and that 615.7 miles have been partially completed since bonds in the amount

[illegible] for this [illegible] in [illegible] for [illegible] have been [illegible] and [illegible] miles have been placed under contract.

Four Commercial Attachés have been appointed by the United States Department of Commerce to travel through [illegible] countries and report upon commercial opportunities for American business firms in those countries. The [illegible] are as follows: Messrs. [illegible] for [illegible] Hall, for [illegible] Verne L. Havens, for [illegible] Chile [illegible] for Rio de Janeiro, Brazil. Mr. Havens's appointment is noted in our personal columns on another page of this issue.

The Watervliet Water Supply Project has been approved by the New York Conservation Commission, provided the supply is filtered in accordance with an advocated [illegible] [illegible] with [illegible]. This project was noted in Engineering News, Feb. 26, 1914, p. [illegible] and Mar. 19, 1914, p. [illegible] [illegible] attaches to its approval on account of its interference with the [illegible] project fostered by the commission [illegible] of Watervliet and neighboring communities (see "Engineering News," July 16, 1914, p. 158.)

Increase in Fares on the San Francisco-Alameda County [illegible] lines of the Southern Pacific Co. have recently been denied by the California Railroad Commission, on the grounds that such increase would result in the confiscation of large property values created by the earlier rates voluntarily fixed by the company. The commission is of the opinion that a return on cost of electrification and other improvements should be eventually secured though not necessarily at present since the improvements were voluntarily undertaken.

A Receiver Has Been Appointed for the Brazil Railway Co. and its subsidiary, the Madeira-Mamoré Railway Co., which are both incorporated under the laws of the State of Maine. The Receiver is W. Cameron Forbes, former Governor-General of the Philippine Islands. It is reported that most of the stock and bonds are owned abroad. This adds another chapter to the interesting history of the Madeira-Mamoré Ry., for details of which the reader is referred to "Engineering News," Oct. 17, 1907, Oct. 24, 1907, Oct. 31, 1907, Mar. 26, 1908, Nov. 12, 1908, Sept. 26, 1912.

The Diversion of Schoharie Creek into Esopus Creek to give sufficient water to fill the Catskill Aqueduct, New York City, has been authorized by the New York State Conservation Commission. We are indebted to Alfred D. Flinn, Deputy Chief Engineer of the Board of Water Supply of the City of New York, for the following concise description of the project:

The city proposes to divert from the upper part of Schoharie Creek, above a dam at or near Prattsville, Greene County, N. Y., sufficient water to fill the Catskill Aqueduct. Only about half the capacity of the Catskill Aqueduct can be obtained from the Esopus Creek, the development of which is now nearly completed. A large reservoir will be created by a dam near Prattsville from which the water will be diverted into the Esopus watershed and Ashokan reservoir by means of a tunnel about ten miles long through one of the ranges of the Catskill Mts. Approximately 310 sq. mi. of watershed of the Schoharie Creek will be utilized.

A Systematic Survey of the City of Chicago has been begun. This work is being done by the Division of Surveys which was organized early last year with T. C. Phillips, Engineer of Surveys, in charge. The initial appropriation for the year 1913 was $22,000. This specifically provided for a survey of all public streets and alleys entering into or crossing the right of way of the Chicago & Western Indiana R.R., with the object of disclosing to what extent the railway had encroached on public ground. The survey of this railway [illegible] right-of-way between Polk and [illegible] St. showed encroachments to the extent of [illegible] sq.ft. of public property, [illegible] in value [illegible]. This, however, is only a small part of the encroachments disclosed by surveys of the [illegible] Division in the course of the year. The value of [illegible] [illegible] [illegible]. The [illegible] of the [illegible] Division of Surveys should be the making of a comprehensive survey of the entire city [illegible] [illegible] in cities of New York, Philadelphia, Baltimore and Cincinnati.—From the 1913 Annual Report of the Department of Public Works of Chicago, Ill.

Fatalities in the Metal Mining Industry [illegible] A. H. Fay, Mining Engineer, U. S. Bureau of Mines, as follows:

	Men employed	Men killed	Fatalities per 1000
1911	[illegible]	[illegible]	[illegible]
1912	[illegible]	[illegible]	[illegible]
1913	[illegible]	[illegible]	[illegible]

The important mining states showing a continuous reduction of fatality rates during 1911, 1912 and 1913 are Idaho, Michigan, Montana, Nevada, New Jersey, South Dakota and Utah—representing in 1913, [illegible] of the mining [illegible]. Alaska, Alabama, Colorado, New York, Oklahoma, Tennessee, Wisconsin and Wyoming showed a decreased rate only in 1913 over 1912. These reductions are attributed to the introduction of safety appliances, better supervision and a more strict enforcement of rules and regulations of the mining companies and a closer observance of state laws. Practically all of the larger companies, and many of the smaller ones, have inaugurated the "safety-first" movement with good results. [illegible] have been [illegible] of short duration and have been kept out of the "serious" or "fatal" classes.

The "Third" Lock at St. Mary's Falls Canal, Sault Ste. Marie, Mich., was opened for traffic without any special formalities on Oct. 21. This lock, which is 360 ft. longer than the Panama locks, forms an important addition to the present lockage facilities between Lakes Superior and Huron.

The first appropriation for the work was made in [illegible], and a coffer-dam surrounding the site was completed in [illegible] when a contract was let for the excavation which required two years to complete. The masonry was built in 1912 and 1913, and the machinery and gates were completed this year. The lock chamber is [illegible] ft. wide by [illegible] ft. in length between the inner gates. There are two pairs of operating gates at each end of the lock to guard against accidents, making the total length of the masonry [illegible] ft. The sidewalls are [illegible] ft. high above the floor, those at the ends, forming the gate abutments, are 36 ft. thick, and the sidewalls in the chamber are 26 ft. thick at the base and 12 ft. at the top. The four pairs of operating gates are of steel and the two [illegible] of guard gates (for unwatering the lock when necessary) are of Western fir. The machinery is operated electrically.

On the first lockage, upbound, the U. S. steamer "[illegible]," the inspection steamer of Col. Mason M. Patrick, the Engineer Officer of the Detroit District, entered the lock first, and was followed by the U. S. steamer "Alfred Noble," the U. S. revenue cutter "Mackinac," the tugs "L. C. Sabin," "S. C. Schenck," "Illinois," and "James Edward." These were followed by the freight steamer "Alva C. Dinkey," which has a length of 600 ft. and beam of [illegible] ft. In the first down lockage were two loaded steamers, the "James A. Farrell" and the "Richard Trimble," both 600 ft. long by [illegible] ft. beam, and loaded with iron ore. The combined cargoes was [illegible] tons, probably the largest lockage ever made in point of tonnage.

The traffic through all the locks at Sault Ste. Marie last year was 79,718,344 net tons of freight, with an average value of $11 per ton, or total valuation of about $866,000,000. The lock work was described in "Engineering News," March [illegible], and April 23, 1914.

The New Union Station at Kansas City, Mo., is to be opened to traffic on Oct. 31. It is located in a different part of the city from the old station and is on a terminal or belt line affording connections with all the railways entering the city. There are 16 station tracks (with room for [illegible]) and two thoroughfare tracks; the station tracks are in pairs, [illegible] and [illegible] ft. c. to c., of sufficient length for two trains of 6 to 11 cars each. While all are through tracks, the station is to be operated on the double-end system, certain roads entering and leaving at one end and the others at the opposite end. Mail and express will be handled at both ends, but mainly at the west end. Baggage will be handled by elevators serving the platforms and a transverse subway. There are 11 railways in all, with about [illegible] trains per 24 hr.

The station building has its main floor at the street level, with track floor beneath and two floors above for offices. It is a low structure, no attempt having been made to utilize the site for a general office building. Its special feature is that the waiting room ([illegible] ft.) extends as a one-story structure across the tracks. On each side of this room is a corridor, with stairways to the platforms. Outgoing passengers reach the stairways by doorways (with ticket inspectors) at the sides of the waiting room. Incoming passengers pass out along the corridors, without entering the waiting room.

The tracks are covered by a steel-frame train-shed about [illegible] ft., the roof being carried by trusses of 41 ft. span on columns spaced [illegible] ft. apart along the platforms. Over each pair of tracks is an opening [illegible] ft. wide for light and ventilation. The clear height from rail to bottom of truss is about 16 ft.

About [illegible] west of the station is the engine terminal with roundhouse, coaling station, ashpit, etc. Here also is the coach yard, having stub tracks in groups of five, with capacity for [illegible] cars on the cleaning tracks and 16 on the repair tracks. This yard is paved and equipped to supply

water, compressed air, steam, gas and electric current for charging batteries.

The station with its tracks and accessories is said to represent an expenditure of about $25,000,000; the total cost, including the new approaches, etc., is put at nearly $40,000,000. The entire terminal is owned and operated by the Kansas City Terminal Co., representing the several roads. John V. Hanna is Chief Engineer, and A. C. Everham, Assistant Chief Engineer; Jarvis Hunt, Architect. The entire terminal system was described and illustrated very fully in our issue of Aug. 7, 1913; the tunnel carrying O. K. Creek across the station site, July 31, 1913; and the trainshed, Oct. 8, 1914.

PERSONALS

Mr. L. M. Dooley, former Inspector of Transportation of the Texas & Pacific Ry., has been promoted to be Superintendent of the Rio Grande division, with headquarters at Big Spring, Tex.

Mr. A. S. Lowrie, for many years Chief Engineer of the Montgomery Light & Water Co., Montgomery, Ala., has been appointed Superintendent of the municipal water and electric plant at Dothan, Ala.

Mr. Robert R. Crowell, who was dismissed as head of the Topographical Bureau of the Borough of Queens, New York City, in 1912, has been reinstated by a decision of the Court of Appeals of New York State.

Mr. David T. Day, M. Am. Inst. M. E., Petroleum Expert of the United States Geological Survey, has resigned to engage in private practice. He is succeeded by Mr. John D. Northrop, Geologist, of the U. S. Geological Survey.

Mr. William A. Mitchell has resigned as Director and Treasurer of A. L. Guidone & Co., Inc., General Contractors, to engage in general contracting under his own name, at 2409 Walton Ave., the Bronx, New York City.

Mr. Joseph Billingham, former General Inspector of the American Locomotive Co., Schenectady, N. Y., has been appointed Superintendent of Motive Power of the Grand Trunk Pacific Ry., with headquarters at Transcona, Man.

Mr. Victor T. Noonan, recently Secretary of the general safety committee of the Rochester (N. Y.) Railway & Light Co., has been appointed Director of Industrial and Public Safety of the State of Ohio, a newly created office.

Lieut.-Col. Chester Harding, M. Am. Soc. C. E., Corps of Engineers, U. S. A., recently Engineer Commissioner of the District of Columbia, has been transferred to the Panama Canal, where he becomes Engineer of Maintenance, succeeding Col. H. F. Hodges.

Mr. B. F. Thomas, M. Am. Soc. C. E., U. S. Assistant Engineer, recently in charge of Kentucky River improvements with headquarters at Frankfort, Ky., has been transferred to his old office at Cincinnati, Ohio, as Principal Assistant Engineer of the Cincinnati District, No. 2, Corps of Engineers, U. S. A.

Messrs. E. Darrow, formerly Manager of the Merchants' Heat & Light Co., and R. M. Cass, formerly Electrical Engineer of the Indianapolis Light & Heat Co., have formed the Indianapolis Engineering Co., with offices in Indianapolis, for engineering, appraisal and operating work in connection with public utilities.

Messrs. Frank A. Randall, Assoc. M. Soc. C. E., formerly Chief Engineer of Morey Newgard & Co., Chicago, Ill., and William H. Warner, formerly with D. H. Burnham & Co., have formed a partnership under the firm name of Randall & Warner, Civil and Structural Engineers, with offices at 511 Rector Bldg., Chicago.

Capt. George E. Burd, U. S. N., Engineer Officer, U. S. Navy Yard, New York City, has been appointed Industrial Manager of the Yard under a new system of organization. The Commandant of the Yard will hereafter devote his whole time to military administration, while the work construction and repair will be under Capt. Burd.

Mr. Wm. D. Kerr has resigned as Director of the Bureau of Public Service Economics and has become a member of the firm of Kerr & Kerr, Attorneys, of Chicago. Mr. Kerr has also been appointed to a lectureship in the School of Commerce of Northwestern University dealing with the subject of Transportation Economics and Law.

Messrs. W. H. Ellison and V. B. Stanbery, both of whom were recently employed by the California State Engineering Department and in the structural engineering department of the Panama-Pacific exposition, have formed a partnership under the firm name of Ellison & Stanbery, Structural Engineers, with offices at 251 Kearny St., San Francisco, Calif.

Mr. Lucien S. Johnson, M. Am. Soc. C. E., U. S. Assistant Engineer, in charge of the Big Sandy River improvement, with headquarters at Louisa, Ky., has been appointed Assistant Engineer in charge of the Kentucky River improvement, with headquarters at Frankfort, Ky., succeeding Mr. B. F. Thomas, transferred, as noted elsewhere in these columns.

Mr. C. E. Coolidge, recently Mechanical Engineer of the Denver & Rio Grande R.R., of Salt Lake City, Utah, has been appointed Associate Professor of mechanical engineering at the University of Idaho, Moscow, Idaho. Prof. Coolidge temporarily succeeds Prof. G. L. Larson, who has been granted leave of absence for a year, to take up research work at the University of Wisconsin.

Mr. Charles G. Elliott, M. Am. Soc. C. E., for many years Chief of the Drainage Investigations, United States Department of Agriculture, recently Consulting Engineer, Washington, D. C., has been appointed Chief Engineer of the Peace Creek drainage district, Bartow, Fla. Mr. Elliott has been Consulting Engineer of the project since early in the year. This is one of the largest drainage projects in Florida, comprising about 46,000 acres.

Mr. Henry H. Westinghouse, M. Am. Soc. M. E., formerly Vice-President, has been elected President of the Westinghouse Air Brake Co., of Pittsburgh, Penn., to succeed his brother, the late George Westinghouse. Mr. Henry Westinghouse has been associated with the company for over 40 years, having been General Agent, General Manager and Vice-President. He was one of the founders of Westinghouse, Church, Kerr & Co., and for several years was identified with its management.

Mr. Arthur F. Barnes, M. Am. Soc. M. E., formerly at the head of the Engineering School of Middlebury College, Vermont, has been appointed Dean of Engineering at the New Mexico College of Agriculture and Mechanical Arts, which has recently been reorganized. The school embraces the departments of mechanical, electrical, civil and irrigation engineering. A new engineering building was completed in 1913 and the shops almost entirely reëquipped with modern machinery and tools. Courses of study are being revised and a new and complete course in irrigation engineering will be made a specialty of the school.

Maj. Charles W. Kutz, M. Am. Soc. C. E., Corps of Engineers, U. S. A., recently in charge of works for the defense of Washington, D. C., and of river and harbor improvement work in the Washington district, has been appointed Engineer Commissioner of the District of Columbia, to succeed Lieut.-Col. Chester Harding, transferred, as noted elsewhere in these columns. Maj. Kutz graduated from the United States Military Academy at West Point in 1893. He has been a member of the board of consulting engineers of the United States Reclamation Service, and from 1911 to 1913 he was Chief Engineer of Philippine division of the Corps of Engineers.

Mr. Thomas J. Kennedy, former President of the Superior Construction Co., Ltd., at Sudbury, Ont., has been elected President of the Algoma Central & Hudson Bay Ry. and the Algoma Eastern Ry., with headquarters at Sault Ste. Marie, Ont. Mr. Kennedy began his railway experience with the engineer corps of the Canadian Pacific Ry. in 1874. Later he was Engineer for a contracting firm for the construction of the same railway. In 1885 he entered the operating department of the Canadian Pacific Ry. as Roadmaster and was soon promoted to be Division Superintendent. Later he was General Superintendent and Traffic Manager of the Algoma Central & Hudson Bay Ry., of which he is now elected President.

Mr. George S. Rice, M. Am. Soc. C. E., Consulting Engineer, of New York City, and former Chief Engineer of the old Rapid Transit Commission, which built the first New York City subways, has been appointed Division Engineer of the Public Service Commission to succeed Mr. Frederick C. Noble, M. Am. Soc. C. E., whose resignation was noted in our personal columns of Sept. 17. Mr. Rice was born in Boston, Mass., Feb. 28, 1849, and graduated from Harvard University in 1870. For two years he was Assistant Engineer of the Lowell (Mass.), water-works and of the Boston water-works. For the five years, 1872-'77, he was Division Engineer for the additional water-supply of Boston, and for a year was Assistant Engineer in direct charge of the main drainage works of the city. He then succumbed to the mining fever which followed the great silver discoveries in Colorado, and along with many other young engineers went West, where for several years he was a Mining Engineer in Arizona and Colorado. He returned East in 1887 to become Principal Assistant Engineer of the main drainage works of Boston. The same year he was appointed Deputy Chief Engineer of the New Croton Aqueduct, New York City. In 1891 he returned to Boston as Chief Engineer of the Boston Rapid Transit Com-

[illegible]

OBITUARY

[illegible] Manager of Sales of the [illegible] Manufacturing Co. [illegible], died Oct. 20, at his home [illegible]

[illegible] of the firm of Steel & [illegible], [illegible] Jersey City, N. J., died at the Roosevelt Hospital, New York City, Oct. [illegible]. He was born at Morristown, N. J., in [illegible].

[illegible] for many years a Superintendent of Construction for [illegible] and the George A. Fuller Co., [illegible], died at his home in Boston, Mass., Oct. [illegible]. He was born in Maine in 1864.

[illegible] General Manager of the North[illegible], died Oct. 3, at his home in St. Paul, Minn., aged [illegible] years. His railway experience was begun in [illegible] as a messenger boy with the Chicago, Burlington & Quincy R.R. He was at one time General Superintendent of the Chicago Great Western R.R. at St. Paul, Minn. He joined the operating staff of the Northern [illegible] Ry. in 1897 as General Superintendent of the Central [illegible].

Daniel A. T[illegible], President of the D. A. T[illegible] Co., Charlotte, N. C., Engineers and Contractors, died Oct. 1[illegible]. He was born in South Carolina in [illegible]. He was educated at South Carolina College and the Rensselaer Polytechnic Institute, where he graduated in [illegible]. Leaving college he entered the [illegible] steel works of John A. Griswold & Co., Troy, N. Y., and [illegible] was with the Bethlehem Iron Works, Bethlehem, Penn., under the late John Fritz. [illegible] he went into the [illegible] manufacturing business at [illegible]. [illegible] he established a business in Charlotte, N. C., as a Contracting Engineer, and as such [illegible] constructed [illegible] manufacturing plants. He was the author of several books on the cotton industry.

[illegible]

and to have laid out and supervised the construction of the [illegible] around the base of the shaft. He supervised the construction of many other [illegible], the most notable of which was the [illegible] Library of Congress. Under the direction of Gen. Casey, Mr. Green organized the office and construction work so [illegible] that the building was [illegible] completed well within the appropriation. Mr. Green also had charge of construction of the Washington Public Library building and was consulted on the construction of [illegible]. He not only was Superintendent of Construction but suggested [illegible] changes in designs and plans which were of great importance. Moreover he was an inventor of library fittings and devices, including the book stacks and carrying system of the Library of Congress as well as special racks for maps and newspapers. He was a member of many scientific and [illegible] societies and was a prominent and useful member of the American Unitarian Association. He is survived by four children, one of whom is Bernard Lincoln Green, M. Am. Soc. C. E., Vice-President of the [illegible] Engineering Co., Cleveland, Ohio. The following tribute was paid to the long, honest and honorable service of Mr. Green on Mar. [illegible], on the completion of his 50 years of service for the government:

On this day you will have completed fifty years of service to the United States. To few, indeed, has such a term been vouchsafed, and, while the individual qualities which have characterized your own relation with the government are happily not unique in its history, few men, indeed, can show a record which combines qualities so [illegible] complete of inventive skill, technical knowledge, executive energy, simplicity in method, [illegible], persistent and unselfish devotion, [illegible] integrity and a modesty more than [illegible].

The permanent memorials of these qualities are in stone and [illegible]. They are in structures of beauty, of dignity and of efficiency, with which your name will forever be associated. But the friends and [illegible] of the public service whose names are signed below, [illegible] in which scores of others would have been glad to [illegible], desire to offer you their acknowledgments, their congratulations and their warmest wishes, [illegible] of the day which [illegible] help to [illegible] such leisure hours as you may allow yourself hereafter.

ENGINEERING SOCIETIES

COMING MEETINGS

NORTHWESTERN ROAD CONGRESS.
Oct. 28-31. Congress at Milwaukee, Wis. Headquarters, [illegible] Sentinel Bldg., Milwaukee, Wis.

AMERICAN ROAD CONGRESS.
Nov. 9-14. Atlanta, Ga. [illegible] American Highway Association, [illegible] Building, Washington, D. C.

INDUSTRIAL WELFARE AND EFFICIENCY CONFERENCE.
Nov. [illegible]. Conference at Harrisburg, Penn. [illegible], Harrisburg, Penn.

NATIONAL MUNICIPAL LEAGUE.
Nov. [illegible]. Annual meeting at [illegible]. Clinton Rogers Woodruff, North American Building, Philadelphia, Penn.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.
Nov. [illegible]. Annual meeting at [illegible], Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
[illegible]. Annual meeting at New York. [illegible] Nassau St., New York City.

AMERICAN PUBLIC HEALTH ASSOCIATION.
Nov. [illegible]. Annual meeting at [illegible]. [illegible] Massachusetts Institute of Technology, Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 1-4. Annual meeting at New York City. [illegible] W. 39th St., New York City.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. [illegible]. Convention at Washington, D. C. [illegible], Washington, D. C.

AMERICAN MINING CONGRESS.
Dec. [illegible]. Annual meeting at Phoenix, Ariz. [illegible]

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.
[illegible]. [illegible] W. [illegible] St., New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Dec. [illegible]. Annual meeting at New York City. [illegible] W. 39th St., New York City.

AMERICAN ROAD BUILDERS' ASSOCIATION.
[illegible]. Convention at Chicago, Ill. [illegible] Broadway, New York City.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
[illegible]. Annual meeting at [illegible]. [illegible]

Engineering News

VOLUME 72 NOVEMBER 5, 1914 NUMBER 19

Ashokan Reservoir Roads, Built by the New York City Board of Water Supply

To replace many miles of country highways wiped out by the Ashokan Reservoir of the Catskill Water Supply of the City of New York, the city agreed to substitute about 30 miles of new highways "equal in every respect to those constructed by the State of New York in the County of Ulster." The agreement was in recognition of the inconvenience caused by having but one means of crossing the reservoir in its whole length of 12 miles.

It was further agreed that the city would undertake to maintain these roads forever. The Board of Water Supply engineers decided to pave these roads with vitrified brick, and bids were obtained from ten bidders rang-

Constructing a Bituminous Macadam Pavement; Ashokan Reservoir Roads

[illegible] from $1,701,1[illegible] to $1,6[illegible]. The aver[illegible] are shown in Table I.

TABLE I. AVERAGE BID FOR BRICK PAVEMENT

Item	Description	Unit	Quantity	Average
1	[illegible]	[illegible]	[illegible],000	$0.319
2	[illegible]	Cu.yd.	[illegible]	[illegible]
3	[illegible]	Cu.yd.	1,000	[illegible]
4	[illegible]	Cu.yd.	[illegible]	[illegible]
5	[illegible]	Cu.yd.	[illegible]	[illegible]
6	[illegible]	Cu.yd.	[illegible]	[illegible]
7	[illegible]	Cu.yd.	[illegible]	7.60
8	[illegible]	Bbl.	[illegible],000	1.90
9	[illegible]	Sq.yd.	[illegible],000	2.22
10	[illegible]	Cu.yd.	[illegible]	2.9[illegible]
11	[illegible]	Lin.ft.	[illegible]	0.402
12	[illegible]	Sq.ft.	1,500	0.347
13	Timber and lumber	M ft. B.M.	[illegible]	[illegible]
14	[illegible]	Post	40	10.72
15	[illegible]	Pound	10,000	0.0[illegible]
16	[illegible]	Lin.ft.	70,000	0.1[illegible]
17	[illegible]	Lin.ft.	100,000	0.028

The Board of Estimate and Apportionment was unwilling to make such a large original outlay and the decision of the type of paving was referred to a committee comprising the Chief Engineer of the Board of Estimate and Apportionment, the Chief Engineer of the Department of Finance and the Consulting Engineers of the five boroughs of the city. This committee recommended "pavement of a bituminous character," and the Board of Water Supply engineers proceeded to write specifications and obtain bids for a very high class of bituminous macadam, or perhaps more properly asphaltic-concrete pavement.

The contract for about 30 miles of this pavement and about [illegible] miles of waterbound macadam road was let in one job to the State Highway Construction Co., of New York City, the lowest bidder, for $659,080, probably one of the largest contracts for road construction ever let. Bids ranged from this figure to $716,115. Table II shows a tabulation of the successful bid and of the average bid.

TABLE II. BIDS FOR BITUMINOUS PAVEMENT

Item	Description	Unit	Quantity	Successful bid	Average
1	[illegible]	[illegible]	180,000	$0.35	$0.4[illegible]
2	[illegible]	Cu.yd.	45,000	0.54	0.5[illegible]
3	[illegible]	Cu.yd.	1,000	1.97	2.1[illegible]
4	[illegible]	Cu.yd.	[illegible]	2.10	1.94
5	[illegible]	Cu.yd.	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	Ton	[illegible]	[illegible]	[illegible]
8	[illegible]	Cu.yd.	[illegible]	[illegible]	[illegible]
9	[illegible]	Bbl.	1,[illegible]	[illegible]	[illegible]
10	[illegible]	Cu.yd.	[illegible]	[illegible]	[illegible]
11	[illegible]	Lin.ft.	[illegible]	[illegible]	[illegible]
12	[illegible]	Sq.ft.	1,500	[illegible]	[illegible]
13	Timber and lumber	M ft. B.M.	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	12.[illegible]	13.[illegible]
15	[illegible]	Pound	[illegible]	[illegible]	[illegible]
16	[illegible]	Lin.ft.	[illegible]	[illegible]	[illegible]
17	[illegible]	Lin.ft.	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The contract was awarded July [illegible], 191[illegible], and work has progressed steadily during seasonable weather to date.

The [illegible] part of the road surface is a well constructed water-bound macadam, with rolled foundation [illegible] 6 in. deep. The bottom course is [illegible] in. of stone [illegible] in. in size, placed in two [illegible] layers, rolled and filled with screenings. Before the bituminous top was placed, the bottom course was [illegible] so that the large stones were exposed and spaces between the stones from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. deep created. This was done to give the bituminous coat a proper bond and to prevent its creeping.

The bituminous coating itself is a 2-in. course of $\frac{1}{2}$-in. to 1½-in. stone mixed with 5 to 7% asphaltic cement. A description of the construction plant and an abstract of the specifications may be found in ENGINEERING NEWS, of Aug. 6, 1914, p. 300.

A Graphic Method of Determining Runoff in Storm Sewers

By O. HUFFLAND*

Among the problems of municipal engineering, none perhaps is today more obscured in the fog of theories than that of sewer design. The subject is a difficult one, and the data at hand on which to base conclusions are meager, so that it is hard to disprove theories that are obviously faulty by direct tangible demonstration of their weakness. But its study has now extended over more than 50 years, and has reached a stage where, in the hands of capable men, it has developed into a true science, so that the continuation of old errors is no longer excusable. That such errors are continued can be attributed to but two reasons: one, ignorance of this progress, and the other lack of courage to admit old errors. Both are unfortunate for the client of the engineer laboring under these shortcomings.

In the scientific periodicals and the publications of our engineering societies, many papers and the resultant discussions have been printed during the last 10 years in which all mention of this progress is omitted; and the old, concededly weak formulas, with assumed factors, startling reciprocals and fractional exponents, have become the shuttlecock between writers of a little book learning and a conspicuous lack of experience. "Capillary action for small depths," "the inertia of the water" on the surface, "wetted film" are illustrative expressions, instead of a plain statement that the delay in runoff is due to unevenness of surface, and a primary absorption and evaporation at the beginning of a storm. Add to the preceding a "cubic parabola" and you have the mystery complete.

These methods have been discarded in other countries, where for at least a half dozen years much simpler and more correct methods have been exclusively used by the best engineers without, so far as I know, getting into print here.

The new method discards many of the fetishes of the old school, and compels the engineer who uses it to have some practical knowledge of the subject, instead of reading his "computations" from a ready-made diagram prepared under some other man's theory, which very rarely fits the conditions which the new work is intended for.

A brief history of the new way may help to give it standing. As early as 1887 an Italian engineer in studies for the sewers of Milan pointed out the inadequacies of the old methods. In 1891, Prof. Frühling, one of the most eminent authorities on sewerage, pointed out the absurdities of the exponential formula for determining the correct quantity of water flowing through sewers

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as the result of a given rainstorm. Between that date and the present time the following have added their approval of the opinions above expressed, and have provided a new graphic method exquisitely simple and elastic enough to adjust itself to any combination of conditions for which sewer sizes must be found: Knauff, 1891, 1896, 1911; Forbat-Fisher, 1901; Hecker, 1910; Schulze, 1902; Frühling, 1904; Heyd, 1905; Kayser, 1905; Vicari, 1907, 1908, 1911; Bange, 1908, 1912; Nehring, 1908; Weyrauch, 1912; Kalbfuss, 1912; in fact, practically all the European writers of this period with one exception, and that is F. Grimm, in the Gesundheits Ingenieur, 1914, who makes a plea for the old methods by saying that five smaller cities have used them in the past and have not yet had trouble, but does not deny that the new methods are better.

One of the underlying distinctions of the new method is an acceptance of the postulate "that a definite intensity of rainfall during a definite period must result in a definite maximum of runoff, but that this maximum does not necessarily occur when the runoff from the whole drainage area reaches a given point in a collecting sewer." A "definite intensity" means, of course, a rate of precipitation which is substantially uniform during the "period," and not an accumulation of rainfall at various intensities during an assumed period. Uniform intensities of 1 in. per hr. and over rarely have a duration exceeding 20 minutes in the neighborhood of New York.

In a sewer system for an area in which the period of maximum intensity of rainfall is less than the time required for the maximum runoff to reach the outlet, the use of a constant formula "is wrong, gives senseless results and is not justifiable, simply because certain systems built upon such computations have not yet failed." (Prof. Weyrauch.)

To say that the eight or ten best known formulas are based on error may seem presumptuous; but the application of a constant to "area" instead of "time" seems to justify such a statement. Mr. Kuichling's is the only departure from such a theory, and for this and the insistence on the use of the actual uniform intensities of rainfall, instead of misleading accumulated quantities over long periods, he deserves the credit not only for correct analysis, but for his courage in dissenting from an old and universally accepted error.

The authors mentioned above describe a number of methods, but the one that has found most favor is a modified form of that given by Vicari and printed in the 1909 and 1912 editions of "Hütte," Vol. III, the well known German engineering handbook, from which I will make a free translation of the essential portions, retaining the metrical units, which can easily be transformed into terms current here.

Vicari's Method of Computing Runoff

If q_r equals the quantity of water in liters per second falling on a hectare, and E equals the number of hectares in the area under consideration, then the total runoff in liters per second, Q_r, is not $q_r E$, but $Q_r = \varphi q_r E$. In this, φ is the percentage of rainfall that is not evaporated or absorbed, and usually is called the coefficient of imperviousness.

The following values may be taken for φ for different surfaces:

Roof surfaces	0.8 to 0.9
Waterproof pavement	0.7 to 0.9
Common pavement	0.4 to 0.7
Macadam pavement	0.4 to 0.6
Park walks	0.2 to 0.4
Unpaved surface	0.1 to 0.2
Parks and gardens	0.0 to 0.1

As a drainage area generally consists of an aggregation of smaller areas of different degrees of imperviousness, the coefficient for the total district would be

$$\varphi = \varphi_1 p_1 + \varphi_2 p_2 + \varphi_3 p_3 + \ldots$$

in which p_1, p_2, p_3, etc., are fractions of the area having a different surface, and therefore a different coefficient φ_1, φ_2, φ_3, *etc.*

Water Reaching Sewer—At the beginning of a rain storm, only that area nearest a given point in a sewer furnishes water to it. As the storm continues, the areas farther away gradually contribute until, if the storm lasts long enough, water from the entire district will reach the given point. From this it appears that the duration as well as the rate of rainfall affects the discharge of a sewer. If it stops raining before water from the remotest part of the district drained reaches the part of the sewer under consideration, then only a fraction of the total runoff in liters per second, $Q_r = \varphi q_r E$, will be carried by the sewer at this point. This fraction was designated by a uniform retardization coefficient by Bürkli-Zeigler, Mank, Brix, Büsing and others; but this method has justly been discarded by Frühling because it failed to regard the size and shape of the area drained, as well as the velocity of flow in the sewers computed.

Method of Computing Runoff—The delayed runoff from the outer areas causes a reduction in the discharge at any point in a sewer, which may be determined by making a flow diagram for that point.

This diagram is developed by plotting the duration of rainfall as asbscissas and the resulting amount of runoff as ordinates of a right-angle system of coördinates.

Flow Diagram—Such a diagram is shown in Fig. 1 and may be obtained as follows: Assuming the distance from the remotest portion of a sewer district to a point in the sewer to be l and the velocity of runoff in the sewer to be v (this assumes that the sewer drains the remote part), then the time, t_l, that it will take water falling at the edge of the district to reach this point will be

$$t_l = \frac{l}{v}$$

At the end of this time, the entire drainage area E_l hectares is supplying the total discharge $Q_l = \varphi q_r E$, liters per sec., providing the storm continues.

In the diagram shown, the point B is located by taking t_l as the abscissa and Q_l as the ordinate. To obtain Q_l, it is necessary to find the rainfall in liters per sec. per hectare, q_r, for the storm for which the system is to be designed. This value of q_r multiplied by the number of hectares E_l and this result multiplied by the coefficient of imperviousness for the area considered gives Q_l.

Under the admissable assumption that the runoff to the sewers is uniform from each contributing strip and that t_r indicates the duration of the storm considered, the runoff Q_t at any time t is represented by the ordinate to the lines A,B,D,C.

It is evident from the diagram that when t (any time

of which the runoff is desired) is less than t_e, the time required for water falling at the edge of the district to reach the sewer junction, that the amount of water flowing in the sewer is only a portion of the quantity which will be flowing at the end of the time t_e. This ratio may be expressed as follows:

$$Q_t = \frac{t}{t_e} Q$$

in which Q_t equals the runoff in liters per sec. at the time t.

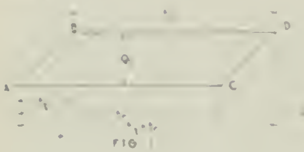


FIG 1

FIG 2

FIG 3

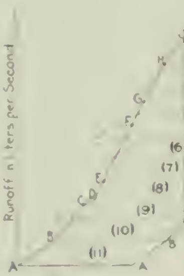


FIG 4

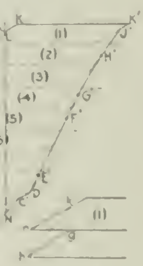


FIG 5

If t is greater than t_e and less than t_r, then $Q_t = Q$. If t is greater than t_r but less than $t_r + t_e$, then

$$Q_t = \frac{t_e + t_r - t}{t_e} Q$$

and, if t is greater than $t_e + t_r$, then $Q_t = 0$.

It takes the same time, t_e, for water falling at the remote portion of the district, at the beginning of the storm, to reach the junctions in question as it does for water falling at the end of the storm to reach this point; therefore, since the duration of the storm, t_r, is a constant and t_e influences the discharge at the beginning and end of the storm by the same amount, AB and CD are parallel.

SUMMARY OF PROCEDURE—In order to make the foregoing nomenclature and results more clear for practical use, they may be summarized as follows:

q = Quantity of water in liters per sec. falling on one hectare.
F = Number of hectares in area considered.
ψ = Coefficient of imperviousness.
Q_t = Quantity of water in liters per sec. running off from F hectares.
l = Length of stretch of area considered.
v = Velocity of flow in sewer.
$t_e = \frac{l}{v}$ = Time required for water falling on remote part of drainage area to reach sewer junction.
t_r = Duration of rainfall.

METHOD OF COMBINING FLOW DIAGRAMS—The preceding has shown how the flow diagram for a single area drained by a lateral is obtained. For a system of drainage areas, the flow diagrams for the individual areas are combined according to the following rules:

1. The flow diagrams for areas which discharge to the same sewer junction have the same initial abscissa.

2. The flow diagram for the area between two junctions has an origin of abscissa to the left of the diagram above it by a distance

$$t_e = \frac{l}{v}$$

where l is the length of the drainage area and v is velocity in the sewer draining that length.

3. In plotting the diagrams, begin with the area at the extreme edge of the district and continue downward step by step.

GENERAL CASE—The foregoing may be made more clear by considering a general case. The combined diagrams for the system of laterals shown in Fig. 2 are shown in Fig. 3 and obtained as follows.

In Fig. 3 (1) represents the flow diagram for the area drained by l_1, Fig. 2; t_1 is the time required for water falling at a to reach I; Q_1 is the total runoff in liters per second from the area drained by l_1, all of which does not reach I until the end of time t_1. Q_1 will be the amount of discharge for which the lateral l_1 must be designed. (2) represents the flow diagram for l_2, Fig. 2, and since l_1 and l_2 flow into the same junction I, they have the same initial abscissa. t_2 is the time required for water falling at b to reach I and

$$t_2 = \frac{l_2}{v_2}$$

Q_2 is the total runoff in liters per sec. from the area drained by l_2, and the quantity reaches I at the end of the time t_2. The total quantity of water per sec. reaching I at the end of any time t is the sum of the ordinates of the diagrams (1) and (2) at the end of that time, t being measured to the right from h.

For (3), the time t_3 is laid off to the left of the origin of (1) and (2) as the area drained by l_3 lies between junctions I and II. t_3 is the time required for water falling at I to reach II.

$$t_3 = \frac{l_3}{v_3}$$

and it will be at the end of this time that water from l_1 and l_2 reaches II. Q_3 is the total runoff from the area drained by l_3. To find the quantity of water in liters per sec. flowing in l_3 at II at any time t, with O as an origin and t as abscissa, sum up the ordinates at the end of time t of all the preceding diagrams. In this case, the maximum amount of discharge that l_3 would be designed for, would be $Q_1 + Q_2 + Q_3$. The diagram is continued in a similar manner for the remainder of the system.

The sum of the abscissas $t_1 + t_3 + t_5 + t_8 + t_{11}$ is the total time required for water falling at a to reach VI. These correspond to l_1, l_3, l_5, l_8 and l_{11}, Fig. 2, which form the main sewer. The laterals l_2, l_4, l_6, l_7, l_9 and l_{10}

discharging into it do not affect this time, but do add to the quantity, as shown by the ordinates in the diagram.

The sum of these ordinates indicates the total quantity in liters per second that flows through the sewers at any required time. For instance, the amount of water passing through the collecting point VI in the time t_n (see Fig. 3) consists of the sum of the ordinates at the end of this time for all the preceding diagrams ($Q_{11} + Q_{10} + Q_9 + Q_8 +$ a portion of Q_7, Q_6 and Q_5, while (1), (2), (3) and (4) furnish no water at this time. For the time t_m laterals l_8 to l_1 furnish water to VI, the quantities from l_{11}, l_{10} and l_9 having already passed VI.

Maximum Discharge—The maximum quantity of water flowing through VI is indicated by the longest ordinate in the combined diagram, Fig. 3, the location of this ordinate also showing the time at which this occurs; or, in other words, the maximum quantity of water that is discharged at VI (and which l_{11} should be designed to carry) would be at the end of the time where the sum of the ordinates of the diagrams (11) to (1) is a maximum.

Method of Revising Combined Diagram—In order to simplify the finding of the required ordinates, a method of adjusting the combined diagram has been devised, shown in Fig. 4. It consists in turning down the projecting ends of the single diagrams on the left and turning up those on the right into a compact figure from which the ordinates may be easily scaled. This is accomplished as follows: The area (1), Fig. 5, protrudes to the left of (2) by an amount nkg. Draw the line hk in such a manner that its vertical distance from hg at any point is equal to the distance of nk above ng at the same vertical; hk is therefore a part of the corrected diagram. By locating points as above, the line $ABCD$, etc., is found, and by a similar method $A'B'C'D'$, etc., may be obtained. Since t_r is constant $A'B'C'D'$, etc., will be parallel to $ABCD$, etc. It would therefore be only necessary to plot and correct one of the ends of the diagram; and by moving the line so found horizontally for the distance t_r, representing the time of the storm under consideration, the diagram may be completed.

Any ordinate of the continuous diagram, Fig. 4, will equal the sum of the ordinates of the individual diagrams, Fig. 3, at the same vertical. The longest ordinate within the diagram, Fig. 4, is at LN, which will be the quantity of water in liters per second for which the outlet l_{11} at VI must be designed. Lateral l_9 would also carry the same amount.

The quantities of storm water for which the system would be designed are therefore as follows:

Lateral	Quantity of water in liters per sec.
l_1	Q_1
l_2	Q_2
l_3	$Q_1 + Q_2 + Q_3$
l_4	Q_4
l_5	$Q_1 + Q_2 + Q_3 + Q_4 + Q_5$
l_6	Q_6
l_7	Q_7
l_8	$Q_6 + Q_7 + Q_8$
l_9	LN
l_{10}	Q_{10}
l_{11}	LN

Caution and Final Comment

In order to avoid misunderstanding, the present author would point out that the method above described permits the use of any formula for fixing the percentage of water that reaches the sewers, as well as any formula for determining the velocity of flow in them. It is sufficiently elastic to fit any condition, and will permit the engineer to make use of information furnished by a study of the area to be drained.

But its most striking advantage is the clear demonstration that the application of a constant to the "area" is wrong in principle. By most of the old methods the total area drained by all the sewers, l_1 to l_{11}, would have been used as a base of computation, resulting theoretically in a sewer gradually increasing in the size to the outlet. The new method conclusively shows that such a theory is faulty, and that l_{11} carries no more water at any time than l_9, notwithstanding the increased area drained by l_{10} and l_{11}, the flow from the latter having passed out before the maximum from the whole area reaches the outlet.

The Illuminating Power of Kerosene Oil is reported on by William Kunerth, Assistant Professor of Physics and Illuminating Engineering, Iowa State College of Agriculture, in a bulletin of the Iowa Engineering Experiment Station. The tests were to determine the quality of kerosene oil used in the state and relations between the illuminating power and physical properties, so that the usefulness of an oil could be judged without the long, tedious tests of burning. Some 61 samples in all were tried.

The oils were burned in a small metal lamp with a No. 2 flat-wick burner and glass chimney. The wicks were all of the same weight and ⅞ in. wide. About one-half pint of oil was used in each test to keep temperature effects similar. Before testing a sample, a new wick was burned in it for three hours to reproduce service conditions. A new wick was used for every sample of oil. The amount of oil burned was determined by balance and stop watch. Candlepower was measured on a 2-in. photometer. Several determinations were made with flame at different heights and the curve of candlepower and illuminating power plotted. Because of great influence of atmospheric conditions, it was necessary to test a sample of one oil selected as standard whenever unknown specimens were tested. The term "illuminating power" used below is used to cover the number of candlepower-hours per gallon of oil.

A greater flux of light was obtained from the cheaper oils, the average cost of 100 candlepower-hours running from 0.89c. for a 10c. oil to $1.97 for a 27c. oil. Higher-priced oils were from Eastern fields and had a lesser density. The heavier oils fogged the chimney more and the lighter oils less, the low illuminating power of the latter being somewhat compensated for by lessening the labor or expense of cleaning. Oils of lowest illuminating power charred the wicks most. No difference in the unpleasantness and quantity of odor given out by the different oils could be detected Contrary to the usual statements, the lighter oils are not as desirable as the heavier ones. The average density of oils whose illuminating power was less than 1100 cp.-hr. per gal. was 0.801 gram per c.c., while the average density of oils with an illuminating power above that figure was 0.818 gram. The oils of greater density also had a greater relative carbon content. All the oils had a flash point above 100° F. The oils having high illuminating power also had a high flash point, and vice versa, those below 1100 cp.-hr. showing 110° average, while those above had 116° average. The relation between illuminating power and burning point was similar, but not as well marked. A range of over 50% was found in viscosity of the samples and the relation of viscosity to illuminating power was not very definite, although in general it appeared that the oils of high illuminating power were comparatively the more viscous. An increase in surface tension was in general accompanied by an increase in illuminating power. Seven of the samples selected had been colored red and were light oils with low illuminating power. Therefore, one of the heavier oils was colored with alkanet root, whereupon its illuminating power was decreased 2%. A sample exposed to daylight and sunlight for six weeks showed a decrease of 15% in illuminating power.

The cost of kerosene illumination from the average of the samples tested was found to be 19c. per 1000 cp.-hr. This was found to be the same as the cost of electric illumination with tungsten lamps in Ames, the lamps having an efficiency of 1.25 watts per candlepower and current selling at 11.7c. per kw.-hr.

Development of Sand and Gravel Deposits

By W. H. Wilms*

SYNOPSIS—The preliminary steps in developing sand and gravel deposits are discussed in detail. The type of steam-shovel, the essential points in stripping overburden by hydraulicking, the layout, grades and construction features of railway tracks are described from the point of view of one having several years' experience in this work. Other articles will follow, describing and discussing methods of operating sand and gravel plants.

With the remarkable growth of the sand and gravel industry during the past five years has come an increased demand for a better grade of material. New standards of quality have been set up which the producer must be prepared to meet if he is to continue in business. For some plants now operating this means better preparation of material; for others it means the abandonment of the inferior deposits now being worked; for no amount of preparation will ever make a first-class product from poor and defective material.

The next five years will undoubtedly witness another large increase in the growth of this industry. New deposits will be opened up, new plants put into operation and many now engaged in other lines of industry will turn toward this. Mistakes, of course, will be made, for the industry is beset with all manner of snares and pitfalls for the inexperienced.

With the idea of giving an outline of the essential requirements in the development of sand and gravel deposits and the present methods of design and operation of screening and washing plants this and a subsequent paper have been prepared. To engineers interested in [illegible] the writer hopes they will prove of special interest and value.

[illegible] of Deposit

[illegible] cannot be laid upon the importance of a thorough examination and test of a deposit under consideration for development. Only too often a hasty and superficial examination is the rule and not the exception.

Test Wells—Due to extreme variations in the character of sand-gravel within comparatively short distances, a sufficient number of test wells should be sunk to make [illegible] the nature and character of the deposit. [illegible]

[illegible]

[illegible]

measured on all four sides of the well. The dip or angle of inclination of each stratum should also be noted. The elevation of the bottom of each stratum referred to a common datum should also be obtained with a view to connecting it, if possible, with similar strata in the other wells.

Analysis of Material—The size and gradation of the material in each stratum should be obtained by taking the entire amount excavated and screening it through a series of sieves. The character or composition of this material should also be obtained, i.e., the percentage of crystalline, granular, slaty and compact rocks and their hardness. The amount and character of the impurities should also be ascertained. The composition, average size and percentage by weight of all stone over 2 in. should also be obtained; this will afford a criterion as to the amount of crushing necessary.

Quantity—The elevation of the bottom of the deposit in each test well should be obtained and referred to a common datum. By connecting up these elevations a comparatively accurate profile can be made of the bottom of the entire deposit—very useful information if it is finally decided that the deposit is worth developing.

Development of Deposit

Considerations of capacity, depth of deposit, presence of water, etc., largely determine, of course, the method of excavation. Where conditions, however, will permit of the development and working with a steam-shovel, this method of excavation has many advantages worthy of consideration. It often happens that where dry deposits have been opened up and worked over with an orange-peel, clam-shell, or drag-line bucket, or any excavator of this class, the pit is left in very bad condition when increased capacity demands a change to steam-shovel operation.

Often steep grades out of the pit and other conditions make the change to steam-shovel operation under the above conditions an expensive proposition, if not absolutely prohibitive. The possibility of a possible future increase in capacity and a change to steam-shovel operation should be kept in mind in considering the type of machine for original development.

Steam-Shovel Development—In considering development with a steam-shovel, where a working face or bank has to be opened up, two methods of attack are possible. The working face may be obtained by the [illegible] method or by a through cut. By the former method the face is obtained by taking a series of [illegible] [illegible]

[illegible]

*[illegible]

side cutting is the necessity of using a shovel that can dig at least from 5 to 8 ft. below the loading track. This means either an A-frame or railroad shovel with an operating crew of three men, or an excessive and impracticable amount of blocking for a revolving shovel.

Unless the deposit presents a natural face or bank from which to begin operations it is generally advisable to make a through cut. In so doing the full working face is quickly attained, assuring a uniform run of material and a low initial stripping charge per cubic yard of material.

Of course there are some disadvantages attending the use of this method of attack such as cramped quarters, the "spotting" of but one car at a time to the shovel, with consequent reduction in the capacity of the machine; but the advantages generally far outweigh the disadvantages.

Type of Steam-Shovel—The type of shovel to use largely depends, of course, upon the capacity required. Where the requirements of capacity come within the limits of a revolving, one-man shovel, however, there is no question but what this is the type of shovel to use. There are many such shovels operating in gravel pits excavating from 300 to as high as 900 cu.yd. of material per 10-hr. day, with an operating crew of one man; and this man does his own firing.

In operating an A-frame or railroad shovel it is necessary, of course, to bring the shovel back to the beginning for each successive cut. Unless a track is kept built up behind the shovel a delay of several days is necessary to "cut out" the shovel, bring it back, shift the running track and "cut in" again. Often this delay must be suffered at the busiest time of the season. Delays to a busy plant are costly and anything that will reduce them is certainly worth consideration.

Stripping Deposits

The problem of the removal of the overburden or stripping should be studied in conjunction with development; for upon the solution of one largely depends the solution of the other. The subject is a large one and demands more space than can be allotted here for even a brief analysis.

Hydraulicking—I will, therefore, confine my remarks to a method of stripping that has been found to be the most effective and economical where the conditions are favorable for it. This is removal or stripping by water or hydraulicking. It has been my experience, that where conditions permit of this method, it is accomplished at a cost far below that of any other. I have removed many hundreds of cubic yards of stripping by hydraulicking for as low as 6c. per cu.yd.

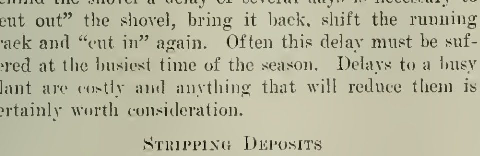


Fig. 1. Sketch of Layout for Hydraulic Stripping

The conditions necessary for hydraulicking are a plentiful supply of water, a disposition for the overburden, drainage for the waste water and ample grades for the flumes or sluices carrying the material. After a gravel bank is opened up, the overburden may be deposited directly on the floor or bottom of the pit provided there is means of drainage to carry off the waste water. Small levees are built up of gravel backed up with brush to retain the material and prevent overflowing. Sewer pipe or box drains are placed in the center of the pond thus formed, their tops flush with the pond level (Fig. 1).

Another method of retaining the material where disposition is made in the bottom of the pit is by means of sheerboards. This method, known as sheerboard construction, is largely used in the building of dams and fills by hydraulicking. Under many conditions it is cheaper and more effective than the construction of earth or gravel levees. In this method the material is retained by two or more small bulkheads or sheerboards made of two 1x12-in. boards, nailed to 2x4-in. stakes about 7 ft. long. The 2x4's are pointed at one end and driven into the ground on about 4-ft. centers. (See Fig. 2.)

After the material is carried up to the top of the first

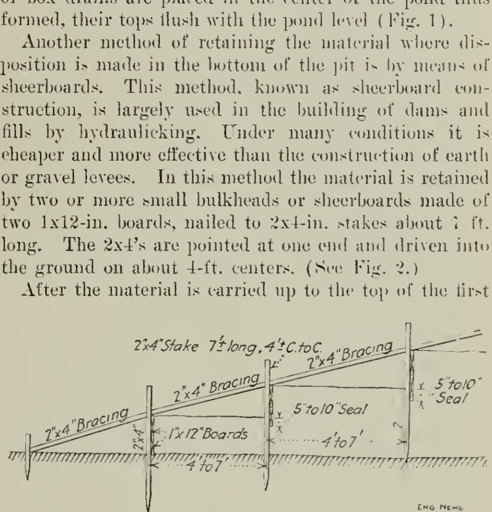


Fig. 2. Sheerboard Method of Retaining Material

row of sheerboards, a second row is built from 4 to 7 ft. back of the first. The bottom of this top sheerboard is placed from 5 to 10 in. below the top of the lower bulkhead to prevent the material from bulging and flowing out between the two bulkheads. The amount of seal necessary depends upon the nature of the material being handled. In ordinary loam 6 in. has proven effective while in fine clay or sandy loam 10 in. is often necessary. As many sheerboards are built in the above manner as is necessary to take care of the stripping over a given area. In this method the water is taken off through spillways which lead to the pipe drain or to some natural drainage course.

If no natural outlet for drainage exists it may be necessary to install a centrifugal pump to take care of this water. Where a small yardage only is required per day, it is often possible to let seepage and evaporation take care of this water, provided there is no natural outlet. However, drainage is always to be preferred and generally is a necessity. Where seepage and evaporation are depended upon to any extent, the bottom is soon silted and clogged up, resulting in the overflow of the levees and break-throughs. Where disposition is made in the bottom of the pit, the fall necessary for the flumes from the top of the gravel bank to the waste pond is generally ample.

The character of the overburden must be such as to be easily handled with water. Clay is generally a very difficult material to handle, requiring more water, greater pressure, and greater flume grades to handle than ordinary loam or dirt. The amount and size of rocks, if any, also affect the efficiency of this method.

Quantity of Water Required—No rules can be laid down for the quantity of water required per cubic yard

of material removed, pressure of water necessary and the grade of flume required, these factors depend entirely upon the nature and character of the material to be handled. There is sometimes found a fine, heavy, dead sand on top of the gravel deposit which requires nearly twice the amount of water, pressure and flume grades to carry it than the sand proper.

The quantity of water is generally more important than the pressure. Comparatively light grades can be used for the flumes if a sufficient quantity of water is present to effect complete suspension. As heavy grades as possible, however, should be used, for the greater the grade the less the dirt has to be carried in suspension, with a consequent increase in the carrying capacity of the water.

An overburden composed of soft loam with no rocks or boulders and no dead sand to contend with has been removed with flume grades of 8%, and a delivery of 1500 gal. of water per cu.yd. of material removed. A pressure of 75 lb. per sq.in. was used.

Due to the comparatively shallow working face and the consequent frequent changing of pipe connections, and flumes, hydraulicking, when applied to gravel stripping, does not show the same degree of efficiency and economy that can be obtained under the more favorable conditions of a high working face. Even under such adverse conditions, however, the economy that can be obtained by this method where the other conditions are favorable is very good.

Layout of Tracks

The track layout should permit of easy and flexible switching operations, otherwise costly and irritating delays and interference in switching are very likely to result. Wherever it is possible the main track serving the plant should have switching connections with the main track of the railway at both ends. Empty and loaded cars can then be switched without interfering with the operation of the plant. Where conditions make such an arrangement impracticable, a runaround track should be built so as to permit of switching operations while cars are being loaded at the bins (Fig. 3).

Switching Tracks—Switching tracks having excessive curvature and grades are a constant source of delay due to derailments and the inability of the locomotive to "pull" the cars [illegible] without [illegible] switching. Where conditions ... [illegible] the alignment and grades that must be used, there is often considerable latitude in the ... of which full advantage should be taken. A curve of 16° should be considered a maximum for switching tracks for road engines, while 18° or 20° is about the maximum for switching engines. Grades for the ... [illegible] should, of course, be kept as low as possible ... [illegible].

Rails—I have learned by costly experience that there is no economy in laying heavy tracks with light 56-lb. rails. The ... [illegible] that one ... [illegible] a gravel pit demands a

Fig. 3. Suggested Track Layout at Loading Bins

good track built of at least 70-lb. rails; an 80-lb. rail is better and is considered by the writer the only rail to use in tracks over which switching operations are performed. Dead-end empty storage tracks over which engines very seldom go is another matter, and here good 60-lb. relayer rails will generally answer the purpose.

Loading and Storage Tracks—Wherever conditions permit, the empty-car storage tracks above the plant and the load-storage tracks below should be on a continuous down grade, so as to permit "spotting" of the cars to the plant by gravity. Straight, empty, storage tracks should have a grade of at least 1%, and better 1½%. The short stretch of track in front of the plant at the loading chutes should have at least a 2% grade. The grade of the load-storage tracks should be at least 1%.

If curvature occurs on any of these tracks, due allowance should be made for it in establishing the grades. If the handling of cars by gravity is going to be a success and not a source of constant delay and trouble, the tracks must have sufficient grades and be so surfaced and aligned that the cars will start anywhere with one or two pinches of the car pinch-bar.

Where the capacity of a plant is 20 cars or more per day, it often pays to install a small electric-drum hoisting engine to expedite the "spotting" of the cars for loading at the bins (Fig. 4). With a [illegible] alongside

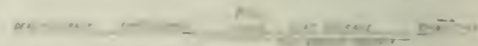


Fig. 4. Arrangement for "Spotting" Cars

the bins, a cut of two to four cars can be handled, the operator having complete control of the cut in either direction.

Locomotive and Cars—The transportation of the material from the pit to the plant is best accomplished by the use of hopper-bottom or standard bottom-dump railroad ballast cars hauled by a four-wheel switching locomotive of about 40 tons weight. The tendency here has been to use too light a locomotive. The maximum hauling capacity of a 40-ton, 0-4-0 locomotive on a 1½% grade with a track resistance (not including curvature) of 20 lb. to the ton—a figure none too liberal for the general run of gravel pit tracks—is about 420 tons.

For regular work a locomotive should be used at not more than about three-fourths of its maximum capacity. This is not only advisable from an economical point of view, but it will also lengthen the life of the locomotive and provide for emergencies and a possible future increase of output. When it is considered that even 4½% grades are often necessary in hauling out of the pit and up to the top of the track hopper, often over light and poorly surfaced tracks having excessive curvature, the necessity of using a locomotive of ample hauling capacity becomes apparent.

Preparation of the Material

Preparation of the material should begin in the bank or deposit. If the material has not a rough gradation from coarse to fine, the production of a uniformly graded material is going to be expensively difficult and nearly if not impossible. Most so-called gravel banks are really sand banks containing only a very small percentage of gravel. Moreover, the small amount of gravel contained in such banks is often extremely coarse, with a large

jumping from sand to 6-in. stone, no amount of crushing and reduction within reason is going to produce a material of uniform graduation. Too much care cannot be exercised in the examination of a deposit before operations are begun.

Graduation of Material—The producer's bank material and his market requirements often make uniform graduation extremely expensive. As an instance, the writer has in mind a producer whose deposit runs high in the ¾- to ¼-in. material. In order to produce a uniformly graded material of from 1½ in. to ¼ in., it is necessary for him to take out a large amount of this ¾- to ¼-in. material.

There is but a comparatively small demand in his market for this ¾- to ¼-in. material; as a result, this must often be sold at an actual loss; which, of course, increases the cost of production of the 1½-in. material. A well graded material, however, is generally worth the price, considering the saving that can be effected in the cement bill by the use of such material.

Fig. 5 shows an analysis of a concrete gravel produced by a plant operating in the Middle West. This gravel is 1½-in. material, uniformly graded, down to sand. This analysis shows what can be done in the matter of graduation when a plant is operating under favorable conditions. This analysis is an average of several hundred carloads, a test being made of samples taken from every three cars of material shipped on this particular contract. The dotted line (Fig. 5) shows the ideal graduation or

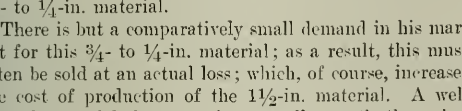


Fig. 5. Typical Gravel Analysis

mixture according to experiments by Fuller. To show the effect on the graduation of mixing sand with the material, 32% of a coarse, well graded sand was mixed with 68% of the gravel, with the results shown by the analysis curve in Fig. 5.

[A second article will describe screening and washing plants.—Ed.]

Patents on Bituminous Road Construction Since 1900*

Over 300 United States patents on road construction have been issued since the year 1900. J. H. Amies, of Easton, Penn., inventor of "Amiesite," a cold-laid asphaltic concrete, has taken out the largest number—34 patents, seven of which were taken previous to 1900. His patents apply to various processes and methods of construction, such as the use of fibrous material incorporated in asphaltic mastics; processes for eliminating heating plants by the use of benzine, naphtha and the like; processes for granulating asphalt for shipment and then heating on the work; processes for making adhesive, fragments of stone previously coated with asphalt mixtures, and numerous other combinations, mixtures and methods.

The other chief figure in patent-road construction has been the late F. J. Warren, of Boston, Mass., who took out or controlled 30 patents (1900-1911) for methods of work, etc. The best known, of course, are "Bitulithic" and "Warrenite." Mr. Warren came from a family which, for many years, had been engaged in the business of importing and handling asphalt. While connected with the street department of Newton, Mass., he first became interested in the application of asphalt to streets and roads. His first patent dates from Jan. 5, 1900. He is generally credited as being a pioneer in the construction of modern asphaltic-concrete road surfaces.

Mr. Warren's other patents relate to the use of different fluxes, using more mineral ingredients, use of asphalt for surface applications, preservative for wood paving blocks, preparing concrete aggregate for shipment, a multi-layer road construction, temporary liquifiers, a mastic to receive a loose layer of rocks, and several patents on apparatus and machinery. The "Bitulithic" pavement was originally patented in 1901, and subsequent patents were issued in 1902, 1905, 1908 and in 1909.

It would seem from a study of the list of titles that patents have been issued covering every phase of bituminous road construction from the refining of asphalt and tar to their use in any form on roads and streets, although probably by far the greater number of these patents have never been tested in the courts.

Numerous patents have also been taken out in England for the use of tar on roads, although tar was applied to macadamized roads in London as far back as 1820. Until recently the tar used came from gas works without refining. Now, there are several costly plants in England for refining tar for highway uses and the product is placed on the market under such trade names as "Tarmac," "Tarvia" (which is also made in this country by the Barrett Manufacturing Co.), and many others. Generally, patents are on materials rather than processes.

*From information supplied by J. B. Gray, 135 N. Ave. 62, Los Angeles, Calif.

An Early Patent for a Grouted Concrete Pavement—In January, 1829, a British patent was granted to one William Hobson, Gent., for an improved method of paving streets, described in the "Journal of the Franklin Institute" of that period as follows:

Instead of picking up the ground loose (as is the practice in the present mode of paving), ram the ground on which the paving is to be placed, well down, until it is as solid as possible, to a form corresponding with the form of the surface the paving is to take when finished. The stones shall be sorted so as to be nearly of an equal depth; mix up gravel or small fragments of stone with lime and water into a composition or kind of coarse mortar, and lay a bed (of sufficient thickness, to allow for the irregularity of form in the bottom of the stones) of this composition, on the ground which has been previously rammed, and in this composition place the paving stones, and grout them full with finely sifted gravel or coarse sand, mixed up into a liquid state with lime and water, in the same proportions as the composition the stones are laid in.

All the paving done in one day must on the same day be well rammed to an even surface, and when so done must again be grouted full, with fine gravel or coarse sand, mixed up with lime and water, as before. This must be done with each portion of paving on the same day on which the paving is executed; and this method of ramming and grouting must be followed up on each day as the paving proceeds, and when so done it would (if practicable) be desirable that the part paved should be left without carriages being permitted to go over it for three or four days, in order to let the composition of lime and gravel, or stone, set and harden, and it will then become firm and solid, and, if the lime is of a proper quality, impervious to water.

This method if applied to paving done with pebbles or unsquared stone, will be found advantageous in a proportionate degree to paving done with squared stones. I recommend that the lime to be used in this method of paving should be stone, or gray chalk lime, as lime of that description will set and harden in water, and if of a good quality the proportions of one measure of lime to four or five measures of gravel or small fragments of stone will be sufficient.

Two Striking Steel Bridges on the Lake Erie & Eastern R.R.

Two of the steel bridges on the new double-track Lake Erie & Eastern R.R., in Youngstown, Ohio, contain various strikingly original features. Both happen to be skew bridges, but to secure square-ended running track they are detailed with square ends. The constructive arrangement of these ends is different in the two cases. Further, one of the two bridges—the plate-girder bridge, Figs. 1 and 2—has a remarkably individual floor construction. There are other novelties in general design, details and equipment, the latter including fender girders to protect the trusses from effects of derailment, and blast plates over railway tracks below to protect the underside of the bridge from the abrasive action of locomotive exhaust.

Three-Span Plate-Girder Bridge with Continuous Expansion

About opposite the center of Youngstown, just south of the city water-works filter plant, the line crosses on a skew over the Baltimore & Ohio R.R. The latter has two main tracks and two sidings at present, but may later add two more main tracks. To fit this condition, the crossing is designed with a middle span over the four main tracks, and on either end a span over the siding. The abutments were built square, while the piers are necessarily skew, as shown in Fig. 1.

On account of the floor-construction, noted below, it was necessary to avoid expansion movements between the several spans. The three spans are coupled together by having sole-plates continuous under adjoining shoes,

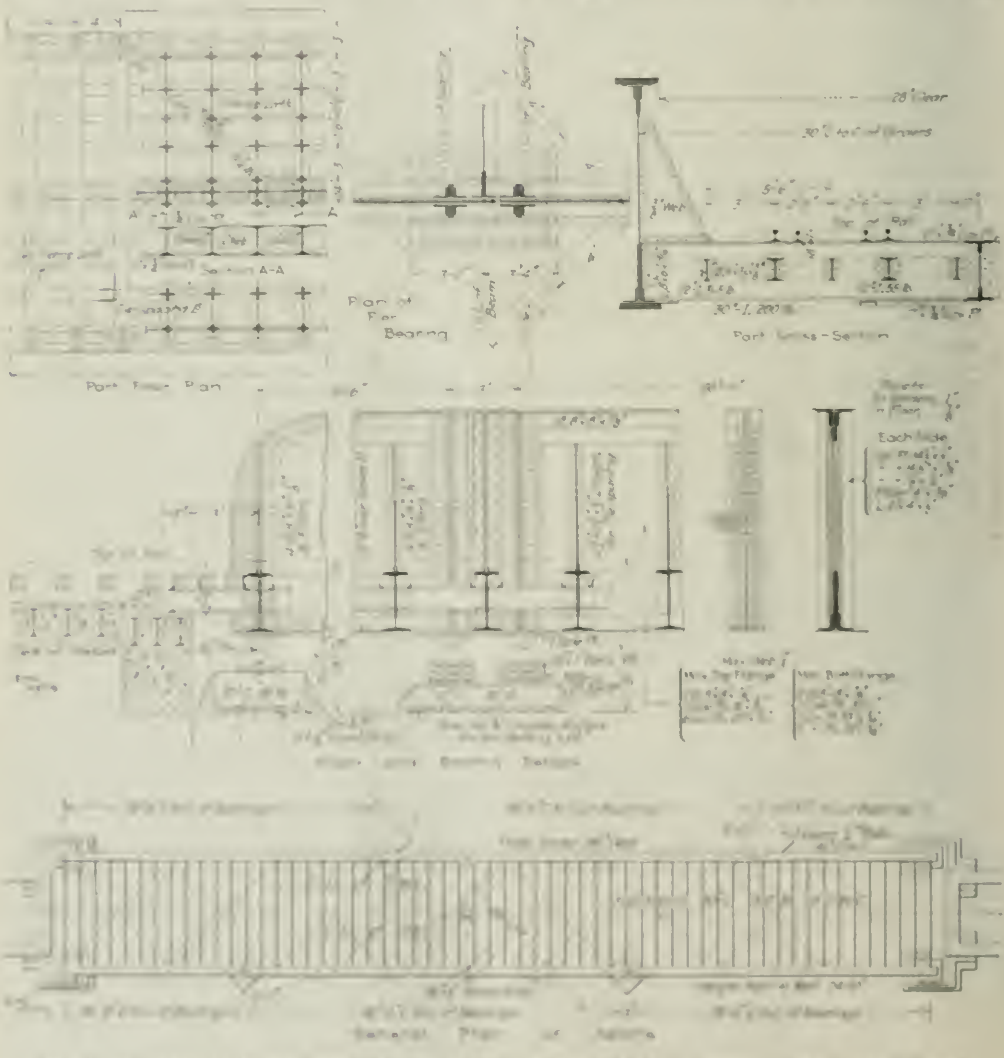


Fig. 1. Three-Span Plate-Girder Crossing over Six-Track B. & O. Railroad; Lake Erie & Eastern R.R., Youngstown, O.

and only the two bearings at one end are fixed, while the other six are expansion bearings. A detail in Fig. 1 shows the connection of adjoining spans at the shoes.

FLOOR CONSTRUCTION—The floor of this bridge consists of 30-in. I-beams at 4-ft. spacing, as floor-beams, and short I-beam stringers cut into the 4-ft. panels. There are four stringers per track, with a view to supporting the ties in such complete manner as to practically prevent the chance of breaking through the floor in a derailment.

The use of what is equivalent to bridging in the floor is a novelty in steel bridge work. Along the longitudinal center line of the bridge a strong longitudinal girder is formed by cutting in longitudinal diaphragms between the floor-beams and riveting a flange-plate on top and on the bottom the full length of the bridge. A thorough distribution of loading among the floor-beams is secured by this artifice. The flange-plates of the longitudinal girder are riveted to the diaphragms only, and not to the floor-beam flanges, as nothing would be gained by also attaching to the latter and their flanges would be weakened.

Another novelty is the provision of angle clips on the tops of the stringers to form abutting blocks to locate the ties. This not only holds the ties in position but prevents their being placed so close to the floor-beams as to form dirt pockets.

The laterals of the bridge are channels laid flat and placed underneath the stringers. They are supported at each end and at the crossing by attachments to their gussets, but in addition, to prevent rattling, are pinned to a stringer at an intermediate point by plate clips.

There is a break in grade on the bridge just over one of the piers. This, of course, suits only the girders on one side, while for the girders on the other side the break in grade comes within the length of a span. On this side, the attachment of certain floor-beams had, therefore, to be adjusted, both in the angle between web of floor-beam and the vertical line of the girder, and in the seating plate or gusset between bottom flange of floor-beam and bottom flange plate of main girder. These seating plates had to be planed to the proper taper (0.3%). All floor-beams are set with webs normal to the grade of track; that is, where track is level the webs are vertical, while where track is on 0.3% grade the webs are normal to this grade line.

The piers of the bridge are in alignment with the skew; this arrangement involves minimum interference between the masonry and the clearance of the tracks under the bridge. The grillages resting on the piers, however, are set parallel to the bridge axis and therefore run approximately on the diagonal of the pier. This is shown in the pier-top detail in Fig. 1.

The connection between the ends of the bridge and the abutments is made by short outside stringers which rest on a ledge of the backwall of the abutment; thus there is room under and back of the steel to get at it for painting, etc.* These stringers can carry a tie close up to the curb tie of the abutment. The drawing makes this arrangement clear.

FIG. 2. DOUBLE-TRACK CROSSING OF LAKE ERIE & EASTERN OVER B. & O. RY., YOUNGSTOWN, O.

(Three spans are joined so as to expand together, with fixed bearings at one end. The ends are square, the intermediate supports skew. The floor-beams are 30-in. I-beams, 4 ft. apart, stiffened at midlength by "bridging" formed by a steel longitudinal girder. There are four stringers per track.)

Over each of the six tracks of the B. & O. R.R., a steel blast-plate is attached to the under side of the bridge in order to protect the steel from the abrasive action of the locomotive exhaust. The same device is used on the truss spans of the Mahoning River No. 1 crossing, which crosses a number of railway tracks, as described just below. These plates are attached in a manner to allow renewals to be made when they are worn out.

FOUR-PANEL TRUSS SPANS AT YOUNGSTOWN PUMPING STATION

The first crossing of the Mahoning River is made by a series of plate-girder spans continuous with a plate-gir-

*This same object was kept in view throughout the design of the bridges of this railway. Thus, large cast-iron and steel pedestals are used on all of the bridge-seats, for the same purpose of giving ample working-room around the steelwork.

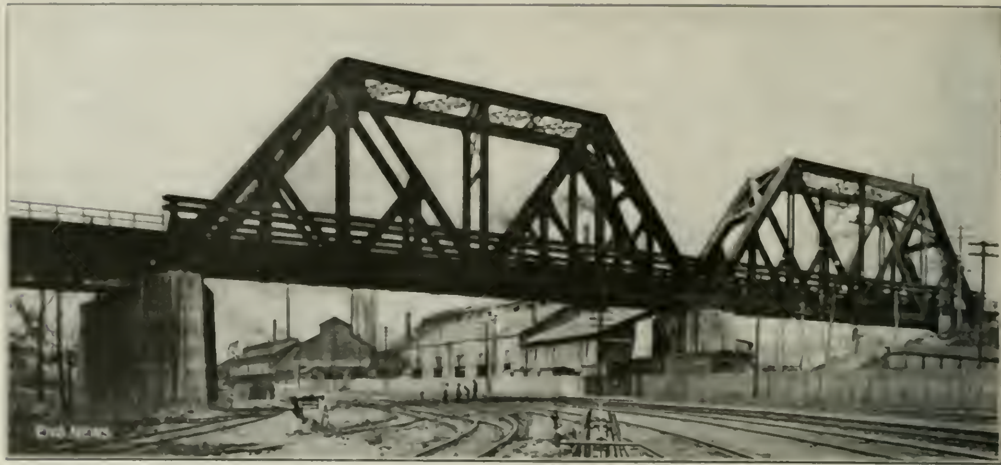


FIG. 3. VIEW OF THROUGH-TRUSS SPAN OVER RAILWAY TRACKS AT MAHONING RIVER CROSSING NO. 1, LAKE ERIE & EASTERN R.R.

der viaduct over the territory of the filter plant of the Youngstown water-works. Just north of the river a series of eight railway tracks is crossed alongside the city's pumping station. For this crossing two through-truss spans of 192 ft. are employed. They have a number of ingenious and original features.

The spans are skew, but their stringers are made to end square. At either end of the set of two spans, the main abutment is built square and carries the stringer ends. As in the case of the B. & O. crossing, this is done

FIG. 4. MAHONING RIVER CROSSING; ELEVATION AND PLAN OF TRUSS

[illegible]

merged into a single stringer-panel, the stringers, part in one span and part in the other, are not supported at the pier. This arrangement is shown by the plan and elevation in our drawing, Fig. 4.

The general outline of these trusses is quite unusual. A four-panel truss is used for the 192-ft. span, giving main panels 48 ft. long. These are subdivided, however, by a hanger-and-substrut system, so that the floor panels

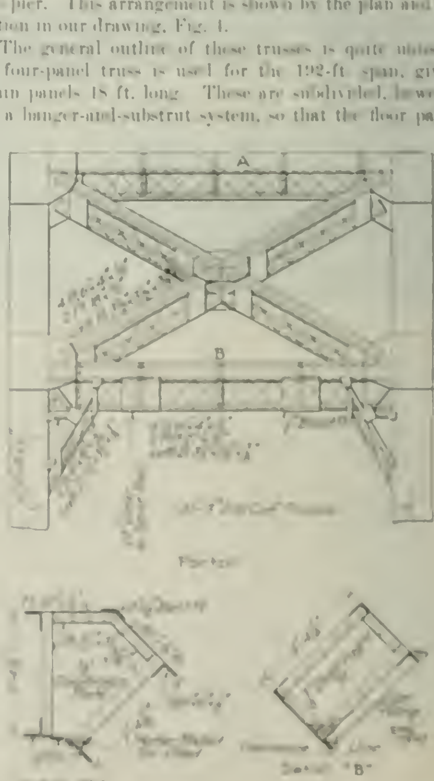


FIG. 5. MAHONING RIVER CROSSING; DETAIL OF PORTAL BRACING

are 24 ft. long. The photograph, Fig. 3, shows well the peculiar chunky appearance of the resulting structure.

Fender girders or "skid girders" are used on this

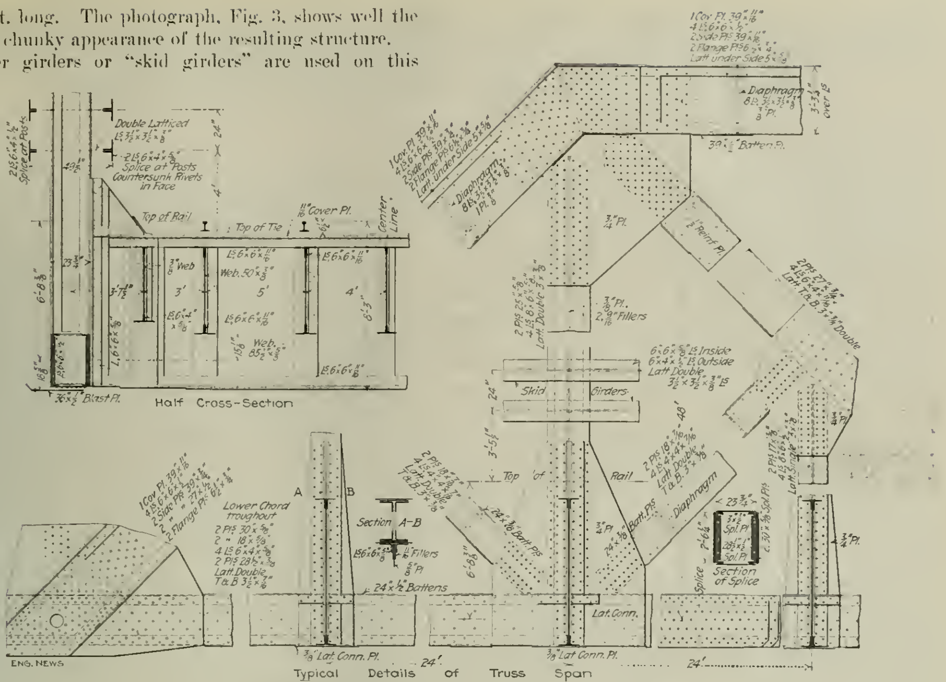


FIG. 6. MAHONING RIVER CROSSING; DETAIL OF TRUSS

bridge in precisely the same arrangement as used on the great Beaver bridge of the Pittsburgh & Lake Erie R.R., built some years ago. A double line is used, 2 ft. apart vertically, the lower one being 4 ft. above the base of rail. The flanges of each of the girders are made continuous from end to end by splices at all posts; the trackside face is made smooth by putting the splices inside and countersinking all rivet heads on the face.

The floor arrangement includes seven stringers: four rail stringers (one under each rail), a middle stringer, and two outer stringers. Thus both ends of the tie are supported. This arrangement, similar to common practice on the Pittsburgh & Lake Erie R.R., is adopted to reduce the chance of any destructive effect of derailment upon the floor, just as the skid girders are intended to protect the trusses.

A further item of protection against derailed equipment is the provision of spacer-blocks between ties. The standard width of space is 3 in. The blocks are attached to the side of the tie and extend from top to bottom of tie. Three blocks are used in each space.

The two spans being connected by their stringers, no relative expansion movements are permissible at the central pier, just as in the case of the B. & O. crossing. The solution is different, however. The fixed support is on the central pier, and the bearings at both abutments are expansion bearings. At the central pier the abutting ends of the trusses are carried jointly on a single riveted pedestal, as sketched in Fig. 4.

Some of the detailing is shown in Fig. 6. As will be seen there, the details are typical for heavy riveted bridge construction. Novelties are found in the use of narrow reinforcing bars on the front and rear edges of some of the chord battens, in the use of asphalt filler to eliminate any water pockets as, for instance, in the portal struts, and in the use of blast-plates over the tracks below. These plates are steel 36x½-in., riveted below the lower lateral system, with support at stringers and laterals.

The portal construction is exceptionally heavy. The lower strut is additionally supported by small brackets in the corners of the clearance diagram. All latticing here is of angles (Fig. 5).

These bridges were designed by Albert Lucius, Consulting Engineer, New York City, for the engineering department of the Pittsburgh & Lake Erie R.R., under J. A. Atwood, Chief Engineer, A. R. Raymer, Asst. Chief Engineer.

The First Concrete Pavement Constructed in Schenectady, N. Y., which has recently been completed, has some interesting features. It is a one-course pavement, 7 in. thick, of 1 : 2 : 4 concrete, made of crusher-run stone graded to 1 in. in size. Expansion joints are placed at an angle of 75° to the curb. William B. Landreth, City Engineer, writes to us, under date of Oct. 27, that "while theory could easily prove that there is no advantage in placing the joints at an angle to the curb, we have decided to give the diagonal joint n practical trial. It is not straining anyone's credulity, however, to believe that the weight of a vehicle may be carried across such a small depression on three wheels." The street is 24 ft. wide, and these expansion joints are placed every 20 ft. These expansion joints are ½ in. wide and are filled with several varieties of joint filler, the intention being to observe the action of these various fillers during the fall and winter, in hopes of finding the most suitable one for the given conditions. In constructing the pavement, the gutters have been made deep enough, and the crown of the pavement is of a shape, that when the pavement is worn to an extent to make repairs no longer economical, the city will be able at moderate cost to place on the old concrete a 2-in. asphaltic-concrete surface. This is the first real concrete pavement in the city, although a short experimental strip was built some years ago.

Kansas City Specifications for Creosoted Wood-Block Paving

By Clark R. Mandigo*

SYNOPSIS—The new specifications for wood-block paving of Kansas City aim to cover more completely and thoroughly than usual the treatment of blocks, this being recognized as a key to the successful pavement. The care of and method of laying the blocks on the street are also covered fully. A few extracts from the specifications are included, but the major part of the article is a discussion of the principal specification clauses and the reasons therefor. A method is described of utilizing wood-block on grades of 5 to 8% by use of special open joints.

In general, specifications for creosoted wood-block paving are indefinite in many of the essentials, as though the engineer preferred to place the responsibility on the block manufacturer and the contractor. This is especially true in the clauses covering the creosote oil and the methods of treatment, and accounts in a measure for the variation in quality of different pavements in the same city.

Kansas City's creosoted wood paving block specifications were open to these objections, although a number of pavements with only minor defects had been laid under them; and now that the ten-year maintenance guarantees on most of the asphalt pavements in the heart of the retail district of the city are expiring, it has been decided to repave immediately with wood blocks, instead of attempting to repair the worn-out sheet asphalt surface.

In redrafting specifications for wood block, an attempt has been made to insure first-class construction in every particular by rational and economical methods, to eliminate as far as possible the nuisance of bleeding, buckling and slipperiness.

Specifications

A few of the more important specification clauses are here given.[1] These and others are discussed in detail in the following columns:

Blocks

TREATMENT—The method of treatment must be thorough and up-to-date, including the necessary air-tight [illegible]

[illegible] any point less than 2[illegible] but more than 10[illegible] lb. per sq.in. and maintained at that figure long enough for the wood to absorb the specified amount of oil. The temperature of the oil after entering the cylinder shall at no time be less than 1[illegible]° F. or more than 2[illegible]° F. The blocks after treatment shall show a satisfactory penetration of oil throughout. All blocks which are in any way defective or which have been badly warped or checked in the process of treatment shall be rejected. Before removing the charge from the cylinder, the blocks shall be given a steam bath lasting at least one-half hour to clean off all the surface oil.

INSPECTION—The manufacturer shall furnish all apparatus necessary for tests and all labor which may be required in removing material for examination. [illegible] tanks and treating cylinders shall be provided with necessary gages, thermometers, draw-off cocks, etc., affording adequate means for determining the absolute weight of oil retained in the blocks. The contractor shall furnish a copy of the plant record showing a complete statement of each operation in the creosoting process.

Foundation

MORTAR CUSHION—Upon the concrete foundation, which has previously been cleaned, there shall be spread a layer of sand and portland cement mixed in the proportion of one part cement to four parts sand. The cement and sand shall be mixed dry until the mixture has a uniform color throughout and shall be spread on the foundation not less than [illegible] in. nor more than 1 in. in thickness, the depth being sufficient to bring the wood blocks to the finished grade of the street, as shown on the plans. The mortar cushion shall be carefully shaped to the true cross-section of the roadway by means of a properly made template covering at least one-half the width of the portion of the street to be paved. The template shall be drawn along guide rails or wood strips placed next the curb and in the center of the street, which have been carefully laid to grade. Where there are street-car tracks on the street, they may be used as a guide for one end of the template. After the blocks have been laid on the cushion prepared in the above described manner, and after they have been rolled, but before any filler shall be placed, the surface of the pavement shall be thoroughly wet so that the mortar cushion may receive enough moisture to cause the cement to set.

Wearing Surface

EXPANSION JOINTS—Before commencing the laying of the blocks, boards [illegible] shall be set on edge next the curb. Any projections or unevenness on the face of the curb shall be removed so that the board will fit snugly against the curb. After the blocks have been laid and rolled as hereinafter specified, these boards shall be removed and the space [illegible] shall be cleaned out and filled flush with the top of the blocks with asphaltic cement. All joints around manholes, sewers, catchbasins, valve boxes, etc., shall be filled with asphaltic cement at the same time.

LAYING BLOCKS—When delivered on the street, the blocks must be closely piled and covered to protect them from [illegible] exposure to the weather. [illegible]

*Assistant City Engineer, Kansas City, Mo.

[1]In general, the specifications are identical [illegible]

FILLING JOINTS—On the portions of the pavement where no transverse joints are specified, the joints shall be filled in the following manner: When the pavement is dry, and after it has been swept clean of all dirt, sticks and rubbish, the expansion joints and joints around manholes and catch-basins shall be filled with asphaltic cement, as hereinbefore specified.

SAND FILLER—The joints in the body of the pavement shall then be filled with clean Missouri River sand, heated to a temperature of at least 300° F. and swept back and forth across the pavement until all the joints are full. A slight excess of sand shall be left on the surface of the pavement after the joints of the pavement are filled, to be removed by the contractor without additional compensation, as soon as directed by the city engineer.

ASPHALT FILLER—The joints in the body of the pavement shall then be filled with an asphaltic cement, heated to a temperature of at least 350° F. and squeegeed into the joints with hot iron squeegees until they are full, and all surplus asphalt carefully brushed off the surface of the pavement. A coating of coarse sand or Joplin chats, heated to at least 300° F., shall be immediately whipped into the surface of the pavement, any surplus to be later removed if so required by the city engineer. Where a bituminous filler is used, the filling of the joints shall be done only in clear, dry weather, with a temperature of the air not less than 50° F.

TRANSVERSE JOINTS—Where shown on plans, which will usually be where the street grade exceeds 3½%, transverse joints shall be made by placing an ordinary building lath on edge between each row of blocks, laid at right angles to the curb, and laying the blocks closely against the lath. A slight joint shall be left between the ends of the blocks in each row. It is important that the rows of blocks shall be set as closely against the lath as possible and that the rows are straight. To this end, the rows of blocks must be driven up tight with a sledge and plank at least every fifth row of blocks. The pavement shall then be rolled as hereinbefore specified and all imperfect blocks replaced.

All of the materials entering into the pavement are first specified, followed by an account of the manner in which these materials are to be handled to form a completed pavement. This is a logical separation, but one which is not followed in any other city specification the writer has seen. It makes possible a more clearly worded specification and one in which actual operations of laying the pavement follow one another in close order. While this may not be considered important by some, it is certainly convenient and lessens the probability of the street inspector overlooking some detail which might be lost in the laboratory and plant tests as in the ordinary form of specifications.

OLD FOUNDATIONS—A great many of the streets to be repaved in Kansas City have a foundation in which a local natural cement was used. These foundations are weak at best; all lack uniformity and most of them can be removed with pick and shovel. By allowing the broken concrete from the old foundation to be used as aggregate in the new work, considerable is saved on the cost of foundation, even where additional thickness is required.

WOOD BLOCKS—In regard to the blocks themselves, it is believed that a partially seasoned timber will treat better and wear better than wood which has been thoroughly air seasoned. A seasoning of from four to six weeks is about right.

No 3-in. depth blocks have been used to date. All of the old pavements had 4-in. blocks, while pavements laid the past year, with one or two exceptions where 4-in. blocks were used, have been of 3½-in. blocks.

Only yellow-pine timber is allowed, as this has proved to be most durable, while other woods require different methods of treating, which have not yet been satisfactorily worked out.

TREATMENT OF BLOCKS—In the writer's opinion, the method used in treating blocks has a great deal more to do with subsequent trouble with swelling or bleeding than is generally believed. Anyone familiar with the operation of various creosoting plants knows that the methods in each differ considerably as does the product.

Most city engineers leave the process of treatment entirely with the manufacturer. This is not good practice, as the time in the cylinder is often a very important element. During the rush season, the plant superintendent who wants to make a good showing is liable to omit the initial steaming, force the pressure rapidly and as high as possible, and hurry the whole process. This will crowd the oil into the outside of the block and the pavement is almost certain to bleed badly, and a great deal of the oil is lost under traffic, after which the blocks absorb water and buckle.

With a timber about four weeks from the mill, a steaming of at least two hours should be required with the privilege of continuing it to four hours if thought necessary.

DUPLICATE **City Chemist's Department**

Tests and Analysis Creosoted Wood Paving Blocks

Test No. ______ Mfg. Plant ______ Date ______ 191

Blocks for ______ Contractor ______

MATERIAL

Kind ______ Condition ______ Seasoning ______

Treatment ______ Required ______ lbs. Cu. Ft.

No. Cages ______ Size Blocks ______ Cu. Ft. in Charge ______

MOVEMENT	TIME	TEMP. RANGE	REMARKS
Doors Closed			
Steam Introduced			
Vacuum Commenced			
Creosote Introduced			
Pressure Applied			
Creosote Forced Back			
Air Released			

TANK READINGS

Before Filling ______ Gallons ______ Degrees Fahr.

After Filling ______ Gallons ______ Degrees Fahr

Low Point ______ Gallons ______ Degrees Fahr.

Final Reading ______ Gallons ______ Degrees Fahr

Calculated Absorption ______ at Working Temp. ______ at 100° Fahr

Actual Absorption ______ at Working Temp. ______ at 100° Fahr.

Car No. ______ Initial ______ Date ______

______ Plant Inspector

OIL ANALYSIS

Sp. Gr. at 38° C ______ Solubility in Benzol or Chloroform ______ %

Distillation up to 100° C ______ % to 150° C ______ % to 315° C ______ %

Petroleum Compounds ______ Raw Tars ______

By ______

By ______ City Chemist

FIG. 1. PLANT TEST RECORD OF WOOD PAVING-BLOCK TREATMENT, KANSAS CITY, MO.

Following this with at least 24 in. of vacuum will remove most of the sap and resinous matter as well as air in the pores of the wood. If this vacuum is destroyed by the admission of the oil and not air, the wood is in favorable shape to get the best penetration.

If, however, the pressure on the oil is run up rapidly—close to 200 lb.—and a pure distillate oil is not used, the pores of the wood become clogged and the heavier portion of the oil remains near the outside of the block. The pressure should be put on gradually and should not be allowed to exceed 130 lb. for a 16-lb. treatment.

A final steam bath after the oil is drained off will clean the blocks and make them easy to handle on the street. A clean block will also take an asphalt filler better.

With such treatment and an oil as described in the

specifications,* almost perfect penetration is obtained. No nuisance is experienced from bleeding even with street temperatures well above 100° F. There will be some bubbles of oil appearing on the surface of the blocks during the first summer, but there will be none of the mixture of tar and sand, which tracks over the sidewalks and into stores.

PRESERVATIVE OIL—There has been considerable discussion recently over the use of a pure distillate oil, the claim being made that with such an oil, all chance of bleeding is eliminated. There is no doubt that such an oil penetrates the wood better, and being free from the heavy coal tar lessens the tendency to bleed; but if the methods described above are not followed at the creosoting plant, even this more expensive oil will bleed. While Kansas City has not tried a pure distillate oil, it has good success with the creosote-coal-tar-oil, the so called "doped oil," of specific gravity between 1.08 and 1.10. The 1.12 to 1.14 oil, specified until recently, caused too much bleeding.

It is admitted, however, that the weakest point in the present specifications is the one pertaining to the oil, and it is hoped that enough time can be devoted to a thorough study of oils this coming winter to much improve this section. It is difficult to write an oil specification which will be entirely open, giving each manufacturer an equal chance, and at the same time making it impossible for anyone to furnish an oil complying with the specifications, but not having all the good qualities desired. An oil entirely unsuitable for paving-block purposes, from the standpoint of preservative and staying qualities, could probably be furnished, which would comply with all the requirements of the present specifications.

PAVEMENT CONSTRUCTION

FOUNDATION—The streets in Kansas City carrying numbers of heavily loaded trucks and wagons are being repaved on an 8-in. portland-cement foundation. On account of the increasing speed, as well as weight of loads, absolute rigidity in the base is essential, and while a 6-in. foundation may be ample to support a quiescent load over a considerable area of soft or weaker subgrade, it does not have mass enough to absorb the vibration and shaking due to the rapid passage of a heavy load and may fail under impact. With the ever-increasing use of trucks it behooves municipal engineers to be on the safe side in laying pavement, the foundation of which should be good for from 30 to 50 years.

[illegible]—It will be noticed in the specifications that the mortar-sand cushion is mixed and laid dry, the water not being added until after the blocks are rolled. This enables the roller to bed the blocks better and get a smoother surface. A mortar-sand cushion should be used [illegible] under all wood blocks, whether along street-car tracks or not.

[illegible]—The blocks when delivered on the street should be closely piled and frequently sprinkled [illegible] in the Engineering News. It is not possible in most cities to lay the blocks directly after coming from the treating cylinder; [illegible] the hot sun and wind during shipment and

before laying will soon begin to check them and start the oil on all sides. Piling them close and sprinkling them will keep them cool and normal, more nearly the conditions they will meet after being laid.

EXPANSION JOINTS—All of the expansion joints necessary should be placed between the curb and the first row of blocks. Placing a longitudinal row of blocks between two expansion joints, as is sometimes done, is bad practice, as the single row of blocks will be almost certain to be raised up above the balance of the pavement as the expansion joints close up. Throwing a longitudinal joint any farther from the curb will be a detriment on account of wear.

If the blocks are hammered tight sidewise, in laying, they furnish each other lateral support in the direction of traffic and by friction between the rows materially reduce transverse expansion. A slight joint at the ends of the blocks allows for good penetration of the filler and transverse expansion.

There is no apparent advantage in laying the blocks at an angle to the curb, except possibly on a narrow roadway where vehicles track one another, while the right-angle method is cheaper. Straight rows are also important so that each row of blocks may act as a straight column under compression caused by expansion forces.

JOINT FILLER—On heavy-traffic streets, a sand filler has usually been specified. The sand should be coarse grained. Fine, round-grained sand has no place in any pavement. It should be applied hot and worked back and forth with wooden pushers until the joints are full. If the joints are close, a sand-filled pavement under heavy traffic will soon seal itself and iron out smooth and waterproof.

There is, however, a risk in using sand filler. Since small portions of the pavement may not get traffic, or weather or street conditions immediately following its completion may not be favorable. Municipal engineers, as a rule, believe that a bituminous filler is best for creosoted wood-block pavement, but they are troubled with the difficulty in getting it into the joints where it belongs without leaving a sticky carpet on the surface. By the use of a pure asphaltic cement, with a high melting point and low penetration, put on as described in the specifications, a great deal of the trouble usual with a bituminous filler can be avoided.

The asphaltic cement described* is very tough and rubbery at ordinary temperatures, and is not cut back materially by the creosote oil. It should be heated hot enough to run like water, and be immediately broomed back and forth across the surface of the pavement with hot iron squeegees. These squeegees are made of a slightly curved piece of ¼-in. steel plate about 18 in. long by 2 to 3 in. wide, fastened and braced to an asphalt rake handle.

At least four squeegees should be on hand and they should be kept hot in the fire pot of the asphalt kettle, two being in use while two are heating. If these are used with skill, even the smaller joints in the pavement can be filled with asphalt and only a very thin coating left on the surface of the pavement.

Immediately after filling the joints a slight coating of very hot coarse sand or dust should be wrapped into the surface. The sand should be hot enough to melt the

*[illegible]

*Penetration at 25° C. with a No. 2 needle, weighing with 100 grams, in 5 sec., not more than [illegible] nor less than [illegible] [illegible] melting point not less than [illegible] C.—Editor.

asphalt remaining on the surface, and not too much should be used so that there will be no surplus to be removed later. It is obvious that this method of applying filler will reduce to a minimum any chance of a sticky surface.

Wood Block on Steep Grades

In Kansas City, nearly all streets have some stretches of more than 3½% grade. If creosoted wood blocks were, therefore, to be used successfully, some method had to be devised for preventing slipperiness on grades. The city has adopted, with some changes, the method introduced by A. H. Stone, Assistant Engineer of the Kansas City Terminal Ry., in the paving of some of the railway's viaducts. The writer understands that this same method of laying blocks on grades was first used in Vancouver, B. C.*

Special Joint Filler—The method consists of laying a line of ordinary building lath on edge on the sand cushion between each row of blocks, and filling the balance of the joint with stone chats and asphalt after the blocks are rolled. Pavement of this kind has been used successfully on grades of 5 and 6% and there is no reason why it should not be used on grades as high as 8 to 10%.

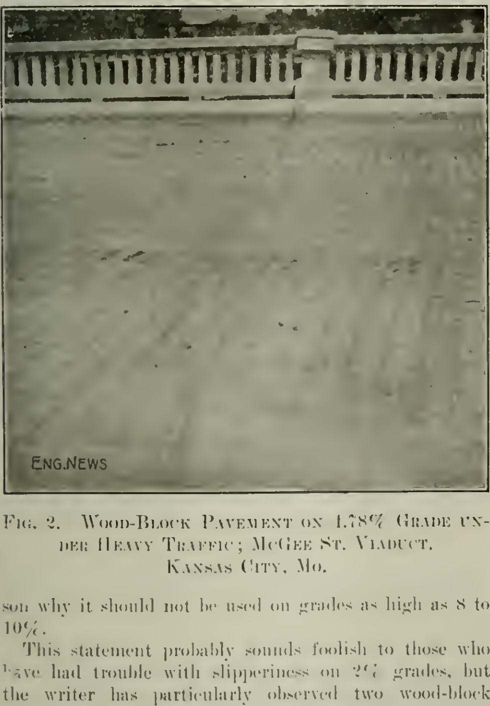


Fig. 2. Wood-Block Pavement on 1.78% Grade under Heavy Traffic; McGee St. Viaduct, Kansas City, Mo.

This statement probably sounds foolish to those who have had trouble with slipperiness on 2% grades, but the writer has particularly observed two wood-block pavements laid with lath joints on 4.78% and 5.17% grades, and subjected to considerable traffic and one short stretch of 11% grade, for more than a year, under all weather conditions; and he has never seen nor heard of a horse falling on any of them.

There is no uncertainty in a team on one of these streets, even with a heavy load; there is no quivering of the horses' legs due to an insecure foothold, but a straight, deliberate, hard-pulling walk possible only when a team is sure footed.

A wood-block pavement laid with lath joints, in the writer's opinion, offers a much better foothold than sheet asphalt or even tar-filled vitrified brick.

Filling Joints—In constructing the open-joint pavement, the rows of blocks must be frequently sledged close to the lath and straight rows obtained. The broken stone which is placed in the joints should be of practically one size and of the largest size that can be swept into the joint. Stone grit should be screened over a ⅜-in. screen before heating, as any fine material in the stone prevents the asphalt penetrating to the bottom of the joint.

The asphalt filler should be heated and applied in exactly the same manner as described for the close-joint pavement in order that there shall be no surplus left on the surface of the pavement.

It is expected the open-joint pavement will not wear quite as long as one with close joints, although at the end of two years there is no evidence to support this. The joints are packed solid and remain nearly flush with the surface of the blocks. The blocks are very firmly bedded and the joint is so small that it is not picked out nor are the edges of the blocks broomed down more than in the ordinary pavement.

There is no fixed rule for the grade at which to change from close to open transverse joints, as this will depend entirely on local conditions as to the general grade on the street to be paved, the class of traffic, the kinds of grades and pavements the local teamsters are accustomed to, and general weather conditions.

Conclusions—Kansas City offered a particularly unfavorable field for creosoted wood-block pavement on account of the topography, practically all streets having some stretches of grades of 4% or greater, while many exceed 6 or 7%. There are long, hot, dry spells during the summer; and no street sprinkling is done by the city.

The entire cost of the paving, repaving or repairing, after the expiration of the guarantee, is assessed in special tax bills directly against the abutting property; so that any attempt to lay a high-priced pavement was met with opposition, until the new pavement could be proved to be cheaper in the long run and entirely satisfactory.

By the use of a heavy foundation, and a mortar-sand cushion, rigidity of the base is obtained, which will hold the block surfacing absolutely true to grade and crown. The 16 lb. of 1.10 oil per cu.ft. of timber, injected clear through the blocks by the method of treatment described, prevents decay and partially waterproofs the block, without, at the same time, causing any nuisance from bleeding. The lath transverse joints will prevent slipperiness on grades; and the asphalt filler waterproofs the surface, preventing swelling and buckling; and if placed as described, does not make an objectionable sticky mass on the surface of the blocks.

There are undoubtedly many points in the laying of creosoted wood-paving blocks which have not been touched upon and many things in the specifications offered which may require changing, especially if they are to apply under different local conditions. They are offered more by way of suggestion than as absolute rules. They are, however, the outcome of careful experiments, in which all of the methods described have been used with success.

*The same method of laying wood block on grades is now being used extensively in Detroit, Mich., where many old granite block pavements are being replaced with creosoted wood-block.—Editor

Winter Stream Measurements in Western Canada

By P. M. Sauder*

SYNOPSIS—This is a description of some interesting stream measurement work under particularly disadvantageous conditions. It forms a valuable supplement to previous articles in ENGINEERING NEWS: *"Determination of Stream Flow during Frozen Season," by C. Robert Adams, Feb. 2, 1911; "Gaging Minnesota Streams in Winter," by W. G. Hoyt, Sept. 12, 1912; "Methods of Estimating Stream Flow When Streams Are Frozen," by W. G. Hoyt, Apr. 10, 1913; and "Stream Flow Gaging under Winter Ice Conditions," by Chester Wason Smith, June 19, 1913.*

The work referred to in this article is that being done by the Irrigation Branch of the Government of Canada, in the Provinces of Alberta and Saskatchewan. All the larger streams in this territory have their sources in the Rocky Mountains. They flow in an easterly or northeasterly direction and after emerging from the foothills converge into two large streams, the North and South Saskatchewan Rivers.

There are, of course, a large number of smaller streams, which drain the prairies and empty into these two rivers; but while some of them have quite a large flow during the early spring, and during wet seasons, the flow, if any, is always very small during the winter months. Even the flow of the larger streams is comparatively small during the winter months.

The Bow River at Calgary, Alberta, may be taken as typical of the streams heading in the mountains, and which receive special attention during the winter months. Its flow ranges from a minimum in the winter of about [illegible] sec.-ft. to an average high-water flow of about 10,-500 sec.-ft. in summer, and the highest known flood due to the combined effect of warm weather melting the snow in the mountains, heavy rains and a cloud burst, is estimated at 51,000 sec.-ft.

*Chief Hydrographer, Office of the Commissioner of Irrigation, Calgary, Alta., Canada.

FIG. 1. OPEN-WATER RATING CURVE FOR SPRAY RIVER NEAR BANFF, ALBERTA

(This open-water curve is based on readings made during [illegible])

FORMATION OF ICE AND ICE CONDITIONS

Perhaps the greatest difficulties in the measurements are met with in the early part of the winter, just as the streams are commencing to freeze up. Especially is this true in the swift-running streams in or near the mountains. Needle and anchor ice often forms in large quantities in rapids, and flowing in masses [illegible] the water, make gagings very difficult and unreliable. Even after a permanent ice cover is obtained at the gaging station, the ice will, in some cases, obstruct the channel below the station and cause "backwater."

A further difficulty is that the surface ice usually forms along the edges of the stream for some time before forming in the center of the channel. At first, this may be broken away if the stream is small and open water measurements made, but later it is necessary to take some observations through holes in the ice along the edge. At

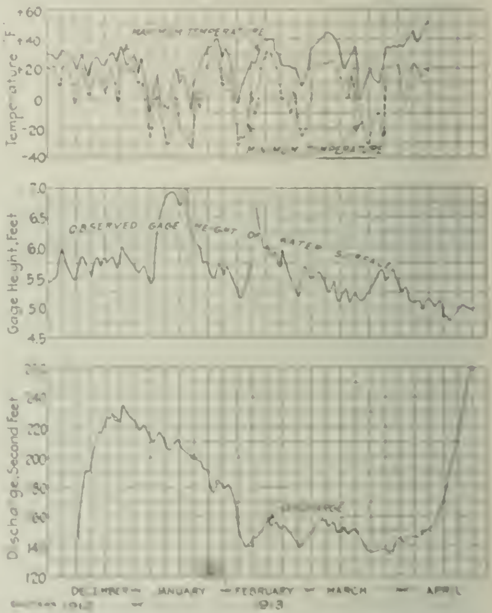


FIG. 2. OBSERVATIONS OF GAGE HEIGHTS ON SPRAY RIVER NEAR BANFF WITH CORRESPONDING MAXIMUM AND MINIMUM TEMPERATURES AND THE ESTIMATED DAILY DISCHARGES FOR THE WINTER 1912-1913

(The circles on the discharge curve indicate actual discharge measurements. Note the rise in gage height in January and February when the temperature was lowest and the discharge measurements showed that the flow was decreasing.)

the streams get farther away from the mountains their velocity decreases, and fewer rapids occur along their course. There is then less trouble with needle and anchor ice, and a permanent ice cover forms much more quickly.

In many cases the section used during the summer is very unsuitable for making measurements during the winter. It may be: (a) too wide and shallow or flowing in two channels during the winter, due to low water; (b) partially open due to swift-running water or warm water running in; (c) affected by needle and anchor ice either by flowing in the water, or causing backwater; (d) located where the snow drifts over the ice to a great depth; (e) that it is likely to have a rough ice cover or pile up with ice, due to swift water and a rough bed; (f) that there is a tendency for ice jams to occur, with consequent backwater, etc.

The typical curve, however, differs from that obtained from an open-water observation in that it is drawn back more at the surface, owing no doubt, to greater friction between the ice and the water as compared with the water and the atmosphere. As a result there are two points in the vertical at which the thread of mean velocity occurs under an ice cover. These points are near 0.2 and 0.8 of the total depth below the bottom of the ice, and the mean of the velocities at these two depths will give fairly accurate results; but when close estimates of the discharges are required, and the conditions are not very favorable, the vertical-velocity method should be used.

It is found that when all the holes are opened on a small swift stream, there are sometimes vertical pulsations of the water in the holes, which affect the velocity readings. This can usually be avoided by only opening one hole at a time, and filling it in again with ice and snow as soon as the observation is finished. It can also be overcome by inserting a thin sheet of galvanized tin or iron at the bottom of the hole, after the meter has been lowered into the water. The meter should always be held near the upstream side of the hole.

FIG. 3. GAGING STATION ON PIPESTONE RIVER NEAR LAGGAN, ALBERTA, IN EARLY WINTER 1912-1913

It is, therefore, often necessary to choose a new section for winter observations. This should be done before the freeze-up, for then, the width, depth, uniformity of flow and conditions above and below can be easily noted. The most suitable stations for winter measurements are those which have a long stretch of very smooth, sluggish water above, and a rapid fall below.

Discharge Measurements

In winter as in summer, the daily discharges of a stream are computed from frequent discharge measurements and daily gage-height observations. The discharge measurements are made through holes in the ice from 5 to 10 or even 20 ft. apart, depending upon the size of the stream, and large enough to allow the current meter to pass through freely.

The gagings are made in the same manner as at open sections except that the depth of the stream is taken as the distance from the bottom of the ice to the bed of the stream. The soundings, however, are always referred to the surface of the water in the holes, the distance from the surface of the water to the bottom of the ice being measured and subtracted from the soundings to obtain the depth.

The vertical velocity-curve method is usually used for the determination of the mean velocity in the vertical. A curve is plotted for each vertical, and the mean velocity is determined in the usual manner. These curves vary greatly as to form for different kinds and conditions of channel.

In using the meter, care must be taken to keep it under the water as much as possible to prevent ice from forming around the bearings. It is a good plan to clean and oil the meter indoors before starting out to make a gaging.

Gages and Gage Observations

The gage is usually read once each day, the observer noting the elevation of the water as it rises in a hole cut through the ice, the height of the top of the ice, the thickness of the ice, presence of needle or slush ice, snow on top of ice, ice jams, and any sudden changes in temperature. To do this, the observers are provided with an ice chisel for chopping holes, and an L-shaped ice scale to measure the thickness of the ice.

A difficulty which arises, in obtaining the thickness of the ice is that in a hole kept open for some time the ice wears away around the bottom of the hole, and may make it necessary to cut a new hole near-by, or enlarge the original.

Any form of gage may be used, but the chain gage is the most satisfactory, as the staff gage, being frozen to the ice, heaves with it, and also in cutting away the ice from around it the figures are effaced. The automatic gage gives trouble with the well freezing over.

Fig. 4. Ice Conditions at the Regular Gaging Station on Pipestone River near Laggan, Alberta, during the Winter 1912-1913

Fig. 5. Ice Conditions at the Gaging Station on Spray River near Banff, Alberta. Taken on Mar. 5, 1912

Fig. 6. Ice Conditions at the Gaging Station on Kananaskis River near Kananaskis, Alberta. Taken Mar. 1, 1913

Estimates of Daily Discharge

While the runoff, particularly during the winter months, does not vary directly or coincidently with the precipitation, the rate at which it supplies the streams is, of course, dependent almost entirely upon the climatic conditions. The climate in the mountains is subject to great extremes, but during the winter almost the entire precipitation is in the form of snow.

There is, therefore, very little surface runoff and the flow of the streams comes almost entirely from the glaciers, groundwaters and lake storage, and except for the losses due to freezing and the slight increases due to the melting of snow and ice by chinooks (warm winds), the flow in the streams would remain constant or would change gradually.

There are, however, certain local conditions in Western Canada which make it exceptionally difficult to make estimates of the daily discharge during the winter. The gage heights in many cases fluctuate very much, and often sudden rises or drops occur. These rises are often

FIG. 7. ICE CONDITIONS AT THE REGULAR GAGING STATION ON BOW RIVER NEAR LAGGAN, ALBERTA DURING THE WINTER 1912-1913

FIG. 8. GAGING STATION ON BOW RIVER NEAR LAGGAN, ALBERTA, IN EARLY WINTER (NOTE THE SLUSH ICE FLOATING IN THE STREAM)

FIG. 9. ICE CONDITIONS AND GAGING TRENCH AT THE REGULAR GAGING STATION ON PIPESTONE RIVER NEAR LAGGAN, ALBERTA, ON FEB. 28, 1912

FIG. 10. MASS OF ICE IN DEVIL'S CREEK NEAR BANKHEAD, ALBERTA, CAUSED BY TURNING IN WATER DURING VERY COLD WEATHER

explained by the fact that during very cold spells a great deal of slush, frazil and anchor ice is formed and chokes up the channel, thus raising the surface of the water, when in reality the discharge is decreasing. Then, again, a chinook causes a sudden rise in temperature and the discharge is often increased while at the same time the gage height gradually lowers, evidently because the warmer weather and water have melted out a lot of the ice from

the channel and gives it a greater carrying capacity.

In order to make reliable estimates of the daily discharge, gagings must be made at short intervals and the weather conditions and temperatures in the whole of the drainage area above the station must be very carefully studied.

W. G. Hoyt, District Engineer, Water Resources Branch, U. S. Geological Survey, has made a very exhaustive study of methods for estimating the flow when streams are frozen. The various methods described by him in the article in ENGINEERING NEWS on Apr. 10, 1913, and modifications of them are used. The graphic method of interpolation has been found to be most generally applicable. But as the precipitation during the winter months has so little effect upon the runoff during that period, it is seldom plotted on the sheets. It is also considered that the extremes and ranges of temperatures are better guides for interpolation than the mean temperatures and the minimum and maximum temperatures are both plotted and given due consideration rather than the mean temperatures.

The weather conditions and temperatures at the gaging station are not always typical for the whole drainage basin above, and care must therefore be taken to have the meteorological observations made at some other place, or if necessary, at two or more places. Of course, care must be taken to study all the possible conditions which may affect the estimates.

Fig. 2 shows typical conditions and illustrates the graphic method of interpolating the daily discharges. The other views show conditions under which gagings are taken during the winter.

Rebuilding and Surfacing the Old National Pike with a Concrete Pavement*

The rebuilding of the old Cumberland or National Pike is of historical as well as engineering interest. The section which lies in Ohio will probably soon be improved throughout the whole length at an expense of about $2,000,000. A typical section, 24 miles long, between Zanesville and Hebron, is now under construction. It is being surfaced with concrete under joint appropriations of the U. S. Office of Public Roads, the counties of Licking and Muskingum, and the Ohio State Highway Department, at a cost of $436,017, including new bridges and culverts.

HISTORY OF THE OLD NATIONAL PIKE—The first appropriation of $30,000 for the Cumberland Road was made in 1806. This stretch extended from Cumberland, Md., to a point near Wheeling. Subsequent legislation for the Cumberland Road carried total appropriations amounting to $7,000,000, paid entirely out of the national treasury. These amounts seem small today, when the 1911 appropriations of states, counties and the national government total about $250,000,000, but they were large considering the scanty population and resources of the times.

The road was built by the Federal government, under the supervision of the War Department. The eastern end averaged in cost from $9000 to $13,000 per mile, which included heavy grading and massive stone bridges.

*Information from J. P. Beck, of the Universal Portland Cement Co., 208 South La Salle St., Chicago, which furnished the cement for the work.

FIG. 1. OLD NATIONAL PIKE OR CUMBERLAND ROAD EXTENDING ABOUT ONE HALF MILE EAST OF GRATIOT, OHIO

In eastern Ohio grading was much less and the cost was in the neighborhood of \$3500 per mile. Rivers and creeks were spanned by handsome stone bridges and culverts.

PRESENT CONDITION—The pike is still in fairly good condition when it is considered that practically no attention has been paid to its maintenance since it was turned over to the various states and later to the counties. Many of the original stone bridges are well preserved.

The class of houses along the Pike distinguish it from other roads. They are substantial, many being of

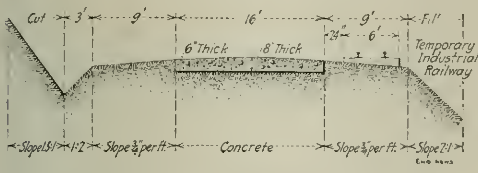


FIG. 2. TYPICAL CROSS-SECTION

stone. Some of the old inns, which were built at intervals of about 15 miles to serve travelers at the end of each day's travel, are still in existence.

NEW WORK—On. Apr. 15, 1914, the contract for the first section of new concrete pavement was awarded. Work was immediately started from both ends by grading gangs operating a traction engine, grader, rooter, roller, steam shovel and 50 teams. Bridge and culvert builders followed soon after, succeeded by gangs laying track along one side of the roadbed. As soon as trains were running, concrete mixers were put in operation.

The pavement is 16 ft. wide, 6 in. thick at the sides and 8 in. in the center and is laid on a flat subgrade. Expansion joints of tarred felt are placed 30 ft. apart at an angle of 75° with the center line.

Preliminary crowning of the concrete surface is done with a strike board made of three 1x6-in. boards bolted together. The lower edge is shaped to the desired crown, shod with a $\frac{3}{16}$-in. plate and additionally reinforced by two small angles. Long iron hooks fitting into eyes serve to move the board, which is held erect by means of ½-in. round steel handles. After the surface has been struck off two or three times it is brought to a still better crown by means of a template similar to, but lighter than, the strike board. Two men operate the template by lifting it a few inches, letting it fall and then moving it forward about 2 in. after each blow.

All curves over 12° are elevated on the outer edge to a maximum of 8 in. The superelevation is calculated for a speed of 30 mi. per hr. This elevation is accomplished by rotating the section of roadway about its horizontal center line so that the cross-section remains the same, the outer edges being elevated and lowered at the subgrade, respectively.

Steel forms are used and have proved very satisfactory. Three complete paving outfits are in operation. The mixers are of the boom and bucket type with batch capacities of 10 cu.ft. Although each crew of 35 men is rated as capable of laying 600 ft. in a day, there has been no time when all were working at maximum capacity so that the best day's run to date has been 1520 lin.ft. (for all the outfits). Wheeling to the mixer is done with a double set of barrows, one set being loaded while the other set is being wheeled and dumped into the mixer.

The contractor has had a private switch built from the railroad at each end of the road. The materials are unloaded to stock piles by clam-shell buckets from where they are loaded to elevated bins opposite. A 3-ft. gage industrial railway serves to haul materials. Cars are run under the hoppers and loaded as required.

A train, consisting of an engine, six cars, a second engine and two more cars, can be operated over a maximum grade of 5%. On steeper grades the last two cars are dropped, the two engines run up with the six cars and the last engine backs down and gets the two remaining cars. A complete train can be loaded in an average of 15 min. Cement is loaded by hand directly from the railroad cars to flat-cars on the industrial railway and hauled to site along with the other materials.

Very little difficulty has been encountered with cars jumping the track or with spreading rails. That the industrial railway has proved an economy is shown by the fact that the cost of hauling, 12c. per ton-mile, is about half the estimated cost of hauling by teams. As the length of haul increases the cost will be further reduced.

A railroad crosses the highway about two miles from the west end. This 2-mile stretch is being supplied with material by means of trains consisting of a traction engine and trailer cars. The cars are pulled into the railroad yard, loaded by clam-shell buckets directly from the stock pile and hauled to the site. The one tractor, hauling four or five 2-cu.yd. cars over this portion of the road, which is practically level, supplies all the materials for the single mixer.

Water for mixing and curing is supplied by pumping stations set at 4-mile intervals. These stations pump 2 miles in either direction through 2-in. mains. The sand and gravel are washed, screened and remixed to the proper gradations. At one end of the road gravel is used for coarse aggregate and at the other end crushed stone, the mixtures being 1 : 1½ : 3 and 1 : 1¾ : 3 for the gravel and crushed stone, respectively.

The federal government has three engineers on the work at all times, while the state has eight inspectors who hand in daily reports, which are compiled on cost-data sheets by the government engineers.

This is the largest and most thoroughly organized concrete road job that has ever been carried on by the Ohio State Highway Department and some valuable data will be available, it is anticipated, as the contractor is coöperating with the engineers in the compilation of all cost figures.

The contractor is the H. E. Culbertson Co., of Cleveland, with whom are associated Frank L. Shoemaker, contractor, and H. A. Johnston, and G. S. Allen, of the Globe Construction Co., all of Kalamazoo, Mich. C. H. Moorefield is the U. S. Office of Public Roads representative and R. N. Waid is Division Engineer for the Ohio State Highway Department.

A Damage Suit to Recover for a Poor Bituminous Pavement has been lost by the city of Hutchinson, Kan., because the city engineer failed to notify the pavement company of defects in the pavement. The company guaranteed the pavement for one year. The counsel for the defense argued that the contract stated that the pavement should be kept in good repair for one year, but that a statement had been inserted in the contract which made the city engineer solely responsible for the pavement. The city engineer neglected to notify the company of the defects which developed, and this, the counsel argued, excused the paving company from further liability. The case was decided in favor of the defendant by the United States court at Wichita, Kan., Oct. 1.

Formulas for Locating Frogs and Switches on Circular and Tangent Tracks

By [illegible]*

The [illegible] of turnouts from tracks [illegible] their curvature between switch and frog points is mostly by analytic methods, the solution being obtained after solving a number of triangles. Little information is to be found on the subject in standard handbooks, although the computations may be very much simplified through the use of worked-out formulas. With this end in view, the table on p. 928 has been prepared.

A variety of cases may arise, according to the features of the main track, the location of the turnout and the quantities to be solved for. However, provided the point to be located falls within a circular or tangent portion of the main track, any problem of this kind permits of a direct solution.

The following denominations will be used:

- P F = point of frog;
- P S = point of switch;
- P C C = point of compound or circular curve;
- P R C = point of reverse curve;
- P T C = point of transition curve;
- S, R = radius of main track;
- r = radius of turnout;
- g = standard gage;
- n = number of frog;
- F = angle of frog;
- J, K, L = angles of lead;
- l = lead on tangent.

Consider first the general case shown in Fig. 1, representing an inside turnout from a compound curve on the main track, the terms "inside" or "outside" being used in the following according as the frog is on the inside or outside rail of the main track.

The main track is here assumed to be composed of two circular portions with centers at i and c respectively. The position of the switch is supposed to be known, the radius through P S forming an angle K with the radius through P C C and intersecting the circle of radius $S + \frac{g}{2}$ at a point d. It is required to find the location of P F and the turnout radius corresponding to a frog angle F.

SOLUTION—Through center c, draw a line at an angle F with radius [illegible] and determine its point of intersection [illegible] with the circle of radius $R - \frac{g}{2}$. Draw a line through [illegible] and [illegible], producing it until it again intersects the circle [illegible]. A perpendicular bisecting line [illegible] at [illegible] will then intersect radius [illegible] at a point [illegible], which is the center of the turnout circle.

This is readily demonstrated by drawing lines [illegible] and [illegible]. [illegible] through [illegible] with [illegible] as a center must hit the [illegible] rail of the main curve at [illegible] and intersect the [illegible] rail at [illegible] at an angle [illegible] = F. [illegible]

[illegible] = [illegible], or, since [illegible] and [illegible], [illegible] = F, according to construction.

The circle [illegible] represents the outer rail of the turnout, P F being determined by the angle J between radius [illegible] and the radius through P C C.

To find the value of J, draw line bm perpendicular to cd. Since $\angle cfb = F$, we have:

$\angle dbm = \frac{1}{2} \angle dif = \frac{1}{2}(J + K + F)$. Further:

$$tan\ dbm = \frac{dm}{bm} = \frac{cd - ce \cos K - cb \cos F}{ce \sin K + cb \sin F}$$

Substituting

$$cd = S + \frac{g}{2};\ ce = S - R;\ cb = R - \frac{g}{2}$$

gives

$$tan\ \tfrac{1}{2}(J + F + K)$$

$$= \frac{S + \frac{g}{2} - (S - R)\cos K - \left(R - \frac{g}{2}\right)\cos F}{(S - R)\sin K + \left(R - \frac{g}{2}\right)\sin F} \qquad (1)$$

Considering that

$$tan\ \tfrac{1}{2}(J + F + K) = \frac{tan\frac{J}{2} + tan\frac{F + K}{2}}{1 - tan\frac{J}{2}\,tan\frac{F + K}{2}}$$

and that from the definition, $n = \frac{1}{2}\cot\frac{F}{2}$, we have by solving for $\frac{J}{2}$ and reducing

$$tan\frac{J}{2} = \frac{ng - S\tan\frac{K}{2}}{R + 2n\tan\frac{K}{2}\left(S - R + \frac{g}{2}\right)} \qquad (2)$$

By drawing line [illegible] and considering the triangles [illegible] and [illegible] we next obtain the following equations:

$$ie^2 = if^2 + ef^2 - 2\,if \cdot ef \cos F$$

$$ie^2 = ic^2 + ce^2 - 2\,ic \cdot ce \cos K$$

Substituting: $if = r + \frac{g}{2}$, $ef = R - \frac{g}{2}$, $ic = S - r$, $ce = S - R$, and substituting $\cos F = \frac{4n^2 - 1}{4n^2 + 1}$ and

$$\cos K = \frac{1 - tan^2\frac{K}{2}}{1 + tan^2\frac{K}{2}}$$

and reducing, we have:

$$r = S - \frac{\left[RS - 2gn^2\left(S - R + \frac{g}{2}\right)\right]\left(1 + tan^2\frac{K}{2}\right)}{(4gn^2 + R)\left(1 + tan^2\frac{K}{2}\right) + (S - R)(4n^2 + 1)\,tan^2\frac{K}{2}} \qquad (3)$$

In equations (2) and (3), J and r are expressed as functions of K. When, however, the location of P S is to be determined from a given P F, the problem is reversed and it is necessary to express K and r as functions of J.

By solving for K in equation (2), we have:

$$tan\frac{K}{2} = \frac{gn - R\tan\frac{J}{2}}{S + 2n\tan\frac{J}{2}\left(S - R + \frac{g}{2}\right)} \qquad (4)$$

*[illegible]

which value is substituted in equation (3). The expression thus obtained may be reduced to:

$$r = \frac{\left[R\left(S-R+\frac{g}{2}\right)\tan^2\frac{J}{2}+S\frac{g}{2}\right](4n^2+1)}{(2gn^2+R)\left(1+\tan^2\frac{J}{2}\right)+(S-R)\left(1+2n\tan\frac{J}{2}\right)^2} - \frac{g}{2} \qquad (5)$$

From equations (2) to (5), expressions covering all the various cases referred to at the outset may be easily derived, as will be shown through a few examples.

Considering the case of an *outside* turnout from the main track shown in Fig. 1, it is evident that, keeping the turnout in the same place, it will change to an outside turnout if the main track on both sides of P.C.C. is first straightened out and then curved the opposite way. In mathematical terms this is equivalent to reversing the signs of R and S.

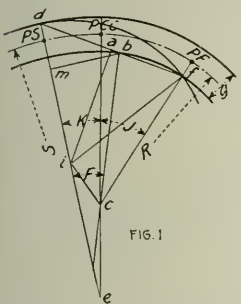


FIG. 1

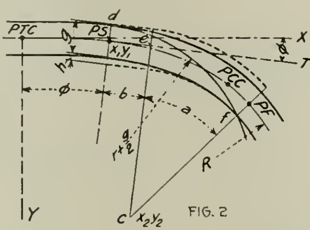


FIG. 2

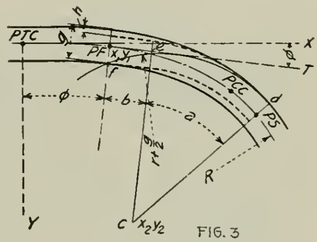


FIG. 3

The corresponding angles J and K, which may be expressed as inverse functions of their radii, would then have to be considered negative. It being more convenient, however, to deal with positive angles, we also reverse the signs of J and K, laying them off to the same sides of P.C.C. as before. If then, J or K comes out negative it is an indication that the frog number originally assumed cannot be used under the conditions given.

By substituting $-R$ and $-S$ for R and S in equations (2) to (5) and noting that $\tan(-x) = -\tan x$, we thus obtain the values for the case considered, as represented by the lower signs in the table. The turnout radius may, in this case, come out either positive or negative, a positive value indicating that at P.F. the turnout and main track are curved opposite ways, while for a negative r they are curved in the same direction (see left-hand and right-hand diagram, respectively).

Similar reasonings are applied in deriving the formulas for a main track made up of two circular portions of reversed curvature: For inside turnouts, reverse the signs of S and K in equations (2) to (5); for outside turnouts, reverse the signs of R and J. In this case, only positive values of r need be considered.

If the main track is made up of one circular and one tangent portion, the value ∞ will have to be substituted for R or S in equations (2) to (5), according as the frog or the switch lies on the tangent portion.

When P.F. is on a tangent, the substitution of $R = \infty$ will make both sides of equation (2) zero, as angle J may be expressed as $\frac{d}{R}$, where d represents the subtended arc as measured along the center line of track. To obtain a definite equation, multiply both sides of equation (2) by $2R$:

$$2R\tan\frac{J}{2} = \frac{2R\left[ng - S\tan\frac{K}{2}\right]}{R + 2n\tan\frac{K}{2}\left[S - R + \frac{g}{2}\right]}$$

Substituting $\frac{d}{R}$ for J, we then have for left and right side respectively:

$$\left(\lim_{R=\infty}\right)\left[2R\tan\frac{d}{2R}\right] = \left[\lim_{\frac{1}{2R}=0}\right]\left[\tan\frac{d}{2R} \div \frac{1}{2R}\right]$$

$$= \left[\lim_{\frac{1}{2R}=0}\right]\left(\frac{d}{\cos^2\frac{d}{2R}} \div 1\right) = d \qquad (6)$$

$$\left(\lim_{R=\infty}\right)\frac{2R\left[ng - S\tan\frac{K}{2}\right]}{R+2n\tan\frac{K}{2}\left[S-R+\frac{g}{2}\right]} = \frac{2\left[gn - S\tan\frac{K}{2}\right]}{1+2n\tan\frac{K}{2}}$$

The limits of equations (3) to (5) are found by simple differentiation, the value of $R\tan\frac{J}{2}$, as found in equation (6) being substituted where convenient.

Similarly, when P.S. is on a tangent, multiply both sides of eq. (4) by $2S$. By substituting $K = \frac{d}{S}$ and differentiating we have:

$$\left(\lim_{S=\infty}\right)\left[2S\tan\frac{d}{2S}\right] = d$$

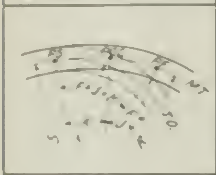
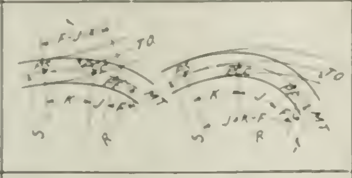
the other three expressions being obtained from equations (2), (3) and (5) through plain differentiation.

The formulas thus derived apply to inside turnouts. To obtain the corresponding expressions for outside turnouts, simply reverse in each formula the sign of the main track radius (R or S) and the corresponding angle (J or K). Where there is only one main track radius to be considered in the final formulas, this radius has, in the table, been designated by the letter R while for the angle of lead the letter L has been used.

Coming finally to the cases where there are several changes in the curvature of the main track between P.F. and P.S., a typical example of this kind is shown in Fig. 2, representing an inside turnout df (only the outer

INSIDE TURNOUTS	OUTSIDE TURNOUTS	SOLUTION

Frog and Switch on Compound Circular Curves

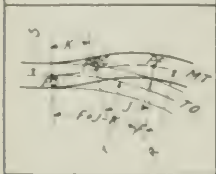
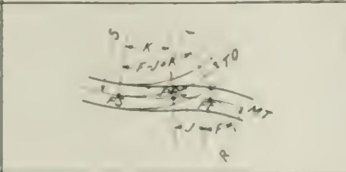



$$\tan\frac{J}{2}=\frac{gn-S\tan\frac{K}{2}}{R\pm 2n\tan\frac{K}{2}(S-R\pm\frac{g}{2})}\quad(1),\qquad \tan\frac{K}{2}=\frac{gn-R\tan\frac{J}{2}}{S\pm 2n\tan\frac{J}{2}(S-R\pm\frac{g}{2})}\quad(2)$$

$$r=\pm S-\frac{[RS\pm 2gn^2(S-R\pm\frac{g}{2})](1+\tan^2\frac{K}{2})}{(2gn^2\pm R)(1+\tan^2\frac{K}{2})\pm(S-R)(4n^2+1)\tan^2\frac{K}{2}}\quad(3)$$

$$r=\frac{[R(S-R\pm\frac{g}{2})\tan^2\frac{J}{2}\pm S\frac{g}{2}](4n^2+1)}{(2gn^2\pm R)(1+\tan^2\frac{J}{2})\pm(S-R)(1\pm 2n\tan\frac{J}{2})^2}-\frac{g}{2}\quad(4)$$

Frog and Switch on Reverse Circular Curves

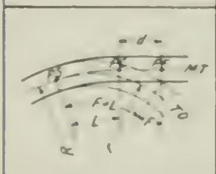
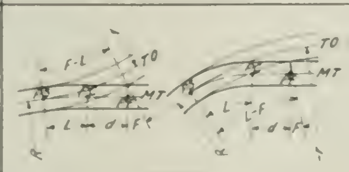



$$\tan\frac{J}{2}=\frac{gn-S\tan\frac{K}{2}}{R\pm 2n\tan\frac{K}{2}(S+R\mp\frac{g}{2})}\quad(1)\qquad \tan\frac{K}{2}=\frac{gn-R\tan\frac{J}{2}}{S\mp 2n\tan\frac{J}{2}(S+R\mp\frac{g}{2})}\quad(2)$$

$$r=\mp S+\frac{[RS\pm 2gn^2(S+R\mp\frac{g}{2})](1+\tan^2\frac{K}{2})}{(2gn^2\pm R)(1+\tan^2\frac{K}{2})\mp(S+R)(4n^2+1)\tan^2\frac{K}{2}}\quad(3)$$

$$r=\frac{[R(S+R\mp\frac{g}{2})\tan^2\frac{J}{2}\pm S\frac{g}{2}](4n^2+1)}{\pm(S+R)(1\pm 2n\tan\frac{J}{2})^2-(2gn^2\pm R)(1+\tan^2\frac{J}{2})}-\frac{g}{2}\quad(4)$$

Frog on Tangent, Switch on Circular Curve

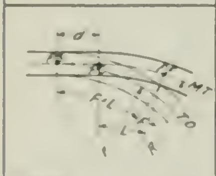
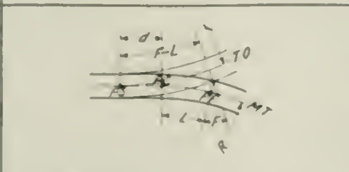



$$d=\frac{2(gn-R\tan\frac{F}{2})}{1\mp 2n\tan\frac{F}{2}}\quad(1)\qquad \tan\frac{F}{2}=\frac{2gn-d}{2(R\mp dn)}\quad(2)$$

$$r=\pm R-\frac{(2gn^2\pm R)(1+\tan^2\frac{F}{2})}{4n^2\tan^2\frac{F}{2}-1}\quad(3)$$

$$r=\frac{(2gR\mp d^2)(n^2+\frac{1}{4})}{R\pm 2gn^2\mp 2dn}-\frac{g}{2}\quad(4)$$

Frog on Circular Curve, Switch on Tangent

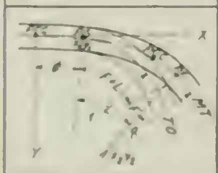
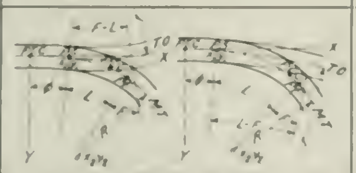



$$\tan\frac{F}{2}=\frac{2gn-d}{2(R\pm dn)}\quad(1)\qquad d=\frac{2(gn-R\tan\frac{F}{2})}{1\pm 2n\tan\frac{F}{2}}\quad(2)$$

$$r=\frac{gn^2(2R\mp g)\pm d^2(n^2+\frac{1}{4})}{R\pm 2gn^2}\quad(3)$$

$$r=\frac{(\frac{g}{2}\pm R\tan^2\frac{F}{2})(4n^2+1)}{(1\pm 2n\tan\frac{F}{2})^2}-\frac{g}{2}\quad(4)$$

Frog on Circular Curve, Switch on Transition

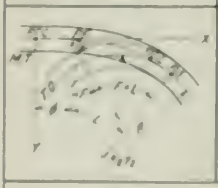
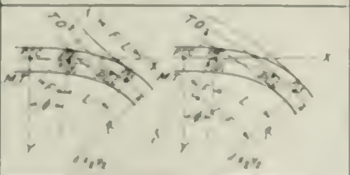
$$\tan\frac{F}{2}=\frac{2n(g\pm h)-b}{2(R\pm bn)+h}\quad(1)$$

$$r=\frac{gn^2(2R\mp g)\pm(b^2+h^2+2h R)(n^2+\frac{1}{4})}{R\pm 2gn^2+2h(n^2+\frac{1}{4})}\quad(3)$$

where $b=(x_2-x_1)\cos\phi+(y_2-y_1)\sin\phi$

$h=(y_2-y_1)\cos\phi-(x_2-x_1)\sin\phi-R$

Frog on Transition, Switch on Circular Curve

$$\tan\frac{F}{2}=\frac{2n(g\pm h)-b}{2(R\pm bn)+h}\quad(2)$$

$$r=\frac{(g\pm h)(2R+h)\pm b^2(n^2+\frac{1}{4})}{R\pm\frac{h}{2}\pm 2n^2(g\pm h)\mp 2bn}-\frac{g}{2}\quad(4)$$

the value of "b" and "h" being the same as in case above

TABLE OF FUNCTIONS FOR g = 4' 8½"

n	gn	2gn²	log gn²	log(4n²+1)	Angle "F"
4	18.833	150.667	1.9768??	1.81291?4	14° 15' 00"
[illegible]	23.542	[illegible]	[illegible]	[illegible]	11° 25' 16"
6	28.250	339.000	2.2291???	2.161368?	9° 31' 38"
[illegible]	[illegible]	[illegible]	2.361???3	[illegible]	8° 10' 16"
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7° 09' 10"
[illegible]	[illegible]	[illegible]	2.?813572	[illegible]	6° 21' 35"
[illegible]	[illegible]	[illegible]	[illegible]	2.60??444	5° 43' 29"
[illegible]	51.79?	[illegible]	2.?536516	[illegible]	5° ?' ?"
[illegible]	[illegible]	[illegible]	[illegible]	2.76?1759	4° ?' 19"

g = Gage of Rails   n = Number of Frog

x, y = Coordinates of Switch or Frog Point

$x_2 y_2$ = do of Center of Circular Curve

φ = Slope Angle of Main Curve at Point x, y

For Locating Frog Points Use Formulae (1) and (3)

" " Switch " " " (2) " (4)

Use Upper Signs for Inside, Lower Signs for Outside Turnouts

For Outside Turnouts a Negative Value of "r" Indicates that Turnout Curves Same Way as Main Track (Right Hand Diagrams)

FORMULAS FOR LOCATING FROG AND SWITCH POINTS ON CIRCULAR AND TRANSITION TRACKS; DEVISED BY ARTHUR BELL

rail shown), having its switch on a transition and its frog on a circular curve, it being required to locate P.F.

A tangent T is drawn to the center line in P.S. and from the center of the circular curve a perpendicular ce to this tangent. The main track is thereupon replaced by the one shown by dotted lines, consisting of a tangent portion b, parallel to the tangent T, and a circular portion a, concentric with the circular main track curve and having an outer and inner rail radius of $ce + \frac{g}{2}$ and $R - \frac{g}{2}$ respectively. Since this change will not affect the position and curvature of the rails intersecting at the frog (f), the problem is reduced to one of those previously considered.

Applying the formulas for an inside turnout having its frog on a circular curve and its switch on a tangent, it should be noted that the gage of the dotted track is wider than the standard by an amount

$$h = ce - R$$

Substituting in equations (1) and (3) in the table, for g, the value $g + h$, and for R, r and d, the corresponding values $R + \frac{h}{2}$, $r - \frac{h}{2}$ and b, we obtain the formulas for the case in question by a simple reduction.

Fig. 3 represents an inside turnout fd, having its frog on a transition and its switch on a circular curve, it being required to locate P.S. By drawing a tangent T to the center line in P.F. and a perpendicular ce, we find in a similar way that by substituting for the original track the one shown by dotted lines, we may apply the formulas for an inside turnout having its frog on a tangent and its switch on a circular curve, the quantities to be substituted for g, R, r and d being, in this case, $g - h$, $R + \frac{h}{2}$, $r + \frac{h}{2}$ and b, h having the same value as above.

The corresponding formulas for outside turnouts have been derived in a similar way.

As to the quantities h and b, they may be considered as the rectangular coördinates of the center c, referred to the given point as origin and the tangent T as X-axis. Knowing the coördinates of the center (x_2, y_2) and the given point (x_1, y_1) in any other rectangular system, we therefore have:

$$h = (y_2 - y_1) \cos \phi = (x_2 - x_1) \sin \phi - R$$

$$b = (x_2 - x_1) \cos \phi + (y_2 - y_1) \sin \phi$$

Where angle ϕ is the slope angle of the center line at the given point.

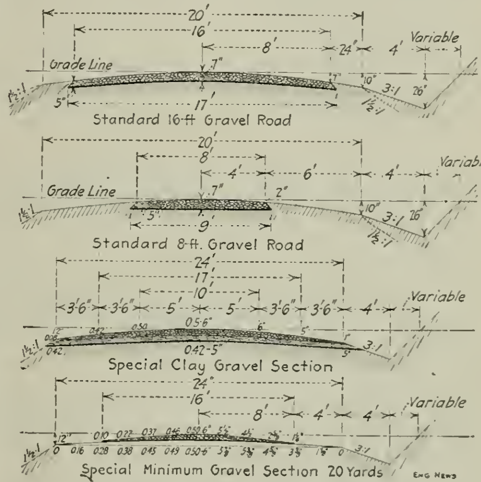
When, as in the above examples, the lead is partly on a transition, P.T.C. is conveniently chosen for origin.

Gravel Roads in Minnesota

In Minnesota, most of the road surfacing is being done with gravel. The specifications are varied to suit local conditions, as the roads are built on all kinds of soil and the quality of gravel must vary accordingly. It is very difficult to secure gravel that is properly graded for road making, and the engineers of the State Highway Commission usually consider themselves fortunate if appropriations can be secured sufficient to haul gravel from available pits without going to extra expense for screening and remixing or grading.

The standard sections for gravel roads with paved widths of 8 ft. and 16 ft. are shown in the accompanying cut. There is shown also a special 16-ft. section which has been adopted; this requires 20 cu.yd. per station, and has proved very satisfactory where sufficient funds are not available for the standard 16-ft. roadway. The clay and gravel section shown in the cut has been adopted for sandy locations where adequate funds for standard construction cannot be obtained.

The 8-ft. width is not considered advisable as a rule, for the maintenance by dragging tends to mix the shoulder material with the gravel, and the turning out of vehicles on this narrow roadway also breaks down the edges so that the gravel is soon lost. It is considered that two applications of the special 20-cu.yd. section would be more satisfactory on heavy-traffic roads which must be built at low cost. The specifications provide that



STANDARD AND SPECIAL ROAD CROSS-SECTIONS ADOPTED BY THE STATE HIGHWAY COMMISSION OF MINNESOTA

when the 8-ft. gravel road is built on heavy soil it is advisable to place a 2-in. layer of gravel for a width of 4 ft. on each shoulder, thus protecting the edges of the roadway proper.

These two special sections, therefore, represent a compromise practice designed to meet conditions where the financial factor is the governing factor as to road improvement. They indicate very strongly the attention which highway engineers are giving to local conditions, to enable good roads to be made at a minimum cost where necessary, both by the use of local materials and by adapting the improvement work to the funds available. This practice undoubtedly increases the popularity of state-aid in road improvement, and is calculated to offset the deep-seated popular suspicion that state authorities in charge of roads will seek to build them in an expensive manner.

The roadbed is graded to the sections shown and the 9-ft. or 17-ft. base is well rolled or otherwise compacted. When the fill is over 5 ft. high, the roadbed width is made 24 ft., with a crown or rise of 12 in. It must be free from ruts and waves or undulations, and gravel must not be deposited upon a wet or muddy roadbed. The gravel must be deposited to rope lines set out at the proper

distance from the center lines, and the specifications provide that the gravel must be shoveled into place and not dumped on the road in such a manner as to develop a wavy surface after settlement. Even when the wagon loads dumped on the road are carefully leveled there is very apt to be greater density at the dumping place, which eventually results in the wavy surface referred to.

In general, the gravel is measured in the wagon boxes as delivered on the work, and checks showing the amount in each load are furnished to the driver by the inspector in the employ of the county.

The gravel is furnished by the county, but is required to be approved by the engineer as to its quality. It must be free from [illegible] and from stones over 2 in. in diameter, while stones over 1 in. diameter must be kept at least 4 in. below the finished surface. The gravel must not contain more than 10% of sand and 15% of clay, but these limiting proportions may be altered at the direction of the engineer in the surfacing of heavy clay roads or sandy roads. When a clay base is required (section C) it must be deposited in advance of the gravel, distributed to uniform width and thickness, and either rolled with a 5-ton roller or dressed with road machine and road drag.

The gravel is finished to a firm and even compact surface, either by means of a roller (not less than 5 tons) or by a system of maintenance by means of dragging and raking for at least 30 days after completion. If for any reason rolling is not done, the work will not be accepted until three months after the gravel is placed, or until it has settled to a permanent base, and the contractor will be required to keep it raked smooth and in good condition until it is accepted by the engineer. This maintenance by the contractor is necessary, of course, to prevent traffic from wearing ruts and holes in the loose gravel.

After the gravel has been thoroughly compacted, the earth shoulder is finished to the section shown, and the whole roadway then rolled or dressed with a road machine and drag.

George W. Cooley is State Highway Engineer and John H. Mullen is Chief Deputy State Engineer. The offices of the State Highway Commission are at St. Paul, Minn.

Concrete Viaduct with 50-ft. Walls

SYNOPSIS—The viaduct carrying Union Ave. over the tracks of the St. Louis (Mo.) Terminal R.R. is mainly a fill between retaining walls, which are of the semi-gravity type and have a maximum height of nearly 50-ft. The tracks are crossed by three slab and girder spans forming a single continuous-girder structure.

One of the works for the elimination of grade crossings at St. Louis is the construction of a viaduct 1190 ft. long carrying Union Ave. over the tracks of the St. Louis Terminal Ry., in the northwestern portion of the city. The line is in a cut in a valley and the track grade conforms somewhat, the viaduct having opposite grades of about [illegible] to attain the required elevation. It is [illegible] ft. wide over the roadway, with a 30-ft. roadway, the sidewalks and parapet walls taking up the remaining [illegible] ft.

The general design is shown in Fig. 1. The structure has three reinforced-concrete spans (of the slab-and-beam type) over the right-of-way, the central span [illegible] ft. c. to c. of piers and the side spans [illegible] ft. For the remainder of its length it is a solid fill between concrete retaining walls. There are only two tracks at present, but there will be additional tracks forming the entrance to a new freight yard. The viaduct was built at the expense of the railroad company.

Design of Retaining-Walls

The special feature of interest is the height of the retaining-walls of the fill. At one point, north of the tracks, the line of the viaduct crosses the bed of an old creek, partly filled in, the flow of the creek being diverted by a pair of cast-iron culvert pipes into a new concrete sewer. This sewer runs under the eastern side of the viaduct for a part of the distance and then makes a turn, crossing under the east wall, as shown. Concrete is filled between the crown of the sewer and the bottom of the wall, and extra heavy reinforcing is used in the bottom of the wall at this point.

For about [illegible] ft. at this creek bed, it was considered necessary to carry the walls to rock, and here they have a maximum height of about 50 ft. The foundations elsewhere are on the bed of yellow clay above the rock, and no piles have been used. Typical sections are shown in Fig. 2, and at some points there is beneath the bottom a [illegible] 3 ft. wide and 2 ft. deep.

The walls are of semi-gravity section throughout, and have steel reinforcement in the bottom and inner face, while additional reinforcement is used in the bottom of the east wall where it crosses the sewer. They were designed in accordance with Rankine's theory of earth

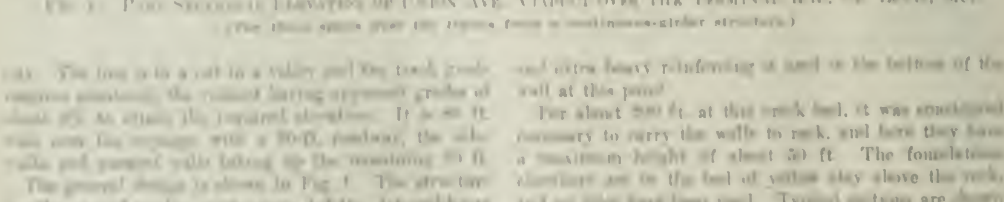


Fig. 1. Part Sectional Elevation of Union Ave. Viaduct over the Terminal R.R., St. Louis, Mo.
(The three spans over the tracks form a continuous-girder structure.)

pressures; the weight of concrete was assumed as 144 lb. per cu.ft., and that of the earth fill at 110 lb., with a surcharge of 1 ft. allowed for live-loads on the fill.

The walls are in 30-ft. lengths, with expansion joints, as shown. The face of the wall is relieved by the pilasters which mask these joints, while the flat surface in each 30-ft. length is relieved by a slightly depressed panel outlined by a broad depression 18 in. wide. The effect is carried out also in the abutments, the track face of each having one large panel. Each section of the wall has two weep-holes of 4-in. vitrified pipe, placed at the elevation of the future fill against the outer side, and having loose stone piled around the inner end.

The parapet wall is of ornamental pattern with a series of vertical openings. This parapet, with its pedestals, was cast in place after the construction of the walls. Gas lamps will be erected on the pedestals. A rather unusual feature in the construction of this viaduct was the placing of its "cornerstone" with some civic ceremonies. The "stone" is the base of one of the end pedestals, of the parapet, and in this was embedded a bronze box containing coins and newspapers. Some trouble was experienced in finding room for the box between the reinforcing rods.

Reinforced-Concrete Bridge Spans

The three spans over the railway are of the slab-and-girder type, with 14 ribs or girders. The facia girders are 17 in. wide and 52½ in. deep over all, and the inner girders are 23 in. wide and 40 in. deep (including the 7-in. deck slab). The four middle ribs come directly under the rails of the street-car tracks. The design is shown in Fig. 3.

The three spans form one continuous structure, the girders being anchored to the piers and having expansion bearings on the abutments. At each end there is an expansion joint between the slab and the face of the back wall of the abutment. In this is inserted a U-shaped strip of copper which is filled with asphalt. Above this is a filling of tar-paper separating the concrete foundation for the paving on the spans and approaches. The ends of the girders have steel shoe plates embedded and anchored in the concrete, and these rest on steel bearing-plates anchored to the bridge seat of the abutment, as shown. These plates are milled, and are coated with tallow on the contact faces.

Upon the deck slab was laid a course of concrete forming the foundation of the paving, 8½ in. thick at the center and shaped to the proper contour. In this were embedded the ties for the street-railway tracks, and upon it was placed a 1-in. sand cushion for the 3½-in. wood-block paving. The sidewalks have a similar concrete base

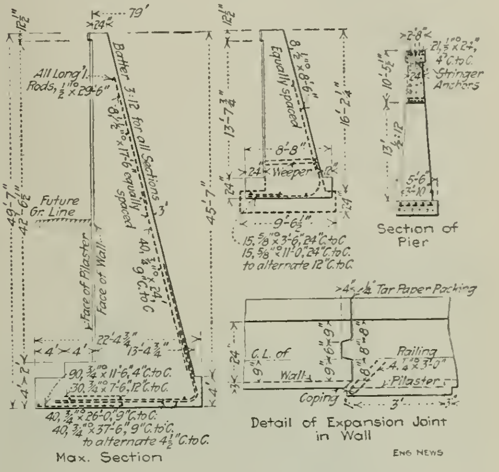


Fig. 2. Sections of Retaining Walls and Piers of Union Ave. Viaduct, St. Louis, Mo.

(The walls are of the semi-gravity type and have a maximum height of nearly 50 ft.)

with a 1-in. top finish. The curbs are of granite, with an asphalt expansion joint between each curb and the wood paving.

The piers are of the section shown in Fig. 2, and each is pierced with three arched openings 4 ft. wide to reduce the weight. They were built with rods projecting from the top to form anchors for the continuous stringers. The abutments are similar to the retaining walls, but with a ledge for the bridge seat and a back wall above this to retain the fill of the approach.

The spans were designed under the following conditions as to live-loads and stresses: (1) Track stringers: two

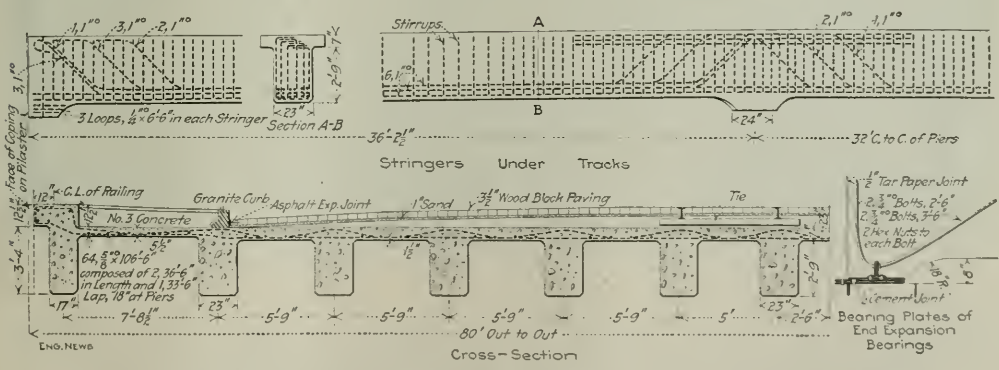


Fig. 3. Track Spans of the Union Ave. Viaduct over the Terminal R.R., St. Louis, Mo.

[illegible] type, having trucks of 11½-ft. wheelbase, 30 ft. c. to c. of trucks, and loaded with 13,800 lb. per wheel. (2) Roadway stringers, an 18-ton road roller, with 6 tons on the roller and each wheel (11-ft. wheelbase, 5 ft. c. to c. of wheels). (3) Roadway slab, a concentrated load of 8 tons on an area 1×1 ft., and a uniformly distributed load of 150 lb. per sq.ft. (4) Sidewalk slab, uniformly distributed load of 100 lb. (5) Impact allowance, 30% on slabs, 10% and 20% on stringers (under and over 25 ft. long). (6) Maximum fiber stresses for concrete, 650 lb. per sq.in. for compression (cross bending), 45 lb. per sq.in. for shear without shear reinforcement, 125 lb. per sq.in. for total shear on section, steel to carry all diagonal tension. (7) Maximum fiber-stresses for steel, 16,000 lb. per sq.in. tension, for cross bending and for shear reinforcement, 100 lb. for the adhesion of deformed bars.

Construction Work

During the construction of the viaduct this section of [illegible] Ave. was closed, being in an outlying section, and traffic was diverted while passengers on the street cars had to walk around the work, using the grade crossing at the next street.

Concrete material was delivered in cars on a siding, and unloaded into stock piles by a stiffleg derrick mounted (with its engine and boiler) on a tower or platform some 15 ft. high. The same derrick and clam-shell bucket handled the material from the stock piles to the storage bins over the 1-yd. concrete-mixing plant, which was located just east of the structure and on the north side of the tracks.

The concrete was discharged into 1-yd. drop-bottom buckets, the bucket standing on a small narrow-gage flat car, [illegible] being put on the ends of the car to support the sides of the bucket and carry its drop-bottom doors clear of the car floor. The cars were then moved a short distance on the track (transverse to the center line of the bridge) and stopped under the cableway used to convey the concrete along the line of the walls. The bucket was then raised, run to the desired point over the retaining wall and dumped into the forms.

The cableway was 600 ft. long, with an 80-ft. tower at the [illegible] end and a single bent 60 ft. high at the [illegible] end. It was placed over each wall in turn, and was shifted laterally 80 ft. from one wall to the other without being dismantled; this was done by placing [illegible] under the towers. Handling the 12,500 yd. of concrete by cableway was economical, as the amount of concrete at the ends of the walls is small, and wheeling it so far would have been slow and expensive.

The walls were poured in alternate 30-ft. sections to allow for contraction, and 2-ply tar-paper was used to fill the joints. The wall forms were built continuously from the footing to the coping of 2-in. sheeting [illegible] and held by [illegible] ¾-in. [illegible] spaced [illegible] in. apart vertically. This proved ample for the rate of filling, which was arranged not to exceed 2 ft. vertically per hour during temperatures from [illegible] to [illegible] F. During the cold spell of [illegible] to [illegible] F. [illegible] the concrete being [illegible] as it [illegible] the [illegible] and [illegible] the heads of the [illegible] in the forms [illegible] the aggregate away from the exposed faces. [illegible] were used with [illegible] lb. weights [illegible] below them. These [illegible] had been [illegible] and were set by the cableway, being

[illegible] moved readily where needed. The bucket discharged into the tray.

A crew of 2 engineermen (75c. per hr.), 8 concreters (30c.), 2 laborers (20c.), and a foreman (62c.), sufficed to unload the materials and put the concrete into the walls. The plant charge was about $10,000. The total price for concrete in place (exclusive of cement furnished by the railway company) but including the forms, was $4.85 per cu.yd. For the walls, the batches averaged 0.9 cu.yd. and 175 to 220 batches were mixed daily. During midwinter, 1212 yd. were placed in the northwest wall in 14 consecutive working days of 8 hr. each.

The concrete was made with 1½-in. washed gravel as the coarse aggregate. It was 1:2½:5 for the retaining-walls, piers, and abutments, 1:2:4 for the girders and deck slab, and 1:4:8 for the paving foundation. For the railings or parapet walls, the aggregate was ¾-in. binder gravel and washed river sand. The walls were completed to the coping at the sidewalk level, the pedestals and panels of the parapets being built later. In this parapet, some trouble was found in placing the reinforcing steel within the small space of the completed forms. This was overcome by building the forms with the inner side omitted, so that the interior was open for placing the steel properly, after which the side was put on and secured.

The exposed surfaces of the walls were wetted and rubbed down with concrete blocks to remove form projections, etc., and were given a wash of 1:1 grout to secure uniformity of color. The parapet railing was not given any finishing treatment.

The bridge spans had to be built without interfering with the traffic on the railway below, which amounts to about ten trains daily. The three spans were poured together, the forms being supported on framed bents between the tracks. For this part of the work ([illegible] yd.) the concrete was distributed by a chute from the head tower of the cableway.

The earth fill between the retaining walls was deposited by dump wagons, the material being taken from widening along the top of the railway cut, adjacent to the viaduct. Over this was [illegible] an elevating grader hauled by a steam tractor, loading the earth directly onto wagons moving beside the grader.

It was anticipated that there might be trouble with water in building the work through the old creek bed, as when the sewer was built (1911) a freshet washed out the forms and temporary work and caused considerable damage and expense. But the season of 1913 was dry and no trouble was experienced.

Engineers and Contractors

The structure was designed and built under the direction of the St. Louis Terminal Ry. Co., H. J. Pfeifer, Engineer of Maintenance-of-Way, and A. E. Anderson, Resident Engineer in charge. Bledsoe & Fay, of St. Louis, were consulting engineers. The work was done by the Fruin-Colnon Contracting Co., of St. Louis, and was in charge of A. P. Greensfelder, Secretary and General Superintendent for the Company. The contract was let in July, 1913, and the work was completed in July, 1914. The contract price was about $115,000, exclusive of the paving of the approaches. The cement was furnished to the contractor by the railway company.

Portable Plant for Asphaltic-Concrete Roads in Chicago

The work of improving main lines of road in the outskirts of Chicago, in order to connect the country roads with the paved streets, was inaugurated in 1913 and was described in ENGINEERING NEWS of Jan. 1 and Sept. 10, 1914. These roads were built of macadam and coated with oil. The amount of maintenance work required has been very high, due partly to the low and wet land, and partly to the tendency of traffic to follow ruts in a road only 18 ft. wide. To eliminate this condition of rapid wear and excessive maintenance, it was decided to cut down the crown and resurface the roads with a 2-in. top of asphaltic concrete.

For this work, under the direction of the Bureau of Streets, a portable plant was purchased, at a cost of $13,000, having all the equipment complete on one railway car. The car is moved from place to place at the outskirts of the city and at each site it is placed on a central track, with a track on one side for the cement car and one on the other side for the oil-tank car, as shown in Fig. 1. The tracks are 16 ft. c. to c. The oil is heated in the tank and pumped to the mixer. The plant with all apparatus folded up for transportation resembles a large furniture car and weighs about 20 tons.

The sand and stone are proportioned and mixed on the ground, and delivered by a bucket conveyor to the dryer, where the material is heated to about 300 ° F. From the dryer it goes to the storage bins, and is drawn off to the measuring bin and the mixer, which is of 15 cu.ft. capacity. Coal or oil fuel may be used, but the latter is employed at present.

For conveying the asphaltic concrete from the plant to the road the city has 20 dump wagons, the number in use depending upon the length of haul. There are also two 5-ton motor trucks, each doing the work of three teams. The average haul is about two miles, with a maximum of five miles. The rolling is done with 10-ton rollers.

The asphalt plant has been turning out 2500 sq.yd. of 2-in. top per day, or 1000 lin.ft. of 18-ft. roadway in nine hours. The Bureau is completing a mile each week at a cost of about 70c. per sq.yd. This includes all cost of preparing the old road and laying the new top. This improvement is expected to last five years without repair, and the maintenance will then be slight in comparison to the old water-bound macadam. It is desirable to have at least 10 in. of stone at the center and 4 to 6 in. at the edges, so that in some cases 3 to 4 in. of new material is laid on the road before resurfacing. The surface is made as flat as possible.

The mix averages approximately 6.5% bitumen, 37.2% sand, 52.3% stone, 1% filler. The aggregate is crushed granite (1/4 to 1 in.), with torpedo sand and portland cement. The price of granite this year is $2.25 per cu. yd. With the plant running at full capacity, the force at the plant and on the street is composed as shown in the accompanying table.

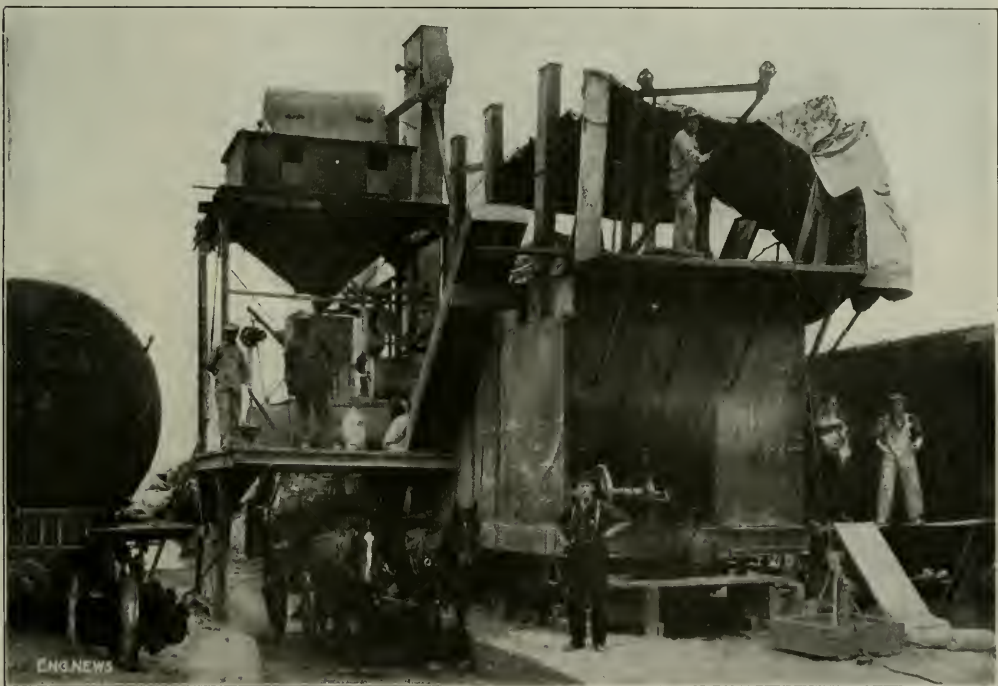


FIG. 1. PORTABLE PLANT FOR MAKING ASPHALTIC-CONCRETE FOR SURFACING MACADAM ROADS ENTERING CHICAGO

[illegible] FOR ASPHALTIC-CONCRETE ROAD WORK

At the Plant		On the Road	
[illegible]	[illegible]	1	[illegible]
[illegible]	[illegible]	2	rakers
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	tampers
1	[illegible]	15	helpers
[illegible]	[illegible]	[illegible]	watchmen
[illegible]	[illegible]	[illegible]	roller engineers
[illegible]	[illegible]		
[illegible]	[illegible]		
1	[illegible]		
2	[illegible]		

The work of preparing the old macadam road varies. Where the existing surface is in good condition and has suitable line, grade and contour, the surface is swept

FIG. 2 IMPROVING COUNTRY ROADS WITHIN THE CITY LIMITS OF CHICAGO

(The view at the left shows the 2-in. top course of asphaltic concrete being laid and rolled. The view on the right shows the old road receiving a course of [illegible] to level it up for the asphaltic-concrete top course.)

thoroughly to remove all the loose particles and expose the rough stone. Any depressions are filled with binder and tamped; in this way the existing road is made parallel with and 2 in. below the finished surface. Along the edges of the road care is taken to provide a good shoulder to hold the pavement in place. Where the soil is soft, [illegible] added and the shoulder rolled.

Where the old macadam is flat or depressed at the center, the sides are picked up and the material moved to the center. Care is taken not to loosen the sides so that there will be less than [illegible] in. of stone in a firm condition. Where the condition is such that additional material is required, the street is scarified to a depth of [illegible] in. and material added to make the depth at least [illegible] in. at the middle and [illegible] in. at the sides. About [illegible] in. fall from the crown to the side is sufficient for drainage.

This work is paid for out of the [illegible], which is imposed on [illegible] for the purpose of providing a fund for road repairing. The description given above is compiled from information furnished by Walter [illegible], [illegible], Superintendent of Streets of Chicago.

Headquarters Inspection Division of the New York State Highway Department

The many difficulties which were experienced in connection with the final inspection and acceptance of roads after they had been completed by the contractor have led George A. [illegible], First Deputy State Highway Commissioner of New York, to devise and install a new method of inspection by a headquarters outpost inspection, which has proved efficient and beneficial in all respects. The function of these inspectors is almost entirely critical; they give no orders and are warned from about offering advice unless it is asked for by the engineers in charge of the roads which they are inspecting. They are all high-class, experienced and well paid engineers.

Mr. [illegible]'s scheme consists in having a number of these inspecting engineers, reporting to and solely responsible to him, continually engaged from the beginning to the end of the working season in making field inspections. There are seven of these inspectors for the [illegible] highway divisions of the state. Each inspector makes the rounds of his territory in about 20 days, coming and reporting upon every piece of construction work during that period. They report regularly the extent and character of the work done to date not only by the contractors but by the state's engineers.

After studying these reports, the Deputy Highway Commissioner takes up with the division engineers any points which may be necessary. These points of criticism are communicated by the division engineers to the engineers in immediate charge of the work in a [illegible] form letter, with a request for explanations and constructive criticism. The reply is made on the back of this letter, and this and the inspector's report are fastened together and filed.

As noted, there is a report on each road on an average of once in 20 days. When the contracts are completed the headquarters office thus contains a complete and detailed history of each road, with complete information regarding it and [illegible] report of surface conditions after the road is completed. This not only greatly facilitates final acceptance of the road from the contractor, but [illegible] or [illegible] out at the time they are made, mistakes and deviations from the contract specifications which would [illegible] final settlement.

Although not at first looked upon with approbation by the contractors, this system of inspection was proved of so much value to them and division engineers as well as to the First Deputy Commissioner, who is [illegible] by the chief engineer of the highway department, that it is now recognized as a very useful and satisfactory adjunct of the department. The scheme has passed the experimental stage and is a regular feature of the organization.

Reconstruction of Pogues Run at Indianapolis

A costly piece of sewer work which has just been commenced at Indianapolis, and is an important preliminary to the extension of track elevation through the union station, is the reconstruction of the Pogues Run drain for a distance of about 2½ miles. This is an old creek now forming an open sewer, which flows approximately southwest across the city and discharges into White River. Its normal dry-weather flow is about 5 cu.ft. per sec., but in times of freshets and heavy rains it may have a flow of 3000 cu.ft. per sec.

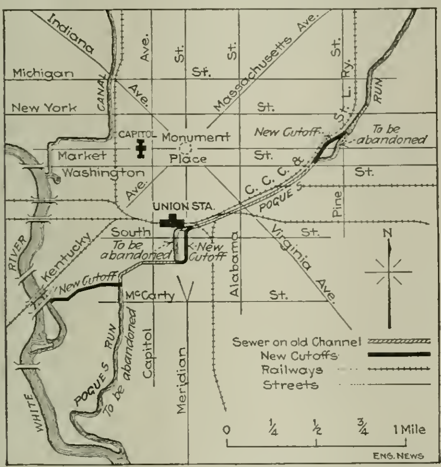


FIG. 1. PLAN OF THE NEW COVERED CHANNEL FOR POGUES RUN AT INDIANAPOLIS, IND.

For a length of about 5100 ft. through the railway yards and terminals the creek is lined with masonry walls 36 ft. apart, and is spanned at some points by plate-girders which carry signal cabins and similar structures. The creek closely follows one of the railway lines and as it crosses the site of the union station and terminal yards the city must replace the present open channel by a covered channel. This will mainly follow the present route, but between New York and Washington St., a bend will be avoided, and near the station there will be a new line along Meridian St. There will be also a new outfall, giving a direct line to the river instead of the present winding course. These diversions are shown on the map, Fig. 1.

The grade in general is 0.15% and 0.20%, but there is a short fall of 0.5% from Washington St., while at the outfall the grade is 0.7%. The sharpest curves are of 100-ft. radius. Beyond the portal will be a 30-in. reinforced-concrete apron on piles, with wing walls. This will be 25 ft. long, with a width (between wing walls) of 39 ft. 2 in. at the portal and 51 ft. 2 in. at the lower end.

The new conduit will be of reinforced concrete, and will be of very exceptional size and construction, consisting of two rectangular channels, as shown by the typical section, Fig. 2. At the upper end these will be 16 ft. wide and 8 ft. high, but mainly they will be 18x8 ft., while for a portion of the lower end and at the portal the width is increased to 19 ft. The two channels are to be connected at intervals of 100 ft. by openings 6x5 ft. in the center wall. The depth of fill over the roof will be from 4 to 20 ft., and at some points the conduit walls will have to carry the columns of street bridges (over the tracks) and of the station structures.

The side walls will be 18 and 20 in. thick and the central wall 18 in. The top and bottom slabs are mainly 21 to 24 in. thick, but at certain points these are increased to 32 in. for the top and 30 for the bottom.

The arrangement of the reinforcing steel is shown in Fig. 2. It will consist of deformed bars. In construction, the bottom and walls will be built first, and then the roof, with a mortised joint along the tops of the side walls, as shown. The concrete will be 1 : 2½ : 5 for the lower portion and 1 : 2 : 4 for the top, using gravel for the aggregate. The construction will be attended with some difficulty, especially where the drain passes under the tracks and adjacent to large buildings, which will have to be shored up while the foundations are being underpinned.

This work was approved by the Board of Public Works in April, and in June the contract was let to Dunn & McCarthy, of Chicago, at $907,000. In addition to this cost, there will be the expense of supporting buildings during construction, and this is estimated to cost about $31,000. The work is under the direction of B. J. T. Jeup, City Engineer, and D. C. Hayne, Assistant Engineer.

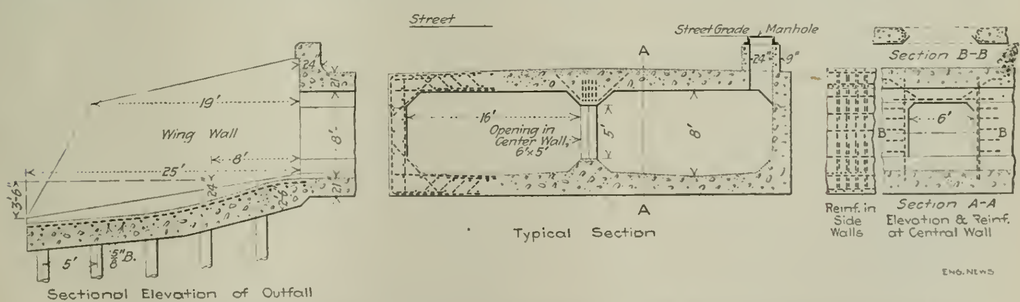


FIG. 2. DOUBLE-BARREL CONDUIT TO REPLACE THE PRESENT OPEN CHANNEL AT POGUES RUN AT INDIANAPOLIS, IND.

Field and Office

Construction Plant Layout for New Filtration Plant at Cleveland, Ohio

Work on the new filtration plant for the Cleveland waterworks system, which is to be located near the lake front between West 29th St. and West 38th St., is progressing very rapidly. The exceptional speed with which the work is being done is due in no little degree to the very well laid-out construction plant which the contractor, John F. Casey Co., has installed and is operating.

Fig. 1. Plan and Section of Construction Plant at New Filtration Plant at Cleveland, O.

The filter plant is on what was a side hill running down in about 500 ft. from an elevation of 90 ft. to an elevation of only 8 ft. above lake level at the north or lake side of the site. The dimensions are 1200 ft. running east and west parallel to the lake and 700 ft. north and south. Previous to the letting of the contract, the city arranged to cut the grade most of the area covered by the various basins of the plant and turned the site over to the contractor in this shape, except for one section at the southeast end of the plant where extensive steam-shovel excavations had to be made later.

The topography of the site lent itself admirably to the cableway installations shown in Fig. 1. Briefly, the layout consists of a concrete-mixing plant accessible from main-line railroad sidings and dumping over narrow-gage tracks running out under two cableway spans, the towers of which travel parallel to the long dimension of the filtration plant and control the narrow-gage track and a main-line siding, and the entire field of construction operations.

The method of carrying on the work can be traced to better advantage by examination of the plan in Fig. 1. The tracks of the Erie R.R. enter the fenced-in site from the northeast. Sand and gravel are brought in on a siding from the main line and carried up on the trestle and dumped into open bins just north of the concrete mixer. From these open bins the gravel and sand are lifted by a locomotive crane traveling on the trestle into storage bins in the top story of the mixing plant. Cement is brought in over the same track and is normally delivered in such quantity that the cement can be loaded directly from the cars in sacks onto the belt conveyor, which is shown leading into the mixing plant where it is stored on the same floor as the top mixing hopper. When a surplus of cement arrives, it is stored in the cement shed shown just east of the mixing plant. All other material is brought in on the main-line track just south of the cement track and is stored in various parts of the yard where convenient.

A mill is placed just near the stub end of this track and another track runs around to the north of the mixing plant, so that it is convenient to the machine shop located there. The cableway tracks, each consisting of three rails to carry the usual pyramidal tower, run in an easterly and westerly direction, one on the lower level north of the work and the other on the upper level, some 90 ft. higher along the top of the original bank and entirely south of the work. The head tower is 74 ft. high and the tail tower 85 ft. high, while the span is 700 ft. There are two cableways provided, each of a capacity of 15 tons and each with its own hoisting-engine equipment. Another main-line stub end runs directly under the cableway span, by which material can be picked directly off the main-line cars and conveyed to whatever part of the work it is required.

For concreting there is a duplicate equipment of Hains mixers of a design improved by Ottmar Stange, a member of the contracting firm which is doing the work, but so far it has been necessary to use only one of the mixers to take care of all the concreting which has been needed. The Hains mixer is of the gravity type, which requires no power. It consists of a series of approximately conical buckets placed one above the other, into the top one of which the various ingredients making up the concrete are dumped and receive the mixing action by tumbling over through the series. As shown in Fig. 3, the sand and

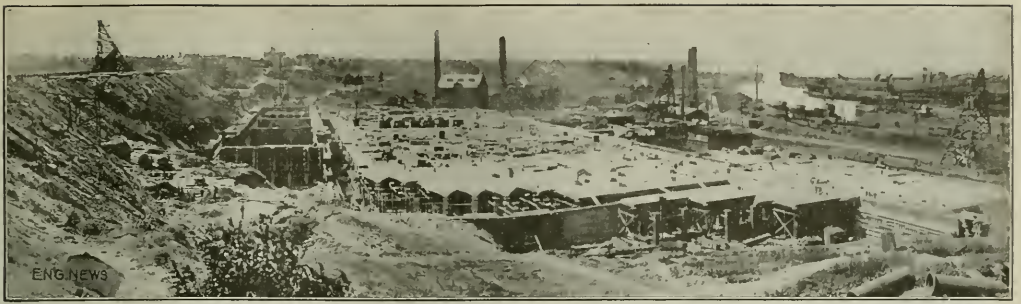


FIG. 2. LOOKING SOUTHWESTERLY OVER CONSTRUCTION PLANT AT CLEVELAND FILTRATION PLANT
(Upper cableway tower on left; lower towers on right. Concrete plant in background.)

gravel are stored on the top floor of the mixer house and can be dumped into the top hopper by merely throwing a gate. Proper measurement is made by marks on the side of the top hopper bucket, which can accommodate about 4 cu.yd. Cement is dumped from the hopper floor where the sacks are stored. Water is led in from a pipe delivering to the top of the hopper.

Concrete is delivered through the bottom hopper into the bottom dumping bucket of a conical shape somewhat similar in design to the individual bucket in the concrete mixer. These buckets have a capacity of 5 cu.yd., so that they are never overflowed by the delivery of one batch from the mixer. They are loaded on narrow-gage cars drawn by steam dinkeys and carried out under the cableway, where the buckets are picked up and swung out over the particular part of the work where they are required. The capacity of this plant is from 1200 to 2000 cu.yd. per day, but so great a capacity has never been required because of the difficulty of finding that much concreting to do in a work which consists of so many articulated small members.

Forms for the various parts of the work are standardized and have been, as a rule, used about four times for each form. About 1500 men are employed on the job.

The work is being done under the direction of the City of Cleveland, with C. W. Schulz, Commissioner of Water, and R. Winthrop Pratt, Consulting Engineer, F. H. Stephenson, Designing Engineer and R. S. Jones, Engineer of Construction, by the John F. Casey Co., of Pittsburgh and Cleveland. Ottomar Stange, of the firm, is in direct supervision of the work, and C. H. McAlister the Cleveland manager. E. J. Gass is chief engineer of the Casey Company, and D. F. Davison, superintendent on the work.

Proposed Standard Abrasion Test for Gravel*

The gravel is first screened through screens having circular openings 2 in., 1 in. and ½ in. in diameter. The sizes used for the test are equally divided between those passing the 2-in. and retained on the 1-in. screen, and those passing the 1-in. and retained on the ½-in. screen. The material of these sizes is washed and dried. The following weights of the dried stone are then taken: 2500 grams of the size passing the 2-in. and retained on the 1-in. screen and 2500 grams of the size passing the 1-in. and retained on the ½-in. screen. This material is placed in the cast-iron cylinder of the Deval machine as specified for the standard abrasion test of broken stone for road-metal.

Briefly described, this machine consists of a frame and two or more cylinders mounted at an angle of 30° with the axis of rotation. The cylinders are of the following size: 20 cm. diameter x 34 cm. deep, inside dimensions. Six cast-iron spheres 1.875 in. in diameter and weighing approximately 0.95 lb. (0.43 kg.) each are placed in the

*Result of an investigation conducted by the Bureau of Tests of the Ohio State Highway Department; published in full in the Ohio State Highway Department Monthly for August, 1914.

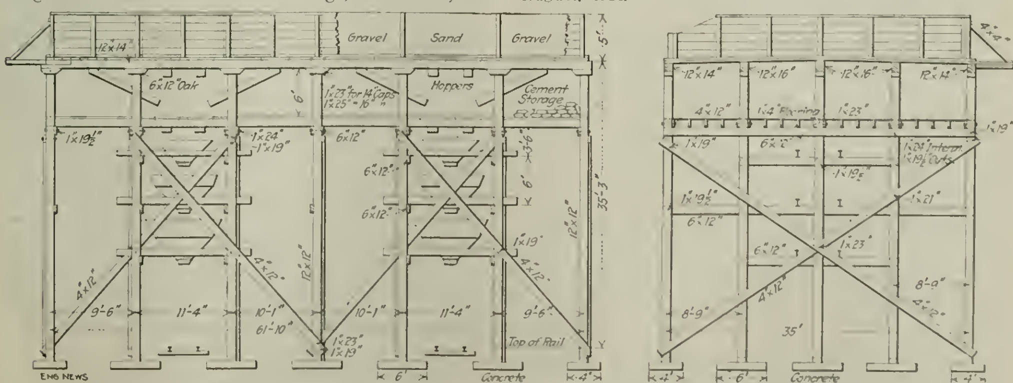


FIG. 3. DETAILS OF CONCRETE-MIXING PLANT FOR CONSTRUCTION OF CLEVELAND FILTRATION PLANT

cylinder as an abrasive charge. The iron composing these spheres, which are the same as those used in the standard paving-brick rattler test, have the following limits of composition:

Combined carbon	Not under [illegible]
Graphitic carbon	Not over 0.[illegible]
Silicon	Not over 1.[illegible]
Manganese	Not over [illegible]
Phosphorus	Not over 0.[illegible]
Sulphur	Not over [illegible]

After the cast-iron spheres have been placed in the cylinder the lid is bolted on and the cylinder mounted in the frame of the Deval machine. The duration of the test and the rate of rotation are the same as specified for the standard test for stone, namely, 10,000 revolutions at a rate of 30 to 33 r.p.m.

At the completion of the test the material is taken out and screened through a No. 16 mesh screen. The material retained upon this screen is washed and dried and the per cent. loss by abrasion of the material passing the No. 16 screen calculated.

As a means of comparing the results obtained from this test with those from the standard stone test, a series of tests were made using the rounded, or abraded, stone from the latter test, but of the sizes and proportions adopted for the gravel test. In order to obtain a sufficient quantity of the smaller size it was necessary to break up an additional amount of stone and subject it to the abrasion test, until all the corners and edges were rounded off.

The advantage of this test over the standard stone test for coarse gravel, aside from the consideration of the use of material, is the increased severity of the abrasion on the soft friable sandstone pebbles and material of a similar nature. In this test the impact of the cast-iron spheres breaks up the soft pebbles, while in the stone test the impact of the stone on stone merely tends to round off the corners and edges.

As the purpose of this test was primarily to indicate the presence of material having a low resistance to wear it is believed that it will be of special value when applied to gravel to be used in concrete which is subjected to wear or abrasion, as well as to gravel for road surfacing.

The use of gravel for both purposes is constantly increasing and the development and examination of the material has become an important industry.

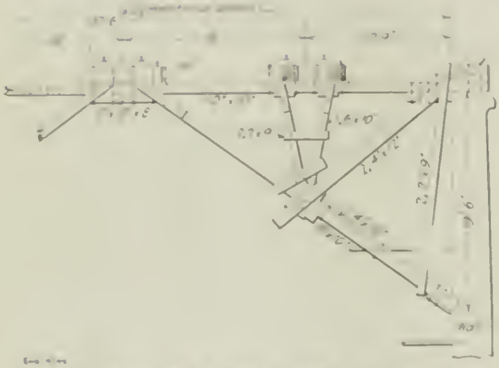


FIG. 1. TYPICAL TRUSS FOR SUPPORTING WORK TRAINS ON EASTERN VIADUCT

Pneumatic Tampers on an Unusual Earth-Filling Job

A most interesting earth-filling job is under way at the Eastern Viaduct of the New York Connecting R.R., Astoria, L. I. The structure is part four-track steel viaduct and part a retaining-wall structure with earth filling. The earth fill work in the latter portion involves several novel features, the most important of which is the use of power tampers.

Work trains bring the earth to the top of the viaduct and dump it between the retaining-walls in four windrows. It is then spread to a 12-in. layer and tamped to a crown (slopes of $\frac{1}{4}$ in. per ft.). The tampers are of the hand-manipulated pneumatic type, illustrated by Fig. 2, as furnished by the Ingersoll-Rand Co. for foundries. A maximum of 10 tampers has been in operation simultaneously on this job, although 20 are at hand.

The viaduct is of unusual construction. Thin reinforced-concrete walls stiffened by tie-rods and cross walls retain the fill, which is tamped and drained to secure the minimum pressure. The side walls vary from 35 to 70 ft. in height and are 3 ft. thick at the top, with stepped footings 6 ft. wide at the base. They contain no expansion joints. The right-of-way here is quite expensive, which makes an embankment too costly. The concrete viaduct was chosen because it was less expensive than steel.

DESCRIPTION OF THE WORK

The fill, which is a mixture of sand, gravel and loam, is obtained free from the Sunnyside yards of the Pennsylvania R.R., about $3\frac{1}{2}$ mi. distant from the site. A steam shovel of $2\frac{1}{2}$-cu.yd. capacity loads the earth on dump cars coupled in 11-car trains drawn by an 18-ton

FIG. 2. TRAVELING DERRICK SETTING FALSEWORK ON VIADUCT

dinkey engine. The cars are rated at about 3.8 cu.yd. each, and from 270 to 300 cars are handled per day. The loaded trains go up on the viaduct by means of trestling. The tracks are carried on transverse timber trusses resting on the side walls of the viaduct, as sketched in Fig. 1. When a bay is filled, the switch tracks and truss caps are removed; the remainder of the truss is left buried in the fill.

That the tamping to a crown may be reasonably accurate, the inspector for the railway marks on the wall the lines to be followed by the tampers. Measurements are taken from the transverse tie-rods between side walls. These tie-rods are an obstacle to rapid tamping, as, whenever they are encountered, tamping must be suspended while the rods are incased in concrete. The tie-rods are spaced 10 ft. apart both in vertical and horizontal planes. In placing, they are lifted in slabs projecting from the

FIG. 3. "CROWN" POWER TAMPERS AT WORK NEAR AN ARCH RIB

FIG. 4. SHOWING TAMPED SURFACE

side walls, by means of turnbuckles. The rods are placed when the tamping has reached a position 4 or 5 ft. below the stubs. When the fill has reached the rods, wood forms are placed around them and filled with 1:6 concrete, which is permitted to set for 24 to 48 hours, depending on the weather.

The first section of the work was completed Aug. 15; about 14,000 cu.yd. of fill were placed. During the work on this section, other parts of the fill were in progress. The total fill will amount to about 200,000 cu.yd., distributed over a distance of about ¾ mi.

FIG. 5. SHOWING RUBBLE DRAINAGE CHIMNEYS AND TIE RODS

Chimneys (2x3 ft. in plan) rise from weep-holes at bottom of sidewalls, to top of fill. View shows tie rods ready for concrete forms.

Air for the tampers is supplied from a compressor rated at 946 cu.ft. of free air per min., 100 lb. per sq.in. pressure, driven by a 150-hp. motor. The plant is located at Potter Ave., whence a 3-in. air line extends westward to the East River, a distance of 1400 ft. The last several hundred feet of line are reduced to a diameter of 2 in. Another air line runs eastward along the viaduct a distance of 2100 ft. The 1-in. air hose of the tampers is connected to a 10-part manifold. One of these manifolds is provided in each bay in which tamping is in progress.

An interesting feature of the fill is the rubble-chimney construction which rises from weep-holes in the lower part of the viaduct wall for draining the bays. Rock packing is also placed between stiffening ribs of abutments and part way up the rear of the street arches. This chimney construction is illustrated in Fig. 5.

Number of Men—The steam-shovel gang at Sunnyside comprises an engineer, fireman and craneman. There are six men in the pit gang. Each of the five trains in operation carries an engineer and a brakeman. Five laborers and a foreman dump the material from the top of the viaduct. Below in the bays, there are 45 laborers, two foremen, and six tampers. The concreting of the tie-rods is done by 12 laborers and a foreman. The fill proceeds at the rate of about 2 ft. vertical per day. Two machinists are employed to insure the smooth operation of the tampers.

Personnel—The work is being done for the New York Connecting Ry. (G. Lindenthal, Consulting and Chief Engineer) by Holbrook, Cabot & Rollins, New York City. The work is carried on by the contractor under the direction of T. B. Bryson. The superintendent at the site is Wyllys Russell.

A Fractured Pipe Casting on the Catskill Aqueduct That Sealed Itself in Service

By A. W. [illegible]*

A manhole casting, one of several large special pieces inserted on the line of the Catskill Aqueduct in the Bryn Mawr connection chamber—the point of junction between the Bryn Mawr steel pipe siphon and the Yonkers pressure tunnel—recently cracked and sealed itself in peculiar fashion. The casting did not fail completely, the crack being about 3 ft. long with an opening midway of its length of 1/8 in. The casting was under pressure from water impounded for a hydrostatic test of the Yonkers pressure tunnel. The leakage was considerable at first but, as time went on, the flow slackened and at last

FIG. 1. THE FRACTURED MANHOLE CASTING IN THE BRYN MAWR CONNECTION CHAMBER

(Looking down on casting; the crack is under the [illegible] [illegible])

ceased altogether, due to deposition in the crack of a hard, white substance that finally completely filled the opening.

The details of the design and construction of the work in this vicinity were given in an article in ENGINEERING NEWS, Sept. 21, 1911. The casting is roughly 6 ft. in diameter, 7 ft. 1 in. long, 2 1/4 in. thick. It weighs 13,700 lb., and has a manhole on the top 3 ft. in diameter.

The crack extended to both flanges (see sketch) but did not pass through either. It was fairly straight, passing practically radially through the shell. The maximum opening occurred on the horizontal part of the pipe next to the manhole. The cause of the fracture cannot be noticed outwardly as the casting is still in place.

The tunnel was being filled to elevation 295, the hydraulic grade (by pumping from a nearby stream), in order to test it under conditions approximating those of actual service. The elevation of the casting is 127.5, the head on the casting in service being thus about 168 ft. The fracture occurred probably between 5 and 8 a.m., Jan. 6, 1914. No one was present; it was discovered at 8 o'clock. As determined from evidences on the walls of the uptake shaft at Hill View reservoir, the water had reached elevation 227.9 when the fracture occurred. Pumping was discontinued and no attempt was made to stop the escaping flow, which at that time was gaged at about 158 gal. per min. After a couple of weeks, it was noticed that the flow was diminishing. After a month had elapsed, the leakage amounted to less than 1 gal. per min., and in two months had ceased entirely, even with the head restored to within a few feet of that at which the break occurred.

The following table gives the leakage and the corresponding elevation of the water in the tunnel. The various fluctuations of the water level were due to a continuous leakage into the tunnel, which gradually exceeded the

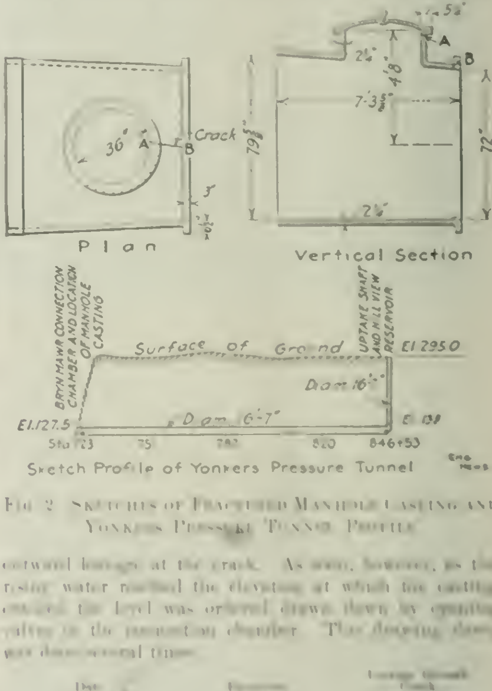


FIG. 2. SKETCHES OF FRACTURED MANHOLE CASTING AND YONKERS PRESSURE TUNNEL PROFILE

outward leakage at the crack. As soon, however, as the rising water reached the elevation at which the casting cracked, the level was ordered drawn down by opening valves in the connection chamber. This drawing down was done several times.

Date 1914	Elevation of Water	Leakage through Crack Gal. per Min.
Jan. 6	227.9	Pumping discontinued
Jan. [illegible]	[illegible]	158 approximately
Jan. 10	[illegible]	[illegible]
Jan. 21	[illegible]	[illegible]
Jan. [illegible]	[illegible]	[illegible]
Jan. [illegible]	[illegible]	[illegible]
Feb. 3	[illegible]	[illegible]
Feb. [illegible]	[illegible]	[illegible]
Feb. 12	[illegible]	[illegible]
Feb. [illegible]	[illegible]	[illegible]
Feb. [illegible]	[illegible]	[illegible]
Mar. [illegible]	[illegible]	[illegible]
Mar. [illegible]	[illegible]	[illegible]
Mar. [illegible]	[illegible]	[illegible]
Mar. [illegible]	[illegible]	[illegible]

In order to avoid the delays due to the replacing of the fractured casting, it was banded with 1-in. rods as shown in the figure, five on the main portion and four on the dome, with a strip of soft sheet lead about 1/2 in. thick and 2 ft. wide laid over the crack. The bands were put on Mar. 10 and the water raised to the hydraulic grade Mar. 15. Twice after that date, on Mar. 18 and 20, the water was raised again to the hydraulic grade. No leakage occurred nor weakness developed, and

*Assistant Engineer, Board of Water Supply, City of New York, [illegible], Yonkers, N. Y.

the hydrostatic test was completed without further incident.

The hard, white substance that was deposited on the casting near the crack and wherever the spurting water struck was analyzed with the following results:

Silica, SiO_2	5.58	Magnesia, MgO	.56
Oxide of Iron, Fe_2O_3	1.30	Sulphuric Anhydride, SO_3	.44
Alumina, Al_2O_3	0.24	Carbon dioxide, CO_2	41.15
Lime, CaO	50.73		

The deposited material was chiefly carbonate of lime.

In April, after the tunnel was unwatered, a flocculent deposit was found to have collected along the entire length of the invert. Samples were taken near the manhole casting and at Stations 751, 782 and 820; the results of their analyses follow:

	Near Casting	Sta. 751	Sta. 782	Sta. 820
Silica, SiO_2, and insoluble silicates	*52.36	6.51	3.46	3.53
Oxide of Iron, Fe_2O_3	7.70	1.26	0.71	0.56
Alumina, Al_2O_3	5.04	4.31	2.12	0.71
Lime, CaO	10.62	40.02	47.19	48.97
Magnesia, MgO	1.53	5.18	3.19	4.10
Sulphuric Anhydride, SO_3	0.27	0.32	0.21	0.18
Carbon dioxide, CO_2	9.43	39.28	41.64	41.25
Organic and volatile matter	13.05	3.12	1.48	0.70

*Chiefly silt.

The silt is accounted for by the water for filling the tunnel up to the time of the fracture being pumped from a near-by stream. The lime was, of course, produced wherever there was percolation of ground water through the concrete tunnel lining.

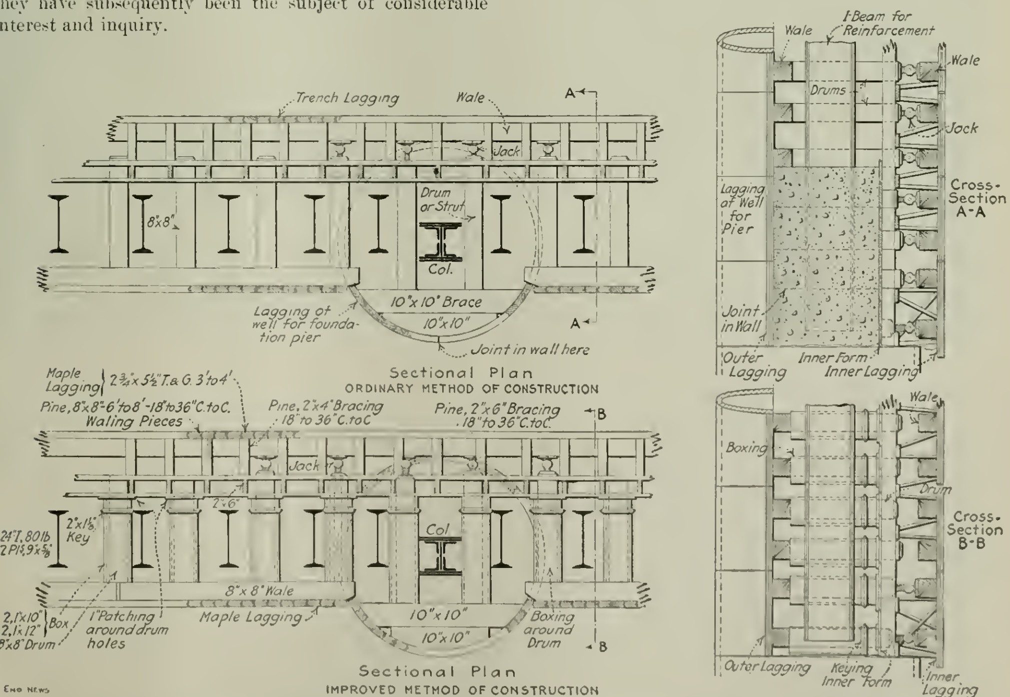
These disconnected details have been collected in this one article because, although each was a part of the day's work and not given much thought at the time, they have subsequently been the subject of considerable interest and inquiry.

Construction of Retaining Walls for Deep Basements in Clay Ground

In many of the large new office buildings in Chicago, having foundation piers sunk through the clay bed to rock, a portion of the area is excavated for two or three (or even four) basement floors. These excavations must be surrounded by heavy retaining walls to resist the pressure of the clay. The walls are built in trenches excavated to the required depth, lined with sheeting against which are placed waling timbers, braced by cross timbers or "drums" having a jack screw or trench brace between one end of the drum and the waling timber.

Ordinary Method of Construction

Under the ordinary method of building the wall, the forms are placed in position in the trench thus braced, and then concrete is deposited up to the level of the bottom of the first row of drums. This layer of concrete is allowed to set or harden for 12 to 24 hours. New drums are then placed behind the concrete-filled portion of the form. Then the drums and jacks of the row above the concrete are removed, after which the forms are set for the next course and another layer of concrete is deposited to fill to the level of the next row of drums. This is indicated by the horizontal dotted lines in the upper drawing of the accompanying cut, and the operations are continued successively until the top of the wall is reached.



Methods of Constructing Retaining Walls for Deep Basements in Clay Soil at Chicago

The upper drawing shows the method ordinarily used. The lower drawing shows the improved method employed by Holabird & Roche on the new Lumber Exchange Building.

The inner lagging is left in place, but the outer waling timbers are removed at the same time as the drums.

This method has several disadvantages, one of them being the slow rate of progress on work where rapid construction is usually most desirable. Then, the walls are not monolithic, but are composed of a series of separate horizontal courses, and although these are united by keys or joints, the arrangement is not well adapted to resist heavy lateral pressure. Certain floor panels in the floors above must be left open to allow of placing a reinforcement of vertical steel beams, as it is not satisfactory to use steel rod reinforcement, owing to the large number of horizontal joints and the difficulty of taking care of these. The pressure of the earth also has to be resisted by the green concrete, which in many cases is displaced or distorted to some extent. This allows a movement of the clay body which may affect adjacent buildings.

New Method of Construction

In the construction of the Lumber Exchange Building, at La Salle and Madison Sts., a new method was adopted for building the sub-basement retaining walls, the lower sub-basement floor being about 50 ft. below the street. The trenches were excavated in alternate sections, the joints being at the centers of the columns. They were 6 ft. wide, and sunk in 3-ft. lifts, each lift sheeted with 3x6-in. vertical lagging and two lines of 8x8-in. horizontal waling. The 8x8-in. drums were then placed between the waling timbers and made as tight as possible by the screws. This process was continued lengthwise in 6-ft. sections along the trench, and then downward to the desired elevation.

After the excavation of the trench was completed about 6 in. of concrete was deposited for a working floor and forms were built for the full height of the wall. The forms were cut away around the drums, which were boxed in or cased with 1-in. lumber; ribs on the boxing formed grooves or keys for bonding with the concrete filling later.

Then the trench was concreted from base to top in one operation, thus giving a homogeneous or monolithic wall, which was allowed to set for about two weeks, the pressure of the earth during that time being resisted by the drums or struts and not by the forms and concrete as in the other method described. The outer waling and lagging are left in place. When the basement is excavated the inner lagging is removed, the drums are pulled out of their boxing, and the inner form and boxes taken down. The holes left by the boxes are then filled with a dry concrete, well rammed, which is held in place by the notches or grooves formed by the keys. This method is shown in the lower drawing.

The advantages of this method are that the work progresses much more rapidly and gives a monolithic construction, while it eliminates the objection to rod reinforcement of these walls (though in this case some of the walls contain I-beam reinforcement). Another important advantage is that the drums take up the pressure, and relieve the wall of all pressure until the concrete has become thoroughly set and hard.

The building in question is a [illegible]-story office building about [illegible] ft. high above the street and with its sub-basement (for boiler rooms) 50 ft. below the street. The prevention of any movement of the clay bed was very important, since the [illegible]-story Y. M. C. A. building with floating or grillage foundations adjoins the south side of the site, while the 13-story Tacoma Building, also with float foundations, is across the street, and an old 3-story building with surface foundation is adjacent.

The architects are Holabird & Roche, of Chicago, and the new method of basement wall construction was devised by them. The George A. Fuller Co. is the general contractor. The structural steel was furnished by the American Bridge Co., and erected by the Oscar Daniels Co., while the shoring was done by the Reed-Neilson Co.

Commissary Supplies on a Canadian Survey

The question of commissary supplies for field parties is always of interest. We give herewith a table of the quantity and cost per man per day at a main camp for survey work on the Abitibi River, in the northern part of Ontario, in the winter of 1913. It is taken from a paper on "Contour Surveys on the Abitibi River," by H. T. Routly, in the annual report of the Association of Ontario Land Surveyors, at Toronto. The average number of men boarded was 18, including the cook. In a brief comment upon this list Mr. Routly says:

"We have always believed in feeding our men what they liked, within reasonable limits, and it is interesting to note the difference in requisitions of different parties.

CONSUMPTION OF FOOD AND SUPPLIES BY A CANADIAN SURVEY PARTY

(The figures are the amount per man per day.)

Supplies	Quantity per day	Cost per day, cents	Supplies	Quantity per day	Cost per day, cents
Apples	.035 lb.	.541	Matches	.0[illegible]6 box	.075
Apricots	.025 lb.	.135	Onions	.00[illegible] lb.	.199
Bacon, Br.	.215 lb.	6.136	Peaches	.02[illegible] lb.	.3[illegible]0
Bacon, L. C.	.475 lb.	7.482	Peas	.019 lb.	.195
Bacon, pickled	.022 lb.	.315	Pepper	.007 lb.	.100
Bak'g powder	.010 lb.	.165	Pickles	.002 gal.	.200
Barley	.005 lb.	.017	Potatoes	[illegible] lb.	.662
Beans	.120 lb.	.677	Potatoes, desic.	.0[illegible] can	2.[illegible]
Butter	.154 lb.	[illegible]	Prunes	.0[illegible]0 lb.	.362
Beef	.813 lb.	8.678	Raisins	.07[illegible] lb.	[illegible]
Candles	.178 candle	.752	Rice	.037 lb.	.176
Cheese	.061 lb.	.880	Rolled oats	[illegible] lb.	.179
Coal oil	.00[illegible] gal.	.077	Salt	[illegible]1 lb.	.088
Cocoanut	.002 lb.	.087	Soap	[illegible]1 cake	.188
Coffee	.017 lb.	[illegible]	Spice		.062
Corn	.061 can	.642	Sugar, brown	.178 lb.	.987
Corn flakes	.098 lb.	.867	Sugar, gran.	[illegible] lb.	1.398
Cornstarch	.001 pkg.	.026	Syrup	.007 gal.	.595
Cream	.200 can	3.172	Tea	.036 lb.	.818
Currants	.052 lb.	.884	Tomatoes	.073 can	.870
Flavoring		[illegible]	Turnips	.07[illegible] lb.	.0[illegible]5
Flour	.825 lb.	[illegible]	Yeast cakes	[illegible] box	.031
Jam	.015 lb.	.118			
Lard	.082 lb.	1.812			61.797
Macaroni	.117 lb.	.052			

The above table is simply an analysis of actual quantities and costs on this particular contract. A change of cooks will often make a great difference in the comparative amounts of various items used.

"In most of our northern work we used desiccated potatoes, but on this contract some of the ordinary tubers were used. These were frozen solid coming in, and it may be of interest to note that the best method of preparing frozen potatoes is not to thaw them with cold water, as is usually done, but to brush them clean, give them a quick rinse with hot water, plunge them at once into a pot of boiling water and cook them with jackets on."

Crowns for Road Surfaces—The committee on roads and pavements of the [illegible] recommends the following average crowns per foot for various kinds of road surfaces: [illegible]

NOTES

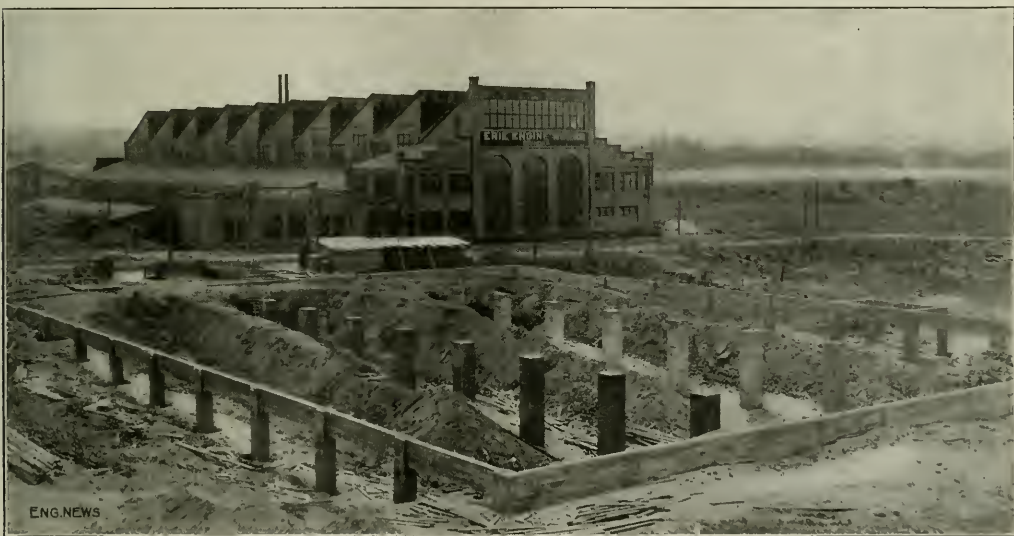
The Conventional Signs for Plans and Drawings compiled and adopted by the American Railway Engineering Association have been specified by the Valuation Board of the Interstate Commerce Commission for use on all maps and profiles employed in the railway valuation work now in progress. These conventional signs are now printed in pamphlet form (6x9 in.), with 12 pages relating to various signs for general maps, profiles and drawings, one page relating to riveted work and 12 pages relating to signal and electrical work (as adopted also by the Railway Signal Association). Several railways are ordering these pamphlets in large numbers for their engineering and drafting departments. Copies may be obtained from E. H. Fritch, Secretary of the Railway Engineering Association, 900 South Michigan Ave., Chicago. The price is 25c., but lower prices are made on orders for 10 or more copies.

Wall Girders in a Machine Shop Building—The walls of a new shop being built for the Ball Engine Co. at Erie, Penn., are carried in part by direct footings and in part by wall girders. This unusual combination is shown quite clearly by the adjoining photographs It was due mainly to the conditions of the subsoil.

The site was formerly a gravel pit, which had been excavated to an average depth of 12 ft. below grade and later partly refilled with foundry waste. This refill was not suited to carrying the column piers or the wall footings. The column piers were therefore carried down to the original bottom, which makes some of the large center piers 16 ft. high. At the rear wall the firm ground was near enough to permit of direct footings of relatively shallow depth, and the heavy weight of the front wall required continuous footings to be used here also. The side walls, however, carry only a 6-ft. height of 8-in. hollow-tile curtain-wall, and as they come over the deep part of the former gravel pit, a reinforced-concrete girder construction was employed to carry these walls, as shown. The space under these girders will be filled with earth.

The building is 150 by 200 ft., of steel frame and hollow-tile walls. The front and rear walls are respectively 16 and 12 in. thick, the side walls 8 in. The girders under the side walls are 12x36 in. by 20 ft. long, the spacing of column piers.

In constructing the foundation, two cuts were made through the waste refill with a steam shovel, to build the center piers. After completion, the whole was filled to grade. Constable Bros., of Erie, Penn., were the contractors. H. Edsil Barr, of Erie, Penn., acting as engineer for the owners, designed the construction.



Foundation of New Ball Engine Co. Shop, Erie, Penn.; Wall Girders for Side Walls, Direct Footings for Front and Rear Walls

The Novelty in Stadia Methods devised by J. Zwicky, of St. Gallen, Switzerland, and described on p. 747 of "Engineering News" of Oct. 8, calls to the mind of one of our readers, G. F. Schlesinger, of the department of civil engineering of the Ohio State University, the following simple method of getting approximate horizontal distances, for which he claims no originality, but which may be new to many readers:

The method, in brief, consist of turning off a horizontal angle of 1° 9′ with the transit, and then measuring the distance between the first and last pointings at the extremity of the course whose length is to be determined. This distance in hundredths of a foot, divided by 2, will be the actual distance in feet; depending, of course, on the fact that the sine (or tangent) of 1° 9′ is 0.02 (approximately).

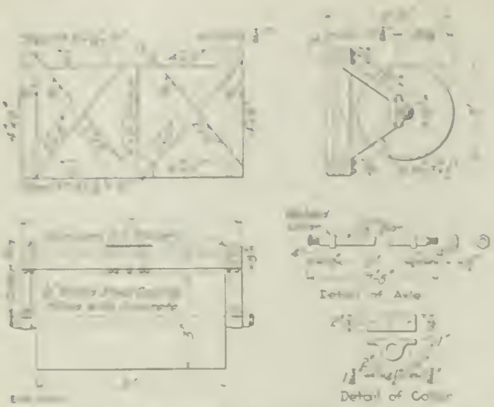
The angle of 34′ may be used, in which case the division by 2 is not necessary and the "spread" is one-half; but the approximation will be greater. The error due to the approximation using the angle 1° 9′ is 1 in 290, and, even in view of other inaccuracies, the results will be sufficiently close for certain classes of work.

By means of this method, remarkable progress can be made in determining small drainage areas by running an angle line around the divide; or, in some cases, by "side shots" from some central point or points within the area.

The party is composed of two men equipped with a plain transit, sight rod, metallic tape and ordinary chaining pin. The rodman selects the points ahead and the transitman takes the magnetic bearings of the courses (when practicable), then sets off the horizontal angle for lining in the rodman for the second pointing. The rodman, having inserted the pin, holding the ring at the end of the tape, at the first point, measures the distance to the second. After marking the first point so that it may be readily found by the transitman, he then proceeds to the selection of the next station, while the transitman moves up.

The following points can be made for this means of approximating horizontal distances: It permits the use of the plain transit reading to minutes with the ordinary cross wires, requires no stadia or level rod, no reduction to the horizontal, and longer courses can be taken than by the stadia or gradienter method. The transitman is not limited by the distance at which he can distinguish figures on a rod, but by the distance at which he can clearly see a sight rod.

Using Old Concrete Pavement Foundations—In New York we have laid both asphalt and stone pavements on the old concrete base. It is not all good, that is, we have to lay a certain amount of new concrete even on the old. The pavements are so cut up during the life of a useful pavement, for instance, 15 or 20 years, that the surface of the concrete foundation is very irregular after the asphalt is taken off. As a rule, it requires from 2 to 3 in. of new concrete to level it up.—George W. Tillson, in a discussion before the Cleveland Engineering Society.



HOME-MADE ROAD ROLLER

A Home-Made Road Roller for $75—Many [illegible] towns which cannot afford to own a steam road roller may construct a very satisfactory substitute in the following manner, according to Bulletin No. [illegible] of the Pennsylvania State Highway Department.

The roller consists of a [illegible]-in. thick rolled steel casing, properly riveted with rivets countersunk on the outside and [illegible] the inside of the casing, but if an old [illegible] of sufficient dimensions can be had, it will answer just as well. The axle is placed in the proper position and securely fastened, and then the casing is filled with concrete [illegible]. Great care must be taken not to disturb the axle from its proper position. The uprights on [illegible] which support the wooden frame are made from [illegible] shown in the sketch and can be [illegible] by a blacksmith. The frame consists of [illegible] timbers [illegible] bolted together; the [illegible] at the ends and fitted into each other [illegible] on top of each other [illegible] at the corners to give a [illegible] on each side of the frame for the [illegible] can be taken [illegible]

Heavy Hand-Operated Gate Hoists, New York Barge Canal—[illegible]

A HEAVY HAND-OPERATED GATE HOIST, NEW YORK BARGE CANAL

[illegible]

[illegible] lb. It was required also that the hoists should close the gates under load.

In the hoists furnished by the [illegible] Machine Works, Inc., of [illegible], N. Y., these requirements have been met by the construction illustrated herewith. The gate stems are [illegible]-in. steel I-beams carrying [illegible] plates on the lower flanges and [illegible] carry the rack [illegible]. Each gate stem runs between a flanged roller and a [illegible]-tooth cast-steel pinion with 7-in. face. The shaft carrying the rollers is [illegible] into the frames, the rollers turning on the shaft and not with it. There are [illegible] of gears and pinions connecting back to the handles, the reductions being respectively [illegible] and [illegible]. The [illegible]-in. arm and [illegible]-in. roller handle are detachable and may be slipped on the second gear shaft to give a higher lifting speed after the gate has been started. A cast steel ratchet and pawl on the shaft serve to hold the gate in any position. The heavy side frame castings are intended to be held in alignment principally by four $1\frac{1}{4}$-in. foundation bolts although there are three 1-in. separator rods.

To Prevent Wear of Concrete Floors, [illegible] the dust resulting from such wear under the influence of heavy trucking, etc., a chemical composition known as "[illegible]" is being introduced. This is applied to the surface of a new or old floor, and is said to be proof against water, oil, acids and alkalies, while it enters into intimate combination with the concrete and will not flake or peel off. It is manufactured by the Dustite Co., 661 Peoples Gas Building, Chicago.

Rust-Resisting Metal Sheathing—Three of the new steel frame pier sheds built at Seattle, Wash., by the Port Commission are sheathed with galvanized corrugated iron of a special grade, having a high degree of purity and consequently a high resistance to corrosion. These properties are expected to make the sheathing durable and economical even under the influence of the damp [illegible] air of the water front at Seattle.

The metal used is known as [illegible] iron, for which 99.80% of pure iron is guaranteed. Analyses by three commercial testing laboratories showed: Carbon, 0.011 to 0.[illegible]; silicon, trace to 0.001[illegible]; sulphur, 0.017 to [illegible]; phosphorus, 0.004 to 0.006[illegible]; manganese, 0.0[illegible]; copper, trace to 0.025[illegible]; oxygen (given by one analysis only), [illegible]; total impurities, 0.116 to 0.12[illegible]; total purity, [illegible]. The makers state that a general average is [illegible] oxygen, 0.0[illegible] nitrogen and 0.00[illegible] hydrogen. A comparison of three physical tests showed the following: Elastic limit, [illegible] to 32,[illegible]00 lb. per sq.in.; ultimate strength, [illegible] lb. per sq.in.; elongation, 32.7[illegible]; reduction of area, 63[illegible] to 71[illegible].

This metal has been used also for roofing, culverts, window frames and sashes, and a variety of other purposes where an important consideration is resistance to rust or corrosion due to moisture, acid fumes and other destructive influences. It is manufactured by the Inland Steel Co. of Chicago, which uses only pig iron and the crop ends from the steel mill, no scrap being allowed in the [illegible]; this is believed to secure high strength in combination with a low percentage of carbon, phosphorus, sulphur and manganese.

Motor Trucks for Water-Works Service—For several years it has been apparent that the work of the Water [illegible] could be made more efficient by substituting automobile trucks [illegible]

[illegible]

Editorials

The Abandonment of a Railway Line

A railway 90 miles long in Western New York was to be abandoned on Nov. 1, according to an order issued by the New York Supreme Court, which has directed the receiver of the property to cease all operation of trains and take up the track. The railway in question is that part of the Buffalo & Susquehanna Ry. extending from near Buffalo southeast to Wellsville. The company owning the road has been in the hands of a receiver for over four years. The court's action in ordering the discontinuance of operation of the road and the taking up of the track was made on petition of the United States Trust Co., of New York, the trustee for the bondholders of the company.

The facts appear to be that the road in question is the least profitable part of the Buffalo & Susquehanna line to operate. Lines located further south in Pennsylvania do an extensive coal business, but the difficult grades to the north make it cheaper to send the coal to lake ports over other roads than to haul it over the Buffalo & Susquehanna line from Wellsville. Undoubtedly, the bondholders have the right to stop operating an unprofitable property and to get what little salvage they can out of it by taking up the rails. This salvage will be small, however; for under present market conditions, relaying rails are salable only at a very low price.

The abandonment of the road will be a serious matter to the farming communities along it which depend upon it for transportation. The roadbed and tracks are in good condition, and represent an investment that could not be replaced, probably, short of $2,000,000.

Residents along the line of the road appealed to the New York Public Service Commission. Through the efforts of that body, the execution of the Court's order has been postponed for one month. It is hoped that prior to Dec. 1, the date at which the Court's order is now scheduled to take effect, someone can be found willing to take over and operate the road.

Of course, it is impossible to operate a road with thin traffic, such as this line has, at any such low rates per passenger-mile and per ton-mile, as prevail on roads which do a large business. It would be far better for the farmers along the line to pay whatever rate is necessary to keep the road in operation rather than have it stop operations entirely. More economical methods of operating the road could doubtless be introduced, such as substituting independent motor cars for regular steam-locomotive train service.

Such instances as this form a useful lesson as to the inevitable result where a railway is unable to earn enough to pay its operating expenses and make some return, at least, to those who have furnished the money to build it.

The railways are indeed public-service corporations and as such obliged to render reasonable service to all alike, so long as they continue in operation. But when any railway becomes unprofitable to its owners and they can see no hope for future profits, they have the undoubted right to do exactly what the owners of the Buffalo & Susquehanna R.R. propose to do—stop operations, take up the rails and sell them for scrap.

The only alternative to this would be the purchase and operation of the railway by the government, state or federal; but even if this were done, the necessity would remain of charging rates on passenger and freight traffic sufficiently high to pay at least the operating expenses and a safety margin over. It could hardly be expected to make up the deficit by laying a general tax on the public.

The Development of Sand and Gravel Deposits

The enormous development in the use of concrete in engineering construction which has taken place during the active life of men who still call themselves young, has been the chief influence in the rapid growth of two collateral industries, namely, the quarrying and stone-crushing business, and the utilization of sand and gravel deposits.

It is probably true that the value of gravel, properly cleaned and graded for use in making concrete material, has not been properly appreciated by the engineering profession until very recently. The old idea dies hard that the rough surface of broken stone made a stronger bond with the cement than the smooth surface of water-worn gravel, notwithstanding the numerous tests which have proved the perfect bond of the cement with the smooth gravel or stone.

It is now realized, however, that for reinforced-concrete work a good gravel concrete will run equally as well if not better around reinforcing bars than concrete made with broken stone; and where clean gravel is obtainable at a low price, there is every reason why it should be used by the engineer. In concrete-road construction, admittedly the most severe service to which concrete is now applied, a large proportion of the concrete roads thus far constructed have been built with gravel instead of broken stone as the aggregate.

The great increase in the market for sand and gravel has been accompanied by rapid developments in plant and machinery for handling these materials; and the design of such plants has now reached the stage where special knowledge concerning the operation of such a plant and the requirements to be fulfilled is necessary, if the best results are to be obtained in the operation.

While a number of descriptions of such plants can be found in engineering literature, there has nowhere appeared, so far as we are aware, any systematic discussion of the principles which should govern their design. We are, therefore, particularly pleased to be able to lay before our readers in this issue a paper dealing with this subject, prepared by an engineer who has had a number of years practical experience in the development and operation of sand and gravel deposits. The author of the article, W. H. Wilms, President of the Universal Sand &

Gravel Co., of Covington, Ind., has himself worked out the principles governing this class of work as a result of many years' costly experience in experimenting with different types of machinery and methods of operation. The article in this issue deals with the testing of sand and gravel deposits to determine their quality and the possibilities of their commercial development, and will be followed by succeeding articles dealing with the design and arrangement of the machinery and plant for operating such deposits.

Creosoted Wood-Block Paving Specifications to Prevent Bleeding and Bulging

The analysis of the new Kansas City specifications for wood-block paving, by Clark R. Mandigo, Assistant City Engineer of Kansas City, on another page of this issue is of especial interest to municipal engineers. In presenting the Kansas City specifications to our readers, however, it is worth while at the same time to call attention to the new specifications of the Bureau of Highways of the Borough of Manhattan, New York City. These are the result of a very thorough investigation and study by a staff of expert paving engineers, and they differ in some essential points from the Kansas City practice.

The New York City specifications cover much more fully than those of Kansas City, the kind and quality of wood and the treatment of the blocks. Only genuine Southern long-leaf pine, subject to inspection in the stick before being sawn into blocks, is acceptable in New York. This must be air-dried, so that the blocks as cut shall not weigh more than 50 lb. per cu.ft.

When ready for treatment the blocks are divided into four lots, according to their varying weights per cu.ft. Those weighing 38 to 42 lb. per cu.ft., 42 to 44, 44 to 46, 46 to 50 lb. per cu.ft. are to be treated in separate batches under varying conditions of steam pressure, temperature and vacuum. The lighter wood is subjected to less pressure than the heavier and to lower temperatures, varying from 2 hr. at 15-lb. steam pressure at 185° F., and a vacuum of 22 in. for 1½ hr., at 155° F., to 5 hr., at 25-lb. steam pressure at 220° F., and a vacuum of 24 in. for 2½ hr. at 140° F., for wood weighing 50 lb. per cu.ft.

Besides detailed specifications for each batch as outlined, the specifications further state that variations and changes may be required by the engineer from time to time in the duration of the treatment and in temperatures and pressures used, to suit the specific gravity of oil and different varieties of timber used. All blocks and materials are inspected at the plant, but acceptance at the plant is not final, the city reserving the right to reject shipments of block, as a whole or in part, after delivery on the work.

The New York specifications for the mortar bed (1 : 4) provide that the mixture shall be made dry and then slightly moistened before the [illegible] surface [illegible]. The mortar bed is also sprinkled immediately in advance of the block laying, [illegible] a different practice from that of Kansas City. No provision is made for [illegible] the blocks previous to laying, but it is specified that the blocks shall show such waterproof qualities that after being dried in an oven at a temperature of 100° F. for a period of [illegible] weighed and then immersed in water for a period of [illegible] and weighed again, the gain shall not be more than 5%. In laying, the blocks are specified to be laid loosely and not driven together—another difference from the Kansas City specifications. Either a coal-tar pitch or asphalt filler may be used.

On the other hand, experiments conducted by C. H. Teesdale, engineer in charge of wood preservation at the Forest Products Laboratory, Madison, Wis., tend to confirm the conclusions reached by those who drew the Kansas City specifications. These experiments were described in a paper read before the American Society of Municipal Improvements at the recent (October) meeting in Boston, Mass.

Mr. Teesdale's general conclusions are as follows:

These tests seem to indicate that longleaf pine paving blocks should be treated in the green condition after being well steamed. All blocks, even if thoroughly air-seasoned, should be well steamed. While it is true that a preliminary and final vacuum greatly retarded bleeding of air-seasoned wood, a preliminary vacuum will tend to make the absorption of oil too rapid during treatment, resulting in uneven penetration. A steaming period is therefore advisable to render the absorption less rapid and allow a longer and more intense pressure period to be applied. Furthermore, if seasoned blocks are steamed, they will take up moisture and expand and should be less liable to give trouble from swelling after laying in the street. For these reasons it would be preferable to treat green material when it is possible to obtain it.

If for any reason the blocks cannot be laid soon after treatment, they should be covered and perhaps wet down occasionally to prevent them from drying out. It is likely that if the blocks are wet when laid, expansion troubles will be much reduced, providing a good job of laying is done.

It would seem to be desirable to give a vacuum treatment after the steaming period and also after the oil has been removed from the cylinder. If tar mixtures are used, a final steam bath should succeed the final vacuum to remove carbon and dirt from the blocks.

Absorptions of over 16 lb. per cu.ft. hardly seem necessary. Data are available which show that heavier absorptions do not greatly retard swelling and they tend to increase bleeding.

It seems very likely that the reasons why some pavements bleed while others do not may very often be traced to the method used in treatment. A plant treating green material would resort to a steaming and vacuum treatment with the result probably, that the blocks would give no trouble. The same plant, perhaps, would later treat seasoned material without steaming it or giving it a vacuum treatment. This would be the simplest method of treating such timber as much time would be saved, and these operations would seem unnecessary. When such blocks are placed in the pavement, however, there is considerable probability that bleeding would follow.

The following conclusions were drawn from all the tests made on swelling:

(1) The rate of swelling was much slower in treated blocks than in untreated blocks. In all cases where the blocks were soaked in water the maximum swelling obtained was at least two-thirds, and in most cases was only slightly less than that of untreated wood.

(2) The maximum swelling was less in blocks treated with tar mixtures than with creosote.

(3) Free carbon did not appear to influence swelling.

(4) No swelling occurred in the case of wood treated in green condition.

Engineers and Civil-Service Examinations

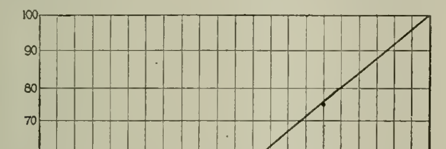
There can be no question that the engineering profession heartily supports the theory of what was known 25 years ago as the civil-service reform movement. It would be hard to find an engineer who would dissent from the proposition that appointments to positions in the public service, municipal, state or federal, should be based on the fitness of the applicant for the job and not on his political affiliations or his power to exert a pull.

But it is one thing to approve the theory of the merit system, and quite another thing to reach the conclusion that the average civil-service examination as it is con-

ducted actually does select the men or women who are best fitted for the work. It is a pretty general rule, we believe, that when an engineer is placed in responsible charge of work, and has to select the employees who are to carry out the work under his direction, he does not ordinarily appeal to the civil-service bureau for candidates unless the law obliges him so to do.

This applies especially to the higher positions, involving more or less of responsibility and originality in the men who are to fill the positions; but it applies also to the lower grades of city employment. Unless the bureau conducting the civil-service examinations goes at its job with the same common sense that should prevail in the employment bureau of a factory or a large mercantile establishment or a general contractor's organization, the examination of men for employment in the work of cleaning streets, excavating sewers, laying paving, firing boilers, and twenty other similar tasks in the municipal service is not likely to secure the men best fitted to perform the work.

An excellent statement of the engineer's attitude toward civil service in connection with a city's business is contained in the annual report, just issued, of Morris L. Cooke, Director of Public Works of Philadelphia. As



Percentage Allowed to Previous Experience in Civil Service Examinations for Engineering Positions in Cleveland, O.

many of our readers are aware, Mr. Cooke holds probably the highest administrative position in the service of a great city of any member of the engineering profession in the United States. He represents the reform element in politics, and has introduced into the public service of Philadelphia standards of efficiency such as have seldom been seen in that city. Mr. Cooke says:

> We wish to register a deepening conviction that some form of civil service is absolutely necessary for a proper conduct of municipal business. Were it not for civil service, the life of the average administrator would be almost unbearable.
>
> At the same time we are convinced that the civil-service system in this country is suffering from an overconfidence in its methods by those administering it. We believe that over a large part of the field the methods used are archaic; that as the grade of the position to be filled rises, the present methods of examining are less and less likely to produce the right kind of man. The civil service should be looked upon as corresponding to an employment bureau in the ordinary industrial establishment.
>
> Among the changes which would appear to be for the good of the system are: That the appointing officer should be allowed greater scope in signifying the particular type of employee he wants at any given time; more weight should be given to a candidate's previous experience and record and less to what he is able to submit in a four-hour examination; promotions should in greater measure be dependent on record of work done rather than on examination; civil service should be operated, primarily, to promote efficiency rather than to check favoritism.
>
> Methods should be adopted that will obtain quicker results from examinations. In departments such as those where there is a great deal of construction work that is not routine and which varies in amount from season to season, it is necessary at times to increase quickly the force in certain divisions. The most desirable candidates will not wait around two months after an examination to find out whether they are to be available for appointment.

We wish that Mr. Cooke's comments above quoted might be read and taken to heart by all those charged with the responsibility of conducting civil-service examinations. The fact ought to be recognized that there are a large class of men who are competent and efficient in doing work but who can by no means attain a high mark in an examination.

Worth especial notice in this connection is the method adopted in the City of Cleveland a few months ago to comply with the civil-service law and at the same time meet the practical needs of municipal service.

The new Cleveland charter, which went into effect at the beginning of the present year, made it unlawful for a city disbursing officer to pay an employee in the classified service unless the city Civil Service Commission had certified to that person's appointment in accordance with the civil-service provisions in the charter. The charter, however, provided that:

> All examinations shall be practical and impartial, and shall relate to those matters which will fairly test the relative capacity of the person examined to discharge the duties of the position for which appointment is sought.

The Cleveland Civil Service Commission is composed of two lawyers and a chemist. After a rather unsatisfactory experience in having its papers for the examination of engineering employees prepared by examiners selected by the Commission, an appeal was made to the Cleveland Engineering Society for aid.

The society at once appointed a special committee which prepared lists of those members of the Society who were by previous training and experience best qualified to prepare examination questions for the various positions. From these lists a subcommittee of two was selected for each examination.

Consultations were held by the committee and the various subcommittees with the commission as to the routine and scope of the work and the relative weights to be given to examination and previous experience. It was felt that in the subordinate positions it is of importance that a man should have thorough technical knowledge but that as responsibility is increased, experience becomes the most important thing. This was apparently recognized by the framers of the charter when they conferred upon the Commission power to exempt certain positions from the competitive class.

It was necessary to reduce this general idea to a definite basis and the committee finally decided that a position paying not more than \$800 a year might be filled by a man with no previous experience, while one paying \$3000 or more should require a man of such extended experience that his early technical knowledge might be relatively of no importance. Between these two extremes the weight of experience was made relative to salary on a nearly straight line, as shown on the accompanying cut.

Letters to the Editor

Experience with Small Cube Granite Block Pavements in Louisville, Ky.

SIR—Supplementing the article in ENGINEERING NEWS, Sept. 10, 1914, on "The Present Status of Small Cube Granite-Block Pavements," the following facts regarding Louisville experience may prove of interest. The Department of Engineering has recently laid about 600 sq.yd. of this pavement in the car tracks on Main St. between 7th and 8th St. The blocks were purchased from the Harris Granite Quarries Co., Salisbury, N. C., and cost $9.00 per ton f.o.b. Louisville (7 sq.yd. to the ton guaranteed). The blocks measure from 3¾ to 4 in. and are in the form of irregular cubes.

The foundation for this pavement is portland-cement concrete extending from a line 6 in. below the ties to a line 5½ in. below the head of the rail. On the concrete foundation was spread a course of pea gravel or roofing gravel in which the blocks were set in straight courses perpendicular to the rail. No especial effort was made to break the joints as this was accomplished by the irregular sizes of the cubes. After laying, the blocks were rolled with a 2½-ton tandem roller and grouted with a portland-cement filler.

To date, the pavement is entirely satisfactory and presents a beautiful appearance, but the short time it has been in use, about three months, is not sufficient to furnish any reliable information.

The cost of the blocks on the railroad cars was 67c. per sq.yd. less than standard-size blocks would have cost from the same quarry, and the amount of filler used was about the same required for standard blocks. However, the cost of paving was considerably higher, as we could only secure a maximum of 20 sq.yd. per man per day of 8 hours, whereas on standard blocks we have no trouble in getting 30 to 35 sq.yd. per man. Granite pavers of this city are paid 50c. per hr., or $4.50 per day, consequently it will be seen that it cost about 50% more to pave with the cubes than with the standard blocks. It should be remembered in this comparison, however, that these blocks were used in the car tracks which always cost more than paving larger areas.

This experimental section of "Durax" pavement has given such favorable impression that we have just awarded contracts for laying 1000 sq.yd. of it on another street. The lowest bid on this contract was $3.40 per sq.yd. including 5-in. concrete base and portland-cement filler.

While we think this price is a trifle high, we account for this largely by the fact that the pavement is practically an unknown quantity to local contractors and we think they have added a liberal margin for safety. We have decided, however, to let the contract at this figure hoping by securing some payment on it to show that it can be laid considerably cheaper than $3.30, and in this way we expect to bring the price down to a more reasonable figure.

From our investigation of this pavement and our slight experience with it we are so favorably impressed that we hope to be able to lay larger yardage of it in the future if it can be done at a reasonable figure.

D. R. LYMAN,
Chief Engineer, Department of Engineering.
Louisville, Ky., Sept. 19, 1914.

Slighting the Humble Land Surveyor

SIR—I have often wondered why that part of engineering dealing with land surveying has apparently not received in the periodicals of the day the amount of attention and discussion it deserves. Is this because there seems to be a quite general belief, even among engineers, that anyone who can run a transit and read a tape is a surveyor?

A case in point might readily be found in the report of the Committee of the Philadelphia Association of Members of the American Society of Civil Engineers, printed in ENGINEERING NEWS, Oct. 22, 1914, pp. 850-852. After setting forth in an able manner indeed, a number of arguments against the proposed act and its principles covering the licensing of professional engineers, the committee recommends a plan, to quote, in part:

To require the licensing of county surveyors and other surveyors in independent practice. Fair examinations for surveyors can easily be set, which would serve to exclude incompetent men where incompetency would be likely to entail property losses and expensive litigation.

To license other classes of technical men whose duties are of a definite and restricted nature in fields where incompetency would be attended by results similar to those just mentioned in connection with surveyors and in which competency may readily be determined by examination.

Here is clearly a case where land surveying is regarded as a fixed and definite proposition, as much so as a problem in trigonometry. The committee report would lead one to believe that its members feel that given a set of circumstances and data, there is in all cases but one correct procedure for a good, let us say a "properly licensed" surveyor to take.

Unfortunately, this is not true. The first part of paragraph (b) under heading (A) in the above report is a good answer to the proposed plan to license surveyors anywhere, for in what part of engineering work is there more judgment required than that of the land surveyor? Besides having often to interpret deeds, descriptions, laws, titles and right of possession, he is obliged to use extraordinary care and all of his experience, in order to insure accuracy at all times in "every measurement." In practice, this is not a matter of running a transit and reading a tape, as a glance at some of the U. S. Coast and Geodetic Survey reports, covering accurate measurements of various kinds will prove.

To quote again from the above report:

It may, in fact, be generally admitted that no form of licensing can serve to eliminate incompetency, though technically competent men will not hesitate to resort to

unprofessional practices insofar as that may be possible with safety to themselves.

Where in the whole field of engineering is there another department, like land surveying, where competition is as keen, with its resultant price-cutting and lowered quality of work, and by reason of the almost criminal lack of proper laws, the chance for careless and troublesome practices so great?

It is true that the land surveyor has not the responsibility of the danger of a catastrophe resting upon him; but from a theoretical point of view there is more judgment, or say more educated common sense, required at times in land surveying than in the design of a bridge or other structure of more or less standard specifications.

The writer is not opposed to the licensing of surveyors as a general proposition since this would perhaps require a working knowledge of mathematics at least, among the "surveyors." The true remedy, however, in my belief, is in the enacting of proper laws covering land descriptions, plats, monuments, etc.

MATHIAS R. KONDOLF.

P. O. Box 713, Rochester, N. Y., Oct. 24, 1914.

A Defense of Railway Location Theories for Highway Location

Sir—In your issue of Aug. 6, 1914, there was a letter under the title of "Highway Location in Mountainous Country." I wish to mention the experience of the writer on highway work with engineers "who had sat at the feet of Wellington," or other high authorities on railway location, and who, the author of that letter seems to think, are not particularly qualified for highway-location work.

In the Philippine Islands we have had engineers with highway, railway and other special experience, and engineers just out of school with no practical training at all.

Where one location made by the railway engineer has been found wanting, a dozen made by men with other than railway experience have not come up to the requirements. Engineers with former highway experience were not found to have any marked advantage over those without railroad experience.

It is an extremely rare occurrence that we have to request the ex-railway engineer to break his grades at more frequent intervals, or that we have to increase his rate of grade or cut down the radius of his curves. On the other hand, it is the rule rather than the exception that the locations made by the non-railroad men are noticeable for the following defects; adverse grades (often maximum both ways), when a broken or uniform grade can be had for the same or but little greater expense, and in some cases for even a lower cost than for the adverse grade (usually there is no attempt to locate these grades with any regard to momentum factors); poor alignment; excessively sharp curves without any reason for their adoption.

We have a form of parabolic curve in the engineers' manual, which can be advantageously used in some cases. This curve may be easily located by offsets.

A common method used by some non-railway engineers is to run in their curves with a certain length of tangent distance, which length remains practically constant for a section of location, with little or no attention to the amount of angle, topography or other conditions. These engineers assume that a tangent distance of say 100 ft will get them around almost any angle and they are content. Frequently curves of from 1° to 20° or more will be made where a tangent would not cost a cent more.

These cases often occur in a country where a swing sufficient to give a straight line would not make any difference in the grading required. This generally comes from running to a point where the locating engineer discovers he has to make a turn to strike his objective point. Light angles come in frequently from getting off a back sight or other cause; but such little things as a rule do not bother the man who has not "sat at the feet of Wellington." However, such defects do not pass entirely without notice from the more or less critical nontechnical users of the road.

The railroad engineer has an eye for country and has methods of overcoming difficulties in grade and alignment, which are not possessed by one engineer in a hundred who has not had his experience or worked on location under the direction of a highly qualified location man.

The writer of the letter in your Aug. 6 issue states: "Highway location is still in its infancy, and a few more railroad ideas will have to be almost forgotten." After going over considerable highway work in the United States, Europe and the Malay States and having had about eight years' experience on road location and construction in the Philippine Islands and Cuba, I believe that the last phrase would be decidedly of more value to the highway cause if it had read "a few more railroad ideas will have to be kept in mind."

I fear that the writer of your letter must have been rather unfortunate in his experience with railroad men on highway work, and one cannot help wondering what kind of railroad men he had to deal with. I do not know of any branch of engineering where men can make money go further or make a dollar earn any more interest than the first-class railroad locating engineer, either on railway or highway location.

Is there any set of engineers who are oftener required to break their long grade lines, use heavier rates of grade, adopt sharper curves and otherwise lower their ideal standard of excellence in order to get their line through for the funds available than the railroad locating engineer? If he can do this on a railroad, he can also do it on a highway.

I do not wish to be understood as harshly criticizing men who have not had the benefit of railroad experience. Many of these men have done and are doing the highest class of highway work. When the man with the nonrailway experience understands what is wanted *and how*, he is as efficient as the railway man.

It is undoubtedly true that all railroad men are not successful highway locating engineers; but I believe that, as a rule, the railroad locating engineer will make better road locations than men from any other school of practice. I also believe that the number of unjustified sharp curves and the heavy grades found in easy country, which have been laid out by nonrailroad engineers, will greatly outnumber the unwarranted light grades and too easy curves in mountainous country for which men of the Wellington school can be held responsible.

W. H. WAUGH.
Senior Supervising Engineer,
Bureau of Public Works.

Manila, P. I., Sept. 18, 1914.

The New York Rapid Transit Railway Extensions*

By F. Lavis†

V--Ventilation, Drainage and Waterproofing

Ventilation

Every effort has been made to so design the new subways, that the excessive heating which occurs at times in the summer in the present subway may be avoided. The tracks are to be divided so that trains going in one direction will be in a separate tube or tunnel from those going the opposite way; by this means it is expected to utilize the movements of the trains (the so called piston action where there is only one track in a single tube) to push the air ahead and out through the openings which are provided for this purpose.

The original subway is completely surrounded by an envelope of waterproofing, and it has been thought that this has prevented the dissipation of some of the heat generated by the motors, brakes, friction, etc., into the ground surrounding the structure. On the new lines waterproofing will generally only be used where actually necessary to keep out water, that is, below the ground-water line, in earth, and on the roof.

Openings in the roof of the tunnel, with sidewalk gratings, are provided over the station platforms, and generally one about half way between each station and one at each end of the stations on the side toward the approaching train, these latter being expected to take care of most of the draft caused by the train, instead of allowing it to create a current at the platform and up the stairways. The general form of these openings, and the details of their construction are shown in Fig. 22, and a typical arrangement of location in Fig. 21 (7th Ave., 17th to 24th St.). The dimensions and numbers of these openings have been so fixed that it is expected that the current of air issuing through the gratings in the sidewalk will be hardly noticeable to pedestrians.

Fan chambers, which are all arranged so that they may be also used as emergency exits to the streets, are provided, one about midway between each station. These are so arranged that they will draw the air from the tunnel at points intermediate between the stations and force it out through the gratings already described, thus, of course, drawing fresh air in at the stations. It is expected that the openings above combined with the action of the trains will ordinarily provide sufficient ventilation, the fans being used only occasionally when circumstances require.

The piston action of the trains in the single-track tube of the Hudson & Manhattan R.R. has been reasonably efficacious in promoting efficient ventilation, but except on the Fourth Ave., Brooklyn, line, where there is a parked space in the center of the street and where walls are provided between each track, it was not considered practicable to divide all the tracks of the new four-track lines so that each would be in a separate tube, on account of the difficulty of providing stations for the center tracks. It would be impractical, of course, to provide openings in the roadway of the streets, and in order that the openings in the sidewalks might be used, the center wall only was built dividing the traffic going in opposite directions, but leaving the two tracks on one side in the one space. If this does not produce the required movement of the air, that is, actual propelling movement, not mere stirring up as in the present subway, the fans must be utilized to supplement it. Openings about 2 ft. wide and 8 ft. high are provided at every 10 ft. in the center wall as a means of communication between the two sides, and as refuge niches, and these may tend to reduce the piston effect to some small extent.

Although this arrangement in the four-track section will reduce somewhat the positive piston action of the trains, it will be beneficial to the extent that it will tend to reduce the air resistance, which has been shown* to be by no means a negligible factor in cost of operation in single-track tubes, though this cost may be offset by the benefits of more efficient ventilation.

The actual effect of all these different items and of the size of the cross-section both on the efficiency of ventilation, as well as the cost of operation, is something of which little is actually known, but in view of the enormous expenditures which are being made and which undoubtedly will continue to be made in underground railways for rapid transit, in subaqueous tunnels, etc., it is hoped that further experiments along the lines of those already referred to* and others of like nature may be continued.

As will be seen by the diagrams, the object of the design of the openings has been to provide at the track level a space into which the air pushed ahead of the train may expand and be detained, instead of being pushed by, and then provide an opening above through which it may escape to the surface, there being apparently little reason to doubt the efficacy of this proposed scheme.

Drainage and Waterproofing

In the general clauses of the specifications it is stated that "it is the very essence of these specifications to secure a railroad structure underground which shall be free from the percolation of ground or outside water. The mixing and placing of the concrete and the placing and protection of the waterproofing shall be with this end in view."

"In general, waterproofing of the structure will be limited to the roof and sidewalls at the stations and over the roof between stations, and to those surfaces near ground water or mean high water if ground-water level is found for any reason to be below mean high water. At other places free drainage shall be provided by pipe drain, hollow tile or broken stone."

The specifications provide for the use of fabric waterproofing, laid in hot pitch or asphalt, and in from three to six thicknesses or plies, and for brick or hollow tile, laid in pitch or asphalt mastic. The latter to contain "one-

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*Copyright, 1914, by F. Lavis.

†Consulting Engineer, [illegible] St., New York City.

*[illegible], "Air Resistance in Tube Tunnels," "Trans." Am. Soc. C. E., Vol. LXXV, 1912.

third pure bitumen, and sand and cement or lime dust in proportions governed by local requirements and weather conditions."

At temperatures of 50° to 70°, the proportions used are usually one-third asphalt, one-third cement, one-third sand; in colder weather the proportion of asphalt is in-

protected from injury by barricades or otherwise, if necessary until thoroughly set.

It is intended to obtain concrete impervious to water; the concrete shall be mixed and deposited with this end in view, and on the roof of the railroad, if waterproofing is not used, the top surface of the concrete shall be carefully troweled as may be directed in order to add to its imperviousness.

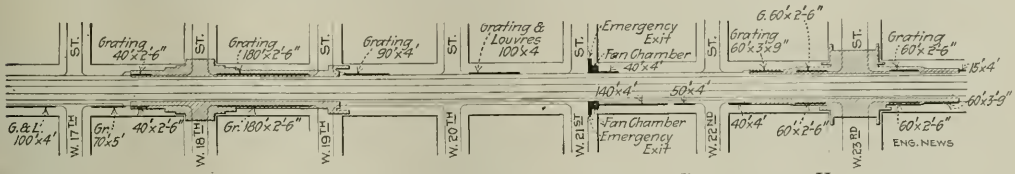


FIG. 21. PLAN OF PORTION OF SEVENTH AVE. SUBWAY, SHOWING PROVISION FOR VENTILATION

creased as required up to a maximum of 60%, though 50% is seldom exceeded. Lime dust is apparently not used in place of the cement, as it appears to require a larger proportion of asphalt to make it workable.

The fabric waterproofing is generally used on the roof or other horizontal surfaces where it may be required, and the brick in mastic on the sidewalls or on any vertical

Reference has already been made to the fact that on account of the supposed influence of the waterproofing envelope inclosing the present subway, in retaining the heat, that waterproofing is only carried out in the new lines where the evident necessity shows the need of protection to keep the structure reasonably dry. Much greater reliance is being placed on the provision of free

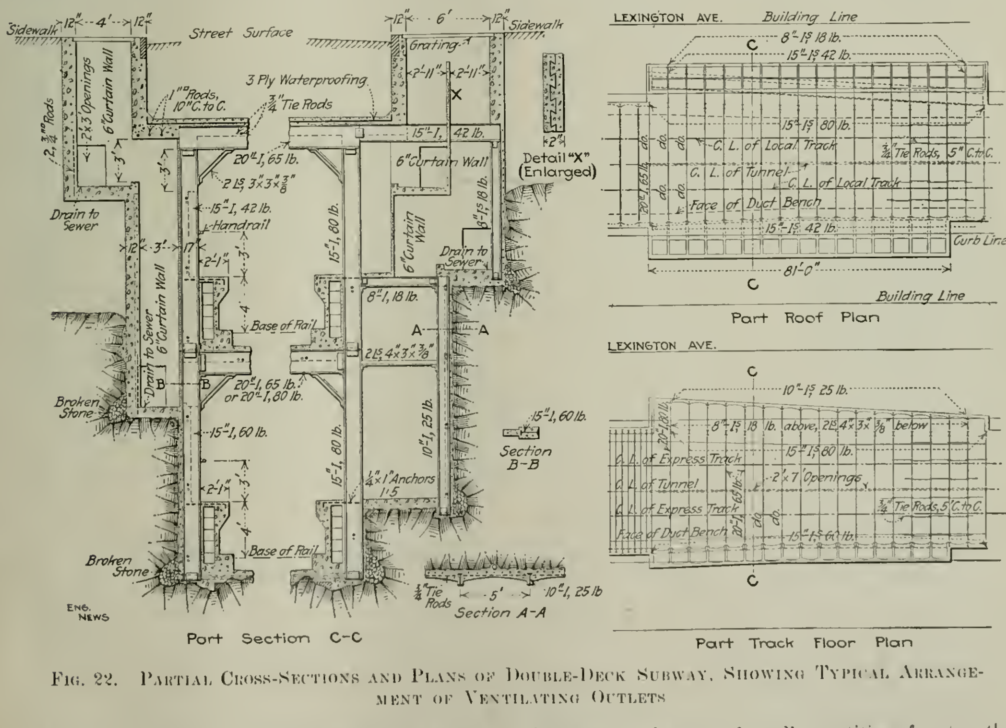


FIG. 22. PARTIAL CROSS-SECTIONS AND PLANS OF DOUBLE-DECK SUBWAY, SHOWING TYPICAL ARRANGEMENT OF VENTILATING OUTLETS

surfaces and under the floor when required there. At stations brick and mastic are used over the roof.

In the concrete specifications, the following clauses apply to the waterproofing:

The proportions of cement and sand and stone (or gravel) used in making protective concrete outside of waterproofing lines on sides and roof, shall be as follows: 1 part of cement, 4 parts of sand and 8 parts of stone.

Concrete to which waterproofing is to be applied shall be made smooth at the time of laying and shall be carefully

drainage to take care of small quantities of water, than has been done heretofore, this being in line with recent experience.

The question of waterproofing tunnels is comparatively modern and its importance is due principally to the development of electric traction and of the numerous underground lines for urban rapid transit. On that section of the Pennsylvania Railroad's New York tunnels,

which passes under the Bergen Hill* on the Jersey side of the Hudson River, and where there was a considerable seepage of ground water, the ample and careful provision of free drainage, without the general use of waterproofing has resulted in a remarkably dry structure.

On all the new subway lines, drain pipes are laid in the floor (under the center of each track) which lead to sumps at pump chambers, from which the drainage is discharged by automatic electric pumps into convenient sewers.

These floor drains have grating openings in the concrete floor every 50 ft. and the floor grades are arranged (irrespective of the track grades) so that there is a summit between each grating (in the case of steep grades 2 or 3%, the summit is just below the grating). 4-in. pipes lead to these center drains from the sides, and, if necessary, part or all the way up, to take care of any seepage there may be. In the case of the Lexington Avenue rock tunnels, these side drain pipes generally reach up to the bottom of the loose rock packing over the roof. See Figs. 12 and 14.

Speaking generally, there are two typical methods of waterproofing. The first where the structure is in earth, where the water level (mean high water or ground water) is above the bottom of the structure. In these cases the waterproofing is carried across the bottom and up the sides to about 2 ft. above the level of the water. See Fig. 15. This drawing also shows the waterproofing carried over the roof, as the section is taken at a station.

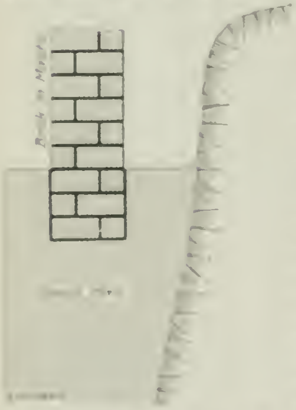


FIG. 24. EXAMPLE OF WATERPROOFED STRUCTURE IN ROCK WITH BRICK WALL LAID IN MASTIC

The second where the structure is partly in rock and where the water level is above the rock. In these cases the waterproofing is carried from a point 2 ft. above the water level to the rock or more commonly sealed into a trench in the sand wall, as shown by the sketch, Fig. 23.

When the water level is below the top of the rock, waterproofing is not generally used except over the roof (see Fig. 15), and in the case of the Lexington Ave. tunnels, even this is omitted.

[illegible]

[illegible]

above the water level, no waterproofing at all is used; on the other hand, just above this point, at about 102nd St., though the structure is wholly in rock, the water level is about 10 ft. above the bottom of the structure and the brick in mastic is, therefore, carried down below the floor at the sides, and the top is covered with 1 ply of fabric and two layers of brick in mastic. Burlap coated with an asphalt compound is generally used for the fabric, but where there is water, as in the bottom under the floor or in depressed bays, etc., one layer of felt is used first.

At stations the waterproofing (3-ply fabric or 1-ply and two layers of brick in mastic) is carried over the roof and down the sides to below the track level, in order to prevent any damage to the decorations, as well as to protect the offices and passengers.

When the floor is to be waterproofed, a 6-in. concrete base is laid in the bottom of the excavation, and two layers of brick laid flat in mastic laid on this; at the sides, if the sheeting is to be left, the two courses of brick in mastic are generally laid right against it, otherwise, where the sides require waterproofing, the steel is first erected, then a hollow-tile or concrete-sand wall is built behind it, on which the waterproofing fabric is hung and then the concrete sidewalls are built. Loose rock is packed behind the hollow tile as it is built up.

In many cases the protection wall of 4-in. hollow tile, or a concrete sand wall is built, then the steel is erected before the brick in mastic is laid up. The steel columns then act as braces for the rough board forms necessary to support this latter until the mastic hardens. These boards are usually painted with a good thick coat of cement grout to prevent their sticking to the mastic, the grout sticks to the mastic and the boards are easily removed.

An inspection of the various bids made up to the present time shows the general average prices for the above classes of work on the contracts awarded to be approximately as follows:

Waterproofing, 1 ply per sq. yd.	[illegible] to [illegible]
Waterproofing, 2 ply per sq. yd.	[illegible] to [illegible]
Waterproofing, 3 ply per sq. yd.	1 [illegible] to 1 [illegible]
Waterproofing, 4 ply per sq. yd.	1 [illegible] to 1 [illegible]
Waterproofing, 5 ply per sq. yd.	1 [illegible]5 to 1 [illegible]
Waterproofing, 6 ply per sq. yd.	1 [illegible] to 2 [illegible]
Brick in mastic, per cu. yd.	[illegible] to 38.00
Vitrified drain pipes, 4 in. per lin. ft.	$[illegible]
Vitrified drain pipes, 6 in. per lin. ft.	[illegible]
Vitrified drain pipes, 8 in. per lin. ft.	[illegible]
Vitrified drain pipes, 10 in. per lin. ft.	[illegible]
Vitrified drain pipes, 12 in. per lin. ft.	1 [illegible]
Cast-iron drain pipes, 4 in. per lin. ft.	$0.75 to $1 [illegible]
Cast-iron drain pipes, 6 in. per lin. ft.	1 [illegible] to 1 [illegible]

Concrete Roads in Wayne County, Mich.

The eighth annual report of the Road Commissioners of Wayne County, Mich., just issued, is of interest to all who are following the progress of concrete-road construction. That these are numerous is indicated by the statement that hardly a day has passed throughout the year without the visit to Wayne County of a delegation from some part of the United States and Canada to examine the concrete roads.

The county now has over 100 miles of concrete road, some of it in its sixth year of service. The Commissioners say that as these roads are without the semblance of a rut and not a single 25-ft. section has been taken up and replaced since its beginning, the adoption of the concrete road as the standard type for Wayne County is justified.

*The Bergen Hill Tunnels of the P. R.R. [illegible]

The success of the Wayne County roads is further evidenced by the adoption of concrete for roads elsewhere in the vicinity. The City of Detroit will put under contract during the present year over 139,000 sq.yd. of concrete paving for streets and alleys. A number of cities and villages near Detroit and across the river in Canada are laying large amounts of concrete road and street paving.

The Commission announces that it has abandoned the construction of roads having a width of concrete of less than 15 ft. and 24 ft. with the shoulders. A number of its existing concrete roads are only 12 ft. wide; but it has been found that when these narrow roads are opened, the amount of traffic attracted to them makes it desirable to have a greater width. In other respects the specifications used last year are unchanged. The principal endeavor now in the road work is to secure a surface even and level, free from wavy depressions and irregularities.

A notable feature of the Wayne County road work is that it is practically all done by day's work by the Commission's own forces, there being at times some 600 to 800 men employed.

The board alludes to the difficulty experienced in financing the work by the sale of county bonds which bear only 4% interest. It became necessary in order to sell the bonds, to appeal to the public spirit of local financiers. Of the entire issue sold last year of $368,000, the Ford Motor Co. took $100,000.

A large part of the cost of concrete-road construction is hauling the material onto the work. The Wayne County plant includes an industrial railway outfit, 100 to 150 teams and wagons and eight traction outfits. The industrial railway is of 2-ft. gage with portable track in 15-ft. lengths. The rolling stock consists of a 7-ton 30-hp. locomotive, 60 steel dump cars 1½ yd. capacity, and five 16-ft. flat cars. The locomotive will haul 30 loaded cars.

Where the industrial railway is not available, material is hauled by teams and tractors. The teams work economically on short hauls, but are often difficult to secure in the road-building season at reasonable prices. Road rollers are largely used for traction, hauling wagons carrying a seven-ton load. Over earth roads this is about all one tractor can haul. Where, however, a concrete road is available for hauling, six wagons carrying 42 tons of material are made up into a train and hauled by one ten-ton roller.

A large amount of water is required in making the concrete road, not only for the concrete but to puddle the subgrade in advance of the concrete laying. It has been found economical to lay a 2-in. pipe along the road from the nearest source of supply and pump the water by gasoline engine or electric motor. In some cases water has been delivered in that way over ten miles from the pumping station.

Curing of the concrete after laying is an important matter. Following the laying of the concrete, it is covered with 2 in. of sand or loose soil, and this is sprinkled daily for ten days. The road is not opened to traffic, however, until three to six weeks have elapsed, according to the season of the year. The shoulders of the road are built of crushed stone or gravel from 3 in. to 7 in. thick and 3 to 4 ft. wide on each side of the concrete.

An interesting section of the report is that on maintenance, as critics of concrete roads have maintained that the cost of keeping them in repair will be excessive. The report, however, contains no separate figures as to the cost of maintaining concrete roads. The total amount expended for repairs on all county roads during the year was $23,393, a saving of $7140 over 1912. This total, however, includes the maintenance of all the gravel and macadam roads in the county as well as the concrete roads; oiling and heavy repairs on the gravel roads and dragging after rain, cleaning of ditches and culverts, and painting of bridges and guard rails, and such necessary work as cutting brush, weeds, etc., and cleaning ditches. The method of repairing cracks or spalling at the joints of concrete roads is the same that has been used in previous years, viz., filling the crack with hot Tarvia of a grade melting at about 80° F., and covering the top with dry sand.

Annual Meeting of the Northwestern Road Congress

The Northwestern Road Congress, organized some months ago, held its first annual meeting at the municipal Auditorium at Milwaukee, Wis., on Oct. 28-31. The attendance consisted largely of township and county officials.

Prof. T. R. Agg (Iowa State University), was President of the Congress. Mr. Hazlewood, Vice-President of the Congress (and Chairman of the Wisconsin Highway Commission), spoke strongly of the necessity of keeping the work and appointments free from political influence.

A paper by Prof. Brindley (Iowa State University) on "The Functions of the State and the County in Highway Administration" had as its keynote the absolute necessity of fixed responsibility and competent supervision to insure good work and economical use of the public funds. He advocated putting the care of secondary roads (representing 75% of the total) in the hands of a responsible commissioner for each township, and the main roads under a county enginer, with a State Commission and enginer in general supervisory charge over all roads, bridges and culverts.

A paper on "The Authority and Responsibility of the County Engineer or Commissioner" was read by Grover Blunt, County Engineer of Fayette Co. (Iowa), and one on "The Inspection of State-Aid Road Work," by John T. McDonaghey, Chief Inspector of the Wisconsin Highway Commission. The latter outlined the system employed in Wisconsin, which was reviewed in Engineering News, Oct. 15. A paper on "Day Labor or Contract Systems for Road Building," by A. R. Hirst, State Highway Engineer of Wisconsin, was very strongly in favor of the former system, as being the more economical and efficient, except for large jobs or for work requiring more special equipment than it would pay the local authorities to own. He stated that in Wisconsin, contract work is rarely done within the contract price, while the engineers of the highway commission are getting work done better and at less cost than it could be done by contract.

In regard to legislation, a paper on "Practical State-Aid Policies," by Mr. Gash (President of the Illinois Highway Commission), reviewed the recent revision of the road laws in Illinois. In the discussion, Mr. Mullen, of the Minnesota Highway Commission, discussed the ques-

and whether the State should undertake construction or merely render financial and technical assistance to counties and townships. In Minnesota the latter system is employed with the important feature that it provides for continuous maintenance of all roads.

A paper by John N. Carlisle (State Commissioner of Highways of New York) was unfavorable to the special-assessment method for financing county road work.

A set of six papers dealt with the technical side of road construction as follows: "Brick Roads," by Mr. McCleary, Engineer of Cuyahoga Co., Ohio; "Concrete Roads," by Mr. Knelling, Highway Engineer of Milwaukee County; "Bituminous Concrete Paving," by Mr. Simmons, Commissioner of Public Works, of Milwaukee; "Gravel and Macadam Roads," by Prof. Agg, Iowa State University; "Earth Roads," by Mr. Sargent, District Engineer of the Wisconsin Highway Commission, and "Highway Bridges and Culverts," by Prof. Marston, Iowa Highway Commission.

Leakage in the Moodna Tunnel of the Catskill Aqueduct near the Hudson River Crossing

Bids are now being called for in our advertising columns, to be opened on Nov. 10, for driving a shaft some 400 ft. deep and a section of tunnel about 900 ft. long to supplement the existing Catskill Aqueduct on the west shore of the Hudson River at Storm King, where the aqueduct approaches the river.

The circumstances which have led to the undertaking of this work are of considerable engineering interest. It will be recalled that the Catskill Aqueduct, from the Ashokan Reservoir in the Catskills to the high level distributing reservoir just north of New York City, is composed of cut-and-cover concrete conduit, tunnels at hydraulic gradient through hills and pressure tunnels deep in solid rock beneath certain major valleys. Under New York City itself also the distribution is to be by a deep pressure tunnel in the rock.

It is well understood, of course, that pressure-tunnel construction can be successfully used only where the rock is solid and unyielding. Concrete lining is put in merely to close possible interstices in the rock, to aid in making the rock more water-tight by grouting and to furnish a smooth surface for the water to flow over. The enormous bursting pressure exerted by the water in this large aqueduct, 14 ft. in diameter, under a head of several hundred feet, would, of course, rupture any concrete lining which could be placed were it not for the resistance of the solid rock back of the lining.

The Catskill Aqueduct passes under the Hudson River at Storm King through a rock tunnel driven at a depth of 1100 ft. below the water surface. The opposite ends of this tunnel connect with shafts reaching to the surface. At the shaft on the west side of the river, at a depth of 300 ft. below the water level, or about 270 ft. from the surface of the ground, connection is made with a tunnel leading to the westward, the so-called Moodna pressure tunnel, driven through the solid rock under the northern toe of Storm King Mountain.

The West shaft of the Hudson siphon (like the East shaft) was sunk by the city as a test shaft to gain information leading to the construction of the siphon. Having developed unusually sound and water-tight rock, it was believed worth while to use this shaft as a part of the siphon, thus saving the expense of another shaft farther west and the consequent additional step in the profile of the tunnel.

The rock was carefully inspected as the shaft was sunk and to all appearances it was, in the judgment of the engineers, stable and unyielding, and unusually favorable material for a water-tight conduit.

The lining of this section of the tunnel was completed last winter, and it was later subjected to the full designed water pressure, with the result that a considerable volume of leakage developed beneath the West shaft and the next shaft, 520 ft. west of it. When the tunnel was pumped out and inspected, it was found that notwithstanding the fact that the minimum depth of rock cover was, as stated above, 270 ft., there had been a slight yielding of the rock at certain points with the result that the concrete lining had been cracked, permitting water to escape. These cracks were very small, the widest, we are informed, being only one-eighth of an inch in width, but under the enormous head, even these small cracks permitted the escape of a large quantity of water, although only a very small percentage of the aqueduct's capacity. No evidence whatever of the movement of the rock is detectable at the surface of the ground.

When the tunnel is once put in operation and becomes a reliance of the city for its water supply, it must be dependable. Moreover, since the statistics of growing water consumption in New York show that the entire Catskill supply may be needed by the city at no distant date, every means possible must be adopted to reduce the amount of leakage from the tunnel.

Under these conditions it was deemed to be desirable to abandon the use of that part of the West shaft of the Hudson River siphon nearest the surface and of a small part of the Moodna pressure tunnel connecting with it. The work on which bids are now called for involves going back 900 ft. farther into the solid rock of Storm King Mountain along the Moodna pressure tunnel, making at that point a shaft 400 ft. in depth, and from its bottom driving a horizontal tunnel 900 ft. long to connect with the deep shaft connecting with the tunnel under the Hudson. It is believed that this will carry the aqueduct so far below the surface that no movement of the rock under the heavy hydrostatic pressure need be feared.

On account of the possibility of shortage in the Croton supply occurring during the next twelve months, should the drought of 1914 continue, the contract calls for pushing the work with the utmost possible speed. One year's time is the amount allowed for the work. However, in case an emergency should arise during the construction of the tunnel compelling the putting into use of the Catskill aqueduct, it would be possible temporarily to cease the work on the new tunnel and shaft and use the aqueduct as now completed, the contractor of course being obliged to suspend his work until the emergency was over and the tunnel could again be pumped out.

Readers desiring a further description of the work previously done at the Hudson River crossing may refer to the extended article on this work by Alfred D. Flinn, Deputy Chief Engineer of the Board of Water Supply, published in our issue of Mar. 23, 1911.

Collapse of Reinforced-Concrete Arcade, Hippodrome Building, Youngstown, O.

A section of a new arcade being built in connection with the new Hippodrome building, to run from Federal to Commerce St., in Youngstown, Ohio, collapsed during construction on Oct. 26, and killed three of the workmen who were in the lower part of the building, and injured three more. Fortunately, a great number of workmen had left the collapsed area just previous to the failure, so a much greater disaster was averted.

The building comprises a theater section of steel construction, with an adjoining arcade building entirely of reinforced concrete. This arcade had a basement and was partly one and partly two other stories in height but at the area of failure had two floors and the roof. It is of straight column-and-beam construction with columns spaced 20 ft. along the narrow dimension of the arcade and 15 ft. 3 in. along the long dimension. The collapsed portion comprised the whole three stories, throughout an area of 40 ft. wide and 107 ft. long, that is, two transverse panels and six longitudinal panels. The columns were square in section, 16x16 for the interior and 14x14 for the outside. They were reinforced with straight rods at the corners. The beams, 20 ft. in span, were 13x16 in. section, reinforced according to the Kahn system. The floors were of rib construction, according to the "Floretyle" system of the Trussed Concrete Steel Co. The floors were designed for 125 lb. per sq.ft. load.

The basement columns were cast on Sept. 22, the first-floor slab Sept. 23, the second-floor slab Oct. 2, and the roof Oct. 24; thus at the time of collapse the age of the concrete varied from two days for the roof to 34 days for the basement columns, with at least 24 days age for all the concrete below the second floor. During the time since this concrete has been laid no particularly cold weather had been experienced.

The precise nature of the collapse has not as yet been brought out. Reports have been circulated that the struts supporting the first floor were removed just prior to the accident, to allow some plumbers to get into the building with their work, but these reports have been strenuously denied by all those concerned with the building. Eye witnesses are few, so it has not yet been brought out whether the first floor failed first and carried down with it the upper portion of the building, or whether the roof collapsed

Collapsed Portion of Reinforced-Concrete Arcade, Hippodrome Building, Youngstown, Ohio

[illegible] broke down the lower floors. As the [illegible] shows, the collapse was complete. The [illegible] at the columns and at the walls [illegible], with one exception, were thrown completely down. The stump of one column still stands.

The [illegible] was all tested by a recognized laboratory and passed the regular standard specifications. The sand and gravel were tested by the city building inspector. It is stated that the loam in the aggregate did not exceed [illegible]. The concrete seems to be all right.

The building was owned by the Youngstown Hippodrome Co. and was designed by Knox & Elliott, architects, of Cleveland. The contractor is the George A. Fuller Co.

NEWS NOTES

A Large Dry Kiln Collapsed at the mills of the [illegible] Lumber & Kiln Co., Samson, Ala., Oct. 27. Four men were killed and 50 severely injured.

A Water Front Fire at San Pedro, Calif., on the morning of Oct. 2[illegible] destroyed the wharves and warehouses of the Crescent Wharf & Warehouse Co., the East San Pedro Cannery and the depot of the Salt Lake, Los Angeles & San Pedro Ry.

The Falling of a Terra-Cotta Cornice on the new building under erection in Jamaica, N. Y., for a substation of the New York & Queens Electric Light & Power Co., Oct. 26, caused the death of three workmen and injuries to about twelve others.

A Section of 6-Ft. Brick Storm Sewer Collapsed, Oct. 1, at Freeport, Ill. The collapse is laid to a want of lateral support caused by excavating for a near-by building. The contractor for the building excavation has been held responsible and will make the necessary repairs.

A Disastrous Mine Explosion occurred Oct. 2[illegible] at the mine of the Franklin Coal & Coke Co., Royalton, Ill., in which about 51 men lost their lives. The explosion is reported to have been due to gas ignited by a miners' lamp. The explosion was followed by a fire and apparently by a second explosion.

Exhibition of Street Cleaning Apparatus—The exhibition to be held in New York City under the auspices of the Street Cleaning Department has been again postponed to Nov. 23-2[illegible]. The exhibition will be held in the Armory of the First Regiment of Field Artillery, Broadway and 68th St. J. T. Fetherston is Commissioner of Street Cleaning.

Another Big Pier Fire, Brooklyn, N. Y.—A new 12[illegible]-ft. [illegible] pier of the [illegible] Line, at the foot of [illegible] St., Brooklyn, N. Y., was badly damaged by a fire of [illegible]. Damage to structure and contents is [illegible] at $[illegible]. Quantities of inflammable freight [illegible] on the pier made the fire [illegible].

A Fast Train Was Derailed on the Chesapeake & Ohio Ry., Oct. [illegible], at [illegible], W. Va. The [illegible] broke in two and the [illegible] [illegible]

Three Fires in or Near Reinforced-Concrete Buildings, [illegible]

[illegible]

[illegible] explosion was of such violence as to blow out a brick wall on the south side of the building on the upper two floors, though no damage was done to the structural part of the building. The fire on the sixth floor started where two carloads of matches were stored. These naturally burned intensely, the fire keeping up for about three hours at a temperature estimated at 1700° F. The roof above the floor was of the tile and concrete beam system. The bottoms of some of the tile were destroyed but the roof remained intact. On a part of the second floor brooms and paper bags were stored to the height of the ceiling, the floor above being loaded with canned goods weighing about 300 lb. per sq. ft. This floor was not seriously damaged by the fire nor did it show any deflection. The damage to the stock amounted to about $200,000, but the building was repaired at very little expense.

On May 16, 1914, a severe fire occurred in the First Christian Church annex, Kansas City, Mo. The first and second floors of the annex were of reinforced concrete. The upper three floors were cast-iron columns, steel beams and wood joist. The building was in course of construction at the time of the fire. The upper three floors of the annex and the church itself were destroyed by the fire, but the concrete part of the building was not seriously damaged. The architects state that after a thorough examination they note that "the reinforced-concrete slabs and columns in the new addition had come through without a scar."

Stone Production in the United States broke all records in 1913, reaching a total value of $83,732,995, according to E. F. Burchard, of the U. S. Geological Survey. These figures show an increase of 7% over the value of the output for 1912, which in its turn broke all records of preceding years. Of the different kinds of stone produced, the largest increase in value was shown by trap rock, which was 23% greater than in 1912.

Some of the Old Wooden Sewers in Boston, which were described in "Engineering News," of Sept. 10, 1914, will be replaced by modern sewers during the coming winter. The work will be done in the vicinity of the post office and will be undertaken this winter not only because of the need of reconstruction but also to afford work to some of the unemployed. It is estimated that work to the value of about $15[illegible],000 will be done.

The First Subway in New York City was ten years old on Oct. 27, 1914. The first section of it to be placed in operation was formally opened on Oct. 27, 1904, when the then Mayor, George B. McClellan, opened the throttle on the first of three special trains carrying city and company officials and their guests. From the date of this opening to the close of the last fiscal year, June 30, 1914, the subway has carried 2,33[illegible],101,305 passengers, an average of more than 233,0[illegible] passengers per annum. (The present week-day number is approximately one million.) The total operating revenue for the same period was $1[illegible], and the operating expenses and taxes $49,[illegible]. The rental paid to the City amounted to $[illegible].

The New Central Station at Memphis, Tenn., was opened for traffic in October. It is owned by the Illinois Central R.R. and is used also by the Rock Island Lines, the St. Louis & San Francisco Ry. and the Yazoo & Mississippi Ry. There are [illegible] through tracks and [illegible] stub tracks, the latter being mainly for the three last named roads, whose trains do not run [illegible] of Memphis. The station building has eight stories, the passenger facilities being mainly on the second or track floor, and the five upper floors being for railway offices. The track elevation work in connection with the new station [illegible] six street crossings, and the tracks are carried over the streets by [illegible] [illegible] Illinois Central R.R. [illegible] "Engineering News," Sept. [illegible], 1914.

The Smallest Central Electric Station [illegible] at [illegible], Wis. The town has a population of [illegible] [illegible] street lamps. [illegible]

The Lowering of Jones' Falls in Baltimore, Md., was officially completed on Oct. 2[illegible], when Mayor Preston set off the [illegible] which broke down a barrier and diverted the water from the [illegible] into the 2[illegible]-ft. tunnel and thence into the [illegible]. The work of [illegible] was described in "Engineering News," July 3, 1913, p. 2. Jones' Falls, an open stream running through the heart of Baltimore, for years [illegible]

street and house drainage and constituted a nuisance to sight and smell. As a part of the new sewer system of the city, now fast approaching completion, the creek was covered from its mouth near the river to near Biddle St., a distance of 5500 ft., with a three-way box conduit of reinforced concrete. From Biddle St. to Mt. Royal Ave. the stream was diverted through a 29-ft. tunnel which takes the stream from the old bed and connects down-stream with the conduit. The covering, together with a reinforced concrete viaduct at the upper end, form a low-grade street connecting the railway stations and wharves, which before had been connected by high-grade streets only.

The work was under the direction of Calvin W. Hendrick, Chief Engineer of the Sewerage Commission.

The New Water-Intake Tunnel at Milwaukee, Wis., had been driven 3017 ft. on Oct. 30, while the total length is 4000 ft. to the new crib, which has already been sunk in place. Following the cave-in and entrance of water described in our issue of Oct. 29, the grade has been lowered slightly to keep the work in solid shale rock. After the accident, it was suggested that the air lock (near the shore shaft) should be replaced by one nearer the heading, but on investigation this was considered unnecessary. A bulkhead was built, however, at about 2950 ft. from the shaft. Air pressure was used only for a short time, and the work is again progressing with the air lock out of service. The work for 1915 will include the land tunnel running southwest from the new shore shaft to the present pumping station, so that, in case of necessity, water can be taken by the new crib and intake tunnel. The intention, however, is not to utilize the new intake tunnel until the pipe lines have been laid from the crib into water about 60 ft. deep. In 1916, work will be commenced on a shore tunnel running due west from the intake tunnel to a new pumping station near the river. The new intake tunnel and its connections were described in "Engineering News," June 18, 1914.

An Injunction Against the Pollution of the Delaware River by the sewage of Phillipsburg, N. J., must be issued, according to a decision recently made by the Chancery Court in the State Board of Health vs. Phillipsburg. The major part of the decision, which is lengthy, disposes of the contentions of the defendants that (1) the power over sewage disposal originally vested in the old State Sewerage Commission was not legally transferred to the State Board of Health, a few years ago; and (2) that the power mentioned did not extend to the potable waters of the Delaware River. The court also declared that "it is idle for the defendant to ask of what avail it would be to stop" it from discharging sewage into the Delaware when Easton, directly opposite, is polluting the river. In addition, the court held, in effect, that threatened pollution would be sufficient cause for the injunction, even though actual pollution could not be proved. The injunction will carry it with the necessity for sewage disposal by Phillipsburg in a manner to be approved by the State Board of Health. An appeal to the Court of Errors and Appeals is expected. We are indebted to R. B. Fitz Randolph, Chief of the Division of Food, Drugs, Sewerage and Water of the State Board of Health of New Jersey, for a copy of the decision.

A Practical Demonstration of Fireproof Residence Construction was given by Edward F. Croker, former Chief of the New York City Fire Department, now President of the Croker Fireproof Construction Co., New York City, at his home at Long Beach, Long Island, N. Y., Oct. 30. The house is constructed of hollow tile and stucco, with steel-frame floors and partitions, metal window sashes and wire-glass windows, steel doors and trim and asbestos-plastered walls. The floors are of a material known as "konpolite." The ceilings, like the walls, are hollow tile covered with asbestos plaster. The demonstration consisted in settling a fire in one of the sleeping rooms, full of furniture and furnishings, helped out by two gallons of gasoline, shutting the door and allowing the fire to burn itself out. No damage was done the house or the walls of the room. As guests of the occasion Mr. Croker had many fire prevention engineers and experts and an illustrated report is to be made. Mr. Croker claims this is the first and only actual fireproof residence in this country. His object, which seems to have been fully accomplished, is stated as follows:

My experience, both as a fireman in the ranks and as a Chief of the Fire Department of the City of New York, covering a period of 27 years, convinced me it was both possible and feasible for the average owner of residences, both private and apartment houses (and particularly large residences in the suburban districts), to construct at very little additional expense, if any, an absolutely fireproof home in every sense of the word; in fact, a residence whereby shutting the door of each room at night, one could feel safe that, even if a fire did occur, it would be confined to the room in which it originated, permitting the occupants of the other rooms to sleep in absolute security.

PERSONALS

Mr. T. R. Quay has resigned as Heating and Ventilating Engineer of the city building inspection department of Cleveland, Ohio.

Mr. Thane R. Brown, Assoc. Am. Soc. C. E., for 20 years with the Wisconsin Bridge & Iron Co., Milwaukee, Wis., has been promoted to be Chief Draftsman.

Col. John Biddle, M. Am. Soc. C. E., Corps of Engineers, U. S. A., has been detailed as a military observer with the Austrian Army. He has been on temporary duty with the Chief of Engineers at Washington, D. C.

Mr. W. J. Dyer, M. Am. Soc. M. E., Assistant Manager of the Honolulu Iron Works Co., Honolulu, H. I., has resigned to engage in private practice, with offices in the Stagenwald Bldg., Honolulu.

Mr. J. M. Keller, M. Am. Soc. M. E., until recently Chief Engineer of the Otis Steel Co., Cleveland, Ohio, has been appointed to the newly created position of Chief Engineer of the National Carbon Co., also of Cleveland.

Mr. John R. Haswell, Jun. Am. Soc. C. E., Drainage Engineer, United States Department of Agriculture, has been transferred to Baltimore, Md., to represent the drainage division of Maryland, Delaware, New Jersey, Pennsylvania and New York.

Mr. F. C. Herrmann, M. Am. Soc. C. E., Chief Engineer of the Spring Valley Water Co., San Francisco, Calif., has resigned to engage in private practice as a Consulting Engineer, specializing in hydraulic engineering, with offices in the Merchant's Exchange Bldg., San Francisco.

Mr. William T. Dougan, M. Am. Soc. C. E., Engineer of Maintenance-of-way of the New York Rys., resigned Oct. 1 to engage in private practice. He graduated from Union College in 1892 and his first experience was as Assistant to the Chief Engineer on the construction of the Fonda, Johnstown & Gloversville R.R. Later he was Chief Engineer on construction of the Herkimer, Mohawk, Ilion & Frankfort Electric R.R. He entered the service of the Metropolitan Street Ry., New York City, in 1897.

Mr. Hugh C. Mitchell, recently Engineer in charge of the Topographic Survey of Cincinnati, Ohio, which was described in "Engineering News," Apr. 3, 1913, has become associated with the firm of Brown & Clarkson, Topographic Engineers, Star Building, Washington, D. C. Mr. Mitchell was for many years an officer of the United States Coast & Geodetic Survey and in coöperation with the firm of Brown & Clarkson will specialize in geodetic survey work and engineering topographic surveys of cities, borough, counties and large land divisions.

Mr. Joseph A. Kitts, Assoc. M. Am. Soc. C. E., has resigned from the service of the Panama Canal and returned to the United States. Mr. Kitts entered the service of the Isthmian Canal Commission, in 1905, when a student on leave of absence from the University of California. He was successively with the engineering staffs of the Bureau of Machinery and Equipment, the Panama R.R. and the Municipal Department. Returning to San Francisco after the fire of 1906 he was engaged on reconstruction work. After completing his studies at University of California, he was reappointed to the Canal Service in 1910, and has been engaged as Principal Assistant in charge of surveys for the construction of the Toro Point Breakwater; Engineer in charge of surveys for the excavation of Mindi cut, installation of machinery, lock gates, towing and return railways, Gatun locks, and construction of the Pacific terminal shops.

Mr. Frank M. Williams, M. Am. Soc. C. E., former State Engineer of New York, has been again elected State Engineer on the Republican ticket, defeating the Democratic nominee, Mr. John A. Bensel, Past-President, Am. Soc. C. E., the present State Engineer. Mr. Williams was born in 1873 and graduated from Colgate University in 1895, and in 1897 from the law department of Syracuse University. He was for a time City Engineer of Oneida, N. Y., and in 1900 became connected with the State Engineer's department of New York, where he was successively promoted until he reached the rank of Resident Engineer of the Barge Canal. He was elected State Engineer in 1908, and served one term of two years. Afterward he was Chief Engineer of the Coleman du Pont Road project in Delaware, and for the past year or two, until recently, he was Chief Engineer of the Portage County Improvement Association in Ravenna, Ohio, where he had charge of the improvement of 900 miles of roads.

OBITUARY

[illegible] L[illegible], [illegible] of the Flatbush Water Co., Brooklyn, N. Y., died Oct. [illegible]

[illegible] C[illegible], [illegible] member of the [illegible] of Canavan [illegible] Co., Contractors, New York City, died Sept. 21. He was [illegible] years old.

[illegible] S[illegible], a civil engineer with the Pennsylvania State Highway Department, committed suicide at his home in [illegible], Penn., Oct. [illegible]

[illegible], a member of the engineering staff of the [illegible] Co., Pittsburgh, Penn., died at his home in that city Oct. 26, aged [illegible] years. He graduated from [illegible] in [illegible]

[illegible] de [illegible] de Sahla, a director of the old Panama R.R. Co. and associated with Ferdinand de Lesseps in the attempt to build the Panama Canal during the eighties, died Oct. 2[illegible], at his home in Fishkill, N. Y.

[illegible] Ives, former President of the Northern Pacific Ry., died Oct. 2[illegible] at his summer home in Ossining, N. Y. He was born at Farmington, Conn., in 1840 and graduated from Yale University in 1861. He served in the Union Army during the Civil War. He was President of the Northern Pacific Ry. from 18[illegible] to 1896, but was chiefly noted as a financier.

Edward F. W[illegible], former President of the St. Louis & San Francisco R.R., died Oct. 22 at his home in Canandaigua, N. Y. He was born in Maine in 1837. During the Civil War he served as an officer in the Union Army. Following the war he engaged in business as a railway contractor and as such built the St. Louis, Vandalia & Terre Haute R.R., now a part of the Vandalia R.R. He was President of the St. Louis & Southeastern R.R. during the construction period and was also a contractor for the construction of other lines in the Middle West. He was Receiver, Vice-President and General Manager of the Burlington, Cedar Rapids & Northern R.R. and subsequently Vice-President of the Atlantic & Pacific R.R., now a part of the Santa Fé System. Later he was Vice-President of the Manhattan Elevated Rys. in New York City. He was elected President of the St. Louis & San Francisco R.R. in 18[illegible] and the following year was also made President of the New York, Ontario & Western R.R. In addition he was President of the North River Construction Co., chief contractor for the construction of the New York, West Shore & Buffalo R.R.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN ROAD CONGRESS.
Nov. 9-1[illegible]. [illegible] headquarters American Highway Association, [illegible] Building, Washington, D. C.

[illegible] WELFARE AND EFFICIENCY CONFERENCE.
Nov. [illegible]. [illegible] Harrisburg, Penn. Secy., [illegible] Harrisburg, Penn.

NATIONAL MUNICIPAL LEAGUE.
[illegible]. Annual meeting at Baltimore, Md. Secy., [illegible] North American Building, Philadelphia, Penn.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.
[illegible]. Annual meeting at Columbus, Ohio. Secy., [illegible] Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
[illegible]. Annual meeting at New York. Secy., [illegible] New York City.

AMERICAN PUBLIC HEALTH ASSOCIATION.
[illegible]. Annual meeting at Jacksonville, Fla. Secy., [illegible] Massachusetts Institute of Technology, Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 1-[illegible]. Annual meeting at New York City. Secy., Calvin W. Rice, 29 W. 39th St., New York City.

AMERICAN INSTITUTE OF ARCHITECTS.
[illegible]. Convention at Washington, D. C. [illegible] Washington, D. C.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.
Dec. 7-10. Annual meeting in New York City. Secy., Percy H. Wilson, Bellevue Court Bldg., Philadelphia, Penn.

AMERICAN [illegible] ASSOCIATION.
Dec. [illegible]. Annual meeting at Phoenix, Ariz. Secy., J. F. [illegible]

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.
Dec. [illegible] at Richmond, Va. Secy., C. A. [illegible], 140 W. 42nd St., New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Dec. 10-11. Annual meeting at New York City. Secy., D. H. Cox, 29 W. 39th St., New York City.

AMERICAN ROAD BUILDERS' ASSOCIATION.
Dec. 14-18. Convention at Chicago, Ill. Secy., E. L. Powers, 150 Nassau St., New York City.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Dec. [illegible]-30. Annual meeting at Madison, Wis. Secy., F. M. White, Madison, Wis.

Society of Naval Architects and Marine Engineers—The annual meeting will be held Dec. 10 and 11 at the Engineering Societies Building, New York City. The program includes 1[illegible] papers by prominent engineers.

Association of American Portland Cement Manufacturers—The annual meeting will be held Dec. 7-10, at the Hotel Biltmore, New York City. The Secretary is Percy H. Wilson, Bellevue Court Building, Philadelphia, Penn.

Snow Removal Conference—The Snow Removal Conference, first held in Philadelphia, Penn., last April, is to have another session Dec. 3, at the annual meeting of the American Society of Mechanical Engineers. The reports of the first conference will be read and discussed and much new matter will be presented.

Cleveland Chapter of the American Society of Civil Engineers—The organization of this Chapter was completed on Oct. 28. A nominating committee was appointed to choose and submit to members of the American Society of Civil Engineers in northern Ohio two names each for president, vice-president and secretary-treasurer.

City Planning Convention Held in California—A convention, held under the auspices of the League of California Municipalities, took place at Santa Cruz, Calif., from Oct. 12 to 1[illegible], 1914. Its object was to discuss city planning and to develop a plan which would be applicable to city extension and new towns in that state.

American Institute of Chemical Engineers—The seventh annual meeting will be held in Philadelphia, Penn., Dec. 2-[illegible]. The program includes excursions to a number of large chemical manufacturing plants in and around the city. There will be a number of papers and addresses on "The Present Opportunities for American Chemical Industries."

Portland, Ore., Association of Members of the American Society of Civil Engineers—The association held its annual meeting Oct. 22, when the following officers were elected: President, George C. Mason, Consulting Engineer, and Second Vice-President, John T. Whistler, Engineer, U. S. Reclamation Service. The terms of the First Vice-President and Treasurer do not expire for another year.

American Society of Heating and Ventilating Engineers—The annual meeting will be held in the Engineering Societies Building, New York City, Jan. 19-21. The following officers have been nominated: For President, Dwight D. Kimball, New York; for First Vice-President, Henry M. Hart, Chicago; for Second Vice-President, Frank T. Chapman, New York; for Treasurer, Homer Addams, New York. The Secretary is J. J. Blackmore, 29 W. 39th St., New York City.

American Road Congress—The prospects are that this congress will be a notable one [illegible]. Special trains will leave New York City and other points in the East and Middle West. The convention lasts from Nov. 9 to 14. The program includes many social events as well as technical discussions. There will be a reception at the state capitol [illegible] as the opening [illegible], a tea for the ladies the second day, an [illegible] the evening of the third day, and probably other events to be announced later.

American Railway, Bridge and Building Association—The [illegible] annual convention of this association was held in Los Angeles, Calif., Oct. [illegible]-13. The sessions were presided over by the president of the society, J. N. Penwell.

Committee reports were presented upon [illegible] Bridge [illegible], [illegible] Concrete Bridge Work, Care of Traffic while Constructing Bridges to Eliminate Grade Crossings, [illegible] and Concrete [illegible]. About [illegible] members were in attendance at the meeting, and [illegible] new members were admitted. The officers elected were as follows: president, L. D. Hadwen, C. M. & St. P.; Vice-Presidents, [illegible], N. Y. N. H. & H.; [illegible] W. [illegible]; and [illegible]; Secretary, C. A. Lichty, C. & N. W.; Treasurer, F. E. Weise, C. M. & St. P.; Executive Committee, W. F. [illegible], N. Y. C. & [illegible]; [illegible], C. & N. W.; W. F. [illegible], B. & O.; C. R. Knowles, I. C. RR.; and A. Ridgway, D. & R. G. [illegible] were taken during the meeting to Redondo Beach and [illegible] Park and to Mount Lowe. The next annual convention will be held at Detroit.

959

Engineering News

VOLUME 72 NOVEMBER 12, 1914 NUMBER 20

A Government Power Dam for Municipal Use

Under quite exceptional circumstances, the United States Government is building a dam in the Mississippi River between St. Paul and Minneapolis, to impound water for 12,000- to 15,000-hp. development, and will probably lease the power site to the two cities and the University of Minnesota.* This is the first case, we believe, where such a relation between the government and local communities has been brought about.

FIG. 1. POWER-HOUSE SUBSTRUCTURE OF ST. PAUL-MINNEAPOLIS DAM

(Upstream side. Photographed Jan. 27, 1914, before coffer-dam was removed. Exciter bay at left. Three main wheel bays are shown, each having four stop-log openings. Fall-increaser openings below. At extreme right, dam buttresses and sluiceway gate seats.)

The government is building the dam for both navigation and power purposes. At one end of the dam is built a lock, at the other end a power-house substructure or set of wheelpits. The user of the power will have to install the machinery and the power house covering it, as well as transmission lines, etc.

Construction by Force Account—Building the lock and dam is carried on as a force-account job by the U. S. Engineer Office at St. Paul. Work on an earlier project on the same site, carried on from 1907 to 1910, was handled in the same way. The work has gone on with perfect smoothness and—so far as indicated by the figures given out up to now—very economically. It is expected that the final record will show low cost figures.

Original Features—The enterprise is full of original features. The dam, a hollow reinforced-concrete structure, has its deck made of premolded reinforced-concrete beams laid on the buttresses and anchored to them. The lock, while of ordinary type in both original (13-ft. lift) and final (30-ft. lift) form, involves the unusual feature of walls raised to more than double their original height, and thickened to correspond. The lower gate of the lock is of the vertical-framed type, a type rarely used; it miters at the top only, while at the bottom it bears against the sill and exerts no thrust at the miter joint. The power-house substructure is designed so as to take either vertical or horizontal turbines, with generator room either on top or alongside the downstream wall of the foundation. This latter arrangement was resorted to because the government wanted to leave the user free in his choice of type of machinery. The construction also includes fall-increasers for the turbine draft-tubes, and débris sluices and log sluices.

*This matter is now before Congress, in the shape of a bill which would authorize such lease.

Various phases of the actual construction work are equally [illegible] with the above structural elements.

The present article describes this novel power project as a whole, leaving its separate elements and construction details to be described on other occasions.

Original Project for Two Low Dams

The original 2-ft. low-water depth in the Minneapolis end of the 14 miles of river lying between the twin cities at no time was able to carry commercial vessels. Twenty years ago, a project for canalizing the river in this section was worked out by the government engineers, and Congress approved this project in 1894. Two timber-crib

FIG. 2. LOCATION MAP OF ST. PAUL-MINNEAPOLIS DAM

dams were to be built—No. 1 at Minnehaha Creek, 6 mi. above the Omaha railway bridge in St. Paul, or about 3½ mi. above the mouth of the Minnesota River; and No. 2 at a point 2 mi. farther up, or about 3 mi. below St. Anthony Falls in Minneapolis. Each dam was to have a lock [illegible] ft., with a lift of about 13 ft. and a miter-sill depth of 5 ft. The upper pool would be about 6 ft. deep nearly to the falls.

Various causes delayed the start of the work until [illegible]. In that year construction of Dam No. 2, the upper dam (see sketch map, Fig. 2), was begun, as this dam by itself would support navigation between St. Paul and Minneapolis at least [illegible] months in the year, while the lower dam by itself would give only one month's navigation. The concrete lock-chamber and the timber dam at No. 2 [illegible] under the disadvantage of interrupted appropriations, and thus were not completed until the end of [illegible].

In [illegible] the construction of Dam No. 1, the lower dam, was started, and by [illegible] it was completed.

The Power Project

[illegible] conditions. The people of the region looked toward the power possibilities of the dams; the same water would pass them that has for years been supplying water to the Minneapolis mills at St. Anthony Falls. But study of the power question showed that the two combined dams would not be economical sources of power as compared with a single dam of the combined head. Upon working out the single-dam project, the conclusion was reached that the old project should be abandoned and the new project adopted. Congress authorized the change in the 1910 River and Harbor Act. The lower dam is being built to a height of 30 ft., and Dam. No. 2 will be submerged, a few feet of its top having been blasted off to give the required channel depth.

The navigation side of the project was modified somewhat in the same revision. A 6-ft. depth was adopted in place of the old 5-ft. depth, and the lock is expected to give 7 ft.; river works below have been planned to give 6 ft. Some account, even, has been taken of a possibility that 9½-ft. navigation may be wanted in the remote future. The dam is higher than the combined height of the original project, and the upper reach and upper entrance of the lock will give the 9½-ft. depth. But the river below the dam would need to be raised for a 9½-ft. depth at the lower entrance, by wing dams or equivalent work.

As designed and as being built, the dam will have a crest elevation of 743.5 Cairo datum (722.24 ft., sea-level datum), and the tailwater an elevation of 712, giving a head of 31.5 ft. Provision is made for using 3 ft. of flashboards, and the river work below will probably lower the tailwater about a foot. Thus the low-water head will be 32.5 without flashboards and 35.5 with flashboards. At high water, the head may be reduced to about 26 ft. Normal floods are expected to flow 4 to 5 ft. over the crest. The upper lock gate and the lock walls are built for extreme floods (never recorded, but believed to be remote possibilities) of 9 to 10 ft. over the crest.

The dam crest is 575 ft. long; out of a river width of about 900 ft. the lock takes up about 100 ft. and the power house about 200 ft.

This power development has an intimate relation to the famous Mississippi headwaters reservoir system. Beginning in the early '80's, a series of six large storage reservoirs was built about 400 miles above Minneapolis, partly by raising the levels of existing lakes and partly by damming river valleys. Their purpose is to increase navigable depths on the Mississippi above Lake Pepin, while the navigation actually existing in this stretch of river is very small, the effect secured in increased depth is considerable.

The normal drainage of the region aided in midsummer by the reservoir discharge, keeps the flow at St. Paul well above a minimum of 5000 to 6000 cu. ft. per sec. throughout the spring and summer months and on into late autumn. Beginning about November, a natural low-water stage and the closure of the reservoirs brings the flow between November and the middle of March to a point below 3000 and sometimes down to 1500 cu. ft. per sec. The high-water flow (June) rarely goes up to 40,000 cu. ft. per sec.; [illegible] is taken as a remote possibility.

The flow at St. Paul is augmented by the Minnesota River. At the dam it is figured at 4000 sec.-ft. summer flow for power.

Under these conditions, the power of the river at 35 ft. head can be taken at about 12,000-15,000 hp. utilizable for nine months of the year. The winter power, however, may at times drop as low as [illegible] hp. The consumption of current for lighting, pumping and street-railway [illegible]

by the two municipalities and by the State and Federal authorities in the local territory amounts to about 3000 kw. (4000 hp.).

The power-house substructure at the dam has been designed for four 3800-hp. units. If this capacity is installed and full demand develops, auxiliary power must be generated or bought, to bring up the deficit during the period from November to March. It is probable that a steam power station would be built as a supplementary source as soon as the demand grows beyond the winter power.

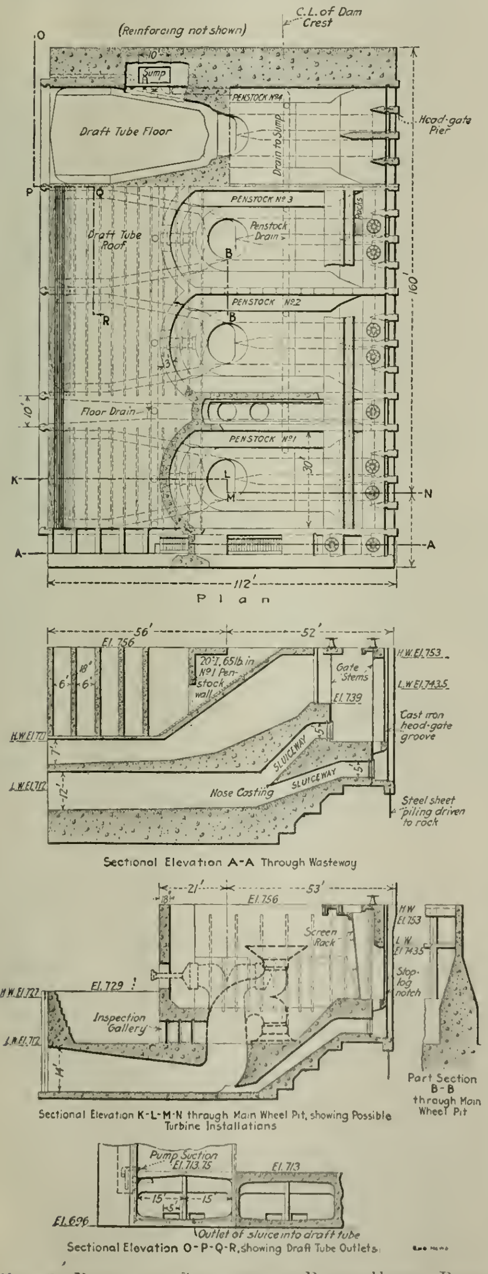


Fig. 3. Plan and Sections of Power-House Base, St. Paul-Minneapolis Dam

The power-house layout is sketched by the two sections and the plan in Fig. 3. At the land end of the four cells or chambers is a narrow bay divided into three sluiceways, one above the other, the lowest two, merging into a common outlet, being the débris chutes, while the upper one is a log chute. Between the first and second power bays from the land end is a narrow exciter bay. The power bays are simple vertical cells divided by a floor some distance above the downstream pool level, which separates the headbay from the tailbay or draft-tube section. The draft tube is a curved tapering passageway changing from circular to rectangular section, and at the same time bending from vertical to horizontal direction. At its lower bend an opening from the upstream side enters; this serves partly as sluiceway and partly as fall increaser (Herschel style). The exciter draft tube has no such fall increaser. The position of screen racks, gates, and stop-log notches is apparent from the drawing.

The water-wheel chambers are intended to be large enough to accommodate either vertical or horizontal wheels. In the case of vertical wheels an intermediate machinery floor would have to be built, and over it a house inclosing and covering the waterwheel cells. In the case of horizontal wheels the power house would be downstream of the lower forebay wall, on a ledge provided for the purpose above the draft tube.

The principal change made from the original designs of Gardner S. Williams, of Ann Arbor, for the hydraulic layout was shifting the exciter bay one panel toward the land—it was originally located between the second and third cells—and making the downstream walls of the forebay in the shape of three chords to the original circular arch.

This concrete substructure is fully reinforced in all directions. The vertical partitions between the wheel cells were designed and reinforced as cantilevers to resist the pressure when one cell is full and the adjoining one empty. In a similar way the downstream walls of the wheel cells are designed as cantilevers from the dividing walls; at the middle of each of the downstream segmental walls there is an expansion joint, to localize any possible formation of cracks.

The foundation work at this locality was somewhat troublesome, inasmuch as the St. Peter sandstone rock which forms the almost vertical bluff of the river gorge dips down below foundation level at about one-third the length of the power house out from the land end. The result is that part of the power house rests on rock and part rests on piles—1200 piles, 10 to 20 ft. in length. The subsoil here is a sand and gravel river deposit which is believed to be very hard and firm. No differential settlement of the two parts of the foundation is anticipated.

The lock and dam were designed by the U. S. Engineer office of the St. Paul District. Up to August of 1912, Lieut.-Col. F. R. Shunk was in charge of the district, and since that period Lieut.-Col. Charles L. Potter has been in charge. During both administrations the work was under the superintendency of Assistant Engineer Geo. W. Freeman, who has also been in charge on the ground as works superintendent.

Operation of Sand and Gravel Plants

By W. H. Wilms*

SYNOPSIS—This is a continuation of the article on "Development of Sand and Gravel Deposits," by Mr. Wilms, in Engineering News *of Nov. [illegible], 1914, p. [illegible]. The present article discusses the necessary equipment for a screening, washing and crushing plant, method of operation, the necessary facilities for a successful plant, with some recommendations based on several years' operating experience.*

Screening and Washing

Screening—The conical revolving screen, better known as the Gilbert screen (patent rights run out) has now practically supplanted all other types of screens in the screening and washing of sand and gravel. The screen is cantilevered, being supported at one end only, except in the very large sizes when the screen shaft extends through the screen with a bearing at each end. The small end of the screen is closed by a solid casting, in which the screen shaft is fastened. In the operation of the screen the material is carried to the small end of the screen in a chute (Fig. 1), which runs into the screen and discharges almost against the head at the small end.

The material, [illegible] must reverse its direction to work out of the screen and in so doing practically all of the original velocity gained in the feeding chute is lost at this point, and the gravel passes slowly and evenly through the screen, due to its [illegible] and inclined [illegible]. Thus the entire screen surface becomes effective and large capacity and uniform sizing result.

The screens are generally arranged in a series as shown in Fig. 1. The oversize from the first screen drops into the [illegible] and the material which passes through the perforations is carried by water through a [illegible] into the [illegible] end of the second screen. This process is repeated [illegible] each size of [illegible] separated.

The first screen has usually 1½-in. or 1¼-in. perforations, and all material over 1½ (or 1¼ in.) is discharged into a chute leading to the crushers for reduction.

Washing—The washing process now begins, the revolving motion of the screens breaking the soil and foreign matter away from the gravel. The next size of gravel is separated from the mass by the second screen in the same manner as the first. The second screen usually has ¾- or ⅝-in. perforations, and the material in the second bin is everything between 1½- or 1¼-in. and ¾- or ⅝-in.

The remaining screens are sand screens with perforations dependent upon the size and grade of the sand desired. After the material passes through all the screens the sand and muddy water remain, the sand being taken from the water by a settling tank.

To assist in the washing process and to prevent the material from discharging too rapidly and carrying over some of the finer parts, fresh water is injected into each screen. This fresh water is a rinsing water also, and prevents the material passing through the screen from piling up in the spouts directly beneath.

This in brief is a description of the screening and

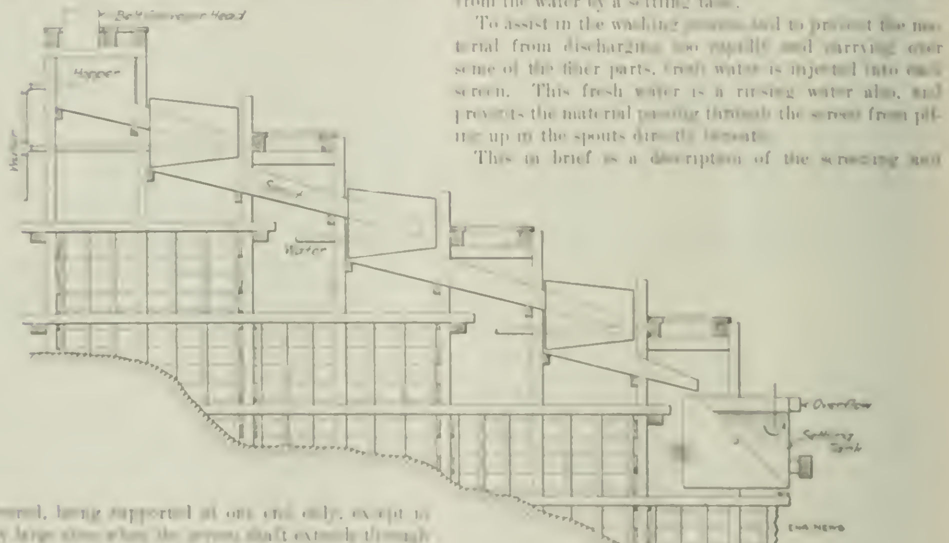


Fig. 1. Ordinary Arrangement of Gilbert Screens

washing process in use at the present time. The arrangement of screens and other details, of course, vary with the conditions and the ideas of the operator, but the process is essentially the same in all plants using the Gilbert screen.

Feed Hopper—By whatever means the material is elevated to the screening bay, it is quite essential that it should first be delivered into a large and ample bin or hopper before being fed into the initial screen, for it is here that the material receives the greater part of its [illegible]. The chute carrying the material from this bin to the initial screen should have as low a pitch as possible; otherwise the water will quickly escape and its [illegible] and [illegible] action will be rendered nil.

Ordinarily at least [illegible]% of the entire amount of water used should be delivered into this [illegible] hopper. I recently visited a large plant where this hopper was nothing more than an extension of the chute leading into

*[illegible] Engineer [illegible]

the initial screen. This chute was on about a 45% slope with the result that the water injected into the material flowing in the chute had no washing action whatever. The material has been so imperfectly washed as a result of this feature that the superintendent of the plant has decided to tear down the present arrangement and rebuild.

Wash Water—There are several methods employed in applying water to the material in the screen, depending upon the amount of dirt and impurities in the gravel and the size of the screen perforations. Fig. 2 shows the ordinary method when the dirt, clay or other impurities are in the free state and easily washed out.

When the material contains considerable foreign matter, or the gravel is coated with a hard film of clay, it is often necessary to supplement the spray pipe, shown in Fig. 2,

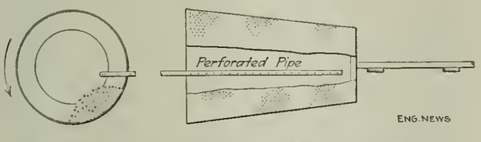


Fig. 2. Ordinary Method of Applying Water to Screens

with an injection of water under pressure in the manner shown in Fig. 3. The pressure of this stream tends to keep the material in the screen for a longer period, resulting in a more thorough washing. In the screening of some sands that have a tendency to clog the screens, it is often necessary to keep a spray of water playing on the outside screening surface to prevent this (Fig. 3).

Amount of Water—The amount of water necessary for the thorough washing and cleansing of the material depends upon the amount of impurities contained in it, the nature of the impurity, whether loam or clay, and whether or not this loam or clay is finely divided and

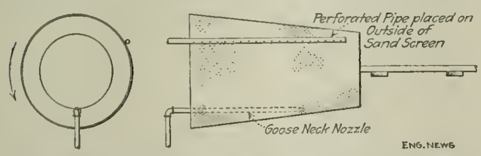


Fig. 3. Method of Applying Additional Wash Water

in a free state or covers the material in the form of a hard film.

The amount of water necessary also depends upon the percentage of sand contained in the gravel being screened and upon the nature of the sand, whether light or heavy, fine or coarse. As a minimum for reasonably clean bank or stream deposits, 1 gal. per min. per cu.yd. of material should prove effective, although if the percentage of sand runs high, this figure will probably have to be increased. Too much water can hardly be used—the more water the more effective the screening. Extremely dirty material will often require double the above amount, and even then the results are not likely to prove entirely satisfactory.

The necessity of an adequate and reliable water supply cannot be too strongly emphasized. I know of an instance where an efficient and otherwise promising plant proved an utter failure due to the impossibility of obtaining a sufficient water supply for effective washing and screening. This feature is of equal importance with the quality of the bank gravel itself, and the determination as to whether there is a sufficient and reliable water supply available should be one of the first considerations in a new development.

Re-using Water—A number of plants that are suffering from a lack of sufficient water—and there are many—have improved the quality of their product considerably by using part of the water over again. The waste water from the settling tank is permitted to flow into a storage tank provided with an overflow, located either upon the top of the storage bins or upon the ground. A centrifugal

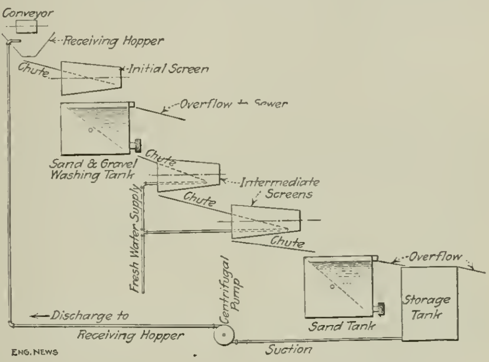


Fig. 4. Washing Arrangement with Automatic Settling Tanks

pump is used to pump this waste water from the storage tank back to the gravel hopper at the head of the screens. No fresh water is used in the gravel hopper, the preliminary washing here being effected with this return waste water.

While this method will undoubtedly improve the quality of the material where the water supply is insufficient, it can be improved upon considerably by providing an arrangement whereby this return waste water after effecting the preliminary washing in the receiving or gravel hopper is not permitted to enter the screens, but is allowed to run to waste. The present methods of washing sand and gravel without exception are all open to the objection of permitting the dirty water from the receiving hopper to travel with the material through the entire battery of screens to the settling tanks. When it is considered that the greater part of the washing is effected in the receiving hopper, the reason why some plants handling dirty material are not producing a clean product becomes apparent.

It is my contention that with dirty material, and most bank gravel contains far more dirt and foreign matter than is generally realized, the water used in the preliminary washing should be taken from the overflow of the settling tanks and should not be permitted to enter the sizing screens at all.

With the same amount of water, a plant washing its material in this manner would undoubtedly produce a cleaner and better material than with present methods. To effect such an arrangement for washing, it would only be necessary to first deliver the material directly from the receiving hopper to the initial screen to take out the oversize and then deliver it to a settling tank, similar in design and operation to a sand-settling tank, for taking off this dirty water. The initial screening is necessary so

go to remove the coarse material which would otherwise clog up the discharge openings of the tank.

Automatic Settling Tanks—Extensive test runs with automatic settling tanks handling 1½-in. material and sand show that such tanks when properly designed with large discharge openings will operate satisfactorily when used for this purpose. It should be understood, however, that complete washing of the material in such a tank is not to be expected, as a considerable quantity of the dirty water must of necessity pass out of the tank with the material to cause it to flow and discharge itself. More than half of the dirt and impurities, however, can ordinarily be removed by the tank. Fig. 4 is a sketch of the washing arrangement above outlined.

Screens

Both round and slotted perforations are used in sand screens, depending upon the shape and size of the sand grains. A great many river sands and some bank sands contain a considerable percentage of long, angular-shaped grains, while the grains of common bank sand are usually round.

Attention should be called to the necessity of providing at least one intermediate screen between the initial and sand screens. Any attempt to screen out all of the sand by means of only two screens will almost surely result in failure. Where all of the material passing through the initial screen is taken direct to the sand screen, as is only too often the case, the sand screen becomes overcrowded and unable to effectively perform its screening, resulting in a large percentage of the sand and dirty water going over the screen with the gravel.

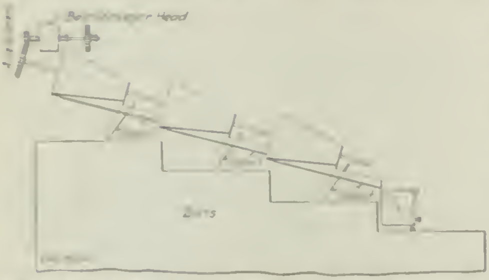


Fig. 5. Battery of Screens of a New Type Made by the Raymond W. Dull Co., Chicago, Ill.

I have seen instances where this crowding of the sand screen was deliberately done to get rid of some of the sand, of which there was an excess in the bank and which could not otherwise be disposed of. It is done, however, only at a sacrifice of the quality of the material produced. To prevent crowding and to permit of effective screening, an intermediate screen should be used even though there may be no demand for the size of the material the screen produces.

Perforations—In screening some sands it is often necessary to use a round perforation, as these long, angular particles of sand would effectively clog up the perforations of a slotted screen, whereas a round hole will reject them. I have also had experience with a sand that, when screened through a screen having round perforations, would so effectively clog them up as to require the use of a screen-guard and hammer to clear the holes. With a slotted screen, however, I had no trouble in getting this sand through without clogging.

In the manufacture of sand screens, that side of the screen plate upon which the punching of the perforations was performed should be made the inside or wearing surface of the screen. Punched holes in steel plate are slightly larger upon one side than upon the other, and in order that the perforations may freely pass through any particle when once started, it is necessary that the small diameter of the hole be on the inside. This feature, though a small one, has caused many operators much trouble and expense. While many screen manufacturers are aware and take care of this detail, many do not; therefore it should always be mentioned when ordering sand screens.

Speed—The speed of conical screens that has been found most effective is from 12 to 14 r.p.m. for the ordinary size of screen, and 9 to 11 r.p.m. for the extremely large sizes. Faster speeds than this cause the material to climb up on the side of the screen with a consequent loss in screening capacity. From test runs it has been found that the most effective speed is that at which the material in the screen makes an angle of about 30° with the vertical.

Pitch—The screening surface of a Gilbert conical screen has a pitch of 1½ in. to the foot for all sizes. While many screens having different ratios of length to diameter at the small end are in use, the following sizes have more or less been standardized, having been found the most effective under average conditions (dimensions are given in the order of small diameter, large diameter and length):

24x30x54 in.	36x54x72 in.
28x44x60 in.	42x61x84 in.
	48x72x96 in.

Size—The size of screen necessary for a given capacity depends upon so many factors, such as size of perforation, uniformity of feed to the screen, amount of impurities in the material, amount of water, etc., that no table of capacities can be given that would be of any value.

The size most used, however, is the 36x54x72, the required capacity being obtained by using a number of these screens in parallel. In order to reduce the number of spare parts necessary to be kept in stock for emergency use and to permit of the interchangeability of the screen plates of the various screens, it is generally advisable to have all of the screens with the exception of the initial screen of the same size.

Wear—The wear on screen plates is very severe and rapid, the perforated holes become enlarged, resulting in imperfect grading. As heavy a screen plate as practicable should be used. It should be remembered, however, that as the thickness of the screen plate increases, a larger diameter of hole becomes necessary for the screening of a given-size material. The following sizes of plates for the different sizes of perforations have been found by experience to be very economical and effective under ordinary conditions:

[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

Size of Perforations—To make a given-size product, a larger diameter of round perforation must be used owing to the angle and thickness of the screen plate at the point where the stone passes through. The follow-

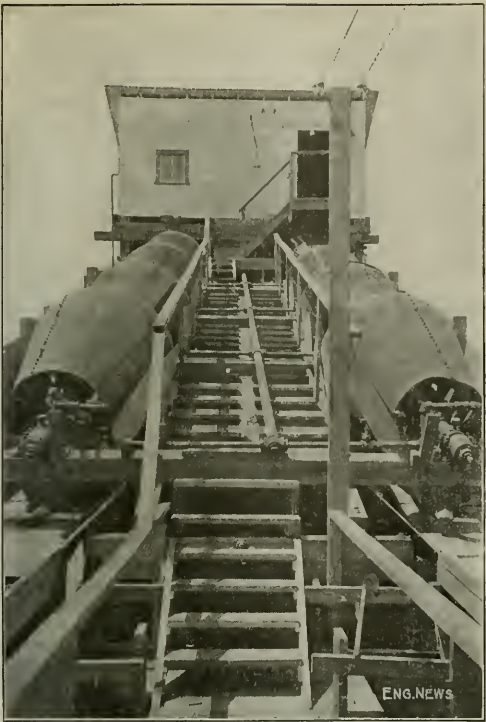


Fig. 6. Battery of Screens; Chicago Sand & Gravel Co.

ing table gives the relative sizes of material and screen perforations:

Size of material	Screen perforation
¼-in.	$\frac{5}{16}$- to ⅜-in.
⅜-in.	½-in.
¾-in.	⅞-in.
1-in.	1¼-in.
1½-in.	1¾-in.
1¾-in.	2¼-in.
2- in.	2½-in.
2½-in.	3- in.

Chutes—The grade of the chutes or spouts into the screens, and of the outer skirts carrying the material passing through the screens, varies from 3 to 4 in. to the foot, depending upon the size of the material and the amount of water being carried.

The tendency here is to use too great a grade for the chutes between the various screens, resulting in an excessive height to which the material must be elevated. I know of a case where in the reconstruction of a certain large plant something like 8 ft. in elevation was saved by reducing the excessive chute grades between the screens. It is not unusual to see plants with chutes having grades as high as 8 in. to 1 ft.

The chutes between the gravel screens very rarely require a fall of more than 3 in. to 1 ft., while the chutes between the sand screens and settling tank can generally be operated on as low a grade as 1½ in. to 1 ft.

In the handling of very dirty gravel it is especially important that the grades of the chutes be no more than what is actually required, for in such cases it is necessary to introduce jets of water in the chutes to effectively wash the material. If the grades of the chutes be excessive the gravel will travel or flow about as fast as the water, consequently the scrubbing action of the water which would obtain on a flatter slope, would here be ineffective.

Double Screens—Where the screening out of the oversize material is performed on top of the plant at the head of the battery of sizing screens, it has sometimes been found advisable to perform this initial screening in the first sizing screen by means of an inner screen plate extending about 6 in. beyond the discharge end of the outer screen plate.

While this method eliminates an extra screen with the consequent saving in head room, a larger screen than is ordinarily required must be used to compensate for the decreased capacity of the outer screen plate.

This screen plate receives its material its entire length and not at the head end as is usually the case. Consequently, material passing through the inner screen plate and upon the outer plate at the end of the screen receives very little if any screening. For this reason, the screen must be made amply large where the two are combined in the above manner.

It is sometimes found advisable to provide a screen with an inner skirt or screen plate with perforations about ¼ in. larger than those of the outer plate, the skirt extending nearly the full length of the main screen plate. This is for the purpose of increasing the screen's capacity by relieving it of the larger sizes and for making the separations more accurate.

Deflector Vanes—Where the material is extremely dirty, short pieces of angle iron bolted to the initial washing screen, and arranged spirally on the inside of the screen plate, have often proved effective by retaining the material in the screen for a longer period, resulting in a more thorough washing.

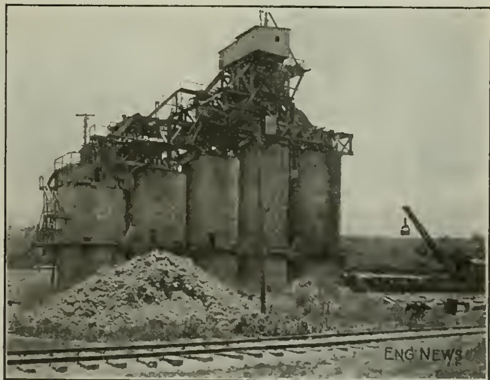


Fig. 7. Storage Bins; Chicago Sand & Gravel Co.

Inclined Gravity Screens—In the operation of a plant, it is often necessary to use short sections of inclined gravity screens; such screens, however, should be used sparingly, for even under the best of conditions such screens produce a material that is very imperfectly graded. The material in sliding over the screen plate acquires a velocity in a very short time that prevents the material from going through the perforations. For this reason only the first 4 or 5 ft. of the screen are really effective.

Inclined screens of the bar type have the further objection of permitting a large percentage of over-size material to pass through the bar openings. Neither can a thorough washing and cleansing of the material be effected on this type of screen. I have yet to see anything like a well graded and washed material produced over gravity screens.

A New Type of Screen.—Mention should be made here of a washing screen that has been in service in a large number of plants throughout the country during the past two years. This screen is giving such satisfactory results that it is worthy of a brief description. One of the largest plants in this country with a daily capacity of [illegible] cu.yd. is now installing a battery of 24 of these screens.

This type of screen is in many respects an improvement over the Gilbert screen. Referring to Fig. 5, the screens of a single battery are all mounted on the same shaft. A single pair of gears is used to drive all the screens, thus dispensing with a separate drive for each screen, with the attendant line shafting, bearings, gears, sprockets and chains. The material also travels differently in this style of screen, being delivered into the large end and traveling toward the small end as shown in Fig. 4.

The feature that appeals to the writer in this type of screen, however, is that the large end of the screen does the principal work. The large end has more perforations, more screening surface and consequently a greater capacity than the Gilbert screen. Greater screening efficiency, less power and small upkeep expense are claimed for this type of screen.

The screen has longitudinal joints and can be dismantled from the shaft without disturbing the shaft. Pipe nozzles are placed at the discharge end of the screens for injecting water to prevent the material from discharging too rapidly and carrying over some of the finer parts. This screen is patented and manufactured by the Raymond W. Dull Co., of Chicago, Ill.

[This article will be concluded in a forthcoming issue.—Ed.]

Rapid Construction of a Large Reinforced-Concrete Warehouse

The Austin-Nichols warehouse, which has just been completed at North Third St. and Kent Ave., in Brooklyn, N. Y., is a good example of a modern reinforced-concrete building of the warehouse type, and the remarkable progress made in its construction is indicative of what can be done in reinforced concrete with proper organization and supervision.

The building is located on the East River waterfront, immediately alongside of one of the railway terminals, tracks from which enter the second story of the

Figs. 1 to 6. Progress Views of Construction of Austin-Nichols Company Warehouse, East River Waterfront, Brooklyn, N. Y.

[illegible]

warehouse. These tracks are carried on steel girders and columns, but the entire remainder of the building is of reinforced concrete, the structure being of the regular column, girder and slab type. The building is 440 ft. long and 178 ft. 8 in. wide, and has six stories and basement, the story height being 12 ft. 6 in. from floor to floor. It is to be used as a storage warehouse for the large grocery firm, Austin Nichols & Co. Each typical floor bay is 16 ft. 6½ in. by 19 ft. 5 in. and is carried on 2-ft. x 7-in. beams framing into 2-ft. 5-in. x 12-in. girders, which frame into the columns. It was erected on soft foundations, which required timber piles and reinforced-concrete grillages carrying the column footings. It contains 23,000 cu.yd. of reinforced concrete, which required 32,200 bbl. of cement and 1567 tons of reinforcement. There were over a million square feet of lumber in the forms and some 2500 piles used in the foundation, which had 26,400 cu.yd. of excavation. These figures will give some idea of the size of the building.

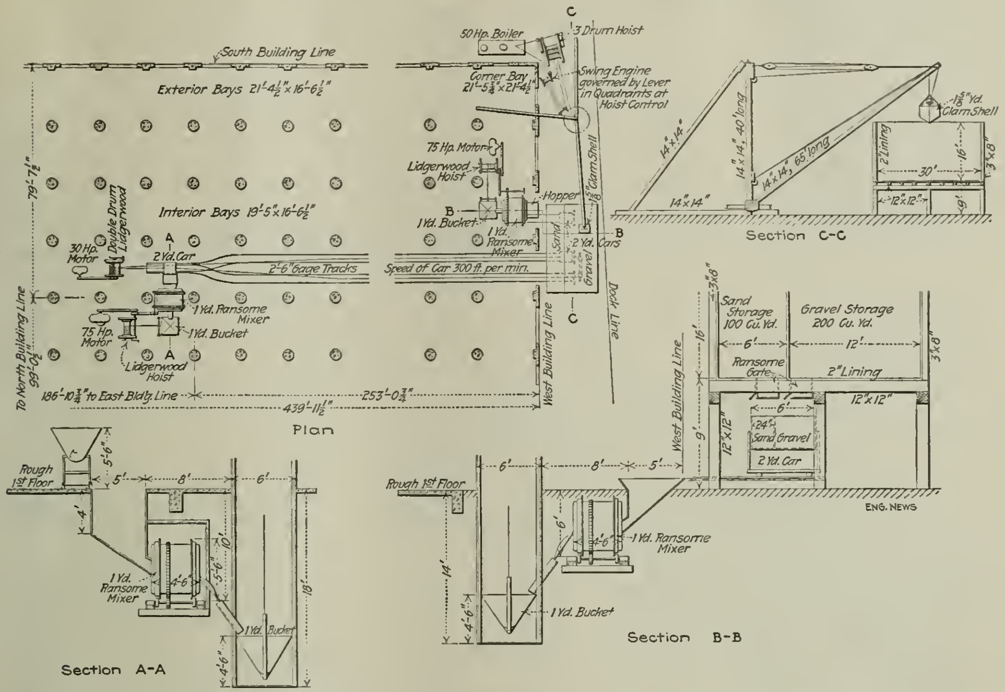


FIG. 7. DETAILS OF CONCRETING PLANT ON AUSTIN-NICHOLS BUILDING

The contract for the building was awarded on Dec. 1, 1913, and called for substantial completion on Sept. 1, 1914. Work was started on the foundations very soon after the awarding of the contract, but concreting was not commenced until March, 1914. From that time on, speed records in concrete construction were made. The mixing plants were installed as shown in the accompanying Fig. 7. One plant was located at the dock line of the building, and here was placed the storage for the concrete material, which was brought in by barges, and loaded directly above the mixer in sand and gravel bins. Alongside of the storage plant was located a mixer and a concrete elevator. Into this mixer the materials were chuted by gravity. The other mixing plant, a duplicate of the first, was located at the other end of the building, and was approached from the storage bin by narrow-gage tracks, on which cars, driven by an endless cable, carried the material to the mixer. All machinery was electrically driven. With these two plants, 695 cu.yd. of concrete were placed in one 8-hr. day.

The progress in carrying up the building is shown in the accompanying views, Figs. 1 to 6, which give approximate monthly progress on the work. As a rule, one entire floor, including columns, beams, girders and floor slabs of 80,000 sq.ft. of floor space, was concreted in five days at the rate of 16,000 sq.ft. of floor per working eight-hour day, with 600 men working on the building. One set of side-wall forms was used and the stated progress permitted the removal of the first placed side forms on any one floor for the beginning of the next floor by the time the first floor had been finished; that is, the side forms were allowed to stay in about five days. The struts supporting the floor system were, of course, allowed to stay in the regulation three weeks.

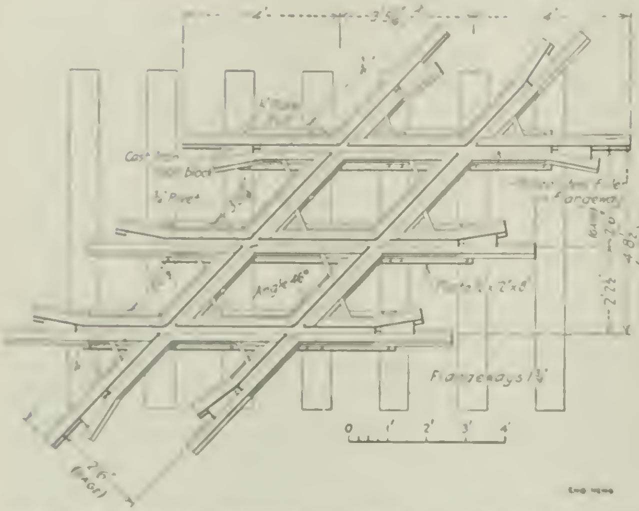
The architectural design of the building, which was made by Cass Gilbert, of New York City, is somewhat unique, as Fig. 6 will show. The grouping of small windows in parallel lines in both directions gives a different appearance to the building than is common in reinforced-concrete buildings. This was permissible, of course, on account of the nature of the building, which did not require any very great amount of natural light.

The entire contract was carried out by the Turner Construction Co., 11 Broadway, New York City, in the contract period of nine months.

Track Crossing for Mixed Gage

In the yards of timber- and tie-treating plants, systems of narrow-gage tracks for the cylinder cars are required to serve the storage yard, treating plant and shipping platforms, and some of these are three-rail or mixed-gage tracks for both the tram cars and standard-gage cars. The crossings of these tracks are somewhat complicated, and we illustrate herewith the crossing of a mixed-gage track and a narrow-gage track in the yard of the new tie-treating plant of the Louisville & Nashville R. R. at Guthrie, Ky.

The crossing is built of 70-lb. rails, with a ½-in. plate, 12 in. wide and 8 ft. long, riveted under each rail of the three-rail track with ¾-in. rivets, thus making a very substantial construction. These plates are punched with



TRACK CROSSING FOR A MIXED-GAGE (4 FT. 8½ IN. AND 2 FT. 6 IN.) AND NARROW-GAGE (2 FT. 6 IN.) TRACKS IN THE YARD OF THE TIE-TREATING PLANT AT GUTHRIE, KY., L. & N. R.R.

¾-in. square holes for the spikes. Fillers of rolled or forged steel extend the full length of the straight portion of the flangeways (which are 1¾ in. wide and 1⅞ in. deep), and 1½-in. knees of the same material are fitted at the intersections. Cast-iron footguards are placed at the flared ends of the guard rails. The rails, fillers, etc., are put together with ⅞-in. bolts, there being seven bolts in each end portion and five between each pair of intersections. J. H. Lindsay is Superintendent of Timber-Treating Plant.

Liquid Chlorine for Water Treatment at Milwaukee, Wis., is being considered as a substitute for the hypochlorite treatment now employed. [illegible]

New Municipal Asphalt Plant, San Francisco, Calif.

By B. E. Dunn*

The city of San Francisco has under construction a new plant for the manufacture of asphaltic-paving mixtures, the cost of which will be approximately $57,000. The plant, property and railroad facilities, represent an investment of about $130,000. The capacity will be 180 batches or 320 cu. yd. of wearing surface, or binder, per day.

AGGREGATES—All material is brought to the plant on cars, no teaming being necessary. The sand, rock or gravel is dumped from the cars into a concrete receiving hopper having a capacity of four carloads or 200 tons, from which it is hoisted to a screen and segregated into the proper bin. The elevator has a capacity of 85 tons per hour. The screen is 18 in. in diameter by 22 ft. long, with adjustable jacket. All lime dust is unloaded from the car into a storage room, whence it can be taken as needed (see plan and elevations, Figs. 1 and 2).

STORAGE BINS—As designed, storage bins for the rock and sand are of reinforced concrete, 12 in number, 12 ft. square and 24 ft. deep and have a combined capacity of 1536 cu. yd. Under the storage bins are two belt conveyors with a capacity of 36 tons per hr., and the material is fed from the bins upon the belt conveyors by special measuring gates (Fig. 3).

SPECIAL MEASURING GATES—These gates can be opened or closed by a shaft gear directly over the belt, which in turn is operated by the belt conveyor. On the shafts are fitted eccentrics, which operate a lever, and by means of a pawl and ratchet the gate is revolved. Each gate has a range of capacity of from 2 to 12 cu. ft. per min., and any mixture of fine or coarse rock or sand can be sent to the dryers.

The material when taken from the belts is hoisted by an elevator and discharged into the uptakes of the dryers. These uptakes are fitted with baffle-plates over which the material slides, coming in contact with and being partially heated by the escaping gases before entering the revolving drying drum.

DRYERS—The drying cylinder is designed with an inclination of 1 in 16. Its shell is ⅝ in. thick, 5 ft. in diameter and 12 ft. long, lined internally with eight 6-in. channels by which the material is carried up and dropped through the flame, gradually working its way toward the lower end of the drum. Each dryer is fitted with a firing hood, on wheels, similar to that used for an ordinary cement cooker.

HOT MATERIAL BINS—Below the firing hood are two flight conveyors each with a capacity of 36 tons per hr., and designed for hot material. The flight conveyors dis-

*Assistant Engineer, Board of Public Works, San Francisco.

charge to elevators of the same capacity, which in turn empty into the small storage bins for hot materials above the mixers.

The lime dust is conveyed from the storage room to the hot bins by a flat belt-conveyor fitted with oak strips. The dust is emptied directly upon the belt through a hopper, and all the free dust arising is drawn through a fan discharging into a centrifugal separator, from which it falls back upon the belt.

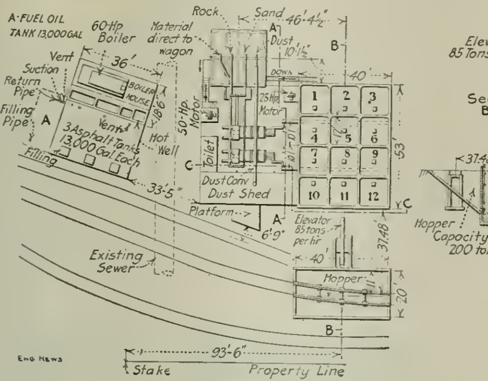


Fig. 1. Plan of the New Municipal Asphalt Plant, San Francisco, Calif.

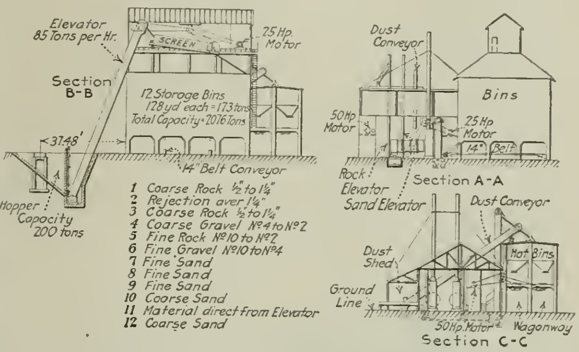


Fig. 2. Sections of New Municipal Asphalt Plant, San Francisco, Calif.

The hot bins and mixing platform are of reinforced concrete and the dryer shed of steel and corrugated iron.

Measuring Hot Aggregates—Under the hot bins are special measuring boxes for sand, rock, dust and asphalt. Those for sand, rock and dust consist of revolving cylinders open on one side. When the opening in any cylinder is opposite the bin material drops in, and when the cylinder revolves again until the opening is underneath, the material drops out into a hopper. The rock and sand cylinders have a capacity of 3 cu.ft. per dump.

Asphalt Measuring Device—Asphalt is fed to the mixers in a liquid state and is measured in horizontal cylinders having an internal piston worked by a screw and hand wheel. By changing the position of the piston the size of the chamber and the amount of asphalt used can be controlled. Each cylinder is steam-jacketed and is fitted with a thermometer so that the attendant can easily read the temperature of the liquid before injecting it into the mixer. Asphalt is forced from the measuring cylinder into the mixer by means of compressed air.

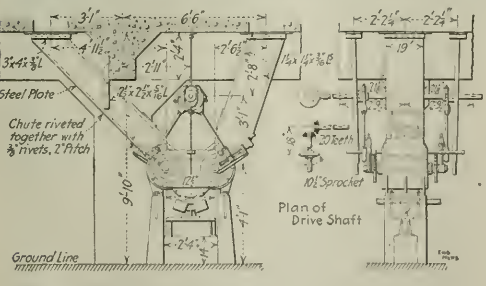


Fig. 3. Measuring Device for Aggregates, San Francisco Municipal Asphalt Plant

Mixing Units—The mixers are 4 ft. 8 in. long x 3 ft. 5 in. wide, with a capacity of 12 cu.ft. per mix. The shafts are 3 in. square and are fitted with 12 sets of semi-steel paddles on each shaft. The shell is ¼-in. steel plate and the heads are of cast iron. While the mixer works on one batch the next batch will be prepared in the hopper directly above. One man can perform all of the operations for each mixer.

Asphalt Heater—A 60-hp. boiler with superheater furnishes steam for heating the asphalt in the tanks, each tank having forty-eight 20-ft. lengths of 1½-in. pipe, with all screwed joints welded. The temperature of the asphalt is controlled by a thermostat operating a valve on the steam line. A steam line also furnishes a means of heating asphalt in the car, which is unloaded by a 2½-in. gear pump, the suction and discharge piping being 3 in. in diameter with an internal ½-in. steam pipe for heating.

An oil-burning system for the boilers is operated with compressed air, which is also used for blowing out the asphalt pipes when closing down. The plant is also equipped with a large centrifugal pump for pumping out any of the elevator pits, should water collect.

All machinery is driven by electric motors, one 50-hp. motor being used to operate the main elevator and screen; one 25-hp. motor to operate the belt conveyors, elevators and dryers; one 25-hp. motor to operate the flight conveyors' elevators and mixers. The air compressor is operated by a 10-hp. slip-ring motor, automatically controlled.

To operate the entire plant, nine men are required: one for the receiving hopper, one in the screen house, one for the dryers, two for the mixers, one for the boiler house, one for the dust shed, one to tend asphalt and dust cars and one superintendent.

The buildings and equipment were designed under the direction of M. M. O'Shaughnessy, City Engineer.

All Paving Records in Galveston, Tex., have been Broken by the city expending more than $200,000 on street pavements during the first nine months of the present year.

A New Rotary Air Compressor

A task which has attracted many inventors is the production of a successful rotary air compressor. For low pressures, such machines are, of course, in very extensive use, the two best known types being the fan blower, suitable for operating against pressures up to a few ounces, and the pressure blower, consisting of two interlocking pistons, which can compress air with fair efficiency up to three or four pounds pressure.

Another type of machine which is becoming more and more common is the high-speed multi-stage compressor, which, while it operates on the same centrifugal principle as the fan blower, is built with an accurately formed blading system like a turbine pump. These machines have to be driven by steam turbines or electric motors to secure high rotative speed and are best adapted to locations where a very large amount of air is desired.

None of these machines, however, meets the demand for a rotary compressor of moderate size which can furnish compressed air at pressures from 10 lb. to 100 lb. per sq. in. and which will be readily portable. The limitations of speed of the reciprocating air compressor and the fact that it is generally an unbalanced machine, requiring substantial foundations, combine to make the positive displacement rotary air compressor a machine of great usefulness if it could be produced and sold at a reasonable figure and were capable of operating at reasonably high efficiency.

There have been occasional attempts to manufacture such positive displacement rotary compressors, but so far as we are aware, none of these have been permanently successful.

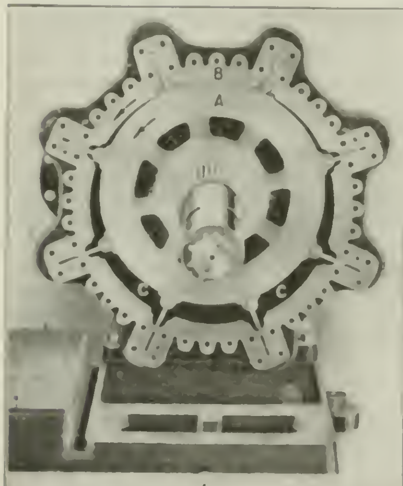
We illustrate herewith a new rotary air compressor designed on very novel mechanical lines, which seems to have considerable promise. The rock on which most designers of rotary air compressors have split has been the great friction between the closely fitting rubbing parts. In the air compressor here illustrated the inventor has overcome this difficulty by ingeniously contriving that both the rotor and its casing shall revolve in the same direction and at the same speed. Being on different centers, however, the rotor has an eccentric motion within its casing, and it is this eccentric motion which is utilized to effect the compression of the air.

The rotor shaft is hollow at each end and serves for the intake and discharge of air. It runs in roller bearings and in the machines now built is driven by a belt. The annular space between the two elements is divided into eight compartments or pockets by plates fitted to recesses in the casing and having shoes which bear against the face of the rotor. For each compartment the rotor has an intake and a discharge passage; these passages are radial and connect with the hollow portions of the shaft.

Fig. 1 is a section of the compressor, the rotor being in position for intake at the lower pockets and compression at the upper pockets, and it will be seen that the clearance or dead space in the latter position is very small. Fig. 2 is a diagrammatic longitudinal section. The rotating parts are balanced, and the sliding parts have relatively short travel and slow motion, thus reducing friction. The pressure in any one pocket during compression is greater than that in the following pocket, so that the sliding vanes are pressed against the walls of the recesses, thus preventing leakage.

The machine is air-cooled, the outer wall of each pocket giving a very large radiating surface in proportion to the volume of air under compression, while the entire outer surface of the outer case (revolving at high speed) forms effective cooling area. Lubrication is effected by a small geared pump.

Each intake valve is operated by means of a lever or link having one end attached to the rotor and the other end upon which the valve stem rests, riding upon a fixed cam. This construction is shown in Fig. 3. The discharge valves are operated automatically, by the dif-



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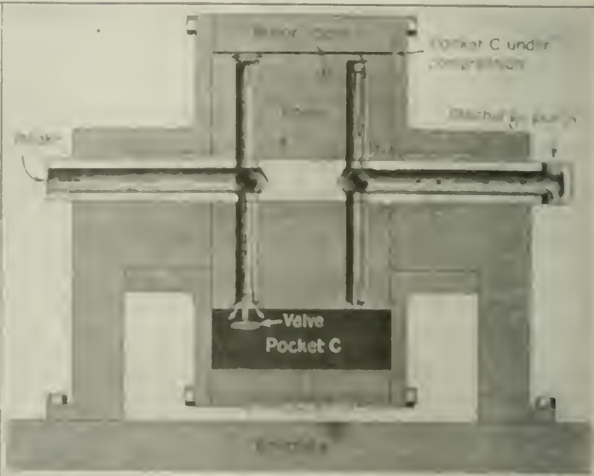


2

A New Rotary Air Compressor

(Fig. 1 is a view of the interior and Fig. 2 is a diagrammatic longitudinal section.)

ference in presure. It is not practicable to operate these mechanically as the time of opening depends upon the receiver pressure, which is not a fixed quantity.

No packing is used between the end faces of rotor and case. The clearance between these faces is very

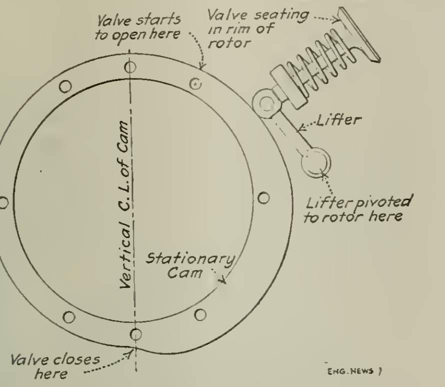


Fig. 3. Intake Valve and Valve-Operating Mechanism of Rotary Air Compressor

small, less than 0.001 in. Oil in very small quantities is fed into the intake to lubricate this surface and helps to seal it. The friction of these surfaces is extremely low because both are revolving in the same direction. The radial movement, or stroke, is small, being only 1½ in. on a rotor of 15-in. diameter.

The machine is at present built in one size only, having a displacement of 86 cu.ft. (or 75 cu.ft. actual delivery) when operating at 100-lb. pressure and at the maximum speed of 400 r.p.m. (giving 3200 compressions per minute). It requires approximately 20 hp. to operate the compressor under these conditions. The weight complete is about 1700 lb. It is claimed that tests thus far made indicate an efficiency at least equal to that of reciprocating compressors of about the same capacity. The rotary compressor is particularly adapted for use as a portable machine on construction work or steel erection, and in mines, quarries and industrial plants. One compressor has been in use for over a year.

This compressor is the invention of W. A. Hatcher, and is being manufactured by the Wernicke-Hatcher Pump Co., of Grand Rapids, Mich.

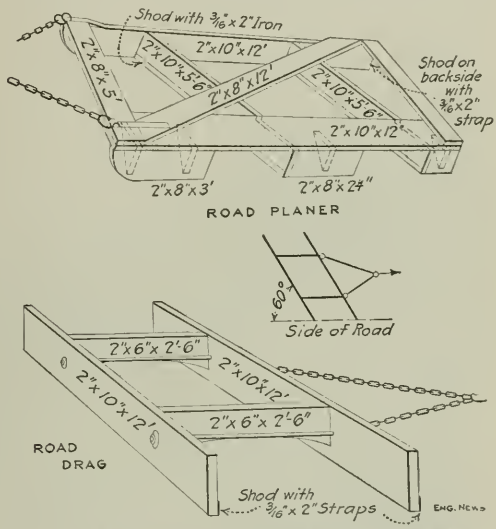
Road Maintenance in Minnesota

Under the road laws of Minnesota, it is the duty of the county commissioners of each county to maintain all state roads within the county, in accordance with the rules of the State Highway Commission, and 20% of the state-aid allotment must be expended for that purpose, with the due proportion of the county funds.

The maintenance may be done under the road-patrol system, the maintenance-section system or the road-drag system. The systems in question are outlined as follows in the rules prepared under the direction of Geo. W. Cooley, State Engineer, and John H. Mullen, Deputy Engineer of Roads:

ROAD-PATROL SYSTEM—One man to be appointed for a 5- to 7-mile section of road, and to be employed continuously from the opening of the season until final freeze-up. He will be furnished with shovel, rake, and such other hand tools as are necessary and also a wheelbarrow to cart surfacing material to fill holes, etc. The duties of the patrol will be to keep ruts from forming, remove loose stones from roadway and to keep surface of road in good condition. He will also be required to keep lines of drainage open and to keep weeds cut along the road. This system is applicable to macadam and well built gravel roads.

MAINTENANCE-SECTION SYSTEM—The state roads in a county to be divided by the County Board into sections of 20 to 30 miles (not necessarily one continuous stretch of road). The section to be in charge of a foreman, hired for the season, commencing as soon as work can be effectively done in the spring. This section foreman should be required to furnish hand tools and a team and wagon every working day, and the county to furnish him with a light grader, a road drag,



Road Planer and Drag Recommended for Road Maintenance Work by the State Highway Commission of Minnesota

slush scraper and plow. The duty of the maintenance-section foreman would be to keep lines of drainage open and weeds cut and to keep the surface of road in best possible condition at all times. The County Board should also authorize the foreman to enter into agreements with residents along the road to drag sections of it after very heavy rains, and also to employ extra men and teams as the occasion might require, but with a limit as to the expense incurred in this manner each month. This system is recommended to be adopted in most cases, as it will meet almost any condition.

ROAD-DRAG SYSTEM—A superintendent of dragging to be appointed by the County Board, who shall be given authority to contract with residents along the state roads to drag the same after each rain or whenever ordered by him. This superintendent also to have available a road grader with authority to employ an engine or teams to operate the machine when occasion requires. He should devote all his time to directing the work of general repair and maintenance, and see that the contracts for dragging are properly executed. Also to see that drainage lines are kept open and to arrange for cutting weeds along the state road. This system is especially applicable to the prairie and gumbo sections of the state.

Road Drags—A large amount of road maintenance by dragging is done in Minnesota, and a pamphlet issued by the State Highway Commission shows the recommended forms of drags. These are shown in the accompanying cut. It is stated that the drags which have proved most satisfactory are the home-made road-planer and the King road drag, and that the consistent use of these will insure a good road surface at all times.

New York Rapid Transit Railway Extensions*

By F. Lavis†

VI--Sewers, Pipes and Conduits

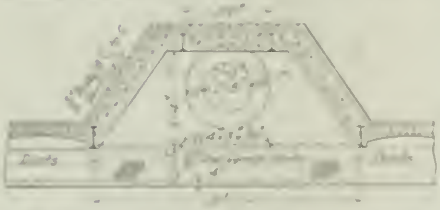
ELECTRIC CONDUITS

Four-way vitrified ducts with round holes (3½ in.) are used almost entirely for electrical conduits in the subway; they are located in the side bench walls, as shown in the various cross-sections, usually a double tier 5 high, making 40 single ducts.

The specifications require that the outside dimensions (of 4-way ducts) be not less than 9¼ in. or more than 10 in., with square outer lines and that the outside walls and webs be ¾ in. thick.

A jointed mandrel is used for laying and the joints are wrapped with muslin wraps soaked in cement grout. The mandrel is arranged so that the back part of it holds the joint last made, while the forward end holds the joint being made. One or two other forms of wraps have been tried but with little success. The whole bank of ducts is usually laid up, then the outer face of concrete, and top of the bench wall put in place. This is usually done before [illegible] to insure the stability of the duct bank.

Wherever it is at all possible, connections are made from all splicing chambers to the street, so that cables may



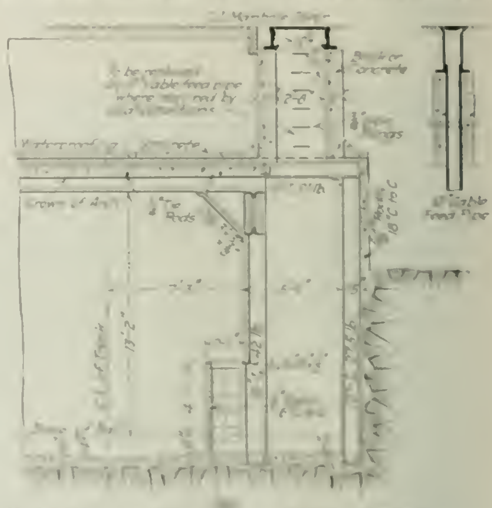


FIG. 24. HORIZONTAL SECTION OF SUBWAY WALL AT CABLE SPLICING CHAMBER AND VERTICAL SECTION THROUGH MANHOLE

be passed or withdrawn from the street surface, on account of the difficulty of handling them in the subway after operation has been started. Where space allows, a separate manhole is built from the splicing chamber to the street surface, but where this is not possible a [illegible] pipe is built in. The splicing chambers are, of course, set back and project outside the ordinary cross-section, a typical form being shown in Fig. 24.

The prices for these conduits as shown by contract abstracts [illegible] are approximately 10 to 15c. per lin. ft. of single duct.

EXISTING UNDERGROUND STRUCTURES

The construction of the subway, of course, necessitates many changes in the existing underground structures, such as sewers, water and gas pipes, electric conduits, etc. The isometric drawing, Fig. 30, shows conditions at Prince St. and Broadway on the line of the present subway as they existed 14 years ago. Since that time very great additions have been made to the underground street piping. The picture, however, gives some idea of what is found at many street intersections, though, as a matter of fact, the general appearance of one of these cross streets in the down-town section is more that of an intricate and confused jumble of pipes and cables of all descriptions instead of the orderly appearance of the drawing. Fig. 30 shows part of the plan of the intersection of Prince St. and Broadway and is fairly typical of conditions in the lower part of the city.

It would seem at first thought that certain large trunk sewers and other important subsurface structures might have considerable influence on the location of the rapid-transit lines, but it has generally been found easier or less costly to change these than to change the position of the subway. This latter, of course, is usually located as near the surface as possible, and any change would mean lowering it, which would be undesirable from the standpoint of those who have to use it, and, of course, would mean increased excavation with proportionately greater expense, so that generally speaking, the subway is located regardless of any of these structures and these latter moved if necessary. There are a few instances where it has not been practical to move some of the large trunk sewers, and these will be noted further on.

The work connected with the changes, etc., required in the existing underground structures is all taken care of by two divisions, each covering the whole city in its own special department. One under C. N. [illegible] has charge of the relocation of all pipes, conduits, etc., and the other under L. D. [illegible] has charge of all the sewer relocation, design and reconstruction. The importance of this part of the work may be gathered from the fact that there are employed in these two departments alone, taking

*Copyright, 1914, by F. Lavis.

†Consulting Engineer, [illegible] New York City.

care of work in a way entirely outside of the main construction, some 150 engineering assistants, the changes in the sewers alone involving an expenditure of $6,000,000 to $7,000,000 and the construction of some 60 miles of new sewers.

Gas Mains—One of the most important developments in taking care of the pipes, etc., on the new work has been the bypassing of all the gas mains, that is, the construction of new pipes for gas, on the surface of the street and the stoppage of the flow in the pipes underneath before commencing the excavation. This, of course, involves also new temporary house connections as well, but the danger of the accumulation of gas underneath the decking is thereby eliminated. The very great danger from this source was demonstrated by the recent explosions at 23rd St. and 5th Ave. (Eng. News, Mar. 12, 1914), which while generally attributed by the public press to the subway construction, were caused if at all only very indirectly by this work. The following description of the method of dealing with the gas mains is contributed by C. N. Green.

"The present specifications for subway construction call for the street to be planked or decked over in the business sections or where traffic is heavy, so that business may be carried on as usual and with as little inconvenience to the public as possible. This decking then forms a temporary street surface under which the excavation is carried on. In time dirt and the sweeping of the street make the decking tight and prevent a circulation of air that would free the excavation of gas if a main should leak.

"Cast iron is used for gas and water mains when they are laid underground for the reason that it lasts much longer under such conditions than wrought iron. It is difficult, however, to keep the lead-calked joints of such pipe tight even when they are undisturbed, but when they are moved in excavating and hung up on the timbering, some joints are sure to be strained and begin to leak.

"All gas mains are, therefore, 'killed' where they would be underneath a closely decked street, except in rare cases where small transverse cast-iron mains are replaced under the decking by wrought-iron pipes with screw connections. A temporary system of wrought-iron pipes or bypasses for gas distribution is laid in the gutters and connected with the live mains in the transverse streets and the house and street-lamp services are transferred from the cast-iron mains below the street surface to the temporary system. There is then no live main or pipe containing gas below the street surface." (Figs. 26 to 29.)

"An 8-in. gas pipe broken off in the excavation might, under existing conditions, deliver 1000 cu.ft. of gas per minute. A 10% mixture of gas and air will perhaps not always produce a maximum explosive effect, but this is assumed for convenience and is very near a maximum. This would make 10,000 cu.ft. of explosive mixture per minute. A subway cut 25 ft. deep, 60 ft. wide, would contain 390,000 cu.ft. in a city block, so that theoretically in 39 minutes the block would be filled with an explosive mixture. This, of course, would not be absolutely true as the gas would not diffuse itself with such rapidity and the mixutre would be higher in gas near the break in the main and perhaps be too low in gas at the farthest point to explode, if the mixture should explode, however, the gas would burn where there is an excess and probably set fire to the timber with results as disastrous as the explosion itself.

"Gas mixed with air forms a very explosive compound which only needs a spark to ignite it. This spark might be furnished by the underground trolley of the surface

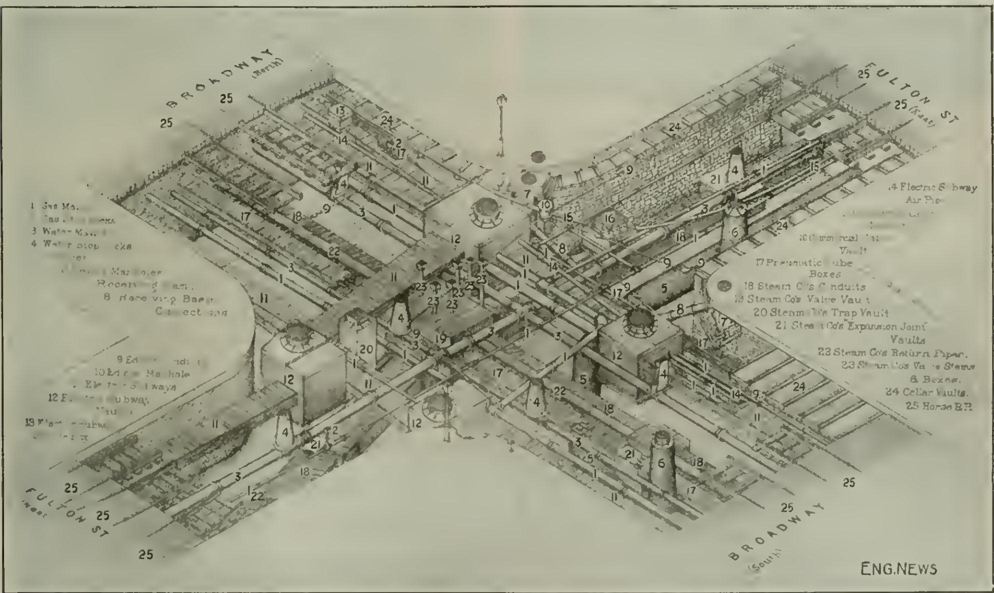


Fig. 25. Isometric View of Underground Piping at the Intersection of Broadway and Fulton St. in 1890

subway, in case of the numerous cables exposed during the construction by a lighted match thrown away, by fire engines, by the shoe of a horse, or by blasting, etc. The violence of such explosions has been frequently shown when manhole heads have been blown into the air, and by numerous sewer explosions which have occurred in the last few years. Philadelphia and Boston had examples in the construction of their subways and various minor instances have attested to the power of such a mixture.

Fig. 26. A Temporary Gas Main Run Next the Street Curb

"Knowing the danger from gas, both the gas company and the engineers of the Public Service Commission have taken every precaution to avert it. It was, therefore, decided not to leave any cast-iron mains, carrying gas, under the decking unless properly ventilated by means of gratings or protected by watchmen. Where mains crossing the subway excavation could not be cut out of service temporarily, wrought-iron pipe bypasses were to be built over the street or in the case of small pipes carried across under the decking. All connections between the cast-iron mains and the wrought-iron bypasses were to be carried far enough back into solid earth to avoid the danger of breaking off the pipe if a slide or cave-in should occur.

"In mains to be 'killed,' the flow of gas was first stopped by inserting bags in the pipe and readings were taken to see if the pressure prescribed by the Public Service Commission could be maintained. The pressures were

Fig. 27. Overhead Gas Main at Lexington Ave. and 112th St.

taken continuously for several days and if these readings were satisfactory the longitudinal mains were cut off and capped at intervals of two blocks. In the meantime the bypass pipes were laid in the gutter and connected up. These were 6, 8, 10 or 12 in. in diameter, depending on the requirements of the different districts. Depending on conditions, one or two lengths of pipe were used to carry back in the transverse street and the turn at the curb was made with a pipe bent to fit the radius of the curb corner, Fig. 26. The pipes in each transverse street

Fig. 28. Overhead Gas Main on Lower Broadway

were then cut and capped about 10 ft. back of the sheeting line on both sides of the proposed excavation. Connection was then made with the largest pipe underground on each side of the street and the bypass continued underground across the transverse street.

"Generally there are from one to five pipes on each side of the transverse streets. Where there is more than one

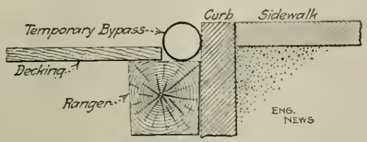


Fig. 29. Typical Method of Placing Gas Main at Curb

pipe on the same side of the street, each is connected back of the caps with a 1½-in. circulation connections, the vertical legs of which are tapped into the top of the pipe.

"In laying the first bypasses little attention was paid to the necessity of keeping the tops of the pipes level with or below the curb. As a consequence, numerous accidents occurred, due to persons slipping or tripping over the pipe. In one instance where the pipe did not lie close to the curb, a boy's leg was broken by being caught between it and the curb. Now all pipes are laid close to the curb, with the top not higher than the curb even if necessary to remove the gutter stones, and the remaining space is filled with concrete.

"Extra heavy wrought-iron pipe has been used generally, so that when the bypasses are moved the pipe can be used to relay the cast-iron mains over the subway. The gas company has found this desirable, as the vibration from the passing trains loosens the calking in cast-iron pipes.

"In Lower Broadway from Canal St. south are two mains 16 and 20 in. in diameter, respectively, supplying the lower part of the city. These mains were bypassed during the building of the subway from Vesey St. to Canal St. Wrought-iron pipes with flanged connections were laid about 14 ft. above the sidewalk. The trestle bents were so placed as to avoid entrances and interfere with business as little as possible. At cross streets where trestle bents could not be erected, the pipe was trussed with wire rope anchored to the pipe with clamps.

"In 138th St. are one 16-in., one 20-in. and one 24-in. gas mains forming a crosstown connection between the works and the lower west side of the Bronx. As these were within the sheeting lines, they were killed, and to take their place two 24-in. riveted steel pipes were laid on trestles, one on each side of the street.

"In various locations are large feeder or pumping mains crossing the line of the subway, and these mains generally were bypassed overhead, giving about 14 ft. clearance for the street cars and other vehicles. A description of one would be typical of all. Fig. 27 shows the bypass for the 36-in. main crossing Lexington Ave. at 112th St. The bypass pipe is a 30-in. wrought-iron riveted pipe carried on two gallows-frame supports back of the building line in the side street. Between these frames the pipe is suspended from two wire ropes carried over the gallows frames and each anchored back to a deadman. The deadman consisted of an inclined I-beam carried well below the street surface and its lower

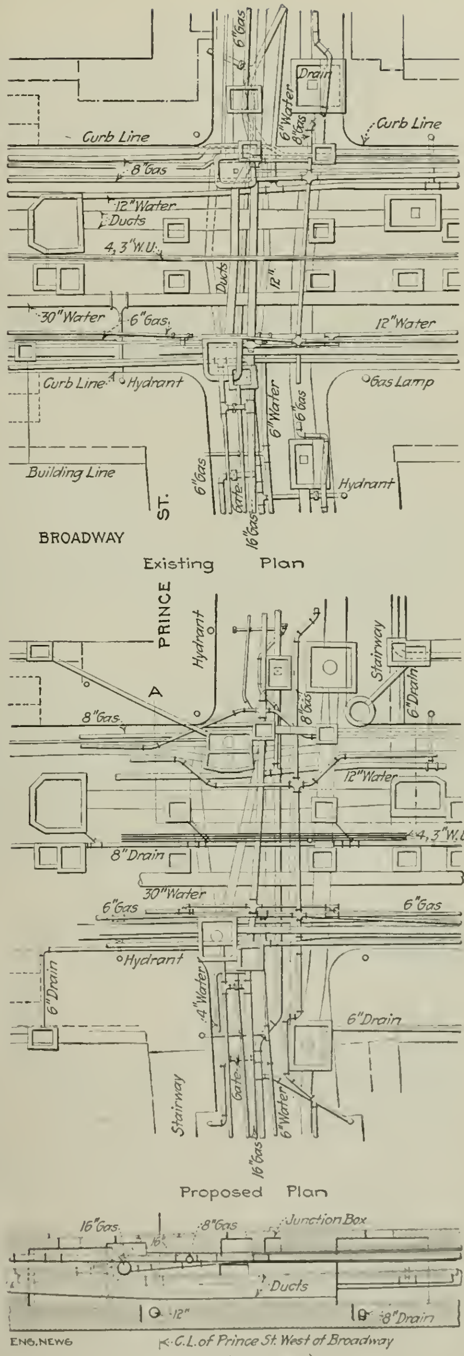


Fig. 30. A Typical Rearrangement of Underground Piping at a Street Intersection. Old and New Plans of Underground Piping at Broadway and Prince St.

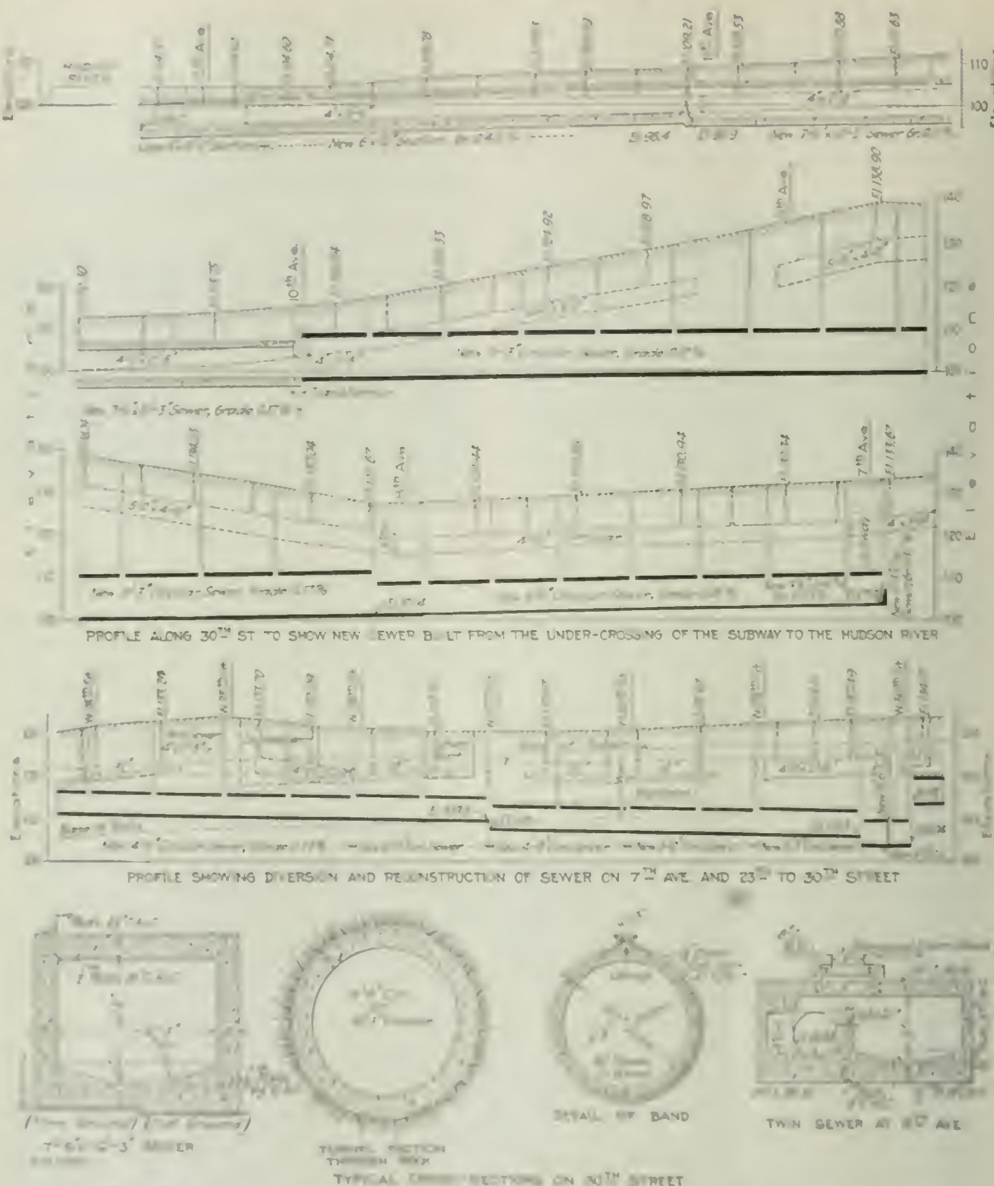


FIG. 10. TYPICAL SEWER RECONSTRUCTION WORK ON 30TH ST. AND SEVENTH AVE.

and embedded in a block of concrete. The main in the street was bagged off, the pipe cut and a three-way and valve inserted at the end of the pipe. This operation was repeated on the other side of Lexington Ave. The bypass was then connected to the three-ways on either side of the section, the bags removed and the valve closed to throw the gas into the bypass and cut the main underground.

"The cost of bypassing service mains, using 6- or 8-in. wrought-iron pipe laid in the gutter, varies but little from $10,000 per mile of street bypassed. The distribution mains requiring 3- to 20-in. bypasses in general run across the island from the east to west, thus crossing most of the subway lines nearly at right angles. The cost of carrying a distribution main across the street we found may vary from $1000 to $10,000, depending on local conditions. The average cost, however, should be about $2500.

"After the construction of the subway and the restoration of the underground pipes, the bypasses are removed and the street restored to its original condition."

Sewers.—The work of the department in charge of the

necessary sewer relocations commences as soon as a new route is proposed, as, although the subways are generally located with little regard for existing subsurface structures, minor changes and adjustments in elevations and gradients are quite often found to be desirable. General studies of the sewer situations are, therefore, necessary from the beginning. The sewer changes are worked out in consultation with the city authorities and the plans are made part of the contract drawings. This same department makes the preliminary studies, final plans and supervises construction.

Generally the existing sewer line is located in the center of the street. The construction of a subway therefore usually involves its complete elimination, and the substitution of two lines, one on either side. In Manhattan also the main trunk sewers and intermediate main lines are generally located in the cross streets running east and west to the Hudson or East River. The construction of a subway on one of the main north and south avenues therefore cuts these all off, as they are nearly always located below the level of the roof.

the surface of the street was raised 5 ft. to enable the subway to pass over the top of the sewer.

Generally speaking, however, the large sewers where they have been encountered have been passed under the subway by means of siphons, and while this is not generally considered desirable for sewers, those so far built seem to be working satisfactorily. The general principle on which they are designed is much the same for all; that is, a comparatively small pipe for the so called "dry-weather" flow, with one or two larger pipes for the storm flow. The plan and section shown, Fig. 32, of the siphon at 110th St. and Lexington Ave. is quite typical. Most of the siphons have been built with easy slopes for the drop or rise, but in one instance in Brooklyn, at Hudson St., perpendicular raises were required on account of the cramped conditions. In this case a wide, very shallow additional safety overflow was provided over the roof of the subway.

Cross-sections of particular forms of construction not usually met with in sewer work, but required by the exigencies of limited clearance in many cases in con-

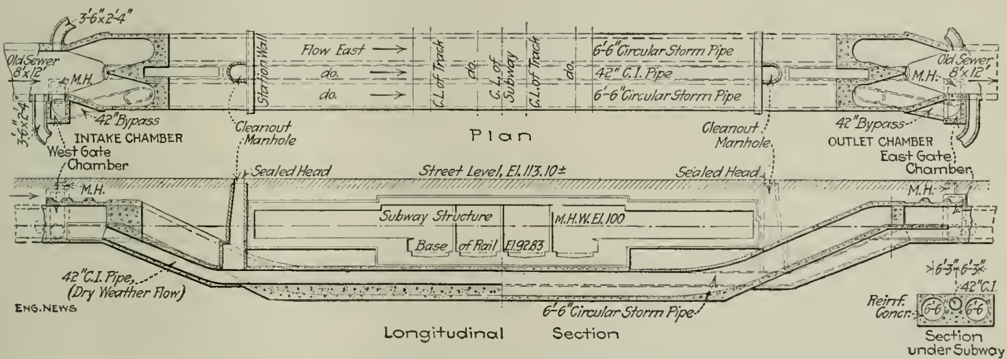


FIG. 32. INVERTED SIPHON CARRYING SEWER UNDER SUBWAY AT 110TH ST.

On what may be referred to as the down stream side of the avenues the problem is usually comparatively simple. A new line is laid between the subway and the buildings, connecting at the cross streets to the existing sewers, which, however, of course only get part of their former flow. On the up stream side, however, not only do the buildings adjacent to the subway have to be taken care of, but also the flow from the cross drains which have been cut off. The least important of these cross sewers are, therefore, collected in a main laid parallel to the subway and carried to some convenient crossing point, where either the subway can be lowered, to pass the sewer over the top, or where topographical conditions permit the sewer to go under and continue with sufficient fall to the point of discharge into the river. The conditions at 30th St., New York, are quite typical of this condition, Fig. 31. The construction of this one line, giving a new outlet all the way to the North River, cost over $500,000.

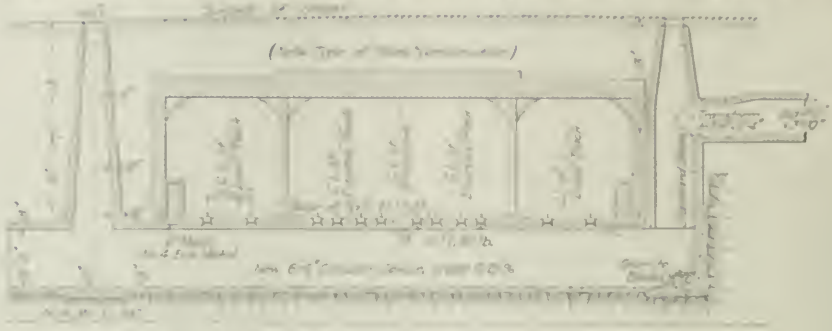
In a very few instances there have been large trunk sewers which could not be changed and which have necessitated a very considerable adjustment of the gradients of the subway to enable the line to pass them. At Canal St. and Broadway and at Duane St. and West Broadway, Manhattan, the subways were depressed to go under the sewer, while at Brook Ave. and 138th St., in the Bronx,

nection with the subways, are shown in Fig. 33. An interesting temporary expedient was adopted on the Fourth Ave. subway in Brooklyn. At one place on this line it was necessary to take care of quite a large volume of sewage until such time as a new relief trunk sewer could be built by the city. The subway at this point was built for six tracks, so one whole bay at one side for a length of 2200 ft. was isolated by being walled in, waterproofed and turned into a sewer until such time as the relief sewer was built.

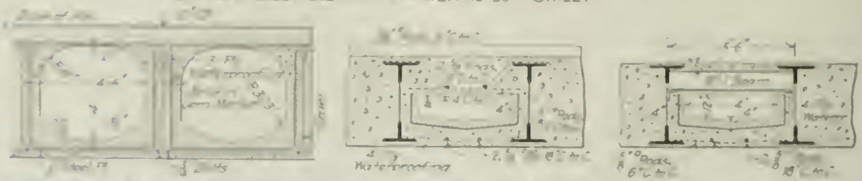
The Duane St. sewer in Manhattan is typical of certain conditions which have to be met and where advantage was taken of the peculiar topography of New York and the long established habit of drainage into the rivers on both sides of the city. The drainage from Centre St., through which the so called Loop line runs from Duane to Delancy, was to the East River. This was cut off by the construction of the Loop, which was too deep to permit the construction of the sewer underneath, so a deep-level sewer was built under the original subway, through Duane St. to the North River, thus reversing the flow from what was formerly the up-stream side of Centre St. It is this new sewer that the Seventh Ave. route in West Broadway has to go under, as referred to above.

The numerous questions which come up in connection

[illegible] standard. Gas meters are to be tested each [illegible] [illegible] test runs must agree [illegible] The test records to be kept are specifically

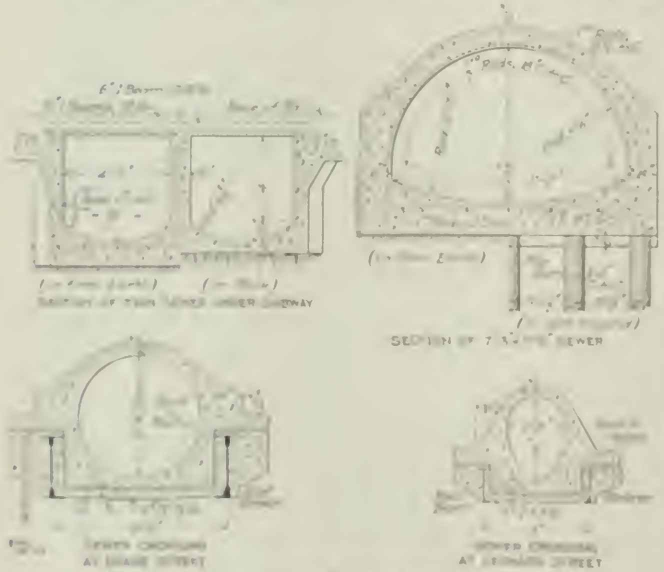


CROSSING UNDER SUBWAY AT 7TH AVE. AND 30TH STREET



SECTION UNDER SUBWAY AT TILLARY STREET AND FLATBUSH AVE. BROOKLYN

SECTIONS OF STORM SEWER OVER SUBWAY AT HUDSON AVE. AND FULTON STREET, BROOKLYN



SECTION OF TWIN SEWER UNDER SUBWAY

SECTION OF 7 [illegible] SEWER

SEWER CROSSING AT [illegible] STREET

SEWER CROSSING AT [illegible] STREET

[illegible]

outlined. Complaining consumers may have meters tested once in six months. Formerly the [illegible] tested meters for a flat fee of $[illegible]; now a scale is established of $[illegible] to $[illegible], depending on capacity. The monthly average of [illegible] value must be not less than [illegible] B.t.u. per cu.ft.; a minimum of [illegible] is fixed. Large producers (over [illegible] million cubic feet per year) must determine [illegible] value on three days a week. The [illegible] outlet pressure is [illegible] from [illegible] to [illegible] in. of water, the [illegible] is [illegible] in., but [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] hydrogen [illegible] [illegible] for pressure records [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible]

Gas and Electric-Service Standards of the [illegible] [illegible]

Nozzle Testing, Fitchburg, Mass., Sewage Treatment Plant*

The problem of finding an efficient method of uniformly distributing sewage over the surface of a rock filter is one which has been the subject of extensive studies.† Severe winter conditions preclude the use of any traveling distributor, and the method generally employed is the discharge in the form of a spray through some type of fixed nozzle operating under a varying head.

No nozzle has yet been used that will give a uniform distribution in practice. Some are better than others, and it has been the purpose to test the types of nozzles now on the market, and from the result of these experiments to select a nozzle and design a tank, which combined, will effect the most uniform distribution. These tests to the first of May, 1914, numbered over 1000.

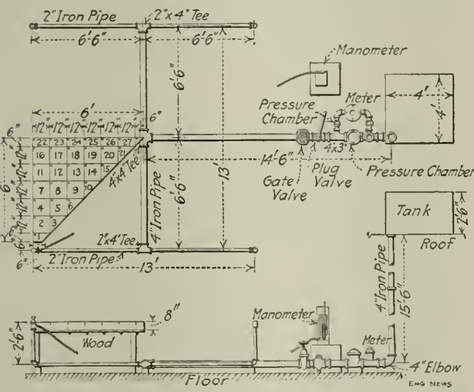


FIG. 1. NOZZLE-TESTING APPARATUS, SEWAGE-TREATMENT PLANT, FITCHBURG, MASS.

The plant for testing the various nozzles was set up in a garage connected with the sewer department building. The first experiment showed that satisfactory results could not be readily obtained by studying the discharge of a single nozzle; consequently, the plant was so arranged that the distribution would be analogous to that obtained in practice if the nozzles were placed on the corners of squares or interlocking hexagons whose sides were 13 or 15 ft.

Fig. 1 shows the apparatus when set up to study the distribution of nozzles set on the corners of a square with a side of 13 ft. The pan and distributors were later extended to study the distribution of the same nozzles spaced 15 ft. Only those nozzles designed to throw a spray over a square area were tested with this form of apparatus.

Three nozzles on the apices of an equilateral triangle are sufficient to show the distribution as effected by nozzles placed on the apices of interlocking hexagons. Fig. 2 shows the apparatus as used when the nozzles were considered as placed on the apices of hexagons with sides of 13 and 15 ft. Only those nozzles which throw a spray over a circular area were tested with this scheme of spacing.

For determining the head under which a nozzle operates, the mercury pressure gage, shown in Fig. 1, was later replaced by a water column, which proved far more satisfactory. It was found that for measuring the actual discharge in gallons of a given nozzle at a given head, it was more accurate to plug all risers except one and insert a small meter in a 2-in. distributor, than to use the large meter for all nozzles. Consequently, the large meter shown in the sketch was removed. The piping was arranged in all cases as symmetrically as possible, and every precaution was taken so that the pressure on all nozzles was equal.

For collecting the discharge and studying the distribution of those nozzles designed to throw a square spray, a 45° galvanized-iron pan representing one-eighth of a square inclosed by the nozzle was used. The pan was divided into sections as shown in Fig. 1. Each section is drained by ½-in. pipe about 3 in. long soldered to one corner and closed with a rubber stopper during the test.

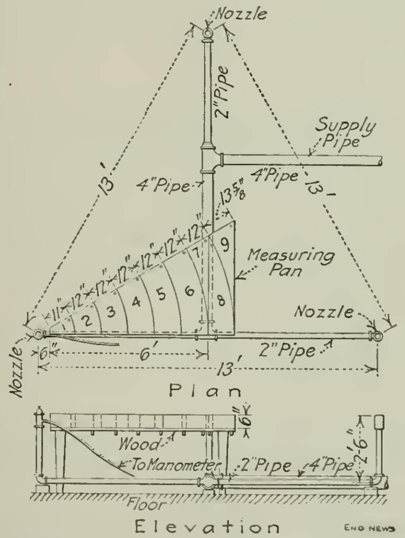


FIG. 2. TESTING APPARATUS FOR CIRCULAR NOZZLES

The whole pan rests on a wooden base and can be moved readily.

For collecting the discharge of those nozzles which throw a circular spray, the pan shown in Fig. 2 was designed. It was later divided into smaller sections along the line of radii drawn from the center to the desired points on the arcs. It covers one-twelfth of the total area dosed by each nozzle when the hexagonal spacing was used.

Using Fig. 1 as an illustration, a typical test was conducted as follows: The tank on the roof was filled with city water by means of a hose and, with the water still running, the pan unstoppered, and the plug valve open, the gate valve was regulated to give the desired head as indicated by a water column.

The plug valve was then closed and the pan stoppered.

*From the Seventh Semiannual Report of the Sewage Disposal Commission of Fitchburg, Mass.; for description of Fitchburg Sewage Treatment plant, see "Engineering News," June 5, 1913, p. 1176.

†For a description of the sprinkler testing apparatus used at the Massachusetts Institute of Technology in 1907, see "Engineering News," Jan. 9, 1908, p. 28; Aug. 20, 1908, p. 199.

At a signal time the plug valve was opened quickly and the water allowed to discharge through the nozzles under constant head for 5 or 2 min. At the end of the time period the plug valve was closed quickly and the amounts collected in the various pan sections measured with a properly graduated cylinder.

The discharge of each type of nozzle was determined separately with a small meter, as noted previously. Consequently, the amount collected in the pan should be one-eighth of the total discharge for any particular head. Any difference at low head would be due largely to eccentricity of the nozzle spindle or variation in the deflecting cone, while at higher heads, the effect of overlapping would be apparent. It was for the purpose of best studying this overlap that the battery of nozzles, instead of the single nozzle was used.

The amounts collected in the pan sections and the meter readings were recorded on special blanks and all subsequent calculations were made from these data. Duplicate or triplicate tests beginning at 2-ft. head and ending with 9-ft. head constituted a series.

Two makes of square type and two of circular type of sprinkler were studied. The work was discontinued through the cold weather, but was resumed in early spring, when a special nozzle designed by the department was studied.

Ladder Dredges with Side Ladder Frames

A type of ladder dredge which is used extensively on the Ohio River, is peculiar in having the ladder frame carried at the side (and clear of the hull) instead of in a central well in the hull. These machines are employed largely in obtaining sand and gravel from the river bed, and are frequently of rather rough-and-ready construction.

The left-hand view, in Fig. 1, shows one of these dredges built by the Missouri Valley Bridge & Iron Co., of Leavenworth, Kan., and now in use by this company on its contract for the construction of Dam No. 14 in the Ohio River at Woodland, W. Va. The arrangement of the machinery, etc., is shown on the plan, Fig. 2. The hull is 24x[illegible] ft., and of very shallow draft. The deck extends on the ladder side to support the ladder and protect it from gravel barges lying alongside. A 10-hp. single-cylinder marine engine is belted to a countershaft from which are driven the tumbler shaft of the ladder (by belt), the pump shaft (by gearing), and the sand screen shaft (by sprocket chain).

The ladder is 63 ft. long, and is made of two timbers 6x18 in., spaced 39½ in. apart, trussed laterally and vertically, and having cross struts about 6 ft. apart. It is pivoted around the main shaft (about 17 ft. above the deck) by means of boxing bolted to the timbers.

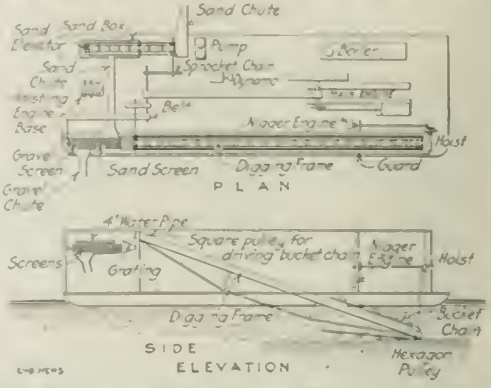


Fig. 2. Plan and Elevation of Side-Ladder Dredge

Keyed to the shaft is a square tumbler, each side of which is equal in length to that of one link of the bucket chain. The lower end of the ladder has a large hexagonal idler pulley, and to this end is attached a hoisting chain for raising and lowering the ladder. The chains wind on a large drum, operated by a small reversing engine through bevel gearings.

The ladder carries an endless bucket chain made up of link bars about 12 in. long, to which the digging buckets are bolted 5 ft. apart. Each bucket holds about 1 cu. ft. As the buckets pass over the tumbler on the main shaft, they dump the dredged material on an inclined grating, from which the larger stones roll back into the water, while the material passing through goes to two inclined cylindrical screens. The first or sand screen is of ¼-in. mesh and about 5 ft. long, following that is the gravel screen, of 2 in. mesh and about 4 ft. long.

The material entering the screen is washed by jets from a perforated 1-in. pipe, placed immediately over the screen, and these jets serve also to keep the meshes free. The finer material passing through the sand screen is led by a chute to a box on the other side of the hull. The material passing through the gravel screen is led by another chute into barges on the ladder side of the dredge. Any stones too large to pass through the screens go overboard. The sand-collecting box is about 4x12 ft.,

Fig. 1. Side-Ladder Dredges for Excavating Sand and Gravel in the Ohio River

(The dredge at the left, operated by the Missouri Valley Bridge & Iron Co., has a hull [illegible] ft. and a ladder frame [illegible] ft. long. The dredge at the right [illegible] has a hull [illegible] ft. and a ladder frame 75 ft. long.)

6 ft. deep, with a small weir on one side for the water to escape, carrying with it the dirt, clay or floating material. A bucket elevator takes the sand from this box and discharges it into a chute leading to barges.

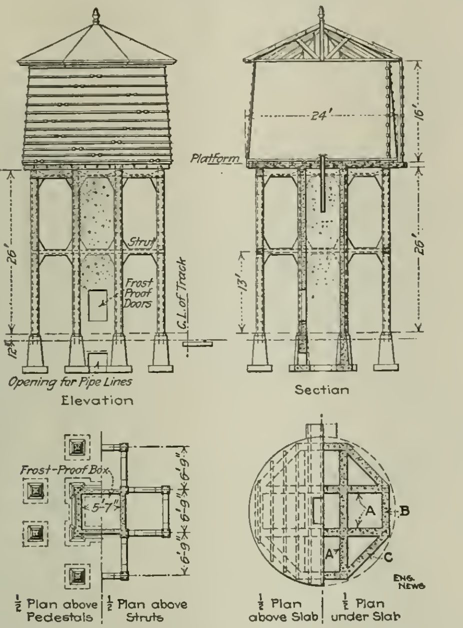


Fig. 1. Standard Reinforced-Concrete Tower or Substructure for 50,000-Gal. Water Tank; Erie R.R.

A two-drum hoisting engine, supplied with steam from the boiler, is used instead of the crabs and capstans usually employed for raising spuds and handling barges. The spuds are raised by cables running to the drums, while the barge lines are moved by the winch heads. The crew consists of engineman, fireman and two deck hands. In ordinary digging the machine will excavate about 50 yd. of sand and gravel per hour.

A larger dredge of the same type is shown at the right in Fig. 1, and is one of two used by the T. A. Gillespie Co., of Pittsburgh, Penn., on its contracts for lock and dam work on the Ohio River. The ladder is 75 ft. long, 4 ft. 6 in. wide over all and carries 28 buckets of 4½-cu.ft. capacity, made of ⅜-in. steel with reinforced lips. The ladder chain makes a complete revolution in about four minutes. The sand conveyor has 16 buckets of 3 cu.ft. capacity, and its chain makes a complete revolution in about 1¾ minutes.

This boat carries two marine boilers, one main engine (10½x36-in.), which operates both the ladder chain and the sand elevator, two capstan engines to operate the ladder hoists, and two double-spool steam capstans; also engines for operating the spuds or anchors, barges, lines, etc. The hull is 120x28 ft. and 5 ft. deep, with a draft of about 2 ft. when coaled and under steam. The weight of the ladder is counterbalanced by placing the boilers, sand bin and coal bunkers on the opposite side of the boat.

The dredge can operate successfully in water 30 ft. deep. Its capacity depends to a large extent upon the material to be handled, but for ordinary purposes it is estimated at 400 yd. per 8-hr. day. This boat was built by the Dravosburg Dock Co. and the machinery was manufactured and supplied by the Goodman Engine & Machine Co., of Pittsburgh, Penn. The total cost ready to operate was about $20,000 for each of the Gillespie Co.'s dredges.

Concrete Tower for Water Tank: Erie R.R.

The towers supporting railway water tanks are usually of timber or steel construction, but concrete has been used in a number of cases and the accompanying cuts show the standard design of the Erie R.R. for a reinforced-concrete tower for 50,000-gal. tanks, the tank itself being of wood. Fig. 1 shows the general design, while Fig. 2 shows some of the details.

There are four inner columns 8x8 in. and eight outer columns 14x14 in., with horizontal connecting struts at mid-height, except that these may be omitted when the height is less than 20 ft. The inner columns are built integrally with 8-in. curtain walls forming a frostproof air chamber around the pipes. At the top there are transverse beams and an octagonal ring girder 16 in. deep, supporting a 10-in. concrete slab 23 ft. diameter. On this are placed 6x6-in. timber sleepers to support the bottom of the tank. The slab is reinforced by 70-lb. rails, laid 2 ft. c. to c. All members have 1-in. chamfered edges.

Gravel concrete is used. The foundations are designed for a load of 30 tons per column, the foundations being

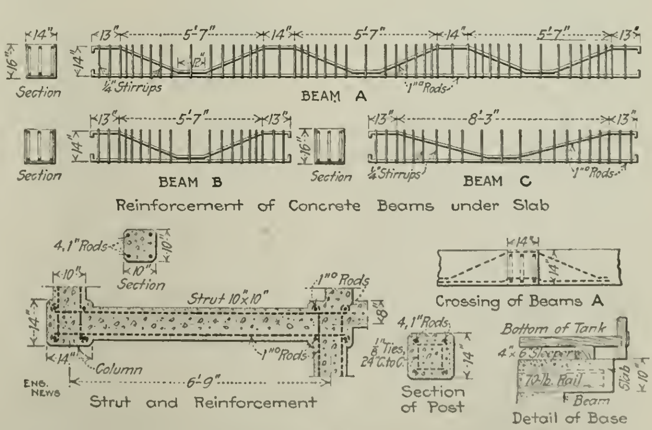


Fig. 2. Details of Reinforced-Concrete Tower for Water Tank

carried to such depths as may be made necessary by the character of the soil. These structures are built under the direction of R. C. Falconer, Superintendent of Construction, Erie R.R.

Field and Office

Bricklaying Costs for 5 to 10-Ft. Brick Sewers at St. Louis, Mo.

By C. L. French*

An attempt to standardize bricklaying methods in sewer construction so as to secure the greatest efficiency at each step of the work was recently made in St. Louis. The contract on which this attempt was made was for the [illegible] section of the Glaise Creek Joint Sewer, which was carried out by the American Contracting Co. This contract consisted of 7510 ft. of brick sewer, varying from 5 to 10 ft. in diameter and from 13 to 18 in. in thickness. The total amount of brickwork was 10,261 cu.yd., consisting of 9600 cu.yd. common and 661 cu.yd. of vitrified brick masonry (to line the invert for the dry-weather flow).

It was found that by planning the work so that a certain number of bricklayers could be constantly employed, the best men could be kept. The importance of this feature is nearly always underestimated by contractors. The difference between the work done by a good man and an average man is at least 10%, and where full time can be made the very best men are obtainable.

The next step was to get the maximum of work from the bricklayers. This meant not harder work, but eliminating lost motion. The essentials were proper working room, sufficient materials in the right place, and safe working conditions. Solving each of these problems required much experiment. Too many or too few bricklayers in a given space was found to be equally expensive. Materials in the right quantity, just where needed, make it unnecessary for a $[illegible]-a-day bricklayer to wait for a $2.50 laborer.

The principle of "safety first" was found to be of more importance than merely a humanitarian measure. Accidents demoralize efficient work, and a little extra care and expense along this line will more than pay for itself. For example, brick baskets were used instead of slings, and only material immediately to be used was allowed on scaffolding.

The elimination of useless labor was one of the greatest problems. Mortar was mixed by machinery at a cost of less than [illegible] per cu.yd. for power. Great care was taken to have the mortar of just the proper consistency. It was found that, everything else being equal, the day's work could be increased [illegible] by having the mortar exactly right all the time. The mortar was dumped directly from the machine into barrows and then passed into chutes. Thus the helpers had only to dump the mortar into the mortar boxes. Mortar mixers and mortar tenders were thus eliminated. Materials were stored as close to the ditch as possible and in the same quantity as would be used in that length of sewer.

The job was started Nov. [illegible], 1913, and finished Aug. [illegible], 1914.

The cost data are based on the following prices for labor and material delivered:

Bricklayer	$1.12½ per hr
Laborer	0.31 per hr
Brick, common	8.50 per M
Brick, vitrified	16.50 per M
Cement	1.40 per bbl
Sand	0.85 per cu.yd.
Electricity	0.10 per kw hr

The constants for each cubic yard of brick were:

430 common brick at	$8.50	$3.66
338 vitrified brick at	16.50	5.58
0.65 bbl. cement at	1.40	0.91
0.35 cu.yd. mortar at	0.85	0.30
0.10 kw hr. at	0.10	0.01

The mortar was 1 part cement to 3 parts sand

This makes the material cost $4.88 per cu.yd. for common and $6.80 per cu.yd. for vitrified-brick masonry.

The monthly records were as follows:

	Cubic yards laid			Cost per cu.yd.		
Month	Common	Vitrified	Per day of 8 hr. per bricklayer	Labor	Total, common	Total, vitrified
Nov., 1913	768	53	9.3	$2.2[illegible]	$7.11	$9.[illegible]
Dec., 1913	1444	99	10.8	2.02	6.90	8.82
Jan., 1914	1290	87	11.7	1.90	6.78	8.70
Feb., 1914	60	4	12.0	3.00	7.88	9.80
Mar., 1914	116	29	10.5	1.90	6.78	8.70
Apr., 1914	1132	78	11.8	1.78	6.66	8.58
May, 1914	970	68	11.0	2.24	7.12	9.04
June, 1914	1419	70	9.9	2.26	7.14	9.06
July, 1914	1912	133	12.6	1.77	6.65	8.57
Aug., 1914	619	41	8.5	2.65	7.53	9.45
	9600	664				

Average cu.yd. per bricklayer per day of 8 hr.		$11.0[illegible]
Average labor cost per cu.yd.		2.02
Average cost of brickwork per cu.yd.	common	6.90
	vitrified	8.82

The high cost of labor in May is due to tunnel work at night, when double time was paid to bricklayers. The high cost for June is due to bad working conditions, where frequent cave-ins caused much delay. The last month's figures are not significant, as the best men had left for other jobs and lots of cleaning up was necessary.

*[illegible] Engineer to Sewer Commissioner, [illegible] St. Louis, Mo.

Adjustable Orifices for Measuring the Flow of Sewage

By John H. Gregory*

The control and measurement of the flow of small volumes of sewage is somewhat troublesome and the writer was especially interested to read the article by Geo. T. Hammond (Oct. 22, 1914, p. 836), on the use of calibrated orifices for the purpose at the Brooklyn Sewage Experiment Station. The writer was confronted with a similar problem in 1904 when designing the sewage-testing station at Columbus, Ohio,[1] and after careful consideration, adopted adjustable brass orifices as being the simplest and most practicable device for measuring and regulating small volumes of flow.

The Columbus orifices, as are the Brooklyn orifices, were used in connection with a box in which the sewage was maintained at a constant level but differed from the Brooklyn orifices in that they were adjustable horizontally instead of vertically and were set inside of the box, with the inside face of the orifice flush with the inside of the box, instead of outside of the box as at Brooklyn. Also they were so constructed that all four edges of the orifice were in the same plane.

*Consulting Engineer, 170 Broadway, New York City.

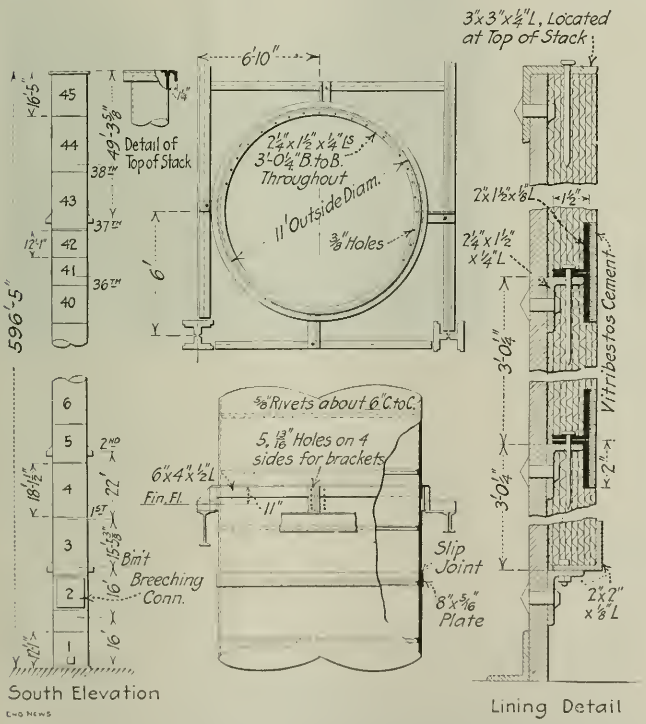
[1]"Engineering News," [illegible]

The orifice was adjusted by means of a handwheel carried on the end of a stem which projected out through a threaded nut set in the side of the box. The opening of the orifice and corresponding flow was obtained by determining, by means of a scale, the position of the wheel with reference to the nut.

The principle involved in the Columbus and Brooklyn orifices is the same, the differences between them being in the details of construction and setting. These differences are only of minor importance, as orifices of this kind should be calibrated if the most accurate results are desired.

Largest Interior Steel Stack, Equitable Building

The largest stack included in the construction of any office building to date, is the lined-steel stack of the new Equitable Building, New York City. It is 11 ft. in diameter by 596 ft. 5 in. high, plates $\frac{5}{16}$ in. thick. The stack is supported on the steelwork of the building at every other story. Just below each point of support is a slip-joint to allow for expansion. The general design of the stack, the method of anchoring to the building steel, design of the supporting bracket, type of slip-joint, the method of holding the stack lining in place, and other features of the construction are shown in the accompanying drawing.



General Design of Equitable Stack

Erection of the Stack—The steel sections, which vary in height from 12 to 18 ft. ½ in., were trucked from lighters on West St. to the front of the site on Broadway. As a problem in transportation, it is interesting to note that only one street was found which gave sufficient clearance throughout its length to permit the sections being carried directly to the site, without being unloaded and rolled under elevated railway structures. The city requires that all structures over streets shall have a height of at least 13 ft. above the pavement. In this particular instance, the loaded truck required a clearance of 16 ft.; a depression on Morris St., under the elevated-railway structure gave a clearance of 16 ft. 4 in., and here the load could get through under the structures on Greenwich St. and Church St.

At the site, a section was lifted from the truck, on Broadway, by a derrick, and deposited on the steelwork above. A second derrick picked up the section and swung it into the stack shaft. An ordinary derrick gang was able to handle a section.

The stack rises from a concrete base at the sub-sub-basement level. Its rate of erection was dependent upon that of the steelwork of the building.

Lining Stack—The lining of this stack differs from that of most interior stacks in that it extends the entire length.

The lining used (J-M Vitribestos) is formed of alternate layers of plain and corrugated asbestos board coated with a supposedly vitrified compound. It comes in curved slabs about 40x35 in. in plan by 2 in. thick. The slabs are sawed to fit between angle irons which encircle the inside of the stack 3 ft. apart, and they are held against the stack by angle clips fastened to the circular angles by nails, and the joints closed with Vitribestos cement, as shown in the vertical section sketch.

Application of the lining was not commenced until the stack steel had risen 26 stories. A piece was then cut from the section at the 12th floor, large enough to permit the entrance of workmen and material. After all the slabs were placed from the 12th to the bottom, the joints were cemented. An opening was then made in the stack at the 24th floor and the above process repeated. Later the cut pieces of steel plate were welded back in place.

The lining was applied by two men on a scaffold suspended in the stack. A third man prepared the cement and lowered it and the slabs, etc., down to the workmen. The work advanced at the rate of about 20 ft. per day, which was considered very satisfactory progress.

Personnel—The steelwork of the stack was furnished by the Dover Boiler Works, and erected and lining applied by the Thompson-Starrett Co. (George Simpson, Chief Engineer; H. S. Gardner, Superintendent of Construction), New York City, general contractor for the building. The lining was furnished by the H. W. Johns-Manville Co.

Notes on the Computation of Boundary Surveys

By A. W. B[illegible]*

Computations for boundary surveys should be put on quadrille ruled paper; that is the results, the logarithmic work not being saved.

In finding the latitude and departure of a course the work is simplified by writing the *log distance* in the center with the *log cos* and *log sin* above and below it, additions being made at both top and bottom. When the latitude and departure of a course are given and the bearing and distance are required, the *log tan* of the bearing is found by subtracting the *log latitude* from the *log departure*.

Then either the *log sin* or *log cos* of the bearing is looked up (whichever is greater; the larger function is always in the right-hand column), and subtracted from the *log latitude* or *log departure* (whichever is greater) which gives the *log distance*. The reason for doing this is that the percentage of error of the smaller function, taken together with the shorter side, is relatively so great as to make it less reliable in determining the length of the hypotenuse.

Searles's five-place *log* tables are nearly as accurate as Vega's for single minutes only, and much quicker. [illegible]'s traverse tables are very quick for finding latitudes and departures, but cannot be used for the reverse operation. If very much of this kind of computation is done, the most efficient way is with five-place tables of natural functions and a computing machine, which will save about 50% of the time. All computations should be checked either directly or by the reverse operation.

With angles read in the field to minutes, and distances to 0.01 or 0.05, the final courses should not be computed any closer than those measured; to do so only gives a deceptive implication of greater accuracy.

It will often improve the closure to first distribute the angular error before commencing computations. The error in latitude and departure is distributed only on the longest courses.

The D. M. D.'s and latitudes need not be closer than tenths in multiplying for areas, which in turn need only be recorded to single square feet. Results will then be reliable to 0.001 acre.

It is quicker to multiply for areas than to interpolate with logarithms. Areas can be *checked* graphically by subdividing the plot into triangles and scaling the bases and altitudes, with results generally accurate to 1 in 300.

When the area is known, in square feet, a rough check on the acreage may be found by pointing off six places and multiplying by 23, which is nearly the reciprocal of 43,560.

*[illegible], N. Y.

Portable Concreting Plant with Telescopic Tower

In building the concrete bridges and the railway floors in the grade-crossing elimination work at Tower Grove, St. Louis, Mo., two different methods were employed for placing the concrete. For the portion over the St. Louis & San Francisco Ry. (done by contract), a portable plant with mixer and short telescopic elevator tower was employed, while for the portion over the Missouri Pacific Ry. (done by company forces) the plant was stationary and had the usual tall tower and long chutes.

The portable plant, shown in the accompanying cut, was very inexpensive, and was readily moved from place to place as the work progressed. It consisted of a $1\frac{1}{3}$-yd. mixer with a small steam engine and boiler, mounted on a self-propelling four-wheel frame or truck. The elevator tower was mounted on a pair of sills, having the end supported by and bolted to the mixer frame, while the rear end was carried by a pair of wheels.

The usual cable for hoisting the charging skip of the mixer was disconnected from the drum, and a right-angled hook was spliced upon its end. A hole was bored in the face of the drum to engage this hook. A similar hook was attached to the bucket-hoisting cable. This arrangement permitted the use of the same drum for hoisting the charging skip and the concrete bucket, the one being removed while the other was in operation. This was done by a man stationed at the drum for this purpose.

Portable Concrete Mixing and Delivering Plant with Telescopic Elevator Tower

The tower was $4\frac{1}{2} \times 4\frac{1}{2}$ ft. in plan in the lower section, which was 3[illegible] ft. high. The upper section was slightly larger than the lower half and could telescope over the latter, so that a minimum height of [illegible] ft. could be obtained, for passing under electric wires. This upper section was 18 ft. high, and the maximum height of tower was 54 ft. The tower was raised and lowered by the hoisting cable and a set of blocks.

A tilting elevator bucket was used, and at the top of its travel it discharged the concrete into a hopper attached to the tower. From the bottom of this hopper extended a chute 35 ft. long, which was suspended by stays from a boom at the head of the tower.

This portable concreting plant with telescopic tower was designed jointly by Percy [illegible], Assistant Engineer, St. Louis & San Francisco Ry. (who is in charge of the grade-crossing elimination work at Tower Grove),

and G. D. Weeks, Superintendent for the Jarrett-Richardson Co., which has the contract for this work.

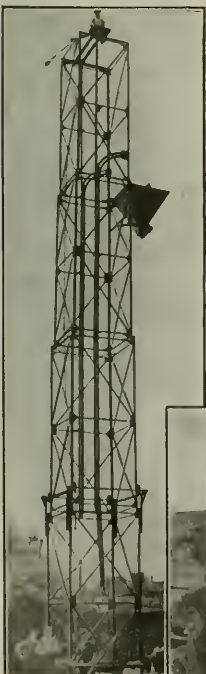
When the nature of the work in progress does not require the tower, it is uncoupled, the charging skip is rigged to the drum and the mixer is then available for concreting the street foundations, sidewalks, etc.

The capacity of this plant was about ⅓ cu.yd. of concrete at a batch and 1½ minutes was required for each batch. The highest record of work done by the plant was 90 cu.yd. in 10 hr. This plant was very satisfactory for the work, which consisted of retaining walls with a maximum height of 14 ft., having expansion joints 35 ft. apart, the wall being built in alternate sections. These walls were situated on three different streets, along which ran numerous electric wires and on two of which ran street cars. The tower was moved twice in the length of the walls, and the work was done without interrupting the street traffic.

Fire-Pail with Foil Cover—An improved metal fire-pail covered with foil to prevent evaporation and the accumulation of rubbish, is made by the Eureka Chemical Fire-Pail Co., Philadelphia, Penn. The pail is refillable. The foil, which is easily broken by the hand, is protected by a metal lid normally. The pail is enameled.

A Sectional Telescoping Hoist-Tower

A sectional telescoping hoist-tower is a novelty brought out by the Lorentz Iron & Machine Works, 95 Liberty St., New York. The two views herewith show such a tower in position, set up and when telescoped and loaded on a wagon. The tower is built in 15-ft. sections, telescoping successively, framed of steel angles. The lowest section is provided with winding shafts, worm-geared, by means of which the several sections are raised to extended position. Important features of advantage are the speed of setting up and taking down the tower, and the absence of damage or deterioration in taking down and reërecting.




Telescopic Concreting Tower

Testing a Testing Machine; Simple Method

By Julian C. Smallwood*

For calibrating vertical testing machines of the Olsen or Riehlé type, the makers recommend the use of "proving levers" such as are illustrated by Fig. 1. Arranged as shown, the force produced by weights suspended from

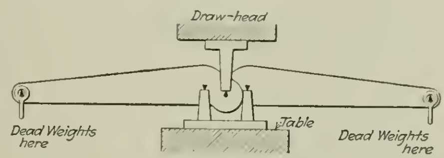


FIG. 1

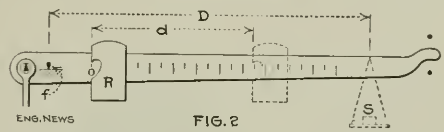


FIG. 2

Fig. 1. Proving Levers on a Testing Machine

Fig. 2. Weighing Beam with Auxiliary Scale Pan in Place

the ends of these levers will be multiplied by the ratio of lever arms, 10, and transmitted to the table of the testing machine. The multiplied force may then be measured on the testing-machine beam, and the machine calibrated. It is customary to test the machine in this manner up to one-tenth its capacity. It should be noted that the calibration, being static, does not duplicate the actual conditions of use, namely, the balancing and measuring of moving forces.

It was sought by the writer to prove a 200,000-lb. machine used in the laboratory of Syracuse University. The method outlined above was objected to because it involved the handling of 2000 lb. of dead weights. Consequently another method was devised, the theory of which is as follows:

The New Method

The weighing beam of the machine, Fig. 2, is fulcrumed at f and carries the rider R which may be adjusted at a distance from the fulcrum such as to balance any load applied to the testing-machine table. With no load, the rider is in the position shown, its pointer being at the zero graduation and its beam floating. With a load W on the table, the rider must be moved through a distance d to secure balance. If the machine is correct, the weight of the rider must be such that the distance d will be that between the zero and the graduation marked W. Now, instead of using the rider, another weight could be applied at any convenient part of the beam as shown by S, of such amount as to secure a balance when the load W is on the table. Therefore, the moment of the weight

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S about the fulcrum F must equal the moment of the rider which is replaced. Letting R denote the weight of the rider,

$$S \times D = R \times d$$

Let the ratio of the load on the table to the balancing weight S be L. Then

$$S = \frac{W}{L}$$

Substituting this in the first equation, and simplifying, we find the weight which the rider must have in order to suit the existing graduation of the beam:

$$R = \frac{D}{d} \times \frac{W}{L}$$

To apply this relation to the calibration, a value of W is chosen, and the distance between the beam graduation marked W and the zero graduation is carefully measured. This determines W and d. A point is then chosen to represent D, and its distance measured from the fulcrum F. To find the ratio L, it is not necessary to apply the full weight W to the table, since the ratio $W \div S$ is constant for all values of W, the ratio of levers being established by the selection of D. Therefore the following procedure is used. An appreciable, but not inconvenient, number of weights is placed on the table, these having been previously measured with a platform scales to within 1 lb. They may consist of anything available that can be readily moved. A balance pan, improvised from pasteboard and wire, is then attached to the beam at the distance D from the fulcrum, and to this pan are added shot or other small weights until a balance is secured. If desired, the weight of the pan may be previously balanced by the usual beam counterweight so that the experimenter need deal with the added weight only. The latter should then be accurately weighed to a fraction of an ounce. This result, divided into the weight applied to the table, gives the desired ratio L. The value thus obtained completes the data necessary to calculate the weight of the rider according to the equation previously deduced. The rider is then removed from the beam and weighed. If the actual checks the calculated weight, the machine is proved at the graduation marked W. Any other graduation may then be checked by proportion, since the distances of the graduations from the zero mark must vary directly with the indicated loads.

Test of a 100-Ton Machine

Following are the data and results from the test of the previously mentioned 200,000-lb. machine:

Beam carried two tandem riders to balance increments of 100,000 lb. each; W was chosen at 100,000 lb. so as to make the error in measuring d as small a percentage as possible; d = [illegible] in.; D = [illegible] in. To find L, a dead weight was placed on the table equal to [illegible] lb. Balancing weight, acting at D, rider being at zero, was [illegible] lb. Hence

$$L = [illegible] \div [illegible] = [illegible]$$

Then the rider should weigh

$$R = \frac{100,000}{[illegible]} \times \frac{[illegible]}{[illegible]} = [illegible] \text{ lb.}$$

The actual weights of the riders were found to be [illegible] lb. and [illegible] lb. The lever system of the machine was thus proved to about [illegible]% of error.

When determining L, it is well to make several trials involving different loads on the table, for checks. It is also important that the error brought about by lack of sensitiveness of the beam be estimated. This may be done after a balance has been secured, by noting what weight of shot may be added to or subtracted from the improvised pan to appreciably disturb the balance. The proportion that this bears to the whole weight of shot gives the proportion of error in the determination of L, since the load on the table is found with comparative exactness.

Sources of Error in Testing Machines

It is believed that this method of calibration is quite as reliable as the proving levers, besides having the merit of convenience; but, on the other hand, it seems that any static calibration should be supplemented by further examination. The question arises, at what points in a geared testing machine may sources of inaccuracy be looked for. One would not expect ordinary service to alter the arrangement of the levers, and, if this is the case, the beam would be expected to retain its accuracy, if the riders are not tampered with. Abuse of the machine might conceivably set the links connecting the levers or the knife-edges awry, which might make the balance sluggish without materially affecting the lever ratio. Grit from stone or concrete samples, if allowed to collect around the knife-edges, would have this result, as would the rounding or flattening of the knife-edges. In regular operation, sluggishness of the lever system would result in the rider being always behind its true position.

The rider is commonly advanced along the beam by means of a screw actuated by a handwheel set in the frame. The reaction on the beam caused by the force transmitted through the screw causes a slight lifting effort on the beam. If the rider does not work freely on its screw, this lifting effort may be considerably increased so that, in operation, the rider will be materially in advance of its true position in order to balance the lifting effort.

From these considerations it will be seen that the static calibration of a testing machine should be supplemented by an examination of all its knife-edges, and that the handwheel controlling the rider should be tried for its frictional resistance. Further, it should be ascertained that the table is free from the power screws, and from the guide bolts passing through it. Finally, a test for sensitiveness may be made as follows:

Test for Sensitiveness

A large rigid metal piece of any convenient shape is placed on the table as for regular compression test. A moderate load is applied, say [illegible] to [illegible] lb., the beam balanced by advancing the rider, and the reading recorded. The rider is now further advanced by a few inches, then returned until the beam again balances, and a second reading taken. If this is less than the first, the difference may be due to the reversal of frictional resistance of the screw, the lifting effort being changed to a depressing one. If greater, it may be due to sluggishness of the lever system. If the two readings depart more than 1 or 2% from their average, the cause of the error should be sought. This experiment should be repeated at several loads, care being taken not to exceed the elastic limit of the material under compression.

Unit Steel Forms for Concrete Floors and Walls

The accompanying view, Fig. 2, shows the wall forms used by Collins Bros., contractors, in the construction of the reinforced-concrete building for Henry Dart's Sons Co., at Rock Island, Ill. These forms, which are used in the building for both wall and floor-slabs, are of special unit type devised by the Blaw Steel Construction Co., Pittsburgh, Penn. The diagram in Fig. 1 shows the sheeting in detail.

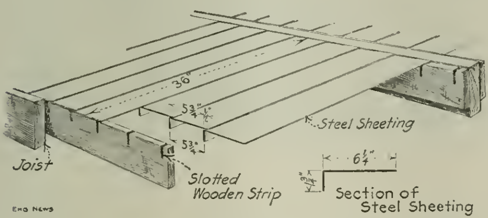


FIG. 1. DETAILS OF BLAW STEEL SHEETING FOR CONCRETE WALL AND SLAB FORMS

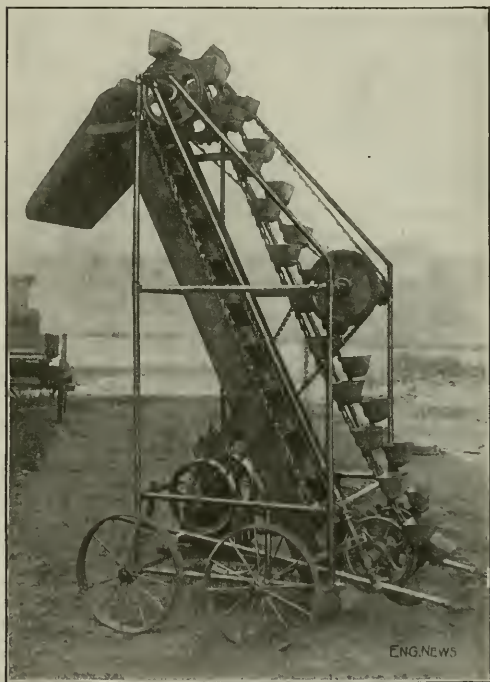
Each unit consists of an L-shaped section of light pressed steel, 36 in. long and 6¼ in. on the long side and 1¾ in. on the short side of the L. This 36-in. length spans the joists of the falsework in a floor or the studding in a wall form, the short leg of the L fitting into saw kerfs spaced 5¾ in. apart on light studding nailed to the main joist, as shown in the upper part of Fig. 1. This spacing allows a ½-in. overlap of the long leg of each unit on the next unit and the continuous line thus presents a tight surface for the concrete of slab or wall, broken only by the evenly spaced ridges at the overlap.

FIG. 2. WALL OF DART BUILDING, ROCK ISLAND, ILL., SHOWING UNIT FORMS IN PLACE

At the end of a few days, when the concrete has taken an initial set, the supporting studding may be taken down and the sheathing made ready for use again; meanwhile the slab or wall is supported at 36-in. intervals by the joist or stud which is left in place for the three or four weeks required before the entire removal of forms.

A Light Portable Wagon Loader

The use of mechanical wagon loaders in place of hand shoveling, for placing gravel, stone, sand, coal, ashes, etc., on wagons or motor trucks, is becoming very general, on account of the large saving in cost over hand shoveling. In the machine of this sort here illustrated, the effort of the designer has been to cut down the weight to facilitate the easy removal of the machine from one place to another. As seen in the illustration, a light steel pipe frame is used, and the weight of the entire machine has been cut down to a thousand pounds. Ball bearings have been introduced into the principal working parts, thus reducing the friction so that a little gasoline engine of only 1 hp. is sufficient to drive it; thus, the power equipment adds but little weight to the loader.



A LIGHT PORTABLE WAGON LOADER

In order to further facilitate the movement of the machine, its weight is balanced about the main pair of wheels, so that by pressing down on the projecting handles one man can balance it on these wheels and readily turn it. After the machine is set in place, ready for work, the handles can be pushed back out of the way. This machine, which is called the Jersey Wagon Loader, is manufactured by the Lorentz Iron & Machine Works, of Jersey City, N. J.

A New Dipper Handle for Dredges and steam shovels is composed of two steel channels placed with their flanges inward and welded together, so that they form a single member of rectangular box section. The design is patented and is being introduced by the American Steel Dredge Co., of Fort Wayne, Ind.

NOTES

A Good Record for an Old Dredge is reported in the "[illegible] Record" of Sept. 16. The French ladder dredge "Rad-[illegible]," which was built in Belgium in 1886, has just been condemned on account of defects in its hull. The dredge was operated at [illegible] for the French company organized after the [illegible] collapse and was beached when the work was suspended. It lay unused until [illegible] when it was repaired and put in service, about $[illegible],000 being expended in the work. Since that time it has been operated almost continuously. The fact that the iron hull and the machinery of this vessel have withstood the tropical climate of the Isthmus for twenty-eight years is noteworthy. The dredge had buckets of [illegible] cu.ft. capacity and was capable of excavation to a depth of [illegible] ft.

Plaster-Board Forms and Ceiling for Ribbed Concrete Floors—A new type of ribbed-floor construction in reinforced-concrete employs inverted troughs of gypsum plaster-board as permanent forms for the ribs and slab, with flat plates of the same material for the ceiling. This material (Sackett plaster-board) is pressed to shape for the troughs, and before setting these in place the ceiling plates are attached to the flanges by means of metal clips. The construction is shown in Fig. 1, and Fig. 2 shows the troughs nested for transportation.

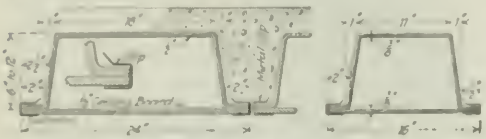


FIG. 1. RIBBED CONCRETE FLOOR CONSTRUCTION, USING FORMS AND CEILINGS OF GYPSUM PLASTER-BOARD

The troughs are made of different sections, in 36-in. lengths, and can be sawed to any required length. Their ends are closed by flat plates. The plaster board is treated with a waterproofing composition, so that it will not be liable to injury by the weather during transportation or on the work. The material adds very little to the weight of the floor, the weight being only about 3½ lb. per sq.ft. for troughs 24 in. wide and 10 in. deep, with ceiling board in place.

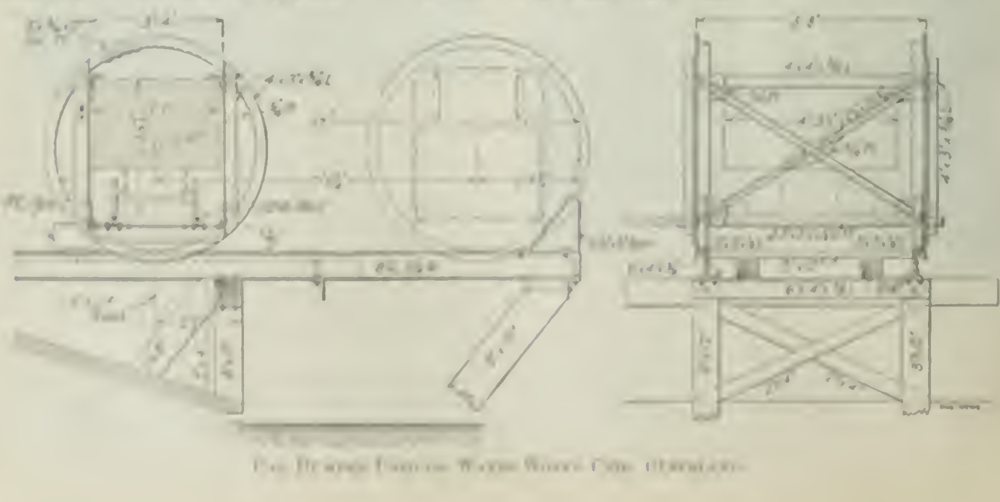
The plastering for the ceiling is stated to cost 25 to 40% less with this construction than with steel lath. The plaster-board form is rigid and will not sag or bulge. The extra fire protection of the surface of the concrete ribs by ½ to 1 in. of plaster-board is claimed as a further advantage.

This system of floor construction has been adopted for the Y. M. C. A. Building now under construction at Streator, Ill. This is a three-story building of reinforced concrete, about [illegible] ft., with spans of 17, 18 and 24 ft. The loads

FIG. 2. FORMS OF PLASTER-BOARD FOR RIBBED CONCRETE FLOORS

are 150 lb. per sq.ft. for the first floor and 6[illegible] lb. for the upper floors. The troughs are 24 ft. wide over the flanges, with a depth of 6, 8 and 10 in. for the three lengths of span noted. The material is supplied by the United States Gypsum Co., of Chicago. The contractor is H. Tappendorf, of Streator. The architects for the building are Foster & McLane, of Streator.

An Improvised Car Dumper, designed by S. E. R[illegible], Assistant Engineer, Cleveland Water Department, and built under his direction, has been in use at the water-works intake at Cleveland in the disposal of the excavation from the tunnel and of the débris from cleaning out of an old tunnel which leads into one of the cribs. In the accompanying figure details of the dumping device are shown. On the crib into which the tunnel leads there is erected a cantilever frame carrying two 8-in. channels out over the lake. On these channels as rails a [illegible] steel framework rolls from a fixed bumper, made of 8-in. channels riveted to the top of the rail channels above the crib, to an outside bumper made of [illegible] in. bars bent up at the extreme end of the cantilever frame. When at its inside position the [illegible] frame carries at its bottom section a narrow-gage track, which is continuous with a track leading out from the elevator in the crib. A small narrow-gage dump car is filled from the elevator and run out over the track into the [illegible] frame. The frame is then given a push by laborers and rolled out by a slight down grade of the cantilever, the car automatically overturning and being held from falling out by brackets [illegible] riveted to uprights shown in the cut. When the car load is thus dumped overboard, the empty car in the frame is pulled back into its place.



CAR DUMPER USED ON WATER-WORKS CRIB, CLEVELAND

Editorials

The Market for Municipal Bonds

In the three months since the declaration of war in Europe, from Aug. 1 to Oct. 31, the sales of municipal bonds in the United States fell off about \$50,000,000, according to statistics collected by the *Bond Buyer*. The total sales of municipal bonds during these three months were \$31,311,000, whereas in the same three months in 1913, \$79,790,000 was marketed. In the three months preceding the outbreak of the war over \$100,000,000 of such securities were sold.

There are signs, however, indicating that the coming month may see a revival in the demand for municipal bonds. A large proportion of the sales of such bonds are to savings banks and life-insurance companies, and there is little doubt that during the closure of the stock and bond markets since the war began, money has been accumulating to a considerable extent which is available for investment. There has been, in fact, a very marked improvement in the general tone of the Wall Street money market.

Two influences which have withheld investors from purchasing have been the feeling that with the opening of the financial markets again it would be possible to obtain exceptional bargains in investments, and the feeling that with the uncertainties of the world situation, it was a safe plan to keep a considerable supply of money available for instant use. Both these conditions are passing, and as soon as the bond market is fairly in operation, a considerable increase in the sales of municipal bonds may reasonably be expected. If this prediction is realized, it will be most gratifying to the cities who are holding back important public works until they can secure capital, and to engineers and contractors whose employment depends upon such financing.

Commission Government for Buffalo

The City of Buffalo at the election last week voted to adopt the commission form of government, and will be the largest city in the United States to try this plan of administering its municipal affairs. As our readers will recall, Engineering News has at no time maintained that the commission plan was an ideally perfect form of municipal government; and as most intelligent men realize, no plan of government for a city, or a state or nation can be successful, save as it is administered by men of ability and honesty.

It remains true, nevertheless, as every engineer, at least, will agree, that the old plan of city government with its multiplication of officers is cumbrous and inefficient compared with the commission plan and its concentrated responsibility.

That old plan of city government, which is still in use in many cities, where the mayor is the executive head with two different legislative bodies to act as a check upon each other, was intended to be a copy of the scheme of government in use in the several states. One main defect of a government of this sort is that it is far better adapted to prevent things being done than it is to do things. A century ago, when the old aphorism that that government was best which governs least was widely accepted, the attainment of efficiency in a municipal or a state government was not necessarily a matter of vital importance.

The governments of the present day, however, are doing many things which were undreamed of a century ago and the tendency all the time is to increase the work undertaken directly by the municipal government. Under these conditions it makes a vital difference to the taxpayer and the citizen whether efficiency or inefficiency prevails in the government of his city. The mere fact that the commission form of government is more efficient by far than the old mayor, aldermen and council plan makes the change in Buffalo one upon which its citizens are to be congratulated.

One-Sided Engineering Contracts

Something is radically wrong with either engineers or lawyers when a lawyer* is led to write as follows:

> The entire trouble is with the present-day construction contracts and their specifications or at least the general conditions of the specifications. In discussing the present-day railroad construction, the following has been stated: "It is safe to say that in no other business relations between men are such one-sided agreements customary; in no other relation is a man conceived to be clothed, by reason of an instrument, in a mantle of infallibility, as is the engineer in customary railroad contracts." The same is true of all United States, state and all municipal contracts, and even of many private contracts. From personal knowledge of contracts of the City of New York and the interpretations by the Corporation Counsel and some of the engineers, I am of the opinion that in signing such a contract the contractor, architect, or engineer gambles worse than on the stock market. He frequently becomes an insurer and an exponent of faith, hope and charity.

A contract is supposed to be a fair bargain. In all the decisions and discussions of engineers, fairness is always assumed to be the keynote of the relations between the engineer and contractor; but by the above quotation and by very general experience as well, many (if not most) contracts are so far from fair that it would be undeserved praise to even call them unfair.

A mere ethical protest against such a condition might be commendable; but it would have little chance of success. If engineers can write such contracts and enforce them, they will doubtless continue to do so, notwithstanding all ethical protests. But when courts of law decline to recognize such contracts, and insist on interpreting them in the courts' own way, on a basis of fairness, regardless of the specific terms of the contract, then engineers are bound to stop and give the matter thought.

*Wm. L. Bowman, in a recent address before the Harvard Society of New York, "The Engineer and the Law."

How long will engineers continue to write contracts and specifications that are not only grossly unfair, but are without legal force?

The Yale Bowl

The novelty of the structure erected at Yale as a football amphitheater lies not only in its popular aspects, but just as much in its construction and design. Gathering 61,000 people in a walled camp, which can be entered and left only through tunnels, is rather radically new. There is every reason to believe that the innovation will be fully justified by the success of its first trial—at the Harvard-Yale football game on Nov. 21.

To build a concrete grand-stand on a freshly placed earth embankment is almost as novel as the general idea of digging out an amphitheater below ground-level in order to furnish material for the embankment—an operation which called for the adoption of very special methods of excavation in order to handle the job cheaply and expeditiously. Of course, the problem was to secure a dense and firm embankment on which the seats could be built without settlement, and there was some difference of opinion, we understand, as to how this problem ought to be handled.

The original project contemplated making the embankment a simple dump, without much or any attempt at consolidation; the material was to be deposited in thick layers and not rolled. The contract and specifications were actually drawn on this basis. Later, when the contract had progressed some distance, after the tunnels through the bank and the first few feet of bank had already been constructed, the engineers in charge modified their views, and came to believe that the embankment should be made fairly firm and solid from the start. The contract was thereupon altered to call for what amounts to reservoir-embankment construction, depositing the material in thin layers and rolling it thoroughly.

Of some interest in the same connection is the fact that it was originally planned to build the concrete seating structure all the way up the slope, on the fill as well as on the part in cut, and thus with unconsolidated fill as originally contracted for. The later decision to put a temporary wooden seat-deck on the embankment, and restrict the concrete seating for the present to the portion which is in cut, will certainly be regarded as wise.

The [illegible] structure, unfortunately, will be very [illegible]. [illegible] it is to be used for the college football games only. It means that only in the fall, and then for not more than possibly half a dozen afternoons, will it be in service. The field is too small for baseball, and the whole structure [illegible] regarded as unsuitable for track and field sports, for which another stand on another field will be provided. On account of its large seating capacity the bowl [illegible] pay [illegible] in [illegible] under the circumstances.

Original Cost vs. Replacement in Railway Valuation

In commenting [illegible] [illegible] the Federal Railway Valuation Act at the time it was passed, we criticized the clause in the act which requires the valuing engineers to determine not merely the cost of replacing the line at the present time, but also what was the original cost of construction, together with the amounts which have been expended since on improvements. We suggested that this clause in the law would require a search into past history, requiring a vast amount of labor, and that many of the facts necessary to complete the records could never be ascertained.

An interesting illustration of how this task of searching past history works out in practice is furnished by a circular issued by the Valuation Committee of the Central Railroad of New Jersey, of which Charles Hansel is the Chairman. The circular states that representatives of the railway company who will accompany the Federal Valuation Engineers, will point out to them certain obscure items which materially increase the cost of the completed work, and which are not apparent in a field inspection. Mr. Hansel makes the following list of some of the items which may have caused a large increase in the cost of original construction, and yet be not at all apparent now.

Sunken embankments, old excavations filled up, trestles and other structures which have been filled with earth embankment, sink holes, cuts which were wet during construction and therefore caused extraordinary costs, but which are now dried out, disintegrated or earth-covered rock cuts, which might now be classified as earth at a low price when compared to the original cost of rock excavation, temporary roads, trestles, tracks, embankments, [illegible] and other structures required during construction, traces of which have disappeared, excessively costly foundations of bridges, [illegible] and other structures, unexpected drains and culverts, conduits, sewers, [illegible], water pipes, [illegible], dams, [illegible], retaining walls, flumes, [illegible], rip-rap, mattresses, etc., not readily discovered, and especially those which are outside of the right-of-way, roads, channels and streams which have been diverted, the knowledge of which cannot be had from mere inspection, [illegible] which were originally [illegible], but which have settled below the subgrade; items incident to eliminating grade crossings, [illegible], or [illegible] trains, particularly [illegible] traffic, and similar extraordinary construction items; [illegible] paid contractors for delay in furnishing material or facilities; extra cost of work owing to extraordinary weather and other conditions, strikes, etc., or on account of [illegible] and other [illegible] of the construction [illegible], [illegible] drainage, etc., of streets, and [illegible] of the construction, [illegible], drainage, etc., of streets, and other improvements of various kinds off the right-of-way, paid for wholly or in part by the railroad companies; [illegible] agreements [illegible] against the railroad companies for [illegible] [illegible], etc.

Mr. Hansel declares that in many cases the only way to determine the facts in the relation to many of the items above cited will be through the personal recollection of those who were connected with the original construction work. He is therefore sending this circular to every present employee of the company and to all former employees, as far as they can be located, especially in the engineering department. He appeals in the circular for old field books, maps, profiles and plans, and for the addresses of retired officers and employees, or of contractors who may have done work for the road formerly.

From the railway company's point of view, it is, of course, desirable to present these matters to the Federal Valuation Engineers to enable them to form a fair estimate of what it would cost to replace the road at the present time, as well as the estimate which the law requires of the original cost of construction. The very fact, however, that a knowledge of these items depends [illegible] on personal recollection makes it clearly evident how futile is the task of trying to obtain a complete history of construction and betterment expenditures on railways built a half century or more ago, as were a large

part of the lines comprising the Central Railway of New Jersey system.

How few of the engineers and contractors, who were in responsible charge of work even 30 years ago, are still living and able to furnish authentic information. Even when such men can be found, their recollection of events occurring so long ago, must of necessity be more or less vague and hazy, and will be an uncertain foundation on which to base a dollars-and-cents estimate of cost.

There is, however, another and still more important aspect of this search into past history. The ultimate purpose of the valuation is doubtless to furnish an authoritative basis for fixing railway rates.

Now a very little study and in fact the common sense of the individual indicates that a railway is entitled to earn a fair income on what its property is worth today, not on what it may have originally cost. This is merely applying to railways the rule which applies to all other lines of business and industry. It is the universal rule that the income from a property—be it a farm, a factory, a mine, a house or a going business—depends on what it will now earn in net income, not at all on what it may have originally cost the owner. Of course, railway rates cannot be based on a valuation governed by net earnings, since the rates themselves determine the earnings, but they can fairly be based on what the railway's entire property as it stands today as a going business could be reproduced for under present conditions, since this is the condition under which other industries are carried on.

A manufacturer, for example, buys a complicated and expensive labor-saving machine as soon as it appears on the market. He thereby gains such an advantage over his competitors that for a year or two he is able to make very large profits. At the end of that time, the machines are produced in such large quantities that his competitors can buy them at a comparatively low figure. He must meet their competition, based on low-cost machinery, and reduce the prices of his goods to compare with their quotations, regardless of the prices he may have paid for his own machines.

If an inventory of his plant were made, the machines would be appraised at what they could be replaced for, no matter what fancy price may have been paid for them originally. Similarly, the owner of a piece of real estate can obtain a rental for it based on its present selling value. This value may be several times as much as he originally paid for it, or on the other hand, it may be very much less.

So a railway company may, in the early years of its history, have spent a vast amount of money in excavating a hard rock tunnel with hand drills and black powder. It is entitled today to earn interest only on what the tunnel could be built for with modern machinery and dynamite. On the other hand, it may have done a large amount of work in its original construction with very low-priced labor or with convicts, whereas today the restrictions of the labor unions or other economic conditions would make the reproduction of the same work twice as costly. The true valuation of its property is the valuation at which it could be replaced under present-day conditions.

So with the real estate that the railway company owns and uses in its transportation business. This may have been secured originally for a nominal consideration, or even given outright by a municipality for use as terminals. The railway is nevertheless entitled to earn an income today on the present value of this real estate, based on what it would cost at present to acquire it. Of course the rule works both ways. Some of the real estate now held by the railways, owing to business and residential changes, is worth less than its original cost.

The economic basis for this rule with reference to valuation lies in the fact that it applies to the public utility corporations the same rule that is applicable to all other industries in which free competition prevails. If it were indeed possible to have free competition in the operation of public utilities, then at any time when a railway charged exorbitant rates a competitor could build a line alongside and could base its rates on the cost of its new construction, which would compel the reduction of rates on the old line to that standard, no matter how much more costly the old line was to build. The rule, therefore, simply aims to compel, by process of law, what would take place through the natural force of competition, were the business one in which competition could prevail.

We are aware that there are strong influences in favor of the other plan of valuation, by ascertaining what the company has actually expended in the creation of its property and upon improvements thereto and taking this sum less depreciation as the value of the plant on which it should be permitted to earn an income.

Were it possible to ascertain these historic facts with anything like accuracy, and if the company had been under public control as to rates, service and expenditures from its establishment, much might be said in defense of this plan. But these conditions obtain in few cases. Many railways were originally built by construction companies, which were organized for the express purpose of making a large profit on the difference in the price paid by the railway company and that received by the actual contractor. A part of this profit may even be legitimate as a part of the necessary promotion expense in bringing the railway into being; but it is not to be believed that the public will stand for rates which make the profits reaped by dead financiers a generation ago a part of the permanent capitalization on which rates are to be based.

The influences which carried the Federal Valuation act through Congress, in fact, bitterly opposed this very thing. The idea that the present railway capitalization represented in large part "dead capital" and not present values, was the impelling motive in bringing about the passage of the act. If therefore, the historic basis should be used for railway valuation instead of the replacement basis, there is danger that the whole work may lose its authoritative character and that the public may refuse to accept it as fair.

We freely admit that the unearthing of past records, showing difficulties and extraordinary expenses in connection with the work, may have a certain value in making the Federal Valuation Engineers give fair allowance in their estimate of replacement value for those extraordinary items in connection with construction, which so often play a large part in increasing the final cost over the original estimate. But to attempt to make a complete valuation on the historic basis is attempting the impossible in most cases and even if it were fully determined, the public would discard it as unfair.

Letters to the Editor

Experience with Concrete-Pile Foundations in the Detroit Clay

Sir—The article on "Foundation Design, Michigan Central Railroad Terminal," in your Oct. 1 issue, has been construed by some to mean that no concrete piles were found which could safely be expected to carry a load of 30 tons each. This was not the conclusion drawn by the Michigan Central R.R. as is evident when it is known that on a portion of this terminal Raymond concrete piles were used on the recommendation of G. H. Webb, Chief Engineer, under the above mentioned loading.

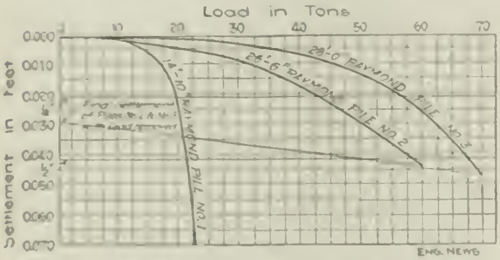


Fig. 1. Load-Settlement Curves for Three Raymond Piles in Tests for Michigan Central Terminal Foundation

Pile 1 was short, being driven through hard-baked crust on surface, but was tested after hard rain. Piles 2 and 3 were driven in pits excavated through surface crust. The final load per square foot of friction surface was nearly the same for the three piles.

Pile	Friction Area, Sq. Ft.	Final Load, Lb. per Sq. Ft. Friction Area
1	3? 50	1064
2	93 50	1130
3	1?? 25	12?0

While some types of concrete piles seemed unadapted to the local soil conditions, the curves in Fig. 1 herewith will show that 30 or even 40 tons could be safely placed on the tapered piles tested, provided, of course, that they were driven to a reasonable depth, which in this locality was from 20 to 30 ft.

Pile 1 was driven under unusual conditions in that the surface of the ground consisted of hard-baked crust caused by an extreme drought which occurred just previous to this time. Piles 2 and 3 were driven in shallow excavations which penetrated this crust. Between the time of driving Pile 1 and the placing of the test load, the crust was thoroughly soaked and softened by abundant rain, so that the conditions when the load was applied were similar to those under which the two other piles were driven, after the upper crust had been removed. This short pile is therefore interesting, not for the total load carried, but for the relative load, i.e., the load carried per square foot of lateral surface. This, as shown below the table of curves, is remarkably close to the frictional value of the two longer piles.

The cost of placing concrete piles, however, together with the fact that there was some doubt as to whether the piles could be driven to a sufficient depth in the large piers required, on account of the extraordinary nonconpressibility of the soil, made the adoption of the mat foundation economical, as stated in your article.

The only gray clay under the Michigan Central Terminal is much more dense than the general soil of the Detroit district. The geological formation is very similar, however, to that found for a considerable distance from this point along the shores of the Great Lakes. Fig. 2 shows the character of this soil, which is so tough that it has to be actually cut out, and handled with a fork (shown in the photograph). The holes in the clay made by the fork can be clearly seen even though the clay has been exposed to a hard rain for several days. In time, however, this material will "weather" and run into a solid mass again. The material under the downtown district of Detroit is much softer and is considered on the whole much less trustworthy for building purposes. In the last few years over 60,000 ft. of Raymond concrete piles have been driven in Detroit, under 12 buildings. None of these piles is loaded less than 20 tons and the majority carry 30 tons. In some cases the calculations have shown that the actual load on the piles after the building had been erected and filled was 35 tons, but in no case has any appreciable settlement been evident or the slightest difficulty experienced with the foundations. Engineers therefore feel justified in using 30 tons as a safe load to allow on tapered Raymond piles.

Fig. 2. Slices of Clay Subsoil Excavated at Michigan Central Terminal Site

(Were excavated by hawk-bill and handled with fork (fork shown in view). The pile was exposed to several days' rain before the picture was taken, but the slices still show the fork holes.)

In 1909, the Bohl Mfg. Co., of Detroit, built their five-story warehouse on Raymond concrete piles, loading them to 30 tons each. Even though these loads have been increased over what was originally contemplated, no settlement has been found. This was the first building in Detroit to be built on concrete piles. Since then, Ray-

mond concrete piles have, been used under the following buildings:

Date	Name	Loading, Tons per Pile
Dec., 1910	Buhl Malleable Co.	25
May, 1911	Boyer Campbell Warehouse	30
July, 1911	Free Press office building, first half	30
Aug., 1911	Kiefer Building, office and store building	30
Aug., 1911	Murphy Iron Works, office building	25
Mar., 1912	Free Press office building, second half	30
Apr., 1912	Murphy Iron Works, factory	25
July, 1912	Central Heating Co., power plant	30
Jan., 1913	Standart Bros. warehouse	20-30
Jan., 1912	Dodge Bros. warehouse	30
Sept., 1913	Michigan Central R.R. Co. station	20

MAXWELL M. UPSON,
Secretary & Gen'l Manager, Raymond Concrete Pile Co.

140 Cedar St., New York City, Nov. 4, 1914.

Flat Slab Indulgences

Sir: In your issue of Sept. 24, 1914, p. 632, there appears the new Chicago building code as applied to flat slabs. Some uncertainties in the ruling for the four-way system should be pointed out:

Strip A (a strip crossing the columns and of a width equal to one-half the panel length) is said to have a negative moment "at the edge of the column cap or over it" with a coefficient $^1/_{15}$. Is the designer permitted to make his own selection as to the location of this bending moment and if he selects "over it," is he permitted to consider the column shaft as part of his resisting section—an inverted T-beam of any depth desired?

Another feature of the code is the entire absence of any provision in columns for the tremendous bending moments that they must take unless the load happens to be balanced. It is true that the code says: "Special attention shall be given to the design of the column capital in considering eccentric loads;" but how on earth can a column capital have eccentric loads without the same being taken by the column shaft?

How any designer can compute tremendous bending moments in column capitals and then totally ignore these in his column shaft is a mystery. And yet this is the common way to design a flat-slab system, and it is sanctioned by this code. The proof that this code allows a bending moment, *even in wall columns,* is found by comparing the moment coefficient for wall panels supported by columns and girders and that for panels on brick walls. Another proof is in the placing of the point of inflection one-quarter of the distance center to center of columns.

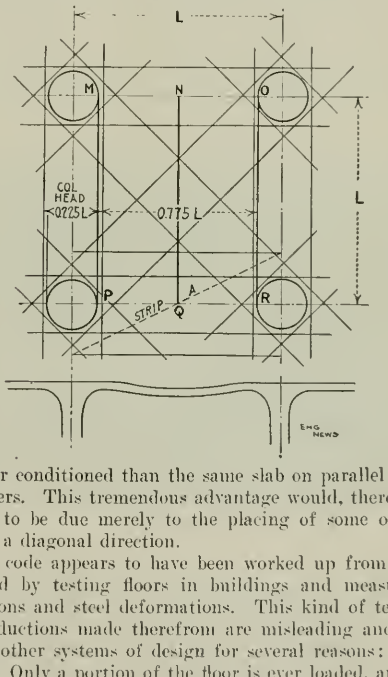
The bending moment in Strip A is found to be $^1/_{80}\ wL^3$ at middle span, where w = total load per sq.ft. on the slab. (The coefficient $^1/_{80}$ is brought in by using w as the load per sq.ft. in place of using W as the load per lineal foot on a strip $\frac{1}{2}\ L$ in width.) Now in the rectangle $MPRO$ (see accompanying cut) we have a slab which, for purposes of discussion, we may consider supported along PM and RO. In the section NQ of this slab there are three complete bands of rods, but since two of these are at 45°, they will be equivalent, if fully stressed, to 1.41 bands. Hence the full resisting value of the bands of rods, assuming all bands alike, is 2.41 times that of one band, in the section NA, or $2.41 \times {}^1/_{80}\ wL^3 = 0.03\ wL^3$.

In the slab $MPRO$, the bending moment at NQ plus that at MP or OR must, by the theory of flexure, be equal to the product of the load on the span and one-eighth of the span length, or $w \times 0.775\ L \times L \times \frac{1}{8}\ L \times 0.775 = 0.075\ wL^3$. The minimum value of the moment either at MP or NQ is then one-half of this, or $0.0375\ wL^3$. In each of these sections named, there is the same reinforcement. Taking, then, the best possible condition, the actual bending moment at its minimum is 25% greater than that given by the code. A similar analysis of the wall-panel moment reveals a somewhat more excessive divergence.

The foregoing presupposes just the proper balance of load over the columns and just the proper deflection to give exactly equal moments at the several sections considered. These are not possible conditions, except for one arrangement of loading; they are, however, the most favorable assumptions possible for the four-way system.

Building codes allow a moment coefficient of $\frac{1}{12}$ for interior slabs. Introducing $0.775\ L$ as the span length, this would be $0.5\ wL^3$ as the moment. Thus the plain-slab designer would have to use 67% more effective steel reinforcement than the flat-slab designer.

The advantage that this code gives to the flat-slab bidder is obvious. It has never been shown, and in fact it is not claimed that a flat-slab over rows of columns



is better conditioned than the same slab on parallel lines of girders. This tremendous advantage would, therefore, appear to be due merely to the placing of some of the rods in a diagonal direction.

This code appears to have been worked up from data obtained by testing floors in buildings and measuring deflections and steel deformations. This kind of testing and deductions made therefrom are misleading and unfair to other systems of design for several reasons:

(1) Only a portion of the floor is ever loaded, and in the nature of the construction the surrounding slab offers large aid to the part tested. Other systems are based on tests of isolated parts.

(2) The tests made are lower stories in buildings where the columns are large and are capable of giving great aid to the slabs not only because of their size, but also because they themselves are only carrying a small part of their load.

(3) The measurements taken are greatly influenced by the tensile strength of the concrete. Users of other systems are compelled to ignore tensile strength in concrete.

EDWARD GODFREY

Monongahela Bank Bldg., Pittsburgh, Penn.,
Oct. 16, 1914.

The Yale Bowl; an Amphitheater of Earthwork

By Thomas C. Atwood*

SYNOPSIS— [illegible]

Yale is building a new coliseum at New Haven to seat 61,000 spectators. It is built on a different plan from that used on previous structures of this type in this country, being practically a mass-concrete and earthwork structure with the seat slabs laid directly upon the earth, instead of the usual reinforced-concrete slab supported above ground on beams and columns. It is built on a level plain in a similar manner to a cut-and-fill reservoir, the earth being excavated to a depth of about 27 ft. in the center and the material used to form an oval-shaped embankment rising to about 27 ft. above the natural ground and completely surrounding the playing field.

FIG. 1. THE YALE BOWL, A 500x300 FT. FIELD SURROUNDED

The "Bowl" occupies a field of 25 acres, ample room being allowed for entrance and exit of the large crowds. The outside dimensions of the structure are 930 by 750 ft., and the playing field is 500 by 300 ft. The main axis of the field lies about NW and SE so that the afternoon sun in the fall will be at right angles to the side lines and not shine in the players' eyes.

It may be of interest to note that the largest of the ancient amphitheaters, the Colosseum of Rome, had outside dimensions of 620 by 513 ft., with inside dimensions 287 by 180 ft., while the great structure at Pompeii, which the "Bowl" most resembles, is 460 by 345 ft. outside and 217 by 114 ft. inside. The seating capacity of Pompeii was 20,000 and that of the Colosseum 87,000, [illegible]

The location is ideal for such a structure with [illegible] the embankment, the material being a coarse sandy gravel giving perfect natural drainage. It was realized that there will probably be some slight frost action (expected to be very slight owing to the coarseness of the sand), but this and also the danger of unequal settlement in the embankment has been provided for by making the concrete blocks of the seating structure quite small and reinforcing them heavily. The embankment is faced on the outside with grass, the slope being approximately 1 on 2. A retaining wall holding the foot of the slope prevents outsiders from climbing up the bank.

The promenade around the top of the bank and the 50-ft. walk around the outside of the Bowl have a surfacing of broken stone with the interstices filled with screenings, all watered and rolled.

Retaining-Walls

The outer retaining-wall is of the gravity type and is 9 ft. high above ground. It has a gutter cast in the top for carrying off the surplus water from the bank above it. The inner retaining-wall, which defines the playing field, is also of the gravity type and has also a gutter cast in the top for carrying off the water falling on the seats.

Both the inside and outside walls have been built in short lengths with pilasters between, the pilasters being built later and acting as expansion joints.

The public entrances are tunnels cut back into the bank with curved walls connecting their portals to the outside wall.

The inner retaining-wall is surmounted by a concrete parapet wall [illegible] ft. high, which serves as a fence between the seats and the field and is so designed as to appear to lengthen the field wall from the field side and thus give a better architectural effect.

The surface of the concrete has been given a smooth finish by rubbing it up with a [illegible] as soon as the forms were removed, except that the pilasters and coping of the outside wall were brushed up [illegible]

*Construction Engineer, Yale University, [illegible] New Haven, Conn.

TUNNELS

There are 30 tunnels provided for the entrance of spectators, all running from the ground level outside to about the middle of the bank of seats inside. These tunnels are 7 ft. wide and 8 ft. high inside. They were built in the open and the embankment built around and over them. The walls of the tunnels are 15 in. thick and the roof 8 to 15 in. thick. The roof is waterproofed with three layers of tarred felt and one layer of "tartex," each layer being thoroughly mopped with pitch before the next was put on, while a single layer of pitch was mopped onto the sides. The tunnels average about 140 ft. in length, some being longer than others on account of the fact that the outside ground level on the northerly side is lower than on the southerly side, thus lengthening the outside slope and consequently the tunnels.

There are two tunnels which run from the outside ground level to the playing field. One of these, the Main Tunnel, is 15x10 ft.; is on a grade of about 7½%, and has an 8-in. concrete pavement. It will admit the working force to the field and will also serve as an exit for processions and for the large crowds which will come down onto the field after the games. The other, the Players' Tunnel, 10x8 ft., gives access to the players from the south side where the visiting team will have its quarters, and where the large clubhouse for the accommodation of all teams will be built.

All tunnels are lighted by electricity.

SEATING STRUCTURE

The seating structure consists of concrete slabs, as mentioned above, laid directly on the surface of the ground with steps cast in the top and with wooden benches supported over the edge of the concrete steps by steel standards. The present contract provides for placing the permanent seating structure up to the original ground level only, and placing a temporary wooden seating structure above that level. It is expected that this temporary structure will be used only for the Yale-Harvard game on Nov. 21, 1914, and that next year it will be removed and the permanent structure carried to the top of the bank. For the opening game over 75,000 applications for seats were made and in order to accommodate as many as possible 7500 additional temporary seats are being built on the promenade at the top.

The concrete slabs vary in length from 8 to 17 ft., most of the slabs being under 13 ft. long. All except those on the cross-aisle are three steps wide, or 8 ft. overall. They are reinforced in both directions and both top and bottom so as to carry their load if supported only at the edges or only in the middle. One radial joint in the seating slab between each pair of tunnels is filled with Carey's "Elastite" to provide for expansion.

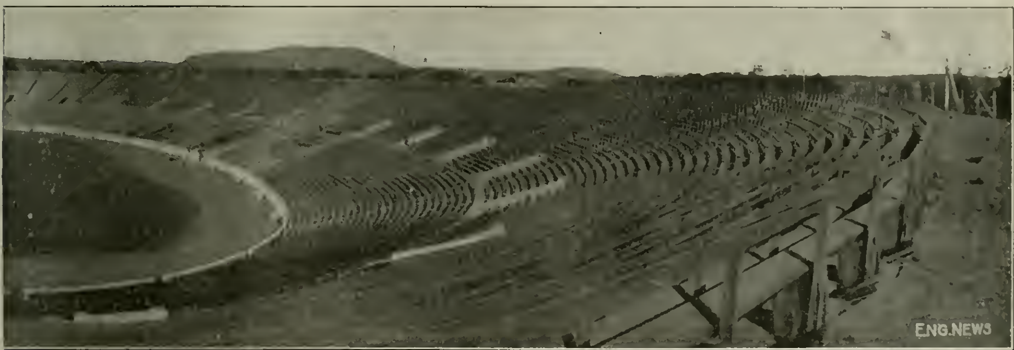
The surface of the steps, both tread and riser, has been given a smooth sidewalk finish with a ½-in. mortar coating placed integral with the concrete. The mortar was colored with lampblack to a dark bluestone, to prevent the glare from the natural cement color.

An aisle leads directly down from the inner end of each tunnel to the playing field, a flight of steps being provided at the foot of the aisle. A cross-aisle connects the inner ends of the tunnels and from this two aisles extend to the top of the bank of seats between each pair of tunnels.

SEATS

The benches are made of 1¾x9¾-in. (finished) planks supported on steel standards or brackets and provided with a back rest consisting of a 1⅛x4¾-in. strip supported on wooden posts bolted to the back side of the steel standard. The steel standards are bolted to the concrete by ⅝-in. Tobin bronze U-bolts. All steelwork is galvanized or sherardized and then painted with a rust-preventive paint. The seat plank is set so that its front edge projects 1½ in. in front of the concrete riser, giving plenty of room for the heels, and it is set so as to slope backward at such an angle so as to give the most comfortable seat. The seat planks are fastened down with lagscrews from underneath so as to leave the top of the seat smooth. The top of the plank is shaped to a special curve determined by experiment and this is thought to be a great improvement in the making of wooden benches. The back rest is curved on the front side so as to have no projecting corners.

The wood for these seats is Douglas fir. This was decided upon after an exhaustive investigation, it being desired to obtain a wood which has a good appearance, which can be obtained in clear lumber and with all vertical grain (to eliminate the picking up of splinters on the top of the seat), and which is as durable as possible.



BY 61,000 SEATS (FROM A PANORAMIC PHOTOGRAPH)

The only woods to fulfill all of these conditions were Douglas fir, Western hemlock and redwood. Redwood was eliminated because it is liable to stain clothing when wet and Western hemlock because it is less durable than the Douglas fir and delivery could not be guaranteed. The only defect allowed in the Douglas fir was a reasonable number of pitch pockets, and trouble from these was eliminated by having the wood kiln dried.

The wood has been treated for preservation by giving it two coats of Carbolineum wood oil, one before erection and one after.

The temporary benches were made similar to those last added to the old wooden football stand, and have a 1⅝x9½-in. spruce seat plank and ⅞x3½-in. spruce back rest. A press box has been built accommodating 100 and provided with ample telephone and telegraph service.

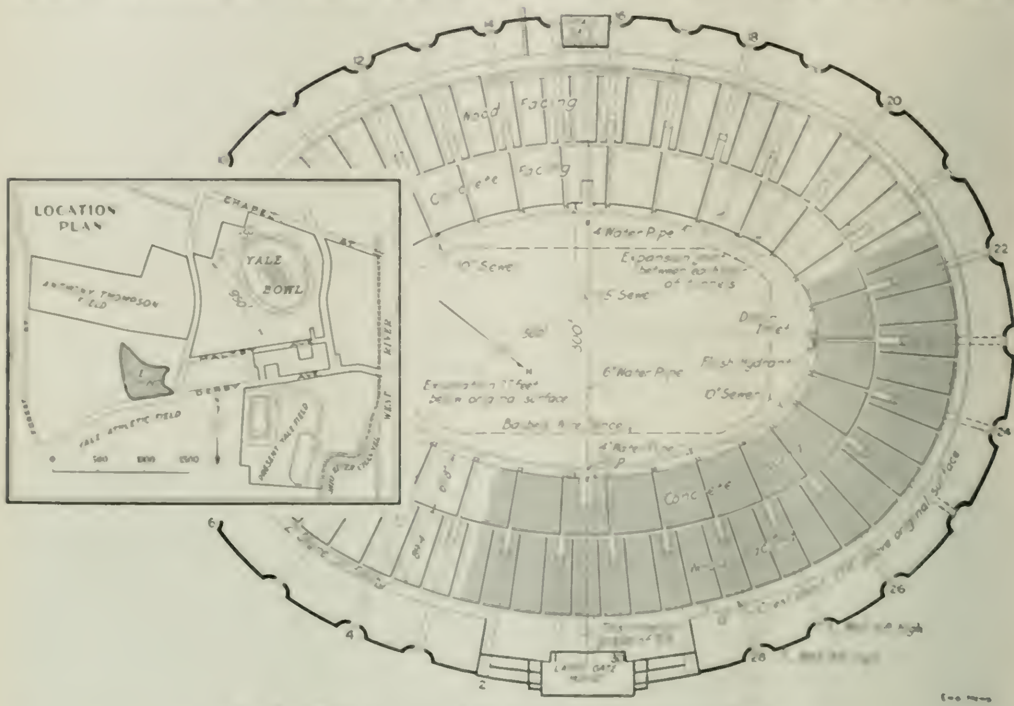


FIG. 2. GENERAL PLAN OF YALE BOWL AND LOCATION PLAN

PLAYING FIELD

The playing field was built on a bed of sand 30 ft. below the original surface of the ground. Special attention was given to designing a field which should be as perfect as possible. It was feared that with the perfect drainage underneath, and only sandy loam to use for surfacing, trouble might be experienced with the field drying out. This condition was met by putting on an extra thick layer of loam (total thickness 18 in.), and mixing into the top layer humus, which is practically a natural leaf mold and has the property of retaining moisture a long time.

FIG. 3. [illegible]

The entire field (and the pipe trenches) were first heavily watered to settle any place which had been accidentally dug below grade, and then an 8-in. layer of black loam was spread and rolled with a 5-ton roller. A second layer was then spread and rolled [illegible] and top dressed to a true surface 17 in. above subgrade. An inch of fertilizer humus was applied and harrowed in, and the surface rolled with a hand roller. Then 2 in. of sod was put on, the field being left 1 in. high to provide for anticipated settlement. The field was turfed the latter part of August except for working space left outside of the gridiron near the wall. Screened loam was spread over the turf and raked in. No further rolling was done until the last of October, when the 5-ton steam roller was put over the field before any practice was allowed on it. The result has been a perfectly smooth field with a fine springy turf.

The field is crowned 12 in. between side walls, 5 in. of this being between the side lines of the gridiron. The crowning was made with a special curve so as to give reasonable drop between the center and side lines without having an excessive drop between the side lines and the wall; it has worked out very well.

Architectural Features

The purely architectural features are in the two large gate-houses, which are expected to be built next year. One of these, the Main Gate House, is 96x47 ft., 42 ft. high, and provides quarters for the home team and for the ticket department. The Small Gate House is 60x43 ft. and 40 ft. high, and provides quarters for the visiting team.

A large stairway is to be built on either side of the Main Gate House, from the top of the bank to the ground, this together with the gate-house providing an impressive feature at the main entrance.

The tunnel portals have been worked out very effectively.

Water-Supply and Drainage

A 6-in. main connected with the city water system is laid into the playing field; a 4-in. main is run around the field and another 4-in. main around the outside of the Bowl. Numerous flush hydrants have been placed to give short lines of hose (2-in.) for watering the grass.

A vitrified drain is laid around the outside of the Bowl and one around the playing field, both emptying into a main drain running to the West River. The water falling upon the seats runs down over the steps to a gutter just in front of the bottom riser, from which it is discharged under the steps leading to the playing field. A small catch-basin located under these steps takes this water and also that which runs off from the playing field.

Automobile Parking Fields

Among the many problems connected with this work, that of handling the enormous traffic was not the least, and the automobile traffic is the most troublesome. The surplus excavation from the Bowl was placed upon the meadow between Yale Ave. and the West River, converting this swamp into 12 acres of good level land, admirably adapted for automobile parking and well above all but extreme floods. This space has been laid out in streets leading to a boulevard along the river, and footpaths between the streets lead toward the Bowl, the arrangement being such that the foot passengers do not cross any street on which the autos travel. Another even larger parking space is provided west of the Bowl.

Fig. 4. General View during Construction of Seatbanks

Contracts

The work has been done under three contracts, all of which were let to the Sperry Engineering Co., of New Haven. The first contract was let in July, 1913, and comprised the main excavation and embankment, the water-supply and drainage systems, the tunnels, and outer and inner retaining-walls. The second contract, let in July, 1914, comprised the seating structure and the parapet walls. The third contract, let in September, 1914, comprised the finishing up of the exterior grading and laying of macadam walks. Work was started on all of these contracts immediately after letting, and they are now practically completed.

Hon. T. De Witt Cuyler is Chairman of the Yale Committee of Twenty-one, Inc., for whom the Bowl is being

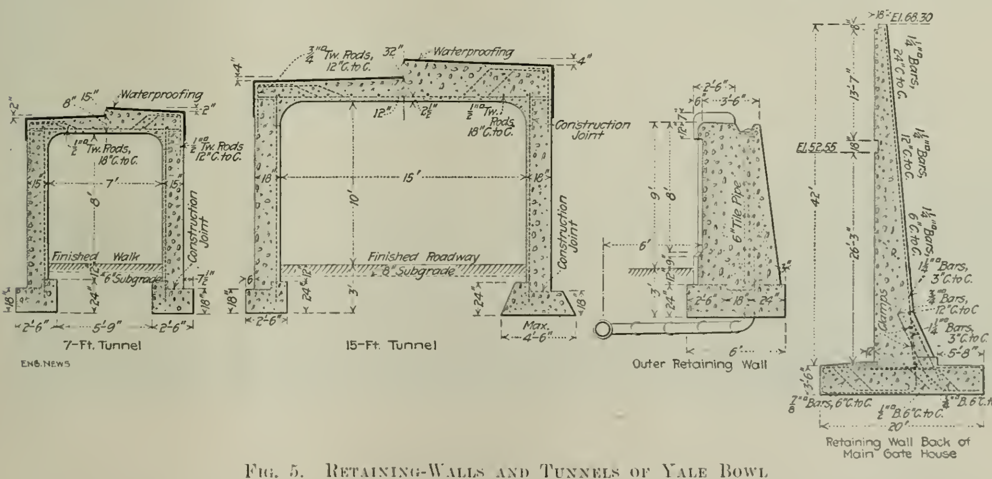


Fig. 5. Retaining-Walls and Tunnels of Yale Bowl

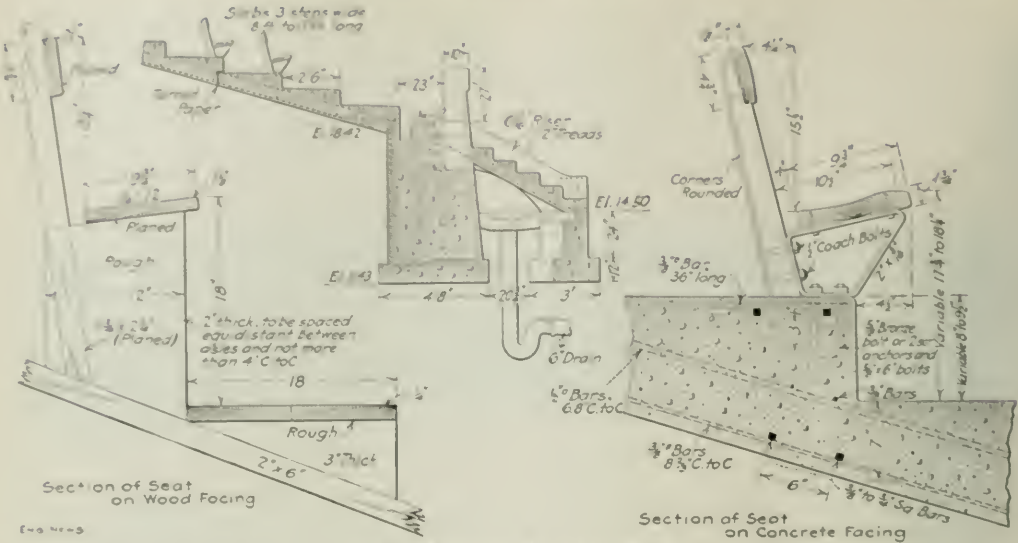


FIG. 6. SEATBANK SLAB AND SEATS

(Seating plank in permanent part of bank was shaped to special curve determined by experiment. The seats are fitted with backs—another unusual feature.)

built. The writer is Supervising Engineer, and C. A. Ferry, who conceived the original design of the Bowl, Resident Engineer. Edward G. Williams, of New York, is Advisory Engineer and Donn Barber, of New York, is Consulting Architect. David Daggett, of New Haven, Secretary of the Committee of Twenty-one, is Chairman of the Structures Committee. The playing field and details of the seating structure have been under the personal supervision of Everett Thompson, Assistant Secretary.

Clearing the Slide in the Panama Canal

We briefly noted on p. 852 of our issue of Oct. 22, the closing of the Panama Canal through Culebra Cut on Oct. 14 and the opening of a channel through it in five days by the canal dredges. A fuller account of the slide and its removal is given in the Canal Record of Oct. 21. We abstract it as follows:

A large slide on the east bank of Culebra Cut, directly north of Gold Hill, [illegible]

[illegible]

FIG. 7. EMBANKMENT OF YALE BOWL DURING CONSTRUCTION

[illegible]

Electric Storage Battery Vehicles [illegible]

The dredges were worked under triple shift. The 15-yd. dipper dredges "Gamboa" and "Paraiso" and the 5-yd. dipper dredge "Mindi" began excavation at the north side of the slide during the night of Oct. 14-15, while the mass was still in motion. The dipper dredge "Cardenas" was added to the fleet on Oct. 15, and during the 16th an extension of discharge pipe was laid from a point opposite Cucaracha slide, which allowed the pipe line suction dredge "No. 86" to take part in the work.

The channel was cleared sufficiently by noon of Oct. 20 to allow the passage during the afternoon of seven vessels, which had been delayed at the south end of the canal. The actual passage of the seven through the cut occupied about four hours; they followed each other at intervals of about half an hour, propelled by their own power, but passing the slide under the control of a tug fore and aft, to hold them to the course. Thirteen vessels were awaiting passage from the Atlantic entrance; nine of them were transferred to the anchorage basin in Gatun Lake, south of Gatun Locks, on Oct. 20, and are being handled through the cut today.

The slide which blocked the canal is 2100 ft. long, and broke back about 1000 ft. from the center line of the channel. It occurred in a part of the bank, formerly involved in the east Culebra slide, and is designated as the "New Culebra" slide. The old slide appeared to be dead, and the channel opposite it had been cleared to almost full width and depth. At the present time, no further movement is indicated, but practically all of the 725,000 cu.yd. involved in the movement of Oct. 14-15 will have to be dredged from the prism, which may cause further motion. The material is masses of rock and earth, in about equal proportions.

Following the preliminary survey made on the morning of Oct. 15, after the slide had come to rest, it was estimated that, unless further movements occurred, the channel could be opened in one week. A still later estimate set Oct. 22 as the first day on which vessels could pass the slide. The performance of the dredging forces in clearing the channel in two days' less time than was believed to be necessary indicates the fitness of the equipment and the loyal persistence of the personnel.

The excavation accomplished by the dredges at the base of the slide, in periods ending at 8 a.m. of each day named, was, in cu.yd.:

Dredge	15th	16th	17th	18th	19th	20th	Total
"Gamboa"	3935	5,160	6,175	6,910	7,800	5,775	35,755
"Paraiso"	4150	6,900	7,625	7,600	6,720	4,975	37,970
"Mindi"	1845	1,000	2,403	2,709	1,640	2,137	11,734
"Cardenas"	....	3,027	3,251	2,031	3,210	2,052	13,571
"No. 86"	....	....	3,825	5,850	6,250	4,650	20,575
Total	9930	16,087	23,279	25,100	25,620	19,589	119,605

The maximum day's output was 25,620 cu.yd. in the period ending at 8 a.m., Oct. 19, or Sunday, when the dredge and towboat crews appeared for duty, without orders or instructions.

On Oct. 31 another slide occurred in the same material north of Gold Hill and blocked the Canal until Nov. 4, when the dredges had cleared the cut sufficiently to allow vessels to pass.

Defeat of Municipal Bond Issues at Dayton, Ohio

The defeat of bond issues for grade-crossing elimination, a municipal electric-light plant and parks and playgrounds by popular vote at Dayton, Ohio, on Nov. 3, was caused by a number of conditions of more than local interest. These conditions are set forth in the following notes sent to Engineering News by S. H. Ankenny, Publicity Manager of The Greater Dayton Association:

Inasmuch as the "Dayton Plan" of municipal government is a subject of great interest at the present time, you may be interested in knowing the result of the first election, at which several municipal issues were at stake, since this form of government has come into power here.

About a month ago, the city commission put up to the people for ratification at the election on Nov. 3, two bond issues: one for $250,000 to be used in buying several dumps and improving them for parks and playgrounds, the other for $1,000,000 to be used in defraying the city's share (35%) of the cost of elevating the joint railroad tracks through the heart of the city.

At about the same time the socialist party, which has been against the new form of government from the first, petitioned the city commission to bring before the voters a bond issue for $500,000 to construct and operate a municipal electric-light plant. The city commission turned this proposition down, believing it would be financially inexpedient to engage in the electric-light business in competition with a private corporation which is now rendering adequate service at a fairly reasonable rate. This corporation has $8,000,000 invested in its local plant and, consequently, a half-million dollar plant would be at a great disadvantage and would be inadequate to meet the needs of all but a small portion of the city. The socialists took the proposition over the heads of the city commission by securing enough signatures to their petition to demand a referendum.

At the same time, the Greater Dayton Association began an active campaign for the passage of the bond issues for parks and playgrounds and grade-crossing elimination, and the defeat of the bond issue for the municipal electric-light plant. The vote Tuesday had the following results:

	For	Against
Parks and playgrounds..............	9,784	16,931
Grade-crossing elimination...........	10,453	15,871
Municipal light plant................	9,193	13,174

From these results it is seen that all of the propositions were defeated. While the city commission lost its proposed bond issues for parks and playgrounds and track elevation, it secured the indorsement of the voters in turning down the municipal electric-light plant.

The one great factor in the adverse vote on the bond issues was the present business conditions and the feeling of financial stringency prevalent throughout the country. There was also sectional opposition, as some parts of the city were opposed to track elevation because the plan did not include the elimination of grade crossings in these suburban districts. Other parts of the city were well provided with parks and, therefore, took an independent attitude upon this question. The municipal light plant, of course, attracted a large number of voters who favor municipal ownership in any form without regard to the reasonableness of the question at hand.

The result of the vote is not considered unfavorable to the city commission. In fact, it puts the present administration in a better position than it was previous to the election, inasmuch as there has been considerable agitation for track elevation and parks and playgrounds, and now all responsibility for failure to secure these things has been placed upon the people at large. There would undoubtedly have been criticisms of the city administration if these questions had not been put before the voters at this time.

NEWS NOTES

Bridge Falsework Was Washed Out at the new Milwaukee Bridge over the Chehalis River, at Mays, Wash., on the Puget Sound & Willapa Harbor Ry. The accident was caused by a log jam.

A 6½-Ft. Rise in the South Canadian River carried out six bents of a timber bridge on the Rock Island Lines, at Bridgeport, Okla., on Oct. 25. Two other similar accidents have occurred this year at the Bridgeport bridge.

A Fire at the New York Dock Co., Brooklyn, N. Y., early on Nov. 9, destroyed a nine-story brick building which contained the machinery for operating two adjoining grain elevators. The origin of this fire is unknown, as was that of the destructive pier fire of the Sicula-Americana line ("Engineering News," Nov. 5), which occurred on Nov. 4, within 150 ft. of the present blaze. The damage caused by the New York Dock Co. fire is estimated at $100,000.

A Collision of Electric Street Cars at Chicago occurred Nov. 3 in the Van Buren St. tunnel under the Chicago River. The tunnel has grades of 6.32% on the west and 11.06% on the east (Engineering News, Sept. 13, 1906). A car that had just passed the center of the tunnel and started up the eastern grade was stalled by the trolley pole jumping off the wire. The rules require that in such cases the conductor shall go back to stop following cars, but in this case the conductor at once mounted to the roof of the car to replace the trolley. Owing to the steep grades, the roof of the tunnel hid the standing car from the motorman on the next car until it was too late to stop, and it is reported that the air-brake did not work properly. One man was killed and five persons were injured. The conditions of steep grades and heavy traffic in the three Chicago River tunnels of the street-railway system would seem to call for the installation of some automatic block-signal system to indicate to each car its clearance from the car preceding.

A Convention of Alabama City Officials has been called by [illegible] of Alabama [illegible] for the purpose of [illegible] League of Municipalities. Address [illegible] of Engineering.

Buffalo, N. Y., Adopted Commission Government by [illegible] on Nov. 3. The general principle was approved [illegible] a few years ago, but it was not until [illegible] charter bill could be got through the [illegible]. [illegible] the bill was vetoed by the [illegible] the vote. (Legislation affecting [illegible] in New York State goes to the mayor for action.)

A Third High-Level Bridge across the Cuyahoga River valley at Cleveland, Ohio, was authorized by a county referendum [illegible] Nov. 3. While it is expected that the [illegible] Lorain Ave. route will be selected, the County Commissioners have asked the city and federal authorities to cooperate in picking [illegible] route which not only will give a desirable crossing but [illegible] to the necessary straightening of the Cuyahoga River. The [illegible] vote authorized a [illegible] bond issue.

Work on the Badin Hydro-electric Development of the Southern Aluminum Co., near Whitney, N. C., is reported to [illegible] although in an advanced stage on a [illegible]. As noted in "Engineering News," June 1, 1911, some 12,000 hp. was being made available for smelting operations. The project was being promoted by [illegible] French [illegible] and the engineers in charge of design and construction are reported to have returned to France.

The Ontario "Hydro-radial" Electric Railway Scheme, proposed to be built jointly by several municipalities and the Hydro-electric Power Commission (as noted in "Engineering News," April [illegible], 1914, p. [illegible]) were approved on Oct. [illegible] at elections in [illegible] towns out of 13 involved. The interurban lines under discussion at present extend from Toronto to Newmarket and Port [illegible], about 2[illegible] and 3[illegible] miles respectively. The construction work must wait on securing a promised provincial subsidy.

Stockton St. Tunnel Delayed by Strike—Work on the Stockton St. tunnel, San Francisco, described in "Engineering News," Jan. [illegible], 1914, p. 1[illegible], has been delayed by a strike of the local Plasterers' Union. This organization is dissatisfied [illegible] the tunnel is not plastered in accordance with the [illegible] of the plasterers, who would like the city to [illegible] to give the interior lining a smooth [illegible], despite the fact that it will probably be lined with [illegible] in the near future.

Bonds for Sewage-Treatment Works at Norristown, Penn., were defeated by a majority vote of three to one, on Nov. 3. The vote appears to have been [illegible] a defiance of the Pennsylvania State Department of Health, which we understand had ordered the Borough of Norristown to provide [illegible] works. [illegible]

Prizes for Essays on Highway Construction [illegible]

Freight Rates on Long and Bulky Materials [illegible]

A Tunnel in the City of San Francisco [illegible] Pacific Exposition has been given a rate of [illegible] per car for exhibits. The bore is [illegible] ft. in length and extends from Van Ness Ave. through Fort Mason [illegible]. Bates, Borland & Ayer are the contractors.

The Reconstruction of the Missouri River Bridge of the Chicago, Burlington & Quincy R.R. at Kansas City, Mo., has been contemplated, and some study of the situation has been made by the railway company, but we are informed officially that there is no prospect of any work being done in the near future, especially in view of the present financial situation. The general plan is said to be to construct a new double-track bridge a short distance upstream from the present single-track bridge. This present bridge is quite strong enough for the modern equipment, but the main purpose of a new structure would be to increase the train capacity by means of a double track. The old bridge, known as the Hannibal Bridge, was built in 18[illegible], but its superstructure was rebuilt in 1891. It has six fixed truss spans and a swing span.

More Rapid Reinforced-Concrete Construction—In our issue of Nov. 12, 1914, p. 966, we noted a large concrete warehouse in Brooklyn on which very rapid work was done. We now have to report similar fast construction on the new building now nearing completion for the Stanley Works at New Britain, Conn. This building, which is being put up by the Aberthaw Construction Co., of Boston, measures 63x2[illegible]3 ft., seven stories and basement. Ground was broken during the first week of August, the foundations poured on Aug. 2[illegible] to Sept. 11, the first-floor slab on Sept. 14 to 16, the second-floor slab Sept. 17 to 19, the third-floor slab on Sept. 24 to 2[illegible], the fourth-floor slab on Oct. 1 to 5, the fifth-floor slab on Oct. [illegible] to 12, the sixth-floor slab on Oct. 15 to 21, the seventh-floor slab on Oct. 24 to 2[illegible]. Roof centering was erected Oct. 2[illegible], and the last section poured Nov. 5.

The Flood Prevention Committee of the Miami Valley, Ohio, has decided to complete plans for flood protection without waiting for the final court decision on the legal questions involved, and the following men have recently joined the staff of the Morgan Engineering Co., which is making these plans: J. H. Kimball, M. Am. Soc. C. E., formerly Acting Chief Engineer for the Commissioners of Sewerage of Louisville, Ky.; B. M. Jones, formerly with the Electric Bond & Share Co., New York City; Walter M. Smith, M. Am. Soc. C. E., formerly Designing Engineer, and H. S. R. McCurdy, M. Am. Soc. C. E., formerly Division Engineer of the Board of Water Supply of New York City; Alfred B. Mayhew, Assoc. M. Am. Soc. C. E., formerly Designing Engineer on Arrowrock Dam, Idaho, U. S. Reclamation Service; S. M. Woodward, M. Am. Soc. M. E., Professor of Hydraulics, Iowa State University. Final hearing before the Supreme Court of Ohio on the constitutionality of the Ohio Conservancy Act will be held Nov. 12.

An 8-ft. Waterway in Illinois, connecting the Chicago drainage canal with the Illinois River, has been proposed as a substitute for the former projects for waterways having depths of 14 and 2[illegible] ft. to the Mississippi River. A report on this new project has been made to Governor Dunne by a board of engineers composed as follows: [illegible] [illegible]

The Specifying of a Patented Pavement by the city of [illegible], N. Y., has been upheld by the New York Supreme Court [illegible]

A 2,500,000-gal. Steel Water Tank, 100 ft. in diameter and 44 ft. 3 in. high, is being built by the Massachusetts Metropolitan Water Board, on Belleview Hill, in West Roxbury, to serve as a reservoir for the Southern Extra High Service. The concrete foundation has been completed by John E. Palmer, Boston, Mass., and the work of erecting the steel is being done by Walsh's Holyoke Steam Boiler Works, Holyoke, Mass. The bottom of the tank, which rests directly on the concrete foundation, is of ⅜-in. plates, while the side plates vary from ⅞-in. at the bottom to ⅜-in. at the top, there being seven courses. The horizontal lap joints are double riveted and the vertical butt joints have plates on both sides with special rivet arrangements. The lowest course of side plates is connected to the bottom by means of 6x3½x¾-in. Ls and the top of the tank is stiffened by 3x⅜-in. Zs. The steel for the plates conforms to the Standard Specifications of the American Society for Testing Materials for flange steel, except that the tensile strength is required to be between 57,000 and 62,000 lb. per sq.in. The butt joints are planed so as to be in perfect contact throughout and all calking edges are beveled. Rivet holes in all plates thicker than ⅜ in. are either drilled from the solid or punched $\frac{3}{16}$ in. smaller and reamed.

PERSONALS

Mr. Ralph H. Wilson has been appointed Advertising Manager of the Walter A. Zelnicker Supply Co., St. Louis, Mo.

Mr. W. L. Schneider has been appointed Inspector of Transportation of the Delaware & Hudson Co., with offices at Albany, N. Y.

Mr. S. E. Hutton, M. Am. Inst. E. E., Consulting Engineer, of Moscow, Idaho, has been appointed Engineer of the Public Utilities Commission of Idaho.

Mr. Olin H. Landreth, Professor of engineering at Union College, Schnectady, N. Y., has been elected a district delegate to the State Constitutional Convention.

Mr. M. F. Clements, M. Am. Soc. C. E., of Ridgefield, Wash., has been appointed Engineer in charge of track elevation of the Northern Pacific Ry. at Spokane, Wash.

Mr. H. N. Underhill, formerly with the Underpinning & Foundation Co., New York City, is now associated with the MacArthur Concrete Pile & Foundation Co., 11 Pine St., New York City.

Mr. H. M. Sperry, M. Am. Soc. C. E., for many years Sales Engineer of the General Railway Signal Co., Rochester, N. Y., has been appointed Manager of the department of publicity and education recently organized by his company.

Mr. R. J. Potts, former Professor of highway engineering at the Agricultural and Mechanical College of Texas, and recently with the Potts-Moore Gravel Co., Waco, Tex., has been appointed Engineer of the proposed country drainage district, including part of the City of Waco.

Mr. Elmer Ambrose Sperry, M. Am. Inst. E. E., of New York City, has been awarded the John Scott Legacy Medal and Premium by the City of Philadelphia, acting on the recommendation of the Franklin Institute. Mr. Sperry is made this award in recognition of his gyro compass.

Mr. M. Liebel, Jr., President of the Liebel-Binney Construction Co., General Contractors, Erie, Penn., has been elected a member of Congress from the 25th Pensylvania district. Mr. Liebel is also President of the Vulcan Rubber Co. and is identified with many manufacturing interests in Erie.

Mr. A. C. Bradley, recently Road Master of the Chicago, Rock Island & Pacific Ry. at Iowa City, Iowa, has been appointed Division Engineer of the Oklahoma division, with headquarters at El Reno, Okla., succeeding Mr. Garrett Davis, who has been transferred to the valuation work of the railway.

President R. C. Sturgis, of the American Institute of Architects, has appointed the following members of a committee to act in an advisory capacity to the Lincoln Highway Association: Messrs. Elmer C. Jensen, of Chicago, Ill ; Wilbur T. Mills, of Columbus, Ohio, and Benjamin Hubbell, of Cleveland, Ohio.

Mr. E. N. Brown, for many years President of the National Rys. of Mexico, has resigned. He has been connected with the construction and operation of the Mexican Rys. since 1887, when he was Engineer in charge of construction of the railway from Saltillo to San Luis Potosi. Later he was made Division Superintendent of this division.

Mr. Garrett B. James, of the engineering staff of the Underwriters Laboratories, Chicago, Ill., has been appointed Consulting Engineer of the U. S. Bureau of Mines, to carry on an investigation of the subject of oil fires. Mr. James has been granted a three months' leave of absence by the Laboratories and is now in the Texas oil fields.

Messrs. C. S. Rindsfoos, recently Secretary-Treasurer of the Foundation Co., New York City, and N. C. Fallor, recently Manager of the machinery department of the Canadian Fairbanks-Morse Co., Montreal, Que., announce that they have formed the United States Purchasing Corporation, with offices in the Woolworth Building, New York City.

Mr. Lynn E. Perry, Jun. Am. Soc. C. E., has been admitted to the firm of Oldfield & Brady, Cairo, Ill. The firm will be known under its present name. Mr. Perry was formerly with the staff of the New York City Board of Water Supply and the Philadelphia Bureau of Surveys. He will take charge of sewer and drainage projects soon to be begun by the firm.

Governor Haines, of Maine, has appointed three lawyers, Messrs. Benjamin F. Cleaves, of Biddeford; William B. Skelton, of Lewiston, and Samuel W. Gould, of Skowhegan, members of the State Public Utilities Commission, created by the new law which went into effect Oct. 30. The salary of the chairman is $5000 per annum, and of the other two members, $4000 per annum.

Mr. John M. Rapelje, recently Assistant General Manager of the Northern Pacific Ry. at St. Paul, Minn., has been promoted to be General Manager of the lines east of Paradise, Mont., succeeding the late E. A. Goodell. Mr. Rapelje was born in Canada in 1857 and began his railway experience as a brakeman on the Grand Trunk Ry. In 1898 he was a conductor with the Northern Pacific.

Mr. H. S. Van Scoyoc, Assoc. M. Am. Soc. C. E., recently Inspecting Engineer of the Canada Cement Co., Ltd., Montreal, Que., has been appointed Chief Engineer of the Toronto-Hamilton Highway Commission, which is to build a new highway between Toronto and Hamilton, Ont. Mr. Van Scoyoc was born in Philadelphia, Penn., and is a graduate of the University of Pennsylvania.

Mr. J. Vipond Davies, M. Am. Soc. C. E., Vice-President of Jacobs & Davies, Inc., Consulting Engineers, 30 Church St., New York City, has been awarded the Telford Gold Medal of the Institution of Civil Engineers, London, England, for his paper on the "Extensions of the Hudson River Tunnels of the Hudson & Manhattan R.R." This is the most coveted honor conferred by the Institution of Civil Engineers for the literary and professional accomplishments of its members.

Mr. F. C. Magruder, Assoc. M. Am. Soc. C. E., who for the past 11 years has been with the United States Reclamation Service, having been in charge of the Belle Fourche Project in South Dakota for the past four years, and Stephen C. Berry, also formerly with the U. S. Reclamation Service, have formed a partnership to engage in the general practice of engineering at Belle Fourche, South Dakota. Special attention will be given irrigation systems, drainage systems and municipal water-works.

Mr. Walter T. Spencer, Assoc. M. Am. Soc. C. E., former Division Engineer of the New York, New Haven & Hartford R.R. at Waterbury, Conn., and Providence, R. I., has been promoted to be Division Superintendent of the Old Colony division, with headquarters at Taunton, Mass., succeeding Mr. H. C. Oviatt, promoted. Mr. Spencer was born in 1869 and graduated from Sheffield Scientific School, Yale University, in 1890. He was Division Engineer from 1893 until September, 1914, when he changed to the operating department as Trainmaster at Providence, R. I.

Dr. J. A. L. Waddell and Mr. John Lyle Harrington, M.'s Am. Soc. C. E., announce the dissolution of the firm of Waddell & Harrington. The firm's business will be conducted as usual until the conclusion of its affairs in July, 1915, except that it is accepting no new commissions. Dr. Waddell will give his attention to special engineering and financial matters and to important advisory work. Mr. Harrington will be joined by the firm's Associate Engineers, Messrs. E. E. Howard, M. Am. Soc. C. E., and Louis R. Ash, M. Am. Soc. C. E., in the establishment of the firm of Harrington, Howard & Ash, Consulting Engineers. Mr Howard has been associated with Dr. Waddell for 14 years; for many years he was Principal Assistant Engineer and later Associate Engineer of the firm of Waddell & Harrington. Mr. Ash was formerly City Engineer of Kansas City, Mo., which office he resigned to become Associate Engineer and Office Manager of Waddell & Harrington. The new firm of Harrington, Howard & Ash is already engaged in a general consulting practice, including the design and construction of movable bridges. The principal office of the new firm is 1012 Baltimore Ave., Kansas City, Mo.

OBITUARY

Charles J. [illegible], a mining engineer, of San Francisco, Calif., died Nov. 1.

William H. [illegible], Treasurer and Superintendent of the [illegible] & Boiler Co., Cleveland, Ohio, died Oct. 9.

John Kilgour, former President of the Cincinnati Street Ry. Co., died Oct. 27, at his home in Cincinnati, Ohio, from [illegible]. He was [illegible] years old.

Charles O. Kruger, President of the Philadelphia Rapid Transit Co., died Nov. 1, in the rooms of the Racquet Club. He was born in Philadelphia in 1861.

Charles M. Gould, Vice-President and Treasurer of the Gould Coupler Co. and the Gould Storage Battery Co., New York City, died Oct. 20 at his home in Bayside, Long Island. He was born in Buffalo, N. Y., in 1873. He was the son of Charles A. Gould, founder of the company.

Emil Kuichling, M. Am. Soc. C. E., one of the best known American hydraulic engineers, died on Nov. 9, at his home in New York City. Mr. Kuichling was born at Kehl, Germany, Jan. 26, 1848. In his early youth he came to the United States and was graduated from the University of Rochester as a civil engineer in 1868; he later studied at Carlsruhe, Germany. His early engineering work was in connection with the New York State canals, of which he was chief engineer from 1880 to [illegible]; since that time he has been in consulting practice in New York City. A more extended biography of Mr. Kuichling will appear in our next week's issue.

F. Augustus Heinze, M. Am. Inst. M. E., owner of large copper interests in the West, died Nov. 4, at his home in Saratoga, N. Y. He was born in Brooklyn in 1869 and was educated at the Brooklyn Polytechnic Institute and the Columbia University College of Mines, where he graduated in [illegible]. After studying some time in Germany, he went to Montana, where he became, when not more than 30 years old, a prominent figure in the copper mining industry. Of late years he gained considerable notoriety because of his connection with several banking institutions, and he was indicted by a federal grand jury for mismanagement of the Mercantile National Bank, New York City.

Henry Gannett, Geographer of the U. S. Geological Survey, [illegible] one of the founders of the National Geographic Society, died at his home in Washington, D. C., Nov. [illegible]. He was the father of Farley Gannett, Assoc. M. Am. Soc. C. E., [illegible] of the Pennsylvania Water Supply Commission. Henry Gannett was born in Bath, Maine, in 1846. He graduated from Lawrence Scientific School, Harvard University, in [illegible]. He served as a topographer on the Hayden survey of the territories before the formation of the U. S. Geological Survey. [illegible]

ENGINEERING SOCIETIES

COMING MEETINGS

[illegible]

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 1-4. Annual meeting at New York City. Secy., Calvin W. Rice, 29 W. 39th St., New York City.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 2-4. Convention at Washington, D. C. Secy., D. Knickerbacker Boyd, The Octagon, Washington, D. C.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.
Dec. 7-11. Annual meeting in New York City. Secy., Percy H. Wilson, Bellevue Court Bldg., Philadelphia, Penn.

AMERICAN MINING CONGRESS.
Dec. 7-11. Annual meeting at Phoenix, Ariz. Secy., J. F. Callbreath, Denver, Colo.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.
Dec. 9-12. Convention at Richmond, Va. Secy., C. A. Prosser, 140 W. 42d St., New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Dec. 10-11. Annual meeting at New York City. Secy., D. H. Cox, 29 W. 39th St., New York City.

AMERICAN ROAD BUILDERS' ASSOCIATION.
Dec. 14-18. Convention at Chicago, Ill. Secy., E. L. Powers, 150 Nassau St., New York City.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Dec. 28-30. Annual meeting at Madison, Wis. Secy., F. M. White, Madison, Wis.

Society for the Promotion of Engineering Education.—The annual meeting will be held at the Iowa State College, Ames, June 22-25. The Secretary is H. H. Norris, 29 W. 39th St., New York City.

American Institute of Consulting Engineers.—The following questions will be considered, at a meeting of the Institute to be held at 8 p.m., Nov. 12, at the City Club, New York City: "A Memorial to Alfred Noble"; "Legislation for the Registration of Engineers"; "The Coming Constitutional Convention in New York State."

Pan-American Scientific Congress.—The United States through the Department of State has invited all the governments of this hemisphere to a Pan-American Scientific Congress, to be held in Washington, D. C., in October, 1915. The first congress of this kind was held in Santiago, Chile, Dec. 5, 1908. The business enacted will be of a general scientific nature, including a department of engineering. The five national engineering societies of the United States, Civil, Mining, Electrical, Naval Architects, and Mechanical Engineers, have been invited to assist in the preparation of the program on engineering. It is believed that this assistance should include suggestion of authors of papers, suggestion of names of the biggest men in the engineering field in the different countries, and urge their appointment as delegates to the congress, and to see that adequate reception for them is provided by the industrial [illegible] of the United States.

American Road Congress.—The [illegible] of these congresses opened on Monday, Nov. [illegible], with a registration of [illegible]. The first session was addressed by Governor Slaton and Senator Hoke Smith, of Georgia, and by Mayor Woodward, of Atlanta. At the same session Logan Page, Director, Office of Public Roads, Washington, D. C., said:

[illegible]

[illegible]

American Concrete Institute.—[illegible]

Engineering News

VOLUME 72 NOVEMBER 19, 1914 NUMBER 21

Erecting the Snake River Viaduct: O.-W. R.R. & Nav. Co.

By W. J. Howard*

The new Snake River cutoff of the Oregon-Washington R.R. & Navigation Co., between Hooper and Ayer, Wash., is a single-track line 17 miles long, which reduces the distance between Spokane and Walla Walla by 30 miles and reduces the grades so that the standard trainload can be increased from 30 cars to 40 loaded cars. This line was put in operation on Oct. 1, 1914.

The construction of the line presented many difficult problems. In the 14 miles from Hooper to the Snake River there are seven tunnels (three on a 6° curve) and four bridges. Three of the bridges cross the Palouse River, which the road follows for the first 11 miles, and which is a small stream in a cañon 50 to 150 ft. wide at the rim and 50 to 280 ft. deep. As the work reached a bridge site, the erection contractor built the bridge, allowing the construction outfit to cross the cañon and continue the work to the next bridge site.

The Snake River Viaduct, which is the last and longest of the bridges, is an important structure, 3920 ft. long, with a maximum height of 300 ft. above the water. It is composed as follows: Five 60-ft. and eighteen 80-ft. deck-girder spans, three riveted-truss deck spans of 226 ft., one of 206 ft. and one of 246 ft. This last was over the low-water channel and was the center one of the five truss spans.

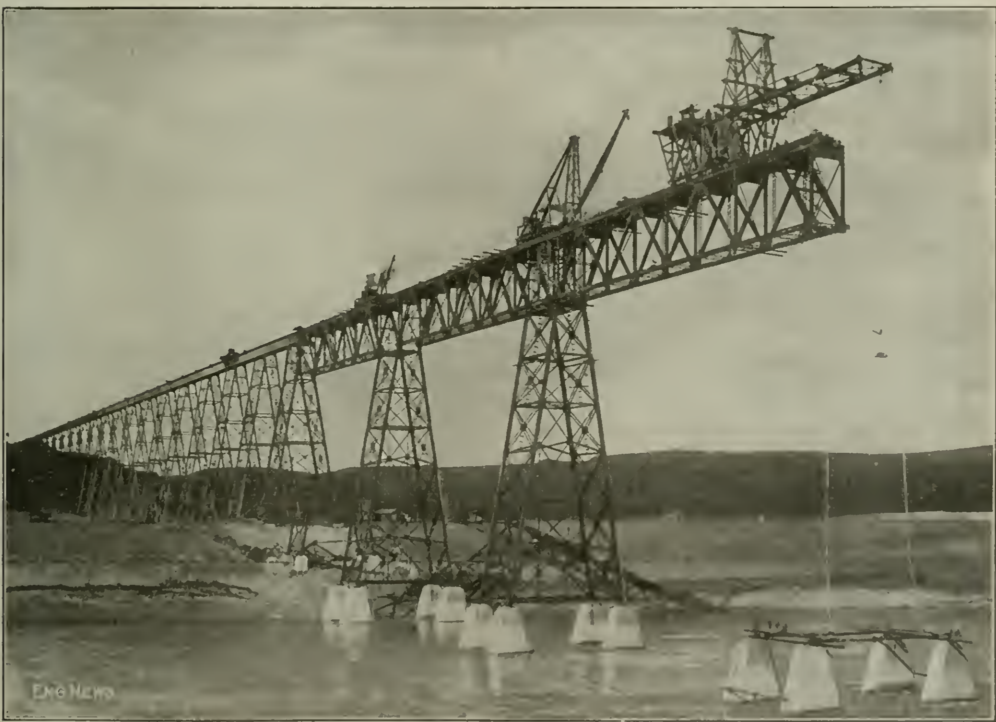


Fig. 1. Cantilever Erection of the 246-Ft. Truss Span of the Snake River Viaduct: O.-W. R.R. & Nav. Co. (300 Ft. above the Water)

(This shows the traveler, the large derrick car and the small derrick car. This last, with a dinky locomotive, delivered material from the bridge yard. On the river bank may be seen the pedestals and base of the temporary steel tower used at the middle of the first truss span.)

Erection of the East Viaduct Approach

The erection beginning at the Hooper (or Spokane) end consisted of three 60-ft. and fifteen 80-ft. deck-girder spans, and 18 four-post towers with their 40-ft. girder

*Engineer, Kelly-Atkinson Construction Co., Chicago.

bays. The height of the towers increased from 33 to 180 ft. The erection of this approach to the truss spans was started Feb. 18, 1913, and completed May 26, 1913. Fig. 1 shows the truss spans under erection and the viaduct approach completed at the Spokane end.

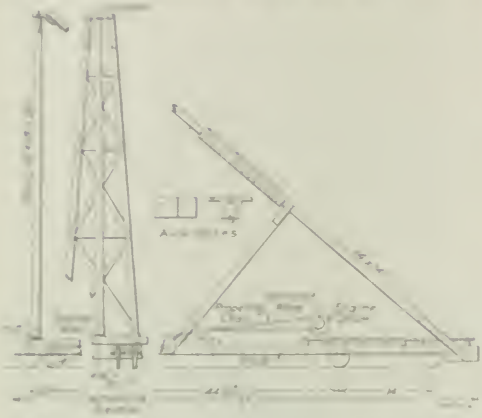


FIG. 2. SELF-PROPELLING DERRICK CAR FOR THE ERECTION OF THE SNAKE RIVER VIADUCT

The rig used was a "mule" traveler or derrick car 70 ft. long and 12 ft. wide, with a deck of 9x18-in. timbers. This is shown in Fig. 2. It was mounted on four sets of wheels, each consisting of four car-wheels on a $4\frac{1}{4}$-in. axle, the two inner wheels being on a gage of 4 ft. $8\frac{1}{2}$ in. and the two outer wheels on a gage of 10 ft. Two sets of idler wheels (with no flanges) were also provided on the 10-ft. gage. The A-frame was of 14x14-in. timbers spread 11 ft. c. to c. at the sill and about 4 ft. at the head frame or spider. The stiff-legs were 14x14-in. timbers, spliced, their lower ends bolted to the deck, behind the engine, and their upper ends bolted to the gooseneck plates. The mast was a 50-ft. timber 18x18 in., with its foot set in a standard derrick shoe and its head having a 5-in. gudgeon pin fitted to a hole in the spider, which was built of channels and plates. The boom was a 72-ft. timber 16x16 in., trussed on four sides with 4x12-in. timbers blocked out at the center and quarter points. It was swung by lines led to a niggerhead on the engine.

This rig was built on the ground from timbers that were at hand, which accounts for its ungainly appearance. The hoisting engine had cylinders $8\frac{1}{4}$x10 in., and the first of its three drums was replaced by a split sprocket wheel placed on the drum shaft. A similar sprocket wheel was placed on the axle of the second set of wheels under the front end of the derrick car. These wheels were connected by a 1-in. chain, and in this way the rig was made self-propelling.

The steel for this east approach viaduct was unloaded at Hooper, the yard at the bridge site not being ready to receive it and the foundation contractors requiring all the car space available for their own equipment. The steel was loaded as required by the yard derrick, and taken to the bridge site by a "dinkey" or small locomotive and a derrick car, and the latter unloaded the material upon a temporary platform. The large derrick car then backed up to the platform (about 200 ft.), picked up the steel, ran it forward and erected it in place.

In the first place, the nearest bent for the towers was erected complete, then the girders of the end span were placed, and the derrick moved out on them to complete the tower. The bents for the higher towers, or those having two or more sections, were guyed longitudinally at the column splices before the car moved ahead to complete the tower.

It was necessary to enthaul the columns of the first

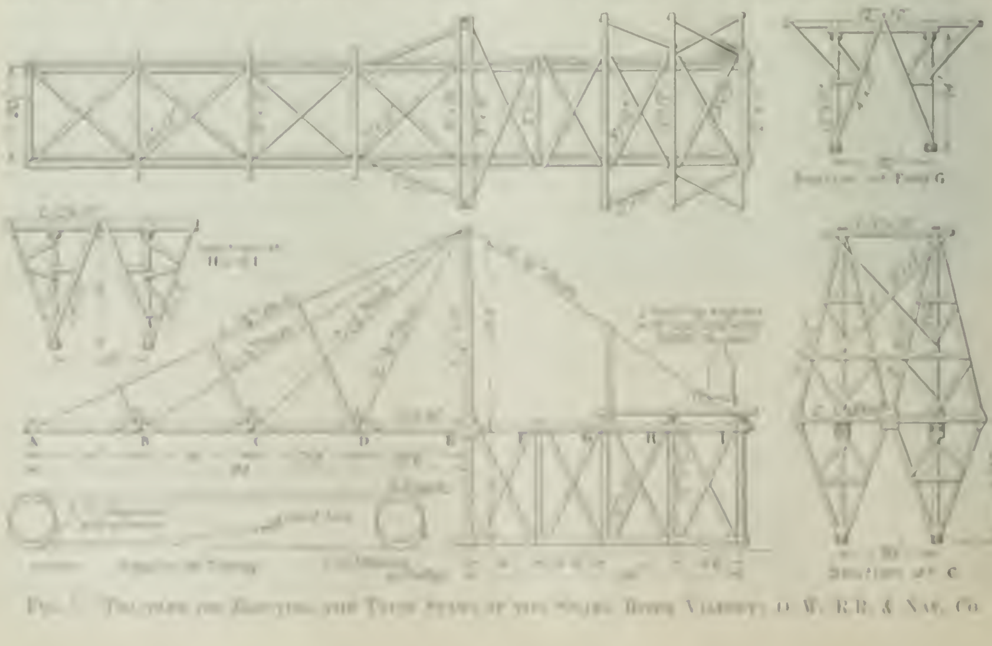


FIG. 3. TRAVELER FOR ERECTING THE TRUSS SPANS OF THE SNAKE RIVER VIADUCT; O. W. R.R. & NAV. CO.

bent of each tower in the 80-ft. spans, the longest outhaul being 21 ft. However, this gave no trouble as there was plenty of drift or leeway.

After the erection of this approach the work was delayed until December, 1913, on account of changes in the plans and by shop delays.

Erection of the Truss Spans

The truss spans were erected as cantilevers, except that the first span had a temporary tower at mid-length. In December, 1913, the erecting contractor started to frame the traveler shown in the accompanying Fig. 3, this is shown also in the view, Fig. 1. The traveler had two 94-ft. horizontal booms for trolleys; these were spaced 20 ft. c. to c., which was the spacing of the top chords of the spans. It was framed and assembled on shore before being erected in place on the completed half of the first 226-ft. truss span.

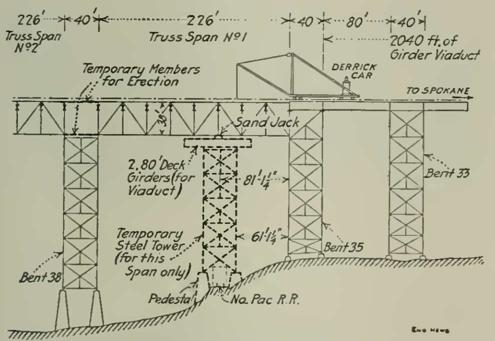


Fig. 4. Temporary Tower Used to Support the First Half of the First Truss Span

This part of the truss span had been erected with its shore end on its permanent tower. The outer end was supported by a temporary tower, as shown in Fig. 4. This tower was composed of parts of one of the river towers capped with two 27-ton 80-ft. girders for the first girder span next to the truss spans at the opposite end of the bridge. These girders were specially designed and made about 7 tons heavier than the rest of the 80-ft. girders, for the purpose of using them to cap the temporary tower and support the projecting end of the truss span. They were the heaviest single pieces handled, with the exception of the 31-ton erecting devices. The temporary tower was erected by the big "mule" derrick car (Fig. 2).

This first half of the first truss span was supported at panel-points L5 by two shoe castings for one of the river towers. These castings rested upon the 58-in. wood plungers of the sand jacks shown in Fig. 5, these jacks resting upon the upper grillage. The lower grillage spanned the two 80-ft. girders. The temporary tower had concrete pedestals similar to those for the permanent towers. It spanned the line of the Northern Pacific R.R. along the river bank, and the bracing of the lower panels of its sides had to be designed to lie outside of the clearance limits for trains, as indicated in Fig. 4. It was 40x68 ft. at the base, and the diagonal bracing in the bottom panels was of 12x12-in. timbers.

This half span being in place, the traveler was erected upon it and finished the other half of the span as a cantilever. The permanent tower was then erected beneath the end of the span, and the trusses lowered upon it by means of the sand jacks. The plungers of these jacks, composed of 12x12-in. fir timbers, had crushed down more than was expected during the erection of the span, and there was barely ½ in. to spare in placing the shoes for the truss seats. The jacks were intended to provide 2-in. clearance, and designed for a load of 350 lb. per sq.in. on the sand.

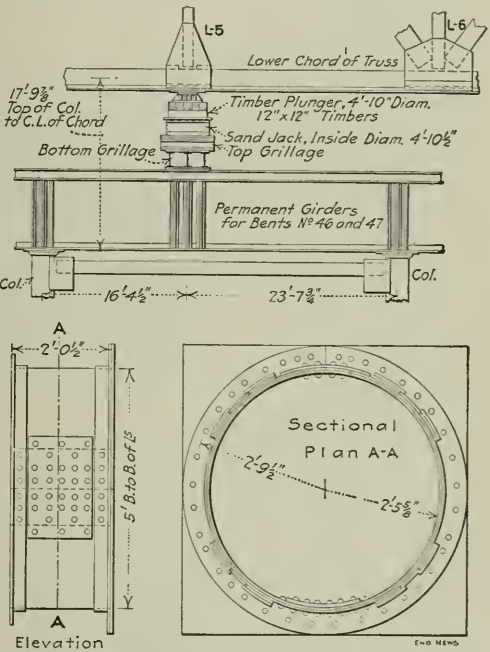


Fig. 5. Sand Jacks for Lowering the First Truss Span to Rest on Its Outer Tower

(The sand jacks were on the temporary tower, as shown in Fig. 4.)

The erecting device used to hold or anchor the cantilever for the other spans consisted of the usual compression members butting against the ends of the bottom chords and tension members pinned to the top chords of the previous span, as shown in Figs. 1 and 4. A wedge between two pins at the center of the tension members allowed the necessary adjustment for erection and for lowering the span upon the tower when completed. The wedge was operated by a screw by men standing on a platform slung below this temporary member. It was operated from beneath instead of from above in order to allow clearance for the traveler in passing over it.

The steel for the truss spans and the west approach was unloaded at the bridge site, and as required it was loaded upon car trucks or buggies and run out to the traveler by the dinky engine. The towers for the truss spans were erected complete under the spans before lowering the latter upon them. It was necessary to outhaul the lower columns, and this was done by means of a runner line at the end of a timber outrigger bolted to one end of the piers, as shown in Fig. 6. With over 200 ft. of drift this worked very well for the bottom section.

The middle sections [illegible] closer [illegible] and as there was [illegible] corresponding [illegible] the [illegible] of [illegible] the erection of both sections was [illegible].

Erection of the West Viaduct Approach

At the Ayer or west end of the bridge, the two 60-ft. girder spans and the first of the three 80-ft. spans were erected (starting at the shore end) by a derrick car with a [illegible] boom.

A special feature of the work was that the first bent of the tower for the 80-ft. span was assembled in an inclined position. This bent was 113 ft. high. It stood at an angle of about 60°, leaning against two timber bents fixed to the next tower. The lower end of one leg was in such position that it would engage the anchor bolts in the base plate when the bent was tipped into position. The other leg being about 6 ft. shorter (and the whole bent being on a 6° curve) was blocked up about 10 ft. in

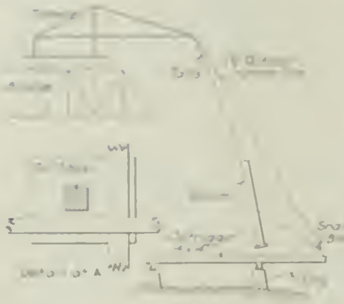


Fig. 6. [illegible] Columns [illegible] Tower of the [illegible] Span

from the pedestal and 6 in. higher than the tips of the anchor bolts; rails were placed under the base plates of the leg to [illegible] to slide it into place when tipped to the perpendicular position.

This placed the bent in a good position for tipping it into place and also brought the legs within the reach of the [illegible] boom of the derrick car. The two lower columns of the bent had to be [illegible], however. The position of this bent and the arrangements for its erection are shown in Fig. 7.

The [illegible] was [illegible] on the [illegible] the [illegible] and a [illegible] was [illegible] about [illegible] in one of the [illegible] and [illegible] on the [illegible] of the derrick car. The 113-ft. bent, weighing [illegible] tons [illegible], was then tipped to an upright position, the [illegible] fall line taking the load when the derrick-car falls had passed the length of the boom.

The bent was then moved and jacked into place, and lowered over the anchor bolts. This bent as erected had all of the transverse struts in place, but none of the bracing. The column splices and struts were 75% bolted.

The remaining two 80-ft. spans (which included the two 27-ton girders used on the temporary tower already

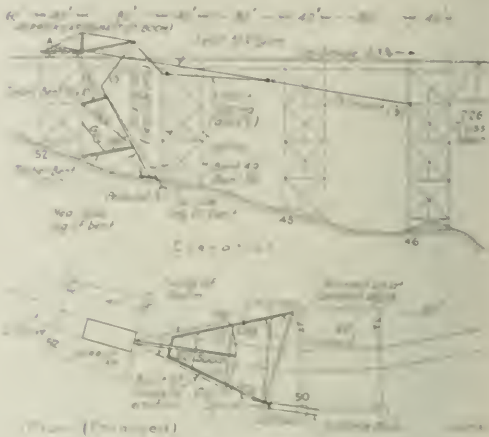


Fig. 7. Method of Erecting Bent No. 50 of the West Approach Viaduct

(The bent was assembled in the inclined position and then raised to its vertical position on the pedestals.)

described) were erected from the end of the truss spans of the bridge by means of the large derrick car which had erected these spans. One tower was also erected by this car. The car could not pass the 6° curve at this end of the bridge, and for this reason the smaller derrick car had to be used (working from the west) on the end girder spans.

The steel for the curved portion at the extreme west end of the bridge was [illegible] at the bridge yard and [illegible] to reach the west end for erection.

Engineers and Contractors

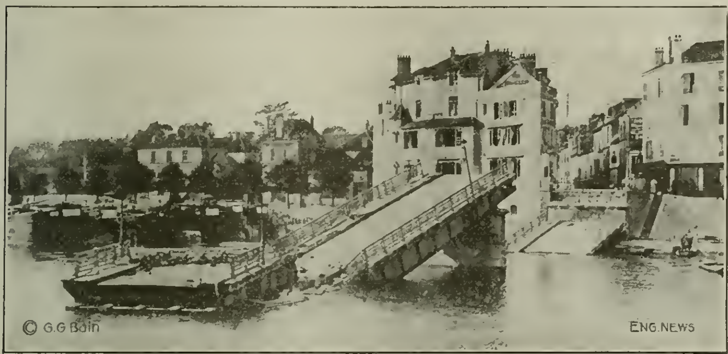
The design and construction of the bridge were under the direction of J. R. [illegible], Chief Engineer of the Oregon-Washington R.R. & Navigation Co., and [illegible] was [illegible] in charge. The steelwork was built by the American Bridge Co. ([illegible] plant). The Missouri Valley Bridge & Iron Works, of Leavenworth, Kan., had the contract for the piers and substructure. The Kelly-Atkinson Construction Co., of Chicago, had the contract for the steel erection, and its force [illegible] [illegible] men. The total weight of steel erected was about [illegible] tons.

Valuable Information on an Accident Report Blank [illegible]

Bridge Destruction in the European War

An army in retreat always endeavors to protect itself against the pursuing forces of the enemy by destroying the bridges in its rear, tearing up railroad tracks, burning rolling stock, etc. Some idea of the destruction effected in the zone of active military operations in Europe during the past three months is shown in the accompanying views.

It is a part of the duty of engineer troops in warfare to destroy the bridges in the rear as the army retreats, usually by exploding dynamite at the base of its piers, or, in case of masonry arches, at the haunch of the arch or the springing line. The duty of the engineer force with the pursuing army is to replace the gap as rapidly as possible by rapidly constructed pile or pontoon bridges. The photographs bring to mind the vast amount of new construction that will be required at the conclusion of the war to restore to normal conditions the avenues of transport and communication.



DESTRUCTION OF A GIRDER BRIDGE AT LAGNY

WRECK OF A MASONRY ARCH BRIDGE AT MEAUX

The Electric Precipitation of Tar Vapors from Gas

An interesting development of (or rather a departure from) the Cottrell process for the precipitation of suspended matter in gases (see ENGINEERING NEWS, Oct. 26, 1911, and Oct. 9, 1913) was described by F. W. Steere, of Detroit, before the American Gas Institute in New York, Oct. 22, 1914. The author, while engaged in research work at the University of Michigan upon the electrical separation of tar from gas, found that high-tension alternating current might be used instead of the rectified high-tension used by Cottrell. The gas to be purified is led through a pipe and the high-tension current discharged between a central electrode and the walls during passage. The gas is ionized and the resulting tendency to recombination of the dissociated atoms results in an agglomeration of the dense tar mist into relatively few and large tar drops. The larger tar particles can easily be freed after the gas has left the electrical chamber by passing through a centrifugal tar extractor, etc.

A plant having a capacity of about 30,000 cu.ft. of gas per hour was built at the Detroit coke ovens. Gas was taken from the hydraulic main, passed through a small washer cooler, and led through the ionizing tube from which it went to a spiral tar extractor and exhauster, a washer cooler and a Venturi meter leading to the main. In some 1200 tests, by aspirating a given quantity of gas through two thicknesses of filter paper, practically white papers were secured. All work was done on the rich gas given out during the first six or eight hours of the coking period of the recovery oven. Best results were obtained with gas entering the ionizer at from 65° to 80° C. It was found that the naphthalene crystals were freed after the tar was extracted, so that they were recovered clean and white.

With the aid of Edward Gray, Chief Engineer of the Ford Motor Co., a cleaning plant was built for the producer gas used in the large gas engines of this company. This plant has been in continuous and successful service for several months, has required no special attention, is self-cleaning, and is stopped and started by the regular employees.

Operation of Sand and Gravel Plants

By W. H. Wilms*

SYNOPSIS—A continuation of article in ENGINEERING NEWS, *Nov. 12, covering crushing, storage and power plant for sand and gravel plants.*

II.

PREPARATION OF SAND

GRADES—Two grades of sand are generally produced, a coarse sand for concrete and a fine sand for plastering and brickwork, often called building sand. The manner of preparation depends upon the character of the sand, the size and gradation of the bank-run material, and its specific gravity.

Coarse sand, or torpedo as it is called in the Middle West, is a sand ranging from 1/4 in. down to fine sand, the gradation being uniform. An analysis of a good grade of torpedo sand is given (Fig. 1).

SEPARATION OF GRADES—It is often the case that the sand contained in a gravel deposit is a well graduated, coarse sand and in such cases all that is necessary is to

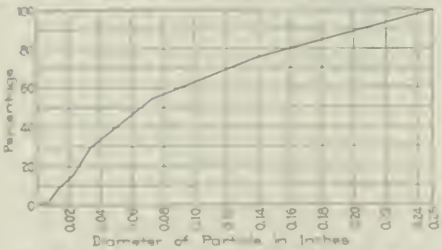


FIG. 1. ANALYSIS OF A GOOD TORPEDO SAND

screen it through a 1/4-in. or 3/8-in. screen (depending upon how coarse the sand is desired), and then take it directly to a settling tank to remove the dirt and water. In many instances, however, the bank sand is poorly graded, containing an excess of very fine sand, which must be removed before a well graded material can be obtained. This is done in several ways, depending upon the amount of the excess fine sand which must be taken out, the amount of water present, and the specific gravity of the sand.

Figs. 2, 3 and 4 show three methods commonly used to effect the removal of the fine sand. In Fig. 2 the sand coming through the perforations of the coarse sand screen is permitted to flow over a fine screen of about 1/4- to 1/8-in. mesh, which screens out any desired amount of the fine material by regulating the feed and the supply of clean water to the screen; an insufficient supply having a tendency to clog up the perforations, thus permitting a part of the fine material to pass over with the coarse.

In Fig. 3 the excess of fine sand is taken out by means of a second settling tank. This method works very well where the material has a comparatively low specific gravity and is [illegible]. Regulation here is obtained by raising or lowering the flashboard A in Fig. 3; by lowering this board the amount of fine sand flowing to the second settling tank is reduced, while raising it increases the amount of fine sand going over. A screen of small mesh is placed at the overflow of the final settling tank to prevent any large light particles from flowing over with the fine sand.

Fig. 4 illustrates a method now quite extensively used. The coarse and fine sand in flowing from the initial sand screen is made to pass over a small-mesh screen placed in the bottom of the trough or chute leading to the settling tank. Directly underneath this screen is a second tank. The screen takes out the fine material, separation of the dirt and water being effected by the settling tank directly underneath. Regulation is obtained by means of a sliding plate placed over the screen; this plate shortens or lengthens the length of the screen, thus regulating the amount of fine material going through.

SETTLING TANK—The settling tank is one of the most important parts of a washing and screening plant. A poor one will spoil material in the bins about as fast as it is prepared. While there are a number of patented sand separators on the market, the ordinary tilting settling tank (Fig. 5), when properly made and regulated will produce entirely satisfactory results.

The correct design of a settling tank for a given material can only be ascertained by trial. The proportions of length, width and depth of tank, the location and length of outlet pipe, the location of the supporting shaft and counterbalancing, all depend for their determination upon the nature of the sand, its weight and behavior in water, the amount of water and sand that the tank is required to take care of, and the uniformity of the flow of material to the tank.

For instance, the longer the discharge pipe, the dryer the sand coming from the tank. This is due, of course, to the greater and more effective seal formed by the longer pipe. There is a limit, however, at which the material will fail to discharge at all. Likewise, the shorter the pipe the wetter the sand discharged. Usually, however, a discharge pipe having a length equal to twice the diameter of the pipe will prove satisfactory. Six- and eight-inch pipes are commonly used.

With a given material and a uniform feed to the tank, a tank can be designed and constructed that will have a practically uniform discharge of material. The trouble experienced with poorly designed settling tanks is their constant tendency to let through the dirty water with the sand. It should be remembered, however, that no tank will operate satisfactorily if the flow of material to the tank is not uniform.

The settling tank is supported by a shaft having two bearings, upon which it has a slight rocking motion (see Fig. 5). The tank is counterbalanced at the rear with heavy weights. The valve opening in front is held against rubber-faced stops as a consequence.

The tank fills full of sand water, which runs off at the spillway at the top of the front. The sand quickly settles to the bottom of the tank, and when it accumulates enough weight it causes the tank to tip forward, drawing the opening in front of the tank away from the rubber-faced stops, the sand running through the opening.

When a sufficient amount of sand has escaped, the reduction of weight of sand in the tank causes the tank to

*[illegible], Portland Sand & Gravel Co., Portland, Ore.

draw back against the valve-stop, closing the opening and stopping the flow. If the material comes into the tank uniformly, the tank will remain in a state of equilibrium, the outflow equaling the inflow. Thus the tank action is continuous and automatic. The very fine undesirable sand is carried away with the waste water.

The supporting shafts of settling tanks should not have journal bearings, for the friction, though slight, is too great for the very sensitive action required in the operation of the tank. Instead, knife-edge bearings should always be used.

Operating Difficulties—More trouble is generally experienced with the operation of the fine-sand tank than with the coarse. It is often a very difficult matter to get this tank to discharge properly, the tendency being for most of the fine sand to remain in the tank, only that portion immediately over the valve opening

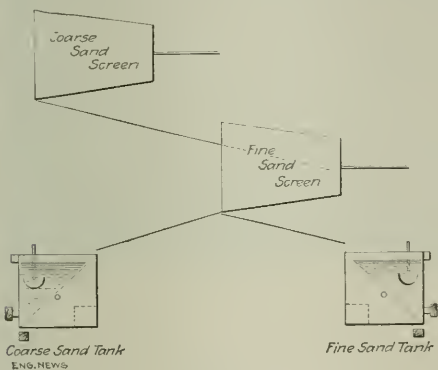


Fig. 2.

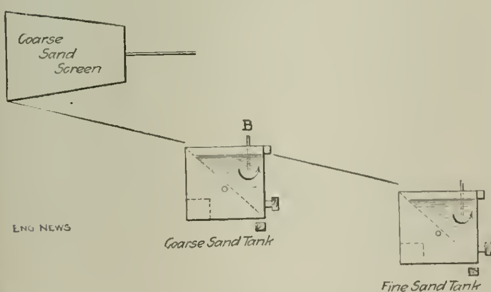


Fig. 3.

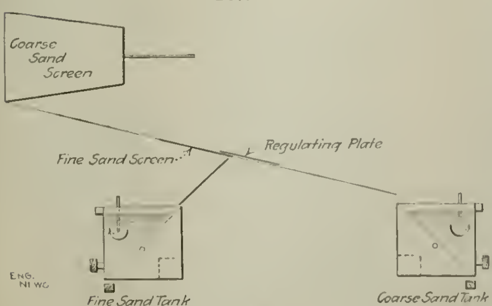


Fig. 4.

Figs. 2-4. Methods for Removing Fine Sand

being discharged. When this happens the tank will frequently "spill" or let through the dirty water. It only takes a very few of such "spills" to ruin an entire bin of sand.

This trouble can often be cured and the tank made to discharge itself completely by providing a small discharge opening with valve stop, similar to the main dis-

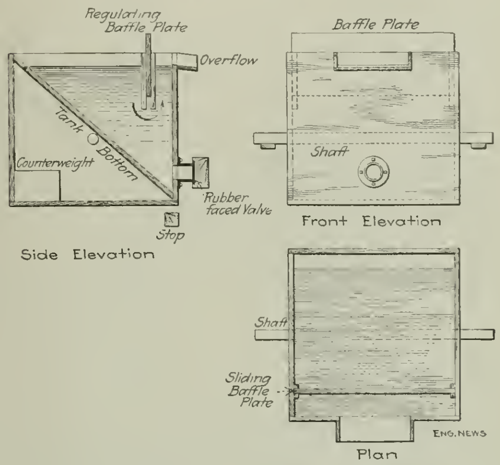


Fig. 5. Ordinary Tilting Settling Tank

charge, near each side of the tank and about one-third its depth from the bottom. This will keep the sand in these dead quarters more or less agitated and prevent it from settling and becoming compact.

Where the pit-run material is largely sand and the capacity of the plant a large one, some trouble is at times experienced with the automatic or tilting settling tank. Under such conditions a number of operators prefer stationary tanks, the discharge openings or valves being manually operated. Instead of one or two large openings, however, these tanks are provided with many small ones distributed around all four sides of the tank. The tank is made sufficiently large so as not to require the constant attendance of an operator, this work being usually performed by the man attending the "top."

Such tanks are usually made rectangular in shape instead of square as in the automatic or tilting tank, having a length of about twice the width and a depth of about one and one-half times the width. The valve openings are usually about 2 to 2½ in. in diameter.

A tank used especially in large ballast washing and screening plants is provided with conical discharge openings projecting from the bottom of the tank, the stop valves of these openings being operated from above by a small rack-and-pinion movement. These tanks are generally provided with two such openings, one being located near each end of the tank. The coarse sand is discharged from the opening near the head end of the tank and the fine sand from the other, separation being effected by the difference in the velocity of the water at the ends of the tank. While I have seen a fairly good sand produced by such a tank, the separation of the coarse from the fine sand is not as complete as it should be nor is the graduation everything to be desired.

Marketable Grades—In the preparation of a well

graded coarse sand, a large amount of fine building sand is often present. Not all producers are so fortunately situated as to have a large market for this fine material, and many plants are now wasting it (which is generally an excellent building sand) for the want of a market. Under such conditions the cost of production of a well graded coarse sand is materially increased.

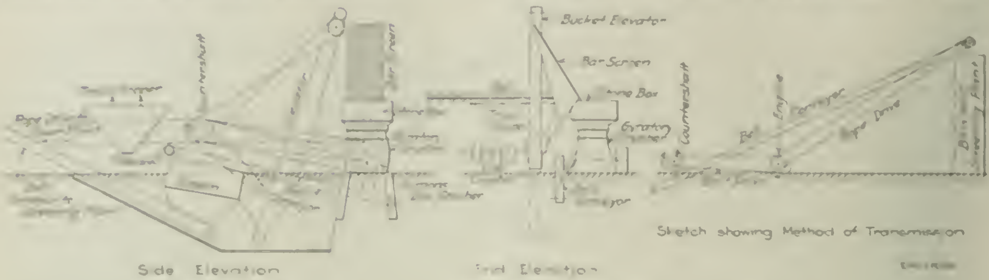


FIG. 6. DESIGN FOR INITIAL SCREENING BEFORE CRUSHING MATERIAL

It may be mentioned here that this question of a market for all grades of sand the plant produces is a vital one to the producer. Quite often it means just the difference between success or failure of the enterprise. The importance of a complete and accurate knowledge of the market requirements and a thorough test and examination of the deposit cannot be too strongly emphasized to those who are contemplating going into this industry.

CRUSHING EQUIPMENT

From the writer's observation and experience the main point of weakness of many screening and washing plants is in their crushing and reduction equipment. It is here that an otherwise satisfactory material falls short of attainment—insufficient reduction. The material often has but one reduction through a gyratory crusher, resulting in a large percentage of over-size material or rejections going into the finished product.

CRUSHING—To produce a uniformly graded material means fine reduction—much finer than the maximum size being produced in a given material. Even where the product from an initial gyratory crusher is screened and the rejections delivered to a smaller secondary gyratory crusher for final reduction, the results are not everything to be desired. In the writer's opinion, the only effective solution of this reduction problem is the installation of a Symons disc crusher for final reduction, the initial breaking being performed by a gyratory. A majority of the largest and best plants in the country are now performing their reduction in this manner.

LOCATION OF INITIAL SCREENS—The top of the screening plant being generally at least 60 ft. high, it follows that the initial screening of the over-size material and its reduction should, if possible, be effected before the material is elevated to the top of the plant for screening and washing. Placing the initial screen on top of the plant and dropping the over-size material to crushers on the ground below and then re-elevating the rejections, is certainly not a very efficient method, to say the least. And yet, with few exceptions, this is the general practice.

There are a few modern, up-to-date plants, however, that are performing this operation of initial screening and crushing before the material is elevated to the top of the plant. Fig. 6 shows the manner in which this is effected in two large western plants.

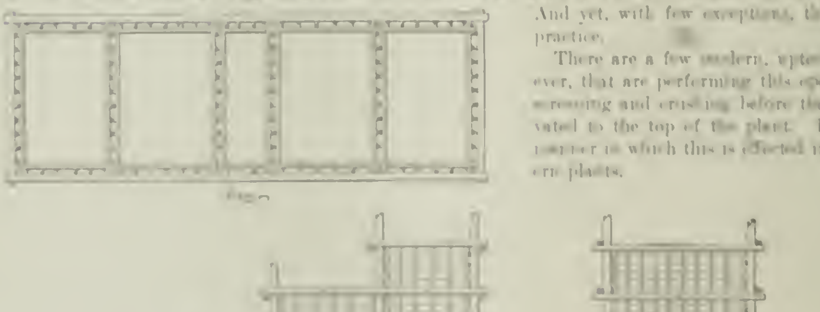


FIG. 7. BIN CONSTRUCTION BY THE MOST APPROVED METHODS

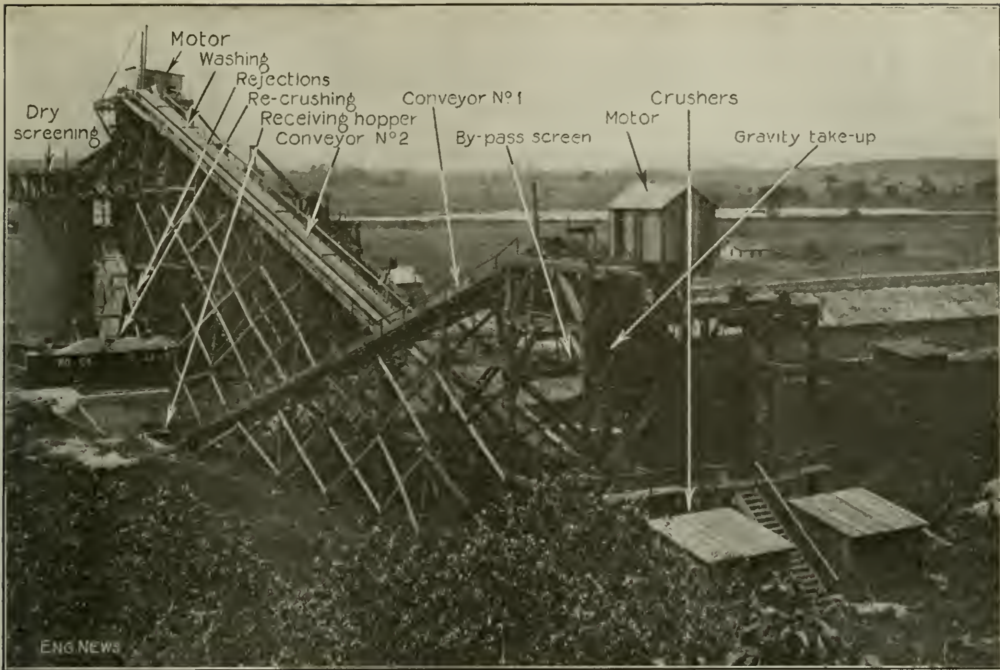


Fig. 8. Plant of the Chicago Sand & Gravel Co.

Elevating and Conveying

For elevating the material to the top of the plant the belt conveyor is almost universally regarded by operators as the best solution of the problem. Its slow and uniform feed to the screens, so necessary for effective screening, combined with large carrying capacity makes this method a very efficient one. While the initial cost and the cost of belt renewals exceeds that of a bucket elevator, the reduction in the amount of delays due to break-downs and repairs more than makes up for the difference.

In elevating the material to the top of the plant where the material is conveyed to the plant by cars discharging into a track hopper, the feasibility of using as heavy a grade as is practicable up to the hopper should be duly considered, thus reducing the height and length of the belt conveyor. Within certain limits it is more economical to elevate by cars and locomotive than by conveyor. Grades of tracks leading to the hopper, however, should not be excessive, 4% to 5% being considered a maximum.

Storage Bins

While storage bins are built of concrete and steel, the prevailing practice is to build them of timber. The bins are built up directly from the ground level, the space between the ground and bin gates being occupied by dead material; the wet material in the bins taking about a 40° slope (Fig. 7).

Construction—Bins of 14 to 20 ft. inside have proved to be the most economical under ordinary conditions. Greater widths than 20 ft. require extremely heavy cross-bracing and tying, making the construction an expensive one.

The old crib style of construction where the walls of the bin are built up of 2-in. plank laid and nailed together flatwise, has of late years given way to the form of construction shown in Fig. 7.

This design is not only somewhat more economical of lumber and labor of erection, but it possesses the additional advantage of easy and quick repairs. Repairs to bins built up of cribbing can be nothing more than patches. One of the main objections, however, to crib construction for sand and gravel bins is their extreme range of swelling and shrinkage in a vertical direction, due to the wet material in the bins. In a bin 35 to 45 ft. high this swelling and shrinkage often amounts to 5 or 6 in.

With the bearings carrying the screening and elevating machinery mounted directly on the top of such bins the results can better be imagined than described. In the frame type of construction the bearings are carried by an extension of the outside upright framing timbers which do not come in contact with the wet material.

Tunnel bins delivering material directly to cars underneath require extremely heavy masonry supports for the bin structure, and ordinarily are much more expensive for the same bin capacity than bins built directly upon the ground and filled up to the gate level with dead material.

Capacity—The capacity of bins necessary for a given daily yardage depends upon so many factors that no fixed rule can be given. The manner in which the plant is operated, extent and character of the switching facilities and service, the regularity in the supply of empty cars to the plant, whether or not open storage is practiced, all affect this question of bin capacity. Where there is a plentiful supply of empty cars but poor switching ser-

tion, it often pays to invest in a small switching locomotive rather than in additional bin capacity. Under ordinary circumstances, a bin capacity of from 450 to 600 cu.yd. is proper, even in the largest of plants.

LOADING FACILITIES.—In order to produce a gravel for roadways and concrete, containing a certain percentage of sand, it is necessary that at least one sand bin be adjacent to a gravel bin so that both the sand and gravel can feed out of the same spout into the car. If the sand and gravel are to be uniformly mixed, it must be effected while the materials are discharging into the car. In discharging sand and gravel already mixed in the bins, the gravel separates from the sand more or less, producing a very poor mix.

STORAGE—Closely connected with bin capacity is the question of open storage. It is here that practically every sand and gravel plant in the country is weak. The producer without provision for open storage is often compelled to sell his material at a loss, simply because he has no immediate market for it at the time it is produced. The demand for sand and gravel fluctuates more or less with activity in building and construction operations.

This wide range of fluctuation in demand causes the sand and gravel industry to operate under anything but favorable conditions, unless there is adequate provision

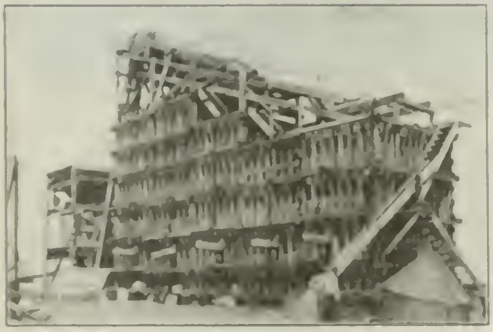


FIG. 9. PEORIA WASHED SAND & GRAVEL CO., PEORIA, ILL.

for large [illegible] storage—at very [illegible] as yet to the industry. The [illegible] situation, far from being perfect [illegible], helps to aggravate the condition. The increasing [illegible] of winter [illegible] is also becoming an important factor in the question of open storage, [illegible] being all that can be attempted during the [illegible] months and this only [illegible] great difficulty and increased cost of production.

POWER

There is no question of the economy of electric power for the operation of a screening and washing plant, where the same can be purchased at reasonable rates and without excessive primary charges. Due to the comparatively large number of units that must be driven and the comparatively great distances that often separate these units, the problem of transmission, where steam power is used, often becomes rather complicated and costly, both in first cost and maintenance. For these reasons, it often pays to use electric power with individual motor-driven units, even where the cost of same is somewhat above the ordinary.

Pertinent to this subject of electric power is the following from the report of the Committee on Electricity in Rural Districts, presented at the annual meeting of the National Electric Light Association, at Chicago, June [illegible], 1915:

Motor drive and central-station service have been thoroughly tried out in this industry (sand and gravel). The flexibility of motor drive is of great value here. Putting individual motors on distant pumps and cutting belts dispenses with the operating troubles from long shafts, belts and long rope drives. On account of pumps being of considerable size and located several hundred feet from the screening plant, the use of [illegible] motors will in general be found desirable.

The sand and gravel season comes as soon as the ground is frozen and [illegible] shut down at [illegible] so that the load is strictly "off peak." Some attempt has been made to do dry screening in winter but with small success.

A combination of individual and group drive will be found most advantageous in crusher plants, and the use of [illegible] motors will generally prove best. Crushers should be driven by slip-ring motors. If a crusher is shut down when it is full of rock it is often a troublesome job to clear it of all rock before starting up again. This is especially true if the crusher is driven by a squirrel-cage motor. If a slip-ring motor is used and the [illegible] belt is [illegible] up a few feet at a time the motor will often be able to start the crusher without its being necessary to clean out the rock. Dust-proof motors should be used on all stone-plant motors, and it will usually pay to install all wiring in conduit.*

Steam power, however, will generally be the only form of power available to sand and gravel plants for a long time to come. The main problem here is to so concentrate the various units as to reduce the number of belt and rope drives and shafting to a minimum. Any method or means by which a belt, rope drive, shaft or gear can be eliminated is well worthy of consideration, for it is in the transmission that break-downs, delays, grief and trouble occur with too great a frequency for the peace of mind of the operator. Fig. 6 shows to what extent this problem of transmission has been solved in one particular case.

As a rule, the power-house equipment should be chosen for simplicity and rough handling rather than for economy and should consist of a plain slide valve or simple automatic engine, tubular boilers, heater, feed pump, etc. High-duty engines, water-tube boilers, and condensers have been installed, however, and this practice will undoubtedly be followed more and more as the industry develops.

Tests of Pipe Coatings as a Preventive of Electrolysis

Tests of "waterproof" coatings of iron and steel pipe have been made by the U. S. Bureau of Standards as a part of its broad investigations of the electrolysis problem and a report on the results has been issued as a bulletin (No. [illegible]) by Burton McCollum and O. S. Peters. The materials which were used as surface coatings are as follows: (1) Paints which may be applied at ordinary temperatures and depend on oxidation, chemical action, or drying for setting; (2) dips intended to be fixed at high temperatures—including asphalt, coal-tar, pitches, etc.; (3) wrappings consisting of alternate layers of cloth or paper and paints or dips; (4) fiber conduits in which the pipes can be laid with or without pitch filling; (5) vitreous enamels; (6) portland-cement mortar and concrete coatings.

The last has been dismissed from further considera-

*The abstract of this report in "Engineering News," June [illegible], 1915, p. [illegible].

ation by the Bureau, after calling attention to the fact that portland-cement mortar absorbs water readily and becomes a conductor of electricity at all times in damp soils. When the concrete is new, however, and contains much calcium hydroxide, there is an appreciable passivating action which allows current to leave a coated pipe without much corrosion of the iron; but, as the calcium hydroxide becomes converted to carbonate, this property is lost and the pipe corrodes rapidly.

The insulating properties of fiber conduits and vitreous enamels are still being investigated, and have not yet been reported on.

For studying the action of the paints, sheet-iron cones of about 7-in. base diameter and 1¾-in. altitude were used, coated on the interior. Four coats were usually found sufficient to give the best results of which any paint was capable, precaution being taken to secure perfect films.

The first test to which the painted specimens were subjected after the paint had dried was one for pinholes and flaws. The cone was filled with salt solution and 80 volts 60-cycle alternating potential applied for 30 sec. If no deflection of the galvanometer needle occurred, the coating was considered perfect. Specimens failing this test were rejected until a set of five perfect specimens was obtained for each paint. The effects of length of drying period were evident; the percentage of defective coatings tested at the end of ten days' drying was four or five times as great as at the end of two months' drying.

In the final test, each cone was filled to ½ in. from the rim with tap water or some electrolyte and placed in a rack. Two cones from each set of five were connected up with the sheet iron as anode and a bare copper wire, dipping into the water, as cathode. A third cone was connected in reverse order. A constant potential of four volts was impressed on the circuit leading to the paint films. Once in about two weeks the water would be completely evaporated from the cones and they would be refilled. This was desirable, to give alternate wetting and air exposure. The first appearance of current flow across the paint film was noted as failure, but the specimens were left in circuit until rupture was complete. There were 32 different paints, covering most of the widely advertised compounds, though not all (no so called "Bitumastic" products).

The general results showed that none was to be heavily relied upon to preserve its insulating barrier. Some lasted only a few hours, others a few thousand. Here and there, certain individual specimens withstood the action longer than others, even of their own makes. In one particular case ("Carbonkote" Interior) only one of the four specimens failed in a year of exposure. The data for each specimen indicate that the voltage had no appreciable effect toward reducing the length of service, which seems to depend upon the properties of the individual samples and the action of the water. However, the manner of failure of the coatings was distinctive of the direction of flow. Where the current was from iron to water, little rust spots appeared which grew to craters or bubbles; removal of a crater bubble revealed a pit filled with rust. Where the flow was from water to iron, no rusting of iron occurred, but gas was liberated under the film and lifted the latter until a blister was formed which left a large area of iron unprotected. Specimens to which no voltage had been applied showed no deterioration visible to the eye, in most cases, though they would permit current to flow.

Tests of fibrous pipe wrapping were carried out in much the same way. Sheet-iron cones were used, lined with alternate layers of dip or paint and paper or fabric. Four specimens were made for each test. These were set up in a rack, as previously described and filled with tap water. Two were set up with the iron positive, and two with the iron negative; a potential of 15 volts was employed. A few cones which were merely dipped were subjected to only four volts. There were 33 samples employing some 14 different compounds with various combinations of wrappings. At the time the report was made 82% of the total specimens had failed in periods varying from 7000 to 14,000 hours. On the remaining cones, the tests were still incomplete.

The results do not indicate that a life of such coatings as an insulating barrier can be expected to be more than two or three years and, in most of the cases, failure may be expected within a few months. The manner of failure was very similar to those of the paint coatings. The rupture of the coatings, however, was slower than with the paint after the first appearance of electrical breakdown—probably due to the thickness and rigidity of the coatings.

To avoid criticisms that the studies did not reproduce practical conditions, 26 specimens of wrapped pipe were buried in earth and connected to the positive side of a 15-volt direct-current circuit, so that the pipe had a potential of about 4.5 volts about the surrounding earth. The ground was quite wet during the spring and fairly moist during the rest of the year. Twenty-four of these specimens were furnished by commercial firms; 12 consisted of 5-ft. lengths of 4-in. wrought-iron pipe wrapped with two alternate layers of pitch and burlap. The other 12 were 5-ft. lengths of 1½-in. wrought-iron pipe covered with four alternate layers of tar and paper. The wrapping was not impregnated and apparently consisted of heavy paper wound spirally over the hot coat of tar, the latter containing 3 or 4% lime (Nichols coating). The electrical connections were soldered on the inside of the pipe, the ends closed with wooden plugs, and capped with several thicknesses of tar paper and pitch. Two specimens of wrapped pipe were made up by the Bureau, each having three coats of insulating paint and two layers of muslin painted on. The pitch-and-burlap specimens failed in from seven to 56 days; the tar-and-paper-wrapped specimens failed in 29 days for the most part, although one lasted 75 days and one failed in two. The paint-and-muslin samples broke down after 36 days. The pipes were left in the ground under test from 10 to 18 months. When they were removed and the wrappings stripped off, they were found to be covered with rough spots and were pitted to considerable depths.

The Bureau concludes that paints, dips and wrappings have little value for protecting pipes from electrolysis. The failure of the coatings they explain by the absorption of moisture which was found when any of the coatings were carefully weighed before and after immersion. These studies, the Bureau cautions, throw no light on the value of these coatings for protecting the various mains from natural soil corrosion, as there is considerable practical evidence that they have a certain protection where no electrical effects are involved.

A Century Rainfall Record at New Bedford, Mass.*

By X. H. Goodnough†

SYNOPSIS—A continuous rainfall record kept by father and son for 92 consecutive years is here rounded out from other records in the same city to a full century. By years the rainfall ranged from [illegible] to [illegible], with an average of [illegible] in. By months, the range was from [illegible] in June, 1912, to 18.72 in. in August, [illegible]. The record shows no progressive change in annual rainfall, but does indicate that for periods of [illegible] to 12 years the annual rainfall continues at a high rate or a low rate. Of six periods of low rainfall within the century, [illegible] has occurred during its last half, and one of these began in 1908. This suggests the possibility that we are now in a period of lower rainfall and stream flow. [illegible]

Among the most valuable of rainfall observations in New England are those begun at New Bedford by Samuel Rodman in 1814, and continued by him until his death on Aug. 1, 1876, and afterward continued by his son Thomas R. Rodman, until he died on Dec. 1, 1905, thus giving a continuous record by these two observers for 92 years. By using the observations at other stations in New Bedford, of which there are several, it is now possible to present a continuous record of rainfall observations at practically the same point for one hundred years.

The rain gage used by the Rodmans was located in the western part of a thickly settled portion of the city upon a ridge about half a mile west of the shore of New Bedford harbor and at an elevation of about [illegible] ft. above mean sea level. The gage was placed near the ground in a large open area where the conditions were favorable for accurate observation. The records are believed to be wholly reliable.

Since 1905 various observations are available, including those made with a gage located on the roof of the city hall, [illegible] Rodman residence, at an elevation of about [illegible] ft. above mean sea level, and those made by Charles H. Adams at a point a short distance north of the Rodman residence and also at an elevation of about [illegible] ft. above the sea. The city hall observations have been [illegible] they were interrupted by the [illegible] of the city hall in 190[illegible], and no observations were made in the years 1907 to 1908. Observations are also made by L. J. Hathaway, Jr., of the New Bedford Engineering Department, at a point about [illegible] miles north of the Rodman gage. These observations are made with a standard gage in an excellent location near the ground at an elevation about [illegible] ft. above the sea.

The monthly, annual and average precipitation for the years 1814 to 1913 is given in Table I. The table has been made up by using the Rodman records from 1814 to 1905, the observations of Charles H. Adams for 1906 and 1907, and the observations of L. J. Hathaway, Jr., [illegible]

TABLE I. A CENTURY RAINFALL RECORD AT NEW BEDFORD, MASS.

[illegible]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*[illegible]

†[illegible]

TABLE II. EXTREMES OF RAINFALL AT NEW BEDFORD, MASS., 1814-1913 SHOWING PRECIPITATION IN EACH MONTH ARRANGED IN ORDER FROM MINIMUM TO MAXIMUM

January	February	March	April	May	June	July	August	September	October	November	December	Total
Year Amt.	Year Amt.	Year Amt.	Year Amt.	Year Amt.	Year Amt.	Year Amt.	Year Amt.	Year Amt.	Year Amt.	Year Amt.	Year Amt.	Year Amt.
1939 0.77	1819 0.91	1853 1.29	1846 1.20	1822 0.58	1912 0.10	1909 0.67	1854 0.24	1865 0.26	1874 0.55	1899 1.11	1828 0.45	1846 34.51
1849 0.88	1895 1.17	1885 1.49	1920 1.23	1826 0.73	1832 0.41	1894 0.74	1881 0.79	1837 0.54	1847 0.62	1890 1.32	1816 0.70	1849 36.42
1976 1.02	1901 1.26	1874 1.59	1896 1.24	1903 0.81	1820 0.46	1817 0.88	1993 0.85	1855 0.62	1842 0.86	1909 1.45	1875 0.94	1885 36.81
1819 1.25	1856 1.27	1910 1.59	1825 1.42	1911 0.97	1876 0.73	1859 0.96	1882 0.99	1877 0.93	1917 1.19	1937 1.50	1877 0.95	1856 37.09
1860 1.37	1858 1.32	1856 1.64	1869 1.42	1817 1.19	1913 0.85	1814 0.99	1907 1.07	1997 0.89	1879 1.19	1847 1.52	1938 0.97	1910 38.02
1931 7.47	1816 6.82	1903 3.02	1952 7.36	1827 6.94	1905 6.77	1883 6.92	1832 8.30	1890 7.55	1894 7.64	1837 8.42	1930 6.99	1898 62.60
1891 9.86	1993 6.90	1912 8.40	1974 8.57	1323 7.67	1817 7.00	1931 7.26	1884 8.49	1854 8.37	1877 7.66	1876 8.42	1950 7.51	1850 62.67
1259 8.53	1991 7.00	1923 8.43	1904 8.84	1901 8.57	1834 7.30	1854 7.44	1997 9.57	1996 8.87	1898 9.93	1854 9.66	1825 7.93	1837 62.90
1329 9.06	1336 7.05	1877 9.42	1850 9.25	1929 8.59	1842 7.40	1851 9.22	1835 10.16	1888 9.52	1890 10.09	1845 9.72	1823 9.74	1830 64.66
1936 9.53	1814 8.30	1990 9.77	1941 9.27	1868 9.42	1862 9.05	1830 12.00	1826 18.72	1950 12.06	1913 10.09	1897 9.74	1901 10.05	1829 65.41
Total 400.56	387.99	433.85	394.74	396.48	307.32	323.26	417.27	350.81	393.51	424.49	415.14	4645.35
4.01	3.89	4.34	3.95	3.96	3.07	3.23	4.17	3.51	3.94	4.24	4.15	46.45

from 1908 to 1913. If observations at other stations had been used for the period since 1905, the difference in the results given in the table would not be important.

For convenience in the study of these records, Table II is presented, showing the extremes of precipitation in each month and year, arranged in order from the minimum to the maximum amount.

The average annual rainfall at New Bedford, as shown by these records, during this period of 100 years, was 46.45 in. The driest year was 1846, with a rainfall of 34.51 in., and the wettest, 1829, with a rainfall of 65.41 in. The driest month was June, 1912, with a precipitation of 0.10 in. The wettest month was August, 1826, with a total precipitation of 18.72 in. It is interesting to note that it was also in the month of August, 1826, that the Willey family was overwhelmed by an avalanche in the Crawford Notch [White Mountains, in New Hampshire], attributed to the excessive rainfall.

The diagram, Fig. 1, shows the variation year by year in the annual rainfall and also the years when the precipitation was less than or greater than the average.

One of the chief values of continuous observation of rainfall covering a very long period at the same place is the evidence that such a record may give as to a progressive change in the amount of annual precipitation. No indication of such a change is shown by these records. A study of the diagram and tables indicates that periods of several years of continuous high or low or average rainfall succeed each other and that these periods have generally averaged, in this instance, eight or ten years in length (see Table III).

TABLE III—TABLE SHOWING GROUPS OF DRY, WET AND AVERAGE YEARS AT NEW BEDFORD

Period	Number of years	Average rainfall per year
1814-1822	9	42.28
1823-1832	10	54.26
1833-1839	7	42.79
1840-1843	4	47.48
1844-1849	6	41.06
1850-1854	5	50.74
1855-1866	12	43.23
1867-1878	12	48.91
1879-1885	7	42.59
1886-1890	5	51.22
1891-1895	5	45.69
1896-1904	9	49.34
1905-1912	8	42.54

The variations in the annual rainfall are, however, shown perhaps more satisfactorily by the diagram, Fig. 2, which shows the three-year progressive averages of the rainfall in this 100-year period. This diagram shows that there have been six periods of very low rainfall at New Bedford since 1814, or an average of one in about 17 years. There was about an equal number of periods of average or high rainfall, the maximum rainfall occurring in the years about 1830, when the precipitation was much greater than at any subsequent time, the nearest approach to it being the period of a few years about 1890.

This diagram is interesting as showing that of the six

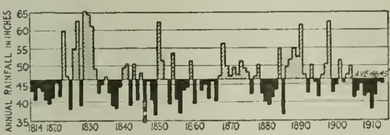


FIG. 1.

(Annual rainfall at New Bedford, Mass., for the 100 years 1814 to 1913 and the excess or deficiency for each year as compared with the average for the century.)

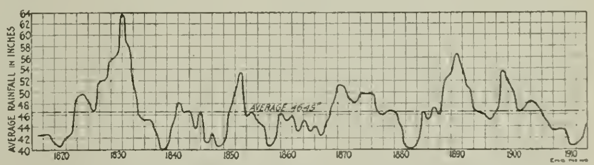


FIG. 2

(Three-year progressive average rainfalls at New Bedford, Mass., 1814 to 1913, plotted on third years.)

periods of very low rainfall at New Bedford only two have occurred in the last fifty years, namely, the period from 1880 to 1883, and the period from 1908 to 1911.

So far as these observations show, there is no indication of variations covering periods longer than about 17 years, but studies of other observations in New England indicate quite clearly that the rainfall for at least 35 years preceding the year 1850, and possibly for a much longer period, was, except for the years about 1830, very much less than the average; while the rainfall from 1850 to about 1903, except for a few years about 1883, was nearly always greater than the average. Since 1903 the rainfall in most parts of New England has averaged much less than the normal amount.

The New Bedford records agree in general with those of other long-continued observations in New England, except that they show as a rule somewhat less rainfall in some of the years between 1849 and 1879, especially in years between 1850 and 1860, than are shown by records of rainfall in this period at stations farther west and north.

The average monthly rainfall at New Bedford during the entire period of 100 years is shown graphically by Fig. 3, a glance at which will show that the month of least rainfall is June, when the quantity has been but little in

amount of 7 in., followed by July, with a rainfall of about 4.5 in. The minimum rainfall has occurred in March, closely followed by November, but there is also a high rainfall in the month of August, the quantity being much greater than in the other summer months.

A study of the seasonal distribution of the rainfall is

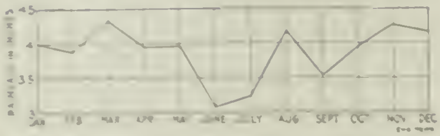


FIG. 3. MONTHLY RAINFALL AVERAGES AT NEW BEDFORD, MASS., 1814 TO 1913

interesting. The average rainfall for the months of December, January and February, taking in each case consecutive months, shows no material variation in the amount of the winter precipitation throughout this long period. The minimum winter rainfall ever recorded occurred apparently in the year of 1838-1839, when the average precipitation per month was 1.48 in. Next in order comes the winter of 1818-1819, with an average precipitation of 2.03 in. per month, and then 1901 with a monthly precipitation of 2.20 in. Next in order come 1876, 1903, 1872, 1890 and 1820, in all of which the precipitation averaged less than 2.75 in. per month. The maximum winter rainfall occurred in 1891, when the average precipitation was 6.95 in. per month. Next in order comes the year 1896 with 6.37 in. per month, then 1887 with 6.35 in., 1824 with 6.30 in., and 1902 with 6.07 in., these being all of the winters in which the rainfall exceeded 6 in. per month.

A study of the rainfall in the spring months, March, April and May, shows that the maximum amount occurred in 1901, when the average monthly precipitation was 7.83 in. Then follow 1890 with 6.90 in. and 1829 with 6.80 in. The minimum monthly precipitation in this period occurred in 1817, and amounted to 1.85 in. per month. Next in order comes 1866 with a monthly precipitation of 2.05 and then 1910 with 2.24 in. Low spring rainfalls were very much more common in the first 50 years of the observations at New Bedford, that is from 1814 to 1863, than they have been in the last 50 years. In the first 50 years the period of spring rainfall averaged less than 3 in. per month in 13 of the 50 years, viz., 1817, [illegible], [illegible], 1833, 1836, 1839, 1849, 1847, [illegible], while in the last 50 years the spring rainfall has fallen below 3 in. only in the years 1881, 1883, 1895, 1905, 1910 and 1911.

The average rainfall in the summer months, June, July and August, was highest in 1826, when it amounted to 7.76 in. per month, due to the great rainfall in the month of August of that year. Next in order comes 1820 with an average monthly precipitation of 7.01, then 1864 with 6.94 in. Except in these years, the average monthly precipitation in summer has exceeded 6 in. only four times. The minimum summer precipitation occurred in 1825, when the average monthly quantity was 1.27 in. Then comes in order 1881 with 1.37 in., 1883 with 1.38 in. per month, 1876 with 1.45 in., and 1907 with 1.61 in. There were three other years, viz., 1841, 1899 and 1876, when the average summer precipitation was less than 2 in. A summer precipitation averaging less than 2 in. per month occurred but once in the first 50 years of these observations and has occurred seven times within the last 40 years.

In the autumn months, September, October and November, the minimum precipitation throughout this period occurred in 1837, when the average quantity was 1.13 in. per month, by far the lowest recorded in the 100 years. Next to 1837, the driest autumn was in 1842, when the quantity amounted to 1.97 in. Besides these years the average monthly rainfall in the autumn has been less than 3 in. in 20 years of the period.

So far as can be judged, these observations seem to indicate on the whole that the rainfall of the spring months has been higher, as a rule, in the last 50 years than in the earlier half of the period covered by these observations, while the frequency of intense summer droughts has been greater in recent years than in the earlier half of the period covered by the observations. These differences are not of great importance, however, and with a different grouping of the months they largely disappear.

The chief result shown by a study of this record of 100 years, which is confirmed by other observations in New England, is that years and periods of years occurred in the early part of the 19th century, in which the precipitation was either lower than in any similar period of recent years or was so distributed as to be likely to produce a much lower flow in the streams than in any similar periods in recent times. They indicate the necessity of making allowance in calculations of yield of water-sheds for the occurrence of drier periods than those which have ordinarily hitherto been regarded as the driest which are likely to be experienced. If there is a variation in the rainfall covering long periods of fifty years or more, it is possible that we are entering now a period which will contain years of much lower stream flow than any that have occurred since the middle of the 19th century.

State Supervision of Engineering Work in Pennsylvania

We published in our issue of Oct. 29 (p. 870) the report of a committee of the Association of Philadelphia Members of the American Society of Civil Engineers relative to the proposed law requiring engineers practicing in the State of Pennsylvania to be examined and licensed. At a meeting of the association on Oct. 26, the committee presented a supplementary report in which it was recommended that the state should supervise the carrying out of engineering work to safeguard the interests of the public. This is in effect a continuation of the established policy of the state to supervise the construction of dams and reservoirs, a policy entered upon after the failure of the Austin dam in 1911.

We print the substance of this report as follows:

In our original report the committee recommended the creation of a state engineering department . . . [illegible] . . . It is of fundamental importance that the state should [illegible] its responsibility for safeguarding the interests of the public in connection with engineering work.

[illegible]

[illegible]

employed are held to little or no direct responsibility under the law. These conditions hold out no assurance of professional competency and integrity on the part of engineers thus employed, for duties in connection with which incompetency is likely to result not only in the waste of public funds, but in the jeopardy of human life, health and safety. The existence of these conditions is discreditable to the State of Pennsylvania, and it is earnestly recommended that adequate remedial state measures be promptly enacted.

In general it is desirable that the employment, retention or discharge of engineers in public service should be governed by the same principles as under private corporate management. The following suggestions are offered as indicative in a general way of the requirements of the situation, without aiming at completeness or the best means of adapting them to existing conditions:

1. **Civil Service Examinations:** It is highly desirable that the appointment of engineers and technical men in general, with duties of a nature in which competency may be readily determined by examination, should be subject to state or municipal civil service regulation. In cities of the first and second class, such civil service examinations may properly be conducted under independent management. For other municipalities, counties and boroughs it is desirable that such civil service examinations be conducted by a state department, in order that these examinations may be governed by reasonable and consistent standards, and that a single body may be charged with the enforcement of such standards.

2. **Exemptions from Civil Service Examinations:** It is desirable that appointments to engineering or technical positions above a certain rank should not be governed by competitive civil service examinations, but that the appointees should be chosen on the basis of their professional record. It is desirable that such appointments should be made either by the state civil service examination department direct, or at the initiative of designated state officers, but with its approval.

3. **Other Functions of the State Civil Service Examination Department:**

(a) It is desirable that the state civil service examination department should be authorized to investigate charges of incompetency or official dereliction on the part of engineers and other technical men appointed through civil service, except employees of cities of the first and second class, and that it alone should be empowered to disqualify such public servants, and only for adequate cause.

(b) It is further desirable that the state civil service examination department should act in an advisory capacity in connection with the employment of consulting engineers or experts for special temporary engagements, and that no engagements of that character should be legal without its approval.

This plan would tend to prevent the engagement through ignorance, or from interested or political motives, of incompetent or unscrupulous engineers and technical men and would likewise tend to facilitate the approval of plans for public works on the part of the several state departments concerned. It would also serve to minimize abuse under the system by which nominally free engineering services are rendered by commercial concerns, and by which patented schemes and devices of questionable merit, or of unnecessary cost, are prescribed in specifications for public works. Finally, it should serve as an effective check upon the prevailing method by which professional engagements are made a matter of competitive bidding. This system, which cannot be too strongly condemned, places a premium on incompetency and unscrupulousness at the expense of public interests. Experienced, able and reputable engineers refrain from participating in such competitions and would, in fact, have little or no chance of obtaining a commission under its operation.

(c) It should be one of the duties of the state civil service examination department to educate public and official sentiment as to methods of procedure in the employment of competent engineers and other technical men, and as to the danger to public interests through the engagement of incompetent men from mistaken motives of economy or other reasons.

In conclusion the committee recommends the creation of a state department of public works which shall be in charge of the administration of the above proposed (1) civil service examination system and (2) supervisory system of plans and inspection of engineering works, and in which shall be centralized such other matters relating to public engineering activities as may seem proper.

The principles embodied in the above report were approved by the Association of Members of the American Society of Civil Engineers at its meeting on Oct. 26 and by the Engineers' Club of Philadelphia at its meeting on Oct. 27.

A Double Loop on a Mountain Railway

The corkscrew loop shown in the view on this page is the Cimbatti Loop on the narrow-gage railway leading up to the hill station at Darjeeling, in Bengal, at the foothills of the Himalayas. This line begins at a point a short distance north of the Ganges River, which is reached from Calcutta by a standard-gage road, and continues on heavy grade to make the 7000-ft. rise to Darjeeling. At the loop shown, the track makes two complete circles each of a radius a little over 100 ft. Such construction is fairly common in the Luna Parks or other amusement parks of this country, but hardly to be expected on a regular passenger- and freight-carrying line.

THE CIMBATTI LOOP ON THE DARJEELING-CALCUTTA RAILWAY, INDIA

Slate Creek Bridge: Building a Concrete Arch Bridge 56 Mi. from Rail

By Jean H. Knox*

The first reinforced-concrete bridge in the Sierra Nevada Mountains of California was completed in October, 1913, spanning Slate Creek on the boundary line between Plumas and Sierra Counties.

In the spring of last year it was found that the Slate Creek bridge, although constructed only eight years, was in a state of ill repair and unsafe for further traffic. This structure, a 72-ft. combination wood-and-steel truss bridge, supported by concrete and steel cylinders, was the fifth bridge to be constructed at this crossing since the early fifties.

For years the people had accepted as fact the statement that the first cost of a reinforced-concrete bridge in a rough mountainous country, isolated from a railroad, was prohibitive, as compared with a wooden or a steel structure. The county engineer of Plumas County and the [illegible] decided to make a test case of comparative bids for various types of bridges. The lowest bid received for the construction of a steel bridge with wood floor and concrete abutments was [illegible], and the lowest bid for a reinforced-concrete bridge was [illegible]. The latter bid was accepted.

A brief description will serve to illustrate the [illegible] of the [illegible] bridge. The structure is a [illegible] rib arch. It was designed for a uniform live load of [illegible] lb. per sq.ft. or a [illegible]-ton roller. With an assumed ratio of moduli of [illegible], the allowed stresses were [illegible] lb. compression and [illegible] lb. shear in the concrete, and [illegible] lb. tension in the steel.

The principal features of the structure are shown in the drawing, Fig. 3. [illegible]

Columns rising from the arch-ribs support transverse floor beams, which cantilever 3 ft. out beyond either column; they were designed as T-beams. The floor of the bridge was designed as a succession of arched longitudinal T-beams running continuous over supports. Expansion joints are located over the hinges at crown and haunches. The columns and floor of the approach spans are similar to those of the arch span.

Ornamental balustrades extend the length of the bridge on either curb line. A blanket wearing surface ½ in. to 1 in. thick, composed of fine, dry gravel and asphaltum road oil, covers the surface of the roadway.

Fig. 1. Old and New Bridges

Fig. 2. East Abutment; Cantilever Type

(Slate Creek arch bridge in the Sierras 56 miles from rail, cheaper than a steel bridge.)

Standard specifications governed the kind and quality of all materials used in construction.

Conditions at Site Governing Construction

The bridge is located between La Porte in Plumas County, and St. Louis in Sierra County. The site is about [illegible] mi. south of Quincy, the county seat of Plumas County, and 56 mi. east of Oroville, in Butte County. [illegible] so all equipment and materials were shipped by rail to the latter town and freighted by six-horse teams to the bridge site. [illegible] The cost of hauling amounted to nearly [illegible] of the total contract price.

Slate Creek, in the vicinity of the bridge, flows through a deep, [illegible] rocky canyon, and the road crossing is located near the [illegible] of a bend in the creek. In the early days of mining, a tunnel was driven, [illegible] and the bed of the stream at the bridge site is practically dry.

[illegible]

*[illegible]

and carried away by scouring, till at this point there was left a clean bank of gravel 25 ft. high by 25 ft. wide near one end of the bridge site. The convenient location and excellent quality of this gravel made the problem of securing concrete aggregate a simple one. The gravel varied from well graded sand to 2-in. round gravel. The sand content was found by screening to be about equal to the coarse aggregate retained on a ¼-in. screen. The sand content was determined from time to time as the work progressed, enough screened coarse aggregate being added to make the proper proportions.

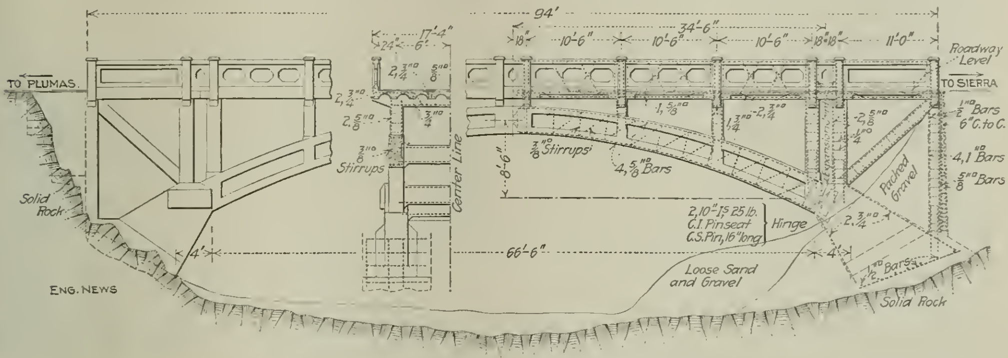


Fig. 3. Design Details of Slate Creek Bridge

Forms: Concreting

The concrete was mixed by hand. For concreting the abutments the mixing platform was placed on the side of the gravel bank, near the north abutment, and at a height that permitted the placing of most of the concrete for this abutment with chutes. Concrete buggies and wheelbarrows were used for placing concrete in the south abutment. Then the concrete for the short approach span over the north abutment was placed, and the mixing platform was then located on this portion of the completed floor. From this location the arch-ribs were poured and all that portion of the superstructure on the north side. The mixing platform was moved ahead on the floor as rapidly as completed, the concrete being shoveled directly into the forms or placed by means of metal chutes. These chutes were made from the rolled-metal forms which were used for the arched-floor system.

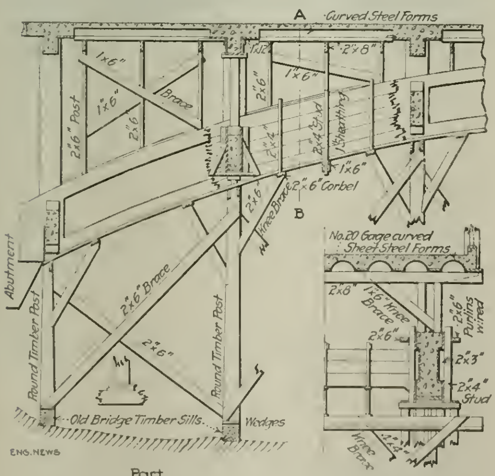


Fig. 4. Falsework and Forms for Slate Creek Bridge

Fig. 4 shows the form construction. Lumber for forms and falsework was hauled from a mill located about 20 mi. distant from the bridge. About 6 M ft. of sawed lumber was used. Round poles cut near the vicinity of the work were used for centering and falsework posts.

The arch-rib forms were supported by vertical posts at points just below the spandrel columns, 10½ ft. apart. The posts were connected at the top by two transverse 2x6-in. ledgers housed into the posts and bolted, and were further braced in two directions with 2x6-in. pieces. The soffit of the arch-ribs was formed with 1½x18-in. lumber bent to the true arch curve and held in position by knee-bracing to the posts.

Side forms for arch-ribs on the north half of bridge were made in sections, jointed at the spandrel columns, and, with the brace-beam forms, were used again for the south half. Forms for the spandrel columns and transverse floor-beams were also used twice.

The small arches in the floor were formed by using curved sheet steel of 20 gage, which was held at the corners of the 2x8-in. piece which formed the stem of the longitudinal T-beams, by 6d. nails. These curved steel forms were removed in from three to four days and were used four times. The forms for each floor panel were supported by three 2x8 joists 18 ft. long, resting on 2x6 posts, which in turn rested on the arch-ribs.

The railing panels, 10 ft. long, 2½ ft. high and 2½ in. thick, were cast two at a time on a level platform at one end of the bridge. After curing sufficiently, they were placed in position in the bridge curbs, framing into the forms for top rail and posts, which were then poured in place. Forms for one-fourth of total railing were framed, then used four times.

For the roadway wearing surface, the hot asphaltum oil was first applied directly on the concrete slab, using ½ gal. per sq.yd.; then the gravel was spread over the area and rolled to a smooth, compact surface. The roller was made by casting concrete in a form about 2 ft. wide and

2½ ft. in diameter, [illegible] through the center for [illegible] axle and [illegible] shafts.

LABOR, MATERIALS AND COSTS

Excepting the time used for removal of falsework and the old combination bridge adjacent to the site, the work was completed in 62 working days.

The working force consisted of one foreman, and 8 to 10 men, the majority of whom were common laborers who lived in the vicinity of the work. The men were willing workers but unskilled in concrete construction. The common wage was $3 for an 8-hr. day.

Materials in the bridge amounted to 60 cu.yd. of 1:3:5 concrete in the substructure, and 93 cu.yd. of 1:2:4 concrete in the superstructure, and 14,000 lb. of reinforcing steel. The structural and cast-metal hinges had a total weight of about 1800 lb.

The contract price for the bridge was $5540, and $170.80 was allowed for extra earthwork and raising the old combination bridge. The total cost of the bridge per square foot of floor area was $2.44.

Including superintendence, the following unit labor costs were deduced:

Bending and placing reinforcing steel	$0.012 per lb.
Mixing and placing concrete	2.14 per cu.yd.
Designing and falsework, including striking and removal	[illegible] per M ft.
Forms and cost of stripping	[illegible] per M ft.
	[illegible] per cu.yd.
Railing, in place	1.[illegible] per lin.ft.

The Slate Creek bridge was constructed and paid for jointly by the Counties of Plumas and Sierra, but the work was contracted for and directed by Plumas County. B. F. Barker is surveyor for Plumas County and was directly in charge of the work for the county. The [illegible] Engineering Co., Inc., of Oakland, were the designing and consulting engineers. [illegible] & Tibbetts, of San Francisco, were the contractors. L. R. [illegible] was resident engineer. D. M. McPhetres, who furnished the cost data and pictures for this article, was in charge of the work for the contractors.

Three-Stage Air Compressor for 2500-Lb. Pressure

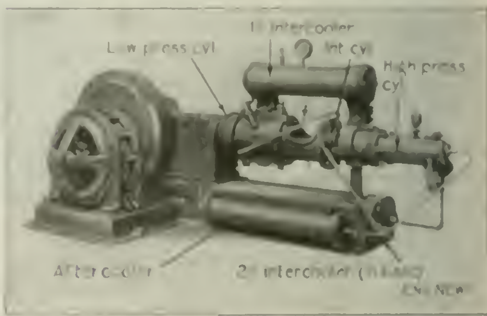
Air compressors with a terminal pressure of 2500 lb. per sq.in. have been built recently for the U. S. Navy Department, for use in the testing of torpedoes. They are of the horizontal type, with an electric motor geared to the compressor crankshaft. The [illegible] is on the [illegible], the crank [illegible]. The [illegible] cylinders are 7, 4½ and 1¾ in. in diameter and have a 10-in. stroke. The delivery capacity is 20 cu.ft. per hr. at 2500 lb. pressure, with a speed of [illegible] r.p.m., and absorb 30 hp. at the crankshaft.

The low-pressure cylinder is double-acting, is water-jacketed on the barrel and ends, and has vertical poppet valves. The intermediate and high-pressure cylinders are single-acting, [illegible] plungers (instead of pistons); [illegible], but the heads are [illegible] to render packing [illegible]. The intermediate cylinder has poppet valves, located at one side. The high-pressure cylinder has special poppet [illegible] and [illegible] valve seats of heat-treated nickel-steel. Each valve [illegible] in a [illegible] ground to fit a tapered opening at the rear end of the cylinder. The springs are within the plugs.

The air from the low-pressure cylinder passes to an intercooler of the ordinary type, with copper tubes, while the air from the intermediate cylinder passes to an intercooler consisting of a coil of seamless copper pipe placed in the bedplate. From the high-pressure cylinder the air passes to an aftercooler consisting of a coil of heavy seamless copper pipe placed in a steel tank at the side of the bedplate. This is to provide against drop in pressure in the storage reservoir due to a fall in temperature.

Salt water is to be used for cooling, and all the iron and steel parts of cylinder jackets, intercoolers and aftercooler with which this water will come in contact have been galvanized. To avoid galvanizing the base, however, the second intercooler is placed in a galvanized tank in the base. All pipes and connections are of brass, and the drain cocks are of bronze.

Six of these compressors have been built, for six navy yards. Three of these have alternating-current motors of slip-ring type wound for 220-volt three-phase 60-cycle current, and running at 855 r.p.m. The others have 220-volt compound-wound direct-current motors with commutating poles, and running at 900 r.p.m. The compressor has a combined flywheel and gear wheel, having



THREE-STAGE AIR COMPRESSOR SUPPLYING AIR AT 2500-LB. PRESSURE FOR TESTING TORPEDOES, U. S. NAVY

(Sullivan Machinery Co., Chicago, Builders)

an internal gear bolted inside the rim. This engages with a cloth pinion on the motor shaft.

The compressors were built by the Sullivan Machinery Co., of Chicago. They were subjected to an eight-hour official test under pressures as high as 3000 lb., with satisfactory results.

San Francisco's New Municipal Street Railways

By A. J. Cleary*

SYNOPSIS—San Francisco officially declared itself in favor of municipal ownership in 1900, when the electorate adopted a new City Charter. The first proposed bond issue of $2,000,000 for a municipal railroad was defeated by a narrow margin at an election held in June, 1909; at a second election in December of the same year, the municipal-railway bond issue was carried by a three-to-one majority. This provided $1,900,000 to build an electric line on Geary St. from Market

*Assistant City Engineer, San Francisco.

to the ocean; the second applied $120,000 to the construction of a line down Market St. from Geary to the ferries.

Construction of the Geary St. railway started in the summer of 1911 and was completed in June, 1913. The cost was $103,564 per mile, and the financial returns on the money expended have been very satisfactory. Thus encouraged and realizing that the success of the Panama-Pacific Exposition depends largely on the adequacy of street-railway facilities, in August, 1913, the citizens approved a second bond issue of $3,500,000 for new lines. The entire municipal system is shown in Fig. 1. Excellent progress has been made in construction and it is expected that all of the lines will be in operation before the end of 1914.

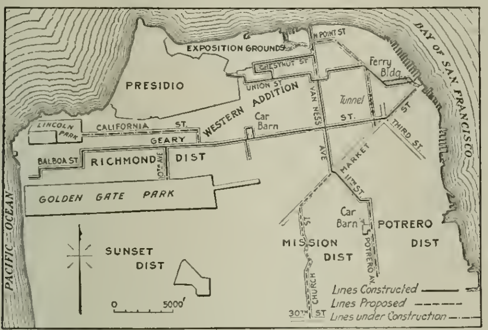


Fig. 1. Map of San Francisco Municipal Railways

Track Construction—The standard track construction consisted of 9-in., 106-lb. girder rails in 60- and 62-ft. lengths, laid on tie-plates over 6x8-in. by 8-ft. redwood cross-ties, at 2-ft. centers, with ⅞-in. round tie-rods spaced 10 ft. in straight track and 5 ft. in curves. Rails in curves are supported by braced tie-plates. Joints have 36-in., 12-bolt plates of standard section. There is 8 in. of broken-rock ballast under the ties in standard track and 15 in. for special work. Copper bonds (900,000 circ. mil) are brazed directly to the rails.

The curves have been designed to give passing cars a clearance of not less than 12 in. All track special work is of solid manganese steel and consists, so far as possible, of interchangeable switches, mates, frogs and cross-pieces, which, in various combinations, will compose any layout of branch-offs, cross-overs and right-angle crossings or combinations thereof, in standard 9-in. track. In the design of these standard pieces, an endeavor was made to reduce the number to a minimum, as their interchangeability will facilitate maintenance. The total number of pieces of different design is 35. The section of all joints in track special work is such as to permit the use of the standard joint plates without modification.

Construction Work—In order to hasten construction, several labor-saving devices were introduced. A 3-in. sharpened circular steel flange attached to the wheel of a steam roller, was used in cutting the asphalt surface of the street pavement. The top and the concrete base beneath were then broken by a 2-ton drop-hammer pile-driver, mounted on skids to permit swinging from side to side of the trench and moving forward as the pavement was broken up. The broken concrete base was next removed from the trench and fed to a movable crusher, which reduced it to ballast size. The roadbed was then excavated to subgrade, by means of a half-yard steam shovel, and 6 in. of crushed concrete was spread and flushed with sand. After this the surface was compacted with a 10-ton steam roller.

Ties were laid, rails were placed on tie-plates, joints were bolted temporarily and the rails spiked to gage. The maximum permissible variation of gage from standard (4 ft. 8½ in.) is $\frac{1}{16}$ in. All rail bending to horizontal and vertical curves was done by the contractor—part in the field by a hydraulic bender operated by a hand pump, and part by power machines at the rolling mills or railroad shops. Such drilling and reaming as was necessary was done with a portable electric track drill. After spiking, the lining and surfacing gang adjusted the track to perfect line, gage and grade. Finally the spaces between ties were filled with ballast, the concrete base for header blocks and pavement was poured and the pavement replaced.

Cars—For the Municipal lines, 125 new cars have been purchased. They are of the "California semi-steel" type, 47 ft. 1 in. long over bumpers, 9 ft. 2½ in. wide and 11 ft. 8 in. high from the top of the rail to the top of the trolley board. All structural parts, up to window sills, are of steel and so formed as to give extreme rigidity with minimum weight. The construction above the window-sill line is of the finest grades of California wood. For instance, the roof has no inner lining as the roof boards were of white cedar, which was purchased in San Francisco by the car builders and shipped east to the factory. This wood was selected for grain and color and has been varnished, presenting a very pleasing appearance and reducing the weight of roof structure without sacrificing strength.

Each car has four 60-hp., 600-volt interpole motors with multiple-unit switch control. The cars can be rapidly accelerated to full speed and can surmount heavy grades at normal speed. Special additional features in air-brake equipment have been provided as emergency devices. A valve under the body will set the brakes if air-brake pipes or appurtenances are disabled; at each end of the car, within reach of the conductor, is an additional emergency valve.

Fig. 2. Special Trackwork of San Francisco Municipal Railways, at Van Ness Ave. and Geary St.

Construction of the Municipal Railroads and their equipment is under the direction of M. M. O'Shaughnessy.

City Engineer. T. W. Ransom is Consulting Engineer, L. E. Hunt is Chief Assistant Engineer and N. A. Eckart, Engineer in Charge of Construction. P. J. Ost & Ebersold, Engineers.

A Large Coaling Station at Toledo; L. S. & M. S. Ry.

A large coaling station for locomotives forms a part of the shop and terminal improvements recently completed by the Lake Shore & Michigan Southern Ry. at Air Line Junction, about four miles west of Toledo, Ohio. It is of the bridge type, spanning seven tracks, and has an overhead storage bunker of 1000 tons capacity, with a weighing hopper over each track. Provision is made also for delivering sand to the engines. Water cranes are located along the engine tracks which pass under the coaling station. About 80 locomotives take coal daily at this point, with an average supply of 8 tons per engine.

FIG. 1. A LARGE COALING STATION ON THE LAKE SHORE & MICHIGAN SOUTHERN RY. AT AIR LINE JUNCTION, OHIO

([illegible])

The construction is shown in Fig. 2, and Fig. 1 is a view of the completed coaling station. The steel bunker structure is about 150 ft. long, supported on four rows of columns 37 ft. 6 in. c. to c. [illegible]. At one end is the tower of the elevating conveyor, carrying the coal from track hoppers at the base, and this end is fitted with diagonal bracing to resist any tendency to longitudinal movement. At the further end the structure extends as a cantilever about 18 ft. beyond the columns, so as to serve the [illegible] track. The side sheathing and the roofing are of corrugated sheet iron. The erection was done with a stiff-leg derrick, having a 115-ft. boom, the derrick occupying one position during the entire work.

At the elevator end, there are two coaling tracks, each with two track hoppers of reinforced-concrete construction to receive the coal from dump cars. Beneath each pair of hoppers is a cracker for breaking large lumps and sizing the coal. A feeder of the reciprocating plate type carries the coal from the discharge opening of the hopper to the cracker. If the sizing is not necessary, the coal can be delivered directly to either of the two elevating conveyors, being fed to the buckets by a revolving loader having four buckets and driven from the conveyor chain.

The two conveyors have chains of steel-bar links $17\frac{1}{2}$ in. long with 6-in. rollers riding on a channel track. The buckets are 30 in. wide, spaced 35 in. apart, and each holds about 250 lb. of coal. The conveyor runs vertically in the inclosed end tower and then extends horizontally over the storage bunker, the buckets being dumped by means of tilting devices, which can be set at any desired point in the horizontal line of travel. These dumpers have cams which engage with cams on the buckets. The driving mechanism is mounted above the bins, and each conveyor is driven at a speed of about 10 ft. per min. by a 25-hp. motor.

Over the track and beneath the discharge gate of the bunker hopper, is a weighing hopper of 20 tons capacity. This is filled with coal and the total weight taken. When an engine is spotted under the weighing hopper, the spout is lowered, the rocking gate opened and the coal dumped on the tender until the enginemen signals that enough coal has been delivered. The gates are then closed, the spout raised and the operator weighs the remaining coal. The difference between these two weights is the amount of coal which has been received by the engine. The tickets upon which this information is printed are sent daily to the accountants, who then issue a coal report at the end of the month.

Each weighing hopper is supported on a 30-ton scale, with type-registering beams placed in the weighing house. The poise on the scale beam has a slot into which a card is inserted, and as a lever on the poise is pressed down, the weight is recorded on the card. The scale man in this cabin has control of the weighing apparatus, the levers operating the gates of the storage bunker and weighing hoppers, and the levers operating the coal chutes to the tenders. From his cabin he has a clear view of the tracks.

There are three sand tanks of 10 cu. yd. capacity, supplied with sand from a dryer. The delivery spout is adjustable and is protected from rain and sleet. The sand valve is [illegible] and of the undercut type, its edges overlapping the discharge openings so that it is sand-tight

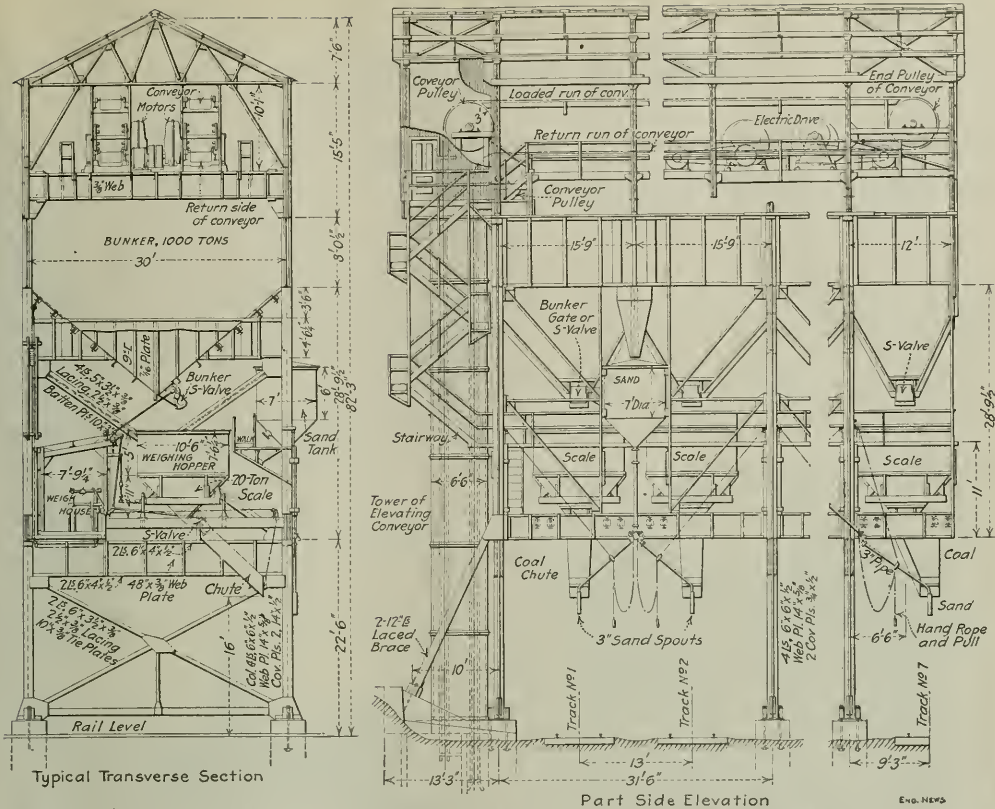


FIG. 2. COALING STATION FOR THE LAKE SHORE & MICHIGAN SOUTHERN RY. AT AIR LINE JUNCTION, OHIO

when closed. The valve and spout are controlled by the fireman on the engine.

This coaling station was designed and built by Phillips, Lang & Co., of Chicago, and its machinery equipment was furnished by the C. W. Hunt Co., of New York. The work was under the general direction of G. C. Cleveland, Chief Engineer of the Lake Shore & Michigan Southern Ry.

Methods of Taking Records of Street Traffic

The following suggestions for a traffic count are abstracted from the report of the Committee on Way, presented at the recent annual meeting of the American Electric Railway Association:

The period to be covered should be 14 consecutive hours, from 5 a.m. to 7 p.m., and during six consecutive or different week days. However, if average weather and traffic conditions are known and selected, the record may cover only three consecutive week days. No traffic should be counted in abnormal weather, such as seasons of snow and ice, nor during continuous rainy, very hot, or excessively cold days, and holidays. The location of the count should be at or near the center of a block and not at any street intersections and traffic both ways must be counted. The observer may be stationed upon the walk, but an elevated position is better and a room facing the street is best.

The general classification of vehicles for practical results is as follows: (1) Horse vehicles; subdivided into one-horse, two-horse, three or more horses; (2) motor vehicles.

The horses as well as the vehicles must be considered in computing weights of traffic from the quantities counted and recorded, because the horse, as well as the vehicle, helps wear the pavement and occupies space. Experience in such counts shows that for general record purposes the average weight of all one-horse vehicles (empty and loaded) can be taken as one ton (2000 lb.); two-horse vehicles as two tons; three or more horse at four tons. Similarly the average of all motor vehicles (empty and loaded) for transportation of persons and goods may be taken at 1¾ tons. Exclude all bicycles, motorcycles and ridden horses.

The record is made on a set of four cardboard slips of different colors, each about 2x9 in., and fastened together by a clip near one end; 14 sets are needed per day, one for each hour. If traffic is extra heavy, more than one set can be used for each hour. Each set is marked for location where count is taken, name of observer, date, hour covered by the set, and the number of standing vehicles. Two observers are required, to relieve one another at the end of each hour, because one recorder cannot work accurately for a longer period.

An ordinary conductor's punch is used and a hole is punched in the proper slip for each vehicle passing in either direction in front of the recorder. One-horse vehicles are punched in the white slip; two-horse in the blue; three- or more horse in the red, and motor vehicles in the yellow slip. Each slip bears a heavy ruled line in the center, lengthwise, and vehicles which are outside of the car tracks are punched above this line and those inside of tracks are punched below the line. A vehicle is to be considered as being in the tracks if the two wheels farthest away from the recorder are on the tracks inside the gage line of the rail nearest the observer.

The number of vehicles standing at curbs is taken generally every two hours, by the relief observer, just prior to the hour, and is recorded on the slips. The number of holes in each slip are not counted until a recorder has stopped observing traffic, either after relief or at the close of the work. The number of holes counted should be written on each slip.

Field and Office

Floating Lock-Gate Lifter for Trent Canal, Canada

The two accompanying views show the new lock-gate lifter which has recently been built for the Department of Railways and Canals of Canada for service on the Trent Canal in Ontario. Its capacity of 50 tons and a clearance above the deck of 27 ft. will enable it to step any of the mitre gates on the canal. The machine consists of a structural-steel collapsible derrick mounted on a steel pontoon, with separate steam engines for operating the derrick, lifting the gates and controlling the balancing weights.

The pontoon supporting the derrick is made of steel plating with extra-strong steel framework, there being two longitudinal and three transverse trusses. Its length is [illegible] ft., beam 27½ ft., and depth 9 ft.

The derrick is hinged at mid-height so that the upper part can be lowered to clear the bridges over the canal.

Fig. 1. In Working Position

Fig. 2. Lowered to Clear Bridge

Floating Lock-Gate Lifter for Trent Canal

Its working position is shown in Fig. 1. In transporting the lifter from one lock to another the upper part is lowered as shown in Fig. 2. The operation of raising and lowering the derrick is controlled by a [illegible] cylinder engine mounted on one of the back legs [illegible]. The gates are lifted through the medium of two [illegible] which are suspended by [illegible] steel cables from the [illegible] of the front legs of the derrick. This lifting is controlled by a [illegible] engine. The operating levers of all engines are brought to one position for the convenience of the engineer.

The pontoon is kept on an even keel during the lifting process by two movable ballast cars under the deck. Each car is moved by a screw operated by an independent engine, which is controlled by pendulum governors automatically moving the ballast to the proper position to put the pontoon on an even keel. In addition to the automatic control the ballast-car engine can be operated from the engine room above deck. Dial indicators are provided there to show the position of the ballast cars at all times.

The device has been used in stepping the gates on the locks of the Ontario-Rice Lake division of the canal and has met all expectations. The total time for stepping each leaf is 20 min. (upper leaf) to 40 min. (lower leaf).

The machine was built by M. Beatty & Sons, Ltd., of Welland, Ont.

Sediment Test for Water and Other Fluids

By Robert Spurr Weston*

For some time a simple device has been used successfully for determining the amount of visible sediment in milk. It was suggested by Prof. George C. Whipple, of Harvard University, that this test be applied to waters, especially those containing suspended algae or other organisms, suspended iron, silt, etc.

The method was illustrated by Professor Whipple in connection with a committee report at the annual meeting of the New England Water Works Association, Sept. 9, 1914, and again at the meeting of the American Society of Municipal Improvements on Oct. 6, 1914.

Briefly it consists in straining a measured volume of water (1 pint) through a disk of cotton felt 25 mm. in diameter and 1 mm. thick. The operation requires but [illegible] of filtration and the result is a visible record of the suspended matter, which record is far more intelligible to the average man than any numerical expression—for example, of "suspended solids," "albuminoid ammonia" or "microorganisms."

*Consulting sanitary engineer, 14 Beacon St., Boston, Mass.

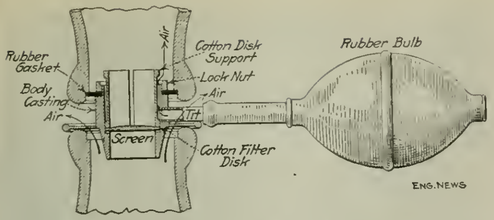


Fig. 1. Sediment Tester in Position for Use

The tester (Fig. 1) consists of a device for holding the cotton disk. The holder has a rubber gasket so that it may be slipped into the cap seat of an ordinary milk bottle. There is a woven-wire screen for supporting the disk in the holder and a rubber bulb for forcing the air into the bottle. After the disk is placed in the holder, it is slipped into the neck of a milk bottle full of water, the bottle is turned upside down and air pumped in to displace the water and force it through the disk.

The disks, after the water has been passed through them, are dried and mounted on sheets of paper.

By determining the sediment in the water at stated intervals, it is possible for any water-works manager to obtain an excellent record of the visible appearance of a water-supply from time to time. It is also very useful in determining the degree of growth of microscopic organisms in various ponds forming the sources of one

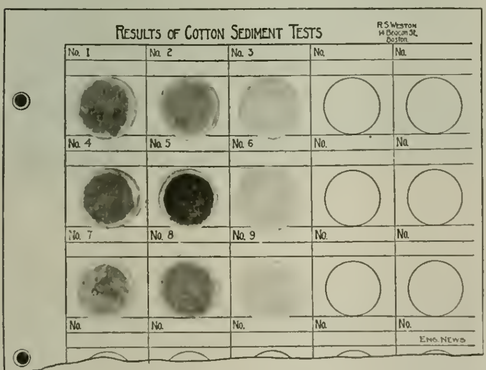


Fig. 2. Cotton Disks After Use for Testing Water for Sediment

(In the practice of the author, these disks are mounted on blank forms, made up as 8x11-in. loose-leaf sheets. Half of one of these sheets is here reproduced.
The samples were taken from the following sources:
1. Charles River at Cow Bay.
2. Wells, Brookline Water-Works.
3. Experimental filter effluent, Brookline Water-Works.
4. Reservoir, Belfast, Me.
5. Coagulating-basin effluent, Belfast, Me.
6. Filter effluent, Belfast, Me.
7. Reservoir, Exeter, N. H.
8. Coagulating-basin effluent, Exeter, N. H.
9. Filter effluent, Exeter, N. H.
Obviously, the colors of the original are lost in the reproduction. To some extent, the relative shades of the originals have also been lost.)

supply; also in determining the relative clearness in different parts of a distribution system, of a water which contains suspended iron rust or silt.

Before the method was published, Professor Whipple suggested its use to the writer, who has made use of it during the past summer with a great deal of satisfaction. Fig. 2 illustrates the results of nine of these tests.

The testing device here described is known as the Wizard Sediment Tester and is made by the Creamery Package Manufacturing Co., of Albany, N. Y. The company also supplies cotton disks for use with the tester.

An Instrument for Recording Roughness of Pavement Surfaces

For the graphic measurement of inequalities in street surfaces, an instrument called the "trafilog," operating on the inertia principle, has been used in Cleveland, Ohio, by a subcommittee of the general good-roads committee called together a few months ago by the Cleveland Chamber of Industry. By attaching this instrument to the floor of a vehicle, charts are obtained containing records of the riding qualities of the streets traversed.

The "Trafilog," an Instrument for Recording the Roughness of Pavement Surfaces

To explain the accompanying illustration, the button *A* on the right is for starting and stopping the rotation of the chart. The chart is mounted on a disk and driven by a clock train. The lower horizontal arm is one of a pair of parallel links which support the clock movement. The movement is counterbalanced by a flat-leaf spring, *B*, a curved part of which is seen on the right. On the left is an oil dashpot *C* for damping the oscillation. The marker *D* has a jewel stylus which scratches the surface of the chart. The chart is a specially prepared paper with a white coating over a dark base.

The pen of the instrument is geared so that a horizontal line is drawn on the face of the chart by the clock movement; a vertical line is made when a wheel of the vehicle drops into a rut. When it comes out of the rut or strikes a bump the direction of the line is reversed. The length of the mark is proportional to the depth of the rut, and the steepness of the lines indicates the nature of the edges. There is no provision to take care of vibrations or usual lateral swings of the vehicle.

The instrument is set on the floor of the vehicle and held down by the observer's feet resting on the base plate, although for continuous or extended runs the instrument is mounted on a bracket in front of the observer. The instrument was devised by W. H. Brown, and is made by the Brown Traffic Co., Rose Bldg., Cleveland, Ohio.

Removing Subway Excavation Spoil with Portable Bucket Elevators

Portable bucket elevators are being used on Section 3, Division 1, of the new 7th Ave. subway on Greenwich St., near Reade St., New York City, to lift excavated dirt to the street. With this type of machine, large street openings are unnecessary, as the standard 24-in. manhole is utilized by extending the bucket chain by means of an idler shown in Fig. 1.

The elevator, illustrated in Fig. 1, is self-contained and consists of a timber frame, chain and buckets, motor and driving mechanism, and feet. The buckets are 8x5 in. and spaced 18 in. on the chain. The outfits can handle 15 to 20 tons of dirt per hour each and are kept fairly busy on this job.

Fig. 1. A Portable Bucket Elevator on Subway Excavation in New York

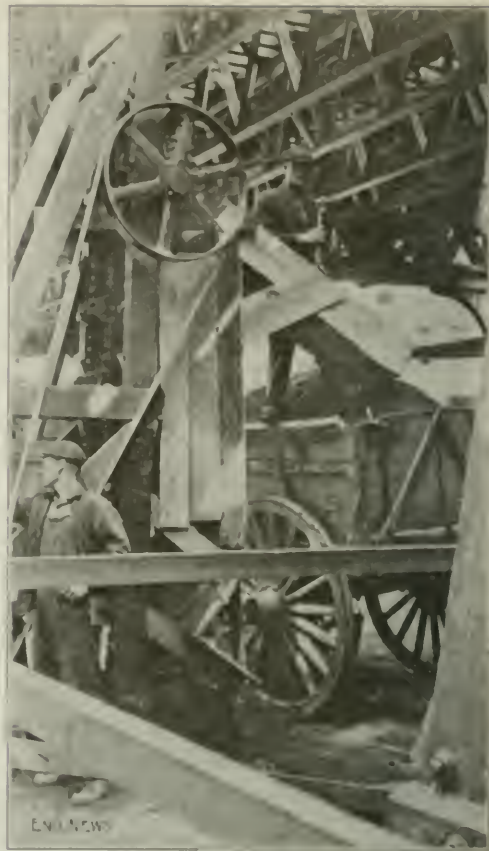


Fig. 2. Cart Being Loaded from Chute Fed by Buckets

The dirt is shoveled or dumped from wheelbarrows into the boot at the foot of the elevator, lifted to the street and chuted into carts, as shown in Fig. 2. A cart is loaded in 10 to 15 min.

When the digging has progressed sufficiently to make it desirable to move the elevator to a new location, the chain (which is of the [illegible] type) is removed from the sprocket in the foot and hauled up on the framework. The whole is then moved where desired. The foot is made to pass through a manhole, so it travels along under the street surface. Manholes are located about 100 ft. apart.

The Degnon Contracting Co. has four of these bucket elevators in operation at the location named. They were furnished by the Robins Conveying Belt Co.

The Efficiency of Clamps on Tie-Rods in forms for concrete work [illegible]

Calibrating Some Venturi Meters for Air Flow

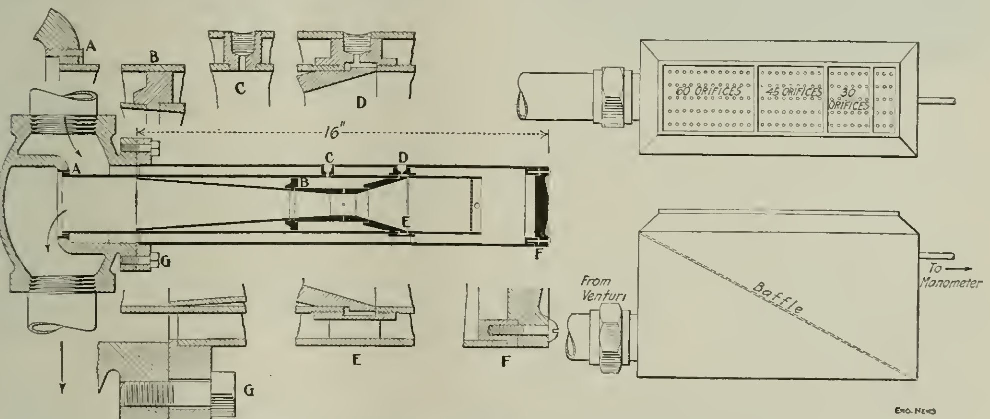
In the design of the Brooklyn Sewage Experiment Station under Geo. T. Hammond, Engineer of Sewer Design, Bureau of Sewers, Brooklyn, N. Y., one of the troublesome problems was in securing a meter for the compressed-air lines. On account of the quantity of air used and the pressure, no form of available gas meter was found to meet the requirements. Therefore, special Venturi meters were designed jointly by Mr. Hammond and Wallace & Tiernan, of New York City. Interest attaches first to the method of calibration and only somewhat less to the details of the meters.

Calibration—The calibration method is of unusual interest and wide application. On account of the quantity of air flowing, it was impractical to use a gasometer for calibrating the meter. Therefore, a special multiple-orifice box was built to receive and measure the air passing through the meter. The top of the box was a metal plate having, in all, 150 orifices of the same size (punched with the same die) equally spaced. This top plate had a cover so arranged that any number of orifices from 1 to 150 might be left open. The orifices were designed to discharge 1 cu.ft. per min., under a head of 10 in. water pressure. A perforated metal screen, placed diagonally across the box, prevented eddy currents. Preliminary readings were made with a small gasometer to determine the air flows from different orifices (for rating the calibration box) and from different groups of orifices to see if there was any variation because of location or number of those discharging. It was found that the flows agreed within ½%.

In calibrating a meter, the box was connected to the air line through the meter and a certain number of orifices were uncovered on the top of the box, a stop valve being opened until the desired head was shown on the box manometer. Knowing the discharge for this number of orifices and the corresponding pressure, it was a simple matter to mark on the Venturi-manometer scale the flow corresponding to the height of liquid. The scale was then fully graduated in cubic feet per minute after having determined several of these points.

Venturi Meters—The specifications, according to which the Venturis were made, called for three sets of meters; one reading from 20 to 150 cu.ft. per min., one from 5 to 20 cu.ft., and a third from 1 to 30—all operating under a pressure of about 40 lb. per sq.in. In order to secure the desired range with accuracy a type was designed with interchangeable throats. To secure accuracy through the range indicated, five meters would ordinarily be employed. Such multiplicity was ingeniously obviated in this case. The meters were assembled in tubes of the same size so that any one could be screwed into the body of an ordinary 3-in. check valve put in the air line. There were three barrels complete, with Venturi throats, etc., for each meter. Two of these three barrels were of small capacity and each had interchangeable throats, while the third was larger and had but one throat.

Air passes from the check valve (following the arrow in the upper left of the section of the meter shown in the accompanying drawing) along the meter barrel, through the throat and out through the air line again.



Venturi Meter for Air Flow and Multiple-Orifice Calibrating Box

To put in a larger or smaller throat giving the desired capacity, the barrel cap is removed, the approach tube screwed out of its bushing, and the throat approach and throat taken out. Without displacing further parts, the smaller or larger throat is inserted. All parts were made of brass and bronze.

The manometer intended for use with these Venturis was of special design. The cross-section of the oil reservoir was made many times greater than that of the manometer tube, so that the zero point was practically unaffected through the range of the scale. The upper end of the manometer tube, which was connected to the Venturi throat chamber, had a reservoir interposed of capacity slightly greater than that of the lower reservoir. This was done to prevent blowing any of the oil into the pipe line by sudden rushes of air.

It may be added that these meters are used to measure compressed air supplied in experiments on the aëration of sewage. The entire equipment of the Brooklyn Sewage Experiment Station was described in Engineering News, Oct. 22, 1914. The same issue contained a short article on the calibrated orifices for controlling sewage flow at the station just named.

A Contractor's Coal Scow with Portable Motor

In designing ditches and an outlet from a lake for purposes of drainage, the contractor found difficulty in getting fuel to the dredge. The shore being of very soft soil, he could not haul the coal near the work, but was compelled to unload it at a road crossing and one other point where the high land came near the ditch, and it was necessary at times to carry it in a scow for about two miles to the dredge.

A Contractor's Scow Fitted with a Portable Motor and Carrying 8 Tons of Coal to a Dredge

The machine requires 5½ tons of coal per day and has storage capacity for 30 tons. The plan is to handle one 8-ton load daily until the bunkers are full, and then wait a day, or if the weather is bad two days may be missed.

The coal scow is 12x18 ft., 28 in. deep, and carries about 8 tons. It is slow and difficult work to navigate it by hand, the ditch being 18 ft. wide on top and 11 ft. deep. The contractor therefore purchased a portable marine motor of 3½ hp., made by the Evinrude Motor Co., of Milwaukee, Wis. With this a speed of 4 m.p.h. is made, while the scow is easily handled. This loaded motor scow is shown in the accompanying cut. The motor has a frame hooked over the stern of the boat and carries a little gasoline motor at the head of a vertical shaft, geared to the short propeller shaft at its lower end. No rudder is required, the propeller being shifted to steer the boat.

The same motor is used on the scow which carries the men from the house-boat to the dredge. When the house-boat is to be moved, it is towed by the empty coal scow. The adoption of this device enables the contractor to use roughly made and cheap barges, which will stand the rough handling, and yet have the advantages of power equipment and save the expense of a gasoline launch for towing.

The work is in Emmet County, Iowa, and the contractor is D. C. Stephens. For information we are indebted to H. B. Whitney, manager for the contractor, Hippee Building, Des Moines, Iowa.

Novel Method of Trench Excavation

By J. C. Lattimer*

The accompanying views illustrate a novel method used by the Ault Construction Co. in excavating a trench for a water main installed by the city of Baltimore, near Clifton Park. The main is of reinforced-concrete pipe, with an inside diameter of 7 ft., the shell being 7 in. thick. The pipe sections are 8 ft. long and were cast in a yard near one end of the trench. The length of the trench dug by the Ault Construction Co. was about 1700 ft. The average depth was 15 ft., varying from 12 ft. at one end, to 20 ft. at the other, while the width was 13 ft.

The method used in trenching is plainly shown by the accompanying illustrations. A dragline bucket with a capacity of 22 cu.ft. was pulled up an incline by an

*Baltimore, Md.

Fig. 1. Incline and Dumping Tower for Dragline Excavator

Fig. 2. Dragline Excavator for Sewer Trenching

ordinary contractor's engine and dumped into a hopper which delivered the earth to carts or wagons.

The total amount of earth removed by this method was approximately 13,000 cu.yd., one-quarter of which was hauled away to allow for the space occupied by the pipe. The balance was piled up at one side of the trench to form an embankment, upon which was placed track for a locomotive and locomotive crane to handle the concrete pipe sections.

The essential reason for adopting this scheme of excavation instead of a steam shovel was that, owing to the character of the material, the banks would not stand without supports. It was found necessary to carry down 2-in. sheeting as the excavation proceeded. Waling strips 6x8 in., about 16 ft. long, were held in place by vertical 6x8-in. timbers, which were cross-braced at the top and intermediate points by other 6x8-in. timbers. At the bottom of the trench 6x8-in. timbers were placed at intervals, so spaced that they would come directly under the joints of the concrete pipe. Concrete was placed under the pipe and between the timbers to prevent settlement.

The sheeting was driven by two small steam hammers, which were carried by block and falls hung from steel cables directly over each line of sheeting. Steam for these hammers was taken from the boiler which supplied the hoisting engine. The capacity of this boiler being insufficient, its output was supplemented by that from a traction engine.

This work proceeded rapidly, as high as 250 scoopfuls being removed in one working day, which means an average of a round trip in two minutes. The sheeting and bracing were carried along simultaneously.

The Ault Construction Co. has another contract for a similar trench in which the material is all solid rock which has to be blasted. They are using a similar device for removing this material.

WHAT IS GRAVEL?

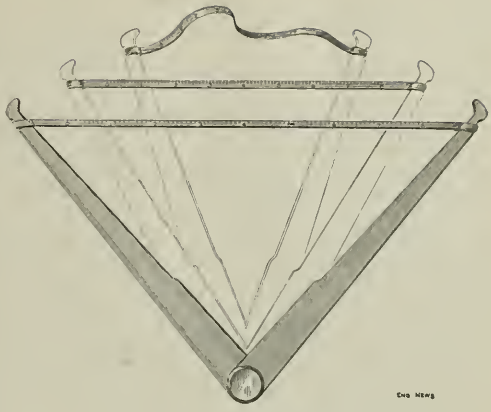
A concise and clear definition of gravel is desired by manufacturers of machinery for excavating and handling this material. What maximum size, proportion and character of stones mark the line between gravel and boulders, when (for instance) a machine is guaranteed for handling "gravel." The dictionary definitions are not sufficiently clear and explicit to meet the requirements of the case. Probably many of our readers have encountered this problem in different ways, as in the classification of material for excavation, and we shall be glad to have their views in the matter.

NOTES

An Ingenious Proportional Scale—Something new in the way of proportional scales for measuring or transferring dimensions has been worked out by F. J. Winters, draftsman, New York City, for use in his own work. The device is sketched herewith. A piece of narrow elastic webbing is stretched between the points of a pair of firm-joint straight-leg calipers. A scale is inked on this webbing, and by changing the spread of the calipers this scale is stretched or shortened to suit the needs of the case.

Whoever has experienced the bother of trying to read dimensions from a drawing which contains possibly half a dozen different-scale sketches will appreciate this device. The device proves especially useful when the scale of a drawing is not given, but a particular dimension is shown, as, say, 7 ft. 10¼ in., in which case there is some difficulty in finding the scale of the drawing in the ordinary way, while with this proportional device the proper setting is made instantly.

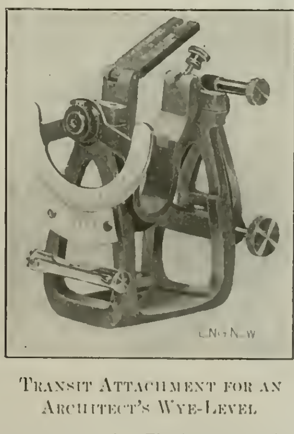
In inking the scale on the elastic band—which is simply



An Ingenious Proportional Scale

narrow elastic hat tape of best quality about $\frac{3}{16}$ in. wide—the markings are made when the band is stretched out. They must be made with a fine-pointed brush dipped in India ink, as a pen will pull the tape out of line and falsify the dimensions or markings. When the band is let go, the marks become fine and sharp. The chief difficulty with this device is that the tape does not retain its proportionality of stretch in the different parts of its length more than three or four months, when a new band must be put on. For those who have much proportional measuring to do, it is of such value that even the frequent replacement of the measuring band is no great objection.

A Wye-Level with Transit Attachment—A new type of surveying instrument has recently been put on the market which combines a 12-in. architect's wye-level with a transit attachment. Obviously the transit is not intended for accurate survey work, for the horizontal and vertical circles read only to 5′. It does answer, however, for laying out buildings and similar work, while used as a wye-level it has much greater accuracy than a cheap transit; and accuracy in leveling is an important factor in the work for which the instrument is designed. The instrument is built like an ordinary wye-level except that it has a horizontal circle below the level bar. In the center of the level bar is a threaded hole into which fits a thumbscrew for fastening on a transit attachment (shown in accompanying illustration) consisting of telescope standards, a 50° vertical arc, reading to 5′, and a level vial. The level telescope is mounted in these standards and the instrument is ready for use as a transit. The instrument is made by Geier & Bluhm, Troy, N. Y., and is listed, complete with tripod and accessories, at \$60. The transit attachment alone is listed at \$10, and can be made to fit any architect's level.

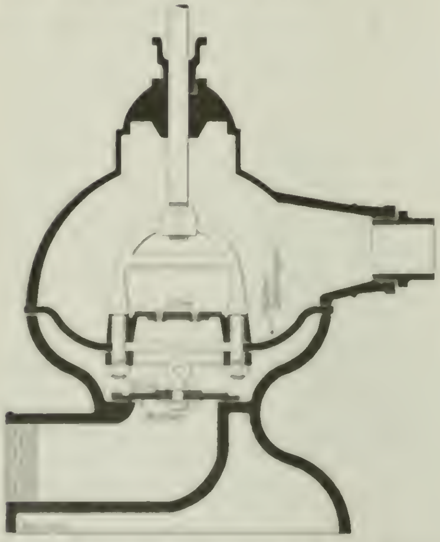


Transit Attachment for an Architect's Wye-Level

A Method of Interpolating Slope-Stakes on Uneven Ground—I had occasion recently to run a survey line crossing a number of small drains, diagonally. The ridges between were not high, approximately 15 ft., and the distance from ridge to ridge varied from 100 to 250 ft. The profile of the line was to be a balanced one, and the side slopes were to be carefully done to give a good appearance, and were to be sodded. To secure nice, even slopes, I realized at once that

[illegible]

Injecting Grout with Diaphragm Pumps—[illegible]



Section of Diaphragm Pump, Used for Grouting by Hugh Nawn Contracting Co.

Manganese Steel Dipper Buckets for Panama Dredges—[illegible]

Manganese-Steel Dipper for Panama Dredges

[illegible]

Fast Work with a Power Saw for Construction Timbers—[illegible]

Gasoline-Power Portable Saw for Construction Timbers

[illegible]

Editorials

The Mechanical Engineer in Municipal Engineering

A notable and unprecedented feature of the coming annual meeting of the American Society of Mechanical Engineers, to be held in New York City during the first week in December, is the devoting of one entire day to papers and discussions on the general subject of municipal engineering. It has hitherto been generally accepted that city engineering work was matter with which the civil engineers had solely to do. Such work as city surveying, paving and sewerage are well recognized as belonging to the civil engineer, primarily. On the other hand, other functions which are becoming more and more prominent in the administration of cities at the present day, such as electric lighting, street railways, treatment of garbage and refuse, necessarily bring in the mechanical engineer to a large extent.

The mechanical engineer, moreover, is laying claim to be considered as an administrator as well as a technical employee. In the broad field of administrative work, the engineer needs, of course, a general grasp of professional knowledge rather than special details. The engineer appointed as a city's general manager, for example, must, through his subordinates, deal with every aspect of municipal work, from the laying out of street grades to the purification of the boiler water-supply in a power station. There need be no jealousy or rivalry, therefore, between the civil and mechanical branches of the profession in municipal engineering work, and in fact a number of those who are on the program for papers at the Mechanical Engineers' Convention on Municipal Day are prominent civil engineers. What is the most important consideration of all is that such an emphasis by a public meeting of the engineer's part in carrying on city administration cannot but have a useful effect in the formation of public opinion as to the value of the engineer's service in the municipal field.

Continuing Activity in the Building Industry

The returns made to Engineering News by the building departments of 17 Eastern cities of the building permits issued for the month of October show a falling off of only 8% in the total value of buildings for which plans were filed during that month as compared with October of 1913. In 20 cities of the Middle West there is a considerably larger falling off, but it is not uniform, and some cities, such as Cleveland, Columbus, Des Moines, Duluth and St. Louis, report more building plans filed last month than in October, 1913.

This is the most notable evidence of returning business confidence and the revival of prosperity that has anywhere appeared. It is a far better index of what may be expected in the near future than any record of current business transactions in the iron and steel market or the clearing-house exchanges. It shows that a large proportion of real-estate owners have confidence enough in the future to carry on work previously planned to the stage of actual construction. It may be assumed where plans are filed for a building that arrangements have been completed for financing its construction. It means, furthermore, that the people who are putting up these buildings believe that the times will be prosperous enough when these buildings are completed, six months to a year hence, so that tenants will be then found for the dwellings and apartments and stores. Moreover, the lists of new buildings include some factories. Certain lines of manufacturing, the woolen industry for example, have been so active during the last few months that they are forced to enlarge their facilities for production. This is most cheerful news to come at a time when even the professional optimist has a hard struggle to maintain his reputation.

Handling Materials on Highway Construction

The fact that road building has been the most active branch of construction work carried on extensively during the past year or two, probably explains why many construction firms whose previous experience has been in railway construction have turned to highway contracting. With them into this work the railway builders have brought methods and equipment, which have gone far to raise the status of the highway contractor. For, while a few years ago the average road contractor was an enterprising farmer or labor foreman, using teams hired by the day from the neighboring farmers, the present-day ex-railway contractor uses an industrial railway, or tractors and dump wagons, or motor trucks, for hauling his materials.

Which of these three new methods to use is always a problem to be solved by many considerations, based on topography, railway service, character of the highways, and many more elements which must be known and studied in advance if the most economical solution is to be made. Perhaps, however, the most interesting development in the solution of this many-sided problem is the apparent increase in popularity of the industrial railway. These are being used successfully on roads having grades as high as 7 or 8%, with the help of pusher engines.

Motor trucks and tractors generally have to navigate some pretty rough going, which is always the case when the new road, torn up in advance of pavement laying, is the only access to the work, for if the hauling is done from the other end, the traffic of the tractors and trucks is not good for the newly made pavement.

On the other hand, the narrow-gage railway laid on one side of the roadway may be so placed as to be seldom or never disturbed, and furnishes ready access to all parts of the work, before, during and after construction. Moreover, small cars on rails are generally easier to handle than heavy dump wagons and traction engines, while

motor trucks have the disadvantage of wasting considerable time and capital while being held at the terminal point for loading.

Like all construction problems, this is one that cannot be decided offhand in the office; but the possibilities of the [illegible] railway for construction work of all kinds is often not appreciated by contractors who have never had experience in railway building.

Where the highway right-of-way is wide enough and has fairly level grades, a contractor might go even a step farther and extend standard-gage tracks to the work, thus avoiding any rehandling of the materials whatsoever. Another possibility is the use of trolley tracks or temporary extensions of trolley tracks.

The Panama Canal and the Transcontinental Railways

During the quarter century since the construction of a transoceanic canal across the Central American Isthmus became a live issue, a vast deal has been printed regarding the effect of such a canal upon the transcontinental railways. It has been very generally assumed that the canal would be a serious detriment to these railways on the one hand, and on the other that its construction would be particularly advantageous to the states on the Pacific coast to relieve them from the alleged exorbitant freight charges of the railways from the East. In recent years, however, a saner view has gradually gained ground, and it has come to be realized by those closest to the problem that the amount of railway traffic which the canal will affect and which will be diverted to the canal will be, after all, comparatively small. Further, it is seen that the stimulating effect upon certain lines of trade and business resulting from the canal will have in all probability some compensating benefits for the railways.

Some attention is given to this matter in the annual report of the Northern Pacific Railroad Co., just issued. The report says:

> The [illegible] of the [illegible] [illegible] out of the ports on [illegible] [illegible] [illegible] for the [illegible] [illegible]. The [illegible] of the Northern Pacific at the head of Lake Superior [illegible] are more than [illegible] miles [illegible] the average haul of a ton of freight on the [illegible] [illegible] last year was only [illegible] miles.

These figures indicate how comparatively small is the percentage of the freight traffic which moves from coast to coast. A considerable part of this traffic also will be carried by the railways notwithstanding the [illegible] of the canal route. For certain high-class merchandise it will be cheaper to pay a somewhat higher freight rate and have the shipment go through by rail in a week or less rather than incur the delay of nearly a month required for the voyage from a north Pacific port to a north Atlantic port through the Panama Canal.

An Explanation of the Autoclave Test for Cement

When the [illegible], some two years ago, of the [illegible] pressure accelerated test of the soundness of cement, [illegible] the "autoclave test," engineers were [illegible] to [illegible] for any good explanation of why a cement which passed quite sound under the ordinary boiling test would show decided unsoundness under the high pressure and temperature of the autoclave. The failure of the opponents of the test to furnish any adequate explanation of this phenomenon was undoubtedly the main reason why many were ready to accept the claims of the autoclave adherents, although these claims were often injudiciously advanced and pressed.

In the U. S. Bureau of Standards "Notes" in the *Journal* of the Franklin Institute, November, 1914, Messrs. A. A. Klein and A. J. Phillips present an abstract of a study on the hydration of portland cement, in which are included three paragraphs which, if not an explanation, are at least an interpretation of the frequently observed behavior of cement in the autoclave. The paragraphs follow:

> On the hydration of cement the first constituent to react is the aluminate with the formation of amorphous hydrated tricalcium aluminate, with or without amorphous hydrated alumina. The sulpho-aluminate crystals are also formed, and the low-burned or finely ground lime hydrates. This occurs within a few hours after the cement is gaged. The next compound to hydrate is the tricalcium silicate. This commences within 24 hr. and is generally completely hydrated within 7 days. Between 7 and 28 days the amorphous aluminate commences to crystallize and the beta-ortho-silicate, the least reactive compound, begins to hydrate. The 24-hr. strengths are due mainly to the hydration of the aluminates and of any fine-grained, low-burned lime present. The large increase in strength between 24 hr. and 7 days is due mainly to the tricalcium silicate hydration. The increase between 7 and 28 days is due to the hydration of the beta-ortho-silicate. Where there is a decrease in strength during this period it is due to the hydration of very high-burned free lime, as in very high-burned, high-limed cements, or to the crystallization of the aluminates, as in high-alumina cements.
>
> Failure of cement in accelerated tests is due to the growth of large lime hydrate crystals. The disrupting action results from the pressure caused by growing crystals. Cement will fail in the boiling test which contains lime sufficiently fine and high burned, so that during boiling it hydrates and crystallizes. The growth of crystals is sufficient to cause disintegration. When a cement passes the boiling test but not the autoclave test, it contains lime so coarse or high burned as not to hydrate in the boiling test, but only in the autoclave, due to the high temperature and pressure employed. Some cements will pass either test only after aging. In this case aeration with insufficient water to allow solution and crystallization [illegible] the lime to hydrate as amorphous hydrate, and in the accelerated tests there is no crystallization and no disintegration.
>
> The reactions when cement is subjected to the autoclave test are not abnormal. The disintegrating action attributed to the crystallization of the sulpho-aluminate has been greatly exaggerated.

It remains now for someone to show just how the "coarse or high burned" lime is sufficiently active under normal conditions to be a menace to concrete in structures.

Accurate Marksmanship in Naval Warfare

Everyone who has had occasion to become familiar with naval matters are aware of the wonderful precision in marksmanship that has been attained during the past [illegible] years in the leading navies of the world. It has been [illegible], however, that the high perfection of marksmanship attained in target practice in time of peace could not possibly be approached under the excitement of a battle. The recent naval engagement off the coast of Chile, however, appears to be a [illegible] illustration of what can be actually accomplished by a fighting ship at long range. According to the newspaper reports of the combat, the German cruisers began firing at their English antagonists at a distance of six miles, and had inflicted serious injuries upon them by the time this distance was reduced to four miles.

In a circle of six miles radius, the length of one minute of arc is approximately 9 ft. A gun trained on the center of a vessel 400 ft. long at a distance of 6 miles, therefore, if rotated only 22 minutes in the horizontal plane, would miss the vessel entirely, and a much shorter distance of rotation would cause it to miss the vital portions of the vessel. If, however, the vessel were approaching, bows on, or fleeing, with her stern toward the adversary, a cruiser of 60-ft. beam would cover less than 7 minutes of arc on the circle, so that a horizontal rotation of the gun of only three minutes from the center of the target would cause it to miss.

Of course, this takes into consideration only the mathematics of the problem. Other factors which may disturb the true flight of the projectile, such as inaccuracies in the gun, or in the projectile itself, influences of the wind, etc., and inaccuracies in the telescopic sighting instruments, have to be taken into account. Incredible though this astonishing accuracy in directing an enormous cannon, weighing many tons, may appear to the layman, it seems insignificant when compared with the difficulties of training the gun in elevation. The same figures, of course, hold good for the same range. That is, an elevation or depression of one minute of the gun about its horizontal axis will make a difference of 9 ft. in the point struck by the projectile six miles away. War vessels have usually a comparatively low freeboard, so that an error in the elevation of the gun of 1½ to 2 minutes may be sufficient to cause the shot to miss its mark. The accurate pointing of the gun, moreover, must be done not from a stationary platform but on board a ship which may be pitching and rolling. All reports agree that the recent battle off the coast of Chile took place in a severe storm, approaching a hurricane in violence.

The latest reports, in fact, claim that the largest English vessel engaged was unable to use a large part of her battery on account of her heavy roll before she had received severe injuries from her adversaries.

The engineer takes off his hat, metaphorically speaking, to "the man behind the gun," whose wonderful skill and careful use of his instruments achieve such results. But these results are also a testimonial to the marvelous accuracy of modern methods of manufacture, which can produce a gun capable of such close shooting. The modern high-power rifle may almost be compared to an astronomical instrument in the accuracy of its workmanship; but while the astronomical instrument is carefully protected against stresses which might interfere with its accurate work, the gun and its mounting are subjected to enormous stresses and shocks, notwithstanding which it must maintain its accuracy unimpaired.

Letters to the Editor

On the Thickness of Pavement Foundations for Heavy Traffic

Sir—Your correspondents in discussing pavement foundations have, I think, entirely missed the essential point and that is: An increase in the thickness of paving foundations over present American practice is a necessity as a protection to wearing surfaces and not to the base itself. A concrete foundation does not need to be badly fractured or shattered to be a failure in this sense; it is in the wearing surface that we must look for foundation failures.

The following are some of the reasons why heavy traffic streets in our cities should have pavement foundations thicker than 6 in.:

(1) The concrete in the base is not uniform in mixture or thickness, and, as laid in the street, its strength falls much below its theoretical value. The thinner it is laid the greater percentage of loss through dirt mixing with the bottom portion of the concrete, the subgrade soaking up the cement and water, and the greater the chances of rock pockets being formed. Even under the most rigid inspection, it is impossible and impractical to avoid these defects.

(2) If it were always possible to detect all the soft spots in the subgrade before the foundation is placed, the idea of thickening the concrete over them might work out. However, our city business streets have been so badly cut up that it is as cheap to thicken the whole base as it is to dig out each cut. Worst of all, the surface of the subgrade may appear uniformly compact and later develop many sunken spots, due to the bottom of an old trench settling, to leaky sewers or service connections or leaky water pipes.

(3) Temperature changes are greater in, and more seriously affect, a thin base than a thick one.

(4) Each wheel of a loaded vehicle is the center of an area of depression which is of considerable extent. The base is not rigidly supported at any point and the maximum deflection may be very appreciable without fracturing the concrete. This will vary with the condition of the soil and subgrade, width of street, weight of load, kind of surfacing and depth of foundation.

The amount of deflection for a given load has been measured by the U. S. Bureau of Standards on various kinds of pavement, and is appreciable on new cement-grouted stone block on 6 in. of portland-cement concrete base, and is very considerable on asphalt laid on a 4-in. base, or in the best forms of bituminous macadam. It is also probable that a cement-grouted brick surfacing, for instance, does not bend on the same curve as the base.

At any rate, the passage of a moving load is accompanied by a series of waves or undulations in the wearing surface, and in my opinion, this deflection or waving is great enough to seriously affect the wearing surface of a pavement subjected to the passage of large numbers of heavy vehicles, when the pavement is laid on a base of 6 in. or less of 1 : 3 : 6 concrete.

While such a statement may appear to be finely drawn, it is to be remembered that the effect of one load must

be multiplied by the headloads for each day and extended over a period of several years.

Owing to the numerous factors acting on the wearing surface, it is difficult to determine the effect of deflection except by comparing pavements subjected to similar conditions, but with different bases, over a period of years. The principle may be laid down that the more rigid the base the more nearly the wearing surface can be maintained to an exactly uniform grade, and thus be more enduring. Greater rigidity can be obtained more economically by increased thickness.

(3) The speed at which motor trucks move over streets demands a more massive foundation than one 6 in. thick. Loads moving over stone block, brick, manholes on a worn hard-rubber tire cause slight impact blows which are so rapidly repeated under a swiftly moving load that series of vibrations are set up in the pavement.

Where the pavement is slightly rough and on a thin foundation, these vibrations can be felt for some distance and are even carried through the earth to nearby structures. These vibrations are evidently a detriment to block pavements and must also affect the sheet surfacings.

A massive foundation will absorb these shocks. The more severe impacts where a heavy load drops into a sharp depression, off a high manhole or car track, soon shatter the base as well as the wearing surface. Such a condition, however, is generally due to faulty subgrade or construction.

In answer to the editorial inquiry as to the effect of impact on paving foundations, probably no base of good concrete 6 in. thick on a good subgrade is shattered where the wearing surface is maintained in good condition. I have seen weaker bases broken up where the surfacing had been allowed to deteriorate.

Impact does, however, seriously affect the wearing surface. Asphalt has practically no cushioning effect after it has been compacted by traffic and during the [illegible] months of the year. The block pavements on sand cushions do relieve the foundation by their cushioning and load-distributing effect.

(4) A review of the increase in wheel loads and traffic conditions on city streets during the last 15 years, as well as the present amount of poor or repaired pavement, should cause municipal engineers to look forward.

While one of your correspondents advises heavy rails, closely spaced ties, and 15 in. of solid concrete under and around the ties of street-car tracks to absorb vibrations and prevent destruction of the pavement, he considers a [illegible] foundation under the street pavement as a "wise precaution."

The fact of the matter is that motor-truck wheel loads are already approaching street-car wheel loads in amount and a motor truck does not run along a smooth steel rail, but is allowed any place on a more or less uneven surface. A pavement foundation which theoretically should be good for 50 to 75 years ought to be designed with the future in mind.

To protect our expensive wearing surface from [illegible], to maintain smooth easy riding pavements, to lessen the frequency, expense and inconvenience of repairs let us provide more rigid, more massive permanent foundations on the heavy traffic streets than has been customary. [illegible] thickness can be [illegible] sat but make 10 or 12 in. the maximum rather than 6 in.

CLARK R. MANDIGO,
Assistant City Engineer.

Kansas City, Mo., Oct. 28, 1914.

Broken Sprinkler Connections at the Salem Fire

Sir—The statements in the paper by Frank A. McInnes and Clarence Goldsmith, read before the New England Water Works Association at the recent meeting in Boston, Mass., with regard to the effect of broken sprinkler connections on the water pressure, are not altogether in accord with the facts. [See abstract, ENG. NEWS, Oct. 22, 1914.]

The breakage of the public water connection to the two sprinklered risks spoken of did not occur until about 3:30 p.m., nearly two hours after the fire started. And this breakage did not begin the demoralization of the fire-fighting service, that began one hour and forty-five minutes before. According to the report of competent engineers, the first fire company to get into action had to retire almost immediately. Another company tried to connect up a chuck hydrant a block away and finding it defective, had to beat a retreat. In the meantime, the fire burned without the least restraint. The day was hot and dry and the heat radiated by the fire was fearful. These conditions, of course, resulted in the opening of hundreds of sprinklers in the Keefe and Carr tanneries and they did not open in vain. These sprinklers contested the progress of the fire in the Keefe and Carr factories for a considerable period. The attack of the fire on these factories began between 1:40 and 1:55 p.m., and the riser pipes did not fall until about 3:30 p.m.

The authors of the paper overlooked the fact that there were many connections with the public water service other than the sprinkler connections. Five tanneries and leather plants were burned in Blubber Hollow. Two of them were sprinklered. All of them used water, particularly the tanneries—and tanneries use considerable water. These plants had regular service connections, some of them possibly as large as 6 in. These connections were independent of the sprinkler connections and added much to the wastage.

It is obviously stretching the imagination to charge that the difference between 8585 gal. and 2500 gal. per min. is due to broken sprinkler connections when numerous spouts from various broken and melted connections were to be seen after the fire had swept on its way.

Moreover, it is difficult to reconcile the statement that 2500 gal. per min. was the limit of the amount of water pumped, when there were 25 steam and gasoline-pumping engines at work in various sections of the city.

Other and competent engineers estimated that the maximum water consumption during the fire was at the rate of 17,750 gal. per min.

And what is more, the low pressure—the minimum was 10 lb. for one hour—was not the sole result of broken sprinkler connections. In a report on the Salem fire, Franklin H. Wentworth, Secretary of the National Fire Protection Association, says:

The [illegible] water-systems of Peabody, Danvers and [illegible] were already [illegible] the Salem system so fast that the [illegible] would shelter [illegible]

good. With water enough to raft Salem out to sea, her citizens on the borders of the fire zone threw away their garden hose and extinguished the sparks on their shingle roofs with tree-spraying outfits.

In the report of the Inspection Department of the Associated Factory Mutual Fire Insurance Companies is this comment:

There was apparently some hesitancy about turning in the higher pressures from surrounding towns until it was apparent that there was sufficient draft from the Salem mains so that the pressure would not build up.

Broken sprinkler connections should not be the "bone of contention" regarding the Salem fire. To be sure they broke and wasted water, but that was not a "lesson" of the Salem fire. The desirability of positive control of connections between public water-service mains and sprinkler systems in buildings cannot be gainsaid, but the arguments for this desirability cannot be strengthened by the happenings in Salem, for the building in which the fire began was not equipped with sprinklers and the pressure began to drop an hour and a half before the sprinkler connections broke. And the conflagration was burning blocks beyond the Carr and Keefe plants when the connections did break.

The one thing in the Salem water system reported excellent by the National Board of Engineers in 1907 was the spacing of gate valves. Why was it that an engineer of an organization of fire-insurance companies had to direct the closing of the sprinkler-connection valve at the Carr plant at 5 p.m., one hour and a half after the sprinkler risers went down? Surely there must have been valves in the public mains outside the fire zone which could have been closed.

Inspector Ames in his report to the Underwriters' Bureau of New England said: "*There was no time when the steamers lacked a water-supply.*" Evidently the breaks in the sprinkler-system connections did not hopelessly cripple the water service. And if the broken sprinkler systems had been immediately shut off and the pressure restored to normal conditions, what then? Franklin Wentworth answers the question: "Water from hose streams never yet stopped nor extinguished a conflagration."

And the fact will bear repeating that there would not have been any sprinkler-system breaks to talk about if the Korn factory had been equipped with automatic sprinklers.

I. G. Hoagland,
Secretary National Automatic Sprinkler Association.
80 Maiden Lane, New York City,
Oct. 26, 1914.

[Proof of Mr. Hoagland's letter was submitted to Messrs. McInnes and Goldsmith. Their reply follows.—Editor.]

Sir—In reply to the foregoing letter from I. G. Hoagland, we would say that our paper was written after an exhaustive study of the conditions obtaining during the first hour of the fire, the period with which we dealt. The officers of every engine company, numerous firemen and a number of others from whom reliable information could be had were interviewed. Information thus obtained was tabulated and only that which was corroborated by several witnesses was accepted.

Our data show conclusively that the three sprinkler pipes in question were broken within the first hour. If the evidence to this effect was not convincing it is inconceivable that buildings of so flimsy construction could survive for an hour under such exposure. Even if the buildings had remained standing and the pipes were unbroken, the systems would have discharged practically the same quantity of water through open sprinkler heads with equally disastrous effect.

Information was obtained in regard to all large service connections within the entire burnt area, and the only one broken in the area covered by the fire within the first hour was a single 2-in. The effect of the other services broken in this area was almost negligible.

We were not forced to exercise our imagination as the facts established by the test were sufficient to prove our point.

At the end of the first hour, ten engines only were at work and our information is conclusive that 2500 gal. per min. is a conservative estimate of their delivery. The figure used by Mr. Hoagland, namely, 17,700 gal. per min., represents the maximum draft during the fire and includes the waste from broken connections, steamer supply and domestic consumption. The fact that the minimum pressure of 10 lb. was not reached until the fire had been in progress nine hours is evidence of the large amount of water wasted.

The assumption that the waste through the three broken connections could have been stopped by closing valves in the public mains outside the fire zone evidences unfamiliarity with water-works systems and their operation.

If this could have been done it would have been necessary to close eight gates, two of which were on the large main feeding the district, with the result that the supply would not only have been withdrawn from many engines then working, but the entire western end of the city would have been without water-supply.

The writers were present during the height of the conflagration and were eyewitnesses to the fact that a considerable area of the city was entirely without water and that the engines even at the lower elevations were seriously handicapped on account of lack of pressure.

We are absolutely of the opinion that the flow of water through the connections to the Keefe and Carr plants practically destroyed the efficiency of the Salem water-works system, and are convinced that the size of such connections should be carefully restricted.

F. A. McInnes.
Clarence Goldsmith.
City Hall, Boston, Mass.,
Nov. 6, 1914.

NOTES AND QUERIES

In the plan accompanying the retaining-wall failure described on p. 894 of our issue of Oct. 29, 1914, the direction indicated by the arrow as north is in reality west.

E. A. Little is Superintendent of the Engineering & Construction Department, United States Realty & Improvement Co., instead of R. K. Smith, as mentioned on p. 885 of our issue of Oct. 29.

An Employment Department has been established by the American Institute of Electrical Engineers. It is proposed to publish, in the monthly proceedings, announcements of positions open, records of men available, etc.

The Road Congress at Atlanta

The fourth annual Road Congress, conducted by the American Highway Association and allied organizations at Atlanta last week, attracted the largest attendance, probably, of any meeting for the discussion of highway improvement ever held in this country.

A large proportion of those at the sessions were county commissioners and county engineers from Georgia and other southern states, but there was also a large attendance of state highway engineers and city engineers in charge of street paving from every part of the country from New England to California.

At previous Congresses, agitation for Federal appropriations to build good roads has loomed large in the proceedings. This year the Federal aid question was kept in the background. At the afternoon session on the first day, which was supposed to be devoted to this topic, the Shackleford Federal Aid bill, which passed the House last spring but failed in the Senate, was generally condemned. On account of present and prospective financial conditions, it is generally realized that any considerable Federal appropriations for road construction are unlikely for some time to come.

A matter which figured more prominently in the Congress than Federal aid was the question whether state funds for road work should be expended on through routes or on radial roads from cities into the country to enable the farmers to reach a market. It is noteworthy that Fairfax Harrison, President of the Southern Ry., who was elected President of the American Highway Association at this meeting, presented a paper on Wednesday in which he declared that the first roads to be improved should be the roads connecting the farmer with the railway shipping point and the market and not the through routes so much desired by the automobile interests.

The Tuesday afternoon session was conducted by the National Civil Service Reform League and was intended to further the merit system in road organizations. The Chairman, Hon. R. H. Dana, and the speakers, Geo. R. Wales, Chief Examiner of the U. S. Civil Service Commission, and Arthur M. Swanson, Chief Examiner of the Philadelphia Civil Service Commission, vigorously supported the policy of selecting candidates by Civil Service methods for high appointive positions as well as for the lower positions.

Strong emphasis was laid by many speakers at different sessions on the desirability of supervising all the road work in a state through a state highway department. All but eight states have now in operation some form of state supervision, and these eight states, all in the South, are likely to create state highway departments next year.

A number of papers on various aspects of road construction and maintenance were read at the convention, and with the discussion upon them (of which the crowded program gave time for very little) will be later published in the Congress proceedings. Of these the most interesting and valuable to highway engineers generally was probably the paper by Col. Sohier, Chairman of the Massachusetts Highway Commission, giving detailed figures as to the cost of road maintenance in Massachusetts, and also in England and France. An abstract of this appears elsewhere in this issue. Another paper dealing largely with foreign practice was by Henry W. Durham, Chief Engineer of Highways of the Borough of Manhattan. Both these papers furnish most useful ammunition to the American engineer beset by a critic who holds the common idea that American engineers are fatally deficient in not copying foreign practice in street and road construction and maintenance.

The use of convict labor on public roads was a prominent subject in several papers before the convention, notably one by Geo. P. Coleman, State Highway Commissioner of Virginia, where 1700 convicts are worked on the roads the year round.

It is of interest to note that the emphasis in the good-road agitation which has been hitherto laid on road construction is now laid on road maintenance. Various speakers at the Congress urged that unless a large part of the money spent on road construction is to be wholly wasted, there must be first created an efficient organization which will see to it that the construction is done honestly and economically and that the completed road is continuously maintained.

The resolutions adopted by the Congress set forth that state-road departments and state aid are necessary to secure economy in highway construction; commend the work of the Lincoln Highway Association; recommend greater attention to the public safety by road officials; and urge that the Federal government undertake the construction of highways across forest and Indian reservations where necessary to provide links in through roads.

Road Maintenance Costs in France, England and Massachusetts*

By William D. Sohier†

French Roads

The French road system was established in 1826, and the total road system of 371,000 miles was built in about the next 25 years. The roads, practically uniform except as to width, have been built almost entirely of local macadam originally, 6 or 8 in. deep on a proper foundation. In resurfacing some of the main roads in later years, a harder stone and Welsh or Belgian granite have been used. The macadam surface of the road on the Routes nationales is 24 ft.; Routes departmentales, 18 ft., and the Routes de grande communication and d'interet commun, 15 ft.

The French engineers last spring contended that some 8000 miles of road ought to be resurfaced, using a tar macadam, because of the large increase in automobile travel around the cities, which travel was rapidly destroying their macadam roads, and they requested the Government to furnish $60,000,000 for that purpose, about $7500 a mile. The greatest problem for over fifty years has been maintenance. The roads are maintained practically by a central organization. The whole country is divided into 86 departments, and all of the county and rural roads within the department are managed by the prefet of that department and the expenditures appropriated by the council.

Direct charge is in the hands of a centralized body of competent engineers, about half of whom are graduates of the National School. Each department is divided into

*Excerpt of paper entitled "Road Maintenance," read before American Road Congress, Atlanta, Ga., Nov. 9-14, 1914.

†Chairman, Massachusetts Highway Commission, Boston, Mass.

four or five political districts, each district being called an arrondissement, and the roads are in charge of a district engineer, who is under the direction of the chief engineer. Each arrondissement is again divided into districts or cantons, and an assistant road engineer under the direction of the district road engineer looks after all the county and rural roads within the canton. Then comes the final subdivision, where the roads are divided into sections of a few miles long, taken care of by patrolmen. All of these are under civil service, and the men are promoted from time to time according to their ability.

Table I gives the approximate cost of maintenance on the French roads annually.

TABLE I. MAINTENANCE COSTS OF FRENCH ROADS

	Miles		Total Expense	Per Mile
Routes Nationales	23,800		$6,500,000	$273
Routes Departmentales	8,100	115,400	1,500,000	185
Chemins vicinaux				
Routes de grande communication	107,300		16,900,000	157
Route d'interet commun	47,500		6,000,000	126
Routes ordinaires	184,700		14,500,000	78

English Roads

In 1878 the cost of main roads was placed upon the counties. In order to even up the expense more or less the English government made appropriations to aid in the maintenance of these main roads, beginning in 1882 with an appropriation of about $800,000. In 1888 about $2,500,000 was appropriated, and now the Road Board has something over $6,000,000 annually which can be spent in improving the main roads. There is now a combination of the county taking care of the urban and rural main roads, with the parish and local authorities taking care of the rural roads. The main roads are something over 20% of all the mileage, leaving out London.

In almost all of the counties there are sections of road in charge of regular maintenance men. Most of the main roads in England outside of Metropolitan London and the other large cities are maintained by the use of tar. Some 40,000 miles of road were tarred in England last year, and some 6500 miles were built of tarred macadam. The system of maintenance now is not only to keep the roads constantly patched, but every year or twice a year the macadam roads are flushed and rolled, filling the holes and depressions first and adding a small quantity of chips and stone dust. On the tarred roads a section man keeps them constantly patched. They usually require a fifth or a sixth of a gallon of tar which is sprayed on once a year, and this is covered with pea stone or gravel and kept covered so it will not pick up. The tar is usually sprayed on under power.

Where there is heavy traffic the roads are being resurfaced with tarred Welsh granite, which is like our trap rock, or with tarmac, which is a tarred iron slag. There is also built a road of 3-in. stone, rolled hard, and grouted with a mixture of hot sand and hot tar, equal volume, poured into the road until it flushes it; then rolled in 1½-in. stone and smaller stone with a surface coat of tar and sand. The macadam roads with a tarred surface require retreatment every year. This costs about 2½ to 3c. per sq.yd. a year. The tar-mix roads require a new coat of a fifth of a gallon of tar applied on the surface every two years.

Average costs of road maintenance are given in Table II.

TABLE II. ROAD MAINTENANCE COSTS IN ENGLAND

County Councils:	Miles	Maintenance	Authorities County Engineers	Yearly maintenance per mile
Urban main roads	4,189	$4,601,790	61	$1100
Rural main roads	23,565	10,177,740		431
	27,754	$14,779,530		
County Boroughs	9,366	$6,437,380	28	$685
London Authorities	2,192	3,691,355	2	1680
	11,558	$10,128,735	30	
			Road Authorities	
Urban roads	11,411	$4,848,020	1733	$425
Urban roads	4,871	2,701,710		555
Rural roads	95,077	$11,562,920		122
	111,359	$19,112,650		
Totals	150,671	$44,020,915	1898	$290

The total expenditures per year, including improvements and interest, $75,990,000

Maintenance of State Highways in Massachusetts

Our Commission began building roads in 1894. The earlier roads were almost entirely macadam with a few miles of gravel or graded road. The standard road with necessary foundation and proper drainage wherever necessary was 15 ft. in width, water-bound macadam either of trap or local stone, 6 in. deep in the center and 4 in. on the sides, with a 3-ft. gravel shoulder on each side and with a ¾-in. crown to the foot.

The ordinary cost of maintenance is in Table IV, but up to 1907, when some of the roads were 12 years old, the cost of ordinary maintenance was substantially $100 a mile a year. Ordinary maintenance with us consisted merely of keeping the gutters, catch basins and drainage open and clean, cutting out the grass and brush on the roadsides, keeping the shoulders in proper condition, spreading a little gravel or sand on the road surface from time to time and filling the few holes or ruts that might occur with broken stone or gravel. Very few miles of road has been actually resurfaced prior to 1907.

In 1906, the automobiles began to come. Our roads were some of them 13 years old and only half the original depth of stone was left. We soon found that automobile travel, especially at high speed, tore up the macadam or gravel roads, especially on the curves, as soon as there were any considerable number, say 50 or more in a day. The traffic, of course, increased tremendously in the number of vehicles, because of the large mileage of the automobiles. What had been locally used country roads developed, between that year and the present year, into main through routes carrying oftentimes away out in the country on a main route over one thousand cars a day. Table III shows the increase in traffic from 1909 to 1912.

TABLE III. TRAFFIC CENSUS, 1909 AND 1912, MASSACHUSETTS

	1909 Census, 238.5 Stations			1912 Census, 156.5 Stations			
Kind of Vehicle Motors	Av. Total No. per Day	Av. No. per Day per Sta.	% of No. per Sta.	Av. Total No. per Day	Av. No. per Day per Sta.	% of No. per Sta.	Inc. or Dec. %
Runabouts	4,958.5	20.8	8.5	5,819.0	37.2	11	+79
Touring cars	17,950.5	75.3	30.5	27,178.5	173.5	49	+130
Trucks	..	.	....	1,800.0	11.5	3	.....
Total motors	22,909.0	96.1	39.0	34,797.5	222.2	63	+131
Horse-drawn vehicles:							
1-horse, light	17,033.0	71.5	29.0	8,380.0	53.5	15	—25
1-horse, heavy	11,762.5	49.3	20.0	7,458.0	47.6	14	—3
2 or more horses, light	1,006.0	4.2	2.0	556.0	3.6	1	—14
2 or more horses, heavy	6,205.5	26.0	10.0	3,870.5	24.7	7	—5
Total horse-drawn	36,007.0	151.0	61.0	20,264.5	129.4	37	—14
Totals of all kinds	..	247.1	...	.....	351.6	..	+42

Table IV gives maintenance charges of the state highways of Massachusetts from 1894 to 1913.

Starting in 1907 it will be noted that the cost for maintenance has risen by leaps and bounds from $158 a mile a year in 1907 to over $850 a mile a year in 1913, and it is still higher in 1914.

Our roads were rapidly going to pieces. We needed more money. We got the Legislature to double its ap-

propriation of $[illegible] a year and make it $250,000 for [illegible] year and $[illegible] a year since. We secured an increase in the automobile fees, and had four-fifths of that money available for the maintenance of state highways, and the other one-fifth for the improvement of [illegible] through routes in the towns. We found that our old roads were being destroyed by the rapidly increasing amount of automobile travel. The traffic on the roads had increased from [illegible] to 40 times in volume.

TABLE IV. COST FOR REPAIR AND MAINTENANCE OF STATE HIGHWAYS FROM 1893 TO 1913, MASSACHUSETTS

	Repair and Maintenance			State Highways	
Year	Cost	Miles	Av. Cost per Mile per Year	Miles Built	Cost of Construction
[illegible]				[illegible]	
[illegible]				[illegible]	$[illegible]
[illegible]	$4,7[illegible]	40.1[illegible]	$[illegible]	57.92	[illegible]
[illegible]	14,[illegible]	120.0[illegible]	[illegible].28	53.2[illegible]	482,070
[illegible]	20,[illegible]	170.2[illegible]	117.[illegible]	42.[illegible]	430,78[illegible]
[illegible]	24,138	221.94	112.[illegible]	44.[illegible]	417,[illegible]
[illegible]	[illegible]	26[illegible].5[illegible]	125.[illegible]	49.40	39[illegible],45[illegible]
[illegible]	[illegible]	3[illegible].[illegible]	98.32	61.[illegible]	451,82[illegible]
[illegible]	[illegible]	377.[illegible]	138.7[illegible]	54.32	460,743
[illegible]	[illegible]	430.[illegible]	127.8[illegible]	74.17	447,972
[illegible]	[illegible]	[illegible]	112.7[illegible]	[illegible]	445,71[illegible]
[illegible]	87,15[illegible]	[illegible]	[illegible]	56.[illegible]	500,007
[illegible]	[illegible]	622.[illegible]	100.[illegible]	47.92	444,6[illegible]
[illegible]	[illegible]	670.[illegible]	1[illegible].40	30.[illegible]	467,944
[illegible]	147,[illegible]	700.70	224.47	[illegible].40	364,719
1909	$2[illegible]; 247,[illegible]	718.27	[illegible]	[illegible].53	431,814
1910	[illegible]; 214,[illegible]	7[illegible]	[illegible].28	32.[illegible]	462,16[illegible]
1911	[illegible]; 117,4[illegible]	[illegible]	[illegible]	42.[illegible]	412,502
[illegible]	[illegible]; [illegible]	[illegible]	70[illegible]	40.7[illegible]	[illegible]
[illegible]	414,867*; 29[illegible]; [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				[illegible]	$9,2[illegible]2,[illegible]74

	Per Mile per Year
Average cost of repair and maintenance, 1893-190[illegible], incl.	$175
Average cost of repair and maintenance, 19[illegible]-1913, incl.	610
Average cost of repair and maintenance, 1893-1913, incl.	267

*[illegible] Fund.

Today [illegible] of all our state highways that have not been resurfaced have been coated and kept coated with some bituminous material and have been kept constantly patched. Where heavy hot oil was used, it has lasted in some instances for five years, carrying a large amount of automobile travel but a small amount of heavy teaming. Under many heavy teams it has failed in a month or two. We have then used a light oil to lay the dust and prevent the automobiles from tearing the road up, and have left the stone to carry the travel until we could resurface the road.

Because of the automobile traffic on many main routes, we are now [illegible] to put [illegible] a bituminous top 2 to 3 in. deep. We have used refined tars in both the mixing and grouting method. We have used asphalts with the same methods, and we believe that use is economical and necessary on any roads that have more than fifty automobiles a day and where there are more than fifty loaded teams.

In Table V is shown the class and character of surfaced roads that we believe will stand traffic of a certain class, kind and character.

Certain exceptions to Table V should be noted. Army [illegible], especially large bodies of cavalry and artillery, will rapidly destroy any bituminous blanket surface. A blanket coat of hot oil on macadam will cause a much larger number of teams if there is a [illegible] of two to three automobiles or [illegible] to each team to keep the bituminous surface constantly rolled down when the hoofs and teams pick it up. A very few teams, or [illegible] at a few very heavy teams every day, will destroy the surface if the load is heavy enough to shear down

TABLE V. COMPARATIVE VALUE OF ROAD SURFACES

(Result of observations of traffic on different types of road surfaces in Massachusetts. Standard road, 15 ft. in width, gravel or waterbound macadam 5 to 6 in. in thickness with adequate drainage and proper [illegible], with 3 ft. gravel shoulder on each side.)

AVERAGE DAILY TRAFFIC

	Light Teams, Carriages, Wagons	Heavy Teams, 1-Horse	Heavy Teams, 2 or more Horses	Automobiles
A good gravel road will wear reasonably well and be economical with	50-75	25-30	10-15	50 to 75
Needs to be oiled with	50-75	25-30	10-15	Over 75
Oiled gravel, fairly good heavy cold oil, ½ gal. to the sq.yd., applied annually with	75-100	30-50	20	500 to 750 or more
Waterbound macadam will stand with	175-200	175-200	60-80	Not over 50 at high speed
Cold oil or tar will prove serviceable on such macadam with	175-200	175-200	60-80	50-500
Macadam will then stand but the stone wears, of course, with	175-200	175-200	60-80	500 or more
Waterbound macadam with hot asphaltic oil blanket will be economical with	100-150	50-75	25-30	1500 and [illegible] with [illegible] teams
And stand at least		[illegible]	[illegible]	50 trucks
But will crumble and perhaps fail with over	150	75	30	
(On narrow tires, ice, farm and wood teams, etc.)				
Waterbound macadam with a good surface coating of tar (½ gal. to the sq.yd.) will stand with	100-150	50-75	25-30	1500 or more
but requires to be recoated annually with ¼ gal. of tar per sq.yd.				

It is assumed that all road surfaces are kept constantly patched, that before applying bitumen the road surface is cleaned and patched, and the bitumen covered with pea stone and sand or gravel and kept covered so that it never picks up.

entirely through the surface to the stone. If this process is repeated once or twice a day, a rut soon develops and the road becomes muddy and the bituminous surface rapidly disintegrated.

Ordinary maintenance, which has consisted of keeping the drainage open, shoulders cut back, and the road sanded, with slight patching, has averaged about $100 a mile a year. Where the road can be maintained with light oil, the additional cost is about $250 a mile a year, or $350 a mile a year in all. The cost of heavy oil or tar on the surface where it is suitable to use it because it will stand the traffic, is about twice the cost of the light oil in the first instance, and with the patching and all that is necessary it will cost about the same figure, or about $250 to $300 a mile a year, this being on a five-year basis.

In resurfacing our roads with 2- to 3-in. bituminous macadam top, the cost has varied from about 50c. per sq.yd. for a 1½-in. top, no stone being larger than 1¼ in., and 1¼ gal. of tar sprayed into it, to $1.10 a sq.yd. for a 3-in. top, made of 2½-in. stone, either mixed or grouted with a good grade of asphalt. The tar-sand grouted macadam has cost from 90c. to $1 per sq.yd. We believe that the roads of this character will have a very small maintenance cost outside of the ordinary maintenance for a period of from eight to twelve years.

Lack of Uniformity in Notation is the cause of no little trouble to engineers in studying theoretical problems. One phase of this question was recently discussed as follows by a speaker before the Concrete Institute in London:

One of the greatest causes of difference in notation is the blind copying of symbols by persons who really do not know what is the origin of a given symbol. In fact, it has been suggested by some brilliant student that people only used algebraic symbols when they did not know what they were talking about, and there certainly seems a great deal of truth in that remark. Another cause of the growth of chaos and deterioration of notation is that when books are translated from a foreign language it may be that the author is not a mathematician—he may be merely a linguist—for he frequently translates the words and leaves the letters in their original form, and the books lose a great deal of their utility. I would ask that if books are to be translated they should be translated by engineers or by mathematicians or by competent persons able to convert the notation into the [illegible].

Emil Kuichling

By Allen Hazen*

Emil Kuichling died suddenly in New York City, Nov. 9, of apoplexy. Although he had lived in New York City for the last fifteen years and much of his best known work had been done there, yet his memory will always be associated with Rochester. In his long previous residence in Rochester, his connection with the water-supply and sewerage systems of that city, first, as Assistant in the Water Department for twelve years, then as a member of the Executive Board for two years, and, after an interval, as Chief Engineer for nine years, and more recently, as Consulting Engineer, he did more than it is often given to one man to do for a city in providing it with a good and ample water-supply and a proper system of sewerage and sewage disposal.

When he gave up the position of Chief Engineer of the Rochester Water-Works and moved to New York, one of the daily papers said of him:

In every capacity his daily course has had four characteristics—absolute integrity, tireless industry, zeal for the public good, professional honor. He had the rare quality of command of detail combined with a broad conception of general principles and far-reaching results.

This unusual tribute to a retiring city official was as unusual as it was gratifying.

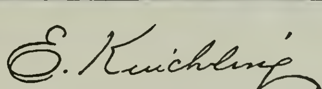
He had an inquiring mind. He was always looking for an explanation of the unexpected happenings in his daily life and work, and in his search for answers he had a remarkable faculty of knowing where to look and of scrutinizing the work and experience of others, and of making it contribute to the explanation.

His ample library was useful to him to an extent rarely reached by engineers. He never spared the midnight oil and seldom forgot, and his mind was loaded with orderly and available memories of the experiences and trials, successes and failures in the line of his chosen work. No one could think of so many reasons why a proposed structure would be weak or would fail in its intended work, or could cite the precedents for it, successful and otherwise, more surely and accurately.

His views as to the merits and defects of works and designs that he examined were bluntly conveyed when occasion demanded, in language so clear that the exact meaning could never be for a moment in doubt. This often led to the feeling that he was severe and too pessimistic about new ventures, but to those who knew him well, and could face the force and vigor of his criticism, he was helpful to an extent that it is hard to indicate adequately.

He was a man who thought vigorously and well, and who made others think for themselves even when they did not wish to think. By his own work in design, by his criticism of the work of others, and by his influence upon the many engineers with whom he came in contact, he contributed directly and indirectly to the sound, safe and durable design of American water-works structures, and his influence will extend far beyond the works with which he was directly connected.

It is interesting to inquire how such men are trained and produced. The answer must often be unsatisfactory because the influences that were strongest in the boy and the young man are not the ones that are best known to those who come after; but in Mr. Kuichling's case may be noted the practical experience of a thirteen-year-old boy with a master builder, the busy summer vacations of the school life always devoted to engineering work, the ample and broad education, first, at Rochester University, and afterward, beginning at the age of 22, at the Technical School at Karlsruhe, Germany, followed by the twelve-year-long drill as Assistant to a strong and able chief, the late J. N. Tubbs, in which there were ample opportunities for study of the qualities of men as citizens, as politicians, as contractors, as chiefs, and as assistants, as well as of the simpler qualities of the masonry, metal and water that were the more direct objects of his work. Experiences during this time led to the drafting of new specifications and contracts to meet local troubles. These were models of expression, always being definite and clear. No paragraphs from specifications have been copied and used more widely than these.



Mr. Kuichling was born at Kehl, Germany, in 1848, came to Rochester as an infant with his father, Dr. Louis Kuichling, and spent the greater part of his life there. He graduated at Rochester University in 1868, and at the Technical School at Karlsruhe, in 1872. He was connected with the Rochester Water-Works as Assistant Engineer for twelve years, from 1873 to 1885, as a member of the Executive Board from 1885 to 1887, as Chief Engineer from 1890 to 1899, and more recently as Consulting Engineer. He also played a most important part in developing and designing the sewerage and sewage-disposal systems of that city.

For many years, while at Rochester, he acted as engineering adviser of the New York State Department of Health. He acted at one time as hydraulic engineer for

*Consulting Civil Engineer, 30 East 42nd St., New York City.

the barge canal, and also conducted, while still at Rochester, a growing advisory practice in water-works and hydraulic matters. Since Jan. 1, 1900, he had lived in New York City, and had continued this practice actively, and as it had aided in the development of water-supplies and water powers all over the country.

With simple tastes and habits, Mr. Kuichling early learned from his parents the rare art of graceful and delightful entertaining, and he was indeed fortunate who experienced the full measure of his hospitality.

He was a member, and had been a Director and Vice-President, of the American Society of Civil Engineers, and had been President of the Rochester Engineering Society. He was also a member of the American and the New England Water-Works Associations, of the American Public Health Association, the Engineers' Club, and of the Masonic Orders.

Among Mr. Kuichling's numerous technical writings a few technical society papers and professional reports may be mentioned:

American Society of Civil Engineers—(1) The Relation between the Rainfall and Discharge of Sewers in Populous Districts. 1889. (2) Loss of Head Resulting from the Passage of Water through a 24-Inch Stop Valve. 1892. (3) The Financial Management of Water-Works. 1897.

New England Water-Works Association—Steel Pipes for Water-Works. 1910.

Professional Reports—(1) Report on the Water Supply of the Proposed Enlarged Erie Canal, 1901. (2) Report on the Disposal of the Sewage of the City of Rochester, 1907.

Mr. Kuichling married Sarah Louise Caldwell in 1879, and she survives him.

Resolutions on the Death of Emil Kuichling

The following resolutions on the death of Emil Kuichling were adopted by the Rochester Engineering Society, of Rochester, N. Y., on Nov. 14, 1914:

Whereas, Emil Kuichling, one of the founders of this Society and its first Chairman, was suddenly taken from us, Nov. 9, 1914, while still in the active practice of his profession; therefore, be it

Resolved, That we, the members of the Rochester Engineering Society, hereby express our appreciation of his notable qualities, which were known to most of us by reputation and to many of us by long personal contact with the man and with his work.

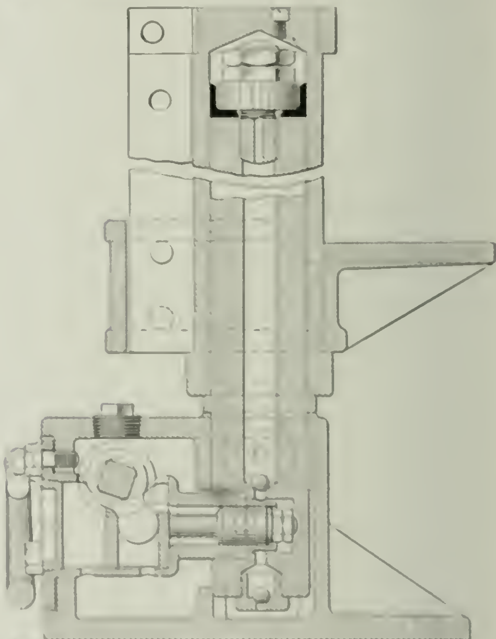
He was a master of detail, a profound student, a tireless investigator and an indefatigable worker, and [illegible] to record, with the greatest care, the results of his investigations, observations and studies.

[illegible]

A Hydraulic Jack for Emergency Service

The unique design of hydraulic jack shown in the accompanying figure was first evolved for electric-railway emergency service (according to the requirements of the Pennsylvania Public Service Commission), but has certain obvious advantages for shop and field use.

The pump (horizontal) and plunger (vertical) are fixed to the base and the cylinder rises, carrying with it an adjustable claw which can be swung through 360° without shifting the jack and which can be set at the most convenient initial height. This arrangement allows the pump handle to be worked from the most accessible position in each case. The handle is curved and the socket has four holes so that the pump can be worked from either above or below or from either front or back.



The Watson-Stillman Emergency Jack

The pump plunger is packed with leather rings between compression glands; the ram plunger has a single cup packing. The valves are simple balls and the oil under pressure flows up through the ram piston and packing [illegible]. For release, a needle valve on the side opens a passage from the [illegible] to the reservoir in the base. An "no-freezing" mineral oil is used, as this has been found to cause no appreciable deterioration of the packing and does not congeal at the temperatures met with in emergency service.

The jack described is made by the Watson-Stillman Co., of New York. Two sizes, five and ten tons, are being put out at present. With each size a 175-lb. man can exert the maximum lift for which the ram is intended. The stroke is 10 in. in both sizes and the parts are proportioned for 50% overload.

NEWS NOTES

Explosions Wrecked Dye Works—The plant of the W. Beckers Aniline & Chemical Works, Brooklyn, N. Y., was destroyed by two heavy explosions resulting from experimentation. A young chemist was killed and 50 other men were injured. The damage was estimated at about $100,000.

The Houston Ship Channel, which provides a 25-ft. depth from the Gulf to Houston, Tex., was formally opened on Nov. 10, by President Wilson pressing a button in Washington, which fired a signal in Houston. The channel was described in "Engineering News," July 13, 1914, p. 188. Wharves, docks and other port appurtenances have not been completed, but a bond issue of $3,000,000 has been approved for that purpose.

Bids for Repair of Moodna Siphon, Catskill Aqueduct—The bids for driving a shaft about 400 ft. deep and a section of tunnel 900 ft. long, to supplement the existing Catskill Aqueduct at Storm King, have been received. The five lowest are as follows: Oscar Daniels Co., $365,926; T. A. Gillespie Co., $382,290; Mason & Hanger Co., $387,499; Pittsburgh Contracting Co., $389,207; J. F. Cogan Co., $394,816. This work was discussed in our issue of Nov. 5, p. 954.

The Club House of the Cleveland Yacht Club is being moved seven miles by means of three scows. It is a 2½-story frame structure, 50x70 ft. in plan. The contractor is G. Alexander & Sons, Movers, and it is understood that the water transportation will be effected by the American Construction Co.

An Ambitious Dock Scheme on Lake Erie at Cleveland, Ohio, has been proposed by O. C. Barber, the Cleveland match manufacturer. The plan contemplates extensive ore, coal and merchandise docks on the lake front between East 55th St. and East 67th St., and a four-track subway connecting the dock and warehouses with the Cuyahoga Valley some miles south, where there would be about eight miles of track frontage for manufacturing sites. The scheme is estimated to cost about $9,000,000. Just at present there seems to be no immediate prospect of its being carried out, and furthermore, it is in violation in some respects of the federal government's scheme for developing the lake front at Cleveland.

The New Refuse Incineration Plant for San Francisco, described in our issue of Jan. 15, 1914, was recently subjected to a 30-day test under the direction of M. M. O'Shaughnessy, City Engineer. On Nov. 14, Mr. O'Shaughnessy reported that the incineration was imperfect, the smoke excessive and that other defects existed. He also reported that the cost of incineration during the test was $1.33 per ton, which is about 20% above the guarantee. He recommended that the city reject the plant and enter suit for the return of the money already paid to the contractor, the Destructor Co., of New York City. This recommendation will come up for action by the Board of Supervisors of San Francisco on Nov. 23.

A Diversion of the Little Calumet River, south of Chicago, is proposed in connection with a land drainage and reclamation project known as the Burns Ditch project. The river now discharges into Lake Michigan at South Chicago, but the diversion channel will discharge at Tolleston, Ind., and will take the water from about 50% of the drainage area of the river, thus reducing the floods which now occur along the river in Illinois. It is considered that this will benefit the drainage problem of the Sanitary District of Chicago, which is now building the Sag Canal from the Calumet region to the main drainage canal. The new ditch would take the water coming from the rural districts, and thus tend to decrease the amount of pollution that is scoured up and discharged into the lake at South Chicago by every moderate flood. The Burns Ditch project is now in the courts, as it is to be paid for by special assessment.

Channel Clearing on the Kaw River—The Board of Directors of the Kaw Valley Drainage District, Wyandotte County, Kansas City, Kan., is contemplating the cleaning out of the Kaw River channel from its mouth to a point at least six miles above same. This work embraces the removal of all solid obstructions such as piling, jetties, rock, box-cars, car tracks, etc., and the removal of dirt lying between levees to a depth of at least 30 ft. below the tops of same. This amounts to approximately one million yards. The Board of Erection contemplates the removal of the dirt by means of a hydraulic dredge discharging on top of and behind the levees at points determined by the Board. The United States Government has reported on the removal of the solid obstructions. The report states that wherever said obstructions might be identified as belonging to any of the railroads, the stock yards company or the various packing companies, the cost of the removal should be charged to said company; the cost of the removal of the unidentified obstructions to be borne equally by the Drainage Board and the Government.

The Largest Automatic Sewage Pumping Station in the World, with a total capacity of 151,000,000 gal. per 24 hr., is now being built by the Public Works Department of Boston at Union Park and Albany St. The sewage will reach the station through a 7 ft. 4 in. by 4 ft. 10 in. sewer, passing through a 15x29-ft. screen chamber to the pump suction well and will be raised about 13½ ft. into a 5 ft. 9 in. by 5 ft. 3 in. force main. Four pumps will be installed, three having 36-in. suctions and 36-in. discharges to deliver 30,000 gal. per min. each, and one having a 26-in. suction and 24-in. discharge to deliver 15,000 gal. per min. The larger pumps will be driven by 150-hp. constant-speed motors, operating on a 440-volt circuit and the smaller pump will be driven by a similar 75-hp. motor. Each pump will be equipped with an air-relief valve, pressure gage, recording tachometer and a 2½-in. gate valve with hose coupling nozzle for flushing. The automatic control is obtained by a float, moving in a 24-in. control-float well, which will actuate a multipoint switch on an independent switchboard. This switch will close five circuits consecutively as the elevation of the sewage in the suction chamber changes. The first circuit energizes the operating winding of the magnetic switch which connects the transformers across the line. The other four circuits control the pumps. The superstructure of the pumping station will be 40x65 ft. and will contain an office, shop, transformer room and motor room.

PERSONALS

Mr. Dorsey J. Parker, of Alabama, has been appointed mining engineer in the Bureau of Mines, Pittsburgh, Penn., and his appointment has been approved by the Secretary of the Interior.

Mr. William T. Sitt, Assoc. M. Am. Soc. C. E., who was connected with Wells Bros Co., of New York City, for the past 12 years, retired from the active service of the company on Oct. 1, and has taken up private practice, specializing in the design and construction of foundations and buildings.

Mr. M. Z. Richards, Land and Industrial Agent of the Southern Ry., has been appointed Commissioner of the Industrial and Agricultural Department recently formed by consolidation of land, industrial, farm improvement and livestock departments. Mr. Richards has been in railway service since 1881.

Mr. Robert Sayre Kent is President of Robert Sayre Kent, Inc., Engineers, recently formed. The new concern will continue Mr. Kent's former business—designing, superintending and operating sugar factories and refineries, iron foundries, etc.—and will have offices at the old address (50 Court St., Brooklyn, N. Y.).

Messrs. Frank A. Randall, Assoc. M. Am. Soc. C. E., since 1912 Chief Engineer of Morey, Newgard & Co., Chicago, and William H. Warner, structural designer with Graham, Burnham & Co., Chicago, have opened an office for the practice of civil and structural engineering in Chicago, under the firm name of Randall & Warner.

OBITUARY

Orlen W. Sealand, Superintendent of the Sun Oil Co., of Toledo, Ohio, was overcome by carbon-monoxide gas at the plant, on Nov. 11, and died from the effects on the same day. Mr. Sealand was graduated from the Case School of Applied Science in 1904.

Louis M. Clement, M. Inst. C. E., a well known West Coast civil and mechanical engineer, died Oct. 29, at his home, Hayward, Calif. He was an engineer on construction work for the Central Pacific R.R. in 1861. Later he designed and built the Hayes St. cable railway in San Francisco and other street railways in that city and Oakland. He was for many years Consulting Engineer of the Southern Pacific Co. He was born in Canada in 1837 and went overland to California in the days before transcontinental railways. He was a former member of the American Society of Civil Engineers, the American Society of Mechanical Engineers and the Canadian Society of Civil Engineers.

Daniel A. Camfield, a contractor of Greeley, Colo., died in New York City, on Nov. 10, as the result of a stroke of ap-

[illegible] years old and for [illegible] in the West, [illegible] large irrigation contracts. He was the [illegible] of a newspaper in Greeley and was interested in the [illegible] Water Co.

[illegible] C. Barnes, M. Am. Soc. C. E., a prominent civil engineer of Jamestown, N. Y., died there Oct. 29, after an illness of more than a year. He was born in New York [illegible] In his youth he attended the [illegible] Preparatory School, Detroit, Mich., where he prepared for the civil engineering course at the University of Michigan, graduating from the latter institution in 1868. After graduation he engaged in railway construction in Iowa and Illinois in positions ranging from rodman to chief engineer until 1871, when he assumed charge of the construction of the Pittsburgh, Bessemer & Lake Erie R.R. as Chief Engineer. In 187[illegible] he supervised the construction of the Buffalo & Southwestern R.R. from [illegible] to Jamestown. From 1877 to [illegible] he was United States Assistant Engineer on river and harbor work, and was engaged in the construction of the Sault Ste. Marie canal, the repair of the St. Clair canal, and the dredging of the Livingston channel in the Detroit River. Since [illegible] he has resided at Jamestown, serving for several years on the Board of Public Works, and has many times been engaged as consulting engineer for the city. He was one of the commissioners for the drainage of the Cinewango swamp and was the engineer of this important work. For thirty-[illegible] years E. C. Barnes was an active member of the American Society of Civil Engineers.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS
Nov. [illegible]-Dec. 1. Annual meeting at New York. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN PUBLIC HEALTH ASSOCIATION
Nov. 30-Dec. [illegible]. Annual meeting at Jacksonville, Fla. Secy., Prof. Selskar M. Gunn, Massachusetts Institute of Technology, Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Dec. 1-4. Annual meeting at New York City. Secy., Calvin W. Rice, 29 W. 39th St., New York City.

AMERICAN INSTITUTE OF ARCHITECTS
Dec. [illegible]. Convention at Washington, D. C. Secy., D. Knickerbocker Boyd, The Octagon, Washington, D. C.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS
Dec. [illegible]. Annual meeting in New York City. Secy., Percy H. Wilson, Bellevue Court Bldg., Philadelphia, Penn.

AMERICAN MINING CONGRESS
Dec. [illegible]. Annual meeting at Phoenix, Ariz. Secy., J. F. Callbreath, Denver, Colo.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION
Dec. [illegible]. Convention at Richmond, Va. Secy., C. A. Prosser, 140 W. 42d St., New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS
Dec. [illegible]. Annual meeting at New York City. Secy., D. H. Cox, 29 W. 39th St., New York City.

AMERICAN ROAD BUILDERS' ASSOCIATION
Dec. [illegible]. Convention at Chicago, Ill. Secy., E. L. Powers, 150 Nassau St., New York City.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS
Dec. [illegible]. Annual meeting at Chicago, Ill. Secy., F. M. White, Madison, Wis.

National Society for the Promotion of Industrial Education—The eighth annual convention of the Society will be held in Richmond, Va., Dec. [illegible], with headquarters at the Hotel Jefferson. The National Vocational Guidance Association will hold its annual meeting in the same city, Dec. [illegible]. The [illegible] program of the Society has been prepared and can be obtained from the Secretary, C. A. Prosser, 140 West 42d St., New York City.

Society of Naval Architects and Marine Engineers—The [illegible] general meeting of the Society will be held in the [illegible] Building, New York City, Dec. [illegible], beginning at [illegible] each day. The annual banquet will be held [illegible]. The [illegible] list of papers includes the following: [illegible]

[illegible] Wentworth, "[illegible] of Warships at Sea;" Spencer Miller, "The Behavior of Riveted Joints under Stresses;" James E. Howard, "The Present Status of Marine Internal-Combustion Installations;" W. R. Haynie, "The Application of Electric Propulsion to Battleships, together with the Experience Gained in the 'Jupiter';" Lieut. S. M. Robinson.

New England Water Works Association—At the first monthly meeting of the 1914-15 season, held in Boston, Mass., Nov. 11, two interesting and instructive papers were presented on the two newest methods of sterilizing water-supplies. Dr. Max von Recklinghausen described the sterilization of water with ultra-violet rays, beginning with an outline of the principles involved, including many results of the author's experiments and experience with French installations, and ending with a statement that several large installations were under consideration in this country. The paper was very optimistic in its conclusions on the efficiency of this method of water purification. Sheppard T. Powell's paper on the use of ozone as a sterilizing agent was read, but in the absence of the author was not discussed. This paper gave an interesting and valuable summary of American experience in the use of ozone, discussing particularly the difficulties and the causes of failure in many installations. The paper gave in some detail the changes which have been made in the Ann Arbor, Mich., plant and the results of experiments there and elsewhere, both in removal of bacteria and of color and odors, together with cost data. Mr. Powell's conclusions were, that ozone was an efficient means of removing all three of these objectionable features in water, but he recognized at the same time that it was not a cure-all; that former failures with ozone as a disinfecting agent were due to want of perfection in mechanical details and operating methods. On the whole, this paper was very optimistic on use of ozone as a water-sterilizing agent. The topical discussion on the general subject of service pipes was long and interesting and many water-works officials of long experience took part. This discussion covered little more than the kind of pipe to use; other branches of the subject will probably be taken up at other meetings. Lead pipe seemed to be the prime favorite, and it was stated that objections to it were in many instances æsthetic rather than founded on any real danger in its use. Cement-lined iron pipe was next in popularity and several instances were given of very satisfactory results with galvanized-iron pipe.

Conference of American Mayors on Public Policies as to Municipal Utilities—A large gathering of mayors and others interested in the regulation of public utilities was held in Philadelphia on Nov. 12 and 14, 1914. The conference was called by the following mayors: Rudolph Blankenburg, Philadelphia; John P. Mitchel, New York; Carter H. Harrison, Chicago; Newton D. Baker, Cleveland; [illegible] W. [illegible], Dayton. At the two evening sessions, the mayors and delegates were the guests of the American Academy of Political and Social Science.

There were numerous addresses on state and local legislation of public utilities, municipal ownership and operation, both in theory and practice, and municipal home rule. The sentiment of the conference seemed to be almost wholly in favor of municipal ownership, qualified chiefly [illegible] conditions of local expediency. There was also expressed much strong feeling against state and in favor of local regulation of public service corporations, but this was tempered with considerable recognition of the fact that utility regulation is largely a matter of state concern, and, except for the larger cities, [illegible] problem for [illegible] communities. [illegible] objections were voiced against state regulation of municipally-owned public utilities, but this view was not accepted by all the members.

At the end of the conference a Committee on Recommendations, of which Mayor Baker of Cleveland was Chairman, reported as follows: (1) No stand should be taken for or against municipal ownership, but it is highly important that every municipality have a free hand in this matter. (2) No stand should be taken on state as against local regulation of privately-owned utilities, but all franchise grants should be [illegible] and municipally-owned utilities should be subject to local control only. (3) The [illegible] of The Utilities Bureau should [illegible] with its [illegible] keep records, employ experts and render service to individual cities. This report was adopted.

It may be added that The Public Utilities Bureau has as its [illegible] the [illegible] named above, and [illegible] Frederick A. Cleveland, Director of the New York Bureau of Municipal Research; [illegible] W. [illegible], consulting engineer, [illegible]; and Chas. R. Van Hise, President of the University of Wisconsin, Madison, Wis. The [illegible] office of the Bureau is [illegible] City Hall, Philadelphia, Penn.

Engineering Literature

CONTENTS

CORRESPONDENCE

A Card-Index Multiplication Table

Sir—I read Mr. Rossiter R. Potter's article on "Cox's Commercial Calculator" in your issue of Oct. 15 with much interest, as I abandoned that system after doing a large amount of work on it in favor of a system which I patented in 1910.

F. C. Williams.

Commercial Bank Building,
Cleveland, Ohio, Oct. 29, 1914.

[From a pamphlet sent by Mr. Williams it appears that his "Multiplying Device" is "simply a large multiplication table," in card index form. Products up to 9×999 can be read directly. Beyond that simple multiplication followed by addition is required.—Editor.]

On Methods of Instruction in Surveying

Sir—I note the criticism on the expediency of teaching surveying by the use of worked-out problems, in the review of my book, in your issue of Aug. 14. You said:

> Is it better to tell a young man what you want done and leave it to his initiative and ingenuity to devise the best ways and means, with the help of necessary text-books and verbal instructions, or to give him a cut-and-dried problem and say, go thou and do likewise? To help train a real engineer, we would prefer the former.

In defense of the above criticism, I wish to state that the "Field Manual of Plane Surveying and Railroad Curves" is intended to be the A B C of Plane Surveying. It is designed to help the student at a time when he not only has to learn the form of report, but also the principle of the problem. By placing a few well selected fundamental problems at his convenience, he is started in the right direction without an excessive amount of personal supervision; that is, he is able to help himself in the early stages of the work by this convenience.

After he has completed these first few problems in plane surveying, he takes up the second and third terms of surveying without any assistance except what he can get from the standard text or his instructor. He is then thrown upon his own resources to make notes to suit the problem he has in hand. We have tried this test for two terms and have found it to give the results that were expected.

If the above criticism can be applied to this text it may also be applied to a number of other texts which have been successful. The only difference between this and other manuals is the matter of convenience. The others have their field notes photographed and printed along with detailed instructions about apparatus and method of procedure.

If the field book is used, it is necessary for the student to carry both manual and field book to the field, which is inconvenient. The student is also expected to buy and read a reference work. The expense of these three books is too large when we consider the fact that he is paying for the same instruction three times. The reference book gives it to him once and the manual twice (first in the form of instructions as to apparatus and method, second in reproduced field notes). If the problem is reviewed in class, he receives the same instruction four times. The purpose of the Field Manual is to eliminate one of these repetitions, by combining the necessary part of the manual and the field book, which reduces the expenses and adds greatly to the convenience of the student. At Valparaiso University we have saved every student \$1.50 on his plane surveying book bill and he has just as much for his money.

It is our policy to encourage a man's initiative and ingenuity to devise the best ways and means to do his work, and this is done in due time, but in the beginning of a subject it is necessary to teach him some form or convention in which there is no opportunity for initiative or ingenuity. Just as soon as the work advances to a stage where a variety of form is possible, we give him the opportunity of making for himself his own plan.

R. C. Yeoman.

Valparaiso, Ind., Nov. 5, 1914.

[The author shows the reason for using the kind of field book we have criticized when he says it answers the purpose "without an excessive amount of personal supervision." In other words, he uses the book for exactly the purpose we suggested. It seems to us that any young man who has a fair knowledge of geometry and trigonometry does not need to exercise any great amount of ingenuity to work out and keep the notes of simple surveying problems, if he is given a very moderate amount of verbal instruction, with what he can glean for himself from standard textbooks. It is not a question of easing the work of the instructor, but of making a surveyor.—Editor.]

REVIEWS AND NOTES

A Brief Text on Foundations

REVIEWED BY C. S. RINDSFOOS*

FOUNDATIONS: A Short Text-Book on Ordinary Foundations Including a Brief Description of the Methods Used for Difficult Foundations—By Malverd A. Howe, M. Am. Soc. C. E., Professor of Civil Engineering, Rose Polytechnic Institute. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. vii + [illegible]; [illegible] text figures. $1.25, net.

It is curious to note that foundations, so long neglected, have become, all at once, a popular subject for the authors of textbooks. Within the past few months, three such books have appeared. In a previous review of one of these, the writer made the criticism that too large an amount of matter had been crowded between one set of covers, and that a division into two volumes would have produced greater convenience. In the book which is the subject of the present review, the opposite extreme prevails. The material is so abbreviated that its use will be found to be quite limited.

The author announces that "the object is to state in an elementary manner the fundamental principles upon which the proper design of foundations is based," and again that "an attempt has been made to so present and arrange the subject matter that the book can be successfully used as a textbook." With these things in mind, the fact that the work is so small is at least understandable, and yet it is hard to see wherein the book will offer any advantage over one of the more complete texts which have appeared previously, unless it be in the matter of cost to the student who will use it, or unless it has been arranged to fit a certain course in a particular college.

The book is divided into six chapters, as follows: Supporting capacity of soils; wall and column footings; piles and pile foundations; chimneys and towers; bridge piers and abutments; and methods employed for difficult foundations.

Many formulas are given for the design of different types of foundations, as well as examples under each topic, the answer in each case being stated.

With one or two exceptions, nothing is presented on any of these topics that had not already appeared in book form several years ago. The descriptions are so brief that the elementary student would not be greatly benefited unless there be amplification in the form of lectures or other reading. Many references to other books and to current periodicals are included for this purpose, and this feature deserves commendation.

In conclusion, it should be said that the book is elementary, concise and will be of some use to the student—though a monograph on so broad a subject can be of but doubtful value.

REPORT ON EUROPEAN PAVEMENTS—By George W. Tillson, Consulting Engineer to the President, Borough of Brooklyn, New York City. [illegible] Paper; [illegible]; illustrated.

The author gives, in narrative form, a description of the kind and condition of the pavements in a number of European cities, as observed by him in the summer of 1913 while abroad as official delegate of the City of New York to the International Road Congress. About 100 illustrations, extracts from specifications, and cost data are also included.

Mr. Tillson concludes that the general condition of pavements in European city streets is better than that of the streets of American cities. In Europe, he says a great deal of attention is given to proper repairs, which he thinks is not true in the average American city. Another reason for the superiority of European pavements, the author thinks, is that fewer pavement openings for subsurface structures are made there than here. In Europe, the authority of highway officials generally includes jurisdiction over the construction of subsurface structures.

* [illegible] Concrete Corporation, Woolworth Bldg., New York City.

Popular Books on Aeronautics

FLIGHT WITHOUT FORMULAE: Simple Discussions on the Mechanics of the Aeroplane—By Commandant Duchêne of the French Génie; author of "The Mechanics of the Aeroplane." Translated from the French by John H. Ledeboer, Editor, "Aëronautics", joint-author of "The Aëroplane." New York and London: Longmans, Green & Co. Cloth; 6x9 in.; pp. 211; 84 text figures. $2.25, net.

HARPER'S AIRCRAFT BOOK: Why Aëroplanes Fly, How to Make Models and All About Aircraft, Little and Big—By A. Hyatt Verrill, author "Harper's Book for Young Naturalists." New York and London: Harper & Brothers. Cloth; 5x8 in.; pp. xv + 245; illustrated. $1, net.

Commandant Duchene and his translator, Mr. LeDeboer, have attempted to execute a flank movement on those would-be deeper students of aeronautics who are deterred by the formidable mathematical expressions encountered as soon as they open the usual volume on the mechanics of flight and flying machines. This book gives no formulas, it is true, but it presents the same information by reverting to ordinary language—divided by, multiplied by, added to, minus, etc., in place of mathematical expressions—and by graphs, when the relations between variables become more complex.

Lift-resistance-speed relations are first presented and followed by power required for sustentation, etc. This last topic is treated at length and occupies some 30% of the book. Stability has a place of equal importance with some 40% of the pages, the matters of longitudinal, lateral and directional stability being discussed in separate sections. Many of the ideas are visualized by simple and interesting experiments easily performed by any reader.

What has been noted so far relates to manipulations in still air; for completeness a neat little discussion of air currents—steady winds and intermittent gusts—is appended as the final chapter.

The author and translator have succeeded in producing a brief treatise of appealing simplicity and pleasing literary style.

The "Aircraft Book" is made upon the usual lines of this sort of treatise and its value depends on detailed explanations of the project rather than results of approach. Conspicuous among the author's efforts are the attempts to explain flight simply enough to fit the minds of boys. Of these attempts he has expressed a most optimistic confidence in his success; however, he can be forgiven such manifest professional pride (perhaps injected by some editor) for the explanations throughout the book, though [illegible] from the engineering point of view, are good for common use.

Early in the discussion of best wing shapes, an unfortunate grouping of diagrams makes the text claim that the short broad plane is more effective than the long narrow type universally seen. A very few minor points are

presented in peculiar prospective—thus the emphasis on inherent stability of certain cambered planes, which is separated from utter instability by a narrow margin and is of no practical utility yet—as the author casually remarks.

The book seems to naturally fall into several parts. One part explains the flight and control of aëroplanes and another describes the construction of small machines. These are of two general types—propelled and gliding. The author does not recommend that boys make propelled machines of carrying capacity but he seems to think it harmless to use gliders of sufficient size to support one small person. A third division of the book describes some of the more notable types of flying machines that have been developed.

A German Textbook on Hydraulic Turbines

Reviewed by H. E. Longwell*

VORLESUNGEN ÜBER WASSERKRAFTMASCHINEN—Von Dr. Phil. Dr.-Ing. R. Camerer, Dipl.-Ing. O. Professor des Maschinenbaues an der Kgl. Techn. Hochschule, München. Leipzig and Berlin: Wilhelm Engelmann. Cloth; 7x10 in.; pp. xxvii + 577; 718 text figures and 55 tables. 25 Marks.

This volume conveys the somewhat unusual, and altogether pleasing impression that the author's first consideration has been the realization of his ideal of an engineering textbook. In every detail it exhibits the perfection of finish that marks the craftsman who cannot permit himself to slight his work in ever so small a degree.

While intended primarily as a textbook for the author's classes, it is none the less a most useful reference work for engineers already established in practice, as it presents the subject from new viewpoints, introduces new methods of calculating, and furnishes in convenient collective form a mass of information regarding successful construction of modern hydraulic turbines, and water-power plants.

The work is divided into seven parts, of which the first is a brief general introduction to the subject, treating particularly of the physical, chemical and electrical properties of water. The second part, of 160 pages, deals with hydrostatics and hydrodynamics with special reference to the needs of the turbine engineer.

Part III treats of water-power machines in general, classifying them into the various types and giving the nomenclature of each type. This section also contains an interesting historical review of the gradual development of the crude apparatus of ancient days into the modern and highly efficient hydraulic turbine. Part IV deals with the general theory of turbines, as developed from the underlying energy law, with analytical and graphical treatment of the equations derived from this law.

Having covered his subject broadly, the author proceeds to a special consideration of the two types of turbine which he regards as the only healthy survivors of the family, viz.—the complete admission, centripetal-flow turbine (Francis type), and the tangential or pure-impulse wheel (Pelton type).

Part V elaborates the general theory of the turbine with special reference to the Francis type and Part VI deals with the practical design of turbines of this class. It is interesting to note that this section is not "padded" with material that pertains strictly to pure machine design; the author confines himself to machine design as influenced by the special conditions obtaining in the particular machines under consideration. The concluding part covers the theoretical and structural design of the tangential or Pelton-type turbine.

The 718 illustrations in the text are supplemented by 55 folding plates of diagrams, halftone reproductions of photographs, and constructional drawings of actual machines, all on a conveniently large scale. These plates are grouped at the end of the book, and have page-width margins at the left, so that when they are unfolded, no part of the engraved surface is covered by the leaves of the book—an obvious convenience for the reader. There is a table of the abbreviations used in the text and a very complete table of all the symbols. In addition to the table of contents and titles of the plates, there is an alphabetical index of subjects covering nine pages.

The printing and paper are in keeping with the excellent quality of the contents. The author has that easy, graceful—almost conversational—literary style that lends a charm to even the most abstruse subject. This style is not altogether unusual in German technical works of the better class, but unfortunately translators do not seem to appreciate its desirability, and in consequence, it is rarely, if ever, reproduced.

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Gas Engines for Amateurs

HARPER'S GASOLINE ENGINE BOOK: How the Engine Is Made, How to Use It at Home, in Boats and Vehicles and Elsewhere, and How to Keep It in Order—By A. Hyatt Verrill, author of "Harper's Wireless Book." New York and London. Harper & Brothers. Cloth; 5x8 in.; pp. xx + 292; illustrated. $1, net.

The constant stream of popular books on gas engines and their applications would lead one to feel that there must be something serious the matter with the previous literature available for amateur readers. If all that have been published were as good as this one, there would not be great demand for new texts. This work, it is stated, is intended particularly for boys, but in spite of such limitations it is well adapted for non-technical readers of more advanced years.

The author's introduction is a very optimistic valuation of his own work, which naturally would tend to make a critical reader prejudiced. But he has lived up to his aims for the most part in a creditable manner—whatever one may think of bold claims to "excel all others of the kind" in this or that particular.

Certain superficialities are to be expected—indeed seem almost necessary. There is no excuse, however, for careless confusion between power and torque or force, or between power and energy, as is seen in discussing the size and power of engines. Right here also is the surprising information that indicated horsepower is computed from bore, stroke and speed alone—other matters being considered constant. It need hardly be stated here that indicated horsepower is computed from mean effective pressures, experimentally determined, dimensions and speed, while the author has confused it with one of the numerous ways of nominal rating. A similar surprise awaits anyone who believes that a two-stroke-cycle engine could be appreciably more powerful than a four-stroke-cycle type of equal weight, etc. With a very few such corrections, the book will be helpful to the me-

[illegible] and automobiles, as well as to the [illegible] engines.

The [illegible] points of [illegible] types and advantages, [illegible] pressures, benefit of oiling and [illegible]. Then a little different [illegible] is made to show how the engine generates its power. Single- and multi-cylinder construction is described and special designs like [illegible], [illegible] and rotating-cylinder or "star" engines. Machines for special work, as for water and air craft and for stationary plants, are well distinguished. [illegible] present general construction features of motor cars, motorcycles, cycle cars, etc. Closing sections discuss inspection and repair and troubles to be expected. An appendix shows symptoms of troubles and remedies which should be close at hand.

Ground-Water Supplies

Reviewed by Emil Kuichling*

DAS GRUNDWASSER, SEINE ERSCHEINUNGSFORMEN, BEWEGUNGSGESETZE UND MENGENBESTIMMUNG—By Dr.-Ing. [illegible] [illegible]. Leipzig and Berlin: Wilhelm Engelmann. Paper; 8x11 in.; pp. [illegible]; 27 text figures. 3.20 Marks.

This monograph was written by a well known hydraulic engineer who has given special attention for many years to the development of ground-water supplies for German cities, and it was recently accepted by the Polytechnic School of Zurich as a thesis for the degree of Doctor of Technical Sciences. It points out the numerous difficulties that have [illegible] in placing the subject on a sound basis, and indicates how they can be overcome in large measure, so as to make subterranean hydrology an approximately exact science.

The text is divided into seven sections or chapters, which embrace a resume of the principal theories of the formation of ground-water, the interchange of surface and subsoil waters, the law of resistance to the motion of water through the ground, the efficiency of different methods of obtaining a water-supply, such as by means of vertical wells, horizontal filter galleries and artesian wells, the determination of the shape of the cone of depression of the ground-water surface by means of experiments with pumps, and lastly, the determination of the discharge of a stream of ground-water through a given [illegible] cross-section.

Wherever possible the subjects are treated mathematically, and formulas are developed for the curve of depression in terms of the pumpage, the thickness of the water-bearing stratum, and certain empirical constants, which are evaluated in a [illegible] manner. The monograph thus becomes a valuable addition to the literature of ground-water and the methods of ascertaining the probable yield for the supply of a community.

HEAT ENGINES: Steam, Gas, Steam Turbines and Their Auxiliaries—By John R. Allen, Professor of Mechanical Engineering, and Joseph A. Bursley, Junior Professor of Mechanical Engineering, University of Michigan. [illegible] New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. [illegible]; [illegible] illustrations. [illegible] net.

In reviewing the first edition of this book (Engineering News, Oct. [illegible], 19[illegible]), attention was drawn to a few [illegible] that [illegible] of the book from the [illegible] volume stage. [illegible] have been [illegible] in the general [illegible] to keep up with the engineering advance in development and design of heat engines. Yet [illegible] hasty statements that were criticized in the [illegible] edition persist. There has been a general improvement and modernizing of details. The new topics cover the Stumpf "Uniflow" engine and the Humphrey direct-acting explosion pump. There are additions to the treatment of steam turbines and gas engines.

To those not familiar with the first edition, the title of the book may not convey a proper idea of its scope—which embraces elementary thermodynamics, properties of steam, [illegible], fuels, boilers, boiler auxiliaries, steam engines, engine details and testing, turbines and explosion engines.

THE AUTOCAR IMPERIAL YEAR BOOK 1914—London [illegible] Tudor St.: Iliffe & Sons, Ltd. Cardboard; 8x12 in.; pp. 12[illegible]; illustrated. 2½ shillings net.

This publication, issued by one of the principal British automobile journals, puts into permanent form, available for reference, some of the important developments of the year in British automobile engineering. The amazing development of the automobile industry in this country is matched by a similar development abroad and it is of interest to note to what a limited extent the practice of one country is reproduced in the other. The number of different makes of automobiles in England appears to be almost as great as in the United States, and the same thing is true of the enormous business in automobile parts. In the carburetor field, for example, there are 25 or 30 popular makes of carburetors in use in Great Britain which are entirely different from the equal or greater number of makes of carburetors in common use in the United States. The engineer interested in any phase of automobile development will find a great deal of valuable matter in this book. The titles of a few of the chapters will indicate its scope: The Modern Chassis, Tendencies of Design, Electric Car-Lighting Systems, Electric Engine Starters, The Progress of the Light Car, Lubricating Systems, Springing Systems, The Principal Makes of Carburetors, Royal Automobile Club's Trials of Motor Accessories and Tires, The Fuel Question, World's Records.

About the only criticism to be made of the book is that it follows the custom common to English technical and trade publications of interspersing advertising pages among the reading matter.

Automobile engineering is perhaps the youngest important branch of the engineering profession, but any civil engineer or mechanical engineer who looks upon the automobile field as a purely manufacturing field which has not yet made use of the engineer's ability to apply science to industry, will learn something if he studies such a book as the one before us.

PRACTICAL CALCULATIONS FOR ENGINEERS: For the Use of Engineering Students, Apprentices, Mechanics, Foremen, Draftsmen and Others Practically engaged in Engineering Work—By C. E. Larard, M. Inst. C. E., M. I. Mech. E., Head of the Mechanical Engineering Department at the Northampton Institute, London, and H. A. Golding, Assoc. M. I. Mech. E. Third edition, revised. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Co. Cloth; [illegible] in.; pp. [illegible]; [illegible] illustrations. [illegible] net.

The first edition of this book appeared in 1907, and was favorably noticed in our issue of March 12th, 1908 (p. [illegible]). An enlarged and corrected edition appeared in 19[illegible] but has been out of print for some time. In the second edition the authors state that they have made

*[illegible] Mr. [illegible] [illegible] [illegible] [illegible] this [illegible].

"certain additions and a complete revision of the subject-matter;" also that they have omitted the major part of Section IV., which is to be published "as a separate volume in order to give a fuller treatment of the more purely commercial or business side of engineering." In noticing the first edition we characterized the book as designed "solely to give practice in making calculations, to help in the difficult task of converting school-taught principles into working tools."

Practical Rate Making and Valuation

PRACTICAL RATE MAKING AND APPRAISEMENT—By William D. Marks, author of the "Finances of Gas and Electric Light and Power Enterprises, 1900," and of Other Technical Papers and Works. South Hadley, Mass.: Office, Presidents House. Cloth; 5x8 in.; pp. 269. $2, postpaid.

Any posthumous volume of an engineer with a long and interesting career is bound to be of unique interest to many; in addition, the present volume has special interest as disclosing the inner workings of the mind of one who was among the oldest public-utility experts of the country.

It will be readily admitted that many of the methods used by the author had to be original, in the absence of precedents for the work which pioneer appraisers and rate-makers have done, but it must be regarded as unfortunate that he had such ties to the children of his own mind that he could not accept any and all improvements on them by some of the more recent entrants to the field. The ideas recorded here were good so far as they went, but they were after all not the only contributions in a field in which a multitude of equally earnest and sincere workers have gradually improved both theory and practice. The author's reluctance to see much good in some of these efforts is reflected in his severe and largely unmerited arraignment of the public-service commissions of various states. The explanation perhaps is found in some ungentle and ungenerous treatment by busy and thoughtless men. The ideas of a few were commended, and we suspect that the originators possessed more gentleness, deference and tact than some of their less fortunate fellows.

The first chapter contains a few very general and miscellaneous remarks on rate problems. These seem to show that the author viewed with suspicion the operation of all utility concerns in cities of over 25,000 population—on account of "growing into vendors of a commodity on a large scale" instead of "rendering service as a public servant." Here are first mentioned, the author's "proportional" or "commodity" and "time" costs which make up his total cost of utility service or product. The author's "proportional cost" includes chiefly productive labor and raw materials; his "time cost" covers interest, profit, depreciation, rent, insurance, general staff employees, etc. The author was on the right track when, years ago, he attempted in this way to adjust rates equitably between the short-time peak-load consumer and the customer who used a smaller amount for long hours. But his scheme will seem to many to be but one step toward the most equitable procedure possible, for on careful analysis "time" and "product" are not the fundamental tests. These are rather (1) the cost of readiness to serve, and (2) the cost of actual service—the former sometimes becoming indistinct, and the latter sometimes splitting naturally into a commodity and a customer charge.

Following are two long chapters summarizing reports made by the author for Spokane (gas) and Minneapolis (arc lighting). They are interesting as showing a *modus operandi*. In the gas case it might seem that the author's "time-cost" allocation, for a utility which stores a commodity, gives a rather high charge to be distributed according to demand whereas we now realize, using the readiness-to-serve test, that comparatively small investment (on storage facilities) and overhead organization charges can be properly apportioned according to peak demand, and that it is sometimes perhaps a distortion to have as much difference in unit prices as $1.40 and $1.04 for the small and the large customer or the ones of long hour and short in this particular type of utility. In the Minneapolis case, where water power is involved, these segregations do not become of such import as fixed charges and capacity reserve naturally control anyway.

In another chapter are discussed "quantity rates for electricity" in which appear again the ideas noted above. Each customer is advocated charged with a unit price which apportions "time" costs according to his probable maximum demand (total kilowatt-hours divided by connected load), and places the operating expenses according to metered quantity, disregarding diversity factors, and off-peak customers who have been won only by keeping them free from fixed charges on investment.

A considerable part of this chapter is given up to a severe arraignment of the electricity-rate system in New York City (based on steps of 10 to 5c. per kw.-hr., etc., without minimum charges) which scheme the author contends bears too heavily on the small consumers and extorts generally some $2,000,000 over a fair profit of 8%. This criticism is made in spite of the acquiescence of the Public Service Commission and is cited as a charge of incompetence and political complexion against this body.

The next chapter is called "Methods of Appraisement" and consists almost entirely of a reprint of the Act of Congress, approved Mar. 1, 1913, providing for the appraisal of railroads, there being appended only the author's claim that American roads are overcapitalized by seven billion dollars out of 12½ billion—a view not generally shared by engineers. In the following four chapters valuation discussions are continued—by suggestions for organizing an inventory-unit price attack; by use of 12½ to 15% for overhead expenses; formulation of depreciation allowances; fixing real-estate values; comparative appraisals; market value, franchise value, development expense, going values, and other intangible elements.

The remainder of the volume may be considered miscellany, more or less connected to the preceding. Under "accounts" is a brief reference to reclassifying a concern's expense reports according to the author's "time" and "commodity" segregation. Under "law of demand for electricity" is a study of rates in Massachusetts cities which shows that sales per capita seemed to depend upon an empirical hyperbolic law [sales = (640 ÷ price) − 15]. The gas sales studied exhibit greater complexity and show no such simple relation. There is a brief review of the London "sliding scale" for gas companies, by which corporation dividends are increased with price reduction, and an outline of a similar dividing scale of the author's devising by which the decrease in rates equals the increased corporation return or other factors.

Compressed-Air Pumping

Reviewed by C. R. Weidner*

PUMPING BY COMPRESSED AIR—By Edmund M. Ivens, Jun. M. Am. Soc. M. E. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. vi + [illegible]; 1?6 text figures. $3.

Mr. Ivens' book on Pumping by Compressed Air is, so far as the reviewer knows, the first written in the English language, which deals exclusively with that subject. An excellent German work has appeared recently, however, and the subject has also been dealt with briefly in various works on Compressed Air.

The author has compiled, in convenient and condensed form, the essential information on compressed-air pumping which has been published in technical-society journals, engineering periodicals and manufacturers' catalogs; with this he has combined matter derived from his personal practice, including tests on operating plants.

The first chapter takes up very briefly the direct-acting plunger pump operated by compressed air. The second and third chapters describe various types of displacement pumps, in which the air displaces the liquid in one or more chambers, and is then either exhausted into the atmosphere or piped back to the compressor. The results of tests on both methods and a theoretical analysis of the return-air system are given. The reviewer would criticise the allotment of space given to the over-detailed description of one of these tests, since the installation described is one rarely met with in practice. Thirty-two out of a total of 2?2 pages of text are used for this purpose, which are quoted from a readily accessible source.

The major portion of the book, chapters 4 to 8, inclusive, is devoted to the history, theory, design, tests and descriptions of the air lift. Engineers will be especially interested in this part, as the air lift offers the most advantageous field for compressed-air pumping and little of definite value has been published in English, relating to the design of this system. Although a proper design is largely a matter of experiment, the fundamental principles are clearly stated, and formulas, diagrams and tables are given, which are extremely useful. As an illustration, a set of conditions is assumed and the design worked out in detail.

Although the material in the five remaining chapters can be found in books on thermodynamics, compressed air, and hydraulics, it is, however, convenient to have it presented here. Chapter 9 relates to compression generally; Chapter 10 to the air used and to air-compressor efficiency, and practical hints on the installation and operation of the compressor are given in Chapter 11. Numerous typographical errors, or errors due to insufficient proofreading, mar Chapters 12 and 13, dealing, respectively, with the flow of air and water in pipes. The formula given in the last chapter for loss of head due to expansion or contraction of section is clearly in error.

The demand for a book of this kind has been made evident to the reviewer by the large number of requests from water-supply engineers and superintendents, chemists and manufacturers, for a bulletin on the air lift, which was published several years ago by the University of Wisconsin; and, notwithstanding the minor defects pointed out, he feels assured that Mr. Ivens's book will meet their needs. For classes in hydraulic machinery and compressed-air practice, it should be of value for reference, both to the teacher and student.

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ACOUSTICS OF AUDITORIUMS—By F. R. Watson. Urbana, Ill.: Engineering Experiment Station, University of Illinois. Bulletin 73. Paper; 6x9 in.; pp. 32; illustrated. 25c.

It would be difficult to find a technical subject of direct interest to the engineering and architectural professions, on which such general ignorance exists, and which is at the same time so important, as the subject to which this pamphlet is devoted. Apparently, most engineers, and architects as well, appear to think that the acoustic properties of a public hall or other auditorium are purely a matter of luck. Knowledge of the investigations that have been made within the last 15 years to determine the laws which govern the acoustic properties of auditoriums, is not yet widely disseminated. This bulletin by Professor Watson summarizes the principal elements which determine the acoustic properties of an auditorium, and describes the various experiments and investigations which were made at the University of Illinois, especially in connection with the auditorium at the University, which was seriously defective in its acoustic properties.

It is a good illustration of the popular ignorance of acoustics, among those who should be best informed, that many of the buildings at our universities are notably bad in acoustic properties. Another illustration is the hall in the house of the American Society of Civil Engineers, in New York City, which is so bad acoustically that a large part of the proceedings of any general meeting there are lost to the audience.

One of the main elements in determining the acoustic properties of an auditorium is the extent to which its wall surfaces reflect sound. There is good reason to believe that the acoustics of the average church or auditorium are a good deal worse today than they were in the simpler structures in use twenty years or more ago, and that the reason for this is the general substitution, which has taken place during that time, of hard patent plasters as a wall covering in place of the more or less porous lime mortar formerly used. A bibliography of publications on the acoustics of auditoriums concludes the bulletin.

REPORT ON THE BUILDING AND ORNAMENTAL STONES OF CANADA—Vol. II. Maritime Provinces. By Wm. A. Parks. Ottawa: Mines Branch, Department of Mines. Paper; 7x10 in.; pp. [illegible]; illustrated.

Engineers, contractors and architects will find this a valuable reference book for building work in the Canadian Maritime Provinces. The fieldwork upon which the report is based included not only about 60 quarries, but many abandoned quarries and prospects. It is believed by the authors that every stone commercially available at the present time in that region has received due consideration. The descriptions of building stone include not only its physical and chemical characteristics, but the facilities and equipment of the various quarries for producing commercial blocks.

A STUDY OF RAPID TRANSIT IN SEVEN CITIES—Prepared under the Direction of Theodore K. Long, Member of the Chicago City Council. Bulletin No. 2, Municipal Reference Library, Chicago, Ill.: Chicago Public Library. Paper; 6x9 in.; pp. 15.

A compilation of available data and general information on the rapid-transit facilities in New York, Chicago, Philadelphia, Boston, London, Paris and Berlin, under the heads of historical development, mileage, cost of sub-

ways and elevated roads, types of elevated construction, pasesnger traffic, motive power, rates of fare, sanitary conditions and noise, general observations.

The Mechanics of Liquids

Reviewed by Winslow H. Herschel*

TEXT-BOOK OF MECHANICS—By Louis A. Martin, Jr., Professor of Mechanics, Stevens Institute of Technology. Vol. V., Hydraulics. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. xii + 223; 114 text figures. $1.50 net.

As the author points out, the science of hydraulics is based on "approximations, assumptions and the empirical results of experiments," and yet under such unfavorable circumstances he considers hydraulics as a branch of the pure science, mechanics, and remarks, "no attempt has been made to include in this text lists of the experimental constants of hydraulics." It is thus clear that the book is intended mainly to give mental training in the classroom. It is written in accordance with the plan of conquering a subject by successive attacks of increasing thoroughness, rather than by one prolonged assault. The former plan has the inherent disadvantage that the student, when he first takes up a subject in an elementary way, is in danger of acquiring wrong impressions, which can only be eradicated afterward with great difficulty. In the chapter on weirs, for example, several pages are devoted to Boussinesq's theory, and a few lines to the Francis formula, from which a student might easily infer that Boussinesq's formula is the more generally employed. Again, the outward-flow turbine is taken as the typical example, in spite of the fact that practically all modern turbines are of the inward-flow type. It is stated that the average value of the coefficient of discharge through a standard orifice is 0.60, and there is nothing to show the range of variation of this coefficient, or the comparative range of other coefficients, and yet it is just such points as this with which a practicing engineer must be acquainted. We must, therefore, regard the book, not as a handbook for hydraulic engineers, but as a text for colleges and technical schools on the mechanics of liquids, for which latter purpose it seems very well adapted.

ADDENDUM, BEING THE FIVE CHAPTERS ON MODERN ROAD CONSTRUCTION Reprinted from "Asphalts" 1914 Road Edition—By T. Hugh Boorman. New York: The William T. Comstock Co., 23 Warren St. Paper; 7x10 in., pp. 169-191; illustrated. 25c. if sold separately; incorporated in new edition of book, price of which is $2.

The review of the original edition of this book (Engineering News, Feb. 18, 1909) stated that the volume consisted chiefly of quotations from various papers and reports. The Addendum seems to be largely of the same character. It consists of a preface to a "second edition," in this country; two pages and a half on asphalt macadam roads; a considerable chapter on cold-laid asphalt roads, or reading on "Westrumite" roads, Westrumite being a patented asphalt emulsion; a chapter on bituminous road surfaces with directions for applying various asphalt treatments, and two pages and a half on the use of asphalt blocks on roads.

The Addendum does not appear to contain much new matter and gives every appearance of being hastily compiled. For instance, the American Road Builders' Association is variously referred to as the National Road Makers Convention and the American Road Makers Convention. This may seem a small point, but to one who has done library research work such confusion and lack of accuracy are inexcusable.

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FARM STRUCTURES—By K. J. T. Ekblaw, Associate in Agricultural Engineering, University of Illinois. New York: The Macmillan Co. Cloth; 5x8 in.; pp. viii + 347; 159 illustrations. $1.75, net.

Now that agricultural engineering has attained a place in our state colleges and universities and has a national association of its own, it is not surprising to see a book on "Farm Structures" written by an engineering professor. The preface states that the book is intended to meet the needs of not only the teacher and student, but also those of the progressive farmer. Rightly used, it promises to serve this purpose.

The plan of this book is simple and logical. After reviewing building materials, from wood and steel to paint, glass and nails, there are a few pages on the location of farm buildings, a longer chapter on building construction and a few pages on estimating. The various kinds of farm buildings are next considered, beginning with granaries and machine sheds, continuing through various minor structures and ending with barns and the farm residence. Separate chapters are devoted to ventilation, lighting, heating, water-supply and, finally, plumbing and sewage disposal.

The author wisely refrains from going far into either the esthetic or sanitary phases of farm structures. Under sewage disposal, however, he goes farther than is necessary in setting forth underlying principles. And that is not all. He characterizes the septic tank as "the most scientific, perfect and efficient system of sewage disposal yet devised"—and describes and figures a most primitive rectangular tank. It is only fair to add that he makes it clear that the septic tank is only a preliminary means of treatment.

NEW PUBLICATIONS

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale, and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

THE CALCULUS FOR ENGINEERS—By Ewart S. Andrews, author of "Theory and Design of Structures"; Lecturer in Theory and Design of Structures at Goldsmiths' College, New Cross, and H. Bryon Heywood. [The Broadway Series of Engineering Handbooks, Vol. XIII.] London: Scott, Greenwood & Son. New York: D. Van Nostrand Co. Cloth; 4x7 in.; pp. xi + 269; 102 illustrations. 4 shillings, net.

COAL GAS RESIDUALS—By Frederick H. Wagner, M. Am. Soc. M. E., author of "Blast-Furnace Gases." New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xi + 179; 44 illustrations. $2, net.

CONCRETE ROADS AND PAVEMENTS—By E. S. Hanson, Editor "The Cement Era"; author "Cement Pipe and Tile." Revised edition. Chicago: The Cement Era Publishing Co. Cloth; 5x8 in.; pp. 338; illustrated. $1.50.

CONCRETE-STEEL CONSTRUCTION—Part I., Buildings: A Treatise Upon the Elementary Principles of Design and Execution of Reinforced Concrete Work in Buildings—By Henry T. Eddy, Professor of Mathematics and Mechanics, College of Engineering, and Dean of the Graduate School, Emeritus, University of Minnesota, Minneapolis, and C. A. P. Turner, M. Am. Soc. C. E., Consulting Engineer, Vancouver, Winnipeg, Minneapolis, New York, Chicago, etc. Minneapolis: The Authors. Cloth; 6x9 in.; pp. xv. + 438; 99 illustrations. $6, net.

ELEMENTARY ELECTRICITY AND MAGNETISM: A Text-Book for [illegible] and Technical Schools—By W. S. Franklin and Barry MacNutt. New York: The Macmillan Co. London: Macmillan & Co., Ltd. Cloth; [illegible] in.; pp. [illegible]; [illegible] illustrations. $1.[illegible], net.

ENGINEERING WORKSHOP DRAWING: First Steps in Engineering Drawing—By Henry J. Spooner, M. Inst. Mech. E., A. M. Inst. C. E., Director and Professor of Mechanical and Civil Engineering, Polytechnic School of Engineering, Regent Street, London; author of "Machine Design, Construction and Drawing," "Machine Drawing and Design for Beginners," "Industrial Drawing and Geometry," "Motors and Motoring," etc., etc. New York and London: Longmans, Green & Co. Cardboard; [illegible] in.; pp. [illegible] + [illegible]; [illegible] text figures. [illegible], net.

FOREIGN TRADEMARKS AND THE EXPORT TRADE of the United States in Central and South America: A Subject of Topical Interest to American Manufacturers in View of the European War—By Lawrence Langner, Singer Building, New York City. Paper; [illegible] in.; pp. 7. Copies sent free upon request.

GAS, GASOLINE AND OIL-ENGINES—By Gardner D. Hiscox, author of "Mechanical Movements," "Compressed Air," etc. Revised, enlarged and brought up to date by Victor W. Page, author of "The Modern Gasoline Automobile," etc. 21st Edition. New York: The Norman W. Henley Publishing Co. Cloth; 5x10 in.; pp. 640; [illegible] illustrations. $2.[illegible], net.

MALLEABLE IRON SHOES FOR CONTINUOUS STAVE PIPE —The Malleable Iron Works, Marion, Ind. Cloth; [illegible] in.; pp. 1[illegible]; illustrated. Sent free on request.

The bulk of this little book is devoted to a "Report on Continuous Stave Pipe," by Robert E. Horton, and to various hydraulic and other tables of use to designers of pipe lines.

MATHEMATICS FOR AGRICULTURAL STUDENTS—By Henry C. Wolff, Assistant Professor of Mathematics, University of Wisconsin. (Modern Mathematical Texts.) New York and London: McGraw-Hill Book Co., Inc. Cloth; 5x8 in.; pp. ix + 309; 127 illustrations. $1.50, net.

MINERAL RESOURCES OF ALASKA: Report on Progress of Investigations in 1913—By Alfred H. Brooks and Others. Washington, D. C.: U. S. Geological Survey. Bulletin Survey. Bulletin 592. Paper; 6x9 in.; pp. 413; illustrated.

MUNICIPAL CHARTERS: A Discussion of the Essentials of a City Charter with Forms or Models for Adoption—By Nathan Matthews, Mayor of Boston, 1891-1895; Chairman, Boston Finance Commission, 1907-1909; Lecturer on Municipal Government in Harvard University. Cambridge: Harvard University Press. Cloth; 6x9 in.; pp. vii + 210. $2.

OUR MINERAL RESERVES: How to Make America Industrially Independent—By George Otis Smith. Washington, D. C.: United States Geological Survey. Bulletin 599. Paper; 6x9 in.; pp. 48.

POLYPHASE CURRENTS—By Alfred Still, Assoc. M. Inst. C. E., M. I. E. E., M. A. I. E. E., author of "Alternating Currents and the Theory of Transformers" and "Overhead Electric Power Transmission." Second edition, revised. New York: The Macmillan Co. London: Whittaker & Co. Cloth; 5x8 in.; pp. xi + 30[illegible]; 101 illustrations. $1.[illegible], net.

POWER, HEATING AND VENTILATION: A Treatise for Designing and Constructing Engineers, Architects and Students. (In Three Parts, Each Complete in Itself)—By Charles L. Hubbard, Consulting Engineer. Part I, Steam Power Plants. Second edition, fully revised and reset. Pp. ix + 399; 182 illustrations. Part II, Heating and Ventilating Plants. Second edition, rewritten and reset. Pp. ix + [illegible]; 107 illustrations. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in. $1.[illegible], each.

PRACTICAL HANDBOOK FOR BEET-SUGAR CHEMISTS: Rapid Methods of Technico-Chemical Analyses of the Products and By-Products and of Materials Used in the Manufacture of Beet Sugar—By Werner Moeller-Krause, Sugar Chemist, Easton, Penn. The Chemical Publishing Co. London: Williams & Norgate. Cloth; 6x9 in.; pp. viii + 1[illegible]; 19 illustrations. [illegible].

PRINCIPLES AND PRACTICE OF ELECTRICAL ENGINEERING—By Alexander Gray, Assistant Professor of Electrical Engineering, McGill University, Montreal, Can.; author of "Electrical Machine Design." New York and London: McGraw-Hill Book Co., Inc. Cloth; [illegible] in.; pp. xxi + [illegible]; [illegible] illustrations. $[illegible], net.

THE REGULATION OF RIVERS—By J. L. Van Ornum, M. Am. Soc. C. E., Professor of Civil Engineering, Washington University, and Consulting Civil Engineer. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; [illegible] illustrations. $[illegible], net.

THE [illegible] PRICE MAKER AND PROFIT DETERMINER [illegible] [illegible] New York City. [illegible] Vol. I, [illegible]; Vol. II, [illegible].

STATE CONTROL OVER WATER SUPPLY AND DRAINAGE [illegible] IN MARYLAND—By Robert B. Morse, Chief of [illegible] of Sanitary Engineering, Maryland State Department of Health, [illegible] Baltimore, Md. (Reprinted from American Journal of Public Health, Vol. [illegible].) Paper; [illegible].

STATISTICS FOR THE CLAY-WORKING INDUSTRIES IN THE UNITED STATES, [illegible]—By Jefferson Middleton. With notes of The [illegible] and Use of Flint Clay by [illegible]. (Mineral Resources of the United States, [illegible].) Washington, D. C.: U. S. Geological Survey. Paper; [illegible].

[illegible] CHARTS, with a Table of Theoretical Jet Velocities [illegible] with [illegible] M. Am. Soc. C. E., Assistant Professor of [illegible] Engineering, Cornell University. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5x10 in.; pp. iv + [illegible]; illustrated. $1, net.

STEEL CONSTRUCTION: A Text and Reference Book Covering the Design of Steel Framework for Buildings—By Henry Jackson Burt, M. Am. Soc. C. E., Structural Engineer for Holabird & Roche, Architects, Chicago. American Technical Society, Drexel Ave. & 58th St. Flexible leather; 4x7 in.; pp. 372; 236 illustrations. $[illegible].

STRENGTH OF MATERIALS—By H. E. Murdock, Irrigation Engineer, United States Department of Agriculture. Second edition, revised and enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. xv + [illegible]; 1[illegible] illustrations. $[illegible], net.

STRENGTH OF MATERIALS—By Arthur Morley, M. I. Mech. E. Third edition. New York and London: Longmans, Green & Co. Cloth; 6x9 in.; pp. ix + 49[illegible]; 2[illegible] illustrations. $2.[illegible], net.

STRUCTURAL ENGINEERS' HANDBOOK: Data for the Design and Construction of Steel Bridges and Buildings—By Milo S. Ketchum, M. Am. Soc. C. E., Dean of the College of Engineering and Professor of Civil Engineering, University of Colorado. New York and London: McGraw-Hill Book Co., Inc. Flexible leather; 6x9 in.; pp. xv + 896; 400 illustrations. $5, net, postpaid.

SURGE TANK PROBLEMS: An Investigation of Surge Tank Regulation, Determining by Graphical and Analytical Methods Proper Solutions of Problems Created by Long Pipe Lines—By Prof. Franz Prasil. Authorized Translation by E. R. Weinmann and D. R. Cooper. (Reprinted from "The Canadian Engineer," Vol. 27, 1914.) New York: E. R. Weinmann, 111 W. 80th St., New York City. Paper; 9x12 in.; pp. 2[illegible]; 17 text figures. 50c.

SURVEYING MANUAL: Designed for the Use of First-Year Students in Surveying and Especially for the Use of Non-Civil Engineering Students—By Howard Chapin Ives, Professor of Railroad Engineering, Worcester Polytechnic Institute. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Leather; 4x7 in.; pp. viii + 196; 56 text figures and numerous plates. $1.[illegible], net.

THEORY AND DESIGN OF STRUCTURES: A Text Book for the Use of Students, Draftsmen and Engineers Engaged in Constructional Work—By Ewart S. Andrews, Lecturer in Theory and Design of Structures at the Goldsmiths' College, New Cross. Third edition. New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. xii + 618; 289 illustrations. $3.50, net.

FURTHER PROBLEMS IN THE THEORY AND DESIGN OF STRUCTURES: An Advanced Text Book for the Use of Students, Draftsmen and Engineers Engaged in Constructional Work—By Ewart S. Andrews, Lecturer in Theory and Design of Structures at the Goldsmiths' College, New Cross. New York: D. Van Nostrand Co. Cloth; 6x9 in.; pp. viii + 236; 99 illustrations. $2.50, net.

The original British editions of these books, which now bear an American imprint, were reviewed in our issue of Oct. 16, 1913.

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UNITED STATES BUREAU OF MINES—Washington, D. C. Paper; 6x9 in.; illustrated.

United States Coals Available for Export Trade—By Van H. Manning. Bulletin 76. Pp. 1[illegible].

The Humidity of Mine Air, with Especial Reference to Coal Mines in Illinois—By R. Y. Williams. Bulletin 83. Pp. 69.

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Quarry Accidents in the United States During 1913—Compiled by Albert H. Fay. Technical Paper 9[illegible]. Pp. [illegible].

Hints on Coal Mine Ventilation—By J. J. Rutledge. Miners' Circular 16. Pp. [illegible].

The Prevention of Accidents from Explosives in Metal Mining—By Edwin Higgins. Miners' Circular 19. Pp. 16.

UNITED STATES BUREAU OF STANDARDS—Washington, D. C. Paper; 7x10 in.; illustrated.

Observations on Finishing Temperatures and Properties of Rails—By G. K. Burgess, Physicist; J. J. Crowe, Assistant Physicist; H. S. Rawdon, Assistant Physicist; and R. G. Waltenberg, Laboratory Assistant. Technologic Paper No. [illegible]. Pp. [illegible].

Units of Weight and Measure: Definitions and Tables of Equivalents. Circular No. 47. Pp. 6[illegible]. [illegible].

Measurements of Standards of Radiation in Absolute Value—By W. W. Coblentz, Associate Physicist. Scientific Paper No. [illegible]. Pp. 1[illegible].

WAGES AND HOURS OF LABOR IN THE IRON AND STEEL INDUSTRY IN THE UNITED STATES, [illegible] to [illegible]—Washington, D. C.: Bureau of Labor Statistics. Bulletin, Whole No. 151. Paper; 6x9 in.; pp. [illegible].

WATER SUPPLY PAPERS, U. S. GEOLOGICAL SURVEY—Washington, D. C. Paper; 6x9 in.

No. [illegible]: Surface Water Supply of the United States, 1912, Part XII: North Pacific Coast Drainage Basins. C. Lower Columbia River and Rogue, [illegible] and Siletz Rivers—By F. F. Henshaw and [illegible]. Pp. [illegible].

No. [illegible]: Stream-Gaging Stations and Publications Relating to Water Resources, [illegible], Part III: Ohio River Basin—Compiled by B. D. Wood. Pp. [illegible].

No. [illegible]: Quality of the Surface Waters of Oregon—By Walton Van Winkle. Pp. [illegible].

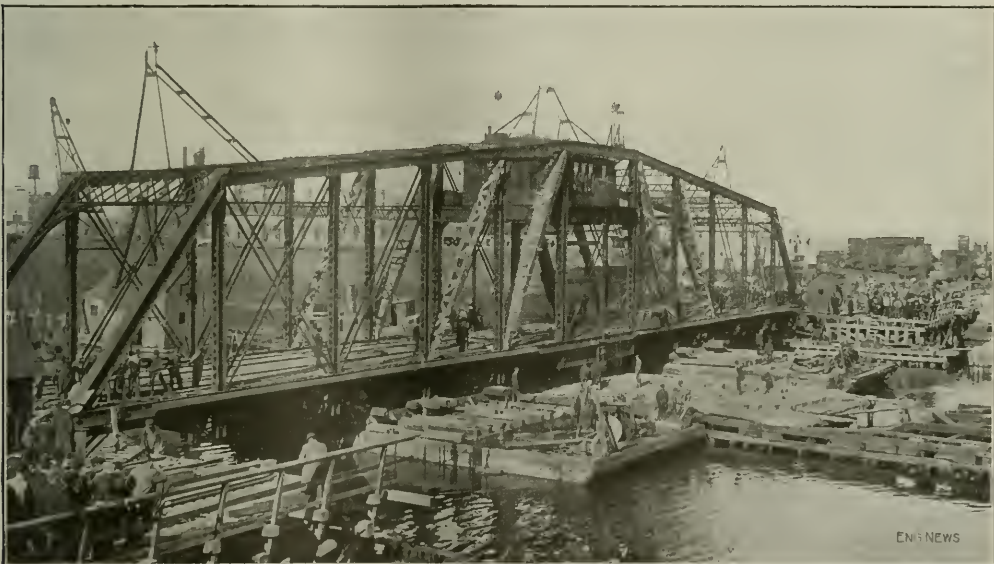
No. [illegible]: Water Analyses from the Laboratory of the United States Geological Survey—Tabulated by F. W. Clarke, Chief Chemist. Pp. [illegible].

Engineering News

VOLUME 72 | NOVEMBER 26, 1914 | NUMBER 22

Shifting the Milwaukee River Drawbridge; C. & N. W. Ry.

The shifting of the 500-ton, 242-ft. double-track swing bridge carrying the main line of the Chicago & Northwestern Ry. over the Milwaukee River, at Milwaukee, Wis., was accomplished successfully on Oct. 25. The bridge was lifted off the old center pier and abutments by means of barges or scows, moved downstream about 60 ft. and placed on a temporary pier about 1 ft. above the former elevation. The time consumed was four hours, and the bridge was out of service for trains for five hours.



SHIFTING THE MILWAUKEE RIVER DRAWBRIDGE OF THE CHICAGO & NORTHWESTERN RY. AT MILWAUKEE, WIS. (OCT. 25, 1914)

(The two scows are floating the bridge down to the temporary center pier at the right of the bridge. The crowds are standing on the new temporary approaches. A group of men with one of the hauling lines is just beyond the near end post. Note the diagonals of the panels next to the center, with timber blocking to form compression members.)

The old bridge is too light for modern wheel loads and train loads, and the foundation must be remodeled for the new bridge. The line has been diverted temporarily, therefore, to leave the site clear for reconstruction, and the bridge was shifted to this temporary location. The river is about 350 ft. wide between dock lines, and the bridge crosses on a skew of about 10°, giving two 85-ft. openings with about 20 ft. of water. It had pile approaches of about 100 ft. at the north and 30 ft. at the south end. The skew and the existence of the protection pier made it necessary to arrange the scows carefully to insure clearance when moving the bridge, particularly as they were placed normal to the bridge in order to avoid undue stresses in them.

Two scows were used; one of steel 100x35 ft., and 8 ft. deep; the other of wood 112x33 ft., and 9 ft. deep. Each had four transverse and four longitudinal trusses (the latter in addition to the heavy side frames), while the steel scow had also a longitudinal and transverse watertight bulkhead. While the 500-ton load could be carried safely as a distributed load upon either one of the scows employed, each having a carrying capacity of about 100 tons per foot of depth, such scows are not designed for such heavy concentrated loads in the middle as would be caused by lifting a bridge. Therefore, all displacements and stresses in both scows were calculated carefully. This showed the necessity of reinforcing the splices in the bottom chords of trusses in the wooden scow, which was done by placing long check planks on both sides of the chord timbers at splices and bolting them up well.

To secure greater height of blocking for better distribution of loads under these conditions, the blocking was placed against the stringers instead of the floor-beams; this afforded 2 ft. greater height.

As the turntable (with wheels, center casting, rack and tread) was bolted up to lift with the bridge, and as the

scows had to be placed at a considerable distance from the center, on account of the skew of the protection pier, a reversal of stress took place in two pair of diagonal braces on each side of the center. These diagonals were eyebars and there were no counters in the panels. It became necessary, therefore, to stiffen the eyebar diagonals to enable them to take compression. This was done by wedging timbers between them and placing other timbers on the outside, all bolted together and laced with 2x8-in. plank, as shown. This bracing will remain in place for the second lift when the bridge is removed finally, after the new bridge has been completed and put in service.

The bridge is so near the mouth of the river that during gales on the lake waves as high as 2 ft. are produced at this location. It was therefore essential to make the movement when lake conditions were good, as with barges or scows filled with water to make the lift, any sudden extra load, thrown unequally on the scows, due to the surge in the river, might have serious results. Owing to a storm, a surge about 18 in. high existed at the bridge site the evening of Oct. 24, but the wind died down during the night, and conditions were favorable Sunday morning (Oct. 25). The work was decided on at 6:15 a.m., and by 8 a.m. the floating equipment had been towed to the site.

Both scows had their pumps, lines, pulleys, jacks and wedges, also as much blocking in place as the clearance allowed, the remainder having been put up at the yard and taken down by the marine crews in the way of practice and preparation. Two 6-in. centrifugal pumps had been installed on each scow at the end hatches, the pumps being fitted with rubber suction pipes so as to be adjustable for pumping water out for raising the scows or for pumping water in to sink them. Large steam siphons were placed in the end hatches to blow out any remaining water that could not be removed with the pumps, which were to be stopped when there remained only about a foot of water in the scows.

The hatches of both scows had been fitted with coamings about 18 in. high, to provide against water running over the decks and into the hatches, due to possible listing. The steel compartments in the steel scow and the partial longitudinal bulkheads placed temporarily for this purpose in the wooden scow further contributed to safety against listing, by preventing large amounts of water running rapidly from one side to the other. All pumps and siphons were fed by lines of armored steam hose, running from tugs and other floating plant, such as derrick boats, pile-drivers, etc., capable of giving ample steam, and moored both above and below the bridge before it was thrown out of service.

At 8:30, filling of the scows was commenced, to sink them enough to give ample capacity for lifting the bridge, also for the 1½-ft. extra raise on the new foundations, and to take care of a drop of about 6 in. in the river level, due to change of wind. The scows were moored on opposite sides of the river, one upstream of the bridge and the other downstream. Pumping was discontinued after 30 to 40 min., when the scows were filled to about their sinking limit, giving 18 to 20 in. of freeboard and 6½- to 7½-ft. draft. At 10 a.m. navigation was closed and the bridge was partially opened to allow the scows to be warped halfway into place under the bridge, the length of centrifugal pumps and siphons prevented the passing of equipment under the bridge when closed.

With the scows finally lined up and well moored by numerous lines, and all clearances against projections, etc., carefully attended to, some further blocking could be placed, but no jacks or wedges could be fitted until the last train had passed in each direction. This was at 11:05 a.m., after which the bridge was turned over to the contractors for removal.

A partial strain was put on the scows by means of railway jacks against the bridge, and the placing of final blocking and wedges was completed. The wooden barge in the north channel was completely blocked and wedged at noon, this being the easier scow to block, as it was on a perfectly even keel, and also had a slightly more expert crew. The steel scow used in the south channel had a slight list toward the middle of the bridge when floated into position, due to the unequal weight of pumps, which were not placed on the center line of the scow, but at the diagonal corners, on account of the hatches. A listing effect is easily produced in a steel barge when well filled with water, making it a less stable craft. In this case, however, it was merely an inconvenience in the quiet conditions of river, requiring slower and more careful wedging against the bridge stringers.

The pumps were started at 12:30 p.m., and worked full speed for some time, taking up the bridge load before the turntable showed any lifting effect, although all anchorages had been removed and steel wedges were kept well driven up under the treads to aid in the release. When the treads finally released from the masonry, it was found, as expected, that the ends of bridge had lifted more than the middle, due to the reversal of stress, and largely, perhaps, to the play in the worn pins and pin holes. The pumps were stopped about 1:15 p.m., and siphons then blew out most of the remaining water. This was completed at 1:30 p.m., the bridge then being ready to move down the river. The turntable showed a lift of 27 in. from its original position, and the ends slightly more.

The wooden scow had 4 ft. of freeboard and an average of about 10 in. of water, which was hard to remove on account of the 12-in. bottom timbers partitioning the water off into pockets. The longitudinal trusses of the scow deflected about 3 in. at the middle. The steel scow had an average of about 44 in. freeboard and only [illegible] in. deflection. It had about 5 in. of water in the bottom, this being difficult to remove on account of the watertight compartments, although temporary bypasses had been made in the steel bulkheads to equalize filling and pumping. The actual displacements of the scows conformed very closely to the advance calculations. The intention was to remove all water as nearly as practicable from both scows, preparatory to any moving of the bridge, in order to minimize the danger of listing.

No tugs or other craft were allowed to pull on the scows in shifting the bridge, these movements being made entirely by the use of numerous hand lines, which accurately controlled the movements. A competent man had been put in charge of each scow, with several marine hands at each line to follow the various directions carefully. All this was necessary, as the shifting of the bridge was not a simple downstream movement in a straight line, on account of the skew of bridge and lack of clearance for inner corners of scows along the bridge protection.

On account of the way the scows had to be placed, to take their loads, considerable maneuvering was necessary.

The old south abutment and the first span of its approach were removed to allow the bridge to be shifted south about 6 ft., after a swinging movement at the southeast corner, to clear the protection pier. The third shift was made downstream in the direction of the axis of the protection pier, until the north end of the bridge reached the center line of the new location. A slight northward movement was then necessary, the south end being allowed to continue downstream and pivot about the center of the north end, which was held stationary until the entire bridge brought up on the center line. The two ends of the bridge were then drawn up against stop timbers which centered it for alignment; wedges at the north end centered it endwise. The bridge was then held in this position ready for lowering.

The above operations took only 15 min., and the engineers then verified the location of the center of the turntable, etc., so that within 30 min. the scows were ordered filled. Pumping was started at 2 p.m.; the scows were filled in about 30 min., and wedges taken out at 3 p.m., the bridge then being in proper position on its abutments. The scows were moved out at 3:30 p.m. Track work and adjustment of ends of bridge continued, so that it was possible to let the 4 p.m. passenger train over the bridge in its new location without delay.

During the reconstruction of the foundations, the new bridge will be erected on falsework in the middle of the river and upstream from the site. This falsework will form an extension of the protection pier, and the bridge will stand parallel with the stream. It is expected that the foundation work will be completed so that early in January the new bridge will be placed in position. It will be raised by barges, moved upstream to allow of turning it crosswise of the river, and then floated down over the falsework to the new pier. It will be at the same elevation as the old bridge, with rail level 8.72 ft. above the water level or U. S. Government datum, but it will be erected on falsework 1.5 ft. higher. When this is in service, the old bridge will be removed again on barges to a distance of about 1000 ft. and there dismantled.

The old 500-ton bridge was built in 1890 and is operated by a gas engine. The new 800-ton bridge will be operated by electric motors. The piers in both cases are of stone and concrete on pile foundations, the old pier being 32 ft. square and the new pier 34 ft. diameter (octagonal). The Cleary-White Construction Co. has the contract for the substructure; the American Bridge Co. will furnish the machinery and structural material, and the Bernhisel Construction Co. will erect the superstructure, while Geo. P. Nichols & Bro. will install the power equipment. The moving of the old bridge was done by the Great Lakes Dredge & Dock Co. All these are Chicago firms. All the work was under the direction of W. C. Armstrong, Engineer of Bridges, Chicago & Northwestern Ry.

Telephone Service Rules of the Wisconsin Railroad Commission

Standards of quality of gas and electric service have been in force in Wisconsin since 1908 (see ENGINEERING NEWS, Oct. 8, 1908), but only recently has it been practical to make definite requirements of the telephone utilities, although the subject has been carefully studied all these years. The following rules were adopted Aug. 13, 1914, and are thought to be the first standards formulated—outside of the operating companies themselves. The rules are intended to fit large and small exchanges. They are on trial, and in cases of their resulting in hardship or increased cost they will be modified.

Line Construction—Rule 1. Equipment and lines shall be so constructed and maintained as to eliminate all cross-talk and noise, which unreasonable interferes with the transmission of messages for ordinary distances.

Rule 2. The number of subscribers on any one line shall not be greater than that consistent with adequate service.

(Under ordinary circumstances, rural lines should be limited to 10 or 12 subscribers, but in special cases a larger number may be justified. Service of a higher class should be rendered to subscribers who demand it and who are willing to pay the additional cost thereof.)

Rule 3. Each utility, furnishing service alone or jointly with other utilities in two or more cities, villages or other exchange points, shall provide at least one line for through traffic between such points, along which few if any subscribers' instruments are installed.

Rule 4. Each utility shall maintain in proper condition the lines, instruments and other equipment used on its system, and shall make such tests and inspections as are necessary.

Central Office—Rule 5. Each exchange shall have sufficient switchboard capacity and a sufficient operating force to handle the traffic at all times with reasonable facility. Traffic studies shall be made and recorded of such extent and frequency as to demonstrate to the commission that sufficient equipment is in use and that an adequate operating force is employed.

(Where operation is not continuous, provision should be made for handling emergency calls during such hours as the exchange is closed for regular service. Traffic studies should include the number of calls made each hour, the hour of heaviest traffic, the variation of these conditions with the day of the week or month or with seasonal conditions, and the distribution of calls among operators.)

Rule 6. Reasonable provision shall be made against the failure of lighting or power service, fires and storms, sudden increases in traffic, the illness of operators, or other emergencies which would seriously impair the service if not promptly met.

Rule 7. At exchanges serving 500 or more subscribers, 94% of the calls should be answered within 10 sec. or less. At all other regular exchanges, 90% of the calls should be answered within 10 sec. or less. At small exchanges operated in connection with other work, slower service may be adequate. Calls shall be carefully supervised and parties disconnected promptly after conversations are completed.

Rule 8. Suitable rules and instructions shall be adopted covering the phraseology and methods to be employed by operators in handling regular and special calls.

(Patrons should be required to call by number wherever practicable. It is advisable for operators to repeat the number. Telephone courtesy is extremely important in stimulating the growth of the business, and in eliminating dissatisfaction and complaints. Employees must not "listen in" on lines except when it is an operating necessity. Care must be taken to avoid diverting business from a subscriber to his competitors, or discriminating between subscribers in the attention given their calls.)

Subscribers—Rule 9. Directories in which 1500 or more subscribers are listed shall be revised at least semi-annually. All other directories shall be revised at least once each year. All directories shall be dated.

Rule 10. Directories shall contain such instructions and rules governing local and toll service and methods of payment as may be necessary to inform subscribers of their rights and obligations.

Rule 11. Reasonable efforts shall be made to eliminate interruptions and irregularities, and to correct them promptly when they occur. Records shall be kept of all complaints or irregularities in the service, showing the day and time at which the trouble is reported, the nature of the trouble, its duration and final disposition.

(Preservation of the ordinary slips filled out when the trouble is reported and the notes of the trouble man or wire chief with reference thereto will be sufficient. Subscribers should be given instructions as to how and to whom they should report difficulties. Employees should be encouraged to report all complaints, irregularities and criticisms. The coöperation of the public in promoting good service should be encouraged in the matter of tree trimming, in refraining from monopolizing party lines and in other matters not wholly within the control of the utility.)

Rule 12. The name and address of the official or employee designated to handle service matters and a copy of each new directory shall be filed with the commission. Upon request, a complete map of each telephone system shall be filed with the commission, and a similar map shall be kept at the principal office of each utility and revised from time to time as changes in the system are made.

Toll Service—No specific rules are prescribed, but the following suggestions are offered. Toll service should be properly routed so as to be most efficient and to secure justice to the telephone companies where more than one utility is involved. In general, each utility should test all toll circuits early each morning and after storms in order that trouble may be promptly eliminated. On joint lines, or when one utility uses the lines of another utility, trouble on circuits should be promptly reported to the utility responsible for the maintenance of the line. Accurate and convenient devices should be installed in order that toll charges may be just and that the service may not be unnecessarily delayed on this account. Operators should cultivate not only a distinct articulation, but low tones and pleasing voice. A record of the condition of long-distance circuits entering each exchange should be kept for the convenience of the utilities in properly maintaining their lines, and for the Commission's information.

A Freight-Handling Equipment for Fertilizer, Central of Georgia Ry., Savannah, Ga.

By F. M. Rhett*

In this country in the past, the application of machinery to cheapen and expedite miscellaneous freight handling has not been as fully developed at seaports as at other points. This is not because our seaports, as links in the chain of transportation, are new, but simply because our attention has necessarily been occupied by other phases of the problem. The insistent demands of traffic are requiring a better solution. With present-day methods of transportation, a seaport must be regarded as primarily a joint terminal for railroad and steamship. We have been occupied heretofore more particularly with the development of the railroad part of the transportation problem, and it must be conceded that we have been conspicuously successful, since our open-road service and inland terminal handling are by far the cheapest in the world.

American engineers are now attacking the seaport terminal problem in a systematic manner. There has been quite a marked tendency to develop ports in self-contained terminal units; that is, each unit including all essential terminal elements, such as railway yards, docks, warehouses, etc., and each unit also being of sufficient size to give a good working whole. The terminal of the Central of Georgia Ry. at Savannah, is such a unit.

A study of this terminal was made about two years ago with respect to three classes of commodities: Fertilizer material imported from foreign countries; miscellaneous (or so-called package) freight, handled by coastwise steamers to and from Boston, New York, Philadelphia and Baltimore; and export cotton. As a result of the study a general plan of development was prepared and certain improvements instituted. Fig. 1, a general layout of the terminal, embodies these plans so far as work which has been completed or is in progress is concerned. The improvement with respect to package-freight handling is under way; berths 1, 2 and 3 are completed and the building of slip No. 2 and adjacent facilities is in progress.

The improvements in the cotton-handling facilities are still in the initial stages, though there has been an interesting development in the application of tractor trucks for handling cotton. The improvement as to imported fertilizer material is essentially completed and tested, except as to the final ship-unloading arrangements. This article is concerned only with this phase. Although not remarkable for size, the fertilizer plant is interesting as an exemplification of seaport conditions.

Characteristics of Fertilizer

The imported fertilizer materials received at Savannah come in two forms, in bulk and in bags. The bulk material consists mostly of various grades of kainit, a [illegible]. It weighs approximately 85 lb. per cu.ft., highly impregnated with various salts of potassium. It is mined only in the vicinity of Stassfurt, Germany, and is brought down the Elbe in barges and shipped from the port of Hamburg. It is highly hydroscopic, absorbing moisture from the air in a surprisingly copious and persistent manner; when in this condition it is an excellent conductor of electricity. When handled carefully in loading it comes from the ship fairly dry, but during handling it gives off considerable quantities of dust which is almost pure salt. This, of course, settles and absorbs moisture when atmospheric conditions are favorable. Special precaution must therefore be observed in the protection of any appliance which may be used in handling it. Another physical characteristic which makes it difficult to handle is its tendency to cement together and become quite hard when allowed to stand for short periods of time. It has frequently to be blasted in the holds of ships and in storage warehouses.

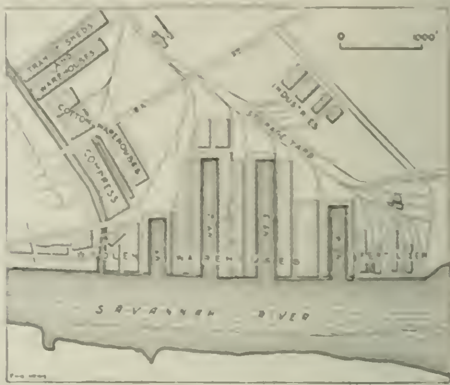


Fig. 1. General Layout of Terminal, Central of Georgia Ry. and Ocean Steamship Co. at Savannah, Ga.

The bagged material consists of various salts of potassium and kindred bases, imported from Europe, and nitrate of soda from Chile. This material is quite valuable, the nitrate, for instance, being worth about $57 per ton. The bags average in weight about 200 lb. From the very nature of the product these bags are usually badly weakened by rotting, which has proved to be a limitation in the speed of handling. The rate of acceleration incident to high hoisting speed causes failure of the bags; this limits the speed to approximately 175 ft. per min.

The material is valuable and of course must be protected from the weather. Although solid cargoes of bulk kainit are very often received, it most frequently comes in quite small lots of a few thousand tons only, which are separated in the ship and must be kept separate in the handling throughout, these lots being of different analysis or for different consignees. The usual loading consists of bulk material in the lower decks of each hatch and bags in the upper.

Ship Unloading

The contrivances for handling free flowing freight, such as coal and ore, have reached a high degree of perfection, particularly in the lake traffic. These narrow waters permit of the design of ships especially for cheap cargo handling. Seaships, on the contrary, must be designed primarily to meet rough ocean voyages. They are divided by transverse bulkheads and each ship's

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space thus formed is divided by horizontal decks. The hatches are small and comparatively few in number. This renders a large percentage of the cargo area not accessible vertically from above.

The hardening of the bulk kainite in the hold requires that it be broken down and the most satisfactory method of handling it consists in the use of buckets, having a capacity of 20 cu.ft., and mounted on rollers, so as to permit being pulled into the space not directly under the hatches. This requires the use of hand labor in the hold. The only possibility of expedition consists in increased speed of hoisting. Under very favorable conditions, grab buckets may be used. For discharging the bagged material the ships' winches are used, because special machinery such as is employed in unloading solid cargoes, of cement, coffee, etc., is not warranted on account of the relatively small receipts, sorting of lots, the bad-season load factor, and other limitations, such as hoisting speed.

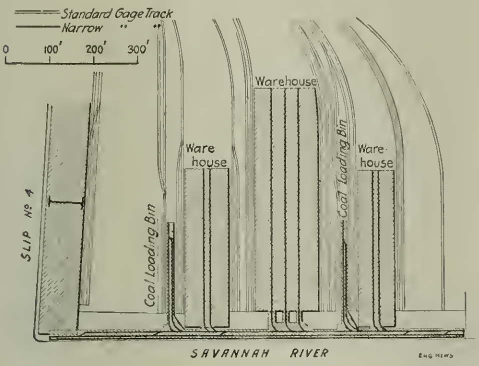


FIG. 2. DETAIL OF FERTILIZER HANDLING PLANT AT SAVANNAH

Delivery from Ship-Side

It has been pointed out that kainite is valuable, and consequently must be protected from the weather and carefully weighed. It must be handled in numerous separate consignments, since the material coming from every hatch may be different. With two ships discharging at the same time, there may be as many as six separate consignments which must be kept entirely distinct throughout all handling. This is a condition entirely different from that found in the usual bulk handling plant, such as for coal and ore.

Much the greater part is handled direct from ship-side to box-cars. The remainder must be held by the terminal company in temporary storage in warehouses.

For handling the bulk material from ship-side the most suitable plan was found to be the use of elevated electric railway with individually driven motor cars. The general scheme of operation is to convey the material to be loaded into box-cars direct from the ship-side hoppers to a system of bins for temporary storage, each bin having a capacity of 10 tons, or one carload. The material for storage is conveyed into the inclosed warehouses and there dumped from elevated trestles.

These motor cars are operated upon a 21-in. gage track system, with a 30-lb. rail, supported on 4x8-in. cross-ties, spaced 24 in. An interesting phase of the layout is the use of spring switches, thus making the switching automatic. Two tracks are provided upon the waterfront trestle and the circulation of motor cars is downstream on the outer track and up on the inner. Numerous cross-overs are provided so as to reduce the average length of the run and prevent interference, etc. The rear rail of the ship-unloading equipment is elevated so as to allow the motor cars to run under to the storage warehouses and the car-loading bins. The operation of this layout has been very satisfactory.

The motor cars are of the side-dumping type, having a load capacity of 5 tons and weighing empty 4 tons. The car body is supported through center pins on two so called maximum-traction trucks. These trucks have cast-steel side frames with rigid bolster; coil springs carry the weight to the axles; roller bearings are employed, principally for the reason that they do not require much attention. One of these cars is shown in Fig. 3. Each truck is equipped with a mine-type motor, geared to the axle; the wheel diameter is 20 in. and the gear ratio 4.77. The motors are connected in parallel, which gives a free running speed, loaded, on straight track of 10.4 miles per hour, corresponding to a tractive resistance of 21 lb. per ton and a power consumption of 68 watt-hours per ton-mile. The motor speed is 830 r.p.m. at the balancing speed of the car. Short-radius curves are, of course, used; namely, 20-, 25- and 50-ft. radius. Curve resistance is a variable quantity, depending upon speed, condition of track lubrication, etc. Measurements showed a tractive resistance of 60 lb. per ton on a curve of 25-ft. radius. A smaller radius than 20 ft. should not be used with cars of this type.

When dumping, particularly into the car-loading bins, or receiving from the ship-side hoppers, quantities of salt dust are thrown up. This penetrates the apparatus and then absorbs moisture. It is therefore absolutely necessary to use fully inclosed motors and to seal all outlets. The wiring too is very vulnerable—a good grade of rubber is satisfactory, but it is exceedingly difficult to prevent serious corrosion at the soldered joints—the use of lead cable is the best solution.

FIG. 3. MOTOR CAR USED IN HANDLING BULK KAINITE AT CENTRAL OF GEORGIA RY. TERMINAL, SAVANNAH

These cars are operated from a third-rail system. It was impossible to use trolleys on account of interfering with the overhead equipment. The third rail is a 20-lb. T-rail, supported every 10 ft. on special porcelain insulators, having large leakage distance. It was necessary

is use a low voltage on account of the formation of salt films on drain insulator resulting in severe shocks from partial grounds.

Car Loading

It was desirable to load box-cars mechanically, principally so as to attain speed and also so as to reduce the number of men required and thus simplify the control for this intermittent service in both respects. The railway tracks were necessarily at right angles to the waterfront and stub ended. The general plan of car loading is to deliver from the overhead trestle into bins spaced 45 ft. c. to c. The material is fed from these bins to portable box-car loading machines which deliver it into the ends of the cars. A partial view of a set of bins is shown in Fig. 4. In order to reduce railway switching, arrangements were necessary so as to permit shifting only once or twice per working shift. This is accomplished by providing motor-operated winches on car pullers. The empty cars are pulled in by means of these and the loaded ones pushed out.

The detail arrangements are as follows: The bins are designed to hold 40 tons of a kainite load. The bin is in the form of an inverted pyramid and was intended to fill and discharge through a [illegible] cut-off valve having an opening of 24x30 in. There were misgivings as to whether kainite could be handled in this manner owing to consolidation into a solid mass and the frequently to be blasted, both in ships and warehouses. It was found by experiment that this consolidation requires some hours and it seems to be due to the presence of moisture included in the salt. With the depth of the bin used, however, and the speed of loading of the bins, it was found that the [illegible] having an angle to horizontal of not less than 55°. On account of the limited height of the trestle, the maximum angle of chute which might be used to deliver from the discharge valve of the bin to the car-loading machine was 20°. At least 55° is required for free flow. It was therefore necessary to use mechanical feed. These chutes are built of sheet steel. They are given a reciprocating motion of 100 r.p.m. by means of a connecting rod and crank having throw adjustment of 0 to 6 in. The feeder is directly driven by back-gear type motor, which is started and stopped by a quick break oil-switch. The spring control and oil immersion of this switch permit frequent starting and stopping with little wear; the operation is very satisfactory. The rate of feed with this equipment is 3 tons per minute.

The feeder delivers the kainite to car loader as shown in Fig. 5. The essential part of the loader is a belt 22 in. wide, driven at a speed of 850 ft. per min. Nothing but

Fig. 4. Trestle over Bins for Box Car Loading of Bulk Kainite

belt was found to be able to stand the action of the [illegible] salt. The belt carriage is moved into the box-car by hand and can then be extended toward either end for a distance of approximately 10 ft.; it may also be elevated toward the roof of the car. The belt requires 10 hp. It is driven by a series wound motor, having a nominal rating of 15 hp. The [illegible] requirement was that the motor should be dust proof and extremely compact; on account of [illegible] it was necessary to use a series motor. The [illegible] depends entirely on the [illegible], the cycle of the operation being such as to require this motor, though of course it is [illegible] than necessary.

The whole machine is mounted on a four-wheel truck having 10-ft. gage and is driven on its tracks by a 10-hp. a.c. motor. This motor is used in switching empty cars and to assist in the spotting of cars opposite the bins. The belt speed is sufficient to load the car-

terial into the ends of the cars; it both conveys and projects.

The placing of box-cars is accomplished as follows: A terminal-yard crew place a string of empties on one of the two tracks leading to the box-car loading bins. Under the end of the bin trestle is placed a double-drum car-puller driven by a 75-hp. motor; the ends of a 1-in. wire cable lying parallel to the track directly in front of the bins are connected to these drums; it passes around 42-in. diameter end sheaves and slack take up is provided. This cable is driven at a speed of 120 ft. per min. It was necessary to provide a tractive effort of approximately 25,000 lb. since a string of 16 to 20 loaded cars had to be pushed out round a 12° curve. This cable is attached to a pusher or barney; a short flat-car loaded with scrap iron. The necessary number of empties, three or more, are pulled in at a time from the empty track and then pushed out on the loaded track.

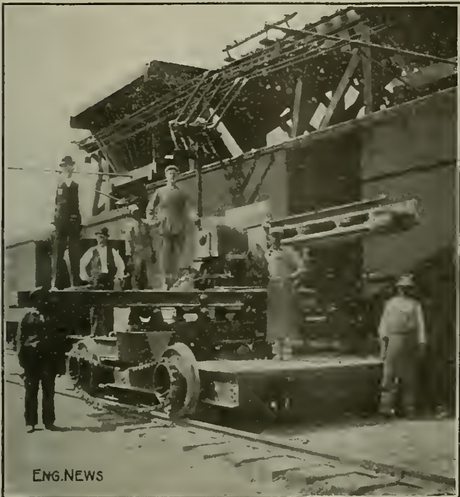


Fig. 5. Box-Car-Loading Machine at Savannah Terminal

Fig. 6. Storage-Battery Truck for Box-Car Loading

Handling Bag Material

As in the case of the bulk material, much the greater portion of the bagged must be delivered direct to the box-cars. With the stub-end arrangement of the railway tracks at right angles to the water front the haul from ship-side to cars is necessarily long. Quite a large part of this material has to be sorted for marks after being delivered from the ship, the consignments being more or less mixed in loading. In the case of solid cargoes, such as nitrate, which is very valuable, the weighing must be very carefully done and there must be considerable sampling. It is most desirable to make use of a mechanism which, at one handling, would take the material from ship-side and deliver it direct into the end of the box-car. Investigation showed the most promising machine to be the storage-battery truck.

The type of machine used is illustrated in Fig. 6. These machines are very flexible in operation; they will go practically anywhere a hand truck will go. The empty weight is 1900 lb. and the full-load capacity 4000 lb. The speed with full load and average battery voltage is 6.3 miles per hour and the free running speed light is 8.8 miles per hour. It is equipped with a 225-ampere-hour, 25-volt battery giving an output of 5.6 kw.-hr. It is really astonishing how effective this small amount of stored energy is in weight transportation. These machines will operate in regular service hauling average loads of 3000 lb. for 12 hours.

It is interesting to compare the performance of this type of vehicle with that of the narrow-gage motor cars above described. Fig. 7 shows the performance of a similar storage-battery truck having a light weight of 2600 lb. and a speed with full load of 7.5 miles per hour.

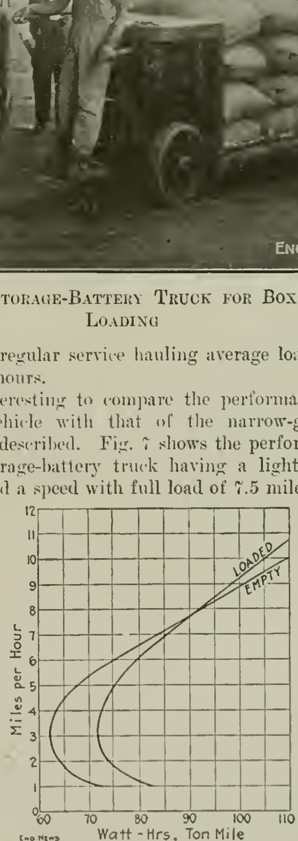


Fig. 7. Power Consumption, Loaded and Empty, of Motor Truck

(Used in freight handling on ordinary brick pavement.)

The tractive resistance of the truck is approximately 34 lb. per ton at 7.5 miles per hour and that of the motor car on 24-in. gage track 24 lb. per ton at 10.4 miles per hour; similarly the watt-hours per ton-mile of the motor cars are 68 and of the truck 88, measuring the input at motor terminals; considering the efficiency of the battery this figure becomes 117. The radically different

type of motor will also be noted, the [illegible]-type motor of the [illegible] being a [illegible]-speed machine, running at 850 r.p.m. at the full-load balancing car speed; the corresponding speed of the [illegible] motor is 2200 r.p.m.

Electrically driven machinery is used throughout the plant. Power is purchased from the local power company at 2200 volts, 60 cycles and is transformed to 440 volts for the hoists and other large motors, and is converted to 230 and 115-volt direct current for use of the railway and for charging storage-battery trucks, etc. The electrical apparatus used in the plant was furnished by the Westinghouse Electric & Manufacturing Co., other equipment by the C. W. Hunt Co.

The work thus far completed was carried out by the railway company under the direction of C. K. Lawrence as chief engineer, H. F. Sharpely being principal assistant engineer, E. M. Rhett being in charge of mechanical and electrical layout and design. The work now under way at Slip No. 2 is being handled by the Ocean Steamship Co., through J. G. Bastinger of New York.

Notes on Massachusetts Highway Work

SYNOPSIS—This article gives the results of interviews with engineers and a tour of inspection of the roads comprising the Boston district of the Massachusetts Highway Department. It gives a summary of the methods of survey and preliminary study, descriptions of the two most notable types of road surface developed in Massachusetts, [illegible] experience, and an outline of the highway department organization.

Surveys and Preliminary Studies

The first survey is made so thorough that it answers all purposes of both preliminary study and permanent location. This survey is made by a headquarters corps reporting directly to the chief engineer.

The survey line or base line is run as close to the center line of the highway as is consistent with all conditions. Stations are marked every 50 ft. with wedge-shaped wood stakes 20 in. long (square stakes used diagonally) on both sides of the traveled way. Stone monuments are afterward set on both sides of the location lines at all P. C. and P. T. stations and at intermediate distances on long tangents.

All property lines, topography, and other data to be used in design are referred to this survey line, which is shown on the preliminary plans by a full red line. The survey line is always run so as to form a closed traverse by returning over a different route, thus giving a check on both distance and direction.

PLOTTING—From this survey line the center line of the highway is offset and plotted in the office on the preliminary plans as a red dash line. Cross-sections are taken at the time of the original survey at every 50-ft. station for the whole width of the roadway. These cross-sections are plotted on a scale of 1 in. = 4 ft. on large sheets (24x36 in.) of cross-section paper in consecutive order, so that by a study of the completed plan and cross-sections, the center-line of the paved strip may be shifted to whatever part of the whole highway will give the best combination of grade, alignment, foundation, preservation of shade trees, etc. The profile of the center-line of the proposed improved road may then be worked out, and this is plotted on the same sheet with the plan (Fig. 1). It is always aimed to keep the new grade line as close as possible to the old one.

DIVISION ENGINEER'S REPORT—These plans, profiles, and cross-sections are then sent to the division engineer in whose division the improvement is projected. The division engineer studies the proposed changes in grade and alignment on the ground, and then makes a preliminary report to the chief engineer on a standard printed form. This report consists of six foolscap sheets, joined at the top, designed to be folded and filed, 8x8½ in. After noting the date of the receipt of the plans, and of the examination of the road, the division engineer fills in the following printed queries and explanations:

(1) Present road surface, character of.

(2) [illegible]

[illegible]

FIG. 1. SAMPLE ROAD IMPROVEMENT MAP AND PROFILE, MASSACHUSETTS STATE HIGHWAY COMMISSION

shall be adopted throughout the entire length of the road. When a change in section will result in a saving of stone by taking advantage of existing conditions, such a change should be recommended.)

(3) Location lines, discussion of.

(If changes can be made so as to avoid unnecessary land damages, division engineers are expected to recommend them.)

(4) Grade submitted, discussion of, with recommendations.

(5) Street railway tracks.

(Division engineers will state whether the present alignment and grade are satisfactory, and if not, what changes are necessary.)

(6) Borrow and gravel, material suitable for, location and quality of.

(Give sufficient data to permit approximate estimate of overhaul.

(7) Culverts, bridges and catchbasins.

(All structures with a span greater than 8 ft. will be classed as bridges. Division engineers will give such information as they can secure concerning drainage areas. When it appears to be necessary to obtain easements for the discharge of culverts on private land, mention should be made of the matter under this heading.)

(8) Bituminous treatment, discussion of.

(9) Foundations and drains, recommendations concerning.

(10) Guard rail, recommendations as to location of.

(11) Trees, value of, for shade.

(12) Ledge and other materials, not otherwise enumerated.

(13) Prices recommended for use in the preparation of the estimates and contracts. [Here follows a list of operations and materials with price per unit: Excavation, earth; excavation, borrow, not including overhaul; excavation, ledge; masonry; concrete, not including cement and steel; gravel; broken stone on cars; broken stone on roads; unloading stone; stone at crusher; breaking stone; teaming stone; spreading stone; watering stone; rolling stone; supervision; extra (3); total for broken stone; bituminous treatment, not including bitumen; various sizes of culvert pipe; guard rail; stone filling in place; cobblestone gutters; delivering and setting bounds; catchbasins, not including frames and grates.]

(14) Provisions for taking care of travel during construction.

(15) Remarks.

This scheme, as readily perceived, gives adequate information to the Commission and to the engineers in the main office, where specifications and contracts are drawn. Ample information regarding kind, character and method of improvement it is desirable to make is given so that final plans, profiles and specifications may be drawn that will properly fit the local conditions.

Changes in Alignment—If a new right-of-way is required, it is referred to the town in which it occurs to act, or to the abutting property owners. The state does not directly condemn land for highway purposes until after the town or property owners have made agreements relative to land damage, as the improvement of the highway is a matter of local option, and the town must not only petition for the improvement, but smooth the way over all legal difficulties before the State Highway Commission will begin an improvement.

Types of Roads

Massachusetts has no hard and fast standard of road types. It thus happens that the state is still building many miles of water-bound macadam or gravel roads, which are cheapest, with the intention and expectation of converting them into bituminous macadam or oil gravel, whenever and wherever the traffic or repair conditions warrant the additional expenditure. In other instances, a bituminous macadam, asphaltic concrete, cement concrete, brick, stone block, or any kind of surfacing, may be used on such stretches of road as experience or the judgment of the engineers shows an economic necessity.

The plain macadam sections have an ordinary depth of surfacing of 4 in. or 6 in., with a flat-sided crown of ¾ in. to 1 ft. on 15 ft. cross-sections and ½ in. to 1 ft. on 18-ft. cross-sections. The 6-in. depth cross-section has a flat base, making the section 4 in. thick at the sides, while the base of 4-in. cross-section follows the crown of the surface, making it uniformly 4 in. thick. If the road is designed to be ultimately surfaced with a bituminous material the crown is made ½ in. to 1 ft. instead of ¾ in.

The bituminous-macadam surfaces are divided into three classes: penetration, surface spraying, and layer methods. In the penetration method the lower course is bound with stone screenings or sand and the upper course is No. 2 stone with a bituminous binder. In the surface-spraying method, the surface coat is of screenings or sand and bituminous binder. For the penetration method there are ordinarily two applications of asphaltic oil, each of ⅝ gal. per sq.yd. There may also be a third application of ¼ gal. per sq.yd. for a surface finish. For the surface-treatment method there is one application of ½ gal. per sq.yd., or two applications of ¼ gal. per sq.yd. on the finished surface of the roadway.

Another form of bituminous macadam is constructed by the so called layer method, which consists of five courses, as follows: One 2½-in. (2 in. at sides) course of 2½-in. stone filled with sand and rolled dry; a second course of ¾-in. to 1¼-in. stone, practically one stone thick, watered and covered with bitumen (not rolled); a third course of the same stone, practically one stone thick, watered and covered with bitumen and lightly rolled; a fourth layer of ⅛-in. to ½-in. pea stone, watered and covered with bitumen (not rolled); a fifth course of clean, coarse, gravelly sand $\frac{1}{16}$ in. to ¾ in. in diameter. This course is thoroughly rolled. This construction requires a total of 1 gal. of bitumen per sq.yd., spread on under a pressure of not less than 70 lb. per sq.in. at a temperature of about 200° F. A similar form of construction in four layers, omitting the second course of 1¼-in. stone, requires ½ gal. of bitumen per sq.yd.

Special Types

The scheme of improvement has naturally led to individual study and experiment to utilize local materials to the best possible advantage, resulting in at least two types of road which are, or at least have been, peculiar to Massachusetts: (1) the sand and oil, mixed, or gravel and oil, mixed; (2) asphaltic concrete by the penetration method.

Gravel and Oil Mixed—The success of the sand and oil roads first constructed on Cape Cod in 1905 led to a continuation of this kind of construction. In 1910, the town of Concord laid down on the main street of Concord a pavement surface made of a mixture of gravel and hot asphaltic oil binder, the work being done under the direction of the Highway Commission's engineers, and this pavement is still in excellent condition (Figs. 2 and 3).

This type of construction is now being used on several roads where traffic does not warrant a bituminous macadam or a broken-stone asphaltic concrete, and where a good gravel is readily available and an untreated gravel would not stand. The bottom course is rolled gravel or broken field stones. The surfacing mixture is spread and rolled 2 in. thick, after the manner of sheet asphalt. After the rolling and surfacing are completed, a seal coat of asphaltic oil is distributed in two applications of ¼ gal. of oil per sq.yd. for each application. Each application of

Fig. 2. Main St., Concord, Mass., Paved with Oil-Mixed Gravel

Fig. 3. Pavement Surface

oil is covered with a thin layer of sand or screened gravel and rolled. Figs. 4 and 5 show the construction of such a road. The plant is simple and easily portable.

Asphaltic Concrete by Penetration Method—A method of spraying a layer of broken stone with hot liquid asphalt makes a pavement which looks like sheet asphalt. As this type costs less than $1 per sq.yd. for a 3-in. surface, it is the cheapest asphalt surface yet constructed. A stretch of road in the town of Weston constructed by this method is in excellent condition after two years' service under quite heavy traffic.

The asphalt used was Bermudez road asphalt, which is a true asphalt, not cutback or emulsified. It was not possible to make this type of pavement until the invention of a spraying apparatus which could handle and distribute the heavier asphalts.

Some points of the specifications for this type of road are of interest. The lower course consists of stone passing a 2½-in. ring but retained on a 1½-in. ring. The lower course is 4 in. deep when rolled. Upon this lower course is spread the upper course, consisting of stone of the same size as the lower course. This upper course is 2 to 3 in. thick after rolling, depending on traffic conditions.

Upon the upper course is uniformly distributed hot liquid asphalt at the rate of 1¾ gal. per sq.yd., and at once covered with a coating of clean pea stone, sufficient to fill the surface voids and permit a steam roller to pass over it without sticking to the asphalt. Brooms are used to spread this first coating of pea stone, and any surplus of stone is swept off the surface. A second application of asphalt is then made with a pressure distributor in such quantity as to completely coat the surface at the rate of not less than ½ gal. nor more than ½ gal. per sq.yd.

The second application must not be poured, but sprinkled or spread uniformly by means of a pressure distributor. After the second application of asphalt the surface is again covered with pea stone and again thoroughly rolled. The asphalt is applied at a temperature of approximately 300° F.

Maintenance Experience

The following notes in regard to maintenance were obtained from an interview and inspection trip with F. C. Pillsbury, who has been division engineer of the Boston district for 19 years.

For the many miles of water-bound macadam and gravel roads with which the state found itself at the be-

Fig. 4. Crushing and Screening Plant for Oil-Mixed Gravel Road

Fig. 5. Constructing First Course of Oil-Mixed Gravel Road

ginning of the automobile traffic period, the best preservative has been found to be an annual application of a light cutback asphaltic oil. Tar preparations have often given the best results, but with tar the road needs more frequent treatment and more constant attention. The light asphaltic-oiled roads invariably become muddy for a few weeks in the spring, but when promptly shaped, crowned, rolled and given a light application of new oil (about ⅓ gal. per sq.yd.), such roads remain in excellent condition for the remainder of the season.

Fig. 6. Type of Concrete Bridge Replacing Old Single-Span Truss

Roads treated with tar preparations are generally free from this mud nuisance, but on the other hand, the tar-treated road dries out quicker, cracks and disintegrates, i.e., loses its life and elasticity much sooner. Where roads could be constantly cared for and more frequently treated, tar is admitted the more satisfactory, but with a yearly or biennial treatment asphalt is preferred. Mixtures of tar and asphalt seem rather to have the bad qualities of both, so that true asphaltic oils are preferred.

These spring resurfacings and applications of oil are done as nearly simultaneously as possible throughout the whole state, both by the state's own forces and equipment and by contract with the different road-oil companies.

Besides this periodical maintenance work, a patrol system of repairing is in force. Barrels of oil are distributed at convenient places, and patrolmen are constantly making patches with a heavy asphaltic oil, which is covered with stone chips or gravel and sand.

Mr. Pillsbury recommended as probably one of the most reliable and useful tests for a bituminous road oil that for adhesiveness (described in Engineering News, Aug. 13. 1914, p. 343), by means of measuring the oil's power to prevent relative motion of two concentric cylinders. This has been found in many instances to be practically the sole test of the binding value of asphaltic oils and is considered by California chemists to be one of the most important tests.

As to maintenance and repair of pavement which is disturbed by subsurface construction, the state is amply protected by acquiring, when the road is taken over, absolute jurisdiction over all such subsurface structures. The division engineer has one assistant engineer whose sole duty it is to investigate petitions and issue permits for sewer, water-pipe, or other underground conduits, and to supervise repair work to insure that the pavement surface is fully restored.

By these methods the State of Massachusetts has maintained and kept in excellent condition many old road surfaces, representing a large original outlay, which under ordinary conditions would have rapidly disintegrated and have now been worse than useless. Such success have the Massachusetts highway engineers had in this work that they are by no means converted to the hard (brick or concrete) pavement theory. Indeed, it must be admitted that the roads in Massachusetts are hardly second to those of any state in the country, and this has been accomplished at a very modest cost, both for construction and maintenance.

Highway Organization

The Highway Department as a whole is divided into two grand divisions under the Chief Engineer, A. W. Dean. The Office Division, under A. M. Lovis, has charge of surveys and designs. The Field Division consists of four territorial divisions, each in charge of a Division Engineer.

Division 1 comprises the west and southwest section of the state, and is in charge of Division Engineer J. A. Johnston, with headquarters at Springfield. Division 2, consisting of the north central portion of the state, is in charge of Division Engineer C. H. Howes, with headquarters at Greenfield. Division 3 comprises the territory in the vicinity of Boston, on the west and north, in the eastern part of the state, and is in charge of Division Engineer F. C. Pillsbury, with headquarters at Boston. Division 4 takes in the southeasterly portion of the state, including Cape Cod and the Islands, and is in charge of Division Engineer W. R. Farrington, with headquarters at Middleboro, Mass.

Each Division Engineer has a Principal Assistant Engineer. Each contract is in charge of a Resident Engineer, who reports to the Division Engineer or his principal assistant. Minor repairs are made by a patrol system under the supervision of an assistant engineer. A slight variation exists in the different divisions in minor points in the organization, such variation being deemed advisable in order to best suit the conditions of the division.

New Dry Dock for San Francisco

Two dry docks are now maintained on the Pacific Coast for the vessels of the United States Navy, one at Mare Island, on a branch of San Francisco Bay, the other at Bremerton on the Puget Sound near Seattle. With the opening of the Panama Canal, naval operations on the Pacific assume a much more important aspect than heretofore. Neither of the above docks will be adequate for the superdreadnaughts that will frequently need overhauling on the Coast. For this reason a contract has been executed between the United States and the Union Iron Works Dry Dock Co., of San Francisco, whereby

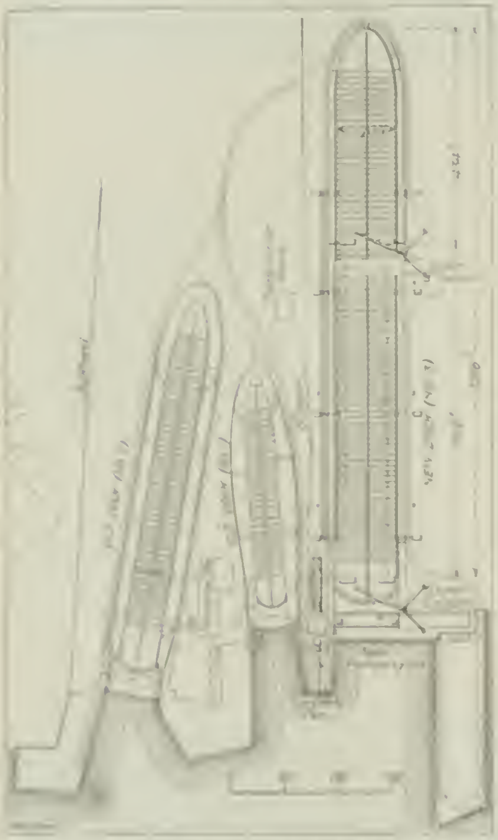


Fig. 1. Location of Two Old and One New Dry Docks at San Francisco

the latter corporation will construct a $3,000,000 dry dock in San Francisco Harbor, under the guarantee that the government will furnish at least [illegible] in business each year for ten successive years.

The new dock will be constructed at Hunter's Point, a promontory extending into the bay from the east shore of San Francisco, where two small dry docks have been in practice for a number of years. The foundation will be of solid rock, and the structure of reinforced concrete, specially designed to withstand severe earthquake shock.

Its length over all is 1006 ft., breadth between vertical walls 120 ft., breadth to top of altars 140 ft. 8 in. and depth from mean high water to top of sill 42 ft. 6 in. Its bow is elliptical and its sides parallel. They rise vertically from the floor to within 12 ft. of the top of the coping, where altars extending for almost the entire length on both sides increase the width from 120 ft. to 140 ft. 8 in.

From the center to the side drainage-gutters the concrete floor has a camber of 12 in. On it are the center keelson working platform and bilge blockways, both of wooden construction. Over the rudder pit, located near the outer end of the dock, the center keelson can be removed in sections.

The dock will be closed by an outer caisson and opened by floating and sliding this into a transverse recess in the side of the concrete structure. A similar recess and second caisson are located forward of the center, so that the dock may be used as a whole by sliding only the outer caisson into position, or the upper end alone may be used by closing the middle caisson, or both ends may be used independently at the same time by sliding closed both caissons. The outer caisson recess is drained through a tunnel 4 ft. 6 in. in diameter, which leads to the pump pit. While the caissons themselves are essentially of the sliding-box type, they can also be floated from one place to another and thus divide the structure in compartments of any desired length. They are designed so as to have ample stability without fixed ballast both when floating light or when partially flooded. This is accomplished by transverse partitions which divide the caissons themselves into three compartments, the middle one of which can be flooded or emptied without lowering the metacenter below the center of gravity.

Four inclined tunnels 10 ft. in diameter, two on each side of the dock leading to the forward and rear sections, and two open-curved stairways at the elliptical bow, provide ready access to the interior. The tunnels are closed by butterfly valves. To unwater the dock these are opened and the water allowed to drain to the pump pit, from which it is withdrawn by 54-in. vertical centrifugal pumps of the single-stage, volute type. Each pump has a capacity of 75,000 gal. per min., pumping against a head up to 42 ft. They are direct connected to 750-hp. motors, which operate at 240 r.p.m. Pump casings are of the volute form, of cast iron, in sections provided with vertical and horizontal joints, so that they may be easily removed through openings in the motor floor above. Impellers of the enclosed type will be of a bronze with a single-suction opening, and are designed to eliminate as far as possible objectionable end thrust. The bay bands are sufficiently large to permit the removal of the impellers for repairs.

Pump house and pit are to be located near the inboard end of the dry dock. The top of the pit will be [illegible] below high water or [illegible] below the top of the dock coping. Besides the four 54-in. pumps for unwatering the dock, the equipment comprises two 18-in. pumps for draining the tunnels, an 8-in. salt-water high-pressure pump, a priming pump and the operating gear for the gate valves and for the butterfly valves which close the tunnels leading to each section of the dock.

For flooding the dock a tunnel 12 ft. in diameter, controlled by a butterfly valve, leads from the bay to the pump pit. Thence the water flows into the dock through

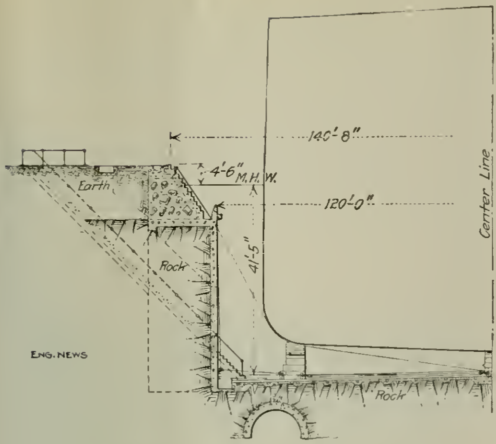


FIG. 2. HALF-SECTION THROUGH NEW SAN FRANCISCO DRY DOCK

the same tunnels by which the structure is unwatered. The operating gear which contains the flooding butterfly valve is housed separately from the main pumps in a small concrete building. The dock with tunnels has a capacity of 5,715,000 cu.ft. and with the four large pumps can be emptied in less than two hours and twenty minutes. It can be flooded in about thirty minutes.

On the port side of the dock will be a reinforced-concrete pier, with railroad tracks so arranged that cars may be landed from barges on the bay. A reinforced-concrete wharf on the starboard side approximately 450 ft. in length and 100 ft. in width at the outer end, will furnish ample wharfage facilities. Electric power will be used for the pumps and machinery as well as for the compressors that will operate pneumatic implements used in ship repair. A transformer house will therefore also be required. This will be of concrete and will be erected on the port side, opposite the inner caisson recess.

Below is a tabular description of the dock and caissons:

Length from outer meeting face to head of dock.	1096 ft.
Length from inner meeting face to head of dock	434 ft.
Length from outer meeting face to inner meeting face,	662 ft.
Width of caissons	22 ft.
Usable length of outer section of dock	640 ft.
Usable length of inner section of dock	434 ft.
Breadth between vertical walls	120 ft.
Breadth at top in way of altars	140 ft. 8 in.
Height of coping above high water	4 ft. 6 in.
Outer sill below high water	40 ft.
Depth from top of sill to top of coping	44 ft. 6 in.
Top of keelson below top of sill	1 ft. 5 in.
Height of keel blocks above top of keelson	4 ft.
Top of keel block above top of sill	2 ft. 7 in.
Top of keel block below high water,	37 ft. 5 in.
Flood camber	12 in.

	Inner caisson	Outer caisson
Length, molded	124 ft.	124 ft.
Breadth, molded	22 ft.	22 ft.
Extreme height at side	48 ft. 6 in.	46 ft. 6 in.
Light draft from third deck	8 ft. 6 in.	8 ft. 3 in.
Light displacement	620 tons	620 tons

Accessories included in the specifications are keel blocks, bilge blocks, air and salt-water piping, fresh-water

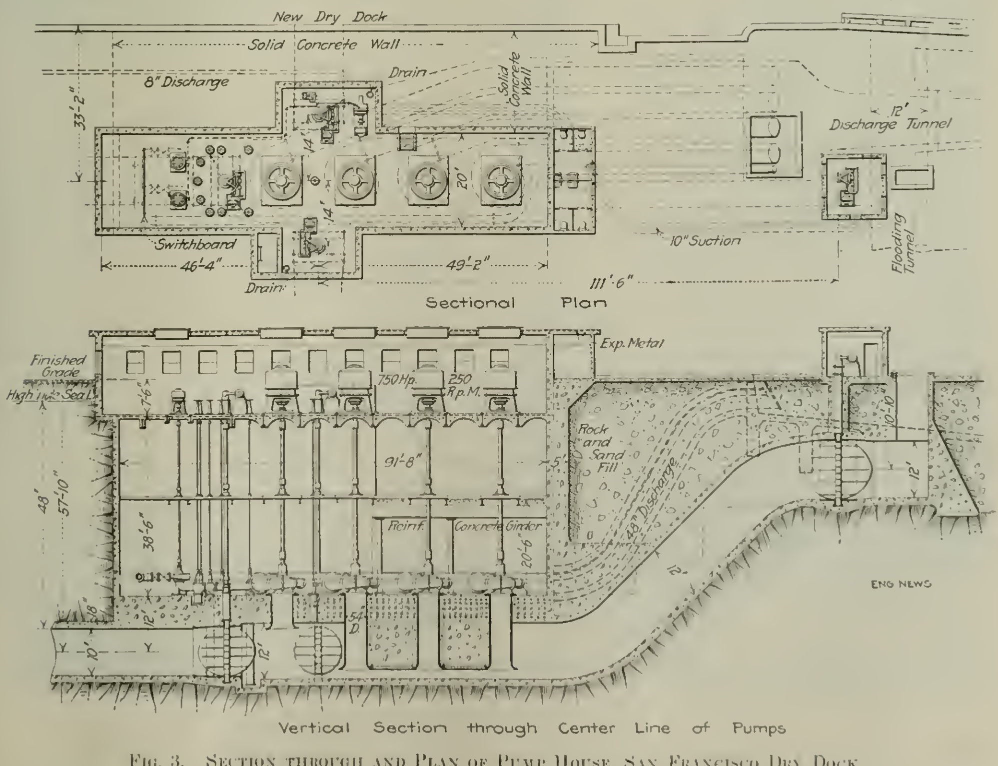


FIG. 3. SECTION THROUGH AND PLAN OF PUMP HOUSE, SAN FRANCISCO DRY DOCK

hydrants, electric windlasses, electric capstans, one 50-ton electric self-propelling traveling crane, cast-iron bitts, [illegible] piles, fenders, blocks, etc.

The dock was designed and specifications prepared by Hugo F. Frost, Assistant for the Union Iron Works Co. and Chief Engineer for the Union Iron Works Dry Dock Company.

The new San Francisco Dry Dock is among the five new dry docks which have a total length of 1000 ft. or over, all of which can dock any vessel now afloat. Two of these docks, the Gladstone at Liverpool and the Alexandra at Bombay, are completed and those at Boston and Levis are now under construction. The general dimensions of the five are as follows:

	Length ft.	Breadth ft.	Depth H.W. ft.
Boston, Mass.	[illegible]	[illegible]	[illegible]
Levis, Que.	[illegible]	[illegible]	[illegible]
San Francisco, Calif.	[illegible]	[illegible]	[illegible]
Gladstone, Liverpool	[illegible]	[illegible]	[illegible]
Bombay, India	1000	[illegible]	[illegible].3

Bulk-Cement Handling Plant, Northwest Station, Commonwealth Edison Co., Chicago

By Harold W. Robbins*

A large concreting plant handling cement in bulk is of particular interest in construction work, especially as considered in connection with the building of one of the greatest of modern power stations, the Northwest Station of the Commonwealth Edison Co., Chicago, which is planned to have ultimately a capacity of over one-third of a million horsepower. Northwest Station is projected to supply in an increasing degree the power and lighting requirements of the adjacent part of Chicago, and to supplement the power stations on the south branch of the river at Fisk St. and Quarry St., which have respectively 165,000 and 84,000 kw. capacity.

Prominent features in this construction work are: the increasing of the floor area to approximately 100,000 sq.ft. and the making provision for four new units, at least, of 30,000 kw. each, which, when they are installed, eventually will bring the total capacity of this part of the power station up to not less than 160,000 kw. Besides the 50,000 cu.yd. of excavation, there are involved 18,000 cu.yd. of concrete, 3500 tons of steelwork and 200,000 rivets. A maximum of about 400 men have been employed on the construction work, and these, with the additional men working for the subcontractors, would probably total about 700 men engaged in finishing the job in record time.

The arrangement by which the 20,000 bbl. of cement, which probably will be required for the concreting work in various sections of the station, are handled in bulk through the central concreting plant is very interesting. This type of construction equipment is not only one of the newer developments for work of this kind, but in addition to its comparatively greater capacity also permits the very efficient production of concrete.

In a general way, it is similar to the one made use of in building the foundations of the new Baldwin Locomotive Works, at East Chicago, Ind., in 1913, where over 10,000 cu.yd. of concrete were placed. The proportionately greater requirements at Northwest Station made advisable the erection of this larger concreting plant, whose general dimensions are approximately 50 ft. length, 38 ft. height over all and 15 ft. width. It comprises essentially elevated storage bins for cement, sand and crushed stone, a bucket elevator, a power scraper for unloading cement from bulk cement cars, a derrick for transferring sand and stone and a batch concrete mixer. The machinery is all electrically driven by connection with the 220-volt alternating current distributed for general use in the yards of the power station.

Description of Plant

The storage bins are large and designed to be ample for supplying material for an average day's requirements.

*[illegible] Portland Cement Co., [illegible]

Fig. 1. General View of Concrete-Mixing Plant

Cement brought in on cars in bulk, [illegible]; sand and stone brought in on [illegible]

The sand-storage bin has a volume of 1260 cu.ft. and the stone-storage bin 2300 cu.ft. The bulk-cement storage bin, located between the other two, and entirely inclosed against the weather, will hold a volume of nearly 1400 cu.ft., or 350 bbl. The unusually great weight of the

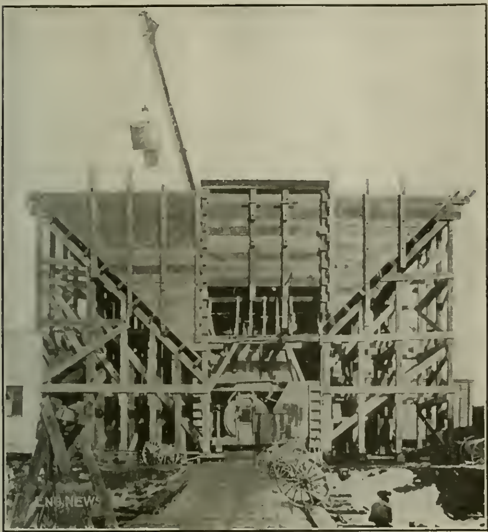


Fig. 2. Delivery Side of Concrete-Mixing Plant, Commonwealth Edison Northwest Station
(Concrete from mixer wheeled in buggies to job.)

material, supported at the elevation of 25 or 30 ft., necessitates heavy timbering for safety, and this is well taken care of by the use of 40 or more 10x10-in. supporting posts, adequately braced with diagonal timbers. As originally designed, the heavy stresses on the sides and bottoms of the storage bins were to be carried by similar 10x10-in. timbers, but it was found practicable to use steel tie-rods instead in connection with the 2x12-in. plank used for the sheathing of the bins, thus appreciably reducing the weight of the elevated sections.

In transferring bulk cement the methods usual in grain handling are employed. As the carloads of cement are received from the Buffington mills and spotted on the side track adjacent to the handling plant, the tapered chute shown in Fig. 3 is connected between the side opening of the box-car and the pit at the bottom of the elevator leg, a distance of 5 ft., and at an angle of about 45°. The chute is 9 ft. wide at the top and tapers down to about 4 ft. at the bottom. It is hinged at its lower end so that it may be swung up vertically out of the way when the cement cars are to be shifted on the side track. When resting against the side of the car, it comes just below the floor level and a canvas slip is fitted over the car edge to facilitate chuting the cement to the adjacent elevator leg.

Bulk cement is unloaded by means of a small steel scraper about 2 ft. wide, power operated, but guided inside of the car by one or two laborers. A 1-in. hemp rope leads from the scraper and around suitable blocks up to the windlass on the "shovel shaft," which is 10 ft. above the ground. Steel-spring shock absorbers connected to one of the blocks take the strain when the scraper is started with its load or in the event of its striking any irregularities on the car floor. The clutch engaging the windlass on the shovel shaft is operated by the men inside the cement car by means of a cord. The shovel shaft is gear driven from an adjacent countershaft.

The elevator (Fig. 1) is a standard type made by the Dodge Manufacturing Co., Mishawaka, Ind., and has a capacity for handling one carload of cement per hour. It is inclosed in a self-supporting steel casing, 38½ ft. in height over all, and is approximately 4x1¾ ft. in cross-section. Cement, on passing in through the grating to the bottom of the leg, is picked up by 6x6x12-in. steel buckets and discharged 35 ft. above, into the storage bin, which has a capacity of about 1½ cars. Drive is by belt from the 15-hp. motor to the countershaft, 12 ft. away. The latter is carried on wall brackets bolted to the upright timbers supporting the bins.

About 50 ft. to the north of the storage bins and with two side tracks intervening is a derrick with 80-ft. boom, by which the aggregates are transferred into the sand and stone bins, which are open to the sky. The hoisting apparatus used in raising the aggregates to the 30-ft. elevation includes an equipment of five power drums

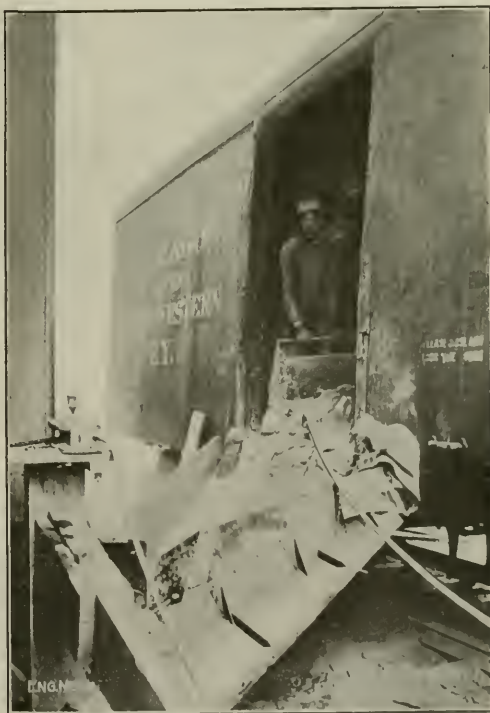


Fig. 3. Chuting Bulk Cement from Car to Elevator

operated by a 50-hp. motor. These drums control the movements of the Kieseler one-yard clamshell bucket in transferring the material from the gondolas to the storage bins or stockpiles on the ground and move the cars as they are unloaded.

In operation the bucket was observed to make a round trip from the gondola to the elevated storage bins in 40

seconds, which would permit the unloading of a 40-ton car (in [illegible]) in three-quarters of an hour. Ordinarily, eight cars per day are found to be handled readily. The crushed-stone stockpile usually has in reserve about 25 carloads and the sand stockpile contains about half of that number of loads.

Bulk cement is discharged from the storage bin through a vertical chute into the mixing hopper. In so doing it passes through a [illegible] measuring section with gates at the top and bottom. One of three [illegible]-in. holes in this section is used to gage the amount required for a given mix—that is, for the usual run or for finishing mortar. The measured cement is released through a hinged door at the bottom of the chute by the operator on the charging platform.

Sand and stone are admitted through oscillating gates to two open steel chutes sloping at an angle of 45° from the bottom of the storage bins into the 40-ft. capacity charging hopper. The opening in front of the charging hopper is covered by a canvas apron, while the cement, sand and stone are being admitted, and this is found to effectually prevent the escape of any dust.

Exit from the charging hopper is controlled by a gate operated also from the charging platform above it (Fig. 2). The water supply is arranged to be automatically sprayed into the batch as it is mixing, and to be admitted in larger quantity when the material passes from the hopper into the mixer. The $1\frac{1}{4}$-cu.yd. Marsh-Capron batch mixer is driven by a 20-hp. motor. In practice here it has been called upon to produce batches of 33 cu.ft. oftener than 40 times within an hour.

Concrete is wheeled to various parts of the work in standing buggies carrying as a rule 5 cu.ft. each. Six or seven loads are made of each batch turned out by the mixer. At times there have been the full list of 18 or 20 buggies in operation, but the production of concrete is varied steadily as there is opportunity to place it in various parts of the building.

PERSONNEL[illegible]

Besides the wheelers and [illegible] men, those actively engaged in the concreting plant are:

On charging platform:	[illegible]
[illegible]	[illegible]
[illegible]	(skill [illegible])
Trimming sand and stone [illegible]	
[illegible]	
[illegible]	

These are exclusive of the inspector employed to check the proportions of the mix and to insure uniformity.

In handling cement in bulk no labor is required on the charging platform to supply or remove sacks. In unloading a car but one or two men are needed [illegible] 250 or more barrels, using the power apparatus. In the matter of economy there is then the saving of the labor of one man in emptying sacks and of another in [illegible] handling and taking them away, while the unloading crew the [illegible] requires no extra men.

The maximum concrete placed in an eleven-hr. day has been slightly over 250 cu.yd. and the average that has been required in a 7-hour run has been 150 to 200 yd. The output is limited by the ability to use the concrete at the various points required and is a fraction of the full output of which the concreting plant is capable. In constructing the plant it was figured for a maximum daily of [illegible] batch a minute from a one-yard mixer. There is [illegible] evidence that it should be easily possible to turn out 60 batches, $1\frac{1}{4}$ yd. each, in an hour with this equipment, which would mean a possible total of over 500 cu.yd. in a day's run. The capacity of the storage bins is enough for 100 batches at least without renewal and the maximum rate of output would be easily obtainable by reason of the adequate facilities for unloading bulk cement and for obtaining sand and stone from the adjacent stockpiles or from supply cars on the siding.

The architectural design of the Northwest Station for the Commonwealth Edison Co. is by Holabird & Roche, Chicago. The steam-engineering work was laid out by Sargent & Lundy, Chicago, and the electrical work by the staff of the Commonwealth Edison Co. The Thompson-Starrett Co., of Chicago, with Fred D. Lyon in active superintendence, is in charge of the building construction and the central concreting plant was designed following the ideas of W. L. Chandler, of the Dodge Manufacturing Co., Mishawaka, Ind. The cement is shipped in carload lots from the mills of the Universal Portland Cement Co., at Buffington, Ind., a distance of 20 miles.

New Formulas for the Flow of Fluids in Pipes

By A. H. ANDERSON*

There is great uncertainty regarding the formula for the flow of fluids in pipes. The following gives a discussion of the subject.

Darcy, in 1857, found that Chezy's formula

$$f \times \frac{v^2}{2g} = \frac{d}{4} \times \frac{h}{l}$$

could be used only with a coefficient f varying with the diameter of the pipe. Engineers dealing with water have used Darcy's results, while gas manufacturers have always used Dr. Pole's formula, which is

$$Q = 1350 \sqrt{\frac{HD^5}{sL}}$$

being a solution of Chezy's formula for the given units with a value of $f =$ [illegible].

Unwin, in 1904, proposed that the value of the Chezy coefficient should be

$$f = a\left(1 + \frac{b}{d}\right)$$

where $a =$ [illegible], $b =$ [illegible], $d =$ diameter of the pipe in feet. It will be noticed that the coefficient decreases as the diameter increases.

In a paper entitled "Flow of Gas Formulas," read before the Illinois Gas Association in 1902, J. M. Spitzglass, of Chicago, has shown by extensive tests that the coefficient of friction has a minimum value for a 12-in. pipe. For smaller pipes, the coefficient increases rapidly; for larger pipes than 12 in., the coefficient also increases, but not so rapidly. This was explained by the fact that loss of head is not entirely due to skin friction between the fluid and the wall of the pipe, but also due to the relative motions in the mass of the fluid, or to the internal friction of the fluid. This was also demonstrated by Prof. Osborne Reynolds (Philosophical Transactions, 1883).

Considering skin friction alone, the head lost will diminish as the diameter increases. Considering the in-

*Assistant Professor, Mechanical Engineering, Armour Institute of Technology, Chicago, Ill.

ternal friction, the head lost increases with the cross-sectional area of the pipe. The internal friction affects the coefficient to a smaller extent than does the skin friction, but the internal friction being in proportion with the square of the diameter, the resultant coefficient reaches a point where, instead of diminishing, it slowly increases with an increase of diameter. This is borne out by the tests of Mr. Spitzglass.

The tests were made on 1-, 1½-, 2-, 3-, 24- and 36-in. pipes for low-pressure gas, and on 10-, 16- and 24-in. pipes for high-pressure gas. These experiments related only to illuminating gas and have been accepted in the gas field as authoritative. However, it is quite certain that the coefficient of friction will vary as stated, no matter what fluid is considered. This is corroborated by the fact that the fundamental hydraulic formula applies to any fluid and the coefficient of friction is taken the same for gas, water, air or steam. Therefore the writer feels justified in assuming that the coefficient of friction, depending upon the diameter, will vary the same way for all other fluids as it does for gas. From the data of the tests a new expression for the coefficient of friction was derived, as follows:

$$f = a\left(1 + \frac{b}{d} + cd\right)$$

where $a = 0.00315$; $b = 3.6$; $c = 0.03$; d = diameter of the pipe in inches.

The following table shows the deviation of Pole's and Unwin's formulas from the Spitzglass formula:

DISCHARGE IN PER CENT. OF SPITZGLASS' FORMULA

Diam. of pipe, in.	By Pole's formula	By Unwin's formula
1	150	111
1¼	135	109
1½	128	107
2	118	108
2½	112.5	104
3	108	102.5
3½	103	102
4	100	101.5
5	97	100.5
6	94.5	100.5
8	92	100.5
10	91	101
12	91	102
14	91.5	104
16	92.5	105.5
20	94.5	108
24	97.5	112
30	100.5	117.5
36	104.5	122.5
42	108.5	127.5

Formulas for Various Cases*

The expression for the quantity of discharge (derived from Chezy's formula) for any fluid has the form

$$q = 3.15\sqrt{\frac{1}{f}}\sqrt{\frac{p}{y}\cdot\frac{D^5}{l}}$$

where

q = discharge, cu.ft. per sec.;
p = friction drop, lb. per sq.ft.;
y = weight of fluid, lb. per cu.ft.;
D = diameter of pipe ft.;
l = length of pipe, ft.;
f = coefficient of friction.

Low-Pressure Air or Gas—Substitute the value of f as determined from Spitzglass' tests, and the formula becomes, for low-pressure air or gas,

$$Q = 3335\sqrt{\frac{Hd^5}{wl\left(1 + \frac{3.6}{d} + 0.03\,d\right)}}$$

where

Q = discharge, cu.ft. per hr.;
H = friction drop, in. of water;
w = density of the fluid referred to air as unity;
d = diameter of pipe, in.;
l = length of the pipe, ft.

High-Pressure Air or Gas—The equation becomes

$$Q = 64.3\sqrt{\frac{pAd^5}{wl\left(1 + \frac{3.6}{d} + 0.03\,d\right)}}$$

where

Q = discharge, cu.ft., free air or gas per min.;
p = friction drop, lb. per sq.in.;
A = average pressure in pipe line, lb. per sq.in. absolute;
d = diameter of pipe, in.;
l = length of pipe, ft.;
w = density of the fluid referred to air as unity.

Steam—For the flow of steam the equation becomes

$$W = 80\sqrt{\frac{pyd^5}{l\left(1 + \frac{3.6}{d} + 0.03\,d\right)}}$$

where

W = discharge, lb. per min.;
p = friction drop, lb. per sq.in.;
y = density of steam at mean pressure;
d = diameter of pipe, in.;
l = length of pipe, ft.

Water—For the flow of water the equation becomes

$$G = 50\sqrt{\frac{H'd^5}{l\left(1 + \frac{3.6}{d} + 0.03\,d\right)}}$$

where

G = discharge, gal. per min.;
H' = friction drop, ft. of water;
d = diameter of pipe, in.;
l = length of pipe, ft.

The writer has developed a slide-rule giving the solution of all these formulas.

*Mr. Spitzglass has developed a slide-rule giving the solution of all the formulas cited below

Track Elevation at Milwaukee, Wis., is being extended north from the Kinnickinnic River to the Milwaukee River under an order of the Wisconsin Railway Commission. The work of the Chicago & Northwestern Ry. includes 1.04 miles of the Wisconsin Division, and 0.77-mile of the Madison Division from Kinnickinnic Ave. north to the junction with the Wisconsin Division. This includes 3.6 miles of main tracks and 1.4 of side tracks, while yard tracks make the total 14.80 miles of single track. There will be three subways at Greenfield, Washington and National Ave. Two railway grade crossings will be maintained at the new elevation, and three interlocking plants installed. The station at Allis has been raised, the new basement being used as a temporary station until the tracks are raised. The underground and foundation work is finished, sand filling is in progress, and concrete deck slabs for the subways have been made and stored ready for erection in the spring. The total estimated cost is $1,225,-000, and the work is about 30% completed.

The work on the Chicago, Milwaukee & St. Paul Ry. extends from Kinnickinnic Ave. north to Fowler St. and from Clinton St. west to First Ave. The distance is about 1.4 miles, with 14 grade crossings eliminated, and a new station at Allis (National Ave.) will be required. This work will bring the track elevation into the center of the commercial district and within a few blocks of the union station. The piling is being driven, the underground work and foundations built, and the retaining walls built. The work is about 20% completed.

New York Rapid Transit Railway Extensions*

By F. Lavis†

VII--Methods of Timbering to Support the Street Surface on New York Subway Construction

The specifications for the construction of the subways in Manhattan and in most of the streets in Brooklyn require that the work be "carried on under covered roadways." This practically means that the paved surface of the street and generally one of the sidewalks has to be taken up and replaced by a timber deck, under which the excavation and construction may proceed with little or no interruption of the ordinary street traffic. Openings for shafts to give access to the excavations are permitted at intervals of 300 to 500 ft. in the upper part of the city, but are about 1000 ft. apart in the lower section.

Fig. 54. Typical Timber Decking over Subway Excavation, Showing Stringers Supporting Street Planking

In nearly all the streets in Manhattan where the subways are being or are to be built, there is a double-track street railway with underground contact system which has to be supported. In Brooklyn, the Bronx and Queens, the overhead trolley is used, which makes the problem of track support somewhat easier, though of course the poles have to be taken care of.

The usual method of procedure is first to excavate about 3 ft. of the street surface on one side of the tracks, putting in the decking and track supports in the form shown in the accompanying views. When one side of the street is decked over, the other side is taken care of in the same way.

Excavation is then carried on under this decking, the first lift being from 10 to 15 ft. in depth, practically the depth of the ordinary cellars and basements, the walls of which usually form the sides of the excavation. In very wide streets the full width is, of course, not taken out, but where the additional width beyond the building lines is not excessive, the whole width is excavated in this first lift, as this permits easy access to the buildings for the underpinning operations. Where the full width to the cellar or vault walls at the sides is taken out, no sheeting is required on this first lift, but if this is not done sheeting must necessarily be driven from the surface.

Below this first lift, the ordinary form of timbering, using rangers and braces (see Fig. 55), may be continued in much the same manner as for the excavation of any trench, though, of course, on a larger scale, or one of the many special forms hereinafter described and illustrated may be used. There are two general types, one for earth and one for rock, the former well illustrated on the left and the latter on the right in Fig. 55 and in Fig. 58 and the accompanying drawings.

The essential differences are the necessity in earth excavation of supporting the side sheeting as well as the decking and in rock the provision of a clear working space and to guard against damage by the blasting or destruction of one or more supports by the blasting oper-

*[illegible]

†[illegible] New York City.

Fig. 55. Timbering in Earth Excavation at Left and Rock Excavation at Right on Lexington Ave.

FIG. 36. STEEL GIRDERS ON STREET SURFACE CARRYING TIMBERING AND DECKING, LEXINGTON AVE., SECTION 11, ROUTE 5

ations or by slides in the very unstable New York rock.

One of the most interesting of the methods used for support in a deep rock excavation is that developed on Section 13, Lexington Ave., by Messrs. McMullen, Snare & Triest and illustrated quite clearly in the photograph, Fig. 38, and the sketch, Fig. 39.

On this section the concrete troughs which support the street-railway tracks are first supported longitudinally by the three or more 6x12-in. timbers laid flat (more than three when there are ducts to be taken care of). These, as the drawing, Fig. 39, shows, are held up by 12x12-in. cross-beams 18 ft. long, which are blocked up from the "needle beams" *F*, which are 12-in. 31½-lb. I-beams 30 ft. long spaced 10 ft. apart. It may be noted that it was not usually possible to put these needle beams directly under the blocking of the troughs of the street-railway tracks, on account of the presence of various gas and water pipes, etc., at about that level, a condition which obtains quite generally.

These needle beams have two pairs of 6x12-in. yellow-pine blocks about 5 ft. long bolted to them, one on each side and spaced so that they will come directly under the tracks, as shown on the sketch. These wooden blocks have their corners cut away so that they fit tight against the web and under the flanges of the I-beams, making at these blocks solid points of support for the longitudinal I-beam stringers underneath or for any temporary blocking or posts which may be required, and tending to prevent any overturning of the needle beam. Long X-braces and turnbuckles are also used between the needles.

At the end of the needle beam, holes are drilled so that 6x12-in. struts to the sides can be bolted to it, the 6x12's being fitted tight to the I-beam the same as the needle blocking.

The needle beams are then supported on the timber towers shown in the photograph, Fig. 38, by two pairs of 20-in. 65-lb. I-beams (*A* in Fig. 39), which are bolted together by long plates to develop full strength at the joints, making them equivalent to a continuous beam the whole length of the work. On either side of these two pairs of what might be called permanent longitudinal supports, are two pairs of the same size I-beams, bolted together the same way, the outer ones *C* 80 ft. long, and the inner ones *B* 120 ft. long, these latter being used as supports from the last timber tower over the face of the excavation to give a clear span of 50 to 60 ft. over the working space.

The inside 120-ft. pair is supported on the tower and on blocking just back of the working face, but also projects back of the tower and beyond the blocking, and these overhanging portions are wedged down tight from the decking, making it act as a cantilever (see sketch, Fig. 39). The 80-ft. pair spans from the tower to blocking ahead of the working face.

The towers are spaced 40 ft. c. to c., and as the excavation progresses, and space is cleared for a new tower, these pairs of I-beams are moved ahead for another space.

FIG. 37. STREET DECKING AND TIMBERING CARRIED ON HOLLOW STEEL PILES UNDER CHURCH ST., SECTION 1, ROUTE 5

In the timbering to support the street decking and the electric-car tracks the plan adopted on Section 9, giving continuous support to the street-car tracks by means of I-beams spliced so as to develop full strength, is worthy of note. As shown in Fig. 40, there are three pairs of these beams directly under the decking. The cross-timber on which the tracks are supported is suspended from the I-beams. The side struts or diagonals also give additional arching support so that the danger due to the displacement of any of the posts in the excavation is reduced to a minimum. Fig. 40 shows an effective method of obtaining clear support over the rock excavation for the construction of the lower-level tracks.

FIG. 38. TOWER SYSTEM OF TIMBERING IN ROCK EXCAVATION, LEXINGTON AVE., SECTION 1[illegible]

On Sections 10 and 11, after some trouble with slipping and sliding rock, an additional means of supporting the street decking was adopted. Continuous girders about 4 ft. high and 150 to 200 ft. long were erected on top of the decking near the edge of the sidewalk and the timbering was virtually suspended from them, as is shown in Fig. 41, and the photograph, Fig. 36. These girders were generally intended to be supplementary to the system of supports beneath the deck and to be necessary only in case of the displacement of these latter. As a matter of fact, however, they proved useful in spanning the space where work was actually being carried on where changes and replacements of these lower supports were frequently necessary. Their disadvantage is that they occupy space on the street surface.

Where the regular system of cross-bracing and rakers are required, as in Section 14, Lexington Ave. (McMullen & Hoff contractors), where there is earth nearly to subgrade, some very elaborate systems of timbering are necessary. The type of timber construction on this section is shown in the photograph, Fig. 35; there are seven sets of braces in a depth of about 40 ft. below the deck and the bents are about 10 ft. apart. Tension rods are put in to help hold up the bottom braces during excavation. The sheeting on this section is mostly Lackawanna steel, 14-in. arched-web, 44-lb., but some 6-in. plank (plain) is used. The steel piling mostly showed up quite well, although there were numerous boulders, and, of course, in some places where they were struck, the piling was more or less out of line toward the bottom.

On this section careful additional horizontal cross-bracing was carried diagonally from the center at each of the shafts through several bents to the sides, which added materially to the rigidity of the whole structure.

On the down-town sections, nearly all of which are in earth, more or less similar types of timbering are used. The sides are necessarily held by sheeting, generally wood, and the timbering is the usual system of rakers, braces and posts, though varied in detail by each of the several contractors.

The street decking is, of course, laid first, in some cases with a heavy wearing surface of 6-in. planks, in others 2-in. planks on closely spaced 6x6-in. timbers or 6-in. I-beams. The first cut of the excavation is then taken out to a depth of 10 or 15 ft., the street-railway tracks and pipes secured and generally one brace is carried across the whole width of the excavation, this first long brace being usually not less than 5 or 6 ft. below the surface. Great care, of course, is taken in all these methods to arrange the timbers so that they will clear the steel when the latter is erected.

The two principal variations seem to be in making either the posts or the braces continuous. On Section 2, the first operation was to sink the posts in sheeted pits to subgrade. The material was sand, and many men in New York now have become quite expert in sinking these 4x4-ft. pits in soft material by the use of horizontal sheeting (which will be described in more detail under the head of underpinning), so that the sinking of this large number of pits is not so serious an operation as might be imagined. No water, of moment, was encountered on this section above subgrade. Once the posts were down, of

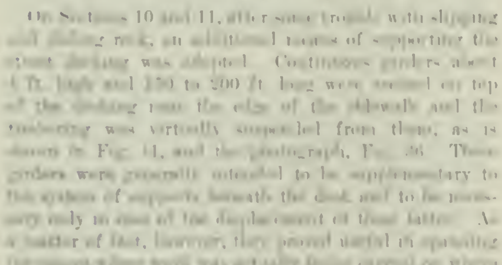


FIG. 39. [illegible] STREET DECK SUPPORTS FOR TOWER SYSTEM, ROCK EXCAVATION, LEXINGTON AVE., SECTION 1[illegible]

FIG. 40. TIMBERING FOR ROCK EXCAVATION FOR DEPRESSED SUBWAY, LEXINGTON AVE., BETWEEN [illegible] AND [illegible] STS., SECTION [illegible]

course, the deck was held in safety for any operation and the continuance of the excavation and timbering was a matter of routine.

A method used on part of Section 3 is clearly shown in Fig. 42, which needs little explanation. The building of the concrete sidewall was not followed throughout the section. The method of framing the timbers to get

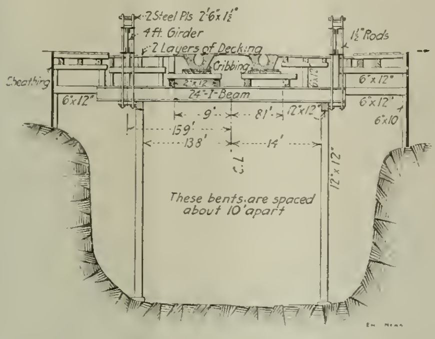


Fig. 41. Timbering Supported from Longitudinal Girders on Street Surface, Lexington Ave., Section 10.

an arching effect is, however, to be noted, as this principle was applied also on Section 1.

The features of this system as developed on Section 1, by J. C. Meem, who was the engineer in charge for the contractors, are the combined arching and bracing effect secured and the use of the continuous girder throughout the length of the excavated section, supported on posts or hollow piles.

At a convenient distance below the decking, continuous 12x12-in. cross-braces spanning the whole width of the excavation were put in, 10 ft. apart. These were usually made up of two 6x12-in. timbers bolted together in as long lengths as it was practical to use. The short 12x12-in. cap, with the ends cut as shown, was then placed under the cross-braces and supported temporarily while the next lift of 5 or 8 ft. was excavated to the level of the next cross-brace.

The hollow-steel piles were then driven, a 10x10-in. post fitted inside of them, the longitudinal girders extended, and the arch legs and posts put in position. The appearance of the lowest level is shown in Fig. 37.

The use of continuous I-beams for the support of the street decking or for tying together the timbering or supports is a feature of quite a number of the sections, differences in detail, of course, having been developed by each individual contractor, but in general the principle is that of a group or series of groups of I-beams spliced together with long plates to obtain 100% strength at the joints and running the whole length of the work under the decking and often supporting directly the street-car tracks. The advantage of this method, of course, is in its general security in case of accident to any one or even more of the supporting columns or bents and also to permit easy removal or change of supports during erection.

An interesting and unusual example of the method of timbering by rangers and braces applied to the excavation of a large area in water-bearing material is that of Sec 2-a at the intersection of Broadway and Canal St., which, on account of its difficulty, was let as a separate contract. A double-deck structure is being provided to permit the future Canal St. cross-town line to pass under the Broadway line. The excavation at this point is some 55 to 60 ft. deep and for four-track lines approximately 250 ft. long on Broadway and 150 ft. on Canal St., joined by a connecting curve in the northeast corner. The extremely heavy floor of steel girders and concrete placed in the bottom of this section to resist the water pressure, as shown in Fig. 11, will convey an idea of the conditions which were successfully overcome.

The normal water level on this section is about 15 ft. below the surface of the street, but water was actually not found in quantity until a depth of about 23 ft. was reached. This left, however, a depth of 30 ft. to be excavated in water-bearing sand and gravel. The entire area is surrounded by buildings and there is a very heavy travel to support on both streets, so that it was necessary to exercise extreme care to avoid losing ground.

The area excavated is surrounded by 6-in. tongued-and-grooved sheeting driven in three lifts, and great care was necessary in spacing the elaborate system of cross-bracing to permit the erection of the steel. There is nothing particularly novel in the layout of this latter, except its great extent over such a large area; special care, of

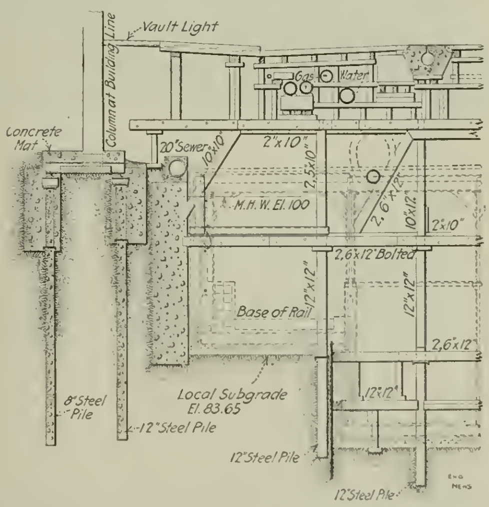


Fig. 42. Concrete Sidewalls and Arched Timber Supports with Hollow Steel Piles Used on Broadway, Section 3, Route 5

course, being necessary to keep the long line of rangers and braces in place with proper cross-bracing, and to so design the whole layout that the steel could be erected with the minimum amount of interference with the timbering.

Fortunately, the large amount of water coming into the excavation seems to be quite clear, and the most careful levels, carried out for a considerable distance in every direction from the excavation and continually checked, indicate little, if any, settlement of the adjacent ground or buildings. The total capacity of the pumps is about 20 million gallons daily, and while the whole capacity has only been infrequently required, a large proportion of it has been needed continuously.

City Switching Service with Geared Locomotives

The operating of industry tracks is one of the troublesome features of railway terminal service, due to the limited space available for sidings and connections. This necessitates the use of very sharp curves, which may be combined with steep grades in cases where the industry tracks are above or below the main-track level. The conditions are specially severe in the comparatively few cases where industry service is given to the business districts of large cities. The Kansas City Southern Ry. meets conditions of this kind at Kansas City, Mo., where its industry connections include depressed tracks leading into the basements of large establishments, and for this service it is using geared locomotives.

This industry service is an important feature both to the railways and the shippers, and the Kansas City Southern Ry. has made special endeavor to give such service to warehouses and wholesale houses, etc., within the business district. The fact that the railway can deliver cars at these establishments is an aid to it in securing traffic, while for the shipper it means the advantage of eliminating all team service to and from the freight houses and team yards. The section of the city thus served is accessible from the freight terminals only by streets having very heavy grades (about 7% maximum), which involved very heavy expense for teaming.

There is a considerable amount of industrial work on grades varying from 0.5 to 6.6 and even 7%, and on curves of 16° to 48°. The operation of switching service under such conditions is apt to be dangerous, particularly when the tracks are greasy or covered with ice or snow. In fact the ordinary engines sometimes could not be operated on the maximum grades, but with the geared locomotives there is no trouble in operating in any kind of weather. A special advantage of these engines is the absence of the noisy exhaust of ordinary engines operating on steep grades, which noise (and the accompanying discharge of cinders and sparks) would be highly objectionable in a city district.

The worst conditions are a combination of 7% grade with a 48° reverse curve having a tangent 34 ft. long. Other 7% grades have 60° curves (not compensated). The length of maximum grade is 1050 ft. Under these conditions, the ordinary switching locomotives of 34,000 lb. tractive power could handle only two cars, and similar engines having sufficient power to handle six or eight cars would be too large and too long to be operated under such track conditions. Two geared locomotives were purchased for this industrial service, but are now used also in general switching work. Their transfer work covers a distance of seven miles, and the industry work covers a territory of about ten blocks. They can push or pull trains of four to eight cars on the severe grades and can control them without the use of the brakes on the cars.

Fig. 1. 100-Ton Geared Locomotive for Switching Service on 7% Grades and 48° Curves; Kansas City Southern Ry.

From the railway company's terminal a main industry track leads up a steep grade and along the side of a street in the warehouse district and has branches laid along alleys. From the main-track lead sidings which occupy sidewalk space and run into the basement levels of the building (the siding being parallel with the main track but on a descending instead of ascending grade). From the alley lines, spurs lead into the various establishments, no cars being allowed to stand in the alleys.

In this wholesale district no objection is made to the occasional interruption of sidewalks. The railway company paves and maintains the paving along its tracks. Turnouts are placed where needed and where they are likely to be needed in future, so as to avoid having to tear up paving and tracks. These turnouts have their rails [illegible] to [illegible], thus making a substantial and permanent construction.

Owing to the way in which these engines run in and out of the "holes," they are known among the switchmen as "alley rats."

The engines are of the Shay type, having a vertical three-cylinder engine at one side of the boiler, with its crank shaft connected by intermediate shafts to a shaft on each truck. These line shafts carry bevel pinions ([illegible] teeth) engaging with bevel gears ([illegible] teeth) on the faces of the wheels. Each engine has three four-wheel trucks, one under the boiler, one under the cab and the rear bunker (for oil fuel), and the third under an independent (but permanently) coupled water tank.

The larger engine, shown in Fig. 1, weighs (with its tender) about 100 tons in working order, has 74,000 lb. tractive power and will push or pull a train of 450 tons up a combination of 5% grade and 60° curve (not compensated) at a speed of 4 mi. p. h. The smaller engine, Fig. 2, weighs about 140 tons, has 35,000 lb. tractive

power, and is designed to handle a train load of 170 tons on a 7% grade, and to pass, with its train, a 48° reverse curve with 34-ft. tangent and tracks spaced 13 ft. c. to c.

The leading dimensions of the larger engine are given in the accompanying table. The locomotive is practically a double-truck machine with power-driven tender, and the boiler and rear bunker are carried by two heavy fish-belly frames. The engine being at one side of the locomotive, the center line of the boiler is offset from that of the track. On the right side (carrying the engine) the frame is 2 ft. 9½ in. from the center of track, while on the left the distance is 5 ft. 3½ in. The engines were built by the Lima Locomotive Co., of Lima, Ohio. For information we are indebted to C. E Oakes, Mechanical Engineer of the Kansas City Southern Ry.; A. N. Reece, Office Engineer, and C. W. Streeter, Superintendent of Terminals.

Fig. 2. 140-Ton Geared Locomotive for Switching on 7% Grades and 60° Curves; Kansas City Southern Ry.

190-TON GEARED LOCOMOTIVE FOR SWITCHING SERVICE —KANSAS CITY SOUTHERN RY.

Driving wheels (3 trucks), 12	4 ft. 0 in.
Wheelbase, truck (and rigid)	6 ft. 0 in.
Wheelbase, engine	36 ft. 4 in.
Wheelbase, total	53 ft. 4½ in.
Weight on front truck	128,900 lb.
Weight on intermediate truck	138,820 lb.
Weight on tender truck	114,150 lb.
Weight of engine (2 trucks)	267,720 lb.
Weight of engine and tender	381,870 lb.
Weight of engine, light	209,500 lb.
Weight of tender, light	71,700 lb.
Cylinders (3), vertical	18x20 in.
Valve gear	Gooch
Boiler, diameter at first ring	5 ft. 7⅜ in.
Boiler, rail to center line	8 ft. 7 in.
Firebox, size inside	10 ft x5 ft. 8½ in.
Firebox, height, front	6 ft. 5¾ in.
Firebox, height, back	5 ft. 11⅜ in.
Tubes, diameter, 2 in.; length	16 ft. 0 in.
Heating surface, tubes	2890 sq.ft
Heating surface, firebox	208 sq ft
Heating surface, total	3098 sq ft.
Grate area	57 sq ft
Fuel (oil), in engine bunker	2200 gal.
Water, in tender	5000 gal.
Length over couplers	64 ft. 7½ in.
Width over running boards	10 ft 10½ in.
Height, rail to top of smokestack	15 ft 0 in.
Tractive power	74,400 lb.
Gear ratio	49 to 20

Limitations of Water Filters*

By George W. Fuller†

While for some years the question of the proper loading or burden on filters has been considered in many places and attempts have been made to fix some sort of a standard which would serve the purpose, these attempts have met with very little success. The difficulties of fixing such a standard are self-evident. It is rather obvious that no exact relationship exists between the sanitary quality of the water and the number of bacteria present, no matter how the bacteria are tested, whether in the form of total bacteria or some special form, such as the colon bacillus. It is possible that some waters should have good sanitary properties and yet have a rather large number of bacteria. Other waters, again, which might be relatively free from bacteria, would show themselves to be unhealthful.

While it has been clearly recognized that some limits, definite if possible, should be placed on the proper burden for filter plants, no such limit has, until recent times, been established.

International Joint Commission Investigation

An International Joint Commission, composed in part of appointees of the United States and in part of appointees of Canada, has been investigating the question of pollution of the international boundary waters, with the idea of determining to what extent pollution must be limited in order not to endanger the health of the communities on the two sides of these boundary waters. The question practically resolves itself to this:

1. Is it possible to maintain the water in such shape that without treatment it shall be suitable for drinking water?

2. If it is not possible to maintain the water in such a condition of purity and it does need filtration before being suitable for drinking water, what is the limit of pollution allowable before the filtration plant will be overloaded and safe drinking water cannot reasonably be obtained by ordinary filtration?

The first source of information is those cities which have been receiving a supply of unfiltered water and which have sufficient data available to show how this water stands in rank on the basis of B. coli present in the water. A second source of information is the various filtered waters which are supplied to a number of communities and the records they have of coli content in this filtered water and the B. coli content in the raw water supplied to those filters. The most of our communities which do have filtered water show a satisfactory effluent and a satisfac-

*Extracts from a paper before the American Society of Municipal Improvements, Boston, Mass., October, 1914.

†Consulting Engineer, 170 Broadway, New York City.

[illegible] typhoid-fever rate, which is some measure of the wholesomeness of the water supplied. An examination of the corresponding raw water applied to the filters gives some indication of where a reasonable standard limit should be placed. A third source of information is the consideration of a standard of efficiency of bacterial removal and the assumption of a reasonable number of B. coli in water supplied for drinking purposes and a corresponding calculation of what would be a proper natural limit of B. coli in the water supplied to the filters under these conditions.

The best that can be done with the data at hand is to consider and properly weigh them, and on the basis of a rather general judgment come to some conclusion on what is a proper limit of B. coli in water to be applied to the filters. Such a conclusion should be considered an average rather than a rigid limit for any particular case. This standard specifies that water applied to filters should show by the presumptive test not more than 500 B. coli per 100 c.c. of water as a yearly average, meaning by this that B. coli should not be found more than 50% of the time in 0.10-c.c. samples. For averages for shorter selected times, monthly, weekly, or daily, the allowable B. coli content may be considerably higher. It is believed that for this purpose the averages based on a year's readings are more useful than averages for a shorter time with a corresponding different standard of allowable B. coli.

The bacterial efficiency of a filter is not an invariable quantity. Roughly speaking, 98 to 99% may be placed as a fair average under ordinary conditions. Percentages, however, are not always a good gage of efficiency, as a water with an initial bacterial content that is high will show a proportionately higher efficiency in a filter than a water with a low bacterial content, and yet the resultant filtered water may be much less satisfactory to the consumer from a health standpoint than would be the case with the other filter with a lower bacterial efficiency. In addition, sterilization is usually applied in modern filter plants as a reserve factor of safety, and should be available to be applied in all plants, and with the use of effective sterilization added to properly filtered water an effluent can be obtained which is almost, if not entirely, sterile for ordinary uses.

With these conditions in mind, it seems reasonably safe to say that a water having in its raw form a B. coli content not exceeding 500 per each 100 c.c., based on yearly averages, will show in the water supplied to the consumer something not more than one to two B. coli per 100 c.c. Such water is believed to be a safe water, when properly sterilized, for drinking purposes and for all other domestic uses.

A Small Reinforced-Concrete Dam with a Large Upstream Apron of Concrete Paving

(Contributed)

A private reservoir recently created in northeastern New York has become locally famous because of the large amount of concrete placed for such a small project. Enquiries and comments show that a certain knowledge of the peculiarities of the construction is spreading so that all [illegible] should be recorded. The project will be recognized at once by those who have previous knowledge of the work; to others it will be the details and not the persons involved that are of interest, so that names have not here been given. The reservoir in question is for purely private service and exact figures on the design and construction have been refused; however, such as are given below are believed to be closely approximate.

In 1909, work was started on a small dam to impound the waters of a little stream, flowing toward Lake Champlain, so that the seasonal flow might be equalized for the better development of electric power on a large farm where many operations were carried on by motor-driven machinery. Surveys were made by a firm of civil engineers in a near-by city and designs were worked out by them in connection with a well known firm of consulting engineers. Finally the latter were asked to supervise the construction of a hollow reinforced-concrete dam in accordance with the plans submitted.

These plans called for a deck, supported by triangular

Fig. 1. Downstream Side of Dam, Showing Gate House and Unassembled Steel Conduit

buttresses approximately 1500 ft. in length, with the crest 45 ft. above the stream bed. The initial contract was placed with a local contractor and the work of clearing the reservoir site of undesirable material was immediately started. The cleared area totaled 160 acres, the greater part of which was solid rock floor.

Little trouble was experienced during construction, until a portion of the structure, located east of the stream, was reached. But there, interesting conditions were met with in the excavation of the foundation trench. While along that portion of the dam west of the stream and extending to the east bank the rock appeared and formed the natural surface, immediately upon leaving the east bank the drift of the rock away from the surface was so very rapid that it was found necessary to dig a trench 40 ft. deep, more or less, and at some points nearly as wide, in order to obtain a satisfactory foundation for the footings.

No little difficulty was experienced in making this excavation, owing to the unusual number of large boulders distributed at various depths throughout the entire length of this portion of the trench. These varied from 3 to 8 ft. in diameter and were surrounded by coarse gravel, much of which was so compact that its removal

was made possible only by the use of dynamite. The hazardous nature of the excavation and the trouble experienced in retaining sheeting in place after driving made it almost impossible to keep laborers on the work for any length of time.

A 100-ft. spillway, of the ogee section, is located at the western end of the main dam, at an elevation 2 ft. lower than the crest. It is equipped with adjustable flashboards, constructed from 3-in. plank, securely cleated together and attached with strap hinges to a 6x8-in. sill that is firmly anchored to the spillway top. The boards are braced against the downstream toe of the dam.

From the western end of the spillway, a cutoff wall of gravity section, having a batter of 6 in. to the foot, upstream, was extended for 325 ft., more or less. Likewise from the eastern end of the main dam a wall of similar design, but of greater dimensions, was extended several hundred feet into the slope.

After the structure was completed according to plans, an attempt was made to fill the reservoir, with decidedly unsatisfactory results. Owing to the porous character of the soil in the east slope, the water upon raising its level began a steady seepage, which increased rapidly with the increased head, to the end that one farmer, living some distance outside the eastern slope, was seriously inconvenienced by the flow. This result was not wholly unexpected, as before construction had started the consulting engineers must have pointed out the very questionable nature of the site on account of the character of the east bank. Indeed the whole countryside is known to have been subjected to severe glacial action. The owner, however, very greatly desired the reservoir at this point and evidently ordered the work to proceed in spite of the undesirable conditions.

Fig. 2. Spillway with Adjustable Flashboards

At this time any immediate attempt at storage was abandoned, and it was decided by the engineers to lay a sheet of concrete, 6 in. in depth, more or less, over that portion of the south slope—some 50 acres or more in extent—through which the leakage occurred. As an additional preventive, a cutoff wall was extended in a northerly direction, approximately, paralleling the stream for a distance of 2500 ft., more or less, this wall forming an impervious joint with the floor sheet and going down to rock. It reached a depth of 35 to 40 ft. for a considerable distance.

The heavy seepage was stopped, but in the summer of 1914 there was still considerable water leaking out. There may be a seam in the rock or places where the cutoff wall does not connect with rock. One reason, undoubtedly, lies in the large and numerous cracks in the concrete floor due to temperature changes, settlement, shrinkage, etc. There are also cracks at the junction of floor and cutoff wall. Very recently, the reservoir has been drained, the floor washed down and the cracks repaired; probably, the necessity for such repairs was

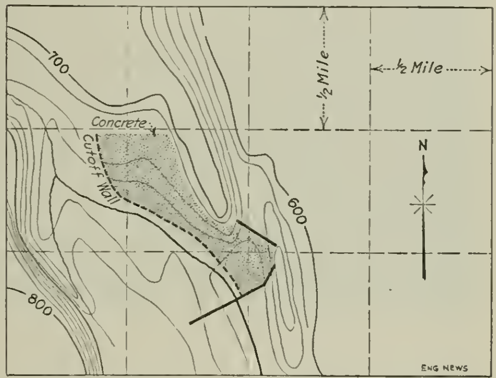


Fig. 3. Sketch Showing Approximate Location of Dam and Concrete Apron

fully known before the concrete was laid and no doubt they were judged to be preferable to greater attention at first to expansion joints, better foundation, etc.

The work on the penstock and power house of this project is progressing rapidly and there is little doubt as to the final technical success of the undertaking. It is obvious, however, that the expense incurred in the whole work was far beyond what would be possible for any commercial enterprise in a hydraulic development of such size and nature. The first estimates of the cost of the project were in the vicinity of $200,000. It is reported locally that the whole work, when completed, will approach $1,000,000.

The Largest Chain-Drive Transmission in the World is said to be that of the Ox-Bow hydro-electric plant on the Snake River at Copperfield, Ore. The installation consists of one 3600-kw., three-phase, 60-cycle generator, running at 225 r.p.m., operated by two water-wheel units. Each of these units consists of two pairs of water wheels of the horizontal type, with 48-in. center discharge, set in open flume, and operating at 21 ft. head and 147 r.p.m. The water is supplied through a tunnel cutting off a bend in the river. Each water-wheel unit is connected to the generator by four Morse chains 21 in. wide, with sprockets of 2-in. pitch on the line shafting, and with shaft centers 10 ft. apart. The generator shaft is in the center and 5 ft. above the level of the water-wheel shafts. This chain drive is said to be three times greater in size than any previously built, the largest one previous to this being at Indianapolis, Ind., and driving a 1200-hp. generator. The Ox-Bow plant was designed originally to operate under a 45-ft. head obtained by a natural fall of 21 ft. by the tunnel through the bend in Snake River, and the building of a diversion dam across the river below the tunnel. Both the water-power and electrical machinery were purchased for this head, but due to financial troubles the company was unable to build the dam and for four years the property lay idle. The plant was put in operation on Sept. 30. It was designed by the W. H. Rosecrans Engineering Co., of Chicago.

Field and Office

Quarrying with Air Hand Drills on Scaffolds, Slings and Ladders

By [illegible]*

Certain new methods of ledge and cliff excavation have been successfully developed since the advent of the self-rotating hammer hand drill which would have been impractical with all previous types of drills. Formerly, the familiar bench method was used, the rock being removed in strips whose depth and width depended upon the size of mounted drills employed. Frequently deep holes were

Fig. 1. Section of Bench Drilling at Campbell & Dence Quarry, Stone Plains, Tenn.

cut from the top of the cliff by [illegible] drills and drill [illegible].

In the new method a support for the [illegible] to [illegible] over the edge of the cliff. There being no drill mounting to adjust, the time consumed in setting up and [illegible] is practically eliminated. This alone consumes a large part of the time of operating with all types of mounted drills and explains the great economy of hand drilling. Yet the methods here described would have been impractical with ordinary hand drills due to the difficulty of holding them by hand in [illegible] positions.

Figs. 1 and 2 show the scheme employed at the Campbell & Dence Co. quarry, Stone Plains, Tenn. The rock is a hard blue limestone. Formerly, mounted piston drills ([illegible]-in. cylinders) were employed to remove the rock in benches. These were capable of drilling holes up to about [illegible] ft. in vertical direction and a maximum depth of about 18 ft.

The present procedure is as follows: A row of vertical holes 18 ft. deep and spaced 6 ft. apart is put in parallel with the face of the cliff by the tripod drills. Two lengths of gas pipe are inserted in the proper holes and ropes are fastened to them so that a scaffold can be lowered over the face of the cliff. The scaffold, shown in Fig. 2, is 11 ft. long and about 4 ft. wide. It is fitted with winding drums so that the drillers can raise or lower it after it has been slung over the cliff. The hand-drill holes are spaced 6 ft. apart, vertically and horizontally, and are 10 ft. deep. At this depth, the steels cut to about 1⅜-in. bottom diameter. The holes are inclined downward at an angle of about 20° from the horizontal. Under present conditions, one man with a hand drill sinks about 80 to 100 ft. of hole per 10-hr. shift.

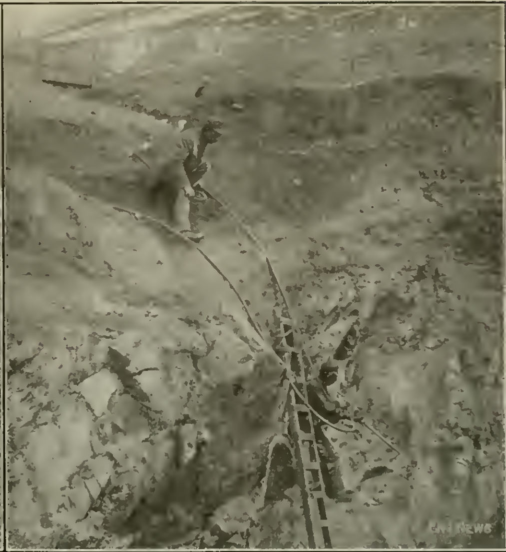
After the 10-ft. holes have been drilled from the top of the cliff to near the bottom, tripod drills are again put into use for drilling a line of horizontal holes on the very bottom of the cliff, these holes being 14 ft. in depth and looking down slightly from the horizontal. The holes in the side of the cliff are loaded each with 12 sticks of 60% dynamite and those at the bottom with 18 sticks. All of the holes are shot simultaneously (by battery). The cost of powder per cubic yard of broken stone is about 3½c. with this system whereas last year, when only tripod drills were used, the cost was 5½c.

Several big blasts have already been made. In the first shot that was set off an insufficient quantity of powder

Fig. 2. Scaffold Near Base of Cliff, Campbell & Dence Quarry

was used, which resulted in large ... of some of the stone. Later, [illegible] lb. was used (as stated above), and the cost quoted is based on this. It is believed that the amount can be reduced slightly, and it is also contemplated using a slightly longer scaffold so that two or three drills can be used at once, which would result in a further low-

*[illegible]



FIGS. 3 AND 4. HAND DRILLS IN USE AT BULLWHACKER MINE, BUTTE, MONT.

ering of operating cost. With the 350-lb. charge of powder, the rock is so well broken up that practically all of it can be handled by the steam shovel and crushers, requiring practically no block-holing.

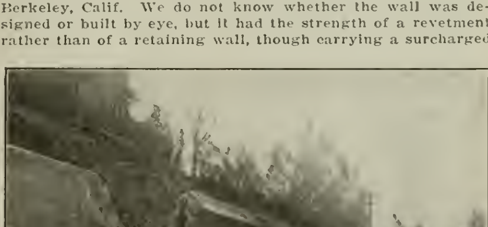
The ease with which the automatically rotated hand hammer drill is handled in inaccessible quarters is further illustrated by Fig. 3, showing work at the Bullwhacker Copper Co. mines in Butte, Mont. The difficult nature of the "glory-hole" mining here may be realized when it is considered that it is 75 ft. from the operator's position to the bottom of the cut, where the broken ore is mucked into cars and hoisted on an incline to the surface. The material is relatively low grade, averaging 4% copper, the vein running about 125 ft. wide at this point.

Frequently the operator works from a boatswain's chair slung over the side of the cliff. Fig. 4 shows a scheme for drilling in a particularly difficult spot where a suspended ladder had to be resorted to. The operator is braced against the ladder and has only sufficient room for one foot on the rock. In spite of the exceptional difficulties at the Bullwhacker mine, the remarkable speed of 90 ft. of hole in two hours has been made, each hole bottoming at 6 ft. The rock, however, was not hard, it being an oxidized granite. Three-foot starting steels were used, followed by 6-ft. drills, the holes being for $1\frac{1}{4}$-in. powder sticks. In a single month, one drill broke enough ore to fill 64 cars of about 50,000 lb. each.

In the two instances cited, it would be quite impossible to employ heavy piston drills. Ordinary plug drills would also be extremely difficult to operate because of the difficulty of rotating them by hand in such cramped quarters. With the self-rotating hand type, however, the operator has merely to apply the tool to the spot to be drilled and open the throttle. A simple steel holder attached to the front head of the hand drill has been found of material aid in withdrawing the steel from the hole. Moreover, it enables the drill runner to lower and raise the steel in the hole, churning up the cuttings and preventing sticking or binding. The latter troubles are still further provided against and the speed of cutting has been increased by a hole-cleaning device with which the operator can send at will a jet of air through the hollow steel to the bottom of the hole.

The writer desires to acknowledge the assistance of L. F. Thompson, of Knoxville, who furnished the data concerning the Campbell & Deane quarry, and of C. M. Hansen, of Butte, who supplied the information on the work at the Bullwhacker mine.

An Overturned Retaining Wall—That structures do not always do what is expected of them is illustrated by the adjoining picture of a 4-ft. retaining wall on Panorama Way, Berkeley, Calif. We do not know whether the wall was designed or built by eye, but it had the strength of a revetment rather than of a retaining wall, though carrying a surcharged



RETAINING-WALL OVERTURNED BY SLIP OF CLAY BACKING, BERKELEY, CALIF.

clay bank. It was only 10 in. thick, without batter front or back, reinforced in the main horizontally (i.e., not at all as regards retaining-wall action), and provided with only occasional counterforts. Worst of all, the soil here is very liable to slip during the winter rains. As a result, the wall recently tipped over as the picture shows. It has been replaced with a somewhat lower wall, of wedge section and counterforted.

Conveying Concreting Materials by Belts, at the Hell Gate Bridge

Belt conveyors have been installed at Randall's and Ward's Islands, New York City, for handling concrete material from boats to storage piles, in the construction of the Hell Gate bridge, spanning the East River. The belt at Ward's Island is [illegible] ft. long by [illegible]-in. wide and inclined at [illegible]°. At Randall's Island a 20-in. belt is used.

The sand and stone or gravel are lifted by the belt to storage piles, where they are dropped by a tripper. From the piles they are later rehandled into cars for distributing to different parts of the work. Coal for the dinkey engines is conveyed by the belt in the same manner. The bags of cement are discharged from the belt on a table in a storage house, where they are piled.

The number of men employed on this work at Ward's Island is as follows: A derrick hoist operator on the scow, a man to direct the sling, three to make up the

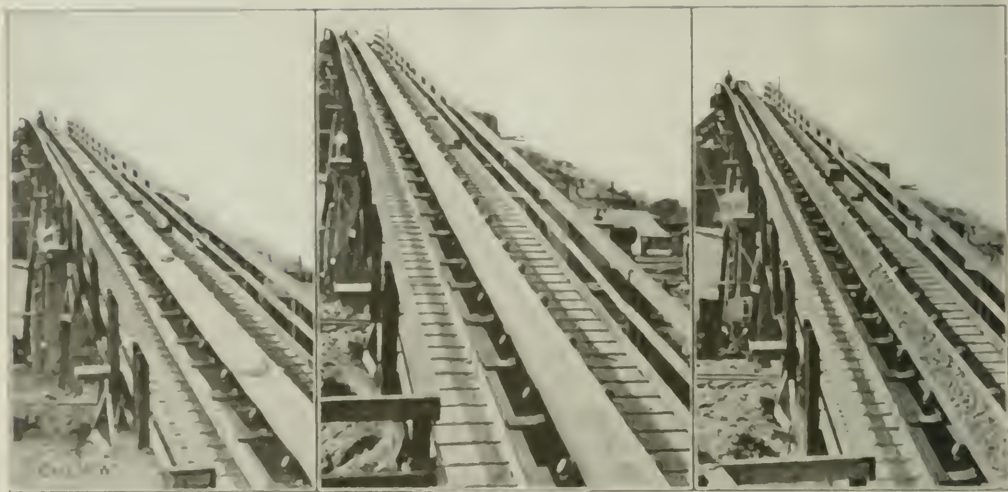


FIG. 1. BELT CONVEYORS AT HELL GATE BRIDGE, HANDLING CEMENT, SAND AND STONE

The receiving dock for materials at Ward's Island is [illegible]. The loose materials are unloaded from the scow into a receiving hopper on the upper deck of the dock, by a derrick equipped with a grab bucket, located on the dock. The belt is fed by a chute from the hopper. The bags of cement are lifted from the scow in sling loads by means of a gasoline hoist on the pier. Four men, working two and two, unloosen the slings and place the individual bags on the belt. As many as 1500 bags per hour have been handled in this manner without [illegible].

FIG. 2. TRIPPER [illegible]

slings; two to place the bags on the belt; one to operate the tripper, and 12 to 15 men in the cement-storage house.

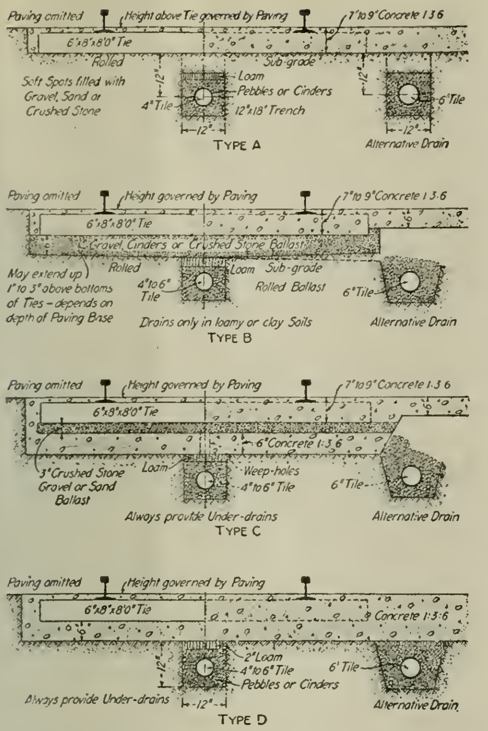
At Randall's Island the scheme of unloading is essentially the same, but instead of having a separate hoist for the cement, the one derrick on the dock unloads all materials. To handle cement [illegible] of the scow, the grab bucket is lowered into the scow and about 12 bags placed on it and lifted to the deck. At this place, also, a second belt, 18 in. wide, runs from the storage piles to the concrete mixer.

The conveyors were furnished to the Patrick Ryan Construction Co., New York City, by the Robins Conveying Belt Co.

Track Foundations in Paved Streets

The four types of street railway track foundation shown in the drawings herewith were recommended by the Committee on Way Matters of the American Electric Railway Engineering Association at its recent convention. It is reported that these designs were evolved after study of all [illegible] factors.

Type A is for moderate traffic of cars up to [illegible] tons and for [illegible], such as [illegible]. Type B is for [illegible] heavy traffic, and for heavy [illegible]



FOUR TYPES OF TRACK FOUNDATION IN PAVED STREETS

(Recommended by the Committee on Way Matters of the American Electric Railway Engineering Association.)

of cars up to 35 tons. Types C and D are for heavy water-retaining soils and uncertain made ground, with heaviest traffic and cars. Surface drains are to be provided in all cases.

Some Neglected Points in the Theory of Adjustment of the Engineer's Transit

By J. A. Kitts*

The writer outlined in the Engineering News, of July 9, 1914, a method of using and adjusting the wye-level, based on the operation of maintaining the vertical axis of the instrument precisely vertical. In using the transit, it is also essential for successful operation that the vertical axis be kept vertical (operation (1) following)—as the horizontal circle needs be horizontal to measure horizontal angles. The vertical axis is necessarily made perpendicular to the plane of the horizontal circle by the instrument maker.

It being shown by application of operation (1) that the vertical axis can be made vertical with fine precision and quite simply even though the plate or telescope bubble tubes are out of adjustment, the adjustment of all the parts is greatly simplified and facilitated and, as far as possible, made independent of each other. The precision of this operation, as also that of any method of adjustment, depends on the spindles and bearings fitting properly, being circular in section, and the outer and inner spindles being concentric. This provides an index to a defect in the spindle.

It will be observed that only one bubble tube is necessary on the complete transit, that on the telescope. One bubble tube on the plate is quite sufficient for convenience in the operation of leveling the instrument and should be placed at right angles to the telescope bubble tube.

In a theoretically perfect transit instrument the following specifications obtain:

(*a*) The inner and outer spindles, horizontal circle and verniers are concentric.

(*b*) The spindles or vertical axes are perpendicular to the plane of the horizontal circle.

(*c*) The horizontal axis is perpendicular to and intersects the vertical axis.

(*d*) The line of sight coincides with the optical axis, is perpendicular to the horizontal axis and intersects the horizontal and vertical axes.

(*e*) The tangential axes of the plate bubbles are perpendicular to the vertical axis.

(*f*) The tangential axis of the tesescope bubble is parallel to the line of sight and optical axis of the telescope.

(*g*) The cross-hairs are horizontal and vertical respectively and intersect on the optical axis.

(*h*) The plane of the vertical circle is perpendicular to the horizontal axis. The vertical circle is concentric with the horizontal axis, and the vernier reads 0° on the vertical circle when the line of sight is horizontal.

(*i*) The circles are graduated uniformly.

Physical changes take place in the instrument, usually on account of rough usage, and it is necessary to test the adjustments often. The following method of adjustment has been found to facilitate a sometimes tedious process.

Adjustments

(1) *Make the vertical axis vertical.*

Bring the plate bubbles to the center over both pairs of leveling screws. Set the vertical circle at 0° and bring the telescope over one pair of leveling screws. Note the end of the bubble near the eyepiece. Revolve 180° in azimuth and again note the eyepiece end of the bubble. Bring the end of the bubble to the mean position over both pairs of screws. The bubble will then remain in the same position for any angle about the vertical axis and the vertical axis is vertical. It will then be observed that the plate bubbles remain in the same position for any angle about the vertical axis, and either of these bubbles may be used instead of the telescope bubble. The telescope bubble, however, is the more sensitive.

(2) *Test the inner and outer spindles for eccentricity.*

Make the vertical axis vertical by (1). Hold upper plate and turn lower plate through a complete revolution. If the bubble remains in the same position for any angle of the lower plate in reference to the upper plate, the spindles are concentric. If not concentric, the correction should be made by the instrument maker.

(3) *Adjust the plate bubbles.*

Make the vertical axis vertical by (1). Adjust the plate bubbles to central position. The bubble will then remain in this position for any angle about the vertical axis.

*Until recently with the Isthmian Canal Commission, Panama Canal.

(4) *Make the horizontal axis of the telescope perpendicular to the vertical axis.*

Make the vertical axis vertical. Sight on a well defined elevated point, telescope level. Depress the telescope and establish a point at about 100 ft. from the instrument. Repeat, telescope inverted, and establish a point beside the one first established. The bisector of the line between these two points is in a vertical plane passing through the elevated point and the vertical axis. Maintain the vertical axis in a vertical position and adjust the horizontal axis until the line of sight remains in this plane.

(5) *Make the horizontal axis perpendicular to the vertical axis by means of the striding level.*

Make the vertical axis vertical. Set the striding level on the collars of the horizontal axis. Note the end of the bubble near the fixed end of the striding level. Reverse ends of the striding level and again note end of bubble at the fixed end. Maintain the vertical axis vertical and adjust the horizontal axis, bringing the bubble to the same position. The horizontal axis will then be horizontal.

The bubble of the striding level may then be adjusted to a central position, although the accuracy of the horizontal axis adjustment does not depend upon the striding level being in perfect adjustment but depends upon the principle of reversion, it being essential that the vertical axis is kept vertical by operation (1).

(6) *Make line of sight perpendicular to the horizontal axis.*

Make vertical axis vertical. Sight on distant well defined point (telescope erect). Transit telescope and establish foresight. Repeat (telescope inverted). The bisector of the line between the two points established is in a vertical plane through the backsight and the vertical axis. Adjust vertical cross-hair, bringing it into this plane. See that the vertical hair follows a point when the telescope is rotated in altitude.

(7) *Make the horizontal crosshair pass through the optical center.*

Make the vertical axis vertical. Level the telescope approximately. Establish a point on a vertical surface about 300 ft. distant and another at about 25 ft. distant (telescope erect). Invert telescope and sight on the farther point and check on the nearer point. Adjust the horizontal crosshair to the mean position. See that the horizontal crosshair follows a point when rotating in azimuth.

(8) *Adjust verniers of vertical circle.*

Make vertical axis vertical. Set vertical circle at 0° and establish a point at about 300 ft. Set the vertical circle at 180° and establish a point above or below the other, as the case may be. The bisector of the line between these two points establishes a horizontal line through the horizontal axis of the telescope. Sight on this point and bring the vernier to 0° or 180°.

(9) *Make telescope bubble tube parallel to the line of sight.*

Make the adjustment supplementary to (8), using the same point determining the horizontal line of sight, and adjust the bubble to the center of the tube.

Accuracy in all adjustments depends upon repetition and judgment in choosing distances.

Bulkheads for Boston Dry Dock

In the preparation for the new dry dock in Boston harbor (ENGINEERING NEWS, Apr. 2, 1914, p. 709), the site was paralleled on north and south by large bulkheads, which are to be joined at their outer ends by a cofferdam to inclose the dry-dock area. Each bulkhead is made up an earth fill between timber bulkhead walls of two types.

The outer wall, about 7500 ft. long, consists of 45-ft. to 50-ft. oak piles, braced by oak spur piles, to which are bolted 8x10-in. wales, holding 4-in. yellow-pine sheeting, 30 ft. long, driven to grade 14 ft. above M. L. W. The sheeting is square-edged and is spiked to the wales. All pile bolts are $1\frac{1}{4}$ in. diameter, and wale and stringer bolts are 1 in. in diameter. A detail is shown in Fig. 2.

FIG. 1. BULKHEADS AROUND DRYDOCK SITE, BOSTON HARBOR

The inner bulkhead wall, 4000 ft. long, and facing the site of the dock, is constructed of spruce piles of the same dimensions as the outer bulkhead piles, similarly braced and sheathed with 4-in. grooved yellow-pine sheeting, fitted together with $1\frac{1}{4}$x6-in. spruce splines. No preservative treatment of any kind was used on the piles or sheeting.

A noteworthy feature of both bulkhead walls is the relieving platform of 4-in. oak plank, which is slung from the top stringer of the bulkhead by 2x6-in. oak straps at about the low-water line. The platform is about 4 ft. wide and extends around the entire length of all the bulkhead walls.

The total area to be inclosed is about 47 acres and

some of the earth fill is to be dredged from the dry-dock site in getting the bottom there down to grade, while the remainder will be dredged from a new channel leading to South Boston wharves.

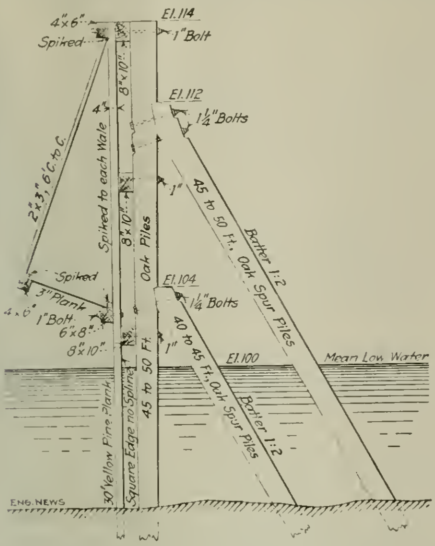


Fig. 2. Section through Outer Bulkhead Wall, Boston Dry Dock

(Note relieving platform.)

The work is being carried out by the H. P. Converse Co., of Boston, under the direction of the Directors of the Port of Boston, with Frank W. Hodgdon, Chief Engineer.

Notes from the Experience of an Old Surveyor

By A. W. Bedell*

Measuring Lines—Probably the most reliable method of measuring existing land boundary lines is to set a station within taping distance of every point to be located and measure angles and distances to each of these points, any of which can then be relocated exactly later. Stadia methods will be found as accurate as taping in the case of slight bends in the boundary line, in locating which some error is allowable in the bearing, provided the angle between boundary and traverse lines is small.

There is one disadvantage in this method—from which, however, most of the others are not free—that no matter how good the traverse closure may be, a mistake in one of the side shots will affect the boundary and pass undetected unless all measurements are checked in the field.

Points on a boundary that are inaccessible or difficult to measure to, can often be located by intersection from two stations. This is reliable if carefully checked, but the triangle should be well proportioned with no angle less than 30° or 40°.

Angle Measurements—There are several ways of measuring angles which are all good so long as consistently used, and the notes should show clearly what is done. Some surveyors measure interior angles only. On a closed figure these should total 180° × (number of angles — 2). Others record the deflections from the line of the backsight produced forward. In this case counting exterior deflections as plus and interior (reëntrant) ones as minus, the algebraic sum for the closed traverse should total 360°.

In all these cases the backsight is set on zero. A common way is to record readings as angles to right or left of backsight or as deflections to right or left of the backsight line produced (Fig. 2).

The bearings of the courses can be figured continuously, checking them with a needle, by considering northeast courses plus (clockwise); left readings will be minus and right ones plus. In a closed figure the algebraic sum of all plus and minus readings should be zero or a multiple of 180°.

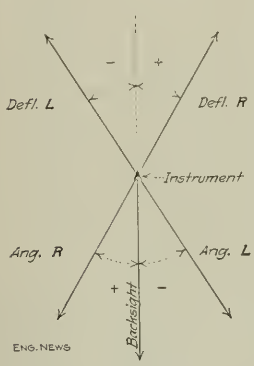


FIG. 1

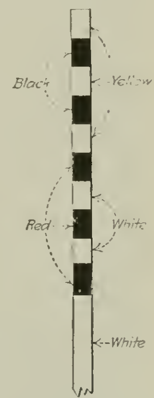


FIG. 3

The most convenient way is to carry the azimuths on the instrument by setting the vernier on the forward azimuth of a line, and backsighting with the telescope plunged; the plate is then always oriented. To do this, the collimation adjustment must be good, or this error accumulates. The advantages of this method are that the azimuth of a line is always known, and that the needle, therefore, gives an instantaneous check. Where greater accuracy is needed angles must be repeated.

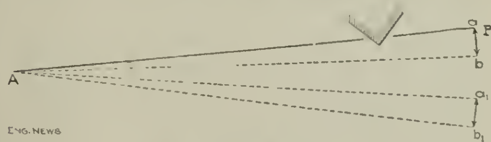


Fig. 2

Sighting around Obstacles—Very often an obstacle on a line prevents a direct sighting between points. In such cases an equal distance may be offset on each side of the point sighted to, and the angle read at each and bisected. A quick way of getting a backsight or zero when an obstacle intervenes was devised by F. R. Raven, of Glen Cove, N. Y. A stick of any convenient size (a_1 b_1 in Fig. 2) is held somewhere near the backsight point in view of the transit and square with the line of sight AB.

*Chappaqua, N. Y.

The circle is clamped with zero on a_1, the end of the stick pointed to the point, and the upper plate is shifted and set on the other end b. The stick is then moved until the [illegible] the required point B (invisible); and without disturbing the vernier reading, the transit is [illegible] on the other end [illegible], whereupon the zero will be in line with the invisible point.

ERRORS FROM DIFFRACTION—There are times when an obstacle is so close to the line of sight that it blurs, although it may not obscure, the object. The writer cautions surveyors against using such sights, for although he has never seen it mentioned elsewhere, it results in errors from diffraction. This is the property of light which causes rays to deflect when passing the edge of an object.

CHECKS—It is a decided advantage to check all measurements when possible, the certainty derived more than compensates for the extra time. Angles may generally be checked by compass readings; stadia sights give a check on distances.

It is best not merely to put check marks in the notes, but to record all readings; they may be useful to refer to if discrepancies arise.

The writer has constructed a range pole with the upper foot subdivided as shown in Fig. 3. Distances are read to all points to the nearest foot at the time of the foresight.

STATION MARKS—Sixtypenny nails as transit points will last longer than soft-wood stakes, and are more convenient to carry and to drive. In fact stakes cannot be used at all in frozen ground. Some surveyors place three stones around each transit point, which makes it easy to locate them even after several years, while a guard stake standing beside the hub might soon be burnt away.

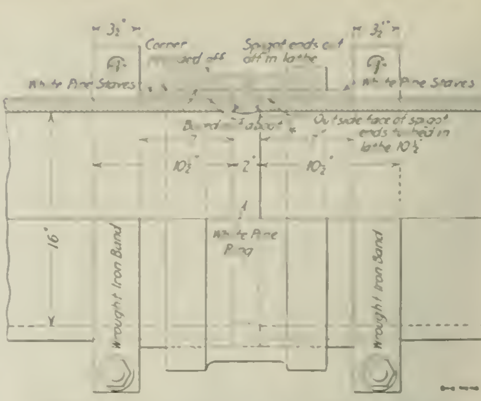
There is nothing that will last longer than stone, and whenever possible it is well to use an outcrop for a station by cutting a deep cross at the survey point.

Important stations on roads, if likely to be disturbed, can be referenced by distances to two or three permanent marks. These may be tacks in trees or fence posts. Only copper tacks should be driven, for nobody uses these except surveyors, while steel tacks might easily be confused with the great number used for bill posting. Moreover, steel will soon rust out, even when galvanized.

When a tack or nail is put in a tree, the spot should first be blazed. This serves to identify the mark, but it may further be of great value in later years by determining the time at which the mark was made. This may be found by cutting out a section of the wood and counting the annual rings of overgrowth. It may not be generally known that a tree trunk does not gain in height after the first few years' growth. Yearly accretions merely add to the diameter. A nail driven into the wood, therefore, eventually becomes covered over, but does not change its position.

NOTES

Wood Insulation Joint for Water Mains—The type of joint shown in the [illegible] has been in use in Providence, R. I. [illegible] since 1897. [illegible]

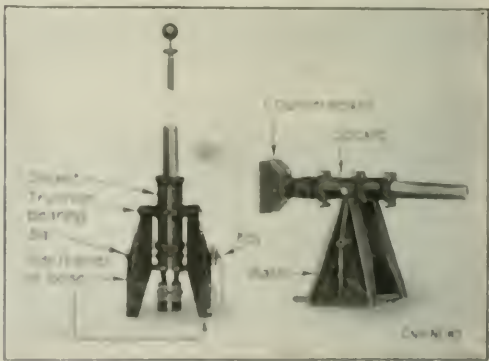


WOOD INSULATION JOINT FOR WATER MAINS, PROVIDENCE, R. I.

Other details are given in the sketch. Very little trouble from electrolysis is experienced in Providence. Where electrolysis has occurred service pipes and meters have been examined and the cause of the trouble removed or the trouble reduced. All the large 16-in. insulation joints are on the high-pressure fire-service mains.

A Tilting Base for Flagpoles—Erecting, inspecting and painting the tall flagpoles commonly used on buildings and in parks, etc., is costly and difficult. The steeplejack is eliminated and the cost reduced by a new type of pole support in which the flagpole is socketed in a tilting base so that the pole can be lowered to a horizontal position and the painting or rigging attended to without difficulty.

The socket is in two parts, bolted together, so as to firmly clamp the butt of the pole for its entire length. It carries counterweights at its lower end and is mounted by trunnions



TILTING BASE FOR TALL FLAGPOLES
[illegible]

[illegible] The pole [illegible] in front of the building.

The [illegible] is made in several sizes for poles [illegible] ft. pole, the [illegible] socket [illegible] is nearly [illegible] and three sets of clamp bolts. The counterweights [illegible] of suitable weight [illegible]

This tilting flagpole support is the invention of Elmer F. [illegible] It has been [illegible] buildings.

The Protection of Watervliet, N. Y., Against Storm Waters

By F. J. Keis*

SYNOPSIS—The City of Watervliet, to protect itself from periodic inundation by water draining off the rolling land above, has created two reservoirs with outlet works to impound temporarily the storm rainfall, spring freshets, etc., and to allow the floods to pass off at a rate within the capacity of the channel provided. The reservoirs will normally be dry.

THE WATERVLIET STORM-FLOOD PROBLEM—The City of Watervliet, N. Y., five miles above Albany, is on the west bank of the Hudson directly opposite Troy. Along the westerly limits of the city, the hills rise abruptly some

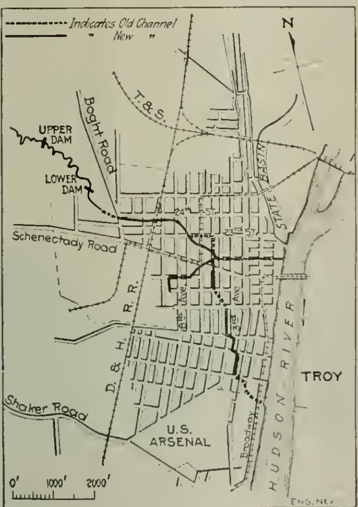


FIG. 1. WATERVLIET SKETCH MAP, SHOWING DRY RIVER AND NEW STORM SEWERS

200 ft. and continue back to the ridge dividing the Hudson and Mohawk watersheds. Practically the entire watershed is under a high state of cultivation and is well and rapidly drained. The soil is mostly clay and quite impermeable. The country is open and undulating and the aforesaid conditions, together with the steep gradient of the watercourses, causes the water from melting snow and ice and from even moderate storms to be discharged so rapidly that the capacity of the channels below is overtaxed. The stream which has caused the trouble in Watervliet is the so-called Dry River, and the works herein described have been built for its control.

Dry River entered the northwestern section of the city and flowed through a winding channel in a general southeasterly direction, discharging into the Hudson River at the Watervliet Arsenal. Beyond the city it winds through the hills and for about a mile west of the limits runs through a deep and precipitous gorge which eventually opens out upon the comparatively level city plane, where the stream's gradient is light.

Many culverts had been built to carry the city's streets across the stream, and its waterway had become more or less obstructed by structures arranged to meet individual requirements. In the summer the stream became practically dry except in pools, which served as catch-alls for refuse, garbage and sewage. The filth accumulated between storm intervals was deposited over the streets and in the cellars during the frequent freshets which occurred often with little warning. During the winter months when heavy ice formed, the culverts would clog, force the water over the streets and add to the already intolerable conditions.

A tributary of Dry River, known as "Gas-House Creek," emptied into it about a half-mile from its mouth. Like the main stream, it was an eyesore, a source of constant expense and annoyance, and a danger to the public health.

Various schemes for improvement had been discussed and some had been tried, but these were local in nature and limited in their scope. They generally succeeded in bettering one place only at the detriment of another. In 1910, after considerable agitation on the part of certain civic organizations, it was determined to devise a

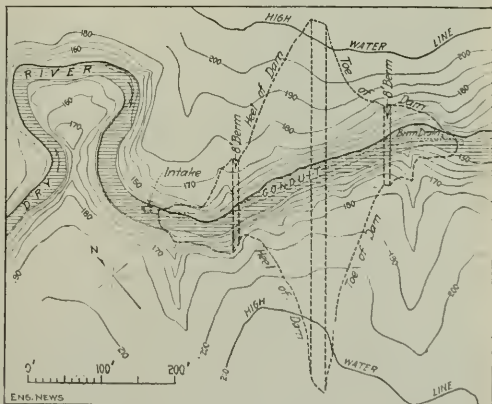


FIG. 2. PLAN OF EARTH DAM

comprehensive plan for the permanent improvement of the stream. The Storm Sewer Commission was authorized by the state legislature, and it engaged as consulting engineers, Solomon, Norcross & Keis, of Atlanta, Ga., to make the necessary investigations.

IMPROVEMENT PLANS—Detail surveys and study of local conditions showed that it was most feasible to create two reservoirs in the narrows of Dry River, west of the city, to release the impounded waters at moderate rates of flow and to carry the stream in a reinforced-concrete conduit built in part along the old stream bed. The two reservoirs would remain empty except in times of freshet, and their principal function would be to retard the ex-

*Solomon, Norcross & Keis, Engineers, Watervliet, N. Y., and Atlanta, Ga.

and flood discharges. Gas-House Creek was to be turned into a [illegible], without control works, and led to the [illegible]. A [illegible] was planned to the Hudson, the old bed of the stream below the point of departure being used for a large concrete sewer to carry off the

slope is paved with old street blocks to a point 10 ft. above the berm, while the downstream slope pavement is stopped at 15 ft. above the foot of the slope.

A reinforced-concrete core wall 6 in. thick, on a base 3 ft. wide, was carried down into the rock. The core wall

Fig. 1. Maximum Section of Upper Dam, Dry River Improvement

storm water formerly entering the stream from adjoining streets.

Upper Dam—The upper dam is an earth fill across the upper end of the rock gorge, where the valley broadens out into an open basin. At the dam site the gorge is about 40 ft. wide at its bottom, but increases to a width of 300 ft. at crest elevation, 85 ft. above the bottom. The crest of the dam is 20 ft. wide. The upstream slope is 1 on 2½ and the downstream 1 on 2. Berms, 8 ft. wide, are built at [illegible] on both slopes and [illegible] carry the drainage to the toes of the slopes. The upstream

was built in lifts of from 6 to 8 ft., the concrete work being carried on simultaneously with the fill. Special effort was made to obtain a tight bond between old and new concrete work by means of steel plates.

The earth for the first 50 ft. of embankment was hauled in 4-yd. side-dump cars over a track laid along the edge of the gorge and dumped so that it would slide down onto the fill. [illegible] distributed the material in 6-in. layers, after which it was thoroughly rolled by a steam roller and sprinkled. After the 50-ft. elevation was reached, all material was hauled from the bor

Fig. 3. Upper Dam and Intake Tower, Dry River Improvement, [illegible], N. Y.

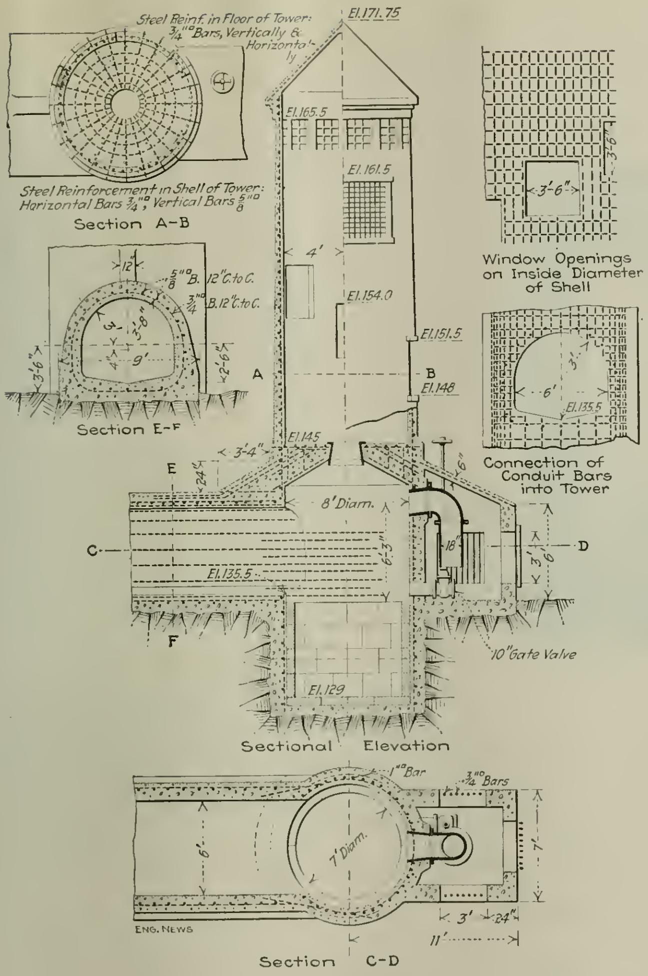


FIG. 5. DETAILS OF REINFORCED-CONCRETE INTAKE TOWER

row pit in wagons and wheel scrapers and compacted as before, the greatest care being taken in the placing of the material for the dam.

INLET TOWER—In order to avoid any moving mechanism and make the operation of the discharge works independent of manual control, a system of orifices, adequately protected against freezing and clogging, was deemed to be best suited for the purpose of regulating the flow of impounded waters. Accordingly, these orifices were placed in a circular tower of reinforced concrete in the positions shown in Figs. 4 and 5. The smallest opening, 12 in. in diameter, is intended for the minimum summer flow. In winter, the 12-in. valve will be closed and the normal flow will be discharged through the 18-in. opening in the side of the tower. When the flow increases above the capacity of this opening, the water will rise to the grated openings set spirally into the tower walls. These openings are five in number and extend to near the top of the tower, where they are capped by a ring of smaller openings extending around the entire circumference. The orifice in the tower floor, which is located above the 18-in. side opening, discharges the water into a granite-lined well, whence it passes downstream to the second reservoir. As the stream flow increases, the reservoir fills until such time as the discharge through the tower equals the rate of runoff. Then the water level remains constant and later it begins to recede. A study of past storms indicates that the reservoir will seldom be filled to any of the higher levels longer than 48 hours.

SPILLWAY FOR UPPER DAM—A depression in the crest of the hills inclosing the upper reservoir forms a natural spillway. This depression opens out into a small tributary of Dry River which enters the stream about a quarter mile below the dam. In the event that the reservoir should ever become filled, the water would flow through this channel to a concrete spillway wall extending across it, discharge upon a paved semicircular apron and be carried thence through an open concrete-lined canal section to the small tributary mentioned.

LOWER DAM—About a half-mile below the earth dam, near the end of the rocky gorge through which Dry River runs and not far from the upper edge of the city plane, is a reinforced-concrete deck dam, 25 ft. high and 105 ft. along its crest. A spillway 72 ft. long is centered on the crest length.

The small reservoir created here receives the discharge from the tower and conduit at the upper dam. The flow from here is regulated in the same manner as at the upper works, though the orifice structures do not much resemble each other. There is, first, a low-lying concrete box with three large orifices for ordinary flows; instead of a tower rising above this outlet chamber, a second orifice box is placed on the deck at a higher level, greater and greater outflow area becoming available as the reservoir level rises.

The ordinary flows are led from the smaller outlet chamber through a 22-in. steel pipe running downstream 1200 ft. to the concrete conduit and entering it about 200 ft. beyond the entrance. The pipe is protected from freezing by lagging on exposed sections. The idea in using the pipe was to prevent the shoals between dam and conduit from freezing over and furnishing ice to choke the sewer intake at spring breakup. The freshet water passes through the deck orifices and is discharged into the stream bed, along which it passes until received by the main conduit.

SEWERS—The concrete conduits are mostly of standard horse-shoe type and range from 6½ to 8½ ft. in diameter. The thickness of walls, arch and floors and amount of reinforcement vary according to the depth and nature of the trench, but for any one diameter of sewer the same steel forms (Blaw) were used and all changes were

[illegible] In that part of the [illegible] through solid rock a special section [illegible] [illegible]. This section had [illegible] vertical [illegible] walls, all [illegible] sloping toward the middle, and a [illegible] arch for the [illegible].

[illegible] below the [illegible] dam, the [illegible] was started. The entrance was formed by the usual

Fig. 6. View Across Lower Dam Showing Outlet Structures

[illegible] wing walls converging on the conduit. The stream bed was dammed [illegible] by a small earth fill.

The diversion from the old stream bed is at the head of [illegible] St., some three-quarters of a mile above the old mouth. In carrying the line westward through this street, the [illegible] [illegible] in 1830 [illegible]. At the [illegible] inlet the arch line of an $8\frac{1}{2}$-ft. sewer, so that a special section had to be substituted to avoid a bypass. The invert grade was maintained and a twin-box culvert [illegible] ft. in height was substituted and built so that from the [illegible] both ends sloped and converged into the standard section. This is shown in Fig. 7.

The channels of both streams being located for the most part through city streets and developed property in the most desirable sections of the city, are now being rapidly filled in and reclaimed, and all vestige of the streams is rapidly disappearing. During the heavy spring freshet of 1913 the system, although still incomplete, worked very satisfactorily and not a street was [illegible].

Cost, Etc.—The total cost of the work above described was $165,000. It was planned and executed under the direction of Solomon, Norcross & Keis, the writer being in active charge. Leary & Morrison, of Fairport, N. Y., were the contractors.

Fig. 7. Old [illegible] Culvert under Erie Canal, Waterford, N. Y.

conduit is $8\frac{1}{2}$ ft. in diameter, but [illegible] gradually [illegible] [illegible] to $9\frac{1}{2}$ ft. to accommodate the city storm water and the flow of [illegible] Creek, which is received at the foot of [illegible] St. This [illegible] stream is intercepted by a [illegible] [illegible] [illegible] so that much of the [illegible] [illegible] of the city, [illegible].

[illegible] the Hudson, [illegible] [illegible] Erie Canal. The [illegible] [illegible]

The Effect of Hydrated Lime on volume change and strength of portland-cement mortars and concrete has been reported upon by Henry S. Spackman, of Philadelphia, to the National Lime Manufacturers' Association, and the results published in Bulletin No. 15, [illegible], of that Association. Tests were made on mortars and concretes [illegible] with varying percentages of lime [illegible] and with the pieces exposed under water and in air outdoors, and alternately in water and air. [illegible] was made to note the expansion of the pieces with variation in moisture content. Curves for all the tests are shown in the bulletin. We give below only the conclusions drawn by the author.

Variation in moisture content as well as change in temperature affect the volume of the test pieces. [illegible] contact with water other than the variations in the air [illegible] a marked tendency to [illegible] of the test piece [illegible] up to and beyond the [illegible] period, where the test piece is in constant or frequent contact with water, the general tendency is toward expansion as [illegible] [illegible] with the [illegible] [illegible] [illegible] [illegible] [illegible] cases by [illegible] [illegible] contact with water and [illegible] [illegible] with water, the [illegible] of hydrated lime [illegible] [illegible] [illegible] [illegible] contraction when the test pieces are [illegible] exposed either to water or dry air, [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] test piece is [illegible] and [illegible].

[illegible] portland-cement [illegible] without the addition of hydrated lime [illegible] [illegible] strength [illegible] [illegible] contact with water [illegible] [illegible] contact with water there is a [illegible] [illegible] [illegible] [illegible] [illegible] of the portland cement [illegible] strength [illegible] [illegible].

Editorials

A Novel Dry Reservoir Project

The control of the flashy little Dry River, whose sudden floods have done so much mischief at Watervliet, N. Y., in past years, is one of the interesting pieces of unusual design in hydraulic engineering which have been carried to completion this year. To many the idea will seem natural, as shown in the description of the Dry River improvement elsewhere in this issue, to build works which will store up the freshet waters and automatically let them out at moderate rates of flow within the capacity of the channels. Yet the only other actual employment of the basic scheme that we have seen in municipal improvement work in this country is at the Paxton Creek flood-control works in Harrisburg, Penn. (described in Engineering News, Feb. 17, 1910). The structures and general layout in the two cases are, of course, quite unlike. The same idea, also, is involved in the flood-prevention schemes which involve dry reservoirs scattered in the headwaters of a large stream such as are proposed for the control of the Miami River above Dayton, Ohio.

The Use of Timber on the New York Subway Work

The average New Yorker hardly appreciates the magnitude of the work on the new subway system, because that work is carried on almost wholly beneath the street surface. When the first subway lines were built, the work was carried on in open cut and the streets on which the lines were located were closed to all traffic for long distances, in some cases for many months. The interference with business caused a public demand that in future subway work the street surface must be maintained and kept open to traffic during construction. The original line on lower Broadway was thus built and the same method is being pursued on the new subway lines now under construction in Manhattan and on many of the streets in Brooklyn.

Elsewhere in this issue, F. Lavis describes the methods of timbering used in supporting the street surface on the New York work. The magnitude of this task is one little appreciated save by those directly connected with the work. At Canal St. and Broadway, for example, the subway excavation is a pit some 60 ft. deep and 100 ft. in width. Mr. Lavis estimates that the temporary timbering of the subway cut for 13 miles on Broadway, Lexington Ave. and 138th St. alone has required some 70 million ft. b.m. of timber; and at least twice as much more will be required on the work still to be done.

A rough computation of the cost of this timber and the cost of cutting and placing it shows that this feature alone of the new subways involves an expenditure of many millions of dollars.

It is to be further noted that this method of construction, filling the excavation with a forest of timbers, has made it necessary to do practically all the excavation by hand, and has prevented the use of modern excavating machinery, thereby adding largely to the cost of the work.

No doubt, the construction methods adopted are the best possible under the circumstances; but it is at least an interesting speculation whether a large saving in the cost of construction might not have been made had it been possible to let the work in stretches of five or six miles to a single contractor on broad specifications which would have allowed the development of a type of structure and also of an economical method for its construction.

In Buenos Aires, the capital of the Argentine Republic, a subway line has recently been completed by the open-cut method. The contractors were allowed to work on only three blocks at a time; on one, excavation was being done by a steam shovel, loading the excavated material into standard-gage cars, which were hauled back through the completed structure and up an incline to the surface-car tracks. On the next block the structure, of steel frame and concrete, was being erected and on the third the street surface was being restored. No one block was kept open more than three months, though it should be noted that there was no rock to be excavated. In this case, the contractor (the operating company) both designed the structure and executed the work.

Of course, there are many sections of New York where no interruption at all of vehicle traffic is permissible; but there are many sections where half of the street could be given up, and many others where, were it not for previous experience, the open-cut method might be used.

It is also worth noting that while most contractors on the New York work complete excavation over a large part of their section before beginning to build, others push the construction work simultaneously with the excavation. On Section 1 of Route 5, for example, there are at all times men putting down the street decking, taking out the first lift, underpinning buildings, etc., followed by others completing the excavation, laying the waterproof floor, erecting the steel, concreting, waterproofing and backfilling.

Had this latter plan been more generally followed, it would probably mean a shorter time between breaking ground and completion of any street block, and apparently some economy in the use of timbering, since more of it could be used over and over.

The Fascination of Railway Location

Was there ever any sort of engineering work which gained such a grip upon its devotees (we use the word advisedly) as the work of railway location?

One of the oldtimers, who played an active part in engineering back in the '80's when more civil engineers were engaged on railway location and construction than in any other field of engineering work—a man who served under Wellington in Mexico—confessed the other day: "I know that some engineers when they have a holiday

or vacation like to go off in the country somewhere and play golf; but when I want to take a vacation and get the most enjoyment out of it, I go off in the wilderness somewhere and locate a railroad line."

We think that there are thousands among our older readers who look back with fond recollection on their years of work in the field ahead of a construction gang. With all the hardships and not seldom the dangers that accompanied the life of the locating engineer, there was a keen fascination about the work. The study of the topography so as to work out the best line through a difficult country to satisfy required conditions was as much a challenge of the engineer's skill as a game of chess or billiards. This was, without doubt, one of the reasons why, notwithstanding the long working hours, the rough fare and the small rate of pay compared with the responsibility carried, there were plenty of railway-locating engineers who stuck to that work in preference to any other field of engineering as long as there was location work to be done.

Hydrated Lime in Concrete

Hydrated lime as an adjunct to portland-cement mortar and concrete is no new thing. Various well known experimenters have shown that small additions of hydrated lime to cement mortars render them practically impermeable to moisture, have no material effect upon their tensile strength and much increase the plasticity of the mortar over that composed of cement and sand alone.

These very commendable characteristics of hydrated lime have been accepted by engineers without much thought as to their application to concrete work. In fact, the makers of hydrated lime, themselves, have not considered it worth while to emphasize any of them except the waterproofing feature, which is unfortunate from a selling viewpoint, because there are many other equally effective ways of making concrete water tight. It is doubtful, however, if one engineer in twenty, accustomed to the use of concrete, has an adequate appreciation of the possibilities of hydrated lime, due to those very qualities which many experimenters have reported.

In two fields of concrete work there would appear to be a distinct advantage in using hydrated lime, in concrete which is to be delivered by the spouting method and in concrete roads. In the former case it has long been a cause for complaint that while spouting is a most, perhaps the most, economical and effective way of getting concrete to the forms, unless the tower is exceedingly high or the horizontal distance quite short, the low angle of slope requires an excessively wet concrete to insure easy spouting, and every experienced engineer knows that an excessively wet concrete is a dangerous concrete. It seems probable, however, that a proper admixture of hydrated lime would give the concrete a "buttery" consistency, a certain slipperiness, as it were, which would lower the friction coefficient and permit of its spouting on a lower slope. Some few attempts to utilize this advantage have been successful, but they have only been extensive enough to show that there is here a field for investigation and practice well worth pursuing.

The desirability of hydrated lime for concrete road work was well advocated at the recent Road Congress at Atlanta by a lime manufacturer, Charles Warner, of Wilmington, Del. A point in favor of the use of lime in road concrete emphasized by Mr. Warner is the effect of the hydrated lime in reducing the tendency to segregation in the wet mixture of cement, sand and stone, and also in reducing the ratio of the expansion when the concrete changes from a dry condition to a wet condition. This reduced expansion is doubtless a result of the decreased permeability of the concrete made with hydrated lime. The importance of reducing segregation ought to be apparent without argument. One of the difficult things in laying a concrete road is to get the mix wet enough so that it can be readily tamped into place and will form a solid mass without voids and yet not so wet that the cement and sand will separate as the water flushes to the surface. The addition of hydrated lime materially decreases the tendency of the cement and sand to separate under the screed or the trowel, and at the same time makes the mass flow more readily into place.

It might be thought that mixing the lime with the cement, even though it did not affect the tensile strength of the mortar, might alter its hardness, since lime-mortar is much softer than cement. Since there is no place in which concrete is used where extreme hardness and resistance to concussion and abrasion are of greater importance than in a concrete road surface, the probable wear of a hydrated-lime concrete road is equally important as the ease of construction. Here is something that experience alone can answer. We are informed that at least one concrete road is this year under construction with the admixture of hydrated lime; its behavior will be watched with interest by engineers.

Of course, it can readily be understood that the hydrated lime must be very thoroughly mixed with the cement to secure the results above set forth. If such thorough mixing is not secured and some parts of the mortar as laid in the completed work have a deficiency of hydrated lime while others have an excess, the strength of the work might be considerably affected. The question how practically to effect such thorough mixing is not as easy as might at first sight appear. Where mortar alone is to be used and the machine mixer is available, it will be comparatively easy to put the right proportion of hydrated lime in each batch and keep the mixer turning until the lime, cement and sand are thoroughly incorporated. The great bulk of portland cement, however, is used in making concrete and the accurate proportioning of the lime to the cement and its thorough mixing with the stone and sand are matters deserving some study.

Indeed, practically all of the advantageous features set forth above have had only limited practical proof. Theoretically and experimentally there is much to be said in favor of the proper use of hydrated lime in concrete. Therefore engineers will look for reports on the actual construction which the next year will undoubtedly bring forth.

Salt Water in Miraflores Lake on the Panama Canal: A Curious Hydraulic Paradox

A very remarkable hydraulic problem has recently been solved on the Isthmus of Panama, and solved by the remedy of experience, in a manner quite contrary to the anticipations of the engineers. The facts concerning it are briefly recited in the Annual Report of Colonel Goethals, Governor of the Canal Zone, just issued. In what

follows, we have added enough to the statements given in the report to make the matter clear to those unfamiliar with the topography of the Canal Zone.

A year and a half ago, the question of a source of water-supply for the towns at the western end of the Canal, including the terminal at Balboa, was under consideration. Various projects were considered, but the one involving the least cost of any was to take the supply from Miraflores Lake. A further advantage of this supply was that its quantity was sufficient for every requirement of the future.

Miraflores Lake is a basin a little less than a mile long, extending from the foot of the Pedro Miguel Locks (which are at the Pacific end of the Culebra Cut) westward to the head of the Miraflores Locks. The water-supply of Miraflores Lake comes from Gatun Lake through the Culebra Cut. Every time a vessel passes through the Pedro Miguel Locks, a lockful of water is discharged into Miraflores Lake, and a similar amount is, of course, abstracted from Miraflores Lake as the vessel passes through the Miraflores Locks. There are also some small streams draining into the lake, and it is, of course, possible at any time to supplement the flow into the lake from Culebra Cut through the Pedro Miguel Locks.

The surface of Miraflores Lake is 55 ft. higher than mean tide in the Pacific. There are two locks in the flight at Miraflores, dividing the lift into approximately two equal parts, although the lift in the lower lock is variable, according to the state of the tide. The extreme range of the tides at Panama is about 20 ft. Besides this, it is to be noted that the Miraflores Locks are about 8 miles inland from the Bay of Panama, on which the terminal at Balboa is located. There is practically no current in the excavated channel at sea level from Miraflores to the Bay, except such as is created by the discharge of water from the locks. The tide merely flows and ebbs; but every time a vessel passes Miraflores a lockful of water is discharged into the channel, and this amount of water, unless the vessel is locked through with the basin part full, means a prism 1000 ft. in length, 110 ft. in width, and some 28 ft. in depth at mean tide. Further than this, the bottom of Miraflores Lake is at a higher elevation than high tide in the sea-level section below the locks.

We have recited all these conditions to show that the engineers who made the decision to use Miraflores Lake for a water-supply had no reason to suspect, so far as we can see, that salt water from the Pacific would invade Miraflores Lake in any material quantity. The possibility that this might occur was, indeed, canvassed. The official report says:

> At the time that the use of Miraflores Lake water was considered, the possible objection was advanced that the chlorine content, by reason of the operation of Miraflores Locks, might increase beyond 75 to 100 parts per million. At the time, it did not seem possible that this would occur, at least for a period of years, on the assumption that intimate diffusion between the salt water admitted by the locks and the fresh water of the lake would not be rapid, especially in view of the fact that water could be pumped from one of the fresh arms of the lake. At any rate, the enormous saving that would result seemed to warrant adopting the Miraflores Lake project.

To the great surprise of all parties concerned, however, salt water from the ocean invaded Miraflores Lake at an astonishing rate, even though there was very little operation of the locks at that time. Chlorine-sampling stations were established at the lake in January, and by February it became apparent that a constant diffusion of salt water was taking place throughout the whole area of the lake, extending back into its arms. The proportion went as high as 15% of salt water. To meet the emergency, about 4000 gal. per min. was drawn from Culebra Cut above the Pedro Miguel Locks, and discharged into Miraflores Lake in front of the water-supply pumping station. This gave a supply of fresh water, but also a muddy water, due to the conditions in the cut.

It was obvious, of course, that with this large amount of salt water already invading the lake it would be impossible to use it as a source of water-supply. It was therefore abandoned, and a pumping station was set up on the Chagres River at Gamboa, requiring laying a line of 30- to 36-in. cast-iron pipe a distance of some ten miles. Before this radical action was taken, an attempt was made to clear Miraflores Lake of salt water by drawing out the water in it through the Miraflores Locks and admitting fresh water in its place through the Pedro Miguel Locks, but the results were not satisfactory.

Now comes the interesting engineering problem: How does this salt water from the Pacific gain access in such quantities and with such rapidity to this lake situated eight miles distant from the ocean, and with its surface 55 ft. above mean sea level, and its bottom also higher than the level of the ocean? The only explanation possible, of course, is the diffusion of the water in the process of lockage.

Suppose a vessel is to ascend the Miraflores Locks. She enters the lower lock and the gates are closed behind her. She is then floating in a mixture containing perhaps 75 per cent. of salt water from the ocean. The valves are then opened, and fresh water from the lake above is admitted into the lock through the openings in the bottom until the level of the water in the lock is raised to the level of the water in the upper lock. In this process of filling the lock, the salt water and fresh water are thoroughly mixed. The water in the upper and lower locks being now on the same level, the gates between the two are opened and the vessel is moved into the upper lock. While this movement is taking place, however, the heavier salt or brackish water in the lower lock flows into the lower part of the upper lock by reason of its greater specific gravity, while the lighter fresh water in the upper lock flows rapidly over the heavier water in the lower lock. In this manner, while the vessel is being transferred from one lock to the other, a considerable quantity of brackish water enters the upper lock.

The gates are then closed behind the vessel and fresh water from the lake is admitted through the bottom of the upper lock, until it is filled to the same level as the lake. By this time, certainly, the percentage of salt water in the upper lock should be reduced to a very small amount. Yet there is evidently enough there so that when the gates are opened and the vessel passes out into the lake, a considerable amount of the water in the upper lock chamber flows out with it, and is replaced by entirely fresh water from the lake.

A question of some interest is whether increased traffic will cause an increased amount of salt water in the lake. While it will cause frequent repetitions of the process above described, it will, on the other hand, bring a larger quantity of fresh water down from Gatun Lake to Miraflores, and will also discharge a larger quantity from Miraflores Lake into the channel below.

Letters to the Editor

Screw Spikes and Auxiliary Rail Fastenings

Sir—An article in your issue of July 16 describes some experiments with screw spikes and auxiliary rail fastenings on the Pennsylvania Lines, being in part compiled and quoted from Bulletin No. 165 of the American Railway Engineering Association (March, 1914). This article omits mention, as does Bulletin No. 165, of common defects in the insertion of screw spikes with Thiollier helical linings, which defects are illustrated by the full-page engraving on p. 300 of the Bulletin and of the 1914

SCREW SPIKE WITH HELICAL LINING SHOWING FAULTY POSITION OF THE LINING IN RELATION TO THE THREADS OF THE SPIKE

Proceedings of the Association. [This is shown herewith.—Editor.] These defects are the following:

1. Threading of the tie to receive the helical lining so that the helical threads are not in the same pitch as that of the screw spike threads. It is very difficult to accomplish this perfectly, and probably a slightly different threading tool is needed for kinds of wood differing in hardness and general character.

2. The helical lining engages the lower part of the screw spike. For good results, the lining should be longer, to reach from bottom of screw spike to close to the top of the tie. If the lining is of present length, the tie should be threaded only deep enough to cause the helical lining to have its top very near the top of the tie, the screw spike then being driven through and projecting below the sink in the bottom of the helical lining, and the spike threads below that point thoroughly engaging the uninjured wood of the tie. By this method, there is less tendency to lateral movement of the spike and very greatly reduced tendency for water to enter the tie and rust the spike and the lining.

3. The cut shows the screw-spike threads on the upper side of the threads of the helical lining and pulling against very much injured wood, instead of the spike threads being where they ought to be, close underneath the threads of the helical lining and pulling against them, as they are designed to do.

Apparently a screw spike inserted as illustrated has much less effective permanence than if placed in the tie without any helical lining and without the defacement of the tie by the threading for the lining. It is worth while to call particular attention to this matter, for the reason that if the screw spike is inserted without special care to start the spike threads under the helical lining, the chances are several times to one that the screw-spike thread will run on top of the helical lining, as shown.

It seems likely that a very large percentage of all screw spikes with helical linings now existing in railway tracks experimentally or otherwise have these defects.

WILLIAM HOOD,
Chief Engineer, Southern Pacific Ry.
San Francisco, Calif., Oct. 30, 1914.

Comparison of Results of Paying for Public Improvements with Bond Proceeds and from the Tax Levy

Sir—In catching up with my professional reading, I note you mention the latest financial policy of the City of New York.

For some time I have been strongly advocating a method almost exactly similar to that now adopted. In this connection a memorandum was prepared analyzing some of the arithmetical differences in the old and the new methods. A copy of such memorandum is attached. Some of your readers may find arguments which can be modified to meet special conditions in municipalities where the old methods may perhaps still be in force.

E. P. GOODRICH,
Consulting Engineer to the Borough of Manhattan.
New York City, Oct. 17, 1914.

[Presumably Mr. Goodrich's notes will interest and they may be some puzzling aspect to many of our readers. Case I shows how a modest "pay-as-you-go" plan will give a considerably larger number of "improvement years" than a heavy bond issue and also shows the relative effects of the two plans upon the taxpayer. Case II shows how 50-year bonds may adversely affect the finances of a city having both a bond and a tax limit. The memorandum follows:

CASE I

Assume 5% for interest and sinking-fund requirements on 50-yr. bonds.
Assume $1,000,000 available annually to finance public improvements.

The $20,000,000 issue of 50-year bonds would provide public improvements immediately (assumed as one year after the bonds were issued). The annual interest on this $20,000,000 at 5% amounts to the same as the $1,000,000 assumed to be annually available for improvements to be paid in cash. Thus, 20 improvements at $1,000,000 each can be enjoyed for 49 years. But if the initiation of improvements is delayed so that only one is initiated each year to the extent of $1,000,000 and cash paid therefor, improvements would be secured and enjoyed as follows:

One improvement would be secured the first year and enjoyed for 49 years.
One improvement would be secured the second year and enjoyed for 48 years, etc., etc., etc.

The 20th improvement would not be secured until the 20th year, and it would be enjoyed for only 30 years; but at the expiration of the 50-year period, 49 improvements would have been secured and enjoyed on an average of 24½ years each; while one additional improvement would have been secured during the 50th year. This makes a total of 1200 "improvement years." In the case of the bond issue, there would have been only 20 × 49 = 980 "improvement years." At the end of the 50 years, the cash method would have secured 225 additional "improvement years." This additional enjoyment would obviously have been delayed until toward the end of the 50-year period; and the question to be answered is whether the additional delayed improvements are worth more than the immediate enjoyment of a less number of improvements.

Total expenditure for improvements by bond method	$20,000,000
Total expenditure for improvements by cash method	50,000,000
Total payment by taxpayers, each method	50,000,000
Interest paid to bankers, bond method	30,000,000

COMPARATIVE EFFECT ON TAXPAYER—It is often stated, as against the cash method, that a taxpayer has the use of his money in his own business during the 50-year period; and that when he pays cash for an improvement, he is thereby deprived of certain profits which he might have made.

Assume 5% for interest and sinking fund on 50-year city bonds.
Assume that an individual taxpayer's share of an improvement was $100.

Obviously, his share of the interest and sinking-fund requirements would be $5 per annum over a period of 50 years. In other words, he would have the use of $95 of his income compounded over that period. On the other hand, if he paid $100 cash the first year, he would have the use of $100 of his income compounded annually for 49 years. The accumulations at the end of the 50-year period are easily computed mathematically by well known actuarial methods, the formula being annual sum involved × ([(one plus the interest rate) raised to a power equal to the bond period] minus one) divided by the interest rate measured in hundredths. Making these computations on the assumption that the taxpayer can compound his money at the 10% rate per annum in each case, the problem resolves itself into $95 compounded for 50 years against $100 compounded for 49 years. The totals in the two cases are, respectively, $110,572 and $105,720. There is a difference, therefore, in favor of the bond method as far as the taxpayer is concerned, of $4852 accumulation at the end of 50 years. This is a matter of only four and a fraction per cent., which is to be offset against the enjoyment of a greater number of improvements where cash is paid for them.

In this connection, it is to be recalled that the majority of taxpayers are wage earners or salaried employees, and that few of them have opportunities or the ability to compound their savings at any such rate of interest. To the large majority of taxpayers, therefore, the problem is not one of a 10% compounding, but only the interest which saving banks will pay on deposits, or which may be realized from absolutely safe investments, such as are always recommended for the man with small earning power. If the above computations are made on the basis of a 5% compounding, the results are, respectively: $19,888 accumulations if bond method is used, against $19,843 if cash is paid for the improvement. This is an insignificant item. Even in the case of a 20% compounding, the taxpayer would have accumulated at the end of 50 years only about 12% more than had cash been paid.

CASE II

Assume a 10% limit of bond indebtedness for the municipality.
Assume a 2% limit in the tax rate for such municipality.
Assume 5% as the interest and sinking-fund requirements on 50-year municipal bonds.

With a valuation of $1000, the bonds outstanding would amount to $100. The eventual interest and sinking-fund requirement would be $5, while the total taxes would be $20. In other words, 25% of the total tax rate would go for interest on indebtedness. The other 75% would normally be expended for general municipal administration. If it be assumed that the full limit of indebtedness is maintained at all times, so long as the municipality is growing at a constant rate per annum (geometrical ratio), improvements can be made through and paid for by bond issues to the extent of 10% of the yearly increase in valuation. Should this increase stop for any cause, public improvements must similarly cease. Under such circumstances, no increase can be made in the tax rate for improvements or for increase in cost of administration. In other words, the municipality is absolutely estopped from developing itself so as to bring about an increase in valuation through the effect produced by public improvements. It has throttled its own growth. Had the "pay-as-you-go" method been adopted, more improvements could have been secured in any period longer than that measured by the bond interest rate divided into 100, and, any time, the community would have been in a position to expand or contract its tax rate (within the assumed 2% limit above mentioned) as community demands required. An elastic method would have been secured with the corresponding beneficial result.

A point which Mr. Goodrich might have made is that although under his "pay-as-you-go" plan a considerable number of the "improvement years" are deferred, a considerable part of the improvements would still have many years of usefulness at the end of the period.—EDITOR.]

Questions in Building the Embankment of the Yale Bowl

Sir—The statements contained in your editorial, "The Yale Bowl," in the last issue of ENGINEERING NEWS, taken in connection with the description of the work by Mr. Atwood, in the same issue, conveying an entirely erroneous impression as to the proposed method of building the Bowl as planned by the writer. The editorial says:

The original project contemplated making the embankment a single dump, without much or any attempt at consolidation; the material was to be deposited in 8-in. layers and not rolled. The contract and specifications were actually drawn on this basis. Of some interest in the same connection is the fact that it was originally planned to build the concrete seating structure all the way up the slope, on the fill as well as on the part in cut, and this with unconsolidated fill as originally contracted for.

The following is an extract from the original specifications as drawn by the writer:

The embankment shall be built to the exact shape shown on the plans, the earth being deposited in horizontal layers not more than 6 in. in thickness, and be solidly compacted by sprinkling with water and rolling with rollers weighing at least 400 lb. per foot of length. Two or more rollers shall be used as may be necessary; one a grooved roller and the other a smooth one. They shall be used together, one following in the track of the other. The embankment on the side toward the field shall be kept "full" of the theoretical lines at least 1 ft. to permit of the earth being rolled out to the edge of the embankment, and to afford a solid foundation for the concrete slabs. The tunnels shall be constructed as soon as the embankment has been built up to the level of the top of them.

With an embankment constructed in the manner specified, the writer believed that it would be perfectly safe to lay the concrete facing directly on the sand, on the filled portion of the slope as well as on that in cut. The Consulting Engineer, however, thought otherwise and maintained that it was impossible to consolidate sand by rolling; that such an embankment could only be made solid by the action of the elements acting through several years. To meet this view, he devised a plan of concrete facing using reinforced slabs supported by reinforced-concrete girders resting on piers built into the face of the embankment; any irregularities in the facing, due to settlement, to be taken care of by, occasionally, shimming

up the grades. As it would be somewhat cheaper to place the material in 18-in. layers without rolling than by the method originally specified, the specifications were therefore changed by him to the form mentioned in your editorial.

When the Advisory Engineer was appointed, the question as to the best method of placing the concrete facing on the slope was, with several other disputed points, referred to him; whether in the form of a solid slab of concrete deposited directly on the earth, as intended by the writer, or in the form of an elevated structure raised slightly above it, as proposed by the Consulting Engineer. The decision favored the solid slab, and the Consulting Engineer thereupon severed his connection with the work.

The Advisory Engineer then made a supplementary agreement with the Contractor in which the specification for making the embankment was, substantially, the same as originally drawn by the writer except that the weight of the rollers was doubled.

In the meantime, most of the tunnels had been constructed, so that the new specification only applied to that portion of the embankment which was above them.

A comparison of the volumes of the cut and fill shows that the material in the embankment is nearly 7% more dense than that in the natural bank.

After the embankment was finished, last June, thirty benches were established around the top. Recent levels show that the greatest settlement at any of these points has been about [illegible] in., the average of the whole being about [illegible] in.

Whether any settlement which is likely to take place will be injurious to the structure is a debatable question, but it is believed, by the writer that, as the blocks are heavily reinforced to prevent cracking, and are "shingled" up the slope—i.e., each block has a 3-in. overlap on the block below—no serious injury would have ensued if the concrete facing had been completed without waiting for further settlement. He believes that the opening between blocks due to temperature changes is likely to exceed that resulting from any settlement.

CHARLES A. FERRY,
Designer of the Yale Bowl

New Haven, Conn., Nov. 18, 1914.

NOTES AND QUERIES

[illegible] In the note in "Engineering News," Nov. 12, [illegible] describing the proposed new [illegible] waterway from Chicago to the Illinois River, [illegible]. The number of locks will be eight instead of [illegible], including a lock connecting with the drainage canal at Lockport, and their total lift will be about [illegible] feet.

In the description of [illegible] in the issue of Nov. 12, 1914, p. [illegible], the address of the maker was omitted. The machine is made by the Whitman Agricultural Co., St. Louis, Mo.

Statistics of Pipe Production in the United States [illegible]

Unsatisfactory Performance of Brass and Bronze on the Catskill Aqueduct*

Many valves, pipe fittings, bolts and other metal objects large and small on the Catskill Aqueduct for New York City were made of bronze or brass wholly or in large part. These alloys were selected for objects to be exposed to corrosive influences where durability was most important because of the difficulty of replacement or inspection. Nevertheless, by far the greater number of sluice gates, valves, pipe fittings and similar objects were made of iron and steel, in accordance with usual practice. On account of the magnitude of the project, however, unprecedented quantities of bronze or brass were used—a total of nearly 3,000,000 lb. About two-thirds of the total consists of castings, and a large part of the remaining million pounds consists of forgings. The remainder comprises rolled plates, rolled and drawn rods, drawn and extruded shapes, etc. The individual pieces range in weight up to 22,000 lb. of castings, and up to 3200 lb. of forgings.

Unsatisfactory results have developed in the case of the cold-worked material (drawn or cold-rolled), and some of the smaller hot-worked pieces. A. D. Flinn and E. F. Jonson (Inspector) made the matter their special study from the time the first defects were found. The study has not up to the present indicated where the responsibility for the trouble rests, but the inspection has been very thorough and successful, every effort being made to find and eliminate defective pieces.

The word "defective," in this connection, describes pieces which appeared satisfactory when made and furnished and whose material met the tensile tests prescribed in the specifications, but which after a time developed cracks.

The larger part of the total of brasses and bronzes used on the Aqueduct consists of so called "manganese bronze." A considerable amount is Tobin bronze and other brasses or bronzes of related composition. These mixtures are of high strength, so far as shown by the standard tests, and were chosen because of the high requirement on some of the parts in question as to loads and stresses, and the necessity for using a metal which would not corrode appreciably in moist atmosphere or water.

The specifications required that manganese bronze should have:

> A tensile strength of not less than [illegible] lb. per sq.in., an elastic limit of not less than [illegible] of the ultimate tensile strength, and an elongation of not less than [illegible].

The general run of the acceptance tests was about as follows: *Castings*—ultimate strength 68,000 to 77,000 lb. per sq.in., yield-point 32,000 to 50,000 lb. per sq.in., elongation 25% to 40%, fracture granular to silky, the breaks frequently being crystalized. *Forgings*—ultimate strength 68,000 to 77,000 lb. per sq.in., yield point 38,000 to 52,000 lb. per sq.in., elongation 31% to 41%, reduction of area 35% to 47%, fracture frequently silky.

It must be noted, however, that the yield point in such material is not sharply defined as it is with structural iron or steel. Moreover, maximum service stresses were allowed by the specifications to go as high as two-thirds of the yield-point in some extreme cases.

Bearing further on the specification requirement, it is

*Abstract of statements by A. D. Flinn, Deputy Chief Engineer of the Board of Water Supply, New York City, in a recent address before the Brooklyn Engineers' Club.

to be noted that pipes were required to stand flattening the end to a separation not greater than twice the thickness of the metal, without cracking, and a piece of the pipe 3 in. long was required to stand splitting and opening out flat without cracking, in both cases after annealing.

Cracking Discovered

Cracking was first found in some bolts and rods installed in a valve chamber, not yet in service, but the examination inspired by this circumstance soon led to the discovery of quantities of cold-worked material such as large plates, bolts, rods, ladder parts, etc., which were in the storehouse awaiting installation, some having been there for months. The pieces showed cracks ranging from superficial to deep, in the cylindrical parts usually circumferential, extending part way or all the way around; a few pieces had actually broken apart of themselves. Some specimens did not show cracking on the first examination, but developed it later.

Extent of the Trouble

The trouble was first noted in cold-worked metal only. Later, however, hot-rolled rods, small forgings, plain extruded (hot) rods, etc., also showed failures "in disturbingly large quantities." The same statement applies to cold-worked brass and bronze rods which had been thoroughly *annealed*. No trouble was experienced with castings and with large forgings, and fortunately these classes cover the largest amount of the brasses and bronzes on the aqueduct.

Summarizing as to the extent of the damage: Large numbers of brass bolts (the term "brass" includes bronze) have been found cracked and broken in their packing cases after storage through a winter without ever having been stressed; others, never exposed to low temperatures and never stressed, have also been found cracked and broken. This statement applies primarily to bolts of ½- to 2-in. size, but it is also true of flat bars, plates and long rods. It applies, moreover, to ¼-in. flanged plates, carefully inspected after manufacture and found in good condition, which some months later showed pronounced cracking and worthless rivets. No brand or make of brass or bronze tested has wholly escaped. In short, the failures were so extensive and numerous (for instance, hundreds of bolts broke at one time or another under tension, heads came off, etc.) as to cause the gravest apprehension and lead to the substitution of steel for brass in a great many cases, in spite of the corrosion trouble with steel.

Attempts to Detect the Cause

Similar trouble has been observed elsewhere in minor degree, and has been studied scientifically. Martens and Heyn, of the German government testing laboratory at Gross-Lichterfelde, concluded that excessive initial stress was usually responsible, and recommended brushing the surface of suspected brass or bronze with a solution of a mercury salt, which in a few minutes would develop cracks if the surface of the brass was under great initial stress. The Aqueduct material also was found to have high initial stress in cold-worked pieces, the surface being usually in tension. But trials of the mercury test were not very satisfactory: many rods which showed no cracking from the mercury solution cracked subsequently, or other rods of the same lot cracked. Further, such a test can be applied to only one rod out of a lot or to only a small part of the surface of a piece, so that even if certain in its results it would not be useful for regular inspection.

Trials of the scleroscope were also made. This well known instrument measures surface hardness. It proved useful, but not sufficient in itself to discover whether a given lot of brass is subject to the deterioration in question. The surface of cold-worked metal being harder than normal metal, the scleroscope indications tend to show whether and how severely a piece has been cold-worked.

General Result of the Studies

A vital question which results from the above recounted experiences is whether brasses of high tensile strength can be produced in such a way as to form a reliable structural material, and what composition or other requirements must be specified in calling for such brass. An equally important question is what tests can be used to detect the defective quality of a piece with regard to the cracking above referred to. A subsidiary question is what safe working stress may be used in designing with high-strength brasses or bronzes. The engineering department of the New York City Board of Water Supply considers it impossible to answer any of these questions at the present time.

The Annual Report of the Panama Canal Operations

The annual reports of the Isthmian Canal Commission, which have appeared regularly since the United States Government assumed control of the work, are now completed with the report for the year ending June 30, 1914, just made public. The present report, in fact, is made by the Governor of the Canal Zone, Col. Geo. W. Goethals, the official existence of the Isthmian Canal Commission having been terminated on Apr. 1 last.

Under the present organization, the Governor of the Zone is in charge of the Department of Operation and Maintenance of the Canal, assisted by an engineer of maintenance and a superintendent of canal transportation, these positions being now held respectively, by Col. H. F. Hodges and Capt. Hugh Rodman, U. S. N. To carry on the remaining construction work as well as work in connection with maintenance and operation, a division of terminal construction was organized in charge of Admiral H. H. Rousseau, U. S. N. The work previously done by the Quartermaster's department and the Subsistence department, is now in control of the Supply department under Capt. R. E. Woods. Other divisions of the organizations are an accounting department and a health department. Work in connection with the civil government of the Zone is under charge of an executive secretary.

The past year has been notable for the practical completion of the construction work. The amount of concrete laid in the Gatun locks aggregates 2,067,731 cu.yd., and the average cost has been $7.21 per cubic yard. Concerning the Gatun dam, whose safety and water-tightness were the theme of so much discussion in engineering circles seven or eight years ago, the report states that seepage from the dam has been negligible. At the close of the rainy season two small streams were found issuing from the north toe of the dam in the west portion, but with the advance of the dry season these ceased entirely.

In the main portion of the dam there was no seepage of any kind apparent.

In the Pedro Miguel locks the total amount of concrete laid has been 928,326 cu.yd., and the average cost was $5.60 per cubic yard. In the Miraflores locks there has been placed 1,707,794 cu.yd., at an average cost of $5.17 per cubic yard. The entire cost of the gates for all the locks has been a little under six and one-half million dollars, of which the contractor for the gates received $5,663,000, and the balance (a little less than $840,000) was paid for inspection, painting, fixed steel, etc. The action of the gates in service has been entirely satisfactory, the leakage at the quoin and miter posts being extremely small.

The report gives information of especial interest relating to the experience with the paint with which the lock gates are covered. Great pains were taken in the specifications for the painting and in the application of the paint, three and four coats being used, the materials being red lead, graphite, United States Navy anticorrosive, and anti-fouling paint, a damp-proof paint, and a hydro-carbon mixture. An abstract of this part of the report appears in the next column under a separate heading.

The machinery installed for the operation of the locks has cost a very large sum of money. A few of the items are as follows: Gate-operating machines, $822,000; electrical appliances for gate machines, $207,000; rising-stem valves and guard valves and machines, $1,509,000; cylindrical-valve machines, $228,000; chain-fender machines, $831,000; spillway gates, $438,000; towing tracks and material, $1,182,000; towing locomotives, $527,000; hydro-electric plants, $628,000; high-power transmission line, $1,014,000. Very considerable sums must be added to these totals for the substations and other items of machinery and electrical equipment. The emergency dams above the locks at the summit level have been completed and tested. As many of our readers will recall, they are similar in general design to those used in the United States ship canal at Sault Ste Marie. They are intended to provide a means for shutting off the flow of water through the locks in case by some accident the lock gates should be destroyed in the upper lock, allowing a continuous flow of water from Gatun Lake. A test was made of the emergency dam at Gatun in May last. With a full head of [illegible] ft. of water against the emergency dam, it was found to have a leakage of [illegible] cu.ft. per second. This leakage did not produce a dangerous current in the locks and it would have been easy to close any of the lower gates in the face of the stream. It was evident, however, that the emergency dam could not be used instead of a caisson for unwatering the locks. Experiments are being made to devise a means of stopping the leakage.

Three central air-compressing stations at Empire, Balboa and Rio Grande were operated during the year, with outputs and cost as follows:

Plant	Output Cu.Ft.	Cost per M Cu.Ft.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Rio Grande	[illegible]	[illegible]

Earthquake shocks at Panama have been more numerous than in any year since the American occupation. [illegible] distinct shocks were recorded at Ancon. Two shocks during the year were severe enough to throw the recording pens of the seismograph off the record. One of these shocks caused slight damage to the new Administration Building under erection at Balboa. No other damage was done to the canal works.

The steam-shovel excavation in Culebra Cut to June 15, 1914, aggregated 110,262,000 cu.yd., at an average cost of 70.6c. per cu.yd. Of this amount over 25,000,000 cu.yd. were removed because of slides. Of the dredging work done in Culebra Cut since water was admitted, 3,402,000 cu.yd. were removed during the year, of which 919,000 cu.yd. were earth. The average cost was 52c. per cubic yard.

The total net cost of the Panama Canal to the government of the United States, including the amount paid to the French canal company and the Republic of Panama and including the appropriation made Aug. 1, 1914, now stands at $353,559,000.

Experience with Paint on the Panama Canal Lock Gates

The enormous steel gates on the Panama Canal locks have cost the government nearly six and one-half million dollars. The lower portions of these gates are immersed in water. In the lowest locks, the water contains a large percentage of salt from the ocean. The fresh water in Gatun Lake, which flows through the locks, moreover, is heavily charged with vegetable acids from the extensive swamps submerged by the lake.

Under these conditions it was realized in advance that the protection from corrosion of the portions of the gates under water would be a very severe test of the paint applied to the gates. Moreover, those parts of the gates which are above water are exposed to much more severe conditions than exist in the climate of the temperate zone on account of the extreme heat and moisture which prevail at Panama.

Engineers interested in the preservative qualities of paints, therefore, will be much interested in the annual report of Colonel Goethals, Governor of the Canal Zone, just made public, in which the experience thus far obtained with the paints on the lock gates is summarized. We reprint this portion of the report in full as follows:

The original contract provided that the contractor should paint the gates with two coats of red lead at his expense, and with a third coat of some other pigment to be furnished by the Isthmian Canal Commission, applied to the gates at the contractor's cost. To provide for more complete protection, this agreement was modified and at Gatun arrangements were made for an additional coat, making two of red lead and two others instead of one. These additional coats consisted of one of United States Navy anticorrosive and one of antifouling paint, and were applied to those parts of the gates in the lower locks which are constantly under water. On the remaining gates at Gatun two coats of equal parts of graphite and red lead were applied.

It was intended that no red lead should be used at Pedro Miguel except for the upper guard gates, the protection to consist of three coats of damp-proof paint. At Miraflores the gates in the lower lock from elevation [illegible] to the bottom were to be given two coats of red lead, followed by one coat of anticorrosive and one coat of antifouling paint. All the other gates were to be given three coats of a proprietary paint consisting of a hydrocarbon mixture.

On account of delay in receipt of the damp-proof paints intended for use on the Pedro Miguel gates, some of these were painted with hydrocarbon paint from Miraflores and conversely a few of the Miraflores gates were painted with damp-proof paint. In all of these cases the third and fourth coats were applied by the Commission forces.

Due to impurities in the water of Gatun Lake some of the [illegible] the bitumastic which was applied directly to the metal on small portions of several of the gates of Gatun, has proved satisfactory, and the paint on those gates which are constantly under water is in very good condition.

An Unusual Type of Storm-Sewer Outlet at Passaic, N. J.

By R. F. Odell*

The unusual storm-sewer outlet here described was designed in the spring of 1914 by the writer.

In improving the street where these outlets are located, it was found necessary to make some permanent provision for caring for the storm water concentrated at this point by a 24-in. vitrified pipe sewer. This sewer had been designed several years earlier to carry the surface drainage of an area of about 40 acres of partially improved land with an average slope of 20 ft. per 1000. As there was no suitable place of discharge available at the time, an outlet into the street gutter was constructed at the point shown by Fig. 1.

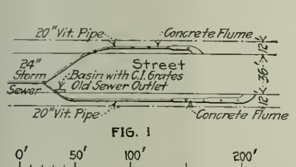


FIG. 1

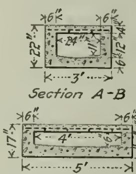


FIG. 3

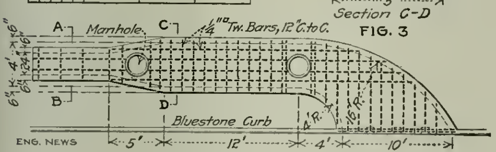


FIG. 2

This outlet was constructed in the form of a catch basin, into which the 24-in. sewer discharged. The point at which the pipe ended was about 5 ft. below the opening at the surface of the street. In times of heavy rains, the great volume of water rushed into the basin with such force as to lift the heavy cast-iron grates completely off the opening, tearing up the roadway and cobble gutters and causing considerable other damage.

When it was decided that the street be improved, including the paving of the road with asphalt-bound macadam, the advisability of constructing a relief sewer discharging into a nearby stream was discussed. It was finally decided that it would be necessary to adopt some other method, and the one here described was followed.

As shown in Fig. 1, two lines of 20-in. vitrified sewer pipe were laid from the existing manhole at the end of the 24-in. line to a point beneath the center line of the flagging on each side of the street. From these points, reinforced-concrete flumes were constructed leading to the gutters. In order to keep the grade of the flumes to the minimum allowable slope of 0.5 in 100, and to bring the two grades, of sewer and gutter, to a proper intersection, it was necessary to place the outlets at some distance from the old opening, as shown in Fig. 1.

The method of reinforcement and a plan of the flumes is shown by Fig. 2, and in Fig. 3 are shown sections at two designated points. A shallow section was necessary owing to the short distance between the run of the flume and the surface of the sidewalk. This was compensated by increasing the width as shown. It may be well to remark here that where shallow outlets or flumes of this type are constructed, it is quite necessary to place manholes or other suitable openings at close intervals to facilitate cleaning and inspection.

At the time the outlets were designed, the objection was raised that the velocity at the openings at the curb might be so great as to cause the water to rush into the street a considerable distance, and perhaps cause as much trouble as the old method. The outlets are, however, giving very satisfactory service, and have as yet shown no fault in either design or construction.

The writer personally knows of but one other flume or outlet of this type, but has heard of one or two others in this vicinity. The present city engineer, Colin R. Wise, was the first to use the idea in this section. The work was done under the writer's direction by the De Vogel Contracting Co.

*Assistant Engineer, City of Passaic, N. J.

A Novel Street-Cleaning Plan for New York City

A well conceived plan for removing snow from the streets of New York City in the winter of 1914-15 was presented to the Board of Estimate and Apportionment for approval under date of Nov. 10 by J. T. Fetherston, Commissioner of Street Cleaning.

Novel features of the plan are "snow fighting" to prevent an accumulation of snow; the largest possible use of the sewers of the city to convey the snow to the waters surrounding the city; and an emergency force of 15,000 men per shift of eight hours. Besides removal through the sewers, cart haulage by contract would be employed. In some sections, instead of removal the snow would be pushed from the center of the streets by motor-driven or horse-drawn plows. Apparently the plan also contemplates the use of the sewer to carry away snow removed by the street-railway companies from between their tracks.

An important factor would be the assignment to snow-removal work of men from other city departments, including extra clerks, inspectors, checkers, etc. The police would render aid in calling out the emergency force.

As an inducement to secure emergency men and efficient work, high rates of pay are proposed, with the choice between 30c. per hr. for regular work and 40c. per hr. for a set task accomplished within a time limit. Regular employees of the street-cleaning department working overtime would be paid regular wages for overtime, "and in addition, if the set tasks are accomplished within the time limits specified," 50% extra. To encourage men from other city departments to accept snow-work assignments, the plan provides for paying them 50% above their regular wages or salaries.

The snow schedule for 1914-15 covers a total length of 734 miles of streets and a total area of 25,830,743 sq.yd., in the boroughs of Manhattan, the Bronx and Brooklyn. Of these totals, it is proposed to use the "snow-fighting" force (to keep the snow from accumulating) on 542 miles, or 19,106,437 sq.yd.; the "snow-removal" or "contract schedule" on 94 miles, or 3,304,009 sq.yd.; and the "street-railway schedule" on 97 miles, or 3,420,297 sq.yd.

An analysis of the snowfall records for the years 1905-11, inclusive, shows the following:

	Maximum	Average
Number of storms per winter	7	4
Duration of single storm, hr.	33	13.5
Rate of fall per hour per storm, in.	0.9	0.5
Depth of snow per winter, in.	42	21.3

Conclusions Drawn from Official Test of the San Francisco Refuse Incinerator

A note to the effect that M. M. O'Shaughnessy, City Engineer of San Francisco, had recommended the rejection of the Islais Creek refuse incinerator after a test to determine whether it fulfilled the contract requirements, appeared on p. 1041 of our issue of Nov. 19. The conclusions on which this recommendation was based, as summarized by Mr. O'Shaughnessy in his official report, are printed below.

Although our note of Nov. 19 stated that the cost of incineration was in excess of the contract guarantee, the last paragraph of the quotation from Mr. O'Shaughnessy's report, given below, states that the cost guarantee "is fully met." It appears from the report that the actual cost of operating the incinerator was $1.33 per ton, as stated in our note of Nov. 19, but that after allowing for (1) steam produced, (2) excessive labor cost due to lack of refuse to operate the furnaces 22 out of 24 hours, and (3) the amount paid the city by scavengers for refuse delivered to the furnace, the contractor's guarantee of [illegible] per ton of profit is considerably exceeded.

Mr. O'Shaughnessy's summary of conclusions drawn from the tests of the incinerator is as follows:

The plant does not meet the first guarantee that no nuisance is created in its normal operation.

The plant does not meet the second guarantee that no [illegible] gases, smoke or dust escape from the [illegible] or the chimney.

The plant does not meet the third guarantee in the requirement that the temperature in the combustion chambers shall at no time fall below [illegible]° F. It does meet this guarantee in that the average temperature maintained in the combustion chambers is in excess of [illegible]° F.

The plant does not fully meet the fourth guarantee that the residue from the furnaces shall be thoroughly burned [illegible] and free from organic matter.

The plant fully meets the fifth guarantee that the furnaces, [illegible], furnaces and combustion chambers shall be so arranged that it shall not be necessary to shut down any one unit for more than [illegible] hr. in any one week in order to [illegible] clinkers, dust and ashes.

The sixth guarantee that the pounds of refuse per hour [illegible] will be incinerated per square foot of grate area shall not be less than stated in the contractor's bid is fully met.

The seventh guarantee that the average cost per ton at such plant for incinerating refuse shall not be greater than stated in the contractor's bid is fully met."

In his letter transmitting the report from which the foregoing conclusions are taken, Mr. O'Shaughnessy recommended the rejection of the incinerator, under a contract provision to the effect that if the plant did not fulfill all the contract guarantees the city might refuse to accept the plant, in which case the contractor should return to the city within 30 days all money paid to him by the city on account.

On Monday, Nov. 23, a protest against this recommendation was lodged with the Board of Public Works by the contractor, the [illegible] Co., of New York City.

[illegible]

Ohio State Highway Contracts [illegible]

[illegible]

NEWS NOTES

A Severe Freight Wreck at Harward's Station, Me., which officials of the Maine Central R.R. claim to be the worst in the history of the road, occurred on Nov. 17. Of the 50 cars in a westbound train, 31 were piled up when a car wheel broke.

A Steamship Collision in New York Bay occurred when the 26,000-ton outward-bound White Star steamship "Baltic" passed too closely on the port side of the 3000-ton "Comal," of the Mallory Line, bound for Galveston, Tex., on the afternoon of Nov. 18. The "Baltic" had drawn up abeam of the smaller vessel and was leaving her astern, when the "Comal" swerved in, her bow raking along the side of the "Baltic," due to the suction caused by the passage of the big steamer. Although she was not leaking, the bow plates and a deck beam of the "Comal" had buckled. The "Comal" returned to her pier and arrangements were made for sending her 60 passengers to Galveston by train. The "Baltic" was uninjured and continued her voyage.

Two Water Mains Were Broken in Greater New York, one in Varick St., Manhattan, that flooded the new Seventh Ave. subway excavation, and the other in Brooklyn, as the result of a heavy rainfall on Nov. 1[illegible]. At Varick and Canal St. a 20-in. main which had been undermined broke, causing a 12-in. high-pressure pipe to give way. The foundation of a 10-ft. sewer on Canal St. was scoured, cracking the piping and permitting the water inside the sewer to issue into the excavation at the Canal St. end, to a depth of 20 ft. The water in that district was turned off as soon as possible and the high-pressure main repaired. Three hours after the break, the 20-in. main had been repaired. Cobblestones were then dumped into the excavation to form a foundation for the replaced sewer, and a temporary connection made to stop the flow into the excavation. The break in Brooklyn was in a 36-in. water main on Bushwick Ave. Sidewalks were ripped up and holes torn in the street, cellars were flooded, and the water stood at street intersections in some places 3 ft. deep. The rush of water from a sewer main through a temporary wood flume in the excavation of the Flatbush Ave. and Eastern Parkway subway, Brooklyn, tore out the sides of the flume, on the same night, and for more than three hours water poured into the excavation, which was filled to a depth of 8 ft.

The East Approach to the Municipal Bridge across the Mississippi River at St. Louis is at last to be built. On Nov. 3 a bond issue of $2,750,000 was authorized by vote of the citizens of St. Louis; this bond issue had been defeated at the three previous elections. For two years the rest of the bridge has been completed, awaiting the east approach. The new construction will consist of a steel trestle, including a combined railway and highway approach [illegible] ft. in length, a railway approach [illegible] ft., and a highway approach [illegible] ft. in length. Plans are in preparation and work will probably start within the next 90 days. No contracts have been prepared to date.

Exhibition of Street Cleaning Machinery and Apparatus—A very interesting and instructive exhibit of apparatus for cleaning streets is being held at the Armory of the First Battalion of Field Artillery, [illegible] St. and Broadway, New York City, during the present week. About [illegible] manufacturers are exhibiting the most recent types of [illegible] street cleaning machinery, covering all kinds of apparatus from [illegible] to the largest automobile trucks and [illegible] street flushers. On Monday, Nov. [illegible], there was a street parade of exhibits and of the city's street cleaning forces. Each day of the exhibition there are band concerts, [illegible] pictures and lectures. The exhibition is being held under the auspices of the New York City Department of Street Cleaning, of which John T. Fetherston is chief.

The Panama Canal Construction has received the [illegible] [illegible] Canal [illegible] [illegible] West Indies, and [illegible] Central America. [illegible]

now out of work. The total number of European laborers employed by the Panama Canal and the Panama R.R. at present is about 1200.

The Cleveland Lake-Front Case has been decided in favor of the city and against the railway companies, after 21 years of litigation. The decision, which was rendered by the United States Supreme Court, on Nov. 16, gives the city possession of 30 acres of land claimed by the Cleveland & Pittsburgh, the Pennsylvania, the Cleveland, Cincinnati, Chicago & St. Louis, and the Lake Shore and Michigan Southern railways. The railways claimed title to the land under a 99-year lease made in 1849, granting the right to lay tracks on what is now West Ninth St., for which right the city was paid $100,000. Subsequently, the city filled in the lake to the north of West Ninth St. The railways claimed the filled land, but the United States Supreme Court holds that the city has title to all improvements made since 1897. The city now has possession of the lake front from West Ninth St. to the mouth of the Cuyahoga River, with the exception of that part lying between West Ninth St. and West Third St.

Bridge Reconstruction, Kansas City—The Mercantile Club, of Kansas City, Kan., held a meeting on Nov. 10, to determine the consensus of opinions of different bodies and associations who are interested in the reconstruction of the Central Ave. bridge across the Kaw River. This bridge is a double-deck structure carrying the Metropolitan cars overhead and a traffic way underneath. Owing to the fact that the bridge does not comply with the requirements of the drainage Board as to length, height above levees, etc., it has been ordered reconstructed by Judge Smith. The Metropolitan engineers have made an estimate of $115,000 on cantilever type, using the present two piers by extending them down below possible scour line. County Engineer L. R. McAlpin has made an estimate of $300,000 on the same type of bridge as is there at present. This would require two new piers and three new spans. The real-estate men and residents adjacent to Central Ave. have formed an association and are demanding a high line bridge which, it is estimated, will cost $450,000. No action has as yet been taken in this mater.

The First Brick Road in Montgomery County, Ohio, was recently completed, as a part of a projected outlay of $180,000 to be expended on similar roads radiating from Dayton, the county seat. The road is one of four radiating main market and intercounty highways. The first, the Covington road improvement, is little more than a mile in length. Two and a half miles of paving is under way on the Dayton-Cincinnati route, a trifle less on the Dayton-Troy road (a part of the through route to Toledo), and one mile on the Dayton-Greenville road. An additional mile and a half of the last named road will be graded this year in preparation for a brick surface next year. This year's program entails the expenditure of about $180,000 owing to difficult grades which have been reduced and the generally substantial scale of the undertaking. Of this, the state is furnishing one-half, a recognition of the extent of the through traffic which is destined to use these main market intercounty roads. The remaining 50% of cost is divided so that 25% falls on the county, 15% on the various townships and 10% upon the owners of adjacent land. The work has been done under the joint direction of Division Engineer Harwood Lersch, of the State Highway Department, and Victor C. Smith, surveyor of Montgomery County.

Opposition of Organized Labor to efficiency systems of shop management was voiced at the Convention of the American Federation of Labor in Philadelphia, Nov. 16. The convention adopted a resolution urging the Executive Council to continue its efforts to have abolished so called efficiency systems by which workmen are speeded up. Another resolution adopted urged that effort be made to have the federal eight-hour law made to apply to the manufacture of all materials used in government work. The ruling of the Attorney-General has been that the eight-hour law does not apply to the manufacture of materials which the government may purchase for its own use. The Federation will attempt to secure a contrary decision from Attorney-General Gregory, and if this is unavailing an effort will be made to amend the law. The Federation further went on record in regard to workmen's compensation laws with the demand that at least 66⅔% of wages should be the rate paid to relatives of workmen killed during their employment. The compensation should be paid to the widow during her widowhood and to children under eighteen years of age. The convention further favored the prohibition of employer's liability insurance companies and also permission to employers to carry their own insurance, thus making state insurance compulsory. To prevent discrimination against married men by employers engaging help, the convention voted to recommend that where a workman who is killed has no wife or other dependent, the compensation should be paid to the state.

Railway Valuation in the United States will cost about $12,500,000 to complete, according to a statement by Judge Chas. A. Prouty, Director of Physical Valuation, at the annual convention of the National Association of Railway Commissioners on Nov. 19. The valuation of the telegraph lines will cost $1,000,000 to $1,250,000 more. Regarding the probable use of the valuation when made in fixing rates and its possible use as the basis of government purchase, Judge Prouty said:

This valuation is national, but is to be made along State lines. When completed, it undoubtedly will supersede all state valuations that have been made. It will be the basis for the making not only of interstate, but of state freight rates.

Probably the most important practical question before this country today is its treatment of our railroads. Is the Government to take over these agencies of transportation, or shall they be left to the operation of private capital? Assuming that we are to leave the discharge of this function to private enterprise, what rates shall be accorded in order that the present investment may be fairly dealt with and that such further investment will be induced as will render possible the proper development of these facilities?

In the past this question has not been acute, for rates have been sufficient to maintain railroad credit, but it is evident that the time is close at hand, if it is not already here, when there is grave doubt as to whether these rates must not be generally increased. This question cannot be satisfactorily answered until there is a national valuation of these properties.

Consider the enormous amounts involved. An error of 6 or 7% in the valuation means nearly or quite a billion dollars. The interest at 6% on that sum is $60,000,000. Whether this valuation is to be used as the basis of rates to be allowed these carriers and paid by the body of our people, or whether, perchance, it may become the measure of the price to be paid by the Government for this property, that error would mean either to the railroads or to the people every year three or four times the cost of the entire valuation.

PERSONALS

Mr. Floyd F. Woods has been appointed Sales Manager of the Epping-Carpenter Pump Co., Pittsburgh, Penn., succeeding Mr. R. Bowen, resigned.

Mr. George W. Hunt, formerly President and General Manager of the Canadian Asphalt Co., Ltd., has been appointed Sales Manager for John Baker, Jr., dealer in asphalt, bituminous products and road oils, 10 South La Salle St., Chicago, Ill.

Mr. Thomas E. Mitten has been elected President of the Philadelphia Rapid Transit Co., succeeding the late Charles O. Kruger. Mr. Mitten has been Chairman of the Executive Committee since 1911. He was formerly President of the Chicago City Ry.

General Hartwig von Beseler, the German commander who besieged and captured Antwerp, has been awarded the degree of Doctor of Engineering by unanimous vote of the faculty of mechanical engineering of the Technical High School of Hannover.

Mr. H. C. Hequembourg has resigned as General Purchasing Agent of the American Locomotive Co., New York City. Until further notice the purchasing and storekeeping departments will be under the jurisdiction of Mr. Leigh Best, Vice-President.

Mr. Edward M. Bigelow, M. Am. Soc. C. E., State Highway Commissioner of Pennsylvania, who was recently indicted by the authorities of several Schuylkill County townships for alleged criminal negligence in not caring for certain roads, has won his case and the indictment has been quashed. The court held that evidence showed the State Highway Commissioner had done his best in apportioning state funds to the townships, and that his action was in no way criminal.

Col. H. G. Prout, M. Am. Soc. C. E., former President of the Union Switch & Signal Co., New York City, has been elected President of the Hall Switch & Signal Co., with headquarters in New York City. Mr. Wm. P. Hall is now Vice-President and Chairman of the Executive Committee. Col. Prout was associated with the Union Switch & Signal Co. as Vice-President and General Manager for several years, and was elected President to succeed the late George Westinghouse.

Mr. Charles W. Mullen, a graduate in civil engineering of the University of Maine, class of 1883, and for several years actively engaged in engineering construction work, has been nominated a member of the Maine State Public Utilities Commission, in place of Samuel W. Gould, of Skowhegan, whose nomination the legislature refused to confirm. The Bangor "Daily News" states that the opposition to Mr. Gould was based largely upon the widespread belief that the board should not be composed entirely of lawyers. Mr. Mullen has been twice Mayor of Bangor, and is a prominent business man of that city.

Mr [illegible] M. Am. Soc. C. E., has resigned as Chief Engineer of the [illegible] Bridge Co., Montreal, Que., to become [illegible] of [illegible]-of-Way of the New York Rys., succeeding Mr. [illegible] T [illegible], M. Am. Soc. C. E., whose resignation was noted in our issue of Nov. 5. Mr. [illegible] was associated with [illegible] & Porter, Engineers and Contractors, New York City, until February, 1913, when he went to Montreal. From 18[illegible] to 19[illegible]2 he was Chief Engineer of the Manhattan and [illegible]borough Bridges, New York City, and from 19[illegible] to 19[illegible] was Consulting Engineer in charge of [illegible] bridges.

Mr. [illegible] F. Wilcox has recently been appointed Deputy Commissioner of the Department of Water Supply, Gas and Electricity, New York City. Mr. Wilcox was formerly Chief of the Bureau of Franchises of the Public Service Commission for the First District, New York, but since July 1, 1913, has been engaged in private practice as a consulting franchise and public-utility expert. Last summer he was employed to take charge of the valuation of the private water companies operating in New York City, such companies being subject to regulation as to rates and services by the Commissioner of the Water Department. In addition to the regular duties of his new office Mr. Wilcox will carry forward to completion this valuation work.

Mr. J. G. Sing, M. Can. Soc. C. E., has resigned as District Engineer, Canadian Public Works Department, Toronto, Ont., to engage in private practice as a Consulting Engineer. He will also continue to be Consulting Engineer of the Toronto Harbor Commission. Mr. J. M. Wilson, Assoc. M. Can. Soc. C. E., Assistant Engineer, is Acting District Engineer. It is reported that Mr. C. H. M[illegible]newson, Assoc. M. Can. Soc. C. E., present Resident Engineer on the Canadian Government work for the improvement of Toronto harbor, will temporarily assume charge of the Government's share in the work, which involves an outlay of $7,[illegible]0. Mr. Sing has been District Engineer for the past ten years and as such has had charge of harbor work in eastern and northern Ontario, including practically all the waterfront on the Great Lakes.

OBITUARY

C. W. Cooper, a levee contractor of Lake Providence, La., was crushed to death in an automobile accident at Waterproof, La., Nov. 6.

[illegible] Freeman Day, former Vice-President and Manager of the Minneapolis & St. Louis R.R. and the Iowa Central Ry., died Nov. 15. He was 66 years old.

W. W. Cain, a bridge contractor for the Chicago, Rock Island & Pacific Ry., was struck and killed by a train at [illegible], Colo., Nov. 2. He was a resident of Denver, Colo., and widely known as a [illegible] owner.

James L. [illegible], a [illegible] civil engineer of Vancouver, B. C., was killed recently on a hunting trip in British Columbia. He was 28 years old, a native of Denver, Colo., and a civil engineering graduate of the University of Denver.

[illegible]

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Nov. [illegible]-Dec. 1. Annual meeting at New York. Secy., W. H. [illegible], 154 Nassau St., New York City.

AMERICAN PUBLIC HEALTH ASSOCIATION.
Nov. 30-Dec. 5. Annual meeting at Jacksonville, Fla. Secy., Prof. S. [illegible] M. Gunn, Massachusetts Institute of Technology, Boston, Mass.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 1-4. Annual meeting at New York City. Secy., Calvin W. Rice, 29 W. 39th St., New York City.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 2-4. Convention at Washington, D. C. Secy., D. Knickerbacker Boyd, The Octagon, Washington, D. C.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.
Dec. 7-10. Annual meeting in New York City. Secy., Percy H. Wilson, Bellevue Court Bldg., Philadelphia, Penn.

AMERICAN MINING CONGRESS.
Dec. 7-11. Annual meeting at Phœnix, Ariz. Secy., J. F. Callbreath, Denver, Colo.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.
Dec. 9-12. Convention at Richmond, Va. Secy., C. A. Prosser, 140 W. 42d St., New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Dec. 10-11. Annual meeting at New York City. Secy., D. H. Cox, 29 W. 39th St., New York City.

AMERICAN ROAD BUILDERS' ASSOCIATION.
Dec. 14-18. Convention at Chicago, Ill. Secy., E. L. Powers, 150 Nassau St., New York City.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Dec. 28-30. Annual meeting at Chicago, Ill. Secy., F. M. White, Madison, Wis.

American Iron and Steel Institute—At the annual convention, recently held in Birmingham, Ala., it was decided to hold the 1915 meeting at Youngstown, Ohio.

Washington (D. C.) Society of Engineers—The annual dinner of the Society was held on Nov. 19. The attendance was about 250. The Secretary is John C. Hoyt, 1330 F St. Northwest.

New York Section of American Water Works Association—The third meeting will be held at the Manhattan Hotel, New York City, on Dec. 3, at 12:30 p.m., when lunch will be served.

Northwestern Road Congress—The officers elected at the annual meeting at Milwaukee, Wis., were: President, George W. Cooley, State Highway Engineer, St. Paul, Minn.; Vice-Presidents, John Hazlewood, Madison, Wis., F. C. M[illegible], Springfield, Ill., and Otto Albertus, [illegible]nd, S. D.; Secretary-Treasurer, James P. K[illegible]enan, Milwaukee, Wis. A report of the meeting was given in our issue of Nov. 5.

Cleveland Chapter of the American Institute of Architects—At the November meeting of the Chapter, in the Hotel [illegible], Cleveland, it was resolved to recommend to the [illegible] General Assembly of Ohio the passage of a law recommending the practice of architecture, with the purpose of [illegible] the profession upon the same [illegible] as the professions of law and medicine; in general, the law to admit men to the practice of architecture by examination and to confer upon them the right to use the title of architect.

Illinois Water Supply Association—A special meeting was held in Chicago on Nov. 11 to take steps for affiliating with the American Water Works Association, as the Illinois section of the latter. This was in accordance with a ballot vote of the association, with a large majority in favor of such affiliation. [illegible]

City Managers' Convention—[illegible]

Engineering News

VOLUME 72 DECEMBER 3, 1914 NUMBER 23

The Floating Caisson for the Panama Canal Locks

By Lewis A. Mason*

A huge floating caisson or gate for the Panama Canal locks was recently towed from San Francisco to the canal. Its object is to close the entrance to any of the lock chambers when the miter gates are to be painted or repaired, or when the culvert gates are to be inspected.

This caisson, designed by the writer, is believed to be the largest one ever constructed. It cost $335,000 and was over a year in building; the Union Iron Works, San Francisco, constructed it. Towing the caisson to Panama was a considerable undertaking in itself, requiring 43 days. Launching took place on July 25, 1914, and the trip to Panama started Sept. 16.

The clear width of the lock chambers is 110 ft. Beyond the line of the emergency dams the approach is widened by an offset of 3 ft. on either side. The shoulders so formed, with the connecting horizontal sill across the bottom of the chamber, will serve as a seat for the caisson. When the caisson has been floated to place in the recess, water is let into its lower compartments, causing it to sink until properly seated. After this is accomplished, pumps in the caisson unwater the lock chamber, while the water pressure from the outer side of the caisson will force it securely against its seat in the masonry. When it is desired to remove the caisson the lock chamber is filled with water by opening the culverts within the lock walls; this relieves the pressure against the outer side and the water within the caisson is then pumped out to allow it to be floated away.

The caisson is designed for use at all of the 12 lock entrances, and the entrance to the permanent dry dock at Balboa, which also has mitering gates of the same type as the locks. It has a light draft of 32 ft. to allow its convenient handling through the various locks. The top of the sill at the Pacific end of the Miraflores locks is 50 ft. below mean sea level; the tidal fluctuation, which raises the level of the water as high as 11 ft. above mean tide, requires that the caisson be sunk to a draft of 61 ft. when used at high tide. Provision for a proper freeboard makes the aggregate depth of the structure 66 ft. The achievement of statical stability at the various depths of immersion without undue bulkiness or excessive weight in the different drafts makes the caisson of especial interest.

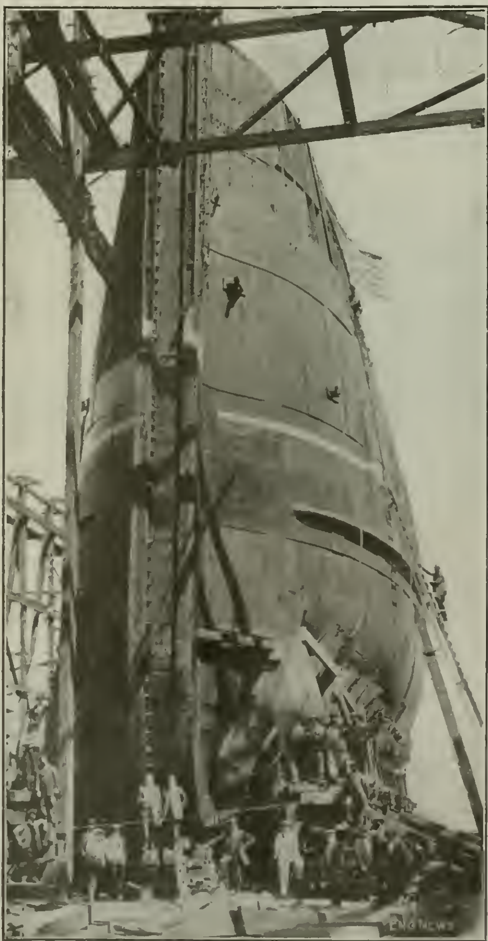


Fig. 1. Bow View of the Gate Caisson for the Panama Canal Locks on Launching Day (July 25, 1914)

(Union Iron Works, San Francisco, Calif., builders.)

In form the caisson has convex bottom, pointed ends, and sides sloped inward from the maximum width of 36 ft. (at about one-third the way up from the keel) to a breadth half as great at the top deck (see cross-section, Fig. 2). The water-line sections resemble those of merchant ships, but are more blunt at the ends on account of the vertical end girders or stems. The length is 112 ft. 6 in. between perpendiculars, and 113 ft. 10 in. over all, including the timber cushions.

Structural Design

The water pressure against the caisson (when

*Assistant Designing Engineer in office of Engineer of Maintenance of the Panama Canal, Culebra, C. Z.

acting at point is transferred to the gate recess by horizontal decks and breasthooks (short decks between the main decks at the ends). A system of vertical framing built intercostally, extending from the keel to the top deck, transmits the point loading to the various decks and cross-frames.

The essential features of the structure are the transverse and longitudinal framing, with bulkheads; the horizontal plate decks, girders and stringers; the girders at the vertical ends and along the keel; the end breast-hooks, and the sheathing plates to cover the skeleton for forming the hull proper. The material of the structure is openhearth structural steel.

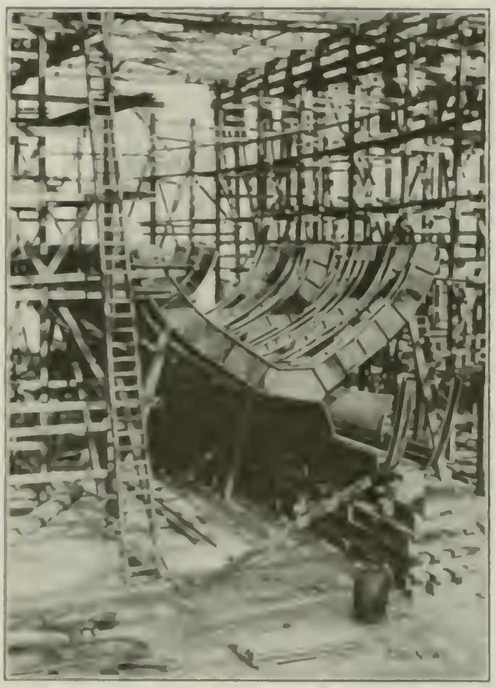


Fig. 2. Keel and Part of Lower Framing in Place (Feb. 24, 1914)

Nine cross-frames spaced 12 ft. apart, extend the entire length of the caisson; intermediate frames are spaced 2 ft. apart between the main cross-frames. All are built intercostally between the five horizontal decks. The last cross-frame at each end is made water-tight, to form peak trimming tanks for maintaining a level keel. The seven other cross-frames serve as swash bulkheads for controlling the water within the caisson.

The five horizontal decks are located, respectively, 16 ft., 25 ft., 37 ft., 49 ft., and 65 ft. above the center line of the keel plate. The 16-ft. deck forms the bottom of the trimming tank. The 37-ft. or operating deck is made absolutely water-tight; it has water-tight manholes for gaining access to the various compartments below and water-tight hatches for the removal of the pumps or valves in case it is necessary to make any repairs, etc., to them. This deck is made of sufficient strength to withstand a hydrostatic head of 25 ft. Upon it are placed the various motors for operating the pumps, the switchboard, the water gages, chain lockers, etc. The 49-ft. deck is of open-truss construction, having diagonal bracing for the central two-thirds of its length and plating covering the ends. Six breasthooks or short decks between the main decks transmit part of the loading to the vertical end girders. In addition there are two lines of longitudinal intercostals located equidistant between the keel and the 16-ft. horizontal deck, securely riveted to the transverse frames and to the sheathing.

Steel castings at the ends of the decks and breasthooks transmit the water loads to the vertical end girders.

The sheathing is composed of longitudinal plating, worked in in-and-out strakes, making lap seams and butt joints which have double splice plates. Around all of the openings in the plate decks and in the sheathing, doubling or reinforcing plates are fitted. To protect the sheathing when manoeuvering the caisson near the lock walls, fenders are provided on the exterior of the sheathing along the 25-ft. and 49-ft. levels and vertical fenders are placed between the horizontal ones at seven of the main cross-frames. The fenders are built of bent plates, so-

Fig. 3. The Caisson Starting from San Francisco for Panama

[illegible]

curely riveted and calked to the sheathing plates; the space between is filled with "Petrolastic" cement (a by-product of crude oil; specific gravity 1.02, expansion at temperature of 110° 0.0018, melting point 150° to 200° F.).

Because of the long towing distance from its place of building, two large towing rings are fastened to the sheathing and to the 43-ft. breasthook at both ends and on each side of the caisson. As a means for towing the caisson from its mooring position to any one of the lock sites, three towing rings are riveted at the level of the 37-ft. horizontal deck on both sides of the caisson.

Along the exterior of the keel and the vertical ends, channel-shaped steel castings are securely riveted to the keel, vertical ends and sheathing. Into these, cushions of British Guiana greenheart and Australian ironbark timber are fitted and bolted. Similar cushions are fitted along the sides of the keel and along the sides of the vertical ends, to serve as a seal against the gate recess.

Equipment

There are three portable cranes located on the top deck, one at each end of the caisson and one in the center. The two end cranes, capable of raising 3000 lb. at a radius of 14 ft. by two-man power, are to be used for lifting various loads from the lock walls, as well as for handling the electric power cables. The middle crane is a little heavier in construction than the end cranes, being capable of raising or lowering a load of 3000 lb. at a radius of 25 ft. by two-man power. This crane will handle the pontoon, stowed on the top deck, when it is desired to make the suction-pump-extension attachments and is capable of lifting the top sections of either of the two skylights. A hand-operated deck capstan is provided and placed at each end of the caisson on the top deck. The capstans are for the purpose of warping the caisson into its seat and each is capable of withstanding a pull of 10,000 lb.

To increase the draft of the caisson to a sufficient depth to insure its stability at light draft, and without any water in the ballast compartments, approximately 800 tons of permanent ballast, composed of iron punchings, concrete, etc., is placed in the bottom.

An anchor chain, made of material $1\frac{9}{16}$ in. in diameter, is provided at each end for mooring the caisson when not in service, to floating buoys in the lakes. The anchor chains are raised or lowered by means of hand-operated winches located at each end of the top deck.

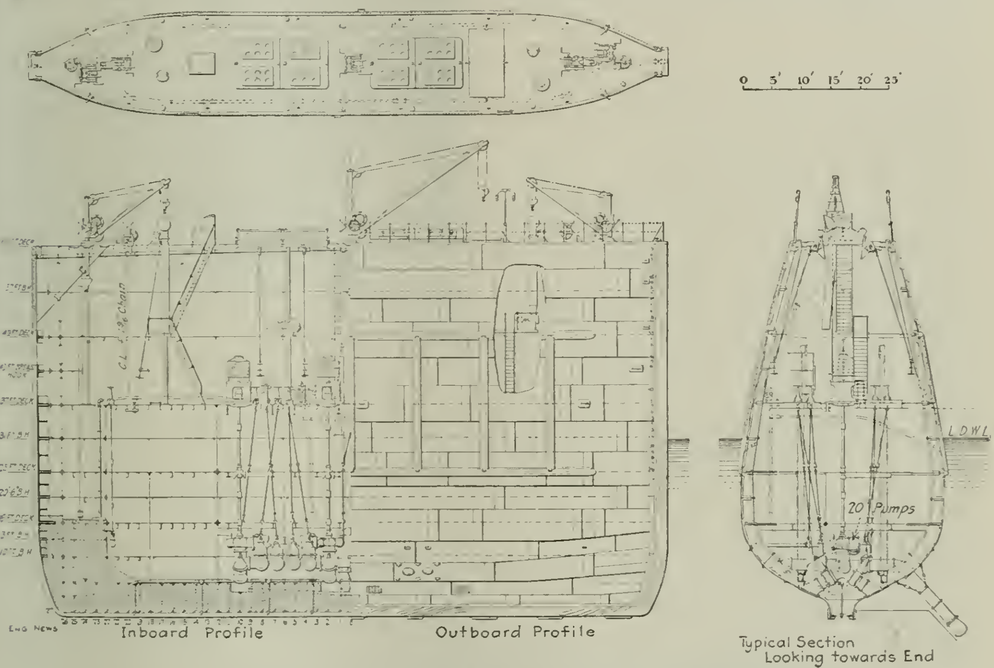


Fig. 4. General Sections, Panama Canal Gate Caisson

Pumping System

Unwatering the lock chambers (excepting the ones which may be emptied by gravity) will be done by pumps in the caisson. The only lock chambers in the canal that can be emptied by gravity are the upper lock chambers at Gatun, whose floor is $13\frac{2}{3}$ ft. above sea level.

The main pumping system consists of four vertical-shaft centrifugal pumps having a 20-in. discharge and a 22-in. suction. The capacity of the pumping system is designed so that it shall pump out in not over 25 hours' time all of the water in the upper and lower chambers of one flight of the Miraflores locks between mean sea level (El. 0) and the top of the sill of the lower chamber (El. —50), the tidal level to be at El. 0 when pumping is begun and the tide rising. The total quantity to be pumped is estimated at 10,285,000 cu.ft., including 518,000 cu.ft. for leakage through the valves in the lock culverts and around the sills of the mitering lock gates and the caisson sill. The pumps will take out, when operating at any stage of the tide, the water from the

dows of the lower lock, from the top of the sill (El. [illegible]) to 8 ft. below the sill, through a 22-in. suction pipe attached to the auxiliary suction inlets in the caisson, and discharging into the nearest lateral culvert in the lock chamber.

Two of the pumps have the piping systems arranged for pumping out the caisson when it is to be removed from its position against the sill.

When not in service, the four suction extension pipes are raised to cradles on the 50-ft. deck. They are handled by the large deck crane located at the middle of the top deck.

An electric horizontal centrifugal pump with 5½-in. suction and 4-in. discharge is located on the operating deck. It has suitable pipe connections leading from the suction to a manifold, and from the discharge to another manifold. From these manifolds piping is connected to the end peak trimming tanks, to the deck scuppers, to the sea and to a mud-sluicing device. The mud-sluicing device is intended to remove mud from the sill in an endeavor to prevent any adhesion to its seat when the caisson is in the act of raising.

The large pumps are driven by 200-hp. vertical three-phase induction motors wound for 25 cycles, 220 volts, and a speed of 750 r.p.m. The motors for operating the ventilating fan and the 3-in. auxiliary pump are induction motors of the horizontal type and with the same wiring as above. For lighting purposes 110-volt current is used. All of the electric motors with the exception of the one driving the [illegible] [illegible], and the switchboards for the same, are located on the operating deck, 47 ft. above the base line. All of the valves in the pumping system are operated from the same deck.

A New Hydraulic Stop Valve

By C. W. Larner*

The new type of hydraulic stop valve, invented by R. D. Johnson, Hydraulic Engineer of the Ontario Power Co., of Niagara Falls, N. Y., and being developed by the Wellman-Seaver-Morgan Co., for waterworks and

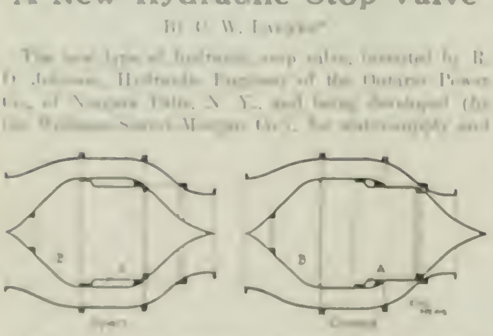


Fig. 1. Section Through a Johnson Hydraulic Valve

subsequent work is attracting widespread interest. Therefore, the following notes on design and construction are offered.

Fig. 1 shows the general arrangement of a horizontal valve of this type. It consists essentially of a circular body forming an enlargement of the pipe-line or penstock, and having an internal cylindrical chamber containing a sliding plunger. The closed end of the internal chamber and the head of the plunger are designed to guide the water smoothly as it enters and leaves the

*[illegible] Engineer, Wellman-Seaver-Morgan Co., Cleveland, Ohio.

Fig. 2. A [illegible]-Ft. Vertical Johnson Valve Built for the Ontario Power Co.

valve. The waterways throughout the valve offer no obstruction to the flow, and the loss of head is practically nothing.

When the plunger is withdrawn into the internal or operating chamber (at the left, in Fig. 1), the valve is open and presents a clear passage for the water. When the plunger is extended from the operating chamber, it seats against a ground ring in the neck of the valve body, stopping the flow. The standard control mechanism provides for only the open and closed positions of the plunger, but it may be specially arranged to hold the plunger at intermediate positions if desired.

The valve plunger is of the differential type, forming an annular chamber A within the operating chamber B. The valve is equipped with suitable vents and a control valve which admits pipe-line pressure to A and exhausts it from B to open the valve, and admits it to B and exhausts it from A to close the valve. The valve may be operated equally well in still or flowing water, and the direction of flow through the valve is immaterial. In contrast with the gate or butterfly types, it may be closed without imposing unusual stress on any part of the valve. In case of a break in the pipe-line beyond the valve, there is no difficulty in closing the latter in the usual manner and at the usual rate. There is no possibility of water-hammer.

The control valve for small valves is of the plug type and that for large valves is of the balanced-piston type. Both may be operated by hand or by electricity. All of the valves so far built have been equipped with both methods of operation. The control valve and its operating mechanism may be located at a considerable distance from the Johnson valve, if desirable. Thus, the latter can be placed outside of a power house and the control mechanism placed inside—an arrangement which may effect a large saving in the cost of a plant.

The neck of the valve body, where the plunger seats,

is made smaller than the other end which connects directly to the penstock or pipe-line. A taper section of pipe is installed between the small end of the valve and the pipe line at that end. This arrangement makes a Venturi meter out of the valve, which may be utilized for the measurement of water. Two 12-ft. valves now under construction for the Utah Power & Light Co. will have recording instruments attached to give a daily chart of the quantity of water supplied to the turbines.

Use of the Johnson design is not limited to stop valves. It may be installed for the regulation of impulse wheels in place of the usual type of needle nozzle. Then the oil or water from the governor system acts directly on the valve plunger. This is much simpler and more direct than the customary arrangement in which the plunger is mechanically operated by a regulating cylinder under governor control. Another application of this valve is for automatic pressure relief. The valve plunger is held closed by air pressure so arranged that it is automatically released and discharged when the pipe-line pressure exceeds normal by some predetermined amount. The advantage of using air pressure lies in the rapidity with which the air may be discharged, and the consequent rapid opening of the relief valve.

It is possible to arrange these valves to close automatically in case of a break in the pipe line on either side of the valve, provided the break is sufficiently bad to reduce materially the pressure at one end of the valve. This feature is of inestimable advantage for water-works service. Great damage to property has resulted in many cases from broken mains, because of the inevitable time which must elapse before the valves can be closed by hand, and the great difficulty experienced in closing gate valves under such conditions.

Periodical Levee Slip at Helena, Ark.

In our issue of Nov. 20, 1913, was given an account of the sloughing off of 1,500,000 cu.yd. of earth from one of the largest levees in the Mississippi Valley, and also some account of the history of that particular levee, which showed that sloughing off during periods of extreme low water was a regular occurrence.

Consequently it was presumed that readers would be interested in the method of reconstruction, and accordingly, in our issue of Mar. 19, 1914, a description of the rebuilding of the levee by dumping from a 20-ft. trestle was given, together with a statement by the engineer in harge defending this method, which he contended resulted in better compacting the earth than when the fill was made by teams in 3-ft. layers, in the regular way.

Be that as it may, our readers will be interested to know that during the dry season of August and September of this year, a new slip occurred in this new levee, which near the place shown in the accompanying illustrations was about 300 ft. in the rear of the old levee. This latest slip occurred at the junction of the old and new levees, or above the breaks of previous years. The estimated loss by the new slip is $20,000. It has not been possible to obtain any information about this latest slip from the engineer in charge.

Fig. 1. Sloughing Off of New Levee at Helena, Ark.; Looking North

Fig. 3. Looking South over the New $20,000 Levee Slip

Fig. 2. Looking South from the Junction of the New and Old Levees

New York Rapid Transit Railway Extensions*

By [illegible] Lavis†

VIII--Excavation

The general specifications provide for the classification of excavation as earth and rock, rock being ledge rock or place rock boulders over ½ cu. yd. Earth excavation is classified as above or below mean high water, and the prices "include the cost of the disposal of the materials excavated, of backfilling, of all decking and bridging for support of street travel, of all sheeting and bracing,

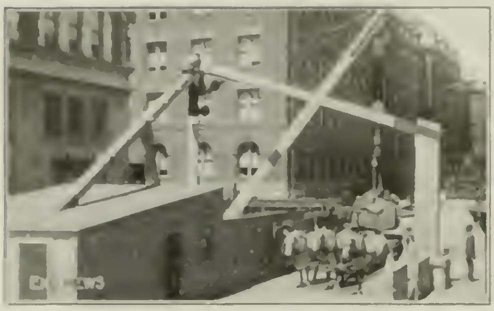


FIG. 43. DERRICK FOR HOISTING SKIPS AT 77TH ST. AND LEXINGTON AVE.

and of maintenance and supporting of [illegible] during and after excavation, of all pumping or bailing, and of the maintenance and support, with all incidental work, labor and material of any kind, of all surface, subsurface and overhead structures and surfaces." (Support of street railway [illegible] and elevated railroads is paid for separately as [illegible].) Underpinning of buildings when required is also paid for separately.

Rock excavation is paid for, for [illegible] in. outside the neat line of the [illegible] but no allowance is made on the bottom. It is required that all excavation in rock beyond the side and lines of the structure shall be refilled solid with concrete which, except for the first [illegible] in., is at the expense of the contractor, so there is every incentive to avoid excessive excavation and for the use of care in drilling and blasting at the sides.

When pipes, sewers, electric-wire conduits, etc., have to be removed and rebuilt elsewhere, the work is paid for separately. All structures of this kind, however, which do not require change have to be supported and maintained by the contractor, the cost being included in the price paid for excavation. All gas pipes are removed and placed above ground during construction and replaced afterwards, the expense being considerable of course, having to be changed each time. This work is paid for at a price bid per lineal foot for each size of pipe which has to be taken care of. The ordinary [illegible] and [illegible] in. pipes from which the house supplies are taken are usually carried along the edge of the sidewalk, on top of the [illegible] decking. The larger [illegible] and [illegible] in. mains are usually supported overhead.

In planning the excavation, it has generally been found advisable to so arrange the work that if the material is suitable, there will be sufficient left till the end to complete or nearly complete the backfill, which the specifications require shall be made with "sand, gravel or other good, clean earth, free from perishable material, or stones exceeding 6 in. in diameter, and not containing in any place a proportion of stone of or below that size exceeding one part of stone to five parts of earth."

Usually there is no opportunity to store material for this purpose, but on some sections, where there is earth, a certain portion at the ends of the section is left to be excavated after most of the structure is completed. When this is not possible, or where there is little or no earth, dependence is usually placed on material excavated elsewhere, mostly from cellars, etc., of which there is usually sufficient available at all times and in nearly all sections of New York. In one case the contractor was able to get a vacant lot for disposal of his earth excavation, conveniently located so that it will be practical to remove the material [illegible] when required and use it for backfill.

FIG. 44. GANTRY HOIST FOR SKIPS AT 121ST ST. AND LEXINGTON AVE.

The following table will give a general idea of the range of prices bid for excavation under the many varying conditions:

COST OF DIFFERENT TYPES OF EXCAVATION

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Concluded [illegible] W. [illegible].
†Consulting Engineer, [illegible] St., New York City.

The cost of supporting the tracks of the street or elevated railways is not included in the excavation price, but is paid for separately. The prices bid on the contracts thus far awarded range approximately as follows:

For the support of elevated-railway columns, from $300 to $500 each, though in one case where there were only two, the bid price was $1000 each.

For the support of main electric-railway tracks with underground trolley conduits from $5 to $20 per lin. ft. of single track. A fair average seems to be about $10.

For horse-railway tracks about $5 per lin.ft.

The excavation price does not include the relaying of the sidewalks or curb or repaving the streets, within the neat lines of the excavation; this is paid for at prices bid per square yard, for the various types of pavement. All street surfaces are first repaved with Belgian blocks and maintained by the contractor for six months, after which the final form of new pavement is laid.

Where auto-trucks are used for disposal of excavation, a storage hopper is usually provided at the head of the shaft, which will hold at least one load (or more, depending on the number of trucks in use, and the kind of material), so that there is no more delay in loading than that necessary to open the mouth of the hopper and fill the truck. The general practice seems to be to use hoppers and chutes when the excavated material is earth or a mixture of earth and boulders and to use some form of skip or bucket for rock.

On the Broadway line below 23rd St. the excavation is nearly all in earth. A small amount of rock is found in places but not enough to influence the methods. On account of the timbering and the necessary supports of the street decking, it has apparently been found most convenient and practical to handle all the material by hand. It is shoveled into buckets of about 1 yard capacity, hauled to shafts, hoisted and dumped into storage hoppers holding 25 to 50 yards, from whence it is discharged into wagons. Haulage to the water front is done almost wholly by teams, but auto-trucks are used on Section 1.

FIG. 15. TELPHER HOIST AT 74TH ST. AND LEXINGTON AVE.

The eight-hour labor law is strictly applied to all this work, no blasting is allowed between 11 p.m. and 7 a.m. and of course, all charges of explosives have to be quite light on account of danger to the timbering or adjacent buildings. On most of the work two shifts are employed, the men generally working from 6 a.m. to 2:30 p.m. and from 3 p.m. to 11:30 p.m. with half an hour for a meal.

All, or nearly all the material taken from the excavation in Manhattan has to be disposed of, usually by haulage to the water front, where it is loaded on scows and towed to the point of disposal. This involves the renting of pier or dock facilities by contractors, and a haul varying from ½ to 1 or 2 miles in wagons or auto-trucks. These latter, holding from 3 to 4 cu.yd., are being quite commonly used, and are generally said to be more satisfactory and cheaper than horse-drawn wagons. It is necessary that they be fully utilized—that is, that there be the least possible delay at loading and unloading points; otherwise the overhead charges, chauffeur's wages, and interest on investment, amount to too large a proportion of the unit cost.

A very efficient and convenient arrangement of hoist and storage hoppers, Fig. 46, was installed at Broadway and Waverly Pl., on Section 4, by the Dock Contractor Co. A vacant lot permitted the construction of a long narrow head-house parallel to the street and over the sidewalk. A telpher was arranged over the shaft and hoppers, which allowed a much more rapid, because better controlled, handling of the buckets than is possible with a derrick boom. A structure of this type would not have been permitted in front of an occupied building.

On one section on Broadway, where the excavation was mostly sand, a belt conveyor was used in the bottom which dumped the material into a hopper, from whence it was elevated to the bin above the street by an endless chain of buckets.

On these downtown sections, fewer shafts are permitted and they are usually from 1200 to 1500 ft. apart, making

Fig. 46. Headhouse over Shaft at Waverly Pl. and Broadway

the necessary maximum load on the bottom about half size. Track of 24-in. gage is generally used, two or sometimes three lines, with mules for haulage. In many places on the upper levels between timbers, small $\frac{3}{4}$-yd. cars are used, which are pushed by hand short distances to where they can be dumped to the lower level. A typical crossing over the street for handling materials is shown in Fig. 47.

Where the line crosses Union Square, most of the work masses of concrete over 20 in. in thickness, and some of it is used for rubble for blocking up the yokes of the street-railway tracks in Manhattan.

Buckets and Skips

On many parts of the work, $\frac{3}{4}$- to 1-yd. buckets as shown at A and B, Fig. 48, are used. These are handled in the excavation on small flat-cars on 24-in. gage track, hauled by mules to the shafts, hoisted by derricks to the surface and dumped into the trucks or hoppers. At the face of the cut the buckets are loaded by hand, the simple form of block and tackle being used to haul out and lift the boulders or pieces of rock too large to be conveniently handled by one or two men.

In one case where turntables were tried opposite the shaft, the tracks being arranged as shown at A, Fig. 49, it was found that they frequently got out of order and caused considerable delay, so they were taken out and the tracks arranged as shown at B, the shaft being enlarged to permit of this being done. On Sections 8 to 11 on Lexington Ave., transfer tables were used at the shafts as shown in Fig. 52.

On certain sections 3- to 4-yd. skips of the type shown in Fig. 44C are used. They are hoisted to the surface and either dumped into a wagon or auto-truck or placed on the wagon bed, and hauled to the place of disposal, where it is again lifted and then dumped. The skips are handled underground on small cars drawn by mules, or in one case where the timbering was very close and the headroom low, pushed by hand, the work being arranged so that there was a down grade to the shaft.

Fig. 47. Bridge and Decking at Grand St. and Broadway

the dirt is dumped into an electrically operated shovel being used. Shovels and trains were used on the open-cut work of the Sea Beach line in Brooklyn, and part of the Van ... was done in open cut.

The rock excavated from the subway is of little general use for structural purposes. A certain amount of the best of it is permitted to be used in ... with ...

The advantage of these large skips over the smaller buckets is greater facility in loading. They are taken off the cars and placed on the ground at the surface, a hoisting engine with a fall suspended from the timbering at the street decking being used for the purpose. There is no lift for the ... and ...

course, very much larger pieces of rock can be handled without block-holing and handled more easily.

On Sections 8, 9, 10 and 11, on Lexington Ave., a type of bucket known on the work as a "battleship" (Fig. 43) is used. These buckets hold from 1½ to 2 yards; they are handled in the excavation and tunnels of these sections on small cars (3-ft. gage) with cradles shaped to fit. The cars coast down grade either to or from the working face as the case may be, and are hauled up grade by small stationary hoisting engines. The line from the hoisting engine is usually carried out by hand and this method of haulage does not seem very efficient.

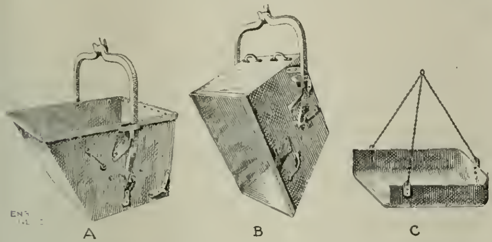


Fig. 48. Dump Buckets for Handling Material

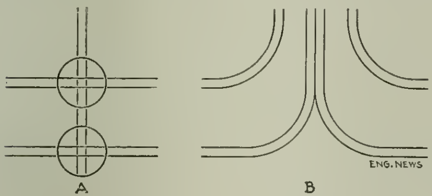


Fig. 49. Sketch of Track Arrangements at Shaft

The buckets are hoisted to the surface by derricks, Fig. 43, or telpher, Fig. 45, placed on wagon beds and hauled to the dock by horses. This type of bucket with the top some 3½ or 4 ft. above the ground (as they remain on the cars while being loaded) involves a fairly high lift for the shovelers, and the necessity of keeping the tracks up close to the face does not permit the flexibility which is possible with the skips, which are taken off the cars and placed in the most convenient position for loading. Many of these small tunnel cars consist merely of a rectangular frame of 6-in. I-beams to which the axle boxes for two axles are fastened. Those for use with the "battleships" have two or three wooden cross-pieces or cradles cut to fit.

The contracts for Sections 8, 10 and 11, Lexington Ave., are being executed by the Bradley Contracting Co., that for Section 9 by Patrick McGovern & Co. Nearly the whole length of the lower level tracks is in tunnel, the excavation of which is described separately, but the upper-level double track has generally been built as cut and cover. An arrangement has been made whereby the Bradley Company takes care of the disposal of all the material, that from the upper section being hauled to the dock at 96th St. and the East River, and from the lower sections to 76th and 68th Sts.

The use of these skips or the "battleships" is probably of greater advantage in rock excavation than in earth, as some kind of mechanical apparatus for handling the rock is generally necessary at the face and is therefore available to handle the skips on and off the cars and to load large pieces of rock. Small power shovels, operated by electricity or air, are often used for loading the spoil on underground work, but on most of the subway work, the extensive and close system of timbering hardly admits of their use.

The system used for the rock excavation on Section 13 (McMullen, Snare & Triest) seems to be quite effective. Here the rock face is 25 to 35 ft. high, and 40 to 50 ft. wide. After the street decking was put in, a top lift, from 12 to 15 ft. high and mostly earth was taken off the whole length of the section, this permitting working access to the whole job, for underpinning, support of pipes, conduits, etc. A shaft was sunk to subgrade at every other cross street, about every 450 ft., and outside the main excavation. The location of the shafts in the cross streets is shown clearly in the photographs, Figs. 44 and 45. From this shaft a cut was drifted across the full width of the work and the excavation carried forward in both directions from it. About 120 skips were used on this section, and about 400 yd. of rock (place measurement) was handled each 24 hours from the two working faces with the two gantries.

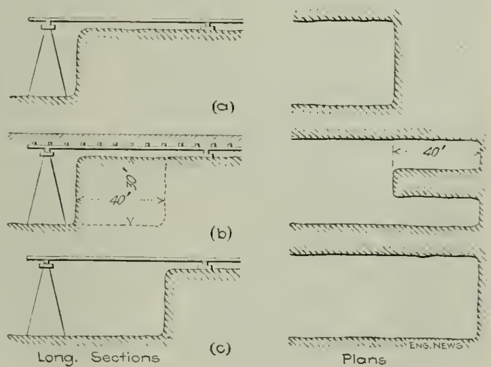


Fig. 50. Sketch Illustrating Progress of Excavation in Deep Rock Tunnel on Section 13, Lexington Ave.

The tower form of timbering (as described under timbering) was used, the working space being spanned by continuous I-beams reaching from the last towers to blocking on the floor of the first lift, as shown in the sketch, Fig. 50. Two side cuts, each about one-third the width of the excavation, were driven ahead 35 to 40 ft., then the center was blasted sideways into these cuts. This, as will be seen, protected the timbering, at least to a considerable extent, from direct blasting against it. When the face at the center was advanced 40 ft., another tower was erected, the girders moved ahead, the process repeated, etc.

Two double-drum air hoisting engines were located back from the face on top, with single fall lines leading over sheaves suspended from the timbers of the street decking above the working space. These two lines (two on each side) handled the larger pieces of rock and the skips on and off the cars, and were also used in handling timbers, etc.

Hoisting and Gantries

On Section 13, Lexington Ave. (McMullen, Snare & Triest), gantries as shown in Fig. 44, have been installed at the shafts, instead of derricks for hoisting material out of the excavation, and for lowering the structural material. The advantages of these gantries are said to be, greater safety to the public in the streets, greater rigidity, and therefore more security; better speed in hoisting, easier spilling of the skips over the wagon bed, less power required for hoisting, and the elimination of booming up and down with loads. It is said that the saving of power (in regard to which no definite data are available) is due largely to the elimination of the swinging engines which are necessary with derricks. It is also stated that there is a considerable saving in the wire hoisting ropes, which lasted only two to four weeks on the derricks, but which last three to four times as long on the gantries.

These gantries will also handle heavy loads with much greater security; those now in use have handled loads up to 25 tons. This is of considerable advantage to the rock excavation, as it permits the handling of large rocks without breaking them up. They are so arranged that from 20 to 25 loaded skips can be stored at them (see Fig. 45), thus permitting night work when the teams are not available to haul the material and also permitting considerable flexibility. This latter is a great advantage, owing to the difficulties of disposal, which is dependent on the availability of the scows, a somewhat uncertain circumstance of the winter season weather, the difficulties of haulage in bad weather, and many other factors, as already noted. The teams which haul the spoil to the dumps work only in the daytime, and by storing the material under the gantries delays are avoided and the work is accommodated to that length of time. On this work the top stone is generally loaded into the skips during the day and the finer material, which must be shoveled, is handled in the night shift.

The first of these gantries was made about 40 ft. long and 20 ft. high, and those built afterwards were made 60 ft. long and 25 ft. high, thus giving more storage room, and the extra height greater facility in handling some of the structural steel. There are altogether seven of these in use on Section 13 and one shaft with a derrick. Their use on Section 13 has been apparently very successful, but it is to be noted that they are peculiarly well adapted to the conditions there, and it cannot be assumed that they would replace derricks to so great advantage under other conditions.

Miscellaneous Excavation Methods

On the first section north of the Harlem River (Section 15, Route 5—Rodgers and Hagerty, contractors), where more latitude was allowed in the matter of opening up the streets, only part of the excavation being decked over, the excavated material was handled in 4-yd. Western dump cars hauled by dinkeys (3-ft. gage) to the disposal grounds $\frac{1}{2}$ to $\frac{3}{4}$ mile distant.

On the next section to the north at the junction of the Southern Boulevard and 138th St., a model 49 Marion shovel is just being installed for loading the cars and a model 60 Marion was used in the deep rock cut through

Fig. 51. A Rock Slide, Lexington Ave. Subway

Fig. 52. A Transfer Platform, Lexington Ave. Subway

Franz Sigel Park, on the northwest end of Section 1[illegible].

On the steep hill on Lexington Ave. between 102nd and 103rd St. where the traffic is light (on account of the steepness of the hill) and where the tunnel with all four tracks at the same level changes to a two-level section, one side of the street was left open and a cableway was installed for handling the material.

Walton St. is being widened from its original width of about 60 ft. to 100 ft. and the excavation in this widened portion is being made in open cut, the original width of the street being decked over and the material under it taken out at the open sides. The first lift of 10 to 12 ft. is loaded directly into wagons by shoveling, cribbing being built from the surface down to this depth. Much of the excavation is sand, and below the first lift this is loaded into 1-yd. V-shaped Koppel cars which are dumped sideways into a hopper, under which runs a short belt conveyor, which in turn carries the material to a bucket elevator which raises it into a storage hopper above the street level.

Steam shovels were quite generally used on the construction of the 4th Ave., Brooklyn, lines in 1909-10 and

are being used now on the open-cut work of the Sea Beach line, but generally speaking, very little use is made of mechanical apparatus of any kind on the subway excavation, most of the excavated material being shoveled by hand.

Drilling

On Section 13 the drillers work in two 8-hr. shifts, from 6 a.m. to 11 p.m., and the muckers in two shifts, from 8 p.m. to 1 a.m. One feature of considerable interest, is the quite extensive use of the so called Jap or hand hammer drill with hollow drill steel. The New York rock, a soft to medium hard gneiss or mica schist, seems to lend itself particularly well to the operation of this kind of drill in excavations where most of the holes are down holes. The type which is in most general use, is the Ingersoll-Rand B.C.R. 33, which weighs about 90 lb., using air at 80 to 90 lb. pressure. The hollow drill steel is usually about 1⅛ in. octagon, the holes are drilled dry, the air through the steel blowing out most of the dust, therefore keeping the holes clean and consequently increasing the effectiveness of the machines. These drills are used for drilling holes to depths up to 12 and 14 ft.; it is stated that they require from 50 to 75% less air at the same pressure than the usual tripod drill does, and only one man is required to operate each of them. The general opinion seems to be that unskilled laborers with very little instruction could use these drills, though, of course, in New York the labor unions compel the employment of regular union drill runners.

On Section 14 (McMullen & Hoff) four men with as many drills were averaging from 80 to 90 ft. of hole per man per day of eight hours. There was one record of 113 ft. for one man in eight hours. It was considered advisable to keep a number of spare drills on hand, so that in case anything went wrong, there was no delay, and any damaged drill could be taken to the shops, where it could be carefully repaired by a competent machinist, even though the trouble was very slight. This was considered to be better than to have an ordinary drill runner try to fix it with the spanner or sledge hammer, the tools usually used by them when anything is wrong with a drill. These drills were also used on the heavy rock excavation of Section 13, a cut 30 to 50 ft. wide and as many feet deep, with excellent results.

On some sections a lighter type of drill weighing about 40 lb. and using about 50 ft. of air per min. is being used; this is the Ingersoll-Rand B.R.C. No. 430 or so called Jackhamer type, used for holes up to 6 and 8 ft. in depth using ⅞-in. hollow steel.

Another point of interest is the almost universal use of machine drill sharpeners, nearly all of which are of the Leyner type. This use of machine sharpeners is possibly due, to some extent, to the use of the hollow steel and the rose-shape form of bit generally used with these hand drills, though of course, it has been shown even with the old type of cross bit, that where the number of drills warranted, the installation of a drill sharpener was an economy.

It was noted that in many cases the heads of the steel drills had sheared square off just back of the head. This type of failure has not previously come to the writer's notice, and no adequate explanation was offered by the men on the work, but it would seem that it might be due to the severe internal stresses set up by the much greater force used in the machine sharpeners in forming the heads, and the fact that possibly in these machine sharpeners, the steel can be, and is, worked at a lower temperature than by hand.

It is stated by the contractors on Sec. 13 and 14 that the general breakage and wastage of steel used is rather greater than with the ordinary steel, and, of course, the hollow steel is more expensive, but it is thought this is much more than compensated by the greater amount of work done. The Leyner drill sharpeners are used to make all the bolts for the timbering on one section, where it was stated that 400 bolts were headed per hour.

Electric current is used for power at most of the compressor plants, and air is usually piped to all points of the work for use in drills, pneumatic riveters, etc. In some cases the air is used for operating hoists and derricks, in other cases electric power is used directly for this purpose; this apparently is governed most generally by the plant the contractor may have had on hand, but the use of air for hoists and derricks, so long as it has to be installed in any event, seems to be the most satisfactory and most generally used.

Various schemes for heating the air during cold weather were noted, some of the apparatus home-made and other manufactured especially for the purpose. On one section (McMullen, Snare & Triest) an upright coil of about 6 to 8 rings, 15 to 18 inches in diameter, was made in the air line near the point where it was to be used, and a fire built and maintained inside the coil. In another case a piece of 6- or 8-in. pipe about 3 ft. long was capped at the ends to take the regular air line (about 2 in.) and a fire built under the larger section. These home-made schemes are probably somewhat wasteful of fuel, but this amounts to very little and they probably stand up better under the rough usage they get on this kind of work than the manufactured heaters.

An Efficient Method of Resuscitation has been developed by a committee of eminent physicians and surgeons appointed by the U. S. Bureau of Mines. As a result of a report made by this committee, J. A. Holmes, Director of the Bureau, has recommended first-aid procedure which has the recommendation of successful experience.

The recommendations are of universal application, not only to men who are overcome by electric shock or gases in mines, but also to persons suffering from the effects of illuminating-gas poisoning or from electric shock anywhere.

An abstract of the recommendations follows:

In case of gas poisoning, remove the victim at once from the gaseous atmosphere. Carry him quickly to fresh air and immediately give manual artificial respiration. Do not stop to loosen clothing. Every moment of delay is serious.

In case of electric shock, break electric current instantly. Free the patient from the current with a single quick motion, using any dry non-conductor, such as clothing, rope, or board, to move patient or wire. Beware of using any metal or moist material. Meantime have every effort made to shut off current.

Attend instantly to the victim's breathing. If the victim is not breathing, he should be given manual artificial respiration at once. If the patient is breathing slowly and regularly, do not give artificial respiration, but let nature restore breathing unaided. In gas cases, give oxygen. If the patient has been a victim of gas, give him pure oxygen, with manual artificial respiration. The oxygen may be given through a breathing bag from a cylinder having a reducing valve, with connecting tubes and face mask, and with an inspiratory and an expiratory valve, of which the latter communicates directly with the atmosphere.

No mechanical artificial resuscitating device should be used unless one operated by hand that has no suction effect on the lungs. Use the Schaefer or prone-pressure method of artificial respiration. Begin at once. A moment's delay is serious. Continue the artificial respiration. If necessary, continue two hours or longer without interruption until natural breathing is restored. If natural breathing stops after being restored, use artificial respiration again.

Do not give the patient any liquid, until he is fully conscious. Give him fresh air, but keep his body warm.

Send for the nearest doctor as soon as accident is discovered.

A Small Slow Sand Water-Filter Plant for the Estate of J. P. Morgan

By John H. [illegible]*

The domestic water-supply for Cragston, the estate of J. Pierpont Morgan, at Highland Falls, N. Y., is ordinarily obtained by gravity through a 2-in. pipe from a spring situated on high ground about one mile distant from the main house. For the greenhouses, sprinkling and other miscellaneous purposes, water is obtained, also by gravity, through a 4-in. pipe from an artificial pond, located about

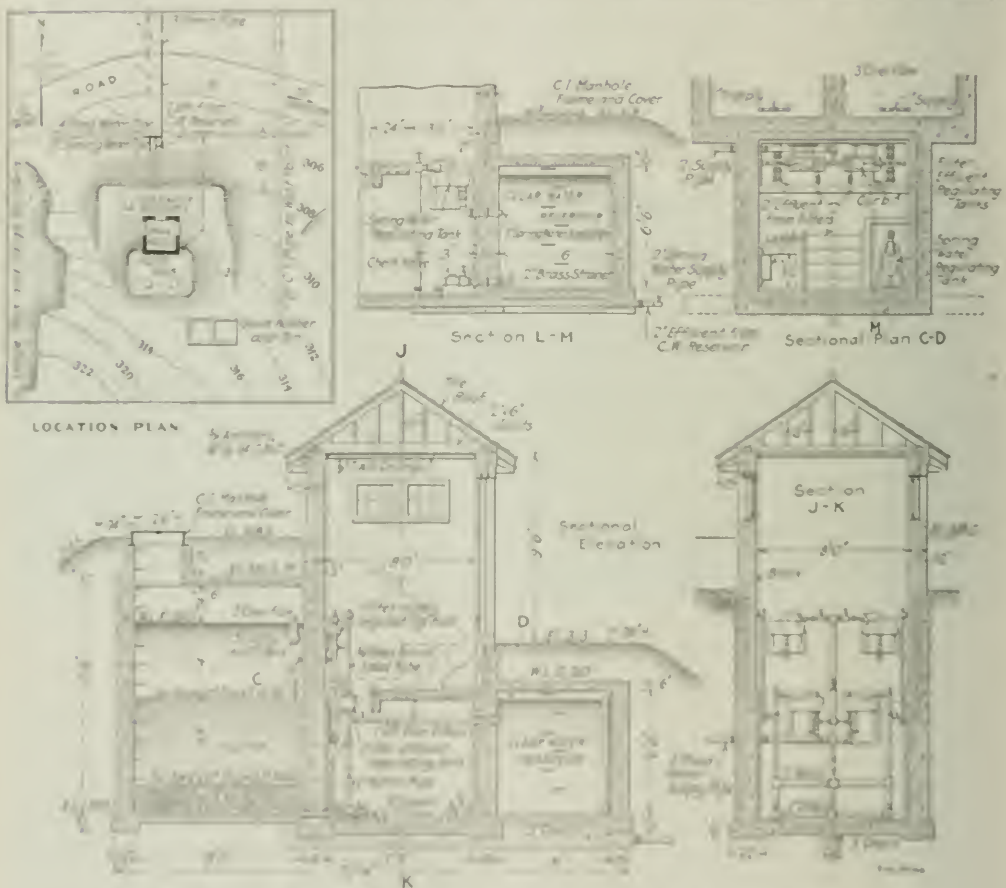


FIG. 1. SLOW SAND WATER-FILTER PLANT FOR THE ESTATE OF J. P. MORGAN

[illegible] ft. from and about 170 ft. above the main house. The water has usually been adequate and sufficient water for all the [illegible], but during a severe drought the spring failed to supply sufficient water and in order to meet the deficiency, as well as to provide a reserve supply of domestic water, a small filter plant was built to filter water obtained from the pond.

The filter plant, which has a capacity of 5000 gal. per 24 hours, consists of two small covered slow sand filters, a regulating house and a clear water reservoir, and is located about 100 ft. in elevation above the main house and at a point where the 2-in. spring-water pipe and the 4-in. pond-water pipe are in close proximity, so that use could be made of both without laying any additional pipe lines. A general plan and details of the plant are shown in Fig. 1.

The filters, which are each 6 ft. wide by 9 ft. long, have a total filtering area of 108 sq.ft. and are designed to operate at a rate of 2,000,000 gal. per acre per 24 hours. The filter sand was purchased from the city of Albany, from the surplus stock of sand on hand at the slow sand filter plant there, and has a total depth of $3\frac{1}{2}$ ft. above the filter gravel. The sand has an effective size of 0.31 mm. and a uniformity coefficient of 3.25, with sizes from 0.17 mm. The depth of water above the sand is 4 ft.

The filter gravel has a total depth of 18 in., placed in four layers as follows:

Size	Thickness, in.
Coarser than filter sand	[illegible]
[illegible] in.	[illegible]
[illegible] in.	[illegible]
[illegible] in.	[illegible]

*[illegible] Engineers and Sanitary Experts, [illegible]

The regulating chamber, which is placed between the filters and the clear-water reservoir, is 7 ft. 8 in. square and contains all the piping and apparatus for operating the filters. The chamber is surmounted by a small superstructure built of brick (Fig. 2).

The clear-water reservoir is 6 ft. wide, 20 ft. long and 6½ ft. deep, and with a water depth of 6 ft. contains about 5100 gal., or a little over one day's supply.

Water for the filter plant is drawn from the 4-in. pond-water pipe through a 2-in. pipe connecting with two filter-supply regulating tanks, from which in turn it passes into the filters. These regulating tanks are each fitted with a balanced float valve to maintain a constant water level on the filters and to prevent overflow, as the filters are located at a point about 55 ft. below the level of the pond.

The effluent from each filter passes through a filter-effluent regulating tank, in which a constant level is maintained by means of a ball cock, the rate of filtration being controlled by an adjustable brass orifice placed in the bottom of the tank. From these tanks the filtered water passes to the clear-water reservoir.

Fig. 2. Regulating House of Slow Sand Filter Plant

The piping connections to and from the plant are so arranged that the plant can be run in connection with or independently of the spring-water supply and also so that the clear-water reservoir can be used to store spring water when the spring-water supply is sufficient. When running independently the spring-water supply will be entirely cut off. When the spring-water supply is sufficient and the clear-water reservoir is used to store spring water, the filters will be cut off. When used in connection with the spring-water supply, all of the spring water will pass through the clear-water reservoir and the deficiency in spring water will be made up by the filters.

Under this last method of operation, the spring water will pass to the clear-water reservoir through a spring-water regulating tank, fitted with a balanced valve to prevent overflow of the clear-water reservoir. As the draft exceeds the supply of spring water, the water level in the clear-water reservoir will drop and the filters will start up slowly until the maximum rate of filtration is reached. Conversely, as the draft decreases and the clear-water reservoir fills up, the filters will gradually slow down and finally cease filtering when the clear-water reservoir is full.

The filters were designed and built under the direction of Hering & Gregory, Consulting Engineers, of New York, with J. K. Giesey and I. S. Walker as Resident Engineers. The construction work was carried out by Westinghouse, Church, Kerr & Co., of New York, with Howard S. Barton in charge.

Alloy-Steel Rails

Extensive experiments with the use of special alloy steels for rails have been made during the past few years. But the report presented at the recent annual convention of the American Electric Railway Association by the Committee on Way, states that the production of such rails has decreased materially during the past few years and is now insignificant in relation to the total rail production. The figures are given in Table I:

TABLE I—PRODUCTION OF RAILS OF VARIOUS ALLOY STEELS (GROSS TONS)

	Openhearth and Electric	Bessemer	Total
1909	13,696	35,699	49,395
1910	27,389	229,935	257,324
1911	38,539	115,450	153,989
1912	40,393	108,874	149,267
1913	33,567	25,952	59,519

TABLE II. CHARACTERISTICS OF ALLOY STEELS

Kind	Steel Containing	General Properties Anticipated
Titanium	0.1% metallic titanium	Less segregation, cleaner metal, hence, longer life.
Nickel	3.5% nickel	Increased life.
Nickel chrome	Containing varying percentages—nickel and chromium.	Increased life by being tough and hard.
Manganese	About 12% manganese	Very tough and hard, cannot be easily cut or drilled, wears slowly.
Electric	Made in electric furnace	Very clean steel, free from impurities, thus adding life.
High silicon	About 0.35% silicon	Increased life. Much used in England.

The reason assigned for this decline is the increased cost of alloy steels over that of openhearth steel, which is now being largely used for rails on account of its much higher wearing quality than bessemer steel, although its cost is higher by $2 per ton (or about 7%). The report states that openhearth rails made with the usual addition of 0.1% of metallic titanium, cost about 12% more than bessemer, while with manganese steel at $80 per ton, the cost is about 186% greater than for bessemer steel. As the use of openhearth steel has increased, the use of alloy steels has decreased. This refers to rails for both steam and electric railways. Quoting now from the report:

The first cost of alloy-steel rails therefore may be not only prohibitive in some instances, but in others so high as to render return on the investment extremely low, especially when a large sum is involved. These matters have doubtless militated against the production of alloyed steel rails, and purchasers have contented themselves with the adoption of openhearth steel on the reasoning that for 7% greater first cost, 50% longer life for the rails might follow.

Under special conditions of quick-wearing track, sufficient benefits may ensue to warrant the adoption of an alloy-steel rail, and the demand for alloy rails seems to be for track of this class. The question of what alloy to use is important. Eliminating matters of cost, the purchaser has ferro-titanium, manganese, nickel, high silicon and electric steel to chose from. It is unfortunate that rail sections are of an intricate and unbalanced character, the girder and high T-rails especially as these odd shapes preclude opportunity for successful heat treatment. However, some attention has been given to the heat treatment of rails.

Experience with alloyed steels is dependent on a number of factors in addition to the metal itself. The mere addition of 0.1% of metallic titanium or 13% of manganese to the steel will not be a panacea for the ills to which track and rails are subject. Reports of breakage and wearing qualities, therefore, are inclined to show divergent results, and even average

results for any particular kind of steel may be greatly exaggerated.

The best cases of rails are those where different kinds of steel are laid in the same type of roadway and subjected to [illegible] conditions and maintenance. Results from such [illegible] afford good comparison, but the tendency even then is to measure the rail wear by the eye rather than by accurate instruments, so that misleading figures may readily result.

In the use of alloyed steel on street and interurban lines, either the rails have not been in service sufficiently long to permit of a fair comparison being made, or else the matter of careful measurements has been somewhat neglected, so that the records are unsatisfactory. It is opportune to emphasize the fact that girder and high T-rails, as well as standard sections, can be easily rolled from the special steels noted in Table II, possessing the general characteristics mentioned.

An English Railway Trainshed

SYNOPSIS—The trainsheds of many large railway stations in England are of types quite distinct from those in use in this country. The accompanying article describes a recent design of a station at Birmingham which consists of transverse girders 275 ft. long, with four supporting columns, spanning the entire width of the station, and having framed between them rows of arch trusses of 40-ft. span. The methods of erection are described also.

The Great Western Ry., of England, has reconstructed and enlarged its Snow Hill station in Birmingham. The new trainshed is of a type practically unknown in this country. The station is a large one, with a track plan as shown in Fig. 1. Four main tracks run through the center, with a single track on the outer side of the two large island platforms, while at the north end of the station each of these platforms is split by a pair of stub

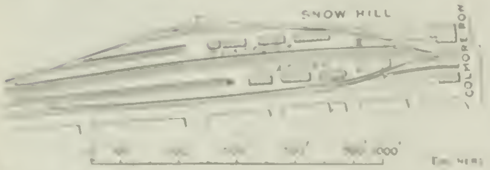


FIG. 1. TRACK PLAN OF THE NEW SNOW HILL STATION AT BIRMINGHAM (ENGLAND), GREAT WESTERN RY.

tracks about 400 ft. long. The two tracks of the longer stub converge to a transfer table (with radial tracks) located at its farther end, so that the engine of an inbound train can be promptly transferred to the outbound track and pass around the train. The six through tracks converge into a double-track approach at the south end (in a tunnel) and a four-track approach on a bridge viaduct at the north end.*

The main platforms are nearly 1200 ft. long, sufficient for two trains, this arrangement being necessitated by the fact that it was impracticable to widen the station, which is flanked by two streets. Each pair of tracks is connected by a double crossover at the middle, so that with two outbound trains standing on the same track (and heading in the same direction) the rear train can pull out ahead of the other if necessary. In the same way, a second inbound train can pass a train standing at the platform and then run onto the same platform track. There is also a trailing crossover between the two pair of tracks. This arrangement of double-length platforms is a feature also of the Victoria Station of the London, Brighton & South Coast Ry., at London, described in ENGINEERING NEWS, Feb. 11, 1909.

The switches and signals are operated from two towers by the Westinghouse all-electric interlocking system. Current at 110 volts is supplied from a storage battery charged by two motor-generator sets. The main platforms are 84 ft. wide, with 24-ft. clear width on each side of all buildings erected on the platforms for waiting rooms, etc. The spur platforms of the stub tracks are 300 to 500 ft. long, and 12 to 20 ft. wide. All platforms are 3 ft. above the tops of the rails.

TRAINSHED

This is the most interesting portion of the station from a structural point of view, and its general design is shown in Fig. 2. Across the entire width of the station extend parallel chord trusses resting on columns in the side walls and on two columns on the main platforms. These trusses are spaced 45 ft. 10 in. apart, and between them are filled trusses (about 15 ft. apart) having curved bottom chords and inclined top chords, with a monitor roof at the top. Thus the trainshed or station roof consists of a series of transverse ridges, or what is known in England as a "ridge-and-furrow" roof (quite different from the American "saw-tooth" type). The upper part of each ridge, on either side of the monitor, is covered with a skylight.

The long transverse trusses are 8 ft. deep, with chords 17 in. deep and 15 in. wide, as shown in Figs. 2 and 3.

*The [illegible] was described in [illegible], June [illegible].

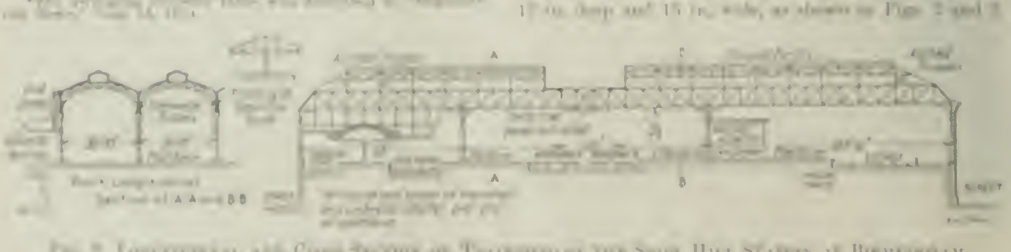


FIG. 2. LONGITUDINAL AND CROSS-SECTIONS OF TRAINSHED OF THE SNOW HILL STATION AT BIRMINGHAM (ENGLAND), GREAT WESTERN RY.

They are riveted up to form continuous girders, and are rigidly connected to all the four columns, as it was considered impracticable to place satisfactory expansion bearings on the tops of the light columns. The columns are designed, therefore, to take up any tension due to expansion and contraction of the 275-ft. trusses. There are 15 of these transverse trusses, so that the trainshed is 550 ft. long. The north end has a glazed screen, carried about 3 ft. beyond the main end trusses, as shown. The sides or walls also are glazed.

It will be seen from Fig. 2 that the end trusses and roofing are omitted over the five central panels. Two of these panels have a low ridge-and-furrow roof between the trusses, but the other three are left open to the air, thus providing a 22-ft. opening for light and ventilation. This shows also in Fig. 4. Along the south end of the trainshed (facing the headhouse) extends a covered footbridge over the tracks, with stairways to the platforms and inclined walks to the main entrance hall.

The arch trusses which are fitted between the main transverse trusses have their ends somewhat deeper than the main trusses, so that the end web members and the top chords of adjacent roof trusses are connected above the top chords of the main trusses. All the members are angles, and all the connection plates are made with curved outlines. A plank walk is placed in each furrow.

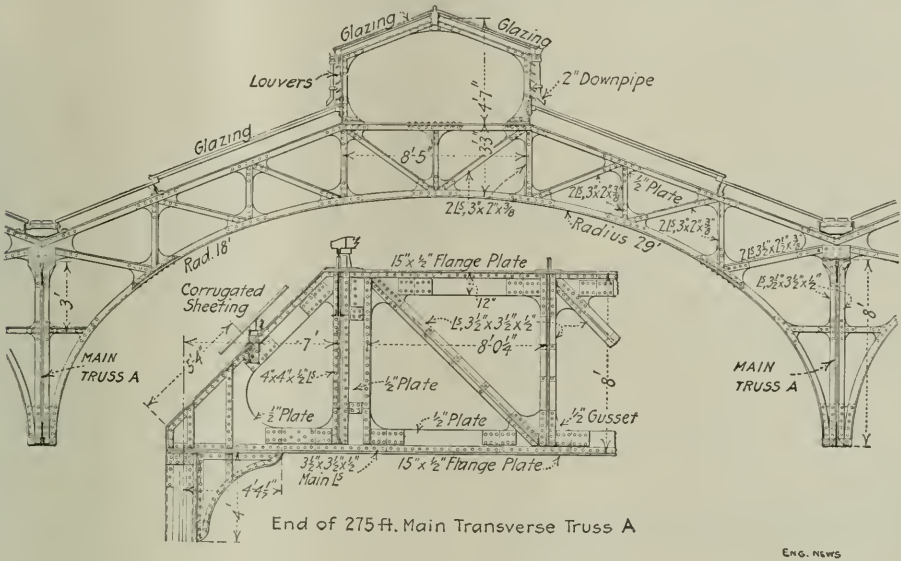


FIG. 3. TRUSSES OF THE NEW TRAINSHED

FIG. 4. SNOW HILL STATION AT BIRMINGHAM (ENGLAND), GREAT WESTERN RY., SHOWING THE TRAINSHED CONSTRUCTION AND BUILDINGS ON THE PLATFORMS

The platforms extending beyond the north end of the trainshed are covered by umbrella roofs or canopies. Each canopy has a single row of columns, 20 to 33 ft. apart, with a double cantilever arm on which are upright members to support the roof framing, as shown in Fig. 2. The columns are anchored to concrete blocks and are designed to resist a 50-lb. wind pressure. The clear height under the cantilever arms is 11 ft. 9 in., and the width of the canopy roof is from 20 to 38½ ft. The sides extend 18 in. beyond the platforms, and are faced with a wood screen whose lower edge is 13 ft. 6 in. above the rails.

Erection of Trainshed

The first step was the removal of the old arched roof, which had crescent-shaped trusses with both chords curved. Beneath this was erected a traveler having three

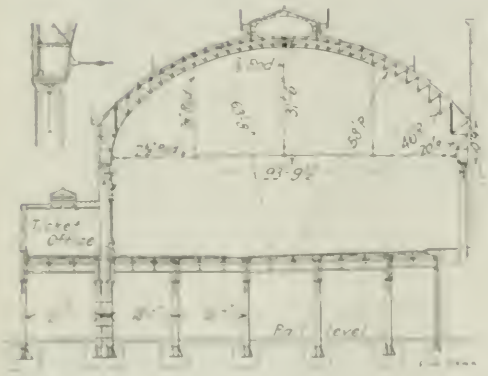


Fig. 5. Cross-Section of Main Entrance Hall, with Three-Hinged Arched-Roof Trusses

timber trusses with curved top chords carrying a curved deck that fitted close beneath the bottom chords of the old roof trusses. The ends of the traveler trusses were carried on timber towers with double-flanged wheels rolling on rails.

For the erection of the new trainshed, the two end portions of each main truss [illegible] from the wall columns to the interior columns [illegible] shipped and riveted completely [illegible] of maximum length [illegible] were shipped in two parts and riveted up on the deck before being hoisted into place. The [illegible] length of the center portion of each truss (between the interior columns) was shipped in two [illegible] sections and assembled in place. These [illegible] lengths were erected from a traveler having a track for a 7-ton locomotive crane of 14-ft. working radius.

The traveler had three [illegible] trusses [illegible] ft. apart, connected by lateral bracing and carrying I-beam joists and a plank deck. The ends of the traveler were supported by trestle towers on rails, the traveler being moved [illegible]. Pneumatic riveting hammers were used. The steel was [illegible] and erection [illegible]. The deck and wall [illegible] were then covered with [illegible], and after [illegible] coats of red lead, two finishing coats of paint were applied.

Arched Roof of the Entrance Hall

The main hall or entrance hall is about 93x165 ft., with a barrel arch roof composed of three-hinged arch trusses of 91 ft. span, 31½-ft. rise. On one side these rest on a lattice truss supported by two end columns. The height from the floor to the springing line is 22 ft.

This roof is shown in Fig. 5. The radius of the bottom chords is from 29 to 58 ft. The feet of each truss are connected by a tie rod, but instead of being attached to the shoe pins, the looped ends are attached to pin plates on the face of the bottom chord. The tie-rods have turnbuckles for adjustment, and to prevent sagging each rod is supported from the arch by three ⅞-in. hanger rods. There are seven of these arches, connected by trussed purlins. Above the arches is a wide monitor roof.

In erection, each arch was delivered in four sections. Each half arch was then assembled, riveted up, and raised by a derrick having a 75-ft. boom. This derrick held it in place until the other half was swung in the same way and the hinge pins were fitted into position.

Other Features of the Station

The Snow Hill station is built on sidehill ground and the adjacent streets are of varying levels and grades. The tracks are elevated above the general street level, the lower floor being utilized for station facilities and for stores fronting on the two side streets which limit the width of the station. At the south end, however, a main street crosses the tracks, and the main entrance is from this street so that the main passenger facilities are at this upper level. This street is reached by inclines from the two side streets. The hotel above the tracks has been converted into an office building for the division offices of the railway, with the main restaurant on its lower floor.

The main entrance hall is behind this building, having a 20-ft. approach corridor from the street, while on the west side is the carriage entrance, with a driveway extending into the hall so that passengers are landed close to the ticket office, booking room, parcels room, etc. From this main hall, two inclined walks lead to a [illegible] footbridge 20 ft. wide, across the end of the trainshed, with a 24-ft. stairway to each platform. The entrance hall is about 93x165 ft., and is [illegible] by heavy plate girders which give a clear headway of 14 ft. 3 in. above the rails. It has a barrel arch roof as described above.

One feature which is in marked contrast to American practice is that there is no spacious and elaborate general waiting room. Instead, separate and relatively small waiting rooms (for the different classes of passengers) are provided along the two main platforms, in connection [illegible] of [illegible] and [illegible]. Similar buildings contain the refreshment rooms, lavatories, offices, baggage rooms.

The design and construction of the new station was under the direction of Mr. [illegible], Engineer of New Works, Great Western Ry. The general contract was let to Henry [illegible] & Co., and the steelwork was built and erected by [illegible] & J. [illegible].

Railways of Queensland, Australia, according to the report of the Commissioner for the year ended June 30, 1914, [illegible] [illegible] miles, of which [illegible] miles [illegible] during the year. [illegible] [illegible] [illegible] have been [illegible] by Parliament [illegible].

Municipal Ownership and Operation of Water-Works*

By M. N. Baker†

The rapid growth both in the number of water-works and in the percentage of those works under municipal ownership was one of the marvels of the nineteenth century. The century opened with 16 works in the United States, only one of which was municipally owned. It closed with perhaps 3500 works, more than half of which were under public ownership and 200 of which had changed from private to municipal ownership. No statistics of ownership for the whole United States have appeared since "The Manual of American Water Works" for 1897, but it is known that changes from private to public ownership have gone on at a rapid pace in the last 17 years and it is believed that of the hundreds of new works built in that period the greater part are now owned by the city which they supply.

All of the major cities of the United States own their water-works until San Francisco is reached. Going over the whole list of cities which the Census Bureau estimates as having a population of 30,000 population and upwards it appears that in round numbers there are 150 municipal to 50 private plants, or 3 public to 1 private. If total populations supplied were considered, the preponderance of municipal ownership would be still greater.

Competing water companies have been few. Competing municipal and private works have been fewer still and such competition ends, sooner or later, with the city in full possession of the field. The reason for this lack of competition is that the water-supply service is one of the most complete natural monopolies in existence.

This natural monopoly feature and the close and vital relationship of public water-supplies to the health of water consumers and to the safety of both life and property from fire, go far toward explaining the rapid growth of municipal ownership of water-works and the persistent demand for a change from private to public ownership where the former prevails. It does not follow, however, that every city still under private ownership is in duty bound to acquire works of its own without delay. A variety of local conditions may determine the wisdom of continued private ownership for a few or even for many years. Good service under private ownership is increasingly possible each year, because the newer water-works franchises and contracts are more definite and fairer to each side than the older ones and because of the growing prevalence of state utility regulation. Nevertheless, no matter how far in the future matters of local expediency may throw municipal ownership it may well be the ultimate goal of every city, town and village that has not yet attained it.

Notwithstanding all that has been said and so well said in favor of home rule, I still believe, as I have long believed, that municipal as well as private water-works should be subject to state regulation. Even if in no other respect, there must be state regulation of the purity of the supply. This principle was recognized and put into effect in a number of states before state regulation of utility rates was thought of. Until recently, state regulation of the sanitary quality of water-supplies was always vested in state boards of health and with one or two partial exceptions this is still true.

The case for state control of the purity of water-supplies rests upon the fact that public health is a matter of state and national concern and cannot safely be left to local control. A city with a polluted water-supply does not stop with causing a high local typhoid rate—though this in itself is a proper matter for state interference. Such a city contributes in numberless ways to the spread of typhoid throughout the whole state and over the whole country.

Besides the question of purity, state control of water-supplies, regardless of ownership, is demanded to settle rival claims for sources of supply which two or a half-dozen cities may wish to draw upon. This matter is now being controlled by state boards of health in some states and by state water or state conservation commissions in others, but not often, if at all, by state utility commissions.

If time permitted I should like to present in detail the argument for state control of water-works accounts and reports of physical data. Where such control is now exercised, it is vested sometimes in a state board or commissioner or auditor of municipal accounts and sometimes in a state utility commission.

Coming to another phase of the subject, I believe that it would be salutary if there were some measure of state control over the way in which a city raises its money to defray the cost of its utility service. In the case of water-works, in particular, rank injustice now prevails in the distribution of the cost of the service between the private consumer and the city at large. I believe the Wisconsin Commission has taken a long step in the right direction in compelling some cities to raise by taxation an adequate sum to pay for fire protection and other public services instead of saddling this charge upon the private consumer. The whole water-works fraternity of the country has for years urged that the taxpayer and not the private water consumer should meet the cost of fire protection, street watering, sewer flushing and the water-supply to public buildings.

Possibly some of you may have observed that such instances of state regulation of water-works as I have specified are vested in four independent commissions: (1) health; (2) water-supply or conservation; (3) utility; (4) accounting or auditing—and there may be still others. Some of these commissions have overlapping jurisdictions. Strongly as I believe in state administrative control of municipal affairs, I do not wonder that there are complaints of over-regulation when there are so many municipal masters—although even a multiplicity of state administrative boards is infinitely better than the old-time state legislative interference which these boards are lessening.

Distasteful as any sort of state control may seem to some, cannot we all agree upon the desirability of placing all such control as may from time to time exist under one instead of many commissions—a single State Board of Municipal Control, under which there would be a bureau for each branch of the municipal service subject to state supervision, the whole working in harmony and so centralized in administration as to give one instead of many municipal masters?

*An address before the Conference of Municipal Mayors on Public Policies as to Municipal Utilities, Philadelphia, Penn., Nov. 14, 1914.

†Editor of "Engineering News," New York City

The Hell Gate Bridge in the Shop

Progress in building the Hell Gate Bridge across the Narrows of the East River between Long Island City and Ward's Island is in accordance with schedule. The steelwork of the 977½-ft. steel arch has been in course of fabrication at the Ambridge, Penn., plant of the American Bridge Co. since early this year, and in May was begun the yard assembly of portions of the arch, which is required in order to make the joints true and assure accurate and easy fit in field erection.

Meanwhile, the work at the site has been advanced, after completion of the piers, by beginning the erection of the towers and temporary backstays which are needed for the erection of the arch by the cantilever method. The program is based on finishing with the backstays during winter, so that erection of the arch itself can be started at the earliest possible time in spring, 1915, and thus give the whole season for erecting and swinging the arch.

A full description of the Hell Gate steel arch, with drawings of typical parts of the steelwork, will be found in ENGINEERING NEWS of Jan. 8, 1914, pp. 59 to 64. The chief features of this bridge from the standpoint of the shop which must fabricate the steelwork are:

(1) The use of high-strength medium steel throughout. The demanded ultimate tensile strength is 66,000 to 76,000, with a desired value of 71,000 lb. per sq.in. The material must meet a cold-bend test of 180° around a diameter of twice the thickness.

(2) The enormous size of the individual members and of the plates which compose it; and more especially the size of gusset plates.

HIGH-STRENGTH CARBON STEEL

The steel at first furnished under this contract ran generally down toward the lower limit of the demanded strength-range, that is, near 66,000 lb. With further efforts, however, the deliveries were of stronger material, and at the present time the average of the tests runs rather over the required average, probably near 72,000 lb. per sq.in. The carbon content of the material varies, to suit the thickness of material (ranging from ½ in. to 2 in.). The ordinary amount is in the neighborhood of 0.30%.

LARGE SIZE OF PARTS

Some of the most difficult pieces to furnish are the large gusset plates, extending through the entire depth of the heavy chord or arch rib and projecting up to take the web members. The largest such plate is 129 in. wide by 17 ft. long and 1⅛ in. thick. Some of the [illegible], with plates [illegible] in. wide, are heavier, but the large gusset [illegible] is at the extreme limit of the capacity of available rolling mills. Doubt was entertained from the start by the shop people whether these large plates would be obtained reasonably straight (flat) and of uniform thickness (i.e., without swell in the middle of the width). Overrun of thickness would make trouble in entering the gussets into the slots in the chord which receive them (see Fig. 2, where the slots are seen just outside of [illegible] in Fig. 2 a [illegible] slot is seen [illegible] of the arch rib which is seated on the [illegible]).

YARD-ASSEMBLY

The fabricating processes in this contract are unusual not only because of the conditions just mentioned but also because of two other requirements: that practically all the holes must be drilled (subpunching is allowed only in ½-in. and less thickness), and that the structure must be assembled in the yard and the field connections drilled to match before the parts are shipped. This last requirement is reflected in the accompanying views, Figs. 1 and 2.

As might be expected from the great size of the structure, it was not possible to yard-assemble the entire arch (i.e., one truss) simultaneously. The assembly of three or four panels at a time was, therefore, taken as satisfactory, but the terminal members of each section are later reassembled with the following section to get the match of the connection.

The view, Fig. 2, pictures the four end panels of the arch; the endpost is the farthest member in the view, the upper chord is at the right, and the lower chord or main arch rib is at the left. In Fig. 1 the lower chord is the farther member and the endpost is at the right.

POLYGONAL-FACED CHORD JOINTS

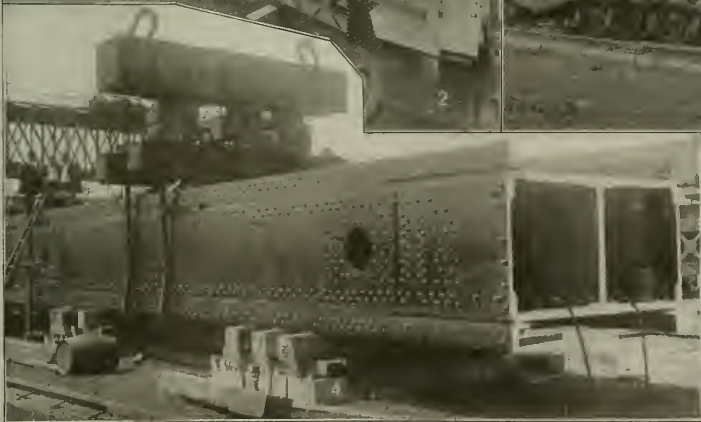
Planing the chord joints is one of the special features of the work, in view of the great size of the parts. This work is done on a traveling-head planer, housed in the shed at the right in Fig. 1 and in the background in Fig. 2. Only one end of the member being planed is in the house, the larger part of the length being outside. The roof of the planer house is removable, so that the yard gantry can lift the piece away or turn it, as may be needed.

This yard gantry was built specially for the work in hand. It is 130 ft. in span and has a capacity of 150 tons, although it will be called upon to lift loads of about 185 tons, which its normal overload capacity permits it to handle.

The main arch rib is of the section exhibited by the piece in the planer in Fig. 1, a box section with horizontal diaphragm at mid-height. The width of the section is 7 ft., and its depth varies from about 7½ ft. at the crown of the arch to 10½ ft. at the abutments (the face shown in Fig. 2). This rib is field-spliced at each panel-point; the joint faces are planed to a polygonal contour, which gives contact over only the middle third of the depth of the section, while the upper and lower thirds are backed off on a taper amounting to $\frac{1}{16}$ in. each at upper and lower flanges. Thus, when the two adjoining sections are butted together in correct relative position, there is an opening of ⅛ in. at top and bottom, with the middle third of the depth in true bearing.

The original requirement of the engineer was that one of the abutting faces should be finished to a slight circular or rocker curve, the other face being plane; but this requirement was, upon consultation with the contractor, modified to give the polygonal outline just described.

In facing the first rib sections fabricated, early the past summer, they were planed on the true joint planes for the full depth of the section, and the first yard assembly was done with the rib sections in this condition. The purpose was to see whether joints could be obtained so true and accurate as to make the polygonal planing unnecessary. On assembling, it was found that the joints made perfect contact. However, the engineer preferred to make still more certain of uniform stress distribution



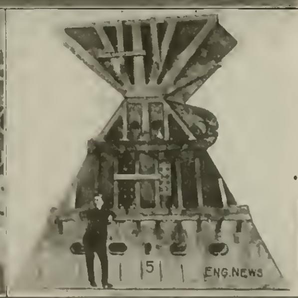


FIG. 1. END SECTION OF ARCH ASSEMBLED IN AMBRIDGE SHOPYARD

(Top chord in foreground, end-post at right; at extreme right, under the 150-ton yard gantry, is the planer house, with a bottom-chord section in place for planing the joint face.)

FIG. 2. ANOTHER VIEW OF THE FOUR-PANEL PIECE OF THE ARCH ASSEMBLED IN THE YARD

(The joint in the right foreground is one of the top-chord panel-points, which have much smaller gusset-plates than those of the bottom chord.)

FIG. 3. END SECTION OF BOTTOM CHORD, ON CARS FOR SHIPPING

(Weight as stripped for shipping, 150 tons; weight with gussets, etc., 185 tons.)

FIG. 4. ONE OF THE BOTTOM-CHORD SECTIONS IN THE YARD

(Note special lifting shackle. The end of the member shows the slots in which the web gussets must be entered to full depth of chord, during erection.)

FIG. 5. END SHOE OF HELL GATE ARCH

be adhering to the [illegible] requirement of [illegible] outline.

EXCELLENT SHOP WORKMANSHIP OBTAINED

The drilling of rivet holes is distinctly slower in the high-carbon steel of this bridge than in normal structural steel; with this exception it may be said that the material works just as easily as any bridge steel. Both the bridge-works officials and the engineer for the bridge say that the shop operations and the workmanship of the finished parts have been in all respects satisfactory. The rivets in the principal members of this bridge are of 1⅛-in. diameter. These are practically identical in material and strength with ordinary bridge rivets.

The group of views also contains a view of one of the end shoes of the arch. Such a shoe built up of steel castings with [illegible] total thickness weighs 500,000 lb. Inasmuch as it sits on a masonry seat inclined about 15° to the horizontal, provision was made for anchoring it in place until the arch is so far erected that the thrust of the structure will hold the shoe securely to its seat. Ears have therefore been cast on the upper member of the shoe, as will be seen in Fig. 5. These will be linked to eyebars [illegible] horizontally into the pier masonry just above the shoe level. After completed erection of the arch, the pins connecting the ears to the eyebars will be removed, the eyebars cut off close to the masonry, and the omitted blocks of facing stone at the location of the eyebars will be set in place.

The end casting of the arch, shown in place on the shoe, has a slightly convex cylindrical face, to give hinge action. A dowel connects the large castings to prevent displacement transversely.

The American Bridge Co., who is fabricating the steelwork, will also erect the arch, and is at present erecting the falsework already mentioned. Gustav Lindenthal, 68 William St., New York, is engineer for the owner, the New York Connecting Railroad Co.

A Year of Commission-Manager Government at Lakeland, Fla.

By [illegible] F. McLean*

The commission-manager government of Lakeland, Fla., the first of its type in the state, came into power in January, 1914. There was no great demand for the commission form of government in Lakeland, only a small vote was polled, and the majority was small. As a consequence, the new form of government has not had a strong backing of public opinion to encourage its efforts for efficiency in public service. Moreover, there has been considerably active opposition. This, at one time, took the form of a largely signed recall petition, which was eventually withdrawn. In spite of lack of support, the first year of the new government has not been barren of favorable results, as will be shown by mentioning some of the changes and improvements made by the various departments of the city.

THE SANITARY DEPARTMENT—This department looks after garbage collection, street cleaning and cleaning of outdoor closets. Although the city has a population of only [illegible] less than [illegible] the building lots are large, many of them having frontages up to 135 ft., and the limits include an area of about 4 sq.mi. The central part has modern sewerage, and a sewage-disposal system with Imhoff tanks. The care of the outdoor closets outside of the sewer zone, and the collection of garbage from the area of 4 sq.mi., constitute the most important duty of the sanitary department.

The following improvements have been made: A general cleaning up of all the alleys, the connecting up of a large number of buildings with the sewers, substitution of quicklime for antiseptics in outdoor closets instead of expensive coal-tar derivatives, a saving of $85 per month by having the head of the sanitary department take over the plumbing inspector's duties in addition to his own, a reduction of about $40 per week in the labor payroll; prompter and more reliable collection of garbage, introduction of "white wings" cleaning on the business streets; changes in the plumbing code, providing for the examination of all plumbers before granting them licenses, and putting all plumbers under bond to the city.

THE STREET DEPARTMENT—The business section is paved with brick and part of the residential section with bituminous concrete, but there is a large extent of sand-clay streets and unpaved roadways. As the cleaning of the paved streets is done by the sanitary department, the principal work of the street department is the maintenance of the sand-clay and unpaved streets. The split-log drag has just been introduced, and is found of great service. The street department has been given, lately, the repair work on paved streets necessitated by the trenching operations of plumbers and others, the cost of the work being charged to those doing the trenching.

FINANCE DEPARTMENT—A budget system of twelve divisions has been developed, instead of the old method of throwing everything outside of the light and water fund into a general fund and a sinking fund. Part of the floating debt due to the old system is being taken care of in the first budget of the new system, which, if carefully adhered to regarding expenditures in the different divisions, will clear off the floating debt in a few years.

FIRE DEPARTMENT—Improvements have been made in the present alarm system by putting in an extra telephone, connected with a large gong, and by having a direct connection from the telephone at the waterworks pumping station to the fire whistle. The citizens have voted to secure money to put in a modern noninterfering box fire-alarm system, a pumping engine, and other apparatus.

POLICE DEPARTMENT—The following improvements have been made in the police department: Patrolmen are required to report their whereabouts to headquarters half-hourly by telephone; data concerning all arrests are entered on printed forms by the patrolmen at the time of the arrests.

WATER AND LIGHT DEPARTMENT—The citizens have voted to sell bonds to enlarge the present overloaded power house and to extend and renew the water-distribution system. This enables the department to lower the rates to consumers, as a large part of the revenue has been expended, heretofore, in installing new mains and other relatively permanent parts of the distribution system. A commencement in lowering the rates has been made by cutting the minimum charge for water to $0.75 per month and for light to $1 per month, as against $1 and $1.50 per month for water and light, respectively. Further reductions will be made, because now only the interest on

*[illegible] Lakeland, Fla. [illegible]

permanent improvements will be paid from revenue, outside of small payments on a sinking fund.

There have been large losses in the past through customers neglecting to pay bills when they changed their places of business or residence. This has been largely obviated through prompter rendering of bills, and discontinuing service to delinquents.

Long-Term Variations in Stream Flow, Croton and Hudson Rivers

By Edward H. Sargent*

The writer has made an investigation of the two longest stream-flow records in New York State, the Croton River (1868 to 1913) and the Hudson River (1888 to 1913), with an idea of finding their diversity of flow.

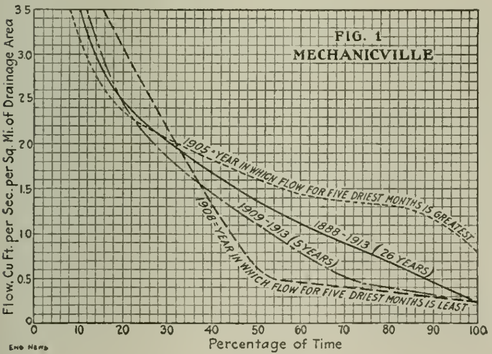
On the accompanying diagrams (Figs. 1 and 2) are shown Duration Curves† for the Hudson River at Mechanicville (drainage area 4500 sq.mi.) and the Croton River at New Croton Dam (drainage area 360.4 sq.mi.). Curves are given for both places for the long-term record, the driest‡ year, the wettest‡ year, and the last five years, 1909 to 1913, inclusive.

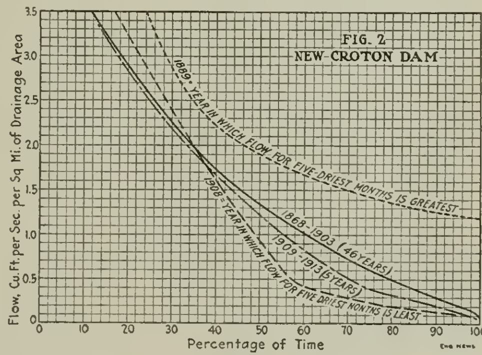
voir was but slightly in excess of the wettest year (1892) prior to its construction.

It was found that to obtain a duration curve for recent years that would closely approximate the low-water portion of the long-term duration curve at Mechanicville, it was necessary to use the records for the last eleven years. In any duration curve computed for any series of years from 1913 backward less than eleven years, the curve will lie below the low-water portion of the long-term record curve.

The Croton River curves were based on the computed natural flows of the Croton River at the New Croton Dam. The estimates of the flows from 1868 to 1899 were made by John R. Freeman, and from 1900 to date, by the Croton Aqueduct Commission and the Department of Water Supply, Gas and Electricity of the City of New York.

The driest year of the Croton River records was 1908, coinciding with the driest year shown by the Mechanicville records. The wettest year shown by the Croton River records was 1889. Similarly, as in the case of the Mechanicville records, it was found that if a duration curve was computed and plotted from the records of the Croton River for the last eleven years (1903 to 1913, inclusive) it would closely coincide with the low-water flow





Duration Curves of Flow of Hudson and Croton Rivers

(Based on monthly records at Mechanicville and at New Croton Dam.)

The Mechanicville curves are based on the records taken at the plant of the West Virginia Pulp & Paper Co. and represent the combined wheel and spillway discharges, which have been checked at various times by current-meter measurements. These flows do not represent exactly the natural runoff from this watershed because of the diversion of approximately 200 cu.ft. per sec. to the Champlain Canal during the navigation season, May 1 to Dec. 1. The natural flow since 1899 has also been somewhat modified by the storage in the Indian River Reservoir, 1,700,000,000 cu.ft. capacity. In view of this storage it is pertinent to note that the driest year (1908) during the entire period 1888 to 1913 was subsequent to the con truction of this reservoir. The wettest year (1905) subsequent to the construction of this reser-

portion of the long-term record, and any duration curve for any series of years from 1913 backward less than eleven years would lie below the low-water portion of the long-term record curve.

The following is a table of the rainfall on the Croton watershed for the various periods for which the duration curves are shown:

Period	Rainfall, In.
1868-1913	48.82
1903-1913	49.22
1909-1913	47.43
1908	43.02
1889	55.70

Rainfall stations have only recently been established on the Hudson River watershed at points which will give an idea as to the precipitation at the higher altitudes, so that it is not possible to determine with a great deal of accuracy the rainfall for the Hudson River watershed.

*Assistant Civil Engineer, New York State Conservation Commission, Albany, N. Y.

†See article on "Stream Flow Studies" by the writer in "Engineering News," April 23, 1914.

‡The "wettest year" has arbitrarily been defined as that year in which the runoff for the five driest months was the greatest, and correspondingly, the "driest year" as the year in which the flow for the five driest months was the least.

Dock Facilities at Guayaquil, Ecuador, are such that most of the unloading is done by lighters. This, however, appears to be partly due to the fact that it is necessary, or at least advisable, for ships to keep away from the docks in order to lessen the danger of infection by bubonic-plague rats.

Flood-Protection Work on Fall Creek at Indianapolis, Ind.

By [illegible] E. White*

The work of providing for flood protection along Fall Creek began while the 1913 flood was at its crest.[1] At that time high-water elevations were taken at each of the 12 bridges crossing the creek and at all points around the flooded margin. The former figures were used in connection with establishing the grade and cross-section of the stream, while the latter were used in making a flood map, which was used as a basis for determining the assessments to cover the cost of constructing the new [illegible] embankment. The elevations and conditions at the bridges are given in the accompanying table. Fig. 1 is a map of the park district along the creek and shows the new work.

FIG. 1. MAP OF NORTH PARK DISTRICT, SHOWING FLOOD-PROTECTION WORK ALONG FALL CREEK, INDIANAPOLIS, IND.

FLOOD-WATER OBSERVATIONS ON FALL CREEK INDIANAPOLIS, IND.

Place	H. w. elev. Mar. 1913	Dist.	Diff. in elev.	Slope
C. I. & W. Ry. Bridge	[illegible]			[illegible]
Fair Grounds Bridge	[illegible]	[illegible]	[illegible]	[illegible]
Monon Ry. bridge	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] St. bridge	[illegible]	[illegible]	[illegible]	[illegible]
College Ave. bridge	[illegible]	[illegible]	[illegible]	[illegible]
Central Ave. bridge	[illegible]	[illegible]	[illegible]	[illegible]
Meridian St. bridge	[illegible]	[illegible]	[illegible]	[illegible]
Illinois St. bridge	[illegible]	[illegible]	[illegible]	[illegible]
Capitol Ave. bridge	[illegible]	[illegible]	[illegible]	[illegible]
Northwestern Ave. bridge	[illegible]	[illegible]	[illegible]	[illegible]
Big Four Ry. bridge	[illegible]	[illegible]	[illegible]	[illegible]
Indiana Ave. bridge	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]

Immediately after the flood a survey of the creek was made, extending from its mouth to a point eight miles up stream. This survey was made with transit and stadia and cross-sections of the stream were taken at 100-ft. intervals. These sections were plotted and were found to range from [illegible] sq.ft. to [illegible] sq.ft. in area. Some of the sections are shown in Fig. 2. One section (A in Fig. 2) between the Fairgrounds bridge and the C. I. & W. R.R. bridge carried all the water that passed down the creek. This section contained 1100 sq.ft., with [illegible] sq.ft. in the channel proper, and with a stream grade of [illegible]%. From these data a maximum flow of [illegible] cu.ft. per sec. was computed. In determining the necessary cross-section to provide for future floods the foregoing 1100-sq.ft. section was used as a criterion.

*Engineer, Department of Public Parks, Indianapolis, Ind.

[1] [illegible]

If the grade and section of the channel had been uniform throughout, naturally a 1100-sq.ft. section would have been required at all sections, or if the cross-section had been uniform and the grade had been variable, the velocity, and consequently the flow, would necessarily have changed. But as both the cross-section and grade were variable, both factors had to be considered in establishing the new grade and section of the channel in order to get as nearly as possible a uniform flow.

Another factor that entered into the question of uniform flow was the capacity of the different bridges and the effect of the Indianapolis Water Co.'s dam at Northwestern Ave. The top of the dam is level with the bed of the stream at a point half way between Central Ave. and College Ave. (see Fig. 1), and this last named point is 8 ft. below the bed of the stream at the Fairgrounds bridge.

If the Board of Park Commissioners were to dredge to a depth of 8 ft., the dam would back the water to the Fairground bridge. This being the case, at flood stage the stream grade would be practically 0.1% and uniform. Then with a section of at least 1100 sq.ft. there would be no doubt as to the efficiency of the channel; the only question would be as to the waterway of the bridges. After the creek has been dredged, all irregular-

FIG. 2. CROSS-SECTIONS OF FALL CREEK, SHOWING IMPROVEMENTS

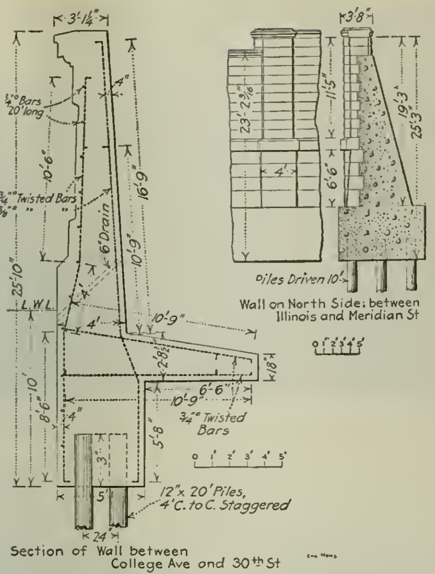


FIG. 3. CROSS-SECTIONS OF RETAINING WALLS ALONG FALL CREEK

ities in the bed will tend to be removed and those bridges not resting on piling will be endangered. However, a minimum section of 4100 sq.ft. has been adhered to, and the Board of Park Commissioners will dredge to a minimum depth of 8 ft. and a maximum of 16 ft. As the 1913 flood water all passed through the Illinois St. bridge, having a waterway of 2825 sq.ft., and on a section of the stream whose grade is 0.01% at that point, a sectional area of 4100 sq.ft. seems to be ample.

The first thing in the construction of the boulevard was the removal of the good soil from beneath the proposed roadway, and the storage of it on either side so as later to be available for surfacing the lawns. This is shown in section *B*, Fig. 2. The portion *Z* was removed with slip and wheeled scrapers, and stored at *X* and *Y*. Then the gravel excavated from the creek was hauled in to make the roadway and fill; when this work is nearly up to grade, the material at *X* and *Y* will be brought to the finished cross-section and grade.

The fill for sections Nos. 1 and 3 (Fig. 1) is being made from excavations from the creek, while that for section No. 2 is being made from material obtained from the grading of streets, excavations from cellars, etc. Along sections 1 and 3 the channel will be excavated to a depth of 8 ft. minimum and 16 ft. maximum and will have at least a 100-ft. base width at right angles to the center line of the stream. Section No. 1 is being constructed by the use of four stationary dragline excavators, stationed at intervals along the work. The material is dredged from the creek and dropped into small dump cars, which operate along the line of the work. These dump cars are pulled by an automobile mounted on car wheels, and a trip forward and back can be made in a very short time.

Where the sand and gravel taken from the creek is in excess of that needed for the embankment, it is stored and sold. The cost of constructing this section is about 12c. per cu.yd.

Section No. 3 is being constructed by the use of one dragline excavator and two trains of dump cars, pulled by dinkey engines, which carry the excavated material forward and back along the embankment. As on section No. 1, the excess sand and gravel is stored and sold. The cost of constructing this section is about 20c. per cu.yd. The cost of constructing section No. 2 will be between 20 and 25c. per cu.yd.

The cross-section of the boulevard embankment is shown at *B*, in Fig. 2. The width of the boulevard at the top is 75 ft. in nearly all cases, but in a few instances it has been made wider, in order to increase the height of the inside berm without making the increase noticeable. The width comprises a roadway 40 ft. between curbs, an inside berm of 5 ft. and an outside berm of 30 ft. The inside berm has a variable slope from 1 on 4 to 1 on 1½, while the outside berm has a slope of 1 on 1½ ft. Both berms have a slope of ¼ in. per ft. toward the roadway. The 30-ft. berm carries two rows of trees: one row being 2½ ft. from the property line and the other 6 ft. from the curb line. This berm also carries a 6-ft. walk at 5 ft. from the property line. The lawns have 2 ft. of good top soil, while the roadway consists of gravel.

At points along the creek from Capitol Ave. to Central

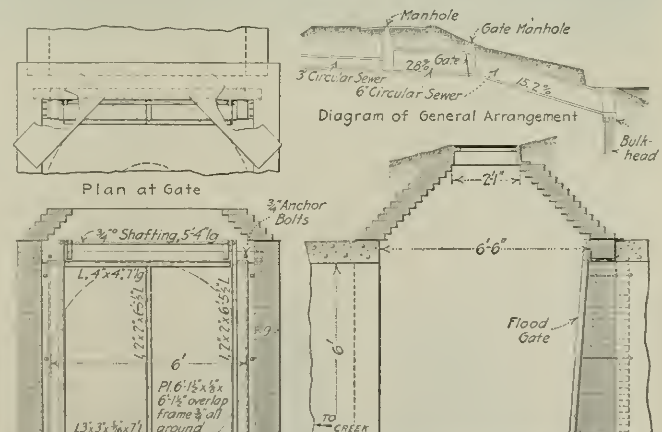


FIG. 4. FLOOD GATES FOR SEWER OUTFALLS ALONG FALL CREEK, INDIANAPOLIS, IND.

Ave., where property values are high, the boulevard is built so closely to the creek that it is necessary to have a retaining wall, not only to carry the embankment, but to give a greater section of channel. The sections of these walls are shown at the right in Fig. 3. They were built shortly after the flood of 1901.

Fig. 5. New Levee and Boulevard along Fall Creek, Indianapolis (Looking West from Northwestern Ave. Bridge)

Fig. 6. Building New Levee with Steam Shovel and Dump-Car Trains

A retaining wall between College Ave. and 30th St. was made necessary by the 1913 flood and is now under construction (Fig. 9). This wall will still slip the stream as shown by section C in Fig. 2, so that present conditions extend into the stream. As only a portion of the backfill will be made at this time, the wall had to be designed so as to withstand a high-water level with no backfill and also to carry a backfill in time of low water. Since this was to be a reinforced-concrete wall, these conditions made it necessary to reinforce the face as well as the back of the wall.

In addition to protection by walls and boulevard embankments, protection from backwater through sewers became necessary. Every sewer emptying into the creek was provided with a steel flood gate, as shown in Fig. 4. This gate was hung in a manhole constructed either at the top of the embankment or within the flood channel; otherwise the top would be raised by the water pressure and flooding would result. Of course, this makes it impossible for surface water to get away during a flood, but it is anticipated that this water will escape before the

Fig. 7. Building New Levee by Drag Scrapers and [illegible]

Fig. 8. River Wall and Fill of Flood-Protection Work on Fall Creek, Indianapolis, Ind. (Showing the Illinois St. Bridge)

creek reaches the elevation at which the gates will close.

With the completion of the work now under construction, Fall Creek will be harnessed as far south as the canal (Fig. 1). It is the intention of the Board of Park Commissioners to extend the boulevards southerly on both sides of the creek as rapidly as possible.

Fig. 5 is a typical view of the new bank and boulevard. The two sides of the fill are of earth, while the roadway fill between them is of gravel several feet deep; the gravel fill may be seen in the distance, to the left of the big trees. Fig. 7 shows a drag scraper plant making the fill north from 30th St. to the Fairgrounds bridge. The scraper cable is carried across the river; the bucket works across the bed and dumps the gravel at the tower, where screens are fitted, separating the gravel from the sand. From this the sand flows through the chutes to form the fill. Fig. 6 shows the fill being made by steam shovel and dump car. Fig. 8 is a view looking west toward the Illinois St. bridge, where the river is confined between masonry walls supporting the fill.

Aluminum Alloys as Surface Protection for Metals Subject to High Temperatures

A process has been developed by the Research Laboratory of the General Electric Co., by which aluminum alloys are formed on the surface of metal articles, particularly iron, steel and copper, and by which they are made more resistant to oxidation at temperatures above a red heat. This process has been called "calorizing." Articles may be heated in revolving drums with mixtures containing finely divided aluminum or those pieces which, because of shape or size, are not adapted for tumbling may be treated by packing them in or painting them over with the aluminum mixtures before heating. In this way the size of the heater which can be employed is the only limitation on the size of the piece that may be treated. Wire or ribbon may be treated by a continuous process, in which it is passed through a heated pipe containing the proper mixture.

The life of the coating seems to depend on the temperature at which it is used, as well as the duration of time allowed for the formation of the surface alloys. Long use at temperatures in excess of 1100° C. results in destruction. The thickness of the alloy formed varies with the length of time to which the piece is subjected to the process. The percentage of aluminum varies through the coating, being greatest at the surface. On a calorized copper rod the line between the alloy and the unchanged copper is sharp, but the color of the alloy varies from golden yellow next to the copper to silver white at the surface. Cross-sectional photo-micrographs show the large crystals of the calorized surface and the typical crystalline structure of the copper beneath. Some blistering of the copper immediately below the calorized surface is indicated by spaces between the copper crystals. If the process is conducted at a high temperature and the mixture is rich with aluminum, two layers of different alloys may result.

When an iron pipe or ribbon is calorized for a heating unit, the resistance and temperature coefficients are changed; the thicker the calorizing coat, the greater the change. The dimensions and weight of either a copper or iron piece are slightly increased by the process. The increase of dimensions is much less than the thickness of the alloy coat. There is a tendency to a greater increase at the edges than on flat surfaces.

Calorizing is not intended to compete with galvanizing, sherardizing, and similar processes for protection against corrosion at low temperatures, although for low temperatures calorizing is effective against the corrosion of copper as well.

The theory of the effect of the aluminum in the surface alloy is that a thin coat of aluminum oxide forms to prevent further attack of the metal beneath. This is similar to the protection which aluminum articles receive under some conditions.

Several recent typical examples of this protection are described in the October issue of the *General Electric Review*. Two pieces of similar iron pipe, one plain and the other calorized, were heated side by side with a laboratory blast lamp to a temperature of about 900° C. for four hours, then cooled and the heat reapplied for another period of four hours. At the end of that time the untreated pipe was badly burned, the metal being reduced at the point of the flame to one-half original thickness. The whole surface was blistered. The calorized pipe appeared to be unchanged. Previously, the calorized piece had been used in an electric resistance furnace where it was heated alternately to 1000° C. and cooled, being maintained at the maximum temperature in all for about 50 hours. The same piece was heated to about 900° C. and plunged into cold water after it had cooled to a dull red. On repeating this three times, the surface showed no signs of crack or scale.

Two pieces of sheet-iron tube, one calorized and the other plain, were subjected to a temperature of 800° C. in a gas furnace for 100 hours. The plain piece was practically destroyed, while the calorized piece was unharmed. An untreated piece of the iron wire or ribbon, such as is used in electric heating units, will burn out in four or five hours at the most, whereas the calorized strips have their life increased at least fifty times and in some cases over one hundred times. A life of 500 hours at a temperature of 800° C. may be expected from calorized heating units.

Calorized seamless iron tubing is being used for combustion tubes in the company's laboratory where pure oxygen is brought in contact with the metal at temperatures of 900 to 1000° C. These appear unchanged after 100 hours' service.

In some cases calorized copper may be used in place of aluminum bronze. In one large power station, which was having trouble from early corrosion of aluminum bronze condenser tubes, a set of calorized copper tubes were installed and in the 2½ years since not one has failed, whereas before the tubes would fail in four to six weeks. Railway controller contacts which had been calorized showed double the life of ordinary untreated parts.

Railroad Ice Storage Houses are the subject of a report which a committee of the American Bridge & Building Association presented at the recent annual meeting. The report is very complete, and in effect constitutes a treatise on the design and construction of such houses. Following a seven-page résumé the necessities of railway ice storage house design and the details of construction, the report contains some 60 pages of detailed description of houses which have been built by various American railroads. Copies of the report probably can be obtained from the secretary of the Society, C. A. Lichty, 319 No. Waller Ave., Chicago, Ill.

Field and Office

Plant and Working Methods on Approaches to North Side Point Bridge

By E. L. Jones*

The erection of two steel spans across the Allegheny River at the extreme point of land where the Allegheny and Monongahela rivers form the Ohio, and at a height of 72 ft. above pool level and 40 ft. above the sloping banks of the river, made it necessary to construct 900-ft. approaches on both sides with a grade of 5%. The approaches as well as the bridge itself are 56 ft. wide with a 36-ft. roadway and two 10-ft. sidewalks, provision being made for two car tracks on the roadway.

The south approach was designed with the idea of utilizing the present approach to the Point Bridge over the Monongahela. This idea was carried out by building reinforced-concrete retaining walls on both sides to widen the approach and raising the street to the new grade by making an earth-and-slag fill. This change in the old approach to the new grade made it necessary to raise the shore span of the old Point Bridge 2 ft. 7½ in. The remaining gap between the intersection of the center line of the two bridges and the new bridge was spanned by two reinforced-concrete arches with a clear span of 7[illegible] ft. 6 in. and 82 ft., respectively.

As conditions were different on the north side of the river, it was found advisable to use six reinforced-concrete arches diminishing from a clear span of 85 ft. at the river to a span of 39 ft. 4 in. at the last arch. From the abutment of this arch to the intersection of the approach with South Ave. [illegible] reinforced-concrete retaining walls were used with an earth-and-slag fill to grade.

The retaining walls were designed by three types, all, however, having spread footings to distribute load over a greater area. Walls up to 15 ft. in height were of the gravity type. Those from 15 to 34 ft. in height were designed as cantilever walls, while those over 34 ft. were all built with counterforts.†

Because the ground on both sides was all filled, consisting of a porous nature, concrete piles were driven under all walls and piers with the cutoff from 8 to 12 ft. below ground level. The arches are of reinforced-concrete rings the full width of the approach, diminishing slightly in thickness under the sidewalk. Spandrel walls carry the flat roadway slab while the sidewalk rests on the side walls and roadway slab.

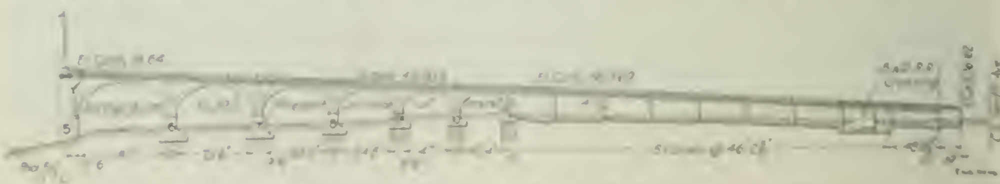
The steel spans over the river were erected by the American Bridge Co. in 1911-12, but, because the City of Pittsburgh had no available money, the contract for the approaches was not let until early in 1914. They are slated to be finished July 1, 1915, at an estimated cost of $575,000.

The work comprises some 15,000 cu.yd. of excavation, 17,300 cu.yd. of plain and reinforced concrete, 600 tons of structural and reinforcing steel, 13,000 cu.yd. of slag fill, 28,000 lin.ft. of concrete piles, also handrail, sewers, paving, sidewalks, etc.

Mixing Plant

Immediately after the contract had been let, the contractor began erecting his plant and getting equipment on the ground, but there was not much that could be done until spring. As all sand and gravel used on this work was dug in the Allegheny River and delivered to the job in wagons, it was necessary to lay out the mixing plants with this in view.

On the south approach the mixing plant was located opposite pier No. 2, in order to take advantage of the sloping ground, which ran up to the present Point Bridge approach, as by building a short trestle, level with the approach, teams were able to dump sand and gravel into the top of the 50 and 60-cu.yd. storage bins. Under the bins was a ⅔-cu.yd. Ransome displacement mixer with concrete hopper attached. Concrete was dumped directly into a [illegible] hoist bucket and hoisted to the top of a 70-ft. wooden tower, from which it was distributed by one especially built concrete chute supported on a 30-ft. latticed boom, which also held up one end of a 20-ft. trussed chute, thus making a full radius of 100 ft. and enabling the contractor to place concrete at any point on piers and arches No. 1 and No. 2, and, by adding 100 ft. more, three sections of wall could be reached. The remainder of the walls were concreted with a ½-cu.yd. Ransome mixer placed on top of the wall and moved ahead by a locomotive crane, which ran on a track parallel to the wall. The capacity of this crane was 15 tons. It had a 50-ft. boom and was used for all wall excavation and to move forms from one section to the next.



North Approach to North Side Point Bridge (Elevation of East Wall)

*[illegible]

†[illegible]

Excavation for pier No. 1, which was 34 ft. deep, was done with a guy derrick handling a 1-cu.yd. dump bucket. This derrick was afterward moved onto the north end of the bridge and used to assist in setting and removing steel centers. Cement was delivered in cars to within about 1000 ft. of the plant; but from that point was hauled in wagons to the top of the bins and dumped down a wooden chute to the mixer. A storage shed for 800 bbl. was provided. With a few minor exceptions, the arrangement of the mixing plant on the north end was the same as on the south end.

All excavation on the north end was done with a $\frac{3}{4}$-cu.-yd. orange-peel bucket, operated by a 30-ton locomotive crane with a 70-ft. boom. This crane was also used for setting arch centers, handling wall forms and placing concrete in the walls. The large mixing plant was located so as to chute concrete to all parts of the six arches, while the walls were taken care of by the same method as that employed on the south end.

Piles

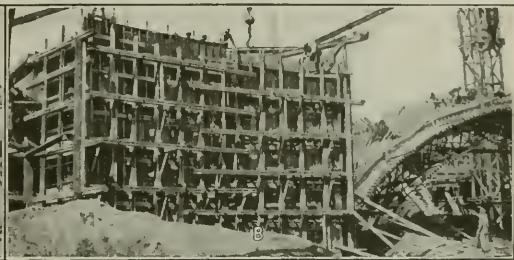
As soon as the excavation on the first pier had been carried down to the required depth, the work of driving the piles was started. The piles were placed 3 ft. c. to c. each way, over the entire bottom of the pier foundations. The large foundations were 26x57 ft. in plan, and as all the excavation was done before the piles were driven and the pier foundations were from 10 to 16 ft. in depth and in most cases sheeted and braced, it was out of the question to lower the piledriver into the hole. Therefore, 24-in. I-beams, 40 ft. long, were placed across the hole to support the piledriver. It was found that about as good progress could be made working from the I-beams as would have been obtained on the ground itself. A row of piles was also driven about 7 ft. c. to c., under the front edge of the retaining walls of the north end, but no piles were placed under the south walls.

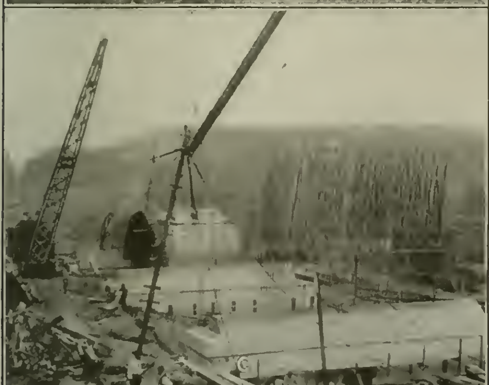
All piles were Raymond cast-in-place concrete piles and the core was driven with a steam hammer. Seven blows to the last inch gave them sufficient penetration to withstand the test required by the city, which was that one pile in each pier be selected and loaded up to 60 tons with an allowed settlement of $\frac{3}{8}$ in.* On account of the irregularity of the underlying gravel bottom into which the piles were driven, their length varied from 12 to 27 ft., averaging 17 ft.

Concrete

Piles were first driven on the south approach, then the piledriver was moved over to the north approach; but on account of waiting to make the tests it was nearly five weeks from the time the selected pile was driven until the concrete could be placed in the piers. Concrete was placed in wood and steel forms in lifts of about 300 cu. yd. at a time, that being about the average amount of concrete placed in ten hours with a $\frac{3}{4}$-cu.yd. mixer. As fast as two adjacent piers were concreted up to the spring line the centers for the arches were set up, and at the same time work was started on the retaining-walls and carried on so that both would be completed at the same time.

The arch rings were concreted in three 18-ft. wide sec-





Construction Views of Approaches to North Side Point Bridge, Pittsburgh, Penn.

A—Steel spans across Allegheny River, with mixing plant. B—Steel forms on 38-ft. counterfort wall. C—Piers on north approach, showing reinforcing. D—Setting steel ribs for arch centers.

*In testing a pile, a circular steel plate was first grouted on the pile head, and on this was placed a latticed steel column which carried balanced on its top the loading timber on which rested the tank framework. Side posts were also provided for carrying the tank framework through the medium of wedges until a balance was attained. When the wedges were struck, the tank, containing the desired load of water, rested on the pile under test. See also article describing these tests, in "Engineering News," Aug. 6, 1914, p. 310.

forms. Concrete was first placed at the spring line and kept at the same height on both sides of the arch until it met at the crown. The flow was regulated by a damper on the chute, at the center of the arch; one batch from the mixer was allowed to flow to one side while the next one went to the other. A section containing 270 cu.yd. could be filled in from 8 to 12 hr.

In all cases the center section of the arch ring was concreted first and allowed to set from 15 to 20 days, depending on the weather, before the center was removed.

Work on the north approach was carried on in the same manner as the south end, walls and arches were worked together.

Forms—The forms on this work were something of a problem, as only two pairs of arches out of eight were identical, and the wall forms had to be constantly changed from one type to another. After a careful study it was decided to use sectional steel forms for the walls, and steel ribs covered with 4x4 lagging for the arches. The steel wall forms were built up in place for the first section and then moved ahead by the locomotive crane in sections 15 to 20 ft. wide and the full height of the wall, which varied from 10 to 26 ft. Some of these sections weighed about four tons, but no trouble was experienced in placing them with the crane. The only difficulty encountered was changing plates to fit around braces in the deep ditches. This sometimes required much time; but on gravity walls and walls where there was no bracing to contend with, the steel forms worked very successfully.

The arch forms were made up with four steel ribs for each 18-ft. section, spaced 5 ft. 6 in. c. to c., and bolted together with angle iron and cross-braced with rods having turnbuckles for adjustment. Planks, 2x12 in. in cross-section, were bolted on each rib and to this was nailed the 4x4 Y. P. lagging which was surfaced on four sides and beveled 1/4 in. on two sides so that the top edge would fit tight. The rim forms were made from 2x12 surfaced yellow pine and were wired down to the lagging.

Reinforcement

Because of its varied lengths and sizes, the reinforcing steel was ordered in 10-ft. lengths and cut on the job as desired, with hand-operated cutters of German manufacture. These cutters were found superior to anything in that line on the market in the United States. The steel reinforcing for the counters in the counterfort walls was made on the ground and hoisted into place by the crane and the forms placed around it. The other steel was placed after the forms were set.

The arch steel was bolted with hookbolts to transverse lattice struts, set radial to the arch, and spaced about 9 ft. 6 in. c. to c. By this means the steel was held rigid.

Diamond bars were used throughout the job, of the same cross-sectional area as square bars of the same weight, but much easier to handle and bend.

Personnel

The work was designed under the direction of N. S. Sprague, Superintendent of the Bureau of Engineering, Pittsburgh; T. J. Wilkerson, Division Engineer of Bridges. Booth & Flinn, Ltd., Pittsburgh, are the general contractors, for whom M. J. Feeney is General Superintendent and the writer Constructing Engineer in charge of the work. The Raymond Concrete Pile Co. were subcontractors for the piles, while the Blaw Steel Construction Co. furnished the steel forms and arch centers.

Tearing Out a Reinforced-Concrete Subway

In preparing to connect the present eastern terminal of the old Steinway tunnel under the East River at New York City with the new line of rapid-transit subways extending into the borough of Queens, it was necessary to remove approximately 800 cu.yd. of reinforced-concrete subway structure. The accompanying view, from a photograph taken within the past month, shows the work of demolition practically completed. The structure re-

East Terminal Steinway Tunnel, Long Island City, Before the New Subway Connection

moved consisted of a 14-in. roof slab supported on sidewalls and intermediate columns, all reinforced and tied together. The old terminal station was completed in 1907, so that the concrete had reached a final set; in fact the monolithic character of the whole structure made its destruction most difficult.

Several methods of razing were tried before a successful one was hit upon. First, holes were drilled for blasting in the center of the sidewalls, but when fired the reinforcing rods held the walls and roof as firmly as before. Next, the roof was attacked with a 2300-lb. piledriver hammer swung from a derrick; this made practically no impression. Finally, it was decided to begin at the joints of the sidewalls and floor where the rods crossed each other at right angles. These walls were 2 ft. thick at the top and reinforced with two vertical rows of $1\frac{1}{4}$-in. rods.

In the horizontal line of the joint between sidewalls and floor, holes were driven downward at an angle of 45°, spaced 18 in. apart. On firing these holes the bond at the joint was broken. The roof was similarly drilled from the outside and broken down by blasting. This plan resulted satisfactorily, and sections of the sidewall and roof were successively tumbled into the tunnel where they were broken up by drilling and firing 6-in. holes.

The piers and columns supporting the roof were blasted out by drilling holes on one side, inclined down about 45°. When fired these charges had a twisting force which cut the columns from off the piers. Two of these piers will be seen in the view, a ladder standing on one. They were originally intended to carry, in addition to the roof of the subway, a six-story office building.

The Degnon Contracting Co. has the contract for the removal of the existing station and loop, and, in addition, will construct a new station a short distance east of the old site, and an elevated structure to the plaza of the Queensboro Bridge.

Fig. 1. Guy Piledriver, Amsterdam, Holland

A Dutch Piledriver

The accompanying views show a piledriver of remarkable design in action in Amsterdam, Holland. In Fig. 2, note how loosely the ram hangs between the leads.

William Hoeker, of 24 Plaats, The Hague, Holland, who furnished the views, says that the Building Department of Amsterdam restricts the loading on an average wood pile (0.24 m. or 9.36 in. diameter) to about 10 tons. He says that few pile failures occur, but that occasionally long piles are driven until they penetrate the hardpan under the mud topsoil, in which case the foundation sinks.

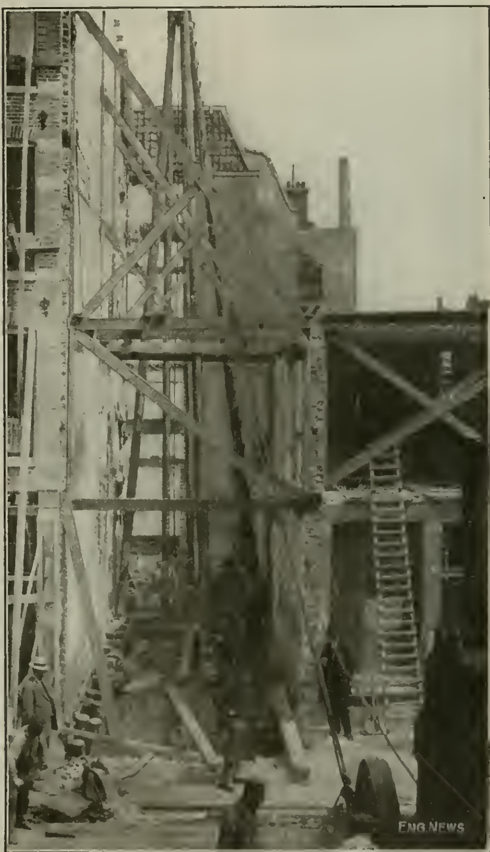


Fig. 2. The Piledriver Working in Restricted Quarters

Points on Waterproofing—In answer to a query as to the preference for brick laid in asphalt mastic over membrane waterproofing on the New York subway work, F. Lavis gives the following explanation: "The brick in mastic is usually used where greater security is required than is afforded by the felt or fabric waterproofing, and where the necessity of making the best possible provision against failure warrants the additional expense. The felt has been known to disintegrate under the action of groundwater strongly impregnated with illuminating gas drip, which does not affect the mastic. Usually the brick in mastic is used below the level of M.H.W. where pressures have to be resisted and where a failure of the waterproofing might mean very serious trouble. The mastic is used hot."

Erecting an Assembled 95-Ft. Steel Stack

[illegible]

[illegible]

[illegible]

Collapsible Inner Forms for Hollow Concrete Walls

[illegible]

[illegible] can follow directly behind the concreting. The illustration shows a partly constructed wall, seen from above.

In the normal walls built under this system, the inner forms are about 3 in. thick; the thickness of the cross-

HOLLOW WALLS BUILT WITH "EFFECTIV" FORMS, SEEN FROM ABOVE, SHOWING STAGGERED CROSS-WEBS

walls is 3 in.; the total thickness of wall is 12 in. Only the outside slab is free from direct bonding.

The Effectiv Building Co., which handles this system of hollow concrete wall building in this country through its representative, S. T. Dahl, 280 West 56th St., New York City, claims that buildings have been erected by this method in Sweden at a cost comparing favorably with that of frame construction.

NOTES

Driving a Ring of Sheeting for a Shaft [illegible]

[illegible]

A Nail Collar to Facilitate Pulling [illegible]

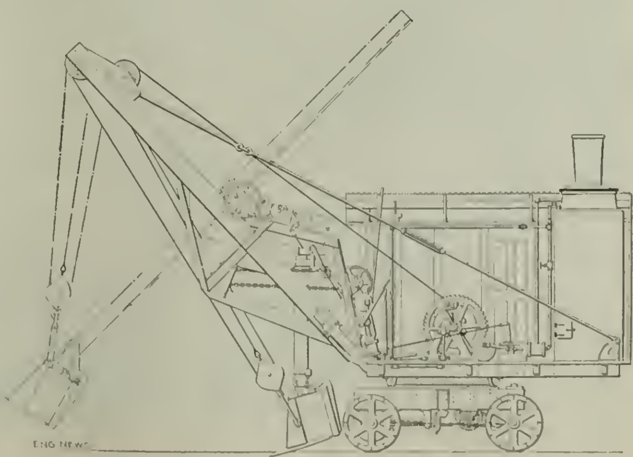
An Ideal Location for Gravity Deposition [illegible]

the bottom of which (and in the foreground of the view) runs a railroad on which the concrete material can be brought in. The material is stored alongside the track, mixed there and brought on the runway in the foreground and wheeled

POURING CONCRETE IN ARCH RIBS OF SHEPHERDS DELL BRIDGE, OREGON

in barrows over the runway, to be dumped into the cars which run directly under the platform on the left. These cars are then pulled by cables up the inclined track to the base of the tower, elevated to the top and spouted through the chutes to the proper location on the bridge. The contractor for the bridge is the Pacific Bridge Co., and the engineering is in charge of the State Highway Department.

A Combination Boom for Steam Shovels—A boom has been designed by the Thew Automatic Shovel Co., of Lorain, Ohio, with which the shipper-shaft motion commonly used on steam shovels can be used, as well as the horizontal crowding motion employed on this concern's machines for many years. The latter is well adapted for shallow cuts and surface work; the former for trenches and where long dumping radius or high clearance lift is needed. The two mechanisms are independent and noninterfering. With the long-handled dipper in use, the short dipper arm is chained to the boom; when the short-handled dipper is wanted the long arm is removed. Change of engine, steam connections and dipper handles takes about three hours. The long handle is of wood, 8x8 in., plate armored and fitted with racks on the under side. Any length up to 24 ft. can be used, although where a clearance lift of over 10 ft. is required, a part of the cab roof must be removed. The striking peculiarity of the combination boom is the diamond frame necessary to accommodate the engine in two positions.



NEW THEW SHOVEL BOOM

Getting Radiators Out of the Way—At the plant recently completed for the Hendee Manufacturing Co., Springfield, Mass., the placing of the radiators offered quite a problem. No wall space was available, and it was finally decided to put the radiators on the interior columns. These are built-up I-columns, as shown in the accompanying illustration. A standard wall radiator, manufactured by the H. B. Smith Co., of Westfield, Mass., was used. These are in seven sections, five pipes per section The radiators were held in place at the bottom by a heavy bracket. The pipe connections were made at the bottom of the stack of radiators.

RADIATORS INSTALLED ON I-COLUMNS IN A SPRINGFIELD SHOP

New York Experience With Winter Surveys for Highway Improvement—In the past many surveys of roads have been made in the winter when the ground was covered with snow and it was difficult or impossible to judge with any approach to accuracy of the soil conditions below. Obviously, too, surveys made under such conditions would be inaccurate. We are now trying to make our surveys in summer and fall in order that these sources of errors and troubles may be avoided. One of the most frequent excuses given for the making of supplemental agreements has been that these surveys were made in the winter when subsoil conditions could not be observed and especially drainage problems anticipated. With surveys made when the ground is bare and when the soil and drainage may be freely and carefully studied, we expect to secure more perfect plans that may be carried out and roads built with much fewer changes in contracts. More attention is being given to the preparation of these plans in detail and greater care is exercised in supervising plans presented by division engineers to headquarters to the end that they may be complete and specific, more quickly read and less liable to misunderstanding.—Geo. A. Ricker, First Deputy State Highway Commissioner, New York, in "New York Highway News" for September, 1914.

Inexpensive Printed Specifications of Pocket Size—It [illegible] a great [illegible] use of [illegible] in the [illegible] of [illegible] specifications [illegible] the [illegible] made [illegible] it almost impossible to [illegible] of the [illegible] consideration [illegible] saving [illegible] by a [illegible] for newspapers, and the specifications [illegible] in the form of a book with pages [illegible] the resulting pamphlet is [illegible] without folding and the pages [illegible] for [illegible] ordinary notes of [illegible]—[illegible] C. Sherrod, Boston, Mass.

Street Crossing Traffic Signals, Cleveland, Ohio—A street traffic [illegible] system was installed last August at the intersection of Euclid Ave. and East 105th St., Cleveland, Ohio, which has given excellent service ever since. The system is [illegible] the same as a railway crossing, although [illegible] in the apparatus itself to suit street conditions. It is estimated that traffic can be handled [illegible] faster than by a traffic policeman in the street.

[illegible] signal lights are placed on the right hand side of each street facing oncoming vehicles. A red light signifies "stop," and green "proceed." The switch controlling the lights is operated by a traffic officer in the booth to the left, in the accompanying illustration. The switch is so interlocked that it is impossible to give conflicting signals. The sides of the booth are glass, so that the officer may see out on all sides. The red light signal is shown on the [illegible] of the crossing street and the green light on the far corner, instead of having both lights on the same pole as in railway practice.

A [illegible] signaling instrument, connected to the fire department headquarters, is located in the officer's booth so that he is warned when it is necessary to clear the crossing for the passage of fire apparatus. On these occasions the officer [illegible] an emergency [illegible] which [illegible] an alarm bell and shows red lights on all corners. He is then free to leave his booth and give his attention to the street. Similar systems using semaphore signals have been tried in other cities, notably in Philadelphia.

The Cleveland installation was made by the American Traffic Signal Co., of Cleveland.

The Crown of Bituminous Macadam Roads in Massachusetts has been reduced to ¼ in. to 1 ft. in accordance with English practice, which is now almost universally ⅛ in. to ⅛ in. or ¼ in. to 1 ft. This is a reduction in crown of [illegible] in. from the standard sections for bituminous macadam roads referred to in the article on Massachusetts highway work in "Engineering News" of Nov. 26, and is a [illegible] for highways in this country. It compares with crowns of [illegible] in. per ft. width for ordinary macadam.

[illegible] Euclid Ave. at the 105th St. Intersection [illegible] Traffic Signals [illegible] (Photograph)

Editorials

A Constructive Policy for Public-Service Corporations

Among the notable papers presented at the recent conference of Mayors in Philadelphia was one by Charles Day, of the engineering firm of Day & Zimmerman, with the suggestive title printed above.

Mr. Day urges that the companies should drop their attitude of antagonism toward the regulating commissions, should frankly recognize that public regulation is here to stay and should heartily coöperate with the public service commissions and city authorities. Mr. Day speaks with full appreciation of the companies' point of view, since his firm controls a large central-station plant in Pennsylvania.

At the present time the attitude of most public-service corporations and their officers toward some of the restrictive measures of the public-service commissions may be fairly described as one of rebellious protest. There is without doubt ample ground on which to base this protest; but Mr. Day declares that instead of hoping for a better state of affairs through the amendment of faulty laws or through a better appreciation of their duties and of the rights of the companies on the part of public-service commissioners, the responsibility rests squarely upon the corporations themselves. Until they come forward to coöperate with the commissions, by furnishing them the basic data on which to ascertain cost of service, bitter contention over rates is bound to continue.

The companies distributing electric current, for example, have almost universally adopted a sliding scale of rates giving a far lower rate to the large users of current, and particularly to the user who takes current at a time when a large part of the station equipment would otherwise be idle, than to the ordinary customer. Mr. Day urges that the small consumers of electric current should likewise have rates adjusted to their needs. Analysis of the operating cost of electric systems shows that a very large part of this cost varies very little with increase in current consumption.

Here, for example, is a small consumer using 10 kw.-hr. of electricity per month from which the station must receive a revenue of $1.20 to cover the fair cost of supplying the current with a reasonable margin of profit. If the consumer pays a flat rate per kilowatt-hour, the straight charge would be 12c. per kw. Analysis of the station-operating cost, however, would very likely show that two-thirds of this amount, or about 81c., would represent the expense incurred in such charges as bookkeeping, reading meters, rendering bills, fixed charges on equipment, distribution, etc., which do not vary with increase in consumption. If, therefore, the consumer were required to pay a fixed charge of 81c. per month whether he used much current or little, and in addition a charge of 3c. per kw.-hr. for current used, the company would receive the same revenue as before, $1.20, but the consumer would have every incentive to increase his use of current; for example, by the use of appliances for electric heating, which now very generally involves prohibitory expense.

Such an adjustment of rates to small consumers, moreover, would go a great way toward producing a better feeling of the public toward the companies. At present it is very difficult to make the average consumer believe that a company is justified in charging him 10c. for current which it cost the company often less than half a cent to produce at the power station.

The New York Alien Labor Law and the Subway Contracts

Probably neither the contractors, the labor leaders nor the Public Service Commission know what is to be the outcome of the controversy over the enforcement of the Alien Labor Law on the New York subway contracts. It is fairly certain, however, that none of these three parties really desires to tie up indefinitely these contracts on which so many thousand men are now actively at work.

The Alien Labor Law makes it mandatory upon the Commission to annul any contract on which it is shown that the contractor has employed alien labor. The labor union which has petitioned for such an annulment of one of the contracts withdrew its complaint on Nov. 28, and it is claimed that this relieves the Commission of the necessity of deciding the case. According to the strict letter of the law, it might indeed be said that it is incumbent upon the Commission to annul any contract on which alien labor is employed as soon as the fact of such employment is established.

It is equally incumbent upon the Commission, however, to observe the spirit of the law and protect the great public interests committed to its care. To cancel the existing subway contracts at the present time would mean a loss of many millions to the city in the delay involved and in the difficulty and complications attendant upon the adjustment with the contractors and the reletting of the work.

Engineers well know the serious difficulties encountered when, through the failure of a contractor when his work is partially completed, the reletting of the work or its continuance by force account becomes necessary. There is trouble enough for engineers and all parties concerned when one or two of the contractors on a great engineering work fail in their task and readjustment is necessary. But the labor thrown upon the engineering force in case a wholesale annulment of existing contracts were attempted would be enough to break down the whole organization.

It is claimed that the Alien Labor Law might be declared unconstitutional as being contrary to existing treaties between the United States and foreign countries in which the citizens of those countries are promised equal rights and protection with American citizens. Certainly, the matter should be settled one way or the other by an appeal to the highest court. It is a serious mistake and

[illegible] such an act as the New York Alien Labor Law remain on the statute books and be ignored. There is always a chance that such laws, after long remaining a dead letter, may suddenly be brought forward to make serious trouble for [illegible] who has merely followed the general custom in his line of business.

A Favorable Time for Construction Work

The amazingly low prices which are being quoted on structural steel at the present time are worthy of notice, especially since there is some reason to believe that prices in this field are about at the bottom and that a considerable advance may be looked for at no distant day. Contracts have recently been awarded by the Panama Canal to the United States Steel Products Co. for about 9,000,000 lb. of structural steel required in the construction of the wharves at the Cristobal coaling plant. The price for the material delivered at Colon is 1.96½c. per pound.

When it is considered that this material has to be fabricated at the shops, carried by rail 400 miles to tidewater, loaded on board a steamship and transported 2000 miles to the Isthmus of Panama, with the cost of marine insurance added to that of freight, and further that the material is subjected to an extremely rigid government inspection, it is evident that the structural-steel business at present is being carried on with an extremely narrow margin of profit.

It is, of course, true also that other engineering materials are being sold at phenomenally low prices. The Metropolitan Water and Sewerage Commission, of Massachusetts, recently purchased 1000 tons of cast-iron pipe at $19.60 per ton, delivered at Boston.

Such prices as these make it a most advantageous time to undertake new construction work, wherever such work can be successfully financed.

Not only are prices of all construction materials extremely low, but on contract work competition is very sharp. Contracts were recently advertised in ENGINEERING NEWS for the construction of a system of water supply and sewerage for a village of 3000 inhabitants in the Hudson valley. In ordinary times such a small contract [illegible] only a limited number of bidders, mostly residents of the locality. In this bidding, however, [illegible] contractors submitted bids for the construction of the waterworks, at prices ranging from $31,[illegible] to $[illegible]. These bidders came from [illegible] different states. For the construction of the sewerage system there were [illegible] different bidders, their prices ranging from $[illegible] to $[illegible]. These bidders also covered a similarly wide geographical range.

The labor market is extremely favorable to construction, whether work is done by contract or by day's labor. [illegible] a fixed rate of wages, [illegible] and [illegible] a good quality of [illegible] that are difficult to [illegible] in ordinary times.

An additional reason for prosecuting public works at the present time is [illegible] in some degree at least, to solve the serious matter of unemployment. In [illegible] are out of work [illegible] public [illegible] it is certainly better to give a man money in the shape of wages, so that the public gets a return for the money in work performed, than to dole out a third, possibly, of that amount in the form of poor relief, from which the public gets no return whatever and the recipient of the relief is pauperized.

At Pittsburgh, the City Council on Nov. 23 appropriated $80,000 to proceed with extensive street improvements in order to furnish work for some of the unemployed in that city.

The Maximum Rate of Safe Retardation for Passenger Cars and Elevators

Collapsible, shock-absorbing vestibules as a means of safeguarding the lives of passengers in steel cars in the event of a train collision are discussed in the report of the Committee on Rails and Equipment, presented at the recent meeting of the National Association of State Railway Commissions. It is obvious that such an arrangement would be of comparatively small benefit to the passengers in cars at the end where the collision occurred, while at the opposite end of a long train the gradual stoppage, due to the collapsing under resistance of the vestibules between the ends of the cars, would doubtless cause the stop to be very easy.

The committee deemed it best to inquire what was the maximum safe rate of retardation which passengers could endure without danger of serious injury. Inquiries were made of Thomas E. Brown, Consulting Engineer of the Otis Elevator Co., and the following reply from Mr. Brown gives very interesting data as to the possible retardation which human beings can endure in falling elevators.

> Our experiments and experience have been entirely with passengers traveling vertically and standing on their feet, where the effects of retardation have been along the axis of the body, the stress being principally on the ankles and spine. Under these conditions I and some of my associates have been subjected to retardations as high as [illegible] ft. per sec. per sec. Such a retardation can be sustained without injury, and, in fact, without much discomfort. The stress on the ankles is quite [illegible].
>
> A man lying flat on the floor of an elevator car would, without doubt, withstand at least double this retardation without serious [illegible].
>
> In [illegible] practice it is customary to allow for retardations of five or even six times that of gravity, i.e., retardations up to nearly [illegible] ft. per sec. per sec., and it is considered that even this high retardation will not be [illegible] to life. Naturally but few actual tests with human beings at such high retardations have been made, but there are several instances on record where it has been sustained without any serious injury. [illegible] there have been cases [illegible] where serious injuries and even death [illegible], but there is reason to believe that in these cases, through faulty design, the retardations were [illegible] in excess of five or six times that of gravity.
>
> [illegible] the physical condition and especially the [illegible] of the subject when undergoing such a [illegible] must be taken into consideration; thus a man in a sleeping berth with feet toward the engine would not be likely to be [illegible] and perhaps not even injured by a retardation of [illegible] to [illegible] ft. per sec. per sec., whereas it is doubtful whether a [illegible] under the same conditions might not [illegible].
>
> My own opinion is, that if the railroad car [illegible] the [illegible] is sufficiently strong not to be destroyed or [illegible] by the [illegible], the passengers, with the exception of some as may be in an [illegible] position, are not [illegible] to sustain other than minor injuries with any stop liable to occur in a derailment or even a collision. In other words, [illegible] the conditions expressed in your letter, viz.: "The [illegible] all dangers from passengers getting into contact

with the car," I am of the opinion that the passengers can stand any retardation that the car itself can stand.

In this connection I would suggest careful consideration of the fastening of the seats to the floor of passenger cars.

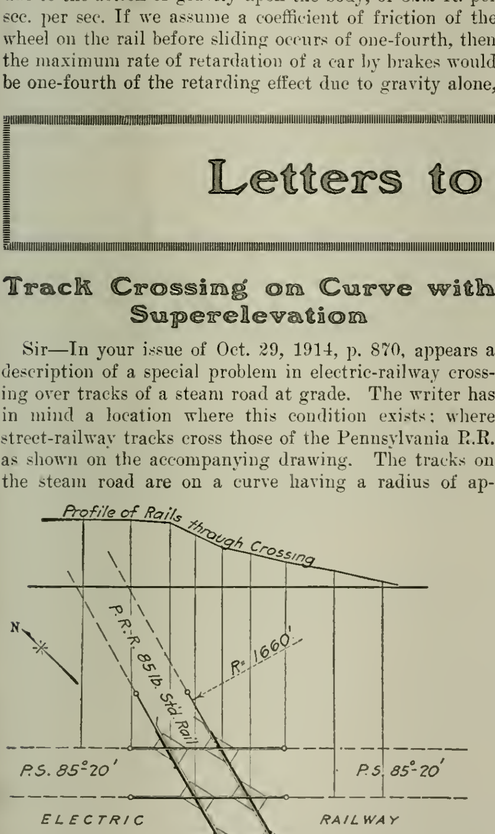
It will be evident, of course, that the retardations mentioned by Mr. Brown are many times what would be practicable in stopping railway cars by the use of brakes applied to the wheels. The limit of retardation of a car by the use of brakes occurs when the wheels slide on the rail. If a body moving at uniform speed is acted upon by a retarding force equal to its own weight, the rate of retardation would be equal to the rate of acceleration due to the action of gravity upon the body, or 32.2 ft. per sec. per sec. If we assume a coefficient of friction of the wheel on the rail before sliding occurs of one-fourth, then the maximum rate of retardation of a car by brakes would be one-fourth of the retarding effect due to gravity alone, or 8 ft. per sec. per sec. In practice it has been found that about half this, or 4 ft. per sec. per sec. is about the maximum rate of retardation by brakes that is permissible without causing discomfort to seated passengers.

The figures given by Mr. Brown for the rate of retardation which passengers in a vertical elevator can endure without danger when it is stopped by a safety clutch or air cushion seem surprisingly high. A rate of retardation of 32.2 ft. per sec. per sec. would have the effect while the retardation lasts of substantially doubling the weight supported by the person's feet and ankles and—what is less serious—that supported by the knees. With a retardation of 72 ft. per sec. per sec., therefore, the feet and ankles of a person weighing 200 lb. would have to support a weight of nearly 650 lb. for the brief period during which the retardation acts.

Letters to the Editor

Track Crossing on Curve with Superelevation

Sir—In your issue of Oct. 29, 1914, p. 870, appears a description of a special problem in electric-railway crossing over tracks of a steam road at grade. The writer has in mind a location where this condition exists; where street-railway tracks cross those of the Pennsylvania R.R. as shown on the accompanying drawing. The tracks on the steam road are on a curve having a radius of approximately 1660 ft. to the inside rail, while those of the street railway are built on a tangent. However, the grade of the street falls away sharply on one side of the steam road. The two profiles show how the rails of the street-railway tracks had to be kinked in order to make the crossing. The gage of the street railway is 5 ft., while the steam road is standard gage.



Plan and Profile of Street Railway Tracks at Grade Crossing of Steam Railway on Curve

The crossing is of the three-rail type and was built in 1912 by the Pennsylvania Steel Co. It is constructed of Pennsylvania R.R. standard 100-lb. rails, the main steam running and bearing rails being of rolled manard-manganese steel. The other rails are of openhearth steel. All intersections are provided with plates fastened to the rails with wrought-iron clips. The fillers are of rolled steel, and the crossing was provided with cast-steel compromise joints at all the external joints.

The connecting rail sections are as shown on the plan. Mayari steel, heat-treated bolts, having an ultimate strength of not less than 105,000 lb., and an elastic limit of not less than 80,000 lb. per sq.in., were used in the crossing, and they were required to bend cold on themselves through 180° without fracture on the outside of the bent portion. This crossing is still in service.

H. G.

Newark, N. J., Nov. 14, 1914.

Practicing Engineers and Industrial Education

Sir—Your readers ought to realize better that engineers employed in all kinds of manufacturing establishments have an unusual opportunity for coöperating and even leading in the various forms of industrial education now coming forward. For instance, in the high school of Passaic, N. J., is an industrial course organized on a half-time basis, somewhat after the Fitchburg plan. The efficiency engineer and the textile engineer from one of the largest textile mills are giving valuable aid in developing the work. These engineers give lectures in the coöperative course on factory costs and upkeep, factory layouts,

and other [illegible] technical topics with special applications [illegible]. They also give instruction to the boys in the technical phases of the work. Foremen of the various [illegible] departments give the instructions in practical operations. By this cooperation with the regular instructors of the school, a thoroughly practical course is guaranteed. Waste of time is avoided. The interests of the boys in the technical aspects of the work are stimulated and economically directed. School work and factory work are [illegible].

In developing cooperative school plans for part-time apprentices, there is a great need for men who actually know both the needs of the factory and the possibilities of the school. School men, even including many of those responsible for industrial schools or courses, know very little about actual factory needs in most cases. They have neither the knowledge nor the experience to make school courses which will supplement the factory work and give the boys what they most need. On the other hand, factory managers, superintendents, and foremen are recruited largely from the ranks of workers, promoted on merit shown for definite lines of work. Many of them know little of school possibilities. Many are even distrustful and skeptical of schools because they know that the schools of the past have been too academic and impractical.

The engineer, however, knows enough of both school and factory to show how they may help each other. He is a practical man and he has had school experience extending through elementary, high, and college grades. In looking back over his school life, he probably sees how much of the work that he was required to do in elementary and high school was really time wasted. He could devise work now on the basis of his factory experience that would have been altogether more worth while than that which he forgot as promptly as he learned it because he never has had any use for it.

The engineer realizes how relatively little of algebra, geometry and trigonometry the ordinary shop man uses, how little of the long, academic courses usually given in mechanical drawing are needed, and how needlessly foreign are the abstract statements and formulas of physics and mechanics to the concrete problems of the workman in foundry, forge room or machine shop. He knows that, in a factory employing a thousand men, the number whose work includes the responsibilities requiring all of this technical knowledge will probably not be over a dozen. What he recognizes is that all of these workers need a little practical knowledge of a few relatively simple parts from all of these fields. They need to know thoroughly, and with a full understanding of their meaning, a few facts and principles in shop mathematics. They should know how to make, and must know, how to read drawings and prints. They should be able to apply a few of the simpler principles of physics and mechanics to their use of tools and machines. All of this knowledge might properly be called mechanical and industrial intelligence. The workman should not only be able to do [illegible] with [illegible] skill but with an understanding of the meaning and reason of it.

Now the [illegible] man with his courses in mathematics, drawing and science will not be able to give this kind of intelligence without a prodigious waste of time. He does not know what to [illegible] or what to omit. The [illegible] cannot give this intelligence. The only hope for the apprentice under the present complexity of factory work is a school plan of some kind in which the school work and the shop work will interrelate at every point. The shop work must give the reason for the school work, the school work must make the shop work meaningful and intelligent. Both going along together will make for an efficiency in the apprentice and a progress in his work which will be compensation equally to him and his employer far beyond the loss of working time given to school purposes.

The engineer has the point of vantage from which to give a great deal of much-needed advice and direction to this cooperative work. He can help to organize and direct the work in mathematics and drawing which will fit in with shop needs. He can point out the parts of physics, mechanics and chemistry which will give the boy that information and that grasp of those principles which will make him an intelligent workman rather than a mere part of the factory's automatic machinery. For the practicing engineer in many manufacturing plants, there is the opportunity for giving substantial and needed aid in building up a more efficient form of common-school education which is necessary to dissipate the frequent charges that our school system is not designed for those multitudes whom we compel to support it. The writer hopes that this statement of the opportunity will lead more engineers to lend their aid.

FREDERICK G. BONSER.

Director Industrial Arts, Teachers College, Columbia University.

New York, Oct. 24, 1914.

The Herschel Fall Increaser and the Ejector Flow Increaser

Sir—On p. 961 (Nov. 12, 1914) of ENGINEERING NEWS, someone describing the power house built next the U. S. dam between St. Paul and Minneapolis, says it is fitted with "fall increasers (Herschel style)."

This is a hard indictment for the invention made by me, which I named the fall increaser, and hard on my interests in it, after spending thousands of dollars to test it at the Holyoke testing flume. The thing shown as having been built on the Mississippi is worthless as a fall increaser, as I can show by experiments made with it elsewhere, while the fall increaser properly so called would generate power at a power house situated as shown in the drawings referred to, and having "backwater" say 30 or more days in the year, at a cost so low that it would not pay to burn fuel to generate the same power in the auxiliary heat-engine plant needed to bridge over the low-water period of the year.

It is adding insult to injury to call this sluiceway built on the Mississippi by my name, not only to me but also to the true fall increaser, for everybody can see how the inevitable failure of the inefficient fake fall increaser is liable to smirch the reputation of the fall increaser that rightly bears that name.

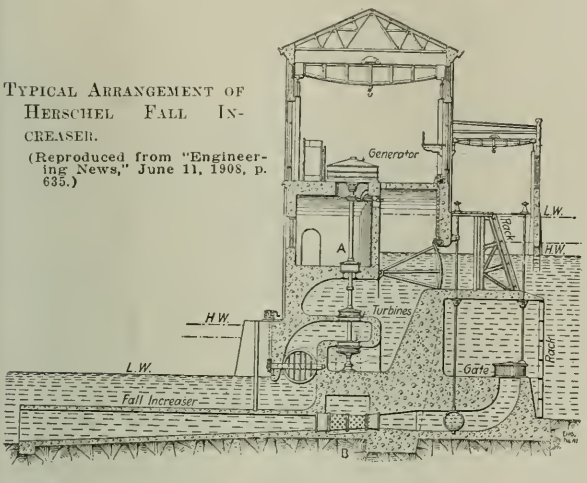
I am sorry to add that this is the third time since the invention of the fall increaser that this same thing has occurred, at Warren, Ohio, at Eldora, Iowa, and now on the Mississippi.

CLEMENS HERSCHEL.

2 Wall St., New York, Nov. 14, 1914.

[The above letter was submitted for comment to Gardner S. Williams, consulting engineer on the power plant of Lock and Dam No. 1 project near Minneapolis. In his comment, which follows, Mr. Williams refers to the auxiliary sluice which opens into the draft tube as an *ejector flow increaser.* The use of the words *fall in-*

TYPICAL ARRANGEMENT OF HERSCHEL FALL INCREASER.
(Reproduced from "Engineering News," June 11, 1908, p. 635.)



creaser and *Herschel style* in the original article is to be charged to the editor.]

Sir—Copy of Mr. Herschel's letter relative to the ejector flow increaser installed upon my recommendation in the power plant at Lock and Dam No. 1 of the Mississippi River Improvement is at hand Mr. Herschel's position is entirely justified. In his fall increaser he has made use very effectively of the principle of the Venturi tube and has produced a device which the writer believes will do all he has claimed for it. The other device depends upon the principle of the ejector and cannot be expected to produce as great effects. It, however, will do somewhat better than Mr. Herschel's letter indicates, and, as in the case in question it was no more expensive to construct it than to omit it. the installation seems amply justified.

GARDNER S. WILLIAMS.

Ann Arbor, Mich., Nov. 21, 1914.

High-Alloy Steels for Bridges have been discussed at some length by J. A. L. Waddell in a paper presented before the American Society of Civil Engineers. In closing the discussion on this paper, in the "Proceedings" of the Society for October, 1914, Mr. Waddell gives the following conclusions:

1. Titanium as a scavenger of carbon steel promises good and useful results at exceedingly low cost. Although it does not increase greatly the elastic limit or the ultimate strength of the metal, it makes it much more uniform and reliable. On this account it should be used in a few cases on bridgework; and then, if it be found satisfactory, its adoption should be made obligatory by railway companies and other builders of carbon-steel bridges.

2. There appear to be great possibilities in the use of aluminum as an alloy for bridge steel. But, very few experiments in aluminum steels have yet been made; hence, the possibilities are more or less hypothetical.

3. The possibility of obtaining a good, high-alloy steel for bridges by the use of vanadium appears to be a settled fact. But the highest elastic limit and ultimate strength which can be obtained on a commercial basis by the use of that element cannot be determined without elaborate and exhaustive experiments.

Water-Works Service Pipes

No problem in water-works operation, apparently, is of greater interest to water-works officials generally than the selection of the kind of service pipe and the method of connecting mains and services. Some points brought out in the discussion of these subjects at the November meeting of the New England Water Works Association are given herewith.

BROOKLINE PRACTICE—F. F. Forbes, superintendent of the water-works of Brookline, Mass., cited 40 years' experience with cement-lined wrought-iron pipe with no record of trouble from corrosion on straight services, but about 30 instances of corrosion at the curb cock connections.

His department has always used a lead goose-neck connection at the main to allow for settlement in the service pipe or main, which is always liable to follow disturbance of the street for subsurface construction. These goose-necks save many leaks, for several instances have been found where the goose-necks had been straightened out by settlement of the pipe yet the connection remained intact.

Service pipes are laid at a depth of 5½ ft. and no trouble is ever experienced with frozen pipes.

Some lead service pipes are used, but difficulty has been found in getting pipe to stand the high pressure used in Brookline.

In getting around subsurface obstructions, it has been found easy to bend cement-lined service pipe to as short as a 10-ft. radius without damage to the cement lining.

The pipe couplings are lined with cement while fastened to one end of a length of pipe, and the cement lining is afterwards dug out of the thread to insert the added length. The F. O. Norton brand of natural (Rosendale) cement is used, as ordinary portland cement is found to be lacking in elasticity.

The pipe fittings are galvanized-iron. Corrosion of the exterior of the pipe just inside the cellar wall is the commonest source of trouble. In such places and in locations subject to alternate wetting and drying the water department now uses galvanized-iron pipe, cement lined.

MARLBOROUGH EXPERIENCE—Geo. A. Stacey, superintendent of the water-works of Marlborough, Mass., said that two cases of lead poisoning through the use of lead pipe for well water, in the early days of the city's water-works, resulted in such a popular prejudice against lead pipe that cement-lined wrought-iron pipe was subsequently adopted for all service connections. Cement-lined iron pipe was used for eight or ten years, but much trouble was experienced by rusting out at joints. Accordingly, about 15 years ago, the water department quietly returned to the use of lead pipe, and it has been used ever since without the least suspicion of lead poisoning.

HOLYOKE EXPERIENCE—Patrick Gear, superintendent of water-works, of Holyoke, Mass., stated that ordinary iron service pipes had been in use for 40 years in Holyoke. No goose-necks are now used for connections at mains, owing to the difficulty in cleaning the service pipes. At present, galvanized-iron and lead-lined iron pipe are being used.

[illegible]—Instances were cited of long life in [illegible] service pipe, but these were exceptions rather than the rule.

An objection was raised to any kind of iron pipe because of the expansion and contraction, which leads to breaks at the curb cock; but this objection is largely overcome by the use of lead goose-neck connections. On the other hand, the objection to a goose-neck connection is the impossibility of cleaning the entire service from house to main. This has led to taking out all goose-necks in Holyoke, wherever new services are placed or renewals are made.

There is a need and a market for some kind of cheap expansion joint for use at curb cock connections, and a need for an effective small pipe-cleaning apparatus.

Difficulties with cement-lined service pipe are chiefly corrosion at joints and want of elasticity. The couplings must be cement-lined, or in some instances rubberoid and tar have been used successfully for lining. Sometimes lead couplings are used. Cement-lined pipe must always be sawed in two and not cut in a pipe-cutting machine, which destroys the lining in the vicinity of the cut.

Lead service pipe is the prime favorite of water-works men generally because of its freedom from corrosion, expansion and contraction troubles, and the ease with which it is bent and cut to fit any location.

Lead pipe should never be used, of course, where there is any chance of lead poisoning, but this is believed to be rare. Robert S. Weston, consulting engineer, of Boston, Mass., pointed out the extreme difficulty in determining by laboratory tests certainty as to whether water would or would not permanently affect lead pipe. Acid swamp waters are particularly dangerous.

The only real guide in many cases is experience; if lead pipe becomes coated on the interior, it is probably safe to use, but any lead pipe which retains a bright interior surface after extended use is almost sure proof that the water conducted through it has dissolved lead and is dangerous. Much popular prejudice against lead pipe is founded on sentiment rather than real reason, was the general opinion.

In many cities public-service corporations place their subsurface structures in any part of the street they see fit, and as the water main is usually near the middle of the street, the result has often been that these public-service structures have completely blockaded the water main, making straight service pipes impossible. This is a condition to be met by a better organization of city departments and by granting more authority to city officials over public-service corporation construction work.

Reported Settlement of a Tunnel in Soft Ground

A report recently came to our attention that the tunnel of the Michigan Central R.R. under the Detroit River was showing evidences of settlement. As most of our readers will recall, this tunnel is a structure of concrete of rectangular cross-section and was built by floating [illegible] into position and filling in around them with concrete deposited under water. There would seem to be no reason why a tunnel of this type should be more liable to settlement than a circular tube tunnel, such as that under the St. Clair River, which is driven through clay very similar to that in which the Detroit tunnel lies.

We find upon inquiry that some settlement did take place during the construction of the Detroit tunnel before it was opened to traffic, and was found to be due to a small amount of leakage coming through the floor of the tunnel. This had the effect of relieving the hydrostatic pressure on the under side of the tunnel and thereby placed an enormous additional load upon the foundation soil underlying the tunnel. Measures were at once taken to stop the leakage through the tunnel floor, and when this was done the settlement stopped. There has been no ascertainable settlement since the tunnel was opened to the operation of trains; and the small amount of water which seeps into the tunnel is steadily decreasing, due probably to the gradual stoppage of the pores in the concrete by particles of silt.

A System for Long Distance Transmission of Readings of Indicating and Recording Instruments

What is perhaps the most noteworthy development in indicating and recording devices since the invention of the several pressure, temperature, position, and other instruments themselves, is a simple system by which the instrument motion is faithfully reproduced at any desired distance up to 40 or 50 miles.

There has been a persistent demand for apparatus to show, at some point remote, temperatures, pressures,

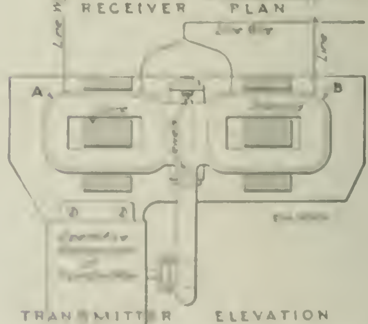


Fig. 1. Diagram of System for Transmitting Movement of Indicating and Recording Instruments

liquid levels, mechanical positions, etc., and various schemes have been put forward with partial success. Pyrometers can be used with the indicator up to 1000 ft. from the work (depending on the types) and millivoltmeters of familiar types have been used with long potential wires to measure distant voltage and current, but

no broadly applicable system for long-distance indicating and recording apparatus has been widely accepted heretofore. A serious limitation of most of the attempted apparatus is its complexity and the step-by-step nature of its operation.

The system described below enjoys the advantages of simplicity of mechanism and steady response. The scheme involved in the commercial apparatus described was worked out and patented a few years ago by J. W. Bard, of the Sangamo Electric Co., and was applied to

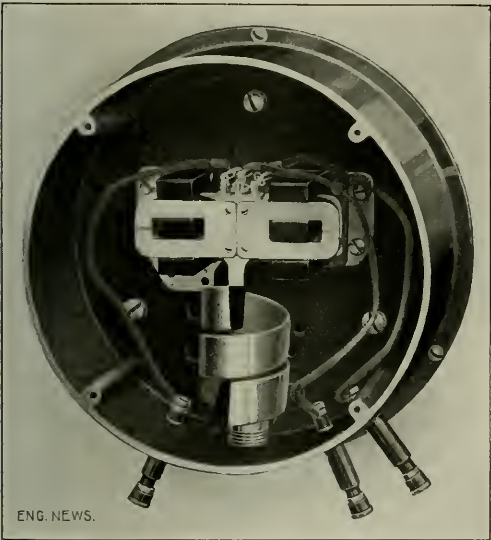


FIG. 2. COMMERCIAL FORM OF TRANSMITTING DEVICE

some Bristol recording instruments for special service. So satisfactory were such services and so frequent the opportunities for extended use, that Prof. Wm. H. Bristol was led to develop the system for use with all sorts of indicators and recorders. Although the system is only now being put on the market, yet over a dozen sets of preliminary apparatus have been in service up to four years, and are reported to be in still satisfactory operation.

The principle of the transmission system is one of induction balance, as may be seen from Fig. 1, which shows the transmitter and receiver (in elevation and sectional plan respectively). Both are similar, and each has a pair of solenoids, balanced on a shaft and hung in jewel bearings so as to swing in a horizontal plane over the ends of laminated iron cores. The transmitter solenoid is swung into some certain position by the arm and link of an operating mechanism which may be, for instance, a series of diaphragms operated by water pressure, etc. The receiver has, instead of such an attachment, a low-friction multiplying arm and link leading to the familiar indicating needle or recorder pen arm.

With the electrical connections as shown in Fig. 1, if the coil *A* of transmitter is caused to swing on and the coil *B* off the iron core, then the inductance of the two coils is changed. That of *A* becomes more and that of *B* less than before, with the result that less current flows from the alternating-current supply circuit through the *A* coils of both transmitter and receiver, than through the *B* side. This causes the *B* coil of the receiver to exert a greater force than the other, so that the moving system is turned until such a position is reached as gives an unequal inductance of its coils, nearly balancing the changed condition in the transmitter coils. Then the current divides between the *A* and *B* circuits inversely according to their inductances until a second shift of the transmitter occurs. The alternating current produces a very slight vibration in the moving systems of both transmitter and receiver, but this is an advantage rather than otherwise, since it reduces any starting friction and makes the system practically "restless." It appears from the diagram (Fig. 1) that the moving systems of transmitter and receiver move in reverse directions as a consequence of the tendency to secure an inductive balance. Where desired, motion in the same direction can be secured by reversing the connections of the *A* and *B* coils.

The mechanism of the present design of transmitter, without an indicating arm, is seen in Fig. 2. Already various combinations of transmitters and receivers are being sought. The most popular form, shown in Fig. 3, comprises a transmitter with indicating needle and a distant recording receiver. By using two or more transmitters and the proper circuits and switches, readings of two or more distant instruments have been easily taken on one receiver.

The service for this system seems limited only by imagination. One of the most common demands is for the distant reporting of reservoir and tank levels, where pressure gages on pipe lines will not give true information because of friction, etc. River-stage data, water, steam, air, and gas flow and pressure, at some inaccessible point, are all items on which current data are frequently required and are satisfactorily furnished by an installation of this

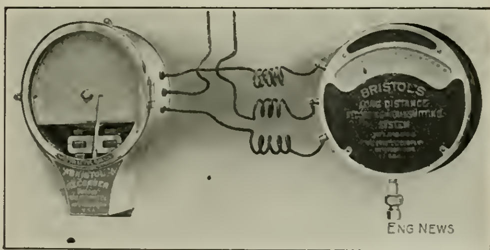


FIG. 3. INDICATING TRANSMITTER AND RECORDING RECEIVER

sort. There is a large untried field of position signal and log work, as on shipboard. Installations have been sought by citrus growers in order that the orchard office may be continually advised and have a record of the weather conditions in the coldest parts of the grove, instead of at present relying on an alarm when the danger point is reached.

The Street Railway System of Guayaquil, Ecuador, is equipped with electric cars having a maximum speed of about seven or eight miles an hour, with tracks zigzagging along the streets without apparent reason for deviating from a straight line. There is also a rival line of street cars drawn by undersized mules. These, a correspondent informs us, "have no difficulty in going as fast as the cars on the electric line."

Engineers from the Contractor's Viewpoint*

By R[illegible] W. S[illegible]†

That complete harmony cannot exist between engineers and contractors, by reason of each in a considerable degree representing opposing interests, is inevitable. The engineering graduate starts with an elevated prejudice against contractors, whom he believes to be, in the main, determined to get the best of engineers, and therefore he is on his guard and purposes not only to take care of himself but to get the best of the contractors.

Contractors dread the "boy engineer" just from college. These young engineers are extremely technical. They expect a literal compliance with every iota of the contract obligations by the contractor.

With rare exceptions, men greatly improve in learning, wisdom and disposition as they grow older. After 20 or 30 years, a man is surprised to find how little he knew when he started his professional or business career. He has grown in riper judgment, and has developed greater patience, discretion and justice toward others. He grows considerate, amiable and kind.

Contractors are largely influenced by their opinions of engineers. The engineer who has a reputation for ability, honesty, fairness and good disposition will attract bidders for any work of which he has charge and the desire to do work under him would be an incentive to reasonably low prices. It is a feature of contracting to "size-up" the engineer with as much accuracy as possible.

In bidding for work, contractors are almost as sensitive as weathervanes. It may be possible to make a profit at a given bid under one engineer and impossible to avoid a loss under some other engineer, with all other conditions similar and the quality and the merits of the work constructed being equally good at the same cost to the owner in each case.

A majority of bids are too high. The highest bid is often twice as much as the lowest even when the lowest is sufficient. Over-anxiety to secure the contract is the commonest cause of low bidding. Low bids are often made to keep a contractor's organization together for future work on which he hopes for better prices.

Contractors who do not care for the contract often bid fairly high on [illegible], without any expectation of securing the contract but merely to avoid a reputation among contractors of being low bidders, and with the bare chance of getting the work at good prices. Excessively high bids are usually the result of lack of knowledge of the value of the work and lack of time to become familiar with it.

If an engineer's preliminary estimate is believed to be too low, it drives away bidders and tends to indifferent, high bidding. Some unscrupulous contractors may be influenced thereby to bid too low. They may secure the work, in which event the engineer has an unpleasant task during construction. There is almost sure to be a disposition on the part of the contractor to save himself from loss and to be thus tempted to slight the quality of the work. Both contractor and engineer are in some degree injured by the work having been done at less than cost.

An engineer who can make reliable preliminary and estimates will find his services in demand by municipalities, corporations and other owners, or if he chooses to practice as a contractor's engineer, he will find his services of great value in that field. Some prominent engineers of my acquaintance would not under any circumstances do engineering work for contractors, confining their services entirely to the owners. I know of other engineers who confine themselves wholly to engineering for contractors and who do a large business as engineering experts for contractors, in litigations.

These two fields of engineering are becoming more and more distinct and it is my opinion that an engineer is wise who makes his choice and adheres strictly either to the one line of practice or to the other.

The contracts and specifications on very large and important works usually are models of perfection. In smaller works, such as may amount to say not over \$200,000, contractors are often confronted with bidding papers, contracts, specifications, plans, etc., which are a disgrace to the engineer who drew them.

There are a few engineers who are sometimes called "specification fiends." They write to many places, where work is advertised, for specifications, etc. They read them eagerly and often clip such paragraphs as catch their fancy—usually those which are harsh, severe and unreasonable from a contractor's standpoint. With these clippings to aid them, they draw up specifications, etc., which often deserve the name of "crazy-quilt" specifications.

Such papers are full of contradictions, useless paragraphs and ambiguities which are almost sure to cause contention and trouble during construction and in the final settlement, or lead to litigation. Such engineers are apt to insert severe conditions such as excessive cash deposits with the bids, unreasonably short time in which to construct the work, excessive per diem liquidated damages for overtime, excessive bonds and sometimes excessive retained percentage where monthly payments are provided. About all they can think of is to make the work undesirable and objectionable to contractors. Such engineers and their work are often avoided by the best class of bidders and the contracts are apt to go to rather undesirable contractors.

*[illegible]

†[illegible]

Sewage Disinfection by Hypochlorite at Providence, R. I., was continued during 1913. The results are summarized in the recently published 1913 annual report of Otis F. Clapp, City Engineer. Of a population of [illegible] about [illegible] are now served by [illegible] miles of combined sewers and there are also 18 miles of storm sewers. The domestic sewage has mixed with it the manufacturing wastes from woolen mills, bleacheries, dye houses, and jewelry factories. The total amount of sewage passing through the plant during 1913 was [illegible] gal. This volume, which included all the storm water, was treated with hypochlorite. The daily flow of sewage ranged from [illegible] to [illegible] million gallons and averaged [illegible] million gallons per day. A total of [illegible] tons of hypochlorite was used. This was at the rate of [illegible] lb. per million gallons. Expressed in terms of available chlorine, hypochlorite was used at the rate of [illegible] parts per million gallons of sewage. [illegible] For earlier use of hypochlorite at the Providence plant, see "Engineering News," Dec. [illegible], 191[illegible] and May [illegible], 1914.

Report on Water-Power Development on the Chicago Drainage Canal

The report of a special commission on the water-power development on the Chicago main drainage canal and the disposal of the energy generated was submitted to the Board of Trustees of the Sanitary District on Nov. 12. This commission is composed as follows: Lyman E. Cooley (Consulting Engineer for the Sanitary District), John Ericson (City Engineer), Wm. Artingstall, H. H. Walker and L. K. Sherman.

The question of water-power development in connection with the drainage canal was considered as early as 1897, but was delayed by litigation and other causes. The District assumed that its general fund was not available for this purpose, but in 1903 a law was passed authorizing a special tax for three years for such development. The tax produced \$3,050,624, but this was exhausted by the end of 1906, and the work was continued by loans (at 4% interest) from the general fund. The plant at Lockport was opened in 1907. The law of 1903 provided specifically for utilizing the water power for the generation of electric current, the use of this current for operating the pumping stations and bridges of the District, and its transmission to municipal corporations within the Sanitary District, the evident intent being that the distribution and retailing of current should be left to these corporations.

The total expenses incident to development, transmission and distribution, up to the end of 1913 amounted to \$6,714,200. Excluding the distribution undertaken, though not originally contemplated, the expenditures were \$5,063,648. In Chicago alone the distribution has amounted to \$1,619,553. It is considered probable that the distribution will be eliminated eventually, in accordance with the original purpose. The present return is barely sufficient to meet current expenses, and unless the rates are increased the District must continue to invest new capital.

The commission considers that the following conditions are necessary for making the water-power enterprise a valuable property: (1) Uniform flow in the drainage canal, with a volume adequate to a sanitary condition and not less than 20,000 min.-ft. for each 100,000 people; (2) increased return on the investment by more favorable rates and increased output (by passing a greater volume of water); (3) modernizing the power plant and thus increasing its efficiency. In addition, various changes in administration and accounting systems are recommended, with the abandonment of all distribution beyond the transmission terminals.

In a separate report, Mr. Cooley deals with the power plant, and states that the present equipment gives a plant of moderate or low efficiency which is costly to maintain and operate. It consists of seven horizontal-shaft units of 6000 hp., with six turbines to each generator. Space is provided for an additional unit. The eight units with 34-ft. head and 80% efficiency would represent 42,650 hp. He advocates new units consisting each of a vertical turbine with an overhead generator, each unit being equivalent to two present units (with their 12 turbines). Such a plant should have an over-all efficiency exceeding 80% under working conditions; this is more than 10% above that called for by the present plant, and still higher than the efficiency realized in practice. His conclusion is that such results call for any betterments than can be made in the plant and in its maintenance and operation, and perhaps would justify a complete modernization of the plant

An Exhibit of Modern Street-Cleaning Apparatus

The first exhibition of devices and machines for municipal street cleaning to be held in this country was very successfully carried out during the week of Nov. 23, under the auspices of the New York City Street Cleaning Department, of which John T. Fetherston is Chief. The exhibits were intended not only for the education of the employees of the department and the general public, but to provide an opportunity for practical tests or demonstrations of unfamiliar apparatus.

The exhibits included brooms, brushes, sweeping machines, flushers and squeegees, snow plows, carts and wagons, and various receptacles for garbage, ashes and rubbish, including special carts and wagons designed to be both dust- and odor-proof. Besides these there was an interesting collection of original posters designed by public-school children as a part of a plan to interest the tenement-house population of the city in keeping the streets and alleys clean and tidy.

The exhibits of street-cleaning apparatus may be divided into four general classes, as follows: (1) Sprinklers, flushers and squeegees; (2) sweepers and sweeping machines; (3) snow plows and scrapers; (4) wagons and receptacles for garbage and refuse. Noticeably absent was an exhibit of vacuum cleaners, which are the most recent development in street-cleaning apparatus.

The accompanying views show some of the more interesting exhibits, excepting those in class (4) above, which will be illustrated in a later issue. The largest exhibitor was Charles Hvass & Co., of New York City, two of whose exhibits, an automobile sprinkler (Fig. 3) and a combined sweeper, sprinkler and scrubber (Fig. 5), attracted attention. The new principle in the sweeper and scrubber is the pushing of the broom instead of pulling it, as is done in other machines. The next largest exhibitor was probably the Studebaker Bros. Manufacturing Co., whose chief exhibits were a constant-pressure flusher (Fig. 2), the pressure being furnished by a centrifugal pump driven by a 30-hp. gasoline engine mounted on the rear of the truck, and a combination sweeper and sprinkler (Fig. 6), which has a spraying device in front of the broom, designed to eliminate dust.

Various types of pick-up sweepers were exhibited, two of which are illustrated. The Hvass exhibit included a small pick-up sweeper. Another type is the "Charlton" sweeper, made by William Dubocq, Brooklyn, N. Y. (Fig. 9), which has had considereable service in New York. The pick-up mechanism in this sweeper is on one side of the rear wheels and the refuse is discharged into cans, which are easily removed from the body of the wagon. The newest type of pick-up sweeper was that exhibited by the Merritt Street Sweeping Machine Co., New York City (Fig. 8). This is a four-wheel, steel-frame vehicle with a rotary broom on either side, set at angles to sweep the dirt into a row under the machine, where a rear broom sweeps the row over a flexible steel shoe to a conveyor, which carries the sweepings up and through a

Exhibit of Street Cleaning Apparatus

Fig. 1. General View of Exhibit in the Armory of the First Regiment of Field Artillery, New York City, Week of Nov. 23, Held under the Auspices of the New York Street Cleaning Department.

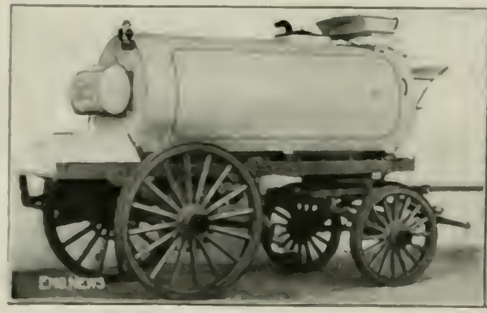


Fig. 2. Constant Pressure Street Flusher Made by the Studebaker Corporation of America

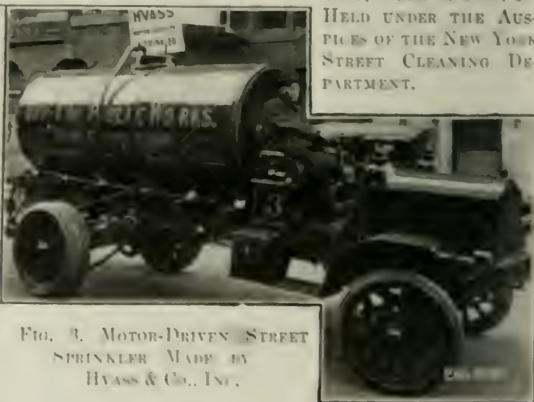


Fig. 3. Motor-Driven Street Sprinkler Made by Hvass & Co., Inc.

Fig. 4. Combination Sweeper, Sprinkler and Scrubber Made by Hvass & Co. Inc.

Fig. 5. Street Washing Squeegee Made by Kindling Machinery Co., Milwaukee, Wis.

Exhibit of Street Cleaning Apparatus

Two Recent Developments in Standard Street Sweepers

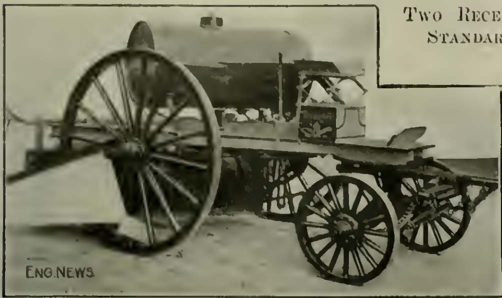


Fig. 6. Combination Street Sweeper and Sprinkler to Eliminate Dust. Made by the Studebaker Corporation of America

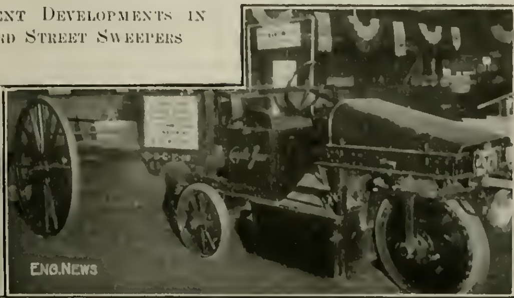


Fig. 7. Electric-Tractor Driven Street Sweeper of the Ordinary Type. Made by the Wirt & Knox Co.

Latest Types of Pick-Up Street Sweepers

Fig. 8. Pick-Up Sweeper. Made by the Merritt Street Sweeping Machine Co. Invented by a New York City Policeman

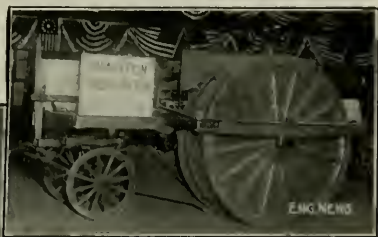


Fig. 9. "Charlton" Pick-Up Sweeper. Made by William Dubocq. View Showing Side with Pick-Up Mechanism; Other Side Has an Ordinary Wagon Wheel

This Sweeper Has Been Used for Some Time in New York City

Fig. 10. "Mason" Snow Plow. Made by the Auto Snow Plow Corporation

Fig. 11. Snow Plow and "Ice Remover" Exhibit of the Baker-Barron Co. In the Background Is the Sweeper Exhibit of the Universal Road Machinery Co., Kingston, N. Y.

[illegible] placed on a revolving platform for [illegible] under the chutes.

Snow-plow [illegible] ranged all the way from the old-style [illegible] to the new "Mason" automobile-truck [illegible], made by the Auto Snow Plow Corporation, New York City (Fig. 10). Snow plows of the road-scraper type were exhibited by the Good Roads Machinery Co., Inc., New York City, and the Baker-Barron Co., Inc., New York City (Fig. 11). The newest device in this class was the "ice remover," made by the latter company (Fig. 11). This is a plow and toothed scraper combined on sled runners, and is designed to remove the thin film of ice and snow which makes smooth pavements so slippery in winter.

Various types of motor vehicles for municipal use were exhibited, including a small three-wheel electric tractor for hauling an ordinary rotary-broom sweeper (Fig. 7), made by the Wirt & Knox Manufacturing Co., Philadelphia, and a gasoline-engine electric-power generating unit for melting frozen water-service pipes, etc., made by the General Vehicle Co., New York City. Other types of motor trucks were exhibited by the Commercial Truck Co. of America, Philadelphia, the Ward Motor Vehicle Co., New York, the Lansden Co., Brooklyn, and the Four-Wheel Drive Auto Co., New York City. The exhibits were particularly interesting in showing the wide adaptability of motor trucks and tractors to municipal uses.

Among the more unusual exhibits were models of a snow-melting device by means of a portable boiler and steam kettles, invented and shown by Howard G. Lapsley, Plainfield, N. J., and a model of a machine designed to sprinkle, flush, rake, loosen, sweep, load, dump and level street refuse; it is also designed to carry and distribute road repair materials and oils, and serve as a road scraper and scarifier. This device was exhibited by the Universal Road Repairing & Street Cleaning Co., Philadelphia. Photographs and drawings of a vacuum-cleaning machine were exhibited by the Way-Cleaner Co., Sandusky, Ohio.

NEWS NOTES

A Grain Elevator Burned in Galveston, Tex., belonging to the [illegible] Pacific Co., on Nov. 17. It is reported that the elevator contained about [illegible] bu. of wheat and that the loss is estimated at [illegible].

An Earthquake in Western Greece and the Ionian Islands [illegible]

Falsework of a New Concrete Building Collapsed [illegible]

A Tight-Joint Sewer System [illegible]

The Cumbre Tunnel [illegible]

Miami & Erie Canal Partly Closed—The Miami & Erie Canal is closed to navigation at the present time from Defiance to Middletown, Ohio. This is the result of failure to provide enough money to maintain the canal. Many of the locks are out of condition and nothing has been done in the last two years to restore them. It is thought probable that the next legislature of Ohio will order all parts of the canal thus out of commission and those not used for hydraulic purposes to be drained. The canal is in charge of the State Department of Public Works, John I. Miller, Superintendent.

Sanitary Industrial Surveys by New York City Health Department—The weekly bulletin of the Department of Health, City of New York, for Nov. 11, makes the following announcement:

The Department of Health is prepared to undertake a sanitary survey of any industry, trade or group of manufacturing or mercantile establishments in this city, with a view to appraising existing conditions and in order to show to employers and workers alike what can be accomplished through a system of voluntary hygienic and sanitary control. Through its Bureau of Public Health Education, the department will be glad to assist in formulating sanitary industrial standards and measures for the prevention of occupational diseases. In addition to this, the bureau stands ready to prepare and furnish health leaflets specially designed for workers in any industry, and to supply popular lectures on health and sanitation to such workers, in coöperation with either employers or trade unions.

A New Record in Precise Leveling has been established by John H. Peters, Assistant, U. S. Coast and Geodetic Survey, whose remarkable record of 120 miles in a calendar month was noted in our issue of Oct. 29, 1914, p. 886. This record was broken in October, in the State of Washington, when 148.3 miles of precise level line was established, equivalent to a total number of miles of single line of 327.7. The party worked 21½ days, and the average amount of time devoted to leveling was 6.6 hr. per day. Benchmarks were set for the most part and records checked by the observing party. All the leveling comes within the requirements that the two runnings of a section agree within 4 mm. $\sqrt{}$distance in kilometers.

Construction of New Buildings at Wellesley College, Wellesley, Mass., to permanently replace those destroyed by fire on Mar. 17, is about to begin. A new college hall will be commenced first. It will be U-shaped, with entrances on the north and south sides. On either side will be a smaller dormitory joined to the main building by stone cloisters. Underneath the cloisters and connecting all buildings will be two tunnels—one for the use of tradesmen, the other to house the heating, water, sewer and lighting piping and conduit. All stairways will be inclosed. A temporary frame one-story building was erected in remarkably short time (March 27–Apr. 7), to take the place of the burned college hall, and was described in our issue of May 7, 1914, p. 1018.

Popular Good Roads Enthusiasm in the mud road districts of the Central West apparently knows no bounds. The following item is from the De Kalb, Ill., "Chronicle" of Nov. 11:

Malta had a most enthusiastic celebration yesterday afternoon about 5 o'clock. Anyone in the vicinity might have thought from the number of whistles that were blowing and the fuss that was being made that the entire town was on fire, but such was not the case. Instead, the cause of the hilarity was the fact that the new cement road [illegible] west from Malta for a distance of a mile and a quarter or so had just been finished and the work was done at a few minutes before the blowing of the whistles [illegible].

[illegible]

Survey for the El Paso Union Stockyards at El Paso, Tex. [illegible]

The Employees of Contractors [illegible] the New York [illegible] during the month of November [illegible] at work on [illegible] employed by contractors working on [illegible] trackking, etc., of the

elevated railway system, which work is done directly by the companies. On the 64 sections now under contract, the total contract price is $146,253,000. Contracts in force for third-tracking involve $8,000,000 to $10,000,000 additional on the Manhattan and Bronx lines and $6,000,000 on the Brooklyn lines, making a total of about $162,000,000 of contracts now in force. Bids were opened on Dec. 1 for the construction of a station on the Fourth Ave. subway in Brooklyn, and are to be opened on Dec. 11 for the Broadway subway between 51st and 59th St. Bids for two or three additional sections will probably be advertised before the close of the year.

The Massachusetts Basis for Utility Rates, or the Public Service Commission's idea of fair value, is thus expressed in the Middlesex & Boston Street Railway Co. six-cent fare case:

It is argued by some of the counsel that the present value of the property used by the petitioner is the only amount upon which it can claim to earn a return. * * * It is sufficient here to observe that few words having a fundamental importance in dealing with questions of law and finance have been found more difficult of accurate and generally accepted definition. * * *

In this fairly consistent adherence to sound principle our Massachusetts public utility code is in striking contrast with the loose and haphazard legislation as to capitalization in many other states, which has requently resulted in compelling their regulating commissions to resort to reproduction cost as perhaps the least unsafe basis for determining a fair rate. Accordingly, we rule that under Massachusetts law capital honestly and prudently invested must, under normal conditions be taken as the controlling factor in fixing the basis for computing fair and reasonable rates; that if there is mismanagement causing loss, such loss must be charged against the stockholders legally responsible for the mismanagement; that reproduction cost either with or without depreciation, while it may be considered, is not, under our law, to be taken as the determining basis for reckoning rates.

In the case at hand the company was ordered to raise the fares to 6c. for single rides, nine tickets for 50c., and ten school tickets for 30c.

An Effective Ordinance for Pavement Preservation went into effect in the Borough of Washington, Penn., Nov. 16. Section 1 of the new ordinance provides that no pavement opening shall be made without a special permit, which (Section 2) must specify where the opening is to be made, the number of square yards of pavement to be disturbed, the time such excavations may remain open, and the total charges for the permit granted. Section 3 provides for a charge of $2 per sq.yd. of paved street opened, payable in advance or within 30 days, or secured by a bond. Section 4 gives authority to the holder of the permit to make the excavation. Section 5 provides that the party shall properly refill excavations in unpaved streets. Section 6 makes it the duty of the Borough Engineer to take over the backfilling in all paved streets. The base of the pavement is cut away 10 in. on all sides of the trench, and where the trench width is less than 30 in., a 5-in. concrete base is laid; over 30 in., a 6-in. base. Violation of the ordinance entails a fine of $25. Section 9 makes it unlawful, except by special vote of the town council, for any person, partnership or corporation to dig or make a trench, ditch or excavation in the streets or alleys of the borough between Dec. 1 and Apr. 1, unless for the purpose of making necessary repairs to leaking gas or water pipes, or to remove an obstruction in sewers, under a penalty of from $5 to $100.

The National Grange on Road Improvement—The discussion of highway improvement by the National Grange, at the recent annual convention in Wilmington, Del., is of much interest because of the political influence, both local and national, wielded by this nation-wide association of farmers. The meeting unanimously adopted a report of a special committee of seven, of which T. C. Atkeson, of West Virginia, was chairman, appointed last year to amplify the Grange road policy. The committee stated that the Grange had been the pioneer in the good roads movement; that the sentiment for good roads was practically universal, but that there was great danger of this sentiment being diverted toward the construction of scenic highways and boulevards, for the benefit of tourists and pleasure-seekers, rather than for the business interests of the general public. The convention, in adopting the committee report, expressed its opposition to the many bonding schemes advanced by those seeking touring roads, and urged the legislative committees of the Grange, both national and state, to use every honorable endeavor to obtain first business roads that will serve the best interests of both producer and consumer. In part, the resolution read:

Roads are local affairs and their control should remain with the people in whose midst they are located. The national and state governments may provide general standards for construction and maintenance of roads and may protect themselves by inspection. We call the attention of all our people to the grave danger in top-heavy, bureaucratic control of road administration, and to the fact that much of the support for the good roads comes from those who are more anxious to build roads for bonds than to sell bonds for roads.

PERSONALS

Mr. R. W. Reynolds has resigned as General Manager of the Springfield (Mass.) Street Ry. Co. to become General Manager of the Mesaba Street Ry. Co., Virginia, Minn.

Mr. Stephen E. Wilson, who designed the new municipal garbage-reduction plant at Dayton, Ohio, has been employed to supervise its construction and manage its operation.

Mr. David McNichol, Vice-President of the Canadian Pacific Ry., Montreal, Que., has resigned. He is succeeded by Mr. George Bury, Vice-President, who heretofore has made his headquarters in Winnipeg, Man.

Mr. E. W. McKenna has resigned as Vice-President of the Chicago, Milwaukee & St. Paul Ry. after over half a century of railway service, begun in 1862 as a messenger and telegraph operator with the Pennsylvania R.R.

Mr. Milo M. Backus, recently Supervisor of the Illinois Central R.R., at Princeton, Ky., has been promoted to be Roadmaster of the Springfield division, with headquarters at Clinton, Ill., succeeding Mr. Lewis H Bond, transferred.

Mr. H. S. Morse, M. Am. Soc. C. E., formerly Engineer in charge of sewerage investigations at Cincinnati, Ohio, is now Engineer of the Ohio Institute for Public Efficiency, Hartman Bldg., Columbus, Ohio. He is temporarily engaged on some special work for the Cincinnati Bureau of Municipal Research.

Mr. H. M. Flanders, Engineer of Maintenance-of-Way of the Springfield (Mass.) Street Ry. Co., has been promoted to be General Manager, succeeding Mr. R. W. Reynolds, resigned as noted elsewhere. Mr. Flanders was educated at the Massachusetts Institute of Technology and was formerly with the Newton (Mass.) Street Ry. Co.

Mr. Otto Lemberger, formerly a consulting engineer and surveyor of Chihuahua, Mexico, who returned to his native country of Austria in 1913 to engage in stereophotographic survey work under Capt. von Orel, the inventor of the stereoautograph, has been made a lieutenant in the Austrian Army and is now on the fighting line.

Mr. Richard Sachse has been appointed Chief Engineer of the California Railroad Commission, with headquarters in San Francisco. Mr. Sachse entered the service of the Commission in 1911 as Assistant Engineer. He was promoted to the position of Principal Assistant Engineer in 1913, and has been Acting Chief Engineer since December, 1913. Prior to his service with the Commission he had been with the Western Pacific Ry., the Southern Pacific Co. and the United States Reclamation Service.

OBITUARY

John C. Muir, General Superintendent of the Chicago, Terre Haute & Southeastern R.R., died at his home in Terre Haute, Ind., Nov. 4, at the age of 50 years. His railway experience began in 1879 as a messenger boy with the Atchison, Topeka & Santa Fé Ry.

Charles Willard Kettell, a retired mechanical engineer, died Nov. 18 at his home in Lexington, Mass. He was born in Charlestown in 1848, and graduated from Harvard University in 1870 and from the Lawrence Scientific School in 1873. He practiced his profession of mechanical engineering first in Fitchburg, Mass., and later in Boston. He is survived by a widow and a daughter.

Forrest E. Barker, Chairman of the Massachusetts Gas and Electric Light Commission, died Nov. 20, in Washington, D. C., where he had gone to attend the annual convention of the National Association of Railway Commissioners. He was born in Exeter, N. H., in 1853, and graduated from Wesleyan University, Middletown, Conn., in 1874. He studied law and for a time practiced in Worcester, Mass. Mr. Barker was appointed a member of the Massachusetts Gas and Electric Light Commission in 1885, and ever since then had been one of its ablest members.

Frank H. Rogers, Superintendent of Construction, United States Treasury Department, died recently in Wheeling, W. Va., from the effects of an accident. He was supervising the construction of a Federal building in Wheeling and was injured by the falling of a block of stone. He was born in West Newbury, Mass., in 1871, and graduated from the Massachusetts Institute of Technology in 1896. He was employed in the city engineering department of Boston, Mass., until 1905, when he was appointed Superintendent of Construction on United States Government work. He is survived by a widow and a two-year-old daughter.

[illegible] S. Martin, former Editor of the "General Electric Review" [illegible] member of the editorial staff of the "Electrical World," died recently at the Boulogne Hospital, [illegible] wounds received in the battle of [illegible]. He [illegible] British Army. Mr. Martin was [illegible] of [illegible] Smiles, author of the "Lives of the [illegible]," and [illegible] brother of T. C. Martin, Past-President of the American Institute of Electrical Engineers, Secretary of the National Electric Light Association. He was born in England and received his education at the Central Technical [illegible]. He was 27 years old.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. [illegible] Convention at Washington, D. C. Secy., D. [illegible] Kendall [illegible] Boyd, The Octagon, Washington, D. C.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.
Dec. [illegible] Annual meeting in New York City. Secy., Percy H. Wilson, Bellevue Court Bldg., Philadelphia, Penn.

AMERICAN MINING CONGRESS.
Dec. 7-11. Annual meeting at Phœnix, Ariz. Secy., J. F. Callbreath, Denver, Colo.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.
Dec. [illegible] Convention at Richmond, Va. Secy., C. A. Prosser, 140 W. 42d St., New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Dec. [illegible]-11. Annual meeting at New York City. Secy., D. H. Cox, 29 W. 39th St., New York City.

AMERICAN ROAD BUILDERS' ASSOCIATION.
Dec. 14-18. Convention at Chicago, Ill. Secy., E. L. Powers, 150 Nassau St., New York City.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Dec. 28-30. Annual meeting at Chicago, Ill. Secy., F. M. White, Madison, Wis.

SOCIETY OF CONSTRUCTORS OF FEDERAL BUILDINGS.
Jan. 4-6. Convention at Washington, D. C. Secy., T. R. Mash, 4213 Westminster Ave., Philadelphia, Penn.

ASSOCIATION OF GOVERNMENT CONTRACTORS.
Jan. 4-7. Annual meeting at Washington, D. C. Secy., Algernon Blair, Montgomery, Ala.

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.
Jan. 12. Annual meeting at New York City. Secy., J. R. Wemlinger, 11 Broadway, New York City.

AMERICAN WOOD PRESERVERS' ASSOCIATION.
Jan. [illegible] Convention at Chicago, Ill. Secy., F. J. Angier, Mt. Royal Station, B. & O. R.R., Baltimore, Md.

AMERICAN SOCIETY OF HEATING & VENTILATING ENGINEERS.
Jan. [illegible] Annual meeting at New York City. Secy., J. J. [illegible], [illegible] W. [illegible]th St., New York City.

AMERICAN CONCRETE INSTITUTE.
Feb. [illegible] Convention at Chicago, Ill. Secy., E. E. Krauss, Harrison Bldg., Philadelphia, Penn.

Compressed Gas Manufacturers' Association—The annual meeting will be held at the headquarters of the Association, [illegible] Madison Ave., New York City, at 2:30 p.m., Jan. 18. The Secretary is [illegible].

Springfield (Mo.) Engineers' Club—An Engineers' Club at Springfield, Mo., was recently [illegible] organized. The membership of [illegible] is composed largely of engineers of the Frisco [illegible], whose headquarters are in that city.

National Conference on Concrete Road Building—[illegible] [illegible] La Salle St., Chicago, Ill., states that the [illegible] national conference on concrete road building will probably be held some time in February, 1915.

American Society of Mechanical Engineers—At the annual meeting, [illegible] New York, [illegible] there will be an [illegible] under the auspices of the Public Relations Committee of the Society.

American Wood Preservers' Association—The [illegible] annual convention will be held in Chicago, Jan. [illegible], with headquarters at the [illegible] Hotel. The program will be [illegible]. The Secretary is F. J. Angier, [illegible] R.R. Co., Baltimore, Md.

Society of Constructors of Federal Buildings—The [illegible] annual convention of the Society will be held in the rooms of the Washington Architectural Club, [illegible], Washington, D. C., Jan. 4-6. [illegible] should be [illegible] Secretary, T. R. Mash, 4213 Westminster Ave., Philadelphia, Penn.

New England Water Works Association—At the Jan. [illegible] meeting, in Boston, Mass., in addition to the [illegible] of [illegible] the [illegible] discussions of the [illegible] will be continued. The Secretary is [illegible].

Duluth Members of American Society of Civil Engineers—A branch of the American Society has just been organized in Duluth, Minn., for the benefit of the 17 members of the national body, living in the city and vicinity. The president is F. E. House, President of the Duluth & Iron Range Ry., the secretary is Walter G. Zimmerman, Manager of the American Bridge Co. Meetings will be held from time to time.

Association of Government Contractors—The third annual meeting of the Association will be held in Washington, D. C., Jan. 4-7, with headquarters at the Hotel Raleigh. This meeting will include a conference on the first day with manufacturers, dealers and subcontractors, on the second day a joint meeting will be held with the Society of Constructors of Federal Buildings.

Engineers' Society of Philadelphia—Plans are being drawn by Philadelphia engineers to unite their several organizations into one body, to be called the Engineers' Society of Philadelphia, with headquarters at the present address of the Engineers' Club, 1317 Spruce St. A committee has drafted by-laws and regulations, which will be presented to each association for acceptance. It is said that there will be about ten such organizations in the new society.

American Society of Agricultural Engineers—The annual meeting will be held at Chicago, on Dec. 28-30. One session will be devoted to a series of papers on "The Place and Field of the Agricultural Engineer," by the deans of half a dozen engineering colleges. Another session will be devoted to papers and discussions on education in agricultural engineering. At the third business session there will be papers on soil treatment, the fuel economy of small gas engines, the draft of farm wagons, and the design of farmhouses. The Secretary is F. M. White, Madison, Wis.

Aëronautical Society of America—What is termed the first joint conference on aviation will be held by the Aëronautical Society of America, in conjunction with other national engineering organizations, Feb. 5-6, 1915, when inventions tending to increase the stability and safety of flight in heavier-than-air machines will be considered. Those wishing to submit their inventions are invited to communicate with the Technical Board of the Society, at 29 West 39th St., New York City. Other societies represented will be the American Society of Mechanical Engineers, the American Mathematical Society and the American Physical Society.

The American Society of Engineering Contractors—The annual meeting will be held in New York on Jan. 12. At a recent meeting of the Board of Directors a report of the record, efficiency and accomplishment of the various committees was submitted by a special committee appointed to revise the present work of the Technical Standards committees. It is very probable that several committees, whose fields overlap those of the larger engineering societies, will be discontinued. It is the desire of this Society to concentrate its efforts on the solution of the problems facing engineering contractors. The Secretary is J. R. Wemlinger, 11 Broadway, New York City.

American Association for the Adoption of the Metric System—This organization was recently launched under the auspices of the Oregon Society of Engineers. Its object is to educate the American public in the advantages of the metric system of weights and measures, to extend its use in the United States, and to [illegible] a rational plan whereby it may be [illegible] adopted without [illegible] or [illegible] loss to existing industries. There are no restrictions as to membership. The fee is $1. Temporary officers have been selected who will serve until the first meeting of the association, which will be held in San Francisco in connection with the International Engineering Congress, Sept. [illegible], 1915, when permanent officers will be chosen. The temporary secretary is J. A. [illegible], Portland, Ore.

Boston Society of Civil Engineers—The Society has recently detailed a member who has a faculty [illegible] to get accounts of its activities into [illegible] suitable for the newspapers. The Society, which is the oldest in the country, and now has a membership of [illegible], is beginning to feel that it should take an active interest in local affairs and especially in legislation affecting engineering matters. It is also beginning to realize that its actions will have greater weight if the people and the legislature are first made to appreciate that its members are responsible for nearly every [illegible] of engineering [illegible] and construction in New England. That [illegible] is [illegible] welcomed by the daily press was shown by the space which the Boston papers gave to an address [illegible] before the Society on Nov. 18 by Henry M. Waite, City Manager of Dayton, Ohio, and formerly City Engineer of Cincinnati. The address was on the city-manager plan of municipal government.

Engineering News

VOLUME 72 DECEMBER 10, 1914 NUMBER 24

Some Bridges on the Columbia Highway

By K. P. Billner*

The Columbia Highway, now being constructed, follows the south bank of the Columbia River from Biggs, Ore., through Portland, to Astoria.

The magnificent scenery along the route, particularly between Portland and Hood River, is unsurpassed in this country. Along this portion of the highway are numerous mountain streams and ravines which had to be spanned, and the writer was asked to work out the designs for the bridges. In this work it has been his aim to build structures which would harmonize with the mighty surroundings and at the same time give the factors of safety and low cost their due consideration. No standard types were adopted, but reinforced - concrete structures had the preference over steel bridges.

Below are given descriptions of some of the most noteworthy of the structures.

Latourelle Bridge

The bridge at Latourelle (Figs. 2-3) is an original type by the writer, although its principles are borrowed from the French expert, the late M. Considère. The principal characteristic of this bridge is its lightness. It is 312 ft. long and 97 ft. high to grade of the roadway. It has a 17-ft. driveway and the total width, including two cantilever sidewalks and railings, is 25 ft. The concrete above ground amounts to only 560 cu.yd., making presumably the lightest concrete bridge, relative to its dimensions, in this country. It was desired to erect a light structure for several reasons, among which the difficulty in securing a firm foundation was foremost. The underlying bedrock is covered with a layer of silt and boulders to an average depth of 25 ft. on the western bank, while on the east side of the creek is a deposit of drift sand, 50 ft. in depth. The cost of building abutments and piers for a heavy type of bridge would have been very high with these conditions of the foundation to contend with.

Substructure—The abutments, as well as the piers, were founded on bedrock. The west abutment and the two central column bents were placed directly on bedrock. The east abutment was put on four columns, two 4 ft. square and two 5 ft. square. The average depth of these

Fig. 1. Footbridge over Lower Multnomah Falls, on the Columbia Highway, Oregon

(Length of span, 45 ft.; height above creek, 105 ft., erected September, 1914.)

*Engineer, Oregon State Highway Commission, Portland, Ore.

[illegible] 15 ft. from the [illegible] side of the abutment on the rock. The tops of the [illegible] columns are connected to the bottoms of the [illegible] columns by inclined struts which transmit the thrust from the arches down to the rock foundation.

SUPERSTRUCTURE—Each end of the bridge consists of two girders, which carry a set of columns and struts on which the roadway is erected. [illegible] cantilever [illegible] the cantilever action which might develop was not considered in the calculations of the stresses in the structure. The central portion of the bridge consists of three [illegible]-ft. arch spans. Two arch ribs carry each span. These ribs are 20 in. square and are reinforced by eight longitudinal 1-in. square bars and No. [illegible] banding of [illegible] diameter and 2-in. pitch. The ribs are parabolic in shape. The deck floor and any superimposed load are carried to the arch ribs by vertical columns placed at 16-ft. centers.

To resist against bending moments in the arch ribs from partial loading, diagonal members are inserted between the junction points of the arch ribs and the vertical columns and the deck and the columns. These diagonal members are subjected to alternately compressive and tensile stresses and therefore special care had to be exercised in the construction of the junction points. The reinforcing bars of the diagonals are hooked around the longitudinal reinforcement of the arch ribs and also around the longitudinal reinforcement of the girders, which form the [illegible] of the deck. Where it was found necessary to [illegible] [illegible] were [illegible] in the forms. The joints [illegible] during the [illegible] of the bridge. The balustrades are made of artificial stone.

QUANTITIES AND UNIT STRESSES—Permissible stresses [illegible] generally [illegible]: Concrete in bending, 600 lb. per sq.in.; [illegible] compression, [illegible] per sq.in.; [illegible] per sq.in.; [illegible] in tension, 16,000 lb. per sq.in.; [illegible] in bearing, [illegible] lb. per sq.in.

LOADINGS—A uniform load of 100 lb. per sq.ft., a concentrated load of 15 tons, and an impact factor of 25% were selected.

The analysis was made for three conditions of loading: First, A uniform load over the entire bridge; second, half the span of one arch loaded; third, two spans were fully loaded, with no load on the third span.

The springing points of the arches were restrained from moving by making the main columns act as beams with double reinforcements.

CONSTRUCTION—The falsework was erected with a tower at each end of the bridge, and a cableway. All of the forms were built and braced before the concreting of the superstructure commenced. The main columns, which are about 90 ft. high, were poured in sections which were allowed to set for a few hours before the next pouring commenced. The arch ribs were poured simultaneously, commencing at the springings and working toward the crowns. The deck, containing 250 cu.yd. of concrete, was poured in a continuous operation lasting [illegible] hours. The maximum settlement during the pouring of the arches was [illegible] in. The deck was poured after the arches had set for 12 days. No settlement took place while the deck was being poured or after. The centers were struck six weeks after the pouring of the arches.

The principal advantage of this type of a bridge is the small amount of concrete required. The added expense of formwork is more than paid for by the saving in materials. The bridge makes a very pleasing appearance.

The contractor for the bridge was [illegible], of Portland. Messrs. [illegible] and [illegible] had a subcontract for the forming and placing of the steel. Credit is due them for the very satisfactory workmanship and for the [illegible] finished structure.

FIG. 2. BRIDGE AT LATOURELLE ON THE COLUMBIA HIGHWAY

BRIDGE AT [illegible] DELL

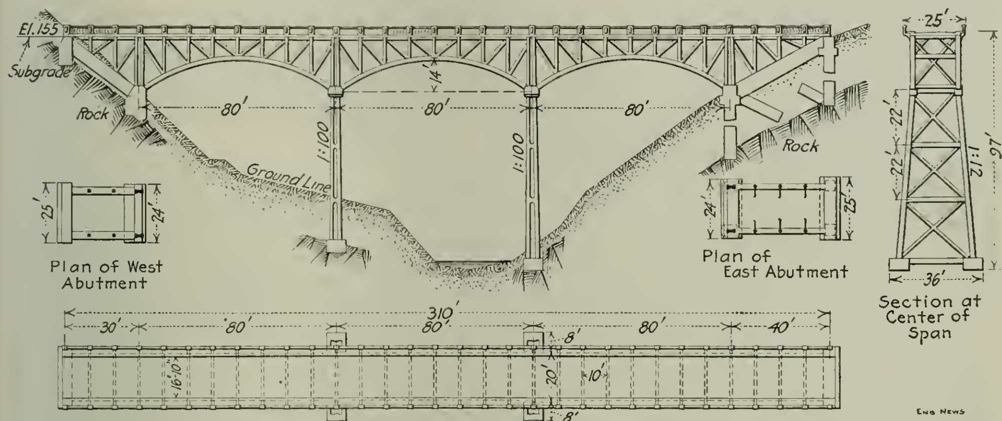
This bridge (Figs. [illegible]) is of a standard type, but has one original feature in the reinforcing of the spandrels.

The spandrels are reinforced in such a way as to make them act as girders, and are capable of sustaining the bending moment from the live load over half the span. These spandrels, therefore, will distribute the loading on the arches. The influence of the stiffening of the spandrels, although of great value, has not been considered in the determination of the dimensions of the arch ribs. The clear spans in the Shepherds Dell bridge are each 100 ft.

Viaducts

Among problems which arose in the construction of the Columbia Highway were two which necessitated the building of viaducts. A glance at Figs. 7 and 9 will be sufficient to explain the situation. The Highway at these places is located on a steep mountainside, at the foot of which the Oregon-Washington R.R. & Navigation Co.'s line is located. To excavate a 24-ft. roadway out of the hillside would have meant the moving of an enormous quantity of earth with no place to dump it. In order to avoid this, the viaducts were erected.

Fig. 8 shows a cross-section of the viaduct at Multnomah Falls and is typical of the design of these "side-hill" viaducts. Essentially the construction is a solid reinforced-concrete slab, crowned to the road crown, which rests on transverse floor-beams spanning between columns on the low side and a continuous girder on the high side. These columns are spaced every 20 ft. and foot on prismatic bases. The up-hill girder rests on square concrete plates and the plates and column footings are tied together by reinforced-concrete struts taking the slope and embedded in ground. Longitudinal stiffness is also given by girders at the top of the columns under the railing.



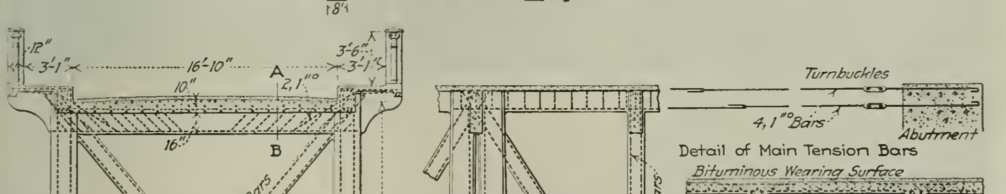


Fig. 3. Details of Latourelle Bridge

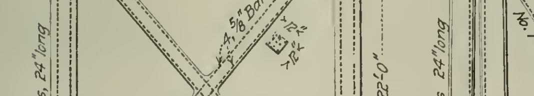


Fig. 7 shows the viaduct from the river side. The peculiar arched railing should be noted. This type of railing was used on a number of the other structures. The total length of these structures is 1260 ft. Besides eight concrete bridges erected on the Highway, there is to be mentioned a footbridge over the lower Multnomah Falls 105 ft. in the air. This bridge, shown in the first-page view, was donated by S. Benson, of Portland, Ore. The total length of roadway of these bridges and viaducts is 2012 ft. The contract price was only $76,500.

[illegible] per square foot of [illegible] surface varies from [illegible] for the viaducts to [illegible] for the high bridges. The [illegible] structures east of [illegible] were erected by the [illegible] Co., of Portland. All of the structures are well [illegible].

PERSONNEL

The Columbia Highway in Multnomah County is being constructed by S. C. Lancaster, Assistant State Highway Engineer, Consulting Engineer for Multnomah County. H. L. Bowlby, State Highway Engineer, J. B. [illegible], Assistant Roadmaster, [illegible], Chairman of the Board of County Commissioners. The writer was appointed engineer for the design and construction of the bridges.

[illegible] Two Views of the Shepperd's Dell Bridge on the Columbia Highway, Oregon

Standards for Gas and Electric Service in Illinois

[illegible] for gas and electric service were recently [illegible] by the Illinois Public Utilities Commission, becoming effective [illegible] 1914. They were prepared by [illegible], Chief of Service Department, and [illegible] Gas Engineer, under the direction of [illegible], Chief Engineer. Companies are required to [illegible] records of [illegible] interruptions, [illegible] of supply, [illegible] and annual [illegible]. Any meter must be tested on complaint [illegible]. [illegible]

[illegible]

gas is defined as volume under existing conditions but at a temperature not over 75° F. Meter provers must determine the accuracy of meters within ½%. When installed, meters must be set not over 1% in passing gas at 6 cu.ft. per hr. per rated light capacity. Meters must be tested at least once in five years. If a meter is accurate within 2%, no adjustment of bills is involved. The commission will test meters at fees ranging from $1 to $8, depending on capacity. A company with output exceeding 20,000,000 cu.ft. per year must have a complete standard calorimeter outfit, and the heating value of manufactured gas must be determined on at least three days a week; for natural gas, three times a year. Manufactured gas must have a total calorific value of not less than 565 B.t.u. per cu.ft., and it must not drop below 550 at any time. Where the gas is carried at [illegible] pressure or over, an allowance of [illegible] B.t.u. in the monthly

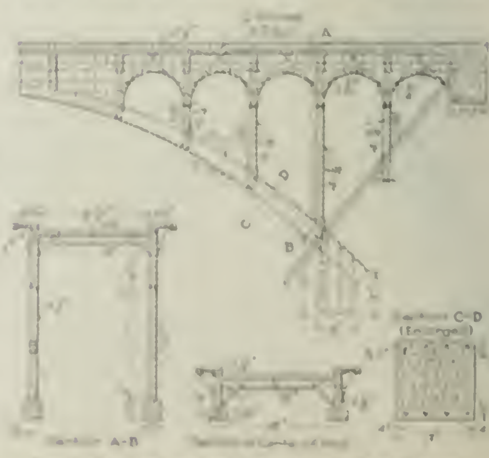


Fig. 7. Details of the Shepperd's Dell Bridge

Fig. 7. Side-Hill Viaduct at Multnomah Falls, 860 Ft. Long

average is made and the minimum value is placed at 520 B.t.u. Sulphur content is limited to 30 grains per 100 cu.ft.; hydrogen sulphide to 1 grain. Outlet pressure must not be less than 2 or more than 8 in., except under special contract. Daily variation of pressure at any outlet must not be greater than 100% of the minimum. Each company must have one or more portable graphic record-

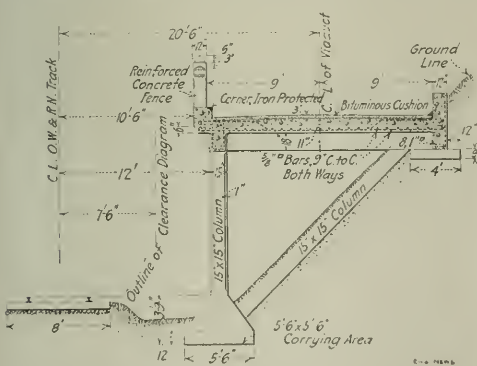


Fig. 8. Section of Multnomah Falls Viaduct

ing pressure gages and must make frequent pressure surveys. Companies must make street-main extensions free of charge, provided the length of the entire extension is not greater than that obtained by allowing 100 ft. per consumer for a low-pressure system and 200 ft. per consumer for a high-pressure system. Extensions above the free limit must be made if proper compensation is offered.

Electricity-supply companies are required to have working meter standards, accurate within ¼%, and check standards. In testing a meter, two determinations agreeing within ½% must be made at 10% and at 75% rated capacity or full connected load. The average error, of these two values, of a meter at installation must be not over 2%. A meter in service may have an error of not more than 4% before adjustment of bills is necessary. The commission will test watt-hour meters at figures ranging from $2 upward. The voltage variation on constant-potential lighting systems must not exceed 5% of the adopted standard voltage; for power circuits the variation may reach 10%. Voltage surveys and records must be made by the company. Sustained variations of frequency on alternating-current systems must be not over 5% of a fixed standard.

Station records must show time of starting and stopping generating apparatus; starting and disconnecting

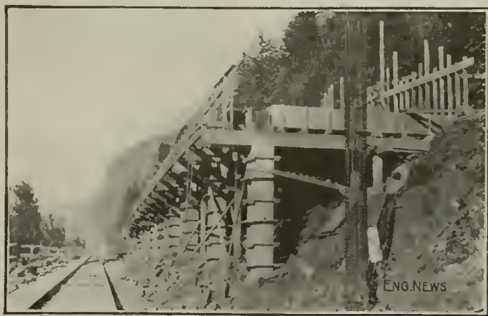


Fig. 9. Multnomah Falls Viaduct under Construction

street-lighting circuits; reading of instruments necessary to determine character of load; all interruptions to service, with time, duration, extent and cause. An interruption is defined as the interval during which voltage falls below 50% normal. Grounding of all secondaries of alternating-current circuits is required in all new construction and according to the rules of the National Electrical Code. Free extensions of service must be made, provided any such line requires no more than twice as many poles at standard spacing as there are individual applicants. Extensions above the free limit must be made if proper compensation is offered.

⁂

British Locomotive Exports—In spite of war, shipments for nine months ending Sept. 30 had a value of $14,648,000, compared with $10,337,000 and $7,155,000 for similar periods in 1913 and 1912 respectively. The locomotives went mostly to India, Australia, Argentina and South Africa.—London "Engineering"

New York Rapid Transit Railway Extensions*

By F. Lavis†

IX--Underpinning Buildings along the Line

Under the general heading of "protection of adjacent buildings" the specifications provide for three classes of work.

A. Buildings "which are supported on firm soils" and bearing such a relative position in regard to the subway structure that a slope "represented by 1 ft. vertical to 2 ft. horizontal, inclined downward from the bottom outer edge of the building foundation, passes beneath the bottom outer edge of the completed subway structure" [illegible] to be taken care of by the contractor, and such [illegible] therefor may be [illegible] in the price for excavation.

B. When necessary to secure adjacent buildings so as to prevent bringing an unusual pressure on the subway structure when completed, the contractors are required to "safely and permanently underpin adjacent buildings the foundations of which are above the bottom of the adjacent subway excavation." This work is paid for at a price bid per front foot of the buildings. The latter are classified according to height: less than seven stories, seven to twelve stories, and over twelve stories. The prices for this work [illegible] range from [illegible] to [illegible] per front foot for 7-story buildings and from [illegible] to [illegible] with an average of about $150 for buildings 7 to 12 stories. The prices are, however, very irregular and [illegible] to [illegible] between [illegible] and [illegible]. Bids for underpinning buildings over 12 stories range from [illegible] to [illegible] per front foot and [illegible] too few and erratic to be of any use as a guide to the cost of the work.

C. In certain cases where underpinning is not considered necessary but where buildings have to be secured and maintained during construction, there is a price bid per front foot for "maintaining, protecting and securing." These prices range from $15 to $60 and average about $40.

It is generally required that underpinning be carried down to solid rock or to at least 2 ft. below the lowest excavation for the subway, if rock is not encountered before that depth is reached.

Often when the necessary excavation for the subway structure takes a fairly large proportion of the width of the street, the excavation of the "first lift" is carried out to the full width of the street between building lines and to the depth of the cellar, thus providing easy access for working as is shown in Fig. 53A. The excavation of this first 10 ft. is generally first carried ahead the whole length of the section, or for a considerable portion of it, and this is followed by the underpinning before any further excavation is undertaken.

Probably the most common way of supporting ordinary buildings is to temporarily carry the walls to be supported on needles, generally I-beams, as shown in Fig. 53A and extend the foundation walls down to rock if this is not too deep.

In cases where the depth to rock or to the required bottom of foundation is deep, piers (from 2 to 3 ft. square for ordinary buildings 5 or 6 stories high) are usually sunk at intervals of 10 to 15 ft. The spacing of the piers depends, of course, on the position of the piers or columns of the building which require direct support, and the front wall of the building between the piers is supported on two or more I-beams spanning the space between these piers. The excavation of the pits for the piers is usually made by hand, the well being sheeted, and the piers are built of concrete. In some cases, instead of the concrete piers, 12-in. pipes in short lengths are sunk either by driving with a weight or with a water jet, the subsequent procedure being the same.

To avoid supporting the buildings on needles, two methods have been used, somewhat similar in principle. Concrete piers 2 ft. square are sunk to rock in pairs, one inside and one outside the wall, each pair 10 to 12 ft. apart, or instead of the piers, 12-in. wrought-iron pipes in lengths of about 4 ft. with inside sleeve couplings are sunk and filled with concrete, the tops of these piers or pipes being 20 to 30 in. below the cellar floor. I-beams of suitable size (50 to 60 lb. generally for ordinary buildings) are then laid on top of these piers or pipes parallel and adjacent to the walls of the buildings; small holes are then broken through the wall and smaller I-beams put through spanning the first two and the walls wedged up on these, as shown in the sketch in Fig. 53B.

On one section where a building of moderate size had to be taken care of, piers were sunk to rock (or to the required depth) and then the walls were widened out at the top in the direction of the line of the building, as shown in Fig. 53C, and filled with concrete, in which reinforcing rods were placed. These piers were 30 to 40

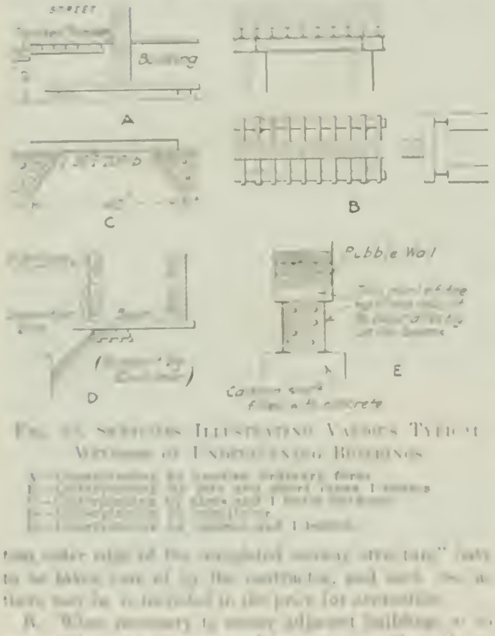


FIG. 53. SKETCHES ILLUSTRATING VARIOUS TYPICAL METHODS OF UNDERPINNING BUILDINGS

A—[illegible]
B—[illegible]
C—[illegible]
D—[illegible]
E—[illegible]

*Copyright, 1914, by F. Lavis.
†Consulting Engineer, [illegible], New York City.

ft. apart and the space between them was spanned by two 30-in., 200-lb. Bethlehem beams, which were placed in niches cut in the wall to receive them.

On Section 14, Lexington Ave., W. Melvin, Superintendent for the McMullen & Hoff Co., devised a form of

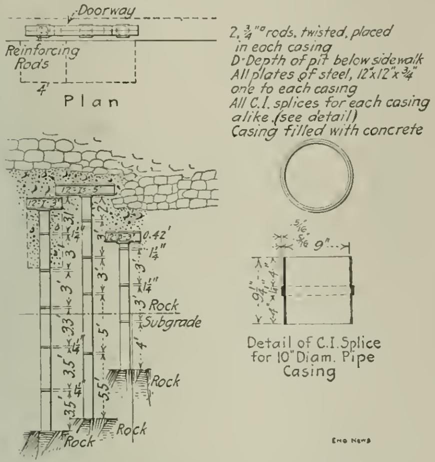


FIG. 54. UNDERPINNING BUILDINGS WITH STEEL-PIPE PILES FILLED WITH CONCRETE

shield on the principle of the tunnel shield, but reduced to its simplest elements, to sink 3-ft. 6-in. cylinders vertically for underpinning. The apparatus is shown by the drawings, Fig. 55, and, as will be seen, consists simply of a cylinder of ¼-in. boiler iron about 3 ft. long with a 3x4-in. angle bent to circular form to fit inside just back from the lower end. Four segments, as shown in the drawing, form an 18-in. ring, which is added to the bottom of the caisson inside the tail of the shield as this latter is shoved down. The shield is "shoved" by four jack bolts, bearing against the 3x4-in. angle of the shield and reacting against the last ring.

The material is removed by means of small buckets which are raised by a hand winch and taken out of the top through the air lock. On account of the small working compartment only one man can work at the excavation, but usually there is another puddling the joints and sealing the shaft.

The shield, of course, was left in the bottom when the caisson was concreted. These caissons were sunk about 20 to 25 ft. apart, directly under the front walls of the buildings, the location depending on the location of the main columns or piers which it was desirable to support directly. The space between them was spanned by two 26-in., 150-lb. Bethlehem beams on which the wall was supported directly, as shown in Fig. 53E.

At one point on Section 13, Lexington Ave., where the rock was quite near the surface and the necessary excavation close to the building line, a slip occurred in the rock, endangering the front of the building. In order to avoid blocking up in the excavation, long I-beams were used as cantilevers, blocked up in the cellar just back of the front wall and running back under the back wall, against which they were blocked and which afforded the necessary reaction, as shown in the sketch in Fig. 53D.

On Sections 8, 9, 10 and 11, Lexington Ave., three methods were used: *First,* the common one of supporting the buildings on needles while the walls were carried down in trenches to rock, this being usually adopted when the rock was not deep. *Second,* piers of concrete about 5 to 6 ft. wide and 8 to 10 ft. long were sunk to rock or subgrade and spanned by two or sometimes three I-beams on which the building wall was carried. This method was usually used where the rock or subgrade was deep, say 10 ft. or more below the basement floor of the building. *Third,* 10-in. iron pipes in lengths of 3 to 5 ft. with inside sleeve couplings were sunk under the walls and capped with I-beams, as shown in Fig. 54. The pipes were forced down by jackscrews reacting against the walls of the building, and were put down under columns or sections of the wall which carried the load. They were sunk dry and the material inside excavated with small orange-peel scoops. The small boulders encountered were taken out by a sort of net on the end of a pole called a "snare." They were supposed to be sunk to rock, sealed to it by a rich cement mortar, and filled with concrete in which were embedded two ¾-in. square steel rods.

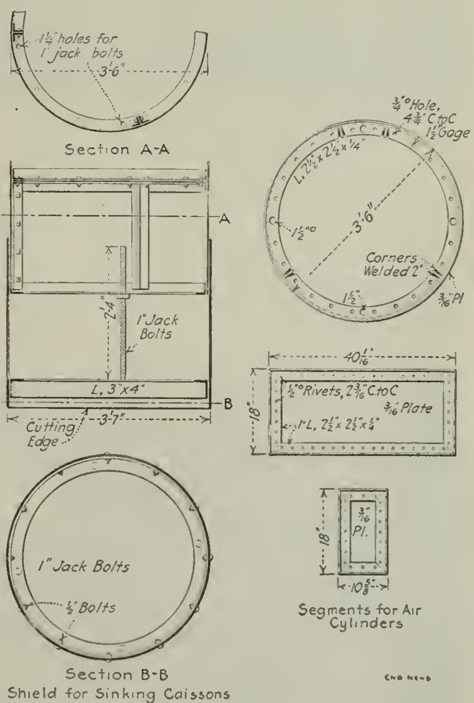


FIG. 55. SECTIONAL CAISSONS OF CAST IRON SUNK WITH SHIELD

This method of underpinning is quite effective and safe in many cases and, of course, is very much cheaper than either of the first two methods, if the foundations have to be carried down to any great depth. The defects are that it is sometimes difficult to tell if the pipes are on solid rock or on a boulder, and if the excavation for the subway or other purpose comes close to the building line, the front of the pipes may be uncovered, leaving

Fig. 56. Putting down Hollow Steel Pile with Hydraulic Jack Reacting against Building

[illegible] unsupported columns. So far as could be learned, however, where they have been used so far, they have served their purpose and no actual difficulty or failure has been encountered. This work was done by the Underpinning & Foundation Co., under a subcontract from the principal contractors.

A method which obviates the necessity of supporting the buildings on needles was developed and used on Sections 1 and 2 of the Broadway line. It consists essentially in tying the foundation columns together with a reinforced-concrete mattress or girder, as shown in Fig. 59, then sinking pits or piles under it to the required depth. Built-up steel girders or I-beams are first laid along on either side of the columns and parallel to the face of the building, at about the level of the basement floor, or just below it, one outside and one inside and tied to each column and to each other. These girders are made up of short sections, on account of the confined space in which they have to be handled, and a convenient form is one made up of four angles latticed together, and riveted so as to be continuous for the length of the front of the building (see Fig. 58), though I-beams are used in some cases. Light hitches are cut in the piers to get a firm bearing, and the girders or I-beams are tied together firmly with rods or sometimes with steel-wire ropes, the whole being then concreted, making a continuous reinforced-concrete girder supporting the whole front. The photograph, Fig. 58, shows in the foreground the two latticed girders and behind that the completely concreted beam or girder.

Rectangular pits are then sunk at intervals under the girder, as shown in the sketch, Fig. 59, and in spaces between the column footings so that the ground under these latter remains undisturbed. The pits are sheeted with horizontal sheeting, and are sunk to the necessary depth, i.e., to 2 to 3 ft. below the subgrade of the subway structure, and filled with concrete. Care is taken not to have the open pits close together. About two at a time, some distance apart, are put down, filled and blocked under the concrete girder before others are started. If water is encountered, hollow steel piles in short sections are sunk from the bottom of the pits below the water level and filled with concrete. All piles are tested by hydraulic pressure to take up any slight settlement.

There are two methods of sinking these hollow steel piles which are quite extensively used, one by the use of

Fig. 57. Underpinning with Needles, Building at [illegible] Broadway

Fig. 58. Underpinning with a Latticed Girder

hydraulic- or screw-jacks reacting against the building above, as shown in the photograph, Fig. 56, and the second, to drive them by a hammer. The first is, it is stated, a patented process. Where the hammer is used it generally consists solely of a weight, about 300 lb.,

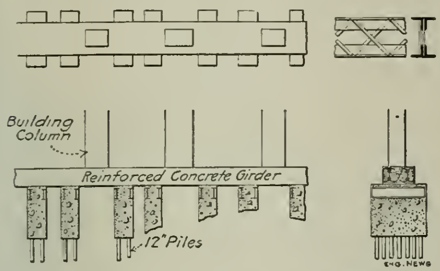


FIG. 59. SKETCH ILLUSTRATING UNDERPINNING WITH REINFORCED-CONCRETE GIRDER

suspended from a rope passing over a single block attached to the floor above the pit, and running to a small single-drum hoist. The fall is usually only a few feet and the hammer is guided by hand by a man standing near the pile being driven. A square cast-iron cap is used on top of the pile.

An interesting detail of the horizontal sheeting so generally used in sinking the pits for underpinning and other purposes is the method of chamfering the corners of the

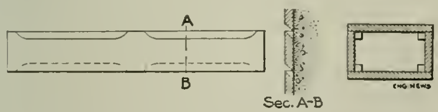


FIG. 60. HORIZONTAL SHEETING FOR SINKING PITS

boards so as to allow of packing the ground solid behind them as they are placed (see Fig. 60). The boards on two opposite sides are cut so that they fit inside those on the other sides, making a brace, and short blocks are spiked on to hold the short sides as shown in the plan. The long sides are placed first, and made to give a firm driving fit to the short ones. Each width is firmly packed as it is placed.

The pits are filled with concrete up to within about 12 or 15 in. of the bottom of the concrete girder. When the concrete in the pit has set, short sections of I-beams are placed on top of it and wedges are firmly driven between these I-beams and the bottom of the foundation girder. This holds the latter while the other pits are being put down, the shrinkage in the concrete in the pits being taken up from time to time by the wedges and the whole finally completely filled in, after all shrinkage and settlement of the new foundation have taken place.

The foundations of the Havemeyer Building (11 stories) are on spread brick piers on wooden piles, the bottom of the brick and the top of the piles being at approximately the level of the floor of the subway. To protect these foundations, additional hollow steel piles were sunk under the front edges of the building piers and then a double row of steel sheet piling 10 or 12 ft. long and with a space of about 3 ft. between the rows was driven as additional protection. This acts as a coffer-dam and not only will tend to prevent any disturbance of the ground around the piles, but also to retain the level of the ground water.

In turning from Church St. through Vesey St. to Broadway, it was necessary to obtain easements under private property at each of the corners in order to get around. One of these is under Trinity Parish House and the other under the old Astor House. That portion of the latter under which the tunnel passes was dismantled and taken down, the city agreeing to provide foundations for a new building along each street line. Open trenches were sunk through the sand to a depth of about 30 ft. and from the bottom of these trenches pneumatic caissons are being sunk to the required depth. The sinking of the caissons is done under a special subcontract by the Foundation Company.

The Trinity Parish House is a four-story brownstone building about 30 ft. wide and 160 ft. long. The tunnels pass under it as shown in the sketch, Fig. 61. Rectangular pits were sunk as shown by the drawing, there being 115 of these pits. Part of these pits supported the building directly; at other places the walls are supported on cross-girders over the tunnel, as indicated on the sketch. With the exception of part of the ground floor and basement the building has been continuously in use during the whole operation.

A method of underpinning was developed on Sec. 3 of Route 5 (see Fig. 42) by the Underpinning & Foundation Co., which consists essentially of the construction of a retaining-wall the face of which is practically at the neat line of the structure. This is made practicable by reason of the fact that along most of the route the space underneath the sidewalks is occupied by vaults used by the

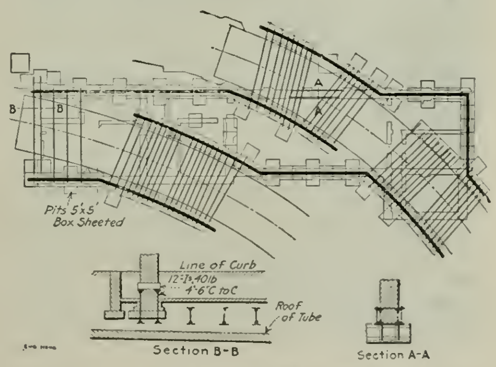


FIG. 61. LOCATION OF SUBWAY TUNNELS UNDER TRINITY PARISH HOUSE

owners of the adjacent buildings under revocable permits from the city. The width of the subway structure makes it necessary to occupy part of these vaults, though any remaining portion is afterward restored for the use of the abutting property owners. Most of the excavation of this section is in sand and the depth is comparatively shallow. The contractor, therefore, took advantage of the situation to build his sidewalls as retaining walls, working from the bottom of the vaults before commencing the main excavation. This effectually prevented any disturbance of the ground under the building and lessened the amount of timber, as no bracing for the sides was required. The retaining wall was built in sections by sinking 4 ft. square pits or wells (using the horizon-

[illegible] sheeting) separately, and some distance apart, then intermediate piles were put down and finally the whole closed up to make a continuous wall.

At the lower end of this section, the two middle tracks are depressed for the [illegible] St. connection, and as this is

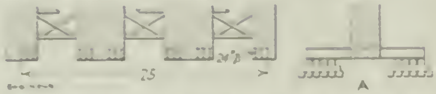


FIG. 62. UNDERPINNING WITH NEEDLES 6-STORY BUILDING, BROADWAY AND 115TH ST.

mostly below ground-water level and quite deep, the method above described did not wholly apply. It served, however, for the upper level and steel sheeting was then driven between the outer tracks and the inner pair, to enable these latter to be taken down to the required depth.

The six-story brick building at the corner of Broadway and 115th St. was held on needles while it was underpinned, and is a good example of what this method involves for a heavy building. The length of the front which was supported is about 25 ft., and eighteen 24-in. I-beams each about 25 ft. long were required to hold the weight. There were two piers between the corners and the three spaces between them were filled with heavy timber

FIG. 63. TEMPORARY SUPPORT FOR ELEVATED-RAILWAY COLUMNS

bracing and blocking before operations were commenced, as is shown in the sketch, Fig. 62. The I-beams were used in groups of three, supported on a continuous grillage [illegible] the [illegible] and on the [illegible] floor outside. Holes were cut one at a time in the sides of the columns to take the I-beams, and the whole load finally transferred to them while the foundations were carried down.

ELEVATED-RAILWAY COLUMNS

[illegible] of the elevated railway so [illegible] built were generally supported beneath the surface of the street on [illegible] footings, although the removal of which is made necessary by the construction of the subway. Temporary supports as shown in the photograph, Fig. 63, are

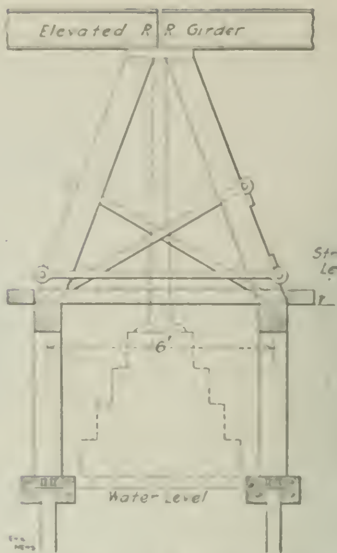


FIG. 64. SUPPORT OF ELEVATED-RAILWAY COLUMNS ON CHURCH ST.

built to hold the elevated structure during construction and considerable care is necessary to prevent any settlement and to provide as nearly as possible absolute safety.

On Sec. 1, Route 5, which is under Church St. and the Sixth Ave. Elevated, the A-frame supporting the cross girder above the column is supported on timber bents resting on steel piles. The spread brick footings are uncovered and spaces are cleared at the two sides of the structure to each of which three 14-in. steel piles are sunk to below subgrade and to a firm bearing; these are capped on each side by a reinforced-concrete beam on which a perpendicular timber bent is erected to about the level of the street surface as shown in the sketch, Fig. 64. These bents are about 18 ft. apart and an A-frame is then erected on them. The legs of the A-frame are held together by tie-bars and [illegible] timber bracing, as shown in Fig. 64. When the final support of the columns is to be below or at subgrade, clusters of hollow steel piles are driven and capped with reinforced concrete to form the new footing, as shown in the photograph, Fig. 65. In many cases, how-

FIG. 65. HOLLOW PIPES FOR FOOTING OF ELEVATED-RAILWAY COLUMN

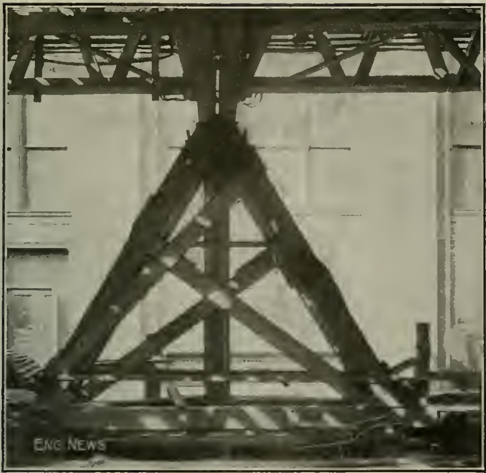


Fig. 66. Timber A-Frame with Eye-Bar Clamp Supporting Elevated-Railway Columns, Church St.

ever, the new column footings are carried directly on the roof of the completed subway structure.

The method of support adopted where the construction of a new sewer, on Third Ave., required temporary support of one pair of columns, is shown in the photograph, Fig. 66, the structure being blocked up from two pairs of girders laid direct on blocks on the paved surface of the street.

On West Broadway, at the lower end of the Seventh Ave.-Varick St. line, the elevated columns are supported above the street surface by a timber tower. Immediately below this and supporting it are two heavy 30-in. Bethlehem beams about 20 ft. long, laid on either side of the brick footing parallel to the street line. Both ends of these are in turn supported by a pair of 24-in. I-beams which rest on timber blocks on the ground outside of the brick footings.

A Year of the Commission-Manager Plan at Titusville, Penn.

By L. O. Bradley*

As the end of the first year under the commission-manager plan of city government draws to a close in Titusville, Penn., I cannot refrain from giving my full indorsement to the plan. At the start I was strongly opposed to it and fought it, but the results obtained in less than a year convince me I was in error.

In December, 1914, the commission form of government was installed, and as soon thereafter as possible, to perfect the ordinance, the city-manager plan was adopted, and City Engineer H. A. Holstein was appointed City Manager. By this action on the part of the council, the offices of street commissioner, water superintendent and city electrician were abolished, and all departments and employees placed under the personal supervision of the city manager, who at once proceeded to systematize the whole working force under one head.

A new method of time keeping has been installed, and all the purchasing of supplies is done by the manager, upon his written orders only, made out in duplicate, and all bills and payrolls pass through his hands before being paid.

In every department the buildings and equipment have been overhauled and repaired and brought up to an efficient working condition.

Street Department—New methods of cleaning the paved streets and working the unimproved streets were adopted, and laborers made to realize that working for the city meant the same as working for a corporation. The old flat rate of \$1.75 per day was dropped and laborers were paid 20c. per hr. for actual time employed.

In the street department the entire equipment has been put in good repair, at a small cost for new parts and materials. This was done by regular employees, in spare time, without additional help or cost.

Lighting Department—The equipment has been overhauled, all poles, wires and suspensions have been inspected, tested and renewed where needed, putting the entire system in first-class condition, ready for the installation of a new lighting system next year, which will be strictly up to date, increasing the efficiency and number of lights, at a reduction in operating expenses of about \$2500 per annum.

Water Department—This department has received like attention, and it is here, no doubt, the best results have been obtained. The manager, during the early spring, caused a complete inspection to be made of all services, connections and fixtures, resulting in a readjustment of the water rates throughout the city, putting them on a uniform basis, without favor to anyone, thereby increasing the revenue in the department about \$3000 per annum. No change of rates was made.

The service has been greatly improved, while the consumption of water has materially decreased. This is clearly demonstrated by the quantity of water in the wells, the reduction, by about two tons per day, of the coal consumed, and an increased pressure throughout the city.

After a systematic test of various kinds of coal, a better quality of coal has been obtained at a reduction of 11c. per ton. New lines have been installed, and leaks repaired continuously throughout the city.

Fire and Police Departments—These have been brought up to a high state of efficiency both as to men and equipment, and a new, modern police station is in process of construction, according to plans and specifications prepared by the city manager.

Finances—The present council came into office handicapped by a deficit of about \$2500, caused by the previous council overdrawing department funds, and further, by the loss of \$1200 in liquor license taxes, caused by the reduction of the number of licensed saloons in the city.

No increase was made in the tax levy, and it is now an assured fact that the finances of the city will show a balance on the right side of the ledger at the end of the fiscal year.

*Commissioner of Public Safety, Titusville, Penn.

Electric Lighting for Trains is to be adopted on all the lines of the State Railways of India, according to orders issued by the Government Railway Board. At present about 13,300 cars are lighted with Pintsch gas and about 5600 with electricity. It has been for some years the practice to equip all first, and second-class cars and all dining cars with electric lighting and electric fans, the latter being especially advantageous for the torrid climate.

A Comparison of the Economy of Powdered Coal, Oil and Water Gas for Heating Furnaces

By C. F. Herington*

Oil

Of the three fuels, powdered coal, oil and water gas, fuel oil has come into use far more than any other. The U. S. Navy yards have been consistent in their adoption of it. All now use fuel oil for heating operations, many to the complete exclusion of coal.

Without a doubt, fuel oil is one of the easiest of fuels to handle. It can be carried in pipes anywhere so long as there is air pressure or pump pressure behind it. It requires only a comparatively small outlay for equipment—all that is necessary is a couple of storage tanks, a pump to fill the storage tanks from the cars, a piping system to the furnaces, and means to secure the necessary pressure.

But fuel oil has one disadvantage—and this is considered by many to be a big one; the price is constantly going up. Ten years ago, fuel oil could be bought for $2\frac{1}{2}$c. a gal., and one could contract for any quantity at that price; now it is $4\frac{1}{2}$, 5 and $5\frac{1}{2}$c. a gal., and one has to take what quantities he can get at that price. Present conditions indicate that this advance in cost will continue beyond the limits of economy.

Powdered Coal

Steady increase in the price of oil has led, quite recently, to extensive experiments in the use of powdered coal and of water gas and producer gas as substitutes. As a fuel for burning under boilers, powdered coal may some time be a success. The use of powdered coal in portland-cement manufacture has proven very economical and here it has come to stay. But when it is claimed that it is equally good for various heating operations, such as welding, [illegible], annealing, riveting and forging, there is apt to be a difference of opinion.

In a recent article in an engineering paper, the following advantages were claimed for powdered coal:

(1) "Complete combustion, doing away with losses due to the carbon contained in the ash and in the escaping volatile matter." This is not correct, for if one stands for an hour watching one of these furnaces working, as the writer did, he will be completely covered with the unburned powdered coal which has escaped through the furnace doors. This has become such a nuisance to the surrounding [illegible] and [illegible] that attempts are now being made to relieve these conditions by placing a hood over the furnace door and connecting it into the furnace stack. This has not proven successful as yet, and probably will not until an exhaust fan is provided to discharge the unburned coal through the roof.

(2) "Total absence of smoke." Certainly this is not true outside of the stack, for powdered-coal furnaces, due to their [illegible] [illegible], smoke worse than oil. Powdered coal, as is well known, must be very fine to be [illegible], and, when pulverized and allowed to remain quiet for 48 hours, it cakes and requires that a man knock on the bins to loosen it. This tends to uneven combustion in the furnace, with large quantities of smoke when there is a large amount of coal coming through the burner, and no smoke when the coal is sticking back in the bins. No doubt this is largely due to inefficient handling of the feeder and burner; even so, a total absence of smoke cannot be claimed when such conditions are met.

(3) "A cheaper grade of coal may be used." The best coal for powdered fuel has a volatile content of not less than 30%, not more than 8% ash, and $1\frac{1}{2}$% sulphur. I think the readers will agree that coal meeting these specifications is of no very cheap grade.

Pulverized coal must be handled with great care, for if it is mixed with any quantity of air, it is highly explosive, as the records of accidents in cement plants will prove. In the January issue of the *Quarterly of the National Fire Protection Association*, the following appeared regarding the hazards of drying pulverized coal:

> Under no circumstances is it recommended that the products of combustion be allowed to come in contact with the coal to be dried. . . . Already there have been quite a number of accidents from this cause in which lives were lost.
>
> A characteristic coal mill explosion (March [illegible]) in New Village, N. J., at the Edison plant, killed six men and burned five others, perhaps fatally, besides injuring a score of others and destroying the coal building. It is supposed that the pulverized coal in the drier fired spontaneously and some of the burning fuel was carried by the automatic conveyor into the blower house. The atmosphere of the blower house being charged with coal dust, an explosion was the result.
>
> On August 19, [illegible], an explosion at the plant of the Nazareth Cement Co., Nazareth, Penn., caused a loss of $[illegible], while on November 28 of the same year $[illegible] damage was done to the Martin's Creek Portland Cement Co. (then known as William Krause Sons), Martin's Creek, Penn. The Dexter Cement Co., Nazareth, Penn., and the Alpha Portland Cement Mill No. 1, Alpha, N. J., had similar experiences the same year.

Another very serious objection to powdered coal, due to the incomplete combustion of all the coal injected into the furnace, is that this coal lies on the work, and when the work is taken out of the furnace, if not cleaned off, it is apt to be hammered into the work and make flaws which later are likely to be more or less serious according to the nature of the work. This is a fact seen from personal observation and cannot be denied.

Powdered coal is not good for small furnaces, as it requires too large a chamber for combustion, and from the experience of the users of powdered coal it is not desirable to have a combustion chamber separated by a bridge-wall from the working chamber. It is found that the trend of the users is to remove the bridge-wall and allow the powdered coal directly upon the work, which aggravates the condition mentioned above. If the large furnaces are changed from fuel oil to powdered coal, there still remain the small furnaces, and especially the portable ones, which will have to work on fuel oil. Then there would be the expense of handling two kinds of fuel where before there was but one.

The pulverizing plant is to be considered. When it is reported that [illegible] to perform a multitude of operations, I feel that [illegible] has not passed the doubtful points, as will be shown later on.

Gas

Greater familiarity and extended experience with natural gas for power and metallurgical purposes have led to better appreciation of the many advantages of gaseous fuel. It has emphasized the value of the gas producer for converting solid into gaseous fuels. But such conversion always involves a loss of a part of the energy of the coal; it is only because the gas can be utilized more

*[illegible], Brooklyn, N. Y.

efficiently that the duty obtained from it is greater than that given by the direct burning of the coal from which it is generated. Hence, any process which claims to deliver in the gas an amount of energy greater or even equal to that in the original fuel is a delusion or worse.

There are at present two kinds of made gases used for heating furnaces—producer and water gas. Industrially, producer gas is the combustible product of rather a complex series of physical and chemical changes induced in the fuel by the heat arising from its incomplete combustion in the producer. The combustion is termed incomplete not in the sense of leaving an unburned residue of carbon or coke, but because the combustible while completely gasified gives up only about 30% of its heat in primary combustion in the producer. The remaining 70% is developed when the gases are burned after leaving. Water gas is made by an intermittent process—first using an air blast to bring the fuel to high incandescence, then shutting off the air and forcing steam through the fire. During the air blow, a lean producer gas is made which may be enriched by the addition of water gas of a higher calorific value and used in the low-temperature furnaces or to drive gas engines. The true water gas is made during the steam blow, the steam being decomposed by the incandescent carbon so that its hydrogen is freed and its oxygen united with the carbon to form carbon monoxide.

The water gas can be used for all purposes where high temperatures must be secured without regeneration, as in factories carrying on a large variety of brazing, small forge, work, etc., where the furnaces are small and distributed over a large area. Temperatures ranging from 2500° F. to 2900° F. are easily obtainable with this gas, and with properly constructed furnaces it is possible to gain an added efficiency in operation so that the total B.t.u. in the gas used need be only 66 to 80% of the B.t.u. required in oil as used in approved oil furnaces for the same purposes. Water gas does not cause the metal forged to scale as does oil. and with gas it is possible to get a closer regulation of furnace temperatures.

Comparative Efficiencies

Now comes the debatable point of what is the efficiency of the furnace when using the different fuels. The powdered coal advocates will claim that the efficiency should be figured on the B.t.u. basis. That is, if a furnace burns say 22 gal. of oil to do a certain piece of work and each gallon contains 140,000 B.t.u., 3,000,000 B.t.u. in all, it will take 3,000,000 B.t.u. in coal to do the same work, but the coal is cheaper. If oil were 5c. a gal., it would take coal at $10 a ton to equal the cost; so the reader will perhaps agree that this is not the proper method of comparing efficiencies, any more than saying that the cost of gasoline per gallon is the operating cost of running an automobile.

The true way is to measure the efficiency of the furnace by the comparison of the input and output, and below are given results of some efficiency tests, made by the writer for a well known concern contemplating a revision of its furnace practice.

POWDERED COAL—(Furnace using preheated air for combustion).
Furnace cold at 60° F.
Steel and furnace heated to 2200° F.
Rise in temperature, 2140° F.
By test, 6.29 lb. of steel heated per pound of coal burned.
Specific heat of steel, 0.117.
0.117 × 2140 = 250 B.t.u. per lb. of steel.
250 B.t.u. × 6.29 = 1572 B.t.u. output.
1 lb. of coal = 14,000 B.t.u., input.

$$\text{Efficiency} = \frac{1572 \times 100}{14{,}000} = 11.3\%.$$

FUEL OIL—Same furnace with same rise in temperature and the same charge of work.
Heated 8.68 lb. of steel per pound of oil.
1 lb. of oil = 19,400 B.t.u., input.
250 B.t.u. × 8.68 = 2170 B.t.u., output.

$$\text{Efficiency} = \frac{2170 \times 100}{19{,}400} = 11.3\%.$$

WATER GAS—(Furnace using preheated air for combustion).
1 cu.ft. of gas = 300 B.t.u.
Specific heat of wrought iron = 0.113 (Kent).
Temperature rise from 1400° to 2500° = 1100° F.
Furnace charged with 3800 lb. iron.
To raise this iron to that temperature required 14,000 cu.ft. of gas.
0.113 × 1100 = 124 B.t.u.
3800 × 124 = 471,200 B.t.u., output.
14,000 × 300 = 4,200,000 B.t.u., input.

$$\text{Efficiency} = \frac{471{,}200 \times 100}{4{,}200{,}000} = 11.2\%.$$

Another furnace using fuel oil. (Not using preheated air).
Temperature rise from 1200° to 2200° = 1000° F.
Charge of wrought iron, 2150 lb.
Oil required, 22 gal.
2150 lb. × 113 B.t.u. = 242,950 B.t.u., output.
1 gal. oil = 140,000 B.t.u.
140,000 B.t.u. × 22 = 3,080,000 B.t.u., input.

$$\text{Efficiency} = \frac{242{,}950 \times 100}{3{,}080{,}000} = 7.88\%.$$

First Costs

In making comparison as to the relative first costs and operating costs with the three kinds of fuel, let us assume a plant now using fuel oil with a consumption of 50,000 gal. of oil per month at a cost of 5c. per gal., delivered at the shop. (These estimates were made for the company already mentioned.)

(1) FUEL OIL:

Cost of equipment (storage tanks in place, auxiliary pressure tanks in place, piping and fittings in place, steam connections, furnace connections, tank-car connections, tank pumps and air-blast outfit)	$21,100
Contractors' profit (15%)	3,165
	24,265
Engineering and contingencies (10%)	2,435
	26,700

(2) POWDERED COAL:

Pulverizing machinery, house, foundations, trestle and track, electric wiring, conveyors, walkways, motors, burners and controllers (30), furnace bins (30), furnace changes, hoods and connections, etc.	$68,100
Contractor's profit (15%)	9,900
	78,000
Engineering and contingencies (10%)	7,800
	85,800

(2A) FUEL OIL FOR SMALL FURNACES:

Tank in place, auxiliary tank in place, piping and fittings, furnace connections, tank-cars connections, pumps, air blast, etc.	$8,800
Contractor's profit (15%)	1,300
	10,100
Engineering and contingencies (10%)	1,000
	11,100

(3) WATER AND PRODUCER GAS PLANT:

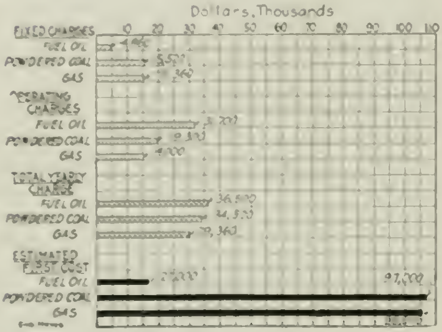
Gas-making machinery, building, trestle and siding, piping, furnace changes	$76,000
Contractor's profit (15%)	11,000
	87,000
Engineering and contingencies (10%)	8,700
	95,700

SUMMARY:

Fuel oil	$27,000
Powdered coal with fuel oil	97,000
Gas plant	96,000

Fuel Consumption of Plants

For the fuel-oil plant, at 50,000 gal. of oil per month and 140,000 B.t.u. per gal., 7,000,000 B.t.u. are consumed per month. If we allow 10 lb. of coal, at 14,000 B.t.u., equal to 1 gal. of oil, we have 500,000 lb. or 250 tons of coal used per month, for the powdered-coal plant. In addition, this plant consumes about 8000 gal. of oil, the difference being compensated for by coal required in drying the main fuel supply. For the gas plant, we require about 60,000 cu.ft. of water-gas per hour; at 20 cu.ft. per lb., we require 3000 lb. of coal per hour or 375 tons per month.



Diagrammatic Comparison of Estimated First Cost and Annual Charges of Coal, Oil and Gas Plants to Supply Fuel for 30 Furnaces

Total Costs

Now the total charges can be assembled.

FUEL OIL PLANT—(Estimated cost $27,000)

Fixed charges		
Interest (5%)	$1,350	
Depreciation (11%)	[illegible]	
Taxes and insurance (1%)	270	$4,860
Operation		
Oil ([illegible])	[illegible]	
Labor ([illegible])	[illegible]	
Electrical current, steam, etc.	[illegible]	
Miscellaneous supplies	[illegible]	[illegible]
Total yearly charge		$36,500

POWDERED COAL PLANT—(Estimated cost [illegible])

Fixed charges		
Interest (5%)	[illegible]	
Depreciation (10%)	[illegible]	
Taxes and insurance (1%)	[illegible]	[illegible]
Operation		
Coal ([illegible])	[illegible]	
Oil ([illegible])	[illegible]	
Labor ([illegible])	[illegible]	
Electricity ([illegible])	[illegible]	[illegible]
Total yearly charge		[illegible]

GAS PLANT—(Estimated cost $[illegible])

Fixed charges		
Interest (5%)	$[illegible]	
Depreciation ([illegible])	[illegible]	
Taxes and insurance (1%)	960	$[illegible]
Operation		
Coal (375 × [illegible] × 12)	$11,250	
Labor (1 operator, 2 [illegible])	[illegible]	
Water	744	$14,[illegible]
Total yearly charge		$29,[illegible]

These several figures are plotted on the accompanying diagram for easy comparison

A Heavy Cut for a Street at Kansas City

One of the municipal improvements around the new union station at Kansas City, Mo., is the extension of Main St. through the high bluff fronting the station, and this work has involved a very heavy cut, known to local engineers as the "Culebra Cut."

Construction

The improvement represents two stages of construction. An ordinance for the work as originally planned was passed in 1908, and a contract was awarded in 1910 for grading the street to 60 ft. width for a distance of 2450 ft. The work was accepted Aug. 27, 1913, and included the removal of 259,963 cu.yd. of earth, rock and shale at 74½c. per yd., or $194,347. Of the total quantity, about 70,000 yd. was due to caving and slippage. The earth removed was hauled about 800 ft. from the north end of the cut and used for filling low ground. The rock was crushed and sold.

Before this contract was completed, the Kansas City Terminal Ry. made some changes in the grade of the union station and enlarged the station plaza, making it necessary to lower the grade of Main St. about 8 ft. at the south line of 24th St. The company leveled to the new grade its property between 23d and 24th Sts. As soon as the first contract for grading Main St. was completed, it was necessary to let another contract cutting 8 ft. deeper at the north line of 24th St. and running out to the original grade at Grand Ave. It was also deemed advisable to widen Main St. from 60 ft. to 90 ft. The estimated quantity to be removed was 115,000 cu.yd. at 90½c. per yd. This contract extended over a distance of 1570 ft. and the cut is 90 ft. wide at the bottom, the maximum depth of cut being 82 ft.

This second contract is about 60% completed. There will be probably about 35,000 yd. of slippage on the sides, increasing the total quantity to 150,000 cu.yd., at a total of $141,[illegible]. The material is being excavated by steam shovels. At the north end a narrow-gage railway

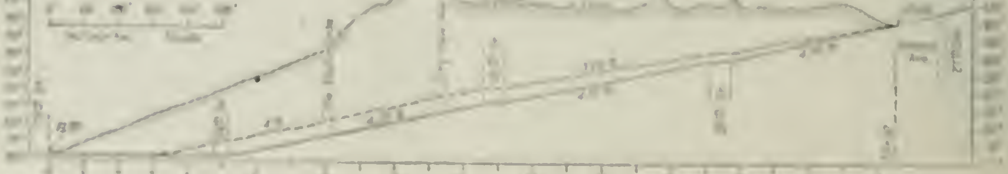


Fig. 1. Profile of Extension of Main St. through a Bluff or Ridge at Kansas City, Mo.

Fig. 2. Deep Cut for Main St., Kansas City, Looking South from the Esplanade

Fig. 3. Main St. Cut during Construction, Looking North at 26th St.

extending about 2000 ft. and crossing several city streets provides for making a fill in front of the city hospital grounds. At the south end, the material is being hauled by wagons to various places on neighboring property which is below grade. It is planned to install another narrow-gage railway south and west to 31st St., about 3000 ft., and to use the material for filling low property in that vicinity. It is expected that this grading will be completed by May, 1915.

The contract calls for cutting the sides vertical, but all slippage occurring before the work is finally completed must be removed, and the City Engineer has the power to order the contractor to remove any unsafe or overhanging ledges. The material is earth, solid rock and shale, and as about half the cut is shale and rock, the sides will stand on a slope of from ½ : 1 to 1 : 1. The contract is held by Spitzcaufsky Bros. All payments are by special tax bills.

The difficulties encountered included caving, and slides due to rain, the latter sometimes burying steam shovels and tracks. As no definite slopes are specified, the sides may be left as they stand at present, with the possibility of slides after heavy rains. Owners of property along the top of the cut must take care of their own property, having been paid damages. There was some trouble with the blasting, to avoid damage to buildings by the shocks as well as the throwing out of material. Difficulty was experienced in removing the excavated material promptly, as the narrow-gage track crosses several streets carrying heavy traffic, and its grades are steep for the dinkey locomotives, while the haul is rather long.

The city is planning to improve its property on the west side of Main St., between 24th and 25th St., as a park, terracing and grading down portions of it at an estimated total cost of about $350,000. The whole of this work will not be done at present, but it is expected that next year about $100,000 will be expended on this park. Some of the private property owners are already grading down their property and preparing to build. The city has started proceedings on the grading of the Esplanade from Grand Ave. to Main St., on which the maximum cut will be about 75 ft., at an estimated cost of about $60,000. It has not been decided what will be done with 25th St.

Assessments and Damages

For the first work on Main St., court proceedings resulted in an award of $49,117 as damages to abutting property on account of the cut. This amount was assessed against the frontage on Main St. between Ninth and 31st Sts., an arbitrary benefit district being fixed by the City Engineer and the City Council. This amount for damages went to the abutting property between the points to be graded, and the cost of grading was assessed against the property half way through the blocks on each side of the street between the points graded. The contractor received no pay until the work was entirely completed, and then was paid in special tax bills against the property.

The regrading and widening proceedings were sent to court and a verdict was returned Dec. 22, 1913, allowing the property owners between 24th St. and Grand Ave. an additional $32,350 for grading damages due to lowering of the old grade, and $11,265 for the 30 ft. of ground condemned (on the west side) in the widening proceedings. About 500 ft. of the ground taken in the widening was

from the Union Station Park, between 24th and 25th St., which is owned by the city, and for this the city received no pay.

These damages were assessed against a benefit district of the abutting property on Main St. between 12th and 35th St., 2¼ miles. Through a waiver of the property owners, the city was allowed to proceed immediately with the work, pending the collection of these benefits, and a contract was let and confirmed on Jan. 27, 1914. The total cost ($141,750), as in the first case, will be assessed half way through the blocks on each side of Main St. between 24th St. and Grand Ave., and special tax bills will be issued.

In the court proceedings outlined above, the property owners within the limits to be graded may submit evidence in court to a jury of six freeholders of the amount their property is damaged by cuts or fills. The jury views the ground, decides on the amount of damage each owner is entitled to, and spreads the total damages over the property in the benefit district. This is usually in the form of a graduated tax per front foot, decreasing as the distance from the work increases. A large part of the damages allowed are usually offset by benefits as the property abutting the portion to be graded is benefited as much or more than any other property in the benefit district when damages are not considered. The amounts given are the net amounts allowed as damages after benefits have been deducted.

For information as to the work described and the methods of assessment, etc., we are indebted to C. R. Mandigo, Assistant City Engineer of Kansas City, Mo.

Rail Failures and Train Accidents

The frequency of rail failures on American railways has been a source of trouble and anxiety for some years, but the fact that relatively few train accidents have been caused in this way has led to the impression that the conditions are not very serious in this respect. Inquiry shows, however, that the number of rail failures is very large and constitutes a serious problem, while the comparatively small number of accidents is due probably to careful watching and protection of the track. This matter has been discussed in our issues of Aug. 13 and Oct. 1, and we give below the results of inquiry as to the conditions on five leading railways. We have discussed the matter further in our editorial columns.

RAILWAY No. 1 (1800 miles)—During the calendar year 1912 this road had 1891 broken rails, of which 56 (or 3%) caused derailments. None of these derailments were serious.

RAILWAY No. 2 (3800 miles)—The statistics in Table I are for the calendar years 1912 and 1913. While none of the accidents resulted seriously, it must be borne in mind that any accident due to a broken rail is a serious matter.

TABLE I. RAIL FAILURES AND ACCIDENTS, RAILWAY No. 2

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Total
1912					
No. of rail failures	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
No. of broken rails	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
No. of derailments or accidents due to broken rails	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1913					
No. of rail failures	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
No. of broken rails	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
No. of derailments or accidents due to broken rails	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

RAILWAY No. 3 (6500 miles)—Regarding derailments due to broken rails, an improvement in the quality of the rail, from a safety standpoint, will reduce the number of rails which break in service and (other things being equal) the number of derailments occasioned thereby. A comparatively small number of derailments due to broken rails may indicate that good rails are being used, but does not prove this, for the reason that the good results obtained may be due (in large degree) to the use of automatic block signals and high-grade maintenance-of-way methods resulting in detection and removal from the track of many rails which might have caused derailments.

In rail statistics, this road rates as "failed" not only rails that break but all rails that have developed defects of any character which would make their retention in the track unsafe. As their removal is a precautionary measure, in all probability many of these rails could have been continued in service for a much longer period without breakages, while others might have lasted indefinitely. The result of this practice is that the ratio of the so called rail failures to breakages is high, the actual proportion being unknown.

The number of rail failures recorded for the fiscal year ending June 30, 1913, is 1131. There were 11 derailments or accidents due to broken rails during the same period, with 12 passengers and employees injured (none killed), and slight damage to property. None of the accidents were serious. The following statistics for the same period are of interest in showing the very high degree of safety resulting from good rails combined with the use of signal systems and efficient maintenance methods. The statement includes both passenger and freight service.

Gross ton-miles per person injured due to broken rail	[illegible]
Gross ton-miles per derailment due to broken rail	[illegible]
Passengers and employees injured per derailment or accident of broken rail	[illegible]

RAILWAY No. 4—The statement in Table II shows the rail failures and accidents caused by rail failures for the six years from Oct. 31, 1907, to Oct. 31, 1913. Failures of rail of 70 lb. per yd. or less and failures in other than main tracks are not reported. All accidents resulting from rail failures are reported, including those on light rail and other than main tracks. The cost for damage to freight, equipment and track, and for clearing wreck, exceeded $150 in the case of five freight derailments in 1912 and two passenger and five freight derailments in 1913.

TABLE II. RAIL FAILURES AND TRAIN ACCIDENTS, RY. No. 4

Year	Failures	Derailments Due to Rail: Passenger	Freight	Total
1908	[illegible]	[illegible]	[illegible]	[illegible]
1909	[illegible]	[illegible]	[illegible]	[illegible]
1910	1749	[illegible]	[illegible]	[illegible]
1911	1882	[illegible]	11	14
1912	[illegible]	1	[illegible]	17
1913	[illegible]	[illegible]	[illegible]	[illegible]

RAILWAY No. 5 (1700 miles)—From Sept. 30, 1913, to Sept. 30, 1914, this road had a total of [illegible] broken rails, none of which resulted in a derailment or train accident of any kind.

An abstract of all the figures is given in Table III.

TABLE III. RAIL FAILURES AND TRAIN ACCIDENTS ON FIVE RAILWAYS

Road	Year	No. of Failed Rails or Rail Failures	No. of Derailments Due to Broken Rails	Rail Failures per Accident
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	11	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* [illegible] † [illegible]

It will be noted that in this table a distinction is drawn between broken rails and rail failures, the latter including rails found to have defects of any character which make it necessary to remove the rails as unsafe. The figures relate to main-track only, and to rails of 70 lb. per yd. and upward. But in at least one case (No. 4) the accidents include those on lighter rail and tracks other than main track.

A notable development during the past few years has been the increasing use of openhearth rails. In regard to such rails, P. H. Dudley, Consulting Engineer for the New York Central Lines, says that the most important work now in hand is the production of basic openhearth rails in which the failures are reduced to a small fraction of those which occurred in the former bessemer rails. He states that the breakages which occur during cold weather are often due to the high tensile stresses from contraction before the rails give or slip in the splice bars, but such fractures rarely cause derailment, as the metal is not brittle and there is simply the fracture or open joint across the rail.

The basic openhearth rails on the above road include 519 miles of 80 lb., 530 miles of 100 lb. and 408 miles of 105 lb. Up to Sept. 1, 1914, the number of broken rails per 100 miles was 1.93 and 0.57 for the first two and none for the last. There was exceedingly cold weather last winter, and the results showed that the failures of the basic openhearth rails and the bessemer rails were as 1 to 22 under the same conditions of locality and traffic.

A New Cast-Steel Clamp for Guard-Rails

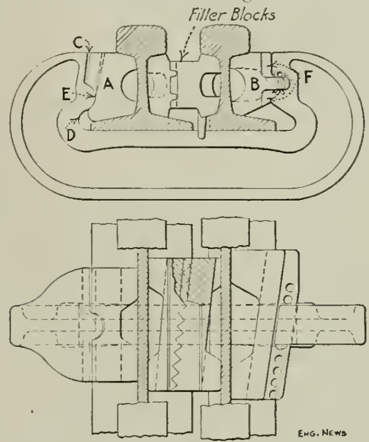
A recent design of guard-rail clamps, for maintaining frog guard-rails in proper relation to the adjacent running rails, is shown in the accompanying cut, and presents some special features. In general it consists of a heavy cast-steel yoke, with blocks and wedges between it and the rails and with filler blocks between the two rails. These latter blocks are wedge-shaped and with serrated contact faces, so as to be adjusted to give the desired width of throat or flangeway.

In fitting the clamp, the two filler blocks are first placed between the rails (being adjusted to the desired spacing), and the guard-rail is then spiked in place. The yoke is next placed and the outer block *A* inserted, and then the inner wedge *B* is inserted and driven home until the clamp is tight. This wedge is held from slacking back by means of a cotter pin and the block is secured in place by a rounded lug on the face of the yoke. The lug also holds the block firmly down upon the base of the rail. The filler blocks are prevented from slacking by means of a lug which engages the bottom of the yoke, as shown.

The yoke is of H-section, having heavy top and bottom flanges to reinforce the web. One of the principal features is the width of the end bearing outside the main rail, the purpose of this being to maintain the yoke at right angles to the rail.

The makers state that it has been found, in experimenting with such clamps, that even on well ballasted track the outer end of the clamp would move vertically, as wheels passed over the rail, causing the point of contact to shift. This would increase gradually, and with the point of contact at the top of the yoke *C*, there would be excessive stress at *D* tending to break or spread the yoke. To prevent this, the face now has the rounded projection *E* and a slight clearance at the top, so that the point of contact is permanently at this projection. The contact at the opposite end of the yoke is at *F*, with no contact against the rib through which the cotter pin is inserted.

The cast steel used is heat treated and has a tensile strength of about 72,000 lb. The weight of clamps complete for 80- to 100-lb. rails averages 50 to 55 lb. Two



A New Clamp for Frog Guard-Rails

clamps to each guard-rail are recommended for main-track service. These guard-rail clamps are in use on several railways. They are manufactured by the Reading Specialties Co., of Reading, Penn.

Resolutions of the International Irrigation Congress

Among the resolutions adopted by the International Irrigation Congress held at Calgary, Alberta, in October of this year, the following are reprinted as of interest to many of our readers:

IRRIGATION DISTRICTS—We recommend the passage by Congress of an act authorizing the Secretary of the Interior to enter into contracts with irrigation districts created under state law, by which the responsibility and control of each reclamation project arising from the Reclamation Act of June 17, 1902, may be turned over to an irrigation district organized under said law; and in the case of interstate projects, we recommend that suitable federal laws be enacted by which interstate irrigation districts may be formed; and in order that federal projects may be turned over to the land owners, as contemplated by the reclamation law, we recommend the careful revision and unification of irrigation district acts by the states of the arid regions, to the end that such projects may be turned over to the control of the settlers through such agency.

ENGINEERING EXAMINATIONS FOR FINANCIAL SAFEGUARDS—Full examination should be made by experienced engineers in the employ of the national, state and federal governments in advance of financing the construction of each large irrigation project, and that no such enterprise be entered upon by the governmental agencies unless it appears that such projects return at least 3% of the total investment for land and construction.

INTERSTATE WATERS—We hold that federal control as between those states which are not in full possession of their natural resources is essential to the equitable distribution and utilization of the waters of interstate streams.

RIVER REGULATION—We commend the efforts by the United States Congress to create a Board of River Regulation, and urge the enactment of suitable laws providing for

[illegible] river connections [illegible] at the head waters and [illegible].

WELFARE OF SETTLERS UNDER RECLAMATION PROJECTS.—We believe the United States Reclamation Service has been carrying out the purposes of the Reclamation Act in so far as the construction of engineering works is concerned. Experience has, however, demonstrated the expediency of extending to the Service additional authority to the end that it may promote, in other ways, the welfare of the settler upon the land.

STREAM-GAGING AND TOPOGRAPHIC SERVICE.—We urge upon the federal governments the necessity for more liberal appropriations for the work of topographic survey and stream-gaging work, and we urge stronger coöperation by the several states and provinces in making appropriations for this important work.

IRRIGATION SECURITIES.—We urge that the states of the arid regions assume their proper burden and legal responsibility for the purposes of the Carey Act, and state irrigation [illegible] and pass such laws as will assure the completion of all meritorious projects now undertaken.

Water Sedimentation, Coagulation and Mechanical Filtration at Waco, Texas

A water-purification plant of unusual completeness for one of its size was put in operation early in 1914 by the City of Waco, Tex. The plant consists of two 600,000-gal. open coagulating basins, giving 6 hr. of sedimentation for 6,000,000 gal. of daily filter capacity; four 1,500,000-gal. mechanical filter units; and a 1,000,000-gal. covered clear-water reservoir. The plant is constructed of reinforced concrete throughout, except that the building which covers a portion of it is of brick, with a tile roof. Among the special features are automatic steam control of the pumps which supply the purification works, electrically driven chemical solution agitators, Earl automatic chemical feed and automatic [illegible] rate controllers, and a steel wash-water tank, in which a uniform water level is maintained automatically. A general view of the pumping and purification plants is shown in the accompanying illustration.

The following description of the plant has been drawn (1) from notes sent to this journal by S. Werenskiold, Consulting Engineer, Dallas, Tex.; and (2) from a paper by F. B. Leopold, General Manager of the Pittsburgh Filter Manufacturing Co., Farmers Bank Bldg., Pittsburgh, Penn., prepared in the summer of 1913 for the annual convention of the Southwestern Water-Works Association.

For many years after about 1872, first one water company, then two companies, and then a consolidated water company supplied water to Waco. Finally, the works were bought by the city. Water was drawn from wells, which required supplementing by additional wells, air-lifts, etc., from time to time. In October, 1911, Mr. Werenskiold was called in by the Water Board to advise on obtaining an ample supply. In February, 1912, he recommended the Brazos River as a source, with mechanical filtration. In April, 1912, the city voted [illegible] for the new supply works, including the river connection, pump-well, pumping station and equipment, coagulating basins, filters and clear-water basin. In addition, $100,000 was voted for main extensions and a 125,000-gal. covered steel standpipe.

The intake and the short intake conduit are of reinforced concrete, as is the pump-well. The latter is elliptical in shape, 25x43 ft. in plan and 34 ft. deep.

Pumping Plant

The pumping plant is divided into two parts: (1) Two 6,000,000-gal. centrifugal pumps, for the low service, are driven by direct-connected vertical compound condensing engines, operating under a maximum head of 36 ft. and having a duty of over 50,000,000 ft.-lb. The steam pipe supplying these engines is provided with a diaphragm controlling valve automatically operated by the changing level of the sedimentation basins. The exhaust pipes from the low-service engines are connected with the extra large condensers of the high-service engines. (2) There are two 4,000,000- to 7,000,000-gal. cross-compound condensing pumping engines, for an average head of [illegible] ft. and having a duty of [illegible] ft.-lb. Both sets of pumps were furnished and erected by the Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

Purification Works

General plans and specifications for the purification works were prepared by Mr. Werenskiold, and bidders were invited to submit detailed plans and corresponding prices. The contract was awarded to the Pittsburgh Filter Manufacturing Co.

Sedimentation Basin, Chemical or Head House, Wash-Water Tank and Pumping Station, Waco, Tex.

Mixing Chamber—As originally designed, the coagulants were to be introduced at the entrance to a mixing chamber of 150,000-gal. capacity. This chamber was 30x54 ft. in plan and 15 ft. deep, and was so divided as to have a waterway 16 ft. wide. Numerous vertical baffles were placed in this waterway. This worked well when the turbidity of the water was low, but, Mr. Werenskiold states, with high turbidities, sediment was deposited in the mixing chamber. The representative of the filter company therefore "removed nearly all the baffles, changed the point of application of the iron and lime to near where the water entered the distributing pipes and placed a baffle in front of these pipes, where they enter the sedimentation basins." By this means the "mixing chamber was practically converted into a small sedimentation basin, allowing nearly an hour for plain sedimentation, and thereby relieving the raw water from the heaviest sediment before the application of the chemicals," thus avoiding "the error of burying expensive chemicals in heavy mud, where the mud can be gotten rid of without cost."

Settling Basins—The two settling basins are 50x115 ft. in plan and 16 ft. deep, and can be operated singly, in parallel or in series, thus giving considerable flexibility.

The following description of the chemical-feed tanks and their control and of the filters and their operation and control is taken from the paper by Mr. Leopold, already mentioned:

The plant is designed for the use of lime and iron and hypochlorite, but alum can be used if desired. It has, however, so far been used with lime and iron and the results have proven most excellent with a turbidity of as great as 22,000 parts per million.

CHEMICAL TANKS AND REGULATING APPARATUS—The solution tanks consist of six tanks, or a pair of tanks for each solution, with dissolving boxes for mixing located on the second floor. Each tank is equipped with an electrically driven solution agitator, and the building is equipped with a hydraulic elevator for raising the coagulant from the first floor up to the storage room.

In the storage room there is a track with a traveler extending around the room and over the top of the solution tanks, so that the chemicals can be raised up to the traveler and carried in the required quantities over to the dissolving tank with the least amount of labor.

On the first floor is located the chemical-regulating apparatus. This consists of the Earl automatic controlling devices. Their function is to apply chemical solution automatically in proportion to the supply of water delivered to the coagulating basin. The apparatus consists of what is known as the master controller and the individual chemical controllers—one apparatus for each of the chemicals provided for.

The master controller is regulated by the velocity of the flow of water through the supply pipe to the coagulating basin, which, through a pilot and piezometer tube, builds up a head in the master controller corresponding to the quantity of water passing through the inlet pipe; and this head, of course, automatically changes with the quantity passing to the coagulating basin and is transferred from the master controller to the individual chemical controllers and in turn regulates, proportionately, the head of the chemical solution over the orifice feed, and in this way gives an absolute proportional feed of the chemical solutions to the quantity of water filtered.

While this apparatus is somewhat elaborate and costly, the economy in operation fully justifies its use, although in smaller plants it is not generally customary to install it. The same type of apparatus is in use in New Orleans, Minneapolis, Grand Rapids, Montreal and other places, but only in one other plant of the size of the Waco plant or anywhere nearly approaching it—that is at Fargo, N. D.

Each of the solution tanks is equipped with a recording gage which gives a definite record of the solutions that are used each day, thus giving a check on the operation of the plant also.

The solution apparatus being located directly over the inlet chamber, the supply line to the inlet chamber is extremely short and the usual troubles from this source are practically eliminated.

On the first floor is also located the laboratory, which is complete in its equipment, and up to the standard found in most of the larger plants in the country.

The filter building proper consists of a one-story building extension from the head house and the filters are four in number, two located on each side of a central gallery. They are equipped with hydraulic valves, operating tables and recording loss-of-head gages which give a record of the operation of the filters.

FILTER BEDS—The filter beds themselves are rectangular concrete units and are equipped with both air and water for washing purposes. Each bed is equipped with three wash troughs of a diamond shape, open at the top. The peculiar shape of this design is to prevent the loss of sand during the washing operation that occurs where a straight-side trough is used. The water is delivered into the filters from a conduit that is carried through between the two rows of filters and passes into an inlet chamber at one end and from there is distributed through the overflow troughs to the sand bed. It passes down through the sand bed in the usual manner and is carried out through the strainer system and through the effluent pipes into the gallery. Here it passes through the Earl type of automatic rate controller into the clear well.

RATE CONTROLLER—This rate controller provides against the filter operating to exceed its certain maximum rate, but within the maximum rate it automatically controls the filters to maintain a uniform level of water in the clear well; in other words, as the consumption decreases and the water level in the clear well rises, the filters are gradually closed off and the rate of flow decreased until when they arrive at a point where the maximum level of the water in the clear well is reached, they are completely closed off without attention from the operator. If the service pump then operates at a rate requiring the full capacity of the filters to supply them, the water gradually receding in the clear well, the filters are automatically and gradually opened to supply the increasing need until the limit of maximum flow is reached, which they are not allowed to exceed but which will be maintained until the consumption has so decreased again that the water level in the clear well gradually rises and again puts them under control. This is accomplished by a master controller which controls all of the individual rate controllers. This master controller is connected to the clear well and the difference in the level in the clear well is used to control the rate of filtration in the filter. The master controller operated by this head then in turn connects to each one of the individual rate controllers. There is also the advantage, if that is desired, that each individual filter-rate controller can be disconnected from the master controller and operated independently as a fixed-rate controller, or as an adjustable-rate controller, in this way giving the greatest flexibility of control of any apparatus that has so far been devised for this purpose.

It will be seen, therefore, that this plant is practically as nearly automatic in its control from the time the water enters the settling basin until it is taken out of the clear-water basin as it seems possible to devise. It is the only plant that the writer knows of so thoroughly equipped with automatic devices. Many of the larger plants have some of these devices but the writer knows of no plant that is completely equipped with them.

WASH-WATER TANK—For washing, a steel tank is used instead of the usual wash pump, for several reasons: One is, that under equal conditions the wash tank is preferable, as it gives a uniform pressure that is almost impossible to secure from a pump; another reason is that conditions here were hardly equal. The water could be supplied to the wash tank with the high-duty pump, probably a little more cheaply than it could be pumped with the ordinary centrifugal pump direct; also the clear-water well being located some little distance from the filter plant, pump connections would have been rather inconvenient and complicated to make. The wash tank is supplied automatically from the main. When filled, the supply pipe is closed. As the washing operation is started and the water level in the tank begins to recede, the supply valve is automatically opened and remains open until the water level in the tank again reaches its maximum level, when it is automatically cut off.

According to information from Mr. Werenskiold, the wash-water tank is a 50,000-gal. covered elevated steel structure, with its top 41 ft. above the filter-operating floor, and "is provided with a Golden-Anderson controlling-altitude valve to prevent overflowing."

W. M. Sleeper is Chairman and E. L. Fulkerson is Secretary of the Waco Water Board. S. J. Quay is Superintendent of Water-Works.

Construction of the Metcalf Ave. Sewer, Borough of the Bronx, New York City

By G. L. Christian*

The Metcalf Ave. sewer has a stormwater overflow into the Bronx River, while the dry-weather flow is carried to the White Plains Road sewer. The overflow starts immediately south of Randall Ave. This part is 9 ft. wide by 6 ft. high and 1300 ft. long, and has a capacity of about 355 cu.ft. per sec.; the capacity of the main sewer beyond this point is about 320 cu.ft. per sec.

The sewer is designed to carry the house sewage and the ... flow and a small percentage of the storm water, the major portion of the storm water being carried into the Bronx River by means of overflows, thus making it possible to construct a much smaller sewer than would otherwise be possible. The drainage area is 1290 acres.

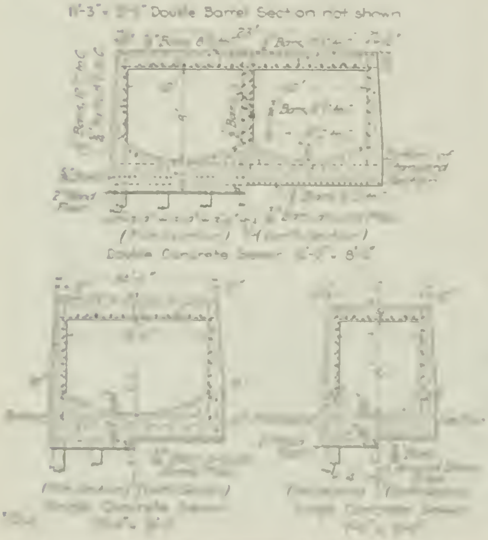


Fig. 1. Typical Cross-Sections of the Metcalf Ave. Sewer, Borough of the Bronx, New York City

The sewer is about 1 1/4 miles long, and is constructed of reinforced concrete throughout. The invert is uniformly 18 in. deep, the sides are perpendicular, and the roof flat. The interior height is 8 ft. throughout, the capacity of the sewer being regulated by increasing or decreasing the width. The center walls of the double sewer are all 12 in. thick, and the side walls of both double and single sewers are 18 in. thick at the springing line of the invert and 12 in. thick at the top of the wall.

Spurs are placed at a uniform height of 18 in. above the springing line of the invert and are spaced 10 ft. c. to c., except at street intersections, where there are none. The spurs enter the sewer at an angle of 60° and have their ends closed by a ... vitrified ... to prevent dirt from entering the sewer, while at the same time permitting ingress of ground water. Wherever they are more than 13 ft. below the grade of the street they are brought up to that height by means of risers incased in concrete.

The manholes are built on the side in single, and in the center in double sewers; in the latter the manholes have an opening, 2 ft. 8 in. in length, left in the center wall directly beneath the manhole opening.

Beginning at the northerly end of the sewer, with a width of 7 ft. and a height of 8 ft., the sewer widens at each street crossing until it attains a maximum width of 12 ft. 6 in. It then changes to two conduits 8 ft. 3 in.x8 ft. in cross-section. From this point it increases in width by steps to allow for the increased flow caused by the connecting lateral sewers until the overflow at Randall Ave. is reached, at which point the sewer consists of two conduits 11 ft. 3 in.x8 ft. in cross-section. South of Randall Ave., the sewer is reduced to a single 11 ft. 3 in.x8 ft. conduit. The excess flow is cared for by the overflow as noted. Fig. 1 shows some typical cross-sections.

Excavation—Over one-half the length of the sewer is built on a pile foundation, the trenches for which it has generally been found necessary to line with sheet piling, previous to excavating. The excavation was removed by clamshell buckets. In the dry earth and rock section the major part of the material was excavated by steam shovel.

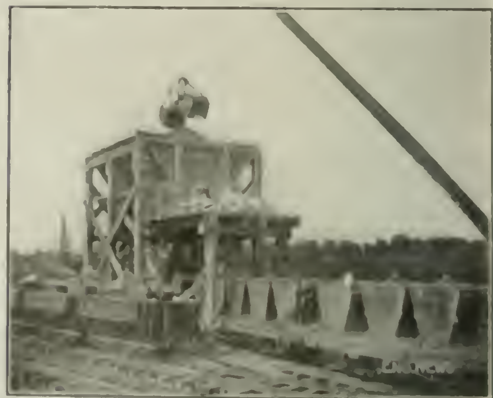


Fig. 2. Loading Buckets with Gravel, Sand and Cement from Hopper at Dock

Considerable water has been encountered and it was found necessary to install several steam pumps, with suction and ... discharge, as well as steam siphons and pulsometers. An electrically operated centrifugal pump has also been used.

Pile Foundation—In the pile-founded section, some of the piles are as long as 60 ft. below cutoff. The bents are 4 ft. c. to c., the piles in each bent being spaced from 2 ft. to 3 ft. c. to c. Halfway between the bents two batter piles are driven, one on each side of the sewer. The batter piles are securely fastened by a 3/4-in. steel bar, which encircles them and is embedded in the concrete surrounding them.

Two steam hammer pile drivers were used in driving the sheet and foundation piles, the guides for which were hinged near the top to allow them to be swung out of the vertical when driving the batter piles. The

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piledriver was carried on a platform spanning the trench, which traveled on a track laid with a rail on each side of the trench.

Contractor's Plant

Mixing and Placing Concrete—The contractor's plant for carrying on the work was a large one, and events have proved it to be ably designed and well

Fig. 3. Concrete Mixer and Concrete Distributing Chutes

fitted for carrying on rapidly and economically a vast amount of work with a minimum of friction. The monthly estimates of work done amounted to as high as $70,000.

At the inception of the work a dock was built at the mouth of the Bronx River adjoining the sewer outlet, upon which was erected and installed sand and gravel bins together with the necessary hoisting plant for unloading piles, steel bars, lumber, etc., and all plant and materials received for use on the different parts of the work.

A 3-ft. gage railway with 57-lb. rails, together with the necessary switches, was laid alongside the work for the whole length of the contract section. Three 18-ton locomotives are constantly engaged in transporting and distributing material along the different parts of the work. The contractor has his own cement boats, scows, etc., the use of which is made to dovetail into the scheme adopted for the mixing and placing of concrete, the net result being a large saving in money when compared with usual methods.

The cement, sand and gravel are handled but once, the *modus operandi* of which is as follows: The sand and gravel bins, together with a cement-storage platform, are located directly above the railway track and are continually fed from the boats by means of a stiff-leg derrick located on the dock. A locomotive drawing two flat-cars (Fig. 2), on each of which are seven bottom-dumping buckets, backs under the bins until the last bucket is under the gravel bin. A measure of gravel is admitted, after which the train is backed until the bucket containing the gravel is under the sand bin and the adjoining bucket is under the gravel bin, when the first bucket receives the required amount of sand while the second bucket is supplied with gravel. The bucket containing the gravel and sand is then backed under the cement platform and four bags of portland cement are emptied into it, each succeeding bucket being filled in the same manner until the fourteen are filled and the train pulls out to be followed by a similar train.

After loading, the train is hauled to whichever one of the concrete mixers happens to be at work. There are two concrete mixers, each of the Hains gravity type and mounted on a timber framework traveling on tracks alongside the trench (Fig. 3). The mixer framework has attached to it a skeleton steel tower 40 ft. high, within which is an elevator consisting of a one-batch bucket operated by a steam hoist located on the first floor of the supporting tower. Beyond this and traveling on the same track is a platform carrying a steam boiler, stiff-leg derrick and a hoisting engine.

The train carrying the fourteen buckets of gravel, sand and cement is run alongside and the buckets emptied one at a time into the upper pan of the mixer. The mixed concrete is emptied from the bottom pan into the bucket at the bottom of the steel elevator. From there the wet concrete is immediately hoisted to the top and automatically tipped and dumped into a hopper, running from which is a chute leading to the forms.

Each batch contains 0.78 cu.yd. of concrete and has at times, for a period covering several hours and with a haul of one-half mile, been deposited at the rate of a batch in 78 sec. Two of these mixers are installed on the work; only one is in use at a time. While the concrete is being deposited by one mixer, the forms are being prepared for concreting at the other, to which the concreting gang is transferred by means of the construction train, at the proper time. The mixers are moved when necessary by one of the locomotives, this operation requiring less than 10 min.

Fig. 4. Forms in Place for Bottom of Invert on a Pile Foundation

The sand and gravel are not moved by hand from the time they leave Cow Bay, Long Island, until they enter the forms as concrete, which requires spreading and spading. The total labor cost of unloading the sand, gravel and cement, transporting them about one mile, and

FIG. 5. REINFORCEMENT IN PLACE FOR LARGE DOUBLE-BARREL SEWER

mixing and depositing the concrete is about 75c. per cu. yd. Wood forms are used throughout. They are made in panels 12 ft. in length and have interior bracing as shown in Fig. 4.

CONCRETING THE PILE SECTION—The tops of the piles are cut to grade and the mud excavated to a sufficient depth to allow 2x4-in. waling pieces to be nailed on the sides of the piles, at right angles to the trench, and with their upper surfaces 12 in. below the pile tops, and a 2-in. flooring is laid thereon; the next step is to tie the batter piles together by fastening a ¾-in. corrugated steel bar around them (see Fig. 3), after which everything

FIG. 6. SEWER TRENCH UNDER CONSTRUCTION

FIG. 7. COMPLETED SECTION OF LARGE SEWER

is in readiness for the placing of the Class B (foundation) concrete.

The concrete is deposited to a depth of 18 in., completely encasing the pile heads and reaching to a height of 6 in. above the tops of the piles. Wooden invert profiles are next set at intervals of 15 ft., after which bars for the side walls and invert are placed.

The concrete is next deposited in alternate sections to within 1 in. of the finished invert surface, after which it is immediately covered with 1 in. of mortar and carefully screeded. After 48 hours the profiles are removed and the remaining sections filled with concrete. V-shaped keys are left at the ends of all unfinished sections and also in the top of the first section of side wall which forms part of the invert construction. These keys are for the purpose of forming a bond between the old and new work.

The province of the 6-in. wall is to have something against which the side forms may fit snugly, thus producing a good alignment and avoiding leakage of cement below the side forms while placing the concrete in the side walls. The forms for the side walls and roof are next set up, the steel bars for the roof put in place and properly fastened and the side walls and roof concreted in one operation.

In addition to the plant already referred to there are 8 dump cars, 28 four-cu.yd., two-way dump cars, 35 bottom-dumping concrete buckets, and two guy derricks, one being 75 ft. high.

The total cost of the work is about $569,000, and it is being done under the authority and direction of the Hon. Douglas Mathewson, President of the Borough of the Bronx; R. H. Gillespie is Chief Engineer of Sewers and Highways; Josiah H. Fitch, Engineer of Sewers, and the writer is Assistant Engineer, in charge of this piece of work. The contracting firm is Rodgers & Hagerty, Inc., for whom P. W. Rodgers is Superintendent.

The Water Filtration Hold-Up at Ottawa, Ont.

The long-standing water-supply muddle at Ottawa, Ont., bids fair to continue indefinitely unless the law courts again come to the aid of the city. This the courts have been invoked to do in a mandamus suit brought to compel the Ontario Board of Health to approve the latest plans for mechanical filtration of Ottawa River water, as prepared by Hazen & Whipple, of New York City.

Following projects for (1) a gravity supply from the McGregor Lakes in Quebec, (2) slow sand, and (3) mechanical filtration of the Ottawa River supply (all three after plans by Hazen & Whipple, New York City), there comes the Binnie and Houston (London, England) project for a gravity supply from Thirty-one Mile Lake, with its various dams and long steel pipe lines.* The latter was killed first by the courts and then by popular vote, the voters declaring for the Ottawa River supply, filtered.

Under a peculiar act of the Ontario legislature, dated Feb. 21, 1914, Ottawa was directed to secure plans for mechanical filters and to submit the plans to the Provincial Board of Health. If the board approved the plans, the city was authorized to borrow and expend $2,000,000 for their execution, and if the city council failed to pass the necessary by-laws to that end, then the board was authorized to build the works. The act also provided that in case of nonapproval of the plans for mechanical filtration by the board, then the city should at once proceed to carry out the Binnie and Houston plans for the Thirty-one Mile Lake project, with authority to borrow $8,000,000 for the purpose. A further proviso authorized the board to execute this project in case the city authorities failed to.

On Sept. 18, 1914, the Provincial Board of Health of Ontario unanimously disapproved the recently prepared Hazen & Whipple plans for mechanical filters, thus:

> The Ottawa River is beyond any question a polluted source of supply at all points in the vicinity of the City of Ottawa. The character of this pollution was pointed out in the report of Nov. 25, 1911, made by Allen Hazen and others, as well as in other reports of later date made by the said gentleman and others, and all experts agree that the danger of pollution is continually increasing. The fact that it is an interprovincial stream renders the control of its pollution all the more difficult.
>
> The board understands it to be a fact that the people of Ottawa have been led to believe that treatment of the Ottawa River water by mechanical filtration will relieve them of the further use of hypochlorite of lime. In reference to this question, Mr. Hazen, in his statement before the board, said that chlorination would be constantly required and that the use of chlorine as well as the administration of chemicals and control of the plant must at all times be under the most careful and unremitting expert supervision.
>
> While the board is sensible of the value of the chlorination of polluted water as an emergency measure, despite the objectionable taste usually associated with its administration, it feels that it would not be doing its duty to the citizens of Ottawa or to the general public of Canada, who may have occasion to visit the Capital City, by countenancing the use of a water which, after mechanical filtration, constantly requires chlorination, when a pure and adequate supply requiring no treatment whatever may be readily procured.

This action was all the more remarkable because a few years ago the board ordered the city to install a mechanical-filtration plant (plans were made by Hazen & Whipple, but the project was defeated at a popular election in January, 1914); and also because since that date the board has approved plans for mechanical filters ("drifting sand" filters; ENGINEERING NEWS, June 25, 1914) for Toronto.

Under date of Sept. 21, 1914, Allen Hazen wired to Taylor McVeity, Mayor of Ottawa, as follows:

> Rejection of plans by Provincial Board of Health seems to turn on my statements regarding hypochlorite. These statements are used in a way which I consider unwarranted. Under the proposed plan the present objectionable use of hypochlorite would cease. I stated to the Provincial Board that good water would be obtained without hypochlorite but that the use of a small amount, perhaps one tenth that now used, or its equivalent in liquid chlorine or other agent, might be desirable. Such quantity is used in most public water-supplies at the present time from even the best sources, and is unobjectionable. Plans do not differ in this respect from those previously approved by the board and present conditions do not warrant a reversal of former action.

The Thirty-one Mile Lake, or Binnie-Houston project, was approved some time ago by the Provincial Board of Health. In the board's memorandum of Sept. 18, 1914, disapproving the mechanical-filtration project, the Binnie-Houston project was spoken of as "one which provides for a supply of unquestionably pure water from a source and in a manner preëminently satisfactory to the board."

Interesting opposition arguments on the Thirty-one Mile Lake project were presented in a letter "from John Murphy, C.E.," of Toronto, dated Sept. 21, 1914, and sent by Mayor McVeity to the city council of Ottawa:

> Was the Ontario Board of Health's decision regarding Ottawa's Water Supply made with the knowledge of the following facts?
>
> The level of Thirty-One-Mile Lake must be raised 24 ft. before it reaches the top of the divide which now prevents it from flowing toward Ottawa.
>
> It will rise to this level, according to Binnie, in 5 or 6 years if 37 in. of rain falls annually. But Ottawa's average rainfall for 40 years is less than 32 in.
>
> Not a single drop of the water which is now in Thirty-One-Mile Lake or of the water that would be in it and the country flooded by it when the level reached the 24-ft. mark above referred to can ever flow to Ottawa. It is only the overflow above this 24-ft. level which can cross the divide and flow toward Ottawa; and yet those who, like the Ontario Board of Health, are bound to force the Thirty-One-Mile Lake scheme on us want the public to believe that all that need be done to get water into Ottawa from Thirty-One-Mile Lake is to tap it with a pipe line.

Even if the court sustains the Provincial Board of Health in its attempt to force Ottawa to go to Thirty-one Mile Lake for a gravity supply, it seems unlikely that the city will be able to finance an $8,000,000 water-supply project for some time to come. A $2,000,000 bond issue for mechanical filters might be taken up locally.

*See "Engineering News," Apr. 9, 1914, pp. 808-9, for review of all the projects, and Nov. 20, 1913, for an account of the Binnie-Houston project.

Field and Office

Concrete-Road Building with Small Concrete Mixers

A rather remarkable record was made during the past summer in concrete-road building in Centralia, Wash., by the use of two very small, cheap, concrete mixers and a force of 16 men.

THE MIXERS—The mixer is known as the "Archer" mixer* and the two units cost a total of only $530. The mixer is of the batch type and consists of a cylindrical drum, on top of which is a small gasoline engine geared direct to the teeth on the outside of the drum. The whole is mounted on a light wheelbarrow-shaped frame, which can be moved by a couple of men. Each mixer has a capacity of 4½ cu.ft. of wet concrete per batch.

METHODS—The road was a two-course concrete pavement 18 ft. wide. The bottom course, 3½ in. thick, was a 1:3:6 gravel concrete and the wearing course, 3½ in. thick, was a 1:2:4 pea gravel concrete.

CONCRETE-ROAD BUILDING AT CENTRALIA, WASH., WITH SMALL CONCRETE MIXERS. AVERAGE PROGRESS 571 SQ.YD. PER DAY

Sixteen men were employed—5 men laying concrete (2 spreaders, 2 tampers, 1 finisher), 1 man tending the machines with cement, 1 man tending the machines with water, 3 men loading and wheeling sand, 4 men loading and wheeling gravel, and 1 man delivering cement to both machines.

Temporary spouts, 7 ft. long and swung from a chain extending from the frame of the machine to the discharge end of the spout, were added to the regular equipment of the mixers. This gave the machines sufficient reach to cover the width of the road, and enough fall from the base to deposit the top course, without any handling of the wet concrete except in spreading.

COST DATA—Fourteen men received $2.50 per day of 8 hr., two men received $3 per day. One mile of concrete road was constructed in 18½ working days. The labor cost was $758.50, or 37c. per cu.yd. of concrete. This does not include the salary of a general foreman, who, in this instance, was the contractor. For the entire 18½ days the average progress was 571 sq.yd. per 8-hr. day. The contractor was J. W. Phifer, of Centralia, Wash.

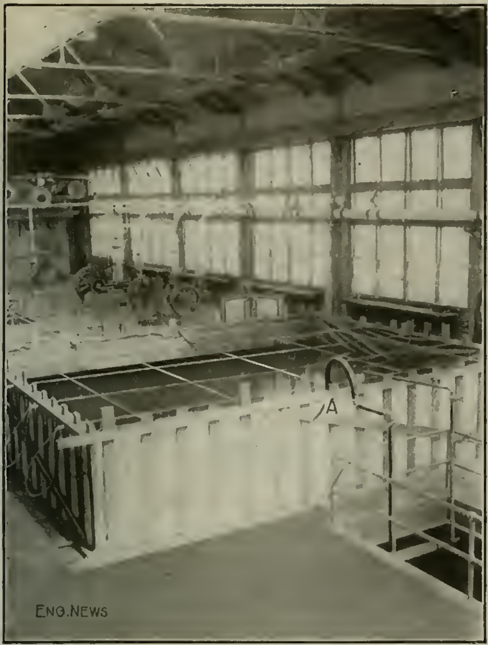
*Made by the Archer Iron Works, Chicago, Ill.

Using Water as Load in a Floor Test

By F. R. McMillan*

The readers of ENGINEERING NEWS may be interested in the accompanying photographs showing a method of applying a test load to a floor slab of a building. The framework shown consists of 4x4 horizontal timbers with 2x6 verticals bolted every 18 in. Each of the four sides is bolted up into a single section, with sway-bracing to prevent sidewise collapse. The opposite sides are tied together top and bottom by light hoisting cables. These pass through the 4x4 horizontal timbers and are secured at the ends by ordinary guy-wire clamps. The lining consists of two sheets, the outer one of plain 12-oz. canvas and the inner one a special rubberized canvas of about the same weight. These sheets are made up square, with eyelets spaced 18 in. on all edges, through which hooks or nails are driven into the verticals of the frame. The corners are made by simply folding one side back on the other.

*Department of Experimental Engineering, University of Minnesota, Minneapolis, Minn.



Canvas Water-Tank for Load Test of Floor

The view shows the test of a 20x24-ft. panel of the Experimental Engineering Building, College of Engineering, University of Minnesota, where the water was carried to a depth of 4 ft., making a live-load of 250 lb. per sq.ft. This maximum load was kept in place for only a few hours. A depth of 3 ft. was in place for two days, after which it was decreased to 2 ft. and left for 72 days longer. No leaks developed in this length of time, but on removing the load it was found that considerable water had collected between the two sheets and between the outside canvas and the floor.

At the end of the test, the canvas was still in serviceable condition, but would hardly permit of another load as great as 4 ft. For loads up to 175 lb. per square foot and where it is not desired to keep the load long in place, the canvas sheet could be used repeatedly.

At the point marked *A* will be observed a gooseneck of 3-in. pipe, which was used as a siphon to remove the water. The siphon would remove all the water but about 2 in. Near-by will be seen a 1½-in. pipe and valve connecting with the city main, through which the water was supplied.

The water loading proved very convenient in this instance, as it was desired to remove and reapply the load a number of times. While the method presents some disadvantages, such as the impossibility of obtaining extensometer measurements or examining the slab at points on the upper surface within the loaded area, it can be used with great economy under many conditions. The cost of erecting and removing the framework is not great, the big items of expense being the cost of the rubberized canvas (about $1 per sq.yd.) and the depreciation. Where water connections and a satisfactory means of draining the water can be arranged, the test with water costs less than other loading materials. With a meter rate of 60c. per M cu.ft., the cost of the water wasted is only 2c. per ton.

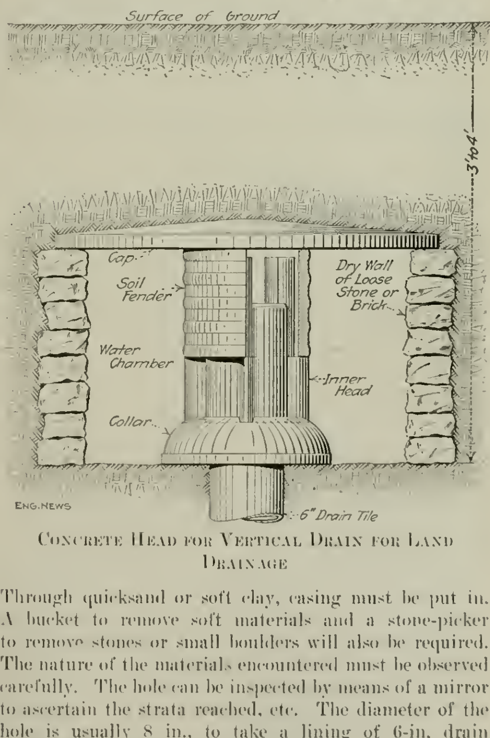
This method was suggested by F. C. Shenehon, Dean of the College of Engineering, University of Minnesota, and was first used in March, 1913.

Draining Land by Wells; Concrete Drain Head

Draining agricultural and swamp lands by wells or vertical drains—instead of by ditches and horizontal lines of tile—has been done successfully in a number of cases throughout the Central states. The wells are sunk to reach underflow strata that will absorb or carry off water readily. Success depends largely upon proper knowledge of the geological conditions, and results are problematical when the drain-wells are sunk at random.

The depth of wells is said to range from 20 to 45 ft. It is claimed that one well will drain from ½ to ¾ acre.

The wells are drilled with augers, pipe extensions being added to the shaft of the auger as the depth increases.



Concrete Head for Vertical Drain for Land Drainage

Through quicksand or soft clay, casing must be put in. A bucket to remove soft materials and a stone-picker to remove stones or small boulders will also be required. The nature of the materials encountered must be observed carefully. The hole can be inspected by means of a mirror to ascertain the strata reached, etc. The diameter of the hole is usually 8 in., to take a lining of 6-in. drain tile.

The drainage is taken from the soil, surface water being excluded. For this purpose special drain heads are made, which prevent the water from carrying soil into the pipe. A patented concrete drain head, made by the American Drainage Co., Dubuque, Iowa, is sketched herewith. The top of the drain pipe is 3 or 4 ft. below the surface of the ground, and above it the ground is excavated to a diameter of about 3½ ft., the lowest part of this hole

[illegible] lined with stones or old brick to form a water chamber. Upon the [illegible] drain pipe is placed a collar, and this supports a grooved inner head surrounded by a [illegible] or [illegible] header. The chamber is roofed with a cap slab. After these parts have been assembled, the ground is filled in above the cap. When the ground becomes wet, the water seeps into the chamber and siphons up under the header, flowing over the top of the grooved inner head into the vertical drain.

Handling Construction Material by Aerial Tramways

The use of aerial tramways for handling construction material is an interesting feature in the construction of the buildings for the new state penitentiary at Bellefonte, Penn., near the Rockview station of the Bellefonte & Snowshoe Branch of the Pennsylvania R.R. The first building, now being erected, is of reinforced-concrete, 25?x?0 ft., with three stories for the central portion and one story for the wings. This is located at about the highest point of the site. It is probable that the entire work will extend over several years.

The stone for the concrete is obtained from a limestone quarry [illegible] mile north of the site, the stone being crushed to [illegible]-in. size at the quarry. The sand or finer aggregate is obtained by crushing and pulverizing field stone, which is very plentiful in the valley along the railway. The pulverizer is located about 1000 ft. south of the building site. In view of these conditions and of the long period of time which the work will cover, it was decided to use aerial tramways for handling the materials. A plan of the plant is given in Fig. 1. At the building site a storage bin was erected [illegible] ft., and 10 ft. deep, so divided as to give a capacity for 130 cu.yd. of stone and [illegible] cu.yd. of sand. Both tramways enter at the top of the structure and dump the materials automatically into the bin. The materials are drawn off through chutes into small cars, which are pushed by hand to the mixer plant. The concrete is handled by an elevator tower and inclined chutes.

The tramways are of two different types. The one for limestone is of the endless type, having a number of traveling buckets which are suspended from trucks running on fixed track ropes and permanently attached to a continuously running traction rope. The carrying capacity is 10 tons per hour with ten buckets of 6-cu.ft. capacity (or 600 lb. of stone), but this will be increased later by attaching additional buckets. There are eight spans, 250 to 460 ft. long.

Of the two parallel track ropes, the one for the loaded buckets is $1\frac{1}{8}$ in. diameter, while that for the empty buckets is $\frac{7}{8}$ in. The endless traction rope is $\frac{9}{16}$ in. diameter, and its driving pulley at the lower terminal is driven by a 10-hp. engine. A friction clutch provides for stopping the rope without stopping the engine. This rope has a speed of 300 ft. per min. The stone from the crusher is carried by a belt conveyor to a bin of 90-cu.yd. capacity. By means of an automatic loader, shown in Fig. 2, the buckets are filled while in motion and are not detached from the hauling rope.

As the amount of sand to be conveyed is only about half the amount of stone, while the length of haul is considerably less, a two-bucket or alternating tramway was adopted for carrying this material. This tramway has considerable rise and is so arranged that the buckets will clear the wall of the penitentiary if that should be built while the tramway is in service. It has two spans of 350 and 630 ft., with $1\frac{1}{8}$- and 1-in. track ropes and a $\frac{5}{8}$-in. traction rope with two buckets of [illegible]-cu.ft. capacity. This rope is driven by a 10-hp. engine and runs at a speed of about 450 ft. per min.

The use of a larger rope on one side is due to the fact that the tramway carries lumber and reinforcing steel,

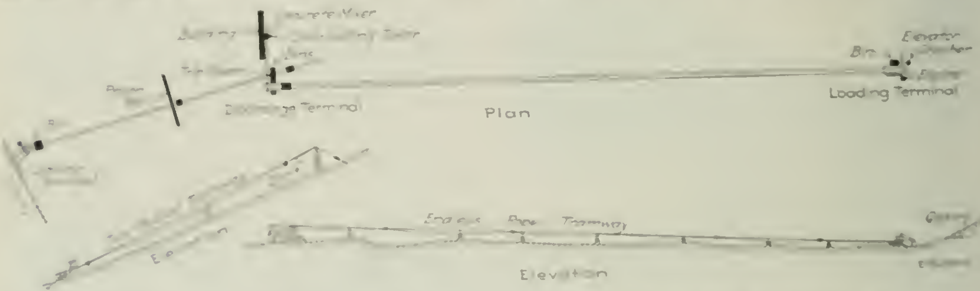


FIG. 1. PLAN AND ELEVATIONS OF AERIAL TRAMWAYS HANDLING MATERIAL FOR A CONCRETING PLANT FOR THE NEW STATE PENITENTIARY AT BELLEFONTE, PENN.

FIG. 2. [illegible] TERMINALS OF THE AERIAL TRAMWAYS

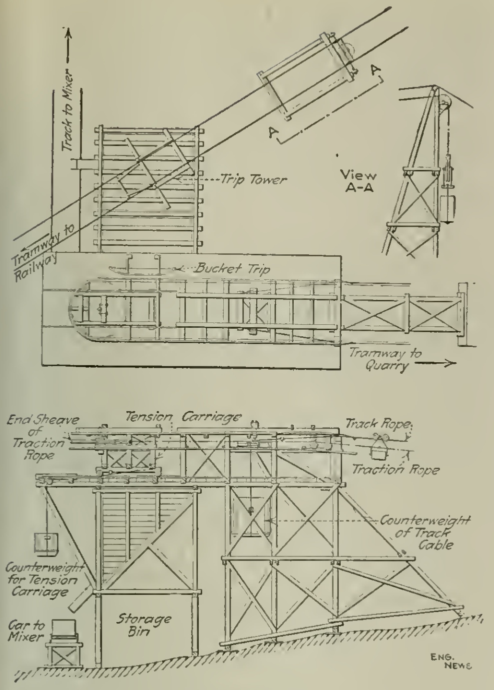


Fig. 3. Upper or Discharging Terminals of the Aerial Tramways

and that these materials are handled on this side only, to avoid complications at the terminals. These materials are loaded and unloaded by hand. The sand or pulverized stone is fed by an elevating bucket conveyor to a small bin, from which it is fed to the buckets by special chutes (Fig. 2).

Both tramways discharge automatically into the storage bin near the buildings, and their upper terminals are shown in Fig. 3. The two tramways are used in series for carrying coal from the railway to the quarry. The elevations above sea level are about as follows: Railway siding, 1014 ft.; rail of lower tramway terminal, 1018 ft.; track ropes of both tramways at bin at upper terminal, 1140 ft. (40 ft. above the ground); rail of tramway terminal at quarry, 1029 ft. The ropes of the limestone tramway are at an average height of 20 ft. from the ground.

The tramways, with their bins and loading devices, were built by the A. Leschen & Sons Rope Co., of St. Louis, Mo.

Notes on Errors in Survey Work

By A. W. Bedell*

Cumulative errors should always be recognized as such and carefully avoided. Personal errors are often of this kind. To illustrate, the vibration of a plumb-bob string will be compensative, but if a chainman habitually stands so that his eye will project the point of the bob to the ground obliquely, the error from this will be cumulative.

If a chain is out of alignment by an amount d in a length l, the error in distance from this will be

$$e = \frac{d^2}{2l}, \text{ nearly}$$

This error is of little importance on long tapes, but it is cumulative.

It is also worth while to notice that a transit should be centered more carefully in one direction than in another (see Engineering News, Jan. 22, 1914, p. 195).

Very often it is required to know what error of closure is to be expected, consistent with the accuracy of the work done. The usual way of designating errors of closure, as 1:3000, etc., is misleading, for the degree of error does not bear a constant relation to the distance. The same accuracy of work which would produce an error of 1 ft. in 3000 ft. would result in an error of $\sqrt{2}$ in measuring 6000 ft., which is 1.4 ft. in 3000 ft.

Since most errors vary with the square root of the distance and since areas vary with the square of the distance, the closing error may be expected to increase with the fourth root of the area. But if the work includes many cumulative errors, it will vary more nearly with the square root of the area.

If the angular error in a course AB is represented by a, which results in a distance y at the end of the course, and if x is the error in distance, the resultant of these is the error of closure e. If the course AB were long enough to continue around the traverse and close upon itself, the total value of e would be the error of closure of the survey.

If the probable angular error (in feet) per 100 ft. is taken as y_1, the probable lineal error per 100 ft. as x_1, n as the average length of a course (in 100-ft. chains), m as the number of courses, and l as the total traverse in chains, equal to mn, then for the whole survey

$$y = ny_1\sqrt{m}$$
$$x = x_1\sqrt{mn}$$

and the error of closure

$$e = \sqrt{x^2 + y^2} = \sqrt{lny_1^2 + lx_1^2}$$

On a transit reading to minutes y_1 will be about 0.01 or 0.02, and according to the skill of the chainman, x_1 will be between 0.01 and 0.10. It will be noticed from the first equation that by increasing the number of courses, the error y will decrease somewhat, for it accumulates on a single course, and it is partially compensated as the number of courses is increased—within limits. This formula is applicable only for compensative errors.

When a measurement is made to the nearest unit of any kind, and made accurately, the probable error (from this source) of a single reading is not one division, but a quarter of one division. The greatest error possible would be half a division, and the mean of all errors from zero to a half would be a quarter division. Using large units, therefore, is not inconsistent with accuracy, providing instrumental errors are small.

It may easily be demonstrated that leveling can be done by reading the rod only to tenths, and with 25 sights to the mile, with an error of $\frac{1}{4}$ of $0.1 \times \sqrt{25} = 1\frac{1}{4}$ tenths. It may be added that for many purposes it is well to use larger divisions, as tenths of feet on rods and

*Chappaqua, N. Y.

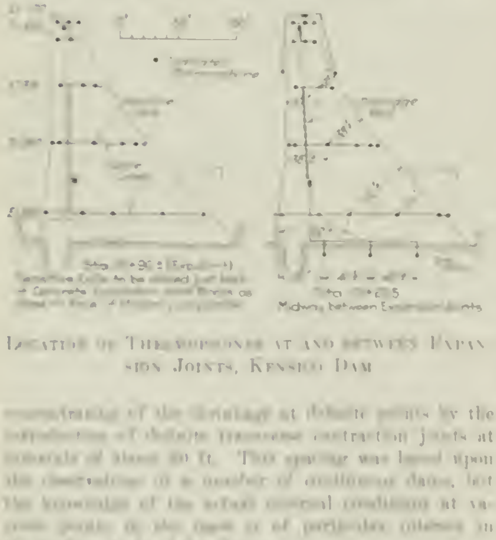
spaces, and to subdivide these to hundredths of feet by estimation with the eye only. Those who have never tried this method will be surprised at the accuracy with which work can be done. The average surveyor with ordinary practice can subdivide a unit into tenths with a mean error of about half a tenth or less. The absence of many small graduations is certainly less confusing.

Thermophones in Kensico Dam

By Wilson Fitch Smith*

A number of thermophones have been placed in various positions in Kensico Dam on the new Catskill Aqueduct for New York City for the purpose of determining the variations in temperature in the body of the masonry as an aid to the study of the stresses resulting from the expansion and contraction of the mass due to temperature changes.

In order to obviate the unsightly cracks which occur at irregular intervals in all large continuous masses of masonry the design for Kensico Dam provides for the



Location of Thermophones at and between Expansion Joints, Kensico Dam

concentration of the shrinkage at definite points by the introduction of definite transverse contraction joints at intervals of about 80 ft. This spacing was based upon the observations of a number of continuous dams, but the knowledge of the actual internal conditions at various points in the mass is of particular interest in the further study of this design.

Variation in temperature in a large mass of concrete masonry is of two kinds: first, a sudden rise of many degrees due to the heat given off by the cement in the chemical process of setting, followed by a gradual fall due to the radiation and dissipation of this heat, and secondly, the gradual changes due to the daily and seasonal changes of atmospheric temperature.

The thermophone consists essentially of two coils of fine wire of metals having different coefficients of electrical conductivity under varying temperatures. In this case, the two coils are of german silver and copper wires and are connected in circuit. The coils are contained in a closed brass tube 1½ in. in diameter and 8 in. long. The three connecting wires are No. 16 insulated copper enclosed in a special insulating wrapping and incased in a heavy lead covering. The lead covering of the connecting cable is soldered tight to the brass tube.

The thermophones are placed in the dam in two groups, as shown in the accompanying figure. One group is in a vertical plane in the center of a section midway between contraction joints, the other is near the face of one of the joints with a view to showing the result of building up one section of the dam in advance of the adjoining section. Owing to the remarkably rapid progress made in the construction of the dam, no marked difference has been shown.

The cables lead through the masonry to the nearest inspection well and thence to the inspection galleries, where terminal boards and dial switches afford easy means of connection to the indicating instrument. This consists of a Wheatstone bridge, galvanometer and battery. The pointer of the resistance bar on the Wheatstone bridge moves over a scale graduated to read degrees F. so calibrated that when the resistances in the two sides are balanced, as indicated by the galvanometer, the temperature of the thermophone is indicated on the scale. Each thermophone was compared with a standard thermometer before it was placed.

The lower thermophones were placed in the late fall of 1913, those at El. 260 and El. 315 during the present season and those at the top of the dam will probably go in this fall.

It is too early yet to draw complete conclusions from the observations as to the effect of atmospheric changes because of the influence of the new masonry as it is added, but one interesting fact has been clearly demonstrated at several different points in the center of the dam, which is that the setting of the concrete causes a rise of 40° in the mass, the maximum occurring in from 7 to 28 days, the cooler the air the slower the rise in temperature.

This result was most clearly demonstrated in the center of a mass of cyclopean masonry, 80 ft. square with 8 ft. below and 19 ft. above the thermophone, all placed within a period of six days. The concrete is of the proportions of 1:9 with from 25% to 30% large stones in the mass.

*Division Engineer, Headquarters Aqueduct Department, Board of Water Supply, City of New York, Valhalla, N. Y.

Earth Embankment and Fill at Shopton, Iowa*

The construction of the Keokuk dam, with a consequent rise of the Mississippi River back of the dam, necessitated quite extensive fill work at the Shopton yards and shops of the Atchison, Topeka & Santa Fe Ry., two miles west of Fort Madison, Iowa. The backwater above the dam formed a lake at Fort Madison 1½ mi. wide and 8 ft. deep.

The elevation of the Santa Fe yards was 518. On Jan. 1, 1913, before the final rise in level, the elevation of the river was 522.00. The Mississippi River Power Co. guarantees that the maximum level will not exceed, in flood times, an elevation of 528. It is expected, however, that the normal elevation will be 525. Before the construction of the dam, the elevation was 510 to 518.

The whole work may be divided into the following elements: Grading and trimming for a new embankment, raising the yard, track and buildings and filling

*Data for this article were furnished by William B. Bush, Engineer, Atchison, Topeka & Santa Fe Ry., Fort Madison, Iowa.

in under and around them; building a concrete retaining wall, 700 ft. up both sides of a creek; re-arranging the sewerage system of the yards; building a $35,000 reading room for employees on an artificial fill of earth with rock shoulder.

The first work to be started, now nearly completed, was building a dike or embankment along the river. The new main tracks are to be built on this embankment,

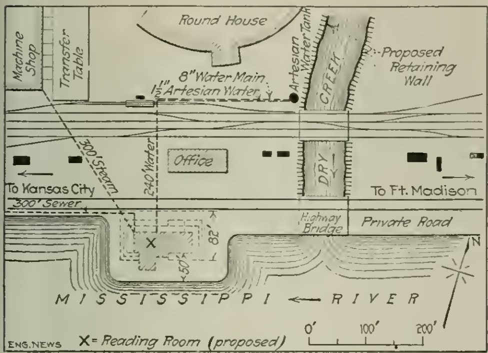


FIG. 1. GENERAL LAYOUT OF MAIN PORTION OF WORK

the present main tracks to be used for switching purposes in yard limits.

Grading for Change of Main Lines

rading for the embankment began on Oct. 23, 1913, and when completed on June 27, 1914, 150,000 cu.yd. had been placed on the south side of the present line, for a distance of 1½ mi. The subgrade is at El. 530.20; base of rail will be 1½ ft. higher. The grading was done by the Mississippi River Power Co., which purchased the land from which to obtain the fill and installed a steam shovel. Earth was moved by a train of 10 cars of 12-cu.yd. capacity each, drawn by a 40-ton locomotive. The average haul was 1 mi., and about 1500 cu.yd. were placed per day. The cost of grading, including the cost of the earth on the land purchased, transportation and placing, coal and engineering, was 28c. per cu.yd.

Riprapping River Bank

Rock for riprapping is hauled from a quarry at Dumas, 20 mi. west. This part of the work began on May 29, and on July 13 the bank was protected for more than a mile; a month later another mile of bank had been riprapped. Work is progressing eastward. The rock is dumped from cars; the average distance from rail to shoulder is 11 ft. Large pieces are used and the interstices are filled with smaller pieces placed by hand.

In the first part of the riprapping, only 1 cu.yd. of rock per lin.ft. was required; but opposite Fort Madison as much as 7 cu.yd. was used, the water being 20 ft. deep. About 30,000 cu.yd. of rock were used to protect the bank to the Mississippi River bridge of the Santa Fé, a total distance of 3½ mi. The cost of riprapping averaged $1 per lin.ft. of bank. L. W. Lewis Sons, Emporia, Kan., was the contractor for the A., T. & S. F. Ry. Co.

Raising the Buildings

All buildings, yards and tracks will be raised 3 ft. The general plan is to raise the doors and windows and to raise the floor by filling. In the machine shop the machinery will be raised, concrete foundations placed under them, and sand filled in around. Some of the smaller buildings can be jacked up. The roundhouse and the apprentice building, built in 1912 and 1913 respectively, are above high water. In addition to the yard buildings, there are 20 boathouses along the river front, which will have to be jacked from 4 to 6 ft. and stone foundations put under them.

It is estimated that the raising of the yards and tracks will require 700,000 cu.yd. of earth. This part of the work has not yet been started, but will probably be done by the railway.

Handling Sewage and Ground Water

The whole work necessitated the rearrangement of the sewerage system. All sewers having outlet to the lake had to be raised, as the flow line was at El. 525. To temporarily handle the sewage from the shops, two 6-in. electric-driven centrifugal pumps were installed and a 6-in. steam-driven emergency pump. These pumps were

FIG. 2. DUMPING RIPRAP ON EMBANKMENT

placed in a catch basin; one pump operates continuously, the other only when there is a surplus of water in the basin.

The pumping plant in the borrow-pit comprises a 6-in. and a 10-in. electric-driven unit and 10-, 12-, and 18-in.

FIG. 3. RIPRAPPED EARTH EMBANKMENT, SANTA FÉ RY., SHOPTON, IOWA

steam-driven pumps. This plant handles the drainage from an area of about 600 acres, and the sewage from the Prairie Oil & Gas Co. and from a packing-house plant nearby. A dike was constructed around a portion of this area to keep out the backwater. These pumps work automatically, and two men are sufficient to attend to them—one in the day and one at night.

W. H. Bush, who has charge of the whole work, sums up the unfinished items thus:

"The buildings and tracks have not yet been raised; the retaining wall up Dry Creek has not yet been built; the reading room is scheduled for erection this fall; the

main tracks will probably not be changed over on the new embankment until next year. The Mississippi River Power Co. can raise the water to El. 525, but it is doubtful whether this will be done for some time, as there seems to be sufficient water at the present time for the development of 150,000 hp. For the past year the river has been at El. 521.

A Home-Made Mowing Machine for Railway Track

The mowing of grass and weeds along the track is slow and tedious work for the section gangs. The accompanying cut shows a weed-cutting machine rigged up by Gordon Briggs, section foreman on the Chicago Great Western Ry., at McIntire, Iowa.

The blades and operating mechanism of a farm mower were attached to a push car, on which was mounted a 2½-

Home-Made Weed-Cutting Machine on the Chicago Great Western Ry.

hp. gasoline engine to propel the car and run the mower. The machine can be run at about 4 m.p.h., and has made 20 mi. with 1 gal. of gasoline. It will cut a strip 6 or 8 ft. wide, and is said to do the work better than hand mowing with scythes. The machine was described by J. T. Evans, formerly Engineer of Maintenance of Way, in "The Maize," published at Chicago by the railway company, to whom we are indebted for the photograph.

NOTES

Working Drawings on Limp Linen are used for all field work on the new [illegible] [illegible]

Developing an Inland Gravel Pit by a Hydraulic Suction Dredge [illegible]

opened up a large gravel pit for ballast, using a steam shovel. Later, a gravel company took over the development of the deposit, erected a hydraulic suction dredge in the pit and dug a ditch from a nearby stream to float and operate the dredge. The gravel bank then stood about 18 ft. above and extended 28 ft. below the water. The gravel overlies strata of blue mud and is about 65% sand, while 92% is fine enough to pass a 1-in. ring. The dredging outfit consists of a [illegible]-ft. hull, an old locomotive boiler, a Morris Machine Co. direct-connected centrifugal pump with about 10-in. suction and 10-in. discharge, three American Hoist & Derrick Co. single-drum reversible hoisting engines for swinging and raising the cutter head, a 4-in. piston pump for priming the centrifugal pump, and a boiler feed-water pump. Pine wood is used for fuel. The crew consists of a chief engineer and two assistants, a fireman and a wood gatherer. The discharge pipe line extends about [illegible] ft. away from the dredge and rises to an elevation of about 40 ft. above the dredge. The discharge is made into a steel pan, which widens out in a length of 10 ft. to a width of [illegible] ft., spreading the sand and gravel on a bar screen [illegible] bars on edge), with 1½-in. openings to remove roots, stones, etc. The material then falls on a series of sloping woven-wire screens and thence into sand or gravel bins from which railway cars are loaded by gravity. In addition to the dredge crew already noted, three men are required to load cars, four in the screen house, and a boy on top of the discharge pipe, whose duty it is to watch the discharge for clay and signal the dredge when the cutter gets into this material. The means of operation seem particularly efficient and cheap.

Semiportable Sand and Gravel Washing and Screening Plant —The plant shown in the accompanying view has a capacity of 110 to 1[illegible] cu.yd. of washed sand and gravel per day and makes a washed sand which is the undersize of a ¼-in. round hole in the "New Century" screen having a speed of 20 r.p.m., located on top of the bins. The washed gravel is the oversize of this ¼-in. hole and the undersize of a grizzly or bar screen having 2-in. spaces between the bars. This screen is located between the head of the elevator and the feed hopper of the sand screen. The oversize from the bar screen passes off to the spoil, as indicated in the illustration.

The washed sand is elevated by the [illegible] into a chamber on one side of the tank in which the sand screen revolves. It then passes to a sand box located between the

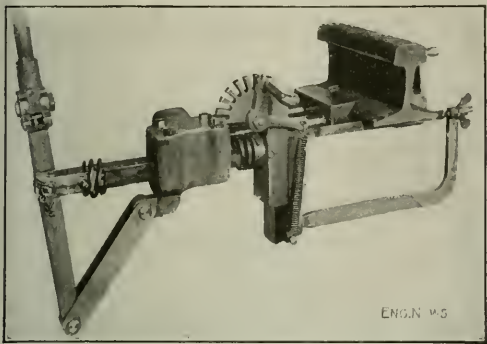
Semiportable Sand and Gravel Washing and Screening Plant

[illegible]

A traction engine is used to drive the plant. The original plans called for a motor of 25 hp. The plant described was built by the American Concentrator Co., Springfield, Ohio.

A Portable Rail Saw for Track Work—The special feature of the rail saw shown in the accompanying cut is that it can be used on rails in the track without interfering with traffic, since it makes its cut upward from the base of the rail. It is of the hacksaw type, with a double-acting saw which is given a reciprocating motion by means of the lever at the left. It is intended for steam, electric and street railway work (cutting track rails and third-rail conductors), and can be adapted for cutting structural steel.

The frame lies between the ties, and is clamped to the base of the rail, the clamp being drawn tight by the small



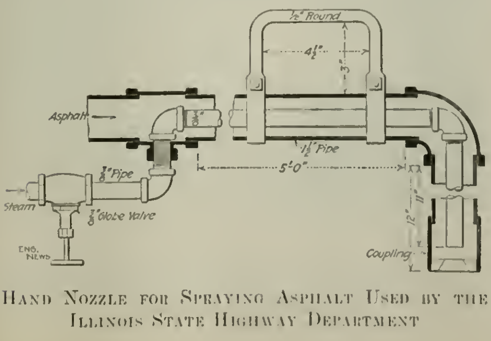
A PORTABLE HACKSAW FOR CUTTING RAILS

lever shown at the right of the rail head. At each vertical inch of cut, the saw frame is automatically shifted upward in the end frame, this being effected by the toothed sector. The machine is entirely clear of trains, except when the saw reaches the height of the wheel flanges. Should a train pass at that time, the wheels would simply snap the saw blade. The operating lever is removable, and its socket is pivoted so that if the level should be struck by a car or train it would be simply thrown over parallel with the rail.

The double-acting saw blade used in the machine is of a special (patented) design. Each saw is coated with a special lubricating composition which is softened by the heat developed in cutting the rail, and which is of such a character as not to affect the temper of the steel.

The machine weighs about 100 lb. in the size for cutting rails up to 6 in. deep or 125 lb. for 9-in. rails. The machine, the double-acting saw blade and the lubricating composition are all inventions of Alex Reitlinger, New York, N. Y. The Western agent is J. M. Scheer, 708 Tacoma Building, Chicago.

A Hand Nozzle for Spraying Heavy Asphalts—The accompanying illustration shows the details of a spraying nozzle used on all the asphalt distributing wagons of the Illinois State Highway Department. Steam and compressed air are supplied by a steam road roller or traction engine, used to draw the asphalt tank wagon. The nozzle is attached to the tank wagon by a flexible hose connection and the hot liquid asphalt is forced out under air pressure in the usual way. This type of nozzle is suitable for all grades of asphalts or

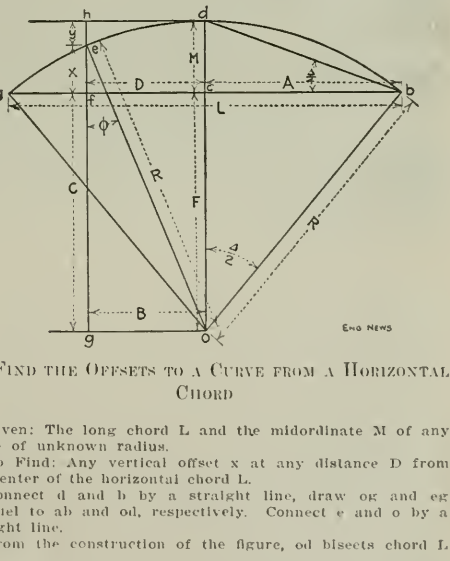


HAND NOZZLE FOR SPRAYING ASPHALT USED BY THE ILLINOIS STATE HIGHWAY DEPARTMENT

tars. It has been found to be very satisfactory in surface-oiling roads, as the material can be applied in a very fine mist in any quantity desired from ⅛ gal. to 2 gal. per sq.yd. The steam connection near the base of the spray superheats the bituminous material and also breaks it up into a very fine spray as it comes from the nozzle under the air pressure. There are other advantages in this type of nozzle, inasmuch as the high pressure that can be secured will remove surplus dust from the surface of the road and also force the bituminous material into all interstices of the road surface.—[P. C. McArdle, Acting Chief Engineer, Illinois State Highway Department.]

For Sanding Slippery Asphalt Pavements and for sanding bleeding wood-block pavements a machine has been recently put on the market by the Kindling Machinery Co., Milwaukee, Wis. The device consists of an ordinary wagon, hopper-bottomed, the hopper feeding into a fan or spiral bladed sheet-steel disk, which revolves in a horizontal plane a few inches above the pavement. The disk is turned by bevel gears, the driving gear being mounted on a countershaft, which in turn is driven by a chain from the axle of the wagon. The sand is thrown, varying with the speed, a distance of from 20 to 60 ft. A lever operated by the driver controls the feed of the sand. The apparatus is claimed to spread 50,000 sq.yd. per hr. The material may vary from fine sand to 1¼-in. stone, so that the apparatus may be used in road-construction work.

To Find the Offsets to a Curve from the Long Chord—The following may not be an original solution, but I do not recall seeing anything exactly like it, and I find the method I have worked out gives accurate results and is easily handled. Besides giving the tangential offset to a curve at any point whatever, the radius and central angle for any simple curve may be obtained, the midordinate and long chord being given.



TO FIND THE OFFSETS TO A CURVE FROM A HORIZONTAL CHORD

Given: The long chord L and the midordinate M of any circle of unknown radius.

To Find: Any vertical offset x at any distance D from the center of the horizontal chord L.

Connect d and b by a straight line, draw og and eg parallel to ab and od, respectively. Connect e and o by a straight line.

From the construction of the figure, od bisects chord L at c.

Call central angle of curve Δ, then angle dbc $= \frac{\Delta}{4}$, then $\tan\frac{\Delta}{4} = \frac{M}{A}$ and Δ is known. The radius, $R = \frac{A}{\sin\frac{\Delta}{2}}$ and $F = R - M$.

Solution 1	Solution 2
In triangle oeg	In triangle oeg
$(x + C)^2 = R^2 - B^2$	Solve for angle ϕ $\left(\sin\phi = \frac{B}{R}\right)$
then $x = \sqrt{R^2 - B^2} - C$	then $\cos\phi = \frac{(x + C)}{R}$
But B = D and C = F.	$\therefore x = R\cos\phi - C$
Substituting we have	C = F, and substituting we have
$x = \sqrt{R^2 - D^2} - F$	$x = R\cos\phi - F$

The tangential offset $y = M - x$.

It will be found that solution 2 is the better, particularly if R and F contain more than four figures, as solution 1 then

[illegible] It will be found necessary to carry [illegible] F [illegible] four [illegible] for accurate results.—[illegible], Engineer, Department of Public Works, Fort Wayne, Ind.]

Care in Handling Paving Brick, to reduce breakage, was [illegible] by a contractor [illegible] at Philadelphia. In [illegible] the bricks from [illegible] to wagons, [illegible] was employed and chutes were used to slide the bricks instead of throwing them by hand. In unloading at the street a gang of eight men was employed, two or three in the wagon passing the bricks to the others, who stacked them in piles. The men wore leather guards on their hands. Other contractors on the same work had the drivers and helpers throw the bricks from the cars into the wagons; at the street, the bricks were dumped and boys were hired to stack them.

A Detachable Stone and Gravel Spreader for use on an ordinary dump-wagon is illustrated herewith. This attachment (Fig. 1) consists of an outwardly flaring extension bolted to the rear of the wagon body. To this extension is hinged a series of chutes of telescopic design to permit of adjustment for spreading different depths of material. The free end of each chute rests upon a rail or track which projects to the rear between the chutes, so that the mouth of the chute is

Road-Oiling Truck with Interior Pump—Road-oiling apparatus often causes waste of time and oil, due to the necessity of cleaning the pump out with distillate to remove gummed oil of the previous day's work, and running out a barrel or so of oil at the side of the road before starting work to get the nozzles open and hot. In a new truck used in Pasadena, Calif., these faults have been eliminated by mounting the rotary oil-driving pump inside the tank, where the heat of the oil warms up the pump, and by using a nozzle header that permits a preliminary circulation of hot oil.—[Frank Reed, Los Angeles, Calif.]

A Remarkable Cotton Duck Belt recently made by the Gandy Belting Co., Baltimore, is 712 ft. long, 36 in. wide. The belt weighs 6[illegible]0 lb. This belt is of the type invented by Maurice Gandy 36 years ago. It is made of heavy-weight cotton duck of special weave, stitched with a heavy sewing cord on machines which make an embedded stitch producing a smooth surface. The stitching is done while the belt is under tension. Both edges of the belt have selvages. After sewing the belt is treated by a special oil process which renders it waterproof and keeps it pliable. Belts of this type have made records of [illegible] years' service as sand conveyors, carrying hot sand at temperatures of [illegible] to [illegible]°.

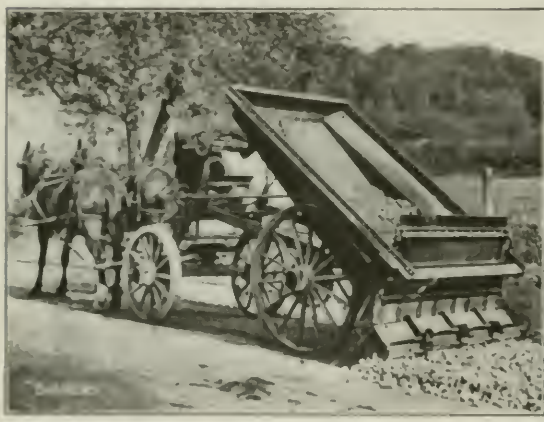


Fig. 1. Detachable Stone and Gravel Spreader for Coarse Material

Fig. 2. Spreader for Fine Material

[illegible] at a fixed distance from the ground. A scraper is attached to the [illegible] of the discharge opening for leveling off the material. In operation, the front end of the body is elevated [illegible] at the side of the driver's seat. [illegible] [illegible]

A New Power Tamping Machine, [illegible]

Widening Streets in San Antonio, Tex.—Extensive street improvements have been in progress in San Antonio, Tex., for the past year. Commerce St. has been widened by cutting off the fronts of most of the buildings and moving back

Widening South Alamo St., San Antonio

[illegible]

Editorials

The Boston Society of Civil Engineers, like the Cleveland Engineers' Club, has recognized its duty to the public and its members by arranging to give out to the daily press readable accounts of such of its activities as are of general interest. Already the Boston newspapers, like those of Cleveland, have shown their appreciation of this action by devoting liberal space to the "copy" supplied them. Doubtless other local engineering societies will follow the lead of Cleveland and Boston. Why should not the national societies do for the daily press of the whole country what the local societies are doing so well for the press of their own cities?

Rails and Rail Failures in Relation to Train Accidents

It is a matter of deep regret that the unsatisfactory quality of our American rails should be so general—a condition which has so often been made apparent. In fact, our rails, railways and rail mills are commonly criticized abroad on account of the amazing character of some of the steel rails furnished to and accepted by American railways. This condition has been contributed to by the policy of the railways in accepting the rails as made to the makers' ideas and specifications and ignoring the protests and specifications of the railway engineers. Some particulars as to experiences and conditions on individual roads are given elsewhere in this issue.

The railway engineers know what rails should be and how they should act. The position taken by the steel companies has been that they as manufacturers were the best judges of what grade of steel should be used and how rails should be made. This may be so in theory, but it does not work out in practice, and their position is not supported by the character of their product. Doubtless one reason for this is that the operations of the mills are controlled by commercial and not by scientific considerations. Prices also are regulated arbitrarily and have little relation to cost or quality of product. The difficulty in getting manufacturers to deliver good rails has been accentuated by the fact that the railway engineers have not always had the full support of the executive officers of their own roads, there having been a tendency to accept statements of the rail makers' representatives at the latter's own value.

This controversy between the railway engineers and the rail makers is of some years' standing. The engineers' side of the case has been most forcibly presented by the Rail Committee of the American Railway Engineering Association, which for some years past has been compiling very complete statistics of rail failures and has made careful examinations of rails, with results far from complimentary to American rail manufacturers. This committee has sought not only to draft specifications which will result in good rails, but has sought also to secure the adoption and enforcement of these specifications. It must not be thought that the Association has assumed an arbitrary position. On the contrary, it has sought strenuously to secure the harmonious coöperation of the steel interests, its sole object being to secure good rails in the interests of the railways and traveling public.

Taking a position of superior knowledge, however, the rail makers have presented steady opposition to the improvements suggested, requirements made, and specifications prepared by railway or independent engineers. In support of their stand they have argued that the main cause of the numerous breakages in modern rails lies in the heavy wheel-loads and high speeds characteristic of modern main-line service. This argument, however, fails to account for the fact that so many rails on investigation show a defective quality of steel and defective methods of manufacture.

It must be said also that by no means all (or even a large proportion) of the rail breakages occur under the most severe condition of service. It seems evident that the lack of strength of the heavier rail is due not to its size or weight but to the defects of its steel. In fact, it has been rather general experience that defects occur in such heavy modern rails which are not found in older rails of lighter weight, even when both carry the same engines and traffic. On this point the 1914 report of the Rail Committee makes the following deductions:

(1) The average performance of the heavy sections (85 to 100 lb.) is not so good as that of the lighter sections (72 to 80 lb.).

(2) The wide variation in results must be due to a large extent to a lack of uniformity in the performance of different mills and in the product of any individual mill.

(3) The majority of failures are head failures (such as split or crushed heads) and are due not to imperfect track conditions, but to defective material in the rail.

Appended to this report is a review of the rail-failure statistics, by Robert Trimble, Chief Engineer of Maintenance of Way of the Pennsylvania Lines (Northwest System). Mr. Trimble's review contains the following statements:

It is evident that the section of the rail as a rule has little influence on the quality of the material. A study of the detail reports makes it clear that other factors in the section are responsible for the difference in performance of different lots of rails. Small differences in chemical composition are not of much importance. Density of traffic, speed and wheel loads are of importance principally as they determine the weight of rail. Probably the majority of rail failures are due to faulty material; that is, segregation, slag inclusion, pipes, etc.

An important indication of the report is the great variation in the rate of rail failures for rails of the same weights and sections under practically uniform conditions of service. On one road, the same section of rail made by two different mills showed 81.5 failures per 10,000 tons for one mill and 124 for the other; in a similar case, the failures were 32.9 and 2.5 for two mills. In a third case, rails of similar section made by three mills showed 35, 186 and 617 failures per 10,000 tons. Mr. Trimble points out that these variations point to the same conclusion that was reached in 1913, namely: "Variations in performance of rails must be attributed to variations in the performance of different mills and also to

variations in the performance of the same mill at different times.

In conclusion, we may state two definite points. In the first place, a small number of accidents caused by broken rails is no evidence of good quality of rails, but is due largely to watchfulness induced by general suspicion of the quality of rails (which suspicion is the result of wide experience). In the second place, a steady improvement in quality of rails is being made, mainly through the united and continued efforts of railway engineers, with some assistance from the steel companies, but in general against the opposition (passive and active) of the companies. Naturally this will result eventually in a reduction of broken rails and accidents due to this cause.

Finally it may be pointed out that while rails of good quality are highly necessary, they are not likely to be obtained under the careless method of simply placing an order and letting the manufacturers decide as to the quality of the material furnished.

The Steam-Boiler Law Proposed by the Mechanical Engineers' Committee

Doubtless the most important subject ever brought before the American Society of Mechanical Engineers is the proposed code for the construction and installation of steam boilers which was laid before the annual meeting in New York City last week. We have referred before to the important work which the committee of the Society is doing in drafting this code.

It would be difficult to find anywhere a precedent for such important work being undertaken by a committee of a technical society purely out of public spirit and without recompense for the time and money spent.

Members of the committee deserve the highest credit for the industry and self-sacrifice they have exhibited in their work on this important matter in the three years since they were appointed, and particularly during the last few months since their work has been under active discussion and criticism by the various interests affected.

Whatever criticism may be made of the committee's work, there can be none of the spirit with which it has pursued its work and with its commendable aim to protect the public safety and bring order out of the present chaos produced by conflicting state legislation on steam-boiler construction.

We believe this situation was generally realized by the members present at the meeting of the Mechanical Engineers last week, and that it was because of respect for the members of the committee and their excellent motives that the committee's report did not receive even more severe criticism.

What happened, briefly stated, was this: The committee presented at the opening business session of the meeting last week the preliminary draft of its progress report, including its rules for the construction and installation of steam boilers, omitting, however, certain tables, tables and forms which have appeared in previous reports and which, it is understood, are to be included in the final report of the committee when completed.

This preliminary draft of a partial report, however, made a book a quarter of an inch thick, and it is this which the committee, after amendment, proposes to have recommended to the various state legislatures for enactment into laws to govern the construction and installation of steam boilers.

The committee brought this preliminary draft to the meeting to have it taken up, section by section, and discussed in detail; and this plan was actually carried out, the committee and those particularly interested in the subject meeting day after day, morning, afternoon and evening throughout the whole time of the convention.

It would be difficult to overestimate the value of this discussion, which was participated in by the ablest experts in steam-boiler design in the United States. There is no doubt that the rules which the committee has drafted will be greatly improved as the result of the discussion last week.

A more important matter than details, however, claims attention and received some discussion in the general business meeting of the Society on Wednesday forenoon. This more important matter is the question whether the committee is proceeding on the right course in preparing this voluminous code for enactment into law. So far as it was possible to gage the general sentiment of the members assembled in the Society's business meeting on Wednesday last, we judge the majority of the members would oppose this. In fact, a motion was made which would have had the effect of putting a sudden end to the committee's work; and though the motion was voted down, it received considerable support.

It seems to us that the committee has been led into error, partly through its zealous desire to accomplish a monumental piece of work and partly through the idea that further state legislation on steam boilers must necessarily follow closely such laws as that of Massachusetts, already in force. Actuated by these ideas, the committee has framed a code which comes near being a detailed scientific treatise on the best engineering practice in the design of steam boilers. Valuable and important though such a treatise may be to the engineering profession, it is most unwise to offer such a treatise for enactment as law by a state legislature. Experience has shown, when legislation on technical matters has been enacted, that it has been well nigh impossible to secure its appeal or amendment when the progress of the art renders obsolete matter which was commendable enough at the time it was embodied in law.

If the Mechanical Engineers' Boiler Code Committee desires to secure useful results from the work it has done, it should at once proceed to divide its voluminous report into two parts. The first part, and admittedly the most important, should cover as briefly as possible only those general features of boiler construction, installation and inspection which might reasonably be embodied in law and issued as a guide to boiler inspectors employed by the state or by insurance companies. Nothing of a controversial nature should be included in this portion of the report and nothing which is likely, so far as can be seen, to be subject to material alteration by the progress of the art in the next twenty years at least.

All the rest of the committee's report should be issued after revision as a committee report of the Society, and would have the same standing for the guidance of engineers engaged in the design, construction and operation of steam boilers as has the Society's standard code for steam-boiler tests so long in use.

If the Boiler Code Committee will proceed along these lines, we believe all opposition to its proposed code will disappear, and all interests will unite heartily in furthering its acceptance by the Society, and its embodiment in state legislation.

If, however, the contrary course is followed and the committee offers its entire voluminous report for approval by the Society's Council, by the Society itself and finally for enactment by state legislatures into law, we believe the code will fail of adoption.

Experience has shown that it is a huge mistake to encumber our statute books with all sorts of detailed, minute provisions for the regulation of every industry and business. The damage and injury which the public suffers from such legislation far outweigh any benefits realized. The American Society of Mechanical Engineers has a great responsibility in this matter, as we have before pointed out. Numerous states desire to pass legislation governing the construction of steam boilers and would welcome the intelligent aid of the leading technical society in this field. For this very reason it is of extreme importance that the Society's leadership shall be a wise leadership. The Society has the opportunity to frame legislation which will be conservative, simple and practicable of enforcement, leaving all the multitude of details, involving intricate matters of detail practice, to the members of the engineering profession who are properly responsible for such work. We repeat that no more important matter has ever been presented to the American Society of Mechanical Engineers.

Letters to the Editor

Financing Public Improvements on the Pay-as-You-Go Plan

Sir—I note in your issue of Nov. 26, 1914, a communication from E. P. Goodrich, Consulting Engineer to the Borough of Manhattan, expounding the financial merits of the pay-as-you-go plan as compared with the bond-issue plan for public improvements. The conclusion at which Mr. Goodrich arrives as to the economy of the pay-as-you-go plan has been set before us by various financial experts and efficiency engineers for some time without calling for a great deal of notice. But when an engineer of Mr. Goodrich's standing brings forward the same claims, it moves me to voice a protest against this method of practically lifting ourselves by our bootstraps.

As an example of arithmetic, Mr. Goodrich's arguments are unexceptional. They rest, however, upon an entirely false assumption. The assumption is tacitly made, without any particular attention being called to it, that an improvement year is always of the same value to the community, no matter at what time such improvement year may be enjoyed. The total number of improvement years obtained from the bond-issue plan is compared with the total number of improvement years obtained from the pay-as-you-go plan, and it is of course found that there is a difference arising from interest paid on the bond issue.

The essential falsity of this assumption lies in the fact that an improvement year today is worth more than an improvement year in the future, and that improvement years are not to be taken together in simple summation, but improvement years must be weighted in accordance with the time of their first being enjoyed, much the same as money values are weighted, and money today is worth more than money 25 years from now and the relative value can be obtained by compounding money today or discounting money values 25 years from now to present worth.

Because many if not most of the improvements obtained by the expenditure of public moneys do not return a direct financial profit, this fact is often lost sight of. If, however, a million dollars be spent in erecting, say a municipal office building, and the annual expenses of this office building and interest, etc., amount to, say $100,000, and the office building saved $200,000 in rent money, there is an evident profit in having the office building erected today rather than 10 years from now, and it is easy to see without further argument that the improvement year at the present time is worth more than the improvement year 10 years from now. For such improvements as street paving, no direct financial comparison can be made. It is fair to assume, however, that the improvements would not be made if they did not bring some return, sentimental if not financial, to the public. It is also fair to assume that the return obtained from such improvement is proportionate to the cost. For instance, if the paving in a street is improved today, it may save the public in hauling charges some definite return on the investment which may amount to as much as, or to a considerable amount more than, the fixed charges. This saving to the public is in itself available for further returns to them, and the total gain at the end of 50 years or so must be the compounded value of these various savings.

Speaking in general terms, and no mathematical determination is possible, the value of improvement years increases from the future to the present, and an improvement year is properly to be taken as more valuable at the present than in the future. The value of an improvement year today, taken at the end of 50 years, is to be the compounded value, the rate of compounding depending upon the value of the improvement to the community. On the other hand, the value today of an improvement year at the end of the 50 years is the reduced or present worth of such an improvement taken at this same rate of interest. An improvement year, 50 years from now, of $1,000,000, if improvements are worth only 5% to the community, is today worth only $87,000. What this rate of interest should be depends upon the nature of the im-

provement and its value to the community, and may well be as much as the rate of interest on bond issues, or even very much more than this rate of interest. Whether the total benefit of the improvement to the taxpayers is greater or less by the bond-issue method or by the pay-as-you-go method depends more upon how the money is spent than upon the method of raising the money. If the money be spent for worth-while improvements it is economical to make them today by bond issue. If, on the other hand, the money is spent for extravagant and wasteful improvements, it is better to use the pay-as-you-go method.

This conclusion may be properly reached quite independently of the question of how much money may be worth to the individual taxpayer. If it should be true that money is worth more to the individual taxpayer than the cost to the community as shown by the amount of interest on the bonds, the value of the bond-issue method may be still greater than indicated by the above.

CHARLES B. BUERGER.

170 Broadway, New York City.
Nov. 28, 1914.

Current Meters for Measuring Flow in Pipes

Sir—On account of the discussion in ENGINEERING NEWS, Sept. 3, 1914, p. 510, on the use of current meters for measuring the flow of water in pipes, and in connection with the previous articles there referred to, it may be of interest to mention an earlier instance of a somewhat similar application of a current meter.

I refer to the adaptation of the Haskell current meter to the measurement of flow from artesian wells in Memphis, Tenn., as early as 1890 or 1891. I think the details of the apparatus were the work of E. L. Cooley, then Chief Engineer of the Memphis Artesian Water Co., and that the idea originated with him or with the late Dana T. Johnston. Mr. Johnston also had an improved current meter constructed for use in the Savannah, Ga., artesian wells in 1897 (and described in the Journal of the Western Society of Engineers, 1897, p. 711).

The writer used the Haskell meter for metering some forty wells in Memphis once each month during most of the year 1892. The meter was attached to the end of a line of pipe and lowered down the well to a point a few feet below a tunnel connection, which was a special T-casting through which the well discharged into the tunnel system there, conducting the water to a wet well under the pump house. The meter was held centered in the well by means of a framework or basket slightly smaller in diameter than was the inside of the well casing.

The revolutions were ticked off on a counter connected in circuit with the current meter and dry batteries. The rating of the meter was made in a pipe discharging water out through the same kind of a T-casting as used at the tunnel connections, the water passing over a weir for measurement.

H. P. BOARDMAN,
Department of Civil Engineering,
University of Nevada.

Reno, Nev., Nov. 14, 1914.

NOTES AND QUERIES

The three-wheel electric tractor for drawing a street sweeper, illustrated on page 1111 of "Engineering News," Dec. 3, is made by the Clarence L. Smith Co., New York City, instead of the Wirt & Knox Manufacturing Co., of Philadelphia, as stated in the caption under the illustration. The Wirt & Knox Manufacturing Co. is a manufacturer of street-cleaning apparatus only and not of tractors and motor trucks.

William E. Per Lee, of Stillwater, Minn., is desirous of learning the present address of his brother, H. B. Per Lee, who was last heard from at New Orleans, La., June 8, when he was registered at the St. Charles Hotel. He is a civil engineer and his last known place of employment was at Elephant Butte, N. M. Any reader knowing his present address will confer a great favor by communicating it to his mother, who is ill, and his brother.

Pavement Problems and Experience in San Francisco

By JAMES M. OWENS*

San Francisco may well be called a City of Hills, for almost in its geographical center are located the "Twin Peaks," approximately 925 ft. above sea level, while just to the southwest of them is Mt. Davidson, some 13 ft. higher, and in addition there are a great many minor hills and ridges. It can readily be seen, therefore, that San Francisco presents to the highway engineer many and serious problems.

GRADE PROBLEMS—Some of the grade problems may be better understood by citing a few examples:

In the heart of the business section there is a block with a gradient of 29.8%, paved with cobbles. In one of the most thickly populated residence districts, along one of the main trunk lines leading to the Panama-Pacific Exposition Grounds, we have a double-track electric railway line operated with cable traction helper over a gradient of 26.5%. This street is also paved with cobbles.

In an outlying district a vitrified brick pavement on a concrete base has recently been constructed on a street whose gradient is 18.1%. This pavement (Fig. 1) is unique in that the brick selected are not of the "hillside" type but of a special, rough, irregular kiln-marked variety. I do not know of another instance where paving brick of this kind has been laid on a city street having such a heavy gradient.

Not far from the Exposition Grounds on Chestnut St., east of Polk St., a block has just been graded, for half of which the gradient is 33.3%.

In the vicinity of the waterfront there is a considerable area of filled-in land, where there is a regular yearly subsidence of about 0.1 ft. Taking care of this settlement and harmonizing the grades in that locality is one of the city's most difficult pavement problems.

ASPHALT PAVEMENT—One of the largest and best known bituminous limestone deposits in the United States is located not more than 120 miles from San Francisco, and this was developed in the early eighties, and as California is now the largest producer in the Union of crude oil and asphalt, it is not to be wondered at that the majority of this city's paved streets are of these materials.

In the past few years, under the supervision of the

*Assistant City Engineer in Charge of Pavement Dept., City Hall, San Francisco, Calif.

city engineer, there have been laid in this city about 798,542 sq.yd. of bituminous limestone rock as against 590,617 sq.yd. of other types of asphalt during the same period.

The bituminous rock, as it is found in California, is graded commercially as hard, medium and soft. The nature of these deposits was described and a chemical analysis of the rock given in an article by me in Engineering News, Dec. 22, 1898.

Fig. 1. Residence Street on a Steep Grade Paved with Special Brick

While the majority of our streets have been paved with this material as it came from the mines, without any attempt being made to grade it, of late years far better results have been obtained by proper grading and mixing. The old-fashioned and highly injurious closed steam kettle has been eliminated and the hot-air process substituted in its place.

Probably due to lack of knowledge concerning the nature of the material, a great many of the older pavements have disintegrated and in many cases present a very irregular surface, due to the tendency of the material to creep and form into waves.

Most of the material flowed toward the gutters, because of its excess of oil, its lack of proper bond with the foundation, and the stress of traffic. In some instances the original 2½-in. surface has thinned out to 1 in. at the center and increased to 4 in. at the gutter line. Probably most of this trouble is the result of excessive crowning, which in some of the older pavements was as high as 10%.

On most of the new asphalt pavements a radical departure from the prevailing height of crown was made, the crown being designed quite flat. This has aided in eliminating the tendency of the surface to wave. The entire absence of waves is particularly noticeable in the case of the Geary St. pavement, where some very flat crowns were used.

The paving of the Junipero Serra Boulevard, for its entire length from Ocean Ave. to the county line, is the most important paving work undertaken by the city during the past year. This stretch of roadway is about 1.6 miles long, and is the main route for motor travel from the city to the Peninsula. This work has been done by the City Street Improvement Co. at a cost of $53,340.

The paved portion of the roadway is 25 ft. in width, with 5-ft. rock shoulders on either side. The 3-in. thick concrete gutters are 5 ft. wide and 1 ft. 10 in. deep where they adjoin existing curbs. The pavement foundation is of cement concrete 6 in. thick. The concrete foundation has edgings 6 in. wide and 2½ in. deep so as to inclose the asphalt surface of 2½-in. thickness.

The asphalt surface consists of a 1½-in. close binder course and a 1-in. wearing surface. For the kind of traffic it will have to support this pavement is expected to give entire satisfaction for many years to come.

Other Pavements—New specifications are now being prepared to cover most of the best known of modern pavements, such as creosoted wood block, vitrified paving brick, asphalt, bituminous rock, bituminous concrete and basalt-block pavements.

On account of the excessive gradients on some of our city streets, cobblestone pavement (Fig. 2), if it can be dignified by the name of pavement, is still used, but probably will be replaced by a rough, irregular, kiln-marked brick, which will be far more sightly, practical and durable.

Vitrified-Brick Pavements—As previously mentioned, these bricks have been used on some of the outlying residence streets where the travel is light and infrequent on account of the grade and only recently on medium heavy traffic streets like 3rd St. and 6th St., where the standard hillside-variety was used. While not down long enough to provide a crucial test, these new brick give every indication that they will be satisfactory. Vitrified-brick pavement is still in its infancy here.

Outside of a few isolated, badly executed attempts made to introduce it formerly, the use of brick in this city practically began with the paving of Powell St. only

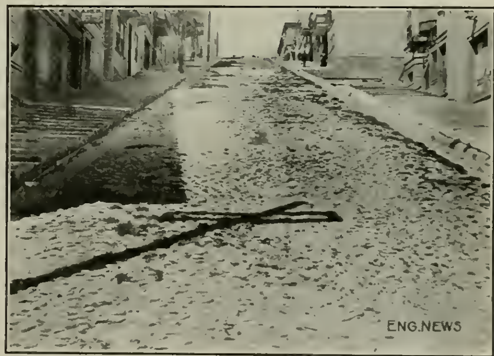


Fig. 2. Typical Cobblestone on Steep Grade Street

two years ago. Vitrified brick were laid on one side of the street and vitrified-paving block on the other. Today this pavement presents a remarkably even and good-looking surface and gives every indication that it will last.

Basalt-Block Pavements—Our basalt-block pavements, used for the heavy traffic streets, correspond to the new granite-block pavements of New York. In fact, the basalt block is a more durable stone and wears more evenly than the Eastern granite. The following is taken from the specifications for basalt blocks:

BASALT BLOCKS—The basalt blocks shall be of the best quality of basalt, not less than 3½ nor more than 4 in. wide; not less than 7 nor more than 9 in. long; not less than 6 nor more than 6½ in. deep. They must be so dressed as to have

[illegible] 3/4 in. and such that when two blocks are placed [illegible] end to end with the [illegible] the average [illegible] between [illegible] will not exceed [illegible] in.

When laid on a concrete foundation with a 2-in. sand cushion and cement grout or gravel filler, this is one of

Fig. 3. Portion of Junipero Serra Boulevard with 3-In. Asphalt Surface

the most durable types of pavement under heavy traffic. The chief objections to its use are its tendency to round off the edges and consequently become slippery and noisy.

Wood-Block Pavements—Outside of a small stretch of experimental pavement, laid under the jurisdiction of the Harbor Commission, on the Embarcadero, there are no wood-block pavements in San Francisco. Some will probably be introduced here in the immediate future, however.

Curbs—At the present time there are three kinds of curb in general use in this city, namely, California granite, armored concrete, and California redwood. Until recently, no concrete curb was specified by the city. It is gradually coming into use, however, and has recently been used to quite a large extent in the rapidly growing suburban districts, and particularly in tracts that have been opened up recently. Its cost is about midway between that of the redwood and the granite. Where sudden grade changes occur with such frequency as they do here, it is apparent that a curb that can be molded to any shape is more adaptable than the more rigid granite curb.

In spite of the heavy toll levied on the pavements of this city by the great fire of 1906, and the few years the city has had in which to recuperate from the catastrophe, street improvements have been carried on at a rapid rate. Much has been accomplished during the interval.

All pavement design and construction are under direction of M. M. O'Shaughnessy, City Engineer.

Fig. [illegible] Diagram [illegible] San Francisco, [illegible]

Pavement Problems; Contrasts of Foreign and American Practice*

By Henry Welles Durham†

A most difficult problem confronting the city highway engineer is to make a correct decision on a suitable form of pavement surface—one that shall, if possible, combine the very contradictory qualities asked for by the different interests involved.

The Requirements—Owners of horse-drawn trucks, who are still very influential, desire a surface that will furnish a good foothold for animals in addition to giving light resistance to traffic. The occupants of buildings desire noiselessness and cleanliness. The necessity for access to subsurface structures often requires the easy opening and restoration of the pavement to a condition substantially as good as the original surface.

Further, the taxpayer demands a form of construction that shall combine a minimum of original cost and subsequent maintenance with a maximum of durability; and the general critic calls for the discovery of some hitherto unknown perfect type, and refers us to the great cities of Europe, in which, as he knows from personal observation (during the few hours he spent in each and on the few blocks which he visited), the pavements are perfect, where repairs are never required, where openings are made during the night and restored before morning—all at practically no expense to the taxpayer.

Investigation does not bear out these claims, nor, unfortunately, does it discover the solution of the pavement problem. The municipal highway engineer [illegible] as in this country, is trying to satisfy the same [illegible] with the same limited [illegible]. The best to be said is that general experience has reduced to a [illegible] the number of desirable wearing surfaces for city streets, and the selection of the most suitable of these for each particular case is usually arrived at through a process of elimination, by taking the pavement that presents the fewest drawbacks.

American Practice—The [illegible] street pavement and that which is laid [illegible] half the area of

*[illegible] "[illegible] of [illegible] Construction and Maintenance of Roads and Streets" [illegible] American Road Congress, Atlanta, Ga., November, 1914.

†[illegible] Borough of Manhattan, New York City.

all city streets in Europe at the present time, is some kind of stone block, ranging in quality from the rough cobblestone pavement—which has been generally discarded in New York City, but is still very prevalent abroad—through various grades of squared block to one of hand-dressed blocks with joints of less than 1/4 in. and heads absolutely plane, found to a very limited extent in such cities as London, Liverpool and Birmingham and costing from \$5 to \$10 per sq.yd.

Citizens of none of our leading American cities would be contented to have in a residential street, macadam and stone block to the extent to which they prevail abroad. Consequently, lessons drawn from foreign practice are valueless to us in this respect; while we have already learned to construct stone and asphalt pavements of a quality equal to the best abroad.

The selection of the types of pavement to be adopted in a great city cannot be laid down to a set of rules whose observation will lead to the satisfaction of any community. Local climatic conditions, economically available sources of supply, the relation to each other of the different localities for commerce, manufacture and residence, and, finally, the financial resources of each city all exercise too great an influence to make the practice of one valuable as more than a general example for another.

Advantages of Modern Stone Block—As compared with other types of pavement, in view of its greater life and consequent ultimate economy, modern smooth-dressed, close-fitting, granite-block pavement on a concrete foundation, with joints filled with a bituminous material, has been decided to be most satisfactory for the heaviest traffic streets in the Borough of Manhattan, New York City. Its freedom from slipperiness and ease of maintaining in a clean condition, the small amount of repairs required, and the fact that it is the only surface in which street openings can be restored to a condition equal to the original surface, have been the determining factors, where the general city noises from surface and elevated railroads and other sources render variations in the type of pavement negligible so far as noisiness is concerned.

Advantages of Wood Block—For a fairly heavy and dense traffic in wide streets subject to infrequent cuts and having a level surface or only moderate grades, there is no question but wood pavements can be laid that are eminently satisfactory. They require the most careful attention for maintenance and perhaps vary in quality between greater extremes than any other type.

Nothing finer in the world in pavement surface exists than can be seen in London on the Mall from Admiralty Arch to Buckingham Palace, a street that is subject to a fairly dense pleasure traffic; or on Whitehall, the Strand, Piccadilly or many other adjacent streets in the heart of Westminster. On the other hand, some of the worst wood surfaces encountered in any city can be found within two or three miles of those just referred to, illustrating very clearly the absolute necessity of constant attention to maintenance and the selection of the best kind of wood and workmanship for this type of construction.

Advantages of Sheet Asphalt—For the combination of economy, cleanliness, absence from much noise, and satisfactoriness for the general city traffic in the residential districts, nothing better has been developed than the modern asphalt pavement. It has been adopted on a majority of the streets in New York City. While many miles of inferior pavement of this type have been laid there in the past, these are as rapidly as possible being replaced by a modern type of construction on a concrete foundation, which promises much greater durability and ease of maintenance.

The relatively lesser amount of this kind of surface in European cities is very largely due to the fact that American cities had no good pavements on any but a few streets up to very recently, whereas it has been the practice abroad for many years to construct good macadam surfaces in all residential districts.

At the present time, foreign cities are following our custom of laying sheet asphalt on new light-traffic streets, and in the large real-estate developments around Berlin asphalt was adopted almost exclusively. The cities of Paris and Vienna last year made contracts for extensive repaving with asphalt, which is being substituted in Vienna for the old stone surfacing of the Boulevard; while Paris is tearing out many miles of stone block, inferior wood and macadam and relaying with asphalt.

Need of Closer Supervision and Inspection—It would seem as if some of our city engineers thought that the whole aim of their office had been obtained when they had succeeded, down to the last period, in describing chemical and physical qualities of the materials to be used and the exact details to be followed; just as we Americans have too great a tendency to regard our record file and office systems as ultimate ends. The specifications used in such important cities as London, Birmingham, Liverpool, Hamburg and Berlin, and even Paris, where the most attention is given to detail of any city in Europe, seem noticeably weak in contrast to ours and to leave much to the honesty of the contractor. But when it comes to the execution of the work the attitudes are reversed, and the European engineer and contractor seem to work in harmony with but one end in view, namely, the construction of the particular piece of work called for at the price agreed upon.

A recognition of the difference of national traits furnishes no indication of how to change them, except in pointing out the direction in which almost all of our cities can obtain better work—that is, in the line of closer inspection of materials and workmanship of construction. It is a problem that is worthy of the attention of many men who may have a tendency to regard anything but the scientific end of engineering construction as beneath their dignity.

Conclusions—In concluding, the fact must be emphasized that the most satisfactory type of wearing surface is largely a local question. New York lays wood-block pavements only on level streets, Berlin only on grades. Other forms of block pavement than those largely used in New York City are giving satisfaction elsewhere. Many successful brick pavements and those of various types of bituminous concrete are laid in neighboring cities. The question of paving construction in and adjacent to the tracks of street railways is a problem by itself.

One point above all must be kept in mind—careful work for a short time will lay a good pavement; but it can be kept in its place in good condition for use only by constant vigilance. A thorough organization, for the purpose of inspecting and reporting defects and for the execution of immediate repairs, is the prime requisite of a good highway bureau.

The Palmer Memorial Stadium at Princeton University

SYNOPSIS—Details of design and construction of the largest reinforced-concrete stadium, seating normally 41,000 people. Simple design consisting of transverse inclined girders on columns and carrying continuous slab of seats.

Some weeks ago ENGINEERING NEWS devoted considerable space to the description of the so called Yale Bowl, the new amphitheater just completed at New Haven for the football contests of Yale University. Practically contemporaneously with the Yale Bowl there was completed at Princeton University, Princeton, N. J., a reinforced-concrete stadium for the same purpose, which, while somewhat smaller in capacity than the Yale structure, is the largest reinforced-concrete grandstand or stadium in existence.

The Yale Bowl is an elliptical amphitheater of earthwork, paved on the inside with reinforced-concrete seats, and having a normal seating capacity of 61,000, although at the Yale-Harvard game of Nov. 21, 1914, there were nearly 69,000 persons present, the extra 8000 being provided for by seats on the upper walkways. The Princeton stadium, on the other hand, is entirely of reinforced concrete. It is U-shaped, as is the Harvard stadium which was completed in 1903 (ENGINEERING NEWS, Apr. 27, 1905, p. 435), and it seats 41,000 persons as compared with 35,000 for the Harvard stadium, the next largest reinforced-concrete structure of this sort. Construction on it was going on all during the past summer and the field itself was used for two games this fall, the Princeton-Dartmouth game of Oct. 24 and the Princeton-Yale game of Nov. 14. At neither of these games were the seats completely filled.

The Princeton stadium was presented to Princeton University by Edgar Palmer, Class of 1903, in memory of his father, who was a graduate of Princeton College. It cost approximately $300,000. The architectural design was made by H. J. Hardenbergh, architect, New York City, the structural design by Purdy & Henderson, consulting engineers, New York City, and the contract was carried out completely by George A. Fuller Co., also of New York City.

Fig. 2 gives a half plan of the stadium, a section through it showing the structural design and a partial longitudinal section. From that drawing the general nature of the structure may be understood. It is horseshoe-shaped, the total length being 652 ft., and its total width 720 ft., both dimensions out to out of all concrete. The seats are in the usual bank, 72 ft. high at the highest point, and extend on tangents parallel to both sides of the playing field for a distance of 454 ft., at the closed end being connected by a variable-radius curve which brings the nearest seat at the crown of the curve as near as is artistically consistent to the goal posts located at that end of the field.

FIG. 1. THE PALMER MEMORIAL STADIUM AT PRINCETON UNIVERSITY, PRINCETON, N. J., AT THE YALE-PRINCETON GAME, NOV. 14, 1914

The entrance, at the outside crown of the curve, is made particularly pleasing from an architectural standpoint, as is shown in the view in Fig. 4. Through this entrance the playing teams enter the field. The stand itself is entered from 26 runways, which incline up from the outside ground level to entrances into the stands about halfway up their slope. The whole stadium is surrounded by a high iron picket fence to control ticket taking.

STRUCTURAL DESIGN

The structure is very simple. Reinforced-concrete columns, founded on simple spread footings, were spaced

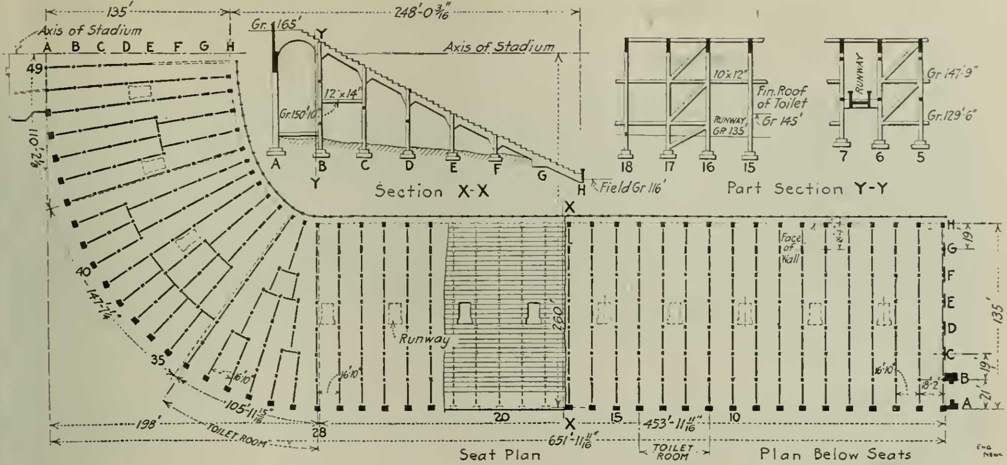


FIG. 2. HALF PLAN AND DETAILS OF REINFORCED-CONCRETE STADIUM AT PRINCETON UNIVERSITY

uniformly 16 ft. 10 in. longitudinally and 19 ft. transversely on the two straight sides of the stand and on approximately the same dimensions but on radial lines in the curved part. The transverse line of columns carries inclined girders which are notched on their top surface to the step shape. Spanning these girders, the steps themselves were cast as a continuous floor clear around the structure. There are no expansion joints, but special reinforcing was placed in the so called riser beams, that is, the steps, to take up any expansion and contraction.

The columns, except for the rear line, are 16x16 in. square, reinforced with straight rods tied together every 12 in. with ¼-in. wire. The two front lines of columns are so short as not to require regular column design, but are in effect mere pedestals. The columns in the rear line are each 4 ft. by 5 ft., and each has a recess on the inside face, as shown in the view in Fig. 5. Columns are braced by occasional horizontal beams in both directions and by longitudinal diagonals in the higher bents.

The girders are each 10 in. thick and vary in depth with the jogs in the steps. At the higher end the girders are formed into an arch which spans the 21-ft. opening, which is used for the promenade leading to the various runways. This arch carries on its forward half the last four

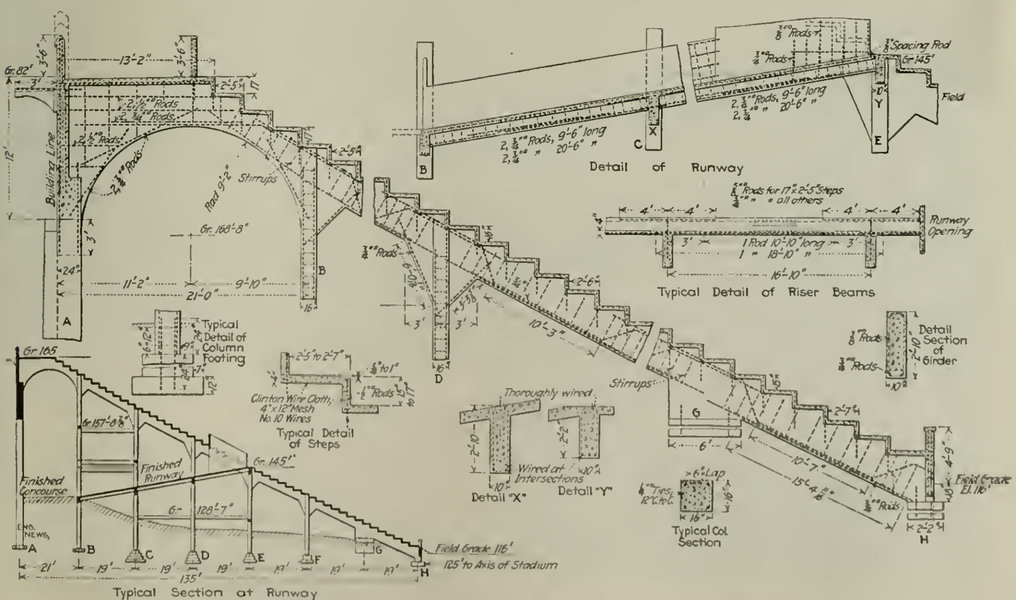


FIG. 3. DETAILS OF REINFORCED-CONCRETE MEMBERS OF THE PRINCETON STADIUM

Fig. 1. The Entrance to the Princeton Stadium

steps of the stand and on its rear half a walkway used as a general concourse for walks before, during and after the game. This walk is protected on each side by a reinforced-concrete railing. The view in Fig. 5 shows the remarkably fine effect which this arcade presents to one passing beneath.

The line of the steps is not straight from top to bottom, but has a slight dip downward at the middle. This curve was worked out by experiments so as to permit each row of spectators to see the field to best advantage. In forming this curve the steps vary from 15 to 17 in. in rise and 2 ft. 5 in. to 2 ft. 7 in. in tread. They are reinforced by wire cloth continuous from bottom to top and by continuous longitudinal rods at each junction of riser and tread. The riser beams are further anchored to the girders by vertical rods 3 ft. long, penetrating both girder and riser. Up to the present the bare concrete steps have been used for seats but it is intended to put a 12-in. planed board seat along the front of each concrete step. The concrete steps, it will be noted, are wide enough to permit such a board to be used as a seat at the front end of the steps and to leave sufficient space at the rear end for a walk on each row.

Fig. 5. View Through Promenade Arcade at Rear of Princeton Stadium

The runways, spaced every third row of columns, are inclined slabs running up from a so-called concourse or walkway between columns A and B to the top of the stand at column E. They rest on transverse girders spanning between the columns and are protected by a solid reinforced-concrete railing. Inasmuch as the elevation of the concourse varies and the level of the runway openings at column E is constant, the slope of the runways varies from $1\frac{1}{8}$ in. to $2\frac{1}{4}$ in. per ft. At the first four runways from either end of the U, steps at the bottom were used in order to keep the slope within the above limits.

The foundation conditions at the site were good. Piles were not necessary. The columns have simple footings placed usually $3\frac{1}{2}$ ft. below ground surface, i.e., below frost depth. A few of them rest on shaly rock, while the others are on sand and gravel. A low soil pressure, 3 tons per sq.ft., was adopted in order to be safe in case variable material were encountered.

Construction

Work was started on the excavation for the Stadium Apr. 17, 1914; forms for the concrete work were started May 19, and the field was opened for its first game Oct. 24. The leveling of the field was the first operation. This was done by steam shovels and carts, 40,000 cu.yd. of earth being moved in this manner. After it was brought down to a level, a 30-in. playing field was made of successive layers of broken stone, cinders and turf, with open-joint drain pipes along the bottom. New turf was placed with considerable success. The playing field for the two games this year was quite up to expectations.

Concreting was carried on by two separate gangs, each a complete organization, beginning at the two open ends of the stand. These two gangs were worked one against the other and by the competition considerable progress was made. The concreting was done by chuting from towers which were about 160 ft. high. Each of these towers had to be moved once. In the beginning they were placed along the side and back of the stand, so that with the use of column-stopped troughs (Figs. 6 and 7), they could control about two-thirds of the straight side. When this had been concreted, they were moved up to near the

FIG. 6. THE PRINCETON STADIUM DURING CONSTRUCTION

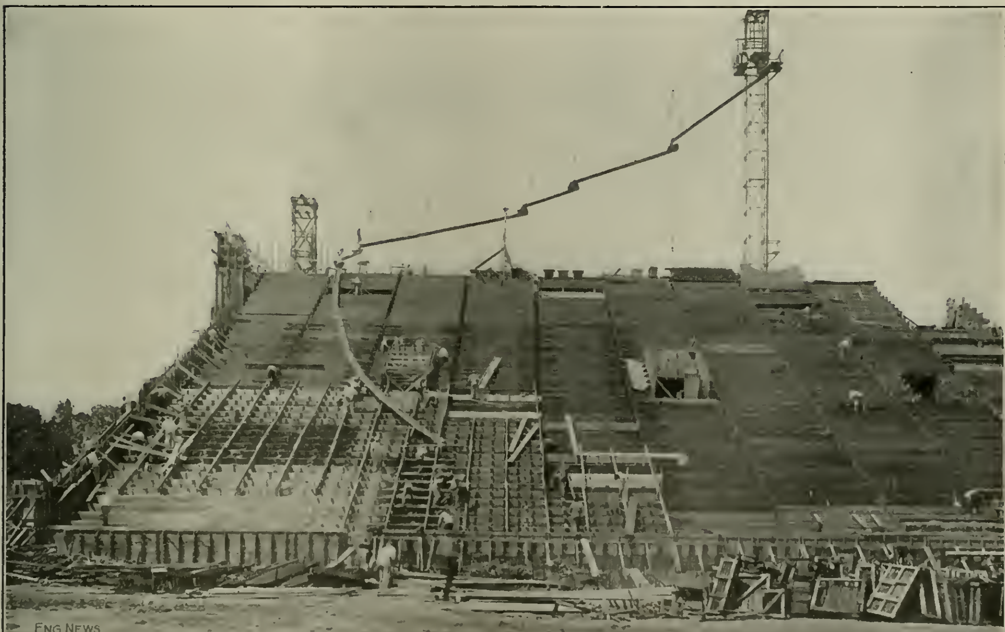


FIG. 7. LONG CHUTING OF CONCRETE FOR LOWER SECTION OF DECK, PRINCETON STADIUM

point of curvature and controlled the remaining part of the straight and half of the curved part of the stand. On account of the great length of trough and the irregularity of the line required a secondary tower was built solely to act as a guy-line tower to support the troughing. It can be seen in Fig. 7.

Mixers at the bottom of these towers were fed by barrows wheeled from the storage piles near-by. All machinery was electrically controlled. The greatest amount of concrete laid with one plant was 227 yd. in 10 hours.

Timber falsework was erected complete for three bays at a time. The falsework was cut at a sawmill on the job and carted to the proper location with horse and wagon. It consisted of straight posts thoroughly braced, carrying at the top the proper boxes for girder and risers. Two sets of three-bay forms were used on each side. Concreting was continuous, so that the first three bays could have been fully moved and in place for the next erection by the time the second three bays of concrete had been laid. Thus the forms were used four times.

Annual Meeting of the American Society of Mechanical Engineers

The 35th annual meeting of the American Society of Mechanical Engineers was held in New York City last week at the Engineering Societies' Building. The attendance was gratifyingly large, 821 members of the society and 512 guests being registered during the week.

At the opening session on Tuesday evening, Dec. 1, the retiring President, James Hartness, President of the Jones & Lamson Machine Co., of Springfield, Vt., gave an address entitled "The Human Element: The Key to Economic Problems." Mr. Hartness presented some of the ideas that were made prominent in his book, "The Human Factor in Works Management," with reference to the importance of recognizing habit as a most important factor in the development of an industrial organization and its personnel. Mr. Hartness also emphasized the idea that for economic production, business must be carried on upon a large scale and held that recent legislation in opposition to monopolies was contrary to the welfare of the nation as a whole.

Tellers then reported the result of the ballot for officers for the ensuing year, which was of unusual interest because of a spirited contest over one of the offices to be filled. This contest brought out an unprecedentedly large vote. Ordinarily, barely a thousand or less of the membership take the trouble to send in their ballots for officers, but this year 2273 ballots were cast. The officers elected without opposition were: President, Dr. John A. Brashear, of Pittsburgh; Vice-Presidents, George W. Dickie, of San Francisco, James E. Sague, of Poughkeepsie, N. Y., and Henry Hess, of Philadelphia; Managers, Chas. T. Main, of Boston, Max Toltz, of St. Paul, and Spencer Miller, of New York City. To fill the unexpired term of the late Alfred Noble as Manager, the regular Nominating Committee named Morris L. Cooke, Director of Public Works, of Philadelphia. An independent nominating committee, made up of over 100 members of the society, nominated George J. Foran, of New York. Mr. Cooke was, however, elected, the tellers reporting 1171 votes cast for him and 859 for Mr. Foran. The reception to the retiring President and President-elect occupied the remainder of the evening.

It would be impossible within the space available to abstract, even in the briefest manner, the twenty-six papers presented at the various sessions on Wednesday, Thursday and Friday, and the discussion upon them. We can merely refer briefly to a few unusual and noteworthy features of the meeting.

First, comes the preliminary report of the Society's committee on a standard code for steam-boiler construction and installation. The discussion of this report occupied practically the entire session on Wednesday morning, and was carried on thereafter as a separate session, occupying morning, noon and night, until the close of the meeting on Friday. As this code is being prepared for presentation to state legislatures for enactment into law, it is without doubt the most important matter ever brought before the Society, and the careful detail work done by those who faithfully attended these sessions from the beginning to the end of the meeting is deserving of high praise. We have discussed this proposed code further in the editorial columns of this issue.

The second most noteworthy feature of the convention was the special municipal engineering program prepared by the Society's Committee on Public Relations, which occupied the entire day on Thursday. The papers and discussions of this day were not confined to the Society's membership, but were participated in by prominent engineers engaged in municipal service from a number of different cities. The session was made noteworthy by the presence of the Mayor of New York, Hon. John Purroy Mitchel, who delivered the opening address, and also of Andrew Carnegie, whose characteristic Scotch wit was displayed when called upon by the President to address the meeting.

Hon. Henry Bruere, City Chamberlain of New York, discussed the application of the engineering principles to the Police Department, referring to the work of Gen. Bingham in New York City years ago.

Morris L. Cooke, Director of Public Works of Philadelphia, read a paper in which he urged greater public spirit and appreciation of the public interest by engineers in dealing with municipal matters, and appealed to engineering societies for support of measures looking to the increased usefulness of the profession in governmental affairs.

C. E. Drayer, of Cleveland, described the work done by a committee of the Cleveland Engineering Society in promoting greater publicity and public appreciation of the engineer and his work.

At the afternoon session a paper on the "Design and Operation of the Cleveland Municipal Electric Lighting Plant" was read by Frederick W. Ballard, Commissioner in charge of the Cleveland Light Department. This notable experiment in the municipal ownership and operation of public utilities, the largest municipal electric station in the United States, was described in our issue of July 30 last. Mr. Ballard's paper gives, for the first time, particulars as to the engineering design of the station, which involves a number of features of advanced practice introduced with the aim of securing a high economic efficiency. Mr. Ballard also submitted financial figures which on their face indicated that the average price of all current sold by the Cleveland station when it is fully loaded need be only 1.65c. per kilowatt hour generated in order to pay all fixed charges, operating and maintenance costs, and 5% earnings on the investment besides.

These figures were criticised, however, by Alex. Dow, President of the Detroit Lighting Co., and others in the discussion which followed. It appears that the Cleveland station, which has a total capacity of some 25,000 kw., has thus far secured business enough to utilize less than one-fourth its capacity. It was argued that in order to secure the business essential to its economic operation, a much larger amount will have to be invested in the distribution system than that allowed by Mr. Ballard.

Still another noteworthy feature of the municipal engineering session was the report of the committee appointed at the Snow Removal Conference held in Philadelphia, Apr. 16 last. This committee was made up of J. W. Paxton, of Washington, R. B. Hamilton and Wm. H. Connell, of Philadelphia, and John F. O'Toole, of Pittsburgh. The resolutions and plan recommended by this committee follow quite closely the scheme of organization outlined by J. T. Fetherston, Street Cleaning Commissioner of New York, in his campaign for the

coming winter outlined in ENGINEERING NEWS, of Nov. 26, p. 1095.

Other papers scheduled for this session were: "The Handling of Sewage Sludge," by Geo. F. Webster, of Philadelphia; "Training for Municipal Service in Germany," by Clyde L. King, and "Cleaning Filter Sands," by Sanford L. Thompson.

A noteworthy illustration of the extent to which the American Society of Mechanical Engineers is handling the difficult problem of specialization in engineering work is that on Thursday afternoon there were four different meetings in progress at the same time for the presentation and discussion of professional papers. Besides the general meeting above described, held in the main auditorium, devoted to municipal engineering work, the discussion of the Boiler Code Committee's preliminary report was in progress in another part of the building; a session on the fifth floor listened to three papers on metallurgical topics, and a group of those interested in cement manufacture assembled elsewhere to hear a paper on the electric drive for cement mills.

Of the social events in connection with the meeting the most interesting was the award on Wednesday evening of the John Fritz medal to Prof. John E. Sweet, of Syracuse. Members of the four great national engineering societies coöperated in this meeting, and presentation of the medal was made by the President of the John Fritz Medal Board, Gano Dunn, President of the J. G. White Engineering Corporation. Notable addresses were delivered by Dr. James Douglas, past-President of the American Institute of Mining Engineers, and Dr. F. W. Stratton, Director of the Bureau of Standards.

The spring meeting of the Society is to be held at Buffalo.

The First Convention of City Managers

Few in number but strong in the conviction that they represented the beginning of a new and better era in municipal administration, there met in Springfield, Ohio, Dec. 2 to 4, the first convention of City Managers. Springfield and the manager of that city were given the honor of the first convention because Charles E. Ashburner, the chief executive officer of Springfield since the commission-manager plan went into effect there early this year, is the pioneer City Manager, having begun service at Staunton, Va., a number of years ago.*

As there were only eight City Managers at the Springfield meeting, the convention was largely, and happily, informal. There were a number of commissioners and other city officials in attendance, besides other guests.

FORMAL ORGANIZATION

The new organization christened itself the City Managers' Association. It decided that anyone may be eligible to membership who is the executive head of a municipality, provided he holds that position by appointment of the legislative body of the city. All City Managers present at the Springfield convention and all who responded to the invitation to be present, even though unable to attend, were declared to be charter members—or 13 of the 20 or so City Managers known to have been appointed thus far. The majority of the Managers, it is interesting to note, are civil engineers.*

Officers for 1914-15 were elected as follows: President, Chas. E. Ashburner, Springfield, Ohio, Vice-President, M. H. Hardin, Amarillo, Tex.; Secretary and Treasurer, Ossian A. Carr, Cadillac, Mich.

Dayton, Ohio, was selected as the meeting place for the 1915 convention.

THE TRAINING OF THE CITY MANAGER—The first place on the formal program was given to Henry M. Waite, City Manager of Dayton, Ohio, the largest city which has yet adopted the plan. Mr. Waite said the City Manager plan is the application of business methods to the operation of a city. Although in many cities engineering problems are the most important; yet the City Manager need not be an engineer.

Summing up briefly, the necessary qualification of the City Manager, Mr. Waite said:

> A City Manager should have at least a fair education, with sufficient theory, but not so much as to overbalance practicability.
> He must be an executive.
> He must know how to handle men.
> He must be fair and just.
> He must be firm but polite.
> He must have the courage of his convictions.

Young men desiring to fit themselves to be City Managers should first go into service in their own community. "An ambitious young man, with eyes and ears open, can learn more in a misgoverned city than in a well governed city."

Mr. Waite advised that City Managers who are trying to build up an efficient staff should take the honest, intelligent men already in their employ, who are "anxious to get ahead but who have been hampered by the old order of things, back them up and weed out the weak men."

CITIZENSHIP COÖPERATION—The first City Manager in any city, said Ossian A. Carr, City Manager of Cadillac, Mich., has so much pioneer work to do in bringing order out of chaos that he has particular need of coöperation from the public. This he can get through civic associations and public-spirited individuals. The old-fashioned town meeting may also be of great assistance through the opportunity it affords for discussion and education.

HANDLING PUBLIC-SERVICE CORPORATIONS AND CONTRACTORS—A spirit of fair play and justice to both sides should be observed in dealing with both public-utility companies and contractors for improvements, argued Claude E. Chappell, City Manager of Big Rapids, Mich.

The feeling on the part of the public that lighting and other franchise companies are making exorbitant profits can be met and the companies at the same time be encouraged to reduce rates by a profit-sharing scheme which permits increases in dividends whenever the service rates are lowered.

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*See "Engineering News," July 8, 1909, for an account of the inception and early history of this plan at Staunton.

*The following is a tentative list of cities which had adopted the City Manager plan up to Dec. 1, 1915, with the names of the Managers, so far as yet appointed and known, and with the names of charter members indicated by an asterisk and the names of those in attendance shown by a dagger:

Niagara Falls, N. Y.; Titusville, Penn., H. A. Holstein; Staunton, Va., S. D. Holsinger; Hickory, N. C., * S. C. Cornwell; Sumter, S. C.; Lakeland, Fla., *D. F. McLeod; Dayton, Ohio, *†Henry M. Waite; Springfield, Ohio, *†Charles E. Ashburner; Big Rapids, Mich., *†Claude E. Chappell; Cadillac, Mich., *†Ossian A. Carr; Jackson, Mich.; Manistee, Mich., *†Charles E. Ruder; Marquette, Mich.; Traverse City, Mich.; River Forest, Ill., *†Karl M. Mitchell; Morris, Minn., *S. A. Siberts, Jr.; Abilene, Kan., *†Kenyon Riddle; Amarillo, Tex., *†M. H. Hardin, Benton, Tex.; Montrose, Colo., *F. W. Pinkerton, Phœnix, Ariz., W. A. Farish; La Grande, Ore., *F. J. Lafky; Inglewood, Calif., Paul E. Kressly.

As to dealing with contractors, Mr. Chappell first called attention to the fact that specifications are so drawn that contractors bid "not upon furnishing a definite amount of labor and material, but upon the temper of the engineer." Then, too, the contractor is "frequently called upon to assume responsibility for both design and construction, although the former may be entirely beyond his control."

Summing up this part of his paper, Mr. Chappell said:

It has been my observation that a contractor is about as honest as the supervision under which he works. If the engineers and inspectors are the soul of honor, the contractor can "put one over on them" only through their ignorance. If they are both honest and competent, they make the rules and he plays the game accordingly.

Much instruction and amusement were afforded by the experiences related by M. H. Hardin, City Manager of Amarillo, a small city on the plains of Texas. Mr. Hardin had been a district-court clerk for twenty years when he was unexpectedly asked to become City Manager of Amarillo. Among other achievements, he has cleaned up the milk supply and collected a large percentage of delinquent taxes. Asked how many commissioners govern Amarillo, Mr. Hardin said: "There are three. It may be that you bigger men can herd more, but it is all I can do to keep three commissioners going in the right direction."

NEWS NOTES

A Fire at Ardsley-on-Hudson, N. Y., on Dec. 6, cost the lives of four persons and destroyed property valued at about $[illegible]. The fire started in a barber shop.

Nantucket Shoals Lightship Adrift—Lightship No. 65 on Nantucket shoals went adrift when her anchor chains parted under the stress of a northeast gale on Dec. 6. The revenue cutter "Acushnet" left Woods Hole, R. I., to lend assistance [illegible] the coast and all steamers were kept informed of the vessel's position by messages sent at frequent intervals by her wireless operators.

Water Flowed Over the Crest of the Scioto River Dam of the waterworks of Columbus, Ohio, on Dec. 6 for the first time since [illegible]. This broke the next to the longest dry spell since the dam was completed, the longest one extending from [illegible] to Feb. 15, six or seven years ago. Notwithstanding the heavy rain during the week ending Dec. 5 the rainfall thus far in 1914 totaled only 29.80 in. up to that date as compared with a normal of 31.61 in.

Ocean Storm Damages New Jersey Coast—A northeast storm accompanied by high tides wrecked shore bulkheads, [illegible] ... resorts on the New Jersey coast on Dec. 4-5. At Atlantic City a pier was damaged. At [illegible] large sections of beach were washed out. The roadbed of the Central R.R. of New Jersey between [illegible] and Highland Beach was damaged. The wind velocity at Atlantic City was about [illegible] mi. per hr. At [illegible] a tide of [illegible] ft. was recorded at noon on [illegible] [illegible] It is claimed that tides as high [illegible] in 18[illegible]. The long [illegible] was damaged. [illegible]

The San Francisco Refuse Incinerator [illegible]

Coordination of the Various Street Bureaus [illegible] revision with that end in view. The present Bureau of Highways has no jurisdiction over the work of the Department of Water Supply, Gas and Electricity, the Public Service Commission, and other departments and bureaus, which are continually opening the pavements for one reason or another.

November Progress of Rogers Pass Tunnel—The following is the record of heading progress on the Rogers Pass Tunnel of the Canadian Pacific Ry. for November:

East end, center heading, 555 ft	Schist with some quartzite.
East end, pioneer heading, 529 ft	Quartzite with some schist
West end, pioneer heading, 817 ft	Slate with small quartzite bands
West end, center heading, 654 ft	Slate with small quartzite bands

The west end pioneer heading footage is believed to be the American record of rock-tunnel progress. This heading was driven down grade through rock that could not be broken over 6 ft. per round. The best day's progress was 37 ft. Joseph Murphy is Assistant Superintendent at the east end, and Joseph Fowler is Assistant Superintendent at the west end. A. C. Dennis, Superintendent, Foley Bros., Welch & Stewart, contractors.

Grade-Crossing Elimination at Columbus, Ohio—Plans were approved on Dec. 4 for grade-crossing elimination on two miles of the line of the Norfolk & Western R.R., mostly within the city of Columbus. The work calls for 700,000 cu.yd. of embankments and the carrying of ten streets beneath the tracks, and is estimated to cost about $1,000,000. The ten streets will be spanned by steel structures on concrete piers. Under a state law, the railroad company will do all the work except paving the subgrade streets. The city will bear 35% of the cost of two-track work, but the company expects to provide for four tracks. J. E. Crawford, Roanoke, Va., is Chief Engineer of the Norfolk & Western, and Henry Maetzel is City Civil Engineer of Columbus. Grade crossings at Columbus have already been eliminated by the Baltimore & Southwestern, Hocking Valley, Toledo & Ohio Central, and the Little Miami Division of the Pennsylvania Lines. The city's share of the work already done has been about $1,000,000. There remain the grade crossings on the Big Four, plans for which may come along in 1915.

Electric Propulsion will be used for the battleship "California," contracts having been given by the U. S. Navy Department to the General Electric Co. for the installation of a complete drive similar to that which has proved successful on the collier "Jupiter." (See "Engineering News," Sept. 12, 1912.) It is reported that the guaranteed speed is 21 knots and the contract price $450,000. While details are not available, it is probable that there will be two high-speed steam-turbine alternating-current generating units and four induction motors, one on each propeller shaft. Presumably there will be two engine rooms, but then all four motors will be run from one turbine unit except at high speeds (above 15 to 19 knots). A new type of motor has been developed for this service, no starting or backing resistance being required as on the "Jupiter." This motor has a double squirrel-cage rotor, the outer layer of conductors having high resistance and the inner layer having low resistance. In starting or backing, the inner one takes very little current while the outer one gives high torque. Toward full speed, the inner cage comes more into action and ordinary induction-motor conditions prevail. The stators would have pole-changing windings to secure a further possible speed reduction between turbines and screws.

Contract Prices for Brick and Concrete Roads in Illinois—Contracts have been awarded during the current year for 74 sections of roads having a total length of 481,[illegible] ft., or 91.27 mi., of which 56 sections with a total length of 388,369 ft. or 73.56 mi. have been concrete and 18 sections with a total length of 93,[illegible]19 ft. or 17.71 mi. have been brick. Almost [illegible] mi. of 10-ft. concrete roads have been contracted for at an average total price of $11,[illegible] per mi., or $[illegible] for the pavement proper, which is at the rate of $1.[illegible] per sq.yd. The minimum was $[illegible], and the maximum $[illegible] per mi., or $1.01 and $1.[illegible] per sq.yd., respectively. The total price for the 10-ft. concrete roads has been $[illegible] or $[illegible] per mi. for the pavement proper, which is a little more expensive than the 10-ft. brick roads which average $12,610 for a total cost, or $11,[illegible] for the pavement alone. The average price for the whole 91.27 mi. (brick and concrete) is $[illegible] per mi., of which $[illegible] is for the pavement proper. The unit price for [illegible] ft. macadam shoulders which average [illegible] in. in thickness is $1930 per mi. In nearly all cases where a long stretch of road is contracted for the unit cost per mile is considerably smaller than where a short piece of road is built. This is due, in part, to the fact that the contractor can organize his force better on large work, which permits him to do better

and cheaper work, and, furthermore, he is willing to make a smaller percentage of profit on a large contract than on a small one.—K. N. Evans, Junior Engineer, Illinois State Highway Commission, in "Illinois Highways," November, 1914.

A Program for Earth-Road Maintenance is given by Frank S. Cook, Superintendent of Highways of Tazewell County, Ill., in the November issue of "Illinois Highways," as follows: "In the spring, as soon as the ground has settled sufficiently to get on the roads with a tractor, clean out the side ditches, using a 6- or 8-ft. grader and going two or three rounds, as may be necessary. Then follow up with the leveler, pulling the loose dirt into the hollow places and giving the road the proper crown. When this is done, I believe the heavy machinery should be put in a shed and left there. Road drags, under ordinary weather conditions, if timely used, will keep the road in good shape until winter, and even then they can be used to advantage. Getting the drags used systematically will be the hardest part of the work. The commissioners should make arrangements with the farmers along a certain road to drag at the same time when called up by the commissioner or by someone appointed to do so. Of course, the entire length of the road in the township should be dragged, for if parts of it are not, then some of the benefits of the dragging that is done will be lost. The work should be done after rains. If the road is not badly rutted, the dragging need not be done until the ground is partially dried out, but if the surface is uneven, then the work should be done while the ground is still wet so as to fill up the hollow places. Each one doing any dragging should be provided with blanks to be filled in and mailed to the commissioner immediately after doing the work. These slips should state the time, section of road, price per mile and the amount due for dragging on that date."

The Opening of the Magnolia Cutoff Line of the Baltimore & Ohio R.R. between Orleans Road and Little Cacapon, W. Va., a distance of 12 miles, on Dec. 6, marked the completion of the largest improvement of the kind ever undertaken. The line cost $6,000,000, or $500,000 per mile. The purpose of the new cutoff is to relieve the traffic congestion on the main line east of Cumberland, caused by the fact that two main lines from the West connect at this point. A third and fourth track were added to the main line, under a plan which eventually will provide a four-track railway to the seaboard at Baltimore. The cutoff is nearly straight and level, saves six miles in distance and 887° of curvature. The work entailed the excavation of 3,500,000 cu.yd. of rock and earth; building four double-track tunnels with a combined length of 7100 ft., erecting 25,000 cu.yd. of concrete bridgework, 50,000 cu.yd. of concrete retaining and inter-track walls, and removing 1,500,000 cu.yd. of material for a four-track cut 200 ft. deep, which takes the place of Doe Gulley Tunnel, where the four parallel tracks reach their highest elevation. Only 3000 tons of steelwork were used on the entire improvement. With the beginning of work 18 months ago, nearly 10,000 workmen and their families moved into the vicinity, locating chiefly in Paw Paw. A modern town was laid out by the railroad. The work was under the direction of Francis Lee Stewart, Chief Engineer, and John T. Wilson, District Engineer, of the B. & O. R.R. The contract was let in seven sections to as many contractors. The completion of the Magnolia Cutoff is the last item of a list of improvements involving the reduction of grades, elimination of curves, removal of tunnels, and purchase of new equipment, costing a total of $100,000,000.

PERSONALS

Mr. John Mitchell, City Manager of Hickory, N. C., has resigned and will reënter the practice of law at Walla Walla, Wash.

Naval Constructor David W. Taylor, U. S. N., has been appointed Chief of the Bureau of Construction and Repair of the United States Navy, succeeding the present Chief, Richard M. Watt, who retires Dec. 10.

Mr. Lazarus White, M. Am. Soc. C. E., recently Division Engineer of the Catskill Aqueduct, Board of Water Supply, New York City, is now Managing Engineer of Smith, Hauser & MacIsaac, Inc., Contractors, New York City.

Mr. William F. Robertson, City Manager of Sumter, S. C., resigned on Dec. 1 to become Secretary of the Chamber of Commerce of Greensboro, N. C. Sumter was temporarily without funds for improvements and Mr. Robertson, who is an engineer, wished a more active position.

Mr. W. F. Graves, Assoc. M. Am. Soc. C. E., Chief Engineer of the Montreal Tramways Co., has been selected as one of a committee of three to make a valuation of the track property of the Detroit United Rys. Co., for the Michigan Railroad Commission. He was formerly with the engineering staffs of the elevated and surface street railways of Chicago.

Mr. Byron T. Burt, F. Am. Inst. E. E., General Manager and Electrical Engineer of the Chattanooga & Tennessee River Power Co., Chattanooga, Tenn., has resigned to become Manager of the South American Trading Co., Buenos Aires, Argentina, which has recently entered the South American field for the sale of American manufactures. He is succeeded as General Manager of the Chattanooga & Tennessee River Power Co. by Mr. George S. Baker, former Auditor.

Mr. Sydney B. Williamson, M. Am. Soc. C. E., of J. G. White & Co., Ltd., London, England, has been appointed Chief of Construction of the United States Reclamation Service, a newly created office. Mr. Williamson is the well known Division Engineer of the Pacific division of the Panama Canal. Since the completion of Panama Canal he has been with J. G. White & Co., of London. He will spend the greater part of his time in the field, his particular function being to expedite construction work, and to secure the greatest possible efficiency.

Mr. Nicholas S. Hill, Jr., Consulting Engineer, New York City, announces that he has formed a partnership with Mr. Smith Farley Ferguson, former President of Mackenzie, Quarrier & Ferguson, Inc., Contracting and Construction Engineers, New York City, under the firm name of Nicholas S. Hill, Jr., & S. F. Ferguson, and with offices at 100 William St. Mr. Hill will continue as a consulting hydraulic and sanitary engineer, devoting his time entirely to work of a technical nature, while Mr. Ferguson will take charge of the office management and construction work.

Dr. John Edson Sweet, Past-President of the American Society of Mechanical Engineers, was awarded the John Fritz Medal of the national engineering societies at the annual meeting of the American Society of Mechanical Engineers, Dec. 2, for his work in the invention and development of the "straight-line" engine. He was born in 1832. His first work was as an apprentice to the carpenters' trade, and previous to the Civil War was engaged in building work in the South. Later he spent two years as a mechanical draftsman and student in England and Europe. In 1873 he was appointed Professor of practical mechanics at Cornell University, where he remained until 1879, when the Straight Line Engine Co. was formed.

Mr. Howard Whitney, a civil engineer of Nashua, N. H., has been appointed Engineer of Maintenance-of-way of the Springfield (Mass.) Street Ry. Co., to succeed Mr. H. M. Flanders, promoted as noted in our issue of last week. Mr. Whitney will have entire charge of the maintenance of track, bridges and structures of the street-railway systems owned or controlled by the New England Security & Investment Co., of which the Springfield Street Ry. is one. Mr. Whitney is a graduate of Tufts College, and his first engineering experience was with the Missouri Pacific Ry. Later he was Resident Engineer of the Grand Trunk Ry. at Woonsocket, R. I., and with the maintenance-of-way department of the Boston & Maine R.R.

Mr. F. H. Newell, M. Am. Soc. C. E., Director of the United States Reclamation Service, has been appointed Consulting Engineer of the Service, and the offices of Director and Chief Engineer have been consolidated, Mr. A. P. Davis, M. Am. Soc. C. E., the present Chief Engineer, becoming Director and Chief Engineer, as noted elsewhere. Mr. Newell is a native of Pennsylvania and a graduate of the Massachusetts Institute of Technology, class of 1885. He was engaged in the hydraulic work of the U. S. Geological Survey in 1888, and for 12 years, 1890 to 1902 was Hydrographer of the Survey. He was Chief Engineer of the Reclamation Service from its foundation in 1902 to 1907, when he was appointed Director.

Mr. Arthur P. Davis, M. Am. Soc. C. E., Chief Engineer of the United States Reclamation Service, has been made Director also, succeeding Mr. F. A. Newell, M. Am. Soc. C. E., who becomes Consulting Engineer, as noted elsewhere. Mr. Davis was born in Illinois in 1861 and graduated from the State Normal School at Emporia, Kan., and Columbian (now George Washington) University, Washington, D. C., in 1888, having won his degree while serving as a topographer in the U. S. Geological Survey. From 1895 to 1897 he was Hydrographer in charge of all government stream measurements, and from 1898 to 1901 Hydrographer of Isthmian Canal Commission, in chargo of hydrographic surveys both at Panama and Nicaragua. He succeeded Mr. Newell as Chief Engineer of the Reclamation Service in 1907. Mr. Davis has also served as Consulting Engineer for the Isthmian Canal Commission, the Russian Government and for large irrigation projects in the American colonies.

OBITUARY

[illegible], a civil engineer of Tokyo, Japan, died Oct. 3[illegible].

[illegible], a [illegible] engineer of Duluth, Minn., died Nov. [illegible] while on a hunting trip in northern Minnesota. He was born in [illegible] and had lived in Duluth since 1886. From 188[illegible] to 1892 he was Manager of the National Iron Works.

[illegible] Christy, M. Am. Inst. M. E., Dean of the College of Mining of the University of California, a well known metallurgist, died Nov. 3[illegible] at his home in Oakland, Calif. He was 6[illegible] years old. He was a native of California and a graduate of the College of Mining of the University of California, class of 187[illegible]. He soon joined the faculty, and in 1879 was made [illegible]. He was known as an author, and was a member of [illegible] societies.

[illegible] Tuttle, former President of the Boston & Maine R.R., died at his home in Brookline, Mass., Nov. 30. He was born in Hartford, Conn., in 1846, and after a public-school education began his railway career as a ticket clerk on the Hartford, Providence & Fishkill R.R. Thereafter he was connected with the passenger departments of various early New England railroads until 1889, when he was made Commissioner of the Trunk Line Association. Subsequently he was General Manager of the New York, New Haven & Hartford R.R., and from 1893 to 1910, President of the Boston & Maine R.R., and its subsidiary, the Maine Central R.R.

Owen J. Travis, former Superintendent of Bridges and Buildings of the Colorado & Southern R.R. and the Fort Worth & Denver City Ry., died Nov. 11 at Everett, Wash., aged 66 years. His bridge-building experience began in 1868 with the Keystone Bridge Co. on the construction of a bridge in Kansas City, Mo. For several years he was Superintendent of [illegible] of the St. Louis Bridge Co., and later Superintendent of Bridges and Buildings of the Middle division of the Wabash, St. Louis & Pacific R.R. He served in the same capacity with the Iowa Central R.R., the Elgin, Joliet & Eastern R.R., the [illegible] Central R.R. and the Colorado & Southern R.R.

[illegible], Superintendent of the Arizona Eastern R.R., [illegible], Ariz., died at New Orleans, La., Nov. 21. He was born in [illegible] in 186[illegible] and received his education at Stewart College, Tennessee. His first engineering experience was with the [illegible] of Morgan's Louisiana & Texas R.R. Later he was Assistant Engineer of the Sabine & East Texas R.R. and the Houston & Texas Central R.R., and Engineer [illegible] on the [illegible] Texas & Mexican Ry. He returned to Morgan's Louisiana & Texas R.R. as Roadmaster and Assistant [illegible], and was promoted to be Assistant Superintendent of [illegible] of the Atlantic System of the Southern Pacific Co. From 188[illegible] to 189[illegible] he was [illegible] and Assistant Superintendent of the Louisiana lines of the company. From 1[illegible] to 1906 he was Assistant [illegible] of the Gila Valley, Globe & [illegible] Ry., and [illegible] of this road and its [illegible], the Arizona Eastern R.R.

ENGINEERING SOCIETIES

COMING MEETINGS

[illegible]

Brooklyn Engineers' Club—The annual meeting of the Brooklyn Engineers' Club will be held at 117 Remsen St. on the evening of Dec. 10. The nominations for officers for the coming year are as follows: President, J. S. Langthorn; Vice-President, G. Laurence Knight; Secretary, Joseph Strachan; Treasurer, William W. Brush; Directors, Carleton A. Graves and Percy C. Barney. The annual dinner will be held at the Club on Dec. 17.

Engineers' Society of Pennsylvania—The following candidates have been nominated for office during the year 1915: President, Farley Gannett, Engineer Water-Supply Commission of Pennsylvania, Harrisburg; First Vice-President, Charles H. Mercer, Chief Engineer of Bridge and Construction Department, Pennsylvania Steel Co., Harrisburg; Secretary, Edward R. Dasher, Harrisburg; Treasurer, R. Boone Abbott, Division Engineer, Philadelphia & Reading Ry. Co., Harrisburg. The election will be held at the headquarters of the Society in Harrisburg on Friday evening, Dec. 11, 1914.

Engineers' Club of Philadelphia—The "Bulletin" of the Club for November announces a plan for the unification of all the engineering societies of Philadelphia, with the Engineers' Club as a nucleus. The Executive Committee proposes to change the name of the organization to the Engineers' Society of Philadelphia, and to establish four classes of members: active, junior, honorary and affiliated. The last class would include all members belonging to affiliated societies. All these societies would have the advantage of the use of the present house of the Engineers' Club, and their members would be eligible for active membership in the Club.

Granite Paving Block Manufacturers' Association of the United States—A number of Eastern granite paving block manufacturers met in Boston, Dec. 3, and organized for the following purpose:

"Whereas, It is desirable that the high value of granite paving blocks for use in the building and constructing of streets and roadways be made known to the general public, and that the manufacture of the same be made to conform to a high and proper standard, and that the use of the same be adapted to other purposes, all to the end that the manufacture and use of said granite paving blocks may be stimulated and increased for the mutual benefit of the public and manufacturers of said blocks, therefore, the subscribers hereto form an association to be known by the name and style of "Granite Paving Block Manufacturers' Association of the United States," in order to promote the welfare of its membership in such manner as this constitution and these by-laws provide."

The following board of directors was unanimously elected: C. Harry Rogers, of the Rockport Granite Co., of Boston, Mass., President; Joseph Leopold, of J. Leopold & Co., Inc., of New York, Vice-President; James Adamson, of Booth Bros. & Hurricane Isle Granite Co., of New York, Secretary; Thomas Lahey, of the Hildreth Granite Co., of Boston, Mass., Treasurer.

New York Section of the American Water Works Association—The third meeting of this local branch of the society was held in the banquet room of the Manhattan Hotel Dec. 3. After the usual luncheon two papers were read. The first, by W. W. Brush, Deputy Chief Engineer of the Department of Water Supply, Gas and Electricity, New York City, described the work, equipment and organization of the maintenance division of the department. The paper was interesting and [illegible] and was illustrated by many lantern slides. The distribution system was described from the point where the water leaves the city reservoirs or the new tunnel of the Catskill aqueduct to the street [illegible], many of which are in very complicated situations, due to the multitude of other subsurface structures. Various yards and equipment were illustrated [illegible] [illegible] [illegible]. The division of the city into repair zones and the organization of the force of about 7[illegible] employees into maintenance and repair [illegible] was of interest [illegible] from the [illegible] of the work to be done. The [illegible] of [illegible] as many [illegible] of valves as possible [illegible] for leaks [illegible] were outlined, but these and many more details are to be given in a more formal paper to be presented later to the parent society. The second paper by [illegible], City Engineer of Yonkers, N. Y., gave a history and [illegible] of the Yonkers water-supply, and the proposed development to [illegible]. The position of Yonkers is interesting because, like other small cities [illegible] the [illegible] to be suburbs of great cities like New York, all the really economical water-supply resources have been [illegible] for metropolitan use. Hence Yonkers is practically shut out from a new supply and is obliged to further develop its present sources to their fullest capacities.

Engineering News

VOLUME 72 DECEMBER 17, 1914 NUMBER 25

Plant Tests of a Low-Head Hydro-Electric Development

By F. Nagler*

The Centralia Pulp & Water Power Co., of Grand Rapids, Wis., has recently placed in operation, on the Wisconsin River, a low-head hydro-electric development for supplying power to the Nekoosa-Edwards Paper Co.'s mills at Port Edwards and Nekoosa, Wis., which were among the first to abandon complicated line-shaft transmission and use simple and direct motor drives.

At the outset it was recognized that the single-runner vertical-shaft turbine was most favorable to high efficiency and to simplicity of station arrangement. Recent improvements in high-speed runners have been very marked and it was found that the cost of single-runner, direct-connected units of suitable size would not be materially different from that of multiple-runner machines at higher speeds. Further, it was found that the power house would be less expensive by reason of its greater simplicity, and this feature, combined with the higher efficiency, decided the type of the installation.

On account of its being the first plant of its kind using high-capacity runners for a low head, very exacting guarantees of power and efficiency were required, with the understanding that carefully conducted tests would be made. It is the writer's purpose to describe briefly the general layout of the plant, but more particularly to outline the power, efficiency and speed-regulation tests at the plant.

Fig. 1. Generating Room, Grand Rapids Station of Centralia Pulp & Water Power Co.

Generating Station

The appearance of the generator room is seen from Fig. 1. Fig. 2 gives a cross-sectional view through one of the main turbine pits. Simplicity is the keynote of the entire plant. The headgate arrangement in particular is extremely plain but ingenious, and has proved very satisfactory in actual operation. The headgate slots are in the main generator room. Each turbine pit has a center column as the span is too great for a single gate. Two gates of structural steel are provided and are ordinarily kept in a slot at the end of the power house. They are provided with eye-bolts and lifting hooks so that they

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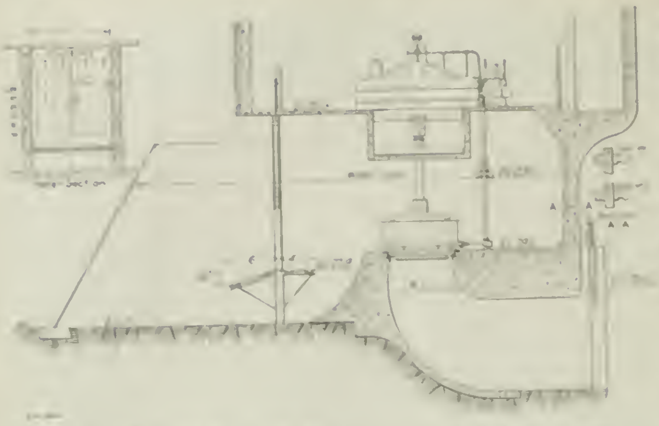


FIG. 2. CROSS-SECTION THROUGH A MAIN UNIT, SHOWING TEST ARRANGEMENTS

can be easily handled by the station crane. Wooden sills are provided at the bottom so as to insure practically a water-tight fit. For most extreme conditions, a few shovel-fuls of cinders serve to make the gate so tight that a 6-in. [illegible] drain will carry away all leakage. This drain is placed along the sloping face of the concrete immediately upstream from the turbine proper, so that the pit floor around the turbine is absolutely dry. One of the main gates is provided with a filler gate so as to prevent the necessity of lifting the gates against full operating pressure. Besides the trash rack at the station, there is additional protection against floating material, particularly ice, by a concrete guard structure at the forebay entrance adjacent to the dam. An apron extends some feet below water surface, and between supporting piers is a special trash rack with bars on [illegible] centers.

The plant comprises four [illegible] r.p.m. hydro-electric units designed for a normal head of 13 ft. Two [illegible] exciter units are provided, one turbine driven and the other motor driven. Power is transformed from [illegible] volts to [illegible] by three [illegible] single-phase oil-filled water-cooled transformers, one spare is provided. The energy is transmitted about [illegible] miles to the paper mills in Nekoosa and Port Edwards [illegible].

Main Units—The main units are of the three-bearing type, with the thrust bearing located on top of the generating housing so that the main shaft is [illegible] in tension. This places the most important working parts on a single operating floor [illegible] a light concrete floor underneath the generator [illegible] below the rotor and around the [illegible] from which the [illegible] and oil pumps are driven. [illegible] through this connecting floor, which runs the entire length of the building, [illegible] in the separate [illegible]. The weight of each generator frame and rotating part of the unit is carried on concrete and steel beams which span the turbine pit. The entire unit, including turbine, generator and governor, was designed together to [illegible] parts, to [illegible] from all [illegible] and, in particular, very close speed regulation.

Not only the runner but also the entire guide case and [illegible] of the same design as the [illegible] model. The runner (Fig. 3) is constructed of plate steel vanes cast-welded to a cast-iron crown plate and discharge ring. The runner has a nominal diameter of 68 in., the outside diameter being about 8 ft. The main turbine guide bearing is located on the cover plate immediately above the runner, and is of the water-lubricated lignum-vitæ type with adjustable bearing blocks. The cover plate itself is rigidly connected to the walls of the pit by cast-iron columns in order to insure absolute alignment.

As is common in low-head plants of this kind, the desirable limits of excavation practically fixed the form of the draft tube. This was built of gradually increasing sections, the exit velocity being under 3 ft. per sec.* The exciter turbine is provided with a straight, tapered draft tube of plate steel, as the turbine is of such size (28-in. runner) that a prohibitive amount of excavation was not required.

The generators are designed with a heavy upper housing, which contains the upper steady bearing and supports the main thrust bearing. The collector rings are located on a shaft extension above the thrust bearing, the leads to the rotating field being carried down through the shaft (bored out) to the rotor. The rotor itself has a very heavy rim in order to assist in securing the close speed regulation required for a paper-mill supply.

FIG. 3. LOW-HEAD HIGH-SPEED RUNNER AT GRAND RAPIDS TURBINE

The thrust bearings are of the plane-disc type, the rotating surfaces operating submerged in a bath of oil. They are [illegible] and the rotating [illegible]

*[illegible]

produces a continuous circulation of oil. Water-cooling coils are placed within the housing. The bearings run at a temperature very slightly above room temperature.

The governors are of the oil-pressure type and are direct-connected to the gate-operating mechanism without the use of any gearing. Lost motion in the mechanical connections has been reduced as far as possible. The regulating shaft is of very large diameter to reduce torsional deflection. The flyballs (inclosed) are driven from a horizontal jackshaft geared to the main shaft. A rotary oil pump (250 lb. pressure), belt driven from the same jackshaft, together with the regulating cylinder, is located in the governor housing which supports the flyballs. The receiving tank is located below this housing, while the pressure tank (plate steel) is located at some distance. Cold-drawn seamless steel tubing with rolled flanges and brass valves is used for the distribution of oil.

The main generating equipment, including turbines, governors, generators, exciter sets and transformers, was furnished by the Allis-Chalmers Manufacturing Co., the exciter governor by the Woodward Governor Co., and the switchboard by the General Electric Co.

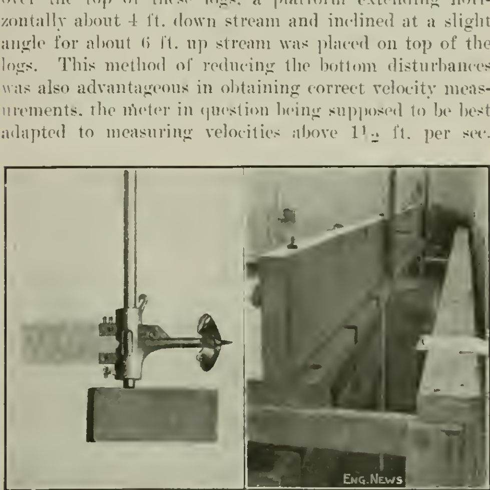
Tests

Careful tests were made to determine the capacity, efficiency and speed regulation of the machinery as installed. Furthermore, the unit was permitted to operate at full runaway speed with the turbine gates wide open and with no load on the generator. In determining capacity the output of the generator was measured by two single-phase indicating wattmeters (laboratory instruments), which were calibrated both before and after the tests. For determining efficiency it was necessary to obtain also the exact operating head and the quantity of water consumed. Speed-regulation tests were made by building up successively the various loads desired, suddenly opening the main generator switch and noting both the speed rise and the time required to resume normal speed.

The operating head was measured by special head and tail gages set and checked before the test work was performed and rechecked afterwards by means of a surveyor's level. Gage barrels were made of 1-in. iron pipes capped at their lower ends and drilled with a large number of ½-in. holes placed on a vertical line. These were wedged into the gate slots in such a position that the holes were flush with the side walls of the flume and the flow of water was tangent to them. Tin floats were used, provided with ¼-in. iron rods which extended up to a gage board. It was feared that the use of iron barrels would cause more or less trouble in midwinter work, but very little difficulty from freezing was experienced, even though the temperature was from 10 to 20° F. during most of the tests.

The quantity of water was measured immediately up stream from the turbine by determining the average velocity past a measuring section of known area. (See Fig. 2.) In determining average velocity, the flume was divided into squares approximately 2 ft. on a side, and the meter rig so arranged that the meter could be placed at the central point of each of these divisions. Depending on the depth of water, either 12 or 18 individual readings were taken for each run. The average of these readings, as determined by integrating the velocity curves, was taken as the average velocity over the cross-section.

It was originally desired to measure the velocities in the flume exactly as it is used in ordinary operation, but examination of the flow conditions by means of an indicator showed that the abrupt rise in the flume bottom immediately down stream from the only available measuring section caused a considerable disturbance and eddy currents which would introduce decided inaccuracies in the determination. On this account a tier of stop logs about 6½ ft. high was placed in the bottom of the gate slot, the top of these logs being slightly below the level of the turbine base. In order to reduce disturbances over the top of these logs, a platform extending horizontally about 4 ft. down stream and inclined at a slight angle for about 6 ft. up stream was placed on top of the logs. This method of reducing the bottom disturbances was also advantageous in obtaining correct velocity measurements, the meter in question being supposed to be best adapted to measuring velocities above 1½ ft. per sec.



Figs. 4 and 5. Current Meter and Position Frame

The only other effect of this stop-log arrangement is probably to the disadvantage of the turbine in that the higher velocities resulting from its use will probably produce more disturbance in the turbine pit, but this effect was considered to be negligible, as average velocities at all times were below 3 ft. per sec.

An accurately rated current meter of the screw type was used (an Ott instrument furnished by the Keuffel & Esser Co.) and is shown in Fig. 4. This was supported at the lower end of a 2-in. pipe which was drilled and arranged so that it could be readily shifted from one position to another, either horizontally or vertically. A plank support was provided, as shown in Fig. 5, to facilitate shifting. The arrangement was very simple, but worked out very satisfactorily in actual use, it being possible to take the 12 or 18 readings in about 35 min.

The number of revolutions were counted simultaneously by two observers. Practically all readings were over ½ min. in duration. Two telephone receivers were inserted in the meter circuit so that the observers could check one another. Alternating current was used to operate these receivers, and proved very satisfactory, as absolutely no difficulty was experienced with the contact points of the meter. It might be mentioned that the meter in question was equipped with two contact points so arranged that the buzz was divided into two parts, one short and one long. This arrangement was provided for

TABLE I. SUMMARY OF EFFICIENCY TESTS, CENTRALIA PULP & WATER POWER CO., GRAND RAPIDS, WIS., DEC. 28-30, 1913

Run No.	Day (1)	Gate Opening (4)	Av. Water Elev. (6)	(7)	(8)	Section Area Sq. Ft. (9)	Mean Vel. Ft. per Sec. (10)	Generator Kw. Output (11)	Losses (12)	Input (13)	Turb. Input Net Eff. Head (19)	Cu. Ft. per Sec. (21)	Hp. (24)	Turb. Output Hp. at Gen. Coup. (26)	Per Cent Capacity (27)	Plant Effy. Overall (31)	Turbine Effy. Guarantee (32)	Turbine Effy. Obtained (33)	
1	Dec. 28	[illegible]	[illegible]	[illegible]	[illegible]	207.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	Overgate
[illegible]	Dec. 28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	Overgate
[illegible]	Dec. 30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	445	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	Dec. 30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Dec. 30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	Overgate
[illegible]	Dec. 29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	470.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	479.[illegible]	13.74	[illegible]	[illegible]	[illegible]	[illegible]	78.0	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13.77	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		74.00	Overgate
7	Dec. 30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	88.10	
[illegible]	Dec. 30	[illegible]	[illegible]	[illegible]	[illegible]	130.1	1.74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	71.80	
[illegible]	Dec. 30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	84.6	87.20	

[1] [illegible] for check of capacity. An approximate determination of efficiency is available by means of taking [illegible] readings at [illegible] [illegible]. From the [illegible] [illegible] between [illegible] velocity [illegible] and the [illegible] at these two points [illegible]. The [illegible] to determine the approximate velocity for these [illegible] as shown in Col. 10, and from these [illegible] were [illegible].
[2] Turbine output horsepower [illegible] generator input (Col. 13) converted, plus 3 hp. used in oil pump.

TABLE II. SPEED REGULATION TEST, DEC. 30, LOAD THROWN OFF

Time Dec. 30	Load Change, Hp.	R.p.m. Normal	R.p.m. Max.	Sec. before Speed Becomes Normal	% Speed Rise Guaranteed	% Speed Rise Obtained
[illegible]	172	[illegible]	[illegible]	22	10.0	3.2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15.[illegible]	6.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

detecting immediately any reversal of flow in the measuring section.

The test in general was kept as simple as possible, only the [illegible] data being taken. These data, together with all the various calculated efficiency results, were tabulated and more in detail than shown in Tables I and II. The column numbers, (1), (4), (6), (7), etc., are retained as on the original sheet to show the omissions necessary here. The missing data cover (2) (3) time beginning and end of run, (5) governor dial, (14) generator horsepower, (15) to (18) generator volts, amperes, field and power factor, (20) head variation, (22) foot-pounds per second turbine input, (23) oil-pump horsepower, (25) foot-pounds per second turbine output,

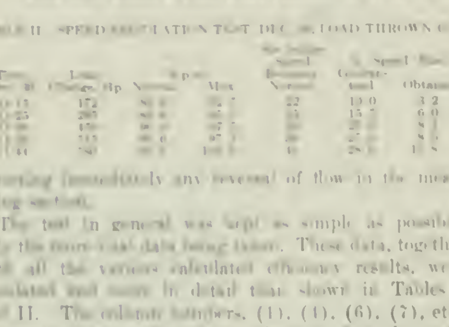


FIG. 6. [illegible]

(28) [illegible] horsepower, (29) per cent [illegible] power, (30) foot-pounds per second [illegible] output. In Table II the load [illegible] in kilowatts has been omitted and the [illegible] readings. Fig. 6 gives the important results in graphical form.

In all of this work, a careful record was kept of the actual gate opening in inches in order that a direct comparison with the Holyoke performance might be possible. [illegible] the drawing [illegible] of the Holyoke curve shown in Fig. [illegible]. It will be noted that a maximum turbine efficiency slightly in excess of 88% was obtained in the power-plant setting. While this efficiency is the highest reported to date on authentic test for a plant of this nature, the inference may be directly drawn that the power-plant setting was not quite so favorable as was the Holyoke setting on a runner of similar characteristics. The difference is undoubtedly traceable to the effect of the more favorable draft tube and to the relatively larger flume at Holyoke. For the plant efficiency overall, considering all turbine and generator losses as well as those in the thrust bearing, governor and governor drive, a maximum of 83.5 was reached. Several of the runs were at "over-gate" points. These were possible by reason of the fact that the gate stops were set back to permit of securing maximum capacity under lower than normal head. The characteristics of the runner are such that the full gate opening is not an over-gate position for heads around 10 and 11 ft., whereas it is very markedly so under heads in excess of normal such as existed during the runs in question.

In making the velocity determinations, the mean readings at the various points were plotted in curve form, these curves being made for both the horizontals and verticals. Fig. 7 shows the vertical velocity curves from which the mean horizontal curve shown at the right of Fig. 8 is drawn. Fig. 8 shows the individual horizontal velocity curves from which mean vertical curve shown at the right of Fig. 7 is drawn. The average velocity was obtained from these curves by means of a planimeter, and the two different determinations checked in all instances well within 1%.

The mean horizontal curve shown at the right of Fig. 8 [illegible] as indicating the distribution of velocities across the flume. It will be noted that the turbine is placed symmetrically in the flume and that the major portion of the water passes to the left, looking downstream. This is in direct accordance with the theory of spiral flow in a runner and affords [illegible] a direct indication that the turbine should be placed slightly to the right of the center line of the flume (looking downstream). The turbine rotates in a right-hand direction, and moving it slightly away from the center line tends to provide larger flowage [illegible] between the guide vanes and side wall where the flow is indicated as being the greatest. This point probably has very little influence on power-plant performance in an installation of this nature, but the indication is commented upon as having more or less bearing on installations of this type where higher velocities are involved.

Results of the overspeed tests are shown in the following table:

Gate Opening In.	Speed (Field Not Excited) R.p.m.	Speed (Field Excited) R.p.m.
1¾	90.0	....
2	91.5	....
3	105.0	....
4	115.0	....
5	120.0	....
6	126.0	....
7	130.0	....
7½	132.5 (147%)	130.5 (145%)

This overspeed run is of interest as indicating what may be expected in actual installations of this nature. The runaway speed of the runner in the Holyoke flume was between 65 and 70% above normal. The effect of windage and friction is very much in evidence in the reduction of this amount to approximately 50% above. Furthermore, the effect of an excited field was somewhat less than was anticipated, as it only affected the overspeed about 2%.

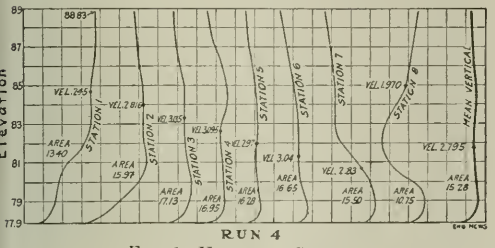


Fig. 7. Vertical Curves

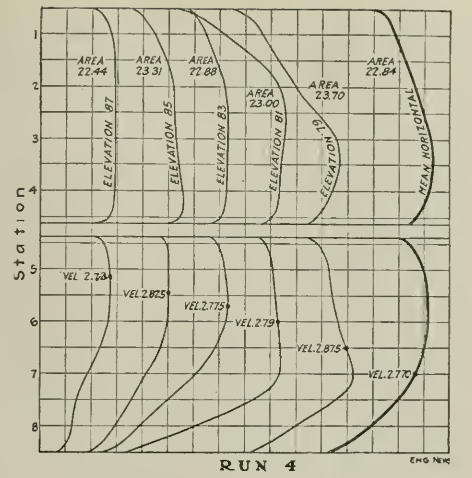


Fig. 8. Horizontal Curves

Velocity Curves Plotted from Meter Readings

Prior to and during the tests, the various methods used were discussed and gone over fully with the representatives of the Centralia Pulp & Water Power Co., G. E. Ackerman, of the Jacobson & Ackerman Engineering Co., of Minneapolis, who designed and installed the plant, and E. C. Gleason, of the engineering department of the Nekoosa-Edwards Paper Co. All points of importance were agreed upon as far as possible before the tests proper, and additional points that came up during the runs were taken up and settled to the satisfaction of all concerned. Gardner S. Williams, consulting engineer, Ann Arbor, Mich., was present during the tests by invitation from the Centralia Pulp & Water Power Co., and very kindly volunteered comment and suggestion. The tests were in charge of the writer under direction of W. M. White.

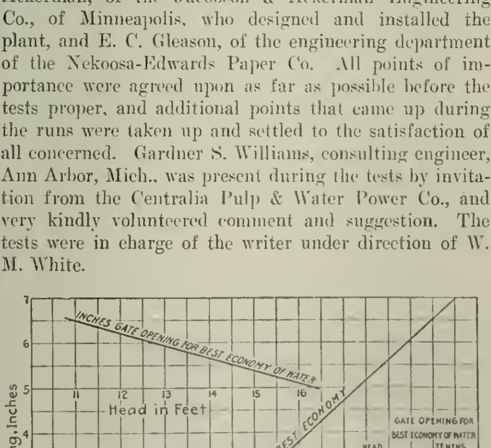


Fig. 9. Curve of Most Economic Gate Opening

At the termination of the tests the head and tail gages were carefully checked over. The check on the tail gage in No. 2 race showed that the gage was slightly off, in such direction and amount that the efficiencies calculated from the test readings should be reduced about ½%. Similar check on the gage in the forebay at the meter section showed a slight error, this being of such amount and direction that the efficiencies as calculated from readings should be increased $\frac{6}{10}$%. It was agreed that the two errors would balance, consequently no account is taken of them. After the tests, the wattmeters were carefully checked and were found to be accurate within $\frac{2}{10}$%. The greatest possibility of error lies in the measurement of the water and in the instrument transformers used for the wattmeters. As regards the former, measurements by the same meter under less favorable conditions of flow have checked within $\frac{4}{10}$% with simultaneous measurements made by a standard Francis weir. As regards the second error, which comes about by reason of the fact that the wattmeters were not calibrated in connection with the instrument transformers which they were used with, it may be stated that similar calibrations have shown maximum errors of about ½%.

Taking into account the above limitations and allowing for the fact that some inaccuracies may counterbalance others, it is believed that the major runs of the tests are accurate within less than 1%.

While the primary purposes of the test work were fulfilled in showing that the machinery exceeded the guarantees of performance, two additional features were of even greater interest. One of these items is of interest to engineers in general and has to do with the extent to which Holyoke test results on model runners may be taken to apply to a power-house setting. Analysis of the Holyoke test sheet as shown in the upper curve of Fig. 6 shows only slight but varying discrepancies in efficiency which are directly traceable to the limits of flume and draft tube.

The other item is of greatest value in connection with future operation of the plant. The record kept of actual gate opening as well as governor-dial reading made pos-

sude an analysis of power-house performance at the same under varying loads. In the operation of the plant, more or less small fluctuations will always be experienced on account of the variations of flow of the river, which may be increased by the operation of plants upstream (some under development), and because the pondage is limited. As the maximum output is desired at all times, it becomes of vital importance to operate the units to best advantage at all loads. Fig. 9 was based directly on the test data taken in the plant and at Holyoke, and shows graphically and in tabular form the approximate gate opening giving most economical performance at all loads.

The importance of test work of this nature and its influence on improvements in design are beginning to be more fully appreciated by power owners as well as by engineers and manufacturers. When it is considered that the entire cost of the test work described above was under $[illegible], it is evident that the expense involved is slight in comparison with the value of the information obtained, and practically negligible as compared to the entire cost of the development.

If test work of this nature is planned in connection with the initial design of the plant, it frequently occurs that various features tending to simplify the testing may be incorporated at practically no extra expense and not materially affect the commercial operation of the plant. It is hoped that this description in detailing the simplicity of method and low expense involved in carrying out typical work of this nature will serve to further encourage the increasing tendency toward carefully conducted power-house tests.

A Novel Portable Substation for the Berkshire Street Ry.*

The familiar advantages of a railway substation on wheels (insurance of continuity of power at low cost, elimination of idle reserve equipment, quick aid for disabled or temporarily overloaded stations, etc.) have been combined with the benefits of the now popular outdoor-type substation (greater safety of high-tension apparatus and elimination of building structures) by the Berkshire Street Ry. of Pittsfield, Mass., in the car shown by the accompanying illustration.

This portable substation consists of an inclosed operating compartment containing the rotary converter, the switchboard and the electric heaters; an inclosed central room for the lightning arresters; and an open section for the main transformer, the current transformer, automatic oil switches, choke coils, disconnecting knife switches, etc.

The car is all of steel (wood in the flooring) ($1\frac{1}{4}$-in. sheet). At the open end, four vertical and four upper channels form a cross-frame for the disconnecting switches and choke coils. A steel angle-iron frame extends from the cross-frame to a wood block on top of the transformer to protect the horizontal high-tension transformer bushings (brought out thus on account of low clearance). A similar cover protects the incoming-line leads and the connections to the arrester compartment.

The operating-compartment inclosure may be entirely removed for the installation or removal of apparatus. The section of the roof over the converter is also bolted down so that it may be readily removed for installing or dismantling the apparatus when a crane is available. A galvanized-sheet metal ceiling is built on the interior so as to form air pockets between it and the roof sheathing to prevent any direct radiation of heat when the car is standing in the sun and also to drain any condensation or possible leakage away from the apparatus. There are two doors into the converter room, a third between the converter and arrester rooms and one from the latter to the outdoor section.

The trucks have 33-in. wheels and are designed to take a curve of 40-ft. radius. The car conforms to M.C.B. standards throughout for passage over steam-railroad lines. The converter is a three-phase 25-cycle 600-volt 750-r.p.m. synchronous type, with commutating poles. The normal rating is for 300 kw. continuously, 450 kw. for two hours and 900 kw. momentarily.

The important data and dimensions are as follows:

Length overall	38 ft.
Width over eaves of car	8 ft. 4 in.
Maximum width (over side channels)	8 ft. 6 in.
Height overall (including running boards)	11 ft. 6 in.
Height of floor above rails	[illegible]
Total length of inclosed car	18 ft. 6 in.
Length of converter or operating room	11 ft. 6 in.
Length of lightning-arrester compartment	[illegible]
Length of outdoor section	[illegible]
Truck base	[illegible]
Wheel base	[illegible]
Wheels	33 in.
Track gage, standard	4 ft. 8½ in.
Total weight	[illegible] lb.

*From information furnished by the builders of the car described, the General Electric Co., Schenectady, N. Y.

Portable Substation of the Berkshire Street Ry., Pittsfield, Mass.

Location and Construction of Highways in Mountain Country

By F. W. Harris*

SYNOPSIS—This article deals with pioneer road building and road improving—in newly settled countries—when the problem is to get as many miles of good passable highway as possible for a fixed appropriation. The current practice of insisting on a maximum grade of 5% is deprecated and many of its fallacies shown. The construction of mountain highways requires especially light equipment and this requires special methods and implements. The author describes the very successful use of a Bagley dragline scraper on work under his supervision in Washington.

The object of this article is to deal with that type of highway location and construction where the end sought is "all the mileage that the money will build." This is based on the idea that in a new country two miles of good road is better than one mile constructed like a boulevard.

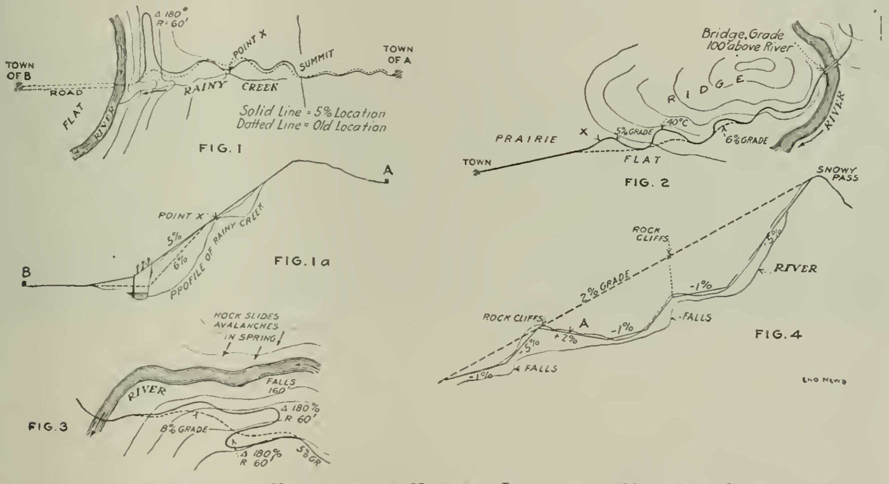
In the far West our problem is not building a particular section of road for a thousand years, but rather building a passable road and allowing posterity the next thousand years in which to improve the road when improvement is justified. By anticipating the wants of our grandchildren we only place such a heavy burden of taxation upon the present generation that *bona fide* efforts for road improvement are discouraged.

All highways are now designed for motor-driven vehicles and these are yearly increasing in efficiency. Observations by the writer show that light cars are a success on roads full of deep ruts and boulders. The light and so called under-powered cars are often given as one of the reasons for establishing a low rate of grade on highways, when in practice such cars have little trouble in ascending 15% grades even on badly surfaced roads.

Maximum Grades—Grade is not an object with the heavier type of motor vehicle; suitable surfacing is the most essential requirement. Automobiles of every rescription travel up 10 and 15% grades in the City of Seattle, Wash. Loaded motor trucks are daily ascending a 12% grade on a country road in the vicinity of Renton, Wash., and this rate of grade is a very common one in the hill country of western Washington.

Trunk-line highways through the mountains located on grades up to 8% will give a much better alignment in nearly every instance than the customary 5% limit now in vogue in this section of the country.

Alignment—Probably half the automobile accidents are due to curvature, and their prevention must be in good alignment, grades receiving secondary consideration. We cannot make our mountain roads fool-proof, but the careful tourist, unfamiliar with the road, is entitled to a chance to dodge the speed lunatics who drive through the hills at 30 mi. per hr.



Figs. 1-4. Examples of Uneconomical Highway Location in Mountain Country

Where the P. C. and P. T. are visible through the long chord of the curve, any degree of curve up to 40° is allowable. Curvature in cuts and around projecting bluffs should be kept down to a limit of 30°, even if the cost of construction is increased at such points.

A farmer or teamster would rather pull up a mile of 8% grade on a good alignment than a mile and a half of curves on a 5% grade, with a possible surprise party awaiting him at every turn of the road.

Examples of Uneconomical Location—The following are a few typical cases taken from located lines. In Fig. 1 the old road is dotted and is on a varying grade of 6% and 7%. The new road is located on a 5% grade. The loop shown was necessary to develop down to the bridge site, for the other side of the river was flat.

The alignment was not the worst feature, however, for

*Recently Locating Engineer, Washington State Highway Commission, Renton, Wash.

at the point *a* the road was almost to the creek, and at the bottom of a narrow ravine, where in November [illegible] little [illegible] the Grand Canal. Had a 7% grade been used at point *b*, and a thousand feet of [illegible] grade used there, [illegible] on a maximum 6% grade, the loop would have been eliminated and the [illegible] on the [illegible] approach to the bridge across the [illegible] would have been cut in half.

In Fig. 3 the elevation on the bridge site was fixed and the ridge [illegible] was followed down to the flat. The [illegible] was used to develop distance as the [illegible] [illegible]. Here [illegible] of 6% grade on the ridge would have eliminated 180° of central angle and [illegible] curves.

Fig. 4 shows a [illegible] development on a steep mountain side [illegible] 5% grade. The development is roughly 2 miles in length. Two [illegible] of 8% would have cut out the loops. The fall of 160 ft. in the river shows how steep the descent is.

To cut out the loops a line was run on the other side of the river, but this was only jumping from the frying pan into the fire, for that side was bare and rock slides and avalanches came down in the months of March and April.

Fig. 5 shows an approach to a typical mountain pass. By breaking grade and following the benches, the cheapest and straightest line is secured. Frequently these benches [illegible] and an adverse grade at point *A* is used. It is better to use an adverse grade than to continue on a straight descending grade and develop around these points. Adverse grades should be frequently used [illegible] of the ground. It will be found [illegible] to [illegible] 20 ft. [illegible] the original [illegible] conditions. Grade should be broken every [illegible] ft. if necessary.

One of the great advantages of a broken grade with an 8% maximum is that it enables the locating engineer to dodge costly construction work such as rock cliffs, bad slides and swamps. A road surveyed on a 2% maximum grade in Fig. 5 would allow the locating engineer no opportunity to avoid costly construction.

Even in the roughest mountain country [illegible] will probably have less than 8% grades.

[illegible]—[illegible] 10 ft. [illegible] on each side of the center line, will make a good map for projecting the location line if the preliminary line is [illegible] the [illegible]. Such a map will [illegible] the use of [illegible] and adverse grades. [illegible] of [illegible] to 1 mile in length can be located in the heart of the mountains.

[illegible] should be [illegible] and curves should be [illegible] from tangents. This [illegible] and results in greater economy. No curve [illegible] 100 ft. in length [illegible]. The location in heavily timbered country [illegible] a total [illegible] [illegible].

CONSTRUCTION

CLEARING WIDTH—Main [illegible] highways through the mountains should have a width of 100 ft. in [illegible] country where [illegible] can be acquired for a nominal sum. This provides for future improvements without the necessity of acquiring a new strip of right-of-way.

SLOPE WALLS—Dry-laid slope walls are a great aid in maintaining alignment on heavy rock work, as it is not necessary to make the rock cuts so heavy owing to the saving in embankment quantities by the use of walls. The thickness of a slope wall at the bottom should be 0.4 of the height; the batter, 0.5 ft. to 1 ft.; the thickness at the top, 1½ to 2 ft., and large stones should be set on top of the wall to serve as a guard-rail. The cost is from 70c. to $1.50 per cu.yd. Italians make good wall builders.

STATION WORK—The season for mountain-road construction is generally short—not over six months. As a rule this work has to be done by station men, and it is generally best to let the work to this class of labor. To that end the work should be made attractive to the station man by keeping the haul down to 200 ft. Work which has short hauls, even with light [illegible], is easily let when good work which involves a haul of 600 to 800 ft. goes begging.

CONSTRUCTION EQUIPMENT—It is always a hard matter to get supplies into a mountain country, so that equipment has to be of light weight, such as picks, shovels, mattocks and wooden wheelbarrows, drill steel and dynamite. This becomes more important where pack-horse trails lead to the work, for then there is no opportunity of hauling material at reasonable cost.

MINIMUM FILLS—In heavily timbered country, where consistent with drainage, the grade should be laid with an average of 2 ft. of fill. This will place the road on as good a foundation as the country affords. Shallow fills of 1 and 2 ft. should be avoided, as any number of inspectors could not watch station men close enough to keep them from making a stumpy fill. For drainage 0.5% should be considered a minimum grade.

DRAINAGE—On steep grades exceeding 5% in sand, clay and earth cuts the side ditches should be filled with 1 to 2 ft. of gravel or small rocks to prevent scouring and undermining the slope. This protection should be done when the finishing stakes are set, as it only requires about one day's heavy rain to pull the toe of the slope in the ditch.

CULVERTS—Timber culverts should be used in new work, as waiting for concrete pipes delays the work. All ordinary timber culverts last ten years and cedar culverts from 20 to 30 years. By the time the culverts are ready to be renewed a better idea of the drainage of the country is obtainable and facilities for hauling cement are [illegible].

[illegible] AND EXCAVATION—It is not advisable to attempt too much refinement in balancing quantities. Excavation should run about 1½ cu.yd. to 1 cu.yd. of embankment.

In timbered country 10% of the total excavation can be considered as [illegible], as it consists of [illegible] logs, roots, etc. Another 10% should be deducted for quantities lost in [illegible]. These percentages to be increased to 15% on each [illegible] where excavation averages less than 4 cu.yd. [illegible]. These percentages also vary with the locality. In the [illegible] Mountains in Idaho they would be about 5% in each case. On the western slope of the Cascades on the Washington and British Columbia coast 15% would not be too high.

ROAD-BUILDING MACHINERY—A great many attempts have been made to use machinery on mountain roads, but these have generally ended in failure. The most common-

ful machine in use that I know of is the Bagley scraper* and a logging donkey engine.

The donkey is first used to clear the right-of-way of logs, stumps, etc., and when this is done the scraper is attached to the same line. The accompanying illustrations show the manner in which this is done.

To work these scrapers successfully their limitations must be recognized. They are useless in mucking out solid rock. They handle all kinds of loose earth, gravel and boulders containing from 1 cu.ft. to ½ cu.yd. The material must be loose. When conditions are favorable they handle from 500 to 1000 cu.yd. per 10-hr. day.

A Bagley scraper can under favorable conditions handle excavation at 7c. per cu.yd., wherever a large fill is to be made with a short haul and the material is sandy or gravel. On general road work where time is lost in moving up, splicing lines, removing large boulders, etc., the average cost for handling material is from 15 to 20c. per cu.yd., to which must be added from 3 to 5c. per cu.yd. for finishing, as the scraper leaves the work in rough shape.

On the particular work shown in the illustrations two Bagley scrapers were in use, each having a capacity of 2½ cu.yd. One donkey engine was 11x13 in. in size; the other 10¼x10½ in. The advantage of the large size is that there are no delays waiting for steam pressure. The wire cables had the following dimensions: Main line, 1⅜ in. in diameter; haulback, ⅞ in.

Cost Data—The crew consisted of:

Foreman	$6.00 per 10-hr. day	
Engineer	3.50	
Fireman	2.75	
Hook tender	4.50	
Pump man	3.00	
2 rigging men, $3	6.00	
		$25.75
1 team hauling fuel, or 2 men cutting fuel on right-of-way		6.00
Fuel		10.00
Use of donkey, including depreciation of lines, etc.		10.00
Finishing gang—		
2 teams and teamsters, $6		12.00
4 laborers, $2.50		10.00
		$73.75

Assuming 400 cu.yd. for an average day's work the cost was 18½c. per cu.yd.

Where this output is cut down by encountering large boulders and rock ledges, the classification of excavation as rock offsets the decreased yardage to a slight extent. Changing the classification is not much help, as the scraper is only a money maker in good digging. Its use requires a very competent foreman and a first-class crew to handle the lines; a green outfit could not earn their board.

With plenty of fuel and water, with a short haul for the material not exceeding 400 ft., the scraper should average at least 400 cu.yd. per day.

The steam shovel is not adapted to mountain work, as it cannot pull itself around the way a donkey engine can, and the handling of cars on 5% grades is both difficult and dangerous. If it is impossible to avoid bad slides or swamps, these can be handled with a scraper at a minimum expense. The donkey-engine boiler can also be equipped with an oil burner to still further cut down haulage.

In light earth and gravel cuts a 2½-cu.yd. scraper will push another ½ cu.yd. of material ahead with a 200-ft. haul; it can easily move 1000 cu.yd. in ten hours. It may not be amiss to add that the scrapers do efficient work on channel changes and in loading gravel into bunkers from river beds. In channel change work the hitch should be placed so that the scraper is pulled upstream.

Bagley Scraper on Mountain Road Construction in Washington

Grade Stakes—The draglines tear out all slope stakes the first thing. The best system for referencing is to mark a tree as nearly opposite the stake as possible, or drive a heavy stake with the two cuts or fills marked on it and also a distance to the center line; thus,

C 4.0 C 8.0 Center 42.4 C 12.0

The last cut of 12.0 is an H. I. for getting grade; 42.4 is distance to the stake on the center line.

The road foreman sets off these reference distances using a hand level and a 16-ft. rod with the feet and five-tenths marked. At every foot is a small hook and to it is attached the ring at the end of a 50-ft. steel tape. The hook tender acts as rodman so that there is no waiting for the engineer to give grade. The engineer follows behind the donkey setting grades for the finishing gang.

With a crew that understands keeping their lines and grades, good progress can be made where, if they had to stop and wait for an engineer to give grade, the construction crew would be idle half the time.

*Described in "Engineering News," Feb. 1, 1906, Mar. 21, 1907.

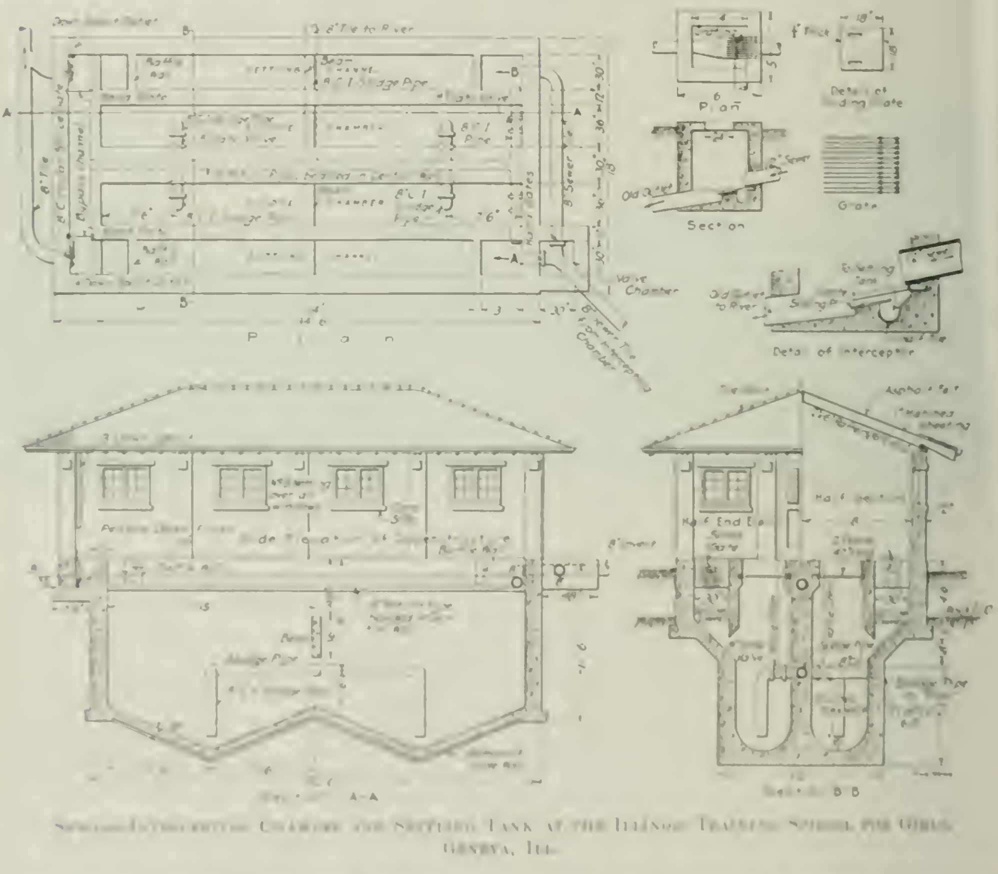
Sewage-Intercepting Chamber and Settling Tank for a Public Institution at Geneva, Ill.

At the Illinois State Training School for Girls, at Geneva, Ill., there are two sewage-settling tanks serving different sections of the institution, with capacity to take care of the sewage from a population of 600 and 400 respectively. The accompanying drawings represent the larger plant. At present the tank effluent is discharged directly into the Fox River, but some further treatment of the effluent may be required later. The tank is built close to the river bank and about 1000 ft. from the buildings which it serves, but is not visible from the buildings.

Originally the sewage was discharged at the east bank of the river through an outlet sewer. This sewer is now fitted with an intercepting chamber (A, B), constructed as shown in the accompanying details. The ordinary sewage flow falls through a grating into a trough leading to an 8-in. tile pipe to the treating plant. Sticks or other large objects are caught by the grating and carried forward to the old outlet. The main sewer from the institution receives the roof water, and any heavy stream of storm water flows across the trough to the old outlet sewer. An adjustable sliding plate provides for regulating the amount of flow to be caught by the trough of the interceptor.

The tank, as shown by the plan and sections, has two settling channels and two sludge chambers. These, normally, are to be operated in series, and with the direction of flow alternating in opposite directions, thus insuring an even distribution of the sludge. Thus the sewage at *A* flows through the first settling channel to the by-pass channel and then through an 8-in. return pipe in the central wall to the head of the second channel at *B*. From the lower end of this channel it enters the outlet pipe to the river. By adjusting the gates, the sewage may enter first at *B*, flowing to the by-pass channel and return pipe, and entering the second channel at *A*. If necessary, either channel can be operated independently, the sewage entering at the upper end and the effluent discharging into the outlet pipe at the lower end. The flow line in the channels is about 13 ft. above normal water level in the river. The rate of flow in the settling channels is about 40,000 gal. per day.

The unusual form of the channels and sludge chambers is designed to give ample capacity and to prevent the flow in the channel from interfering with or disturbing the sludge as it settles in the upper part of the chamber. In the longitudinal direction, the chamber forms



SEWAGE-INTERCEPTING CHAMBER AND SETTLING TANK AT THE ILLINOIS TRAINING SCHOOL FOR GIRLS, GENEVA, ILL.

two settling hoppers, into each of which depends the vertical end of the 8-in. sludge pipe. The sludge pipes unite in an 8-in. discharge which extends to the river.

The tank is of concrete, in proportions of 1 : 2 : 4. The water surfaces are given a smooth dense finish by waterproofing. The tank is covered by a concrete building with a stucco finish and a red tile roof.

Both of the tanks at the school were designed by the W. S. Shields Co., consulting engineers, of Chicago, and are now being built by the Nash-Dowdle Co., also of Chicago. The contract price of the two plants complete, including the intercepting chambers and the river outlets, which are short, was about $5800.

An Ambulance Train on an English Railway

In no previous war in the world's history have such measures been taken for the rescue and care of the wounded as are now being adopted in Europe. In all the countries now engaged in war, special trains have been fitted up for the transport of those of the wounded able to bear the journey from the field hospitals at the front to permanent hospitals in cities far removed from the scene of action.

INTERIOR OF A HOSPITAL CAR ON THE GREAT EASTERN RY. OF ENGLAND

The accompanying view shows the interior of one of the cars of an ambulance train on the Great Eastern Ry. of England. It might be thought that the English compartment cars, with side corridor, would be better adapted for hospital purposes than the American type of car with its central passageway. The latter, however, has the great advantage of providing a much larger amount of accommodation in a given space

To adapt the English car to its new use, therefore, the compartment partitions were removed and all the side doors were permanently fastened, except one pair at the end of the car formerly used by the guard and luggage. Wooden studs were then fastened to the car sides and to these were secured two tiers of hinged metal berths arranged to fold up against the sides of the car when not in use. The lower berth has its outer edge supported by legs extending to the floor and the upper berth by inclined struts running back to the side of the car. The limitations of English rolling stock make this arrangement less roomy than would be possible on an American railway. In the car illustrated, the clear width inside is 8 ft. 9 in., and the berths are 2 ft. 6 in. wide.

Besides the cars made up with berths in this way, other cars of this hospital train contain accommodations for the surgeons and nurses to attend the wounded. There is a kitchen car for the preparation of food, compartments containing medical and surgical supplies, an office for the chief surgeon in charge of the train and an operating room.

Bacteriological Standards for Drinking Water Supplied in Interstate Commerce

Bacteriological standards of purity for drinking water supplied to the public by interstate common carriers were promulgated on Oct. 21, 1914, by W. G. McAdoo, Secretary of the Treasury (acting in behalf of the U. S. Public Health Service), as follows:

The following are the maximum limits of permissible bacteriological impurity:

1. The total number of bacteria developing on standard agar plates, incubated 24 hr. at 37° C., shall not exceed 100 per c.c. Provided, that the estimate shall be made from not less than two plates, showing such numbers and distribution of colonies as to indicate that the estimate is reliable and accurate.

2. Not more than one out of five 10-c.c. portions of any sample examined shall show the presence of organisms of the bacillus coli group when tested as follows. [Technical details omitted here.—Editor.]

3. It is recommended, as a routine procedure, that in addition to five 10-c.c. portions, one 1-c.c. portion and one 0.1-c.c. portion of each sample examined be planted in a lactose peptone broth fermentation tube, in order to demonstrate more fully the extent of pollution in grossly polluted samples.

4. It is recommended that in the above-designated tests the culture media and methods used shall be in accordance with the specifications of the committee on standard methods of water analysis of the American Public Health Association, as set forth in "Standard Methods of Water Analysis" (A. P. H. A., 1912).

The standard given is one recommended by a commission of 15 chemists, biologists and sanitarians appointed by Secretary McAdoo on Jan. 22, 1914.*

In concluding its "progress report," the commission states:

In submitting the recommendations herewith presented it may be again emphasized that the limits defined are recommended with reference solely to the special object of the control of the supplies of common carriers, having in mind that these supplies constitute a special case because of the following reasons:

1. The supplies come from widely diversified and mixed sources.

2. Samples taken from common carriers represent water stored for various lengths of time under varying conditions.

3. In view of the impossibility of accurately ascertaining the source and history of each supply examined reliance must be placed upon the results of laboratory examination to a greater extent than is necessary or justified in estimating the quality of a supply from a known source with a known history.

It is requested that the recommendation of these hard-and fast limits of bacteriological impurity be not interpreted as

*The names of the members of the commission, a "progress report outlining the problem which confronted the commission, and fuller technical details for determining the standards are printed on pp. 2959 to 2966 of "Public Health Reports" (Washington, D. C.) for Nov. 6, 1914 The chairman of the commission is John F Anderson, Director Hygienic Laboratory, U. S. Public Health Service, Washington, D. C.

[illegible] in general. It [illegible] in order to form an [illegible].

[illegible]

Use and Tests of Unscreened Gravel: Illinois State Highway Department

By [illegible]

For a number of years the Illinois Highway Department has [illegible] the use of unscreened or pit-run gravel for concrete in the building of highway bridges.

The specifications provide that such gravel be of standard quality and that cement be proportional to the sand

FIG. 1. GRAVEL-TESTING OUTFIT USED BY THE ILLINOIS STATE HIGHWAY DEPARTMENT

[illegible] in the gravel. For instance, "Class A" gravel concrete must contain 1 part of cement to each $2\frac{1}{2}$ parts of sand, [illegible] the resulting concrete may vary from the equivalent of a 1 : $2\frac{1}{2}$: [illegible] mixture to a [illegible] mixture. Sand is defined as that portion of the gravel which will pass a $\frac{1}{4}$-in. screen.

[illegible]

[illegible]

[illegible]

It is somewhat unusual in testing a carload of unscreened gravel to find a total variation of more than 5% in the sand content. It is not unusual to find as great a variation as this in aggregate artificially proportioned by methods in common use.

GRAVEL TESTER

In order to facilitate making tests of unscreened gravel, the writer devised the testing outfit shown in the illustration, Fig. 1.

At the left is shown the testing can, which is provided with a close-fitting telescope cover. The testing can serves also as a convenient carrying case when provided with a shawl strap as shown.

The various articles to the right nest one within the other from right to left and fit in the main receptacle or testing can. There is room also to pack the inspector's hand level, a 50-ft. steel tape, a 5-ft. folding rule, and, if not too bulky, a set of bridge plans. Fig. 1 shows only the articles used in testing. All of the articles except the scale and the 200-c.c. glass graduate are made of galvanized iron.

The testing can is [illegible] in. in diameter and without the cover is exactly 10 in. deep inside. The scale is 10 in. long and is graduated to inches and tenths.

The screens used by the Illinois Highway Department have $\frac{1}{2}$-, $\frac{1}{4}$- and [illegible]-in. square openings. The $\frac{1}{4}$-in. screen is used to determine the ratio of sand to gravel. The [illegible] and [illegible] screens are used to check the gradation of the sand and stone, respectively. Obviously, any other set of screens may be substituted if desired.

The can of small diameter is used as a protector in which to pack the glass graduate and for washing sand in making the clay test. The 200-c.c. graduate is used for measuring [illegible] sand and sediment in the water-settlement test for clay.

TESTING GRAVEL

In testing the sand for clay, [illegible] c.c. of sand screened from the gravel are measured by means of the graduate

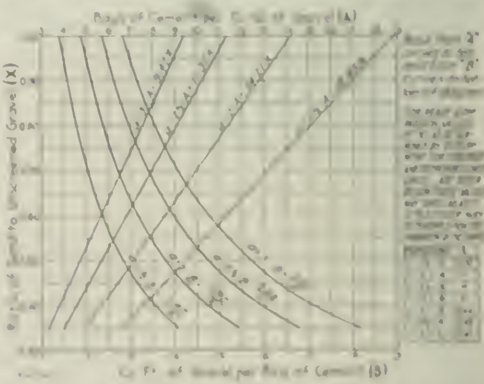


FIG. 2. DIAGRAM FOR USE IN PROPORTIONING CEMENT TO UNSCREENED GRAVEL

and poured into the smaller galvanized can. The sand is then washed repeatedly with clean water until the water runs off clear. The wash water is poured into the gravel can and allowed to settle. When clear, the water is [illegible] down to about 200 c.c., which should contain all the [illegible]

This is poured into the graduate and at the end of three hours, the depth of sediment is read. The reading divided by two equals the percentage of clay.

The results obtained by the water-settlement test (three hours' time) have been found, by a large number of determinations, to be from two and one-half to three times as great as those obtained by dry volume or weight tests. The ratio of the settled volume to dry volume is not constant, but varies with the character of the sediment. If, therefore, the water-settlement test shows between two and one-half and three times the allowed dry volume, the test should be confirmed by a dry volume or weight determination.

It has been found that volumetric determinations of the percentage of dry clay correspond very closely with weight determinations. The water-settlement test is very simple and the only practical one for field use.

A graduate having an internal diameter of about 1 in. is recommended, as the readings may more accurately be made than in tubes of greater diameter.

Washing with repeated changes of water is essential, as all of the sediment is separated. Merely shaking 2 or 3 in. of sand in the tube with clear water and allowing the whole to settle leads to error: first, because of the sediment in the muddy water contained in the voids of the sand; second, there is no check on the thoroughness of the washing, and third, the dividing line between the fine grit and clay is not always distinct.

Repeated changes of clean water separate all of the ediment, and, in addition, the number of changes required affords a means of judging the practicability of a thorough washing of the gravel, if washing proves necessary. Sand containing soft grains may also grind up in the process of washing. The necessity of many changes of water may indicate a material which will grind to powder in a mechanical mixer and is therefore unfit for use.

To test a sample of gravel for sand ratio, the testing can is filled level full with the selected sample of gravel, and the sand and stone are separated by the use of the ¼-in. screen. The sand and stone may be caught on newspapers and poured separately in the testing can for measurement. As the can is cylindrical in form and $\frac{1}{10}$ in. represents $^1/_{100}$ of the depth of the can, the reading of the scale, when placed in the can zero end up, represents to the nearest 0.01 the ratio of the volume of sand or stone to the volume of the original gravel.

The amount of sand or stone in any given volume of gravel may be found by applying these ratios. Convenient formulas may be written for determining proportions. The following notation will be used:

- x = Ratio of volume of separated sand to volume of unscreened gravel;
- y = Ratio of separated stone to unscreened gravel. (For well graded gravel $x + y$ should be from about 1.10 to 1.25);
- a = Required ratio of sand to cement;
- b = Maximum ratio of stone to sand;
- A = Bags of cement required per cubic yard of gravel;
- B = Cubic feet of gravel to use with one bag of cement;
- C = Amount of stone to add to a unit volume of gravel in order that the minimum amount of cement may be used.

Considering one bag of cement to contain 0.95 cu.ft., the following formulas may be written:

$$A = \frac{27\,x}{0.95\,a} = \frac{28.4\,x}{a}$$

$$B = \frac{0.95\,a}{x}$$

$$C = bx - y$$

The following example illustrates the use of these formulas:

Assume that a batch of gravel tests 0.60 sand, and 0.50 stone, and that the mortar ratio is to be as one of cement to 2½ sand.

$$x = 0.60;\ \ y = 0.50\ \text{ and }\ a = 2.5$$

$$A = \frac{28.4 \times 0.60}{2.5} = 6.8$$

$$B = \frac{0.95 \times 2.5}{0.60} = 4.0 \text{ (practically)}$$

If it is desired to add stone to the above gravel in such quantity that the proportions may be represented by the formula, 1 cement, 2½ sand, 5 stone, then $b = 2$ and $C = (2 \times 0.60) - 0.50 = 0.70$.

One bag of cement would be used with 4 cu.ft. of gravel and 2.8 cu.ft. of stone.

The diagram, Fig. 2, is plotted from the formulas for A and B, and affords a convenient method of determining the amount of cement required when unscreened gravel is to be used.

Boiling Test of Cement

The gravel tester may conveniently be used for making the accelerated or boiling test of cement in the field. Temporary wire shelves are fixed in the screen of largest diameter. On these shelves are placed the glass plates, which should be cut roughly circular in form. The screen then forms a rack, which with the pats in place may be placed in the testing can. The testing can then serves first as a moist closet and later as a receptacle in which the pats are boiled. Fig. 1 shows the large-mesh screen arranged with two pats in place. Standard methods are used in making the test.

Conclusions

With the outfit described, after a little practice, an inspector can make a sand test in about 70 sec. It is practicable, therefore, particularly on small work, to test every wagon load of gravel before it is dumped and by dumping loads bearing practically the same sand content in separate piles, the proportioning is very simple.

Ordinarily, two or at the most three separate piles will provide means for fully as exact proportioning of cement as is ordinarily secured with screened materials.

Commonly, however, such frequent tests are not necessary, particularly when the gravel is handled a number of times between the pit and the site of the work as in case railroad transportation is required.

Except in making preliminary tests at the pit, for the purpose of determining what the character of the delivered material is likely to be, it is not necessary or desirable to select representative samples and by mixing and quartering endeavor to secure an average sample.

Modifications of the testing outfit and methods of proportioning described have been used by the Illinois Highway Department on bridge work for several years. The results obtained are considered to be entirely satisfactory. The testing outfit is not patented.

The New York Rapid Transit Railway Extensions*

By F. Lavis†

X--Tunnels in City Streets

The Lexington Ave. Tunnels

With the exception of the tunnels under the rivers, referred to in the next article, practically the only parts of the subway lines as now laid out, to be built as true tunnels, are those under Lexington Ave. for the two lower-level tracks from about 53rd St. to 78th St., and for all four tracks from about 91st St. to 102nd St. The total length of these four sections is about 2.6 miles, of which about 2 miles is to be built in tunnel. The tunnels on Sec. 9 are being driven in part by Messrs. Douglas & Shaller, under a subcontract for P. McGovern & Co. The rest are parts of Secs. 10 and 11, and are being built by the Bradley Contracting Co.

No particularly new methods of driving these tunnels or of handling the material have been used, but some features of the work are of interest on account of the difficult and uncertain nature of the rock which has been encountered. This is the typical gneiss or mica schist which underlies the whole of Manhattan, varying from quite hard to very soft and partially disintegrated material, containing many seams and dipping and striking very irregularly, thus tending to cause slips and slides, which the utmost vigilance and care cannot always avoid. Driving a tunnel, therefore, or even making an open cut through this kind of material under a street carrying heavy city traffic, and with important buildings on both sides of it close to the work, requires most careful methods of excavation.

On Sec. 11, the situation is complicated by the change from double-deck, two-track tunnels, one over the other, to a four-track section, with all the tracks at one level, making a tunnel section of practically rectangular shape 17 ft. high and nearly 60 ft. wide (see Fig. 68).

A power plant which supplies air to all four of these sections was established by the Bradley Contracting Co., at 96th St. and the East River. It contains five compressors, each of a rated capacity of about 2100 cu.ft. of free air per min., which is piped through a 10-in. main to all sections, the distance from the power house to the center of the farthest section being about 1½ miles. Comparatively little trouble has been experienced with this line, though of course, with four contractors and their large organizations depending on one source for their supply of air, there have been times occasionally when all would be working or attempting to work at full capacity and the pressure would consequently drop.

A supplementary compressor of about 1000-cu.ft. capacity, connected to an electric motor, for use in emergencies has been installed in a part of the temporary subway on Sec. 9, at 77th [illegible] St., but so far it has not actually been used. There has been some trouble on the long pipe-line lines with freezing in cold weather, but nothing of importance. The main is carried underneath the decking of the plant.

The Bradley Contracting Co. arranged for the hauling and disposal of the muck from Sec. 9, as well as from all its own sections, so the same type of buckets are used throughout all four sections; they are the so-called bottle-tops already referred to in the article on excavation.

In the tunnels, four small power shovels (Marion model 40) were used for handling the muck in as many headings, where there was room for them, but a great deal of the material was handled by hand shoveling. Some experiments were made with other types of mechanical excavators, designed for use in a more limited space than that necessary for the operation of a shovel, but they were not successful enough to warrant their continued use.

The buckets, placed on small four-wheel cars (Fig. 66, lower view), were hauled back and forth between the shafts and the headings by various means, but no mechanical locomotive power was used. Single-drum air hoisting machines were arranged on platforms above the floor of the tunnel to haul the cars up grade, either the loads out of the heading or the empties back as the case might be, the cars being allowed to coast down grade. A single haulage line was used, the end being carried back by hand or by a mule.

Where the rock was good the full section of double-track was usually taken out by driving a top center heading about 8 ft. high and 12 ft. wide, keeping the enlargement close up. The heading was pulled by the usual V-shaped center cut, with necessary side rounds, 30 to 40 holes 6 to 8 ft. deep, according to the character of the rock, being required for the whole heading. About 5 lb. of 60% dynamite was required per cu.yd. in the headings in hard rock, 40% was used in the softer rock.

In one case a pilot heading was first driven all the way through between two of the shafts to permit better ventilation, especially for the erection of the structure, which it was desired to keep fairly close up to the excavation.

Timbering was required to support the roof in many places, and although segmental timbering was used, the arch was so flat that intermediate supports were almost always required. The original design for the double-track tunnels provided for a reinforced-concrete center wall, but here as in the use of this kind of material in the cut-and-cover sections, where the ground at the street surface required continuous support, it was found to be difficult to make a good job with it. The type of structure shown in Fig. 9 permits the construction of the center wall from the two benches, as shown in outline, before the roof of the structure is built and permits support on the permanent steel structure at once. This method is shown also in the sketch Fig. 77, which shows the various stages of construction in the double deck, double-track tunnels on Sec. 11 and also incidentally the enlargement for the upper level local station at 96th St.

Figs. 69 and 70 show typical methods of supporting the timbering and the rock above, where the latter was generally fairly good. The methods used varied in detail in different headings, but in general were more or less

*Copyrighted, [illegible]

†Consulting Engineer, [illegible], New York City.

ring erected, in the position in which poling boards would usually be driven. These projected forward over the position of the next ring and were blocked up from it after it was erected. This slight variation from the method of placing the lagging provided some protection from small dropping rocks, and was more easily accomplished than driving the poling boards, which would have been difficult in the material excavated.

The general appearance of this timber section is shown in the upper left view in Fig. 66, but in some parts of the work where the ground was particularly heavy, the space between the timber rings was filled with concrete, as soon as possible after they were erected, and the ground overhead was thoroughly grouted. Even then it was necessary to use some temporary supports for the center. Details of two types of timbering used are shown in Figs. 69 and 70.

As is indicated in this latter drawing, the wall plates were sometimes supported on a ledge of rock, but more often were posted down to subgrade when the bench was

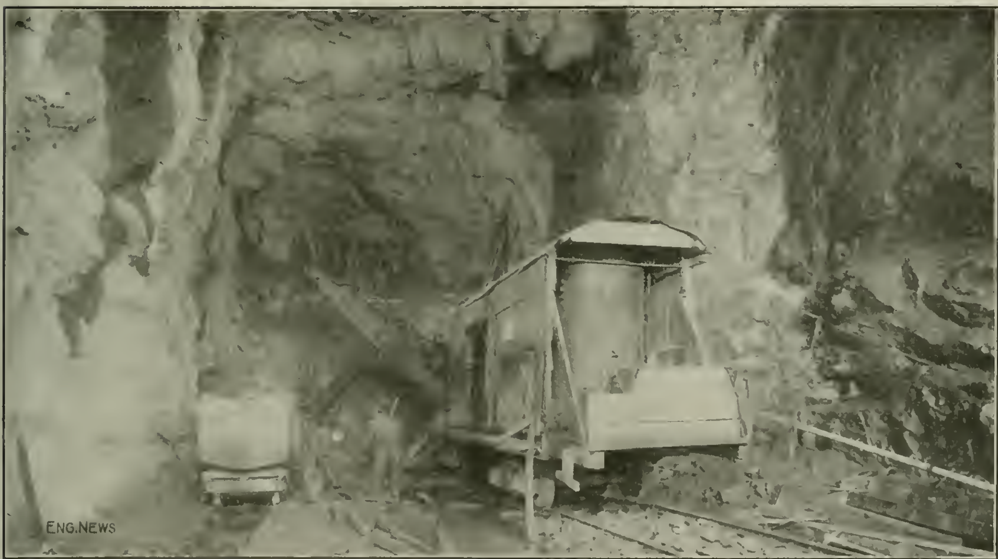


Fig. 66. Views in Lexington Ave. Tunnel

Segmental roof timbering (upper). Shovel and car (battleship) for handling muck (lower).

alike. The flatness of the arch will be noted and the supports on either side of the center wall, permitting the construction of this latter and the transference to it of the load, thus permitting the construction of the two arches.

Near the upper end of Sec. 8 and 9, from 56th to 78th St., very soft disintegrated rock, carrying considerable water, was found, necessitating typical soft-ground tunneling methods. Timbered side drifts were driven for the wall plates, segmental timbering tightly lagged was erected from them with about twelve inches between each ring, crown bars and poling boards were used, but the latter were not usually driven, as the rock would hold for a short time. The method actually used was really to place lagging over the top of the arch in the position of poling boards, wedged down at one end, over the last

excavated. The raking braces shown were usually only used temporarily to help support the wall plate while the posts were set under in very soft material, but occasionally they were left in.

Fig. 71 shows a method of timbering used as part of Sec. 9 south of 78th St., where the rock, while quite hard, required support to prevent slides or the possible movement of large masses. A center top heading was driven and as soon as the enlargement was made, which was kept close up, the timber was erected, as shown in the "first stage" cross-section. In the "second stage" the two pairs of continuous I-beams are placed to span the bench excavation as shown in the longitudinal section in Fig. 70. These I-beams were joined with long splices to develop full strength at the joints and were made continuous throughout the work. The muck from the heading and

DIAGRAMS SHOWING METHOD OF ROOF SUPPORT FROM CENTER PARTITION WALL - SECT II R 5 LEXINGTON AVE

FIG 67

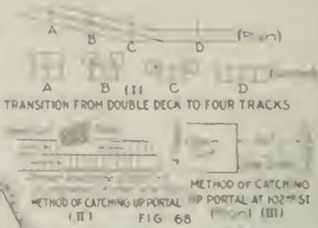


FIG 68

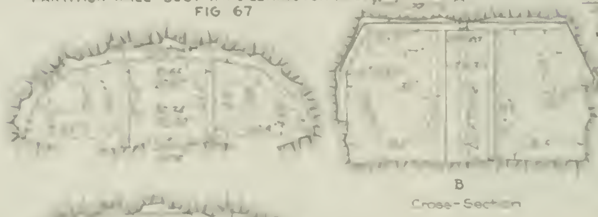


FIG 69 - TIMBERING METHODS. SECTION 8 LEXINGTON AVE TUNNEL

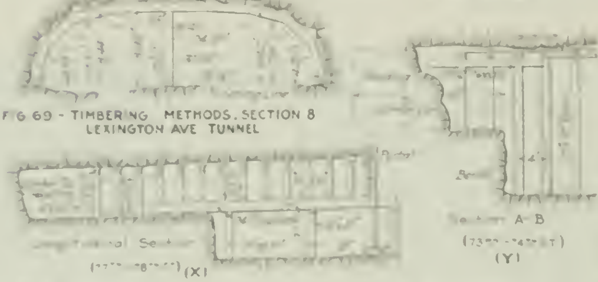


FIG 70 - TIMBERING METHOD SECTION 9 LEXINGTON AVE TUNNEL (X & Y)

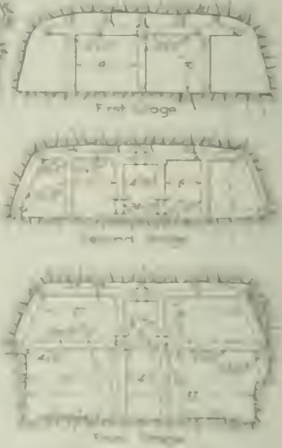


FIG 71 - SKETCHES SHOWING TIMBERING SUPPORTS ETC SECT 9

LEXINGTON AVE TUNNEL

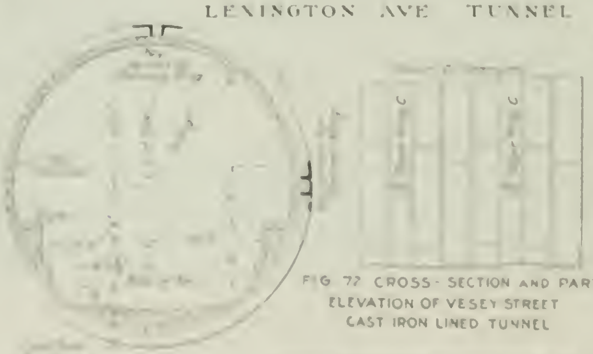


FIG 72 CROSS-SECTION AND PART ELEVATION OF VESEY STREET CAST IRON LINED TUNNEL

FIG 74 - SKETCHES SHOWING MEEMS METHOD OF TUNNELING (a, b, c, d)

VESEY ST TUNNEL

enlargement was brought out in small buckets on the tracks, laid on the cross-braces at the springing line and dumped into the buckets on the tracks below, at a point back of the face of the bench.

All timber is provided and placed by the contractor at his own expense, the cost being included in the excavation price. The extra excavation necessary to place the timbers outside the lines of the structure is also at the contractor's expense, the payment line being confined to the neat line of the structure. Concrete placed between the timbers, however, is paid for where ordered, as is also the grouting.

At some places a center top heading was driven ahead, then the enlargement was made all on one side just large enough to permit the steel and concrete structure for one track to be built in it, then the further enlargement was made for the second tunnel, the top of the center wall forming the abutment for the arch first erected being necessarily braced to the sides until the second arch was erected. This method obviated the necessity of anything but occasional support of the rock where there appeared to be a tendency to slip.

On Sec. 8 and 9, the cut-and-cover excavation for the upper-level tracks was quite generally completed and the structure erected in it before the tunnel underneath was driven. No damage to the upper structure or difficulty of moment has been experienced due to this method of procedure except in one or two cases, where the extremely heavy rains of last fall, working under the completed upper structure, washed some of the material under it, into the excavation of the tunnel below, the heading of which happened at that time to be in very soft disintegrated rock. The upper tunnel structure at this point was temporarily supported by heavy timbers and girders which spanned the washed-out portion and the latter was then thoroughly grouted and the trouble remedied. Close watch was kept at all times of the upper tunnel at points just above the places where work was being carried on below, and any indications of trouble, as were shown in one or two cases by small cracks, were investigated and the ground below thoroughly grouted if this appeared necessary. The efficiency of this grouting under high pressure was shown in one case where grouting was done from below, the grout being forced up into the upper tunnel.

Just north of 98th St., the two upper tunnels spread out, and as soon as they get far enough apart, drop down to the level of the lower tunnels, until all four are at the same grade, as shown in Fig. 68-I. Working from the shaft at 97th St. toward the north, the two lower tunnels are being driven first and the steel and concrete structure erected in them, then the two upper tunnels are to be driven at the sides. The cross-section *C* will show the necessity of this, as it will easily be seen that the corners *X* and *Y* will probably break through, and the character of the rock is such that it would hardly be possible to hold up the mass between.

At the upper end of this section at 102nd St., working southerly in the four-track section (Fig. 68), the method which has been developed and started is based on the idea of driving one side of the tunnel first for a distance of about 80 ft., then erecting the structure in it, then starting the second tunnel, and so on, thereby avoiding having the excavation open for more than the width of one tunnel at once.

Some difficulty was experienced in catching up some of the portals, a typical method of overcoming it being shown in the sketch, Fig. 68-II. At the beginning of the double-deck tunnel just south of 95th St., the lower level was driven through, the steel structure erected and concreted, then the upper level was worked back from the inside to the portal, as shown.

At the portal at 102nd St., where the four tracks are all at one level, a side drift was driven for a length of almost 80 ft., a crosscut was then made from this drift the full width of the structure, as shown in the sketch, Fig. 68-III, and the structure then erected so that the rock was caught up and then the excavation carried back out to the portal.

Vesey St. Iron-Lined Tunnels

On Sec. 1-A of the Broadway line there is a reversed curve where the route passes from Church St. through Vesey St. to Broadway, and the narrowness of the streets makes it necessary to pass under private property at each of the corners. The material for a considerable depth (50 to 60 ft.) below the streets in this section is sand, but it is comparatively dry down to the level of the bottom of the subway structure, which latter is about 4 ft. below M.H.W.

Easements were obtained under the two pieces of private property referred to, namely, the Trinity Parish House and the old Astor Hotel, on condition that the former should be properly supported on new foundations, bridged over the tunnel, and that on the site of the latter (which was razed) suitable foundations for the heaviest type of building should be provided, also, of course, bridged over the tunnel where this passed through them. Under these conditions it was thought desirable to design two separate circular cast-iron lined tunnels or tubes. The two tubes together have a length of about 1200 ft. and will require about 4350 tons of cast iron for the lining and about 17,000 cu.yd. of concrete.

As these sections of iron-lined tunnel are comparatively short, the use of the usual type of pneumatic shield for driving them would have involved a somewhat high cost for plant, chargeable to only a small amount of work. Besides this, the driving of tunnels by the shield method on curves of as small radius as this is a somewhat difficult operation, though on the Hudson & Manhattan R R. there is at the corner of Morton and Greenwich St. a curve of 150-ft. radius, which was successfully driven by the use of the shield. The diameter of these tunnels was, however, some 3½ ft. less than those at Vesey St.

The contractors, Messrs. F. L. Crawford, Inc., adopted therefore, for this work, a method developed by them and their engineer, J. C. Meem, M. Am. Soc. C. E., some years ago in the construction of some large circular brick trunk sewers in Brooklyn and which was quite fully described in a paper presented by Mr. Meem to the Brooklyn Engineers' Club in May, 1905.

This method as modified for the construction of these tunnels is shown quite clearly in the drawings and photographs, Figs. 73 and 74. A top heading is driven, the roof protection being afforded by the five sectional shields or jills, a detail of which is shown in Fig. 74d, and the front end in the photograph, Fig. 73-1. These are shoved ahead by hydraulic jacks, and a lining of 2-in. hardwood lagging put in behind them, under the tail; this is temporarily supported by crown bars and blocking, which

[illegible] the drawing, Fig. [illegible] and [illegible], and the photograph, Fig. [illegible]

[illegible]

[illegible] ... the bottom of the heading.

This permits the advancement of the so-called pilot [illegible] ... the center in the position [illegible]

[illegible] to fit the curvature. The girder flanges are [illegible] angles, and the lattacing [illegible] angles. The girders are 3 ft. on centers held together and braced by [illegible] bars. The roof load of the tunnel, which the girder supports, is estimated to be about 10 tons per lin. ft., but the girders are designed to carry a maximum load of [illegible] tons per lin.ft. for spans of 12 ft., thus providing for uncertainty and probable irregularity of loading and support.

The hardwood lagging is left in place when the cast-iron lining is erected. This latter weighs approximately 6600 lb. per lin.ft. of tunnel and it is cast in the usual segmental form. The individual segments are 6 ft. 2 in. long, 20 in. wide and weigh about 1500 lb. each. Every fifth ring is a taper ring for the curves, other taper rings (with considerably less taper) are provided for correcting the alignment when this becomes necessary.

Fig. 79. Views in [illegible] St. Tunnel

[illegible]

[illegible]

[illegible] Anderson & Barr [illegible]

[illegible]

In making the excavation, the ground at the [illegible] as well as the [illegible] held at all points by [illegible] to prevent any [illegible]

The Hudson River tunnels, the East River tunnels and the [illegible] New York Central R.R. [illegible] will be described in the [illegible]

The Ordinance to Reduce Elevator Accidents [illegible]

The Design and Maintenance of Sewage-Treatment Works*

The use to which a stream is put and the available water for dilution should be factors in the design of every plant, and treatment should not be carried further than is made necessary by the conditions of the stream which is to receive the sewage after treatment. Where streams are used as sources of water-supply for near-by towns, a higher standard of effluent is required than where the purpose of the treatment works is only to prevent nuisance.

All disposal works should be recognized as machines which require intelligent supervision and which, if properly designed and maintained, can be made to produce just that quality of effluent which the diluting capacity of the local stream will render satisfactory. In this way greater general progress in the betterment of stream conditions will result.

It will frequently happen that, in small streams, the dry-weather flow can, with profit, be increased by the intelligent use of stored upstream water, and the discharge of a partly treated sewage thus made possible at all seasons.

Where the two-story type of tank is adopted care must be exercised that the tanks are not made too large, as under such circumstances they are liable to fail of their purpose by reason of the sewage in the settling chamber becoming septicized and creating nuisance.

PATENTED PROCESSES—Town authorities should not deal with the proprietors of any patented processes or devices for sewage treatment without the assistance of some competent advising engineer.

The treatment of sewage has always seemed to be a particularly fertile ground for the exploitation of patented methods, from the early days of the many processes of chemical precipitation to the present-day electrolytic treatment; many of these schemes, while apparently successful in the experimental plants, are entirely infeasible on a practical scale. There is danger in deducing results from small test apparatus without scientific study by a qualified expert; often the cost of such treatments, when undertaken practically, is prohibitive. The proprietor of a process who is looking for a contract will give a bond and make various propositions which appeal to the people of a town and in this manner lead them to favor the acceptance of such propositions. Many costly mistakes have been foisted on communities in this way.

PROCESSES OF TREATMENT

SEDIMENTATION AND SLUDGE DIGESTION—Usually the first process of treatment is the removal of the solid matters which have been maintained in suspension by the velocity of flow in the sewer. In the past, when the solids were allowed to settle in tanks in which the sewage flowed over and in contact with the putrescent deposits in the bottom, odors resulted. Also, when the deposit from such tanks, called sludge, was placed upon the ground or upon drying beds, the foul emanations added to the nuisance. But within recent years, two-story tanks have been devised and are in successful operation whereby the sewage is settled for a short period of time in the upper story and the sludge allowed to remain in the lower compartment of the tank sufficiently long for the decomposable matters to digest, and the settling sewage is kept from coming in direct contact with the digesting sludge.

Such tanks will discharge an effluent practically free of settleable matter in nearly as fresh a condition as when received. The gases evolved during digestion of the sludge away from contact with the sewage are principally methane or marsh gas and carbon dioxide, both of which are inodorous. Sludge withdrawn from such tanks after digestion is inoffensive, dries quickly and may be used for filling low land or for agricultural purposes with no danger of nuisance.

OXIDATION—If the conditions require more refined treatment than sedimentation, it becomes necessary to adopt processes for oxidation. This may be accomplished by means of intermittent sand filters, contact beds or sprinkling filters, the choice of which is largely dependent on the availability of different construction materials and the size of plant to be installed. Intermittent sand filters are only economical where large areas of sandy soil are available. The sprinkling filter, on the score of economy and on account of the maximum efficiency secured on a minimum area of land, is generally given preference; yet under certain conditions contact beds are justified.

The present-day tendency is to adopt processes which will maintain, as far as possible, aërobic conditions in the liquid at all stages through the plant; the maintenance of such aërobic conditions is the primary consideration in avoiding nuisance.

DISINFECTION—As the purpose of disinfection is the destruction of pathogenic bacteria, in order to provide a double safeguard against water-borne diseases, it can be generally said that disinfection of sewage is an unnecessary refinement, unless the effluent of the sewage-treatment works is discharged into a water course adjacent to and above the intake of a water-purification plant, and even in such a case the responsibility of protecting the public health should rest upon the purification of the water.

It is not practical to disinfect crude sewage containing particles of organic matter of appreciable size, as with the usual period of contact it is impossible for the disinfectant to penetrate the solids.

ODORS AND THEIR AVOIDANCE

The amount of odors depends largely on the freshness of the sewage and the method of treating and handling the sludge. The freshness of the sewage depends largely on time of travel and the design of the collecting system, on the adaptation of size to discharge, the provision for self-cleansing velocities and on the ventilation of the sewers so as to provide as much natural aëration to the liquid as possible. If the sewage is fresh or if, in other words, it contains dissolved oxygen, there will not be serious odors from the application or treatment of the liquid portion, provided the plant is maintained with no lodgment of sewage in pools or overloading of the surface of the filters.

There is a potential cause of odors in the sludge. But by the use of the more modern type of tanks, with thorough digestion of the decomposing solids and discharges on properly prepared sludge-drying beds, under favorable

*Condensation of a progress report of the committee on sewerage and sewage disposal, presented to the sanitary engineering section of the American Public Health Association, Jacksonville, December, 1914. The members of the committee are: Geo. S. Webster, Philadelphia, Chairman; Frank A. Barbour, Boston; Geo. A. Johnson, New York City; Langdon Pearse, Chicago; F. Herbert Snow, Harrisburg.

[illegible]

Making Sewage-Works [illegible]

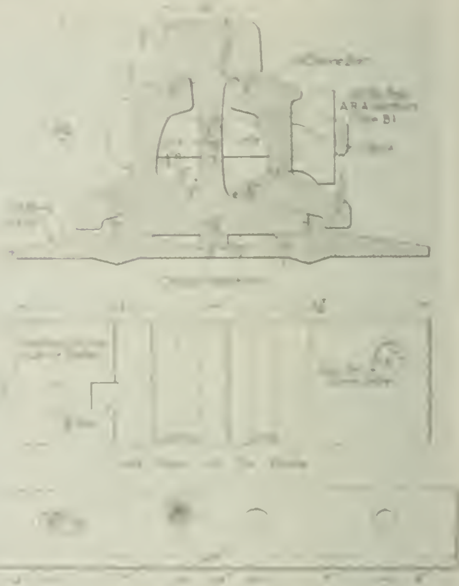
[illegible]

Traffic through the Panama Canal [illegible]

Rail Joints and Tie Spacing

In the work of rail renewals it has been general practice to shift the joint and shoulder ties to adjust them to the position and specified spacing at rail joints, since the joints of the new rails rarely coincide exactly with those of the old rails. This shifting of the ties and handling of ballast involves considerable work and time, and a large number of men; in fact, rail-renewal gangs of [illegible] men employed on one railway have [illegible] of these men assigned to the spacing of ties.

It will be understood that the shifting of the ties results in a disturbance of the ballast and of the firm roadbed which has been secured by months of tamping and maintenance work, and several months of such work will be required again to restore the roadbed to its former condition. This means that much of the expense due to



Rail Joint with Heavy Section Rails, Pittsburgh & Lake Erie R.R.

J. A. Atwood, Chief Engineer.

[illegible]

the position of ties is not changed [illegible] charged to ordinary maintenance.

There is a growing doubt as to whether this work is necessary, and whether it is worth the expense and trouble involved. This is especially the case for main track laid with heavy rails and splices. Some amount of tie shifting will be necessary where the splices are of a type that [illegible] the rail base, or where the old plan is followed of slot-spiking the splice bars to prevent creeping of the rails. In modern practice, however, the tendency is to use rail anchors or anti-creepers for this latter purpose.

The practice of laying new rails without reference to the position or spacing of ties at the joints has been adopted by some important railways, and with entirely satisfactory results.

The Pittsburgh & Lake Erie R.R. has followed this practice for two or three years. The rail joints are spliced with bars of high-carbon oil-tempered steel, having a large proportion of metal in the top chord, as shown in the accompanying cut. These are hot-punched for the bolt holes. The use of slotted splice-bars has been discontinued for several years, as it was believed poor practice to rely on the joint ties to prevent creeping. It is considered that the preferable method is to use sufficient anti-creepers to prevent such movement. The maintenance engineers and the track men are convinced that the practice of keeping ties with uniform spacing, and regardless of the position of the rail joints results in considerable direct and indirect saving, while the track rides very easily.

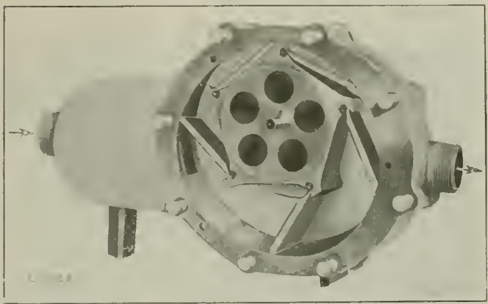
The Illinois Central R.R. has adopted (in 1914) a new design of heavy high-carbon angle splice-bar for 85- and 90-lb. rail. The bar is not slotted or punched for spikes, as it is intended to use anti-creepers to hold the rail where there is any tendency to creep. No attention is paid to the spacing of the ties when the new rails are laid, and respacing will be done only at such times as the track is surfaced "out of face." It is considered that a great economy in rail-renewal work is effected in this way. The same conditions apply on the Lehigh Valley R.R., where the opinion is held that the respacing of ties involves an expenditure of time and money that gives no good results, while the time might be spent to much better advantage in maintenance work upon the track.

A Direct-Reading Volumetric and Velocity Meter for Measuring Fluid Flow

In a meter for fluid measurements which is now being introduced, the meter chamber is divided into a series of compartments by means of vanes or blades on a revolving drum, and the volume and velocity of flow are determined by recording the number of compartments passing the discharge port. The revolutions are recorded on a register which gives direct readings of the volume and velocity.

The fluid entering from the pipe connection passes through a screen chamber (packed with sponge or other material suitable for arresting solid matter), and then enters the meter chamber through a port in the end wall. This chamber is elliptical in form and within it revolves a drum to which are attached hinged vanes, which are held out in contact with the side of the chamber by springs as well as by centrifugal force. The pressure of the fluid against the vane beyond the inlet port forces the drum to revolve, and when the next vane passes the port a definite volume of the fluid is isolated between the two vanes. As the first vane reaches the enlarged section of the chamber at the outlet end, the fluid escapes through the discharge pipe. A counter on the spindle of the drum is graduated to give a direct reading in cubic feet (or other volumetric measurement). The accuracy is claimed to be within 0.25%.

The chamber and springs are of phosphor bronze, and the vanes of hard brass. There is very little wear of the contact surfaces as the difference in pressure on opposite sides of the vanes is very slight. In the meter with 1-in. pipe connection, the chamber has diameters of 7½ and 7 in. on the major and minor axes, and is 2½ in. wide, while the size of the meter over all is 15½x9x9 in. At present the meters are made in sizes of ½-in. to 2-in. but larger sizes have been designed, including an oil-pipe-line meter to be put on a 48-in. main. They have been applied mainly for metering of compressed air, but are suitable for any fluid or liquid, and a modified design has been prepared for use with high-pressure steam. One field of application is on the pipes of oil-tank steamers. The amount delivered on board is measured and recorded, and the consumer can see that this same amount is passed through the meter in being pumped from the vessel to the tanks.



THE KREUZBERG DIRECT-READING VOLUMETRIC AND VELOCITY METER WITH END PLATE REMOVED

Several railways and factories are said to be using the meter on compressed-air piping to determine the proportions of the total supply that are delivered to different departments, so that proper charges can be made against these departments. Compressed-air tool companies also are using them to test the consumption of air by tools of different kinds or sizes or to test the consumption of a tool when new and after a period of service. In this latter case, if the consumption has increased excessively, the tool may be subject to inspection to determine where the leakage occurs and how this can be reduced so that the tool will retain its original efficiency for a longer period. Further, tools may be tested periodically, and sent to the toolroom for repair when they show an excessive consumption of air.

The device is known as the Kreuzberg volumetric and velocity meter, and is being introduced by J. S. McChesney & Co., 139 No. Clark St., Chicago.

A Toll Road of Concrete for use by automobiles is projected by the Texas Concrete Motor Highway Co. of Austin, Tex. The company proposes to build a network of concrete toll roads in Texas and estimates the average cost of construction at $20,000 per mile. It plans for the sale of toll privileges to automobile owners at the rate of $50 per year, and estimates that an average toll rate of 1c. per mile would be sufficient to make the enterprise a paying one. The reduced cost of fuel on such a smooth roadway compared with the power required to drive a machine over the ordinary dirt roads, with the reduced wear on tires, would make the patronage of the road an economy for automobile owners. Inasmuch as the only traffic over the road would be rubber-tired vehicles, with no wear from steel tires or horses' hoofs, it is claimed that the cost of maintenance of the road once well constructed would be practically nothing. A law passed by the Texas legislature in 1913 permits the organization of toll-road companies in Texas and gives them the right of eminent domain to secure their right-of-way. The general attorney for the company promoting this enterprise is Worth S. Ray, 601 Littlefield Bldg., Austin, Tex.

A New Flat-Slab Reinforced-Concrete Floor with Striking Features

The Harvard Avenue shops of the Cleveland Railway Co., Cleveland, Ohio, are being built with a rather remarkable reinforced-concrete floor construction, invented by David Morrow, of the firm of Morrow & Coss, civil and architectural engineers, Cleveland. The prominent feature of the Morrow floor is the arrangement of the columns in substantially equilateral-triangle grouping. This means, of course, that successive rows of columns are staggered, instead of being square and opposite, as in all other floor systems. Naturally corresponding to this column arrangement is the reinforcement of the floor. The bands of rods run in three directions 60° apart, crossing over the columns. The view in Fig. 1 and the plan in Fig. 2 show this very clearly.

Fig. 1. View of Reinforcement of Morrow Floor, Ready for Concreting

A second feature of the Morrow floor is the omission of any special secondary reinforcing means at the column head. Simple bar supports or formspacers carry the bands of rods and hold them up at the right level until the concrete incases them. The nature of the support will be seen from the sketch. Polygon rods are set on concrete blocks of such height as to bring the reinforcement into the top of the slab.

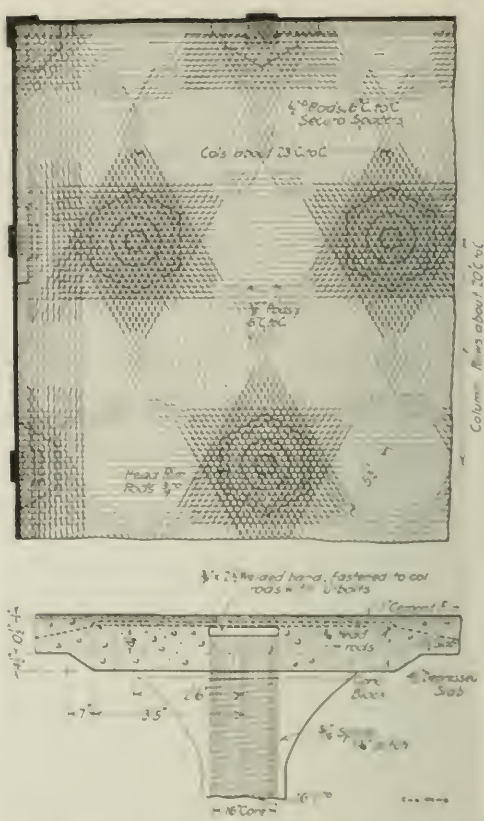


Fig. 2. Floor Used in Store Building at Harvard Ave. Shops of Cleveland Ry. Co.

(New floor invented by David Morrow)

Fig. 3. View Showing Staggered Column Arrangement of Morrow Floor

The inventor's leading idea in the arrangement of reinforcement appears to be that there is greater symmetry of the reinforcing metal, that is, a more equal distribution of the reinforcement in all directions from the column than in other systems. From this he concludes that the reinforcing metal can be placed in the slab more nearly in proportion to the stresses than other systems permit, which fact should mean economy. The Morrow patent is [illegible], dated June 17, 1913.

The buildings of the Harvard Avenue shops cover an area of about [illegible] acres and cost about $1,000,000. The Morrow slab is being used in the store building, 180 ft. by 126½ ft., in the 30,000-ft. floor over the basement of

the armature room, and over the 57x30½-ft. basement of the oil-storage building. Further, the roof over the 150,000-gal. fire-protection reservoir (55x32 ft. by 13 ft. deep) is of the Morrow system, and a similar reservoir (48x28 ft. by 11 ft. 3 in. high) is being built at Lake View Road and Superior Ave.

In constructing this reinforced work the rods were wired at all their intersections. This apparently tied them sufficiently to prevent chance displacement, as the runways for the concrete buggies were laid directly on the reinforcement, and often the buggies were turned out from the runways and run short distances to points of unloading directly on top of the reinforcing steel without disturbing the position of the bars.

Fundamental Planks in a Public-Utility Program*

By Delos F. Wilcox†

I have sometimes spoken of the relation between a city and its privately owned public utilities as an irrepressible conflict. The expressions "traction war," "gas fight," "telephone controversy," "electric light dispute," etc., are familiar to everyone. In the picturesque language of the newspaper and the street, public-service corporations have long been described as public enemies, and the attitude of belligerency toward them has become chronic in many, if not most, American cities.

While this antagonism often assumes exaggerated, unintelligent and even fantastic forms, and while there is a substantial community of interest along many lines between the public and the utility corporations, we must not blink the fact that there is a permanent and fundamental conflict of motives between them. No amount of regulation and no possible development of good will and the spirit of coöperation can change the fact that private corporations operating municipal utilities do so for profit and for as much profit as they can get, while the consumers and the public strive to get as much service as they can at the least possible cost.

The discussion of plans of campaign against high rates, poor service, political interference, financial tyranny and all the rest of the evils which we have set out to smite can only lead to confusion of counsels unless we clearly grasp certain underlying issues involved in the relations between the cities and the public utilities. Without having definite thoughts on these issues, we can not think straight on anything else, and without knowing what any particular speaker's thoughts upon them are, the rest of us can have no measure by which to gage the importance or fathom the meaning of what he says.

The underlying issues are:

(1) What shall be the recognized character of public-utility investments?

(2) What shall be the attitude of the city toward public utilities as money-earning enterprises?

(3) What attitude shall the cities take toward ultimate municipal ownership?

I shall answer categorically, according to my lights, the questions I have propounded under these three heads:

*Condensed from a paper read before the American Mayors' Conference on Public Policies as to Municipal Utilities, held at Philadelphia, Penn., Nov. 13 and 14, 1914.

†Consulting franchise and public-utility expert, 93 Nassau St., New York City.

(1) Character of the Investment

Public-utility investments should be placed upon a nonspeculative basis, and their security should approximate that of municipal bonds.

In the establishment of the nonspeculative character of these investments, *cities should not undertake to make good past losses.*

So far as future investments in the standard utilities are concerned, *the cities should assume the risks of loss due to unforeseen causes,* and should substantially guarantee the integrity of all investments made at the request or with the approval of public authority.

(2) Public Utilities as Money-Earning Enterprises

In my judgment, public utilities should not be regarded as a legitimate source of profit to be used for the relief of general taxation.

Compensation for franchise grants, and special taxes or license fees imposed upon public-service corporations should not be encouraged, unless the proceeds of such compensation or taxes are to be used in paying for the property.

Every individual public utility should be made to render a clear account of itself and, as a general rule, should be self-supporting.

Public-utility services should be rendered as nearly at cost as practicable, except that the rates should include a sufficient contribution to retire the investment within a definite period of time.

Public utilities should receive credit for all the service rendered by them to the city and its various departments, but only under unusual conditions should the city assume to subsidize a public-utility service out of the proceeds of taxation or otherwise.

(3) Ultimate Municipal Ownership

In my opinion, cities should *not* assume that public utilities are to remain permanently as private investments under private operation.

On the contrary, they should assume that all the well established utilities will sooner or later be publicly owned private capital being entirely excluded from the public streets except as it is loaned to the city.

In their franchise grants, and in all contracts affecting rates or granting privileges, the cities should establish the option to take over the utilities either at pleasure or at reasonable fixed intervals.

Wherever possible, the cities should go still further and without more delay definitely set in motion the machinery necessary to compel the gradual withdrawal of private capital from the public streets and the gradual acquisition of the utility plants by the cities as public property.

Subway Contracts in New York—The total contract price of the 64 subway sections on city owned lines already awarded is $146,253,346, of which $76,172,289 is on Interborough lines and $70,081,056 on the New York Municipal lines. In addition to these, the Interborough Rapid Transit Co. has under way third-tracking of the Manhattan and Bronx elevated lines, the first of which is estimated at from $8,000,000 to $10,000,000, and the New York Municipal Railway has under way elevated third-tracking and extension contracts involving an outlay of upward of $6,000,000, so that the grand total of work now going on in different parts of the city on the dual subway system involves an expenditure of about $152,000,000 contracted for on Dec. 1, 1914.

Field and Office

Methods of Filling and Dredging for a Jersey City Freight Terminal*

[illegible] dredging and filling operations on the Jersey City water-front at Communipaw, which have been in progress for the past [illegible] years, are now approaching completion. [illegible] made a freight terminal of the Central R.R. of New Jersey is being constructed. The filled-in strip is immediately back of the government bulkhead line, at which is being constructed a timber-crib bulkhead on hard-bottom foundation. It is built as the dredging and filling proceeds. The extent of the work is shown by Fig. 1.

Back in 1900, when the work was started, under permission granted by the War Department in 1898, the first operation was to float in a large number of old canal boats, fill them with stone and sink them from 400 to 500 ft. back of the bulkhead line. Just back of the canal boats an earth dike was made by unloading (by hand) cellar dirt from scows. The dike formed by the earth-backed canal boats prevented the new fill from being washed away by the tides. At various points back of this dike transverse dikes were built. Then the general filling-in operations began. These were carried on in four sections, three of which are about finished and the fourth under way at the present time.

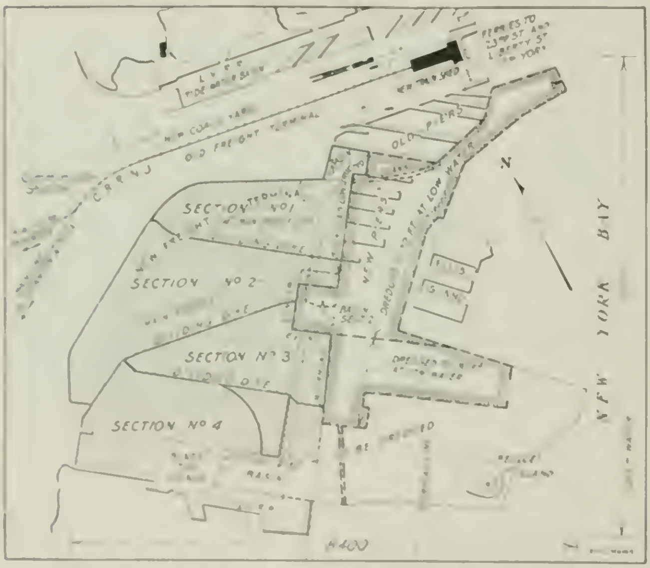


Fig. 1. [illegible] Map of Filled and Dredged Areas, Jersey City Freight Terminal

On section 1 and a part of 2 the general manner of conducting the work was to build trestling over the section, beginning at a basin dredged in the northeast corner of the section and connected to the bay by a channel. Mud and dirt brought in on scows were unloaded into cars on the trestle by clam-shell and orange-peel buckets on floating dredges, and the cars taken out on the trestling and dumped. When the fill was brought up above mean tide level, it was dressed with dirt.

[illegible] The work is at a distance [illegible] as the Tide-water Flats, and amounts to about [illegible] ft. of water front, averaging [illegible] ft. in width. On the ground thus [illegible]

Work on a section was carried on continuously, the material dredged outside the bulkhead line of each section was deposited inside the line. Section 1 was filled principally by the dump-car method described, but sections 2

*[illegible]

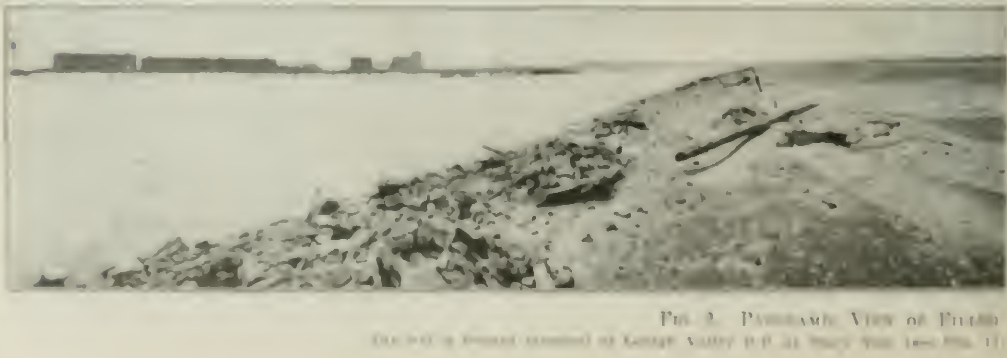


Fig. 2. Panoramic View of Filling

[illegible]

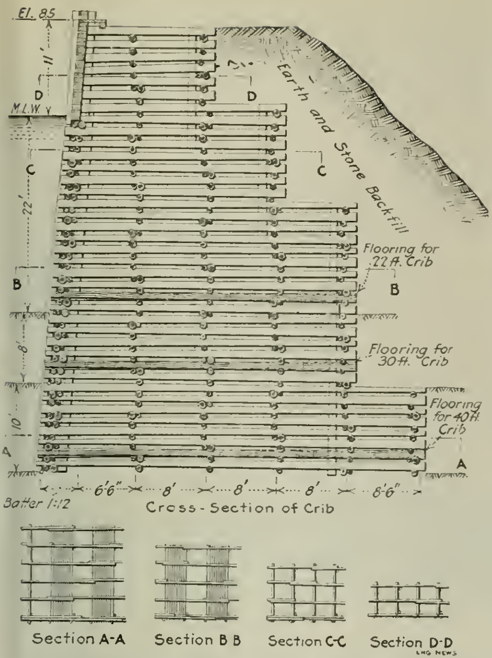


Fig. 3. Typical Sections of Large Timber Crib

and 3 were filled mainly by the action of large suction dredges. From the 800-hp. centrifugal pump of a dredge the discharge line was carried on pontoons to a pipe trestle extending out from the fill, thence over the made ground and discharged where desired, which was sometimes 6500 ft. distant from the dredge. As high as 190,000 cu.yd. of mud, sand and soft clay were put ashore in one month by one of these suction dredges.

The Dredging Plant

The powerful dredging plant consisted of as many as six units, working simultaneously on different classes of work. A suction dredge furnished hydraulic fill; a ladder dredge removed hardpan; two dipper dredges dug trench for the crib and removed hardpan, while two clam-shell bucket dredges unloaded material from scow to dump car, and placed fill immediately back of the bulkhead.

Hydraulic Filling—The suction dredges used are described as follows: Length, 160 ft.; width, 40 ft.; draft, 11 ft.; three boilers of 300 hp. each. The pump itself is 13 ft. high by 2 ft. 4 in. wide, and has a 5-bladed impeller which revolves at 350 to 400 r.p.m. The normal discharge pressure of the pump is 40 to 60 lb. per sq.in., and the diameter of the discharge pipe is 24 in. Solids amounted to about 5% of the total discharge, the water returning through a sluiceway.

The cutter consisted of a series of 6 heavy plates, each 6x1½ ft., varying in thickness from a cutting edge to 5 in., attached to a frame which revolves at 7 to 10 r.p.m. It is placed directly above the suction pipe and cuts the bottom so that the material can be taken up by the suction. An important feature of a fill thus made is that the harder and heavier materials are deposited at or near the point of discharge, so that by fanning the pipe line out in several directions a good, hard fill is left at the top, requiring no further dressing.

This plant was used on section 3. On section 2 the same method was employed, but the plant was not quite so large—an 18-in. discharge line was used.

Dredging Hardpan—In addition to the dredging of the materials used for the fill, a considerable amount of hardpan dredging and the removal of some rock were required in order to obtain the required depth of water. This hard dredging was accomplished by two kinds of plant: one, of two scoop or dipper dredges of 8 cu.yd. capacity each; the other the endless-chain bucket-conveyor dredge, with 29 buckets of ⅞ cu.yd. capacity each, as illustrated in A (Fig. 4).

This latter dredge is a familiar type in Europe, but is not used largely in the United States. The one used on this particular job has a 175-hp. boiler supplying two 150-hp. engines geared to the shaft which operates the buckets.

New Crib Bulkhead

When a section was filled from the main dike west, the permanent timber-crib bulkhead was built on the government line. The first step was to dig a trench down to hard bottom for the crib foundation. Accurate soundings were then taken to enable the crib builders to frame the crib sections, as the hard bottom ran as deep as 10 to 50 ft. below mean low water in some cases, while in others hardpan had to be removed. At other places where considerable inflow was expected in the trench, a rock fill was made as soon as the dredging was completed, and on it the cribwork was erected.

A cross-section of the crib is shown in Fig. 3. It is

Site of New Freight Terminal

at upper right is a dipper dredge digging trench for timber crib bulkhead)

formed by framing round logs together on the surface of the water, notching to fit and spiking them together. The crib was divided into square bays of about 9 ft. dimension, in which stone was dumped to give stability. After sinking and completing, the crib extended about 10 ft. above low water. The fill was even with the top.

SHORE BULKHEAD AND NEW PIER CONSTRUCTION

The land reclaimed to date comprises an area of about [illegible] acres filled to about 10 ft. above low water. The water in front of the improvement has a depth of 22 ft. at low water at its northerly half and will have, when completed, a depth of 30 ft. at low water at its southerly half. Material amounting to [illegible] cu.yd. of mud or silt, sand and clay has been put ashore by suction operations, and about [illegible] cu.yd. of hardpan, with

some rock, have been dredged and towed to sea. [illegible] lin.ft. of crib bulkhead have been built, and [illegible] lin.ft. are at present under contract.

In front of the area filled, [illegible] new piers have been built since 1907 with an aggregate length of [illegible] ft., giving a length of wharfage available for shipping of about [illegible] ft. Several more will be built in the near future.

The general construction of the open piers is creosoted piles on rock foundations, with [illegible] creosoted [illegible] decking. [illegible]

DREDGING.

The [illegible] Dredging Co. of New York has the general contract for the dredging and filling. The hydraulic dredge shown belongs to the Metropolitan Dredging Co., of New York. The work has been done for the Central R.R. Co. under the direction of Joseph O. Osgood, Chief Engineer, and A. E. Owen, Principal Assistant Engineer; C. M. Titsworth is Assistant Engineer in Charge of Construction.

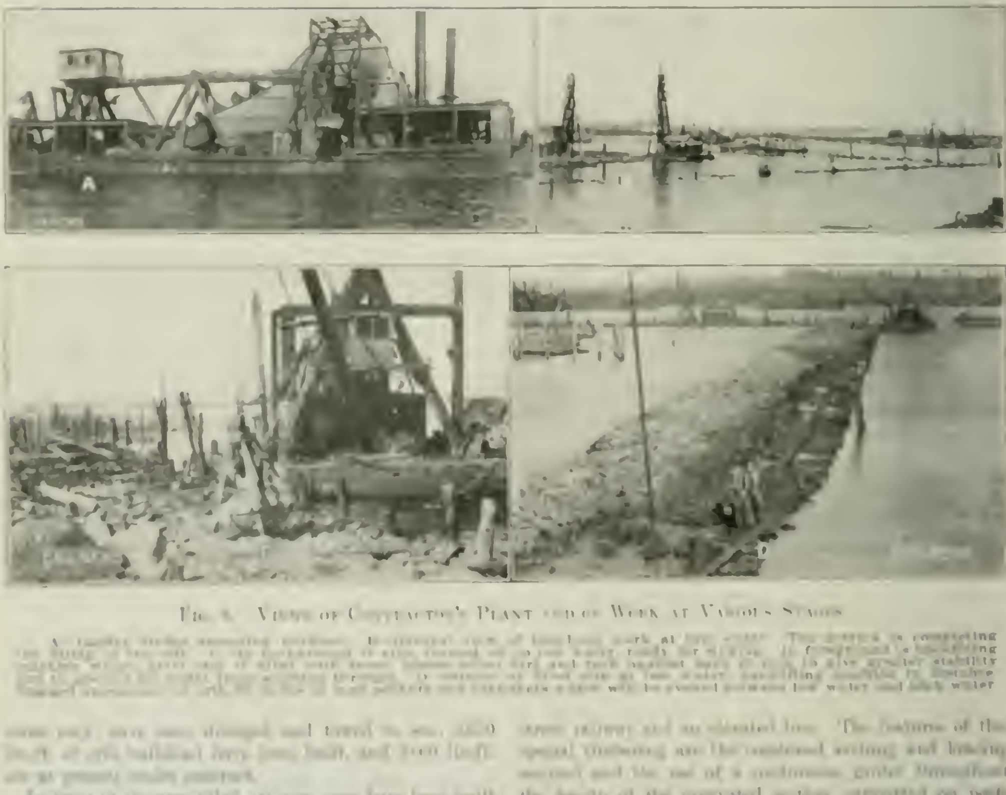


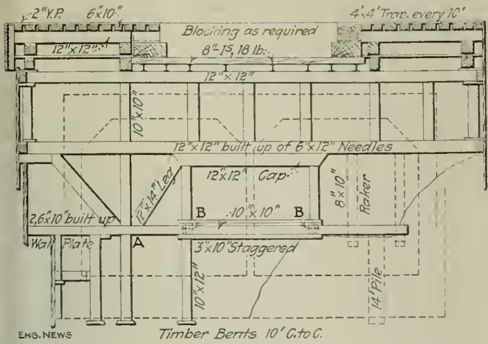
FIG. [illegible]. VIEWS OF CONTRACTOR'S PLANT AND OF WORK AT VARIOUS STAGES

[illegible] The dredge is completing [illegible] give greater stability [illegible] will be placed between low water and high water

Special Subway Timbering on Section 1, Lexington Ave. Route, New York

A double method of support is employed for the timbering on the Broadway line, Morris to Dey St., of the Lexington Ave. subway, New York City. On this section, support has to be provided for both a double-track upper railway and an elevated line. The features of the special timbering are the continued arching and bracing secured and the use of a continuous girder throughout the length of the excavated section, supported on posts or fender piles.

Placing the timbers as shown in the diagrams practically insures the support of the whole structure from the two side posts at C, to which the load is transmitted. The continuous longitudinal girders B also afford redundant support which is not likely to be wholly destroyed even by the failure of several of the columns below. This design, it will be noted, provides for the entire support of the dense overhead traffic without the use of an excessive amount of timber and makes ample allowance for contingencies and the possible failure or permissible removal of one or more of the supporting posts or columns.



Special Subway Timbering on Section 1, Lexington Ave. Route, New York

Reference was made to this method of timbering by Fred Lavis in his seventh article on "New York Rapid Transit Railway Extensions," in Engineering News, Nov. 26, p. 1071.

Tamping Track with Air Power*

Pneumatic tamping of ballast under railway ties has been tried successfully on the River Division (West Shore) of the New York Central Lines. The tamper used in this work is very similar to a valveless hand-hammer or pneumatic drill, but fitted with a special tamping bar.

Tamping Outfit—A complete outfit or unit consists of two tie tampers and a portable gasoline-driven air-compressor, with 600 ft. of hose. The car which carries the compressor outfit is self-propelled and geared for a speed of 12 to 15 mi. per hr. It has space for a gang of 12 men, weighs 1700 lb., and can be removed from the track by four men in 45 sec. This quick handling is effected by the aid of a special derailing wheel at each end, these wheels being at right angles to the track.

Each tamping machine weighs 37½ lb. and can be manipulated by one man. It is provided with two spade handles placed at right angles to each other for easy handling. The air pressure is 80 lb. at the tamper and the consumption is about 20 cu.ft. of free air per minute.

In tamping a tie a pair of tampers is always used, one tool on each side of the tie, operating at an angle of about 15° toward each other. A tie can be tamped in two minutes. The tamping bar is curved to permit easy tamping under frogs and switches, and in other contracted places.

New York Central Test—The tamper was tested on a 1600-ft. section of track where new rail had been installed. Of this, 800 ft. were hand-tamped and 800 ft. tamped by the pneumatic tamper. This was done in 1913; after six months of heavy traffic the track was inspected, with the following results:

Greatest Settlement		Least Settlement		Average Settlement	
Hand	Machine	Hand	Machine	Hand	Machine
0.116 in.	0.063 in.	0.018 in.	0.004 in.	0.067 in.	0.033 in.

Cost of Operation—The cost per hour of operating a unit (compressor and two tampers), with gasoline at 20c. per gal. and gas-engine oil at 10c. per gal., was found to be: gasoline, 32.6c.; oil, 1c.; labor, 34c.; total, 67.6c. The average number of ties tamped per hour was 26, at a cost of 2.6c. each. The average number of ties tamped per day of 5½ hr. was 140. In this test the track was lifted from 2 to 4 in. G. W. Vaughan, Engineer of Maintenance-of-Way, under whose direction this test was carried out, believes that an average of 300 ties can be reached in a 10-hr. day.

The road now has 12 of these outfits in service. The pneumatic tampers and the compressors are manufactured by the Ingersoll-Rand Co., 11 Broadway, New York City.

*An electric tamping device invented by Mr. Collet, and used on the Paris, Lyons & Mediterranean Ry. (France), was described in "Engineering News," June 23, 1904. Each tamping bar was operated by a horizontal motor mounted on a pair of small wheels to ride on the rails, the two opposite motors being connected by a cross bar. An extension shaft from the motor drove the inclined tamping bar by gearing, the bar sliding in a guide fitted with cross handles held by the operator. Current was generated by a plant on a light motor car, and this car (like the gasoline car described above) had wheels at right angles to the rails to facilitate running it on and off the track as required. A light portable transmission line was used. The same equipment was used for driving screw spikes.

Fig. 2. A Track-Surfacing Gang; Compressor Car at Left

(Small transverse wheels are provided under the car so that it may be easily slid from the track on a temporary track of 2x4 scantlings.)

Fig. 1. A Tamping Unit in Action

A Water-Supply Main at Keyser, W. Va., was packed full for 50 ft. recently by roots from a single poplar tree. The pipe was a gravity supply main of vitrified tile with cemented joints, and had been laid for over twenty years. The roots nearly stopped the flow of water in the pipe.

City of Jacksonville Engineering Building

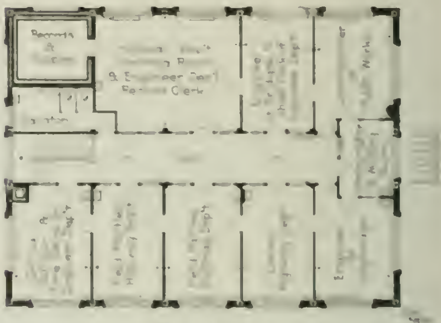
By [illegible]

[illegible]

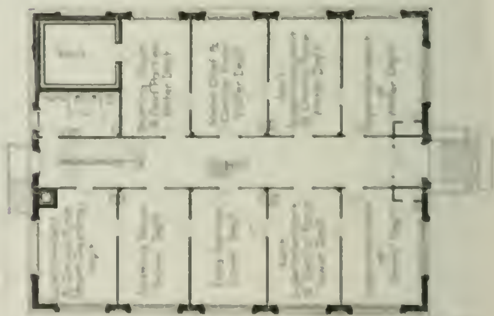
Fig. 1. The City of Jacksonville Engineering Building

[illegible]

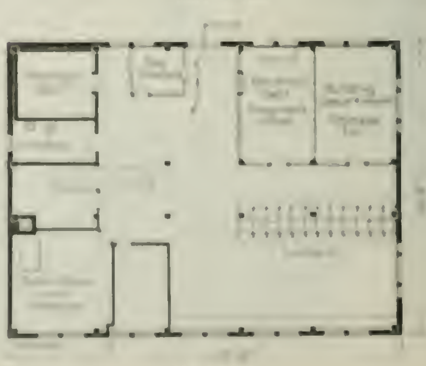
Third Floor



Second Floor



First Floor



Basement

Concrete Anchor Piles for Steel Sheeting

[illegible]

around each rod, as shown. At two opposite corners are inserted the two halves of a split steel pile, the stems being held together by ¾-in. bent tie-rods. The steel sheeting engages with the projecting portions of the steel pile. In the center of the pile is a 6-in. pipe, and when the pile was in place a drill was dropped through it and a hole drilled into the rock. An old car axle was then

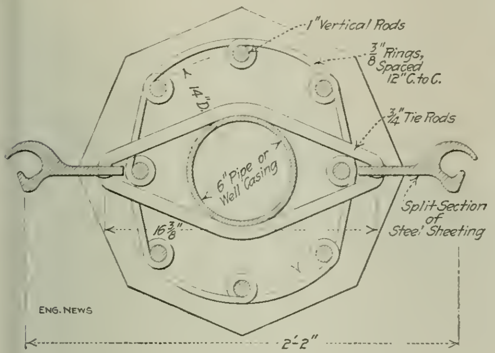


FIG. 1. SECTION OF REINFORCED-CONCRETE ANCHOR PILE USED IN A LINE OF STEEL SHEETING

dropped into the hole and grouted into the rock and the pile, thus anchoring the pile securely.

The construction of the dock is shown clearly in Fig. 2. The anchor piles are spaced 8 ft 9 in. c. to c., and at the center of each panel of steel sheeting is a horizontal anchor rod attached to the top of the sheeting and anchoring it to a concrete beam on the opposite side of the pier. Each of these anchors consists of a pair of 2-in. rods secured by washer plates to old rails at either end, and

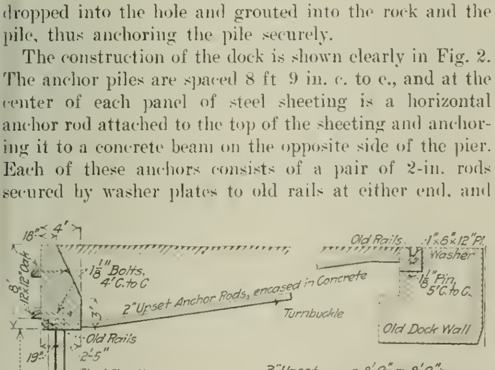


FIG. 2. PIER WALL CONSTRUCTION WITH STEEL SHEETING HELD IN PLACE BY CONCRETE ANCHOR PILES

the rods are incased in concrete for their entire length. This construction was designed and built by the Great Lakes Dredge & Dock Co., of Chicago, and has been used in the Black Rock harbor work at Buffalo, as well as at the Sandusky pier. For drawings we are indebted to the engineers of the Pennsylvania Lines.

A somewhat similar construction of pile, but intended to be used to form interlocking sheeting, was part of an alternative design for the new municipal pier at Chicago, but is not being used in the work now being constructed. As shown in ENGINEERING NEWS of Sept. 18, 1913, the pile was rectangular, 24x18 in., with half of a steel sheetpile embedded in each end, so as to make the piles interlocking. The socket part of the steel was flush with the face of the pile, so that the piles would be in close contact when driven.

A Small Incubator for Testing Water-Chlorination Results at Hudson Falls, N. Y.

By M. F. TIERNAN*

In connection with liquid-chlorine apparatus recently set up in three hours' time at Hudson Falls, N. Y., there was also supplied an incubator to enable the operator of the chlorine apparatus to make daily tests for the presence of B. coli in the raw and treated water.

A special incubator was devised for the purpose. It is 10x10x14 in. in size and is heated by two 16-cp. lamps. Bimetallic thermostats hold the temperature to within ½° C. The equipment also included two dozen 1-c.c. glass pipettes, a small sterilization case, one dozen ground stoppered bottles for samples and 100 lactose bile tubes. The glassware is sterilized by putting it in an ordinary basting pan in the oven.

The attendant was instructed to take samples of raw water and treated water in the sterilized bottles and then inoculate the bile tubes with 1 c.c. of the samples. They would then be incubated for 72 hr., which is the standard method for such work, and if B. coli were present there would be a formation of gas in the bile tubes.

Error or carelessness of any kind on the part of the attendant will be counted against him in the bacteriological results. If he should not have the glassware thoroughly sterilized or should be careless in taking samples or in making the inoculations, he will get results which will show. On the other hand, if the lactose tubes show no growth he can then be sure there are no B. coli present and that he has added the proper amount of chlorine.

We find that the water requires different amounts of chlorine at different times of the year for proper disinfection. Temperature, rains, and other meteorological conditions enter into the problem of water disinfection, and the whole thing centers in the question whether or not enough chlorine is added to destroy the B. coli.

The writer was gratified to find that the water-works officials entered into this scheme with enthusiasm, and is quite sure that they will give the chlorine apparatus careful attention when they can see for themselves the effect the chlorine treatment has upon the water.

NOTES

To Smooth Out Old Plans—When it is desired to flatten out old mounted plans, old paper drawings or old cloth or paper prints, the following method has been found to work successfully in every instance where harsh handling or reverse rolling would ruin the appearance of a drawing: Make a thick, boiled starch of flour by boiling flour and water down

*President, Wallace & Tiernan Co., Inc., 136 Liberty St., New York City

[illegible] — Frank B. Jones, Wollaston Hill, Mass.

... end of wire held in contact with the steel tape completes the circuit except for the small gap between the end of the brass rod and the mercury.

When the wooden rod has reached the water level in the well and has become submerged sufficiently to float, its weight is taken off of the tape, a very slight additional lowering of which causes the brass rod to touch the mercury, thereby closing the circuit and sounding the buzzer.

A distance "K" from the water line of the float rod to [illegible]

CEMENTED GRAVEL ON ST. PETERS CANAL, CAPE BRETON, N. S.—DIFFICULT "EARTH EXCAVATION" WITH A STEAM-SHOVEL

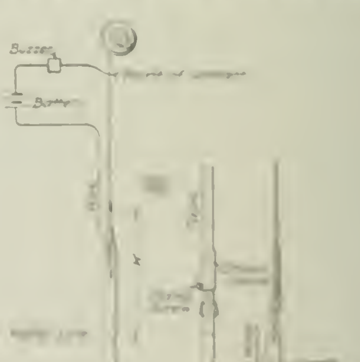
Difficult Steam-Shovel Excavation in "Earth"—The difficult digging a steam shovel is sometimes called on to do is well shown in the accompanying views of excavation on the St. Peters Canal, Cape Breton, Nova Scotia. The material is a glacial gravel very closely cemented into a hardpan. [illegible]

Track Foundations in Paved Streets—In "Engineering News," [illegible]

Sounding Device for Well Tests—[illegible]

the end of the tape [illegible] reading.

This device is also adapted to measure the depth of [illegible] etc., and with slight modification can be used for [illegible] A convenient adjunct is a small electric light which [illegible]



SOUNDING DEVICE FOR WELL TESTS

[illegible]

Editorials

What Is the "Cost" of Service by a Municipal Electric-Light Plant?

The interesting question has recently been answered by the Massachusetts Gas and Electric Light Commissioners as to what "price" a municipally owned utility could legally make to private customers and to the municipality itself. The statutes require that the minimum price to private consumers shall not be less than "cost," including interest on investment, maturing debt requirements, and depreciation. A maximum price is fixed at "cost" plus 8% profit, "cost" in both cases evidently meaning an average figure distributed over all the current generated, and neglecting well known differences in the actual cost of serving different classes of customers. Prices of less than this "cost," however, may be fixed with the consent of the Gas and Electric Light Commissioners. A municipality is to be "charged at cost" for all current supplied to it.

It appears that the municipal electric-light plant of Reading, Mass., had been operating with a small deficit each year in providing for operation, interest, maturing debt and depreciation, which deficit has been met out of the tax funds. Naturally, a sharp local controversy arose as to whether certain rates for private heat and power were not too low, or the supply to the town itself were not below the "cost" required to be charged by statute. The Board of Gas and Electric Light Commissioners, being asked to review the situation, approved the existing private rates although some are below the average cost of the governing statute. It held that these prices cover the various true cost items in fair proportion, and that accordingly the town is properly "charged at cost" for what it uses, so long as the direct appropriation plus the deficit met out of general funds keeps the plant solvent. As to how the various departments should handle their bookkeeping, the commission disclaims jurisdiction.

Well Deserved Support of the Coast and Geodetic Survey

The U. S. Coast and Geodetic Survey is the oldest scientific bureau of the government service, but there has long been an unfortunate lack of appreciation of the public importance of this bureau's work, and for many years it has been obliged to get along with inadequate appropriations and very defective plant. The Survey has now had the good fortune to find in Secretary of Commerce Redfield and President Wilson strong supporters of its work.

Secretary Redfield, in his annual report, just issued, and in recent public addresses, has shown the difficulties under which the officers and men of this bureau are attempting to accomplish their tasks. To take but one example: Secretary Redfield states that three of the vessels used in the Coast Survey work are, respectively, 38, 39 and 52 years old, one of them having been built as a Confederate gunboat in 1862 They are so unsafe and so unsanitary that if they were owned and operated by private parties the Government's Steamboat Inspection Service might well condemn them on the ground of public safety and public health. In fact, Secretary Redfield declares these ships are so bad that no private owner would use them, yet these are the vessels which the Survey has to use to carry on its work on the stormy and dangerous coast of Alaska. As for the buildings in which the Survey is housed in Washington, the walls of some of them, after being twice condemned by the District of Columbia authorities, were shored up to keep them from falling, and the Public Health Service has recently condemned them because of their unsanitary condition.

High commendation is given by Secretary Redfield to the wire-drag system of making soundings, which has been used by the Survey in recent years and is being extended as rapidly as funds are provided. In the eight years since the wire-drag surveys began on the Atlantic coast, 3300 rocks with less water over them than the charts showed have been discovered by this method. Nearly 900 of these were distinct menaces to navigation.

It seems to us that there is here an opportunity for the engineering profession to make itself heard in support of a government engineering bureau whose work in accurate mapping, precise leveling and the charting of the coasts of the United States is of immediate interest to engineers everywhere. Secretary Redfield's report makes clear that this bureau is hampered in the performance of its work for public safety by lack of sufficient appropriations. The engineering societies of the United States might well reinforce the recommendations of Secretary Redfield and President Wilson by the passage of suitable resolutions appealing for ample appropriations by Congress for this most important division of the government's engineering work.

Concrete Surface Finishes and the Test of Time

The early treatment of the surfaces of concrete structures, where there was any treatment at all, was consistently a mortar wash over the board-marked surface of the concrete. With few exceptions, this surface rapidly deteriorated. The light finish sloughed off and left scabby patches anything but pleasing. With the development of concrete work, an effort was made to procure for concrete surfaces some degree of artistic merit which would have for an important secondary consideration a good wearing quality. The primary consideration of an initially good appearance was satisfied by a number of different methods, but sufficient time has hardly elapsed to get much evidence as to the permanency and extended wearing qualities of these surfaces.

Recently, however, the observation of a number of concrete structures of approximately ten years of age

had impressed upon us the extremely successful wear of two particular types of surfaces, one a bushhammered surface crushed-granite concrete, and the other, the familiar so-called selected aggregate surface devised by H. H. Quimby when he was Engineer of Bridges of the City of Philadelphia, and applied by him to a number of the bridges in that city. All surfaces of the former type show that even after ten years of life the bush-hammered granite concrete has as sharp and sparkling a face as the day it was made, and compares favorably with the surface of a natural granite. Precisely the same may be said of the Quimby surface on the Philadelphia bridges. Contrasted with the frequently scabby, pitted or stained condition of the old smooth concrete surface, the selected aggregate surfaces of the Philadelphia bridges are quite remarkable.

It is probable that some of the other methods of treatment are equally successful and possibly somewhat cheaper, but these two particular methods have been brought so strikingly to our attention as to appear to us to be worthy of commendation.

Railways Which Ought Not to Have Been Built

We noted in our issue of Nov. 5 the impending abandonment of the Buffalo & Susquehanna Ry. in western New York, on which the traffic was no longer sufficient, in the opinion of the owners, to make it worth while to continue operations. Since then, announcement has been made that a railway line in Iowa of considerable local importance is to be abandoned for similar reasons, and that the residents along the line of the road are appealing to the State Railway Commission to compel the company to continue its operations. There are undoubtedly many hundreds or thousands of miles of railway lines in the United States which ought never to have been constructed. They were built either at a time when exaggerated ideas prevailed as to the prospects of profit in railway operation, or in the days when railway competition was active and the paralleling of existing railways was a recognized and fairly respectable industry.

It is not generally known, however, that similar conditions have prevailed in European countries, and notwithstanding the barriers which have existed there against the [illegible] of railway franchises. In the recent presidential address before the Institution of Civil Engineers, Benjamin Hall Blyth reviewed fifty years of railway construction in Scotland and gave some interesting illustrations of unprofitable railways which have been built in the Scotch Highlands.

The Invergarry & Fort Augustus Ry. was promoted in 1896. The line is [illegible] miles in length and was originally estimated to cost about [illegible], a little under [illegible] per mile. The actual cost, however, was nearly [illegible] of that sum. The company which built the railway leased it for operation, but there was so little traffic on the line that the leasing company finally refused to continue it and the road was for a time abandoned altogether. The local [illegible] finally secured the resumption of operations, and last year the company operating the road purchased it outright for [illegible], probably less than one-tenth of its original cost.

In 1897 three different companies appealed to Parliament for permission to build a railway from Fort Augustus to Inverness, about 31 miles, paralleling the Caledonia Canal. The estimated cost was from $1,800,000 to $2,700,000. All these bills were thrown out by Parliament. The district through which the line was projected is almost without population or production, and it is exceedingly doubtful now with motor cars available for land service and steamboats running on the Caledonia Canal whether the intervening gap between Fort Augustus and Inverness will ever be filled by a railway.

Another remarkable enterprise was the Paisley & Barrhead Ry. It was authorized by Parliament in 1897 and was finally completed and taken over by the Caledonian Ry. Co. From the day of its completion to the present not a single train has ever run over the line.

A Projected Concrete Toll Road for Automobiles in Texas

A century ago the building of toll roads by private companies was actively going on in many parts of the country. The coming of the railway diverted attention from highway construction, and after 1840 very few toll roads were constructed.

In recent years there has been a widespread movement for the condemnation and acquirement by the state of the few remaining toll roads owned by private companies. It is doubtful whether a toll road has been built in the United States in the last quarter century, unless such automobile speedways as the Long Island Motor Parkway, described in ENGINEERING NEWS, Sept. 17, 1914, be considered toll roads.

A project has just been launched in the State of Texas, under the authority of an act passed by the Texas legislature last year, for the building of concrete toll roads as a private enterprise. It may be of interest to discuss very briefly what are the general financial possibilities of such a scheme.

The cost of construction of such a road is estimated at $20,000 per mile. If we assume a width of 18 ft. and a cost of $1.25 per sq.yd. for the concrete paving, both of which figures should be adequate, this would give a cost of $13,200 per mile for the concrete alone, leaving $6800 per mile for right-of-way, grading, draining, fencing, bridging and all expenses in connection with the corporation. On the level plains of Texas and in a farming region where right-of-way could be secured at reasonable figures this allowance would seem to be sufficient. In fact, it would be possible, under favorable conditions, to considerably reduce the cost.

Interest on the investment of $20,000 per mile at 6% would amount to $1200 per mile of road per year. The promoters claim that the concrete road, once well built, would cost nothing for maintenance if it were used exclusively by automobiles with rubber tires. It will be admitted that the maintenance of the road surface should be very small under such conditions, especially in the Texas climate, where the temperature seldom falls very low and no trouble from frost attacking the foundations of the road need be feared. There would, however, be a certain expense for maintenance on other parts of the roadway, such as the bridges, ditches and other drains, the cutting weeds along the right-of-way, maintenance of fences, etc., and the wages of toll keepers. It would hardly be safe to figure on any smaller sum certainly than

$200 per mile per year. Some provision must be made also for a sinking fund to pay off eventually the bonds issued for the construction of the road, so if the road is to be a profitable commercial enterprise it must average earnings from tolls of at least $1500 per mile per annum.

The projectors of the Texas road propose a toll rate for automobiles of 1c. per mile and make the not unreasonable claim that an automobile owner will save at least 2c. per mile in gasoline, tires and general wear and tear on the machine, by running his car over a smooth concrete road compared with the ordinary Texas dirt road. They also propose a special tax on motor trucks according to the weight of freight carried.

It would seem not unreasonable to assume that an average toll rate of 2c. per mile on automobiles would be practicable, since a graduated tariff could be applied, charging a lower rate for the cheap small cars of the farmer and mechanic, and a considerably higher rate for the costly high-powered cars. The owners of the latter would be willing to pay a considerably higher price for the privilege of using a first-rate road.

If we assume an average toll rate of 2c. per mile, it would require an average traffic of 75,000 automobiles per annum to yield a revenue from tolls of $1500 per mile. This would be an average traffic of 206 cars per day, and if this traffic were evenly distributed throughout 12 hours of the day, it would be 17 cars per hour. Of course, there are many roads in the suburbs of large cities which have an automobile traffic very greatly in excess of this. Whether an average traffic of this amount could be counted on for an interurban road in Texas, such as is proposed by the promoters of the toll-road company above referred to, is a matter on which traffic counts in the locality should furnish fairly accurate information.

It will, of course, be apparent that such an enterprise would have far greater possibility of success in a state like Texas, where there are few roads outside of the cities which have paved surfaces of any sort. It must be borne in mind, also, that the use of automobiles is increasing to an amazing extent. The automobile registration in Texas in the years 1910 to 1913, inclusive, increased 452%, a greater percentage of increase than that of any other state of the Union except Kansas.

We are informed that the promoters of the Texas concrete toll road are reputable business men. The above analysis indicates that their project has at least a chance of yielding a return to those investing in it. It is to be hoped that the project may be carried into effect and that a practical demonstration may be given as to the possibilities of toll-road construction for automobile traffic.

A New Process for Improving Steel-Rail Manufacture

It has been known in railway circles for several months that the Lackawanna Steel Co. was developing a new process of treating steel rails during their manufacture, which it was claimed would effect a considerable improvement in the quality of the product. The company, however, has been hitherto unwilling to give out for publication any information concerning the nature of its new process. The first public statement concerning it is given in the paper by Capt. R. W. Hunt, just presented at the meeting of the American Society of Mechanical Engineers and printed in this issue.

The aim of the new process is to remove from the top and bottom surfaces of the billet which is ultimately to form the finished rail a skin of partially decarburized metal, containing blow holes and imperfections which were formed when the ingot was originally poured in the mold. These imperfections become longitudinal surface seams as the ingot is drawn down under the action of the rolls to a billet and finally to a finished rail.

The method by which this result is accomplished is something truly unique in mechanical engineering. The skin of metal is cut off the surface of the white-hot billet by a huge milling cutter running at a speed of 2500 ft. per minute, and cutting off metal at the rate of 500 to 800 cu.in. per minute. The removal of metal at this enormous rate is possible through the fact that the work is done upon metal so hot that it is in a plastic condition.

With the exception of the cutting-off saws in general use in rolling mills, there are very few cases that we recall where white-hot metal in a plastic condition has ever been subjected to cutting tools. From Captain Hunt's paper, however, it appears that the milling cutters used in the Lackawanna process are entirely durable, much more so in fact than they would be if used for cutting the metal cold.

Captain Hunt's commendation of the process is, of course, praise from a very high source. It will be evident that the new process has no effect on any interior defects in the ingot, such as piping or segregation, to which undoubtedly many rail fractures are traceable. There does seem good reason to believe, however, that the type of rail failures known as split heads and split flanges, which have been uncomfortably common in recent years, may be materially reduced, if not wholly eliminated, by the Lackawanna Steel Co.'s new process.

The Lesson of the Edison Fire

The disastrous fire which gutted a large part of Thomas A. Edison's manufacturing plant at West Orange, N. J., on December 9, was another of those catastrophes from which the engineering world increases its knowledge. The damage was so extensive and the clearing up since has been so active that it is difficult in the short time since the fire to get any account of the precise nature of the conflagration or any official statement of the losses, but an examination of the ruins is sufficient to make evident certain lessons that, doubtless, later thorough investigations will amplify.

First and foremost, the Edison fire emphasizes once again that most trite of fireproofing axioms—a nonburnable frame does not in itself constitute a fireproof building. To go to the expense of erecting many large and elaborate reinforced-concrete buildings, housing most inflammable materials and surrounded by wooden structures, and then to light those buildings with plain glass windows in wooden frames and to omit any automatic sprinkler or emergency water service can be excused only as an eccentricity of a genius whose transcendent ability in certain fields has in no wise made him omniscient. While the conflagration at its height was so severe as probably to make impotent all such precautions, a proper equipment with some such fundamental fire-protection appliances would have either prevented the initial spread of the fire or confined it to a comparatively limited area.

From a structural standpoint the lessons taught are

radically new. The gutted buildings in the plant demonstrate beyond contradiction that the column is the critical element in reinforced-concrete design. In every building, including those most seriously damaged, the remarkable toughness of the reinforced-concrete frame was evident. Totally stripped by fire of all contents, window frames and floor coverings, the naked concrete frame is standing, in every instance but one, with only minor cracks in beam and slab and hardly a perceptible sag or lean except where the columns have given way. In all but two of the reinforced-concrete buildings a superficial examination indicates that, after washing out with a hose and placing new window sash and glass, the buildings will be ready for installation of equipment.

In the remaining two buildings the trouble without exception lies in the columns, which have buckled and broken in an unprecedented manner. The immunity of certain columns and the destruction of others is not easy to explain, although the degree of heat and the application of water may be responsible, but those columns which have failed point decidedly to one conclusion—the straight-rodded reinforced-concrete column is dangerous in a hot fire. The views and description of the columns on another page of this issue will make every concrete designer pause and consider the possible ultimate economy, from a fire-resisting standpoint, of hooped reinforcement.

The Edison plant today is a field museum of reinforced concrete construction; it should be studied by everyone interested in the industry. Only after a thorough examination can a proper report be made on the conditions before and after the fire; and in the interest of good practice in concrete design, it is to be hoped that such study will be undertaken. Meanwhile, the observer must look at the wreck with mixed feelings: deep respect for the ability of the concrete frame to withstand the hard usage it received and wonder, not to say perplexity, at the manner of failure of some of the straight-rodded columns.

Letters to the Editor

The Low Headway on the New York Barge Canal as a Hindrance to Traffic

Sir—The writer accompanied the Atlantic Deeper Waterways Association on its excursion up the Hudson River on Sept. 25, and there for the first time learned that New York's new barge canal will have a clear headway of only 15½ ft. between the water surface and fixed bridges over it. This news gave the writer about as severe a shock as he ever experienced.

For years we have looked forward to the reopening of the modern Erie Canal, with the expectation that it would have some such favorable influence on transportation as the original Erie Canal in 1825. It was, therefore, a tremendous disappointment to learn how far below its anticipated effectiveness the Barge Canal would prove with its limitation of dimensions of vessels.

It was humiliating to hear the Governor of New York and other prominent speakers, during the progress of the excursion up the Hudson, give eloquent assurances as to what would follow the opening of the new canal, when big steamers from the head of the Lakes would traverse the canal from Buffalo to Troy and Albany, and after going down the Hudson, reach and load at other Atlantic seaports. In like manner we were treated to equally eloquent assurances that the vessels steaming up the Hudson would pass through the Erie Canal for delivery of return cargoes at various ports on the upper lakes.

Naturally, after my return to Philadelphia it was demonstrated to my satisfaction that such barges as for years have traversed the Chesapeake & Delaware Canal, the Lake Drummond Canal and the sounds of North Carolina, could not pass through the New York Barge Canal either light, loaded or partly loaded.

These barges carry loads of 675 long tons, drawing 8 ft., and 1000 tons at 10-ft. draft. The dimensions of these barges are substantially 210 ft. in length, 32 ft. in width, and measure from bottom of flat keel to the top of the pilot house: steel barge, 30 ft., and wooden barge, 32 ft. The wooden barge when light is 13½ ft. and when loaded 6½ ft. too high to clear the bridges.

During the past season steamers carrying 320,000 bushels or more of wheat have left Duluth, Fort William and Port Arthur, passed through the Soo Canals and unloaded their cargo destined to Montreal, at Owen or Parry Sounds, or Port Colborne, Canada. At Owen Sound and Parry Sound the transportation unit is reduced to 1500 bushel "carload units," and forwarded by railroads to Montreal. At Port Colborne the wheat is transferred to smaller steamers carrying, say 80,000 bushels wheat, which proceed through the Welland and Lachine Canals to Montreal.

The improvements under way at the Welland Canal, at an estimated expenditure of $50,000,000, to be supplemented by harbor improvements at Toronto costing probably $10,000,000 more, when completed, will still farther improve the Canadian export routes.

From May 1 to Nov. 28, 1914, there were exported from Montreal, 60,000,000 bushels of wheat, while during the same period New York exported only 20,000,000 bushels.

Prompt action would seem imperative upon the United States and New York State authorities, to rectify, so far as possible, the minimizing factor of insufficient height of fixed structures throughout the length of the new Barge Canal, as at present constructed.

FRANK L. NEALL,
Manager Philadelphia Transportation Bureau.
Bourse Building, Philadelphia, Dec. 6, 1914.

The New York Alien Labor Law

Sir—In an editorial in your issue of Dec. 3, referring to the New York Alien Labor Law, the general [illegible] that was that the law was not a good one.

I think you have overlooked the real intent of the law—that it is not its purpose to protect the public interest of New York, but to protect the interests of the American laborer, both skilled and unskilled. When aliens are entering the port of New York at the rate of a million a year, the enforcement of a law of this sort is necessary. Foreigners can get employment and live comfortably (according to their standards) when a native cannot live at all because his higher civilization exacts a higher standard of living. Under these conditions the American workman cannot survive—he simply disappears in the struggle for existence. No contractor can pay the American union rate without financial failure, where his competitors are paying aliens one-half to two-thirds as much. And with unrestricted immigration, this means that either our workman must be protected by legislation or else disappear from the industries.

To me it seems criminal to do anything in opposition to this law, which is only a last attempt on the part of the American workman to keep his footing in his own land.

A. W. Bedell.

Chappaqua, New York, Dec. 10, 1914.

[A careful rereading of the editorial referred to will show that we did not discuss in it the merits or demerits of the Alien Labor Law. The purport of our editorial was to show the enormous public loss which would result were there to be a wholesale annulment of the subway contracts because of past infractions of the law. We urged also that the status of the law should be promptly settled and it should then be either enforced or repealed.—Ed.]

Paint Protection of the Panama Canal Lockgates

Sir—My attention has been directed to an article in your issue of Nov. 26, on "Experience with Paint on the Panama Canal Lockgates," in which you refer to the poor results obtained with the paint applied to these gates.

It seems proper to point out that the unsatisfactory results mentioned in Col. Goethal's report refer entirely to the *exterior* surfaces of the gates, especially to that portion permanently under water. All *interior* surfaces, which comprise three-quarters of the total area, have remained perfectly protected, although in both the air and water chambers the conditions are rather more severe than on the outside of the gates. These surfaces were not painted in the usual manner, but were treated with a bituminous compound applied in a hot, molten condition to the clean metal.

Coatings of this kind, under the trade names of "Bitumastic" or "Bitulithic" enamels, have long been used in the bilges of war and merchant ships and have given excellent results in difficult locations where ordinary paints fail. It was, therefore, thought, although they are very expensive, that the use of such enamels would be fully justified for the interior compartments of the lockgates, which are dark and difficult of access so that proper inspection and repainting are not easy.

In accordance with the writer's recommendation, the contract for the construction of the gates provided that their entire interior should receive two coats of a bituminous compound of this kind.

Before the material left the contractor's works at Pittsburgh, all the surfaces were cleaned by a sandblast or by pickling, and those parts that would ultimately form the inner surfaces in the gates received a coat of bitumastic "solution" applied cold like any other paint. After the gates were fully erected in the locks, a second coat of the cold "solution" was applied, and before this had become thoroughly dry a heavy coating of the hot "enamel" $\frac{1}{16}$ to $\frac{1}{8}$ in. thick was finally brushed on. It is understood that up to the present time all these interior surfaces remain in perfect condition in both the air and water chambers.

At the time that the contract for the Panama Gates was let, it was feared that difficulties might be encountered in applying the hot coating successfully to the large exterior vertical surfaces on the gates. Experiments made under the writer's direction since then at Panama and also by others elsewhere lead him to believe that this fear was unwarranted and that it would have been better to treat the exterior surfaces in exactly the same way as the interior, or at least those parts of the outside which are permanently under water.

While they are probably too expensive for general use, it is believed that compounds of the character described above offer the best means now available for protecting metalwork under especially trying conditions.

The painting of lockgates to protect them from corrosion is a problem which has not yet been satisfactorily solved. It is important to secure good protection at all times without frequent repainting, as this interferes seriously with the operation of the locks, especially in warm climates, where the operation is continuous during the whole year.

Apparently, no one paint has given perfect satisfaction, as at different places various kinds are found in use. Thus, in the Naval Dockyard at Plymouth, England, the writer in 1908 found a preference for a coal-tar paint of simple character, applied in numerous very thin coats, while in the new docks at Bristol, only a few miles away, red lead was exclusively used. It is understood that in the Sault Ste. Marie locks, where steel gates have been in use since 1895, no one paint has been found entirely satisfactory, although many different kinds have been tried.

The conditions of the water in the Panama locks are especially severe, owing to the large amount of vegetable matters contained in the water, which generate sulphuretted hydrogen, carbonic acid gas, and various vegetable acids. The same conditions, perhaps to an even more marked degree, prevail in other tropical rivers, such as the rivers of British Guiana, where it has proved very difficult to protect ships' bottoms and other metalwork.

The writer has always felt that for such waters the selection of a satisfactory paint, which should not be too expensive, would require a rather long period of trial.

Henry Goldmark,

Late Designing Engineer, Panama Canal.

103 Park Ave., New York City, Dec. 7, 1914.

NOTES AND QUERIES

We published on p. 1160 of our issue of Dec. 10 reports of rail breakages on various railways. After that issue went to press we received additional figures from a railway company controlling 6000 miles of road. On this system during the 20 months from January, 1913, to August, 1914, there were 1891 broken rails and 17 train accidents caused by broken rails, of which 15 occurred during the winter months. Of the 1891 rails broken, 230 were 80-lb. and 1661 were 85-lb. rails

The Mechanical Elimination of Seams in Steel Rails and Other Steel Products*

By Robert W. Hunt†

No part of railway maintenance has been given more discussion and greater publicity than steel rails. The question of safety to human life and limb, to say nothing of property, is so dependent upon the quality of rails, that the reason for this publicity is easily understood.

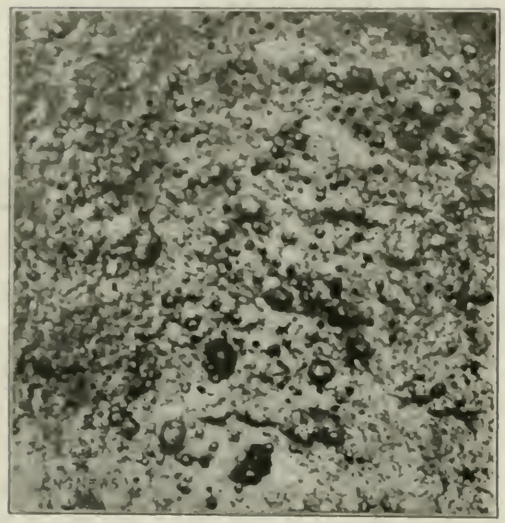


FIG. 1. PART OF THE FACE OF A STEEL INGOT, FULL SIZE, SHOWING SURFACE IMPERFECTIONS

Increased weight of rolling stock and speed of traffic have necessitated increasing the size of the rail sections, and hence their weight; and as many of the details of rail manufacture have been changed with such alterations, it is not surprising that new and unexpected physical weaknesses developed in the heavier rails. One of the most notable was failure through crescent-shaped pieces breaking out of the rail flanges, followed by at least one, and in many cases several, fractures across the whole section of the rail. Investigation showed that in practically every instance of such failure there was a more or less pronounced seam running longitudinally in the bottom of the rail near its center, and thus immediately under the web. This seam occurs at the top of the curve of the crescent-shaped break and is undoubtedly the point at which the fracture starts.

Those familiar with steel rail making know that it was practically impossible to make rails entirely free from seams, and that as the seamy condition of the steel forming the head of the rail increased, so would its wearing quality decrease, but I doubt if it was not until the [illegible] experience with the "crescent-shaped" failures that the danger from seams in the base of the rails was fully realized.

The crescent-shaped breaks were of such frequent occurrence that they led rail makers to experiment with the design of their rolling passes with a view to obviating the formation of the bottom seams. Fewer seams were produced as a result of such changes, but they were not entirely eliminated. While more or less successful in preventing the formation of seams through lapping on the bottom of the rails, the formation of seams in other parts of the section was not particularly affected.

It is a well known fact that it is not alone the quality of rails which deteriorates through the use of seamy steel, and the fundamental causes in one will more or less apply to all cases. T. H. Mathias, assistant general superintendent of the Lackawanna Steel Co., determined that the most certain way of getting rid of seams was to remove that portion of the metal which contained them, and, as applied to steel rails, thus to eliminate them from both the base and head of the rail. This was a reasonable assumption, but its execution, I think, would have seemed very impracticable to the minds of most metallurgical engineers.

Mr. Mathias reasoned that the primary causes of seams existed previous to any rolling of the steel, in fact, were incident to the casting of the molten metal into ingots. He knew that disk-like apertures were formed on the sides of ingots while the molten metal was being cast and were probably caused from air being entrapped against the sides of the ingot molds by the hot steel as it rises in the molds. This condition is illustrated by Fig. 1 which represents a section of the face of such an ingot, actual size, and illustrates how serious such apertures may be.

It will be appreciated that, as the section of the ingot

FIG. 2. CROSS-SECTION OF BAR FOR A STEEL RAIL POLISHED AND ETCHED TO SHOW LOW CARBON METAL ON EXTERIOR

is reduced and elongated in the rolling process, the apertures will be stretched longitudinally and thus be formed into seams.

Mr. Mathias further demonstrated that in the heating of large steel ingots a decarburized surface is formed on all of their four faces, about $\frac{1}{16}$ in. deep, and containing from eight to ten points lower carbon than the metal

*Abstract of a paper read at the annual meeting of the American Society of Mechanical Engineers.

†[illegible], Chicago, [illegible].

immediately under it, the decarburized envelope undoubtedly being produced through the oxidizing conditions to which ingots are subjected in the soaking pits where they are heated preparatory to rolling. A thick oxide scale is always formed on the surface of ingots in the pits, so that

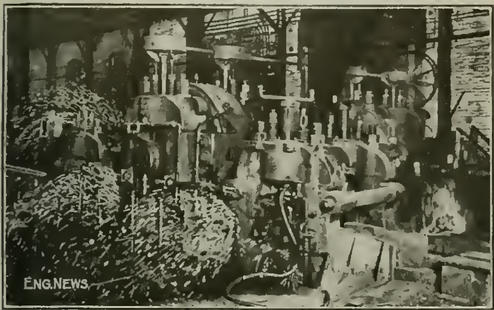


Fig. 3. Mathias Hot Saw in Lackawanna Rail Mills, Planing Metal from Top and Bottom of Rail Bloom

conditions are invariably present for the production of such a layer of lower-carbon metal on their outside faces. Fig. 2 illustrates the presence of this lower-carbon envelope or skin. It shows a polished and etched cross-section of a part of an ingot which has been heated to a rolling temperature in the soaking pits and has been reduced by five passes through the roughing rolls.

Mr. Mathias was convinced that during the process of rolling ingots into rails it was practical to remove mechanically the parts of the enveloping steel which would form the top of the head and bottom of the flange of the rail, and he experimented accordingly. He designed and his company installed as an addition to their rail train, a milling, or a hot sawing machine, as I believe Mr. Mathias designates it, to cut off this layer of lower-carbon metal without retarding the regular operation and thus interfering with the production of the mill. This is illustrated by Fig. 3, which is a photograph of the machine in operation. The machine is located in echelon in relation to the rest of the rail train.

The ingot is reduced in the blooming rolls to an 8x8-in. cross-section; and after cropping the ends, the bloom is further reduced in the roughing or shaping stand of rolls by five passes. When it leaves these rolls, it is approximately 75% finished, and at this period it is carried to the right and entered between two pinch rolls with its base or flange side up. A bar which will make four 33-ft. rails is at this point in the rolling operation about 60 ft. in length; therefore, the area of metal to be cut off or removed in the milling machine is approximately $\frac{1}{8}$ in. deep, 7 in. wide and 60 ft. long. It is driven through the pinch rolls at a rate of 60 ft. in 30 seconds. The pinch rolls have a draft of about $\frac{3}{8}$ in. and thus force the bar between the two milling saws, which are so arranged in the housing that they may be raised or lowered as desired. There is from $\frac{1}{32}$ to $\frac{3}{64}$ in. of metal milled from the head and base of the bar, the front end of which, immediately on passing from between the rolls, is caught by a second set of pinch rolls which have a draft of about $\frac{1}{16}$ in. These pinch rolls force the bar between the tools, pull it from between them, and also hold it in practically perfect line for the milling operation. The milling apparatus is driven electrically and requires about 600 hp. for its operation.

As the milled dust or particles of steel are thrown out, they are hit by water under pressure which forces them into a chute and also prevents the material from adhering together. By the chute they are carried below the mill and caught in boxes or receptacles suitable for charging as scrap into the openhearth furnaces.

Fig. 4 shows the accumulated material removed by the hot saw which, as will be seen, is in regular openhearth furnace charging boxes.

Fig. 5 shows one of the milling tools. It is 5 ft. in diameter with an 8-in. width of face and revolves at a peripheral speed of 2500 ft. per minute, thus causing an engagement of about 400,000 teeth per minute on the hot rail bar. The teeth are of 0.80 carbon steel, and it has been demonstrated that they will mill at least 30,000 tons of material without requiring dressing. The one shown had milled about 15,000 tons.

The work of rolling which the steel receives after the removal of the more or less laminated metal must produce a better product than if such elimination had not taken

Fig. 4. Steel Cuttings Removed by Hot Saw

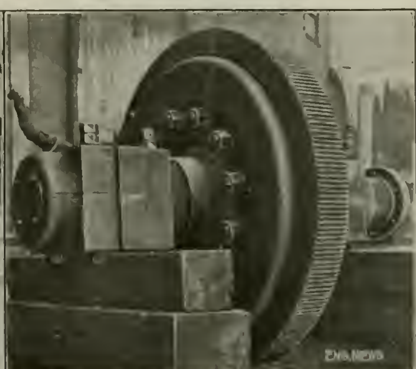


Fig. 5. Milling Cutter Used in Hot-Saw Machine

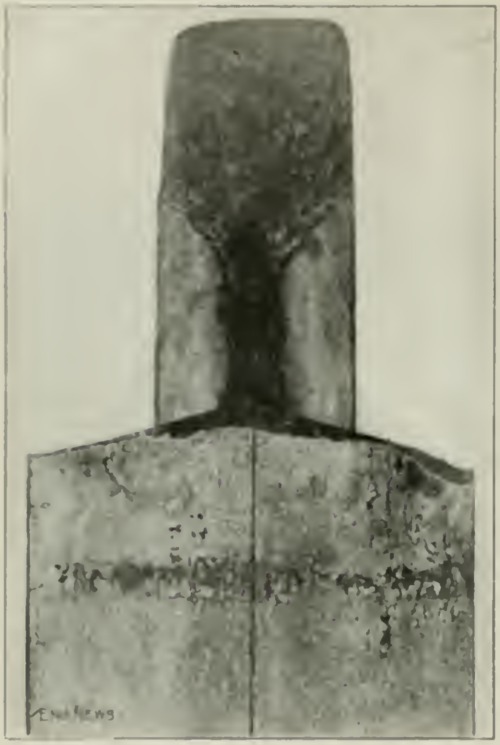


Fig. 6. Steel Rail Broken in Drop Test, Showing Longitudinal Seam in Center of Base

place, and, in the case of steel rails, it should not only make them less liable to breakage on account of seams in their flanges, but also enable them better to resist the abrasive effects of traffic.

During the many years of my connection with rail making I have examined a great many etched specimens of rails, not only directly in connection with the process under consideration, but for various other reasons. From such experience I can fully appreciate what Mr. Mathias has accomplished. The surfaces of practically all rails, when etched, will show some seams on both base and head, and very frequently the extent of such defects will not be appreciated if the scale has not been removed. Even then, it is not always an easy or certain matter to estimate the depth of the seams. When the rails have been subjected to the Mathias milling operation and still show pronounced seams, it has been found that breaking tests will practically always develop the fact that the suspicious marking is an actual seam.

Fig. 6, which is a piece of rail broken under the drop press, plainly shows a pronounced seam in its flange directly under the center of its base, and is an illustration of a dangerous rail. As the original defects on the sides of the ingots vary in extent, so will the character of the resulting seams vary and it can be readily appreciated that some of them may have been too deep to have been completely eliminated by the milling.

To illustrate the appearance of many ordinary steel rails, Fig. 7 shows the surfaces of both heads and flanges. These specimens were taken from rails made by several different makers, including the Lackawanna Steel Co. These illustrations not only clearly show the field for such an operation as I have described, but also the extent to which Mr. Mathias has been able to accomplish it.

While I have confined myself to the matter of steel rails, it is patent that the process will be of great value in

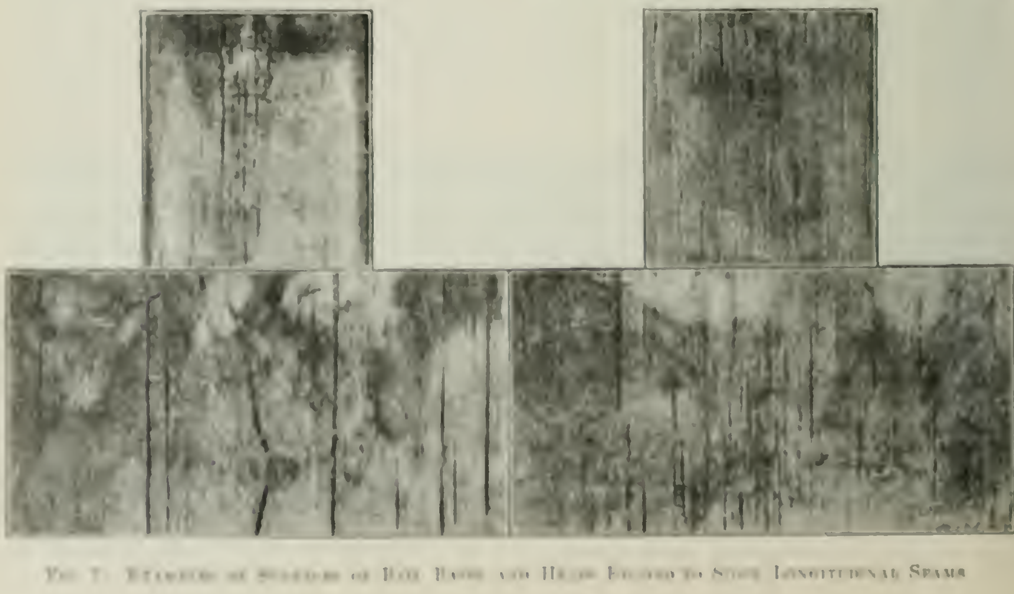


Fig. 7. Etchings of Surfaces of Rail Bases and Heads Etched to Show Longitudinal Seams

FIG. 8. SURFACE OF RAIL BASE AND HEAD TREATED BY LACKAWANNA DESEAMING PROCESS

the preparation of blooms for axles and all other kinds of forgings. As is well known, it is practically the universal custom to endeavor to remove the seams developed in rolling axle billets by chipping them out through the use of pneumatic hammers, and for some of the higher characters of forgings, notably for automobile parts, the endeavor to eliminate the seams is carried to the extent of turning off the whole surface of the billets. I am confident that by the Mathias plan the greater part, if not all, of such work can be superseded, and I regard the invention and its practical installation as a notable achievement in the art.

Flood Protection in China; Report of the Board of Engineers

The report of the Board of Engineers appointed by the American National Red Cross in May last to investigate projects for flood protection on the great plain of eastern China, has just been made public. In our issues of Sept. 25, 1913, and Feb. 12, 1914, we described the plans for control of the Huai River developed by Chas. D. Jameson, an American engineer long resident in China, and later the connection of the J. G. White Engineering Corporation with the project.

The report of the Board of Engineers just issued describes the unusual topographical conditions which have made the great plain of China at once one of the most fertile and densely populated regions on the face of the globe and likewise the greatest sufferer from alternate floods and drought. While the average annual rainfall over this area is approximately 36 in., it is subject to torrential rains of extraordinary severity. Local rainfalls of 25 in. in 48 hr. have been recorded, and storms of 4 to 8 in. in one to three days are quite frequent. The Huai River has not slope enough in crossing this plain to excavate for itself a deep channel, and it has in historic times frequently changed its course, thereby bringing calamity to millions of people.

The Board of Engineers in its report gives full credit to Mr. Jameson for the surveys and investigations carried on under his direction, but much more data are needed for the preparation of a final project. From such data as are now available, however, the Board is unable to recommend any of the projects heretofore suggested, and outlines instead a project of its own.

The Board's project involves the diversion of the Huai River where it enters Hungtse Lake and drainage of the bed of the latter, thereby reclaiming 400,000 acres of excellent land. The Board further proposes a system of control works and locks for the waterways affected, so that the channels it proposes to create and improve would be benefited for navigation and irrigation, as well as for flood prevention.

It is estimated that the entire work included in the Board's project would require the excavation of about 375,000,000 cu.yd. of material, or an amount 50% greater than the volume of excavation for the Panama Canal. The material to be excavated on the Chinese plain is nearly all earth, however, and the labor is phenomenally cheap. The total cost, including the proposed locks and controlling works, is estimated at $30,000,000. The direct benefits to the lands affected, estimated at over 7,000,000 acres, are appraised at $48,350,000. The members of the Board were Col. Wm. L. Sibert, Corps of Engineers, U. S. A., Prof. Daniel W. Mead, of the University of Wisconsin, and Arthur P. Davis, Chief Engineer of the U. S. Reclamation Service.

Annual Meeting of the Society of Naval Architects and Marine Engineers

The 22nd general meeting of the Society of Naval Architects and Marine Engineers was held at the Engineering Societies Building, New York City, Dec. 10-11. In the absence of Colonel Thompson, on account of illness, Stevenson Taylor read the presidential address. He called attention to the increase in the number of commercial seagoing vessels equipped with Diesel or other oil engines. The largest installation is 4000 hp. (six cylinders on each of two shafts), and more than 100 oil installations are in service at sea. Attention was directed also to the development in the geared-turbine system of propulsion. The number of such installations in service at present, or under way, is 126, amounting to 1,000,000 hp. During the past year 620,000 hp. in such turbines have been ordered. The submarine has undergone great development also. The modern type can steam at 20 knots on the surface and develop 5000 hp. with a combination of boilers, oil fuel and turbine-geared machinery. Storage batteries are employed for submerged driving. Several of the 14 interesting papers presented are abstracted below:

"Safety of Life from Fire at Sea," by W. O. Teague, listed a number of typical marine fires and their causes.

Means of [illegible] were then discussed, of which the two most important were the use of non-inflammable [illegible] in the construction of the vessel, and automatic sprinklers. The use of steam for extinguishing purposes has not [illegible] unqualified success. Tests have been made on shore where combustible materials were completely [illegible] although exposed to an atmosphere of steam. Furthermore, steam will [illegible] [illegible] water and is very powerful. Furthermore, as it is applied only to holds, it is at best only a partial [illegible].

[illegible] gases are good fire-extinguishing agents when the [illegible] is confined, but they are not as effective as water in absorbing heat, and have little cooling effect on the fire.

The use of carbon dioxide is objectionable since it [illegible]. A 10-lb. tube is required to each 1000 cu. ft. of air space. The gas is not injurious to [illegible].

Stress was laid upon the value of automatic sprinklers, whose application to vessels has only just begun. The estimated cost of a sprinkler equipment on shipboard, exclusive of pumps and tanks, is about $1 per sprinkler, these being spaced about 10 ft. apart, each one protecting 100 sq.ft.

"The Stability of Vessels as Affected by Damage Due to Collision," by William Gatewood, discussed the best design to give both stability and comfort. He stated that—

[illegible] prefer a vessel with a long period of roll, as the [illegible]. To obtain a long period, it is necessary to have a large vessel or a small metacentric height, and the combination of the two requisites in the large Atlantic liners renders travel on them a pleasure instead of a hardship to the [illegible] with a "[illegible]" stomach. [illegible] metacentric height [illegible] accompanied by a long [illegible] and a [illegible] range of stability, there is small danger of capsizing due to wind and wave when intact. The comfortable condition of a vessel, however, may be a source of great danger [illegible] if the vessel is damaged by collision.

"Refueling Warships at Sea," by Spencer Miller, interestingly described the gradual development of methods of getting coal and oil on board when at sea. The value of doing this [illegible] was illustrated by a number of instances in [illegible] operations during the present war. Attention was called to the record performance with the U. S. S. "Wyoming," coaled at Guantanamo Bay in the spring of 1913 from the U. S. colliers "[illegible]" on one side and the "[illegible]" on the other. In [illegible] hours 2000 tons of coal were taken on and stowed, an average of 21[illegible] tons per hour. The colliers rigged out eight booms over the deck of the "Wyoming" and discharged with clam-shell buckets.

The [illegible] at [illegible] the [illegible] of [illegible] ships in a seaway was fully described. The U. S. collier "Cyclops" illustrates the highest development in this direction. The [illegible] of this vessel is [illegible] of [illegible] automatic [illegible] [illegible]. [illegible] [illegible] the "[illegible]" in the [illegible] of the [illegible] cable produced a corresponding and [illegible] change in the [illegible] pressure. A [illegible] of the [illegible] cable [illegible] an [illegible] in the [illegible] sufficient to restore the tension to normal; while a [illegible] of the cable [illegible] an [illegible] in the [illegible] pressure, permitting the cable to pay out until the tension is restored to normal. This cableway has been tested in heavy seas, with the "Cyclops" rolling 20°. On another occasion coaling was carried on between the collier "Vestal" and the battleship "Virginia" in a dense fog, in which neither ship could see any part of the other.

"The Behavior of Riveted Joints under Stresses," by James E. Howard, called attention to the fact that few, if any, riveted structures are erected which are free locally from strains which exceed the elastic limit of the material. The structures are not necessarily endangered by the presence of these overstrains. It depends upon the character of the work which they have to perform, however, whether ultimate failure will result and the place of rupture be located by an overstrained zone. The strength of various kinds of riveted joints was then discussed.

"The Applicability of Electrical Propulsion to Battleships, together with the Experience Gained with it on the 'Jupiter,'" by Lieut. S. M. Robinson, U. S. N., was a paper whose presentation was awaited with great interest by the membership. The author stated that "I do not believe there is any question of the relative economy of the two methods—the electric drive is far superior. The 'Jupiter' was in commission over a year and a half, during which time two official trials were conducted, and the usual routine work of a navy collier carried on. She covered about 14,000 miles, and was handled around docks, in narrow channels, and in other places demanding flexibility of drive. About one-half of the steaming was done in the tropics, with circulating water over 80° F. and correspondingly poor vacuum, so that the economy of the ship is known under all conditions. The fuel economy was excellent, being on the average about 25% better than the best of her sister colliers."

The annual banquet was held in the Astor gallery at the Waldorf-Astoria, on Dec. 11. The attendance was about 260.

In the election of officers for the ensuing year, the following were elected vice-presidents: Rear-Admiral W. L. Capps, retired, W. L. Babcock, W. S. Durand, and D. W. Taylor. Members of the Council elected were: J. J. [illegible], D. H. Cox, H. L. Ferguson, C. H. Peabody, E. L. DeBaque, H. C. Sadler, H. S. [illegible], and H. L. Aldrich. D. H. Cox was re-elected Secretary.

Sewers as Obstructions to the Chicago River [illegible]

[illegible]

The Fire in the Edison Works at West Orange, N. J.

During the night of Dec. 9, 1914, fire in the main plant of Thomas A. Edison, Inc., and associated companies at West Orange, N. J., very seriously damaged eleven buildings and burned over an area of nearly 6 acres in which these and other buildings were located. Estimates of loss run all the way from $750,000 to $3,000,000, the correct figure being largely dependent on the amount of reclamation of machinery and structure. Outside insurance was held to the amount of about $200,000. Only one person was killed, although a number of work people had to get out of the plant after the fire started and men were engaged all during the fire saving equipment and products.

FIG. 1. LOOKING SOUTHEAST OVER THE BURNED AREA OF THE EDISON PLANT WHERE THE FIRE STARTED
(Concrete building in left background is the phonograph building, where the columns, shown in Fig. 3, were all shivered.)

The plant comprised a great number of closely spaced buildings, separated by narrow interior streets and alleys and by the wider streets of the city. Structural design varied with the age of the buildings. The earlier buildings were one- and two-story structures with brick walls and timber floors, and in one or two cases steel roof trusses. About seven years ago reinforced-concrete buildings were started and this type of construction has been followed since.

The fire started in one of the low brick and timber buildings, probably from an explosion or rapid combustion of some of the elements of moving-picture film manufacture, and rapidly spread to the immediately adjacent low brick shops and storage houses. The contents of these proved such effective fuel that the fire soon spread into and through the reinforced-concrete buildings which housed film stock, phonograph cases, phonograph disks and cylinders, packing boxes and office records, all except the latter being highly inflammable. The fire started at 5:30 p.m. and was fought all through the night by the united fire departments of West Orange and the surrounding communities, but with the exception of the saving of the famous Edison laboratory (brick and timber buildings) and one concrete building alongside, all that the firemen could do was to prevent the fire from jumping a city street to the newest concrete buildings of the plant, those used for storage-battery manufacture. The fire was thus confined to buildings in a city block. It was not under control until the early morning of Dec. 10.

Water supply, practically entirely from the city service, was low in amount and pressure, though the severity of the fire and rapidity of its spread were such that probably this inadequacy had no effect on the final result. Of the entire plant only the laboratories were equipped with sprinklers, and the fire never came near enough to them to require the sprinkler service.

The reinforced-concrete buildings varied in height from four to seven stories and were all, with one exception, of the same general type, though varying somewhat in design and layout. In general, they had beam-and-slab floors spanning square, straight-rodded columns, with fascia wall girders holding wooden window frames with plain-glass lights. The exception was one of the older buildings, which had, for the lower floors at least, hooped round reinforced-concrete columns. The ends of some of the concrete buildings nearest the low brick buildings had concrete curtain walls instead of windows.

The effect of the fire on the brick and timber buildings has nothing of novelty; the view in Fig. 1, overlooking the site of the initial fire, shows the complete destruction wrought

The effect on the concrete buildings, on the other hand, is interesting in the extreme. Every concrete building

Fig. 2. The Third Floor of the [illegible] Record Building
(The outside of this building is shown in Fig. [illegible])

Fig. 3. Interior of the Phonograph Storage Building, Showing Column Destruction
(This building is the one shown in the left background of Fig. 1.)

Fig. 4. The Only Collapse in the Edison Fire

(Heavy machinery was stored on the upper two floors.)

Figs. 5 and 6. Further Examples of Interior Column Failure

Fig. 2. Reinforced-Concrete Columns Destroyed by Fire at the Edison Plant

[illegible] was gutted of contents. The fire readily broke through the glass windows and, aided by the inflammable contents and wooden trim, soon destroyed everything except the concrete frame. The view in Fig. 1 shows the extent of this damage in two of the buildings, a condition practically duplicated in all the rest. Counting certain wings as separate structures, there were seven large buildings thus affected.

In most of the concrete buildings the concrete has stood up remarkably well. With machines reduced to scrap and [illegible] with the floors [illegible] burnt phonograph records, and with the wooden sleepers burned out from their grooves in the concrete floor, the concrete itself is remarkably free from cracks and spalls. In two of the buildings, however, the destruction of concrete, particularly of the columns, is more serious than has ever before been noted in concrete buildings under fire.

The views of Figs. 2, 4-8 show the conditions in these buildings. It will be noted that the common type of failure is in the straight-rodded column and its progression can be shown in different columns in the figures. Evidently the action is as follows: Under the heat of the fire the longitudinal steel rods (which were only at the four corners and evidently not tied horizontally) expand, and in expanding throw off the outside coating of concrete. Once exposed, they are free to expand further and, in their softened condition, to bend under load until finally the weakened section of concrete crushes under the load, the column drops and the rods bow out almost in a loop. Fig. 5, a view in the first floor of the phonograph warehouse, where the packed machines made a very hot fire, shows the secondary stage in this failure. Practically every column in this building is shattered seriously at the reinforcing rods and many are reduced in section or broken. The whole seven-story building is still standing on columns which can hardly have 50% of their original section.

The views in Figs. 3 and 8 show the third floor of the phonograph-cylinder shop, a floor on which were thousands

Fig. 3. Outside of [illegible] Building, Showing Third-Floor Columns Destroyed

[illegible]

of the wax dictating records and which was subjected to the hottest kind of a fire. It is evident that concrete heated almost to incandescence is much more apt to break down and spall if wet down than if left to cool naturally. This may account for the condition of the columns on this third floor. The fire here was much hotter than on the other floors of the same building and was the main point of attack of the engines, which were able to take a near-by stand for a time at least. The third-floor columns are in the last stage of failure and have dropped from one to two feet, carrying the floors in a sag, but in no case causing total collapse. The remaining floors of the building are remarkably free from cracks and breaks.

The hooped columns were in the building where were stored undeveloped moving-picture films and which was burned out. The precise nature of their design is not now available, but the one column that is stripped in one small patch shows a heavy expanded-metal cylindrical covering. All the columns on the floor are practically intact.

In many of the views cracks in the beams and girders may be noted. In every case these are over reinforcement, which has expanded as in the columns, and forced off the concrete covering. The depth of this covering varies, but in most cases it is equal to or greater than the 2 in. required in modern practice.

At one point only were the column failures of sufficient extent to cause collapse, and that was at the corner of the upper floors of a six-story factory, on which floors heavy machinery was located. The collapse is shown in Fig. 4. It is rumored that the largest explosion of the night took place at this point and caused the collapse, but it appears that the failure of some corner columns was the initial cause. The behavior of the lower floors and of the adjoining building in standing up under this heavy impact testifies to the integrity of the structure against mere load conditions.

At the present stage of investigations there is no definite record of differences of age or peculiarities of material, design or temperature conditions during the fire which might cause the different effects on the various buildings. To a somewhat superficial examination, the structure in all of the buildings is equally good; the concrete seems to be admirable. How far the peculiar fire or explosion conditions resulting from the permeating volatile oils which were present in the plant are responsible for damage is also a matter that may be cleared up in the thorough investigation which it is hoped may soon be under way.

NEWS NOTES

A High Wind Lifted a Steel Stack at the Flatbush Waterworks, Brooklyn, N. Y., and carried it 50 ft. through the air, dropping it through the roof of a house, where it fell through the ceiling into the room below, on Dec. 8. No one was hurt. The stack spent the night in the house. The next morning derricks were placed for its removal.

An Acetylene Tank Exploded in a junk yard at Hagerstown, Md., on Dec. 5. The gas was used in the cutting of scrap iron. The tank exploded when a match was applied to the end of the tube leading from it. One man was killed and another injured.

A Pipe Plant Burned in Birmingham, Ala., on Dec. 6, belonging to the Southern Sewer Pipe Co. The main building, 500x80 ft., three stories high, of brick and wood, was destroyed. The total damage was estimated at $100,000. The manager stated that the plant would be rebuilt

Collisions on Elevated Railways, New York—On Dec. 9 a local northbound train on the Ninth Ave. Elevated Ry. crashed into the rear of an express train standing at a station. Two persons were killed and 18 injured. Preliminary investigation by the Public Service Commission developed the fact that the local was being operated from the fourth car, on account of derangement of the electric control machinery in the first car. The motorman depended for guidance upon signals given him by a conductor stationed on the rear platform of the first car. This car telescoped the rear car of the express train and both took fire from the third rail and were consumed. A public inquiry into the accident was scheduled for Dec. 16 by the Public Service Commission. On Dec. 11 a local southbound Sixth Ave. train struck the rear of a Ninth Ave. local standing at 150th St. Seven persons were injured. The motorman was driving from the first car. He is reported to have stated that he did not see that the train ahead had stopped, until it was too late to avoid collision.

Macadam Pavements Have Been Laid in Winnipeg, Man., since 1894, to a total of nearly 600,000 sq.yd. Since 1901 nearly 165,000 sq.yd. have had to be removed.

The Field Work of the Topographical Survey of Ohio has been about completed by the United States Geological Survey. It is expected that all the sheets not yet published will be available within two years.

The Proposed Freight Terminal of the Lehigh Valley R.R. at Buffalo, N. Y., requires the demolition of 30 buildings on the ¼-mile square, recently purchased by the railway for $1,200,000. Most of the buildings are small frame stores and dwellings, and their demolition is under way at the present time.

A Bill for Licensing Engineers is, according to report, again to be introduced in the New York legislature, which assembles on Jan. 1. The bill originates with the Technical League of New York, and it is supposed will follow generally the lines of the bills pushed by that organization in previous years.

The U. S. Steamboat Inspection Service in the year ending June 30, 1914, inspected 7930 vessels, with a gross tonnage of nearly 10,000,000. There were 232 accidents during the year on vessels subject to inspection, resulting in a loss of 105 passengers and 477 members of the crew. One passenger was lost for each 3,029,000 passengers carried. The report recommends legislation to require fireproof construction on all excursion steamers hereafter built, and that the designs for the hulls and boilers of all vessels hereafter built should be first examined and approved by a corps of inspectors in the office of the supervising inspector general.

3512 Men on Panama-Pacific Exposition Construction—A census of employees of the Panama-Pacific Exposition on Nov. 1, showed a total of 3512 men engaged on construction work. This force was distributed as follows:

Exposition board of works, engaged on main buildings	723
State and foreign buildings	1060
Concessions	663
Exhibits	96
Office force	298
Landscape gardeners	99
Firemen	74
Sculptors	40
Clearing grounds	339
Guards	120

The Standard Form of Building Contract adopted by the American Institute of Architects is in process of revision by a committee of the Institute in coöperation with a committee of the National Association of Builders Exchanges. At a joint meeting in Philadelphia in September last, a preliminary draft of the revised form was prepared, and this revised form has now been printed for further discussion at the annual meeting of the American Institute of Architects to be held in Washington this month. Copies of the revised draft can be obtained from the General Commissioner of the Builders' Exchanges Association, Mr. I. H. Stales, 15 East Fayette St Baltimore, Md.

A Municipal Refuse-Utilization Plant is being built by Columbus, Ohio. The salable refuse will be picked from an inclined conveyor belt and baled. The tailings will be burned in a two-cell Stirling furnace, built by the Griscom & Russell Co., New York City. The cells will have a rated capacity of about 45 tons a day. Steam generated by a 150-hp. boiler will be utilized at the near-by municipal electric-lighting plant. T. D. Banks is Superintendent of Garbage Reduction and Refuse Disposal at Columbus. The plans for the refuse-utilization plant were originally made by Ira S. Osborn, but have been remodeled somewhat by J. J. Morgan, Commercial Building, Columbus. The abandoned West Side pumping station is being remodeled to house the refuse-utilization plant.

To Provide for Unemployed Men in Los Angeles County [illegible] the board of supervisors has authorized road work [illegible] will [illegible] arrangements are under way [illegible] work [illegible] men. In the [illegible] who have lived in Los Angeles County one year will be given preference.

The Chicago River Protective Association has been organized by a group of [illegible] owners. Its purposes are to promote the [illegible] of the river and prevent its further obstruction, to secure the removal of the center-pier swing bridges and other obstructions, to secure a width of [illegible] ft. and a depth [illegible] for modern commerce, and to aid in [illegible] a [illegible] for the solution of the drainage problem of Chicago. [illegible] W. [illegible] is chairman of the association.

Better State Highway Legislation is the object of a committee to work for revision of state road laws appointed by the directors of the American Highway Association on Dec. 1. The committee consists of Walton Moore, of Washington; Chas. J. Bennett, State Highway Commissioner of Connecticut; A. N. Johnson, Chief Engineer, Bureau of Municipal Research, New York City; Francis J. Caffey, of the Department of Agriculture, and J. E. Pennybacker, Chief of Road [illegible], U. S. Office of Public Roads.

Adequate Survey of Pacific Needed—In his annual report [illegible] on Nov. 22, Secretary of Commerce Redfield emphasized the need of legislation and money for the protection of [illegible] and safeguarding vessels against needless destruction. The immediate need for three vessels for survey work along the Alaskan coast was pointed out. He said "Our [illegible] have been drowned (31 in one case), and both private and public property repeatedly lost, because the United States Government has not more rapidly provided the force and apparatus with which to survey and chart the dangerous waters of our Pacific and particularly of our Alaskan coasts."

Geared Steam Turbines for ocean steamship propulsion have been adopted on the "Transylvania," the new Cunard transatlantic steamship of 1[illegible] tons which arrived in New York Nov. 17. According to "The Engineer" of London the propelling machinery of the vessel consists of two sets of Parsons steam turbines, the high-and low-pressure drums being on separate shafts. Each turbine shaft carries a helical spur gear in mesh with a gear wheel on a propeller shaft. The gear reduction is 12½ to 1, and the propeller shafts are [illegible] at [illegible] revolutions. With both sets of turbines developing 9[illegible] hp. it is expected to give the ship a speed of 15½ knots.

The Building of Wooden Passenger Cars has ceased in the United States. The report of the Committee on Rails and Equipment to the National Convention of State Railway Commissioners in Washington last week showed that of 31[illegible] passenger train cars under construction on Jan. 1 last [illegible] were of steel, [illegible] had steel under frames, and only [illegible] were of wood. Only two of these were intended for the use of passengers. The number of steel and steel under-frame passenger cars in service on Jan. 1 was about [illegible] and the number of wooden cars about [illegible]. It is also becoming common to use steel cars for cars having [illegible] frames and wooden upper construction.

A River Straightening Job at Dayton, Ohio, part of a larger scheme which had been planned before the great flood of 1913, has been completed under the direction of the Public Service Department of the city. [illegible]

Fast Third Tracking on Second Ave. Elevated Ry., New York—[illegible]

Changes in Lime Handling at the Cincinnati Water Filtration Plant [illegible]

[illegible] received in cotton duck sacks, each holding 1[illegible]0 lb. It is now bought in bulk in carload lots and passed through a swing-hammer crusher, direct connected to, and driven by, a [illegible]-hp. [illegible]-volt, direct-current electric motor. The lime is [illegible] from railway cars to the hopper of the crusher. The crushed lime is discharged into the boot of an elevator and carried to the second floor of the chemical house of the filtration plant, where it is dropped into a drag conveyor hung from the ceiling of the [illegible]-house roof. The valves in the bottom of the conveyor drop the lime into a room which has been partitioned off in the chemical house by corrugated iron. The elevator and conveyor are operated by a [illegible]-hp. motor. These improvements cost about $2[illegible]. The new method of handling lime will save at least [illegible] per ton and perhaps more on the cost of the lime alone, besides a saving in freight for the return of empty sacks to the kilns to be refilled. The cost of the labor for unloading will also be less. Altogether the annual saving will probably be about $[illegible] a year. J. W. [illegible] is Superintendent of the Cincinnati Filtration Plant, and J. A. Heller is General Superintendent of the Cincinnati Water-Works.

The Centennial Anniversary of the Steam Printing Press has just occurred. On Nov. 29, 1814, the issue of "The Times" of London, England, was for the first time printed by steam power. The machine used was a cylinder printing press, also the first of its kind ever produced. A full description is given in the "Times" Engineering Supplement of Nov. 27, 1914. This steam press was invented by Friedrich Konig, a native of Eisleben, Saxony, the birthplace of Martin Luther. Konig was a printer's apprentice at Leipzig and after making various inventions which found little appreciation in his native country, he emigrated to England in 1806 and obtained the financial assistance of Thomas Bensley, a printer. The general principle of the cylinder press had been developed by an English inventor, William Nicholson, in a patent dated 1790, but Nicholson was without means and was in fact found by Konig in a debtor's prison. Konig's designs, which he patented in 1811, were taken up by John Walter, the head of the London "Times," and after three years of patient labor the first cylinder press driven by steam power was completed. This machine printed one side of a sheet at the rate of 11[illegible] copies an hour, and was later improved to reach 1[illegible] copies an hour. Three years later the machine was improved by Konig to print on both sides of the sheet.

A New Railway Route between the Northwest and the Gulf ports has been established by the completion of the Chicago, Burlington & Quincy R.R. extension from Casper to Orrin Junction, Wyo., about [illegible] miles. This completes a low-grade line from Billings, Mont. (on the Northern Pacific and Great Northern railways), to Orrin Junction, 3[illegible] miles, where connection is made with the Colorado & Southern Ry. to Denver and Gulf ports. These four railways are owned by the same interests. The maximum grades on the new line are [illegible] 0.[illegible]%, with two pusher sections having grades of 0.[illegible] to 1.[illegible]%. The maximum curvature is [illegible] on most of the line, and [illegible]° in some parts. There is some very heavy construction, and the line traverses three deep and narrow [illegible], the Wind River cañon being about eight miles long. For about 10[illegible] miles west of Orrin Junction the new line parallels the Chicago & Northwestern Ry. line to Lander, Wyo., both lines following the Platte River.

Two extensions or links in the Burlington system are [illegible] east of Orrin Junction, one from Bridgeport to Newark, Neb., and the other from St. Joseph to Mexico, Mo. These will complete a low-grade line from the Ohio River at Metropolis, Ill., and the Mississippi at St. Louis, to the Northwest and Pacific ports. The new Ohio River bridge and connections between Metropolis, Ill., and Paducah, Ky. (now under construction), will also establish connection with the South.

Conference of Hydraulic Engineers—A conference of hydraulic engineers engaged in water-resource investigations was held last week at the offices of the Water Resources Branch of the Geological Survey at Washington, D. C. [illegible]

ments and equipment used in hydrographic work. The following papers were included in the program: "Standardization of Equipment," G. L. Parker; "Refinement Justified in Field Equipment and Methods," C. C. Covert and W. A. Lamb; "Automatic Gages"; "Work of Groundwater Division," O. E. Meinzer; "Method of Correcting River Discharge for a Changing Slope," B. E. Jones; "Determination of Drainage Areas" J. H. Morgan. Further information can be obtained by addressing John C. Hoyt, Hydraulic Engineer, in charge of Division of Surface Waters, U. S. Geological Survey, Washington, D. C.

Alum for Water Coagulation at the water-purification plant of Columbus, Ohio, will be manufactured by the city in a plant which it is expected will be put in operation by Dec. 15. Either bauxite or halloysite will be bought in carload lots. The ore will be dumped into a crusher beneath the floor. The crushed material will be lifted by an elevator which will discharge the bauxite into a pulverizer where it will be powdered so fine that 90% will pass through a screen having 200 meshes per in. The halloysite will not be pulverized, as it gives better results when merely crushed to the size of grains of crushed corn. The crushed and pulverized bauxite, or the crushed halloysite, as the case may be, will be elevated to lead-lined tanks, where it will be treated first with sulphuric acid, then boiled with steam to complete the reaction. The material will then be diluted with water and the proper quantity drawn off into a measuring tank on a lower level, and from there ejected to a chemical-solution tank. From the latter the solution will be fed into the water to be treated. Any suspended matter present in solution will settle out in the regular sedimentation basins. Commercial alum now costs about $17 per ton, f.o.b. at Columbus. It is expected that the new plant will produce alum at about $12 a ton. The plant will cost about $12,000. One ton of bauxite will make 2½ tons of 17% alum (Al_2O_3). The new alum plant will be operated about two days a week, on different days, by only one man. The plant was designed and is being built by C. P. Hoover, Chemist-in-Charge of Water Purification Plant, Columbus, Ohio. Jerry O'Shaughnessy is Superintendent of the Columbus Water-Works.

PERSONALS

Mr. G. Masunaga, Electrical Engineer of the Imperial Government Rys., Tokyo, Japan, is in this country inspecting electrified railways.

Mr. E. Wanamaker has been appointed Electrical Engineer of the Chicago, Rock Island & Pacific Ry., succeeding Mr. F. J. Glover, resigned.

Mr. George Bird, of Harrisonville, Mo., has been appointed Chief Engineer of the Grand River Drainage District of Cass and Bates Counties, Missouri.

Mr. Ivy L. Lee, recently Executive Assistant of the Pennsylvania R.R., has been appointed a member of the personal staff of Mr. John D. Rockefeller, of New York City.

Mr. James R. Valk has been appointed Western Sales Manager of the United States Asphalt Refining Co., New York City, with offices in the Harris Trust Bldg., Chicago.

Mr. Charles Hurdleston, formerly Division Superintendent of the Missouri, Kansas & Texas Ry., has been appointed Manager of the Texas State R.R., with headquarters at Rusk, Tex.

Mr. F. C. Elliott, a lawyer, of Chicago, Ill., has been elected President of the White Pass & Yukon Route, with headquarters in Chicago, succeeding Mr. O. L. Dickeson, who recently resigned.

Mr. E. P. Laird, Engineer of Roadway of the Atlantic Coast Line R.R., at Rocky Mount, N. C., has been promoted to be Superintendent of the Richmond district, with office at Richmond, Va.

Mr. Dale S. Cole, Assoc. Am. Inst. E. E., formerly Electrical and Mechanical Engineer of the Globe Stove & Range Co., Kokomo, Ind., is now Superintendent of the Reliance Gage Column Co., Cleveland, Ohio.

Mr. F. D. Egan, M. Am. Inst. E. E., Electrical Engineer of the Pittsburgh Crucible Steel Co., Midland, Penn., has been appointed Steam and Hydraulic Engineer of the company in addition to his present duties.

Mr. H. C. Westover, Assoc. M. Am. Soc. C. E., formerly of the firm of Rollins & Westover, Consulting Engineers, Kansas City, Mo., has opened an office at Beaumont, Texas, to practice municipal engineering.

Mr. F. L. Bunton, M. Am. Soc. M. E., recently Manager of the Chicago office of the Heine Boiler Co., is now Manager of the Chicago office of the Goulds Manufacturing Co., with headquarters at 3801 South Ashland Ave.

Mr. John H. Roemer, Chairman of the Wisconsin Railway Commission, is to join the organization of H. M. Byllesby & Co., of Chicago, Ill., on Feb. 1, 1915. He will be in charge of the legal business of the organization.

Mr. J. M. Tomlinson, of Bridgeport, Conn., Acting Vice-President and General Auditor of the New York, New Haven & Hartford R.R., has been elected Vice-President and Comptroller, succeeding Mr. H. M. Kochersperger, resigned.

Mr. John A. Hense, formerly with the National Malleable Castings Co., Chicago, and recently with the Dravo-Doyle Co., Philadelphia, has been appointed Manager of the St. Louis, Mo., office of the Kerr Turbine Co., of Wellesville, N. J.

Mr. L. C. Bewsey, recently Superintendent of the Indianapolis division of the Union Traction Co., of Indiana, has been appointed Superintendent of Transportation of the Buffalo, Lockport & Rochester Ry. Co., with headquarters at Rochester, N. Y.

Mr. George H. Mueller, for some time Chief Engineer and now Assistant Sales Manager of the Jeffrey Manufacturing Co., Columbus, Ohio, will become District Manager of the New York office of the company on Jan. 1, 1915, with offices at 77 Warren St.

Mr. Kempter B. Miller, M. Am. Inst. E. E., of the firm of McMeen & Miller, Consulting Engineers, Chicago, Ill., has been appointed Chief Engineer for the receivers of the Central Union Telephone Co. He will continue to make his headquarters in Chicago.

Mr. H. C. Oviatt, recently Superintendent of the Old Colony division of the New York, New Haven & Hartford R.R., has been appointed Assistant Mechanical Superintendent in charge of a new bureau known as the Bureau of Fuel Economy, with headquarters at New Haven, Conn.

Mr. A. E. Seelig, former Sales Manager of the L. J. Wing Manufacturing Co., New York City, recently Manager of the machine tool department in the New York City office of Schuchardt & Schütte, has been appointed General Sales Manager of the Kerr Turbine Co., Wellesville, N. Y.

Mr. W. E. Smith, Superintendent of Construction of the Louisville & Nashville R.R., Louisville, Ky., has been appointed Superintendent of the Louisville and Nashville divisions, with headquarters at Evansville, Ind., succeeding Mr. John W. Logsdon, temporarily retired on account of ill health.

Messrs. Frederick Holbrook and W. S. Patton, of the Holbrook, Cabot & Rollins Corporation, General Contractors, New York City, sailed for France, Saturday, Dec. 5. It is reported that the firm has large contracts for rebuilding French bridges under consideration. At present the firm has several subway contracts in New York City.

Maj. Gen. William W. Wotherspoon, U. S. A., retired, is to be appointed Superintendent of Public Works of New York State under the administration of Governor-Elect Whitman, according to press announcements. Gen. Wotherspoon was born in 1850 and was appointed a Second Lieutenant of Infantry from civil life in 1873. All his army service was with the Infantry branch of the service. At the time of his recent retirement he was Chief of Staff of the United States Army. The salary is $6000 per annum.

Messrs. George C. Whipple, M. Am. Soc. C. E., Consulting Engineer, New York City, and Professor of sanitary engineering at Harvard University; W. T. Sedgwick, Professor of biology and public health at the Massachusetts Institute of Technology; Milton J. Rosenau, Professor of preventive hygiene at Harvard University; William J. Gallivan, a physician, of Boston, Mass.; David L. Edsall, Professor of clinical medicine at Harvard Medical School, and Joseph E. Lamoreaux, a physician, of Lowell, Mass., have been appointed members of the advisory council to the Massachusetts State Commissioner of Health, Allan J. McLaughlin.

Mr. Maxwell Carson Maxwell, M. Am. Soc. M. E., for the past seven years head of the Department of Applied Mechanics, Pratt Institute, Brooklyn, New York City, and a consulting engineer, has become identified with the Yale & Towne Manufacturing Co., of Stamford, Conn. He is now Superintendent of Power and Plant and is responsible for the power generation and distribution, the building maintenance, all new building construction, the general repairs and maintenance of all machinery, shafting, etc., throughout the plant. He also has charge of the tool department, being responsible for all tool designing, the machine shops for building tools and the forge shop.

Mr. William B. Landreth, M. Am. Soc. C. E., City Engineer of Schenectady, N. Y., has been appointed Deputy State Engineer of New York under the State Engineer-Elect,

[illegible] Amsterdam, N. Y. [illegible] White Plains, Port Jervis and [illegible] N. Y. [illegible] In 1897 he was appointed [illegible] of the New York State Barge [illegible] was made [illegible] Resident Engineer, and [illegible] State Engineer in charge of the Barge Canal.

[illegible] President of the E. I. Du Pont de Nemours Powder Co., of Wilmington, Del., has [illegible] a 100-mile boulevard to the State of Delaware [illegible] the United States Supreme Court [illegible] that the law passed by the Delaware legislature [illegible] authority to acquire land for right-of-way by condemnation proceedings is constitutional. The work of construction was begun about two years ago, but was held up by a [illegible] who sought to prevent the [illegible] of his land. The Delaware court decided against the [illegible] who then appealed to the U. S. Supreme Court. The [illegible] subsequently died and his heirs declined to continue the suit. The Supreme Court recently dismissed the suit without a ruling on the constitutionality of the law, and it will be necessary to institute another suit to get a decision on this point.

OBITUARY

Charles Arthur Moore, President of Manning, Maxwell & Moore, New York City, died recently on the steamship "Rotterdam" while en route to Naples, Italy.

William David Cantillon, former General Manager of the Chicago & Northwestern Ry., died at his home in Chicago, Ill., Dec. 14. He was born in 1861 and entered the service of the Chicago & Northwestern Ry. as a brakeman in 1883.

James H. Waters, President and General Manager of the Florence & Cripple Creek R.R., died Nov. 27 at Colorado Springs, Colo., from injuries received on Nov. 25 when a railway motor car in which he was riding collided with a locomotive.

Eli Stillson Hart, Chairman of the Board of Directors of the Rodger Ballast Car Co., Chicago, Ill., died Nov. 23. He was born in Rochester, N. Y., in 1832 and was educated as a lawyer. In 1874 he gave up the practice of law and was one of the founders of the Rodger Ballast Car Co.

[illegible] Cooper, a retired civil engineer, died Dec. [illegible] at his home in [illegible] County, Va., aged 68 years. He was born in Baltimore, Md., and for many years had charge of construction work for H. A. Ramsay & Co., of Baltimore, including the [illegible], Va., waterworks and the St. Paul St. Bridge, Baltimore.

[illegible], Past President of the American Society of Mechanical Engineers, died Dec. [illegible] at his daughter's home in New York City. He had been in ill-health for several months. A portrait and biographical sketch were published in "Engineering News," [illegible] at the time of his election to the presidency of the American Society of Mechanical Engineers.

[illegible] a member of the staff of Mr. Charles T. Main, M. Am. Soc. C. E., of Boston, Mass., [illegible] M. Am. Soc. C. E. [illegible] Recently he had been in charge of construction work in Montreal.

[illegible] of the Pennsylvania R.R., at [illegible], Penn., died Nov. 21 at his home in [illegible]. He was born at [illegible] in 1867. He attended [illegible] College for two years and then entered the [illegible] of the Pennsylvania R.R. as a rodman. He [illegible] in 1903.

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN [illegible] ASSOCIATION.
Dec. [illegible] Convention at Chicago, Ill. Secy., [illegible], New York City.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Dec. [illegible] Annual meeting at Chicago, Ill. Secy., F. M. White, [illegible]

SOCIETY OF CONSTRUCTORS OF FEDERAL BUILDINGS.
Jan. 4-6. Convention at Washington, D. C. Secy., T. R. [illegible], 4217 Westminster Ave., Philadelphia, Penn.

ASSOCIATION OF GOVERNMENT CONTRACTORS.
Jan. 4-7. Annual meeting at Washington, D. C. Secy., [illegible], Algernon Bldg., Montgomery, Ala.

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.
Jan. 19. Annual meeting at New York City. Secy., J. R. Wemlinger, 11 Broadway, New York City.

AMERICAN WOOD PRESERVERS' ASSOCIATION.
Jan. 19-21. Convention at Chicago, Ill. Secy., F. J. Angier, Mt. Royal Station, B. & O. R.R., Baltimore, Md.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. 20-21. Annual meeting in New York. Secy., Charles Warren Hunt, 220 W. 57th St., New York City.

AMERICAN SOCIETY OF HEATING & VENTILATING ENGINEERS.
Jan. 20-22. Annual meeting at New York City. Secy., J. J. Blackmore, 29 W. 39th St., New York City.

AMERICAN CONCRETE INSTITUTE.
Feb. 9-12. Convention at Chicago, Ill. Secy., E. E. Krauss, Harrison Bldg., Philadelphia, Penn.

AMERICAN CONCRETE PIPE ASSOCIATION.
Feb. 15-16. Annual convention at Chicago. Secy., E. S. Hanson, 538 South Clark St., Chicago, Ill.

St. Louis Railway Club—The Christmas entertainment of the St. Louis Railway Club will be held in the auditorium of the American Hotel Annex on the evening of Dec. 18. The Secretary is B. W. Frauenthal.

Seattle Association of Members of the American Society of Civil Engineers—At the November meeting of the Association representatives of the various technical societies of Seattle were present to discuss the feasibility of a federated union.

American Society of Civil Engineers—George A. Harwood has been nominated for Director of the Society (first district) on an independent ticket, as against the regular nominee, Frederick Mollitor. The other nominations were noted in our issue of Oct. 22.

American Institute of Architects—At the 48th annual convention held in Washington, D. C., Dec. 2-4, the following officers were elected: R. Clipston Sturgis, President; Thomas R. Kimball, First Vice-President; D. Knickerbacker Boyd, Second Vice-President; Burt L. Fenner, Secretary; John Lawrence Mauran, Treasurer.

Southern California Association of Members of the American Society of Civil Engineers—At the annual meeting of the Association, held at Hotel Clarke, Los Angeles, Calif., Dec. 9, the election of the following officers was announced: President, Capt. C. T. Leeds; Vice-Presidents, H. Hawgood, G. S. Binkley, Charles H. Lee, W. K. Barnard. The membership of the Association is now 93.

St. Louis Engineers' Club—At the recent annual meeting of the Club it was voted to appropriate [illegible] of the general funds as the beginning of a building fund for the construction of a new home for the Club. It is hoped that the new building will be completed before the end of 1915. The results of the annual election will be announced at the annual banquet at the City Club on Dec. 16. The nominees for President are E. L. Ohle, H. J. Pfeifer and J. W. Woermann.

Highway Engineers' Association of Missouri—The eighth annual meeting of the Association is being held at Jefferson City, Mo. (Dec. 17-18). Among the papers presented are the following: "Reinforced Concrete," by E. Lee Heidenreich, Kansas City; "City Streets and County Roads," by C. M. Talbert, St. Louis; "[illegible]," by F. D. Hughes, Kansas City; "Power Road Machinery," C. M. DeWind, Chicago, Ill.; "[illegible] Roads," by R. H. Russell, U. S. Dept. of Public Roads. The Secretary is Howard M. [illegible], Richmond, Mo.

New England Water Works Association—The [illegible] meeting was held in Boston Dec. [illegible]. After the usual luncheon two papers [illegible] of small town water supplies were read. [illegible]

[illegible]

Engineering News

VOLUME 72 | DECEMBER 24, 1914 | NUMBER 26

The Hill Building: Special Building Design for Special Use

The problems of designing a building for a particular specialized use were handled with unusual care and originality in the case of the new Hill Building, New York City, the present home of ENGINEERING NEWS, occupied only a few months ago. The Hill Publishing Co. was unable to find a building in New York City suited to the requirements of a large printing and editorial enterprise, and therefore proceeded to plan and construct such a building for itself.

Located in a new growing industrial quarter of the city, the region lying north of 34th St. and west of 9th Ave., the building secures the advantages of free exposure on all sides. By employing very large glass surfaces and an exterior of cream-colored mat-glazed terra cotta and buff brick, as well as by the orientation and arrangement of its ground plan, the building retains maximum advantages as to light. By exclusive reliance on artificial ventilation with air washed and humidified, and keeping all windows locked shut, the best atmospheric conditions are secured, to the advantage of the printing operations as well as to the benefit of the occupants. By the provision of great strength in the structure—for 300 lb. live-load per sq.ft.—ample capacity is secured for any service. By spacing the columns to suit the setting of printing machinery, quite out of accord with usual arrangements, a high space efficiency is attained. By the careful study of service requirements in the details of construction and equipment, followed by the creation of numerous articles and constructions not previously manufactured, the building is made throughout to correspond in efficiency with the space utilization.

FIG. 1. THE COMPLETED HILL BUILDING, SPECIALLY DESIGNED FOR PRINTING AND EDITORIAL USE

Above all, the building is really fireproof. Except for exposure fires on the street fronts, no fire contingency can prove serious to either building or occupants. There is not a stick of wood in the structure, no wooden floors or sleepers, and no wooden window frames or sash. The windows (except on the streets) contain wire-glass. Doors are self-closing and present only asbestos-lined steel plate in integral steel frames. Vertical openings are inclosed. Even water damage through vertical openings is forestalled by dams at riser pipes, and by scuppers. Finally, the whole building is sprinkled. Therefore the lowest insurance rate in New York is secured—5.68c. per $100 on building, and 14c. on contents.

PLAN OF BUILDING

The building is roughly 99x175 ft. in plan, and has twelve stories and a mezzanine or gallery in the upper story. As the stories are materially

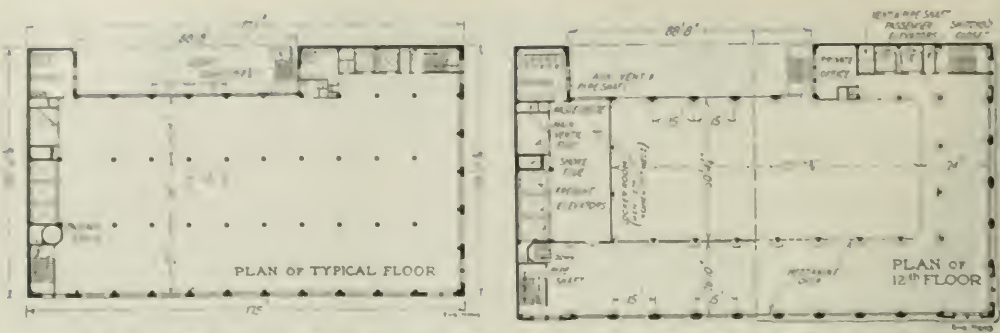
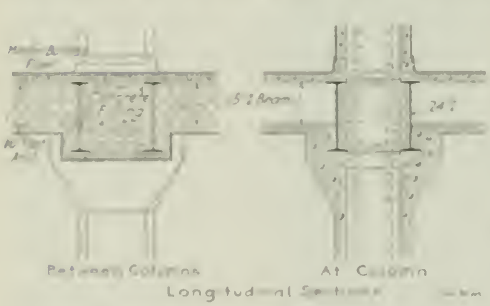


FIG. 2. TWO FLOOR PLANS OF THE HILL BUILDING, SHOWING EFFICIENT SPACE UTILIZATION

higher than is customary, being 16 ft. from floor to floor or about 14 ft. in the clear (the first story 16 ft. in the clear), the total height of the building from street to roof is no less than 206 ft.

The general plan of the building, with entrances at the diagonally opposite corners on the two street fronts, follows current practice in loft and warehouse building construction, but is worked out in detail for space utilization efficiency. By elimination of hallways at the elevator entrances, and by using the two wings at front and back of the court for service purposes (see plans, Fig. 2), the available working space of the floor is left in almost completely rectangular shape. The whole area is of full value because the window arrangement, the large glass area, and the exposed position of the building give excellent lighting all over.



As the building was designed for printing use, the governing item in occupancy was printing-press machinery. The column spacing was therefore made no wider than just enough to accommodate one press per panel. In place of the usual spacing of 20 to 24 ft., this building has panels sufficient for any probable width of press, and small enough to waste a minimum amount of space whatever size of press is installed. The longer dimension—which is transverse to the building, as presses are to be placed transversely, abutting on longitudinal gangways—ranges from 21 ft. 4 in. to 20 ft. 10 in.

The unequal lengths of bay represent one of the provisions against vibration. The different girder spans having different natural periods of vibration, it was believed that resonance effects would not occur as freely as with uniform spans. But to retain the desirable features of uniformity in column spacing, the spans are varied by only 2½ ft. from shortest to longest.

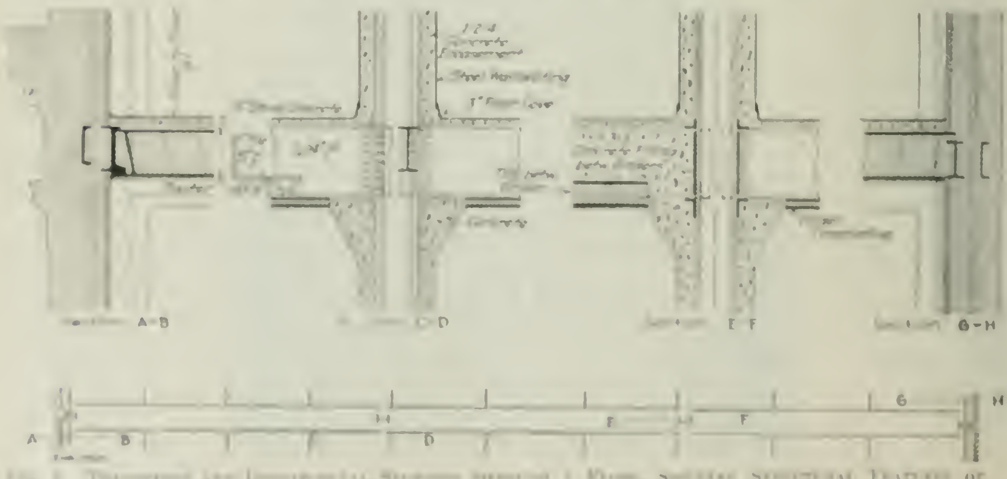


FIG. 3. TRANSVERSE AND LONGITUDINAL SECTIONS THROUGH A FLOOR, SHOWING STRUCTURAL FEATURES OF THE BUILDING

Freight-Entrance Driveway into Building

The rear entrance of the building is developed into a complete entrance and interior driveway, so that wagons can load and unload in the building, receive mail directly from the spiral mail chute, etc. The asphalt-block-paved driveway is at sidewalk level. Just at the driveway the sidewalk is sheltered by a steel-and-glass marquise, and it is over this marquise that the entrance opening for air for the ventilation system is located.

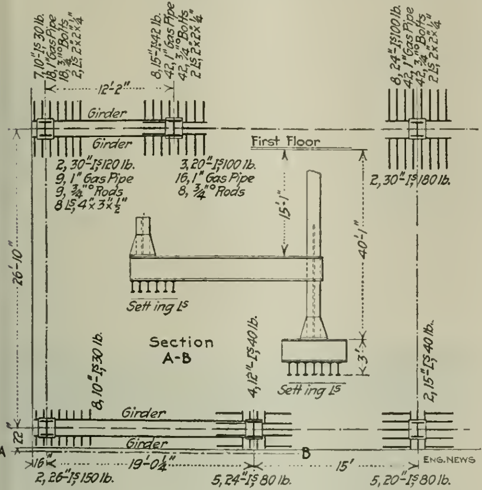


Fig. 4. Southwest Corner Grillages

Foundations and Framing

The site of the building had rock exposed nearly at ground surface. This fact limited the problems of sub-surface construction and of foundations. There is a single basement story over the whole area of the building, with a sub-basement for the boiler room only.

The location of boiler room was determined in part by a deep pocket in the rock, going down some 50 ft. below curb; as this occurred at the west end, near the originally planned location of the boiler room, the latter was shifted to occupy the pocket. The same dip in the rock is also responsible for the fact that the foundations, which generally are simple grillage footings of small size to distribute the column loads from the cast bases to rock at the unit-pressure allowed by the Building Code, include a few concrete piers.

Fig. 4 sketches the footings at the southwest corner, including group footings on the building and typical interior footings.

Structure Very Massive

The steel frame of the building,* as well as the terra-cotta floor construction, is unusually heavy, on account of the high live-load of 300 lb. per sq.ft. The steel frame weighs slightly over 2 lb. per cu.ft. of contents. In spite of the heavy construction, columns of simple Bethlehem H-section were used throughout. In the lower stories

*See an article on the erection of this frame, "Engineering News," Dec. 25, 1913, p. 1298.

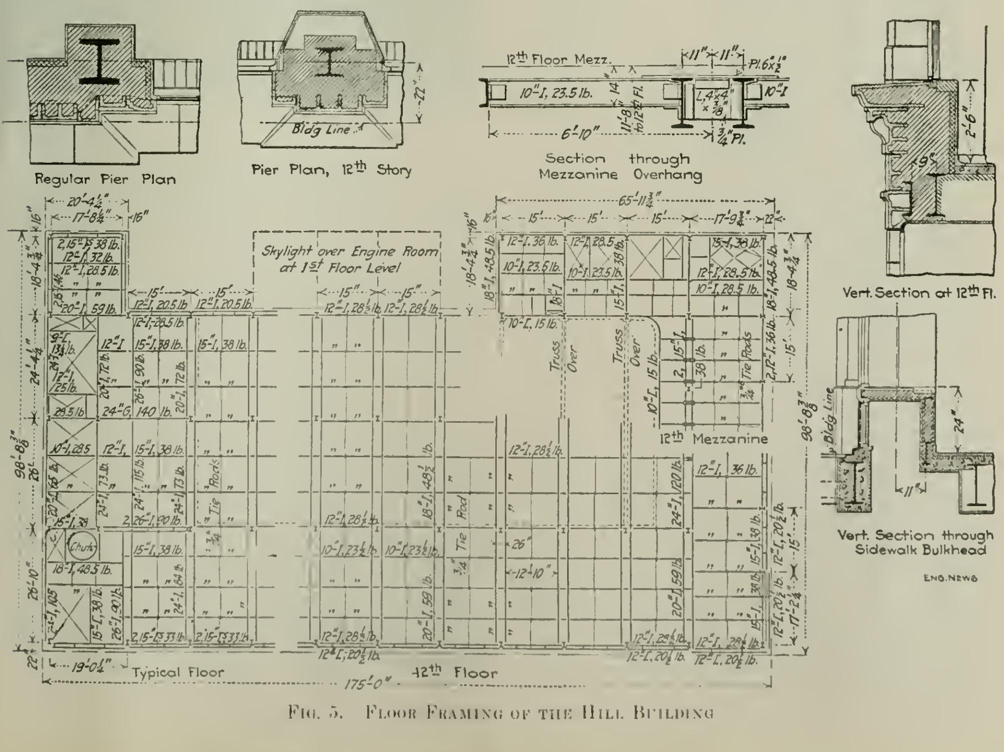


Fig. 5. Floor Framing of the Hill Building

the heaviest section rolled, the 14-in. H weighing 287½ lb. per lin.ft., was reinforced with flange and web plates to [illegible] three times its sectional area. The maximum column was 285 sq.in. section.

The floor framing presents an unusual arrangement. The main girders, running transverse to the building, are double, straddling the columns. While this arrangement was adopted chiefly with a view to getting good details for the construction of the transverse bents, it proved an advantage in laying out the beam framing. The beams are 15-in. I's, spaced about 8 ft. on centers, taking a 16-in. flat-arch terra cotta floor, the strength of both arch

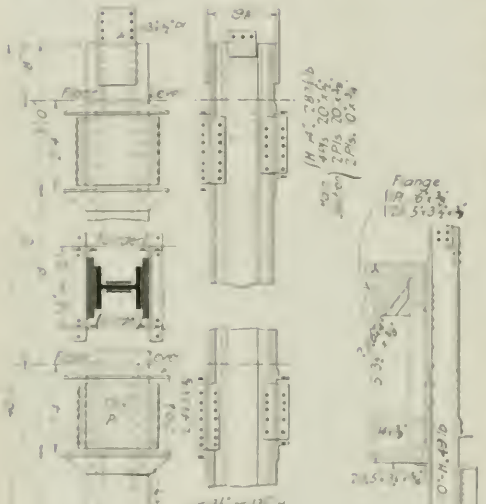


Fig. 6. Two Representative Column Details

and beams [illegible]

[illegible]

Provision for Rigidity

Printing-press buildings are notoriously weak in the matter of vibration resulting from the reciprocating movements of heavy masses in flat-bed presses. The presses used by the Hill Publishing Co. are rotaries, but as the tenants of the building would probably employ flat-bed presses the problem of suppressing vibration was considered of primary importance.

Great reliance was placed on the massive character of the structure as a steadier and stiffener. For rigidity of the transverse bents, effort was centered not on making the steel connections particularly stiff (as by brackets or by pure shear connections), but upon obtaining a securely connected composite structure through the use of concrete incasement of the columns and flaring concrete column caps merging into substantial concrete girders—the filling between the pairs of steel girders.

With the same purpose in mind of suppressing vibration and stiffening the whole construction, a rich stone

Fig. 7. View in Web-Press Department of Hill Publishing Co., 10th Floor

(Permanent lighting fixtures not in place. [illegible] has been installed.)

concrete was employed for the [illegible] of columns, filling of girders and floor surfacing layer. No cinder concrete was used anywhere except in [illegible] on the roof.

The unequal length of the transverse [illegible] in the building, already referred to, was [illegible] as a protection against vertical [illegible] rather than against lateral sway. The fact is worth recording that during the past [illegible] months' service the building has proved remarkably rigid.

Floor Construction

The [illegible] National Fireproofing Co. arch used in the floors is a novelty. The capacity of the arch is probably limited by the tie-rods rather than by the strength of the tile. In this case tie-rods were put in according to the requirements of the New York Building Code. Each floor-beam panel has one [illegible] tie-rod [illegible]

Architectural Composition and Finish

The brick-pier surface, which [illegible] characterizes the building, can be seen in the general view on the first page of this issue. The problem of securing proper appearance of a building in which flat wall surfaces are reduced to a [illegible]

believe that in this case they hit upon a pleasing solution. Unfortunately, the picture does not do the fact justice, as it cannot reproduce the appearance of the cream-colored mat-glazed terra cotta upon which the effect of the exterior really depends. The entire surface of both street fronts is of this material.

The edge faces of this terra cotta were ground, with a view to giving neat and close joints (see Fig. 8). The cost of this terra cotta face (in place) may be put at about twice the cost of face brickwork and about one-half the cost of stone facing. The court wall shows Kittaning face brick, with terra-cotta lintels. The rear wall is of common brick laid with a panel bordering of terra cotta.

Every block of terra cotta is anchored with a $\frac{3}{8}$x$1\frac{1}{2}$-in. galvanized ashlar anchor. At cornices and other special points, special anchoring is used. The balustrade which caps the wall is also of terra cotta, and here vertical tie-rods through each baluster with a continuous channel under the cap rail form the connection.

The roof is covered with Ludowici roofing brick laid in portland cement over "Barrett Specification" tarred-felt roof. Bent copper expansion-joint strips are laid in the brick at 50-ft. intervals in both directions.

Floors—As already mentioned, the floors have a 5-in. layer of concrete over the tile arches. This is stone concrete instead of cinder concrete, for strength and stiffness. It was believed that a very extensive load distribution would be secured through so thick and strong a surfacing layer; concentrated loads and impact from machinery being rendered harmless.

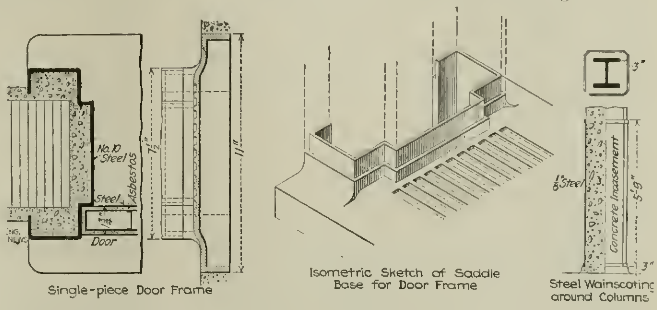


Fig. 9. Door Frame and Sill Details, and Steel Wainscoting of Columns

Fig. 8. Entrance Detail, Showing Good Effect of Glazed Terra Cotta with Ground Joints

The upper 1 in. of this 5-in. coat is Master Builders' floor surfacing, chosen for its waterproof and wear-resisting qualities. This is used on all the manufacturing floors, but is omitted on the office floors (12th and mezzanine), where ordinary concrete floor finish was used; this floor is completely covered with interlocking rubber tiling, and the concrete is thus not exposed to wear.

Reference has already been made to the column incasement. This is 1 : 2 : 4 stone concrete in a square pier with chamfered edges, which gives a minimum thickness of 3 in. over the extreme points of the steel. The lower 5-ft. height of each column is surrounded by a steel wainscot jacket of $^{11}/_{64}$-in. plate with reinforcing bands at top and bottom. This wainscot was cast in, being set around the steel column and the concrete molded in it.

Sanitary Cove—As a novel feature of the floor construction, the concrete is carried up around walls and columns to form a lip or edge 3 in. high with cove of 2-in. radius. This simple expedient greatly reduces the amount of dust accumulation occurring in corners and angles in normal service. All door frames and column wainscoting are seated on this concrete lip. The door saddles are detailed to merge into the cove and form the actual support for the door frame and casing (see isometric sketch in Fig. 9).

In the 12th and 12th mezzanine stories the column casings are surrounded by furred false incasement for architectural effect; the interior finish here is wholly of Caën stone imitation. The spaces back of the furring are utilized for carrying up the radiator risers and the air ducts.

Ceilings and walls are finished in hard plaster. In the manufacturing stories the exterior walls are furred with 2-in. hollow terra cotta for plastering.

Stair and elevator partitions are 6-in. hollow terra cotta, without steel studding. Even door bucks are dispensed with; the formed steel door-frame is set direct in the partition masonry.

The main vent shaft shows ingenious design. It is divided into a supply and an exhaust shaft. Since the aggregate area of the two should be the same for all floors, the supply decreasing from basement up and the exhaust increasing, a sloping partition might have been used to

across the shaft. This, however, would have made for two [illegible] pressure [illegible] front [illegible] along the east wall [illegible] where the ducts lead off (Fig. 10). A [illegible] partition was therefore designed, which divides the front wall into two equal parts at all floors, but swings around from the left side to the right side of the shaft all the way up through the 12 stories. The partition is formed of plaster on mesh attached to small [illegible] angles connected to a vertical front angle and a [illegible] rear-wall angle.

WINDOWS

The building is equipped throughout with steel sash [illegible] with [illegible] two [illegible]. Minimum steel

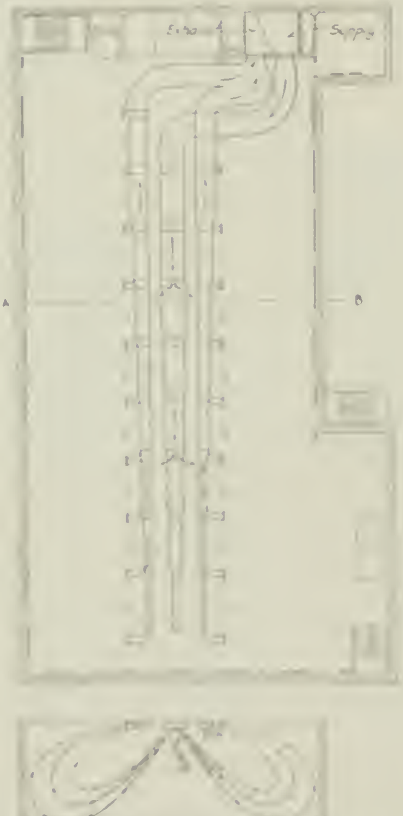


FIG. 11. [illegible] DUCT PLAN

[illegible] to a given window area, i.e., [illegible] glass [illegible] [illegible]. A careful [illegible] of the steel sash on the [illegible] was [illegible], with the result of [illegible] an [illegible] pattern [illegible] of [illegible] quality [illegible] by the [illegible] Co. These sash were fully described in Engineering News, Apr. 16, 1914, p. 8[illegible]. They are glazed with [illegible] glass. The advantages of light and [illegible] secured by these windows and by their [illegible] [illegible] is [illegible] the building. The [illegible]

sill, adjoining the [illegible] sill [illegible] of the window. A [illegible] tile with [illegible].

STEEL DOORS AND INTERIOR TRIM

All doors and door frames throughout the building are of [illegible] sheet steel. The doors themselves are not [illegible] or [illegible] but are [illegible]. The frames represent a [illegible] departure from [illegible] practice. Instead of making frame and casings three separate pieces, the whole was formed of a single width of steel sheet. Thus, a door frame comprises only three pieces of metal, the [illegible] and the [illegible], which [illegible] at the corners and are [illegible] by angles.

The door itself is made of [illegible] steel sheet over a [illegible] steel construction covered with [illegible] asbestos board. Between the [illegible] are channel-shaped ribs, to which the outer shell is spot-welded.

All doors are hung on [illegible] hinges, at upper and lower [illegible], [illegible] type. With few exceptions the doors are self-closing, the lower [illegible] being a [illegible] spring and check box set into the [illegible] sill.

HEATING AND VENTILATION

It was natural that the equipment of the entire building should be particularly adapted for printing and publishing. Printing requires uniform humidity and temperature for best results. Therefore, in the Hill Building the windows are [illegible] [illegible] and conditioned air is supplied, [illegible] [illegible] cu.ft. per min. per floor.

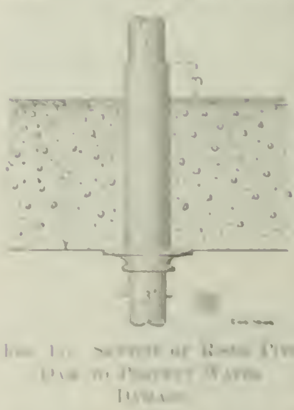


FIG. 1[illegible]. SLEEVE OF [illegible] PIPE [illegible] TO PREVENT WATER DAMAGE

The supply is drawn in from the street at the [illegible] level, passed through [illegible] screens, [illegible] through [illegible] [illegible] into a spray chamber, past drying baffles and heating coils, and finally through the fans which send it up the main vertical [illegible] through the distributing ducts on each floor. [illegible] the air is not needed, [illegible] across the [illegible] of the [illegible].

In the basement [illegible] there are three [illegible] [illegible] [illegible], each with a [illegible] [illegible] [illegible] [illegible] of [illegible] [illegible] cu.ft. per min. When the outside temperature falls to [illegible]° F., the [illegible] water is heated with [illegible] steam automatically [illegible].

Exhaust ducts [illegible] take the [illegible] to the [illegible] of the [illegible]. [illegible], are [illegible] [illegible] [illegible] [illegible] through [illegible]. In addition, two [illegible] [illegible] [illegible] from the [illegible] and [illegible] throughout the building.

The air supply is [illegible] a few degrees below room temperature so that it will [illegible] from the [illegible] and [illegible] proper circulation. The [illegible]

supply is from radiators hung on the walls of each story under the windows and supplied with hot water. The temperature of this is regulated from the engine room according only to the outside temperature (being varied between 195° in 5° weather and 100° for 65° outside).

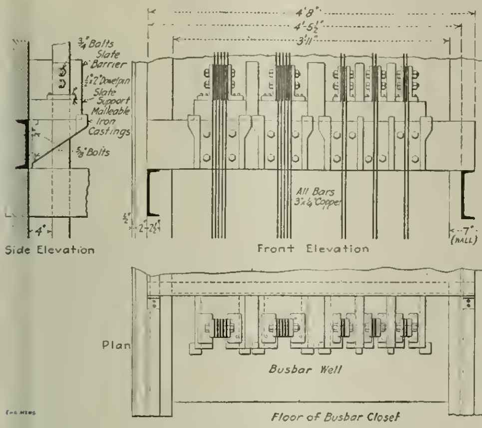


FIG. 12. VERTICAL BUSBARS IN INCLOSED WELL

(At each floor a panel-board is mounted in front of the well. Switchboard and well are inclosed in a closet.)

The circulating system has two Alberger closed heaters, using exhaust steam, and a 35-hp. motor-driven centrifugal pump with a De Laval turbine driving a pump of the same type and capacity as a spare unit.

The heating and ventilation facilities are sketched in Fig. 10 for one of the printing floors. The arrangement is modified for the twelfth floor and the ducts are concealed by the ceiling (Fig. 13).

WATER-SUPPLY AND FIRE PROTECTION

Water is pumped from two street services to a 10,000-gal. square steel tank in a house above the roof. This supplies the toilets, slop sinks, hot- and cooled-water circuits, etc., and the power plant. A 5x8-in. motor-driven triplex pump is ordinarily used, with a 10x6-in. steam duplex as a spare unit (both McGowan designs). Hot water for the slop sinks and wash sinks comes from a gravity circulating system using exhaust steam in a closed heater.

Drinking water is taken from the house line, filtered, cooled and circulated around the building, there being two bubbler fountains on each floor. For cooling the water a 4-ton 10-hp. York ice machine is used and a 2-hp. motor-driven centrifugal pump circulates the supply.

For the sprinkler system, water is stored in four 9000-gal. cylindrical closed tanks under the house tank. To secure adequate pressure on the upper floors of the building these tanks carry 80 lb. air pressure (obtained from a Westinghouse locomotive-type direct-acting double-compound steam-driven compressor which also supplies the air-washer sprays and the pneumatic carriers). One main sprinkler riser drops down through the building with branches for each floor. Should any valve be closed or any sprinkler head let go, alarm circuits are closed to advise an insurance supervisory bureau. In case of such warning, a runner is dispatched to advise of the trouble and see that it is remedied. The sprinkler mains also have a siamese street connection for fire engines. Each floor has two hose racks with connections to the house

FIG. 13. INDIRECT LIGHTING AND ORNAMENTAL OUTLETS OF CONCEALED VENT DUCTS IN OFFICE OF HILL PUBLISHING CO.

(12th floor, Hill Building)

[illegible]. A [illegible] fire-alarm system, with [illegible] boxes and bells on all floors, connects directly with the city fire department.

To prevent damage from water dripping through the floors, scuppers with [illegible] are provided to drain the floors into the [illegible]. The [illegible] risers which pass from floor to floor are carried through the floors in pipe sleeves (Fig. [illegible]), which rise above the finished surface some [illegible] in. to serve as a [illegible] for accumulated water.

Lighting and Power Service

Each manufacturing floor has some 60 ceiling outlets for lighting, besides 42 floor and 22 pilaster and column outlets for power. Such of these floors as are used by the Hill Company have [illegible]-reflecting ceiling fixtures, each with a [illegible] nitrogen-filled incandescent lamp. This gives about [illegible] per sq.ft. of floor area, which is supplemented by a few individual lamps for the [illegible] parts of presses and some proofreader's desks.

From the high ceiling of the twelfth floor, there are hung [illegible] indirect fixtures, each reflecting the light of [illegible] lamps. This allows about [illegible] per sq.ft. of floor. Above and below the mezzanine are two similar fixtures per bay, each containing three [illegible] lamps, giving [illegible] per sq.ft. of floor, but about the same resultant illumination is secured as [illegible] from under the mezzanine.

Vertical Busbars

Current for the several floors is supplied from the power-plant switchboard through five vertical busbars, [illegible] for the three-wire 240-volt lighting circuits and [illegible] for 240-volt power. Each lighting bus comprises two [illegible] copper bars and each power bus [illegible] for each [illegible].

The busbars are [illegible] in lengths reaching from floor to floor. They pass through a special well and at each joint are bolted together and to a [illegible] which rests on a [illegible] insulating block supported by [illegible] to the floor beams.

Power Plant

The [illegible] [illegible] and the power is [illegible] supply of the [illegible] [illegible] electric [illegible] [illegible] of 1350 kw. There are three engine-generator units on the basement floor and three [illegible] boilers in a sub-basement. There are [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

The [illegible] of the [illegible] [illegible] [illegible] [illegible] [illegible] built by the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] with 150-lb. steam pressure. The [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] a [illegible] gallery.

The boilers have [illegible] balanced draft and [illegible] to the freight driveway.

The [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] of hand labor. Coal is dumped through sidewalk scuttles into a 500-ton sloping-bottom storage bin from which it runs through four gates 4 ft. above the floor. A 1000-lb. bucket receives it and is hoisted by an electric trolley crane (designed by the Northern Engineering Co., with a scale in the track) and carried to the stoker hoppers.

The entire plant is thoroughly provided with recording, as well as indicating, meters and gages (Venturis for steam, a Cochrane metering feed-water heater, outside and inside thermometers, circulating-system thermometers, voltmeters, ammeters and wattmeters for power and lighting, air and steam-pressure gages, etc.), assembled so far as practical, so that there is complete supervision of operation and check on efficient performance.

Conveying Facilities

The equipment for the necessary movement of persons, freight, mail, printers' copy and proofs, waste, etc., comprises power elevators, gravity chutes and pneumatic carriers, the first two serving all floors and the last only the editorial and printing departments of the Hill company.

There are two [illegible] Otis electric passenger elevators carrying some [illegible] persons each (or 1500 lb.) and developing a possible speed of 600 ft. per min. The three [illegible] freight elevators have a 7x16-ft. floor and a lift of 8000 lb.; they open into the 20-ft. interior freight driveway, so that vehicles can discharge and load at the elevator doors.

A [illegible]-ft. spiral steel chute, with three separate slides, serves all floors for the descent of outgoing printed matter, mail, etc. One slide delivers over the sidewalk and two beside the freight elevators. There is a straight vertical steel chute for dropping waste paper into the baling room on the ground floor.

Starrett & Van Vleck, of New York, were the architects of the Hill Building, and also carried on the construction as superintendents. John A. Hill, President of the Hill Publishing Co., was active in all stages of the design and construction.

Fumes from Gasoline Locomotives in Tunnels and Mines—[illegible]

Reconstruction of the Beds of the Cincinnati Water-Filtration Plant

The beds of the rapid sand filters of the water-works of Cincinnati, Ohio, are being reconstructed. The brass wire-cloth screen between the sand and gravel layers is being removed, and the depth of the gravel layer increased to 14 in. in place of the 8 in. of gravel formerly used. The sand layer will remain 30 in. in depth, as heretofore. This will decrease the distance between the level of the sand and the top of the wash-water troughs about 6 in. Thus far, two of the 28 beds have been reconstructed and one is now under reconstruction. Eventually, all of the beds will be changed.

On account of the breaking of the brass wire screen and the consequent trouble encountered with the mixing of the sand and gravel, it is deemed advisable to remove the screen entirely, as experiments made at the plant had shown that this was feasible when the gravel layer is properly graded. In some places the screen was found to be torn away from its original fastenings because of their faulty character, while in others the wires of the cloth were broken. Unequal distribution of the wash water resulted in such cases, and although no bad effects have been traced to the breaks, so far as shown by the bacterial results, it has been thought best to make these changes before serious disturbances which might affect the purity of the water could take place.

The brass wire-cloth was constructed with No. 20 wire and had 10 meshes per lin.in., or 100 per sq.in. It has been in use for seven years, although evidences of its deterioration were noticed within three years from the time the plant began to be operated. The destruction of the wire cloth appears to be due to the small quantity of carbonic acid which remains in the filtered water after undergoing treatment. Corrosion of the wire of the cloth is plainly evident, and is progressing rapidly in places. The slight movement of the wire cloth due to the washing process is another factor in hastening the rupture of the wires. They become brittle under this movement, which, coupled with the lessening diameter of the wires on account of corrosion, causes them to break easily.

The original cost of the brass wire-cloth alone for the 28 filter beds, each of which has an area of 1100 sq.ft., was $10,688. To replace the screen and to provide better methods of fastening it would have probably cost between $20,000 and $25,000, including labor and material. Reconstruction of the beds without the screen and with deeper, larger and heavier gravel, will probably cost about $8500, including the rehandling of the sand, the screening of the gravel, and the necessary repair work upon the strainer plates. The latter require some cleaning out of the perforations ($\frac{3}{32}$-in.), and in some places a renewal of broken hook bolts is necessary.

The sand in each bed is being lifted by a portable hydraulic sand ejector and transferred to a bed, the bottom or gravel layer of which has already been reconstructed. The transfer of the sand by the ejector from one bed to another will effect a certain amount of cleansing of the sand.

The new gravel costs $1.39 per ton delivered at the filtration plant. This is equivalent to approximately $2.08 per cu.yd., and will amount to about $1500 for the new gravel for the 28 beds. Separating, grading, and placing the gravel, together with the necessary repair work and transferring the sand, will bring the total cost of reconstructing the beds up to the figure previously mentioned.

J. W. Ellms is Superintendent of the Filtration Plant and J. A. Hiller is General Superintendent of the Cincinnati Water-Works.

The Cobwell Garbage-Reduction Process

A single-unit garbage-reduction process which extracts the grease and converts the remaining solids into animal food, all in one small tank, has been under experimental and practical test for about a year past. The system is all the more noteworthy because the small size of a unit makes it possible to treat the garbage of even a small city by reduction, a thing heretofore thought to be impracticable. The new system has been in use at New Bedford, Mass., for six months, and is being installed at Los Angeles, Calif., and at the Panama-Pacific Exposition at San Francisco.

In this new system the garbage is treated in airtight units (steel tanks) of about three tons capacity. Here it is heated with a solvent for 6 to 10 hr. at a temperature sufficiently low to retain all the food values. Grease is drawn off continuously until practically all of it is removed. The tankage is then taken from the digestor, screened, and, so far as is necessary, crushed to the form of a meal, ready for stock food. Garbage meal made by this process is said to contain 20% of protein and animal meal (from dead animals) 65%. It is also said that from one ton of garbage about 500 lb. of solids and 100 lb. of grease are recovered, only some 2% of grease being left.

The process was first tested experimentally at the works of the C. O. Bartlett & Snow Co., Cleveland, Ohio, under the personal direction of Mr. Bartlett. For the past six months a unit has been in regular use as a part of the reduction plant of the New Bedford Extractor Co., of New Bedford, Mass., under the direction of M. J. Springborn, who, as Director of Public Service of Cleveland, was responsible for the municipal garbage-reduction plant of that city. In two or three months the whole of the New Bedford reduction plant will be changed over to the new system.

A practical test of the use of the stock food for hogs and chickens has been made by Mr. Bartlett at his farm, with satisfactory results.

At Los Angeles a 100-ton plant is being installed by the C. O. Bartlett & Snow Co., to carry out the contract awarded by the city in 1913 to C. D. Crouch. Under this contract (see ENGINEERING NEWS, Aug. 28 and Nov. 27, 1913), the city is to be paid 51c. per ton for all garbage delivered by it to the plant. It is expected that the Los Angeles plant will be completed in about four months.

The Panama-Pacific Exposition plant will consist of two units. It will be in operation about the middle of February, 1914.

The name Cobwell, which has been given to this new system of garbage reduction, is made up from the initials of Mr. Bartlett and from the name of the chemist, Mr. Wells, who has carried through the chemical end of the work.

New York Rapid Transit Railway Extensions*

By F. Lavis†

XI--The River Tunnels

The Harlem River Tunnels

The general design of these tunnels is shown in the cross-section, Fig. 76. It was determined by two principal factors. First, the necessity on account of the conditions under which the approaches were located of keeping the tunnels as near the surface as possible; second, the desirability of obtaining a minimum total width to avoid encroachments on valuable private property.

The methods developed in the construction of the tunnels under the Harlem River for the original subway (see Engineering News, Oct. 13, 1904) and at Detroit‡ for the tunnels of the Michigan Central Ry., had shown the practicability of sinking tubes from the surface, and these methods also permitted much closer spacing than would have been possible with shield-driven tunnels, which latter would necessarily or at least most conveniently have had to be circular, with a reasonable space, say 10 ft. or so between each tube. It may be noted, however, that the tunnels which had been previously built by sinking from the surface were for two tracks only, whereas, the new Harlem River tunnel is for four.

Bids were originally called for late in 1910 on two types, H and K. Type H was similar to that of the original Harlem River tubes, and type K similar to the Detroit River tubes.

The bid prices were as follows, per lin. ft. of four-track tube:

Type K—Lowest $[illegible], highest $[illegible], per lin. ft. of four-track tube.
Type H—Lowest $[illegible], highest $[illegible], per lin. ft. of four-track tube.

Before the contracts were awarded it was decided to change the dimensions; the bids were therefore rejected and the work readvertised, this time calling for bids on three types, H, K and L. Types H and K remained the same except for the changes in dimensions. Type L was a modification of Type H, having the four tubes all together instead of in two pairs.

The bids on the latter two types were all rejected and that of Messrs. Arthur M. Mullen and Olaf Hoff, the lowest bidders on type K, was accepted; the range of bids at this last letting for the lower-tunnel section having been as follows, per lin. ft. of four-track tube:

Type K, $[illegible] to $[illegible], [illegible] bids
Type H, $[illegible] to $[illegible], [illegible] bids
Type L, $[illegible] to $[illegible], [illegible] bids

The contract price of $[illegible], equal to $[illegible] per lin. ft. of tube, may be compared with the cost of the Detroit River Tunnels, which has been given as $[illegible], exclusive of contractors' profits. However, the inside diameter of the Detroit tunnels was [illegible] ft., as compared with [illegible] ft. [illegible] in. for the Harlem River tubes.

The method adopted by the contractors with very few modifications was that developed for the construction of the Detroit River Tunnels, which has been quite fully described§ in various papers and articles in the technical press. The article in Engineering News, of Feb. 15, 1906, is interesting as showing the development of the process. It consists essentially in the erection of the steel tubes in suitable lengths on shore, bulkheading the ends to get flotation, launching these sections, towing them to the site which has previously been dredged to the required depth, and sinking them in place by filling them with water (see photographs in Fig. 75). The concrete is then deposited around the outside by means of tremies, the sections unwatered and the inner concrete lining placed. This method, of course, obviates the necessity of general work in compressed air, though divers are used to a limited extent.

The accompanying drawings and photographs show the essential details of the structure and the methods of sinking and as the general methods have already been so fully described, it seems only necessary to call attention to such changes and improvements as experience and the particular conditions of the Harlem River work have shown to be desirable. The tunnel was divided into five sections, four of 220 ft. each and one of 200 ft.

In the Detroit River tubes, the circular stiffening angles, which are spaced about 8 ft. apart, were placed on the inside, as then it was thought necessary to provide temporary interior bracing in the form of the spokes of a wheel. Experience showed, however, that this might be dispensed with, and on the Harlem River tubes the stiffening angles were placed on the outside. This permitted the construction of the braces or struts to the wooden bulkheads or forms at the sides, which materially decreased the necessary thickness of the timber, which latter, in the case of the Detroit tunnels, was [illegible] in. thick at the bottom and [illegible] in. thick at the top. For the Harlem River Tunnels, [illegible] in. plank was used for the lower half and [illegible] in. for the upper.

The manner of making a tight joint between each of the sections shows an important modification in the direction of simplicity. The old joint with the pilot pin is shown in the drawing, Fig. 77a. This joint was not altogether satisfactory, as it was somewhat difficult to fit and the rubber gaskets are, of course, perishable. The new joint (see Fig. 77b) is a butt joint instead of an overlapping or sleeve joint, and the bolts on the outside are easily placed by divers. The inner plate, which, of course, is riveted in place after the tubes are unwatered, insures practical water-tightness. It will be remembered that the concrete is placed outside this joint before the tubes are unwatered, and tests made with the concrete deposited by the tremies at Detroit showed it to be of very good quality, sufficiently impervious to prevent any leakage of moment. The space between the joint in the shell and the inner plate is to be filled with grout after the latter is riveted in place. There is a pilot pin on each of the two outer tubes and when both are home, the accuracy of the construction insures a good fit everywhere. The unwatering of the tunnels has shown these joints to be remarkably tight.

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†Consulting Engineer, [illegible] New York City.
‡[illegible]

Fig. 75. Views of the Harlem River Tubes during Construction

A—Construction, partial. B—Construction, completed. C—Towing to site. D and E—Sinking. F—Inside.

Attention may be called to the method of tying the tubes and the partition walls together, as shown in detail, Fig. 76. Reinforcement of 1-in. square rods is placed in the inner concrete lining. Longitudinal rods are spaced 12 in. apart at the sides. It is probable that this might be omitted and still leave the tunnels entirely safe, but is an added precaution thought advisable in view of the comparative novelty of the method.

Before launching a section, the two outer tubes were tightly bulkheaded at both ends, but the inner tubes only about 4 ft. up, as shown in the sketch, Fig. 78, that is, just high enough to provide flotation while being towed to the site. The outer ends of the *end* sections are, of course, tightly bulkheaded on all four tubes with bulkheads to stand total pressure for the depth, so they will hold when the tubes are unwatered. Photograph 75D shows the south-

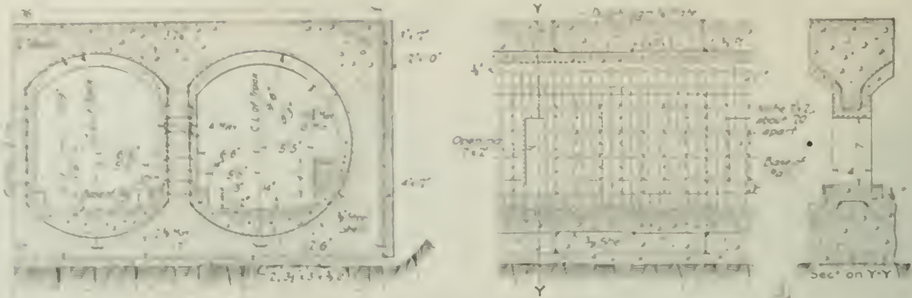


FIG. 76—SECTIONS OF HARLEM RIVER TUNNEL

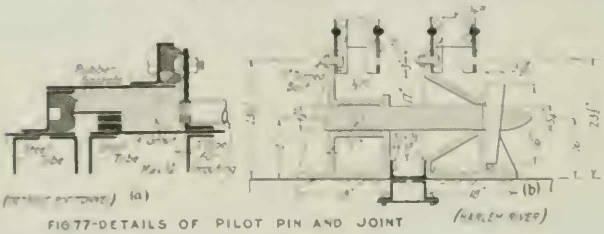


FIG 77—DETAILS OF PILOT PIN AND JOINT

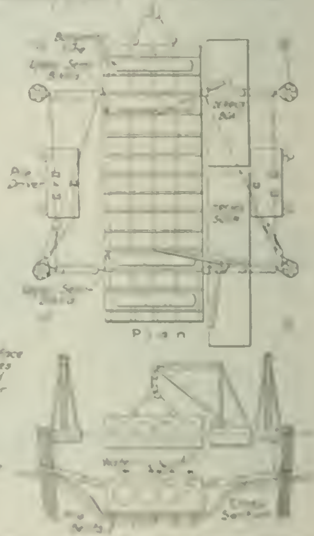


FIG 79 · FLOATING EQUIPMENT FOR SINKING TUBES

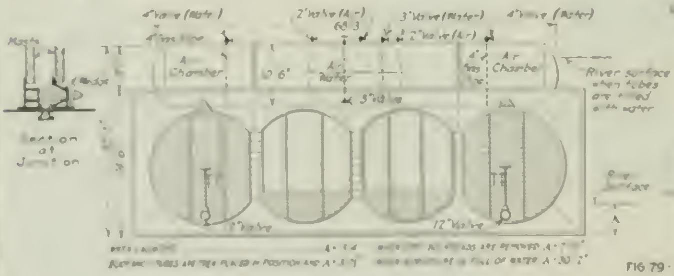


FIG 78—DETAIL OF BULKHEADS

HARLEM RIVER TUNNEL

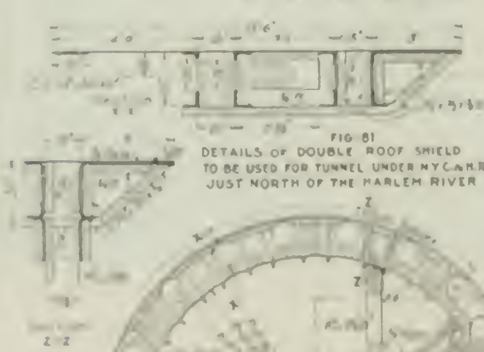


FIG 81
DETAILS OF DOUBLE ROOF SHIELD
TO BE USED FOR TUNNEL UNDER N.Y.C.&H.R.R.
JUST NORTH OF THE HARLEM RIVER

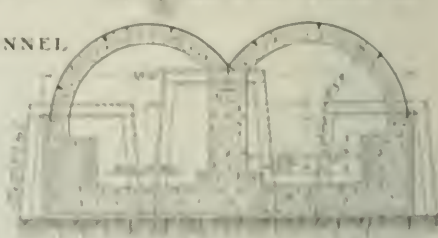
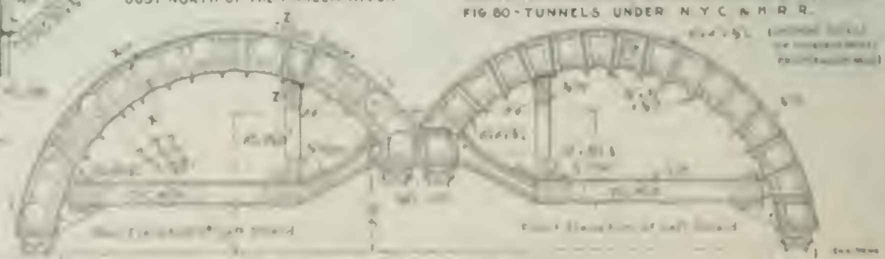


FIG 80—TUNNELS UNDER N.Y.C.&H.R.R.



N. Y. C. & H. R. R. TUNNEL

erly end of the first section *A* with all the bulkheads in. At Detroit the tubes were actually launched, by allowing them to slide down the ways as a ship is launched; on the Harlem River, however, it was thought best to build the structure on an open platform over the water, so that flat-decked lighters could be floated underneath to lift them off. The lighters used were water boats which could be filled by the opening of valves provided for the purpose and emptied by pumps. They were floated under at low water, raised by the tide to lift the tubes off the platform, and then when the tubes were moved over deep water were scuttled, leaving the tubes floating. On account of the narrowness of the Harlem River, there would have been some difficulties attending launching, but, in any event, the method used was thought to be better, and proved to be practical and very satisfactory.

The method of depositing the concrete around the outside of the tubes, and tests showing the good quality of concrete so deposited, were fully described in Engineering News, Mar. 17, 1910; the method and plant used on the Harlem River was almost exactly the same with one important improvement in the control of the tremies. The tremies are so arranged that they can be raised or lowered to accelerate or retard the flow of the concrete. At the head of each tremie and attached to it, is a platform on which stands the man who controls it. Individual hoists were provided for each tremie, controlled by a continuous rope passing by the platform, so that at any position of this latter the rope could be reached by the man, and the raising or lowering of each separate tremie made almost instantly and as required.

At the Detroit River a steel grillage embedded in concrete was placed in the bottom of the trench at the joints between each section, but at the Harlem River timber bents were driven. There were 4 to 6 bents at each joint; they were framed on shore and driven by two piledrivers, moored facing each other with long followers to reach to the necessary depth. On the first section the bents were driven an inch or two low so that the tubes might be blocked up; it was found, however, that such good control was possible that they were afterwards driven almost exactly to grade.

The method of sinking the tubes is very simple; 12-in. valves are opened in the bottom of the bulkheads in the two outside tubes, allowing these latter to fill gradually with water; the two inner tubes are entirely open. The rate of sinking after the tubes are half full is controlled by air valves at the top of the main tube, if necessary. There is apparently no difficulty in keeping them level, but to aid in this two cross bulkheads are provided, reaching half-way down from the top, providing three sections from which, after the tubes are half full, the air escapes and, consequently, the amount of water entering can be controlled by opening or closing the air valves. The tendency of either end or corner to get out of level was, therefore, easily controlled. As the tubes become completely filled, the flotation is carried by the four cylinders on top, which are in turn gradually partially filled and the excess weight, which is not great, is taken by derrick boats moored on either side during the sinking. The method of control of position is shown in the diagram, Fig. 79.

Some interesting statistics are as follows:

Weight of steel per lin.ft. of structure	5600 lb.
Amount of exterior concrete per lin.ft. of structure	30.0 cu.yd.
Amount of interior concrete per lin.ft. of structure	11.6 cu.yd.
Maximum depth M.H.W. to subgrade	57.2 ft.

The weight of the structure equipped for sinking, with masts, bulkheads, sheeting, buoyancy cylinders, etc., complete is 646 tons.

Buoyancy of four cylinders (on top)	722 tons
Excess buoyancy four cylinders	76 tons

requiring 19 tons of water in each to overcome buoyancy. One hour is required to fill the structure with water.

Cross passages are provided between the tubes at approximately every 50 ft., in the outer partitions, and two openings in the whole length of the tubes through the center partition. There is a sump in each tube at the lowest point, universal-joint cast-iron pipe being used for discharge. Access shafts—one for each tube—are provided near the ends of the end sections, by which access can be obtained to the interior of the tubes after the outside concreting is completed. The ends of the last sections are fitted with slots (two angles) to take the sheeting of the coffer-dams which are built to connect them with the land sections built in open cut. The connecting coffer-dam is of a single row of steel sheet piling; clay being dumped on the outside, if necessary, to make it tight.

Roof Shields

Just north of the Harlem River the westerly branch of the subway passes under the main line of the N. Y. C. & H. R. R.R., which at this point carries all the traffic from its own lines as well as from those of the N. Y., N. H. & H. R.R., to and from the Grand Central Terminal. The railway has five tracks and is carried on a fill between high masonry retaining-walls. The base of rail of the subway line is to be between 40 and 50 ft. below that of the railway above.

It was at first thought that this work might be carried out in open cut, carrying the railroad on timber falsework, but the acute angle of the crossing, depth and character of material would have made this a somewhat hazardous undertaking, and it was finally decided to adopt the method shown in the accompanying drawings.

Timbered drifts have been driven, as shown in Fig. 80, the center one, as will be noted, being considerably higher than the other two on the outsides. The material encountered has been mostly rock, but the work was rendered quite difficult in parts by reason of the fact that the top of the rock was just below the top of the drifts, requiring the support of the earth overhead and blasting of the rock below.

In these drifts the side and center walls are to be built of concrete and then the balance of the excavation is to be taken out under the protection of the double, segmental roof shields, details of which are shown in the drawings, Fig. 81. These shields, as will be seen, are quite unique in design and form. It is intended to work each independently of the other, shoving one at a time, but, of course, not to be the extent of one entirely clearing the other, as they necessarily react on each other to take up the side thrust.

The writer is especially indebted to Mr. Olaf Hoff, of the firm of McMullen & Hoff, the contractors for this work, for the above information, for the plans and details of these shields, and of the Harlem River tubes, he being principally responsible for the design and execution of this portion of the work.

The East River Tunnels

The additional connections between the new lines in Brooklyn and those in Manhattan are to be by means

of two pairs of tunnels under the lower end of the East River, as described in ENGINEERING NEWS, Apr. 30, 1914. The contracts for all four tunnels were recently awarded to the Flinn-O'Rourke Co. on a total amount of about $12,500,000, and work was actually started about Nov. 1 on the sinking of the shafts.

The tunnels are to be driven by the shield method and there are two novel features which are to be tried to which attention may be called at this time.

In several places the roofs of the tunnels are quite close to the river bed, so that additional cover must be provided. Owing to the swiftness of the tidal current at this point and its scouring action, the problem of retaining a clay blanket in place according to the method heretofore used in East River tunneling seemed to be one of some difficulty. The method proposed, however, will not only probably retain the clay, but by placing the material at this time (November, 1914) it will settle well into position and become nearly impervious, by the time the tunnels are driven. A comparatively narrow, thin blanket of clay is first deposited on a line on each side of the location of the tunnels. Rock from any of the numerous excavations always going on in and around New York is dumped on top of this and a clay blanket varying in thickness from 5 to 15 ft. is then dumped between these piles of rock, and is finally covered with other rock, as shown in the sketch Fig. 82. This blanket will be approximately 125 ft. in width over all. It is believed this clay blanket will stay in position and effect the desired purpose. The contractors have been fortunate in being able to obtain an excellent grade of clay from dredging in progress on the Hudson River, near Edgewater, N. J., which ordinarily would have to be towed to sea for disposal.

The second feature is a method of filling the annular space around the outside of the tunnel left behind the tail of the shield, after the latter is shoved ahead. The outside diameter of shields used for tunneling is usually from 6 to 8 in. greater than the outside diameter of the tunnel, thus leaving a space of 3 or 4 in. all around to be filled by the movement of the surrounding material or in some other manner as the shield is forced forward. This movement, while not always of importance, does tend to pro-

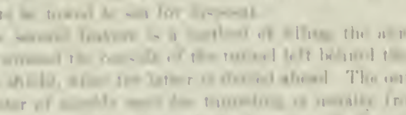


FIG. 82. METHOD OF COVERING RIVER BOTTOM OVER EAST RIVER TUNNELS

duce distortion in the cast-iron lining and a settlement of the ground above the tunnel, which latter may be very disastrous by reason of possible damage to overhead structures, as in the street approaches to these East River tunnels, and as happened in Joralemon St., Brooklyn, during the construction of the Battery tunnel on the first subway line to Brooklyn. In such materials as that under the East River, which is mostly sand and gravel, and especially with the tunnels so near the surface, any disturbance of the ground above the tunnels, [illegible], is undesirable. The prevention will probably also tend to lessen the waste from pumping air.

The shield is to be built with a double skin of 1/2-in. plates separated by a space of 1 1/4 in. The clearance between the shield and the tunnel is 3/4 in. The two skins are separated by 1 1/4x1/2-in. separators. Eight rectangular pipes 7/8x1 1/8 in. inside, 1/8 in. thick, project through the back of the shield, and gravel similar to that used for roofing purposes, is blown through these pipes by air pressure to fill the space as the shield is shoved ahead.

Experiments on a small scale have already been made which show fairly conclusively the feasibility and practicability of this method for preventing any movement of the surrounding material into the space left by the shield, but a full-size shield is now nearing completion with which final tests are to be made with the complete apparatus.

If the two improvements above described succeed in any marked degree in overcoming the difficulties usually experienced in tunneling through water-bearing loose sand and gravel, with light cover, by reason of blowouts, the generally quite considerable loss of air, consequent heating of the tunnel, and the settlement of the ground above, they must be considered as a distinct advance in the art of subaqueous tunneling.

The writer is indebted to John F. O'Rourke and W. Gray, who have developed these methods, for the above information.

Some Results of Experience with Piles and Pile Tests

The following interesting statement is made by J. W. Taussig, for the part of the Raymond Concrete Pile Co. It is elicited by our request for information on pile tests and the conclusions derived from the results of that test.

In the last fifteen years the Raymond company has made upward of 200 tests on piles of all kinds, driven under every condition. Wood, precast, and various kinds of molded-in-the-ground piles have been loaded, and close observations made as to their behavior. Without drawing any comparisons, the following facts have been learned which are applicable to all pile tests:

1. *Age of Pile*—The bearing power of a pile increases greatly with the time the pile is in the ground. The increase is very rapid immediately after the pile is driven and continues for an uncertain length of time. Our experience leads us to believe months elapse before the full strength of the pile is developed.

2. *Speed of Loading.* The test load a pile will carry more nearly approaches the ultimate value of the pile if the load is applied slowly. By ultimate value we mean the load under which the pile would fail after the structure it is designed to carry is in place. [illegible] Just what relation the ultimate load bears to the time allowed for testing we have been unable to determine.

3. *Vibration.* Vibration of the pile, [illegible] will not appreciably reduce the test load carried, unless the soil is of quicksand or very soft character. A pile in soft material depends almost entirely on skin friction generated by the adhesion of the soil to the pile and not on the ordinary friction due to compression of the soil as well as its adhesion. The adhesion of the soil when acting without the assistance of compression is apt to be

destroyed by shocks so that failures may come suddenly under comparatively light load.

Comparison of Test Load and Bearing Power

Economic circumstances usually require the test to be made under the worst conditions for the pile. The sooner a pile can be tested, the quicker the work can proceed, which is always of great importance. The same desire for speed necessitates the loading of the pile in the least possible time, so that often 50 or 60 tons is placed in a single day. The test is often made while other piles are being driven in close proximity. This sets up the most violent vibrations in the test load.

Under actual conditions the load is put on the piles very slowly. By the time the structure resting on the piles is completed, enough time has elapsed to allow the piles to reach their full or ultimate value. Even though the foundation may be subjected to vibrations after the structure is completed, the effect of these shocks is minimized as the entire structure is bonded together and the working load is usually only half to two-thirds as large as the test loading.

It is evident, therefore, that a pile giving satisfactory results under test will give a much better account of itself when subjected to its working load. Comparisons between the bearing power of piles must be drawn under as nearly similar conditions as possible. Wood and cast piles can be tested immediately after driving, so far as their own internal strength is concerned. It is, however, unwise to test these in less than two or three weeks, as this time is necessary to allow them to get a fair bearing value. Piles molded in the ground must not be tested until the concrete has attained sufficient strength to support the load. This usually requires about three weeks, although piles only two weeks old are often tested satisfactorily. Raymond piles have been tested in three weeks to a point where the concrete at the top was under a compression stress of over 1100 lb. per sq.in. This high loading is undoubtedly made possible by the support afforded the concrete by the spirally reinforced shells, which contain about 10 lb. of steel per lineal foot of pile.

Test Method

Tests are made in a number of ways. The load, consisting of a platform loaded with sand, water, iron, lead or other material, is usually balanced on a single pile, as the testing of more than one pile at a time requires handling an excessive amount of loading material and prohibitive expense in providing a suitable holder.

The value of results obtained from loading three or four piles at a time is incommensurate with the expense and difficulties attaching to the test, as experiments have shown the loads carried on a group of piles are closely proportional to the number of piles tested.

Cost of Tests

The expense of tests varies greatly, but usually approximates $2 a ton for load applied. This seemingly high cost is due to the expense of the testing platform and other special apparatus necessary. Careful and experienced supervision is of the highest importance, as not only must the test be conducted in a suitable manner, but the results obtained must be properly interpreted in order to draw the correct conclusions.

Portable Buildings of Monolithic Reinforced Concrete

The use of portable monolithic reinforced-concrete buildings for such railway structures as oil houses, switchmen's cabins, telephone booths, and waiting stations or shelters is increasing, and these buildings have advantages in cost, durability and appearance.

The smaller buildings are hexagonal or octagonal in plan, and range from 4 to 8 ft. diameter, with a minimum ceiling height of 7 ft. 4 in. The floor is about 4 in. above the bottom, in order to provide an air space beneath, and the sides ($2\frac{1}{2}$ to 4 in. thick) are paneled on the outside

A Portable Reinforced-Concrete Building
(A shelter station for an interurban railway, but suitable also for a watchman's cabin at a road crossing.)

for the double purpose of reducing the weight and improving the appearance. At the top is a 6-in. opening, with concrete ventilator. The weight of these structures is from 2 to 5 tons. The larger buildings are rectangular in plan, 8x10 ft., and weigh about 9 tons.

The reinforcement consists of electrically welded wire mesh and horizontal bars fastened to heavy vertical bars which are placed at the corners and extend to the middle of the roof. In the smaller buildings these rods are placed radially within the roof and are hooked to a circular rod around the ventilator opening.

These concrete buildings are manufactured by the C. F. Massey Co., of Chicago, Spokane and New York. The buildings are handled by cranes or derricks, the hoisting chain being dropped through the ventilator opening and fastened to a timber placed across the inside of the roof.

Beargrass Creek Storm-Water Channel at Louisville, Ky.

By J. H. Kimball*

SYNOPSIS—The Beargrass Creek was practically an open main sewer, with an irregular channel and numerous bridges, and its banks constantly encroached by filling and its serious flooding in times of freshet. It has been straightened, deepened and lined with concrete to form a storm-water channel, an intercepting sewer being built to carry the sewage. It is 40 to 70 ft. wide, with concrete retaining walls 4 to 18 ft. high, the walls including granite and reinforced surfaces. The construction work was done by day labor.

The city of Louisville, Ky., is provided on its northern and western boundaries with a convenient means of disposal of its drainage by the Ohio River. In the eastern section, Beargrass Creek, the only open stream of material size within the city limits, has served as the natural outlet for drainage. Other smaller creeks have been replaced by trunk sewers, but this stream (draining a considerable territory both within and beyond the city limits) will remain as an open channel.

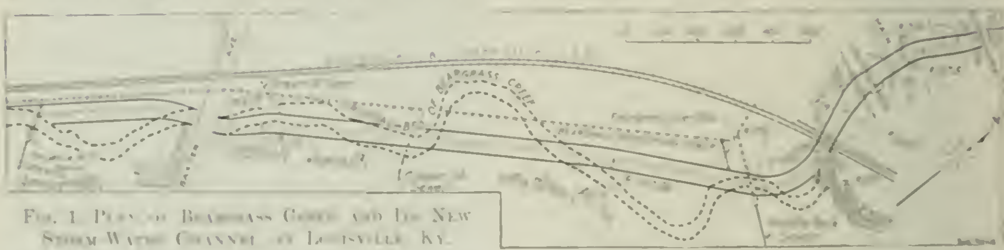


Fig. 1. Plan of Beargrass Creek and the New Storm-Water Channel at Louisville, Ky.

Beargrass Creek drains a territory of 63.4 sq.mi. The soil throughout the basin is clayey, and the surface is undulating, with some small hills of steep slopes. The maximum difference in elevation is about 250 ft. and the average slope of the branches is from 4 to 5½ per 1000. Only a small proportion of the territory lies within the city limits and this is practically all improved as a closely inhabited residence territory. The area outside of the city is largely cultivated land.

The course of the stream was originally meandering (Fig. 1), and the bed lay in a valley often of considerable width. As the property became more valuable, the waterway was improved to a slight extent by occasional straightening, but the principal change was that of filling and encroachment by which the course became much restricted. Bridges have been built, obstructing the flow to a greater or less extent, and trestles, which collected obstructions, rubbish and débris in large quantities, especially where the trestle bents were not parallel to the direction of the stream. In none of the bridges was the span equal to the present channel width. At one of the cross streets, the abutments and wing walls were so built as to interfere greatly with the flow, and other bridges were poorly designed with reference to location and direction of stream.

In addition to earth filling placed for the purpose of reclaiming land, there has been dumping of all kinds of refuse materials and dead animals. No abuse apparently was thought too great to heap on the stream. It was the natural outlet for drainage, and not only storm water but sewage was discharged into it through public and private sewers. Such treatment naturally caused a very offensive condition, particularly in warm and dry seasons. In periods of low precipitation, the flow of the creek within the city consisted almost wholly of sewage, and septic action was very noticeable in the numerous pools along its course.

In the preliminary plans of the Commissioners of Sewerage an intercepting sewer was planned to take the sewage of the many public sewers discharging into the stream. This has been built, but in times of storm these sewers still overflow into the creek. Only such work as was necessary to drain the stagnant pools was planned to be done on the creek itself.

The improvements on the watershed naturally developed a greater concentration of flow, and the filling of land along the creek caused a loss in storage. With these conditions and the encroachments and obstructions in the channel, floods have occurred with increasing frequency. Not only was this an annoyance and injury to private property, but during the most severe freshets streets and railway tracks were flooded, traffic stopped, and water forced back into the sewers.

During the early part of the work of the Commissioners it was decided to make an exhaustive study of the creek in order to design a comprehensive plan for its improvement. Fortunately, a very heavy storm on Feb. 25-26, 1908, while the investigation was in progress, enabled means of collecting data on flood conditions. From all data available, this flood was the greatest ever occurring on the creek. The rainfall was [illegible] in., according to the recording gage at the office of the Commissioners, and [illegible] in. by the Weather Bureau gage. This was the heaviest fall on record in Louisville with one exception.

This flood was the cause of great damage. Streets were flooded, traffic on the Louisville & Nashville R.R. was stopped and the smaller frame buildings were washed away, basements of dwellings and industrial establishments were flooded. One very important feature of

*Engineering Assistant, [illegible], Louisville, [illegible]

the freshet was the effect on the storm flow from sewers discharging storm water into the creek. Two of the principal sewers of the city were entirely submerged and the water level in the creek rose to a height several feet above the top of the sewers and nearly equal to the elevation of the surface of the ground at many points in the system, and backing into cellars through private drain connections. The intimate relation between the condition of the creek and the efficiency of the sewers, as shown by this freshet, showed very forcibly the importance of an improved channel for the stream.

The investigation resulted in a report on a general scheme for straightening, deepening and widening the channel, and providing masonry walls and floor. The most serious problem was that of adjusting the location of the improved channel so as to conform to existing structures, extensive changes in which would necessitate too great an expense.

The problem of deepening was not particularly serious. At the junction of the South and Middle Forks, the bed was at a sufficiently low elevation, so that along the main stem between this junction and the Ohio River the problem was one of removing elevations in the bed to produce a uniform or at least a continuous grade. The bed of the South Fork was found to be 3 ft. above the invert of the largest sewer discharging into it, and also somewhat above the invert of another large sewer, these being the sewers mentioned as submerged in the great freshet. A further requirement, and the one which determined the grade of the South Fork, was the necessary elevation of an important relief sewer to be built in the future. The maximum depth below the old creek elevation required for these storm-water sewers was about 7 ft., excavation for which would be largely in rock.

The line of the creek was found to be largely controlled by the many railway and highway bridges. These influenced the stream in three ways: by acting as obstructions, by causing bends in the course of the stream, and by narrowing the channel. The chief offenders of the first class were the trestles, carrying spur tracks of the L. & N. R.R., and it was considered that these should be replaced by plate-girder bridges, but after conferences with the railway company, industrial tracks were built to parallel the creek on the opposite side from the main track, thus obviating the necessity of any spur-track bridges. The elimination of one of the plate-girder bridges was made possible by the closing of the street which passed over it. In the design of the improved channel, the waterway provided was to be clear without piers or other obstruction.

The location of the bridges was not, in the main, unfavorable to the course of the stream. In two cases, however, in which the main line of the railway crossed the channel on plate-girder bridges, it was found necessary to relocate these as skew bridges of longer span and on a different location. One of the largest and most expensive bridges, a stone arch carrying a street with very heavy traffic, was built at right angles to the street, although the general course of the stream was at a considerable angle with the street. On account of the expense of building a new bridge, the line of the creek was curved on either side of the bridge to conform to its location.

The most serious trouble to be found with the bridges was the insufficient width of waterway provided. Fortunately, it was possible to increase the grade of the creek through the localities where the bridges were most frequent, which made it possible to design a waterway which would be theoretically sufficient at nearly all points. The location of the improved channel is shown as Fig. 1.

The Improved Channel

The improved channel for Beargrass Creek was designed for a runoff of 185 cu.ft. per sec. per sq.mi., for the South Fork and 180 cu.ft. for the creek below the junction of the South and Middle Forks. An increased depth beyond the 9 ft. assumed in the design would increase the discharge to 200 cu.ft. per sec. per sq.mi. or more without damage to surrounding property.

The design provided for concrete-masonry walls and floor (Fig. 2) shows the typical section, southwest of Baxter Ave. For about 7500 ft. from the river, the channel was designed to have a width of 70 ft., with side walls 4 ft. above the floor and banks graded to a slope of 1 on 2. The floor is depressed at the center 3 in. below its elevation at the side walls, and has a small channel 11 ft. wide and 9 in. deep to carry the dry-weather flow. From the upper end of the 70-ft. channel to the junction of the South and Middle Forks (a distance of 580 ft., within which five bridges were to be passed), the grade was increased and the width reduced to 15 ft.

For the first 2500 ft. on the South Fork, there was room for any desired width of channel, and there was but one bridge. The width selected was 50 ft., narrowed at the bridge to conform to its width. For a distance of 1500 ft. above this section, the available room was very limited although a steeper grade was possible, so that the width was made only 40 ft. The walls varied in height from 4 to 24 ft., according to the elevation of the abutting land, the use to which it was put or its value, and the possibility of sloping the banks. The accompanying table shows the sizes of channel, velocity of flow, discharge, etc.

Distance, ft.	Channel width, ft.	Grade, per cent.	Velocity, ft. per sec.	Discharge, cu. ft. per sec.	Capacity, cu. ft. per sec. per. sq. mi.	
7500	70	0.20	18.2	11,800	180	Main Stem
580	45	0 40	24 1	10,070	183	" "
2575	50	0.80	10.95	5,070	184	South Fork
1270	40	0 14	13.9	5,150	187	" "

In all sizes, the depth of flow is taken at 9 ft., that being the elevation at which it was desired to limit the flow under all but extreme conditions. During the great floods in the Ohio River, back-water from the river will stand at an elevation much higher than this.

In explanation of the high velocities shown in the table, it may be stated that an examination of the inverts of old storm-water sewers in the city indicated that the material carried by them had but little effect on the masonry. The only case in which a measurable scour was found was in a sewer built over 50 yr. ago, in which the theoretical velocity was 26 ft. per sec., and the invert brick had lost but 1/4 in. by erosion. In hardness tests made with a machine of the Dorry type, samples of concrete made with Ohio River gravel (1:2½:5) showed wearing properties superior to those of brick from the Louisville sewers. In fact, the concrete was found to compare very favorably with samples of street-paving brick.

This absence of wear in the old sewers may be due to the nature of the mineral matter carried in these sewers. The detritus from street wear in the macadam streets is composed principally of the fine limestone dust

resulting from the material of which the streets were [illegible]. The detritus from a macadam street built of a harder material would undoubtedly have caused a greater scour. The abrasion from granite and vitrified-brick pavements is apparently too small in amount to cause [illegible] wear on the sewers.

Some observations by the Reclamation Service [illegible] ("Safe Velocities of Water in Concrete," Engineering News, Jan. [illegible]) indicate that in the absence of gritty matter, concrete is able to withstand very high velocities of water. The watershed of Beargrass Creek having for nearly its whole area a [illegible] surface soil, the storm flow has a very high turbidity but the matter held in suspension is not of a gritty nature. In the future, when the creek is improved throughout its length in the city, and the upper areas are developed so as to increase the runoff and develop the theoretical velocities, the sloping earth banks above the tops of the low walls will need protection. For the present, high velocities will be diminished by the retardation of the flow due to the lack of improvement in the lower reaches of the creek.

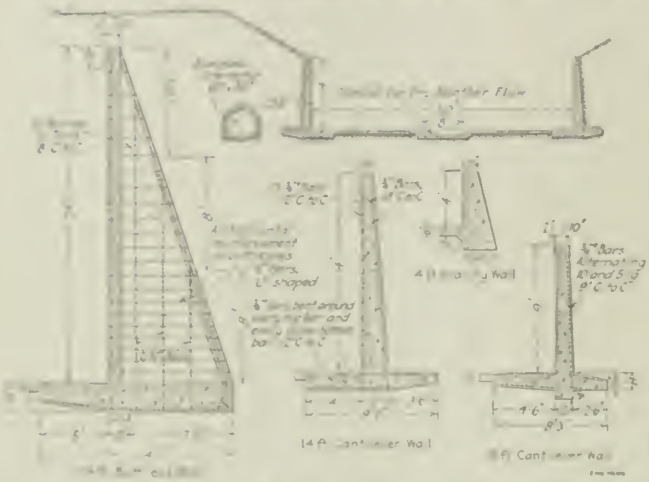


FIG. 2. CROSS-SECTION OF BEARGRASS CREEK CHANNEL AND TYPICAL SECTIONS OF THE RETAINING WALLS

Although the line of the improved channel was made as direct as possible, changes in direction were necessary at the various bridges and also to a slight extent on account of topographical features. All changes in direction were made with curves and the channel lines were made tangent to the lines of the bridges (Fig. 1). The minimum radius used for the center line was about twice the width of the channel. This short radius was used in one instance only and then from necessity on account of existing structures. That this curve was sharper than desirable was shown by the fact that a deposit was formed on the inner side of the curved channel after a heavy freshet.

The studies on the best type of wall for the channel resulted in the selection of the gravity type for the 4-ft. walls, the reinforced-concrete cantilever type for walls 9 ft. to 14 ft. high, and the buttressed or counterfort type for the 24-ft. walls (Fig. 2). The changes in height from 4 ft. to 9 ft. were made with a sloping wall of the gravity type, and from 9 ft. to 24 ft. with a sloping wall

FIG. 3. CONSTRUCTION OF THE CONCRETE CHANNEL OF [illegible] CREEK, SOUTH OF BAXTER AVE. BRIDGE, [illegible] (30 FT. WIDE; WALLS 14 FT. HIGH)

of the cantilever type. As it was decided to construct the floor of masonry, it was thought wise to utilize the toe of the wall as a part of the floor. For this purpose, the base was set farther to the front than is commonly done. This design lessened the amount of excavation and of concrete masonry. The floor was designed of masonry to obtain a smooth surface for the sake of capacity and to facilitate the cleaning of the bed of the creek when it should become necessary. The floor was designed

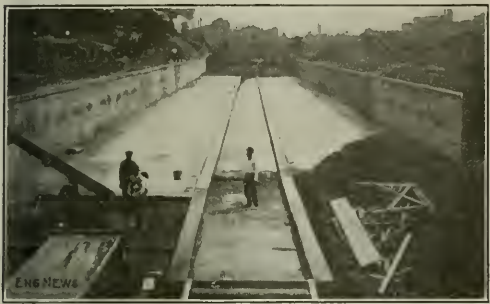


Fig. 4. A Completed Section of the Beargrass Creek Channel (South of Junction with the Middle Fork)

with a thickness of 6 in., but during construction this thickness was reduced (where rock was encountered) to a minimum of 2 in.

The Commissioners of Sewerage were directed originally to construct a comprehensive system of sewers, and no more work was contemplated in the preliminary plans than a slight improvement in the grade and the removal of obstructions in the bed. As the importance of a substantial improvement became more apparent, the situation was studied to determine the value of a partial improvement. As a result, it was decided to construct about 2700 ft. of the channel complete with masonry walls and floor. About 400 ft. of this was built to facilitate the construction of a section of the intercepting sewer at the side of the creek.

Fig. 3 shows the work under construction just south of Baxter Ave., where the walls are 14 ft. high. In the center of the view is a length of the form for the wall, while at the left is a completed stretch of the opposite wall, with form being erected for another section. Fig. 4 shows a completed stretch of the improved channel, south of the junction of the Middle Fork. This shows clearly the arrangement of the floor slabs on either side of the central channel, with a chute for depositing concrete at the left. Fig. 5 shows an interesting view on the completed work.

Construction Work

On account of the uncertainty of determining in advance the cost of the work, which was nearly all to be done in the existing bed and subject to serious delays and damage by flows in the creek of all degrees of intensity, and by floods in the Ohio River, it was decided to perform this construction by day-labor. A day-labor force had been organized under F. C. Williams, Resident Engineer, for certain sewer construction on which the contractors' bids were considered unduly high. This force had been very successful with the previous work and was well organized for the creek construction. Another advantage of the day-labor system was the ease with which the amount of work to be done could be adjusted to suit the amount of funds available. This was desirable as this work was postponed until near the end of the construction of sewers. The total expenditure for the creek was about $170,000, which was less than the receipts from interest gained through the good management by the Commission of the $4,000,000 bond issue. The expense of the investigation and construction together was met out of the surplus above the face value of the bond issue.

The construction work was facilitated by the use of the intercepting sewer built in the valley for the disposal of the flow of water in the creek in dry weather. By this means, all but a small amount of water was avoided, except at storms, in the majority of the work. At the junction of the South and Middle Forks, a sand-bag dam was used to divert the flow into the sewer. At two points where the new channel was built on a new location, and where the excavation was between 9 ft. and 24 ft. deep, the earth (20,000 cu.yd.) was removed by contract; in one instance, by wheel scrapers and in the other by steam-shovels and teams.

The work of construction as a whole was of such a nature that the use of extensive equipment was not warranted. A traveling derrick with buckets and small steel

Fig. 5. The Beargrass Creek Channel, Louisville, Ky.

(Just below junction of the South and Middle Forks, with three railway bridges.)

dump-cars were used to move earth and rock excavation by the day-labor force, and these with a concrete mixer and a number of light drills operated by steam comprised the total equipment in addition to small tools. With the exceptions noted above, the excavation was, to a large extent, of slight depth and was moved with pick and shovel either with or without the use of the derrick. The excavated material was deposited back of the walls and used in raising the level of land in the immediate vicinity of the channel. In order to prevent the pressure on the walls from a heavy fill of mixed rock and earth, the rock was carefully deposited or piled so as to be self-supporting, so that it would relieve rather than add to the pressure on the walls.

Excavation beneath the bridges was necessarily car-

ried on with extreme care, particularly where rock was encountered. [illegible] limestone bridge, the excavation of 4 ft. of rock was required. Blasting was done at the center with light charges of dynamite, and [illegible] holes were drilled as close as possible to the abutments, but no dynamite was used in holes less than 6 ft. from the abutments. The rock at the abutments was trimmed off with [illegible]. Although no signs of weakness were apparent in the arch, the excavation revealed a very poorly constructed foundation, the abutments resting on large [illegible] on the bed of the creek. The bridge masonry was carefully underpinned not only to prevent settlement in the structure but also to secure it against erosion. In another old limestone arch, immediately below the junction of the South and Middle Forks, the bed of the stream had been eroded nearly to the extent of endangering the bridge abutment. At this point, the bed required filling in order to raise it to the proper elevation for the masonry floor.

Expansion joints were designed to be placed at the joints between the toe of the wall and the floor, and between the floor and the center channel. Transverse expansion joints in the wall and floor were required at a maximum distance of 30 ft., but as built, an expansion joint was used at the end of each section, which, in the case of the lower walls, was 15 ft. The 24-ft. wall was built in independent sections 30 ft. long, with expansion joints at the ends. These joints in the walls were made of layers of tarred paper coated with pitch. The joints in the floor were generally made by pouring pitch into the space left by the removal of thin boards or shingles temporarily placed along the planes of the joints at the time of placing concrete. The expansion joints were varied in thickness, according to the season, those placed in winter being much thicker than those placed in summer.

Drainage of the material behind the wall was provided by a 4-in. pipe laid continuously back of the wall, with [illegible] outlets through the wall to the channel at intervals of 30 ft. or less. The backfilling immediately behind the wall was of selected porous material.

Some consideration was given to the necessity of reinforcing the cantilever and buttressed walls against pressure from the channel side, on the assumption of a channel filled by a freshet before the earth pressure back of the wall was developed. But as water in the channel would find its way to the back of the wall at an equal height [illegible] around the back of the walls, this [illegible].

Although the work of the Commission covered a length of only [illegible] ft., it accomplished a [illegible] reduction in the height of the flood waters. A storm of [illegible] occurred near the close of the work which demonstrated the value of the work done. Although it had a greater total precipitation and greater intensity than the storm of [illegible], it caused little or no damage. [illegible]

Since the completion of the work of the Commissioners of Sewerage, the improvement has been taken up and continued by the city through its Board of Public Works. This work, covering a length of nearly 5000 ft., has followed in general plan, the scheme of the Commission.

J. B. F. Breed was Chief Engineer, and Harrison P. Eddy, of Boston, Mass., was Consulting Engineer of the Commissioners of Sewerage.

Lamp Signals for Day Service on Electric Railways

An interesting development in the introduction of block-signal systems for interurban electric railways is the use of lamps for both day and night indications, thus dispensing with semaphores and their operating mechanism and simplifying the signal equipment very materially.

Two daylight lamp signals are shown in the accompanying cut; the one at the left is on the Indiana Union Traction line and the other is on the Terre Haute, Indianapolis & Eastern Traction line, both being of the "absolute-permissive" automatic block system of the General Railway Signal Co. There are three lights in each signal, the two upper lights constituting the main signal, while the bottom light is the permissive indication which practically subdivides the block for following movements and enables trains in the same direction to run at closer intervals than the distance between passing sidings (this distance being the length of the main block). The visibility of each light by day is increased by a hood projecting over the top and side of the lens, as shown.

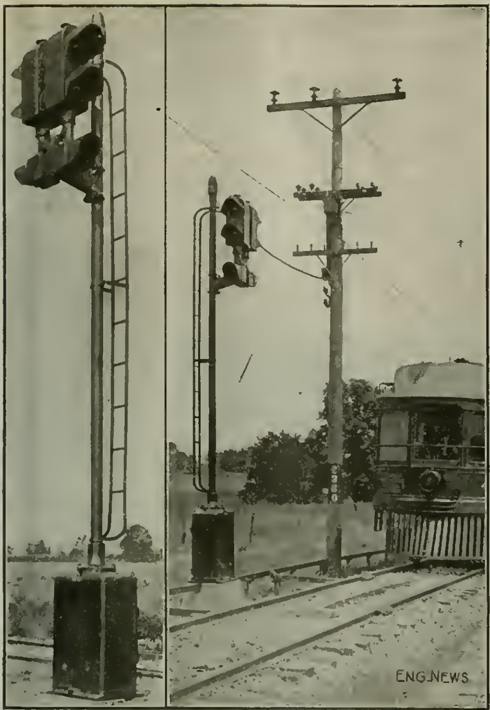
The development of this type of signal is reviewed in the report of the Joint Committee on Block Signaling, presented at the recent annual meeting of the American Electric Railway Association. A condensed abstract of this part of the report is given below.

The first installation of signals constructed on correct principles for both day and night service was in 1907 on the Brooklyn Bridge, by the Union Switch & Signal Co. These signals had 5-in. lenses giving both green and red indications and were equipped with [illegible] hood but were not provided with any artificial background. Two 16-cp. lamps were mounted behind each lens. In 1911 short range light signals for daylight conditions were installed in the Pennsylvania [illegible] in New York by the same company.

The use of light signals on high-speed interurban lines having continuous track circuit control is of recent origin and the first trial was made on the Michigan United Rys. in February, 1911 by the General Railway Signal Co. This was a temporary signal mounted in a wooden case and arranged so that either [illegible] or [illegible] red and green lenses could be used. The 110-volt [illegible]-watt tantalum lamps were [illegible] so that the [illegible] of the lamp [illegible] was directly behind and [illegible] with the focus of the lens. [illegible] Energy for the lights was taken from the [illegible] and cut down to [illegible] by resistance. It was found that with the sun shining directly into the face of the signal the red light could be seen about [illegible] ft. and the green light about [illegible] ft.

In 1911 the above company installed a light signal on the line of the Lehigh Valley Transit Co., near [illegible] Valley, [illegible]. This was in connection with an installation of [illegible] signals for the purpose of comparing the suitability of the light signal for interurban service; but it was finally taken out and replaced by a semaphore in order to have all signals uniform.

Long range signals of this type were installed by the Union Switch & Signal Co. on the [illegible] Washington, Baltimore & Annapolis Electric Ry. in 1911. They were of the type installed in 1907 on the Brooklyn Bridge, except that the hood length was increased to [illegible] in. and a shield extending [illegible] in. on each side was added to form an artificial background. Each signal had two lenses, one red and one green, and behind each were mounted two [illegible] 16-cp. tungsten lamps wired in multiple. No [illegible] were employed, so that indications could not be affected by headlights. The use of [illegible] lenses without [illegible] and the white light



LIGHTS AS BLOCK SIGNALS FOR DAYLIGHT INDICATIONS

(The lights are hooded to increase their visibility and to screen the lenses from direct rays of sunlight [and headlight]. The signal at the left is one on the Indiana Union Traction System, and that at the right is on the Terre Haute, Indianapolis & Eastern Electric Ry.)

of the tungsten lamps so improved this signal as to provide suitable indication at 1600 to 1800 ft. under the most severe daylight conditions.

The first complete signaling installation with light signals throughout was on the Brazil Division of the Terre Haute, Indianapolis & Eastern Traction Co.,* and was completed and put in operation in the early part of August, 1912, by the General Railway Signal Co. An installation on the Indiana Union Traction System,* by the same company, consisting of 29 blocks of light signals which protect 50 miles of track, has (according to the company) proved entirely satisfactory, although at first the continuous track circuit gave trouble from dirty rails in paved streets. Since the cause has been recognized, this trouble has not interfered with operation.

These signals have 40-watt lamps, and 8-in. lenses with hoods, and in daytime the signal indications can be read clearly at 3500 ft., and at night on the longest tangent, 2.05 miles. This installation has been in service since 1912 and so far there has been but one false clear indication given by the signals, and it is doubtful if this could be charged against the signals. No difficulty has been experienced in picking up signals, and phantom indications (due to arc headlight reflection) have not so far been given, nor has the continuity of operation been affected by heavy sleet storms experienced in the winter of 1913. So far as operation and cost of installation are concerned, the light signal is the equal of the semaphore. No complaints have been received from the trainmen with regard to these signals.

The Illinois Traction System, although having the majority of its signals of the semaphore type, has some light signals and believes that the light signal is of advantage because it can be read a greater number of hours during the average day of operation.

The one all-important feature of light signals is the correct reading of the indication, and while in most cases the lenses are hooded to shade the rays of the sun and headlights, it is said that with an 8-in. lens a layman can read the indications at 2000 ft. and a motorman at 2500 ft. Recent tests at New Haven have shown that with existing types of light signals using 15-watt lamps, indications were distinctly visible 1500 ft. distant. These signals had 8-in. lenses, and it is said that if they had been equipped with 10-in. lenses, the indications in the daytime would have been visible at 3500 ft.

The committee submits what it considers to be good practice in regard to sizes of lenses for use with light signals: (A) For high-speed interurban service, a lens of not less than 8⅜-in. diameter should be used on all light signals operated by continuous track circuits. (B) For moderate-speed roads, a lens of not less than 5⅜-in. diameter should be used where light signals are operated by trolley contact or other end set devices.

*The signals of these two installations are shown in the accompanying cut.—Editor.

Large-Sized Stone for Bituminous Macadam in Ohio

A part of the $7,500,000 of contracts let by the Ohio State Highway Department in 1914 was for roadway having a top course of bituminous macadam, built by the penetration method. The broken limestone used for this top course was from 2½ to 4 in. in size. The general specifications under which this work was done, after stating how the stone should be spread and then rolled to a firm and even surface, continued as follows:

Where this top course is thicker than 3 in. after rolling, the bottom voids up to within 2½ in. of the surface shall be filled with coarse sand, or screenings, as the Commissioner may direct. Each shovelful of screenings shall be applied thinly over the surface and the rolling continued as the screenings are being applied.

After the top course has been rolled and completed as specified above, the voids in this course shall be partially filled with screenings, free from dust, that will pass through a ¾-in. and over a ¼-in. circular mesh, which shall be whipped into the surface from shovels. The surface shall then be gone over with a stiff fiber broom, and the loose screenings remaining on the top swept into the voids, or off the surface. When deemed necessary the rolling shall be continued during the application of the screenings. The filling of the voids in this top course shall be such that the amount of bituminous material specified shall fill the remaining voids just sufficiently to produce a dense surface when the road is completed. Any dust remaining on the surface shall be removed by sprinkling with water. Sufficient time for the stone to dry shall elapse before any bituminous material is applied.

The hot bituminous filling, either tar or asphaltic, was applied at the rate of 1¾ gal. per sq.yd. The surface was then dressed with "hard, clean screenings of stone, slag or gravel, ¾ to ¼ in. in size, and rolled until firm." Finally a seal coat of ½ gal. per sq.yd. of the same bituminous material, heated, was applied, more screenings added, the roller used, and then a final dressing of screenings was applied "to protect the surface of the road while setting up."

James R. Marker is State Highway Commissioner of Ohio, and C. E. Schoenmaker is Deputy Commissioner for Construction.

Steel Railway Ties are likely to be largely substituted for wooden ties on Indian railways, according to the government report on Indian Railways just issued. Both steel and cast-iron pot sleepers have been used in India for many years with a fair degree of success, but have hitherto been found expensive in comparison with wooden ties. The diminishing supply of timber with the steady increase in price has changed conditions, and it is stated that the use of metal ties will probably be greatly extended in the next few years. The government is also experimenting with various processes of treating timber ties to increase their life and preserve them from the attacks of white ants, and has asked for bids for the supply of wooden ties so treated.

Vitrified-Brick Pavement on an Old Macadam Base, Carlisle, Penn.

By John C. [illegible]*

During the past season [illegible] sq.yd. of vitrified-brick pavement were laid by the Street Department of Carlisle, Penn., under the supervision of the writer.

Track Section—The section paved comprised [illegible] on High St., the main business street, through which the tracks of the Cumberland Valley R.R. run. The railroad company was unwilling to pave between and along the tracks, but it agreed to construct a concrete curb, [illegible] supported the 5x8-in. by 16-ft. guides for a striking template.

Concreting Fills in Trenches—The Gas & Water Co. had recently renewed a great many trenches along the street, and poor foundations existed in the old gutters, so it was deemed advisable to fill all these new trenches and the gutters with concrete 5 in. deep.

Stone Cushion—The cushion was composed of limestone dust and screenings, 1½ in. in thickness, and was struck off by means of a short striking template drawn by three men, as illustrated in Fig. 1. The cushion was then rolled with a 250-lb. roller drawn by hand.

Laying Bricks—The bricks were laid by one foreman and two men, one of the men breaking half-brick to fill

Figs. 1-4. Construction of a Vitrified-Brick Pavement on an Old Macadam Base

(1) [illegible] (2) [illegible] (3) Laying brick. (4) Rolling

[illegible]

Pavement [illegible]—The old macadam with which the street was paved was used as a base for the new paving. This macadam had a double [illegible] crown of [illegible]

[illegible]

[illegible]

*[illegible], Carlisle, Penn.

[illegible] Usually there were [illegible] [illegible]. An average of 7000 bricks were laid by each man per day. Vitrified shale paving blocks were used.

[illegible] Rolling was done with a [illegible]-ton [illegible] roller [illegible]

Grouting—The joints were grouted with a 1:1½ portland-cement grout.

Expansion Joints [illegible] "Elastite" [illegible] joint was used longitudinally along the [illegible] and [illegible]

"Elastite" was found to be a great improvement over the [illegible] joint filler, doing away with the

[illegible]

boards, wedges, heating the pitch, etc., and the first cost of the joint was practically the entire cost, as it took very little time to place it in position.

SAND COVERING—The green pavement was covered with ½ in. of sand for several days. Traffic was turned on the pavement at the end of five days.

COST DATA—The following is an itemized list of cost data:

	Total	Cost per Sq.Yd. of Pavement
Unloading and hauling brick	$193.74	$0.0777
Grading and rolling subgrade	280.73	0.1126
Concreting trenches	211.36	0.0848
Crushed stone cushion	135.50	0.0543
Brick	2143.98	0.8600
Laying brick	93.85	0.0376
Rolling brick	15.64	0.0062
Grouting	210.72	0.0845
Expansion joints	88.75	0.0356
Covering with sand	11.74	0.0047
Total	$3386.01	$1.358

Dump wagons were charged at the rate of 10 and 15c. per hr. The reason for this was that they were fire teams; one

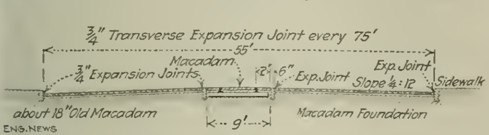


FIG. 5. CROSS-SECTION OF BRICK PAVING ON AN OLD MACADAM BASE, CARLISLE, PENN.

was paid 10c. per hr.; for the use of the other the Street Department paid the driver's salary, which was $1.50 per day, or 15c. per hr.

The bricks were purchased in March at a reduction of $1 per M. The great advantage in this was that we got a better run of bricks and had them when needed, and we saved $1 per M, or $100 on the year's work.

All macadam excavated was used in resurfacing streets adjacent to the work. Approximately 20,000 sq.yd. were thus resurfaced.

It will be noticed that a stone cushion was used instead of sand. The reason was that when first tried as an experiment the stone formed a compact cushion without becoming too solid, and at the same time reduced the cost by one-half.

A Dinner Party in a Boiler Furnace

The huge Stirling boilers installed in recent years at the Del Ray plant of the Detroit Edison Co. have attracted wide attention in the engineering profession, being by far the largest boiler units ever constructed and having attained a phenomenally high efficiency, together with a capacity to be operated at several times their normal rating.

A new boiler of this type has recently been installed at the Connors Creek plant of the Detroit Edison Co., and to celebrate its completion a dinner party was given inside the furnace of the boiler on Saturday evening, Nov. 28, at which 46 guests sat down. There was ample room inside to have seated at least a dozen more people with comfort.

Those present at the dinner were the officers and directors of the Detroit Edison Co., with their wives, the members of the construction force, and a few guests present by special invitation. Mr. Alex Dow, President of the Detroit Edison Co., is the central figure in the group. To prepare the boiler for the festal occasion, a wooden floor was built over the stokers and the tubes overhead were concealed by festoons of ribbon.

The boiler is rated at 2355 hp., but it is capable of furnishing sufficient steam for the development of 10,000 kw. of current by the turbine generators. The approximate exterior dimensions of the boiler are 30 ft., depth, width and height.

The boilers were built by the Babcock & Wilcox Co.

DINNER PARTY INSIDE THE FURNACE OF BOILER NO. 2, CONNORS CREEK PLANT, DETROIT EDISON CO., NOV. 29, 1914

A New Species of Engineer is reported from England, where a firm advertises in the London "Times" as "Laundry and Cooking Engineers." What is doubtless meant is that the firm in question specializes in the design and installation of machinery for use in laundry and large culinary establishments in hospitals, hotels, etc. There is no apparent reason why the design and installation of such machinery is not as legitimate a field for an engineer's expert services as the design of machinery for power development or for cutting metal, but it is doubtful whether in this country, at least, such designers and constructors have risen to the dignity of separate nomenclature.

Field and Office

Lowering a Submarine Pipe by Piledrivers

An interesting piece of submarine pipe laying recently completed was the laying of a 16-in. main across the west branch of the Chicago River in Chicago (near Hoyne Ave.) for the International Harvester Co. The purpose was to extend the high-pressure fire-protection system from the main plant on the north side of the river to the binder twine and other parts of the plant on the south side. The

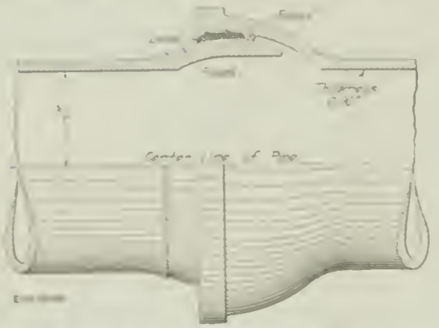


FIG. 1. FLEXIBLE JOINT FOR SUBMARINE PORTION OF HIGH-PRESSURE FIRE-PROTECTION MAIN AT CHICAGO

river is about 200 ft. wide, and the pipe is laid 25 ft. below the water surface.

About 20 ft. of dock was removed on the north side of the river and a dipper-dredge cut it then dug a trench across the river to a depth of 25 ft., carrying the excavation well back of the dock line on either side of the river to receive the inclined portions of the submarine main. Some hard digging was encountered in the lower part of the trench, though the upper part was of slushy material.

The main, 16-in. inside diameter and about 225 ft. long, was of heavy cast-iron pipe for a working pressure of 100 lb. per sq.in. It was made up in the usual 12-ft. lengths, but with the special flexible joints shown in Fig. 1. It was assembled in horizontal position on two deck scows, falsework being erected at the extreme ends of the scows to receive part of the inclined portion of the pipe.

The two scows, with pipe assembled, were floated to a convenient dock on the river, and four floating piledrivers were placed alongside. Four sets of bridles, made of 1-in. cable, were lashed to the pipe and fastened to the pulling blocks in the leads. (Although the piledrivers were fitted for much heavier lift, the pipe was handled on the pulling blocks as it was thus more easily manipulated.) The pipe was then lifted off the scows and hung on the leads. The scows were removed and the drivers swung around in position for lowering the pipe, as shown in Fig. 2. This operation required careful manipulation of the lines to get and hold the piledrivers in position.

The pipe was lowered in the water about 8 to 10 ft. and held there while messenger lines were put out from the leads of the end piledrivers, and additional lengths of pipe were set in place at each end (to lengthen the inclined portions). These joints were made with lead gaskets. Then the pipe was lowered about 8 ft. more and the ends again lengthened, until finally the main was in position in the bottom of the trench. The diver had trouble in releasing the bridles from the pipe on account of the amount of slush that had run into the trench.

When the pipe was in place, it was tested under hydraulic pressure at 150 lb. per sq.in. The dock wall at

FIG. 2. LAYING A SUBMARINE PIPE IN THE CHICAGO RIVER BY MEANS OF PILEDRIVERS

([illegible])

the north side was then reconstructed, and connection was made to the pipe systems on both sides of the river. The work was done last summer by the Great Lakes Dredge & Dock Co., of Chicago.

A New Sampling Outfit for Bacterial Samples

By Robert Spurr Weston*

Frequently bacteriological samples of water, sewage, milk, etc., must be collected during warm weather. At such times it is necessary to transport them to the laboratory under conditions which as far as possible will prevent growth. For this purpose, many engineers and analysts have packed samples in ice, or in ice and saw-

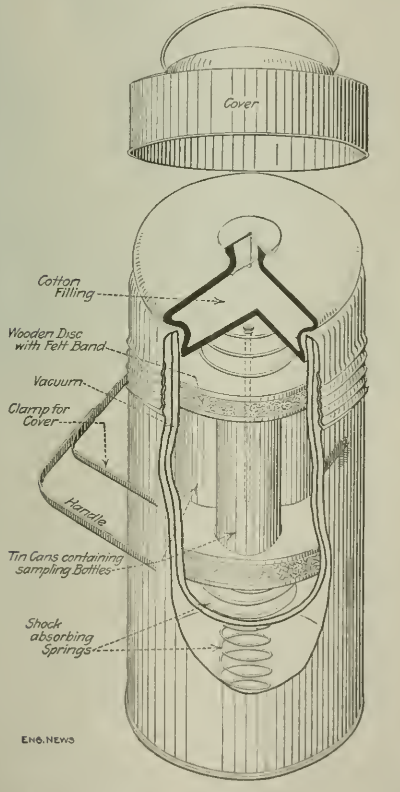


Fig. 1. Vacuum Jar for Use in Collecting Samples for Bacterial Examination

dust. Recently, there has come into use a device based on the fireless-cooker principle, which, though very satisfactory, is rather large, especially for a small number of samples, and, on account of its weight, costs a good deal to ship by express.

Recently the writer has made use of vacuum jars of various sizes with success. These can be arranged to hold from one to eight of the ordinary 2-oz., salt-mouthed, glass-stoppered bacterial sample bottles, inclosed in screw-capped tin cases. The following is a description of the outfit for three samples.

The isometric sketch, Fig. 1, shows the arrangement of the parts, and the view, Fig. 2, shows the parts separately. In a stock quart "Hotakold" jar is placed a holder for three tin cases. This holder consists of two disks of wood or metal with a band of felt at the edge so that the disks will make a loose fit with the sides of the jar. The disks are provided with circular depressions for receiving the bottoms and tops of the tin cases and a brass bolt with a thumb nut is used to secure them in place. By loosening the nut, the cases can be quickly removed from the holder. The holder moves freely within the jar, and is held in position by two springs at top and bottom respectively.

When shipped by express, the whole outfit can be placed

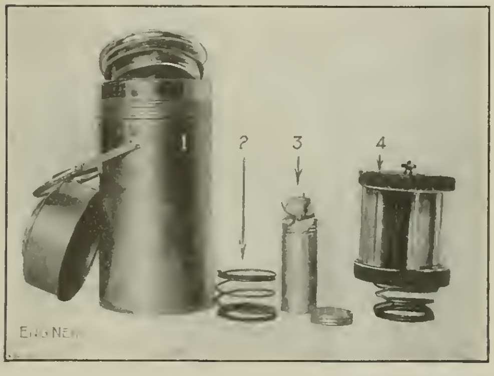


Fig. 2. Parts of Outfit for Collecting Bacterial Samples

(1) Vacuum jar, with metal cover removed and vacuum cover lifted. (2) One of the shock-absorbing springs. (3) Tin case and screw cover with the top of the sample bottle sticking out; the bottle is covered with the usual cloth cap. (4) Holder, with two cases containing bottles in place.

in a willow basket or a box. It is a very convenient apparatus to carry around, and may be covered with a cloth bag or leather case. A few lumps of ice placed in the bottom of the jar keep the samples at a low temperature for hours.

The apparatus above described weighs only 6 lb.

Building Gravel Roads in Logan County, Illinois

By John I. Miller*

We start the construction of a gravel road exactly as we would the improvement of a dirt road. Of course, the most essential thing is thorough drainage both by tiles, if necessary, and by shaping and crowning the subgrade exactly the same as if it was to be the wearing surface. With such a base for the gravel, water will not lie on the surface of the road at any place or in the side ditches.

First Gravel Coating—The next step is to haul the gravel and place it along the center of the road, about 1 cu.yd. to 10 or 12 lin.ft. of road, or 528 loads per mile. In Logan County, the gravel is generally donated by generous land owners, and this first layer does not cost more

*Consulting Sanitary Engineer, 14 Beacon St., Boston, Mass.

*Commissioner of Highways of East Lincoln Township, Logan County, Lawndale, Ill.

than $[illegible] per mile for hauling. The gravel is then left as is, spread and beaten down by traffic. It will slowly be shaped into a smooth, even surface—about two years' time is required.

SECOND GRAVEL COATING.—When the first layer has become compacted, we follow this course with another, using the same amount of material, also leaving it to be spread and compacted by traffic. At the end of another year, the road is hard and compact and usually of a width of about 14 ft. The cost of this kind of a road seldom exceeds $640 per mile, but this does not include all of the cost, because of material and labor donated, as above stated. Charging the value of the donations, the cost would probably be 25% more.

MAINTENANCE—The continual upkeep of this kind of a road is only nominal. The regular four-horse "King" drag is all the equipment which will be necessary. There may appear "spring" spots where water collects at the surface, or a hole may appear where the gravel has sunk into the subgrade. These are promptly repaired by dumping one or more loads of gravel on these spots, or as much gravel as experience shows to be necessary.

My experience has been that such a gravel road as the one described is a great favorite in the black muck fields of Logan County and is so reasonable in cost that we may improve at least 10% of our roads per annum.

Razing a 400-Ton Brick Chimney

The construction of tall chimneys has from time to time been discussed in engineering publications, but little has ever been written about the most efficient method of chimney destruction.

An interesting work of this character was performed in San Francisco on Oct. 24 last.

Immediately after the San Francisco earthquake of 1906 the cable street railways of the United Railroads were converted into electrically operated lines. This led to the abandonment of numerous steam plants which had been used to operate the cable roads. Among these was the power house situated on McAllister St. between Central and Masonic Ave. The brick chimney for this plant was originally 155 ft. in height with a square base 14x14 ft., 12 ft. in height, surmounted by a circular radial superstructure that tapered to a diameter of 10 ft. at the top. It was built 30 years ago. The quake of 1906 shook off the top a 25-ft. section. It was calculated that the 100-ft. section still standing weighed 400 tons.

Fig. 1. [illegible] Chimney, Showing Direction of Fall

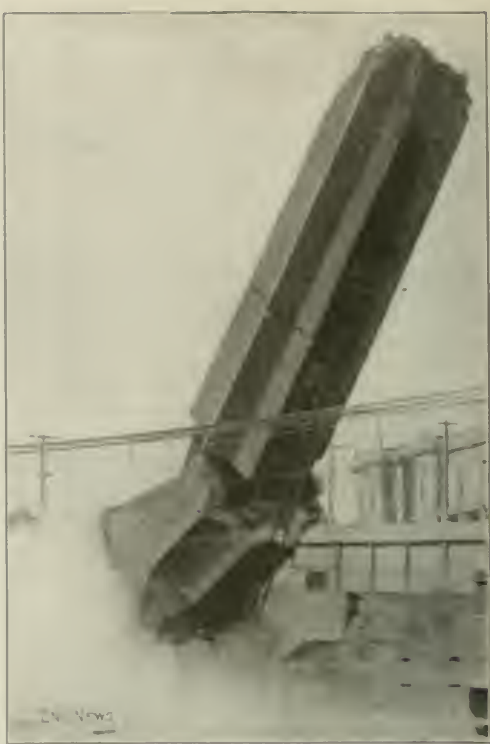


Fig. 2. Razing a 400-Ton Brick Chimney, San Francisco, Calif.

As the city expanded and the vicinity of the power house developed into a residential section, the unsightly ruined stack with its fractured top was regarded as a disfigurement to the neighborhood, and the street railway company was asked by the residents to remove the structure. Accordingly the chimney was razed in the following manner:

It was desired to throw the chimney along a line approximately N. 60° E., in order to parallel the tracks of the present electric road, which ran in that general direction at a distance of about 40 ft. from the base of the chimney. A section 2½ ft. in height extending through the chimney to the east of its center, in the direction shown on diagram, was removed with jacks from the base of the chimney. Some [illegible] by 2½-ft. pine blocks were loaded at the ends with two vertical sticks of dynamite, one 8½ in. long in the top and another 4½ in. long in the bottom. The fourteen caps that were to discharge the dynamite were connected by wire so that the charge could be set off by electricity. The loaded and [illegible] blocks were then placed vertically in the aperture [illegible] through the walls, and the blast was fired. Due to the opening for the doorway in the south wall, the chimney fell almost due east. In falling it separated into three sections, as shown in the accompanying photograph. On striking the ground these shattered, the frag-

ments all being thrown forward in the direction of the fall, for a distance of about 200 ft. from the base of the chimney. A few reached the tracks of the adjoining line above referred to, but were removed and traffic resumed in less than five minutes.

The razing of the stack was performed under the direction of B. P. Legare, Chief Engineer of the United Railroads.

Special Outrigger for Driving Piles under Trestles

A special outrigger designed for putting down piles in restricted quarters or where it is desired that the piles be inclined in any direction, was used in building the pier footings for the new steel bridge of the New York & Long Branch R.R. (C. R.R. of N. J.) across the Shrewsbury River, at Red Bank, N. J. The device consists of a movable steel frame pivoted on an ordinary piledriving machine, at about two-thirds the height of the leads (Fig. 1). The frame can be inclined in any direction by means of the pivot shown in detail (Fig. 2).

The driving is done by an ordinary ram whose rigging is simple: The line is run to a pulley at the top of the frame and down under another pulley near the pivot, thence leading back to the hoisting engine. Of course, a steam hammer could just as easily be hung in the channel ways. A battered group of piles, 16 ft. in diameter at low water, can be driven without moving the float.

The new Red Bank bridge was built partly under an old two-track wood trestle (the first half taken down was 20 yr. old; the second half, 40 yr.), one track of which was continued in operation. The contractor was not allowed to use this structure either in handling material or as a base for his plant equipment. This difficult condition led to the development of the rig described.

The outrigger was designed by John Anderson, contractor, 90 West St., New York City. When the rig was used on the Red Bank bridge, Mr. Anderson was general superintendent for G. B. Spearin, New York City.

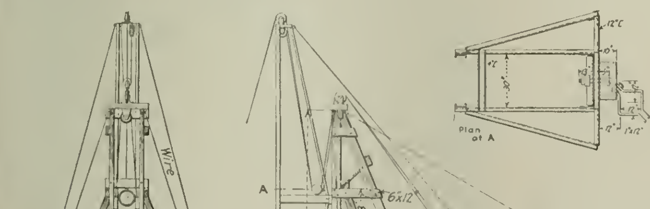


FIG. 2. GENERAL DESIGN OF FLOATING PILEDRIVER WITH SPECIAL OUTRIGGER

(Detail in upper right shows method of pivoting frame to stationary structure.)

A Large, Long Reinforced-Concrete Flume of Catenary Section

The following interesting description of a remarkable irrigation flume, with cogent reasons why a flume instead of a siphon was used, and why a catenary section was adopted, is taken from an address by H. B. Muckleston, Assistant Chief Engineer, Department of Natural Resources, Canadian Pacific Ry., delivered before the recent International Irrigation Congress at Calgary, Alberta. The flume is a part of the eastern section of the Canadian Pacific Ry.'s immense irrigation system southeast of Calgary.* We quote from Mr. Muckleton's paper as follows:

FIG. 1. SPECIAL RIG DRIVING PILES UNDER A TRESTLE, AT RED BANK, N. J.

The outlet at the north end [of the large storage reservoir] supplies the Bantry canal system, which irrigates 120,000 acres. About four miles from the reservoir this canal comes to a cross valley, and here was met the toughest engineering problem encountered in the design of the whole system. It was required to convey 900 cu ft. of water per sec., or 330,000 gal. per min., across a valley two miles wide and 60 ft. deep, crossing the main line of railroad on the way, and do it with as little expense as possible, coupled with the least loss of elevation. The solution of the problem has resulted in a structure which has no parallel on this continent, or anywhere else.

In cases of this kind there is always the choice between a flume and a siphon, and the designer can properly decide after a careful analysis of all the conditions and circumstances. When there is plenty of head available, especially if the depth of the valley is comparatively great, a siphon is usually the cheaper in the long run, though not necessarily so in the first cost. But when the available head is restricted a siphon frequently involves either a single pipe so large that it is impracticable or else a number of smaller pipes are required, which not only runs

*See "Engineering News," Apr. 27, 1905, for general description of the whole system; Aug. 8, 1912, for notes on the progress of the system; and Aug. 27 and Sept. 3, 1914, for a description of the 7000-ft. dam across and alongside the Bow River to divert water for the eastern section.

of the [illegible] very [illegible], but also involves a prohibitive loss of head, and consequently a flume is usually preferable, provided the valley is not too deep.

Owing to the size and importance of this crossing it was desired to take no chances with fire, and for reasons of durability a reinforced-concrete structure was preferred over steel if it could be had at a reasonable cost, so designs were worked out using this material.

Most flumes are rectangular if built of wood, and semicircular if built of iron or steel, in the latter case being suspended from girders instead of supported by them. In designing this flume, the suspended steel flume was taken as a model, but instead of using a semicircular section, which is convenient but incorrect, the proper section was chosen, that is the same section as the flume would assume if it were made of a flexible material like canvas instead of a rigid material like steel or concrete. Distortion of a semicircular steel flume under load does no particular harm, because the material can stand it, but with a concrete shell excessive distortion would certainly result in cracks, so the shell was given the correct shape in the first place.

The water channel is 21 ft. wide on top and 8.7 ft. deep at the center. The concrete shell is only 5 in. thick. The lower part or substructure which supports the actual water channel is also of concrete and consists of a series of braced towers 24 ft. apart, carrying reinforced-concrete girders, from which in turn the concrete shell is suspended.

The problem was complicated by the existence of the main line of the Canadian Pacific Ry., which crosses the aqueduct [illegible] near the eastern end. The track is too high to admit of taking the flume over this railway, so it had to go beneath, and is accordingly taken under the railway by a concrete pipe 8 ft. in diameter.

The total fall in the two miles of flume is a little more than 4 ft., which gives a velocity of nearly 8 ft. per sec., or about 6 mi. per hr.

A Condition Gage for Centrifugal Pumps

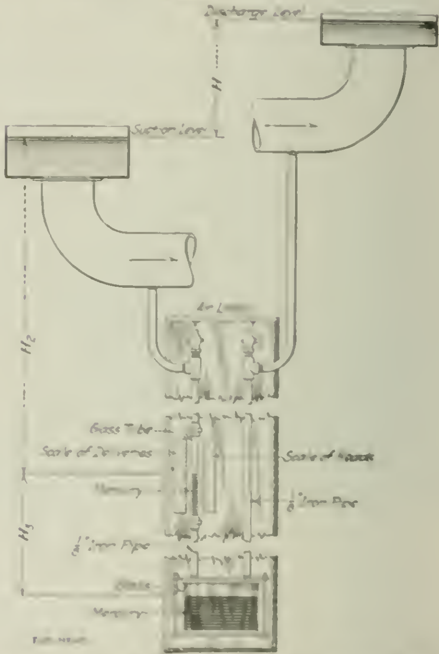
By George M. Peek*

Some means was found desirable of quickly testing the condition of centrifugal pumps in the Chain of Rocks station of the St. Louis water-works. Since the water carries considerable abrasive material, there is apt to be excessive wear, particularly in the labyrinth rings, with reduced delivery and efficiency. The condition of reciprocating units can easily be determined, knowing only speed or strokes (giving total plunger displacement) and metered discharge. (Each pump here discharges through Venturi meters.) But with centrifugals at constant speed, the delivery varies considerably with the head.

At this station, the net head varies between 16 and [illegible] ft., with the river stage and with the amount of water pumped (due to varying friction loss in intakes). The [illegible] centrifugal pumps here have each a capacity of 10,000,000 gal. per 24 hr. against 56 ft. The pumps were tested when in first-class condition and delivery-head curves were plotted. A gage has been set up to show net head and expected delivery, so that a comparison with the Venturi reading gives at once the departure from best condition.

The accompanying drawing shows the arrangement of the gage. The mercury well was made by clamping two steel disks on a [illegible] lubricator glass. The glass tube has a bore of about [illegible] in. Since the area of a [illegible] tube is a very small quantity when compared with that of a [illegible] lubricator glass, the error due to change of mercury level in the well for the total range is negligible; therefore the scale of heads was permanently mounted on the board. The scale of deliveries (determined from the test curve) was installed opposite. The graduations on the scale of heads were based on 1.13 in. of scale per foot of water head (ratio of inches of mercury to feet of water), corrected to 1.047 for the excess depth of water in the discharge-pressure leg (H_3 in the drawing).

In case there were a suction lift on the pump, instead of a suction head as we happen to have in St. Louis, it would be necessary to connect the air cock on the suction side to the air pump or some other means of exhausting any air which may accumulate in the tube above the mercury column.



A Net-Head Gage for Indicating Condition of a Centrifugal Pump

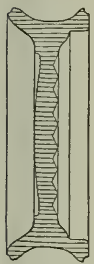
Trouble was experienced with the Venturi meters in this station by the dirty water leaving deposits in the [illegible] mercury chambers. This trouble was eliminated by making a connection with the clear-water pressure mains to the pipes connecting the upper parts of the mercury chambers with the throat and large part of the Venturi tube. In order to prevent deposits of dirt in the mercury chambers, valves are opened when the pumps are started and at such other times as may be necessary, thereby washing all dirt from the connecting pipes.

Philadelphia Municipal Water-Works Employees—The [illegible]

*[illegible] Water Works Commissioner [illegible]

Partitions of Translucent Pressed-Glass Units

Glass units for building partitions of translucent, yet unclouded glass—units held in place by practically invisible joints of reinforced cement-mortar—were recently introduced into the United States. Keppler pressed-glass partitions have been known in Europe for several years. Fig. 1 shows a completed partition built of the sort of units shown in detail herewith.



The glass is very strong, being double-annealed. It is made in 6x6-in. and 8x8-in. sizes and weighs, erected, 10 to 15 lb. per sq.ft. The glass is either clear or amber, although it can be supplied in any color.

In a fire test by the Royal Testing Station, Berlin, a window of this glass was subjected to a temperature of over 1800° F., reached in 30 min., and maintained thus for a half-hour, when water at ordinary hydrant temperature and pressure was played upon the heated glass. Fig. 2 shows the window before and after the test.

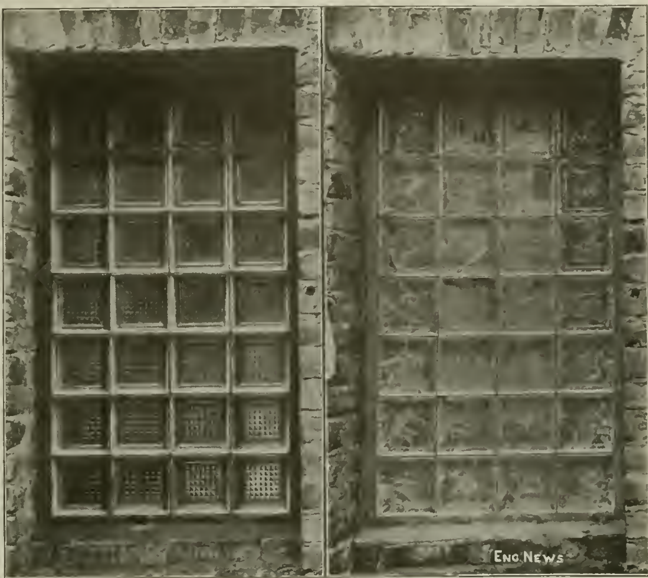


FIG. 2. A KEPPLER-GLASS WINDOW BEFORE AND AFTER FIRE TEST TO 1800° F.

The glass is formed in such a way that while admitting the maximum light, objects a few feet distant from the other side are indistinguishable. This type of construction is also practically soundproof.

The units are furnished with the concave ends painted white and a layer of asphalt over the paint. Light striking the cement frame is reflected into the room by the white surface. The asphalt permits expansion of the units.

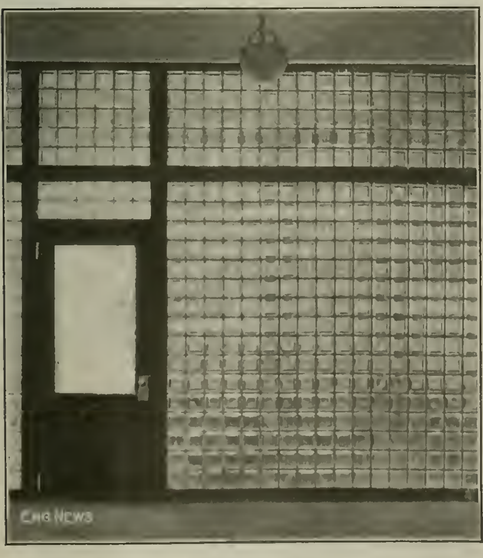


FIG. 1. A PARTITION BUILT OF KEPPLER-GLASS UNITS

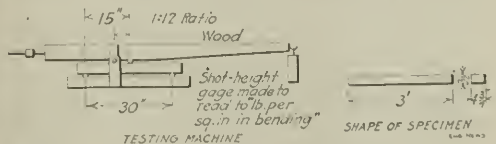
The units are laid up in the same general manner as is terra-cotta tile, and any bricklayer is capable of performing the work. Reinforcing rods are placed both in the horizontal and the vertical joints. The total cost of completed partition varies from $1.20 to $1.50 per sq.ft.

The glass for these partitions, and for other constructions as well, is furnished by Keppler Glass Constructions, Inc., 101 Park Ave., New York City.

A Concrete Field Testing Machine

A very simple testing machine is now in use on the new Welland Ship Canal in the investigation of the strength of field concrete. It is not claimed that the machine is very precise, but it does give a simple method of judging comparative strength of the various concretes being used over the length of the work.

Concrete samples are taken at the mixer and rammed into portable molds giving pieces 36x1¾x3½ in., unreinforced. These pieces are brought into the main office and stored for varying periods and are then broken in the simple leverage machine illustrated in the accompany-



CONCRETE FIELD TESTING MACHINE

(Testing machine for field samples of concrete, Welland Ship Canal.)

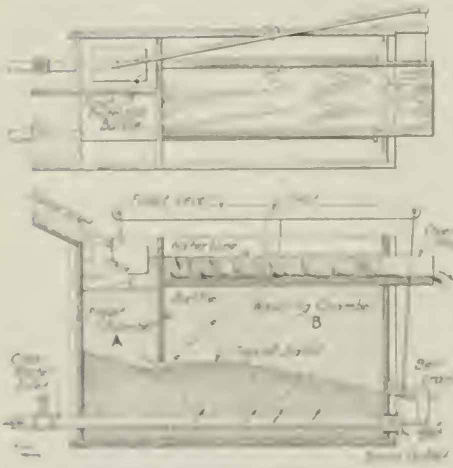
[illegible] The weight at the end of the lever is produced by pouring uniform-size shot into a bucket and the breaking stress in bending (lb. per sq. in.) is read directly on a gage which measures the depth of shot in the bucket and which is scaled to read directly in pounds per square inch. The frame is all of wood, except the steel pins and fulcrum. The leverage is 1 to 12. Comparative records are kept of the breaking stress of different pieces, the [illegible] age of specimen, mix, history of ingredients and location of work from which specimen is taken.

NOTES

An Improved Automatic Sand-Washing Box—The accompanying sketch shows the essential parts of a sand-washing-box discharge [illegible] arrangement designed to overcome some of the [illegible] of discharging described in the excellent article by W. H. Wilson on the operation of sand and gravel plants in the Nov. 19 issue of "Engineering News." This design, in addition to being automatic, avoids the [illegible] of muddy water with the sand, at the cost, however, of [illegible] clear water [illegible] with sand at the bottom of the box, as well as with the sand in the usual way.

The washing box itself consists of a rectangular box with an overflow trough extending about three-fourths its length, [illegible] with the top a few inches below the top of the box. Water overflows the entire length on both sides of the trough and [illegible] at the end of the trough. At the inner end of the trough a baffle is made from side to side of the box, extending from the top about halfway to the bottom.

The [illegible] sand and muddy water enter the [illegible] space between this baffle and the end of the box, in which is [illegible] a [illegible] shown in the illustration, protected somewhat by the baffle, to prevent the [illegible] agitation of the surface water. At the bottom of the trough are two or three water pipes [illegible] on the lower side by [illegible] or [illegible] holes to admit



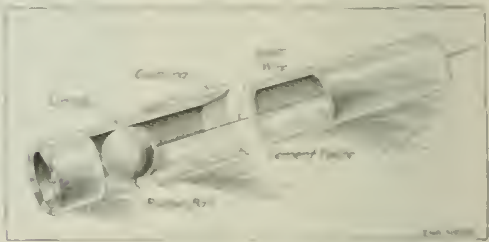
An Improved Automatic Sand-Washing Box

[illegible]

of sand and water in a fluid state. This mixture, being much heavier than the muddy water alone, maintains more or less of a level surface, preventing the muddy water from reaching the outlet until the sand is nearly all out, or the valve is closed, which is adjusted to close after lowering the sand in the box 2 or 3 in.

In operating this box we found it to be well adapted to removing fine grades of sand from the washed product. Of course it took every grade from the coarsest to dust, and when operated slowly made a very clean sweep of it, much better, I think, than mechanical screening would ordinarily do without excessive cost; but as this was of no particular value to us, it was not investigated further. The sand used in this washing box averaged much finer than the analysis of torpedo sand given in the article mentioned before, but had about the same maximum sizes.—T. L. Morton, Cincinnati, Ohio.

A Cement-Lined Joint for a Cement-Lined Pipe was described by J. D. MacBride, manager of the MacBee Cement-Lined Pipe Co., of Boston, Mass., at the November meeting of the New England Water Works Association. The one fault found with cement-lined pipe, in the meeting's discussion on service pipes, was the difficulty in getting a protected joint, for, although the coupling may be cement lined, there is no assurance that there is not an opening at the end of the thread where water will come in contact with the iron and cause corrosion. On a recent piece of work Mr. MacBride was asked to guarantee a fully protected joint and the accompanying sketch shows how he made the joint.



Method of Making a Continuous Cement-Lined Joint in Cement-Lined Pipe

A [illegible] as the pipe was inserted in the length of pipe to be added to. To the ball was attached a stiff wire, which was passed through the length of pipe to be added. The inside of the coupling, threads and all, was then coated with cement paste and the pipe length screwed on, after which the ball was drawn ahead to the next coupling. This insured a continuous cement-lined surface on the interior of the joint and obviated the difficulties met with in the ordinary joint.

Motor Trains for Railway Construction Gangs [illegible] on the Chicago Great Western Ry. as a means of carrying the men rapidly between their work and the camp. [illegible]

A Eulogy on a Hard Working Government Engineering Bureau is given in the following words by Secretary of Commerce Redfield in his recent annual report:

[illegible]

Editorials

Long-Term Highway Bonds

The reckless financial policy of building perishable roads and pavements with borrowed money obtained by issuing long-term bonds, not to be paid off until after the destruction of the work for which the money was borrowed, has often been condemned by engineers. Many counties, cities and states, nevertheless, are still continuing the practice of creating a debt which a future generation will have to pay although little will be left at that time of the improvement which the debt paid for. Engineers, of course, recognize on the other hand that a certain portion of the expense in constructing a road is laid out on work of a permanent character, to pay for which the issue of long-term bonds may be justifiable.

The Department of Agriculture has just issued a bulletin entitled, "Highway Bonds," in which an estimate is made of the percentage of cost in construction of different types of improved roads which is expended on its foundation, such as drainage, grading, etc., and the percentage which is expended on the surfacing which must eventually be renewed. These figures are said to be based on a study of 244 different types of roads. A summary of the figures in this bulletin shows that on a typical gravel road 20 ft. in width, costing $4400 a mile, the expenditure on the foundation features, such as drainage and grading, will be 41% and on the surfacing 59%. On a water-bound macadam road 15 ft. wide, the foundation features cost 37% and the surfacing 63%. On a bituminous macadam road 15 ft. wide, the foundation features cost 27% and the surfacing 73%.

Of course, the above figures represent merely broad averages and the bulletin points out that part of the cost of the surfacing, the foundation course for example of a telford road, may also be regarded as a permanent investment. Bearing this in mind, it is estimated that on a water-bound macadam road, 62% of the cost might be regarded as a permanent investment, and on a bituminous macadam road about 56%.

It is to be hoped that a wide circulation of this bulletin may have some influence toward checking the indiscriminate issue of long-term bonds for road building purposes. In a number of states in the West especially there has been a carnival of extravagance in the issue of county bonds for highway work, and much of the money thus raised has been expended in a manner which will leave little benefit in the way of improved roads to be found after a very few years.

Eliminating Politics from New York Highway Work

"A study of the legislation relating to the New York State Highway Department clearly shows that this department has been looked upon in the past as a great political machine." This statement is made by John M. Carlisle, State Commissioner of Highways of New York, in a recent letter to the New York *Times*, in which he points out that during the past ten years there have been seven different heads of the New York Highway Department, and says "it is remarkable that as good results as have been secured have been attained under such a system."

In order to do away with this constant tinkering with the Highway Department by legislatures of changing political complexion, Mr. Carlisle urges that the coming Constitutional Convention in New York should make the headship of the Highway Department a constitutional office, with a term of at least five years in case of a single commissioner, or of six years in case a commission of three members is established, with one member going out of office every two years.

Mr. Carlisle's recommendations ought to carry great weight. Engineers, at least, realize that the first essential to economical and efficient work in highway construction and maintenance is the creation of a permanent working organization, to be conducted without regard to politics. It is well nigh impossible to create such an organization if its responsible head is subject to change for political reasons at every election.

A Suggestion for Water-Works Valuation

An interesting discussion of this question was recently given by J. W. Ledoux, Chief Engineer of the American Pipe & Construction Co., in a paper entitled "Some Observations on Water-Works Valuation" read at the Atlantic City meeting of the Pennsylvania Water Works Association.

Mr. Ledoux is an engineer of long experience in water-works construction and operation. He estimates that the average appraisal for the total value of a going water-works plant should be in the neighborhood of 183% of its physical cost. Mr. Ledoux distributes this allowance as follows, and states that the percentages are the result of his judgment based on a considerable amount of practical experience:

Physical cost, 100.
Promotion, 2½.
Organization expenses, 2½.
Engineering, 3.
Financing, 18.
Legal expenses, 2.
Rental or cost of construction plant and housing of employees, 2.
Contingencies, 10.
Interest during construction, 5.
General contractor's profit, 15.
Development cost, 20.
Allowance for useless items, 3.
Total, 183% of the physical cost

It will be noted that the two largest items in the above table are financing and development expenses. Regarding the first, Mr. Ledoux says that in selling bonds to obtain money for construction, the usual method in financing private water-works, 90 is about as good a price as the water companies can expect to obtain from the bond houses. As the final cost of the plant must include all

[illegible] as well as the physical cost, it may be assumed that the total amount to be provided will be 165% of the physical cost and dividing 165 by 90 the total expense of financing will be 18% of the physical cost of the plant.

Regarding the 20% allowance for development cost, Mr. [illegible] says this will be more often exceeded than not. A public utility must, like any other business enterprise, gradually acquire its customers, and must expend a certain amount of energy and expense in order to secure them, oftentimes finding it necessary to operate at a loss or at reduced profit for a time in order to do this.

The allowance of 5% for engineering expense will be generally agreed to be extraordinarily low. Even for plants of considerable size, 6 or 7% would be not an extravagant allowance.

It is worth noting that most of the items included in Mr. [illegible]'s statement above apply to a municipally constructed plant as well as to one built by a franchise company. The only items that would not be at least as large in a city-built plant would be those for promotion, organization expenses, and financing. The promotion of a city-owned plant may be done as a matter of public spirit; but there will generally be some outlay for financing, as many cities have to allow some commission to brokers in order to dispose of their bonds.

Wanted: Engineering Promoters

There is one profession, if we may call it a profession—although most people would doubtless call it a business—and many of them a bad business—the ranks of which are seldom overcrowded. We refer to the profession, art or calling of promotion.

It is named promotion for want of a better name, and, unfortunately, the name carries with it very nearly an indictment of doubtful moral character. Yet it is strictly true that in practically every business enterprise of magnitude, and particularly in enterprises connected with engineering, [illegible] on the [illegible] which is generally termed promotion, and on the way in which this work is done the success or failure of the enterprise will very often turn.

It is often said that an engineer is of no use as a promoter, [illegible]. This, however, is a cynical view and does not bear careful examination. Experience shows that the dishonest promoter, like the dishonest banker, while he may sometimes [illegible] of [illegible] prosperity, very soon finds his occupation gone. Conditions in business and engineering have changed so vastly in the past [illegible] years that the old-time promoter, made famous by Mark Twain in his biography of Colonel Sellers, has become nearly extinct. The more [illegible] and less [illegible] type of promoter than Colonel Sellers—well illustrated by the [illegible] of [illegible] opportunities in [illegible] [illegible]—has been pretty thoroughly put out of business by the [illegible] of the Federal courts. [illegible] the disappearance of the class of men who made the name of promoter [illegible], it is worth while to call attention to the fact that the business of promotion in the engineer [illegible] a field which offers [illegible] opportunities.

[illegible] of these opportunities, for example, is advertised in the "Situations Open" columns of our current issue.

A very large engineering enterprise of undoubted public benefit is to be carried forward. It is a public enterprise and not that of a private corporation; consequently, the public which is to eventually foot the bills must be shown that the project is a sound, safe and beneficial one. The men who are in charge of this large work are far-sighted enough to see that this task of public education is not a thing which can be done by spasmodic efforts, nor is it one that the ordinary engineer of high technical qualifications is at all fitted to perform. The man to fill this place, for one thing, must be a good speechmaker, able to talk before an audience at a public meeting, to meet and disarm criticism, and to convince those in attendance that he has sound sense on his side.

He must know how to practice the art of publicity, how to reach and interest the newspapers, not spasmodically but continuously. He should be a man whose personality is such as to command the confidence of the men whom he meets in all walks of life. Finally, he must be a man knowing at least enough about the technical engineering features of the project to be able to explain it clearly and convincingly to anyone and everyone, and to meet technical criticism from any source.

It will be evident that this specification is not easily filled. We allude to it here, not because of this one opening, but because it is typical of the class of openings that are available in many places for men with such qualifications as are described. It illustrates a class of opportunities open to young men in the engineering schools, provided they have the proper amount of natural talent on which to build, and this amount need not be as great as is sometimes thought. The reason why most lawyers are far better public speakers than engineers is undoubtedly because the lawyer, engaged in court practice at least, is continually cultivating the art of addressing an audience, while most engineers seldom have occasion to cultivate whatever talent they may possess in this field.

We are told that notwithstanding the fact that old graduates are repeatedly urging upon the boys in the technical schools that they should cultivate the art of writing good English and of excellence in debate, few of the engineering students take any interest in these branches of the curriculum. If they realized how largely ability in this direction would aid in their progress toward success in active life, in comparison with their expertness in the technical work of their profession, there would doubtless be more earnest work in the English classes in our engineering schools.

Some Further Lessons from the Edison Conflagration

In connection with the conflagration in the manufacturing plant of Thomas A. Edison at West Orange, N. J., so fully illustrated in our last week's issue, some further comment is justifiable, in view of the unusual character of the fire and the wide interest in its results.

A superficial observer who visits the scene of the conflagration, or who scans the photographs of the gutted buildings in our last week's issue, may perhaps get the idea that a reinforced-concrete structure is deficient in resistance to fire. Such an observer, however, who visited the scenes of the conflagrations in Baltimore or in San Francisco, or examined the pictures of the fireproof buildings in the burned area that were fully shown in Engi-

NEERING NEWS at the time, would likewise become firmly convinced that the steel-frame structure protected by fireproofing was deficient in its resistance to fire.

Our readers who do not recall definitely the occurrences in those fires can easily refresh their memories by turning back to our issues published at that time, and will find it interesting to compare the behavior of a number of the steel-frame structures there exposed with the condition of the buildings in the Edison plant.

It should be distinctly borne in mind that the destruction of the Edison plant is to be classed as a conflagration and not as an ordinary fire. The number of buildings involved, the juxtaposition to each other, the almost total absence of effective fire fighting make the conditions in the Edison plant strictly comparable to what occurs in a city conflagration. Further than this, it is altogether probable that the inflammable material contained in the Edison buildings burned more quickly and possibly produced a greater degree of heat at some points (though this latter is uncertain), than occurred in the Baltimore or San Francisco conflagration, where nearly all the steel-frame fireproof structures affected were office buildings containing only the usual amount of office furniture.

Some comment seems worth while also regarding the relative damage done to surface finish in the reinforced-concrete structures and the steel-frame structures protected by fireproofing. The office buildings in the Baltimore fire which passed through the conflagration with little structural injury, required renewal of practically all of their plaster finish on walls and ceilings, which was, of course, to be expected. A noticeable feature in the reinforced-concrete buildings at the Edison plant is the very small amount of injury done to the ceilings. In the manufacturing plant there was, of course, nothing in the way of surface decorations to be destroyed, but the behavior of this monolithic concrete surface under the severe exposure to fire is a notable testimonial to the excellence of good concrete construction.

From the description and illustrations in our last week's issue, it is evident enough that another of the lessons of the fire, to the engineer engaged in the planning of industrial plants, is the desirability of generous space between buildings, and further the provision of some resistance to the spread of flames in the shape of wire-glass windows, and fire-resisting division walls to divide up the large floor areas. It is quite true that most large manufacturing plants, especially those which have grown by successive increments, are much more crowded than considerations of safety would dictate, or even requirements of good lighting.

The plea is often made that the economy in inter-works transportation resulting from placing buildings close together offsets the increased fire risk; but with a plant equipped with modern methods of transportation, when material is once loaded upon a car or motor truck, it makes comparatively little difference if the length of haul from building to building is 100 to 200 or even 300 ft. greater.

Referring again to the general behavior of the reinforced-concrete structures at West Orange, it is to be remembered that these buildings were most of them four or five years old, and it is needless to say a great deal of progress has been made in the art of reinforced-concrete design during that period. It is altogether probable that expert analysis will show that in some respects the design of the buildings was not all that would be found in the work of first-class engineers at the present day, aside from the particular question of the column design, which was discussed in our last week's issue. That under these conditions the buildings made such an excellent showing is to be accepted as a testimonial to the fire-resisting quality of reinforced concrete.

Letters to the Editor

Mechanical Resuscitation Devices

Sir—In your issue of Dec. 3, p. 1109, you have a note entitled "An Efficient Method of Resuscitation." This note refers to the method developed by the U. S. Bureau of Mines. I have not had the pleasure of reading the report from which your article is abstracted, but I believe that some harm might be done to at least one perfectly safe and very useful resuscitating device if engineers should implicitly believe that part of the note which says "no mechanical artificial resuscitating device should be used unless one operated by hand that has no suction effect on the lungs."

This letter is prompted by experience with a device for resuscitating persons overcome by illuminating gas, which is entirely automatic and is only operated by hand in case the operator so desires. There is also no suction of sufficient force to cause the least danger to the lungs.

R. C. KELLOGG,
Civil Engineer, Brooklyn Union Gas Co.
Brooklyn, N. Y., Dec. 7, 1914.

More 1000-Ft. Dry Docks

Sir—I beg to call your attention to the omission of the Balboa Dry Dock, Pacific Terminals, from your list of dry docks over 1000 ft. in length, given in ENGINEERING NEWS, Nov. 26, 1914, p. 1064.

The Balboa dock is under construction and will be finished during the year 1915. The principal dimensions are:

	Ft.
Length over all	1110.0
Maximum length of ship dockable	1000.0
Width of entrance, clear	110.0
Width of body of dock at coping	140.0
Width of body of dock at floor	117.0
Depth, coping to floor	56.0
Height of keel blocks	4.6
Depth of water over tops of blocks	
Mean sea level	35.0
Mean high water	41.5
Mean low water	29.3

RAY W. BERDEAU,
Resident Engineer's Office.
Paraiso, C. Z., Dec. 3, 1914.

[Since the article in question was written it has also been announced that the Pearl Harbor dock at Hawaii, for the United States Government, will be rebuilt for a

length of [illegible]. It will be remembered that the found[illegible] of [illegible] (then [illegible] in length) failed during construction some years ago.

The [illegible] dry docks and the proposed docks of about equal length at Halifax, N. S., and North Vancouver, B. C. (noted in the Construction News sections of ENGINEERING NEWS, Dec. 3 and Sept. 24, 1914) show clearly that the "[illegible] dry dock" is no longer a novelty. —EDITOR.]

The Chicago Flat-Slab Ordinance

Sir—Being particularly interested in concrete flat-slab design, the writer read with interest the Chicago Building Code on this type of construction, as given in your issue of Sept. 24, 1914, p. 602, and its subsequent criticism by Mr. Godfrey, Nov. 12, 1914, p. 993.

There is one point of inconsistency that the writer would like to call to your attention, that is, the case of rectangular panels. Where the difference between the length and breadth is less than 5%, the panel is designed as a square panel of average length; but for over 5%, a different procedure is resorted to.

The article in the code pertaining to the latter case permits of two different interpretations, the ambiguity possibly arising from an attempt on the part of the writers of the code to combine the regulations for two-way and four-way reinforcement in the same article. An illustration of the procedure for each interpretation and its results are given below. First:

Let [illegible] length 10% greater than the breadth; then for L = length and B = breadth, $L = 1.10\,B$ and the average panel is $1.05\,B$. The moment at the center of strip B (diagonal band) is

$$M = \frac{w\,L^2}{40} = \frac{w\,1.05\,B}{40}$$

The steel in the strip along length L is then taken as $\left(\frac{1.10}{1.05}\right)^2$ times that obtained by the above formula, which is equivalent to designing for a moment,

$$M = \frac{1.1^2 w\,1.05\,B}{40} = \frac{w\,1.[illegible]\,B}{40}$$

On the other hand, if we were to take the formula for differences of 5% or less we would obtain the moment at center of strip A (diagonal band):

$$M = \frac{w\,1.05\,B}{40}$$

This difference is altogether too great in panels of a [illegible] [illegible]. [illegible] and [illegible] by the same design.

The second and more likely interpretation assumes that the strip A is to be designed for bending moment $\frac{w\,L^2}{40}$ (where L is to be the average panel length), the steel required [illegible] and multiplied by one-half the average panel length to obtain the amount of steel required for the panel. The amount of steel required [illegible] of the rectangular panel is then found in [illegible] to the amount required by dividing the [illegible] of the actual panel length by the [illegible] of the average panel length.

This method will resolve itself into the following: Moment for center of strip A for average panel is,

$$M = w\frac{\overline{av.\,L}^2}{40}$$

where $av.\,L$ = average panel length. The steel required would be given by formula,

$$M = w\frac{\overline{av.\,L}^2}{40} \times \frac{av.\,L}{2}$$

For longer span L, steel required would be obtained from formula:

$$M = \frac{w\,\overline{av.\,L}^2}{40} \times \frac{av.\,L}{2} \times \frac{L_1^2}{\overline{av.\,L}^2} = \frac{w\,L_1^3}{2 \times 40}$$

which is the same as the moment for square panel of length L_1 and therefore independent of the other dimension. Similarly, for shorter span B steel would be given by formula

$$M = \frac{w\,\overline{av.\,L}^2}{40} \times \frac{av.\,L}{2} \times \frac{B^2}{\overline{av.\,L}^2} = \frac{w\,B^3}{2 \times 40}$$

which is the same as the moment for square panel of length B.

If this is the intent of the code, it certainly could be much more clearly and simply stated, but it would give results almost as inconsistent as the other interpretation, particularly apparent in the case of the negative moments over the [illegible], where the moments would be $\frac{w\,L_1^3}{2 \times 15}$ and $\frac{w\,B_1^3}{2 \times 15}$ respectively, on adjacent edges of the caps, and for the limiting value of $L_1 = 4/3\,B$ would require 2.4 times as much steel on one edge as that required on the adjacent edge.

As for Mr. Godfrey's criticism, it seems that although [illegible] of the omission of a provision for taking consideration of the bending in the columns is just, his attitude toward the slab design is not justifiable. Nobody can at the present time state what the exact theoretical [illegible] this type of construction are, but the [illegible] [illegible] at times stated in the code could be [illegible] [illegible] two-way reinforcement with no much apparent [illegible]. A consideration of the bending moments must include a consideration of the lines of inflection and these are entirely different in the various types of slabs and would account for the difference in the moments.

M. [illegible].

[illegible] W. [illegible] St., New York City, Nov. 21, 1914.

Sir—The criticism "Flat Slab [illegible]," by Edward Godfrey, in your issue of Nov. 12, regarding the new provisions of the Chicago building ordinance for the design of flat-slab construction, should hardly be allowed to pass without discussion.

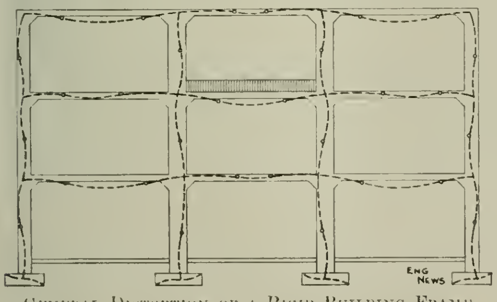
I have devoted twelve years to theoretical study and practical experience in the design and erection of all types of reinforced-concrete construction in Germany, France and the United States. Fortunately, I am not connected with any concern commercially interested in reinforced-concrete construction and, therefore, my conclusions may be considered as unprejudiced and based entirely on experience and science.

Mr. Godfrey's ideas may be divided into two groups: the first in criticism of the attitude of the Chicago build-

ing ordinance toward concrete construction in general; the second in criticism of the late additions to the ordinance respecting flat-slab construction. In order to maintain a scientific point of view, it is necessary to separate these two ideas strictly. I agree with Mr. Godfrey in the first instance; it seems surprising that the ordinance of a large progressive city like Chicago should not make more concessions to a scientific treatment of continuous-slab, beam, and girder construction, inasmuch as the best ordinances of most of the progressive countries do so. But with the second group of Mr. Godfrey's ideas, I must disagree. In my judgment the new additions to the Chicago building ordinance relating to flat slabs reasonably accord with scientific principles and the practical conditions governing the actual interior stresses.

Mr. Godfrey's first objection is to the paragraph regarding negative moments. If the designer reinforces the edge of the column cap where the effective depth is a minimum, he surely will be safe, because the increased effective depth of the column cap will always offset the increase in negative moment, and the experienced designer always will run the reinforcement across the column head in order to secure the necessary bond and to splice the rods at the points of inflection where the bending moment is a minimum.

The effect of negative moments on the columns is quite frequently overestimated by engineers. It requires, of course, a study of statically indeterminate stresses in



General Distortion of a Rigid Building Frame under Localized Load

order to value this influence reasonably. The sketch herewith shows that, under usual conditions where flat-slab construction is used, the negative moment is not taken care of by one or two columns, but by the entire structure. The four supporting columns are not only rigidly connected with the columns above and underneath, but are also connected by means of the adjoining slabs with the next two or three surrounding vertical rows of columns, thus forming a framed structure out of the entire building. The apparently large influence of the negative moments on the columns will become very small, being divided among so many different members of the structure. It is easily proved by analysis that the combined stresses due to bending and direct load will never, under normal conditions, exceed the stresses due to the maximum direct load.

As to Mr. Godfrey's criticism regarding the positive moments in the slab, the following may be stated. The assumption of support on two sides only is opposed to the fundamental principle of the square-panel slab, which is to support the slab on four sides. It is evident that the fractions given in the ordinance, to be used in determining the moments, are only a means to simplify the method of designing and checking. To satisfy himself every conscientious engineer will check up the suggested fraction. A thorough investigation will prove that a scientific determination of the moments, following the theory of elastic deformation of the material, in continuous and framed structures gives practically the same results as a design according to the regulations of the Chicago Building Ordinance. Everyone will agree that the final result is the important part of the design and not the method of arriving at this result.

Mr. Godfrey's supposition as to the method of deriving the empirical formulas for computing the interior stresses in flat slabs in this code are at least questionable and require no discussion.

Curt Von Mueller,
Civil Engineer.

Chicago, Ill., Nov. 24, 1914.

Sir—In the article on the new regulations formulated by the Commissioner of Buildings of Chicago, for governing reinforced-concrete flat-slab floor design, it was stated that this ruling is the result of some four years' study and testing. According to information which I have, this new regulation does not differ materially from the tentative one which has been in force by the Chicago Department during these four years of study. This tentative ruling in substance was the so called McMillen formula, to which was added a definite requirement for the cantilever portion of the slab. The new ruling differs from the method used by McMillen (Engineering News, Mar. 31, 1910) in that the moment in the diagonal center of the panel for four-way system is 20% less, and that in the direct belts 20% more. It is to be supposed, therefore, that this change is the result of four years' study and testing by the Chicago Department.

It is not apparent to me, in just what way this new regulation is the result of test experience so far as same has been published. Tabulated below are values which are given for the steel stresses as measured by strain gages and as computed by this new Chicago regulation for five buildings, reports of the tests of which have been published.

SCHEDULE OF STEEL STRESSES

Names of Buildings	Test Load, Lb. per Sq.Ft.	Mid-Span Computed (Lb. per Sq.In.)	Mid-Span Measured (Lb. per Sq.In.)	Edge of Capital Computed (Lb. per Sq.In.)	Edge of Capital Measured (Lb. per Sq.In.)
		25,800†	8,200		
Northwestern Glass Co.	400	14,400	4,300	28,800	20,000
		26,400	6,900		
Deere & Webber Co.	340	10,000	5,100	27,700	20,700
		12,700	4,540		
A. J. Frank	250	7,500	1,070	8,050	4,575
		25,000	3,300		3,500
Larkin Co.	370	15,100	3,000	18,100	5,400*
		16,200			
Shredded Wheat Co.	191	19,000	19,000	25,500	17,000

*At edge of drop.

†Upper values for direct belt stresses; lower values for diagonal.

The results given are for the loadings in the respective buildings, which were uniform over several panels. The first two buildings are in Minneapolis, the second two in Chicago, and the last one in Niagara Falls, N. Y. Reports of tests of all these can be found in engineering literature.

It should be noted that the two Minneapolis buildings were designed with the old standard flared capitals without the depressed panels; the two Chicago buildings had depressed panels adding to the thickness of the slab in the

region of the columns, the Niagara Falls building also had a depressed panel, but this was so little (2 in.) as to be of much less importance than those in the Chicago buildings. The Minneapolis and Chicago buildings are of the four-way type of reinforcement, while the Niagara Falls building is of the two-way type.

The Chicago rules give stresses from two to three times those measured in the mid-span for the four-way types, while for the two-way type the Chicago rules agree with the higher measured stress. For the cantilever steel stress over the edge of the capital the Chicago rules result in stresses about [illegible]% above those measured, where no depressed panels are used, and about 100% higher than those measured for the two Chicago buildings having substantial depressed panels.

It has been stated in engineering discussions in this connection by some of the Chicago engineers that tension in the concrete reduces the stress in the steel reinforcement, and accordingly computed stresses should be higher than those measured, in order to allow for this tension effect of the concrete. Probably most engineers will agree that the concrete tension does produce lower measured steel stresses for buildings relatively over-designed, like the Larkin Building, where the unit working stresses measured from three to four thousand pounds. These stresses might be about double with the concrete tensile strength not acting. No engineer can put up a very strong argument that the tensile strength of the concrete affects the steel stresses when the latter measure 15,000 to 20,000 lb. per sq.in., and the concrete is broken up by tension cracks of considerable size. Even with low steel stresses of some 8 to 10,000 lb., the concrete loses its tension effect after the load is left on a day or two because under continued stress it gradually stretches out and leaves the steel to assume the entire tension. This property of the reinforced slab is familiar to those with experience in testing, and can be verified by the outsider who may be unfamiliar with testing, if he will but refer to reports of load tests where he will find cases in which the loading has been left on overnight or for a day or two. These cases show the steel stress materially increased after a day's time, with no increase of loading.

The table shows that the rules required in effect a factor of safety of six for the cantilever portion of the slab, and a factor of safety of eight or ten for the mid-span in the four-way systems and a factor of safety of four for the mid-span of two-way systems. It appears to the writer that this new regulation should be revised to give requirements in accordance with the test data, and that until it is revised, one is not justified in claiming that this ruling is based upon test data.

E. S. Martin,
Designing Engineer, C. A. P. Turner.
[illegible], New York City, Dec. 8, 1914.

(In Engineering News, Nov. 19, 1914, p. [illegible], there were [illegible] the new flat-slab portion of the Chicago Building Code. Some of these objections seem to be due to the fact that each requirement had given the code an [illegible] study.

He mentions the "uncertainties" which [illegible] [illegible] and then proceeds to point out [illegible] of considering the column shaft as part of the resisting section and bending moment over the face of the column. The very definition of "strip A" in the code precludes the suggested interpretation, when it says:

Strip A shall include the reinforcement and slab in a width extending from the center line of the columns for a distance each side of this center line equal to one-quarter of the panel length.

No mention of including the column shaft or cap in the above definition is to be noted.

The design of flat slabs is admittedly somewhat empirical and the phrase quoted, "At the edge of the column cap or over it," was doubtless inserted to emphasize the necessity of providing within the slab depth sufficient resisting moment from one edge of the column cap to the other. The necessary increase in total resisting moment from the edge of the column cap to the center is provided by the specification covering the size of cap. This increase is assured by requiring that the cap and slab shall be cast monolithic. It, therefore, seems that the only "uncertainty" pointed out is more or less mythical.

The code is further criticized for ignoring the bending in the column shaft. Section 552 limits a reinforced-concrete column in ordinary construction to one-twelfth of its length. The flat-slab code limits the column size to one-twelfth of the panel length. The same section limits in all cases the minimum steel to $1\frac{1}{2}$% of the concrete area. The least sizes, therefore, for columns with an average story height of 10 ft. and an average panel of 20 ft., are in the proportion of 20 in. to 10 in., when contrasting flat slab with any other type of reinforced-concrete floor. For direct load, the flat-slab minimum column is, therefore, four times as strong as the regular column, and for bending eight times as strong, since the column area varies as the square, and the section modulus as the cube of the side of a square column. Thus, this flat-slab code very definitely recognizes and provides for the moments induced in the column shaft, again emphasizing its superiority. Its originators are to be praised for the good judgment shown by inserting this "one-twelfth of the panel length" provision.

Even though the critic's contentions were true for this flat-slab code, the last sentence of paragraph (a), Section 552, of the original code makes it necessary to design columns for the unbalanced moment. The completeness of the flat-slab code, however, prevents any differences of opinion as to the magnitude of the unbalanced moment where small columns would otherwise carry the load.

Your correspondent's demonstration of minimum moment coefficient is delightfully simple. Unfortunately, however, the observed deflections do not conform to the simple assumptions which he has tacitly made. Uniformly increasing bending from his section "MP" to section "NQ" does not obtain, due to the stiffness existing adjacent to the columns by virtue of the bands of steel parallel to "MP" as well as the diagonal bands. Even on so fundamental a proposition as the total of positive and negative moments for panels, authorities are quite opposed in their views. One estimate, obtained by integration of radial elements, gives a total of about [illegible] WL, where W = total panel load and L = distance c. to c. of columns. The other estimate, by demonstrating to the satisfaction of its adherents that "circumferential moments" equals "radial moments," gives a total of about [illegible] WL. On the same basis, the Chicago Code has [illegible] WL negative at column top in each of the two rectangular directions and [illegible] WL in each of the two diagonal directions, or a total of [illegible] WL negative. Each diagonal band has

$^1/_{120}$ WL and each rectangular band $^1/_{80}$ WL or a total of $^1/_{24}$ positive moment. The sum for both positive and negative equals $\frac{1}{8}$ WL, a commonly accepted total in ordinary construction. These facts seem to indicate that the totals used by the Chicago Code lean decidedly toward the conservative, as is entirely proper in a public regulation. Properly considered, there does not seem to be the element of weakness which the critic fears from his simple demonstration. As for distribution between positive and negative, suffice it to say the coefficients specified by the code accord admirably with the tests upon this type of construction.

Tests, however, upon completed buildings are tabooed. The reason assigned is that "only a portion of the floor is ever loaded." And yet, when discussing moments, emphasis was placed on the fact that the conditions analyzed were those of perfect balance at the columns. One would surmise, therefore, that tests on "portions" would reveal by the extensometer readings, unit stresses far beyond the 25% excess which the critic discovers for ideally balanced conditions. The fact that such excesses do not occur is evidence of the sanity of the code coefficients.

One of the most admirable features of this code is the provision for negative moment in the so called "strips B." Although practically every test shows a tendency for the slab to crack in the top on the rectangular lines between column centers, designers have been altogether too slow about making definite provision for the moments thus indicated. To the writer's knowledge this Chicago Code is the first formal regulation to definitely recognize this weakness in past designs.

It appears, therefore, that its sponsors are to be especially congratulated: (1) Upon the excellent choice of moment coefficients; (2) upon the provision that the minimum column diameter must equal one-twelfth of the panel length; (3) upon the requirement that negative moment must be considered across the top of the rectangular bands.

O. W. Irwin,
Chief Draftsman, Trussed Concrete Steel Co.
Youngstown, Ohio, Nov. 23, 1914.

NOTES AND QUERIES

Data on the life of cast-iron pipe used for discharging sewage are desired by a correspondent in Columbus, Ohio.

G. H. H., Clinton, Mass., writes: "Can you refer me to any souce of information as to the effect of dyehouse acids and steam upon concrete?"

In the article describing the floating caissons for the Panama Canal, by L. A. Mason, in our issue of Dec. 3, due credit should have been given to Henry Goldmark, who was responsible for these structures as Designing Engineer for Lockgates and Protective Devices on the Canal, and to Col. Hodges, Assistant Chief Engineer, who had the primary responsibility for all features of design in connection with the machinery of the locks. During preliminary studies on the lock gates of the canal and their operation, Mr. Goldmark became impressed with the necessity for floating caissons, and advocated their use. After the construction of these caissons was authorized, he was entrusted with the preparation of the plans and specifications for them, and this work was prosecuted under his direction from 1910 until 1913, the final plans being submitted to Col. Hodges, Assistant Chief Engineer. The principal drawings and computations for the caissons were made by Mr. Mason, the author of the article in question, who was an assistant to Mr. Goldmark in the Lockgate Subdivision, a work for which Mr. Mason's long experience in shipbuilding made him particularly valuable. All parts of the design, however, remained under Mr. Goldmark's immediate supervision.

The American Good Roads Congress

The fifth good roads congress of the American Road Builders' Association was held at Chicago last week.

The President, W. A. McLean, Commissioner of Highways for Ontario, in his address pointed out that the use of the term "permanent" as applied to surfacing materials for roads gives the public a wrong impression. Any road surface is subject to wear and disintegration and adequate provision should be made for repair and renewal.

A paper on "Concrete Roads," by J. H. Kuelling, County Highway Commissioner, Milwaukee, Wis., described the extensive construction of such roads in Milwaukee County. The question of expansion joints is unsettled; the spacing has been increased from 25 to 35 ft. and then to 50 ft. without unsatisfactory results. He doubted the necessity of using steel plates in the joints, as these cause the concrete to chip, thus demanding an almost immediate tarring of the joints. A joint with felt filling and slightly rounded edges would meet the requirements. In placing the concrete he preferred a gravity spout to a dump bucket on a boom.

In the discussion, P. C. McArdle, Acting State Highway Engineer of Illinois, advocated thorough rolling, rather than relying upon the concrete to bridge over soft spots. He did not approve of spouting the concrete as it is apt to be made much too wet, which results in ultimate cracking of the concrete. He agreed that armored expansion joints are not desirable, and stated that in Illinois the joint spacing had been increased from 50 to 75 ft., and now to 100 ft.

In a paper on "Brick Roads and Streets," John Laylin, Division Engineer of the Ohio Highway Department, said that while a concrete base is used as a rule, much brick paving has been laid directly upon a sandy or gravelly soil and has given good service for several years under light or medium traffic.

A paper on "Wood and Granite Block Paving," by William A. Howell, Engineer of Streets and Highways, of Newark, N. J., dealt with the practice in that city. Wood blocks are 4 in. thick, laid on a 1-in. cushion of cement and sand (1:4). An unusual feature is the dipping of the blocks in water before laying them. The practice has been successful.

The blocks were treated with 18 lb. of creosote oil per cubic foot of wood. There was some bleeding of oil upon the street, but sand was sprinkled and the coating scraped off, so that there was little complaint of the oil being tracked into buildings. In the discussion, Geo. W. Tillson (Consulting Engineer to the President of the Borough of Brooklyn) briefly reviewed present practice in wood paving, and spoke of slipperiness as a common defect. This may be provided against by open joints, formed by lug blocks or by strips of lath between the blocks, this latter practice being used in Kansas City.

Features of the granite-block paving at Newark are the use of close joints (which gives a smoother and less noisy surface) and the use of old blocks cut in half and dressed to shape. The city proposes to do this cutting and dressing and then sell the blocks to the contractor. Mr. Tillson favored the close-joint stone paving, and thought that the reduction of noise due to rubber-tired motor vehicles would result in bringing granite-block paving into more general use, in view of its high wearing qualities. Mr.

D[illegible], Chief Engineer of Highways, Borough of Manhattan, New York City, also favored the close-joint paving, and also the use of a bituminous rather than cement filler, as making a less noisy pavement and making easier the inevitable tearing up and relaying of the pavement.

"Bridge Floors and Paving" was dealt with in a paper by Clifford Older (Bridge Engineer of the Illinois Highway Department). This related to steel bridges on country roads and showed the advisability of continuing the regular road-surface material across the bridge. For old bridges, a good floor consists of 3-in. creosoted plank covered with a bituminous gravel composition.

The subject of "Convict Labor in Road Construction" was presented in a paper by T. J. Ehrhart, State Highway Commissioner of Colorado. The system has been in use in that state for 14 years. No armed guards are employed, each man giving his word not to run away, and in six years less than 1% of these men have attempted to escape. About 300 men are now employed in this way.

The exhibition of road machinery, appliances and materials was notably complete and comprehensive.

A Batch Timing and Measuring Device on a Concrete Mixer

The concrete mixer for road work exhibited by the Koehring Machine Co., at the show accompanying the annual convention of the American Road Builders' Association at Chicago last week, has as auxiliary equipment a new attachment for recording the number of batches and for determining the duration of a mix of each batch.

This attachment, called the "Batchometer," consists of a small recording meter and an automatic signal bell, housed with necessary dry batteries in a metal case with [illegible] 14 in. square by 4 in. thick. This case is shown in the accompanying view.

When the side loader is raised the short arm shown is also raised, operating the meter and at the same time raising the [illegible] in the cylinder, which is filled with glycerine. After a definite time, which can be adjusted as required by a little contact point fastened by a setscrew to the vertical rod and has a range of from 3 sec. to 3 min., the bell is rung as a signal to the operator to dump the batch. The same signal can be used to control the operation of the side loader so that loading and dumping can be made practically simultaneous. Such an equipment eliminates guesswork from the time of batch mixing and should assure the uniform mixing of all the batches. At the end of the day there is also readily available a complete record of the total number of batches run.

OPERATING PARTS OF THE "BATCHOMETER"

Notes from Engineering Schools

UNIVERSITY OF ILLINOIS—The cornerstone of the new Laboratory of Chemistry has recently been laid. This will be a five-story structure occupying a ground area a little over 200 ft. square. It is aimed to make this one of the most complete institutions of the kind in the world and one well adapted for the complete training of men in every branch of chemical work. There are now 1500 students in this department and 54 instructors.

NEWS NOTES

An Ore Wharf and Warehouses Burned at Skagway, Alaska, on the night of Dec. 12. The damage is estimated at $210,0[illegible]—$60,000 on the wharf and the remainder on the buildings and contents. A fireboat saved the ore bunkers. This wharf handled all shipping at Skagway.

A Heavy Blast Sent Eight Boulders into a House [illegible]0 yd. distant, in Philadelphia, on Dec. 1[illegible]. The blasting was done by a contractor, and it is not known how heavy a charge he used. The City of Philadelphia limits dynamite charges to [illegible] lb. The Bureau of Highways is investigating the cause of the accident. The damaged house was a three-story stone dwelling.

A Universal Water-Meter System for Sheboygan, Wis., is proposed and a popular vote on the subject will be taken in April, 1915.

A Road Congress at San Francisco in 1915 will probably be conducted jointly by the American Highway Association and the American Road Builders' Association. [illegible] is to appoint a committee of two, and the four thus appointed are to choose a fifth member, thus forming an executive committee of five to conduct the congress.

"Car Full" and "Limited Stop" Signs are [illegible] on street cars [illegible] from [illegible] points. The "car full" sign is shown at the discretion of the [illegible], and while [illegible] the cars stop to [illegible] passengers, but will take on no more. The "limited stop" sign is used during the evening rush hours and cars carrying [illegible] not stop to let off passengers until reaching a point some distance out, but stop to take passengers on before reaching that point.

An Architectural Competition for the Australian Parliament House, [illegible] the site of the new federal capital of Australia, has been announced. Designs must be delivered in London or in Australia by Mar. 11, 1915. Prizes totaling [illegible] are offered, the first prize being [illegible]. The judges are [illegible] of Australia, John James Burnet, of London and Glasgow; Victor Laloux, of Paris; Otto Wagner, of Vienna; Louis H. Sullivan, an American architect, with offices in the Auditorium Tower, Chicago, Ill.

Reconsideration of the Passaic Gas Case is [illegible] New Jersey Board of Public Utility Commissioners [illegible] the [illegible] Passaic [illegible] "Engineering News," [illegible] 1913, but the Public Service Gas Co. appealed. The State Supreme Court [illegible] the commissioners [illegible], but the highest court (Errors and Appeals) recently reversed the decision. The vote was [illegible] to [illegible] and the [illegible] a hearing by the full court. [illegible] will be [illegible]

The City Manager Plan will be voted on at Los Angeles, Calif., on Dec. 31, as a part of a charter amendment which also provides for a city council composed of a mayor and eight other members, all elected at large. The manager would be appointed by the council and would in turn appoint ten department directors, as follows: Public works, public service, harbor, library, health, public utilities, playground, park, fire, and finance. There would also be a city clerk department, under the manager, but the clerk would be nominated by the mayor and confirmed by a majority of the council. The mayor would also nominate and the council affirm a city prosecutor, city treasurer, two police commissioners, five civil service commissioners and nine art commissioners. The people would elect (besides the mayor and councilman) an attorney, auditor, assessor and seven members of a board of education.

An Anti-Civil-Service Policy has been adopted by the West Chicago Parks Commission in restricting employment to residents of the park district. This commission has control of the parks on the West Side. Its argument is that the parks are for the people of that district and that competent employees can be found in its population. Representatives of several civic organizations have appeared before the Commission to protest against this as contrary to the civil-service principle and adverse to the interests of the city as a whole. It was pointed out that, even if this restriction should be applied to ordinary labor positions, it should not be applied in regard to administrative and technical positions, as it would tend to exclude men of competence and special training.

The Bloor St. Viaduct at Toronto, Ont., is to be built of steel, as was noted in our Construction News section of Dec. 17. The contract for the Don section has been let to Quinlan & Robertson for $947,076.01. This viaduct has been the subject of considerable controversy. An effort was made to have it designed in concrete, but the city authorities would not accede to this demand, and made an official design comprising two sections of steel arch viaduct. They, however, permitted alternative concrete designs to be submitted. For the Don section 10 designs were submitted, five of which were on the official steel design and five on special concrete designs made by the bidders. The steel bids varied from $996,500 to $1,353,000 for the steel bridge with the lower deck completed, and from $849,000 to $1,250,000 for the concrete bridge of the same general nature. The accepted bid of $947,076 was for a steel bridge with the lower deck to be completed in the future. The bidder had the low bid also, that is, $996,500, for the steel bridge with a lower deck completed. The Works Commissioner, R. C. Harris, stated in presenting the bid that none of the concrete designs fully complied with the requirements laid down in the advertisement.

Rebuilding the Edison Plant at West Orange, N. J., after the destructive fire of Dec. 9 ("Engineering News," Dec. 17, 1914) is proceeding as rapidly as possible. T. L. Condron, M. Am. Soc. C. E., of Chicago, has been retained by Thomas A. Edison as consulting engineer in the reconstruction work. The first step toward rebuilding was the leasing of two complete cement-gun outfits from the Cement Gun Co., of New York City. It is the intention to use these machines in repairing the damaged columns and girders, though the precise methods of repair have not been fully decided upon. Steel window sash with wire-glass are already being installed in some of the burned-out buildings. The phonograph record building is being inclosed with these windows, and the job will be finished in about two weeks, comprising some 125 windows 12x8½ ft.. Remarkably rapid work is reported in this connection. The order for the sash was received by the Trussed Concrete Steel Co. on Dec. 12; regular factory-type "United" sash, with lights 12x23 in., three swing sections per bay, were called for. Six days later, on Dec. 18, the first lot of sash was shipped from Youngstown, Ohio, by express, and was delivered the following morning, so that some sash were already erected by noon Dec. 19. By Dec. 22 nearly 40 openings had been fitted with sash, and the erection will be completed soon after Jan. 1. The glazing will be Syenite wire-glass. The American Concrete Institute has appointed a special committee to investigate the behavior of the concrete buildings in the Edison plant. The committee consists of Cass Gilbert, the well known architect, chairman; E. J. Moore, of the Turner Construction Co., New York, secretary; Walter Cook, architect; J. Max Taylor, architect; R. P. Miller, of the New York building department; W. H. Ham, engineer, of Boston; Prof. Charles L. Norton, of the Massachusetts Institute of Technology; Richard L. Humphrey, consulting engineer, of Philadelphia, Penn.

Changes in Sewage-Treatment and Pumping, Columbus, Ohio—Acting under orders from the State Board of Health to stop discharging sludge into the Scioto River, plans are being prepared for two-story or Imhoff tanks, and for sludge-drying beds. For the past two years sludge has been discharged into a gravel pit, but the sludge is flooded at high water. It is expected that the new tanks will give so much better sedimentation than the present ones that no changes or enlargements in the dosing chambers and sprinkling filters will be necessary—at least not until they have been well tried with the improved effluent. Money for the proposed improvements has not yet been appropriated, but it is expected that the council will authorize bonds after the plans have been approved by the State Board of Health. The general design for the new tanks was made by Clarence B. Hoover, Chemist and Superintendent of the Sewage Purification Works and Pumping Station, and the construction details are being worked out by J. J. Morgan, Commercial Building, Columbus, Ohio. The Columbus Sewage Works were shut down on Nov. 15 for the balance of this year, on account of lack of city funds to run this and some other city departments.

The sewage pumping station is being remodeled. Under a contract let early in November to Dravo & Doyle, Pittsburgh, the old steam pumps will be replaced by three motor-driven centrifugal pumps of 15,000,000-, 10,000,000- and 5,000,000-gal. capacity, working under a 40-ft. head. Current to drive the pumps will be bought from the municipal lighting plant at 1½, 1¼ and 1c. per kw.-hr. for each successive 25,000 kw.-hr. and ¾c. for all above that, bringing the average price slightly under 1c.

A Coöperative Agreement has been made by the California Water Commission and the U. S. Secretary of Agriculture, to facilitate approval of applications for water rights and occupancy of forest-reserve lands in the development of power. Whenever application for permit for a water-power site is filed with the U. S. District Forester, in San Francisco, notification will be given the commission. When permit to appropriate water is sought from the commission, and use of the water involves occupancy of forest-reserve lands, the U. S. District Forester will be notified and such permit not issued until a complete application for use of the U. S. forest lands has been filed. The commission will defer final approval of such a permit until the District Forester advises that final application for occupancy has been filed or a preliminary application granted with rights to do construction work. The District Forester will confer with the commission before arranging terms of a preliminary permit and file copies of permits as issued. Preliminary occupation permits will allow construction work only in emergency or to comply with state law, and then only upon approval of the commission. Final permits for a site will be issued by the Forester only after the commission has approved the appropriation of water or disclaimed jurisdiction. If the times between beginning and completion of construction, provided in a state water-appropriation and a federal site-occupation permit, are different this will not affect, under state law, the permittee's liability or the cancellation of water right. Loss of state water right, through failure to begin construction, will be sufficient cause for revocation of federal site permit. If either the District Forester or the commission shall fail, within 60 days, to notify the other of action contemplated above, then the one reporting may act without securing notice.

PERSONALS

Mr. Herman Watson has resigned as Superintendent of the Water-Works of Kalamazoo, Mich.

Mr. Heinrick J. Freyn, M. Am. Soc. M. E., has resigned as Third Vice-President of H. Koppers Co., Chicago, Ill.

Mr. William W. Marr, M. Am. Soc. C. E., Consulting Engineer, of Chicago, has been appointed State Highway Engineer of Illinois, to succeed Mr. A. N. Johnson, M. Am. Soc. C. E., who resigned some months ago.

Mr. E. A. Humphrey, Assistant Electrical Engineer of the Great Northern Ry., has been promoted to be Electrical Engineer, succeeding Mr. C. L. Daugherty, recently appointed Assistant General Manager of the St. Petersburg (Fla.) Light & Power Co.

Mr. Layton F. Smith, M. Am. Soc. C. E., Engineer-Architect, Baltimore, Md., has been appointed representative of the city of Baltimore and the Merchants' and Manufacturers' Association, of Baltimore, on the "Link the Americas" cruise, which has in view the bringing into closer contact the business people of South America and the United States. This cruise will leave New York, Jan. 29, and return to that city May 11, 1915. The cruise will entirely encircle the continent of South America, and stops will be made at all the important cities on both coasts. Return will be made through the Panama Canal.

OBITUARY

[illegible] S. [illegible], a civil engineer of York, Penn., died Dec. [illegible] at the [illegible] County Hospital, Hagerstown, Md., aged [illegible] years.

[illegible], Assistant Director of the Pekin Kalgan Ry., of [illegible], China, who was sent to this country by the government of China to study railway management, died Dec. 13, at [illegible], N. Y., after an illness of two months.

[illegible] A. [illegible], Assoc. Am. Inst. E. E., Engineer of the [illegible] Telephone Co. of Canada, Ltd., died at his home in Montreal [illegible] Dec. 7, from pneumonia. He was born in Montreal in [illegible]. He graduated from the Worcester Polytechnic Institute in mechanical engineering in 1889 and in electrical engineering in [illegible]. The same year he joined the staff of the Bell Telephone Co. at Toronto, Ont. In 1895 he went to Montreal as engineer.

[illegible] H. Jackson, formerly a civil engineer of note and in the later years an amateur artist of some fame, died on Dec. 15 at his home in Boston, Mass., at the age of 81 years. He was born in Watertown, Mass., and before the Civil War was employed as an engineer by the City of Boston. He served in the 13th Massachusetts Volunteer Infantry as a Captain throughout the Civil War, and subsequently carried on a private practice as a civil engineer, having his office in the [illegible] Building, Boston. Capt. Jackson spent the later years of his life in painting, and although self-taught he was considered an artist of considerable ability. He was a member of the Boston Art Club.

Henry S. Hayward, M. Am. Soc. M. E., Consulting Engineer of Floating Equipment of the Pennsylvania R.R., New York City, died Dec. 14 at Augusta, Ga., aged 70 years. He entered the [illegible] department of the Pennsylvania R.R. in 1873 as a [illegible] and draftsman. For many years he was Assistant [illegible] and later Superintendent of Motive Power of the United R.R. of New Jersey. In 1912 he had been Consulting Engineer of Floating Equipment of the Pennsylvania R.R. with headquarters in New York City. He was a charter member of the American Society of Mechanical Engineers. He is survived by a son, Henry S. Hayward, Jr., M. Am. Soc. M. E., Consulting Engineer, 30 Church St., New York City.

[illegible]

[illegible]

ENGINEERING SOCIETIES

COMING MEETINGS

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.
Dec. [illegible] Annual meeting at Chicago, Ill. Secy., F. M. White, Madison, Wis.

SOCIETY OF CONSTRUCTORS OF FEDERAL BUILDINGS.
Jan. 4-6. Convention at Washington, D. C. Secy., T. R. Maul, 4213 Westminster Ave., Philadelphia, Penn.

ASSOCIATION OF GOVERNMENT CONTRACTORS.
Jan. 4-7. Annual meeting at Washington, D. C. Secy., Algernon Blair, Montgomery, Ala.

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.
Jan. 1[illegible]. Annual meeting at New York City. Secy., J. R. Wemlinger, 11 Broadway, New York City.

AMERICAN WOOD PRESERVERS' ASSOCIATION.
Jan. 19-21. Convention at Chicago, Ill. Secy., F. J. Angier, Mt. Royal Station, B. & O. R.R., Baltimore, Md.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. 2[illegible]-21. Annual meeting in New York. Secy., Charles Warren Hunt, 220 W. 57th St., New York City.

AMERICAN SOCIETY OF HEATING & VENTILATING ENGINEERS.
Jan. [illegible]-22. Annual meeting at New York City. Secy., J. J. Blackmore, 29 W. 39th St., New York City.

INDIANA ENGINEERING SOCIETY.
Jan. 21-23. Annual meeting at Indianapolis. Secy., Charles Brossmann, 1616 Merchants Bank Building, Indianapolis, Ind.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
January 27-29. Annual meeting at Springfield, Ill. Secy., E. E. R. Tratman, 1131 Monadnock Block, Chicago.

AMERICAN CONCRETE INSTITUTE.
Feb. 9-12. Convention at Chicago, Ill. Secy., E. E. Krauss, Harrison Bldg., Philadelphia, Penn.

AMERICAN CONCRETE PIPE ASSOCIATION.
Feb. 1[illegible]-16. Annual convention at Chicago. Secy., E. S. Hanson, 538 South Clark St., Chicago, Ill.

Association of Highway Commissioners of the United States—This Association was organized at a recent meeting in Atlanta of the American Road Congress. Its first meeting was held on Dec. 12 for the purpose of electing officers and of discussing Federal highway legislation to be taken up by Congress during the present session.

Montana Institute of Municipal Engineers—The third annual meeting of the Institute will be held at Helena, Mont., Jan. 18-2[illegible]. Among the papers to be presented are the following: "Publicity and the City Engineer," by Henry Herbers; "Objects and Use of Testing [illegible] for Paving," Wm. [illegible]; "Present Status of the Pollution of Waterways in Montana," Prof. Wm. M. [illegible]; "The Experimental Sewage [illegible]," Carl C. Widener. The secretary is Carl C. Widener, [illegible], Mont.

San Francisco Association of Members of the American Society of Civil Engineers—At the [illegible] regular meeting of the Association the address of the evening was given by Prof. [illegible] on the [illegible] Tower at the University of California, Berkeley, Calif. [illegible]

Engineering Literature

CONTENTS

CORRESPONDENCE

A Card-Index Multiplication Table

Sir—In your editorial remarks on my letter of Oct. 29, published in your issue of Nov. 19, you say of my card system of multiplication:

> Products up to 9 × 999 can be read directly. Beyond that simple multiplication followed by addition is required.

I think if you had understood more fully the purpose of the device, you probably would have said:

> Beyond that by a proper manipulation of the cards any two numbers (no matter how large) may be multiplied together by simple addition. Also, the device may be used for performing division by simple subtraction.

F. C. WILLIAMS.

Commercial Bank Building,
Cleveland, Ohio, Nov. 24, 1914.

REVIEWS AND NOTES

An English Translation of a German Gas-Engine Book

REVIEWED BY H. E. LONGWELL*

HIGH-POWER GAS ENGINES—By H. Dubbel. Translated from the German, and Edited and Expanded so as to Include British Engines and British Practice by F. Weinreb. New York: D. Van Nostrand Co. Cloth; 7x11 in.; pp. xii + 197; 423 illustrations and 13 folding plates. $5, net.

The author has been a frequent and acceptable contributor to the *Zeitschrift des Vereins deutscher Ingenieure.* Inasmuch as he has been able to satisfy the critical editor of that journal, it is more than probable that the book as originally written was a reasonably good one. One cannot conscientiously say as much of the translation. Evidently, it has suffered considerably at the hands of the translator who claims to have "edited and expanded" it. Notwithstanding the translator's expressed obligations to the gentleman "who read and corrected the first English version of the manuscript in a most thorough manner," the style is so obscure and the punctuation so bad that in many places the text is unintelligible.

The work is copiously illustrated with detail drawings and diagrams, most of which have appeared on a larger scale in sundry European technical journals during the past twelve or fourteen years. These illustrations, in connection with the generous size of the pages, and the excellent quality of the typographical work, give the volume an attractive appearance that makes the worse than mediocre quality of the text all the more noticeable.

We are advised, on p. 18, that "the thermal efficiency is found from the heat consumption in the B.t.u. per i.hp. per hour *for which the usual value is from 478 to 504 B.t.u. per i.hp. per hour*" (italics mine). To engineers who have been laboring under the impression that the heat consumption of an engine of 100% efficiency is not less than 2545 B.t.u. per hr., these figures indicating efficiencies of over 500% will be a trifle startling. The probable explanation is that in translating calories into British thermal units the ratio, approximately 3.96, has been used as a divisor instead of a multiplier.

We find in detail, p. 85, the calculations for determining the size of the air and gas pumps for a two-cycle gas engine of 800 b.hp. The result of the calculations indicates that *the displacement of the gas pump should be somewhat greater than that of the working cylinder.* This on its face is, of course, ridiculous. A critical examination of the calculations shows that the displacement of the air pump was first determined, and the displacement of the gas pump was fixed by multiplying the displacement of the air pump by the ratio of gas to air in the working mixture. The trifling incident of some 40% of the air being used for scavenging purposes, and not requiring to be mixed with gas, seems to have been overlooked.

These examples will suffice to indicate the inexcusable carelessness displayed in the preparation of the work.

As an illustration of the effectiveness with which words may be used to conceal an idea, the following quotation, p. 31, is submitted:

> When quantity governing is adopted, the mixing valve may close at no load at the beginning of the suction stroke, and at full load at the end of the suction stroke. The time available for governing will then last up to the time of ignition during a crank travel of 180° to 360°. If the governing is effected by throttling, the time available for governing will only last during 180° before the ignition point, and the governor therefore has to act quicker.

Most engineers imagine that governing by throttling *is* quantity governing; and they will wonder why the

*Consulting Engineer, Westinghouse Machine Co., East Pittsburgh, Penn.

governor can act only during that part of the revolution in which there is no inflow of fluid to be acted upon.

Speaking of the action of the governor on the inlet valve-gear of blowing engines the author says, p. 34:

With [illegible] governing the gas valve remains open during the whole suction stroke and therefore gas enters the cylinders [illegible] during each minute quite independently of the number of revolutions per minute, one suction stroke taking place every four strokes.

The amount of gas entering the cylinder per minute when the speed is reduced therefore remains the same as at the higher speed if the inlet area remains constant, as the gas is supplied above atmospheric pressure.

Note the second paragraph!

Evidently the author is not familiar with the common expedient of using a regulating apparatus in the supply line to maintain the gas pressure constant and substantially equal to that of the atmosphere.

Even the descriptions of the illustrations are not free from error. In describing the cylinder construction of a well known American engine, p. 112, it is stated that "the internal cylinder and external jacket are cast together." Anyone with reasonably good eyesight can see, from a casual inspection of the drawing, that the jacket is a separate casting.

In Chapter XI, on Stuffing-boxes, we are gravely informed that "when arranged in a vertical direction the packing can be adapted to the rod," which doubtless will be a comforting assurance to the designer of gas engines.

In Chapter XIV, on Starting, we have the following:

Fig. [illegible] shows a compressed air starter (Krupp). The piston valve admitting the compressed air is moved by a hand lever.

When compressed air is used for starting it is generally delivered by an independent auxiliary air compressor, and [illegible] at a pressure of from [illegible] to 3[illegible]0 lb. per sq. in. These receivers have to be provided with water [illegible] to prevent [illegible] on the ignition plugs.

When the reader turns to Fig. [illegible], and sees that it illustrates a simple compressed-air motor acting on the flywheel and exhausting into the atmosphere, he is naturally at a loss to understand how the compressed-air supply can have any effect on the ignition plugs.

As will be gleaned from the foregoing extracts the quality of the book—or rather its lack of quality—is such that a detailed outline of its contents and general plan would not be of much interest.

[illegible]

latent heats, entropy, etc., which take into account fundamental thermodynamic relations, (2) checking constants to agree with the most reliable data, and (3) arranging equations in simple form and so that modifications to compensate for new data will make slight changes.

A New Edition of Murdock's "Strength of Materials"

Reviewed by Lewis E. Moore*

STRENGTH OF MATERIALS—By H. E. Murdock, Irrigation Engineer, United States Department of Agriculture. Second edition, revised and enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5x8 in.; pp. xv + 314; 137 illustrations. $2, net.

The first edition of this book was reviewed in these columns on Jan. 18, 1912. The new edition is virtually identical with the old, with two added chapters on reinforced-concrete beams and columns.

The chapter on reinforced-concrete beams is clearly written and the author very carefully points out the assumptions made, and indicates plainly that reinforced-concrete design is by no means mathematically exact. The most generally accepted theories are developed and explained lucidly, although the common assumption that the resultant of the compression stresses in a T-beam acts at the mid depth of the slab is not mentioned.

The chapter on reinforced-concrete columns is little more than a résumé of the generally accepted principles of design for such members. The author wisely does not attempt to deduce any mathematically exact formulas for columns of this class.

PLANE SURVEYING: For Use in the Classroom and Field—By William G. Raymond, M. Am. Soc. C. E., Dean of the College of Applied Science, State University of Iowa. Second edition. New York and Chicago: American Book Co. Flexible leather; [illegible]

The original edition of Prof. Raymond's book was reviewed in these columns, Dec. 31, 1896. Until now the book has undergone no changes. In revising the book the author seems to have kept the original method and style throughout, although some additions and changes have been made in the text.

In reviewing the original edition we commended the book for the fullness and clearness of its text, and although many books on surveying have since appeared, this may still be said to rank among the first in these desirable qualities. [illegible]

[illegible]

*[illegible]

already issued extend to 800 pages. The revised work is characterized by Prof. R. DeC. Ward (Howard University), in *Science* of Nov. 27, "as the master-work on the science of the earth's atmosphere."

Express Company Service

THE EXPRESS SERVICE AND RATES—By W. H. Chandler, Assistant Manager, Traffic Bureau, The Merchants' Association of New York. Chicago: LaSalle Extension University. Cloth; 6x9 in.; pp. v + 340. $3.

The intricacies of the transportation system comprised by the services of the many express companies in this country were once a complicated puzzle to which few, if any, had the keys before these independent and secondary agents were specifically put under federal regulation on the same basis as the railroads. The several reports of the Interstate Commerce Commission have opened up the situation marvelously and made possible still further study by such interested students as the author of this work.

Mr. Chandler's treatise is a part of a home-study course in interstate commerce and railway traffic. The first part of the work covers the early history of the express industry, its organization, capitalization, earnings, internal organization, character of service rendered, relations with railroads, etc. Unfortunately, this was written before the recent liquidation of the United States Express Co. and the consequent transfer of its routes to other concerns.

It is known in a general way that the entire express service of the country has been radically changed since the Interstate Commerce Commission was given control. How this has come about and what it now means is well approached by a short review of the common-law attitude, the various state attempts to regulate the business, the powers of the Interstate Commerce Commission and the practices that needed its attention. Then follows the new rate system, prescribed by the Commission and in force for at least two years.

Chapters follow on the special services of the express companies—money order and financial, order and commission and foreign. Finally, there is a brief exposition of the undeveloped electric-road express, the influence of the parcel-post competition (which the author shows is not so fundamentally serious as imagined and may decline once the novelty has worn off), and of Canadian tariffs.

A POPULAR TREATISE ON THE COLLOIDS IN THE INDUSTRIAL ARTS—By Prof. Dr. Kurt Arndt, Private-Dozent at the Technische Hochschule, Berlin, Germany. Translated from the second enlarged German edition by Nahum E. Katz, Chemist to the Eagle Cotton Oil Co., Meridian, Miss. Easton, Penn.: The Chemical Publishing Co. London, England: Williams & Norgate. Cloth; 5x7 in.; pp. 72. 75c.

In as nontechnical language as could be expected without going to an extreme, the author presents, as he says in his Preface he aims to do, *"a Vivid Picture of the Great Significance* which the Colloids have in numerous important practices." The book is all the more interesting because the knowledge of colloids is so new, the word itself having been "first used by Th. Graham half a century ago to denote various substances which, indeed, chemically, have nothing to do with glue, but which resemble in appearance the soaked-up cabinet-maker's glue."

Besides colloids in the hydraulic-cement industry, in sewage purification, lubricating grease, varnishes and soap, the author tells about their relation to ruby and other glasses, silver and gold mirrors, ceramics, tungsten lamps and a variety of other things.

The book can be read in an hour and bids fair to amuse and instruct many who have noted the increasing use of the word colloids in various technical discussions, but who have felt that the subject was beyond the ken of ordinary mortals—if, indeed, it was really understood by anyone.

A New Book on Steam Engines

Reviewed by Winslow H. Herschel*

MECHANISM OF STEAM ENGINES—By Walter H. James, Assistant Professor in the Department of Mechanical Engineering, and Myron W. Dole, Instructor in Mechanical Engineering, Massachusetts Institute of Technology. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. viii + 170; 183 illustrations. $2, net.

Until some other form of prime mover is developed which can be started, stopped and reversed with the speed and facility of a steam engine, this old and reliable servant of man will continue to be a suitable subject of instruction for each succeeding generation of students. The steam-engine designer must be acquainted with the relative motion of parts, or kinematics, the action of the working fluid and the strength of parts to resist the forces to which they are subjected. The elementary treatise of James and Dole deals mainly with the kinematics of the problem, though indicator cards and valve diagrams are treated briefly so as to make the whole subject clearer to a student whose previous knowledge was derived from casual references to steam engines in a book on the elements of mechanism. The book might well be called "Valves and Valve-Gear Mechanisms." One chapter is devoted to typical problems of the slide-valve engine, but otherwise no problems are given. In a subject requiring graphical solutions, a student may sit and study almost indefinitely without any certain knowledge as to whether or not he understands what he reads. But let him try to solve some problem and he will soon realize whether he can find the answer. It is therefore most desirable that a book on valve-gears should be well supplied with problems. The last two chapters are devoted to the mechanisms of steam turbines, a subject not usually found in a book on valve-gears. While keeping within a small compass, the book explains, with a minimum amount of mathematics, all the kinds of steam-engine mechanisms that would be usually met with. It is to be regretted, however, that the authors have not fulfilled the promise of the introduction to deal with the kinematics of other machines, such as pumps and compressors, since this is a much neglected subject about which very few elementary textbooks are available.

An interesting report of ten printed foolscap pages on "Investigations of Land Settlement and Irrigation Development in America" was made under date of June 29, 1914, to the Minister of Water Supply of Victoria, Australia, by Elwood Mead, Chairman State Rivers and Water Supply Commission (Treasury Gardens, Melbourne, Victoria, Australia). The report is based on a recent visit by Mr. Mead to the United States and Canada. It outlines irrigation conditions in Victoria, as well as in North America, and deals with some problems common to both continents. The "closer settlement" pol-

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ing and irrigation of Victoria, with its loans to settlers, is approved by Mr. Mead. The financial troubles of American irrigation development are commented on, and are summarized as follows:

(1) Construction of works before the demand for irrigation or means also to pay for it.

(2) Failure to [illegible] of small capital to overcoming initial obstacles.

The report concludes with some agricultural and horticultural notes, based mostly on observations in California.

British Methods of Factory Management

Reviewed by Rossiter R. Potter*

FACTORY ADMINISTRATION AND ACCOUNTS. A Book of Reference with Tables and Specimen Forms, for Managers, Engineers and Accountants.—By Edward T. Elbourne, Department Works Manager to the Birmingham Small Arms Co., Ltd. With Contributions on "The General Problems of Industrial Works Design," by Andrew Home-Morton, M. Inst. C. E., of Home-Morton, Ker & [illegible], and "Financial Accounts," by John Maughfling, Secretary to J. Thornycroft & Co., Ltd. New York and London: Longmans, Green & Co. Cloth; 7x10 in.; pp. xv + [illegible]; illustrated. $7.[illegible], net.

It should be mentioned first of all that this is primarily a reference book, a sort of encyclopedia of methods. It is analytical in the extreme, in the sense that it delves deep into the small details of management. For example, a page and a half, mostly in fine print, is devoted to the proper duties of a factory gatekeeper, with a specimen set of gatehouse regulations.

The book is divided into six chapters or sections. The first section (only 25 pages) appears to be the contribution of Andrew Home-Morton and deals with the general problem of industrial works design, including the [illegible] of old works. In this chapter appears the interesting admission that the subject of factory design being well thought out there is much better understood in the United States than in Great Britain. Section II takes up General Administration; III, Works Administration; IV, Works Accounts; V presents an exhaustively complete collection of routine forms, and Section VI a definite set of financial accounts for a large manufacturing concern. The forms shown in these last two sections are made to harmonize in a general way with the ideas set forth in the preceding sections.

Sections II and III, on general administration and works administration, cover about the same ground as the various American books on "scientific management." The author's attitude is sane and conservative and he puts things in a way that can be accepted even by those inclined to harshly criticize the more rabid type of efficiency promoters. The subject is dealt with here, however, rather more from the viewpoint of the business man than from that of the engineer. Section IV (Works Accounts) covers the same field as American books on cost keeping. [illegible] American writers on this subject in advocating the [illegible] rate as the most nearly exact practical method for apportioning indirect expenses or "oncost" as [illegible]. About 75 pages in this section are devoted to the problem of [illegible] or stock taking and to the valuation of buildings and equipment.

The book is well arranged to facilitate quick reference to any desired item, and there is an exceptionally complete index. The table of contents is printed with two columns to the page, one sub-topic to a line. With this arrangement, the contents of a whole chapter can be noted almost at a glance, so that the table becomes of really usable value in supplementing the index. This is a feature that might well be imitated in all technical books. The table of contents of the prevailing style, with subtopics run together in solid paragraphs, is so slow and painful an affair to use that nobody ever thinks of consulting it when looking for anything in a hurry.

The chief use of this book for American readers will be for reference and comparison when establishing new rules and methods or revising printed forms. The differences between British and American conditions, laws, shipping facilities, etc., are of some effect in reducing the book's value. American managers will entirely forget their own comparatively trivial worries while reading of the snarl of red-tape and "system" necessitated by the British national health insurance act, applying to practically all working people between the ages of 16 and 65. All things considered, this book will have to be classed as a luxury rather than a necessity in this hemisphere, but those who can easily afford it to use for reference only will doubtless get their money's worth.

*[illegible]

GRAPHIC METHODS FOR PRESENTING FACTS.—By Willard C. Brinton. New York: The Engineering Magazine Co. (Works Management Library.) Cloth; 7x10 in.; pp. xii + 371; 256 illustrations. $4.

While figures cannot lie, when marshaled in sufficient number and complication they can often present a pretty fair semblance of deception. For this reason it has long been a practice among statisticians to reduce their figures and facts to a graphic concentration that permits of easy and rapid understanding of the data. It is a part of the engineer's business to be familiar with such graphic presentations but there are many quirks and turns in the statistician's graphical methods with which the engineer rarely comes in contact. Mr. Brinton's book is of value to the engineering profession mainly on this account. To the statistician it probably has greater value, but on that score we are not so competent to judge.

Briefly, the book is a conscientious effort to give all of the various methods of graphic representation. This necessarily includes the ordinary curves and diagrams and the higher cumulative and mass curves, frequency curves, etc., with which the engineer is familiar. In addition it comprises the different photographic and pictorial representations of comparative figures and the various curve forms which are adapted to business enterprises, such things as cost and production records. In addition to being very interesting, the book should make a valuable reference, for from the text an example may be found of any proposed type of graphical representation.

UNIT CONSTRUCTION COSTS. From the New Smelter of the Arizona Copper Co., Ltd.—By [illegible]. New York and London: McGraw-Hill Book Co., Inc. (Republished by Special Arrangement with the American Institute of Mining Engineers.) Cloth; [illegible]; pp. [illegible]; illustrated. [illegible]

This is by far the most specialized cost-data book which has ever come to our attention. It is purely and simply a list of cost sheets giving unit-construction costs of the building of the Arizona Copper Co.'s new smelter at Clifton, Ariz. Practically its only value is in the design and construction of a smelter plant, though possibly some of the detailed figures may be of use in other types of work.

A Handbook in a New Field

HANDBOOK OF CONSTRUCTION PLANT; Its Cost and Efficiency—By Richard T. Dana, M. Am. Soc. C. E., M. Am. Inst. M. E., Consulting Engineer. Chicago: Myron C. Clark Publishing Co. London: E. & F. N. Spon, Ltd. Flexible leather; 5x8 in.; pp. 702; 312 illustrations. $5.

The vast business of contracting is gradually acquiring a literature, but the process is slow and hard. Mr. Dana's book is, however, quite a forward step in developing that literature. Possibly the most important single thing in a contracting operation is the plant, and the cost of that original plant and the cost of operating it are factors upon which contracting failure or success depends. It has been Mr. Dana's object to reduce to lowest terms such itemized costs. These are presented in this book in alphabetically arranged sections, and the list includes practically every machine or device which can be used in contracting work.

Merely to glance through that list we might name the following headings as an indication of the type of subjects considered: Air Compressors, Asphalt Distributors, Automobiles, Bar Benders, Barges, Blacksmith Batteries, Boots, Cableways, Cameras, Carts, Conveyors, Crowbars, Derricks, Drawing Tables, Dredges, Drill, Explosives, Fuse, Hammers, Hydraulic Giants, Ladders, Log Chains, Mauls, Pile-Drivers, Poles, Pumps, Rails, Roofing, Saws, Scows, Spreaders, Switches, Tarpaulin, Teams, Traction Agents, Unloaders, Wagons, Wheelbarrows. Under each of the headings, of which the above list is only a small part, is given a recent series of prices, a brief description, sometimes with illustrations, of the device, and in most cases some cost data with a brief description of the work on which it is used.

The book is valuable for any one estimating on construction work—provided, of course, that they combine with the figures given in the book a fair knowledge of local conditions and of the business in which they are engaged, so that they may temper the printed words with personal authority. As the author truly says in the preface, no book can tell a contractor automatically what equipment is the best for his use, but it is possible to put him in possession of vastly more information than has heretofore been available, and this has been attempted in the present volume.

RURAL IMPROVEMENT: The Principles of Civic Art Applied to Rural Conditions, including Village Improvement and the Betterment of the Open Country—By Frank A. Waugh. New York: Orange Judd Co. London: Kegan Paul, Trench, Trübner & Co., Ltd. Cloth; xi + 265; illustrated. $1.25, net.

Professor Waugh gives much sensible advice on how villages and outlying sparsely settled districts may enter more largely into the benefits which come from intelligent city and town planning, modern sanitation and community improvement generally—physical, economic and social.

In the opening pages more is said about civic art and the beautiful than is likely to be relished by some people who read the book, but the doctrine is sound. Elsewhere the author tends to mislead the uninformed to put too much faith in the septic tank as a means of sewage treatment, and to think that macadam roads are not only the ideal to which every community and country-side should look forward but also that they can be built for $3500 to $4000 a mile. These dangers are perhaps more than offset by repeated advice to call in the engineer or other competent professional adviser wherever and whenever problems outside the ordinary are met.

A moderate number of line and halftone engravings, for the most part well chosen, add to the interest and value of a book which deserves wide circulation in the rural districts, villages, and even in many so called cities of the United States and Canada.

SURVEYING MANUAL: Designed for the Use of First-Year Students in Surveying and Especially for the Use of Non-Civil Engineering Students—By Howard Chapin Ives, Professor of Railroad Engineering, Worcester Polytechnic Institute. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Leather; 4x7 in.; pp. viii + 296; 56 text figures and numerous plates. $2.25, net.

Like many similar texts this "surveying manual" is chiefly in the form of specific instructions to students for performing certain surveying problems. Included are brief descriptions of instruments and discussions of their adjustments, a brief chapter on the elements of railroad curves, one on the United States system of laying out public lands, on computations, on plotting, and a few pages on astronomy. About 100 pages of tables for stadia reduction, logarithms, trigonometric functions, etc., add considerably to the practical value of the book, but even then a book of this type, of which there are a great many, is not sufficiently complete or practical to be of any permanent use to the field engineer.

For students of civil engineering who must ultimately own larger and complete texts on surveying, and books of formulas and tables such as Searles' "Field Engineering," these various elementary surveying manuals seem a little superfluous, although the use of them unquestionably eases the work of the instructor. Surveying is nothing but the application of geometry and trigonometry to the ground under our feet by the use of implements and instruments, and the principles involved are generally very simple and easily understood. Detail instruction for simple problems may be essential with some students, but such instruction is merely a substitute for a very elementary knowledge the student should have before he begins his course in surveying.

Space is given in most of those manuals, and we believe in most engineering schools considerable time is also given, to exercises with the surveyor's chain, which is obsolete so far as real engineering work is concerned. It is very doubtful if the old-time Gunter's chain can be found anywhere nowadays except in the instrument rooms of technical schools, and whatever value the experience in using it may be to the student, just as much good could be had by following the same exercises with a steel tape. The reduction of old-time surveys in chains and links to feet and tenths is much more easily performed on paper than with a chain in the field.

A history of the American Society of Mechanical Engineers from its organization in 1880 to the present year, has been compiled for the Society by Prof. F. R. Hutton, who, by his 24 years' experience as Secretary of the Society, is best able to write with authority on the subject. The history, which is now ready to go to press, is to be published by subscription, and will be a book of 200 pages, uniform in style with the Society's "Transactions."

A new periodical, entitled "Structural Conservation," appeared under date of October, 1914, as Vol. I, No. 1. According to its editorial page, its mission is threefold, educational, instructional and discussional, and its main purpose is to educate its readers in the fundamental and underlying principles of waterproofing. The first num-

...er contains an article by A. R. A. Plumb on "Structural Waterproofing and Dampproofing", another by Myron H. Lewis, on "Waterproofing as a Problem in Conservation," and a third by A. D. Hyman, on "Theoretical and Practical Considerations in the Successful Application of Waterproofing." Other brief articles are not signed. The new periodical is edited by E. G. Frank and is published in Detroit on the 15th of each month, but the publisher is modest; nowhere in the first issue can we find his name or the address of the publication office.

Notes on the Examination of Lubricants

EXAMINATION OF LUBRICATING OILS—By Thos. B. Stillman, Late Professor of Engineering Chemistry in the Stevens Institute of Technology. Easton, Penn.: The Chemical Publishing Co. London: Williams & Norgate. Cloth; 6x9 in.; pp. iv + 125; illustrated. $1.25.

Prof. Stillman's comprehensive collection of notes on the laboratory examination of lubricants will be welcome to a wide range of readers, so far reaching is the use of scientifically prepared oil and grease compounds and so difficult is prior assurance that they will prove adapted to the expected service.

The several tests are presented in the following order: specific gravity, congealing, viscosity, iodine absorption, flash and fire temperatures, acidity, temperature and color action under acid, separation of mineral and vegetable or animal oils, gumming, sulphur content, water content, gasoline solution, microscopic scrutiny, carbon residue, paraffin content, soap content, saponification value, tar content, coefficient of friction, rape-seed and cotton-seed content, cylinder-deposit analysis, scrutiny of petroleum, and the behavior of lubricating oils in saturated and superheated steam, air, carbon dioxide and other gases.

Although the volume is of uncommon value, yet it is to be regretted that there could not have been more care and time spent on the finish of the text, which gives evidence of a hasty assembly of disjointed notes. It is decidedly inconvenient to have various general specifications for miscellaneous oils and greases scattered through the book and attached to one test or another which forms but a part of the specified examination. Thus, some lard-oil specifications are appended to notes on "acid test," and several railroad oil specifications follow "friction tests," though a few follow "cold tests." There are some obvious errors in words and figures which will cause faint doubts in the mind of the inexperienced reader on the complete accuracy of other statements.

THE CLEANING OF BLAST-FURNACE GASES—By [illegible]. New York and London: [illegible]. Cloth; [illegible]

The aim of the author to place on record in easily available form, the latest information of cleaning blast-furnace gas is commendable. The book should be interesting to all [illegible] in cleaning these the gases that have been taken to secure a clean waste gas from which power may be developed economically and continuously.

The author first outlines the demand for clean [illegible] gas which [illegible]. Then the theoretical aspects of cooling and [illegible] are presented. The cleaning processes and apparatus are described under three heads: (1) first-stage or dry-dust catchers; (2) second-stage or wet cleaners and coolers; (3) third-stage or final cleaners. The first-stage machines described are the "centrifugals" and the "whirlers." The second-stage equipment covers coke and grid scrubbers, baffle and spray towers, slow rotary washers, high-speed centrifugal washers. The final-stage equipment includes centrifugals, "disintegrators" (combination fan sprays), washers, bag houses, water-coil towers with screens and baffles, and the Cottrell electric-precipitation scheme. Much of the apparatus described is European, so that the author has found it advisable to append a chapter on operative plants in America.

A New Edition of Foerster's Taschenbuch

REVIEWED BY LEON S. MOISSEIFF*

TASCHENBUCH FUR BAUINGENIEURE—Herausgegeben von Max Foerster, Geh. Hofrat, ord. Professor an der Technischen Hochschule in Dresden. Second edition. In two parts. Berlin: Julius Springer. Cloth; 5x8 in.; pp. xvi + 2078; 3054 text figures. 20 marks.

To attempt the publication of a new civil-engineering "pocket book" in German after the famous "Hütte" had attained its twentieth edition and was expanding into a third volume was a daring act on the part of Prof. Foerster, as well as on that of his publisher. The new book met, however, the demand so well that the first edition was exhausted in three years and a second and an enlarged one has been published.

This civil engineers' pocket book is in 27 divisions, each representing in a condensed form the established knowledge of the treated subject. It covers the entire field of civil engineering and even contains a very substantial treatise on machinery generally used in connection with civil-engineering work and a short one on the principles of law. This wealth of information is condensed on twenty-one hundred pages and illustrated by more than three thousand figures, forming a book which requires a very substantial pocket to contain it. Like most modern works of its kind, it is a result of the coöperative efforts of more than a dozen specialists. With a few exceptions, the book is a product of the Dresden Polytechnic School and in many ways it displays characteristics distinct from the Berlin center of engineering influence.

Engineers familiar with the works of Prof. Mehrtens, the dean of the Dresden Polytechnic School, will be pleased to learn that four hundred pages have been written by him. Prof. Mehrtens deals with the theory of trusses, graphical statics, strength of materials, and the statics of structures. He also covers the field of steel bridges. It is needless to add that the treatment is lucid and practical.

Prof. Foerster, who is well known by his book on steel buildings and his comprehensive treatise on building materials, has chosen for his subjects the theory of reinforced-concrete construction, building materials, and the structural elements of steel buildings. The important subject of hydraulic engineering, exclusive of water supply and sewerage, is treated by an eminent authority in Prof. [illegible].

Chapters have been added in the new edition on harbor building, on special structures of reinforced concrete, and

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as foundations, bins and reservoirs, and on city planning.

A judicious introduction of numerical examples serves to enhance the usefulness of the book. The book is well gotten up and is a fine example of German efficiency.

Ore Deposits

IRON ORES, Their Occurrence, Valuation and Control—By Edwin C. Eckel, Assoc. M. Am. Soc. C. E. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xvii + 430; 66 illustrations. $4, net.

THE DEPOSITS OF THE USEFUL MINERALS AND ROCKS; Their Origin, Form and Content—By Prof. Dr. F. Beyschlag, Geh. Bergrat, Direktor der Kgl. Geolog. Landesanstalt, Berlin; Prof. J. H. L. Vogt, an der Universität, Kristiania, and Prof. Dr. P. Krusch, Abteilungsdirigent a. d. Kgl. Geolog. Landesanstalt u. Dozent a. d. Kgl. Bergakademie, Berlin. Translated by S. J. Truscott, Associate Royal School of Mines, London. In Three Volumes. Vol. I, Ore-Deposits in General—Magmatic Segregations—Contact-Deposits—Tin Lodes—Quicksilver Lodes. London: Macmillan & Co., Ltd. New York: The Macmillan Co. Cloth; 6x9 in.; pp. xxviii + 514; 291 illustrations. $5, net.

The annual output of iron is of more than twice the value of any other metal produced: so far as tonnage is concerned iron is 19 times as important as all other metals combined. These and many other facts of popular interest are given in the opening chapter on the industrial status of iron. Likewise the whole book is of much more interest than its title indicates, for the author has admirably fulfilled his intention to discuss iron ores "not merely in their geologic and technical relations, but in their more general relations to industrial conditions." Consequently, the book is of value not only to mining engineers but to all engineers.

Part I, on the origin of iron-ore deposits, contains chapters on the geologic and chemical relations of iron; the iron minerals and their relationship; the formation of iron-ore deposits; sedimentary or bedded deposits; replacements and cavity fillings; alteration deposits; igneous iron deposits. Part II is on the valuation of iron-ore properties, containing chapters on the basal factors in ore valuation; prospecting and tonnage determinations; mining conditions and costs; furnace and mill requirements; composition and concentration of iron ores; ore prices, profits and markets; the effect of time on valuation. Part III treats of the iron ores of the world in 11 chapters. Part IV is on the extent and control of iron-ore reserves and contains much information of general interest. The estimated iron-ore reserves of the world are given and the bearing of these estimates upon the probable future development of the iron industry is discussed. This part of the book cannot fail to be of interest to every student of the world's progress and future, and certainly engineers should be in this class.

The second book listed above is the first of three volumes of an apparently very complete and exhaustive treatise on ore deposits of all minerals. The work is done with characteristic German thoroughness and will undoubtedly prove of the greatest value as a reference book to those readers who are unable to read the original German text, which was published in 1909.

GEOLOGICAL AND TOPOGRAPHICAL MAPS, THEIR INTERPRETATION AND USE: A Handbook for the Geologist and Civil Engineer—By Arthur R. Dwerryhouse, Lecturer in Geology in the Queen's University of Belfast. London: Edward Arnold. Cloth; 6x9 in.; pp. 133; 90 text figures. $1.25, net.

While intended primarily for the twofold purpose of those who make maps and of those who interpret maps of topographical and geological features, this little textbook contains as much geology as the average civil engineer stands much in need of. As it is an English textbook, the illustrations and conclusions are based on the British Ordnance Survey, and hence must be modified somewhat to correspond with American practice. The main part of the book is an explanation of the principles of geological formations and their representation on paper. There is also a chapter on methods of conducting a geological reconnaissance.

NEW PUBLICATIONS

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale, and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

AIR, WATER, AND FOOD FROM A SANITARY STANDPOINT—By Alpheus G. Woodman, Associate Professor of Food Analysis, and John F. Norton, Assistant Professor of Chemistry and Sanitation, Massachusetts Institute of Technology. Fourth edition, revised and rewritten. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. 248; illustrated. $2, net.

"AMERICAN EXPORTER'S" EXPORT TRADE DIRECTORY FOR 1915: A Complete List of the Export Commission Houses, Foreign Buyers, Manufacturers' Export Agents, Foreign Exchange Banks and Bankers, Marine Insurance Companies, Export Truckmen, Foreign Freight Forwarders, etc., in All the Principal United States Ports; Also Foreign Consulates in the United States, American Consulates Abroad, etc.—Compiled Under the Supervision of, and with Explanatory Notes to the Various Sections, by B. Olney Hough, Editor "The American Exporter." New York: The Johnston Export Publishing Co., 17 Battery Place. Cloth; 6x9 in.; pp. 369. $3, postage paid.

ANALYSES OF MINE AND CAR SAMPLES OF COAL COLLECTED IN THE FISCAL YEARS 1911 to 1913—By Arno C. Fieldner, Howard I. Smith, Albert H. Fay and Samuel Sanford. Bulletin 85. Washington, D. C.: U. S. Bureau of Mines. Paper; 6x9 in.; pp. 444.

ANNUAL REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY, For 1913—Washington, D. C.: War Department. Cloth; 6x9 in.; pp. 1509; illustrated.

ANNUAL REPORT OF THE DEPARTMENT OF THE INTERIOR OF CANADA (Ottawa, Ont.), For 1913, Part VIII—Annual Report of Water Power Branch for 1912-13. Paper; 7x10 in.; pp. 216; illustrated.

ANNUAL REPORT OF THE ISTHMIAN CANAL COMMISSION AND THE PANAMA CANAL for Fiscal Year Ended June 30, 1914. Washington, D. C.: The Commission. Paper; 6x9 in.; pp. 601; numerous plates, and accompanied by portfolio of maps and diagrams.

An abstract of this report was published in the Nov. 26, 1914, issue of "Engineering News," p. 1093.

ANNUAL REPORT OF THE NEW YORK STATE COMMISSION OF HIGHWAYS, For 1913—Albany, N. Y. Two Volumes. Cloth; 6x9 in.; pp. 602 and 221; illustrated.

ANNUAL REPORT OF THE SOUTH AUSTRALIAN RAILWAYS COMMISSIONER, For 1913-14—Adelaide, The Commissioner. Paper; 8x13 in.; pp. 48; illustrated.

ANNUAL REPORT OF THE U. S. COMMISSIONER OF PATENTS, For 1913—Washington, D. C.: Division of Public Documents. Paper; 7x11 in.; pp. 1095.

ASSAYING IN THEORY AND PRACTICE—By E. A. Wraight, M. Am. Inst. M. E., Late Senior Demonstrator in the Assaying Laboratory of the Royal School of Mines, London. New York: Longmans, Green & Co. London: Edward Arnold. Cloth; 6x9 in.; pp. xi+323; 70 illustrations. $3, net.

AUTOMATIC TELEPHONY: A Comprehensive Treatise on Automatic and Semi-Automatic Systems—By Arthur Bessey Smith, M. Am. Inst. E. E., Formerly Professor of Telephone Engineering, Purdue University, and Wilson Lee Campbell, Fellow, Am. Inst. E. E. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. xii+ 407; 271 illustrations. $4, net.

CANADIAN REPORT OF PROGRESS OF STREAM MEASUREMENTS FOR 1912—Prepared under the Direction of F. H. Peters, Commissioner of Irrigation, by P. M. Sauder, Assoc. M. Can. Soc. C. E., Chief Hydrographer. Ottawa: Department of the Interior. Paper; 7x10 in.; pp. 459; illustrated.

CARRYING OUT THE CITY PLAN: The Practical Application of American Law in the Execution of City Plans—By Flavel Shurtleff, of the Boston Bar, in collaboration with Frederick Law Olmsted, Fellow, American Society of Landscape Architects. New York: Survey Associates, Inc., 105 E. 22d St. Cloth; 6x8 in.; pp. ix+349. $2, postpaid.

CHEMICAL AND BIOLOGICAL SURVEY OF THE WATERS OF ILLINOIS—Report for Year Ending Dec. 31, 1913. Water Survey Series No. 11. Urbana: University of Illinois. Paper; 6x9 in.; pp. 478.

COMPENSATION FOR ACCIDENTS TO EMPLOYEES OF THE [illegible] (Whole Number) 155. Washington, D. C.: U. S. Bureau of Labor Statistics. Paper, [illegible]

A COMPILATION OF THE LAWS OF VARIOUS STATES in [illegible] Tax-status of Municipal Bonds—By the [illegible] & Trust Co., [illegible] Cedar St., New York City. Paper, [illegible]

CONVICT LABOR ON COUNTY ROADS. How Fulton County, [illegible] Has Solved the Convict Labor Problem—By [illegible] C. [illegible], Warren Brothers Co., [illegible] Boston, Mass. Paper, 6x9 in., pp. [illegible]; illustrated.

[illegible] convict labor on Fulton County [illegible] the use of convict labor in other states and the [illegible] of organized labor toward the use of convicts in road work.

ELEMENTS OF FORESTRY—By Frederick Franklin Moon, [illegible] of Forest Engineering, and Nelson Courtlandt Brown, Professor of Forest Utilization, New York State College of Forestry, [illegible]. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth, 6x8 in.; pp. [illegible]; [illegible] illustrations. $2 net.

EXPERIMENTS UPON THE PURIFICATION OF SEWAGE AND WATER at the Lawrence Experiment Station During [illegible]—By H. W. Clark and Stephen DeM. Gage. (Reprinted from the [illegible] Annual Report of the Massachusetts State Board of Health.) Boston: The Board. Paper, 6x9 in.; pp. [illegible]

FAILURE OF IRRIGATION AND LAND SETTLEMENT POLICIES OF THE WESTERN STATES—By D. W. Ross, [illegible] Sacramento Valley Irrigation Co., Willows, Calif. (Address delivered before International Irrigation Congress, Calgary, Alta., October, [illegible].) Paper, 6x9 in.; pp. [illegible]

After reviewing "failures" the author outlines a plan "to [illegible] evils and prevent their recurrence" in the Carey Act States. An irrigation commission is proposed, [illegible] which investigations should be made and irrigation [illegible]. Those receiving land allotments would be [illegible] to pay [illegible] of the estimated cost of reclamation at the time of entering the lands, to make sure that those who receive allotments are prepared to make use of the land. While State Engineer of Idaho, Mr. Ross had intimate experience with the workings of the Carey Act.

FOURTH ANNUAL REPORT ON THE STATISTICS OF EXPRESS COMPANIES IN THE UNITED STATES, For the Year Ended June 30, 1912—Prepared by the Division of Statistics. Washington, D. C.: Interstate Commerce Commission. Paper, [illegible]; pp. [illegible]

GAS POISONING IN MINING AND OTHER INDUSTRIES—By John Glaister, M. D., Professor of Forensic Medicine and Public Health, University of Glasgow, and David Dale Logan, M. D., Surgeon to the Coltness Iron Works, Newmains. New York: William Wood & Co. Cloth, 6x9 in.; pp. [illegible]; [illegible] illustrations, plans and colored plates. [illegible] net.

HANDBUCH DER WASSERBAUES Für Das Studium Und Die Praxis—Von Hubert Engels. In Two Volumes. Leipzig and Berlin: Wilhelm Engelmann. Paper, 8x11 in.; pp. [illegible]; 1617 text illustrations. Paper, 100 Marks; bound (in [illegible]), [illegible] Marks.

THE HUNTER RIVER FLOOD OF MAY, 1913—By H. H. Dare, Chief Engineer for Water Conservation and Irrigation, [illegible], [illegible] St., [illegible], New South Wales. (Read before the Sydney University Engineering Society, Sept. [illegible].) Paper, 6x9 in.; pp. [illegible]; illustrated.

INDUSTRIAL GAS CALORIMETRY—By C. W. Waidner, Physicist, and E. F. Mueller, Assistant Physicist. Washington, D. C.: Bureau of Standards. Technologic Paper 36. Paper, 7x10 in.; pp. [illegible]; illustrated.

[illegible] LIGHTING CONNECTIONS: A Waistcoat-Pocket [illegible] for the [illegible] Engineer and Contractor, the [illegible], the [illegible] and the Student of Wiring [illegible]. With Introductory and Explanatory Notes by [illegible], M. I. E. E., Author of "Alternating [illegible]." Third edition. London, England: A. P. [illegible] & Sons, Ltd. [illegible]. Leather, 3x5 in.; pp. [illegible]; [illegible] text illustrations. [illegible] net.

MATERIALS OF MACHINES—By Albert W. Smith, Director of Sibley College, Cornell University. Second edition, revised. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. [illegible] in.; pp. [illegible]; [illegible] illustrations. [illegible] net.

[illegible] PUBLIC UTILITY RATES [illegible] [illegible] by the Municipal Reference Bureau of the [illegible] [illegible]. Minneapolis: University of Minnesota. Paper, 6x9 in.; pp. [illegible]

[illegible]

[illegible]

[illegible]

PERFORMANCE TESTS OF SUGAR HOUSE HEATING AND EVAPORATING APPARATUS—By E. M. Kerr, Professor of Mechanical Engineering, Assisted by J. F. Gunther and W. A. Ralston. Bulletin 14[illegible]. Agricultural Experiment Station, Baton Rouge, La.: Louisiana State University and A. M. College. Paper, 6x9 in.; pp. 175; illustrated.

PROCEEDINGS OF THE AMERICAN RAILWAY ENGINEERING ASSOCIATION, Vol. XV, Containing Reports of the Meeting held at Chicago, Mar. 17-19, 1914, also papers and discussions. Chicago: E. H. Fritch, Secretary. Cloth, 6x9 in.; pp. [illegible]; illustrated.

PROFILE SURVEYS IN THE BASIN OF CLARK FORK OF COLUMBIA RIVER, Montana-Idaho-Washington—Washington, D. C.: United States Geological Survey. Water-Supply Paper 346. Paper, 6x9 in.; pp. [illegible]; [illegible] folding plates.

PUBLIC HEALTH MANUAL, 1914: Containing the Public Health Law, the Sanitary Code, the Provisions in Other General Laws Relating to Public Health and Rules and Regulations of the New York State Department of Health. Albany, N. Y.: The Department. Paper, 4x7 in.; pp. [illegible]

RAPID EARTHWORK CALCULATION—By C. E. [illegible], Late of the Public Works Department of India. New York and London: Longmans, Green & Co. [illegible] in.; pp. 31; illustrated. [illegible]

REPORT ON BOW RIVER POWER AND STORAGE INVESTIGATIONS, Seasons 1911-12-13—By M. C. Hendry. Ottawa: Superintendent of Dominion Water Power Branch. Water Resources Paper No. 2. Paper, 7x10 in.; pp. [illegible]; illustrated.

REPORT OF COMMISSIONER OF WATER CONSERVATION AND IRRIGATION, NEW SOUTH WALES, 1912-13, and Amalgamated General Balance as at June 30, 1913—By Alfred Borchard. Sydney: The Commissioner. Paper, 8x13 in.; pp. [illegible]; illustrated.

REPORT OF JOINT COMMITTEE ON VALUATION OF OHIO PUBLIC UTILITIES, Under Order No. 176 of the Public Utilities Commission of Ohio, 1914—Cleveland: Andrew P. Martin, Secretary, 620 Illuminating Bldg. Paper, 6x9 in.; pp. 4[illegible]. [illegible]c.

After the orders of the Ohio Public Utilities Commission requiring that inventories and valuations be furnished it, the several state associations of various utilities combined their efforts, through a joint committee, to make a formal statement of principles to be followed. The statement finally agreed upon is fairly brief and follows the method of "reproduction cost new less depreciation." The report defines (1) property used and useful, (2) reproductive cost, (3) period of theoretical production, (4) working capital, (5) unit costs, (6) overhead costs, (7) apportionments, (8) depreciation methods, and (9) depreciation reserves. The report also gives an inventory outline and explains the various items.

REPORT OF THE PUBLIC SERVICE COMMISSION FOR THE FIRST DISTRICT of the State of New York for 1913—Vol. III, Statistics of Gas and Electric Companies. New York: The Commission. Cloth, 6x9 in.; pp. [illegible]

THE SALEM FIRE—By Arthur B. Jones, Ex-Assistant Fire-Chief of Salem, Mass. Boston: The Gorham Press. Cloth, 5x8 in.; pp. 13[illegible]; illustrated. $1.

SOME CONSIDERATIONS REGARDING CAST IRON AND STEEL PIPES—By John Sharp, M. I. Mech. E., Author of "Modern Foundry Practice." New York and London: Longmans, Green & Co. Cloth, 6x9 in.; pp. [illegible]; 21 illustrations. $1.50, net.

STANDARD SPECIFICATIONS FOR CAST IRON PIPE AND SPECIAL CASTINGS. Adopted October, 1911, and October, 1913, by the American Gas Institute. Office of Secretary, [illegible] West 39th St., New York City. Paper, 6x9 in.; pp. [illegible]; illustrated. [illegible]

STRUCTURAL DESIGN, Vol. II: Design of Simple Structures—By Horace R. Thayer, Assistant Professor of Structural Design, Carnegie Institute of Technology. New York: D. Van Nostrand Co. Cloth, 6x9 in.; pp. [illegible]; [illegible] illustrations. $4 net.

THE SUCCESSFUL HANDLING OF THE SMALL CONSUMER IN [illegible]—By S. E. [illegible], Chief Engineer. Bulletin 21, Engineering Department. (Reprinted from the Proceedings of the National Electric Light Association.) Cleveland, Ohio (Nela Park): National Lamp Works of the General Electric Co. Paper, 6x9 in.; pp. 75; illustrated.

TAXATION AND REVENUE SYSTEMS of State and Local Governments: A Digest of Constitutional and Statutory Provisions Relating to Taxation in the Different States in 1912. Washington, D. C.: U. S. Bureau of the Census. Paper, 9x11 in.; pp. [illegible]

THIRTY-FIFTH ANNUAL REPORT OF THE DIRECTOR OF THE U. S. GEOLOGICAL SURVEY For the Fiscal Year Ended June 30, 1914. Washington, D. C.: The Survey. Paper, 6x9 in.; pp. 163; illustrated.

TWENTY-FIFTH ANNUAL REPORT ON THE STATISTICS OF RAILWAYS IN THE UNITED STATES For the Year Ended June 30, 1912—Prepared by the Division of Statistics. Washington, D. C.: Interstate Commerce Commission.

THE WATER RESOURCES OF [illegible], MONT.—By O. E. Meinzer. Water-Supply Paper [illegible]. Washington, D. C.: U. S. Geological Survey. Paper, 6x9 in.; pp. [illegible]; illustrated.

WATER RESOURCES OF [illegible]—By A. H. Horton, Hydraulic Engineer, U. S. Geological Survey. With [illegible] [illegible] Illinois Rivers and Lakes Commission, [illegible] First National Bank Bldg. Cloth, 6x9 in.; pp. [illegible]; illustrated.

WATER SUPPLIES: Their Purification, Filtration and Sterilization. A Handbook for the Use of Local and Municipal [illegible]—By Samuel Rideal, Public Analyst [illegible] [illegible] and [illegible] K. [illegible]. New York: D. Appleton & Co. Cloth, [illegible] in.; pp. [illegible]; [illegible] text illustrations, [illegible] plates. [illegible] net.

Preliminary Report on Emscher Tanks and Kindred Sewage-Clarification Processes*

By Prof. Dr. K. Thumm and Prof. Dr. Eng. C. Reichle†

(1) The Formation of Acid Sludge in the Sludge-Digesting Chamber

As is well known, good Emscher tank sludge has a deep black color given to it by ferrous sulphide, and will naturally react alkaline, as it is impossible for ferrous sulphide to exist with free organic acids, as occur in sludge. It has a peculiar, not disagreeable, odor, somewhat like sealing wax, and is easily drained. The water contained in this sludge, which can be easily filtered off through filter paper, is more or less clear and colorless, does not smell putrid, contains ammonia and free carbonic acid, and reacts alkaline, as all normal, clarified or raw sewage does.

But occasionally the sludge from Emscher and similar clarification plants is of an altogether different quality, especially if it has been left in the sludge chamber for a few months. It is not black, but yellow, like milk-feces, grayish yellow or gray, has an evil smell, is very difficult to drain, has a distinct acid reaction, containing none or very little ferrous sulphide. The water contained in such a sludge has some ammonia, but has, like the sludge, a more or less but always distinct acid reaction, and finally the water as well as the sludge in the whole chamber will show this acid reaction.

Emscher tank sludge drawn from tanks that are in the process of ripening has, like the above described acid sludge, a gray to gray-black color, but the reaction of this sludge and the water in it is alkaline. The water is easily filtered off, the nearer ripe the tank is the easier the sludge can be drained.

With the preponderance of carbon hydrates and a small amount of nitrogen combinations, such as ammonia and other bases, acid sludge must be expected with every method of separate sludge digestion, and later on, as the acid reaction progresses, also acid water. A preponderance of nitrogen combinations or other acid-neutralizing matter assures the formation of alkaline sludge and alkaline water in the sludge-digesting chamber. From sludge and water, which have only small acid-neutralizing ability, an acid sludge is to be expected. Great acid-neutralizing ability will guarantee good Emscher tank sludge having an alkaline reaction.

We have already pointed out the necessity of the right mixture of sludge and sewage to obtain a good sludge, in a report which we made in 1908, on our West End test plant with a modified Emscher tank, a so called Kremer-Imhoff tank. The agitator, mentioned in this report, was ready for operation in the summer of 1909. In the meantime, numerous troubles occurred, bad sludge, spitting and frothing and the formation of scum. The installation of the agitator and its daily use brought an alkaline and better sludge. We tried to overcome the frothing and the scum formation by a timely withdrawal of sludge, but in spite of this sometimes the whole contents of the sludge-digesting chamber threatened to boil over. After long consideration, it was decided to drain off the water in the sludge-digesting chamber. This was done in December, 1910. The sludge-digesting chamber was refilled from the top with clean water from the municipal water system and the sedimentation chamber refilled with sewage; the usual operation was then resumed. A week later we had for the first time a fully satisfactory typical Emscher tank sludge and it continued to be of the same good quality until the plant was discontinued during the summer of 1913. The operation of the sludge-digesting chamber, to which no more clean water was added, was as follows:

The agitator was run for a short time every day. On every Saturday, an exact predetermined amount of sludge was withdrawn from the sludge-digesting chamber. Care was taken that after the withdrawal of the sludge, the proportion of sludge and water in the sludge-digesting chamber remained in the ratio of 1 : 2. Frothing and the formation of injurious scum did not occur again.

The principal conditions which lead to the formation of good sludge are, in our opinion, quite clear. The proportion between water and sludge and between acid-neutralizing agents and sludge must be right; the mixing of the parts, by agitators, if necessary, must be thorough, if the plants are expected to ripen and the formation of acid sludge is to be avoided. Regular withdrawal of sludge, of proper amounts, will assure good operating results. The sludge-drying beds should be so arranged and partitioned that the sludge can be easily measured. The operation should include frequent tests as to the reaction of the sludge and the supernatant water. It should be taken into consideration that not only organic acids, but also carbon dioxide, mineral acids and sometimes acid salts, are able to cause an acid reaction.

(2) The Formation of a Scum and the So Called Frothing or Spitting of a Sludge-Digestion Tank

The causes and the detrimental influence of the following phenomena have to be judged differently, depending on whether the sludge considered is already ripe or still in the ripening period. The difficulties on account of the formation of a heavy scum cover are greatest in the latter case.

A skin of microörganisms and particles of fat are formed on an ordinary covered septic tank, rising sludge sticks to this, and the cover gradually increases in thickness. With purely domestic sewage only a floating cover is formed, with practically no layers in suspension. If storm water only is handled, suspended layers only are found.

Sludge in the digestion chamber of Emscher tanks and kindred installations is originally settled sludge from the sedimentation chamber. Sludge that forms the sludge cover obtained its floating properties only in the digestion chamber, a property due to its entrained gases of decomposition. The rising to the surface, and remaining there, of single sludge particles or whole sludge cakes, is doubtless dependent on the composition of the raw sludge in the sludge chamber and the intensity of the gas formation (proportional to the unit area of chamber). Fresh sludge will act differently than putrifying sludge, the latter causing less floating scum.

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*From Communications of the Royal National Institute for Water Hygiene in Berlin-Dahlen, Vol. 18, 1914, Art. 3. Here condensed from a translation made for the Sanitation Corporation, 50 Church St., New York City, which will publish the full paper as a pamphlet.

†Division Superintendents of the Royal National Institute for Water Hygiene, Berlin, Germany.

FIG. 2. REFUSE WAGON TRUCK WITH CANS WHICH CAN BE LIFTED OUT AND DUMPED

almost wholly used in New York City for ashes and street refuse, and frequently for garbage.

Fig. 4 shows a pick-up can for street sweepings, made by the Ferrer Manufacturing Co., Saratoga Springs, N. Y. The hood-shaped funnel scrapes the pavement and refuse is swept into it. It is then lifted by a double lever

FIG. 3. DUMP CART FOR REFUSE COLLECTION RECENTLY INTRODUCED IN NEW YORK

to dump into the can, making a vast improvement over the old-style hand shovel, still used by sweepers in most cities to pick up street refuse.

FIG. 4. PICK-UP CAN MADE BY THE FERRER MANUFACTURING CO., NEW YORK CITY

A Railway Mail-Transfer System for collecting and dropping mail bags from trains has been adopted for the Chicago and St. Louis line of the Chicago & Alton R.R. At each mail exchange station there will be a shallow concrete trough about [illegible] ft. long, with [illegible] and above [illegible] track [illegible] the [illegible] from the track. This is to receive the bags dropped from the mail cars. Above it is a platform carrying the mail cranes to which are attached the bags to be picked up by the trains. The crane [illegible] horizontal arms, attached to the top and bottom of the bag. There is a crane for each bag [illegible] can be taken by one train.

A special feature of the system is that the [illegible] the [illegible] is operated from the [illegible] the axle [illegible] into gear by means of a track trip so that it is independent of the attention of the mail clerks. [illegible] the trough [illegible] to the [illegible] for collecting the bags and also [illegible] the chute containing the bags [illegible]. The chute [illegible] vertical position [illegible] the trough so that the bags [illegible] might drop are caught by the trough.

When the crane [illegible] comes to a [illegible] automatically. When the [illegible] is arranged [illegible] stand clear. A lever in the [illegible] position [illegible] independent [illegible] of a system [illegible] existing mail [illegible] enable the [illegible] to be operated [illegible]. The apparatus is made by the [illegible] Mail [illegible] Co. of Chicago.

the sanitary officer. As before stated, sewage from the mechanics' quarters discharges into a septic tank. The upper town discharges its sewage into a septic tank with filter beds.

Amusements

Realizing that a contented employee renders more efficient service, the question of amusements has received considerable attention in this camp. There is a paid Y. M. C. A. secretary, who devotes a large part of his time to the creation of amusements. A high-class amateur orchestra gives frequent free concerts; baseball teams have been organized; frequent dances are given at both camps; tennis courts and croquet grounds are maintained; a boy-scout class gives diversion to the boys who have in ordinary camp life little to amuse them; each camp has a pool table, and a reading room. Also, as before mentioned, there is the moving-picture theater and the ice-cream parlor. Secret orders have built lodge halls.

Conclusions

Three years of experience in this camp has led the writer to the following conclusions:

That anything tending to create a better moral or sanitary environment increases the efficiency and output of the employee.

That the price of good sanitation is an eternal fight—a continuous campaign.

That good sanitation, even though expensive, pays a good return—besides it is humanitarian.

That perfect disposal of camp wastes will produce the millennium in camp life—a flyless camp.

That liquors are not only useless and undesirable in camps, but a real detriment from every point of view.

That examination as to physical fitness is not only practicable, but advisable.

That under average conditions private stables should not be maintained, and that there must be an eternal fight for cleanliness.

An Exhibit of Modern Street-Cleaning Apparatus: Refuse Collection

Supplementing the article and illustrations in Engineering News of Dec. 3, pp. 1139-1143, describing the exhibit of street-cleaning apparatus held in New York City, Nov. 23-29, under the auspices of the New York Street Cleaning Department, of which John T. Fetherston is Chief, we present herewith some illustrations and brief descriptions of special apparatus for refuse collection.

Figs. 1 and 2 show two styles of dust- and odor-proof wagons for refuse collection, such as have been used in German cities for at least ten years. They are made by Anton Fügert, Karlsbad-Fisshern, and were exhibited by H. Kastor, New York City, American agent. In the wagon, Fig. 1, the refuse is dumped into the rectangular cans hung on the sides, which are hinged to the wagon body, so that in lifting the cans up the covers of the cans and those of the wagon body open simultaneously and the material is handled without exposure to the air. The wagon itself has a bottom-dumping arrangement. Fig. 2 shows a truck with steel cans which are designed to be lifted off and dumped into a refuse destroyer.

Fig. 3 shows a type of odorless, dustless dump cart with can-dumping device similar to that used in the wagon shown in Fig. 1. This was exhibited by the City Street Cleaning Department and was made by Charles Putzel, of New York City. Other forms of dustless wagons had canvas tops. Obviously, any and all of them are great improvements over the open dump cart, which is now

Fig. 1. Ash and Refuse Collection Wagon of the Dustless, Odorless Type Used in Europe

well as the health feature may be mentioned here. There has been a determined effort in this camp on the part of the construction engineer to limit to the very minimum the importation of liquors. The effort has yielded a fine return. There is practically no drinking, and a drunken man is so rare an exception as to occasion great surprise. It is generally known throughout the camp that drunkenness or intemperate drinking will result in the dismissal of an employee. Early in the work it was stated that such strict rules would handicap the Service in securing workmen. It seems to have had the opposite effect.

Sanitary Department

The question of sanitation at Elephant Butte has naturally resolved itself largely into a relentless war upon the fly, and the efficient removal of stable, human, and kitchen wastes. In this camp a stable owner is required to keep his corral well cleaned, failure resulting in the

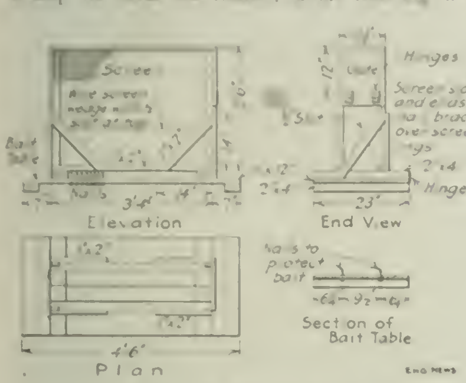

Fig. 5. Fly-Trap Details

work being done for him at his expense. The second offense cancels his permit to keep horses.

The matter of abolishing all private corrals in this camp is under advisement. Should this be done, persons who still desire to keep horses will be required to stable same in the government corral, for which a maintenance charge will be made. Hesitation along this line arises chiefly from the fear that such drastic action might affect the labor question, on account of the fact that a great many of the laborers are from the villages and ranches at a considerable distance, and come to camp in wagons.

However, it is believed that this course would effectually do away with the fly nuisance. It is noted that fly traps at the government corral catch but few flies, the reason being that the wastes are carted off every morning and there are no breeding places. It is also to be noted that at the upper camp, where there are no corrals, flies are so scarce that screens are almost unnecessary.

Fly traps are placed here and there about the camp, and in this way millions of flies are caught. These traps are put in place at the very earliest moment of spring, when flies begin to breed. Fig. 5 shows a trap of great fly-catching capacity. It is believed that the ceiling of these traps should be painted white and the floors of a dark color, carrying out a little further the idea that the fly after feeding on the bait will have just so much more light above to aid in his extinguishing, and after feeding he moves to the point of greatest light.

Garbage Disposal—The disposal of garbage and general camp wastes in a camp composed largely of foreigners by hand forces, becomes a rather simple matter, but where a camp assumes the nature of a small city of 2500 people, chiefly foreign, where you have all the problems of village sanitation except that enforcement, you have then confronting you a complex problem.

Some 150 garbage cans are stationed about the camp, requiring 425 barrels. All camp refuse, except a part of the kitchen garbage, is dumped into these receptacles and carted to a specific dumping yard, at which point it is burned. All such wastes are removed by a man who is paid a small salary, but who depends chiefly for his income upon the food value of the slops, which he removes to a remote point and feeds to hogs.

It is believed that the garbage cans mentioned are a very small source of fly breeding, for two reasons: First, the frequent removal; and second, that practically all cans are used in the disposal of a great amount of wood ashes. Just how to keep flies off garbage cans is as yet a problem. If each family had an individual can, responsibility could be placed and the solution would be easy, but since garbage cans are community affairs, no one family can be held accountable.

Night-Soil Disposal—The location of the greater part of this camp is such that a complete sewer system with septic tanks and filter beds is impracticable, although desirable. The only disposal practicable is by means of the ordinary privy vault. This has necessitated the building of many privies.

At first these were built on ordinary lines with screened gables and screened doors, and self-closing lids. The latest privy design has such a seat that fouling, ordinarily a source of much trouble, is impossible. A solid door, hung inside, now replaces the screen door, which, when closed, keeps the vault fairly dark, so that flies attracted by odors are found near the roof about the screens.

Such a disposal of night soil is admittedly far from ideal, but it seems the most practical method under existing conditions. Privy vaults are treated frequently with chloride of lime. If ground water rises in them, the surface is floated over with crude oil. If particularly malodorous, crude carbolic acid is used.

Inspection—The camp is policed daily by a sanitary officer, who is responsible to the camp physician. This inspector's duties include attention to drainage, the treatment of stagnant pools with crude oil, the destruction of causes of malodors, attention to closets, the spraying of bunk houses with a 10% solution of carbolic acid and Vermicide, twice monthly.

Where fumigation is impracticable, and such is the case where construction is being pushed with three shifts, the use of Vermicide is very effective in clearing a structure from insects, especially bed bugs. In one of the bunk houses the sprinkling of formalin upon the floor has been used apparently to a good advantage in driving away insects of various kinds, and as a deodorant.

Sewerage and Drainage—The camp, as will be seen by the map, is well drained, except a part of the residence section of the lower town, which is so flat and of such extent that sewerage is impracticable. For this part of the camp a system of open drain ditches for surface water is provided, which receive careful attention from

the same style, with double-decked cots, accommodating eight to each tent, are provided for Mexican laborers.

Besides these tent-style bunk houses there are three houses of frame construction, each accommodating 64 men in double-decked cots. These buildings are provided with good ventilation by means of swinging, side-hinged windows between each tier of beds, and by louvers. All permanent bunk houses are screened and provided with electric lights, water and shower baths.

In the American quarter there are three bath houses, 12x16 ft., accommodating the families of this part of the camp. They are equipped with a hot-water heating apparatus, two showers and one tub.

The Reclamation Service has built 26 tent houses and cottages for rental purposes, none of which is ever without occupants. The moving-picture theater and the ice-cream parlor are operated by the Service, and are built solely for the entertainment of the camp. Sufficient revenue only to meet expenses is expected.

Hospital Department

As will be seen from the map, the hospital is somewhat isolated, though conveniently situated near the center of construction activities. The building (see Fig. 4) is of pebble-dashed adobe, well finished and equipped. For the

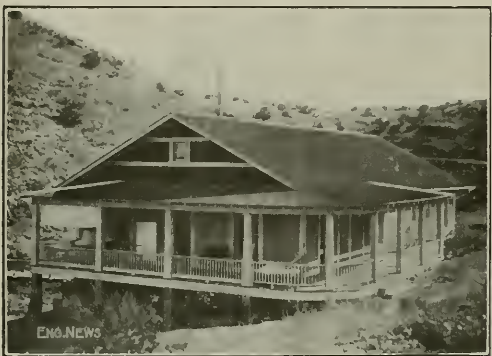

Fig. 4. Hospital Building, Elephant Butte Camp

care of the sick and injured, there are two private rooms and a ward. (A well regulated field hospital should have two or three private rooms on account of the absolute necessity of isolation in many cases.) Beds are furnished for twelve, but more can be accommodated.

The arrangement of the building is such that the reception room can be utilized as a second ward, as has been necessary a number of times on this work. The dining room, kitchen and steam-heating apparatus are in the basement. The operating room is well equipped and splendidly lighted. The dispensary is well filled with such medicines and supplies as are required, besides a few drug sundries, the latter articles, however, being handled chiefly by the commissary.

Besides the physician and nurse, the force includes an orderly and a housekeeper (cook). A contract is also in force with a consulting surgeon, who makes visits on request, assisting in any manner of operation at one specific price.

Stretchers and crutches are stationed at convenient points about the work, as are also small first-aid emergency kits, containing peroxide, cotton and bandages. If the case is one in which actual hospital confinement promises a salutary effect in reducing the days incapacitated to a minimum, the patient is required to remain. Otherwise, he may go home, reporting as ordered for treatment. However, to get credit for meals he must take same at the hospital. If incapacity from injury extends to or beyond 15 days, claim is made for compensation, as provided under the Congressional law.

Immediate report of injury is made on specific blanks, giving name, age, kind of work, salary, character of injury, witnesses and circumstances attending the inquiry. A duplicate of this report is retained. An employee laying off on account of sickness or injury must have an order from the physician before he will be allowed to return to duty.

The physician makes to the engineer, ten-day, monthly and yearly reports, covering the health of the camp, sanitation, number and ratio of days lost on account of injury and sickness, and points of interest in the general management of his department. Drugs and hospital supplies are purchased in large quantities. Duplicates of all orders, invoices and reports are kept on file.

A compulsory deduction of $1 per month is made from each pay check, which entitles the employee to all reasonable dispensary or hospital service. It is found that there is practically no disposition to abuse the privilege. At this time the hospital fund is showing a balance in its favor.

Preventive Measures—The business of the camp physician is not so much to treat the sick as it is to create conditions which will keep sickness at its lowest ebb. To this end, for instance, with the first suspicion of a disease from which there may be possible dissemination, precautions are taken at once without waiting for a positive diagnosis. If the suspected disease is one from which contagion may occur from human wastes, a flyproof receptacle, usually a garbage can, is placed conveniently near, into which all body wastes are thrown, where they receive special treatment before being carted away.

Typhoid prophylaxis through vaccination has been introduced. It may be of interest to note that not an employee has lost a shift from its effect.

Each applicant for work is given an employment slip, which must be O.K.'d by the physician before his name can appear upon the time book. Applicant's age and conjugal condition are taken, and a record made of the notification address, to be used in event of serious sickness or injury.

Physical examination, as practiced here, is more in the nature of an inspection. Gait is noted, eyes, tongue and skin inspected, and examination made for rupture and heart disease. If such examination suggests unfitness, a more thorough one is made. Special attention is given to employees requiring special standards.

It has been urged that contractors would be handicapped in securing labor if insistence was made upon examination as to physical fitness. To disprove this it may be stated that since this system was installed, a little over two years ago, only three out of a total of over 3000 applicants have refused to be examined. There have been as many as 347 examined in one month without any objection whatever. A very few make a mild protest, but a little tact overcomes this.

A matter having bearing both upon the economic as

Fig. 2. Upper Town, Elephant Butte Construction Camp

has 32 rooms accommodating 66 men. A small wing of this building, 16×36 ft., is equipped with 12 shower baths, the usual urinals and lavatories, discharging into a septic tank. This building is equipped with steam heat and electric lights.

The bunk houses in the American quarter are of the tent-house style, 14×16 ft., well screened, and particularly well adapted to the climatic conditions, so far as the comfort of the men is concerned, but ill advised from the economic point of view on account of much necessary repair from time to time. These tents accommodate from two to eight, according to the necessity. Four bunk houses of

Fig. 3. Lower Town, Elephant Butte Construction Camp

Construction Camp, Elephant Butte, N. M.

By J. Dale Graham*

SYNOPSIS—Description of the construction camp of the United States Reclamation Service at the Elephant Butte dam; hospital department; preventive measures, which include the physical examination of every employee, vaccination against typhoid fever; sanitary features of camp; garbage and night soil disposal and fly prevention.

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The Elephant Butte camp, New Mexico, is composed of 3000 inhabitants, 1200 of whom are employees of the Reclamation Service. The camp is fortunate in being considerably removed from any large city, thereby greatly limiting the danger of contagion through carriers. There are, however, some nearby small villages which have menaced the usual good health of this camp. Experience has shown the value of extending to these villages and towns some manner of inspection (however unauthoritative).

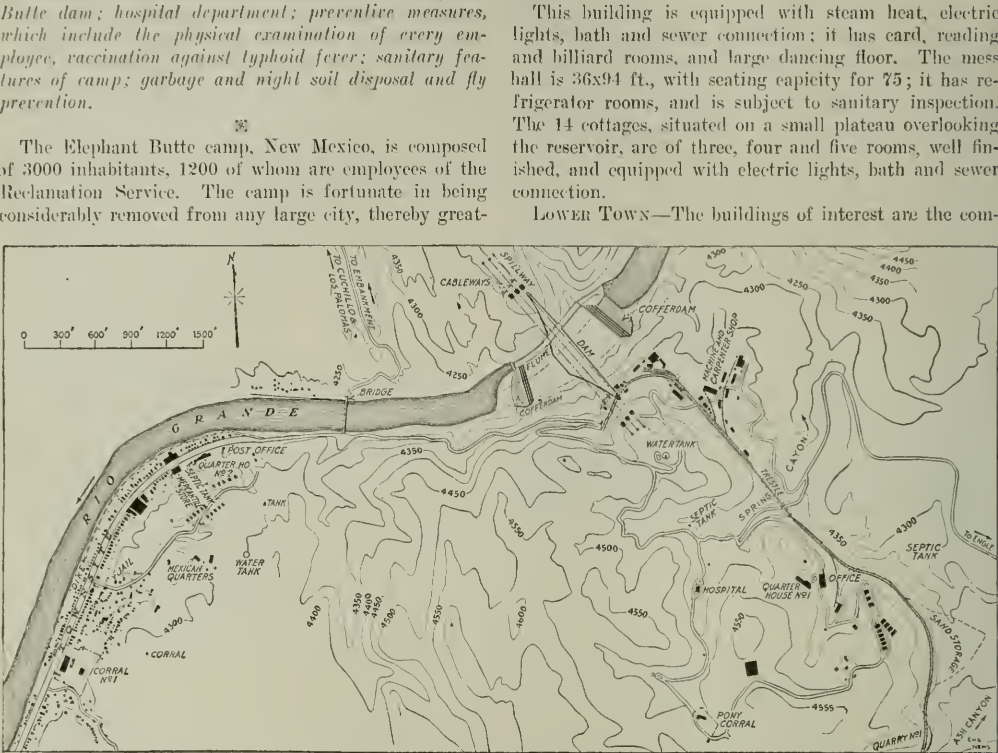


Fig. 1. Map of the Elephant Butte Construction Camp and Surroundings, New Mexico

Description of Camp

Geographically the camp is divided into an "upper town," where the engineering and office force lives, and a "lower town," for the foreman, mechanics and laborers, the latter town being further divided into an American and a Mexican quarter (see map, Fig. 1).

Upper Town—The buildings of interest are the main office, quarterhouse, mess hall, chemical laboratory and cottages, all of pebble-dashed adobe construction (Fig. 2). The main office, 36x110 ft., is the center of all executive work. The quarterhouse, 34x145 ft., two stories, has accommodations for about 50 persons, and is a stopping place for transients, though in no wise considered a hotel.

This building is equipped with steam heat, electric lights, bath and sewer connection; it has card, reading and billiard rooms, and large dancing floor. The mess hall is 36x94 ft., with seating capicity for 75; it has refrigerator rooms, and is subject to sanitary inspection. The 14 cottages, situated on a small plateau overlooking the reservoir, are of three, four and five rooms, well finished, and equipped with electric lights, bath and sewer connection.

Lower Town—The buildings of interest are the commissary, mess, mechanics' quarters, bunk houses, moving-picture theater, churches, school houses, accommodating 420 pupils, and a large number of cottages, government and private (Fig. 3).

The mess hall is 42x126 ft., with seating capacity of 200; it is doubly screened at entry ways, has good ventilation by means of fans and louvers, and is subject to inspection. A hall, 65x42 ft., is a part of this building, and originally was intended as a dining room, but is now used for a Y. M. C. A. headquarters.

The commissary, 57x77 ft., is under government management, and is the only store. It supplies the general mercantile needs of the people at reasonable prices. Vegetables and fruits are kept in season. The meat market, a part of this building, is well screened, and subject to rigid inspection. The ice house and cold storage are also under the same roof. The fact that it requires ten men to do the work connected with the commissary gives some idea of the large volume of business.

The mechanics' quarters, 26x150 ft., 2 stories high,

*Camp Physician, Elephant Butte, N. M.

Widening a Business Street at St. Paul, Minn.

A municipal improvement of an unusual character which is now being carried out in St. Paul, Minn., is the widening of a street through the business part of the city. Robert St. extends north from one of the Mississippi River bridges, and lies in the retail shopping district. It has a heavy team traffic, and is occupied by a double-track street railway for six blocks. The width was only 58 ft., so that traffic was badly congested, and in March, 1912, the City Council passed an order for widening it to 78 ft. from 2nd St. (at the end of the bridge) to Central Ave., a distance of 4227 ft., or about 15 city blocks. Central Ave. is a mall or boulevard 132 ft. wide, which runs in front of the State capitol and will become a part of the general approach scheme.

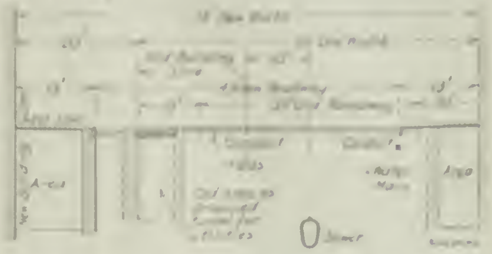
The work is in progress now on the first six blocks, to 8th St., beyond which the street is built up largely with dwelling houses and small stores. The accompanying cross-section shows the general arrangement. It will be noted that it is proposed to cover the old sidewalk-area space with a concrete roof and utilize this as a tunnel for public utilities. This is conditioned upon the public-utility corporations agreeing to use the space, which it seems they will not do.

The widening is done entirely along the west side. Fortunately all the buildings were old, from three to six stories high, and mainly of brick construction with wood floor framing and with light interior iron columns in the stores, etc. The only new building affected had been designed with a view to this change, and had a steel frame at 20 ft. back from the old street front to allow for removal of the outer panel. Under these conditions, it was practicable to cut off 20 ft. from each building and put in a new front of modern type, thus greatly improving the general appearance of the property. Eventually, much of this property will be replaced with larger modern buildings. A 16-story frame building now being built at 4th St. replaces a six-story brick building and its construction was delayed until the widening of Robert St. was undertaken.

All alterations were required to be approved by the Building Department. In the residential blocks, part of the widening will simply take gardens and open ground, some of the buildings may be altered and others may be moved back to clear the new street line.

The total estimated cost of widening the street is $887,000. This includes cutting off 20 ft. from the buildings and replacing a new front, also the value of the 20 ft., the repaving of the street, moving sidewalks, lamps, etc., and consequential damages. Of this amount, $592,000 was assessed back against the property on the west side of the street as benefits, and a bond issue was made to take care of the balance. The assessments were spread 150 ft. each way from the old street lines. The benefits assessed amounted to as high as $700 per front foot between 4th and 5th Sts. The property on both sides was assessed, although that on the east side incurred no expense for alterations.

The property owners in general accepted the conditions in view of the eventual benefits. About 13 appeals were made from the assessment. Only ten of these went into court and six of them have been settled, the city winning three and losing three cases. One of the interesting features in connection with the assessment was that the Merchants' Bank, a [illegible]-story brick building, was allowed $[illegible] damages for moving the front back 20 ft., notwithstanding that the owners were already planning, before the Robert St. widening was completed, to tear down the old building and put up a new [illegible]-story building. The assessments are payable in five annual installments with interest at 6%. The bonds are taken up as the assessments are paid. Damages were paid in several instances to tenants for injuries to business, but these damages were but few.



THE WIDENING OF ROBERT ST. AT ST. PAUL, MINN.

The work was planned under the direction of Oscar Claussen, Commissioner of Public Works.

It is of interest to note that in 1912 a proposition to widen this and other narrow streets in the business district by forming arcades (or sidewalks) along the street fronts of the buildings, was made by Geo. H. Herrold, Assistant City Engineer. The store fronts would be moved back about 15 ft., the supporting columns under the front wall being replaced (where practicable) by columns of uniform design and spacing, so as to give an improved architectural effect. The roadway would then extend the full width between building lines. It was suggested that such arcades or covered walks would be beneficial to the public and the stores, and would not affect the buildings (except at the street level).

Enforcement of Ordinances by Public Officials—The Appellate Court of Illinois, in a recent decision, declared that a public officer in enforcing an ordinance must act as the ordinance provides and has not discretionary powers. A theater building was under construction which embodied violations of the city ordinances, and the work was stopped on this account, but the permit was not revoked by the Commissioner of Buildings, and work was afterwards permitted to be resumed. Suit was brought to compel the Building Commissioner to revoke the permit, to stop the work, and not to issue a new permit until changes had been made to comply with the ordinances. The Circuit Court awarded a writ of mandamus to this effect, but instead of complying with this, the matter was taken to the Appellate Court, which has affirmed the action of the lower court. In the light of this decision, municipal officers are not free to decide for themselves whether or not to follow the duties explicitly prescribed for them by the ordinances. The decision says:

Under the provisions of the ordinances set out in the petition, there is, in our opinion, no liberty or power of discretion conferred upon the Commissioner of Buildings upon his own judgment as to what action is just and proper under the facts and circumstances presented by the petition. The ordinances clearly direct him as to his course of action. Section [illegible] says: "If the work [illegible] in violation of [illegible] this chapter, it shall be the duty of the commissioner to revoke the permit." Another section provides that whenever it shall be found that a structure is being built in violation of any of the provisions of this chapter the Commissioner of Buildings shall [illegible] notify the owners," etc. "If at the expiration of the time specified in the notice the person so notified shall have refused, neglected or failed to comply with the [illegible] order in such notice, it shall be the duty of the commissioner to proceed forthwith to tear down or cause to be torn down such structure." These provisions are mandatory and specific, and leave no room open for the exercise of personal judgment. They command ministerial acts to be done by the commissioner.

It will be noted from Fig. 86 that the arches curve both ways, giving somewhat the effect of a dome. The central third of each arch extending right across the structure, together with a part of the two side parapet walls, was first poured, then when that had set, the two sides between the central third and the cross-girders were poured together. The forms are left in place 28 days and it is expected to use each set of forms three or four times.

For pouring the arches, hoppers are erected above them into which the buckets (Fig. 88), lifted off the cars by the cranes, are dumped (Fig. 89). The concrete is then distributed from the hopper by short chutes as required. For the central section one hopper is used, for the end sections two hoppers, one for each; the central section is placed without top forms, but these latter are required for the steeper slopes of the two end sections.

It is proposed to hammer-finish all exposed concrete faces, using a patent-hammer for all plain surfaces and a bush-hammer for recessed panels. The ends of the cross-girders on top of the columns and the longitudinal panels of the parapet walls are to be faced with colored ornamental tiling.

This is the last of the 12 articles on the "New York Rapid Transit Railway Extensions." The respective titles and dates are as follows:

I.—"History and Extent," Oct. 1.
II.—"Organization and Personnel of the Engineering Staff," Oct. 8.
III.—"General Arrangements for Construction," Oct. 15.
IV.—"Design of Structure and Track," Oct. 29.
V.—"Ventilation, Drainage and Waterproofing," Nov. 5.
VI.—"Sewers, Pipes and Conduits," Nov. 12.
VII.—"Methods of Timbering to Support the Street Surface on New York Subway Construction," Nov. 26.
VIII.—"Excavation," Dec. 3.
IX.—"Underpinning Buildings along the Line," Dec. 10.
X.—"Tunnels in City Streets," Dec. 17.
XI.—"The River Tunnels," Dec. 24.
XII.—"Concrete Work," Dec. 31.

Ocean Storms at Seabright, N. J.

That Seabright, N. J., is at the mercy of northeast storms is evidenced by the accompanying views of the damage wrought on Dec. 5-6. The force of the water and the weak resistance offered by the puny shore bulkheads provided are plainly shown.

About a year ago two other ocean storms, also accompanied by record tides, all but obliterated the Seabright beach and damage to abutting property amounted to $600,000. At that time Engineering News made an investigation of the conditions at Seabright, and published the findings in the issue of Jan. 8, 1914, p. 102. Practically the same lack of protection exists there today.

A conference was held at Trenton, N. J., on Dec. 16, to devise means for protecting the state seaboard. It was attended by delegates from most of the shore towns.

Fig. 2. Damage Caused by Lack of Adequate Groin Protection
(Note typical bulkhead at right, with waves dashing over it.)

Fig. 1. Proximity of Cottages to Deep Water
(A flimsy groin in foreground; shore bulkhead gone at right; waves pounding shore-property bulkheads.)

was expected to be almost as rapid as any operation; this method should have advantages if successful, as it would avoid lifting the cars or buckets to reach a platform and the concrete dropping into the forms.

As many as 40 batches (30 yd.) have been placed in one hour but the average for an 8-hr. shift is just over 60 to 70 yd., due to delays for shifting forms, shifting the pipe, etc. The work is being prosecuted continuously day and night, three 8-hr. shifts being worked. The average amount of concrete placed is from 165 to 190 yd. per day of 24 hours.

The discharge pipe is 8 in. diameter, flanged and bolted, made of a very mild but tough steel, which is expected to have a life estimated by a capacity of about 4000 cu.yd. passing through it. The present pipe, however, which has been used for the discharge of almost 2000 cu.yd., is beginning to show some signs of wear. This was particularly noticeable at the bottom of the perpendicular drop, and a new bend made of extra-heavy cast-iron segments, bolted together to make a curve of about 5-ft. radius, was installed and seems to work satisfactorily.

Reinforced-Concrete Elevated Railway.

A part of the elevated structure to be built between the Queensboro Bridge Plaza in Long Island City and Corona, is of reinforced concrete. This section, which is 1951 ft. in length, is that which traverses Queens Boulevard, a parkway 200 ft. in width and one of the main arteries of travel from New York City and the Long Island. It was desired to make this an ornamental structure, and the drawing reproduced in the first of this series of articles (Fig. 81) gives an idea of the appearance of the completed structure.

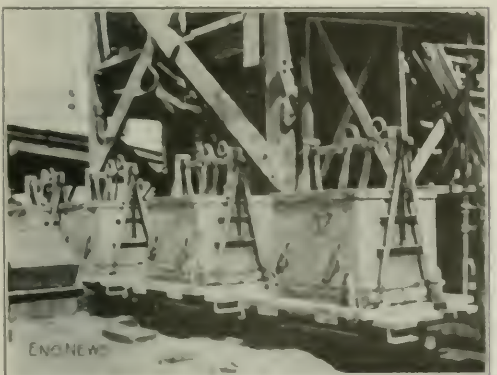


Fig. 88. Concrete Buckets about to Be Loaded

The views in Fig. 85 show the construction of the column foundations, the columns and the abutment at the New York end. A longitudinal section on the center line of the structure through the end abutment, is shown in Fig. 87, and longitudinal and cross-sections of the main viaduct arches and piers in Fig. 86. The type of stations, of which there are three in this reinforced-concrete section, is shown in the perspective drawing already referred to and the details, and particularly the overhang for the platforms, in Fig. 87.

As will be seen by the photographs, the columns were first built up to a point slightly above the springing line of the arches; then the heavy cross-girders at each pier were placed in position, after which the arches and parapet walls were poured.

A central mixing plant for the concrete was established near the New York end with a 1-yd. batch mixer operated by an electric motor with chain drive. The concrete was distributed from this plant by dinkeys and trains of small four-wheel flat-cars each carrying a single 1-yd. double-hinged bottom-dumping bucket. A standard-gage railroad track was first laid the whole length

Fig. 89. Lifting Concrete Buckets into Place, Queens Boulevard Viaduct

of the work, between the two rows of columns. This was used for the operation of two Union locomotive cranes, and for the distribution of material. The cranes were used for various purposes in place of derricks, and for handling the forms and the concrete in the buckets, the latter being picked up off the cars and dumped directly into place. The concrete trains and dinkeys were operated on the 2-ft. gage track laid in the center of the standard gage, during the construction of the piers, five cars being used in each train.

As soon as the construction of the columns was finished, the cross-girders, which weighed 27 tons each, were placed on top of them, being handled by a derrick car, as they were setting sufficiently for the locomotive cranes.

For the construction of the arches, a standard-gage track for the two cranes was laid just outside the westerly row of columns, and a double-track narrow-gage line for the concrete train outside of this. When concreting from 1000 to 2000 ft. away from the mixer, three trains of five cars each were used to distribute the concrete. Clean rounded gravel of fairly uniform size, graded from ¼ to 1½ in., is used for the aggregate, making a mixture which will probably give good results for the proposed hammered finish for the surface.

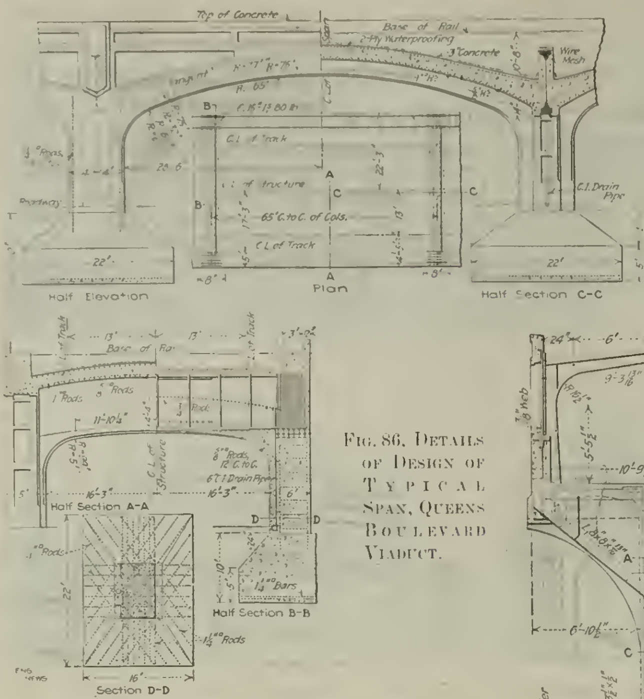


FIG. 86. DETAILS OF DESIGN OF TYPICAL SPAN, QUEENS BOULEVARD VIADUCT.

out removing them. On this section the work is only partially decked over and the track is laid over the open trench. The cars with the buckets are run to the point where the work is being done, spotted over the top of a chute and hopper and each bucket dumped in succession into it.

For the Harlem Tubes, the outer concrete, as has already been described, was mixed by machinery on a lighter and deposited by means of tremies. For the lining of the inside of the tubes, the compressed air or pneumatic system controlled by the Chicago Concrete Placing Co. was tried at the northerly end for a part of the section.

The views in Fig. 84 show the general layout of this plant, which it was expected to use for the lining of half the length of the tubes. It is installed on a platform built over the water. The materials are fed in the proper proportions from the overhead bins into the cylinder of the machine in half-yard batches. Water is added, from a pipe leading into the top of the cylinder at the same time as the dry material enters from above, the quantity being carefully measured, as it is of some importance to get the proper consistency. An air valve is then opened, and used as a blower to clean the gasket forming the seat of the top door which is then closed. Air is then admitted from the second valve over the top of the mixture to seal the top door, and apply pressure behind the mass, then the lower air valve opening into the elbow in the pipe just below the discharge at the bottom of the cylinder is opened, to loosen up the material as it feeds into the pipe, and both these last two valves are kept open until the drop in the pressure shows that the batch has been discharged from the end of the pipe.

Normally, very little, if any, trouble has been experienced in discharging the concrete at distances up to 500 ft., for which an air pressure of about 80 lb. is used, and the material has been carried over 800 ft. in the work, but to do this the air pressure had to be increased to 100 lb. and there were some few difficulties which, however, should be overcome in similar work as the men get used to the apparatus.

On leaving the main cylinder the pipe runs horizontally for 25 or 30 ft., then drops vertically 50 ft. or so to the bottom of the tunnels, and then along the floor to the point of discharge. Only the bottom of the tunnels was put in by this method, which for this kind of work probably has few advantages over any other method. In placing the sides and arch, however, which it

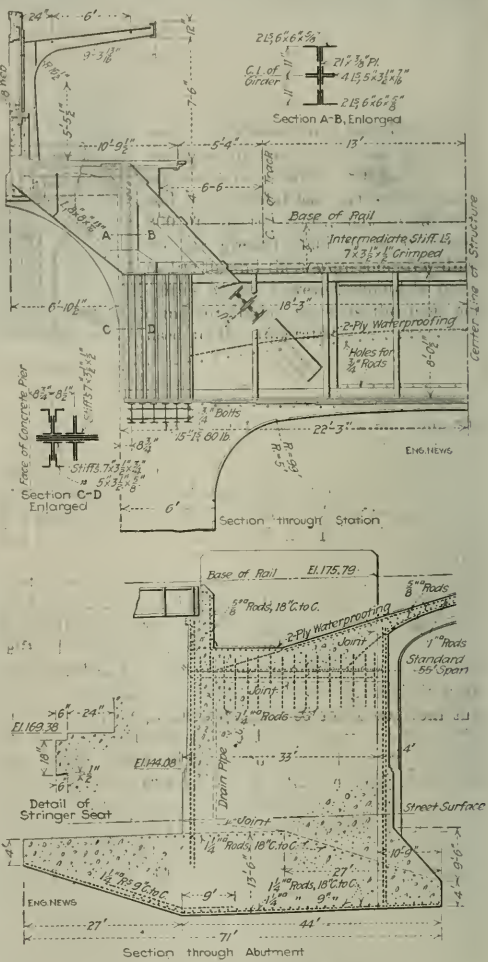


FIG. 87. SECTION THROUGH STATION AND DETAILS OF ABUTMENT, QUEENS BOULEVARD VIADUCT

FIG. 85. VIEWS OF QUEENS BOULEVARD REINFORCED-CONCRETE VIADUCT DURING CONSTRUCTION

(A) Columns completed (B) Foundation for column (C) Column showing forms (D) Abutment at New York end

for both the traveler and the forms were laid on them. The track in one tunnel was used for concrete cars, and in the other for the muck cars. The concrete cars were brought up under the traveler, hoisted by the elevator to the upper platform, from which both arches could be reached. The general layout is shown in the sketch, Fig. 83.

Wooden and steel forms have both been used on all four of these sections; the general opinion seems to be that where there is a length of say over 300 or 400 ft. of lining all of the same section, steel forms of the Blaw type are cheaper and quite satisfactory. The Blaw forms keep their shape quite well under ordinary conditions, but they could not be used to advantage in the sections where continuous support of the ground by posts was necessary, and, of course, not at all in sections where posts had to be left in while the lining was placed and only removed after the arch had taken the weight.

On Sec. 9 motor trucks were used for the concrete, thus permitting the complete mixing with water at the dock, which was possible by reason of the rapid means of transit these trucks provided.

On Sec. 12 a ¾-yd. batch mixer was used, set up along the side of the street and moved along as the work progressed, the concrete being mixed at the point where used. Blaw forms were used, but on account of the continually varying dimensions of structure, were found to be not as easily adaptable as on work where they could be used over and over again without change.

On Sec. 13 the concrete-mixing plant is located at the dock at the foot of 125th St., the average haul to the work being about half a mile. A 2-yd. batch mixer is used, arranged with the necessary bins, etc., for convenient feeding of the materials, and so as to deliver the mixed concrete about 10 ft. above the ground. Two motor trucks with self tipping bodies holding 4 yd. each are used for hauling the mixed concrete to the work. The latter is mixed fairly wet at the mixer, and a little more water is added for cleaning as it is dumped; an air pipe is kept in readiness to be used if necessary, to help get it out and clean the wagon. This is just a short length of 5 or 6 ft. of inch pipe at the end of a hose, capped at the end and with small holes bored in it. It can be pushed into any mass which has shaken down so as to become a little tight and so start it. At the work when a section is ready for concrete, holes are cut in the wooden street decking at suitable intervals and a line of 8-in. [illegible] sheet-metal spouts in 5-ft. sections is hung to lead from the hole in the decking to the forms. The sections are slung one below the other by chains. Over the hole in the decking is placed a wooden hopper 7x10 ft. and 2 ft. deep, into which the truck dumps its load and is away in about two minutes.

The hoppers are on skids and are not connected with the spout or the decking. They are moved by hitching them by a chain to a truck. The trucks make a round trip from the mixer to the place of dumping and return to the mixer in from 15 to 20 min.

On Sec. 15 there is a central mixing plant with a [illegible] batch mixer. The concrete is [illegible] in [illegible] double hinged bottom-dumping buckets, two of which are mounted on a flat-car; two cars are hauled together by a dinkey on 3-ft. gage track. The cars are arranged on the flat-car frame so that they can be dumped through [illegible]

New York Rapid Transit Railway Extensions*

By F. Lavis†

XII--Concrete Work

The total amount of concrete to be used on the whole of the subway construction is, of course, quite large, but speaking generally there is little of the work where there are large masses, or where a great deal is required at one time, so that there are no elaborate plants for turning it out in large quantities. Three general methods are used, a central mixing plant of comparatively small capacity, the material being hauled in motor trucks to the point of delivery into the forms, a portable or movable mixer at the site, and hand mixing on the planking of the roadway immediately over the work. This latter seems an anomaly in these days of the very general use of machinery; but in reality on account of the relatively small amount of material usually required to fill a considerable space in the forms, this latter method in many cases seems to be quite as economical and efficacious as any of the others.

Concreting Plants

The few specific plants and methods described below are fairly typical. On Sec. 8, 10 and 11, Lexington Ave., the concrete was all mixed dry in two 1-yd. batch mixers, at the 96th St. Dock on the East River, from whence it was hauled in wagons holding about 3 cu.yd. to the point at which it was to be used. The use of horse-drawn wagons prevented the addition of the water before hauling on account of the length of time required to make the trip. It was usually dumped on the street decking, water added, and the mixture shoveled into chutes directly into the work in the cut-and-cover sections, or delivered down the shafts into 1-yd. cars for the tunnels. These cars were hauled to the point where the material was to be used and there dumped directly when the material was placed in the floors or footings of the walls, or hauled up a short section of movable inclined track to a platform at about the level of the springing line, where they were dumped and the material shoveled into the forms for the arches and sidewalls.

In one case in the tunnels on Sec. 9, a timber platform was suspended at about the springing-line level from eyebolts, built into the concrete arch. The concrete was delivered into cars at the level of this platform at the shaft, and pushed along a track on it to the point where it was to be used. This required the permanent use of a considerable quantity of timber, however, and after a length of some 300 or 400 ft. had been built this way, a small traveler with an elevator was built to hoist the cars from subgrade level to the springing line. This was in a section where the rock required no support so that the whole section was clear. The platform of the traveler at the springing line reached across both tunnels and was located in the clear excavation ahead of the forms. The footings of the sidewalls were built first and kept ahead, and tracks

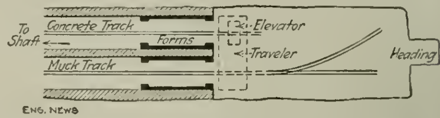


Fig. 83. Layout of Plant for Placing Concrete in Double-Track Tunnels, Lexington Ave.

Fig. 84. Pneumatic Concrete Mixing and Conveying Plant for Harlem River Tunnels
(Mixer on left, bins on right.)

*Copyright, 1914, by F. Lavis.
†Consulting Engineer, 50 Church St., New York City.

and are manufactured by the Cambria Steel Co., of Johnstown, Penn.

THE AJAX GUARD RAIL

This is a self-supporting guard rail of cast-manganese steel, and the casting comprises the guard rail proper, its braces, and the tie-plates which support the track rail. The only additional parts are a spacing block at the middle, and a malleable-iron foot-guard at each end.

FIG. 1. THE MORRISON ROLLED-STEEL GUARD RAIL, CAMBRIA STEEL CO., JOHNSTOWN, PA.

The face of the guard rail is a vertical web, reinforced by a wide top flange and vertical ribs. Slotted spike holes provide for adjusting the position of the guard in relation to the rail. The construction is shown clearly in Fig. 2, while Fig. 3 shows the guard rail in the track.

The rail is made ordinarily 9 ft. 10 in. long, straight for 3 ft. 10 in. at the middle and then flaring outward with a gradually increasing flare, the rail being set with 2 ft. 8 in. of the straight portion ahead of the frog point.

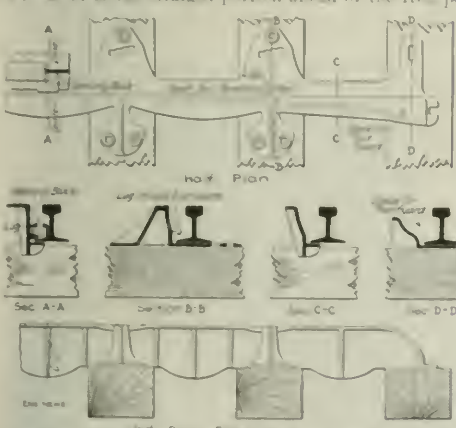


FIG. 2. THE AJAX MANGANESE-STEEL GUARD RAIL, AJAX FORGE CO., CHICAGO, ILL.

It is considered that on the sharp curves of yard turnouts a greater length of straight guard rail is inadvisable, especially as engines designed for No. 8 turnouts are often operated through still sharper turnouts, which leads to distortion of the track.

A special feature is that the guard rails for use on heavy curves are made 1¼ in. higher than the running rail, for the reason that [illegible] with long wheel-base will sometimes [illegible] a heavy side thrust as to [illegible] the weight on one rail [illegible] so that the [illegible] which may lift from the rail. The high guard rail will also engage the [illegible] during [illegible]. The principle is the same as in grooved rails for sharp curves on

FIG. 3. FRONT AND REAR VIEWS OF THE AJAX GUARD RAIL IN THE TRACK

street railways, which are made with the guard higher than the rail head.

This guard rail is made by the Ajax Forge Co., of Chicago, and is in use on a number of railways, particularly at large terminals. They are found to show very little wear after considerable service under severe conditions of traffic, and they require very little maintenance. In some cases, however, it is thought that there is little if any advantage in raising the guard rail above the level of the running rail.

THE MORDEN GUARD RAIL

This also is a manganese-steel casting, but the guard rail proper is of heavy angle section with lugs by which it is secured to cast-steel chairs which carry the running rail also. Thus the only part made of the more expensive manganese steel is that which actually takes the wear. The foot guards are of malleable iron.

The guard rail is 10 ft. long, straight for 3 ft. at the middle and then curving out at each end on a radius of

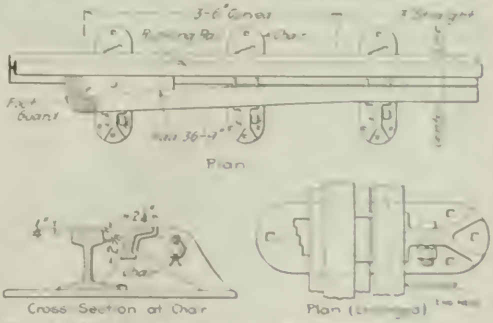


FIG. 4. THE MORDEN MANGANESE-STEEL GUARD RAIL, MORDEN FROG & CROSSING CO., CHICAGO

26 ft. 9 in. The rail when in position is slightly higher than the running rail in order to take the lateral thrust to better advantage. This guard rail, shown in Fig. 4, has been used experimentally. It is made by the Morden Frog & Crossing Co., of Chicago.

to the air for several seconds, resulting in an oxidation of the organic matter in the water, thus removing the cause of taste and odors. The simplicity and small cost of this method are strong arguments in its favor.

The above general remarks apply only to upland soils. Where swamps, bogs or river bottoms, containing deep deposits of alluvial mud form a considerable part of the reservoir bottom, special treatment of some kind will probably be desirable. The following notes describe a simple treatment which gave very satisfactory results and made possible the immediate use of stored water on a swamp area.

Treatment of Swampy Area of Reservoir Bottom

The new Kensico Reservoir, a part of the Catskill water-supply system for the City of New York, which is now nearing completion, is located in the Valley of the Bronx River a few miles north of White Plains, in Westchester County. It is formed by a large masonry dam, described in Engineering News, of Apr. 9 and May 21, 1911, and will cover 2218 acres of land, submerging the old Kensico Reservoir 110 ft. The old reservoir was built in 1883 by the Department of Water Supply and developed the local drainage of the upper reaches of the Bronx River and its tributaries, including the Rye Ponds, and by a diverting weir and tunnel that portion of the Byram River drainage in New York State.

The most favorable location for the new Kensico Dam was found to be about 400 ft. above the old dam. In order to make this site available, it was necessary to provide a temporary substitute supply. This was done by building two rolled embankment dikes farther up the valley, each about 40 ft. high, one across the Bronx River and the other across the Rye outlet and extending the Bronx pipe line by a 36-in. riveted steel pipe to the Rye dike. The two basins thus formed were connected by a short tunnel and have an available capacity of 5064 million gallons, which is 1800 million gallons larger than the old Kensico Reservoir and more than compensates for the reduced catchment area, which is three miles less than the old reservoir.

This temporary reservoir covers 708 acres, 200 acres of which was swamp land about 28 ft. below the surface of the full reservoir. A large portion of these swamps was of considerable depth. Samples from a depth of 30 ft. showed more than 75% of organic matter. These areas were covered by a rank growth of tussocks and other swamp vegetation. It was feared that these swamps would impart both tastes and odors to the water to an objectionable extent, and as it was essential to use the water as soon as it could be stored, the special treatment of these swamps was considered.

On account of their depth, it was practically out of the question to strip the swamps completely, and to remove only the surface growth would lay bare the underlying muck, which would probably prove more objectionable than the surface growth. It was finally decided that satisfactory results would be obtained if the swamps were cleared and covered with a thin layer of soil, which would act as a blanket to prevent the decomposed organic matter from mingling with the water. Favorable borrow pits were located on the margin of each swamp. The material ranged from a modified glacial drift of fine sand to a more compact soil of finer grain. Steam shovels and an equipment of narrow-gage 18-ton locomotives and 4-cu.yd. side-dump cars were installed by the contractor. The swamps were first cleared by cutting off the surface growth, including tussocks, down to the general swamp level. The tussocks offered considerable resistance, but yielded to sharp grub hoes. The disposal of the tussocks was at first a problem, but it was found that after drying in piles for several months they would readily burn. Fig. 1 shows the character of swamp and swamp growth. Fig. 2 shows a swamp after clearing.

The covering was run out onto the swamp in 10-car trains running on tracks of 60-lb. rails carried on 8-ft. ties laid on the cover. After dumping, it was spread to about 12 in. depth, over the shallower and dryer swamps, while on the deeper swamps it was necessary to increase the depth of cover to about 18 in. This would usually support the load satisfactorily, and it was surprising to see how elastic it was. As the trains passed over it the surface would deflect several inches, forming a wave under the traffic, but as long as the covering did not become saturated by absorbing the swamp water by capillarity, it would satisfactorily sustain the load. A large part of the cover was spread by hand, but later the contractor provided car scrapers which were operated by locomotives. Fig. 3 is a general view of the covering operation. Fig. 4 shows a swamp after the covering was spread.

Aërator on Reservoir Outlet

An aërator of capacity sufficient to pass the whole supply was built on the pipe line (see front-page view). This consists of a circular concrete basin 100 ft. in diameter with a 24-in. delivery pipe laid in a circle of 20-ft. diameter, carrying 44 nozzles. The nozzles are of special design, having interior spiral flanges which impart a decided spiral motion to the jet, causing it to completely break into spray a short distance above the nozzle. This aërator absorbs about 20 ft. effective head.

Frog Guard Rails of Special Design

The guard rails placed opposite frogs in railway track, to hold wheels in position while passing the frog point, are usually pieces of ordinary rail, suitably fastened to the ties and to the running rails. Guard rails consisting of heavy steel angles have been use to a limited extent, and we describe below three other special designs.

Morrison Guard Rail

This is a rolled steel rail of distorted T-section, as shown in Fig. 1. It has a narrow flange on the inner side, and a head of unsymmetrical section, while the web is inclined toward the track rail so as to better resist any thrust coming against it from the back of the wheel. A special tie-plate is used, holding both rails. This has a lug to hold the inner flange of the guard rail and prevent it from tilting under pressure, and has also shoulders to engage the outer flange of track rail and so prevent them from being displaced laterally.

The guard rail has spikes only on the outside, while the track rail has spikes on both sides. There are three holes for the outer spikes, in staggered position, as shown, so that the rail can be shifted inward to maintain the proper width of flangeway when the head is worn. The guard rail and tie-plates are in use on several railways

Fig. 1. Swampy Area of Kensico Reservoir after Having Been Covered with Dirt

from the old Kensico Reservoir, averaged 40% organic matter, and eight samples from the Jerome Park Reservoir, after only 13 months of service storing Croton water, averaged 22.2% organic matter. One of the Central Park reservoirs and the Williamsbridge and Jerome Park reservoirs have concrete floors, the depth of water being 30 ft., 17 ft. and 23 ft., respectively. In these, the depth of silt indicates an accretion of from $\frac{1}{8}$ to $\frac{1}{4}$ in. per year. The microscopic examination of the residue of the samples from these storage reservoirs showed it to consist largely of algae and diatoms with very little vegetable fibre.

In general practice, filtration has for a long time been employed as a means of removing tastes and odors from stored waters and is more or less efficient, depending upon the type of filter used, adequate design and management. More recently, aeration has been employed for this purpose, and with increasing success. The most efficient aeration is that which divides the water into a fine spray under such a head that the individual drops are exposed

with Dirt from Borrow Pits after Removing Growth

FIG. 1. CHARACTER OF SWAMP GROWTH

FIG. 2. AFTER REMOVING GROWTH

SWAMPY BOTTOM OF PORTION OF KENSICO RESERVOIR

Samples were procured from the bottom of the old Kensico Reservoir, built in 1883. This reservoir covered 255 acres to a maximum depth of 15 ft. The area was a rolling open valley of glacial origin with a light soil under farm cultivation. Except for the clearing and burning of the vegetation, no special treatment of the bottom was made. The soil of the adjacent sides contains from 4.7% to 9.9% of organic matter. Samples of the bottom secured at 18 stations in various parts of the reservoir after 24 years' service showed an average of 8.5% organic matter in the original soil, and 12.7% organic matter in the overlying deposit of silt. The depth of the latter varied up to 18 in. and averaged more than 6 in. These results clearly show that in this reservoir the stored water has produced and introduced organic matter which in a comparatively few years has accumulated to an extent to surpass the organic condition of the original bottom soil, and that the beneficial results of stripping would have been only temporary.

To further demonstrate the character of reservoir silt, samples were taken from several of the storage reservoirs of the city which receive water only through aqueducts or pipes from the impounding reservoirs. Twelve samples of the bottom silt from the Croton reservoirs in Central Park averaged 16.5% organic matter, while four samples from the Williamsbridge Reservoir, receiving water

FIG. 3. COVERING SWAMPY AREA OF KENSICO RESERVOIR

Engineering News

VOLUME [illegible] DECEMBER [illegible] NUMBER [illegible]

The Influence of Reservoir Bottoms on Stored Water

By WILLIAM FREDERICK SMITH*

The nature of artificial reservoir bottoms has a direct influence upon the quality of the stored water. The character of the soil and vegetation of the bottom and adjacent sides of the reservoir, the depth and the presence of shallow-flowage areas, all have important influences upon the tastes and odors of stored waters. The objectionable tastes and odors are produced either by the putrefaction of the organic matter on the bottom as the result of stagnation in deep basins or by the decay of organisms, such as algæ, which grow near the surface of the water. The oxidation of organic matter provides the growing organisms with food, and when present in quantity is an active means of encouraging their growth. Therefore, it would appear that if the organic matter present in vegetation and soil is removed by clearing and stripping the soil, the source of bad tastes and odors would be removed.

At one time it was felt by many engineers and chemists that the best results could be obtained only by a complete stripping of the surface soil [illegible] that the [illegible] exposed surfaces [illegible] have [illegible] percentage of organic matter, and [illegible] amount of money have been expended in removing the surface soils from certain reservoirs with [illegible] good results. Experience has shown, however, that these results are not a permanent prevention of tastes and odors, as there are other sources of organic matter. The incoming water brings with it in suspension organic matter from the surrounding drainage areas, and this, with the remains of the dying surface growths, is continually precipitated to form increasing accumulations on the bottom, which in time will result in a bottom condition that will be the same whether the bottom was stripped or not.

AERATOR ON PIPE LINE FROM TEMPORARY RESERVOIR ABOVE THE NEW KENSICO DAM
(Temporary dike in background)

SAMPLES OF KENSICO, WILLIAMSBRIDGE, JEROME PARK AND CENTRAL PARK RESERVOIR BOTTOMS

That the accumulations on the bottoms of reservoirs may contain more organic matter than the original soil was demonstrated by some investigations made by the Board of Water Supply at the time the question of treatment of the bottoms of the Ashokan and Kensico reservoirs of the Catskill Water Supply System for New York City was under consideration.

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The size of the deposited sludge particles also plays an important part in this matter. Disintegrated sludge particles, if not too fine, will gasify much quicker than coarse ones. It is important whether feces reach the sedimentation tank well broken up or in large pieces, as it is known that feces retain their floating ability for a long time, apparently because their compact structure offers a considerable resistance to the liberation of the inclosed gases. Finally, the manner in which the sludge particles settle, their sticking together through fat, hairs, etc., have great influence on the formation of sludge cakes, which to a great extent form the sludge cover. The influence of the intensity of the gas formation will be greater the deeper the sludge layer is. With a small free surface, where it can accumulate, the forming scum cover will be thicker. If the surface is too small for the scum, too many gas-laden particles will rise, so that the top layers cannot get rid of their gas quickly enough to sink.

A disadvantage of such a cover is that after it reaches a certain size the rising sludge cakes seek a way out through the open slots to the sedimentation chamber.

Different methods in practice have been tried to destroy and sink the scum covers, such as stirring it with poles or breaking it up with high-pressure water. None of these have been a permanent success, as they do not accomplish the necessary continued mixing of the newly rising sludge. This can only be done by the installation of a mechanical agitator or apparatus, which not only stirs the sludge, but also brings about a thorough mixture of the sludge with the sewage.

The sludge entering the sludge chamber should be well disintegrated. Any scum cover in formation should be broken up by a stream of sewage under high pressure, mechanical agitators, or lowering of the water level in the sedimentation chamber. The plant always ought to be so designed as to have a sufficiently large surface for the escape of the gases.

The appearance of frothing (spitting) in an unripe sludge-digesting chamber is a mere secondary phenomenon. It is similar to the so called "hut" formation in yeast fermentation, and is mostly caused by large amounts of gas rising to a small surface and carrying the sewage and finely divided sludge with it in the form of bubbles.

In ripe sludge-digesting chambers, the scum formation is much lighter and not liable to cause trouble, as the rising sludge is well mixed with sewage and the sludge at the surface loses its gas more readily than fresh sludge, not forming as much gas. But it must be removed from time to time. The spitting and frothing and entrance of sludge into the sedimentation chamber are generally caused by a too heavy floating layer or a too large accumulation of undissolved matter in the sludge-digestion chamber, in which case the gas will carry up froth if the free surface is too small. This can be helped by simply drawing off some of the sludge or permanently prevented by keeping the sludge at a permanent level.

(3) The Different Types of Fresh-Water Clarification Plants with Separate Sludge Digestion

Injurious formation of scum covers, frothing or spitting of the sludge-digesting chamber, acid sludge and, finally, acidulation of the supernatant water are the operating difficulties which are liable to appear in sludge-digesting plants if there is not sufficient room provided to accommodate the floating sludge, a too heavy formation of scum prevented and the sludge withdrawn at the right time.

The sludge-digesting plants under discussion can be divided into two groups. The first group includes those plants in which the sludge-digesting chamber is below the sedimentation chamber, and is connected to it by open slots, through which the sludge drops automatically. Under this head come the Emscher tanks, the Travis tanks, Kremer septic tanks (Kremer-Imhoff tanks), Stiag tanks, Spree tanks, Bus tanks, etc. To the second group belong those in which the sludge-digesting tank is a separate unit and is located beside the sedimentation chamber. The fresh sludge is periodically pumped or drained from the sedimentation tank to the sludge-digesting chamber.

Sludge-Digesting Chamber under Sedimentation Tank

These plants have the great advantage of an automatic sludge separation. But if the sludge is not removed at the right time, rising sludge will enter the sedimentation tank, which is a common occurrence in spite of the overlapping edges of the slots. Difficulty is found in giving the right dimensions to the sludge-digesting chamber in proportion to the sedimentation tank.

All installations coming under this group require expert supervision while ripening. To avoid acid sludge or a heavy sludge cover, which almost always gives an acid reaction, it is recommended to fill the digesting chamber only partly with sludge during the ripening period, and always to keep the sludge at the same level by periodically removing a like amount of sludge. As putrefactive decomposition can only take place while the sludge is alkaline, it has to be kept so at all times—if necessary, by the addition of chemicals. For protection against floating sludge covers, it is to be recommended from a technical point to make the free surface of the sludge-digesting chamber not too small. The partition walls between the sedimentation and digesting chambers should be so arranged that no sludge can collect under them and that the sludge carried up by the gases will be deflected either to the open surface at one side or the gas vents directly over the digestion chamber. The latter should be of sufficient size. Wide longitudinal openings, as are used on the Travis tank, seem to be the best. The long sludge chamber of these and similar plants should be divided into two parts, as in ordinary septic tanks: a larger chamber in which the sludge is digested, and a second smaller chamber in which the sludge particles carried up by the gases are separated. To obtain the largest possible surface and save construction costs, this Institute has sometimes recommended the use of earth ponds with large free surfaces as sludge-digesting chambers.

Separate Sludge-Digesting Chambers Beside the Sedimentation Tank

Under the head of separate sludge chambers, located beside the sedimentation tank, come the designs of Færster, Mondrion, the Neustadter sludge tank, etc. Opposed to the disadvantage of the cost of pumping is the not-to-be-lightly-valued advantage of the complete separation of the sedimentation tank from the sludge tank, so that the latter can never have any detrimental influence on the former. Besides the possibility of unlimited extension, separate sludge tanks have the further advantage that they are very accessible and easily inspected. The decomposi-

tion of the sludge can be [illegible] in all its stages and can be [illegible] as necessary or desirable. With high ground water, the first cost of the shallow tanks will be considerably less.

Separate sludge-digesting tanks can be built as single units which are intermittently filled (Foerster), or as a group of tanks which make a continual operation possible (the Neustadter tanks). A good sludge digestion is obtained by both types. The single units require individual expert operation, but the continual (daily) operation of tanks in series can be made almost entirely automatic. The first mentioned construction can be easily arranged so that the tanks can be operated either as units or in series. In arranging the tanks in series, the different processes can be separated. The fresh decomposition of the sludge and sewage will take place in the first tank, and in the last tank the sludge can be "washed" by the introduction of clean water before it is drawn off. The advantage of washing the sludge in no way interferes with the addition of the sewage, necessary for a brisk decomposition. Sewage should always be introduced into the first tank, if not enough is contained in the withdrawn fresh sludge. The following arrangement can be recommended: The clean water should be introduced into the tank that contains the best digested sludge, then passed from there to the tank that contains the second best sludge, etc., until it is let off, so that the sludge in a certain stage of digestion never comes into contact with sewage from a sludge in a less advanced state of decomposition. The capacity of such tanks ought to be about the same as those that proved sufficient for Emscher tanks.

Result

Fresh-water clarification plants, with a separate sludge digestion, considered as a whole, are a distinct advance in the field of sewage and sludge treatment. They simplify the mechanical clarification of the sewage, lessen the sludge nuisance and have advanced the solution of the sludge question.

The obtaining of a good sludge did not prove to be such a simple matter as was originally supposed. Communities which have their plants built by contractors will do well not to accept the plants until the sludge-digestion chamber delivers a good sludge. Very careful preliminary investigation should be made in each case to find out whether such a process is suitable to local conditions. Due consideration should be given to the difference of construction and operation. Other points to which attention should be paid are: Whether the sludge-digesting chamber should be located below or beside the sedimentation tank, or whether both types should be used; also whether it would be best to [illegible] an [illegible] of one or only tanks [illegible] for a future installation.

With proper design and expert supervision, it is possible to avoid the above [illegible] operating troubles, which often make an otherwise good plant troublesome. It will be absolutely necessary to stop the now prevalent custom of [illegible] all plants after one pattern. Also when considering the efficiency of a plant, a sharp line should be drawn between the two functions, sedimentation and sludge digestion.

Good Roads Construction in Colorado [illegible]

Repairing and Resurfacing Bituminous Pavements

By Samuel H. Lea*

A cheap but effective method of renewing the surface of old bituminous pavements was employed by the writer recently on some streets in Charlotte, N. C. In this city there is a considerable area of "bitulithic" pavement, laid in 1907-'08 under a 5-year guaranty by the contractor. Since the expiration of the guaranty period it has become necessary for the city to maintain this pavement.

Failure of Macadam Foundations—The area under consideration comprises some of the principal business streets in the heart of the city, where traffic is quite heavy. These streets were originally macadamized and, since the old macadam had been in place for many years, it was thought to be suitable for a base for the "bitulithic" pavement, which, accordingly, was laid directly upon it. This method of construction has not proved satisfactory, especially for streets with heavy traffic, and it has been discontinued. The city's specifications now require all pavement to be laid on a concrete base.

Repair Work

Soon after the expiration of the contractor's guaranty the pavement began to show signs of wear and, in many places, small holes appeared; these quickly enlarged by raveling, becoming in some cases sufficiently large to cause serious inconvenience to traffic.

Patching—The first repair work undertaken by the city was in January, 1911; this consisted in cutting out the raveled places and patching the holes with new material. The work was done by a contractor who was then engaged in paving other streets in the city with sheet asphalt, which material was used for making the patches in the "bitulithic" pavement. The patches thus made were strong and durable, joining up smoothly with the adjacent surfaces. The appearance of the finished work, however, is not uniform; the patches are rather conspicuous, especially after rains.

The work was confined to the repair of worn places and depressions in the pavement and no attempt was made to treat the adjacent surface of old pavement. In making the patches the edges of cuts were trimmed smooth and vertical and all loose material was removed from the holes, care being taken to cut into the old macadam foundation as little as possible. The edges and bottom of the cut were then painted with hot liquid asphalt, and the hole was filled with asphalt paving mixture heated to a temperature of about [illegible]° F. The edges of the patch were then smoothed with a hot iron, tamped by hand, and the patch compacted with a steam roller. The appearance of typical cuts, ready for filling, is shown in Fig. 1. The loose stones in the bottom are part of the old macadam base; this was carefully tamped by hand before the cut was filled with new material.

Cost Data—Since the repairs were made in the form of isolated patches, scattered over a wide area, no satisfactory unit price for the completed work could be agreed upon in advance, and it was decided to have the contractor perform the work at actual cost for labor and material plus [illegible]% for use of tools and plant. The city provided an inspector who accompanied the repair gang from

*City Engineer, Charlotte, N. C.

place to place and supervised the work. After the completion of repairs the total cost was determined, also the extent of work. From these data the following statement has been compiled:

Total area of patches made: 308.6 sq.yd.

Material and labor	$609.75
Cost of inspection	32.00
Total cost of repairs	$641.75

Unit cost of work: $2.08 per sq.yd.

Repairs with Asphalt "Pancakes"—The foregoing repair work was completed in the latter part of January, and it was then thought that additional repairs to the pavement would not be necessary for a considerable while, since there were at that time no further signs of raveling. This condition did not continue long, however, for within a few weeks new holes began to appear and the surface of the pavement continued to deteriorate, assuming a deeply pitted appearance over practically the entire area. On College St., where the traffic is heavy trucking for wholesale houses, the pavement soon raveled badly and was worn into holes in many places. This condition is shown in Fig. 2, which is from a photograph of a portion of College St., taken in May, 1914.

Fig. 1. Cuts in 7-Year Old "Bitulithic" Pavement on Old Macadam Foundation; Ready for Filling with Asphalt Mixture

Fig. 2. North College St., Showing Condition of a 7-Year Old "Bitulithic" Pavement on Old Macadam Foundation; before Patching

In June, it was decided to make the additional repairs that were then necessary, and a repair gang was organized from the city street department. This gang included a foreman, four laborers, a driver with a one-horse wagon. The patching material was obtained from "pancakes" or slabs of ready-mixed sheet asphalt, which had been made up for this purpose during former paving operations in the city.* These "pancakes" had been stored under cover and were in good condition for use upon being heated to the proper temperature. The city's 10-ton steam roller was used for compacting the patches after the cuts were filled and the edges had been tamped down by hand and bonded to the adjacent pavement with a hot smoothing tool. It was found that the three-wheel roller, used under these conditions, did very good work, making a smooth and compact surface.

Cost Data—The total area patched in June was 422.14 sq.yd. as compared with 308.6 sq.yd. in the first work described. The regular tools and equipment of the city street department were used as far as practicable, and such additional equipment as was purchased for the work was charged to cost of work. The steam roller was charged at the rate of $10 per day for machine and roller man. The ready-mixed asphaltic paving material used was estimated as being worth 40c. per sq.yd. in finished patches. The following statement covers the cost of the work:

Total area of cuts filled: 422.14 sq.yd.

Labor and tools	$294.18
Patching material	168.86
Total	$463.04

Unit cost for area repaired: $1.10 per sq.yd.

Surface Treatment

Soon after the completion of repair work in June it was decided to apply a flush coat of cold refined tar to the entire pavements under discussion. The object was to fill up the small pits and depressions in the surface of the old pavement and also to renew or replace, as far as practicable, the cementing material or bitumen that had escaped from the body of the old pavement; and to prevent, for a while at least, further raveling or disintegration of the pavement.

Materials and Methods of Work—The pavement was first gone over with the city street-sweeping machines; usually on the night before repair work was commenced. Later, a suitable area was roped off from traffic and the surface was swept by hand immediately before applying the refined tar. The working force comprised a foreman, six laborers and a driver with a one-horse wagon. Sand was delivered at convenient places by contractors at a fixed unit price. The wagon was used to haul and distribute the other materials as needed. The refined tar was brought to the job in barrels; from these it was pumped into buckets and spread by hand over the pavement.

The tar was then swept along by laborers, using wire push brooms, and distributed so that every portion of the pavement surface was covered. The tar was sufficiently thin to penetrate readily into the pavement. A sufficient quantity of the tar was poured over the surface to allow the pavement to absorb it to saturation; the surplus tar found its way to the gutters, from whence it was later taken up for further use. The tar was forced into the pavement by the sweepers as much as possible, the object being to make it serve both as a filler and a seal coat for the pavement.

*A more detailed account of this method of making repairs will appear in a subsequent issue

After application, the treated surface was allowed to remain uncovered for from one to three hours; it was then covered with coarse sand to a depth of about $\frac{1}{4}$ in. The street was then opened to traffic.

COST DATA—A careful account was kept of every item of expense entering into the work; from this the following statement of cost has been compiled:

Total area of pavement covered by surface treatment [illegible] sq.yd.	
[illegible]	$[illegible]
[illegible]	[illegible]
Trucks [illegible]	[illegible]
[illegible] of refined tar at [illegible]	[illegible]
Total	$[illegible]

Unit cost of work [illegible] per sq.yd.

CONCLUSIONS

A comparison of unit costs for the two jobs of patching shows a much lower rate for the work done by the street department, using ready-mixed paving material. As a result of the experience herein described, it is probable that the city will adopt this method for future repair work. If bituminous paving material, prepared for use, can be obtained at a reasonable price, there is no necessity for a city to purchase and maintain an expensive asphalt plant for ordinary repair work; in such cases repairs can be cheaply and effectively made with a comparatively small outfit.

The surface treatment of the old pavement after the completion of repairs was in the nature of an experiment, it being the first work of the kind attempted in this city. Considering the low unit cost of the work, less than [illegible] per sq.yd. of pavement covered, the results obtained are quite satisfactory.

In addition to the operation of flush coating, and while this was in progress, some shallow patches were made without cutting the old pavement. This was done by filling the depressions with finely crushed stone coated with the surfacing material and tamped with hand tampers until the patch was thoroughly compacted and bonded to the old pavement.

Experience has shown that more sand was used in the work than was necessary for the best results. The sand, after being spread, was allowed to remain in place for a week or more, and while a considerable portion was taken up by the tar, much of it was washed by rains into the gutters, from whence it was later removed by the street-cleaning department. About one-half the quantity of sand used would have been sufficient for the purpose.

The bituminous coating went much further and covered more area than was expected. One gallon of the refined tar covered a fraction over [illegible] sq.yd. even after being allowed to soak freely into the old pavement. The penetration was good as was shown by cutting into the pavement in several places after the tar application. It was found that the tar had in most cases penetrated as far as [illegible] below the surface.

A noticeable feature was the springy, elastic nature of the surface of the old pavement after treatment. This was a matter of general comment by citizens, many of whom had been skeptical about the work in the early stages. The seeding of the pavement was arrested by the [illegible] by the treatment; it is not expected, however, that [illegible] will be prevented for any great length of time. Such a consummation would be too much to expect from a superficial application of a cold bituminous material.

On the whole, the results obtained from this experimental work are considered quite satisfactory, and it is thought that the work done has been efficient and economical and well worth the cost.

A Snow-Removal Plan for New York City*

In past years the city depended upon trucks alone to haul snow from streets to waterfront dumps, the work starting as a rule after the storm was over and traffic retarded or completely blocked. No other method was considered available, and the speed of clearing snow from streets thus depended upon the supply of trucks for snow work. The maximum number of vehicles which could be procured last winter was 3000, and each truck averaged 50 cu.yd. per day. Under these conditions 150,000 cu.yd. of snow was the maximum amount per day that could be removed from roadways. With the [illegible] snowfall in February and March of this year, it required over [illegible] days to clear snow from the 1911 scheduled area of 20,000,000 sq.yd.

The only additional method of accelerating the removal of snow, up to last winter, was by decreasing the length of haul for trucks through the use of main trunk sewers for snow disposal, and only a limited number of such sewers was allowed in the Borough of Manhattan.

As a result of last winter's experience and tests it appears that the city has had available for years past a possible solution of the problem of rapid snow removal through the extensive use of sewers, not alone after a snowfall, but during the progress of the storm. It was also learned that snow work should be started with the storm, *clean* snow dumped into sewers as it falls, and the attempt made to keep pace with the storm, instead of trying to dig the city out after the block has occurred.

It should be recognized that these discoveries regarding snow work need be tested by a winter's experience, but whatever is done next winter in the disposal of snow through sewers must be [illegible] as a decided addition to past methods, which likewise will be continued in operation.

THE 1914-1915 SNOW FIGHTING CAMPAIGN

Based upon the data concerning sewers, it is planned to utilize all sewers having a sufficient flow of water to transport snow and by means of regular sweepers acting as squad foremen, to assign emergency laborers in sufficient number to place in manholes snow falling at the rate of $1\frac{1}{2}$ in. per hr. The number of emergency men required for this purpose will approximate [illegible] per shift of eight hours.

In addition to pushing snow into sewer manholes in adjacent streets where sewers are available for snow disposal, the snow-fighting force will remove snow from intersections of [illegible] streets, placing it in sewers where such can be used, or else piling it. It is also part of the plan to assign the snow-fighting force to clean the roadways at [illegible] crosswalks.

Last year's experience in disposing of [illegible] cu.yd.

*From a report by J. T. Fetherston, Commissioner of Street Cleaning, New York City, to the Board of Estimate and Apportionment on "Snow Work" [illegible] of [illegible]. The report was dated [illegible] 1914. It was submitted in part for the purpose of securing the approval by the board of certain [illegible] of the plan. [illegible] from the [illegible] in our issue of [illegible] 1914, p. [illegible].

of snow in large sewers demonstrated the economy of this method, the cost being approximately 15c. per cu.yd. Special tests in the various boroughs, together with scientific observations conducted by the Sewer Bureau of the Borough of Manhattan,* verified the general conclusion that all sewers having a sufficient flow of water can be utilized for the disposal of *clean* snow without injury to the sewers. On streets where sewers are unable to carry off the snow, the roadway will be cleared and the snow piled for removal by carts or trucks.

For the purpose of showing the advantage of snow-fighting work over contract removal, a tentative estimate of the time required to clear the scheduled area in the three boroughs and the cost thereof is presented herewith.

Assume snow falling at the rate of ½ in. per hr., the storm continuing for 14 hours:

Item	Snow Fighting Force	Contract Work
Estimated time required to complete work after storm ceases	4 hours	168 hours
Estimated cost per million square yards cleared	$5,460	$22,438
Estimated total cost of clearing scheduled area	109,200	448,760

This estimate, as well as all plans for snow fighting, is based on the following assumptions:

(1) That a sufficient force of emergency labor can be started at work, day or night, within four hours after a continuing snowfall begins.

(2) That a rate of pay sufficient to attract labor and make the men anxious to work can be offered by the city.

(3) That the weather conditions will not be so extreme as to prevent men from working during the storm.

(4) That a sufficient amount of normal sewage is flowing in the bulk of the sewers to transport snow to the rivers and harbor.

(5) That the ordinary flow of sewage can be supplemented by water from hydrants where the normal flow is insufficient to transport the snow.

As the snow-fighting method involves a new departure in snow removal, every effort has been made to plan the work so as to meet anticipated conditions. This has involved a tremendous amount of detail study and observation of factors heretofore unknown.

To meet the various requirements of the snow-fighting problem, the following work has been completed.

1. Survey of Sewers—The depth of sewage and quantity of sediment in 50,000 sewer manholes and the velocity of sewage in 1098 miles of sewers, in the boroughs of Manhattan, the Bronx and Brooklyn, have been determined and the information plotted on maps.

2. Weather Conditions—Meteorological information regarding the duration, rate and fall, and depth of snowstorms has been studied and all published figures concerning snowfalls and their prediction by observation of the barometer, wet- and dry-bulb thermometer, direction and force of wind, cloud formation, etc., are available and will be used in conjunction with the weather reports from the United States Weather Bureau.

3. Labor Conditions—A general examination has been made of the available supply of labor and plans for quickly filling the quota required on snow fighting have been prepared. Registration of snow fighters at the various section houses and stables will be started about Nov. 15, 1914. All printing and forms for this purpose have been ordered.

4. Assignments—After the registration begins, notification cards will be sent to all men on the list, giving their assignments and information as to time for reporting and location of stations. Each individual or gang will have a set task to accomplish within a specified time.

5. "The Call to Work"—Should a snowstorm start during the day, the street-cleaning force will be available, and emergency laborers with notification cards will have instructions to report without special notice. If, however, a storm starts during the night, it will be necessary to call all men. It is proposed that the police shall coöperate with this Department, so that when notice is given by the Commissioner to Police Headquarters, all patrolmen will be reached by telephone as soon as possible and will call out the regular employees of the Department, as well as the emergency men. A list of all employees and registered laborers will be furnished for each patrolman's beat in the three boroughs, and in this way it should be possible to get a large number of men into service on short notice. In addition to the notification by the Police Force, the night workers in each Department stable will be utilized for calling men to work.

6. Equipment—The principal tool used on snow fighting will be the sweeper's pan scraper, supplemented by road scrapers, scoops, plows, picks, etc., all standard Department equipment. It is likewise proposed to increase the snow-carrying capacity of sewers by using bags as temporary dams where necessary to increase the depth of water in the manholes.

7. Unscheduled Streets—On streets where removal is not deemed essential, snow plows attached to automobiles and horse-drawn plows will be used for opening roadways for traffic. Street intersections with near-side cars will be cleared while the storm is in progress.

Organization and Management of the Snow-Fighting Force

Organization—Three divisions will be organized for snow fighting: (1) The first line of attack will comprise regular Department employees, supplemented by emergency laborers. The unit of organization will be based upon the sweeper as leader of a squad of emergency laborers, working under the direction of regular department officers.

(2) The first reserve will consist of regular drivers with horses and carts, drafted for a night shift, to clear streets where the snow-fighting force cannot use the sewers.

(3) The second reserve will consist of private trucks for day and night service, used as a supplementary force when the two regular forces have been unable to cope with the storm. This reserve force will be covered by the registration of private vehicles and assigned as may be necessary according to the requirements of the situation.

Management—Definite printed instructions have been drafted to cover all phases of the work, and classes have been started for the officers of the Department. Drills of regular employees will be held after Nov. 15, and night or day calls will be tried to prove their effectiveness.

*See article in "Engineering News," Oct. 29, 1914.—Editor.

Hell Gate Arch Bridge Not a New Thing—The following is a curious allusion to the 977½-ft. steel arch which the New York Connecting R.R. is now building across Hell Gate, East River, New York:

> Never perhaps since our first Bridge-Builders, Sin and Death, built that stupendous Arch from Hell-gate to the Earth, did any Pontifex, or Pontiff, undertake such a task.

It is taken from Carlyle's "Sartor Resartus," Book I, Chapter XI. The "pontifex" of the present Hell Gate arch is Gustav Lindenthal.

Field and Office

Portable Hoist Towers for Concreting*

Portable hoist towers for conveying and placing concrete are gaining in favor with contractors. Very often it is cheaper to employ a movable tower than to erect a high stationary structure.

An interesting application of this method on retaining-wall construction is described below. A second case is given where the mixer and the tower are both portable, mounted on standard flat-cars, and moved about a large area, with excellent results.

Stationary Mixer and Moving Hoist Tower

A hoist tower mounted on trucks is used to convey concrete from mixer to construction in the four-tracking work of the New York Central & Hudson River R.R., now under way at Poughkeepsie, N. Y. This work includes the building of several retaining walls, one of which is shown in the making, with the portable tower at work, in the accompanying views, Figs. 1 and 2.

The wall is of the standard gravity type. It is about 28 ft. high at the northern end, 10 ft. wide at the base, and 21 in. at the top with a 2-ft. coping. The lower end is 6 ft. high, with other dimensions corresponding.

In building the lower portion of the wall wheelbarrows were used instead of the tower. By this method 20 men placed 40 cu.yd. of concrete per day. After 15 days a movable hoist tower was brought on the job from a wall near-by which had been built with the tower, and the 20 men then handled 125 cu.yd. daily.

This portable hoist tower is mounted on four wheels, which run along at the base of the wall on a standard-gage track. The tower is 34 ft. high and is equipped with a ½-cu.yd. bucket which can be tipped at any elevation desired. The general layout of the work is shown in Fig. 2.

Fig. 3 shows the rigging of the tower. A cable runs from a drum of the two-drum hoisting engine to a pulley on the car, thence over two pulleys at the top of the structure, down to a pulley on the bucket and up to a fixed point on the top of the tower. The car is moved forward by means of a cable from the second drum to a deadman at the farther end of the track and back to the front of the car, as shown in the diagram. To return the tower to the mixer, the bucket is blocked and the hoisting drum of the engine operated.

A depression in the track at the mixer allows the bucket to be lowered below the level of the chute from the

*The following articles on hoist towers have appeared in "Engineering News" of recent date: "Steel Concreting Tower Designed for Rapid Erection," Sept. 24, 1914, p. [illegible]; "Movable Concreting Plant with Telescopic Tower," Nov. 12, p. [illegible]; "A Stationary Telescopic Hoist Tower," Nov. 19, p. [illegible].

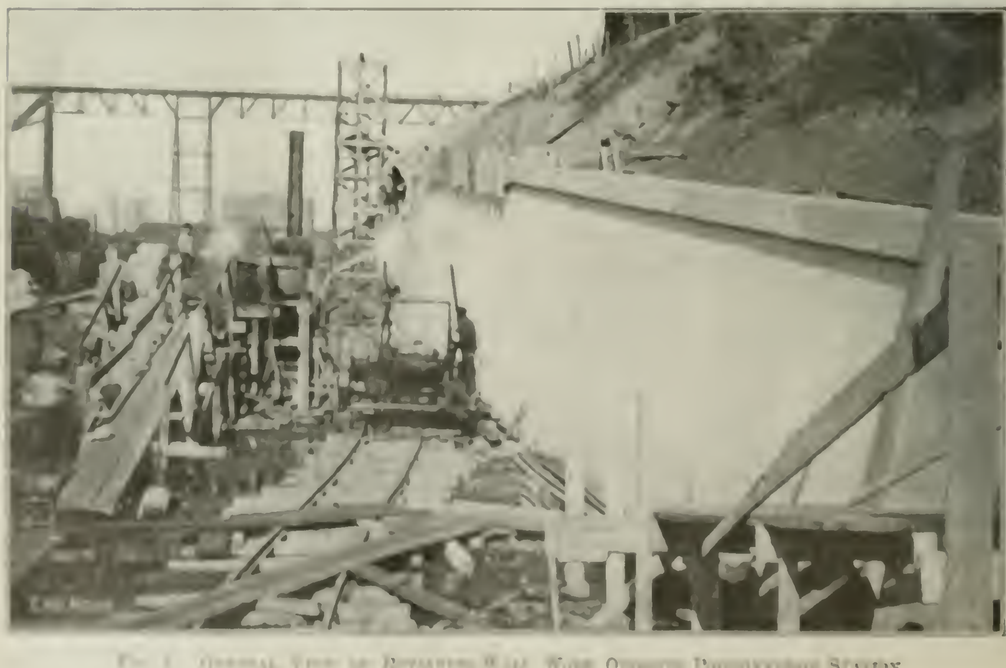


Fig. 1. General View of Retaining-Wall Work Opposite Poughkeepsie Station

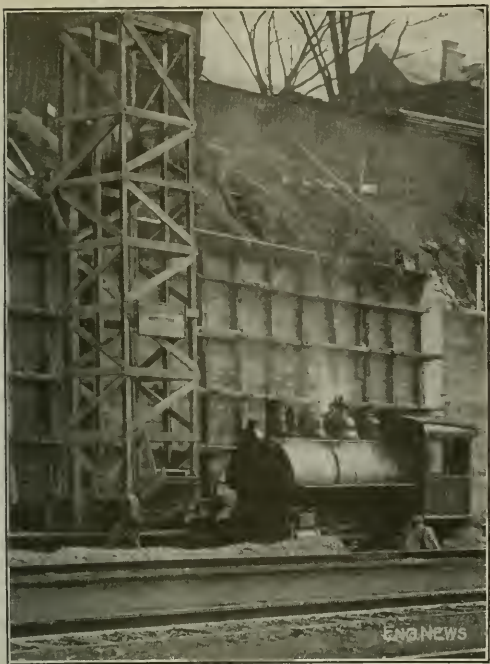


FIG. 2. PORTABLE TOWER AT POUGHKEEPSIE, BUCKET IN DUMPING POSITION

mixer, so that the concrete may be discharged into the bucket by gravity.

The work is being done for the New York Central & Hudson River R.R., under the direction of G. W. Kittredge, Chief Engineer; J. W. Pfau, Engineer of Construction; R. E. Dougherty, District Engineer, Eastern District, by Richard & Gaston, contractors, New York City (W. McKee, Superintendent on the job).

FIG. 3. RIGGING OF POUGHKEEPSIE CONCRETING TOWER

MIXER AND HOIST TOWER ON FLAT-CARS

At the Jersey City terminal of the Central R.R. of New Jersey, a portable mixing and distributing plant was desirable on account of the large area over which the work was distributed, the small amount of concrete placed in any one location and the difficult conditions imposed by sustained traffic. The work of handling materials, mixing and hoisting to roof were all done on two existing standard-gage tracks, 13 ft. c. to c., immediately adjacent to the work. The concreting materials were brought in on cars directly to the ¾-cu.yd. mixer mounted on a standard 40-ft. flat-car and which was fitted with permanent runs, water-tight cement bins, and water connections.

After mixing, the concrete was dumped directly into the hoist bucket which was permanently located with tower and hoisting engine on a standard 50-ft. flat-car, with permanent sway braces, guides, etc. The tower was 82 ft. high, and near the top was equipped with an ordinary receiving hopper, which discharged into three Insley steel chutes, 30, 20 and 15 ft. long.

The chutes were supported at their hopper joints by rigging hung from two booms, 30 ft. and 32 ft. in length, respectively, which were attached to the side of the tower, well up toward the top. The whole rigging was supported from the tower, with the exception of the discharging end, which was moved from place to place by two men. The booms were free to swing in any direction, and the plant discharged over a semicircular area having a radius of about 50 ft.

FIG. 4. CONCRETING TRAINSHED, JERSEY CENTRAL TERMINAL, WITH HOIST TOWER ON FLAT CAR

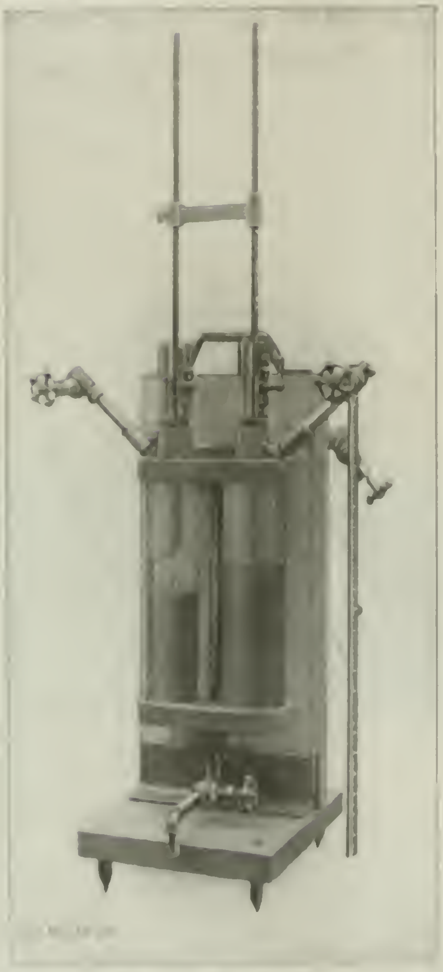
This mobile mixing plant allowed the concreting to proceed very rapidly; in fact, practically as a continuous operation. The plant was often moved 100 ft. or more during the noon half-hour. With this plant from 60 to 90 cu.yd. of concrete were placed in 3½-in. roof slabs, which were cut up with numerous skylight curbs, smoke ducts, etc., by about 30 men in an 8-hr. shift.

The work was done by R. P. and J. H. Staats, New York, under the direction of Joseph O. Osgood, Chief Engineer of the New Jersey Central; A. E. Owen, Principal Assistant Engineer. C. M. Titsworth was Assistant Engineer in Charge of Construction, for the railroad.

A Differential Gage for Very Small Pressure Differences

By William Easby, Jr.*

A novel form of differential gage, capable of accurately measuring very small differences of pressure, is shown in the accompanying illustration. It differs in two respects from the usual forms in which a gage liquid heavier than water is used. First, the tubes are so large in diameter that the troublesome irregularity of the meniscus so common in the small sizes of tube is confined entirely to



Differential Pressure Gage for Measuring Small Pressure Differences

the edge, leaving a large plane surface unaffected by capillarity. The second point of difference is in the use of special hook-gages to measure the deflection. The hook end was originally provided with the customary sharp point but it now finished in a small [illegible] (more easily seen) which can be accurately set in the surface of the meniscus by bringing it tangent to its reflection. These hook-gages have a common vernier reading to 0.001 ft., attached by an arm to one of them and surrounding the graduated rod of the other. To set the vernier, the tubes are subjected to the same pressure. The ends of the hooks are then brought tangent to the menisceses and the arm is moved until the zeros of the scale and of the vernier coincide. Colored carbon tetrachloride, to which benzine has been added to obtain the desired density, is used for the gage liquid.

It is essential for accuracy, particularly when the deflections are but a few thousandths, to rid the gage and connections of all air, which is most easily accomplished if they are placed lower than the source of pressure. Caution should also be used respecting the effect of heat. It was found that a lighted incandescent lamp held for a few minutes close to one side of the gage caused sufficient expansion of the carbon tetrachloride in the tube on that side to render observations almost worthless.

This instrument has been used successfully in the hydraulic laboratory of the Civil Engineering Department of the University of Pennsylvania, to investigate the distribution of velocities of approach in weir tanks, to study the critical velocities in pipes and for other experimental work. It can be adapted to a considerable range of pressure by varying the density of the gage liquid, but it is of greatest service in measuring very small differences of pressure.

*Instructor in Hydraulic Engineering, University of Pennsylvania, Philadelphia.

Irrigation Flumes of Ingot Iron

Flumes made of ingot iron are being used on a number of irrigation projects in the Western states. The Cascade Irrigation District, Ellensburg, Wash., will have 15,000 lin.ft. of metal flume, which is said to be the longest large flume of this kind in the United States. 7000 ft. of this were installed in 1913 and 8000 ft. (cf. No. 26

Irrigation Flumes Built of Ingot Iron Plates

gage) in 1914. This district will have also four concrete-lined tunnels aggregating $1\frac{1}{4}$ miles, $\frac{3}{4}$ mile of concrete-lined canal, and 30 miles of earth canal. This district has an area of 13,000 acres, to be supplied with water from the Yakima River, and the work is provided for by a bond issue of $700,000. R. W. Rea is chief engineer; D. C. Henny, U. S. Reclamation Service, is consulting engineer.

The Tumalo Irrigation District, of Laidlaw, Ore., has an area of 22,000 acres under irrigation from the Deschutes River, and about 9000 ft. of metal flume have been installed. About $450,000 of state funds have been expended on this project during the past two years. O. Laurgaard is project engineer.

The metal flumes on the above works are of the Lennon type, made with semicircular sheets of the Armco ingot iron, and supplied by the Coast Culvert & Flume Co., of Portland, Ore., to which we are indebted for photographs and information. In the accompanying cut the upper view shows a long stretch of hillside flume. The portion built against the bluff has an inclined roof to throw off any débris falling upon it. This roof is shown more distinctly in the lower left-hand view. The lower right-hand view shows the connection of a concrete feed canal with an iron flume.

High-Head Centrifugal Pumps may be installed shortly in the Aspinwall pumping station of the Pittsburgh (Penn.) water-works. This station is one of two handling the filtered water from the city's filtration plant at Aspinwall, 5 mi. above the city. It pumps against 280 ft. head into the new Cabbage Hill reservoir, North Side, but will later handle part of the pumpage into the Highland reservoirs, the upper one of which gives a head of 375 ft. now handled by the Brilliant pumping station, on the opposite bank of the Allegheny. A two-stage centrifugal pump driven by a steam turbine is contemplated.

Outline of Data to Be Obtained for a Report on the Feasibility of Any Irrigation Project

By H. F. Robinson*

In preparing data for a report or in the consideration of a proposed irrigation project, either nonstorage or storage, even the most experienced engineer often inadvertently omits the discussion of some item that has a vital bearing on the success or failure of the project, or fails to look up in the field something that necessitates another trip or the omission of important matter. It was to put into suggestive form, especially for the engineer in the field, the principal things to be observed and investigated, and as a list of topics that might be followed in making up the report, that the following outline was arranged. Since it was first compiled, ten years or more ago, it has been tried out in the field and amended from time to time, as experience directed, until it is thought that most topics that may be needed have been included.

Copies of the list or outline have been made and supplied to the engineers of the U. S. Indian Irrigation Service and others, and it has proven of value in their work. It is now offered to other engineers in the hope that it may assist them in similar work:

*Superintendent of Irrigation, in charge of all irrigation work for the Indian Service in Northern Arizona, New Mexico and Colorado; Albuquerque, N. M.

Outline of Required Data

NONSTORAGE SYSTEM

Physical features in general.
Altitude and climatic conditions.
Area that may be irrigated.
Nature of the land.
  Rough or smooth.
  Cost of clearing.
  Cost of leveling.
  Natural growths.
  Value of natural growths.
Ownership of land.
Source of water-supply.
  Quantity of water available.
  Flow of stream by gaging.
  Records of flow.
  Rainfall.
  Drainage area, its character and probable runoff.
  Prior rights involved.
  Is water adjudicated?
Quantity of water for this project.
Local laws and litigation.
Duty of water.
  Nature of crops.
  Length of irrigation season.
  Soil.
  Alkali.
  Seepage and evaporation.
  Amount of water needed for the land, or how much land may be covered with the water available.
  Methods of using water.
  Crop requirements.
  Rotation.
  Proposed methods of distribution.
Diversion works.
  Physical conditions at the proposed heads.
Dam.
  Kind.
  Cost of materials.
  Where obtained.
  Nearness and kind of rock.
  Other material that may be used, as timber for cribs, lumber that may be cut, sand, gravel, etc.
Carriers of freight.
  Distance from railroad.
  Cost of freighting.
Roads.
  Existing, required and changes necessary.
Headgates, waste gates, etc.
  Size and kind.
  Gate lifts.
Canal.
  Size, length, slopes, grades.
  Nature of material excavated.
  How excavated; teams, dredge or other methods.
  Labor; kind, availability, cost.
  Special or unusual structures.
  Automatic spillways, flumes, culverts, sand traps, bridges, etc.
  Laterals and structures.
Silt.
  At normal flow.
  During floods.
  Nature of.
  Drifting sand in water.
Possibility of increasing water-supply.
  Return water from seepage.
  Reservoirs.
  Pumping underground water.
  Cost of fuel.
  Depth to ground water.
  Other data relative to pumping.
Possibility of water power.
  Its value and market.
Products.
  Kind and market.
Condemnation and damages.
Rights-of-way.
Total cost of project.
  Cost per acre of ground covered.
Basis of return on investment.
Method and period of repayment.
Sinking fund. Interest.
Maintenance.
Very brief comparison with other similar projects.

STORAGE SYSTEM

Physical features in general.
Altitude and climatic conditions.
Drainage area.
Streams and tributaries.
Flow by gaging.
Records of flow.
Rainfall.
Probable runoff of drainage area.
Vegetation in storage basin.
Timber and fuel adjacent to basin.
Prior rights to any of the flow.
Water adjudicated or not?
Amount for storage.
Silt and sediment.
Alkali and salt.
Reservoirs.
  (A failure of any of the seven following requirements ruins the project.)
  1—Sufficient supply.
  2—Good basin.
  3—Good dam site.
  4—Good material.
  5—Good foundation.
  6—Sufficient good land.
  7—Sound commercial basis.
Dam.
  Kind proposed.
  Nature and cost of material.
  Where obtained.
  Carrier and freight.
  Nearness of rock supply, nature and quality.
  Sand and gravel.
  Other building material.
Temporary diversion of stream.
Permanent outlet of reservoir.
Spillway.
Amount of storage at varying dam heights.
Physical and chemical tests in general.
Power canals.
  Horsepower available.
  Power plants.
  Transmission.
  Use to be made of power.
  Value of developed power.
Maintenance.
Roads
  Existing, now required, changes.
Underground water-supply in irrigated district.
  Analyses of underground water.
  Depth to water table.
  Probable quantity for pumping.
  Pumps and pumping.
Cost.
  Present and probable future cost.
Existing appropriations of water and rights.
Existing and proposed methods of distribution.
  (Cf. memo. under nonstorage supply.)
Local laws and litigation.
  Water rights.
    Existing and proposed.
    Attached to land?
Methods of using water.
  Duty of water in locality.
  Length of irrigation season.
  Crop requirements.
  Rotation.
  Seepage and evaporation.
  Losses in distribution.
  Return flow from irrigated areas.
  Depth to water table.
Soils.
Products.
  Markets.
Rights-of-way.
  Condemnation and damage.
Total costs.
  Cost per acre-foot of water stored.
  Cost per acre-foot of water supplied.
Cost of pumping.
  Area of land supplied.
  Cost per acre watered.
  Cost per acre-foot per foot of lift.
Basis of returns on investment.
Methods and periods of repayment.
Sinking fund. Interest.
Maintenance.
Relations of the users of water to the government, including contract for water (in case the project is a government project).
Very brief comparison with other similar projects.

Small Caterpillar Tractors for Miscellaneous Hauling

The accompanying illustrations show a type of gasoline tractor which is gaining favor in the Far West for a variety of hauling purposes. While not very rapid (about 3 mi. per hr.), these tractors are efficient and economical for hauling over roads and across country where no other kind of motive power, except perhaps several teams of

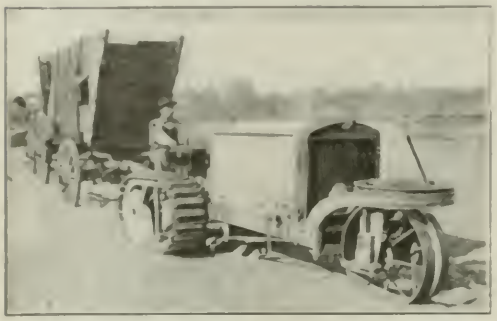


FIG. 1. SMALL CATERPILLAR GASOLINE-ENGINE DRIVEN TRACTOR USED IN THE WEST

oxen, could make any headway. They are used for drawing cultivators and other agricultural implements, for lumbering, freighting, and have proved of special value in engineering construction work.

For road building they are used to haul scarifiers, plows, scrapers, and grading machines, as well as material wagons. As stationary power plants they can be used for pumping, running concrete mixers, etc. For irrigation, ditching and levee building their ability to get over rough ground and soft, like new embankments, is a great advantage. They will climb up a levee slope or ride down into an irrigation ditch without the least difficulty. The front wheel operates on the same principle as the ball-bearing caster of a piece of furniture, and will turn the tractor around almost within its own length.

FIG. 2. CATERPILLAR TRACTOR HAULING A LOAD OF 7 TONS OF DREDGE BUCKETS UP A [illegible] GRADE

To protect the engine from shocks the [illegible] in the hubs of the [illegible] wheels, [illegible] against a powerful spring, which carries the weight of the forward end, and the track frames are supported [illegible] by heavy compression springs [illegible] to the main frame. The [illegible] of the tractor [illegible] is a ball-bearing tread. All the weight borne by the treads is carried on a double row of large balls of chilled cast iron between each tread and its frame. The track links are of manganese steel. Two sizes of these tractors are made with pulls of 12 and 18 hp., respectively, and of 20 and 25 hp. as stationary power units. These tractors are made by Yuba Construction Co., of Marysville, Calif.

Some of the History of Steel Tapes

A correspondent has asked, "When were steel tapes introduced into surveying work?" This question is not so easily answered as it looks. Letters addressed to the leading instrument manufacturers brought indefinite replies in all except two or three instances.

Theodore Hase, Vice-President and Treasurer of the Lufkin Rule Co., wrote:

We have no definite or authentic information on this subject, except that the first steel tapes were made in England and the first ones in the United States by the George M. Eddy Co., Brooklyn, N. Y.

The George M. Eddy Co. informs us that steel tapes were introduced in this country by Col. W. H. Paine about 1870. The use of a home-made steel tape during the same year is described by L. A. Nichols, President of the Chicago Steel Tape Co., in the following answer to our query:

Steel tapes have been used for surveying purposes for probably 100 years. At first these tapes may have been of a nature to make questionable their title of steel tapes; they were measures on more or less narrow, thin pieces of iron, and were used where particular care was required in certain measurements, and preceded the advent of what is known as Gunter's chain.

So far as the writer's knowledge goes, a real steel tape, that is a tape made of steel instead of iron, and of a length which made it really a tape, and graduated at different points, was in use in America prior to the Civil War. It may have been in use for certain purposes a number of years before that date. By the writer's personal knowledge, the first use of a tape in this country occurred in 1870, when some hoop-skirt wire was marked off for measuring bridge spans.

The graduation or marking at first was merely scratched on the steel. As this became easily obliterated, the engineer in charge had solder run on the two sides, and marks made on this solder. Shortly afterward, and within the year 1870, an engineer, a Mr. Wheeler, of Worcester, Mass., obtained some of the hoopskirt steel rolled at the Washburn-Moen Mills in Worcester, put on a drop of solder at each foot and marked the graduations on this solder, the tape being 100 ft. long.

The experiment with this tape was so satisfactory that Mr. Wheeler made several more, and the writer, who was in Mr. Wheeler's party at the time and assisted him, shortly afterward [illegible] and made several short tapes, [illegible] marking the graduations on solder run on the steel.

These, so far as the writer's knowledge goes, were the

first steel tapes ever made with graduations marked on solder or babbitt metal run on the steel. Since then the writer has used these tapes generally, in preference to chains, in his work; and from comments received from other engineers he felt convinced that it was a worthy article of commerce, and in 1900 advertised to make this kind of tape, although as early as the '80s he had made several extra onces and sold them to associates. In 1900 the name, "Chicago steel tape," was adopted for that kind of a tape.

Prior to this, however, if the word steel could be considered in the light of any preparation of iron or bronze, the writer believes he has read in a translation of some foreign work, that a standard of measure made of metal was used in the construction of the Roman aqueducts.

Our own research shows that the first English patent for the manufacture of surveyors' tapes was granted in 1842 to James Chesterman and John Bottom, of Sheffield, County of York. This was for a tape partly or wholly formed of metal. The patent specifications read:

This may be done by means of thin plates of metal or woven metallic fabrics, or by the introduction of fine wires or an open woven metallic fabric in the manufacture of the tape. We prefer, however, introducing fine wires of silver or copper.

This is interesting because it proves that the manufacture and introduction of the well known metallic tape were coincident with the tape made of Sheffield steel. Subsequently, in 1847, James Chesterman was granted a second patent which fully covered the manufacture of steel tapes.

At first these were made of ribbons of steel joined together, and some were plated with copper or tin with engraved graduations. Later it was possible to roll the entire length in one ribbon.

The second patent also covered the machinery for making metal ribbon and metallic tapes, so that for many years Chesterman had a monopoly of the business in Great Britain. For many years, also, Chesterman tapes were used throughout the world. The firm still exists and is still turning out tapes, with which most surveyors are familiar, by name at least.

The only American patent granted previous to 1870 for a metal ribbon tape was in 1860, for a combination of a metal tape and a scale or gage for indicating or setting off the expansion. The tape was defined as a "jointless metal strip." This shows that the tape itself was neither new nor novel in America in 1860.

A Drill Boat Which Lifts Itself Clear of the Water

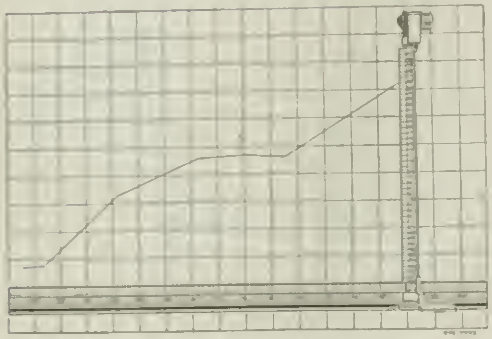
In the harbor of Port Weller, the Ontario entrance of the new Welland Ship Canal, there is now in operation a drill or sounding scow which has the unique ability of lifting itself clear of the water on its own spuds. The two views herewith show the method of operation of the scow. It is about 40 ft. square, of catamaran type, carrying a deck on which is an engine and upon which may be placed an ordinary field drilling machine, such as the one shown in the views. The scow was built for the general purposes of the survey staff of the new canal in connection with the harbor work, but principally to ascertain the elevation of the surface of the rock beneath the overlying material. As it was liable to be caught in rough weather, particularly as the harbor is a new one being built between breakwaters on an exposed shore, a steady platform was required. The engineer in charge first considered using one of the walking stages which were described in Engineering News, Nov. 2, 1911, p. 523, but the present design was found more practicable and cheaper.

Drill Boat Which Lifts Itself Clear of the Water

The scow is framed to slide at each corner through a very heavy spud which carries two sheaves at its top. Over these sheaves passes wire cable from the outer part of the scow to individual engines, one just inboard of each spud. Normally the scow floats as shown in the left view, or is held at anchor in the normal fashion of dredges, but when a more rigid platform is required or when storms approach, the engines are individually started and the scow is lifted up to the position shown in the right view. The engineer in charge of the Welland Canal and responsible for the construction of the scow is J. L. Weller.

NOTES

A New Plotting Scale—The accompanying sketch illustrates [illegible] by Edward A. Zeresh, [illegible] The horizontal arm has a [illegible] graduated. The vertical arm [illegible] perpendicular to the other, has a beveled straight-edge [illegible] and adjacent to this straight-edge there is a [illegible] tape with corresponding



Plotting Scale for Cross-Sections and Profiles

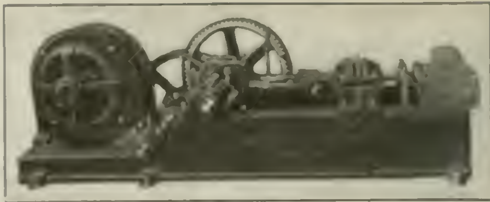
graduations [illegible] over the lower end of the straight-edge and over a movable [illegible] at the top. A projector on the lower part of the arm fits into the groove on the horizontal arm. The device is intended for plotting profiles and cross-sections. The horizontal arm is placed with its straight-edge on the datum line and the tape on the vertical arm is adjusted to this datum line, so that the elevation of the point may be read directly on the arm scale. By use of the horizontal and vertical scales simultaneously, profiles may be plotted rapidly on plain, unruled paper.

A New Pipe-Joint Compound for use on pipe threads [illegible] [illegible] is claimed to have material [illegible] over red lead and other pipe-joint compounds [illegible] has recently been put on the market and is [illegible]

[illegible]

A High-Pressure Plunger Pump for Tunnel Service—[illegible]

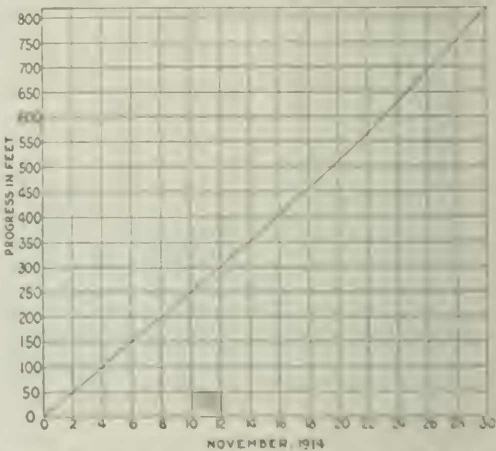
[illegible]



A Horizontal High-Pressure Pump for Tunnels

friction. The machine shown has a capacity of 10[illegible] cu ft per min at 3[illegible]00 lb pressure, and is 7 ft 6 in long, 3 ft wide and 2 ft 10 in high. Other sizes are built.

American Record of Rock-Tunnel Progress—The daily footage made in November, 1914, at the pioneer heading of the Rogers Pass tunnel, of the Canadian-Pacific Ry., is shown by the accompanying curve. The curve indicates that the rate of progress was practically constant (the lowest daily footage was 21, and the greatest 37). A total of [illegible] ft were made—an average of 27.[illegible] ft per day. This is believed to be the American record of rock-tunnel progress, previously held by Mackenzie, Mann & Co., on the Mount Royal tunnel, Montreal, Que. ([illegible] ft in 31 days, [illegible] ft heading; see "Engineer-



Curve Showing Constant Progress at the Pioneer Heading, Rogers Pass Tunnel

ing News" [illegible]

[illegible]

A Standard System of Accounting [illegible]

[illegible]

Editorials

The Lavis Subway Articles

In this issue is concluded Mr. Lavis' notable series of articles describing the extensions of the New York subway system—the greatest engineering work now in progress in the world. We feel sure that many of the readers who have followed these pages for the past twelve weeks will be interested to know that the series is to be republished in book form, where it will be more readily available for reference than in the pages of Engineering News. The work which it describes is only about half done, but practically all of the design and the more difficult elements of construction are of the past, so the present text is adequate as a complete exposition of the subject. One further item—the design and construction of the steel elevated structures—will be taken up in a separate article in Engineering News at an early date.

British Sewage-Works Standards

Hard-and-fast standards for the effluent from sewage-treatment works have been the desire and aim of a certain class of sanitary reformers since sewage treatment began. Two years ago, the British Royal Commission on Sewage Disposal, in its Eighth Report, recommended a general standard with variations up or down, according to local conditions. This was a marked advance, but in the opinion of a committee of well known sewage-works authorities, printed nearly in full elsewhere in this issue, the Royal Commission went too far, in that it recommended any sort of a Parliamentary standard.

Instead of a Parliamentary standard, or even a standard set and subject to modification by a central authority, the Committee holds that since "no two cases are precisely similar," a central authority should have power to say what sort of an effluent "any sewage works ought to produce." The object should not be to secure uniform effluents but "to improve or conserve the conditions of the rivers"—quite another matter.

Of course, the Committee believes that all this means a strong central authority, with technical knowledge and with full power to control the character of the effluent from any and all works, and with no overlapping jurisdiction with any other central authority. With this, as well as the other main conclusion of the report, American engineers and sanitary chemists will agree.

Contests in Engineering Society Elections

Most elections in engineering societies, carried on by letter ballot, are tame affairs, as the ticket selected by the official Nominating Committee is voted on without opposition and the result is a foregone conclusion. Occasionally it happens, however, that some candidate named by the official committee will displease a certain proportion of the membership, an independent committee will be organized and another candidate named in opposition. This happened in the recent annual election in the American Society of Mechanical Engineers, and has happened again in the election of the American Society of Civil Engineers, in which balloting is now in progress.

This last contest deserves attention in these columns because of the unusual grounds on which the opposition to the regular candidate is based. The regular candidate, F. A. Molitor, of New York City, is admitted to be an engineer of high standing in the profession and of high ethical standards, interested deeply in the welfare of the profession and of the Society, and in every way competent to fill the position in question. Those who oppose Mr. Molitor base their opposition on the fact that he wrote a letter, published in Engineering News of May 8, 1913, in which he criticized the conduct of the Society's affairs, and enumerated various directions in which, in his opinion, the conduct of the Society could be altered to the advantage of the membership. Mr. Molitor has promptly replied to the circular sent out by those opposing him, stating that he stands by the letter which was published in Engineering News, and if elected to the Board of Direction, will use his influence toward carrying out the changes he has indicated.

So far, the issue would seem to be clear cut, so that the members can vote understandingly, according to their opinions.

It may be worth while to say a word here as to the opinion, which is undoubtedly honestly held by some, that it is not proper for a member of an engineering society to discuss the society's affairs in the columns of a technical journal. This opinion is based, doubtless, on the idea that a technical society is like a family or a social club, whose internal affairs are the business of its own members and of nobody else.

But a great national engineering society is an entirely different sort of organization from a social club of limited membership. The affairs of the American Society of Civil Engineers are of importance and interest, not alone to the thousands of its own members, but to the profession as a whole. Honest and intelligent criticism is a good thing for any organization; and as a matter of fact, the affairs of the national engineering societies have been a frequent subject for discussion in the technical journals ever since the societies were organized and the technical journals were founded.

There is, in fact, no other means by which general critical discussion of the Society's affairs can be freely carried on, since the official publications of the Society are necessarily under such restrictions that they could not give place to such criticisms save in publishing proceedings of the meetings.

It may be said, perhaps, that the place for such criticisms is at the meetings which the Society holds. These meetings, however, for the transaction of general business, occur at long intervals, not more than once or twice a year. The number of members who do or who can attend these

meetings is usually not a tenth or a twentieth of the Society's membership. As a practical matter, therefore, the only means by which a general discussion of the affairs of the Society can take place with free and candid criticism is through the columns of the technical journals.

We could cite instances in which the free discussion in the technical journals of the affairs of other engineering societies than the American Society of Civil Engineers has prevented such societies from adopting unwise policies, and on the other hand, has greatly aided such societies in their development. Under these conditions, it is difficult to see how any sound indictment for disloyalty can be maintained against an engineer because he discusses in the columns of an engineering journal the affairs of the society to which he belongs.

A Derailment Easy to Explain

The Interstate Commerce Commission has just issued an official report on its investigation of a derailment on the Kansas City Southern Ry. on Oct. 19 last. In this accident the locomotive of a passenger train running at 15 miles an hour was derailed, overturned and went down the bank, causing the death of the engineman.

The track on which this derailment occurred was in such bad condition that at some places the gage at the rail joints was 4 ft. 8 in., while at the center of the rail it was 4 ft. 9½ in. Fifty angle bars were found in a short distance having only one or two bolts in them, while some of the rails had no bolt holes drilled in the webs. Twenty-five angle bars were found within a mile which were broken or badly cracked, and in some cases there were spaces between rail ends as great as 2 in. The rail spiking was so poor that many spikes were loose, some of them standing an inch away from the base of the rail; and in one rail only two spikes out of seventeen on the inside of the rail were holding.

The division engineer in charge stated that the appropriation for the maintenance-of-way department was spent in keeping up the weakest points in order to keep the traffic moving, but was barely sufficient to do this, the condition of the track being substantially the same at the time of the derailment as it had been for year previous, although ten or a dozen derailments had occurred during the year.

There can be no doubt whatever that such a railway track as is described and illustrated in the commission's report is unfit to run trains over. The plea may possibly be made that the railway which allows its track to get in such a condition is forced to do so by lack of funds to properly maintain its road. This defense, however, will not bear analysis. The wear and tear of rolling stock operated over such track, with the loss in accidents that are bound to occur, and the increased expense of moving traffic due to the enforced slow speed, all combine to make the running of trains over a track of this sort the worst kind of extravagance instead of economy.

If a railway company is in such financial condition that it has not the money to maintain its track in reasonably safe condition, its officers should not quietly follow the custom of the past, but should notify the state commission that unless permitted to charge rates high enough to provide earnings sufficient to properly maintain the road they will no longer assume the responsibility for the operation of the railway. On the other hand, if a railway company diverts funds that should be applied to track maintenance in order to engage in outside operations or pay unearned dividends, then the state authorities having the power to do so should compel necessary repairs to be made as a condition to continuance of operation.

The Importance of the Local Engineering Society

At a recent meeting of the Seattle Association of Members of the American Society of Civil Engineers, a resolution was adopted requesting each technical society in the city to appoint representatives to form a joint committee which should plan for coöperation between the different societies. We recently reported a similar movement in Philadelphia, where the Engineers' Club is taking the lead toward the organization of a federation of all the technical societies of Philadelphia with the Engineers' Club as a nucleus. These movements are typical of the progress being made in a number of different cities toward the strengthening of the local engineering society.

In an address on Dec. 17, at the annual dinner of the Engineers' Club of Youngstown, Ohio, F. E. Schmitt, of the editorial staff of ENGINEERING NEWS, emphasized the importance of the local engineering society to the engineer and to the community. There is no doubt that the enormous growth of the national engineering societies during the last quarter century has to a certain extent operated to reduce the importance and the strength of the local engineers' clubs. It is true that the national societies have the power to do for their members and for the profession many things that would be impossible for the local society. It is equally true, however, that a local engineering society, properly organized and supported, can yield benefits to its members and to the public which are impossible for the national society.

One of the greatest benefits yielded by an engineering organization is the promotion of mutual acquaintance and friendship among the men engaged in similar work. This was a comparatively easy accomplishment a quarter of a century ago, when the profession was small and the field of work which it covered was limited. At that time it was possible for a member of one of the national societies of engineers to be personally acquainted with a considerable proportion of his fellow members. Under present conditions this is no longer possible. The average member at one of the great national societies probably attends one of its general meetings not oftener than once in four or five years, and probably finds then that he knows only a handful of those present. We are speaking here, of course, of the average member and not of the men in the higher ranks of the profession who by frequent travel are brought in touch with fellow members in the profession over a wide range of territory.

In a local engineering society, on the other hand, holding fortnightly or monthly meetings throughout the season, with opportunities for social intercourse as well as technical discussion, it is easily possible for an engineer to become personally acquainted with most of the engineers in his own locality and not only with those working in his own immediate specialty, but with engineers in all branches of the profession.

The governing bodies of the national engineering societies have come to realize during the last few years, that if these societies would become truly national organiza-

tions, they must establish local branches in the principal cities where their members can meet each other. Simultaneously with the organization of these local chapters or sections of the national societies in different cities, however, the members conducting them have realized that it was far better to merge these organizations in a single strong, local engineering society rather than attempt to keep alive three or four weak, struggling sections of the national societies, able to hold only infrequent meetings and with small attendance and interest.

In the city of Buffalo, for example, there has long been a small engineering society, made up chiefly of civil engineers and holding very infrequent meetings, so that the organization has, we believe, become little more than a name. A year or two ago, officers of the American Society of Mechanical Engineers visited Buffalo and brought together the resident members of that society for the organization of a local section. The Buffalo members in charge of the movement, however, shortly perceived that in order to form a vigorous, useful organization, its membership should not be confined to those already belonging to the American Society of Mechanical Engineers, but all members of the engineering profession should be invited to join. The name of the organization, therefore, was changed to the Buffalo Engineering Society and a strong influential society has been developed there.

There are two cogent reasons why the engineering profession needs strong engineering societies in each important city as well as the national engineering organizations. The first is that the local engineering society can often accomplish more for the profession in keeping its work before the public than can the national societies. The second is that the public is more and more looking to influential organizations of engineers for guidance on important public questions; and a strong local engineering society, officered by men of ability and good judgment, can deal with public engineering questions in a city or county or state that could not possibly be handled effectively by a national engineering society.

We would by no means be understood as doubting in any way the importance of the national engineering societies or undervaluing the service they have rendered and can render to the profession. What we wish to emphasize is that the local engineering society, well supported and properly organized, has a far larger field of opportunity and usefulness than has been generally realized.

Letters to the Editor

Engineering Societies and the Coast and Geodetic Survey

Sir—I have noted with interest and pleasure your editorial of Dec. 17, concerning our effort to get proper support for the Coast and Geodetic Survey. I am particularly grateful for your suggestion that the engineering societies might well come to our assistance. I earnestly hope this suggestion may be adopted. The Coast and Geodetic Survey is an organization which merits the approval and support of all engineers and just at present it needs that support urgently. If the societies would report their action to the Chairman of the Committee on Appropriations, House of Representatives, I am sure that the information thus sent him would be appreciated.

William C. Redfield,
Secretary, Department of Commerce.

Washington, D. C., Dec. 19, 1914.

[We suggest that any engineering society desiring to investigate this matter with a view to action address a request to the Department of Commerce for a copy of Secretary Redfield's annual report, and if fuller information is desired, address O. H. Tittman, Superintendent of the Survey, Washington, D. C.—Editor.

Cycles of Rainfall and the New Bedford Records

Sir—In September, 1913, the writer published an article in the Stone & Webster *Public Service Journal* entitled "Cycles of Rainfall." It is thought that this may prove of interest in connection with X. H. Goodnough's article on "A Century Rainfall Record at New Bedford, Mass.," published in Engineering News for Nov. 19, 1914.

In the article on "Cycles of Rainfall" attention was called to several very general methods of analyzing precipitation data, all of which gave somewhat different conclusions and impressions. By chance the New Bedford records up to 1906 were included in that discussion, although the records for the subsequent years, as given by Mr. Goodnough, were not then available.

The writer's conclusions regarding the occurrence of cycles of rainfall were that cycles appear in all records, but that the magnitude and length of time of the departure from the normal is quite variable at different stations. Some records indicate a decreasing rainfall for a given period, while others at no very great distance may perhaps indicate the very reverse for the same period. Needless to say, all comparisons should be over the same term of years. In general, the occurrence of rainfall might be likened to the waves on the ocean, varying all the way from the little ripple to the big wave, with resultant diversity of period and magnitude.

It is probable that the major variations occurring in a record 100 years in length may become minor variations over a period of 1000 years, in just the same manner that we find variations occurring between 10- or 15-year periods and 100-year periods. This is, of course, only a mere guess, but has been substantiated to the satisfaction of some people, by the size of the annular rings in the large trees of California and by recent theories regarding the effect of sun spots.

It is desired to call attention to the fact that the method used by Mr. Goodnough in preparing his Fig. 2 is similar to the one used by the writer in preparing his successive

ten-year averages, the latter method being first developed by the U. S. Army engineers in a recent report on the Merrimac River. A comparison of the two charts will show quite marked differences in the shape of the curves. These differences are of sufficient amount to furnish quite different conclusions regarding the cyclical occurrence of rainfall.

The stations selected in the article on "Cycles of Rainfall" were chosen not only because of their length of record, but also because it was thought that they were located sufficiently near together to enable tracing out some general similarities. A reference to the tables and diagrams in that article will, however, show that even in a relatively short distance, as from Boston to Albany, or Boston to New Bedford, the records may be quite different in their characteristics, and warrant quite different conclusions.

The writer believes that Mr. Goodenough has chosen the right theory for smoothing out the yearly abrupt changes in rainfall by using progressive averages. Whether the three-year period is better than a ten-year or any other length of period is extremely uncertain. It is true, however, that the length of period chosen may affect conclusions materially.

Taking the New Bedford records alone, perhaps the conclusion might be warranted that a period of exceptionally dry years may be expected to continue in the near future. The study of other long-term records, however, would warrant the conclusion that we have already reached the lowest point in the cycle. The writer believes that the safest conclusion is that no man can predict whether the future rainfall over the country as a whole is likely to be lower, equal to or greater than that of the past few years.

He thinks, also, that when other stations are analyzed as well as New Bedford, when considering the theory of probability and chance, it is quite likely that the next few years will yield better results than have the past few years. This statement is meant to apply to total yearly amounts and not to the monthly or seasonal variations as the writer is not in a position to discuss the latter, or to offer any opinion regarding the question of future summer runoff in the future.

DANA M. WOOD.

Sears & Webster Building, Boston, Mass.,
Dec. 11, 1914.

A Graphic Method of Determining Runoff in Storm Sewers

Sir—I have taken great pleasure in carefully going over "A Graphic Method of Determining Runoff in Storm Sewers," by O. Hufeland, in your issue of Nov. 5, 1914.

It might not be amiss to call Mr. Hufeland's attention to a paper entitled, "The Theory of Storm Water Drainage in Sewer Systems," presented by the writer before the Western Society of Engineers, May 18, 1910. The principles there presented are identical with those mentioned by Mr. Hufeland, and were worked out entirely independently and with no knowledge of a similar development by engineers in Europe.

The graphical part of Mr. Hufeland's paper is new to the writer and would appear to be of a limited advantage over some of the methods of computation employed at Kansas City, where the writer's method was developed.

J. B. BALCOMB,
Executive Engineer, Buena Vista Power & Irrigation Co.
Alberson, Ore., Nov. 16, 1914.

Sir—In presenting "A Graphic Method of Determining Runoff in Storm Sewers" in your issue of Nov. 5, O. Hufeland appears to criticise quite severely American practice in sewer design. The writer wishes to agree that the continued use of the old formulas or of any formula may be attributed to one of the unpleasant reasons cited, and the censure given is well merited.

Mr. Hufeland, however, goes further and apparently disapproves of everything written on the subject in the past ten years. He apparently approves of Kuichling's work (published in 1889) but evidently does not appreciate the widespread application of the resulting "rational method." A number of modifications and methods of design following Kuichling have been published in the last ten years and several others are in use in the larger cities. It is probable that with a little more publicity for the newer methods and further public condemnation of the use of formulas, the rational method will be adopted in all offices where sewerage work is in the hands of specialists.

It will be difficult, however, to persuade the engineers in smaller places, who have many other phases of municipal work to consider, to give the proper time to the study of improved methods of sewer design. And this missionary work is not helped by the exposition of methods carried to an extreme of refinement far beyond the accuracy of the data in hand and obviously involving greatly increased labor. It is, therefore, extremely advisable that nothing be published which would tend to confuse the issue in the minds of those entering the subject for the first time.

The method given by Mr. Hufeland is an interesting study. As presented, however, it is not a method which can be applied directly to the design of sewers. The writer has used for some time a method very similar to Mr. Hufeland's in interpreting the results of coincident rain and sewer-gage operations for a particular storm.

The vital defect in the method as presented is that the whole system of sewers is designed for a particular storm having a duration of t_c and an intensity of q_c. He fails to give any suggestion as to how the choice of this particular storm for any one sewer system is made. Even if he had laid down a rule for choosing the values for this storm and had designed the system according to the procedure indicated, the result would be that one single piece of sewer would accidentally be designed for critical conditions and that the remaining sections both above and below would be too small. This is evident from the fact that the critical rain for the first branch would be the heaviest rain which could last for a time t_c, and by all the laws of probability this rain would have an intensity much in excess of the value of q_c.

Similarly, the maximum runoff in Section 11 would result from a rain of greater duration than t_c, of duration such that the runoff from all the elementary areas would be contributed at one time. Such a rain would naturally be expected to be of less intensity than q_c, but unless the drainage area were of very unusual shape, the

runoff would be greater than for the conditions given by Mr. Hufeland.

The writer is unable to believe that Mr. Hufeland has correctly interpreted the foreign practice quoted, and would be interested in having this work reëxamined in order that what has been published may be properly supplemented and revised.

W. W. Horner.

325 City Hall, St. Louis, Mo.

Sir—In your issue of Nov. 5, 1914, there is an article by O. Hufeland on a graphic method of determining storm-water runoff. Mr. Hufeland is entitled to many thanks for his assault upon the exponential formulas, which, like all popular fallacies, die hard, but why thicken that "fog of theories" to 100% opaqueness by importing an ultra-theoretical method?

Mr. Hufeland asks us to assume that the rainfall commences suddenly, continues uniformly and ceases abruptly. He says that a "definite intensity" means a "rate of precipitation which is *substantially* uniform during the period" (the italics are mine), and this definite intensity is the foundation stone of the method.

To anyone who has even an elementary knowledge of the subject, the salient point about rainfall is that it is decidedly nonuniform. Therefore, how is it possible that results predicated on *substantial* uniformity should hit anywhere near the mark?

It is hard to see why this method by Vicari should be advocated when the best practice in America tends toward the use of Mr. Kuichling's Rational Method, which involves no such absurdities in its theory, and which is much easier to use.

It is true that the Rational Method assumes the maximum discharge to take place when the water arrives from the furthest points and that this is not true for all drainage areas with the hypothetical storm assumed by the Germans. It is a fact, however, that in practice the Rational Method is very near the truth. For here in America the general type of storm is characterized by a moderate rate of rain for a short time, then a heavy downpour that lets up more or less gradually and irregularly. For this type of storm, which we naturally design our drains to carry, the maximum discharge actually does occur when the water from the furthest point arrives, and the Rational Method is theoretically and practically correct.

It is, to say the least, inconsistent to talk of a "fog of theories" and then attempt to promulgate the doctrine that the discharge of a lateral is characterized by a period of absolutely uniform increase, then a long period of constant rate of flow and another of absolutely uniform decrease. That such assumptions are the wildest kind of theorizing is apparent to anyone who has watched a sewer during a storm or inspected a gage record.

Mr. Kuichling is quoted as insisting on the use of "actual uniform intensities of rainfall." The writer of this letter once elaborated a method of computing runoff which was designed to remove some of the theoretical deficiencies of the Rational Method. As a consequence, he enjoyed the acquaintance of the late Mr. Kuichling and obtained his opinions on the subject direct. Neither by any spoken word nor in any published account can he recollect any such statement. The rate of rainfall used in the Rational Method is the *average* rate of rainfall during the period of concentration, irrespective of whether that intensity was constant or varied.

Mr. Kuichling did, however, urge runoff investigators to pay particular attention to those rare intervals when the rainfall is constant or nearly so for a time, for he considered that in this way only could the value of the coefficient of imperviousness be obtained. His insistence was that these values should be rationally obtained and poor guesswork eliminated. The wisdom of this can be appreciated by referring to the values given by Mr. Hufeland. Roofs that shed only 80% of a hard rain are certainly in need of repairs, and pavements classified as "waterproof," which retain 30% of heavy precipitations, demand a graft investigation.

Carl H. Nordell,
Assistant Engineer, Sewerage Commission.
Milwaukee, Wis., Nov. 24, 1914.

Sir—The article on "A Graphic Method of Determining Runoff in Storm Sewers," which appeared in Engineering News, Nov. 5, 1914, is of particular interest to the writer, who has been studying this subject somewhat of late.

Even a slight investigation of the common formulas for runoff reveals their crudeness for use in rational engineering designs, unless they are based on some local conditions unknown to the average engineer, which make them applicable only under the conditions assumed.

One part in the paper is not entirely clear to the writer. The method seems to cover a design which is correct for only one storm of a given uniform intensity for a given or assumed period of duration. What would be the effect upon the design if the storm were of shorter or longer duration with correspondingly greater or lesser rates of precipitation? If the rate of precipitation in inches per hour were a linear function of the period for which that rate were constant, the effect of different storms might be practically negligible. However, the rate of precipitation is not a linear function of the time as is evident from the published curves, showing the observations made in numerous localities.

If my understanding of the graphic method is correct, Fig. 3 or Fig. 4 of the paper can be made applicable to storms of other durations than that assumed in the example by decreasing or increasing the length t_r and using a new vertical scale proportional to the new rate of precipitation. This can be easily done by shifting the curve $A'K'$ to a parallel position. But this will change the location of the maximum ordinate NL, since the points N and L will no longer be in the same vertical. A new maximum ordinate must, therefore, be found for the new condition, and its value, reduced or increased in proportion to the change in the rate of precipitation, compared with the first value obtained. For example, if t_r were reduced, say 20%, or from 20 min. to 16 min., the ordinate NL would be reduced perhaps 10%, while the rate of precipitation might be increased 15%, leaving roughly 5% to be provided for by increased capacity. The section l_{11} still need only be designed for the same capacity as l_a, as shown in the paper.

Now suppose the duration of the storm to be increased 50%, then t_r would be increased 50% and NL might be increased about 25%, while the rate might be decreased only 20%, leaving 5% increase in capacity to be provided for by change in the design. But in this case the section

L_{1} will carry a greater quantity than L_{2}, since the maximum ordinate extends into section (11) of the flow diagram.

It would, therefore, seem to the writer that a complete analysis of the problem would require an extension of the diagram by adding parallel positions of the curve $A'K''$ (Fig. 3) for periods varying by five or ten minutes, from storms of very short duration, which might alter the design of some laterals, to storms having a duration equal to the time required for water to flow from the most remote inlet through the entire length of the sewer. A comparison of the corrected values of the maximum ordinates for the several positions of the curve $A'K''$ will then give the absolute maximum capacity required for the correct design of the sewer. It should be noted that the method set forth by Mr. Hufeland is admirably adapted for the investigation of the effect of various storms, as the labor of finding the length of the maximum ordinate for any storm is very small after the diagram has once been constructed.

Such an extension of the diagram as that suggested above might result in designing a sewer "gradually increasing in size to the outlet," especially when the duration of the storms considered is equal to the time of flow through the sewer and the rate of precipitation is heavy.

R. D. Goodrich,
City Engineer.

Cheyenne, Wyo., Nov. 12, 1914.

[Replies by Mr. Hufeland to each of the foregoing letters follow. — Editor.]

Sir—I am under obligations to J. B. Balcomb for calling my attention to his paper of 1910, one of the few that I had not seen when I wrote my article. It is interesting in this connection because of the cumulative method which he describes and which resembles the Vicari method in that he draws curves for each drainage unit and adjusts their relation to each other to correspond to the time required for the flow from one unit to reach the next. On page 8 of his paper he says:

A really rational method would consider each sewer an entity—treating it as though it were the only storm drain in the city. This would mean determining the time of storm concentration, the imperviousness of the surface, the frequency with which it would be permissible to flood it, a precipitation curve suited to the particular circumstances, etc.

With the method described by me every one of these requirements can be provided for with the minimum [illegible] [illegible] of labor.

Answering W. W. Horner, I do not "disapprove of everything written on the subject in the past few years." I am also aware of the seven or eight modifications of Mr. Kuichling's work, some of which seemed rather expensive [illegible] [illegible] [illegible]. My "disapproval," if the [illegible] [illegible] word is permissible, is confined to the publication of complicated formulas involving [illegible] [illegible] computations that are based on a few reliable data. A thirty years' experience in sewerage practice and a personal acquaintance with some of those who wrote these papers led me to draw the [illegible] of some of the [illegible]. [illegible] [illegible] American practice, I [illegible] [illegible] American theory as it is [illegible] [illegible] [illegible] [illegible].

The third paragraph of Mr. Horner's letter [illegible] [illegible] [illegible] a [illegible] of personal opinion and I concede only his right to hold the opinion there expressed. The charge that the method proposed is one of "extreme refinement, etc.," embarrasses me somewhat because some of the comments made to me complain of the reverse.

I have answered Mr. Horner's letter so far as it relates to the personal views expressed in the article, but a discussion of the Vicari method would take more room than could be devoted to it in a letter. I do wish to call attention, however, to the fact that the correctness of the graphic method described has nothing to do with the storm selected, nor with the percentage of runoff, nor with the velocity formula used. The article clearly states that its use is based on the "acceptance of the postulate 'that a definite intensity of rainfall during a definite period must result in a definite maximum of runoff, but that this maximum does not necessarily occur when the runoff from the whole area reaches a given point in a collecting sewer.' A definite intensity means, of course, a rate of precipitation which is substantially uniform during the 'period,' etc." If it is correct to use the data available in the above way, the result given by the graphic method should be correct. I will concede that some engineers do not believe that the quantity of storm water reaching a sewer can be determined in so direct a manner. Mr. Kuichling was one of those who did and the writer agrees with him.

At some other time I hope to be able to present data justifying the latter view.

Carl H. Nordell's letter evinces a degree of heat that does not seem to be warranted by the criticisms which he makes. I am quite familiar with the "Uniform Method of Runoff Determination of Storm-Water Sewers" which he presented to the Municipal Engineers of New York in 1909. While very painstaking, it was an effort to prescribe a theory based on very few data, resulting in a theoretical rainfall curve and a slide-rule for sewer computation (now in the market), based more or less on this curve. With the adoption of any other method, particularly if it is one that, due to its simplicity, may find a larger application, his theory and slide-rule will suffer more or less from discredit.

Of course every writer on this subject today talks of the rational method, and [illegible] [illegible] with Mr. Kuichling's name in connection with it, often, as I have said in my answer to W. W. Horner's letter, to Mr. Kuichling's sorrow and anger. To soothe Mr. Nordell in that respect, I will inform him that Mr. Kuichling read my article, took down his copy of [illegible] of the date of 1909, said he had seen the method, and his marks in the book proved it, but had dismissed it because at the first glance it seemed to be based on a table of runoff that he thought was wrong. In that respect he was like Mr. Nordell, who also objects to the runoff, but when I pointed out to Mr. Kuichling that these figures "had nothing to do with the case" he tabled Mr. Nordell's [illegible] again and said in his emphatic way: "It's a damned good thing." That illustrates the difference between Mr. Kuichling and Mr. Nordell. The [illegible] [illegible] [illegible] of making a definite intensity the [illegible] [illegible] [illegible] of the method, I admit it.

Whether I have "next to elementary knowledge of the subject" of rainfall, as compared with the [illegible] [illegible] [illegible] knowledge of Mr. Nordell, is not for me to determine, but I hope in the near future to lay before the engineering profession a careful analysis of a very

long period of rainfall records from self-recording gages which may interest those who still have something to learn of this vexed subject. Unfortunately, I do not deserve the credit for the method with which Mr. Nordell finds so much fault, but have merely made accessible to some engineers a not altogether new help in computation. As I have said in my article, it is a free translation and the credit for it or the lack of "even an elementary knowledge of the subject" must fall on K. Meier, Chief Engineer of Sewers in the city of Berlin, Germany, who wrote the original in "Hütte." My guilt is confined to the "importing," as Mr. Nordell expresses it.

R. D. Goodrich's understanding of the method is quite correct. Not only the maximum flow for the whole area, but the flow through any of the laterals at any period of the storm, will be represented by the ordinate for the time required.

One gratification furnished by the letters on this subject that have reached me is the conviction that the exponential formula is rapidly going to its long deserved obsolescence.

O. Hufeland.

Municipal Building, New York City, Dec. 21, 1914.

NOTES AND QUERIES

The thickness of the asphalt pavement on the Junipero Serra Boulevard, San Francisco, Calif., is 2½ in. and not 3 in., as stated in the caption under Fig. 3, p. 1182, in our issue of Dec. 10, 1914. Also, through an oversight, the author referred to the bituminous rock deposits in the vicinity of Santa Cruz as biteminous limestone. These deposits are bituminous sandstone.

On Establishing and Enforcing a British Standard for Sewage Effluents

A brief but important British report on a standard for sewage-works effluents and means for the enforcement of such a standard, has been made public. The committee was selected by the Association of Municipal Corporations and its members were chosen "for their skill in the design and maintenance of sewerage and sewage-disposal works." The report was submitted, on behalf of the committee, by its chairman, John D. Watson, Engineer to the Birmingham, Tame and Rea District Drainage Board, Tyburn, Birmingham, England.*

The deliberations of the committee were on the recommendations of the Royal Commission on Sewage Disposal dealing with standards of purity (Summary of Conclusions, par. 62, p. 17, Eighth Report; see Engineering News, Jan. 9, 1913).

After introductory statements the committee declared that although it believed British legislation on stream pollution (Public Health Act, 1875) "is greatly in need of amendment," yet "it is not desirable that standards of purity be prescribed by Parliament as the Royal Commission recommend." The remainder of the report, which is also the substance of the document, reads as follows:

4. The discussions established the fact that the Committee are in complete agreement that the law as it stands is greatly in need of amendment, but that it is not desirable that standards of purity should be prescribed by Parliament as the Royal Commission recommended.

5. The predominating factor in considering the advisability of creating a standard by Act of Parliament is the fact that no two cases are precisely similar. Differences manifest themselves in the character and volume of the stream into which the sewage effluent is discharged, and in the strength and characteristics of the sewage itself. In practice it is found that the strength of the sewage varies considerably even during a day of 24 hours, that no bacteria bed or irrigation field emits effluents of unvarying quality, and that it is unreasonable to expect a purification plant of excellent design and ample capacity to give as good results during a time of abnormally cold weather as it would during a normal season. If such a plant were large enough to produce a standard effluent in mid-winter, it would obviously be too large and expensive to meet the demands of the statute at other seasons, and vice versa.

6. In view of these varying conditions, the Committee think that it should be left to a central authority possessing adequate technical knowledge and power to determine finally all disputes, whether with public authorities or private persons, relating to the quality of sewage effluents, effluents from storm-water tanks, or any other liquid discharges into tidal rivers, streams, canals, ponds or lakes, and to settle any incidental questions, such as the amount of compensation or damages. Such central authority should not only have power to indicate the quality of the effluent which any sewage-works ought to produce, but should also have power to make regulations as to how and when samples should be taken for the purpose of ascertaining whether such effluent is produced.

7. The Committee have come to this view with reluctance, as they are aware of the prevalent objection to multiplying Government Boards, but they see no workable alternative to giving a Government Department absolute power to determine what must be done in individual cases, unless setting up a standard of purification by Act of Parliament. The latter course they believe to be quite impracticable, and any suggestion to make it less impracticable, by authorizing the central authority to override the statute in the interest of a municipality for any reason whatever, would probably be unsatisfactory even to the community in whose interest the concession is made.

8. Any amendment of the law should be to improve or conserve the condition of the rivers, and not to compel municipalities to discharge sewage effluents of uniform quality. The authority of the central authority should be paramount, and every municipality should be obliged to accept their dictum as to what is necessary; not, however, until a careful and unbiased inquiry into all the circumstances of each case has been made. As the judgment of the Local Government Board in reference to size and form of tanks, capacity of bacteria beds, etc., is now accepted, so should the decision of the central authority be accepted, in all matters relating to the pollution of rivers; and as the Local Government Board have power to vary their requirements as a condition of sanctioning a new loan, so should the central authority have power to vary their requirements as a condition of assuming responsibility for allowing effluent to enter a stream.

9. Whether the central authority should be affiliated with the Local Government Board, or with a new department under a Public Health Minister, it is not for this Committee to discuss here, but there should be no overlapping, and it should not be possible for one authority to order works to be constructed which another authority might deem useless or redundant.

10. The Committee believe that a central authority could greatly help municipalities by establishing and maintaining a national research department.

*Among the other members of the committee were Gilbert J. Fowler, of Manchester, Geo. A. Hart, of Leeds, Joseph Garfield, of Bradford, and E. G. Mawbey, of Leicester. The report was dated Oct. 3, 1913, but was not made public until a few weeks ago. The report was addressed to H. G. Pritchard, Secretary, Association of Municipal Corporations, 9 Bridge St., Westminster, S. W., England.

Sewage Disposal for Indiana Cities by discharging the sewage into the Chicago drainage canal instead of into Lake Michigan has been proposed by the Sanitary District of Chicago as a means of reducing the pollution at the southern end of the lake. The cities in question are Whiting, Hammond, East Chicago and Gary, and the Sanitary District has offered the use (without charge) of the new Sag Canal, which is now being built from the Calumet River to the main drainage canal. The cities will vote in a few months on the acceptance of this proposition, which will involve a rearrangement of the sewers and the construction of the necessary connections.

The Failure of the Hippodrome Arcade, Youngstown, Ohio

On Oct. 26, 1914, a section of the reinforced-concrete part of the new Hippodrome Building, under construction in Youngstown, Ohio, collapsed and carried down in the [illegible] a number of workmen, three of whom were killed in the accident. Engineering News has refrained from any discussion of the design or construction of this building, or of the causes of its failure until the results of official investigations might be available. It now appears extremely unlikely that any such official investigations will take place, so an effort has been made to procure all possible information regarding the building with a view to establishing, if possible, the cause of the failure.

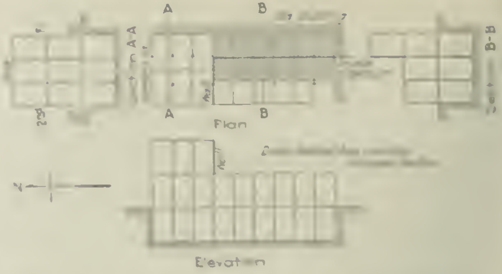


Fig. 1. Outline Plan and Sections of the Hippodrome Building Arcade, Youngstown

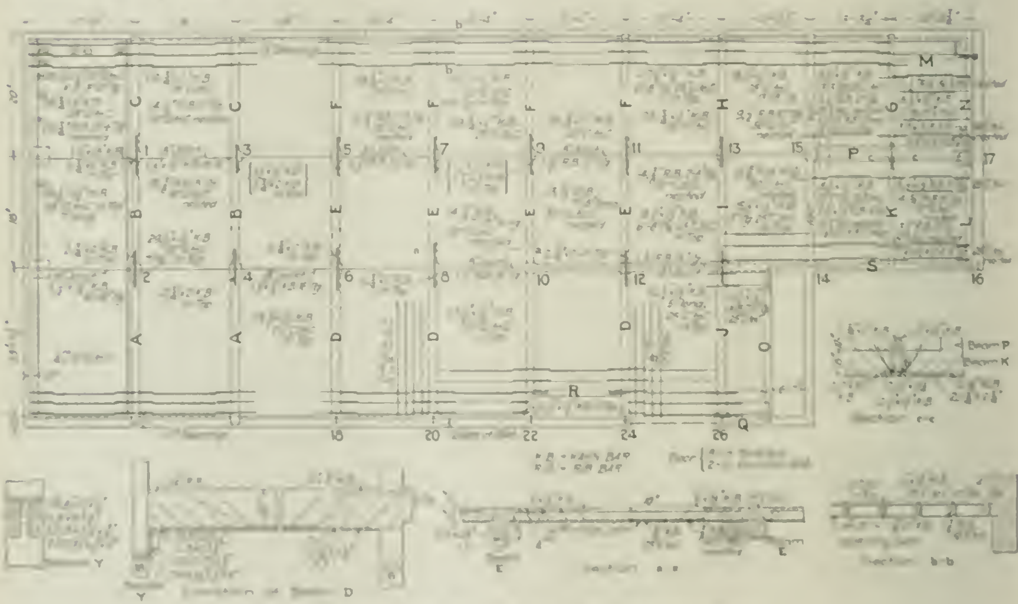


Fig. 2. Details of First Floor, Hippodrome Arcade

The following data regarding the design of the building are authoritative, inasmuch as they are based on drawings and computations freely offered to the investigator. The statements regarding the construction of the building on the other hand, while made only after the most studied effort for accuracy, are subject to the doubt which must affect all [illegible] testimony and eye-witness statements.

GENERAL DESIGN

The Hippodrome Building, in Youngstown, is a steel [illegible] structure, having at one side of the main auditorium an arcade and office building, mainly two stories and basement in height, which opens on [illegible] St. at one end and which at the other end is reached from Federal St. through an arcade built part way in an old structure facing Federal St., and the rest of the way in the new Hippodrome addition.

As originally designed, the whole building (theater and arcade addition) was of steel construction. Some time after the letting of the contract, however, the contractors,

TABLE 1. GIRDER SCHEDULE FOR FIRST FLOOR

Mark	[illegible]	[illegible]	[illegible]	[illegible]	Length	Mark	[illegible]	[illegible]	[illegible]	[illegible]	Length
		Steel				Concrete					
A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	J	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	K	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	L	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	M	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	O	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
F	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
G	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Q	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
H	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	R	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
I	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	S	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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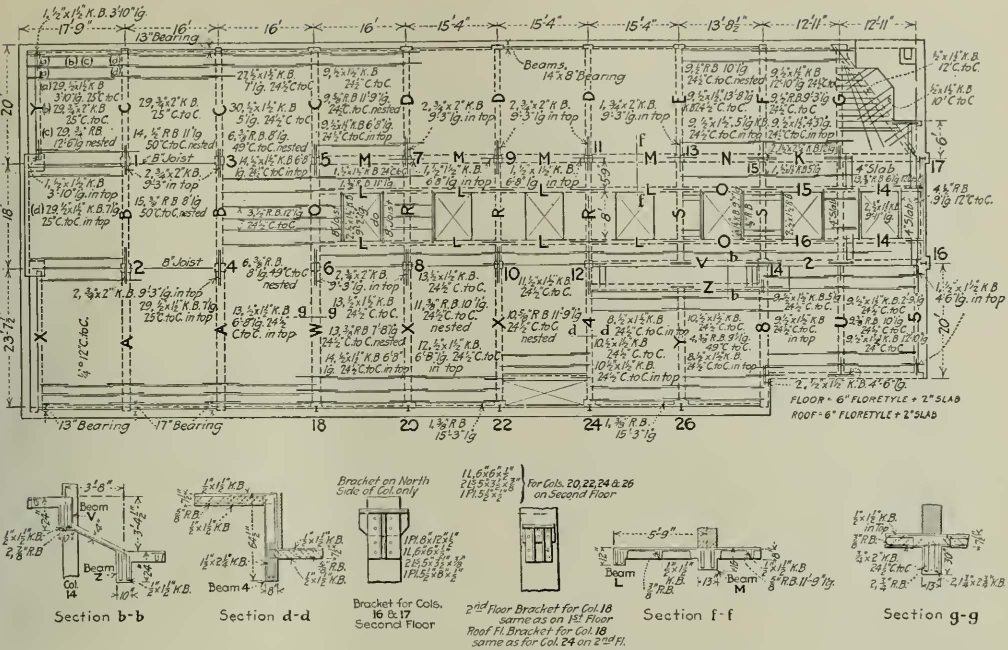

Fig. 3. Details of Second Floor, Hippodrome Arcade

with the full approval of the architects and of the architects' engineer, changed the design of the arcade addition to reinforced concrete. Work was proceeded upon on this basis.

The building was designed by Knox & Elliott, architects, of Cleveland, Ohio, who had for their structural engineer, J. C. Spencer, M. Am. Soc. C. E., also of Cleveland. The reinforced-concrete design for the arcade was made by the Trussed Concrete Steel Co., and approved by the architects. The building is being erected by the George A. Fuller Co., under the direction and inspection of the architects.

The arcade addition is in plan a rectangle, 151 ft. long and 62 ft. wide, and has in its main section two stories and a basement, the first floor being at the street level. The framing is complicated by the central arcade, but can be understood from the following description and a study of the accompanying drawings.

In general, the building is divided into three bays across its narrow portion and nine bays along its length. The arcade extends north six bays from the south end of the building. The northerly three bays are all two stories and basement high, but in the southerly six bays the easterly bay is two stories and basement high, and the westerly two bays, one story and basement high, with the arcade in the center bay. The west and south sides of the second story of the building have brick curtain walls pierced with numerous window openings and resting on the reinforced-concrete beams of the frame.

TABLE II. GIRDER SCHEDULE FOR SECOND FLOOR

Concrete				Steel		
Mark	No.	Section, In.	Tee, In	No.	Size, In.	Length, Ft.-In.
A	2	12x28	28	2	1¾x2¾K.b.	25-0
				1	1R.b.	27-0B.
				2	¾R.b.	18-6N.
B	2	10x22	20	2	1½x2¼K.b.	18-0
				1	⅝R.b.	28-0B.
C	3	10x24	21	2	1½x2¼K.b.	19-6
				1	⅞R.b.	21-6B.
				2	⅝R.b.	14-6N.
D	3	10x24	22	2	1½x2¼K.b.	19-6
				1	¾R.b.	21-6B.
				2	⅝R.b.	14-6N.
E	1	10x24	21	2	1½x2¼K.b.	19-6
				1	⅝R.b.	21-6B.
				2	⅝R.b.	14-6N.
F	1	10x24	18	2	1¼x2¼K.b.	19-6
				1	⅝R.b.	21-6B.
				2	½R.b.	11-2N.
G	1	10x24		2	¾x2K.b.	19-6
				1	⅝R.b.	15-0
				2	½R.b	15-0N.
H	1	10x19	21	2	1½x2¼K.b.	19-6
				2	⅝R.b.	15-0N.
I	1	10x12	0	2	½x1½K.b.	9-0
J	1	10x12	0	2	½x1½Kb.	6-3
K	1	13x24	51	2	2x3½K.b.	26-2
				1	1½x2¼Kb.	26-2
				1	⅞R.b.	28-0B.
				2	1R b.	20-0N.
L	8	8x12	0	2	½x1½K.b.	15-3
M	4	13x16	13	2	¾x2K.b.	15-3
N	1	13x16	13	2	¾x2K.b.	13-8
O	2	8x12	0	2	½x1½K.b.	13-8
P	2	8x12	0	2	½x1½K.b.	9-11
Q	1	13x23½	16	2	1½x2¼K.b.	18-0
				1	½R.b.	28-0
				2	¾R.b.	13-6N.
R	3	10x19	13	2	¾x2K.b.	18-0
				1	⅝R b.	13-6
S	2	10x19	15	2	¾x2K b.	18-0
				1	¾R.b.	13-6
T	3	10x19	13	2	¾x2K.b.	18-9
				1	⅝R.b.	13-6

Concrete				Steel		
Mark	No.	Section, In.	Tee, In.	No.	Size, In.	Length, Ft.-In.
U	1	10x19	27	2	1½x2¼K.b.	20-0
				2	¾K.b.	15-0N.
V	1	10x21	23	1	1½x2¼R.b.	29-4
				1	1½x2¼K.b.	29-4
				1	⅝R.b.	32-0B
				2	⅞R.b.	22-6N.
W	1	13x30	26	2	1¾x2¾K.b.	23-6
				2	¾R.b.	18-6N.
				1	¾R.b.	26-2B.
X	1	12x24	25	2	1½x2¼K.b.	24-0
				1	¾R.b.	24-9B.
				2	¾R.b.	18-6N.
Y	1	12x22	15	2	¾x2K.b.	19-0
				2	¾R.b.	14-6N
				1	½R.b.	15-6
Z	1	10x24	36	1	2x3½K.b.	29-6
				1	1¾x2¾K.b.	29-6
				1	⅞R.b.	30-8B.N
2	1	8x59½	0	2	1½x2¼K.b.	26-2
				2	½R.b.	34-0B.N.
				19	¼rd.*	8-7B.
4	1	8x64½	0	2	1½x2¼	23-6
				1	⅞R.b.	29-0B.
				17	¼rd.*	10-11B.
5	1	10x16	0	2	¾x2K.b.	20-0
				1	⅞R.b.	15-0
6	1	8x14	0	2	½x1½K.b.	15-6
7	1	12x24	23	2	1½x2¼K.b.	26-8
				1	¾x2K.b.	26-8
				2	¾R.b.	28-5B.N.
8	1	13x24	30	2	1¾x2¾K.b.	25-0
				1	1R.b.	26-6B.
				2	⅞R.b.	18-6N.
9	1	12x25½	18	2	1¼x2¼K.b.	25-0
				1	1⅛R.b.	25-11B.
10	1	12x25½	0	2	¾x2K.b.	17-10
11	1	12x25½	0	2	¾x2K.b.	19-2
				1	⅞R.b.	20-10B

*18 in. c. to c.

Reinforced-Concrete Design

The reinforced-concrete design comprises columns spaced in fairly uniform bays, carrying transverse girders which, in turn, carry the closely spaced beams of a beam-and-slab floor. The only variation from a normal reinforced-concrete frame is caused by the exterior wall

[illegible]. The [illegible] wall is the curtain between the theater and the arcade and is carried on the steelwork of the theater; the reinforced-concrete girders of the arcade frame into the steel columns of the theater and rest on brackets provided for that purpose (see Fig. 3). The north or street wall is carried on pilasters into which the various floors frame. The east wall is a brick bearing wall with pilasters, in which rest the girders and slabs of the floors. The design here calls for 13 to 14 in.

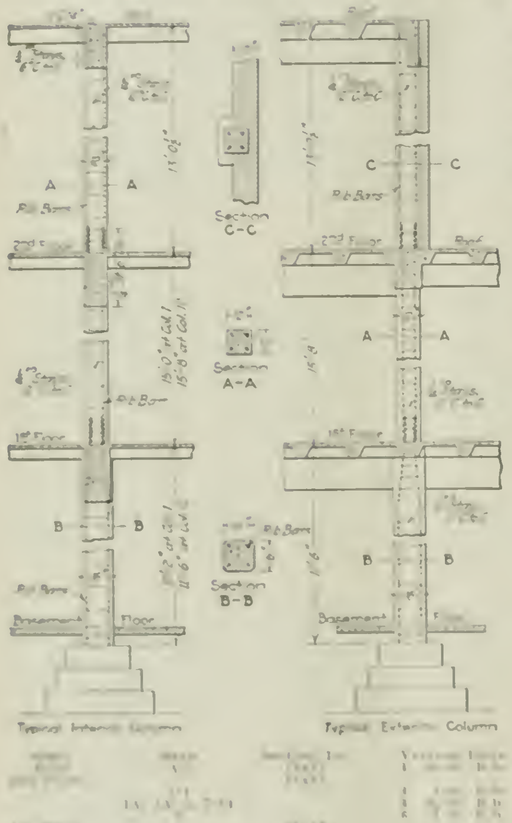

FIG. 4. COLUMN DETAILS

bearing for each girder and at least [illegible] in. bearing for all slabs. The south wall is the old brick wall of the adjoining building. In the westerly panel, there being a stairway well in the southwest corner, the floor was carried in girders out to this wall; but the middle panel was to be carried on steel columns provided for the purpose. The construction at this point is quite critical and is described in detail later in this article.

COLUMNS—The column details are shown in Fig. 4. They rest on concrete footings of low soil pressure and are reinforced at the four corners with straight rods tied together every 10 in. with wire. They vary from 18x18 in. in section in the basement floor to 12x12 in. at the second floor. The columns in the theater section wall, that is, the west side of the arcade, are of steel H-section, and carry on their other side the framing for the theater floors. They are provided on the arcade side with brackets (see Fig. 3), having a 6-in. outstanding leg, on which rests the girder.

GIRDERS—The girder schedules for a number of the girders are shown in Figs. 2-3. These are typical. The girders are reinforced with straight rods with integral stirrups (Kahn type) and, where required, by deformed bars, rested in the pronged bars and bent up to go over the supports. In other girders continuity is provided by one or more separate Kahn bars, turned upside down and placed in the upper part of the beam over the column. At both the east and west walls the girders have only a bearing with no very effective steel continuity into the wall or column; they are figured as semi-continuous for these two outside panels.

FLOORS—The floor-slab detail is shown in Fig. 2. The intermediate beams of the floor slab are parallel to the long side of the building and frame into the main girders, and continuity over these girders is taken care of by rods in the upper part of the beams. The slab is formed by the so called "floretyle," that is, the opening is made by a pressed-steel continuous form, which gives the required shape.

LOADS AND STRESSES—The design was made according to the following specifications:

Span length, center to center of span;

f_s = 16,000 lb. per sq.in.;

f_c = 700 lb. per sq.in.;

Shear in concrete = 60 lb. per sq.in.;

Compression in concrete in columns, 500 lb. per sq.in.;

Moment coefficient of partially continuous span, one-tenth; fully continuous, one-twelfth; negative moment over support, fully continuous beams, one-twenty-fourth.

Figuring live loads for columns, 25% reduction is made for the second floor and a 30% reduction for the first floor.

The loads on the first floor for floor design were 150 lb. live load + 18 lb. for floor finish + 5 lb. for ceiling; for the second floor, 100 lb. live load + 16 lb. finish + 5 lb. ceiling, and for the roof, 40 lb. live load + 24 lb. finish + 5 lb. for the ceiling.

All beams and columns were figured according to the principles laid down in the report of the Joint Committee on Concrete and Reinforced Concrete, following the above noted specifications. The editors of ENGINEERING NEWS have not checked the whole design, but they have checked a number of the members, both beams, columns and slabs and have found that they are designed within the specifications laid down above.

COLUMNS 16 AND 17.—With one exception, the design was followed in construction. This exception is, however, rather important and should be noted in detail.

The plan in Fig. 2, which in this respect at least is a facsimile of the concrete drawing, shows the 2d floor columns 16 and 17 at the south entrance to the arcade. The detail in Fig. 3 shows also the bracket provided on the reinforced-concrete drawings to carry Beams K and 2 on Columns 17 and 16, respectively. The steel columns at these points were provided in the original design to carry

not only the steel-beam framing of the arcade, but also a new lintel over the arcade under the old wall of the building, which lies to the south of the arcade. The steel drawings, which were turned over to the reinforced-concrete designers, showed steel columns at this location and they assumed that such were required, and therefore left the column design as it was and provided steel brackets onto which to rest the concrete beams.

The construction was proceeded with upon this basis. The steel columns shown were detailed by the engineer, ordered, fabricated and brought to the job, as was also

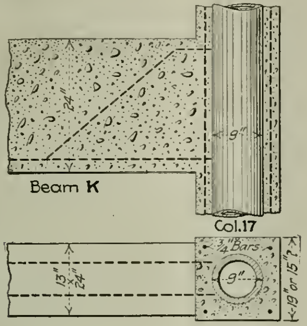

Fig. 5. Sketch of Connection of Beam K to Column 17, as Built

the steel I-beam lintel. When construction reached this point, however, and the brick wall was pierced, it was found that it had been carried across this space on an I-beam lintel and there were in the location of these steel columns two 9-in. cast-iron columns on which the steel lintel rested. After due consideration on the part of the architect and the engineer, but without consultation with the reinforced-concrete designer, it was decided to clear out the brick wall from around the cast-iron columns, to incase them with concrete and to rest Beams K and 2 on this concrete.

Testimony is somewhat vague as to the precise method by which this connection was made, but according to our best information the sketch in Fig. 5 shows the condition at Column 17, which presumably was duplicated at Column 16. It will be seen that the 9-in. cast-iron column was incased with concrete to make a square 19-in. column (other testimony is to the effect that this incasement made only 15 in. square), which concrete incasement was reinforced with four ¾-in. rods, one in each corner of the square. Into this the 13x24-in. Beam K was framed, having for its sole bearing the 5 in. (or, according to the other evidence, 3 in.) on the concrete casing of the cast-iron column feebly reinforced by the slender rods. The reinforcement of Beam K was continued up to as close as possible to the cast-iron column, which incidentally had its top some inches above the top of Beam K.

Construction

Construction of the concrete portion was started early in September and the various parts were begun on the following dates: Basement columns, Sept. 22; first floor, Sept. 23; second floor, Oct. 2; roof concrete, about Oct. 19; roof covering of cinder concrete, Oct. 21. On Oct. 26, at 4:45 p.m., that part of the reinforced-concrete structure lying east of the west arcade columns and south of the transverse arcade wall (shown in the plan in Fig. 1) collapsed without apparent warning. The collapse was complete from roof to cellar and the testimony of eye witnesses is so vague and confused that it cannot be determined in what part of the structure failure started nor in what manner it progressed. The five columns (numbered 7, 9, 11, 13 and 15) in the collapsed zone were thrown down, except that a stump of Column 7 remained standing. The girders at the east wall were pulled clean from the wall, as was to be expected inasmuch as their connection there was one of bearing and not of reinforcement. The girders on Columns 6, 8, 10, 12 and 14 were sheared off quite clean at the column head, and the rods which extended up into those columns and over the column head to insure continuity were pulled clean from the concrete of the beam. The plane of the floor slabs in the débris sloped down from either side of the break. The breaks at Columns 17 and 16 were clean, with no indication of any rod tie into the concrete surrounding those columns. Testimony is not clear as to whether the concrete casing of the cast-iron Columns 16 and 17 were sheared off beneath the bearing of the beams which framed into them or whether the break was in effect a continuation of the plane of the column casing.

Material—The cement used in the structure was the Alpha brand, which was tested by the Pittsburgh Testing Laboratory and which passed with a good margin all the standard specifications for portland cement.

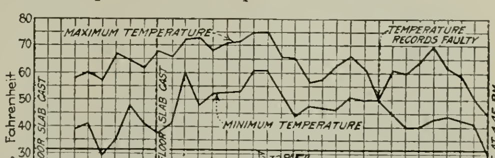

Fig. 6. Temperature Record, Youngstown, Ohio, Sept. 23-Oct. 26, 1914

The aggregate was a separated sand and gravel coming from the local pit of the Concrete Stone & Sand Co. This aggregate is decidedly subject to suspicion. The testimony of a number of competent engineers in the Youngstown district is to the effect that it has a decided tendency toward loaminess and that it should never be used for reinforced-concrete work. So far as we were able to discover, it never had been used previous to this construction in reinforced-concrete work, although it has been used for concrete on street-paving work in Youngstown. The building inspector of the City of Youngstown states that he inspected the sand for the Hippodrome job and never found more than 4% loam, the inspection being the ordinary rough test in a graduated glass of water. The reinforcing steel was furnished by the Trussed Concrete Steel Co. There seems no reason to believe that this steel is in any way responsible for the failure.

The concrete was mixed in a batch mixer and in 1 : 2 : 4 proportions, and chuted into place from the high adjoining roof of the theater building. The chute was at a steep angle so that it was not necessary to add any great excess of water to make it flow freely. The temperature

during the laying of the concrete is shown in the accompanying Fig. 6, which record is taken from a local newspaper's recording thermometer for three-hour intervals throughout day and night, except for the period each week from 3 p.m. Saturday to 9 a.m. Sunday, when no record was taken. From this it will be seen that just after the casting of the basement columns was a three-day period of quite low maximum temperature, with at least one day below freezing. From that time on until ten days before the collapse, however, the thermometer was well above freezing. A cold spell set in the day of the collapse, and snow fell that night.

Struts—The struts to support the floor consisted of [illegible] spaced about [illegible] in both directions and braced with at least one horizontal line of plank.

The question of strut removal under the floors is an extremely difficult one. Everyone connected with the building admits that the struts under the first floor, that is, the basement struts, were removed entirely at least a week before the collapse. It is agreed also that the struts were still under the third-story roof. There is, however, some question about the struts under the arcade roof and the second floor—that is, the struts in the street story. The contractor's superintendent states that while some of the struts in the north end of the building (the portion which did not collapse) had been removed on the night of the collapse to allow the tearing down of box forms preparatory to putting up the ceiling, he is emphatic in his statement that none of these struts under the collapsed portion of the second floor had been removed up to the time of the collapse. The city's assistant building inspector states that at nine o'clock on the morning of the collapse (the last time he was on the job before the failure) some workmen were taking down some of the struts in the collapsed portion of the first floor, but were taking them down one at a time in order to permit the removal of some of the box forms under the beams and slabs and were replacing the struts as the boxes were taken out. Some outside observers state that at three o'clock on the afternoon of the failure they noticed carpenters removing some of the struts on the street floor under the collapsed portion of the building, but they are unable to testify certainly that these struts were not replaced one by one as they were taken down. That part of the building which remained standing after the collapse was fully strutted.

Concrete—Specimens of concrete from the fallen floors and columns seemed entirely satisfactory, although there are no available tests from which its strength might be determined. However, there are two [illegible] of concrete in evidence [illegible] which might [illegible] taken from [illegible] the day of the failure [illegible] the head of the [illegible]. The [illegible] some ten weeks later were [illegible] of the concrete, indicating that a certain degree of set had then taken place. There is no way of proving [illegible] where this particular concrete was [illegible] in the building. It might have been [illegible] which was at most seven days old at the time of the collapse. At any rate, these concrete specimens [illegible] which were examined are not what would be called good concrete. It had reached a [illegible] set, as would be expected [illegible] but it [illegible]. In its present condition it undoubtedly would not be [illegible] a cause of a concrete failure, but its present condition also would throw considerable suspicion upon its strength at the time of the failure.

CONCLUSIONS

There are three factors which may contribute to the failure of a reinforced-concrete structure; the design, the materials and the construction.

The design of the Hippodrome arcade is somewhat less conservative in unit stresses than the report of the Joint Committee, but in that respect it does not differ from many other accepted reinforced-concrete designs, nor can it be said these higher stresses are so dangerous as to cause failure. In the matter of beam reinforcement and connections, and column reinforcement the design follows standard practice and is at fault only so far as that practice is at fault.

Of the materials the cement and steel are beyond suspicion, but the concrete aggregate had a bad reputation in general and in this particular job was of doubtful quality, for the reports on its freedom from loam are not reassuring. In fact, it seems probable that the set of the concrete was retarded by the character of the aggregate to such an extent that its strength at the time of failure was considerably less than it should have been. While there is no absolute evidence that this poor aggregate or resulting poor concrete was the cause of the collapse, suspicion may justly be directed toward it.

The construction was carried out by an experienced contractor of high reputation under the inspection of the architect. Except for the fact that the city's inspection service was perfunctory (a common enough condition) and the reinforced-concrete designer had no responsibility for the construction, the conditions of erection were ideal. The resulting work was satisfactory, except for the possible premature removal of forms and the elimination of the bracket from Columns 16 and 17, as noted above.

It seems probable—and this statement is made after listening to two absolutely contradictory statements by equally reliable men—that there was no intention to remove forms under the second floor on the day of the accident, but that there was a progressive removal and replacement of some of the struts, which might have thrown some of the girders into bearing. In view of the fact that there had been some cold weather and particularly in view of the poor aggregate, it is more than probable that the girders thus relieved would be strained to the point of failure, although they were at the time over three weeks old. The connections of Columns 16 and 17 were doubtfully weak and if the beams framing into these columns were thrown into stress by the removal of the centering, failure might readily have occurred there. It should also be noted that the centering under the first floor was removed when the columns and beams there were about four weeks old. While this is ample time under ordinary conditions, the aggregate and the temperature make this another possible failure point.

The final conclusion then is that the design of the structure was ample to have held up under the loading conditions at the time of failure if the concrete had had the expected strength of a 1:2:4 concrete three to four weeks old. That leaves as an alternative either that the basement columns and first-floor girders were not sufficiently strong at the time of collapse to carry the upper floors, or that the partial removal of struts at the street floor threw an excessive strain on the obviously weak concrete of the second floor.

An Example of Fire-Resistant Windows and Structure

The recent successful fire test passed by the new building for the Reliance Gauge Column Co., Cleveland, Ohio, is a very good testimonial to the possibilities of really fireproof construction. This company had a new building nearly ready for occupancy, when on Dec. 14 last, at 2 a.m., a fire broke out in an immediately adjoining frame building. The engines, which were soon called, were in service until 5:30 of the same morning, by which time the frame building had been totally destroyed. The fire

Fig. 1. Interior of First Floor of Reliance Gauge Column Co.'s Building, Cleveland, Ohio, after Fire of Dec. 14

(Note that the whole damage is the warping of the steel sash, the breaking of one or two of the wire-glass panes, and the removal of an entire steel window frame to permit the entrance of firemen to fight the fire outside. The building was about to be occupied and contained considerable loose timber.)

Fig. 2. Appearance of the Concrete, Brick and Stone Face of Reliance Building after Fire of Dec. 14

was intensely hot as the frame building was over 30 years old, and during that time had served as a home for a number of manufacturing concerns, with the result that it was very thoroughly dried out and fairly well saturated with oil.

The new Reliance Gauge Column Co. building is a four-story structure with reinforced-concrete frame, brick curtain walls lighted with factory-ribbed wire-glass in steel sash. At a somewhat greater distance from the frame building was a brick building with wooden window frames and fire shutters of wood coated with sheet metal. In this latter building a number of the shutters were badly damaged and some of the window frames were nearly destroyed. Its contents were damaged to the extent of \$5000 by fire and water.

The new reinforced-concrete building was immediately alongside of the burning structure and exposed to the full heat of the conflagration, but it resisted the fire with hardly any damage. In order to get at the blaze outside the firemen found it necessary to remove one of the steel window frames on the first floor. This was very difficult on account of the secure manner in which the frames were anchored into the structure, but by the use of a block and fall with twelve men on the line, the frame was finally torn loose and the building entered. Except for this damage and for one or two window panes broken during the fire, the damage to the concrete building was confined to the surface effect on the brick and concrete, which is well shown in the view in Fig. 2. The intense heat of the fire, it may be noted, spalled off the brick walls and the stone window sills on the second floor there shown.

The steel sash, which was of the Fenestra type, made

by the Detroit Steel Products Co., of Detroit, Mich., was warped in places, but in spite of this warping the joints around the ventilator section of the sash remain comparatively tight.

A Prominent Firm of Early American Bridge Builders

Some time ago, in an article in ENGINEERING NEWS, describing some old structural work, mention was made of "a Mr. Wilson, of Philadelphia," as having been connected with its design. This reference was to a member of the firm of Wilson Bros. & Co., whose members were among the notable bridge designers and builders in this country during the period following the Civil War.

The firm of Wilson Bros. & Co., Civil Engineers and Architects, was founded in January, 1876, by John A. Wilson, Joseph M. Wilson and Henry W. Wilson, all Members of the American Society of Civil Engineers. They were the sons of William Hasell Wilson, Honorary Member of the American Society of Civil Engineers, and also grandsons and great-grandsons of distinguished American civil engineers. John A. Wilson died Jan. 19, 18[illegible], and Joseph M. Wilson, Nov. 24, 1902. The other brother, Henry W. Wilson, still lives in Philadelphia. After the death of the two elder brothers, the firm became Wilson, Harris & Richards, with Mr. Wilson as senior partner. Since he retired, about four years ago, the firm has been Harris & Richards.

John A. Wilson was born in 18[illegible]. He graduated from Rensselaer Polytechnic Institute in 1856 and some of his earliest engineering experience was with John C. Trautwine, as topographer on railway surveys in Central America. From 18[illegible] until the formation of the firm of Wilson Bros. & Co., he was with the Pennsylvania R.R. and its subsidiaries, except during the Civil War period, when he served as Captain on the staff of General Couch. Mr. Wilson was at various times Chief Engineer of the Philadelphia & Erie R.R. (Pennsylvania R.R. Co., lessee), Chief Engineer of Maintenance of Way on the main line of the Pennsylvania R.R. and Chief Engineer of Location and Construction of the Low-Grade Division of the Allegheny Valley R.R. He was a member of the American Institute of Mining Engineers and of the Franklin Institute.

Joseph M. Wilson was born in 18[illegible] and graduated from Rensselaer Polytechnic Institute in 18[illegible]. He entered the service of the Pennsylvania R.R. in 18[illegible] and in the course of a few years became Engineer of Bridges and Buildings, which office he retained until 18[illegible]. He served as Engineer and Expert for several Commissions on [illegible], including the Washington, D. C., tunnel and [illegible], the Providence, R. I., terminal [illegible], [illegible] of the Brooklyn Bridge, New York City, and New York City rapid-transit problems. He was the author of many papers and articles on engineering subjects. He was a member of the Institution of Civil Engineers of Great Britain and a winner of the Telford Premium of that Society, a Fellow of the American Institute of Architects, a past president of the Franklin Institute and of the Engineers' Club of Philadelphia.

Henry W. Wilson, the surviving brother, was born in 18[illegible]. He graduated at the Rensselaer Polytechnic Institute in 18[illegible]. He had engaged as surveyor for the Southern Pennsylvania R.R. in southern and western Pennsylvania as Assistant Engineer. In 1866 he resigned to enter the service of the Pennsylvania R.R. Co., where he was employed in bridge designing and in construction work until he entered the firm of Wilson Bros. & Co.

Notes from Engineering Schools

YALE UNIVERSITY—Land for a summer surveying camp has been obtained by the Sheffield Scientific School. It is located in East Lyme, Conn., about 40 miles from New Haven and easily accessible by the Shore Line Electric Ry. A number of farms have been purchased, which, with a strip of land donated by Morton F. Plant, make a tract $3\frac{1}{2}$ miles in length and $1\frac{1}{2}$ wide in portions, altogether embracing more than 1400 acres. The topography is varied and is adaptable to all kinds of surveying work. For over a mile a portion of the land borders on an inland lake. Rising up from the lake is elevated ground, making an admirable location for the camp site.

CORNELL UNIVERSITY—This fall, for the first time, the entering class in the five-year course in mechanical engineering registered in Sibley College and will consequently be under the supervision of this college from the time it matriculated until it graduates. Formerly the students in this course registered in the College of Arts and Sciences during the first two years. The young man who has completed the ordinary four-year high-school course, but who is not credited with the full four units of mathematics required for admission as a four-year engineering student, may now enter Sibley College in the five-year course; thus, instead of spending an additional year in a preparatory school in order to secure the mathematical training required for the four-year course, he may enter at once and obtain an additional year's work at college and thereby secure a more liberal training than is afforded by the regular course, which is limited to engineering subjects or those preparatory to such. This extra work may be distributed through the five years in such manner that, starting with elementary courses in the first year, the student may subsequently pursue in proper sequence the more advanced courses based on the preliminary ones. The extra time may be devoted to liberal or cultural subjects, to courses preparatory for the business or administrative side of engineering, to specialization in chemistry, physics or geology, or to mining or civil engineering.

KANSAS STATE AGRICULTURAL COLLEGE—The Division of Mechanic Arts has established a group of short courses in mechanic arts more or less parallel to the short courses usually given in agriculture. Courses are offered in (1) concrete construction, (2) shop work, including wood and iron working, (3) road building, irrigation and drainage, (4) steam and gas traction engines. These are open to men not less than 18 years of age, who have had a fair common-school education. Each course is ten weeks in duration, and will be offered during the winter term, beginning Jan. 5, 1915.

The college has also recently established, in its secondary school, a series of trade practice courses in [illegible]

arts. Courses are given in (1) blacksmithing, (2) carpentry, (3) concrete construction, (4) gas engines, (5) steam engines and boilers, and (6) traction engines. Persons who are 14 years of age or older, and who have completed the eighth grade of the public schools, are admitted to these courses without examination. The courses are each three years in length, and have much work in common, including English, mathematics, history, physics, drawing and beginning shopwork. The differentiation comes mostly in the second and third years, in the former of which about one-third and in the latter of which three-fifths of the time is devoted to the specialized subjects. The purpose of the courses is to teach the elements of the trades, while a general training is being given similar to that of the high school, with the foreign languages omitted.

The Department of Civil and Highway Engineering is planning to give a short course in road building, irrigation and drainage during the coming winter. The course will be of ten weeks' duration and is intended to accommodate county surveyors and county engineers, at present in practice, who desire additional technical work along lines in which they are particularly interested. Surveying, road construction, bridge and culvert construction, road laws and administration, irrigation and drainage engineering, and specifications and contracts are among the subjects which will be treated in the course.

NEWS NOTES

A 30-In. Water Main Burst in Portsmouth, Ohio, on Dec. 16. The main was located 6 ft. below the surface. The work of repairing the main began early on Dec. 17 and was completed on Dec. 20.

By Recent Annexation Richmond, Va., has added materially to its area and increased its population by some 20,000.

Typhoid Fever in Chicago has shown some increase lately, and the Health Department attributes this to pollution of the water-supply taken at the Chicago Ave. pumping station. Consumers have been advised to boil the water, and treatment with hypochlorite of lime has been instituted.

The Near-Side Stop Is a Success in New York, according to reports received by the Safety First Society, from the officials of the companies operating surface car lines. For example, the Third Ave. Ry. Co. reported a decrease of 245 accidents during September, October and November of this year over the same period in 1913. The near-side stop ordinance became effective Sept. 1.

The Water-Supply of Steamers on the Great Lakes is a serious menace to public health according to the annual report of Dr. Blue, Surgeon-General of the U. S. Public Health Service. It is pointed out that about 16,000,000 passengers are carried annually by steamers which draw their water-supply from the lake, and he recommends that this water should be treated on board the vessels before being distributed for drinking purposes.

An Automobile Speedway to be built for the Chicago Speedway Association will have a 2½-mile oval track designed for the highest possible speeds. The track will be 70 and 80 ft. wide on tangents and curves respectively, and will have a wood surface on a concrete base. Subways under the track will give access to the infield, which will be used for parking vehicles. Graham, Burnham & Co., of Chicago, are the architects.

The Smallest Central Electric Station in the country is probably that at Waldo, Wis., instead of the one in Clayton, Wis., noted in "Engineering News," Nov. 5, 1914. Five customers are supplied with 30-volt direct-current survice from a ¾-kw. generator and storage battery. The town has 325 population and is undergoing a transition from kerosene to electric lights. There is a transmission line within 4½ miles of the village and service from it is agitated.

The Gold Medal for Safety presented annually by the Travelers Insurance Co. under the direction of the American Museum of Safety to "the American employer, either an individual or a corporation, who during the year has, in the judgment of the jury of awards of the Museum, achieved the most for the safety of employees," has been awarded this year to the Commonwealth Edison Co., of Chicago. The four previous winners of the gold medal have been the United States Steel Corporation, the Pennsylvania R.R. Co., the New York Edison Co. and the New York Telephone Co.

Municipal Improvements at Quito, Ecuador, are not as yet very extensive, according to a report received from a South American correspondent. The city has about one-half mile of streets paved with Belgian blocks, 28 miles with rough cobbles and 12 miles unpaved. The city has recently entered into a contract with William Schroeter & Co., a German concern, for installing fire hydrants and for putting in sewers. The city expects to buy fire engines soon. Our correspondent states that: "Heretofore, fires have been very rare and have been extinguished by hand or allowed to burn out. The houses are separated by very thick walls (3 ft.), and there is very little in them to burn."

Motorman's Cab Signals are provided for in the new automatic signal system adopted by the New York Municipal Railway for its portion of the new subway lines to be operated in New York City. The award of the contract for this system to the General Railway Signal Co. has been approved by the Public Service Commission. The new system provides block intervals and speed control with signals in the motorman's cab: if for any reason he fails to slow down at proper signals, a track device engages car attachments automatically reducing the speed to the desired rate independent of the motorman's action. Thus the train is allowed to continue at properly reduced speed, but is not stopped completely, as at present is necessary with the use of track trips in connection with block signals. The total bid of the Signal Company for equipping all the subway and elevated lines to be operated by the Municipal Railway Corporation is about $1,413,000. The Public Service Commission is considering the issue of an order requiring the installation of such signals on the elevated lines in New York City, on which two serious accidents have occurred recently—both due to failure of the employees to perform their duties properly.

New York's Engineer Regiment Disbanded—An order by Governor Glynn of New York disbanding the 22d Regiment of Engineers, New York National Guard, was issued on Dec. 24. It reads as follows:

In accordance with the military law and to meet the requirements of the War Department, the Corps of Engineers is reorganized as follows: The regimental organization of the Corps of Engineers, known as the 22d Regiment, N. G. S. N. Y., and the battalions and companies as now constituted, except the band, are hereby disbanded. The officers serving with the same being surplus are hereby placed on the reserve list. The enlisted men will be transferred or discharged, as may be necessary to carry out this order, and will be continued in the service until so transferred or discharged.

Only 15 of the officers will be retained, it is reported, and 25% of the enlisted men will be discharged or transferred to other regiments. Major-General O'Ryan, commanding the state militia division, said: "The 22d Regiment is steeped in old infantry methods. All the officers and men capable of performing the services expected of engineers will be assigned to duty after the regiment is disbanded and the battalions reorganized." A special examining board (Colonel Van C. Lucas, chief engineer officer of the state militia, President) has been appointed to pass upon the qualifications of the officers.

PERSONALS

Mr. Milton H. Bronsdon has been reappointed Chief Engineer of Power and Lines of the Rhode Island Co., Providence, R. I. He was Chief Engineer from 1907 to 1912, and since then has been engaged in general practice in San Francisco, Calif.

Mr. Friend P. Williams, M. Am. Soc. C. E., Resident Engineer of the New York State Barge Canal, Mechanicsville, N. Y., has been apointed Division Engineer of the Western Division under State Engineer-elect Frank M. Williams, M. Am. Soc. C. E.

Prof. Charles M. Spofford, M. Am. Soc. C. E., head of the technology department of civil and sanitary engineering, Massachusetts Institute of Technology, has been appointed Expert Advisor for the City of Cambridge, Mass., in connection with some taxation problems.

Mr. J. A. Almirall, M. Am. Soc. M. E., and W. C. Adams announce that, owing to the recent death of Quimby N. Evans,

[illegible] Evans, Almirall & Co. has [illegible] Almirall & Co., Inc., has succeeded to the business of the former firm. The new company has the same personnel as the old firm, with the exception of Mr. [illegible]

[illegible] M. Am. Soc. C. E., First Resident Engineer, Middle Division, New York State Barge Canal, has been appointed Division Engineer of the Middle Division by State Engineer-elect Frank M. Williams, M. Am. Soc. C. E. [illegible] connected with the Barge Canal work for a number of years and was Division Engineer during the former administration of Mr. Williams.

[illegible] M. Am. Soc. C. E., of [illegible] N. Y., a brother of Mr. Frank M. Williams, M. Am. Soc. C. E., State Engineer-elect of New York, has been appointed Division Engineer of the Eastern Division of the New York State Canals [illegible] M. Am. Soc. C. E. [illegible] Division Engineer under the former administration of his brother as State Engineer.

[illegible] M. Am. Soc. C. E., of Cornwall, N. Y., has been appointed [illegible] of the New York State Barge Canal at a salary of $[illegible] per annum, to succeed Mr. [illegible] M. Am. Soc. C. E. Mr. [illegible] graduated from Cornell University in [illegible] and began his engineering experience as a [illegible] with the Newport News Shipbuilding & Drydock Co., Newport News, Va. From 1[illegible] to 1911 he was with the New York State Highway Department. [illegible] and since then he has been in private practice.

[illegible]

Mr. [illegible] M. Am. Soc. C. E., whose appointment as [illegible] was briefly noted in our issue of last week, was born in Chicago in 1876. He graduated from Notre Dame University [illegible] in 18[illegible] and received [illegible] For [illegible] years he was in the service of the City of Chicago, Ill., as Assistant Engineer and [illegible] For the past six years Mr. [illegible] has been in private practice [illegible] Chicago.

OBITUARY

[illegible]

[illegible] in New York City, [illegible] at Virginia City, Nev. [illegible]

[illegible] tives and mining machinery. In 187[illegible] he was engaged as Consulting Engineer on the famous Sutro Tunnel in Nevada. Later he was employed by the U. S. Geological Survey to report on the mechanical appliances of the Comstock Lode, at Virginia City, Nev. For the past 3[illegible] years he was a Consulting Engineer with offices in San Francisco.

ENGINEERING SOCIETIES

COMING MEETINGS

SOCIETY OF CONSTRUCTORS OF FEDERAL BUILDINGS.
Jan. 4-6. Convention at Washington, D. C. Secy., T. R. Maul, 121[illegible] Westminster Ave., Philadelphia, Penn.

ASSOCIATION OF GOVERNMENT CONTRACTORS.
Jan. [illegible] Annual meeting at Washington, D. C. Secy., [illegible] Blair, Montgomery, Ala.

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.
Jan. 1[illegible] Annual meeting at New York City. Secy., J. R. Wemlinger, 11 Broadway, New York City.

AMERICAN WOOD PRESERVERS' ASSOCIATION.
Jan. 19-21. Convention at Chicago, Ill. Secy., F. J. Angier, Mt. Royal Station, B. & O. R.R., Baltimore, Md.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. [illegible] Annual meeting in New York. Secy., Charles Warren Hunt, 220 W. 57th St., New York City.

AMERICAN SOCIETY OF HEATING & VENTILATING ENGINEERS.
Jan. [illegible]-22. Annual meeting at New York City. Secy., J. J. Blackmore, 29 W. 39th St., New York City.

INDIANA ENGINEERING SOCIETY.
Jan. 21-2[illegible] Annual meeting at Indianapolis. Secy., Charles Brossmann, 1[illegible] Merchants Bank Building, Indianapolis, Ind.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
January 27-2[illegible] Annual meeting at Springfield, Ill. Secy., E. E. R. Tratman, 1[illegible] Monadnock Block, Chicago.

AMERICAN CONCRETE INSTITUTE.
Feb. [illegible]-12. Convention at Chicago, Ill. Secy., E. E. Krauss, Harrison Bldg., Philadelphia, Penn.

AMERICAN CONCRETE PIPE ASSOCIATION.
Feb. 1[illegible]-16. Annual convention at Chicago. Secy., E. S. Hanson, [illegible] South Clark St., Chicago, Ill.

IOWA ENGINEERING SOCIETY.
Feb. 1[illegible]-1[illegible] Annual meeting at Iowa City. Secy., [illegible] Woodward, Iowa City, Iowa.

Cornell Society of Civil Engineers—The annual banquet and reunion in New York City will be held [illegible]

American Public Health Association—It has been decided to hold the next meeting of the Association [illegible] N. Y., probably in September, 191[illegible]

Missouri Highway Engineers' Association—At the annual meeting of the Association, held in Jefferson City, Mo., [illegible] the following officers were elected: President, [illegible]; Secretary, E. W. [illegible] The meeting next year will be held at [illegible]

National Lime Manufacturers' Association—The annual meeting will be held in Washington, D. C., [illegible] the object of the meeting is [illegible] to [illegible] the Treasury Department [illegible] The secretary is [illegible] Chicago, Ill.

American Institute of Consulting Engineers—The annual meeting of the Institute will be held [illegible] New York City [illegible]

Engineers' Club of Trenton—[illegible]

Youngstown Engineers' Club—[illegible]

Prices of Engineering Materials

PRICE CHANGES AND THE BUSINESS OUTLOOK

Improvement in general business and contracting is confined to a few localities while from many quarters come authentic reports that business is more unsatisfactory than at any corresponding time in several years. Building activity is less, iron production smaller, consumption of metals not so large as a year ago, fewer men are employed, and fewer freight cars are in use. Against these unfavorable factors is that knowledge that there is more State and municipal work in progress than a year ago and that a plethora of idle funds awaits employment. Prospects for excellent business later are particularly bright when viewed from the agricultural side. Never has there been such an excellent outlook for wheat. Other crops will be large and farmers are undoubtedly more prosperous than ever before. The prosperity of the farmer is a good foundation upon which to build an active business season for all kinds of trade.

The inability of a dry-goods distributing house of international reputation to meet its obligations is of deep significance. Mindful of the fact that New York has ceased to be a dry-goods jobbing center, and perhaps that kind of business will have to make way for more modern methods, this failure indicates clearly that merchants scattered in the smaller towns in the West and the Southwest have been unable to make collections with sufficient regularity to pay the wholesaler. That it did not have a more serious effect is a strong testimonial to the stability of business.

It should be distinctly understood that present conditions are the result of commercial ad not financial ills. The abundance of funds is recognized in almost every section of the country, and exports of gold although frequent have caused no disturbance in monitary conditions. The trouble is clearly a lack of business.

Contract work has improved. This applies almost wholly to municipal, county and state work, and the reason for it is not hard to find. For the last two or three years municipalities have been unable to sell their bonds at anything like a satisfactory rate, and now funds are plentiful, work has been started. Then, too, there has been a more or less general awakening of civic pride in many of the older cities through the country. Albany, N. Y., may be pointed to as an example of this. Moreover, in some cities at least an effort has been made to advance construction work this year so that employment could be given to many who would otherwise be idle.

Prices in important lines continues to decline steadily. A quotation of \$1.05 Pittsbugrh, for plates has been recorded. The index figures issued by the government show a lowering in the cost of living and even a well known maker of motor cars cut the price of this luxury \$200.

The unfavorable conditions in the iron trade are attracting more attention than in any other line. Production continues to decline, unfilled orders of the United States Steel Corporation are less and less each month, and prices in every line are the lowest in years and while stocks continue to accumulate. Contracts for the cast-iron segments for the East River tubes call for about 80,000 tons which went at an unusually low price, something under \$27 a ton, or a price close to the figures which were made for the Hudson tube at the time of severe business depression.

Labor is easy to obtain; in fact, there is no difficulty in obtaining any number of workers for outside construction at \$1.50 a day for ordinary work. Immigration figures also tell a story. For the first five months of the year the number of steerage passengers coming into the country was 180,000 less than during the corresponding time last year.

Cement manufacturers are maintaining a price which is equivalent to about 90c. per bbl. in bulk at the mill. The mills are working to about 50 per cent. of their capacity.

Prices of metals continue to decline. Copper is below 14c., and tin is sold around the lowest prices reached in the last three years. Stocks of copper are accumulating; the same is true of tin.

The decline in crude oil has not been so spectacular as it was two months ago, but ther has been much competition and in the East some particularly low prices have been named to the retail trade. Some garages sell gasoline as low as 9c. per gallon.

LABOR

Contractors can get all the men they want for \$1.65 a day, and in many places \$1.50. Most laborers on state road work are paid \$1.50 for grading and \$1.65 for quarry work. Enforced vacations are the rule in a number of lines. Many of the leading railways have reduced forces 10% by compelling all employees from the president down to take a three-days' vacation each month. The Ford plant is granting a month's vacation, without pay, and this has been extended to a number of other factories. Skilled labor is in somewhat better demand, but there is a drastic weeding out of inefficient help in all quarters. The Westinghouse strike in Pittsburgh is the most serious labor disturbance reported this month. It seems unlikely that there will be any compromise to the Union as such. Business in the electrical line has shown a distinct falling off.

Imigration statistics for the first five months of the year indicate clearly that there is less incentive for contract laborers to come to this country. For this fiscal year to June 12 and incoming steerage passengers numbered 437,000 compared with 620,000 in the corresponding period last year. This was a falling off of 183,000. At the same time the steerage passengers leaving this country in 1914 numbered 229,000 compared with 159,000 at the same time last year, showing more departures by 70,000 this year than last, and making a difference of 250,000 in the number of laborers of this class.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—Sellers of crushed stone in the New York market are of unanimous opinion that business has not been so unsatisfactory in a number of years. Indeed when the capacity of the stone-crushing plants is taken into consideration it is difficult to find a time when there was so little business ruling. Some more business has been placed in June than in May, but only a little more and it is doubtful if for the first six months of the year there has been 50% as much stone delivered in New York as there was last year in the same time. Prices are steady at 90c. to \$1 for 1½-in. stone, and 95c. to \$1.10 for ¾-in. stone. These quotations are for full cargo lots of 500 cu.yd. delivered alongside of dock New York or Brooklyn.

Sand and Gravel—Business is very light. There is practically no demand for gravel except subway gravel and little sand is moving. Gravel sells at 90c. for 1½ in., while special gravel for subway specifications is quoted at \$1.15.

Sand sells at 50c. per cu.yd.

The above quotations are for full cargo lots of 500 cu.yd. delivered alongside of dock, New York. In Boston gravel sells at 35c. per cu.yd. at quarry 25 mi. out, the freight rate to Boston being 40c.

CEMENT, LIME AND BRICK

Portland Cement—The most surprising thing in the cement trade is that prices have been maintained. There is of course, some cutting, but there always is at such a period when the smaller mills are out for business. In some cases the cut has amounted to more than 10c. per bbl., but in general prices are firm. Most of the business now being placed is for road work in various states. The leading manufacturers of cement in the Lehigh Valley district are maintaining their position with a great deal of stubbornness and refusing to make concessions of any kind, this in spite of the fact that they do not seem to be running more than 50% of capacity. In the West business is slightly better, but not as good as it was hoped early in the year.

Quotations are unchanged at \$1.58 per bbl. for delivery within lighterage limits New York. This is equivalent to \$1.46 in Jersey City and 95c. per bbl. in bulk at the mill. Quotations given below do not include the allowance of 40c. for baks returned. They are as follows per bbl. f.o.b. the points named, not including package:

Boston	\$1.32	Chicago	\$1.15
Cleveland	1.30	Detroit	1.19
Duluth	1.38	Jersey City	1.06
Minneapolis	1.35	New York	1.18
Pittsburgh	1.10	St. Paul	1.35

Brick—Within the last week there has been improvement in the business situation and brick are in much better demand. Prices are steady at \$5.75 per M. in New York. From yards in Newark, \$7.25 is demanded.

Lime—Business is quiet, but prices are unchanged at 97c. per bbl. for state common, 200 lb. net; \$1.37 for 300 lb. "Star"; \$1.55 for 300 lb. finishing; \$1.10 for 200 lb. finishing and \$1.72 for 350 lb.

Plaster Blocks—Prices are without change, and the market is fairly active, quotations being as follows:

	Weight, per sq.ft., lb.	Price, per sq.ft., cents
2-in.	7	6
3-in.	8½	6½
4-in.	11	7¼

These blocks are made 32 in. long by 13½ in. wide, containing 3 sq.ft. of surface. The 2-in. blocks are solid, but the others are hollow.

IRON AND STEEL

Pig Iron—Sales of pig iron have been limited, and prices have declined to still lower levels, though stocks do not seem to be accumulating. The Southern iron market has been of more interest than anything else, and some sales in Birmingham have been made as low as \$10. The general market there, however, may be quoted at \$10.25@10.50. In the North there has been very little new buying. The chief feature of interest was 80,000 tons of tunnel segment for the two East River tubes in New York, and although no quotations or authentic figures have been given out, it was understood that the price was below \$27 per ton for castings delivered in New York, machined, and ready to be placed. This is an unusually low quotation, and almost duplicates the low figure at which the Hudson Tunnel segments were placed a number of years ago, when labor and materials were quoted at less than they are today. The unfilled orders of the United States Steel Corporation continue to decline, and on May 31 were slightly less than 4,00,000 tons.

Quotations for lots of 100 tons or over, and the prices named, are as follows: Cincinnati Southern Foundry No. 2, \$13.50@14; Northern Foundry No. 2, \$14.75@15.25; Northern Foundry No. 3, \$14.50@14.75; in New York, Northern Foundry No. 1, \$14.75@15; Northern Foundry No. 2X, \$14.50@14.75; and Southern Foundry No. 2, \$14.75@15; in Chicago, Northern Foundry No. 2, \$13.75@14.25, and Northern Foundry No. 3, \$13.50@14. In Pittsburgh, besemer is \$14.90 and basic \$13.90. These quotations include the 90c. freight rate from the valley to Pittsburgh. In Birmingham, Southern Foundry No. 2 is quoted at \$10.25@10.50, but there some few sales were made as low as \$10.

Steel Rails—[illegible]

Track Supplies—[illegible]

Structural Material—[illegible]

The Unfilled Tonnage [illegible]

Plates—[illegible]

Cast-Iron Pipe—[illegible]

Pipe—[illegible]

	Black	Galvanized
[illegible]	[illegible]	[illegible]

Sheets—[illegible]

Old Material—[illegible]

Coke—[illegible]

Rivets—[illegible]

Piling Steel Sheet—[illegible]

Freight Rates—The freight rates on finished-steel products from the Pittsburgh District, including plates, structural shapes, merchant steel and iron bars, pipe fittings, plain and galvanized wire, nails, rivets, spikes and bolts (in kegs) black sheets (except planished), chain, etc., are as follows, in cents per 100 lb.: Albany, 16; Buffalo, 11; Boston, 18; Baltimore, 14½; Canandaigua, 13½; Cleveland, 10; Columbus, 12; Cincinnati, 15; Chicago, 18; Denver, Colo., 85½; Harrisburg, 14½; Louisville, 18; New York, 16; Norfolk, 20; Philadelphia, 15; Rochester, 11½; Richmond, 20; Scranton, 15; St. Louis, 23; Washington, 14½.

Steel Shapes—Some lines show an improvement but business is still dull. Large consumers are more willing to buy in carload lots for they feel the bottom has been reached and this reduces the volume of business that the jobber has. From warehouse New York prices are as follows:

	Cents Per lb.
Refined iron.	
1 to 1⅞ in., round and square	1.80
1½ to 4 in. x ⅜ to 1 in.	1.80
1½ to 4 in. x ¼ to $\frac{5}{16}$ in.	2.00
Norway bars	3.20
Burdens bar iron	3.15
Soft steel:	
¾ to 3 in., round and square	1.80
1 to 6 in. x ⅜ to 1 in.	1.80
1 to 6 in. x ¼ and $\frac{5}{16}$ in.	1.95
Rods—⅝ and $\frac{11}{16}$ in.	1.90
Bands—1½ to 6x$\frac{3}{16}$ in. to No. 8	2.10
Beams and channels—3 to 15 in.	1.85
Angles:	
3 in. x ¼ in. and larger	1.85
3 in. x $\frac{3}{16}$ in. and ⅛ in.	2.30
1½ to 2½ in. x ⅛ in.	2.05
1½ to 2¾ in. x $\frac{3}{16}$ in. and thicker	1.95
1 to 1¼ in. x $\frac{3}{16}$ in.	2.05
1 to 1¼ in. x ⅛ in.	2.10
1½ to 2½ x ¼ in.	2.00
1½ to 2½ x $\frac{3}{16}$ in.	2.10
3 in. and larger	1.90

Spiral Riveted Pipe—Prices are without change. The following quotations are f.o.b. factory, freight equalized with New York, being figured at a discount of 50, 10 and 10% from list. These are for orders amounting to approximately $250. For large orders, prices are cheaper by 12½ to 20%.

Diameter in in.	*Thickness Birmingham wire gage	Net price per 100 ft. With bolted joints complete: Plain	Asphalted	Galvanized
4	18	$19.76	$21.48	$30.74
5	18	23.40	23.70	37.14
6	16	33.05	35.76	49.73
7	16	37.58	40.76	56.82
8	16	43.17	46.80	65.00
9	16	50.06	50.10	74.22
10	14	66.42	71.08	96.15
11	14	71.20	76.57	102.24
12	14	83.75	89.15	118.30
13	14	89.67	96.55	127.98
14	14	99.14	105.51	138.85
15	14	108.05	114.89	151.92
16	14	117.53	124.82	166.58
18	12	167.43	175.95	226.44
20	12	183.79	193.30	248.39
22	12	200.48	210.64	269.21
24	12	219.92	231.07	293.99
26	10	280.20	292.41	370.78
28	10	301.32	314.89	395.37
30	10	324.81	399.15	430.64

*Made in both lighter and heavier gages at corresponding differences in price.

Chain—Prices are steady and without change, as follows. These prices are per 100 lb., f.o.b. Pittsburgh:

$\frac{3}{16}$ in.	$7.50	½ and $\frac{9}{16}$ in.	3.00
¼ in.	4.95	⅝ and $\frac{11}{16}$ in.	2.90
$\frac{5}{16}$ in.	3.95	¾ and $\frac{13}{16}$ in.	2.80
⅜ in.	3.40	⅞ and $\frac{15}{16}$ in.	2.70
$\frac{7}{16}$ in.	3.20	1 to 1¼ in.	2.60

EXTRAS TO ABOVE LIST PER 100 POUNDS

	For BB	For BBB
$\frac{3}{16}$-in. and ¼-in.	$1.50	$2.00
$\frac{5}{16}$-in. and larger	1.25	1.75

Switch Points—The following prices are named f.o.b. mill, for switch points in lots of ten or more pairs: for 60-lb. rail. 10-ft. points, $16.25; 15-ft. points, $17.50; for 70-lb. rail, 10-ft. points, $18; 15-ft. points, $25; for 80-lb. rail, 10-ft. points, $25.50; 15-ft. points, $27.75; for 90-lb. rail, $33.50. All of the above are furnished with three rods, except the 10-ft. points for 60- or 70-lb. rail, which have only two.

Nails—Wire mills are operating at about 50% of capacity. The base quotation in Pittsburgh is $1.50 to $1.55 per keg of 100 lb. In New York wire nails from store are $1.95 to $2, and in Chicago nails are $1.88 to $2.95.

Wire—The mills are operating to 50% of capacity, but this is the dull season. Prices are as follows: Plain barbed wire, $1.35; painted barbed wire to jobbers in carload lots, $1.55; to retailers in carloads, $1.65; galvanized barbed wire, $1.95. These quotations are f.o.b. Pittsburgh. In Chicago plain wire is $1.55, painted barbed wire $1.78, and galvanized barbed wire $2.10. All of these prices are per 100 lb.

REINFORCING MATERIALS

Triangle Mesh—Business is not especially active. Quotations are without change as follows:

PRICE PER 100 SQ.FT.

Style No.	Cross sec. area per ft. width	Plain material: Carload lots	Plain material: Less than car lots and over 10,000 sq.ft.	Galvanized: Carload lots	Galvanized: Less than car lots and over 10,000 sq.ft.
*4	0.102	$1.00	$1.23	$1.12	$1.34
5	0.077	0.80	0.97	0.89	1.00
6	0.058	0.63	0.77	0.71	0.84
*7	0.041	0.49	0.60	0.55	0.66
*23	0.140	1.69	2.05	1.88	2.24
24	0.142	1.46	1.77	1.62	1.93
25	0.124	1.29	1.57	1.43	1.71
*26	0.110	1.17	1.42	1.30	1.55
*27	0.085	0.96	1.17	1.07	1.28
28	0.066	0.80	0.97	0.89	1.06
29	0.049	0.66	0.80	0.73	0.87
31	0.2 1	2.49	3.02	2.76	3.29
32	0.225	2.16	2.62	2.40	2.86
33	0.196	1.93	2.34	2.14	2.55
34	0.115	1.48	1.80	1.64	1.96
35	0.109	1.117	1.42	1.30	1.55
36	0.075	0.87	1.05	0.97	1.15
38	0.350	3.55	4.30	3.93	4.68
*39	0.325	3.05	3.70	3.38	4.03
40	0.283	2.68	3.25	2.97	3.54
41	0.208	2.05	2.48	2.27	2.70
42	0.151	1.55	1.88	1.72	2.05
*43	0.101	1.10	1.34	1.23	1.46

*This material is made in regular widths of 18, 22, 26, 30, 34, 42, 46, 50, 54 and 58 in. Standard lengths in rolls are 150, 250, 300 and 600 ft.

Bars, Concrete Reinforcing—In some quarters there has been competition which forced prices below the 1.15c. price but in most cases that has been the bottom figure. Business is better than a month ago.

Quotations are as follows:

Size	Cents per pound: Mill shipments Pittsburgh	Warehouse Pittsburgh	Delivered from warehouse New York
¾-in. and larger	1.15	1.65	2.25
⅝-in.	1.20	1.65	2.30
½-in.	1.35	1.95	2.30
⅜-in.	1.45	2.05	2.45
¼-in.	1.75	2.30	2.75

METALS

Copper—Prices have declined almost continuously throughout the month and very little business has been done. It is true that around the 14c. level there was some buying, but this was only in small lots, and consumers have taken no more than an academic interest in the market. For foreign accounts business has been light. The chief trouble with the trade in finished material is, while a fair business is ruling, there is on incentive to do it, because there is no profit. Prices at the end of the month were barely steady at 13.62½c. delivered in 30 days.

Tin—A fair business has been transacted, but it has been spotty—one week good and another week extremely poor. The statistical position of tin would seem to warrant somewhat higher quotations, but a powerful clique is operating in the foreign market and has thus far been successful in keeping prices down. Stocks are good and deliveries during June were about 4000 tons.

Lead—Some of the largest sellers of lead had a most satisfactory business during May; others reported little activity. Prices are undeniably low and there seems to be little doubt that the low quotations has induced some business. In New York lead can be had at 3.90c, and in St. Louis at 3.75c.

Spelter—The market is exceedingly dull and prices are unremunerative to the producer. In fact, producers are in a bad way. Spelter is selling at about 5.05c. New York and 4.95c. St. Louis.

Miscellaneous Metals—All kinds of old metals are in fair demand, but prices are low, and it is sometimes possible to shade even the quotations given below, which are for small lots:

Bismuth	$2.25
Brass tubes, iron-pipe sizes:	
½-in.	.17
¾- to 3-in.	.16
3½-in.	.16
4-in.	.17
Brass rods	.15¼
Brass sheets	.15½
Solder, half and half guaranteed	.21
Zinc sheets	.08½
Manganese bronze rods	.23½
Copper sheets, base	.19
Pig tin (five-ton lots, cash)	.31

Old Metals—Prices are lower and there is very little demand. The following quotations are for small lots delivered to buyer's warehouse:

	Cents
Copper, heavy and crucible	12.00
Copper, heavy and wire	11.75
Copper, light and bottoms	10.25
Brass, heavy	7.75
Brass, light	6.25
Heavy machine composition	10.50
Composition turnings	9.00
Lead, heavy	3.40
Lead, tea	3.15
Zinc scrap	3.50

MILL SUPPLIES

Belting—There is [illegible] business, but prices seem fairly well [illegible]. The [illegible] on rubber belting are as follows: [illegible] 40 and 10 and 10% [illegible] competitive, [illegible] and 1[illegible]. Leather belting can be had as follows: Extra heavy, [illegible]; heavy, [illegible] and 10 and [illegible]; medium, [illegible].

At the [illegible] discounts, the net prices per foot of leather belting are as follows:

LEATHER BELTING PRICES IN CENTS PER FOOT

Size Inches	Extra Heavy	Heavy	Medium
1	11 [illegible]	10 10	7 20
1½	1[illegible]	1[illegible] 20	10 80
2	[illegible] 75	21 [illegible]	14 40
2½	[illegible] 0	26 00	18 00
3	[illegible]	31 00	21 60
3½	[illegible] 0	36 00	25 20
4	[illegible]	41 00	28 80
5	[illegible] 80	51 [illegible]0	36 00
6	6[illegible] 0	62 00	43 20
7	[illegible] 80	72 00	[illegible] 10
8	92 00	82 00	57 60
9	$1 [illegible]2	93 00	61 80
10	1 14	$1 03	72 [illegible]0
11	1 25	1 13	79 20
12	1 38	1 24	87 40
14	1 60	1 44	$1 01
16	1 82	1 65	1 16
18	[illegible]	1 85	1 30
20	2 29	2 05	1 44
22	2 [illegible]0	2 26	1 59
24	2 74	2 45	1 71
30	3 1[illegible]	3 10	2 17
36	4 10	3 70	2 60

Chain Belting—Prices continue unchanged. Quotations are as follows: From 3 hp. to 10 hp., 30-in. centers complete with two sprockets, $7@8 per horsepower. From 10 hp. to 25 hp., 36-in. centers complete, $5@6 per horsepower. For 25 hp. to 1[illegible] hp., 56-in. centers complete, $4@5 per horsepower. From 1[illegible] hp. to 500 hp., 72-in. centers complete, $3@4 per horsepower.

CLAY PRODUCTS

Sewer Pipe—Business continues unusually quiet and the drastic cut of last month failed to bring orders. Prices are not as low as last month, the discount for the smaller sizes being 7[illegible]% from list instead of 75%. Revised discounts are as follows: [illegible] to 24-in., 7[illegible]%; 27- and 30-in., 67[illegible]%; 33- and 36-in., 62[illegible]%.

At these discounts the net prices per foot in New York are as follows:

SEWER PIPE PER FOOT

Size	Delivered N. Y.	Size	Delivered N. Y.
3 in.	$0 [illegible]5	18 in.	$0 418
4 in.	0 [illegible]5	20 in.	0 495
5 in.	0 [illegible]	22 in.	0 66
6 in.	0 0[illegible]	24 in.	0 715
8 in.	0 121	27 in.	1 49
10 in.	0 121	30 in.	1 82
12 in.	0 [illegible]	33 in.	2 38
15 in.	0 2[illegible]7	36 in.	2 67

Flue Linings—The [illegible] last month evidently was not drastic enough and [illegible] have again been revised. The new discount is 41% from list. At this discount the net prices per foot, New York delivery are as follows:

	Weight in lb.	Price per ft.		Weight in lb.	Price per ft.
4½x13-in.	14	$0 067	8½x13-in.	28	$0 124
[illegible] in.	2[illegible]	0 [illegible]	8½x18-in.	45	0 1[illegible]
[illegible] in.	10	0 19	13x13-in.	38	0 167
7½x7½ in.	15	0 076	13x18 in.	57	0 2[illegible]
8½x8½-in.	19	0 [illegible]	18x18 in.	75	0 [illegible]

Hollow Tile—Prices are steady and unchanged as follows, f.o.b. Perth Amboy:

Size	Price per block: Hollow wall tile	Size	Price per block: Interior partition block
4x12x12-in.	$0 06	2x12x12-in.	$0 048
6x12x12-in.	0 0[illegible]	3x12x12-in.	0 048
8x12x12-in.	0 1[illegible]	4x12x12-in.	0 053
10x12x12-in.	0 13	6x12x12-in.	0 072
12x12x12-in.	0 15	8x12x12-in.	0 094

OILS AND PAINTS

Petroleum Products—A number of new producers in the Los Angeles district have begun to ship oil. The market for [illegible] products is [illegible] as [illegible] earlier in the year and [illegible]. [illegible] Pennsylvania, second sand [illegible] [illegible] black and New Castle is [illegible]. [illegible] and Oklahoma are [illegible] at [illegible]. California oils are quoted as follows: [illegible] gravity, [illegible] gravity, 5[illegible]; [illegible] gravity, [illegible] gravity, [illegible].

[illegible] products are cheaper. [illegible] is quoted at [illegible] in steel barrels. Some very low retail [illegible] have been established in northern New Jersey and as [illegible] per gal. has been quoted. Petroleum is still quoted at [illegible].

Linseed Oil—Prices are slightly higher at [illegible] to [illegible] for [illegible] and [illegible] for [illegible] of town raw. Flaxseed in [illegible] is [illegible] higher than last month at $1.[illegible] per bu.

Spirits Turpentine—Business is light and prices are steady. [illegible] New York spirits are quoted at [illegible] and in Savannah at [illegible].

Carbolineum—This preservative is sold in lots of one or [illegible] at [illegible] per gal., f.o.b. New York. In half barrels of [illegible] and [illegible] gal. at [illegible] per gal., f.o.b. New York.

Paints—Prices are steady in New York as follows: White lead in oil in 100-, 200- and 500-lb. kegs is 7¼@7½c. per lb., in 25- and 50-lb. kegs, 7¾c. per lb. Red lead and litharge in 100-lb. kegs is 7@7½c. per lb.

Hydrex preservative paint is 75c. per gal. in bbl. lots, New York, N. Y.

Colors in oil are quoted at the following prices per lb.: Lamp black, 12@14c.; Chinese blue, [illegible]; Prussian blue, 32@36c.; Van Dyke brown, 11@14c.; Chrome green, 12@16c.; raw or burnt Sienna, 12@15c.; raw or burnt Umber, 11@14c.

LUMBER

While the lumber trade has been generally depressed, stocks are low and prices have appeared to be near bottom.

Spruce—In Boston spruce is selling at $23.50 to $24 base, and quotations for frames are as follows: 8 in., $23.50 to $24; 9 in., $24.50 to $25; 10 in., $25.50 to $26; 11 and 12 in., $26.50 to $27.

Hemlock—Prices show no changes and the base quotation New York is $22.50. In Boston hemlock is selling at $22, but the cheapness of other lumber makes it difficult to sell at this quotation.

White Pine—The Boston market is dull. Up to 2 in. sells at $100 to $101, 2½ and 3 in., $110; 4 in., $120. Common sells at $73 to $78 for 1 to 2 in.

Railway Ties—Business is exceedingly dull. Some very tempting quotations have been made, but without success. The market is dull and prices are as follows: for 7x9-in. by 8-ft. 6-in., 80c.; 6x8-in. by 8-ft., 70c.; 6x9-in. by 8-ft., 78c. These are f.o.b. New York.

MISCELLANEOUS

Explosives—Dynamite of the kind generally used by contractors is approximately 11@13c. per lb., f.o.b. factory, in ton lots. Blasting powder, classified as "soda" grade, is sold at $1.20@1.40 per keg of 25 lb. in lots of 10,000 lb.

Exploders, per hundred, are sold at the following prices: 4 ft., $3.60; 6 ft., $4.10; 8 ft., $4.60; 10 ft., $5.10; 12 ft., $5.60; 16 ft., $6.60; 20 ft., $7.50; 25 ft., $9.40; 30 ft., $12; 36 ft., $14.60.

Caps in lots of 10,000 are $7@8 per thousand.

Blasting machines for 10 holes are $12; 25 holes, $20; 50 holes, $40; 100 holes, $60.

Telegraph Wire—The demand for telegraph wire has been fair. For lots of fair size, the wire measured in Birmingham wire gage, prices are as follows: "Extra Best," Nos. 6 to 9, 4⅜c.; Nos. 10 and 11, 4½c.; No. 12, 4⅝c.; No. 14, 5¼c. "Best Best," Nos. 6 to 9, 3½c.; Nos. 10 and 11, 3⅝c.; No. 12, 3¾c.; No. 14, 4c. Actual freight is allowed from Trenton, N. J., where it does not exceed 25c. per 100 lb.

Lighterage Limits—The free delivery or "Lighterage Limits" in New York City are as follows: In Manhattan, from a point opposite the Fort Lee ferry, south along the Hudson River around the Battery and north along the East and Harlem Rivers to the Jerome Ave. Bridge at 155th St. In New Jersey, south from Fort Lee ferry to Bayonne City points on the north and east shores of Staten Island between Bridge Creek (Arlington) and Clifton, both inclusive, and including Elm Park, Erastina and Shooters Island. In Brooklyn, from 69th St., Bay Ridge, north to Pot Cove, Astoria, Long Island City.

Asbestos—Asbestos building felt and sheathing in less than ton lots is 3½c. per lb. for the light, weighing from 6 to 30 lb. per 100 sq.ft. [illegible] per lb. is charged for the heavy, weighing from 45 to 66 lb. per sq.ft.

Millboard is made in standard sheets 40x40 in. and 41x[illegible] from 3 to 37 lb. per sheet. The net price in 100-lb. lots is [illegible] per lb.

Asbestos wood, used for fireproofing, ventilators and smoke jacks, comes in sheets 36x[illegible] in., 42x[illegible] in. and 42x96 in. The prices per sheet, f.o.b. factory, in New England, are as follows:

Thickness	Weight, pounds	Price	Thickness	Weight, pounds	Price
1/16-in.	1	$0 [illegible]	[illegible] in.	5	$0 [illegible]
3/32-in.	1½	0 12	[illegible] in.	6	0 [illegible]
⅛-in.	2	0 14	[illegible] in.	7	0 [illegible]
5/32-in.	2½	0 [illegible]	1 in.	9	0 [illegible]
3/16-in.	3	0 [illegible]	1¼ in.	10	0 [illegible]
7/32-in.	3½	0 29	1½ in.	12	0 61
¼ in.	4	0 31	1¾ in.	14	0 [illegible]
5/16 in.	4½	0 34	2 in.	16	0 [illegible]

Asbestos sheathing, corrugated, sells at 15c. per sq.ft. f.o.b. mill eastern Pennsylvania.

Rubber—Prices continue to decline and stocks are increasing. Up River Para fine can now be had at [illegible] per lb. compared with [illegible] a year ago and $1.12 two years ago. Up River Para coarse is [illegible]. Caucho balls are 3[illegible]. African rubbers are no cheaper and [illegible] is noted. Scrap rubber is slightly lower as follows: Automobile tires [illegible] to 5[illegible]; bicycle tires 3¼@3[illegible]; air brake hose 2¼ to 3[illegible] and inner tubes 14 to 17[illegible].

The Peebles Paving Brick Co., which has two plants at Portsmouth, [illegible], has purchased a plant at Firebrick, Ky., and will manufacture the Dunn brand of Wire-Cut-Lug Brick.

The Philadelphia office of the Mack Manufacturing Co. is now located in the Lincoln Bldg., directly opposite the City Hall. This office is in charge of R. T. Hutchins.

The France Engineering Co., Second National Bank Bldg., Toledo, O., has been organized by George L. Kirby, Willis R. France and Isaac Hartman to conduct a general engineering practice. The company would like to receive catalogs bearing on construction work.

Construction News

★ Denotes work advertised in ENGINEERING NEWS.
✚ Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS

✚Florida—Tampa & Gulf Coast Ry.—This company has awarded the contract for construction of its proposed line from Belleair, Fla., to St. Petersburg. C. H. Lutz, Odessa, Fla., is Gen. Mgr.

Alabama—Alabama Great Southern R.R.—This company, it is reported, will ask for bids in about two weeks for double-tracking two sections of its line. The first work will be between Birmingham, Ala., and Mobile Junction, Ala., 14 miles, and between York, Ala., and Meridian, Miss. This is part of the plan to double-track the entire line from Chattanooga, Tenn., to Meridian, Miss., for which $25,000,000 in bonds have been issued. C. Dougherty, Cincinnati, Ohio, is Ch. Engr. Noted June 25.

Mississippi—Alabama Great Southern R.R.—See item under Alabama.

✚Mississippi—The Commercial Club of Yazoo City, Miss., has awarded the contract to WALTER C. MURPHY, Yazoo City, for the construction of a standard gage railroad from Yazoo City to Carthage, Miss. Bonds for $100,000 have been issued.

Mississippi—Mobile & Ohio R.R.—This company plans to double-track its line between Corinth, Miss., and Jackson, Tenn. B. A. Wood, Mobile, Ala., is Ch. Engr.

✚Louisiana—Vicksburg, Alexandria & Southern Ry.—This company has awarded a contract to FRANK T. CONSTANT, Alexandria, La., to construct 8½ miles of its proposed line, from Tioga, La., to Alexandria.

Tennessee—Mobile & Ohio R.R.—See item under Mississippi.

Tennessee—Belt Ry. of Chattanooga—This company, it is reported, has purchased 50 acres of land about two miles north of Chattanooga, Tenn. Terminals and yards will be constructed. H. S. Chamberlain, Chattanooga, is Pres.

Tennessee—Nashville, Shiloh & Corinth Ry.—The citizens of Perry County, Tenn., will vote July 11, on the proposition to issue $100,000 in bonds to aid the construction of this company's proposed line. The county seat of Perry County is Linden.

Tennessee—Alabama Great Southern R.R.—See item under Alabama.

Kentucky—Wasioto & Black Mountain R.R.—This company plans to construct an extension from Benham, Harlan County, Ky., to coal and timber lands in Letcher County, 16 miles.

Kentucky—Illinois Central R.R.—This company plans to start work soon to double-track its line from Princeton to Eddyville, 40 miles, at an estimated cost of $500,000. A. S. Baldwin, Chicago, Ill., is Ch. Engr.

Ohio—Tri-State Rys. Co.—See item under Michigan.

Ohio—Akron, Canton & Youngstown Ry.—This company plans to construct an extension to Canton, Ohio, from its present terminus at Magadore, Ohio. Estimated cost $3,000,000. J. A. Donahey, Akron, Ohio, is Gen. Supt. and Ch. Engr.

✚Michigan—Tri-State Rys. Co.—This company has awarded the contract to A. C. LINGEBACH & CO., Chicago, Ill., for constructing its proposed 18-mile railroad from Hillsdale, Mich., south to Pioneer, Ohio. Noted June 25.

Illinois—La Salle Terminal R.R.—This company is having surveys made for its proposed seven-mile industrial line in the La Salle District, Ill. Isham, Randolph & Co., Chicago, Ill., are Engrs.

Wisconsin—Wisconsin Southern Ry.—This company is receiving bids for the construction of 32 miles of railroad in Wisconsin. The officials of the company are located at Fond du Lac, Wis.

Nebraska—Missouri Pacific R.R.—This company, it is reported, plans to rebuild its low-grade line between Omaha, Neb., and Kansas City, Mo. J. R. Stephens, St. Louis, Mo., is Ch. Engr.

Missouri—Rolla, Ozark & Southern R.R.—This company was granted a charter, June 11, to construct a railroad out of Rolla. J. J. Cope, Salem, Mo., is interested.

Arkansas—The construction of a railroad from Hot Springs, Ark., to Mena, Ark., 65 miles, is under consideration. W. E. Womble, Womble, Ark., is interested.

Arkansas—Free Valley R.R.—This company has been granted a charter by the State Board of Railway Incorporation, Little Rock, to construct a railroad from Eagle Mills, Ark., to Princeton, Ark., 25 miles. Edward Bower, Little Rock, is interested.

Texas—Kansas City, Mexico & Orient Ry.—This company plans to construct a line from Alpine, Tex., to the Rio Grande crossing, six miles from Presidio, Tex. R. P. Parker, San Angelo, Tex., is Ch. Engr.

Texas—The Chamber of Commerce of Dallas, Tex., it is reported, is considering the construction of a railroad from Dallas to Palestine, Tex., 105 miles. J. R. Babcock, Dallas, is interested.

Idaho—Oregon Short Line R.R.—This company plans to construct a line from the Yellowstone Park Branch into Teton Basins, Idaho, a distance of 75 miles. E. E. Calvin, Salt Lake City, Utah, is Gen. Mgr.

Nevada—A merger by which two parallel lines of railroad in Nevada are to be made one, and trackage abandoned whose initial cost was $1,200,000, was decided upon at a conference in this city June 17, between the officials of the Las Vegas & Tonopah R.R. and Tonopah & Tidewater R.R., which was the Bullfrog Goldfield R.R. The two roads were built when the Goldfield-Tonopah District was prospering, but when the mines began to show disintegration it was found that one line was not needed. As mapped out, about half of the roads between Goldfield and Beaty will be abandoned, and the remaining segments hooked together. J. Ross Clark, Los Angeles, Calif., is Pres. L. V. & T. Ry.

California—John Thorp, Memphis, Tenn., and Y. S. Scritsmier, Portland, Ore., are interested in the construction of a railroad from Sacramento, Calif., to timber lands in Eldorado County, Calif.

★Canada—A Canadian holding company owns the charter for a continuous line of railway in western Canada, covering a distance of approximately 1250 miles. The line traverses a territory containing coal, timber, oil and various kinds of minerals and also a most productive wheat country. The company has made reconnaissance, route and location surveys costing about $150,000, and has also made accurate estimates of the cost of construction. Bonding powers and government grants considerably exceeding the estimated cost of construction are granted to the company by acts of Canadian Parliament. The holding company owns several valuable tracts of coal, oil and timber lands and also a number of valuable terminal sites, situated in leading commercial centers. The company wishes to place the whole proposed line under construction immediately and is prepared to treat with capitalists or large contractors who will take the construction bonds at an agreed price and build and equip the said proposed lines according to the plans prepared by the company's engineers. Offers will only be entertained from capitalists or contractors of known standing. Correspondents are therefore required to give full particulars of their name and address in the first instance. Address first correspondence to Canadian Railway Builders, P. O. Box 601, Winnipeg, Man., Canada.

ELECTRIC RAILWAYS

Limestone, Maine—George Cook, Caribou, is interested in the construction of an electric railway from Limestone to Caribou, about nine miles.

Buffalo, N. Y.—The International Traction Co. contemplates the extension of its lines into the Reusens Park section. J. A. McKenna, Buffalo, is Secy.

Cortland, N. Y. — The Cortland Traction Co. has been granted permission to double-track its line in Cortland. Edwin Duffey, Cortland, is Treas. and Mgr.

Gleasonton, Penn.—The Gleasonton & Paddy Run Ry. Co. has been incorporated to construct an electric railway from Gleasonton to a point near Renovo, about 10 miles. I. W. Gleason is Pres.

Lititz, Penn.—The Berks & Lancaster Ry. Co. has been incorporated to construct an electric railway from Lititz to Womelsdork. The incorporators are Frank J. Duckett, T. Holland Paist, William Grimshaw, Oscar R. Dare, Joseph J. Dimond, and H. B. Longbottom, Philadelphia, and V. J. McGlesney, Phœnixville.

Augusta, Ga.—The Augusta-Aiken Ry. & Electric Co. has been granted a franchise to extend its line on Walton Way to the city limits. E. C. Deal, Augusta, is Gen. Mgr.

Savannah, Ga.—The Savannah Electric Ry. Co. is preparing plans for the extension of its line on Habersham St. to 49th St. A. L. P. Smith, Savannah, is Pur. Agt.

St. Petersburg, Fla.—The St. Petersburg & Gulf Ry. Co. contemplates double-tracking its lines on various streets in St. Petersburg. H. Walter Fuller, St. Petersburg, is Gen. Mgr.

Cincinnati, Ohio—The Cincinnati, Indiana & Ohio River Ry. Co. has been organized to construct an electric railway from Cincinnati, Ohio, to Louisville, Ky. L. S. Cook, Cincinnati, is interested.

The Cincinnati Traction Co. contemplates the extension of its Gilbert Ave. line on Hewitt, Wold and Fairfax Aves. T. Fitzgerald, Cincinnati, is Gen. Mgr.

Columbus, Ohio—The Columbus Ry. & Light Co. is considering plans for double-tracking its line on Oak St. H. W. Clapp, Columbus, is Gen. Supt.

Georgetown, Ill.—W. C. Jones, Georgetown, is interested in the construction of an electric railway from Georgetown to the new Bunsen mine.

Kewanee, Ill.—Preliminary arrangements are being made by the Kewanee, Bradford & Henry Interurban Ry. Co. for the construction of an electric railway to connect Kewanee, Osceola, Bradford and Henry, about 35 miles. C. G. Lampman, Cedar Rapids, Iowa, is interested. Noted Apr. 9.

Pekin, Ill.—[illegible] will be received July 6 by the City Clerk for the [illegible] of about [illegible] miles of [illegible] in Pekin.

Fond du Lac, Wis.—The Eastern Wisconsin Ry. & Light Co. contemplates the extension of its lines into the [illegible] of the city. J. P. Pulliam, Oshkosh, is Gen. Mgr.

Hutchinson, Kan.—The Hutchinson Interurban Ry. Co. has applied to the City Council for a franchise to build a single-track [illegible]. W. A. [illegible], is Gen. Mgr. and Pur. Agt.

Dallas, Tex.—Plans are being prepared by the Texas Traction Co. for double-tracking its Main St. line in Dallas. [illegible], Dallas, is Gen. Mgr.

The City Council has granted a franchise to the Dallas [illegible] Ry. Co. to double-track its [illegible] line to the Southern Methodist University in Dallas. [illegible], Dallas, is Mgr. Noted Jun. 18.

[illegible] a new application with the City [illegible] for a franchise for a double-track [illegible] from the end of the [illegible] Heights car line to the [illegible] Heights [illegible].

Fort Worth, Tex.—Preparations are being made for the construction of an interurban electric railway from Fort Worth to [illegible], about [illegible] miles.

Hillsboro, Tex.—J. C. [illegible] of the Commercial Club of Hillsboro, Tex., and associates are interested in the construction of an interurban electric railway from Hillsboro to [illegible], about [illegible] miles. The route of the proposed line is [illegible].

Mexia, Tex.—Plans are being considered for the construction of an electric railway from Mexia to Fort Worth. [illegible], Hillsboro, Tex., is interested.

✦Ogden, Utah—The Ogden Rapid Transit Co. has awarded a contract for the extension of its line to Huntsville, to the UTAH CONSTRUCTION CO., Ogden.

Tucson, Ariz.—The Tucson Rapid Transit Co. contemplates the extension of its line on [illegible] Ave. and Speedway. [illegible], Tucson, is Gen. Mgr.

Astoria, Ore.—The [illegible] Power & Light Co. has been granted a franchise to extend its lines in Astoria. James E. [illegible], Portland, is Gen. Mgr.

Benicia, Calif.—The [illegible] Land & Terminal Co. contemplates the construction of an electric railway from Benicia to Vallejo. J. R. [illegible], is Mgr.

Ocean Beach, Calif.—The [illegible] Ry. Co. has been incorporated to construct an electric railway to connect Ocean Beach and [illegible]. The incorporators are Charles W. [illegible], [illegible], John F. [illegible], Jr., and J. H. McK[illegible].

San Diego, Calif.—The [illegible] Ry. Co. has secured a franchise to extend its line to the wireless station and to Fort Rosecrans. [illegible], San Diego, is Gen. Supt.

✦San Francisco, Calif.—The Board of Supervisors has awarded the contract for the electrical [illegible] for the [illegible] to [illegible] CO. at [illegible].

Toronto, Ont.—The Toronto Ry. Co. is preparing to reconstruct [illegible]. About [illegible] miles of track will be [illegible]. [illegible], Toronto, is Gen. Mgr.

LIGHT, HEAT AND POWER

✦East Norwalk, Conn.—Contracts for the municipal electric [illegible] have been awarded to M. J. [illegible] and the LEWIS ROTH CO., Philadelphia, Penn., for the equipment. The building will be six [illegible]. A. N. [illegible], [illegible] Ave., [illegible], New York, N. Y., is the Engr. The cost will be about [illegible].

✦Amsterdam, N. Y.—[illegible] have awarded a contract to [illegible] W. [illegible], [illegible] St., [illegible], Mass., for the construction of a power plant in connection with its establishment.

New York, N. Y.—[illegible] will be received by the Board of Water Supply, Gas and Electricity until July [illegible] for the construction of a transmission line [illegible].

Oswell, N. Y.—The [illegible] Power Co. is preparing plans for the construction of a power dam on the [illegible] River, [illegible].

Wayland, N. Y.—The Wayland Electric Light & Power Co. has [illegible] of transmission lines in [illegible].

Jersey City, N. J.—The [illegible] will [illegible] on the plant on [illegible] Ave. [illegible].

Newark, N. J.—Plans are being prepared by the Public Service [illegible] Co. for the construction of a power plant at [illegible] on the Passaic River. [illegible].

Tallahassee, Fla.—[illegible].

Springfield, Tenn.—[illegible] the City [illegible] for the improvement and enlargement of the municipal electric-light plant.

Norwalk, Ohio.—Bonds for [illegible] have been voted for the construction of a municipal electric-light plant.

West Union, Ohio.—[illegible] for the construction of an electric-light plant at West Union.

Wyoming, Ohio.—[illegible] are being prepared for the construction of a municipal electric-light plant in Wyoming.

Tell City, Ind.—[illegible] for the purpose of [illegible] the municipal electric-light plant.

Lincoln, Ill.—[illegible] County Gas Co. for laying about three miles of gas mains in Lincoln.

Springfield, Ill.—(Official.) Bids will be received by the Board of Local Improvements until [illegible] a.m., July 6, for the installation of an ornamental lighting system on [illegible] St. from [illegible] to [illegible]th St. [illegible] D. Seeley is City Engr. Noted Apr. [illegible].

Columbus, Wis.—Bids will be received by the Water and Light Commission until July [illegible] for the construction of an addition to the municipal power plant. A. H. Procter is Secy. of the Comn.

La Crosse, Wis.—The Wisconsin-Minnesota Light & Power Co. has increased its capital to provide funds for the purchase and [illegible] of several power plants in western Wisconsin. Joseph H. [illegible] is Pres.

Aurora, Minn.—Bonds for [illegible] have been voted for the improvement and enlargement of the municipal electric-light plant.

Arma, Kan.—Plans are being prepared by Albert C. Moore, Engr., Joplin, Mo., for the improvement and extension of the municipal electric-light plant and water system. Estimated cost [illegible].

Douglass, Kan.—The city has petitioned the Board of Public Utilities for permission to issue bonds for [illegible] for the installation of an electric distributing system. C. A. Ogg is City Clk. and Albert C. Moore, [illegible] Bldg., Joplin, Mo., Engr.

Effingham, Kan.—The city has decided to construct a transmission line from [illegible] to Effingham.

La Crosse, Kan.—An election will soon be held at which the proposition to issue bonds for [illegible] for the improvement of the municipal electric-light plant will be submitted to the citizens.

Leavenworth, Kan.—W. J. [illegible] has applied to the City Council for a franchise to construct and operate an electric-light plant at Leavenworth.

Powhattan, Kan.—A bond issue of [illegible] for the construction of a municipal electric-light plant was voted at the recent election.

✦Decatur, Neb.—The city has awarded a contract to ROBERT BURNS for the construction of an addition to the municipal power plant.

St. Paul, Neb.—The City Council is considering plans for the construction of a municipal electric-light plant in St. Paul.

Alexandria, S. D.—Bids will be received by the city about Aug. 1 for the construction of a municipal electric-light plant. H. M. S[illegible] is City Aud.

Grand Forks, N. D.—[illegible]—The city will lay about [illegible] ft. of underground conduit and extend the ornamental street-lighting system. A. J. Smith is City Engr.

Choteau, Mont.—Plans are being prepared by the Choteau Light & Power Co. for the improvement and extension of its electric-light and power plant.

Nevada, Mo.—The city [illegible] the construction of a municipal electric-light plant.

Palmyra, Mo.—See item under Water Supply and Irrigation.

Fort Worth, Tex.—The Fort Worth Gas Co. will extend its mains and distributing system through the suburbs of Arlington Heights, River Crest and H[illegible].

Gorman, Tex.—Plans are being prepared by the DeLeon-Gorman Light & Power Co. for the construction of a power plant at Gorman.

Taft, Tex.—Preliminary arrangements are being made for the reconstruction of the municipal electric-light plant, which was recently destroyed by fire.

Victor, Idaho.—The City Council has under consideration the construction of a municipal light and power plant, which will supply the city and vicinity.

Ridgefield, Wash.—J. H. [illegible], Portland, Ore., has been granted franchises for an electric lighting and water system for the city.

White Salmon, Wash.—The Northwest Electric Co. will soon start work on the construction of a power plant on the White Salmon River, about [illegible] miles from White Salmon.

Tillamook, Ore.—F. J. [illegible] and D. C. [illegible] have been granted a franchise to construct and operate an electric-light plant in Tillamook. Estimated cost [illegible].

✦Fresno, Calif.—The contract for the installation of an ornamental street lighting system has been awarded by the [illegible] to NE PAGE & McKINNEY, Seattle, Wash., at [illegible].

Oroville, Calif.—Plans are being considered by the [illegible] to extend and improve its system in the [illegible] District. A. A. Davis is Supt.

Montreal, Que.—The city will build a municipal electric-light plant to cost [illegible].

The Cedar Rapids Power Co., Power Bldg., Montreal, is preparing plans for the construction of a transmission line from the Cornwall canal south to the International boundary.

Lucan, Ont.—Plans are being prepared for the construction of a new hydroelectric system at Lucan. George [illegible] is interested.

✦Owen Sound, Ont.—(Official.) The contract for the construction of a power [illegible] at [illegible] Falls, near Owen Sound, has been awarded by the Hydro-Electric Power Commission to the AMBURSEN HYDRAULIC CONSTRUCTION CO., Montreal, Que.

Stony Mountain, Man.—The construction of a substation at Stony Mountain is under consideration.

Sudbury, Ont.—The Sudbury & Copper Cliff Ry. Co. is preparing plans for extending [illegible] and a new electric [illegible] power house and general equipment.

Wolseley, Sask.—Preliminary arrangements are being made for the improvement and extension of the municipal electric-light plant. [illegible] is Mgr.

BRIDGES

★**Cambridge, Mass.**—(Official)—Bids will be received until noon, July 13 for rebuilding the Walden St. Bridge over the tracks of the Fitchburg R.R. The bridge will be 63 ft. long and 42 ft. wide. L. M. Hastings is City Engr.

Hartford, Conn.—Bids will be received until 2 p.m. July 14, by the State Highway Commissioner, Hartford, for constructing bridges in several townships.

Albany, N. Y.—Bids were received as follows, June 23, by Duncan W. Peck, State Supt. Pub. Wks., Albany, for Barge Canal contract No. 121, bridge work: General Erecting Co., Syracuse, $9670; M. Fitzgerald, Hoosick Falls, N. Y., $10,507; Lupfer & Remick, Buffalo, N. Y., $10,416; engineer's estimate, $9590.

★**Albany, N. Y.**—John A. Bensel, State Engr., Albany, opened bids, June 16, for constructing the proposed viaduct over Normanskill Creek, at Bethlehem. The lowest bid was submitted by the Penn Bridge Co., Beaver Falls, Penn., at $58,234.

Albany, N. Y.—(Barge Canal Work)—Bids will be received until noon, July 21, by Duncan W. Peck, State Supt. Public Wks., Albany, for Barge Canal Contracts Nos. 109 and 118, which provide for bridges over the Mohawk River at Crescent, N. Y., and Amsterdam, N. Y. The Crescent bridge will be about 1135 ft. long and will have five spans. The cost is estimated at $190,243. The bridge at Amsterdam will span the Barge Canal and the river at that point. The cost of the bridge is estimated at $153,000.

Buffalo, N. Y.—The city plans to reconstruct the condemned Hamburg St. and Michigan St. viaducts. Bids will be received until July 8 by Francis C. Ward, Dir. Pub. Ser.

Norwich, N. Y.—The citizens, June 11, voted in favor of constructing a reinforced concrete bridge at South Broad St.

✚**Westfield, N. Y.**—The town has awarded the contract to E. N. & R. E. SPAULDING, Sheffield, N. Y., for constructing a reinforced-concrete arch across Little Chatauqua Creek, at $9765. Bids were opened June 12. Noted June 11.

✚**Freehold, N. J.**—The Board of Chosen Freeholders has awarded the contract to OWEN J. MELEE, Long Branch, N. J., for raising and improving the bridge over Parker's Creek, near Little Silver, at $17,900. Bids were opened June 10. Noted June 4.

Newark, N. J.—The Board of Public Works, in conjunction with the Lehigh Valley R.R., plans to construct a viaduct over the company's tracks at Bay Ave. The structure will be used in connection with the opening of Haynes Ave.

★**Perth Amboy, N. J.**—Bids will be received by the Board of Chosen Freeholders, County Record Bldg., New Brunswick, N. J., until 2:30 p.m., July 20, for the construction of a reinforced bridge across the cut or crossing of the Lehigh Valley R.R. at Convery Place, Perth Amboy, accordng to plans and specifications on file at the office of Thomas H. Hagerty, County Collector, New Brunswick, and at the office of Alvin B. Fox, Perth Amboy.

Trenton, N. J.—The Board of Chosen Freeholders plans to construct a bridge at Lee Ave., Trenton. Theodore Tobish is County Engr.

Grindstone, Penn.—Bids will be received until noon, July 8, by Harry Kisinger, County Controller, Uniontown, Penn., for constructing a reinforced concrete bridge over Redstone Creek at Grindstone.

Guthsville, Penn.—Bids will be received until 10 a.m., July 9, by the Lehigh County Commissioners, Allentown, for constructing a bridge over Jordan Creek at Guthsville. Harry C. Weinart is Clk.

Pittsburgh, Penn.—Bids will be received until noon, July 12, by R. J. Cunningham, County Controller, Pittsburgh, for constructing Bridge No. 7 over Thompson's Run in Penn and Patton Townships.

Scranton, Penn.—J. D. Hayes, Dir. Pub. Wks., has approved plans and specifications for the proposed steel bridge to be constructed across Leggett's Creek. Estimated cost, $6000.

✚**Waynesburg, Penn.**—The Green County Commissioners have awarded the contract to the CROSSON CONSTRUCTION CO. for constructing a concrete bridge over Pumpkin Run, at $10,778.

West Chester, Penn.—Bids will be received until noon, July 6, by Isaac Y. Ash, County Controller, West Chester, for constructing a steel bridge over Doe Run Creek. Noted May 14.

✚**Wilkes-Barre, Penn.**—The County Commissioners, Wilkes-Barre, have awarded the contract to F. A. REYNOLDS & SON, Scranton, Penn., for constructing a 12-span concrete highway bridge at $19,466. David A. Keefe, Athen, Penn., is Engr.

Wilkes-Barre, Penn.—Bids will be asked at once by the City Council for the proposed bridge to connect the East End, Wilkes-Barre and North Wilkes-Barre. B. K. Finch is City Engr. Noted June 25.

York, Penn.—Charles Williams, County Engr., York, has prepared plans and specifications for one stone arch and five reinforced concrete bridges to be constructed in various parts of the county.

✚**Oakland, Md.**—The County Court, Oakland, has awarded the contract to the FARRIS BRIDGE CO., Charleston, W. Va., for the construction of a bridge at Davis Ford in Patterson's Creek, at about $5000.

✚**Durham, N. C.**—(Official)—The contract has been awarded by the county to the CURTIS-THORNTON CO., Burlington, N. C., for constructing two bridges, at $1937.

✚**Hillsboro, N. C.**—(Official)—The contract has been awarded by Orange County to the CURTIS-THORNTON CO., Burlington, N. C., for constructing seven bridges, at $4700.

✚**Lexington, N. C.**—(Official)—Davidson County has awarded the contract to the CURTIS-THORNTON CO., Burlington, N. C., for constructing 13 bridges, at about $7000.

Americus, Ga.—The Commissioners of Sumter and Crisp Counties plan to construct a steel bridge connecting the two counties. Americus is the county seat of Sumter County.

Bay Minette, Ala.—Bids will be received until July 14 by H. H. Smith, Probate Judge, Bay Minette, for constructing two bridges, one of steel and one of concrete.

✚**Hamilton, Ala.**—The County Commissioners have awarded the contract to the SOUTHERN BRIDGE CO., Birmingham, Ala., for constructing a steel bridge across Buttahatchie River, one mile east of Hamilton, at $6435.

Meridian, Miss.—Bids will be received until July 6 by the Board of County Supervisors, Meridian, for constructing two steel bridges.

Vicksburg, Miss.—Bids will be received until noon, July 6, by J. D. Laughlin, Chancery Clk., Vicksburg, for altering and repairing the steel bridge over Durden Bayou.

✚**Crowley, La.**—The city has awarded the contract to AUSTIN BROS., Houston, Tex., for constructing a bridge, at $5275.

✚**Winnsboro, La.**—The Police Jury, June 22, awarded the contract to the VINCENNES BRIDGE CO., Vincennes, Ind., for constructing five steel bridges, at $5527.

Covington, Ky.—The city plans to construct a viaduct at Delta Ave. to eliminate the grade crossing at that point. Frank Rashaig is City Engr.

Louisville, Ky.—Bids are being received by the Board of Public Works for the construction of a concrete bridge over Beargrass Creek at Ellison Ave. Estimated cost, $12,000. D. R. Lyman is City Engr. Noted Apr. 16.

Whitesburg, Ky.—Bids will be received until Aug. 3 by the Judge of the County Court, Whitesburg, for constructing three bridges over the Kentucky River. The bridges will be of 108-, 114- and 120-ft. spans. I. N. Lewis, Whitesburg, is County Rd. Engr.

Cincinnati, Ohio—The citizens, July 14, will vote on the proposition to issue $50,000 for constructing and repairing bridges. Fred Schneller is Clk. of Council.

Miamisburg, Ohio—Bids will be asked at once by the County, Commissioners, Dayton, Ohio, for constructing the Linden Ave. Bridge at Miamisburg. The structure will be 660 ft. long. Victor C. Smith is County Surv.

✚**Tiffin, Ohio**—(Official)—Bids were received, June 20, by the Commissioners of Seneca County for constructing three steel bridges in various parts of the county. The contract has been awarded to the MODERN CONSTRUCTION CO., Fremont, Ohio, at $8140. J. E. Hershberger is County Audr.

Toledo, Ohio—Bids will be received by the Lucas County Commissionsers, Toledo, until 10 a.m., July 17, for constructing several bridges over the Miami & Erie Canal Charles J. Sanzenbacher is County Audr.

✚**Aurora, Ill.**—(Official)—Bids were opened, June 20, by the Town Clerk for constructing the Montgomery Bridge over the Fox River. The contract has been awarded to NEWKIRK & POWERS, Joliet, Ill., at $13,307.

Waupaca, Wis.—Bids will be received by the County Clerk, Waupaca, until July 7, for the construction of three bridges.

✚**Council Bluffs, Iowa**—The County Supervisors have awarded the contract to the LANA CONSTRUCTION CO., Council Bluffs, for bridge work in six townships, at $24,958.

✚**Fort Dodge, Iowa**—The City Council has awarded the contract to N. M. STARK & CO., Des Moines, Iowa, for constructing two reinforced concrete bridges over the ravine north of Prospect Hill and over Lizard Creek, at $15,300.

West Union, Iowa—The county plans to construct bridges in various parts of the county to cost $26,000. G. A. Blunt is County Engr.

Hastings, Minn.—Bids will be received until noon, July 13, by P. A. Hoffman, County Audr., Hastings, for constructing three reinforced concrete bridges in various parts of the county.

Minneapolis, Minn.—F. W. Cappelen, City Engr., has estimated the cost of the proposed bridge over the Mississippi River between 14th Ave. South, and 19th Ave., S. E., at $365,000.

Stillwater, Minn.—Bids will be received until July 7 by the City Council for constructing a concrete bridge across Kusick Ravine. L. W. Clark is City Engr.

Concordia, Kan.—A. R. Losh, Engr., Topeka, Kan., has prepared plans for eight concrete bridges for the Cloud County Commissions, Concordia.

Erie, Kan.—The Neosho County Commissioners, Erie, plan to construct four concrete bridges to cost $20,000.

La Crosse, Kan.—Bids will be received until noon, July 6, by the Board of County Commissioners, La Crosse, for constructing the superstructure of the proposed steel bridge over Walnut Creek. The structure will have one main span, 70 ft. long and two approaches 25 ft. and 30 ft. long, respectively. M. M. Wilson is County Clk.

Mankato, Kan.—Plans have been prepared by A. R. Losh Engr., Topeka, Kan., for seven concrete bridges for the Jewell County Commissioners, Mankato.

✚**Nebraska City, Neb.**—(Official)—Bids were opened June 8 by the Board of Commissioners of Otoe county for constructing a concrete bridge across North Table Creek. The contract has been awarded to the WILSON REINFORCED CONCRETE CO., Nebraska City, at $5700. Noted May 28.

✚**Fromberg, Mont.** The contract has been awarded by the county to the RELEY CONSTRUCTION CO., Livingston, Mont., for constructing a concrete bridge over Clarks Fork River at Fromberg, at $20,000. Noted May 21.

Malta, Mont.—Bids will be received until July 6 by the Glasgow County Commissioners, Glasgow, for constructing a steel bridge over Flat Creek, about 33 miles south of Malta.

Nevada, Mo.—Bids will be received until noon, July 21, by the Vernon County Court, Nevada, for constructing five bridges. J. B. Akers, Nevada, is County Clk.

Savannah, Mo.—Bids will be received until 2 p.m., July 8, by J [illegible] County Engr., Savannah, for concrete bridges, steel bridges and culverts.

Springfield, Mo.—Bids will be received until July 6, by J. [illegible] McAfee, County Supv., Springfield, for constructing two bridges, one over the Pomme de Terre and the other over [illegible] River.

Batesville, Ark.—Bids will be received until July 10 by J. W. [illegible] County Judge of Independence County, Batesville, for constructing a concrete bridge to cost $[illegible]. Noted Dec. 4, 1913.

+Fayetteville, Ark.—The Bridge Commissioners, June 19, awarded the contract to the VINCENNES BRIDGE CO., Vincennes, Ind., for constructing two steel wagon bridges, one over the Illinois River at Howes' Ford and one over West Fork at Combs' Ford, at $7680.

+Angleton, Tex.—The Commissioners Court has awarded the contract to [illegible] G. BURNS & CO., for repairing the Co[illegible] Bridge, at $29,[illegible].

+Beeville, Tex.—The Bee County Commissioners, June 11, awarded the contract to A. A. ALSBURY & SON, Dallas, Tex., for the construction of a steel bridge, at $5750.

+Waco, Tex.—(Official)—Bids were received, June 22, by the Commissioners Court of McLennan county, Waco, for bridges and road work in Dist. No. 2. Contracts have been awarded as follows: To the McCALL-MOORE ENGINEERING CO., Waco, for bridges Nos. 1, 2 and 3, at $80,226; for bridges Nos. 4 and 5, to RICHARD MOREY, St. Louis, Mo., at $32,900; for roads Nos. 4 and 5, to RICHARD MOREY, at $262,710; Road No. 3, to FLANAGEN BROS., Waco, at $129,448; Road No. 2 to [illegible] H. PRICHETT, Waco, at $34,605; Road No. 1, to [illegible]KANDER BROS., Waco, at $197,381.

Buttes, Colo.—Bids will be received until noon, July 2, by Elroy C. Sheldon, County Clk., Colorado Springs, Colo., for constructing a reinforced concrete bridge across the Fountain River near Buttes.

Challis, Idaho.—Bids will be received by the Custer County Commissioners, Challis, until July 11, for constructing three steel bridges over the Salmon River.

Phoenix, Ariz.—Bids will be received until noon, July 13, by James Miller, Jr., Clk. Bd. of Supervisors, Phoenix, for constructing the proposed reinforced concrete bridge across the Salt River Valley Canal on the Phoenix-Tempe Highway. Noted May 28.

Bellingham, Wash.—The County Commissioners of Whatcom County, Bellingham, have decided to build the Chuckanut Bridge on the Waterfront Road, in the city limits. Bids for the work will be asked at once.

Salem, Ore.—Plans have been completed by the Highway Commission for two 210-ft. bridges to be constructed near [illegible] and Molalla, Ore. H. L. Bowlby, Salem, is State Highway Engr.

Alhambra, Calif.—Bids will be asked soon by the city for constructing a reinforced concrete bridge over Mill Creek between Alhambra and San Gabriel. Bonds for $25,000 have been [illegible].

Kernville, Calif.—Bids will be received by the Board of [illegible], George [illegible], Clk., until 10 a.m., July 1[illegible], for the construction of a [illegible] trestle bridge 2[illegible] ft. long and 20 ft. wide over the Kern river near Kernville; also a pile trestle bridge [illegible] ft. wide over a trash channel of the same [illegible] the bridge site.

+Klamath, Calif.—The county has awarded the contract to FRANK [illegible] SMITH, [illegible], Calif., for constructing the proposed [illegible] bridge over the Klamath River at Martin's Ferry, at $[illegible].

San Diego, Calif.—The Board of Supervisors, San Diego, [illegible] bonds for $[illegible] for constructing concrete [illegible] bridges throughout the county.

+Toronto, Ont.—The Board of Control has awarded the contract to W[illegible], T[illegible] & SAUNDERS, for constructing a reinforced concrete bridge over [illegible] Park, [illegible] and Arthur Sts., at $[illegible].

York, Ont.—Bids will be received until July 6 by Frank [illegible], Township Engr., [illegible] St. East, Toronto, Ont., for constructing a reinforced concrete bridge over the Don [illegible], Township of York, York county.

Windsor, Ont.—[illegible] County plans to spend $10,[illegible] for [illegible] bridges.

Calgary, Alta.—The City Council will ask for bids [illegible] for [illegible] bridges [illegible] to cost $[illegible]. Noted June [illegible].

Regina, Sask.—[illegible] until July 11 by F. J. [illegible], Highway Comm., Regina, for constructing [illegible] bridges [illegible].

Victoria, B. C.—The City Council has [illegible] the City [illegible] bridge [illegible]. C. H. [illegible] is City Engr.

WATER SUPPLY—IRRIGATION

++Boston, Mass.—[illegible]

[illegible] Noted June 11.

+Fall River, Mass.—(Official)—The contract for furnishing a motor driven centrifugal pump has been awarded to the WILSON-SNYDER CENTRIFUGAL PUMP CO., Pittsburgh, Penn., at $[illegible]. Bids were opened June 2[illegible]. Noted June 18.

Waterbury, Conn.—Three holding basins will be constructed by the manufacturers of the Naugatuck Valley in Lead Mine Brook Valley to conserve the water. Charles H. Preston, Consult. Engr., Waterbury, is a member of the Comn. Noted May 28 under Thomaston.

Cohoes, N. Y.—The Board of Water Commissioners contemplates laying a 3[illegible]-in. main from the pumping station to No. 3 reservoir. The estimated cost is $1[illegible],000.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by William Williams, Comr. Water Supply, Gas and Electricity, Municipal Bldg., until 2 p.m., July 3 for transferring taps and rearranging connections on existing water mains in various streets in the Borough of Manhattan.

(Borough of Brooklyn)—(Official)—Bids will be received by William Williamson, Comr. of Water Supply, Gas and Electricity, until 2 p.m., July 3 for cleaning water mains and setting additional valves.

+New York, N. Y.—(Official)—See item under Guayaquil, Ecuador.

+Pittsford, N. Y.—(Official)—The contract for constructing a water system has been awarded to GEORGE H. BRICKLAND, Rochester, at $4220. K. H. Smead is Engr. Noted May 21.

Bound Brook, N. J.—The Board of Public Utility Commissioners has granted the Bound Brook Water Co. permission to issue bonds for $[illegible]0,000 to be used for extensions to its plant and system.

Harrison, N. J.—(Official)—Bids will be received by C. T. Van Deren, Chn. of the Water Com., until 9 p.m., July 7, for c.i. water-pipe and specials.

(Official)—Bids will be received by C. T. Van Deren, Chn. of the Water Comm., until 9 p.m., July 7, for laying water-pipe, setting valves, etc. Plans are on file with Borrie & Kreiner, Kinney Bldg., Newark, N. J.

Hopewell, N. J.—Bids will soon be received for the installation of a new pumping plant. J. D. Kilpatrick, 30 Church St., New York, N. Y., is the Engr. Noted Apr. 3[illegible].

Perth Amboy, N. J.—The Board of Water Commissioners has voted bonds for $100,000 for improvements and extensions at the Runyon pumping station, including the installation of new pumping machinery. Noted June 4.

+Pompton Lakes, N. J.—(Official)—The contract for constructing a water system has been awarded by the mayor and council to PARTRIDGE & BURKE, Hohokus, N. J. Noted Apr. 23.

Butler, Penn.—The Butler Highfields Water Co. has been organized with a capital of $[illegible]0 and will construct a water system. H. G. Conley, Butler, is interested.

Uniontown, Penn.—Press reports state that the Uniontown Water Co. will reline Coolspring No. 2 with concrete at an estimated cost of $[illegible]. Hutchinson reservoir will also be repaired.

+Baltimore, Md.—(Official)—Bids were received June 17 by the Board of Awards for constructing superstructures at Lake Montebello under contract No. 2[illegible] as follows: The CONSOLIDATED ENGINEERING CO., Inc., Baltimore, at $[illegible] (awarded contract); Charles L. Stockhausen, $[illegible]33,613; Henry Smith & Sons Co., $2[illegible]; David M. Andrew Co., $27,[illegible]; and Morrow Bros., $2[illegible],113. J. W. Armstrong is Engr. Filtration Div. Noted June 4.

+Brooklyn, Md.—The contract for extending the water mains has been awarded by the Brooklyn & Curtis Bay Water Co. to RIGGS, DISTLER & STRINGER, [illegible] Light St., Baltimore, at $[illegible]0,[illegible]. Noted Apr. [illegible].

+Greensboro, Md.—(Official)—Bids will be received until 1 p.m., July [illegible], for constructing a water system. Temple Smith, Greensboro, is Supt. Noted June 4.

Mount Olive, N. C.—The [illegible] contemplates constructing a water works and sewer system, estimated to cost $[illegible].

Columbus, Ga.—Bonds for $[illegible] for the construction of a [illegible] water system have been sold. Noted Jan. [illegible].

+La Grange, Ga.—(Official)—Bids will be received by J. D. [illegible], Mayor, until [illegible] p.m., July 11 for installing a water works. James [illegible], [illegible] Atlanta, is Consult. Engr. For details see advertisement under "Contracts To Be Let."

Quitman, Ga.—The [illegible] contemplate improvements to the water and sewer systems.

Bushnell, Fla.—The city contemplates installing a water system [illegible].

Clearwater, Fla.—[illegible] will be received about Sept. 1 by [illegible] ft. of water pipe. The estimated cost is $[illegible]. Noted June 11.

Crystal River, Fla.—The citizens have authorized the expenditure of $[illegible] for the installation of a water system.

Tallahassee, Fla.—The city contemplates spending $[illegible] for improvements to the water system and electric light plant.

Bay Minette, Ala.—Plans are being prepared by [illegible], Consult. Engr., Montgomery, Ala., for the construction of a water works and a sewer system. The estimated cost is $[illegible].

Cullman, Ala.—(Official)—At a recent election the citizens voted bonds for $[illegible] for the improvement of the water system. A concrete [illegible], a pumping station, [illegible] and tower will be constructed. [illegible] Bldg., Birmingham, Ala., is Engr. Noted May [illegible].

Hazard, Ky.—The Hazard Water Co. contemplates making improvements and enlarging its plant.

Akron, Ohio.—(Official)—Bids will be received by C. [illegible], [illegible] until noon, July 3 for laying [illegible] water pipe [illegible].

Cleveland, Ohio—(Official)—Bids will be received by the Commissioner of Purchases and Supplies, until noon, July 9 for furnishing stop cock boxes for the department of Public Utilities.

★**Cleveland, Ohio**—(Official)—Bids will be received by the Commissioner of Purchases and Supplies until noon, July 23 for constructing a concrete coagulant house and wash-water reservoir.

Columbus, Ohio—Bids will be received by S. A. Kinnear, Dir. of Pub. Serv., until noon, July 7 for furnishing materials for the alum plant under Contract No. 24. Jerry O'Shaughnessy is Supt. of the Water Works.

✚The contract for laying a water main in High St. has been awarded by the Board of Control to S. T. KNIGHT, at $29,860.

★**Columbus, Ohio**—(Official)—Bids will be received by S. A. Kinnear, Dir. of Pub. Serv., until noon, July 23, for the equipment now located in the West Side pumping station. For details see advertisement under "Contracts To Be Let."

Ironton, Ohio—The City Council contemplates purchasing Nixon Hill to be used for a reservoir for the proposed new water system.

Portsmouth, Ohio—(Official)—Bids will be received until July 9 for furnishing the following material: 2400 ft. of 8-in. c.-i. pipe; 300 ft. of 6-in. specials, 21 hydrants and 12,000 lb. of pig lead. George P. Chute, Portsmouth, is Engr. Noted May 28.

Michigan City, Ind.—Bids will be received until July 11 for constructing a 42-in. intake pipe 3000 ft. into Lake Michigan. Noted June 4.

Saranac, Mich.—Plans are being prepared by James R. Fitzpatrick, Engr., for the construction of a water system for Saranac.

★**Chicago, Ill.**—(Official)—Bids were received June 25 for the construction of Sec. 2, of the Wilson Ave. Tunnel as follows: M. H. McGOVERN CO., Chicago, at $1,243,130 (low bidder); Ulen Contracting Co., $1,282,002; Keystone State Construction Co., $1,343,471; Byrne Bros. Dredges & Eng. Co., $1,608,030; Oscar Daniels Co., $1,620,239; Joseph Hanreddy, $1,786,188. Noted June 11.

Litchfield, Ill.—The City Council has appropriated $75,000 for the installation of a water system at Litchfield.

Rock Island, Ill.—The City Commission will lay water main in the factory district. The estimated cost is $13,735. W. Treichler is City Engr.

Kenosha, Wis.—The Board of Water Commissioners contemplates installing new equipment in the water station to increase the supply; the plant for a larger intake has been dropped and the new centrifugal pump is being considered. B. C. Brennen is City Engr.

Manitowoc, Wis.—The City Council has authorized the extension of the water mains 20 blocks. The estimated cost is $10,000. E. K. Pitz is City Engr.

Des Moines, Iowa—Bids will soon be received for the construction of a water system. The estimated cost is $7000. G. T. Simpson is Consult. Engr. Noted June 4.

Morning Sun, Iowa—Press reports state that Harper & Stiles, Grand Ave., Temple, Kansas City, Mo., are preparing plans for the construction of a water system at Morning Sun.

Aurora, Minn.—The city will issue bonds for $15,000 for the improvement of the water system. Noted May 28.

Duluth, Minn.—According to press reports the City Council has authorized the laying of a 36-in. water main near the Lakewood pumping station. The estimated cost is $21,500.

Holton, Kan.—Plans are being prepared for the installation of a water sy**em for which bids will soon be received. Worley & Black, Ka..sas City, Kan., are the Engrs.

✚**Nickerson, Kan.**—Contracts for installing a water and a sewer system have been awarded to the following companies: J. H. SHEARS & SON, Hutchinson, contract for sewer work, including laterals at $5926; SQUIRE ELECTRIC & CONSTRUCTION CO., water works, mains, and power house at $5394; UNITED STATES CAST IRON PIPE CO., c.-i. pipe water mains at $10,509; DES MOINES BRIDGE & IRON CO., water tank and tower at $3590; WORTHINGTON PUMP CO., pump and motors at $1715; LUDLOW VALVE CO., valves and hydrants at $1199. Bids opened June 12. Noted June 4.

✚**Veblen, S. D.**—(Official)—The contract for constructing a water system has been awarded to TANNER BROS., St. Paul, Minn. Noted June 18.

Winner, S. D.—At a recent election the citizens voted $30,000 in bonds for the improvement of the water system. Claude Maule is City Audr.

Carrington, N. D.—Bids will be received by the City Council until 7:35 p.m., July 10 for the extension of the water works. G. W. Meinmiller is City Engr.

Kirksville, Mo.—At a recent election the city authorized the expenditure of $25,000 for the installation of a water system. Noted June 18.

Neosho, Mo.—The citizens contemplate spending $60,000 for the improvement and extension of the water system. Albert C. Moore, Bartlett Bldg., Japlin, is Engr. Noted Oct. 16, 1913.

Palmyra, Mo.—The citizens contemplate spending $26,000 for extending the water system and electric light system.

Harrison, Ark.—(Official)—Bids will be received until 3 p.m., July 22 for $40,000 in water bonds and $30,000 in sewer bonds. George W. O'Neal is Secy. and M. A. Earl & Co., Muskogee, Okla., is Engr. Noted Jan. 15.

★**Killeen, Tex.**—(Official)—Bids will be received by the Mayor and City Council until July 13 for furnishing c.i. pipe and specials. For details see advertisement under "Contracts To Be Let."

Milford, Tex.—(Official)—Bids are being received by the mayor for the construction of a water system estimated to cost $14,000. Henry E. Elrod, Dallas, is Consult. Engr. Noted May 28, and June 25.

Nixon, Tex.—A. W. Norton & Son have been granted a franchise by the City Council for the construction of a water system at Nixon.

Boise, Idaho—The Little Willow Creek Irrigation Co. has filed application with the local land office for right of way over government land, for the construction of a reservoir and irrigation ditches. The estimated cost of the project is $220,000

Paris, Idaho—The citizens contemplate constructing a municipal water system.

Rigby, Idaho—The citizens contemplate spending $7500 for the construction of a water system. Henry Hill is Town Clk.

✚**Klamath Falls, Ore.**—The contract for constructing the Lost River Diversion channel of the Klamath Falls Irrigation Project has been awarded to W. M. MASON, Klamath Falls, at $13,922.

Warrenton, Ore.—(Official)—Bids will be received until 2 p.m., Aug. 3, by John Evenden, Clk. of Water Comn., for $150,000 in bonds for the construction of a gravity water system. Noted June 18.

Brawley, Calif.—Bonds in the sum of $35,000 have been authorized for the extension of the water mains. Noted Apr. 16.

El Monte, Calif.—Bids will be received by the City Trustees until 6 p.m., July 6 for constructing a municipal water system. I. Worth Everett is City Clk. Noted Feb. 15.

Garden Grove, Calif.—The three water companies of Garden Grove will consolidate and install a new water system.

Guernsey, Calif.—The Burke Ditch Co. has been organized to construct irrigation canals near Guernsey. J. M. Richard, Guernsey, is interested.

Oakdale, Calif.—The Oakdale Irrigation District contemplates spending $40,000 for the construction of laterals.

Richmond, Calif.—An election will be held July 22 to ratify an issue of $2,500,000 bonds. The proceeds will be used to bring water from the Sacramento River. Noted June 11.

Sacramento, Calif.—According to press reports the city contemplates extending the water system.

San Francisco, Calif.—Plans for tunnel and aqueduct lines, the Hetch Hetchy reservoir and the Cherry Valley reservoir for the city and county of San Francisco have been approved by Secretary Lane, Washington, D. C.

✚**Santa Barbara, Calif.**—(Official)—Bids were received June 15 by the Board of Water Commissioners for constructing a concrete foundation for the Gibraltar Dam, as follows: ARTHUR S. BENT CONSTRUCTION CO., 520 Central Bldg., Los Angeles, Calif., at $40,560 (awarded contract); Mesmer & Rice, $42,257; P. H. Ehlers, $44,015; Kling Co. & J. C. Beer, $43,643; S. M. Kerns, $39,643; Putnam-Stone Co., $51,708; Russell-Govern & Foell, $45,852. Noted June 11.

Susanville, Calif.—The Town Trustees contemplate purchasing the water system for $40,000. If the plant is purchased it will be enlarged.

Newmarket, Ont.—The City Council will extend the water system at an estimated cost of $15,000.

Orillia, Ont.—Bids will be received by W. K. Greenwood, until July 13, for furnishing gate valves, steel water pipe and c.i. water pipe and specials for the water system. Noted May 28.

Bids will be received by W. K. Greenwood until July 27 for furnishing motor-driven pumps, a Diesel oil engine and equipment for the water system. Noted May 28.

Ottawa, Ont.—The City Council contemplates making alterations to the new intake pipe costing $50,000.

Tilbury, Ont.—The Town Council contemplates installing a new water system and fire protection system. The mayor is in charge.

★**Guayaquil, Ecuador**—(Official)—Bids will be received by J. G. White & Co., Ltd., 9 Cloak Lane, London. E. C. England or 43 Exchange Pl., New York, N. Y., until July 20 for furnishing approximately 4000 tons of c.-i. water pipe with specials and fittings for the sanitation works of Guayaquil.

SEWERS

Milford, Maine—(Official)—Bids will ne received by the Board of Selectmen until July 15 for constructing about 6935 ft. of sewer. Lond & Holmes, 15 State St., Bangor, are the Engrs.

✚**Boston, Mass.**—The contract for constructing sewers and drains in Lake St., Brighton District has been awarded by the Department of Public Works to McCARTHY & WALSH at $6778. Other bids were from, William L. Dolan, $6839; Daniel E. Lynch, $7080; James L. Bryne, $7093; M. H. Kelley, $7151; M. De Sisto, $7230; Antony Cefalo, $7290; George J. Regan, $7766. L. K. Rourke is Comr. Noted June 11.

★**Bridgeport, Conn.**—(Official)—Bids will be received by the Paving and Sewer Commission until 8 p.m., July 14, for constructing sewers in various streets. Bernard Keating is Secy.

Hartford, Conn.—(Official)—Bids will be received by the Board of Contract and Supply, City Hall, until July 7, for constructing the Homestead Ave., Intercepting Sewer and branches. R. N. Clark is City Engr. W. S. Brewer is Dir. Engr. in charge of sewers.

✚**Southington, Conn.**—The contract for constructing about 13.5 miles of sewers has been awarded to BERNARDINO & TOMASSETTI, at $108,222. Noted May 14 and June 25.

West Haven, Conn.—The following bids were received by the [illegible] on June 24 for (a) the construction of [illegible] of vitrified pipe sewers from [illegible] to 24-in. in diameter, and (b) a pumping station and sewage disposal plant. [illegible] Bailey & F. F. Maher, New Haven, Conn., (a) [illegible], (b) $7[illegible]; J. W. Hiller Construction Co., New York, N. Y., (a) $1[illegible], (b) $14[illegible]; [illegible] Construction Co., New York, (a) $1[illegible], (b) $1[illegible]; [illegible] Co., Bridgeport, Conn., (a) $1[illegible]; [illegible] Co., Boston, Mass., (a) $1[illegible]; Connecticut [illegible] Co., Norwich, Conn., (b) $47,7[illegible]; [illegible]-Hilton Co., New York, N. Y., (b) $4[illegible]. Clyde Potts, 3[illegible] Church St., New York, N. Y., is the Engr and Walter A. Main, West Haven, is First Selectman. Noted Mar. [illegible], May 28 and June [illegible].

+Albany, N. Y.—The contract for constructing the Beaver Creek sewer and its branches has been awarded by the Board of Contract and Supply to the RIVERDALE CONTRACTING CO., at $[illegible].

Lyons, N. Y.—The city voted $31,000 in bonds for a sewer system.

+Medina, N. Y.—(Official)—Bids will be received by the Board of Sewer Commissioners until 8 p.m. July 11, for constructing an addition to the sewer system. Frank J. [illegible] is Clk.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by L. H. [illegible], Pres. of the Borough, until 11 a.m. July [illegible] for constructing sewer basins in various streets.

(Borough of Manhattan)—(Official)—Bids will be received by [illegible], Pres. of the Borough, until [illegible] p.m. July [illegible], for constructing a sewer in East [illegible] St. between East [illegible] and First Ave.

(Borough of [illegible])—(Official)—Bids will be received by [illegible], Pres. of the Borough, until noon, July [illegible], for constructing [illegible] sewer in [illegible].

Hightstown, N. J.—Bids will be received by the Common Council until July [illegible] for constructing sewers in Academy St., [illegible] Third Ave.

+Newark, N. J.—(Official)—Bids were received by the [illegible] Sewerage Commission for constructing [illegible] of the Main Intercepting Sewer in Newark and [illegible] as follows: [illegible]

+Indianapolis, Ind.—Press reports state that the contract for constructing the Pogues Run Drain has been awarded to the DUNN-McCARTHY CO., Chicago, at $907,067. Noted May 21.

+Niedo, Ill.—The contract for constructing 9[illegible] ft. 6- and 8-in. tile sewers has been awarded to DALTON BROS., Wilmette. W. S. Shields, 8 Dearborn St., is Engr. W. D. Emerson is City Clk.

Chicago, Ill.—(Official)—Bids were received by John McGillen, Clk. of the Sanitary District, for constructing the North Shore intercepting sewer, under contract No. 3, from Nash Bros., (a) concrete, $2[illegible],376, (b) brick, $2[illegible],396; Ulen Contracting Co., (a) $249,[illegible]; Marquette Construction Co., (a) $[illegible],98[illegible], (b) $2[illegible],276; Nash Dowdle Co., (a) $637,3[illegible], (b) $617,[illegible]. Noted June 11.

The following bids were received for constructing the Morton Grove sedimentation plant: John T. Washbridge Engineering Co., $[illegible]; Nash Dowdle Co., $10,[illegible]22; Schillinger Construction Co., $10,[illegible]; William Davidson, $12,2[illegible]3; J. M. Corbett & Co., $13,961; Universal Construction Co., $11,61[illegible]; U. S. Development Co., $16,[illegible]; J. J. [illegible], $19,163.

Elgin, Ill.—(Official)—Bids will be received by the City until 10 a.m., July 6, for constructing about 37,0[illegible]0 lin. ft. of 6- to 15-in. sanitary sewers. Morgan H. Brightman is City Engr.

+Georgetown, Ill.—The contract for constructing the proposed sewer system has been awarded to the CARSON-PAYSON CO., Danville, at $76,[illegible].

Lockport, Ill.—Bids for the construction of a sewer outlet in Division St. will soon be asked for by the City Council. C. S. Calkins, Joliet, Ill., is Engr.

Manhattan, Ill.—The Board of Trustees contemplate the installation of a sewer system.

Superior, Wis.—The lowest bid received by the city for constructing a sewer in alleys between Missouri and Maryland Aves. and Belknap and [illegible] Sts. was from Rastoret & Co., at $11,983.

[illegible]

Astoria, Ore.—Press reports state that the City Engineer is preparing plans for a trunk sewer to run from Ninth to 17th Sts.

Dallas, Ore.—The city has voted $7500 in bonds for constructing a septic tank. Noted Dec. 4, 1913.

Portland, Ore.—The City Council contemplates the construction of a trunk sewer in Willow and East 84th St. at an estimated cost of $109,793 and in Fulton Park and Carson Heights at an estimated cost of $47,706. A. L. Barbour is City Audr.

+Exeter, Calif.—The City Council has awarded a contract for the construction of a sewer system to C. D. VINCENT, Oakland, at $31,432. Noted June 4.

Fortuna, Calif.—The Town Trustees contemplate extending a concrete sewer diagonally across the city.

+Ocean Beach, Calif.—The contract for constructing a sewer system has been awarded to H. M. SHAFFER, San Diego, at $44,699. Cement pipe will be used.

Riverside, Calif.—The city will construct a sewer in the Hibington District to cost about $30,000.

Sacramento, Calif.—E. M. Wilder, City Engr. has completed plans for a sewage pumping station at Franklin and Riverside Aves. A reinforced concrete building will be constructed. The estimated cost is $125,000.

St. Lambert, Que.—Bids will be received by the Town Council until July 6, for the construction of storm and sanitary sewers. The estimated cost is $50,000. T. Drinkwater is Engr.

GARBAGE

+Norfolk, Va.—The Board of Control has awarded the contract to the NYE ODORLESS CREMATORY CO. for constructing two garbage crematories.

+Lansing, Mich.—The City Council, June 15, awarded the contract to H. E. WAGGONER, Huntington, Ind., for constructing the proposed garbage incinerator, at $30,000.

Coffeyville, Kan.—The city plans to construct a garbage incinerating plant to cost $4000. A. C. Gillam is City Engr.

Joplin, Mo.—The city plans to construct a garbage disposal plant. C. B. Anderson is City Engr.

Tropico, Calif.—The towns of Tropico, Glendale and Casa Verdugo plan to construct a community garbage incinerator.

South Vancouver, B. C.—The City Council will ask for bids soon for the construction of a 50-ton garbage destructor.

STREETS AND ROADS

Boston, Mass.—Bids will be received until July 7 by the State Highway Commission for building 6200 lin.ft. of road in Sudbury, 16,500 lin.ft. in Williamstown, and 4200 lin.ft. in Peabody. Arthur W. Dean, 15 Ashburton Pl. is Chief Engr.

+Boston, Mass.—Contracts have been awarded for building 4300 lin.ft. of state macadam road in Windsor and 10,000 lin.ft. of oil macadam road in Freetown to the HORNE LOWE CONSTRUCTION CO., Millbury, at $11,320, and S. L. CONEDY, Lakeville, at $12,687, respectively. Noted June 18.

+Boston, Mass.—(Official)—Contracts for paving Zeigler St. from Warren to Dearborn St. and Eustis St. from Dearborn to Magazine St., Roxbury have been awarded to JOHN F. BEATTY at $6029 and $14,579 respectively. Noted June 11.

Boston, Mass.—The city contemplates expending about $800,000 on street construction, as follows: Widening Chelsea St., Charleston; Norfolk St., Dorchester; Hyde Park Ave., Hyde Park, and North Beacon Ave., Brighton.

+Springfield, Mass.—The contract for constructing 11,627 sq.yd. of Bitulithic paving on a 5-in. concrete base has been awarded to ADAMS & RUXTON CONSTRUCTION CO.

+Woonsocket, R. I.—The contract for paving North Main and Winter Sts. has been awarded to SIMPSON BROS. CORPORATION, Boston, Mass., at $40,940. Noted May 21 and June 18.

+Bridgeport, Conn.—The City Council has awarded a contract to PAUL SVIHRA & SON, Beechmont Ave., for the construction of about 35,000 sq.ft. of concrete sidewalks in Seaside and Beardsley Parks.

Hartford, Conn.—Bids will be received by the State Highway Commission, State Capital, until 2 p.m., July 14, for the following state road work:

Huntington Township, about 5750 lin.ft. gravel or native stone macadam construction on the Huntington Center Road. Also 6750 lin.ft. gravel, native stone or trap rock macadam on the Piver Road. Plans are on file with the Town Clerk, Huntington.

Norwalk City, about 5840 lin.ft. warrenite, amiesite, hassam or concrete (plain or reinforced) construction on Winfield St. Plans are on file with the City Engineer, Norwalk.

Westport Township, about 4050 lin.ft. warrenite, amiesite, hassam or concrete (plain or reinforced) construction on the Old Highway. Plans are on file with the Town Clerk, Westport.

Fairfield Township and Bridgeport City, about 4470 sq.yd. warrenite, amiesite, bituminous concrete or asphalt pavement on Brooklawn Ave. Plans are on file with the Board of Public Works, Bridgeport.

Cornwall and Goshen Townships, about 10,150 lin.ft. special 3-in. native stone construction and 13,550 lin.ft. native stone resurfacing. Plans are on file at the office of R. S. Hulbert, Div. Engr., Winsted.

+Manchester, Conn. (South Manchester P. O.)—The contract for laying concrete walks and granite curbings, bids for which were received several days ago, has been awarded to the W. F. POTTER CO., North Haven, for about $16,000. Noted June 18.

★Albany, N. Y.—Bids were received by the State Highway Commission, 55 Lancaster St., June 25 for the construction of public highways by State Aid as follows:

Road No. 1175. Fairhaven Village, Cayuga County, 1.82 miles. J. H. Weidman, Syracuse, $33,299; Greece Conctruction Co., Rochester, $30,810; Chambers & Barnes, Rochester, $31,267; Ribstine-Holter Co., Rochester, $31,186.

Road No. 1195. Elmira City: Division & Grand Central Avenue, Chemung County, 1.14 miles. Conners & Gallivan, Elmira, $34,291; John Kelly Elmira, $25,534; Ballard & Mahara, Oneida, $35,954; James McGuigan, Elmira, $33,714; Holleran Bros., Elmira, $36,309; Edward W. Walsh, Elmira, $33,591.

Road No. 5340. East Branch-Sullivan County Line, Part 2, Delaware County, 6.84 miles. John F. Dolan Contracting Co., New York, $103,234; Nathan E. Young, Harpursville, $96,918; Ruddy-Saunders Co., Troy, $97,632; John DeMichael & Bro., Torrington, Conn., $100,375.

Road No. 5493. Batavia-Stafford, Part 2, Genesee County, 0.27 miles. S. V. R. Malcolm & Son, Medina, $7645; Witt & Blades, Hornell, $7142; J. W. Brennan Co., Geneva, $7460; Frank P. Brotsch Co., Rochester, $7318; Thomas Fitzgerald Co., Buffalo, $7155; Brooks & Julian, Rochester, $7216.

Road No. 1193. Lowville-Croghan, Lewis County, 9.17 miles. James L. Kehoe, Newburgh, $105,465; Joseph Mascetti, Torrington, Conn., $96,674; Winston & Co., Brown Station, $110,414; Burns Bros. & Baley, Watertown, $111,961.

Road No. 1191. Carthage-Maumburg, Part 2, Lewis County, 6.38 miles. A. J. Rockwood, Rochester, $64,598; Joseph Mascetti, Torrington, Conn., $58,960; James L. Kehoe, Newburgh, $64,254; Frank Arrigano & Bro., Middletown, Conn., $64,780; Fort Schuyler Construction Co., Utica, $62,667; Thomas O'Brien, Watertown, $67,697.

Road No. 1192. Naumburg-Croghan, Lewis County, 5.73 miles. Joseph Mascetti, Torrington, Conn., $59,613; James L. Kehoe, Newburgh, $67,139; Fort Schulyer Construction Co., Utica, $64,251; Newport Construction Co., Herkimer, $60,686; A. J. Rockwood, Rochester, $68,047; Burns & McConville, Ogdensburg, $64,121 and two others.

Road No. 5492. Hamilton-Bouckville, Madison County, 5.79 miles. Fort Schuyler Construction Co., Utica, $55,196; Newport Construction Co., Herkimer, $54,622; Paddleford & King, Sherburne, $53,234; Guy B. Dickson, Syracuse, $56,280; Olin T. Benedict, Pittsfield, Mass., $59,028; Winston & Co., Brown Station, $56,482; John De Michael & Bro., Torington, Conn., $56,241.

Road No. 5486. Oswego City-West Seneca St., West Bridge St., Oswego County, 1.13 miles. Thomas Hucknall & Co., Albion, $48,942; S. V. R. Malcolm & Son, Medina, $31,278; Ballard & Maher, Oneida, $48,579; Guy B. Dickinson, Syracuse, $46,580; Empire Contracting Co., Newark, $48,994; J. A. Culkin & Co., Oswego, $47,471.

Road No. 487. Oswego City: East Ninth and Oneida Sts. and State Road, Oswego County, 1.47 miles. Guy B. Dickison, Syracuse, $32,106 Thomas Hucknall & Co., Albion, $30,709.

Road No. 662. Rushville-Gorham, Ontario County, 6.06 miles. J. W. Brennan & Co. Inc., Geneva, $45,366; William H. Madden, Rochester, $44,232; Frank J. Foote, Nunda, $46,681; E. R. Weed & Son, Holley, $44,693; Thomas Hucknall & Co., Albion, $45,637; Thomas Grady, Rochester, $46,434 and ten others.

Road No. 1196. Gorham-Stanley, Part 2, Ontario County, 1.89 miles. Wood & Tompkins, Hilton, $16,642; Frank B. Brotsch, Rochester, $16,539; J. W. Brennan & Co., Geneva, $15,797; Thomas Hucknall Construction Co., Albion, $15,872; E. R. Weed & Son, Holley, $15,311; Wm. H. Madden, Rochester, $15,998 and four others.

Road No. 1119-A. Troy City-Spring Ave., Rensselaer County, 1.72 miles. Parker Hassam Paving Co., Worcester, Mass., $74,079; County Construction Company, Troy, $75,148; Edward Walsh, Troy, $73,566.

Road No. 1194. Rensselaer City-High St., Rensselaer County, 0.39 mile. James J. Rignay, Rensselaer, $6058; Olin T. Benedict, Pittsford, Mass., $7058.

Road No. 981-A. Defreestville-Couse, Rensselaer County, 3.14 miles. Roger B. Kennedy, Utica, $22,845; Olin T. Benedict, Pittsfield, Mass., $24,381; C. D. Dean, Albany, $23,338; County Construction Co., Troy, $23,327.

Road No. 1115-A, Road No. 1116-A. Castleton-Rensselaer, Parts 1 and 2, Rensselaer County, 1.91 miles. S. B. Van Wagonen, Rondout, $29,741.

Road No. 5497. Ogdensburg-Waddington, Part 1, St. Lawrence County, 9179 miles. A. J. Rockwood Co., Rochester, $126,603; Samuel Beskin, Beacon, $114,165; Richard Hopkins, Troy, $117,785; Y. H. Gill Co., Boston, Mass., $110,194; Spellman-Oliver Co., Chateaugay, $121,804; Burns Bros. & McCnnville, Ogdensburg, $114,014 and two others.

Road No. 5494. Schoharie Village-Main St., Schoharie County, 0.70 mile. Joseph P. Scanlon, Albany, $20,255.

Road No. 5488. Patchogue-Moriches, Suffork County, 12.89 miles. Gifford Construction Co., Jamaica, $173,902; Murray & Gardner, Center Moriches, $170,192; John J. Hart, Peekskill, $170,703; William Baker, Inc., New York, $170,139; Frank Arrigano & Bro., Middletown, Conn., $156,687; Samuel Beskin, Beacon, $169,318 and two others.

Road No. 5409. Monticello Village-Broadway and Jefferson St., Sullivan County, 1.56 miles. Heneboldt & Washington, Monticello, $52,973; Murray & Gardner, Center Moriches, $56,487; William P. McDonald Construction Co., New York, $55,921; Newton Paving Co., Trenton, N. J., $58,123; John I. McDonald Co., Mt. Vernon, $55,322.

Road No. 5253-C. Jasper-Addison Steuben County, 4.37 miles. J. G. Hayes, Hornell, N. Y., $48,671; Witt & Blades, Hornell, $50,808; Frank J. Foote, Munda, $46,626; T. H. Gill, Boston, Mass., $45,902; Bradley & Nolan, Corning, $52,297; McGuire & Fahey, Hornell, $48,073.

The following bids were received by the State Commission of Highways June 25, for the repair of public highways by State Aid:

Repairing Contract No. 660, Road No. 508, Selkirk-Coeymands, Albany County: Joseph P. Scanlon, Albany, $15,737, Beiotte & Marchese, Troy, $14,747; W. L. Lawton, Glens Falls, $15,438.

Repair Contract No. 530, Road No. 505, Norwich-North Norwich, Chenango, County: Phelan & Sullivan, Utica, $18,520, Paddleford & King, Sherburne, $17,847; Nash & Griffin, Norwich, $18,452.

[illegible] Contract No. 667, Road No. 5892, Red Hook-Rhinebeck, [illegible] County, D. [illegible] Lynch, Rhinebeck, $[illegible] John [illegible] Mt. Vernon, $[illegible] Thomas J. Martin, [illegible] Saugerties, $17,136; R. R. Kaln, [illegible] $21,1[illegible] Murray & Gardner, Center Moriches, $21,7[illegible] William Doyle, Saugerties, $1669.

[illegible] No. [illegible] Road No. 841, Crown Point-Port [illegible] County [illegible] Ticonderoga, $6775, Richard Hopkins, Troy, $[illegible]

[illegible] Contract No. 661, Road No. 436, Little Falls-East [illegible] County, Road No. 5179, East Creek Herkimer County, Road No. [illegible] East Creek-St. Johnsville, Montgomery County: Flood & Van Wirt, Hudson Falls, $15,338, [illegible] Little Falls $14,531; John P. Dugan & [illegible] $16,2[illegible] D. D. Cooper, Little Falls, $14,376, [illegible] Utica, $14,571

[illegible] No. [illegible] Road No. 154, Chester-Valls Gate, [illegible] County: [illegible] Construction Co., Highland Mills $[illegible] Murray & Gardner Center Moriches, $64[illegible] James [illegible] $[illegible]

[illegible] Contract No. 621 Road No. 77 Albia-Wynantskill, Rensselaer County: [illegible] & Marchese, Troy, $28,751; County Construction Co., Troy, $[illegible],644 Edward Walsh, Troy, $30,381.

[illegible] Contract No. 577, Road No. 436 Jericho Turnpike-[illegible], Nassau County: Powers & Wheeler, Oyster Bay, $[illegible] William R. [illegible] Babylon, $23,356 H. J. Mullen Contracting Co., Jamaica, $22,186 Murray & Fardner, Center Moriches $[illegible]

[illegible] Contract No. 6[illegible], Road No. [illegible]6, Pearl River-Nanuet, Rockland County: Aetna Contracting Co., Nyack, $26,671; [illegible] & [illegible], Kingston, $29,467, Murray & Gardner, Center Moriches, $[illegible]

[illegible] Contract No. 5[illegible] Road No. 441, Saratoga-Glens Falls, Saratoga County: W. H. Gaylor, Saratoga Springs, $2[illegible] W. L. Lawton, Glens Falls $19,6[illegible] John De Michael & [illegible] Torrington, Conn., $2[illegible],437 Flood & Van Wirt, Hudson Falls $2[illegible] Champlain Construction Co., Saratoga Springs, $[illegible]

[illegible] Contract No. 67[illegible] Road No. 5361, Yonkers-White Plains Road No. [illegible] White Plains-Rye, Westchester County: [illegible] & Son, Mt. Vernon, $[illegible],355, William Doyle, Saugerties $[illegible] William P. McDonald Co., New York City $[illegible] Hughes & Gardner, North Terrytown, $11,036 William F. McCabe Construction Co., White Plains $8710 Murray & Gardner, Inc., Center Moriches, $1[illegible]

[illegible] Contract No. 664 Road No. [illegible] Briar Cliff Manor-[illegible] Lake, Road No. 113 [illegible] Lake-Pines Bridge Road No. [illegible] Mt. Kisco-Millwood, Westchester County: Hughes & Gardner North Tarrytown, $[illegible] Murray & Gardner, Center Moriches $6[illegible] Wm. Doyle Saugerties, $[illegible] Delta Contracting Co., Jamaica $6[illegible] James Garafano & Son, Mt. Vernon, $[illegible]

Repair Contract No. 665, Road No. 35 White Plains-Armonk Road No. [illegible] White Plains-Cross Roads Westchester County: Wm. Doyle, Saugerties, $3[illegible] Hughes & Gardner, North Tarrytown $412[illegible] James Garafano & Son, Mt. Vernon, $[illegible] Delta Contracting Co., Jamaica $[illegible] Murray & Gardner Center Moriches $[illegible] William F. McCabe Contracting Co., White Plains, $[illegible] William P. McDonald Co., New York City $[illegible]

[illegible] Contract No. 663, Road No. [illegible], Mt. Kisco-Pleasantville, Westchester County: Hughes & Gardner, North Tarrytown $[illegible] James Garafano & Bro., Mt. Vernon, $[illegible]15 Murray & Gardner, Center Moriches $1[illegible] William P. McDonald Construction Co., New York, $[illegible] White & Culligan, Purchase, $[illegible]

Road No. [illegible], White Plains-Village, Westchester County, [illegible] miles: John P. McDonald Construction Co., Mt. Vernon, $[illegible] William F. McCabe Construction Co., White Plains, $[illegible] [illegible] Yonkers $[illegible],373 Murray & Gardner Center Moriches $[illegible] James Garafano & Bro., Mt. Vernon, $[illegible] [illegible] Mt. Vernon $[illegible] and [illegible] others.

Road No. [illegible] [illegible] Part I Madison County, [illegible] miles: [illegible] Construction Co., Buffalo $[illegible] Paddleford & [illegible] $[illegible] [illegible] & [illegible] Oneida, $[illegible] [illegible] $[illegible] [illegible] Construction Co., [illegible] and [illegible] others.

+Ithaca, N. Y.—A contract for paving has been awarded to [illegible] Troy, at $[illegible]

New York, N. Y.—(Official)—(Borough of the Bronx)—Bids will be received by [illegible] Pres. of the Borough of the Bronx, [illegible] Crotona Park, until [illegible] July 14, for [illegible] of asphalt road [illegible]

New York, N. Y.—(Official)—(Borough of [illegible])—Bids will be received by [illegible] Pres. Borough of [illegible] [illegible] Hall until 11 a.m., July [illegible] for regulating the following streets: [illegible] Ave. [illegible]

[illegible] (Borough of Manhattan)—Bids will be received by Marcus M. Marks Pres. of Borough of Manhattan, [illegible] until [illegible] July [illegible] for [illegible]

[illegible] (Borough of [illegible])—Bids will be received [illegible]

North Tonawanda, N. Y.—Bids will be received [illegible] July [illegible] for the sale of $[illegible] [illegible]

[illegible] N. Y.—(Official)—The contract for paving [illegible]

[illegible] N. Y.—(Official)—Bids will be received [illegible]

+Rochester, N. Y.—The contract for paving [illegible] has been awarded to [illegible] at $[illegible]

+Rome, N. Y.—The contract for paving Jay, John and River Sts. has been awarded to WARREN BROS. CO., at $33,[illegible]20

Metuchen, N. J.—(Official)—Bids will be received by the Borough Council until 8 p.m., July 6, for flagging about 1[illegible] lin. ft. with 3-in. blue stone. Charles B. Cartman is Borough Engr. Noted June 4.

+Morristown, N. J.—The Board of Freeholders has awarded the following contracts for road paving: To FREDERICK S. SMITH, Madison Ave., at $17,4[illegible] to SALMON BROS., Denville and Pine Brook Road, at $11,[illegible] to OSBORNE & MARSELLIS CO., Blackwell St., Dover, Main St. with brick, Main St. with amiesite, Boonton, Morris St. and the road from Madison to Cooks Bridge at $23,3[illegible], $13,6[illegible]7, $9577, $71[illegible]2 and $11,[illegible] respectively. Noted June 11.

+Newark, N. J.—The contract for paving South 13th St., Lehigh Ave., South 18th St., 17th Ave. and Bragaw Ave., to the STANDARD BITULITHIC CO., at $16,717, $13,6[illegible]1, $25,[illegible]19, $7[illegible]33 and $16,322, respectively.

New Brunswick, N. J.—Bids will be received by the Board of Chosen Freeholders until 2:3[illegible] p.m., July 1[illegible], for constructing 8262 ft. of concrete pavement on the Roosevelt-Woodbridge Road. A. J. Gebhardt is Dir.

+Allentown, Penn.—GEORGE H. HARDNERS, has been awarded the contract for paving three blocks of street with amesite, on a [illegible]-in. concrete base, at $1.[illegible] per sq.yd.

Harrisburg, Pa.—(Official)—Bids will be received until 10 a.m., July 21, at the office of the State Highway Dept., Capitol Bldg., for the following road construction:

Ridgway Borough, Elk County—6111 ft. beech block paving 16 ft. wide.

Telford Borough, West Rockhill Township, Bucks County—12,065 ft. amiesite-warrenite-filbertine unionite and asphaltic bituminous macadam (penetration method) 16 ft. wide.

Milford Township, Somerset County—[illegible] ft. water-bound macadam and asphaltic bituminous macadam (penetration method) 16 ft. wide.

Bristol Township, Bucks County—[illegible]24 ft. amiesite-warrenite-filbertine-unionite and asphaltic bituminous macadam (penetration method) 16 ft. wide.

Summit Township, Somerset County—[illegible]2[illegible]6 ft. asphaltic bituminous macadam (penetration method) 16 ft. wide.

Franklin Township, Greeen County—1[illegible],[illegible]63 ft. brick block pavement, 16 ft. wide.

Blossburg Borough, Tioga County—10,907 ft. brick block pavement, 16 ft. wide.

Allegheny Township, Westmoreland County—15,450 ft. water-bound macadam, 16 ft. wide.

Jackson Township, Venago County—[illegible]796 ft. brick block pavement, 14 ft. wide. E. M. Bigelow is Comr.

***+Scottdale, Penn.**—(Official)—The contract for improving Mulberry and Merchant Sts. has been awarded to L. H. HILEMAN & CO., Ford City, at $7718. Noted June 4.

Vandergrift, Penn.—Bids will be received by the Town Council until July 6, for paving Sherman, Columbia, Grant and Washington Aves.

***West Hazleton, Penn.**—(Official)—Bids will be received by the Borough Council until 7 p.m., July [illegible], for paving. For particulars see advertisement under "Contracts To be Let."

Wilmington, Del.—Highway bonds to the amount of $10[illegible], voted on June [illegible]3, were sold.

Towson, Md.—Bids will be received by the County Commissioners until July 2 for improving two miles of the Paper Mill Road, one mile of the Freeland [illegible] Road and 10 miles of the Hartford Road from Parkville to Rickford.

New Martinsville, W. Va.—(Official)—Bids will be received by the County Court and County Engineer of Wetzel County, until noon, July 1[illegible] for grading [illegible] miles of road in Grant District, in the vicinity of Jacksonburg. A. D. Williams is Chief Road Engr.

Hayneville, Ala.—(Official)—Bids will be received by the Board of Revenue until noon, July 13 for improving public roads. D. C. Leatherwood is Clk.

Jasper, Ala.—An election will be held July 13 to vote on the proposition to issue $[illegible] in bonds for road construction in Walker County.

Clarksdale, Miss.—Bids will be received by S. L. Carr, County Clk., until noon July 6 for the sale of $[illegible] of road and bridge bonds.

Gulfport, Miss.—Bids will be received by M. P. [illegible] and H. [illegible], Commissioners of [illegible] Harrison County, until July 6, for road work in District No. [illegible]

[illegible]ville, La.—An election will be held July 11 to vote on $[illegible] in bonds for road construction in Road District No. [illegible] St. Charles County.

Ripley, Tenn.—An election will be held July 11 to vote on $[illegible] in bonds for street improvement.

Danville, Ky.—Bids will be received by W. P. Caldwell, County Road Engr., until [illegible] July 14 for furnishing gravel and stone on different pikes of Boyle County.

Louisville, Ky.—Bids will be received by the Board of Public Works until July [illegible] to pave [illegible] [illegible] with asphalt. The estimated cost of the work is $[illegible]

+Versailles, Ky.—L. W. HANCOCK & CO., Louisville, have the contract for paving with brick two blocks on Main St. at $[illegible] Noted May 14 and [illegible]

Akron, Ohio—(Official)—Bids will be received by the Board of County Commissioners until 11 a.m., July [illegible] for grading, draining, curbing and paving the Arlington and [illegible] Roads. C. L. [illegible] is Clk.

Ashtabula, Ohio—Bids will be received by M. H. [illegible] Dir. of Pub. Ser., until noon, July [illegible] for improving [illegible] Ave. from [illegible] Ave. to the State Road.

Cincinnati, Ohio—(Official)—Bids will be received by [illegible] until noon July [illegible] for [illegible] a number of streets and roads.

+Columbus, Ohio—The CLEVELAND TRINIDAD PAVING CO., Cleveland has been awarded the contract for paving High Street from Livingston Ave. to the Viaduct at $105,659. Noted June 11.

+Delaware, Ohio—(Official)—The contract for road construction has been awarded to J. S. EDWARDS, Sunbury, at $30,380. Noted Apr. 30.

Edon, Ohio—(Official)—Bids will be received by H. L. Ryster, Village Clk., until noon, July 24, for paving Michigan Ave. from the Wabash R.R. to the North Corporation Line and Indiana St. from Union St. to the East Corporation Line.

Ghent, Ohio—Bids will be received by F. Bechtel, Village Clk., until noon, July 6, for the sale of $15,500 of street improvement bonds.

+Marysville, Ohio—(Official)—The contract for improving the Highland and Cray Roads has been awarded to J. M. SNOUFFER, Columbus at $16,486. Noted June 25.

Perrysburg, Ohio—(Official)—Bids will be received by John W. Lyons, Village Clk., until noon, July 22, for paving Louisiana Ave. from the southerly line of Indiana Ave. to Grassy Creek.

Pioneer, Ohio—(Official)—Bids will be received by the City Council until noon, July 16, for paving 13,760 sq.yd. The Smith-Boulay Co., 322 The Nasby, Toledo, is Engr.-in-Charge.

+Ruggles, Ohio—(New London P. O.)—(Official)—The contract for improving 5.2 miles of road has been awarded to C. MALOY, Nova. Noted June 18.

+Toledo, Ohio—The contract for resurfacing Lewis Ave. with macadam has been awarded to M. P. HAMLIN at $14,824.

Toledo, Ohio—(Official)—Bids will be received by the Board of County Commissioners, Court House until 10 a.m., July 14, for improving Clark Ave. in Adams Township.

Bloomington, Ind.—(Official)—Bids will be received by the Common Council until 7:30 p.m., July 9, for improving East Kirkwood Ave. Horace Blakely is City Clk.

Brownstown, Ind.—(Official)—Bids will be received by the Town Trustees, until 7:30 p.m., July 13, for grading and paving Stout St. with gravel. A. L. Lucas is Town Clk.

+Connersville, Ind.—(Official)—The contract for constructing a gravel road has been awarded to D. H. FATOUT, Indianapolis at $15,450. Noted June 11.

Gary, Ind.—Bids will be received by W. J. Fulton, City Engr., until July 6, for improving Sixth and 11th Aves. and two alleys. The cost will be approximately $30,163.

Bids will be received by W. J. Fulton, City Engr., until July 22, for improving Pennsylvania St., 25th Ave. and one alley. The estimated cost is $52,975.

+Greenfield, Ind.—(Official)—The contract for constructing a highway on the Madison and Hancock County line has been awarded to JOHNSON & BRONNURBUG, Anderson, at about $18,000. Other bids were: Greenfield Bridge & Sewer Co., $20,759; D. H. Fatout, $21,536; Walker & McMahan, $21,128, and J. D. Reasin & Co., $18,992. Noted May 28.

Lebanon, Ind.—Bids will be received by the Common Council until 7:30 p.m., July 13, for grading and paving West South St.

+Logansport, Ind.—The contract for paving High and Market Sts. has been awarded to the ANDREWS ASPHALT PAVING CO., Hamilton, Ohio, at about $115,000

+Salem, Ind.—The contract for paving East Market St. has been awarded to the MILROY CONSTRUCTION CO., at $11,000. Noted June 18.

South Bend, Ind.—Bids will be received by the Commissioners of St. Joseph County until 11 a.m., July 13, for constructing a gravel road in Union Township. Clarence Sedgwick is Audr.

+Marshall, Mich.—(Official)—The contract for paving East and West tSate St. has been awarded to the ANDREWS ASPHALT PAVING CO., Hamilton, Ohio, at $55,090. The Smith & Boulay Co., 322 The Nasby, Toledo, Ohio, is Engr.-in-Charge. Noted June 11.

+Palmer, Mich.—A contract for contracting ten miles of road has been awarded to J. E. BLOMGREN, Norway, at approximately $25,000.

Allison, Ill.—Bids will be received by J. L. McAndrew, Clk., until July 18 for gravel roads. The estimated cost of the work is $12,000. John Spiker, Noble Block, Vincennes, Ind., is Engr.

+Galesburg, Ill.—The contract for paving Losey and West Losey Sts., has been awarded to P. H. TIERNAN, Macomb, at $47,948.

★Rockford, Ill.—(Official)—Bids will be received by W. W. Bennett until 11 a.m., July 9, for constructing approximately 11,277 sq.yd. of brick pavement and 7300 lin.ft. concrete curb and gutter.

Springfield, Ill.—(Official)—Bids will be received by the State Highway Commission until noon, July 8, for State Aid work in Coles, Peoria, Livingston and Champaign Counties.

+Eau Claire, Wis.—The contract for reinforced-concrete paving has been awarded to the CAST STONE CONSTRUCTION CO., at $10,547. Other bids were A. Larson, $11 027; Thos. Wooley, La Crosse, $12,287; Fred Eul, Neenah, $12,929, and Widell Co., Mankato, Minn., $11,989.

+Kenosha, Wis.—Contract has been awarded to GEORGE R. WADE for the construction of concrete pave...ent on Park Ave. at $5335 and Lake Shore Road at $72,947.

Manitowoc, Wis.—Bids will be received by A. Reichert, City Clk. until July 3, for improving 25th St. between Clark and Wollmer Sts.

Watertown, Wis.—Bids will be received until July 17, at office of Board of Public Works for constructing about 7000 sq.yd. of concrete pavement on North Second St.; 4371 ft. curb and gutter; 2500 yd. excavating.

+West Salem, Wis.—The contract for paving Hamilton St. with concrete has been awarded to THOS. E. WOOLEY, La Crosse, at $11,565.

Dubuque, Iowa—(Official)—Bids will be received by J. J. Shea, City Recdr., until 8 p.m., July 2, for improving Locust and South Locust Sts., and Southern Ave.

Mason City, Iowa—Bids will be received by J. H. McEwen, City Clk., until 10 a.m., July 6, for paving 26,700 sq.yd. and curbing 14,300 lin.ft.

Schleswig, Iowa—Bids will be received by B. S. Anderson, Town Clk., until 8 p.m., July 7, for constructing concrete crossings.

Wapelo, Ia.—Bids will be received by H. W. Baker, County County Audr., until 11 a.m., July 15, for grading Section "E" of the Wapello Newport County Road, Section "H" of the Wapello-Columbus City County Road, and Sections "B" and "C" of the Newport to the Morning Sun County Road.

Aitkin, Minn.—Bids will be received by J. B. Lemire, County Audr., until 10 a.m., July 14, for grading and ditching 2½ miles of road.

Alexandria, Minn.—Bids will be received by the Board of Commissioners, until 10 a.m., July 17, for building and improving State Road No. 1. E. J. Brandt is County Audr.

Anoka, Minn.—Bids will be received by Arthur A. Caswell, County Audr., until 2 p.m., July 13, for surfacing 860 sq.yd., graveling 954 sq.yd., and macadamizing 954 sq.yd. on Central Ave.

Duluth, Minn.—(Official)—Bids will be received by R. Murchison, Comr. of Pub. Wks. until 10 a.m., July 6 for improving South First Ave. and Sutphin St.

Grand Rapids, Minn.—Bids will be received by M. A. Spang, County Audr., until 10 a.m., July 13, for construction work on State Road No. 1.

Ivanhoe, Minn.—Bids will be received by Karl A. Hansen, Audr., Lincoln County, until 1 p.m., July 11, for constructing State Rural Highway No. 54.

Olathe, Kan.—The Johnson County Board will receive bids until 11 a.m., July 8, for the improvement of the W. F. James Road. The cost is estimated at $10,000.

+Falls City, Neb.—The contract for paving District No. 8 has been awarded to BOHRER BROS., at $18,000. Noted June 18.

University Place, Neb.—Bids will be received by C. C. Gates, City Clk., until 8 p.m., July 7, for paving ten blocks of St. Paul Ave.

Billings, Mont.—Bids will be received by the City Clk. until July 7, for paving the eastern end of First Ave. North. The estimated cost of the work is $14,000.

+Harlowtown, Mont.—(Official)—The contract for constructing sidewalks, retaining walls, etc., has been awarded to L. W. SCHRUTH, Fargo, N. D., at $14,532. Other bids were: Miracle-Tripp, $17,010; R. M. Bardsen & Co., $17,274; J. W. Maitland, $17,454; Biley & Heaton, $17,876, and Miracle Construction Corporation, $18,471. Noted June 18.

+St. Joseph, Mo.—Contracts for paving 28th St., from Lafayette to Monterey St., to the METROPOLITAN PAVING CO., at $29,200, and Hanson Ave., 28th and Plattsburg Sts., to the STANDARD CONSTRUCTION CO., at $22,876.

+Webster Groves, Mo.—The contract for improving Greeley Ave. has been awarded to FOXHALL P. McCORMICK at $5000.

+Houston, Tex.—The contract for improving Rusk Ave. to EUREKA PAVING CO., Carter Bldg., at $29,768; Congress St. to UVALDE ROCK ASPHALT CO., 528 Binz Bldg., at $25,494. and Wood St., to the TALBOT CO., at $39,000.

McKinney, Tex.—Paving bonds for the amount of $125,000, voted on June 1, have been sold.

Mason, Tex.—An election will be held July 7 to vote on the question of issuing road bonds.

+Waco, Tex.—(Official)—See item under Bridges.

Waxahachie, Tex.—The citizens will vote July 18 to issue $90,000 in bonds for road construction.

+Kingman, Ariz.—The contract for building roads throughout Mohave County has been awarded to A. A. JOHNS and J. T. TRENBERTH, Prescott, at approximately $100,000.

+Mt. Vernon, Wash.—The contract for constructing the McMurry-Montbourne Road has been awarded to HERMAN BURMASTER at $48,095.

+North Yakima, Wash.—The contract for paving Division St. has been awarded to W. M. WALKER, at $9458.

Olympia, Wash.—Bids will be received by the State Highway Board until 2 p.m., July 6, for sudfacing approximately 13.5 miles of Sunset Highway from Wenatchee northerly in Douglas County.

Pasco, Wash.—Bids will be received by the County Commissioners until July 6 for constructing two miles of permanent highway at Connell.

+Seattle, Wash.—Contracts for constructing the Des Moines-Pierce County Road and the Derby-Woodinville Road have been awarded to the MATTSON-CARLSON CO., Tacoma, at $64,399 and to PAUL GRAY at $12,666 respectively. Noted June 11.

+Contracts have been awarded for paving East 72d St. to KROGH & JESSEN at $18,720; First Ave. South to the ROLLINS INVESTMENT CO., Henry Bldg., at $19,019.

+South Bend, Wash.—The contract for paving Water St. has been awarded to ROSS & MUMFORD, at $5853.

+Tacoma, Wash.—The contract for paving South 23d St. from J to Wilkeson St. has been awarded to JOSEPH WARTER, SR., at $26,750. Other bids were Washington Paving Co., $26,964; W. J. Murphy, $31,750, and McHugh Contracting Co., $29,400.

+Oregon City, Ore.—The Clackamas County Court has awarded a contract for the reconstruction of the Lazelle road to HENRY CROMER at $6000.

Portland, Ore.—The County Commissioners of Multonah County will shortly receive bids for the hard-surfacing of the Base Line Road. The estimated cost is $123,561.

+Coronado, Calif.—The contract for improving the [illegible] has been awarded to the FAIRCHILD-GILMORE-WILTON [illegible]

+Eureka, Calif.—The contract for constructing [illegible] awarded to FRANK H. GREEN, at $[illegible]

+Los Angeles, Calif.—The contract for improving First St. [illegible] Ave. to the East City Limits has been awarded to the FAIRCHILD-GILMORE-WILTON CO., at $27,[illegible]

+Manhattan Beach, Calif.—The contract for improving [illegible] from Manhattan Ave. to the [illegible] Ft. [illegible] has been awarded to the [illegible]ER ASPHALT CO., at $[illegible]

+Sacramento, Calif.—(Official)—Contracts for constructing roads in four counties have been awarded as follows: [illegible] County, about [illegible] miles to be graded to F. [illegible] at $6,[illegible]

[illegible] County, about [illegible] miles of concrete pavement to [illegible] at $[illegible]

[illegible] County, about [illegible] miles of concrete pavement to F. L. [illegible] San Francisco, at $[illegible]

[illegible] County, about [illegible] miles of concrete pavement to [illegible] JACINTO A. L. DA ROZA & T. M. [illegible] Sacramento, at $[illegible] Noted May 21 and June 18.

San Francisco, Calif.—Bids will be received by the Board of Public Works until July 8 for improving Twenty-[illegible] Ave. from California to Clement, Nineteenth Ave. from Lake [illegible] and on Geary St. from Twenty-sixth to [illegible] Ave. Frederick J. Churchill is Secy. of the Board.

San Francisco, Calif.—M. M. O'Shaughnessy, City Engr., is preparing plans to construct a road to the Hetch Hetchy [illegible] The estimated cost of the work is $1[illegible]

+San José, Calif.—The contract for paving San Salvador [illegible] has been awarded to the RANSOME-CRUMMEY CO., at $[illegible]

Tulare, Calif.—Bids will be received by E. Oakford, City [illegible] until July 6 for street paving, the cost of which will be about $[illegible]

+St. John, N. B.—The contract for paving Main St. has been awarded to [illegible] MOONEY & SONS, Queen St., at $26,7[illegible]

+Sandwich, Ont.—The contract for constructing reinforced-concrete pavement has been awarded to L[illegible]NANNE [illegible], Detroit, at $1[illegible]

+Sault Ste. Marie, Ont.—The contract for constructing [illegible] of concrete sidewalks has been awarded to the [illegible]LEAF PAVING CO.

+Welland, Ont.—A contract for constructing [illegible] miles of [illegible] good roads system has been awarded to the [illegible] STONE CO., Niagara Falls, at $[illegible] per mile. Noted May 14.

+Morris, Man.—(Official)—The contract for grading and [illegible] Highway has been awarded to SHER-[illegible] & [illegible], Winnipeg, at $[illegible] Other bids were J. G. [illegible], $[illegible]; M[illegible] & [illegible], Winnipeg. [illegible]

South Vancouver, B. C.—The following bids were received [illegible] for paving [illegible] Harrison & [illegible], $[illegible]; J. Kerr, $[illegible] and Dominion Creosoting Co., $[illegible]

INDUSTRIAL WORKS

+Brockton, Mass.—The contract for the construction of [illegible] brick and stone building on Perkins St. [illegible] has been awarded to W. H. [illegible] Warren Ave., Brockton, [illegible]

Holyoke, Mass.—[illegible] M. [illegible] Inc., Springfield, Mass., is preparing plans for the construction of a four-story [illegible] addition to the plant of the [illegible] Mills, on [illegible] St.

Stoughton, Mass.—Bids will be received by the [illegible] for the construction of an addition to its plant [illegible] Estimated cost, $[illegible]

+Sutton, Mass.—The [illegible] has awarded a contract to the [illegible] CONSTRUCTION CO. [illegible] for a [illegible]-story and basement building. [illegible]

Chester, Conn.—[illegible]

New Britain, Conn.—[illegible]

New Britain, Conn.—[illegible]

New Haven, Conn.—[illegible]

[illegible]

Seattle—[illegible] Seattle firm regarding a site. The firm manufactures oil-burning boilers and will build a $[illegible] factory.

+Jamestown, N. Y.—The general contract for building the addition to the plant of the Acme Worsted Mills Co. has been awarded to CHARLES HAAS at about $[illegible]. L. M. [illegible] is Gen. Mgr.

New York, N. Y.—(Borough of Brooklyn)—The Gretsch Corporation will build a seven-story factory, at Berry and South Fifth Sts., Williamsburg.

New York, N. Y.—(Borough of Brooklyn)—The Vitagraph Co., 116 Nassau St., New York, N. Y., will build a four-story brick addition to its plant, at Liberty and Locust Aves. The cost will be $[illegible]. W. L. Stoddard, 4[illegible] West 38th St., New York, N. Y., is the Arch.

New York, N. Y. (Borough of Manhattan)—Bids are being received by Albert E. [illegible], Arch., [illegible] East 13th St., for the construction of a factory at 137th St. and Southern Blvd. for Winters & Co. Estimated cost, $1[illegible]

Syracuse, N. Y.—Plans are being prepared by Merrill C. Conway, Arch., [illegible] Furman St., Syracuse, for the construction of a three-story, 72x[illegible]-ft. factory for the New Process Gear Corporation. Estimated cost, $40,000.

Gloucester, N. J.—William Steele & Sons Co., Arch., 16[illegible] Arch St., Philadelphia, Penn., is preparing plans for the construction of buildings at Gloucester for the Campbell Soup Co. Estimated cost, $1[illegible]

Jersey City, N. J.—The N[illegible] Packing Co. will build a $1[illegible] beef packing plant on 20th St.

Jersey Shore, Penn.—The Susquehanna Silk Mills will build a new mill building and an addition to the weave shed. They will be of brick mill construction, with sawtooth roofs, and are estimated to cost $80,000. The Samuel M. Green Co., Springfield, Mass., are the Engrs.

Newark, N. J.—The Broham Co., Center St., manufacturer of infants' wear, will build a three-story and basement addition to its plant.

Newark, N. J.—The Newark Poster Advertising Co. has purchased a site at King and Miller Sts., on which it will build a two-story 12[illegible]-ft. factory.

Paterson, N. J.—The L[illegible] Machine Co., Warren St. [illegible] the Erie R.R., will build a $[illegible] addition to its plant.

+Paterson, N. J.—The M. H. Ellenb[illegible] Shirt Mfg. Co. has awarded a contract at $41,[illegible] to the JOHN W. FERG[illegible] CONSTRUCTION CO., for a five-story factory.

Paterson, N. J.—Bids are being received by L. S. [illegible]ley, Arch., 3[illegible] West 3[illegible] St., New York, N. Y., for the construction of a two-story, 6[illegible]x[illegible]-ft. addition to the bakery of the Consumers' Baking Co., [illegible] Ellison St. Estimated cost, $3[illegible]

The S[illegible] Machine Co. will build a $1[illegible],000 addition to its shops.

Allentown, Penn.—(Official)—F. C. K[illegible]h will soon begin building a three-[illegible] and basement, [illegible]-ft. bakery. Charles [illegible], [illegible] Walnut St., Philadelphia, Penn., is the Arch. Noted June [illegible], under Reading, Penn.

Manayunk, Penn.—(Philadelphia Post Office)—The M[illegible] & W. H. N[illegible] Paper Co. will build a [illegible]-story, 1[illegible]x[illegible]-ft. brick factory, to cost about $1[illegible]

Philadelphia, Penn.—H. M. [illegible] will build a three-story, 70x1[illegible]-ft. brick and concrete commercial garage, at [illegible] and Brandywine Sts. M. [illegible] is the Arch.

+JOHN N. GILL, 1[illegible] Filbert St., was awarded the contract for construction [illegible] five-story, [illegible]x[illegible]-ft. reinforced-concrete warehouse addition for the M[illegible] North Broad Storage Co., [illegible] North Broad St.

W[illegible] & Charles [illegible] will build a two-story, 60x11[illegible]-ft. [illegible] on Fox St. The cost is estimated at $1[illegible],000.

+Philadelphia, Penn.—J. Sullivan & Sons, Ninth and [illegible] Aves., have awarded a contract to the TURNER CONCRETE STEEL CO., [illegible] St., for a five-story, [illegible]x[illegible]-ft., reinforced concrete factory.

Baltimore, Md.—Plans are being prepared by Otto G. [illegible], Arch., Maryland and Casualty Bldg., Baltimore, for the construction of a [illegible]-story [illegible] for Harry M[illegible] [illegible] about $1[illegible]

The [illegible] Co. of New Jersey will build a [illegible]-story, [illegible]-ft. [illegible] building and a two-story and basement [illegible]

+Cincinnati, Ohio—The contract for the construction of [illegible]

Cleveland, Ohio—The [illegible] Co. will build a [illegible] Ave. and [illegible] The cost will be $1[illegible]

Columbus, Ohio—The Columbus [illegible] Co. will build a [illegible] to cost $[illegible] F. [illegible] Columbus, is the Arch.

Dayton, Ohio—The [illegible] Co. will build a [illegible] at a cost of $[illegible] & [illegible] are the Archs.

Sandusky, Ohio—[illegible]

Springfield, Ohio—[illegible]

Milwaukee, Wis.—[illegible]

Wausau, Wis.—The Badger Bag & Paper Co. will construct a two-story and basement, 132x146-ft. factory. Estimated cost, $30,000. L. A. De Quere, Wood Block, Grand Rapids, is the Arch.

+**Davenport, Iowa**—Ewert & Richter, East Fourth St., have awarded a contract at $60,000, to the PARSONS CONSTRUCTION CO., Omaha, Neb., for a six-story, 60x150 ft., warehouse. It will be of mushroom, flat-slab construction. Contracts for plumbing, heating, a sprinkler system and electrical fixtures are yet to be awarded, at about $12,000.

Independence, Kan.—The National Sash & Door Co., of Coffeyville, Kan., will establish a plant at Independence.

+**Kansas City, Mo.**—THE SWENSON CONSTRUCTION CO., Kansas City, has been awarded the contract for the $250,000 building to be erected at 21st St. and Grand Ave. for the Coca-Cola Co.

Bids are being received by Smith, Rea & Lovitt, Archs., Finance Bldg., for the constructio nof a one-story, 118x200-ft. factory for Ingle Bros.

New Cambria, Kan.—The New Cambria Commercial Association has plans for the establishment of a $50,000 flour mill.

Dallas, Tex.—The Egan Mill Co. has purchased a site at Dallas for the construction of a mill. Besides the mill an elevator of 75,000-bu. capacity and a large warehouse will be constructed. The initial cost of the buildings and machinery will be more than $50,000.

+**Galveston, Tex.**—Wily, Nichols & Co., have awarded a contract to J. W. ZEMPTER, for a four-story reinforced-concrete storage warehouse, at $25,000.

San Antonio, Tex.—The Texas Refining Co. of Greenville has purchased a site at San Antonio for a proposed cottonseed oil mill that it will construct at a cost of $125,000. The building will be two stories and of brick and reinforced concrete construction. In connection with this mill the company will erect a plant for the manufacture of cottonseed oil compounds. Frank J. Philips is Pres.

Tulsa, Okla.—The city administration will build a $10,000 soap factory, to utilize its garbage. A fertilizer plant will be included.

Calexico, Calif.—The Pacific Cotton Co. will build five cotton gnis in the Imperial Valley. The Calexico plant will include a 4000-ton, 60x200-ft. seed house, an eight-stand, 27x90-ft. gir, an oil mill, five 10,000-gal. oil tanks and a power house.

Oakdale, Calif.—J. P. Olsen contemplates the construction of a sash and door factory at Oakdale. Estimated cost, $10,000.

Montreal, Que.—W. W. Burland, Pine Ave., will construct a garage on Cedar Ave. to cost $35,000.

Brantford, Ont.—The Brantford Industrial Realty Co., Brantford, will erect a $30,000 factory at Park Ave. and Rawdon St. Barber & Tilley are the Archs.

Hamilton, Ont.—F. J. Rastrick, 30 King St. East, Hamilton, is preparing plans for a new $35,000 factory for the McGregor Shirt Co.

Toronto, Ont.—M. E. and M. McCarthy will build a six-story warehouse, at Youge and Albert Sts. The cost will be $100,000.

Toronto, Ont.—The F. S. Thomas Co. will build a five-story, 80x110-ft. warehouse, at John and Queen Sts. The cost will be $70,000. S. L. Zolles is the Arch.

+**Calgary, Alta.**—JANS BROS. & CO. has been awarded a contract for a 2,500,000-bu.grain elevator, at $788,000.

+**Medicine Hat, Alta.**—The Maple Leaf Milling Co. has awarded a contract to ARCHIBALD & CO., for a $1,000,000 flour mill. Noted June 4.

Medicine Hat, Alta—The Alberta Clay Products Co. is preparing plans for doubling its plant at a cost of $60,000.

+**New Westminster, B. C.**—The St. Mungo Cold Storage Plant has awarded a contract to W. HAYMAN for a new building, at $165,000.

FEDERAL GOVERNMENT WORK

Oil Engine—Boston, Mass.—Bids were received June 23, by the Lighthouse Inspector, Boston, Mass., for furnishing one oil engine for propelling purposes in light vessel No. 54, as follows: Corliss Gas Engine Co., $5978; A. P. Homer, $7550; Standard Motor Construction Co., $8550; August Mietz, $8800; the New London Ship & Engine Co., $10,500. Noted June 18.

Repairing Vessel—Boston, Mass.—Bids were received June 20, by the Lighthouse Inspector, for repairing light vessel No. 42, as follows: New London Marine Iron Works Co., New London, Conn., $6533 (recommended for award); Richard T. Green Co., $6921; Walter F. Chace, $7133; Bertelsen & Petersen Engineering Co., $7408; U. S. Navy Yard, $8757; Lockwood Mfg. Co., $8828. Noted June 11.

Wire and Tubes—Springfield, Mass.—Bids will be received until July 21, by the Commanding Officer, Springfield Armory, for furnishing about 26,000 lb. of medium soft and hard brass wire and 38,000 brass tubes.

+**Roads and Walks**—Newport, R. I.—The contract for constructing roads and walks at the Naval Station, Newport, R. I., has been awarded to PETER BOMPIANNA & CO., Boston, Mass., at $6388. Noted June 18.

Moorings—Tompkinsville, N. Y.—Bids will be received until 2 p.m., July 15, by the Lighthouse Inspector, Third District, Tompkinsville, N. Y., for furnishing moorings for vessels and buoys, during the next fiscal year, as follows: Chain for buoys, chain for light vessels, mushroom anchors of cast steel and cast iron, light-vessel shackles, buoy shackles, swivels, etc.

Cow Sheds—Anacostia, D. C.—Bids were received, June 18, by the Interior Dept., for the erection of the cow barns at the Government Hospital for the Insane, Anacostia, as follows: McCay & Morris, Washington, D. C., $30,887; W. E. Mooney, $27,571; Arthur Cowsill, $32,199; Melton Construction Co., $26,000; Burgess & Parsons, $30,300; J. L. Marshall, $28,327; W. H. McCray, $32,000; Skinker & Garrett, $26,717; Andrew Murray, $29,000; R. L. Jennings, $28,490; all bidders of Washington, D. C.

Promenade Roof Covering—Washington, D. C.—Bids were received June 22, for the construction of promenade, roof covering for the Bureau of Engraving and Printing, Washington, D. C., as follows: J. L. Marshall, Washington, D. C., $6506; Skinner & Garrett, Washington, D. C., $6162; W. E. Mooney, Washington, D. C., $6093; Chesapeake Iron Co., Baltimore, Md., $7900. Noted June 18.

+**Post Office**—Moundsville, W. Va.—The contract for the construction of the post office at Moundsville, W. Va., has been awarded to W. H. BATSON, Moundsville, W. Va., at $59,850. Noted May 14.

+**Power House and Machinery**—Wheeling, W. Va.—Contracts for building a fireproof powerhouse and furnishing and installing machinery at Dams Nos. 15 and 20, Ohio River, have been awarded as follows: (a) Dam No. 15 (b) Dam No. 20, H. L. KREUSLER, 3301 Penn Ave., Pittsburgh, Penn., for power house and boiler chimneys, complete, (a) $26,694, (b) $26,300; one main boiler, one auxiliary boiler, and accessories for both, The BABCOCK & WILCOX CO., Farmers Bank Bldg., Pittsburgh, Penn., (a) $2811, (b) $2961; boiler feed pump, delivered complete, The INTERNATIONAL STEAM PUMP CO., Pittsburgh, Penn., (a) $48, (b) $48; feed water heater, oil separator, and grease trap, (a) WARREN WEBSTER CO., Camden, N. J., $200, (b) The DRAVO DOYLE CO., Diamond Bank Bldg., Pittsburgh, Penn., $193; service pump, The INTERNATIONAL STEAM PUMP CO., Pittsburgh, Penn., (a) and (b) $610 each; air compressors and accessories, BURY COMPRESSOR CO., Erie, Penn., (a) and (b) $2300 each; two air receivers and accessories, (a) BURY COMPRESSOR CO., Erie, Penn., $790, (b) INGERSOLL RAND CO., Farmers Bank Bldg., Pittsburgh, Penn., $785. Noted June 18.

+**Post Office**—Tarboro, N. C.—The contract for constructing the U. S. post office at Tarboro, has been awarded to R. P. FARNSWORTH & CO., Owensburg, Ky., at $55,268. Noted Apr. 23.

+**Post Office**—Bennettsville, S. C.—The contract for constructing the post office at Bennettsville, S. C., has been awarded to DIETRICK RICHARDSON, Richmond, Va., at $37,837. Noted May 7.

+**Steel Towers**—New Orleans, La.—The contract for the foundations for two 300-ft. steel towers, to be erected at the naval station, New Orleans, has been awarded to HENRY MONK, Pensacola, Fla., at $2450., and the steel towers to the PITTSBURGH-DES MOINES STEEL CO., Pittsburgh, Penn., at 4.88c. per lb. for steel work. Noted June 18.

Post Office—Covington, Tenn.—All bids received bty the Superv. Arch., Treasury Dept., for the construction of the post office at Covington, have been rejected. Noted June 18.

+**Steel Barges**—Cincinnati, Ohio—The contract for constructing three steel deck barges has been awarded to CHAS. HEGEWALD CO., New Albany, Ind., as follows: Two steel barges delivered at Marietta, Ohio, $3699 each, one delivered at Cattlettsburg, Ky., at $3699. Noted June 25.

+**Breakwater**—Cleveland, Ohio — The contract for completing east breakwater extension, Cleveland Harbor, has been awarded to the EDWARD GILLEN DOCK, DREDGE & CONSTRUCTION CO., Racine, Wis., at $148,441. Noted June 25.

+**Erecting Storehouse**—Cleveland, Ohio—The contract for erecting storehouse at foot of East Ninth St., Cleveland, Ohio, has been awarded to ANDREWS BROS., 130 B. of L. E. Bldg., Cleveland, Ohio, at $10,877. Noted June 25.

Motor Boats—Detroit, Mich.—Bids will be received until 2 p.m., July 6, by the Lighthouse Inspector, Detroit, Mich., for furnishing and delivering two 21-ft. motorboats for light vessels Nos. 96 and 98.

Building—Mackinac Island, Mich.—Bids will be received until 2 p.m., July 6, by S. I. Kimball, Gen. Supt., 11th Life Saving District, Harbor Beach, Mich., for constructing a lifesaving station house, launchway and accessories at Mackinac Island, Mich.

Building—Port Austin, Mich.—Bids will be received until 2 p.m., July 13, by the Treasury Dept., U. S. Life Saving Service, for constructing a boathouse and accessories for the Port Austin Life Saving Station, Port Austin, Mich.

+**Steel Towers**—Great Lakes, Ill.—The contract for the construction of two 500-ft. steel towers at the naval station, has been awarded to the PITTSBURGH DES MOINES STEEL CO., Pittsburgh, Penn., at 4.78c. per lb. Noted June 18.

+**Post Office**—Macomb, Ill.—The contract for the construction of the post office at Macomb, Ill., has neen awarded to R. S. MOORE, Lafayete, Ind., at $60,941. Noted June 25.

+**Post Office**—Lake City, Minn.—The contract for constructing the U. S. post office at Lake City, Minn., has been awarded to the NORTHERN CONSTRUCTION CO., Milwaukee, Wis., at $44,454.

+**Post Office**—McPherson, Kan.—The contract for constructing the U. S. post office at McPherson, Kan., has been awarded to the HIRAM LLOYD BUILDING & CONSTRUCTION CO., St. Louis, Mo., at $43,366. Noted June 25.

★+**Earthwork and Structures**—Vandalia, Mont.—The contract for constructing earthwork and structures at Vandalia Point, Vandalia South Canal, has been awarded to W. J. HOEY & CO., St. Paul, Minn. at $42,640. Noted June 11.

Gasoline Motor Launch—Galveston, Tex.—Bids were received June 16, by the Lighthouse Inspector, Eighth District, New Orleans, La., for a gasoline motor launch for Galveston Harbor, as follows: Z. W. Carter, Biloxi, Miss., $3400, alternate $3985; R. J. Terrebonna, Morgan City, La., $1975, $5000; Thomas M. Favre, Gulfport, Miss., $3100, $3684; Walin Marine Equipment Co., 305 Vernon Ave., Long Island City, N. Y., $5160; Smith & Williams Co., Salisbury, Md., $6250; Sidlone Krebs, Pascagoula, Miss., $4325; Gas Engine & Power Co., and Charles L. Seabury & Co., Consolidated, Morris Heights, New York, $6125 and $6450; Astoria Boat Works & Marine Equipment Co., Inc., 561 Boulevard, Long Island City, N. Y., $4100 and $4660; Greenport Basin & Construction Co., Greenport, N. Y., $4070, $4560, and Racine Truscott Shell Lake Boat Co., Muskegon, Mich., $3360, $3950.

Earthwork—[illegible] Junction, Colo.—The lowest bid received [illegible] for earthwork [illegible] project [illegible] was submitted [illegible] Minneapolis, Minn., as follows: [illegible] per cu yd overhaul [illegible] and grubbing, $[illegible] per acre. [illegible] Wood, [illegible] & Ivey, [illegible] Construction Co., [illegible] Construction Co., Springfield, $[illegible]. Noted May 7.

Head Gates—[illegible], Wash.—Bids will be received until July [illegible] by [illegible] Electrical Engr. U. S. Reclamation Service, Los Angeles, Calif., for head gates for Okanogan project, Wash.

✦Hydraulic Apparatus—Okanogan, Wash.—The contract for [illegible] for the Okanogan project has been awarded to the PELTON WATER WHEEL CO., San Francisco, Calif., at $[illegible]. Noted June 4.

Turbine Exciter—Puget Sound, Wash.—Bids will be received until 11 a.m., July [illegible], by H. P. Stanford, Chief Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing and installing one new turbine-driven exciter in the central power plant at the Navy Yard, Puget Sound.

✦Machinery and Valves—Seattle, Wash.—The lowest bid [illegible] for valves and operating machinery for Lake Washington Canal locks has been submitted by Meacham & Babcock, Central Bldg., Seattle, Wash., at $11[illegible],622. Noted June 11.

✦Reinforcing Dike—Mare Island, Calif.—The contract for reinforcing dike No. 12 at the Mare Island navy yard, has been awarded to the THOMPSON BRIDGE CO., San Francisco, Calif., at $[illegible]. Noted May 7.

Hopper Dredge—San Francisco, Calif.—Bids for constructing the hopper dredge "San Pablo" have been received as follows: [illegible] Co., Seattle, Wash., $[illegible]; Mare Island Navy Yard, $[illegible]; New York Shipbuilding Co., $[illegible]; Union Iron Works, San Francisco, Calif., $[illegible]; Skinner Dry Dock & Construction Co., Baltimore, Md. Noted Apr. 23.

Cable Tank, Cars, Mine Storehouse Cars, Air Compressor Plant, Etc.—Panama—Bids will be received until 10:30 a.m., July [illegible], by Maj. F. C. Boggs, Gen. Pur. Officer, Isthmian Canal Comn., Washington, D. C., for furnishing cable tank cars, bolts, nuts, etc., at Panama.

MISCELLANEOUS

Fire Station—Portland, Maine—The city plans to construct a fire station for its automobile fire apparatus. F. F. [illegible] is Fire Chief.

Riprap, Dredging—Boston, Mass.—Bids will be received by the State Harbor and Land Commissioners, Boston, for placing [illegible] tons of rip rap in the bank of the Connecticut River at [illegible], and for dredging at Rockport Harbor. William Y. Williams is Ch. Engr. Comrs.

Elimination of Grade Crossings—Boston, Mass.—The Directors of the Port of Boston, acting jointly with the Public [illegible] Commission, plan to eliminate two grade crossings on the Boston & Maine R.R. at Charlestown Neck. This will [illegible] the grade crossings on the [illegible] of the New York, New Haven & Hartford R.R. [illegible]. Plans for this work have been made. [illegible], 10 Central St., Boston, is Ch. Engr. of the Directors of the Port.

✦Grading and Riprap—Boston, Mass.—(Official)—Bids [illegible] June 23 by the State Board of Harbor and Land Commissioners, Boston, for placing [illegible] ft. of grading and [illegible] in the [illegible] bank of [illegible] River, [illegible]. The contract has been awarded to JOHN CASHMAN [illegible], Boston, at $[illegible].

River Work—[illegible], Mass.—The Governor has signed the bill [illegible] for the [illegible] and [illegible] of the [illegible] for the purpose of [illegible]. [illegible] which will cost approximately $[illegible].

Fire Apparatus—[illegible], Mass.—[illegible]

Harbor Development—New Bedford, Mass.—[illegible]

Barge Canal Work—[illegible], N. Y.—[illegible]

Barge Canal Work—[illegible], N. Y.—[illegible]

✦Barge Canal Work—[illegible], N. Y.—[illegible]

Creek Work—[illegible]

Fire Alarm System—New York, N. Y.—[illegible]

Floor Work—New York, N. Y.—(Borough of Richmond)—(Official)—Bids will be received until [illegible] p.m., July [illegible], by John H. Kingsbury, Comr. Pub. Charities, Municipal Bldg., Borough of Manhattan, for removing the present sanitary [illegible] and renewing same in the bath and toilet rooms of three pavilions at the New York City Farm Colony, [illegible] of [illegible].

Cabinets—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until 2 p.m., July [illegible], by F. J. H. Kracke, Comr. of Bridges, Municipal Bldg., Manhattan, for installing security cabinets in the vault in the Municipal Bldg.

Ice Making Tank, Etc.—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until [illegible] p.m., July 2, by John A. Kingsbury, Comr. Pub. Charities, Municipal Bldg., Borough of Manhattan, for installing [illegible] ice-making tank, ice-storage box and ice slide, etc., in the kitchen and dining hall, city hospital district, Blackwell's Island.

Pier Work—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until noon, July 2, by R. A. C. Smith, Comr. of Docks, Dept. of Docks and Ferries, Pier A, foot of Battery Place, North River, Borough of Manhattan, for repairing a portion of the pier and approach at the foot of West 96th St., North River, Manhattan.

✦★Subway—New York, N. Y.—(Borough of Brooklyn)—The Public Service Commission has awarded the contract to the CRAWFORD CO., [illegible] Montague St., Brooklyn, N. Y., for constructing Sect. 1 of Route 12, a part of the Fourth Ave.-Lexington Ave. and Eastern Parkway rapid transit railroad at $2,1[illegible],296. Bids were opened June 16. List of bidders noted June 18.

Comfort Stations—Trenton, N. J.—The Municipal Improvement Committee, of the Chamber of Commerce, is considering the erection of a series of comfort stations in the central section of the city.

Elimination of Grade Crossings—Erie, Penn.—The Lake Shore & Michigan Southern Ry. plans to elevate its tracks in Erie to eliminate grade crossings at Peach, Sassafras and Parade Sts.

✦Pier—Philadelphia, Penn.—The GUERNSEY-O'MEARE CO., 11[illegible] North American Bldg., Philadelphia, has been awarded the contract for the construction of warehouse pier No. 47 for the Pennsylvania Sugar Refining Co. It will be 125x228 ft. and will cost about $2[illegible].

Oil Tanks—Cumberland, Md.—The Standard Oil Co. plans to construct oil tanks at Cumberland to cost $[illegible].

Levee Work—New Orleans, La.—Bids will be received until 3 p.m., July 7, by the Commissioners of Orleans Levee District, New Orleans, for 179,000 cu yd. of levee work.

★Dredging—New Orleans, La.—(Official)—Bids will be received by the Board of Commissioners of the Port of New Orleans, until 8 p.m., July 20 for dredging in the Mississippi River. For details see advertisement under "Contracts To Be Let."

Bank Protection Work—Shreveport, La.—Bids will be received until noon, July 1[illegible], by the Commissioners of Caddo Levee District, Shreveport, for bank protection in several reaches in Caddo Parish, aggregating 19,[illegible] ft. W. A. Kerley is Secy.

✦Ditch—Lexington, Tenn.—Beech River Drainage District has awarded the contract to the McGINNIS CONSTRUCTION CO., Memphis, Tenn., for the construction of a [illegible] ditch, at $23,[illegible].

Drainage—Henderson, Ky.—The County Engineer, Henderson, is preparing plans for a drainage system for [illegible] Creek.

Sheet Steel Piling—Cleveland, Ohio—(Official)—Bids will be received until noon, July [illegible], by the Commissioner of Purchases and Supplies for sheet steel piling for the [illegible] of [illegible] water basin at the filtration plant, [illegible] Ave. pumping station.

Wall—Youngstown, Ohio—The contract has been awarded to WILLIAM McINTYRE & SONS, Youngstown, for [illegible] a retaining wall along the west side of [illegible] between the state [illegible] and a point [illegible] of the [illegible] at about $[illegible].

✦Drain—[illegible], Ind.—The Board of Public Works has awarded the contract to [illegible] McCARTHY & CO., [illegible], Ill., for constructing [illegible] at $[illegible].

Ditch—[illegible], Ind.—Bids will be received until July [illegible] by [illegible], Fulton County, [illegible] for constructing [illegible] ditch.

Ditch—Warsaw, Ind.—Bids will be received until 1 p.m., July [illegible] [illegible] for the construction of the [illegible] ditch.

Creek Work—[illegible]

Drain Work—[illegible]

Drains—[illegible]

Fire Apparatus—[illegible], Ill.—[illegible]

Park Breakwater—[illegible]

Dam—[illegible]

✦Drain—[illegible]

Ditch—Perry, Iowa—Bids will be asked about July 7 by the County Clerk, Adel, Iowa, for Ditch No. 30. Estimated cost, $10,000. Charles E. Wilson is Engr.

Ditch—Slayton, Minn.—Bids will be received until 10 a.m., July 7, by W. A. Seeman, County Audr., Slayton, for constructing Ditch No. 29. Estimated cost, $21,670.

Stockyard Pens—Kansas City, Mo.—The Union Pacific R.R. plans to construct pens at the Kansas City stockyards.

Levee—Austin, Tex.—Burleson County Improvement District No. 1 plans to issue $136,000 in bonds for repairing, reconstructing and enlarging levees. J. C. Nagel, Austin, is Dist. Comr.

Drainage—Cuero, Tex.—The taxpayers have voted in favor of issuing $30,000 in bonds for a drainage system.

Shed—Galveston, Tex.—The Harris-Irby Cotton Co., Galveston, plans to construct a cotton shed between 42nd and 43d Sts. on Ave E. Estimated cost, $30,000.

✚★Dam—Luling, Tex.—The contract for the proposed reinforced concrete dam for H. & C. Zedler in San Marcus River, has been awarded to TADLOCK BROS., Gonzales, Tex.

Wharf Superstructure, Etc.—Seattle, Wash.—Bids for the superstructure of the Hanford St. Wharf, and for the foundations of the 500,000-bu. bulk- and sack-grain elevator, to be erected by the Seattle Port Commission, were opened recently. Fourteen bids were received on each improvemnt. The three lowest bidders follow: For the wharf superstructure: A. S. Peterson, $78,235; Harrington-Peters Co., $87,000; Weymouth Construction Co., $88,731; for grain elevator foundations: W. T. Butler Construction Co., $25,180; Weymouth Construction Co., $26,272; Franklin Engineering Co., $26,696, all of Seattle. Paul P. Whitham is Ch. Engr.

Park Work—Ashland, Ore.—The citizens have voted to improve Cañon Park at a cost of $175,000.

Dock—Brandon, Ore.—The City Recorder will ask for bids soon for the construction of a floating dock at the foot of Chicago Ave.

Fire Apparatus—Fresno, Calif.—Bids will be received by W. H. Ryan, City Clk., until 8 p.m., July 6, for a motor-driven hose-wagon, fully equipped with power to draw a 7500-lb. fire engine; motorization of an 8500-lb. steam engine and motorization of a hose-wagon.

Elimination of Grade Crossings—(Subway)—Fresno, Calif.—The City Engineer has been instructed to prepare plans for a subway under the tracks of the Southern Pacific Co., to eliminate the grade-crossing at Monterey St.

Drainage—Knights Landing, Calif.—The Trustees of Knights Landing Ridge Drainage District plan to improve the district by constructing a canal five miles long. Estimated cost, $800,000. P. A. Haviland, Oakland, Calif., is Engr.

Wharf—Martinez, Calif.—The Shell-Royal Dutch Syndicate have purchased 200 acres of bay shore at Martinez and will construct a wharf. They will also erect a refinery with a capacity of 10,000 bbl. per day.

✚Ferry House—San Francisco, Calif.—The Panama-Pacific International Exposition Co. has awarded a contract for the construction of a ferryhouse to STREHLOW, FREESE & PETERSEN, San Francisco, at $42,200.

Fire Apparatus—Santa Maria, Calif.—The city plans to purchase a motor-driven truck, fully equipped, and 1400 ft. of fire hose. Bonds for $12,500 will be issued for this purpose.

Dock—Juneau, Alaska—The Du Pont de Nemours Powder Co., Wilmington, Del., plans to construct a dock and magazine at Smugglers' Cove, about five miles south of Juneau.

✚Dredging—Montreal, Que.—The Cedars Rapids Mfg. & Power Co. has awarded a contract to SIMPSON BROS., of Montreal, for dredging work. This work consists of the removal of the barrier at the head of the canal and dredging out the forebay immediately above the intake. There is involved the removal of about 175,000 cu.yd. of material.

Conduits—Montreal, Que.—Bids will be received until July 10, by the Board of Control for the construction of underground conduits in Craig, Notre Dame and St. James Sts., between St. Lawrence and McGill Sts.

Wharf—St. Alphouse, Que.—The Roberval-Seguenay Ry. Co. will ask for bids soon for the construction of a wharf to cost $25,000. Gernon & Lavoit, Chicoutimi, Que., are Engrs.

Dredging—Fort William, Ont.—Bids will be received until July 3 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for dredging required in McKellar River, Fort William.

Docks—Calgary, Alta.—See item under Bridges.

✚Wharf—Gleneden, B. C.—The Department of Public Works has awarded the contract to JAMES McDONALD & CO., Victoria, B. C., for constructing a wharf at Gleaden.

Elimination of Grade Crossing—(Subway)—Vancouver, B. C.—The city plans to construct a subway under the tracks of the Canadian Pacific Ry. to eliminate the grade crossing at Carroll St.

BUILDINGS

✚Portland, Maine—The contract for the erection of the Putnam Exposition building on Bank St., has been awarded to F. W. CUNNINGHAM & SON, 130 Congress St. F. A. Thompson, Y. M. C. A. Bldg., is the Arch. The estimated cost is $75,000.

✚Manchester, N. H.—The contract for the erection of a theater for Victor Charas, Beacon Bldg., has been awarded to HARRY MACROPOL, 100 Hanover St. It will be 78x100 ft., of brick, to cost $75,000. Leo Lempert & Son, Rochester, N. Y., are the Archs.

✚Worcester, Mass.—The general contract for the erection of the Park Building, at Park and Franklin Sts., has been awarded to GEORGE A. FULLER CO., New York, N. Y., at about $400,000. Cross & Cross are the Archs.

✚Providence, R. I.—The contract for the erection of the Courtland St. school has been awarded to WILLIAM WILLIAMS, 86 Weybossett St. Hoppin & Field are the Archs., 32 Westminster St. The estimated cost is $300,000.

Greenwich, Conn.—Plans are being prepared by Carrere & Hastings, Archs., 225 Fifth Ave., New York, for the erection of a general hospital. The estimated cost is $250,000.

South Manchester, Conn.—The Ninth School District is planing the erection of a building for the Westside School. The estimated cost is $64,200. Frank Farley, 15 West 38th St., New York, N. Y., is the Arch.

✚Stamford, Conn.—Contracts for the erection of the addition to the high school have been awarded as follows: General contract, HARRIS CONSTRUCTION CO., Bland Bldg., at $93,449, and electrical work, $3477; heating and ventilating, OPPERSAN & HENNESSEY, 73 Pacific St., at $12,236. Other bidders for the general contract were as follows: Carlton Co., New York, $91,188; Oscawanna Building Co., New York, $93,570; A. M. Barrows, $94,235; John Lowry, Jr., $95,500; Casper Ranger Construction Co., Holyoke, Mass., $109,935; A. A. Scofield, Stamford, Conn., $118,517; G. G. Fearon, New York, $119,968. Noted June 18.

Stratford, Conn.—Bids are being received for two schools, one to be erected on Nichols Ave. and the other as an addition to the Washington schol. Frank H. Beckwith, 16 P. O. Arcade, is the Arch., Bridgeport, Conn.

New York, N. Y. (Borough of Bronx)—(Official)—Bids were received June 22, by C. B. J. Snyder, Supt. of School Bldgs., Park Ave. and 59th St., for the general construction of the Evander Childs High School, on East 184th St., as follows: Midtown Contracting Co., $414,141; John T. Brady & Co., $439,510; T. A. Clarke Co., $418,600; Conners Bros. Co., Inc., $421,590; Libman Contracting Co., $453,680; H. C. Stowe Contracting Co., $427,270; all of New York. Noted June 11.

New York, N. Y. (Borough of Bronx)—Bids will be received until 3 p.m., July 13, by C. B. J. Snyder, Supt. of School Buildings, 59th St. and Park Ave., for general construction of additions to and alterations in school 12, Benson Ave. and Overing St.

✚New York, N. Y. (Borough of Manhattan)—The contract for the erection of the store and office building at Columbus Circle, Eighth Ave. and 61st St, has been awarded to the COLUMBUS CIRCLE CONSTRUCTION CO., American Bldg., 58th St. and Broadway. The height has not been decided. Noted June 25.

Jackson, Rosecrans & Waterbury, Archs., 1328 Broadway, are preparing plans for the erection of the Irvin Hotel for Women ,to be erected at 308 West 30th St. It will be 12 stories, 66x100 ft. The estimated cost is $250,000.

(Borough of Manhattan)—Donn Barber, Arch., 101 Park Ave., has been commissioned to prepare plans for the erection of a building at Lexington Ave. and 53d St. for the Y. W. C. A. The estimated cost is $600,000.

Newark, N. J.—The Board of Education will erect a seven-story, 150x121 ft. administration building at Washington and Academy Sts. The estimated cost is $500,000.

Trenton, N. J.—Bids were received for constructing the municipal hospital addition as follows: Charles R. Randall, $37,293; Louis Levy, $38,167; David Dietz, $38,500; Elmer H. Stout, $42,918; Samuel Hilton, $39,800; S. W. Van Loon, $46,171; S. W. Mather & Son, $38,533; Winfield S. Hill, $42,000; Samuel Wiley, $39,643. Noted June 4.

✚Philadelphia, Penn.—The contract for the erection of a seven-story 72x75 ft., office building for Powers, Weightman & Rosengarten, has been awarded to WILLIAM SEELE & SONS CO., Philadelphia, Penn. The estimated cost is $100,000.

✚Philadelphia, Penn.—The contract has been awarded to WILSON MINOR, 4636 Penn St., for the erection of the two-story stone and brick office building at Frankford and Overington Sts.

Arlington, Md.—Plans have been completed by Owens & Sisco, Archs., Continental Bldg., Baltimore, for the erection of a two-story, 50x60 ft. bank building for the Commercial Bank of Maryland. The contract will be awarded July 7.

✚Charleston, W. Va.—The United Fuel Gas Co. has awarded contract for a four-story 40x90 ft., office building to the RAGLAND BAXTER MORFORD CO., Nashville, Tenn., at $50,000.

✚Hazard, Ky.—The contract for the jail to be erected at Hazard, has been awarded to J. C. & C. S. TODD, Richmond, Ky. Weber, Werner & Adkins, are the Archs., Mercantile Library Bldg., Cincinnati, Ohio.

✚Cincinnati, Ohio—The contract for the brick work on the Good Samaritan Hospital, has been awarded to the SCULLY CONSTRUCTION CO., G. W. Drach, is the Arch., Union Trust Bldg., Cincinnati, Ohio.

Lancaster, Ohio—Bids will be received until July 18, for the erection of a State Armory. The estimated cost is $43,000.

Bessemer, Mich.—Charlton & Kuenzil, Archs., Camp Bldg., Milwaukee, Wis., are preparing plans for the erection of a three-story and basement, 80x60 ft. court house. The estimated cost is $75,000.

Detroit, Mich.—Plans are being prepared by Malcomson & Higginbotham, Archs., 405 Moffat Bldg., for the erection of a three-story, 203x256 ft., high school on Woodward Ave. The estimated cost is $440,000.

✚Chippewa Falls, Wis.—The general contract for building the State School for Feebleminded has been awarded to the WISCONSIN CONSTRUCTION CO., Chippewa Falls. Noted June 11.

✚Milwaukee, Wis.—The following contracts have been awarded for the superstructure of the Washington High School at Sherman Blvd. and Wright St., as follows: Carpentry, HENRY JAHNS, $29,563, plastering, A. H. BUEL & CO., $18,000, painting, F. SPETZ, JR., $7680, tile and marble, BREIDSTER MARBLE CO., $33,936, heating, DOWNEY HEATING & SUPPLY CO., $29,461, heat regulation, NATIONAL REGULATING CO., $3333. Noted June 25.

Waterford, Wis.—Bids will be received until July 6 by [illegible] for constructing the Waterford Joint High School. [illegible] & [illegible] are the Archs., Racine, Wis.

+Council Bluffs, Iowa.—The contract for the erection of the [illegible] to the hospital for the Sisters of Mercy, has been awarded to WICKMAN BROS., 19 Scott St.

Minneapolis, Minn.—Bids will be received until 2 p.m., [illegible] by [illegible] Comptroller, University of Minnesota, for remodeling the Chemistry Building.

+New Ulm, Minn.—The general contract for the erection of the [illegible] of New Ulm has been awarded to WELLANDT & [illegible]MANN, New Ulm.

+St. Paul, Minn.—The excavation contract for the 10-story building to be erected at Sixth and St. Peter Sts. for [illegible] has been awarded to FRED C. NOLLENBERG, [illegible] Bank Bldg., St. Paul, Minn. The estimated cost is $[illegible].

San Francisco, Calif.—Bids were received by the Board of Public Works for the general construction of the jail and [illegible] of the City and County Jail buildings, as follows: W. A. Newsom, $41,[illegible]; T. W. [illegible] & Co., $39,340; [illegible], $47,882; [illegible], $41,812; Larson, Sampson Co., $4[illegible]; William [illegible], $[illegible].

Kansas City, Kan.—Bids will be received by the Board of Education until 8 p.m., July 6 for the construction of the [illegible] Primary School, the Chelsea Primary School, the [illegible] School, and the Frances Willard School. James A. [illegible] is Pres.

CONTRACT PRICE

Dry Dock—Boston, Mass.—Bids were received June 15 by the Directors of the Port of Boston for Contract 25—Constructing a dry dock at South Boston. The bidders were: (A) [illegible] Bros., Chelsea, Mass.; (B) Winston & Co., Brunt [illegible], N. Y.; (C) T. Stuart & Sons Co., 242 Pearl St., Newton, Mass.; (D) Hugh Nawn Contracting Co., Boston; (E) H. P. [illegible] & Co., 15 Broad St., Boston; (F) Maryland Dredging & Contracting Co., Baltimore, Md.; (G) U. S. Realty & Improvement Co., 111 Broadway; (H) S. Pierson & Son, Inc., New York; (I) Holbrook, Cabot & Rollins Corporation, 6 Beacon St., Boston, Mass.; (J) [illegible] & Sangster, Seneca Falls, N. Y.; (K) W. P. [illegible], 342 Fifth Ave., New York; (L) Norcross Bros., Worcester, Mass. The item bids were as follows:

Lawrence, Kan.—W. F. Gernandt, Omaha, Neb., is preparing plans for the erection of three schools to be erected by the Board of Education, at Lawrence, Kan. The estimated cost is $75,[illegible].

Kansas City, Mo.—Bids will be received until July 10, by the Board of Public Works for the construction of the tuberculosis hospital near Leeds, Mo. Edgar P. Madorie, Reserve Bank Bldg., is the Arch.

Salt Lake City, Utah.—The Salt Lake County Club will erect a clubhouse at 23rd East and South 13th Sts. The estimated cost is $[illegible]. D. C. Jackling is Pres.

Kingman, Ariz.—The lowest bid submitted for the construction of the Mohave County Courthouse, at Kingman, Ariz., was that of T. J. Mahoney, Phoenix, Ariz., at $[illegible]. Noted May [illegible].

+Pocatello, Idaho.—The contract for the erection of the building for the Mountain States Telephone & Telegraph Co., Pocatello, has been awarded to C. F. WALKER CONTRACTING CO., Denver, at $[illegible].

Olympia, Wash.—The State Capitol Commission has decided to issue bonds to cover the completion of the unfinished temple of justice and for the erection of the [illegible] building of the new capitol group. The estimated cost is $1,[illegible].

Seattle, Wash.—The Board of Regents of the University of Washington have approved plans for the erection of a [illegible]-story building on the University tract, estimated to cost $450,000.

La Grande, Ore.—The B. P. O. E. will erect a lodge building at La Grande. Estimated cost, $[illegible].

+Portland, Ore.—The Dunwiddie Construction Co., general contractors for the 11-story Meier & Frank building, have awarded to the NORTHWEST STEEL CO. the contract for furnishing all the structural steel.

Fresno, Calif.—W. D. Coates, Jr., Arch., has been commissioned by the Board of Education to prepare plans for the erection of a group of schools, estimated to cost $[illegible].

Pasadena, Calif.—The Pasadena Theater Co. will erect a theater to cost $[illegible]. Louis Du P. Millar, 31[illegible] St. [illegible] Bldg., is the Arch.

+San Francisco, Calif.—The Washington State Exposition Commission has awarded the contract for the construction of the Washington Building at the San Francisco Fair Grounds to the DUNNAVANT-HOUGHTON CO., San Francisco, at $44,964. Noted June 1.

CONTRACT 25 SOUTH BOSTON DRY DOCK, BOSTON, MASS.

	A	B	C	D	E	F	G	H	I	J	K	L
	$	$	$	$	$	$	$	$	$	$	$	$
Cofferdam and [illegible]	[illegible]	[illegible]	40,[illegible]	125,[illegible]	255,738.00	[illegible]	180,[illegible]	280,[illegible]	[illegible]	67,[illegible]	78,217.00	82,[illegible]
[illegible]	[illegible]	0.31	0.45	[illegible]	0.20	0.27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0.25	0.20	[illegible]	0.297	0.16	0.20	0.25	[illegible]	[illegible]	[illegible]	0.21	[illegible]
[illegible]	1.00	[illegible]	1.00	[illegible]	1.17	1.25	[illegible]	[illegible]	[illegible]	[illegible]	1.00	[illegible]
[illegible]	2.50	2.25	2.15	[illegible]	1.74	[illegible]	2.00	4.45	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1.50	2.25	1.75	[illegible]	1.74	[illegible]	2.00	2.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	8.00	12.[illegible]	13.50	12.[illegible]	14.00	10.[illegible]	9.00	16.95	[illegible]	[illegible]	[illegible] (a)	9.[illegible]
[illegible]	0.50	[illegible]	0.75	0.75	0.82	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	0.70	0.82	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	110,[illegible]	120,[illegible]	[illegible]	120,[illegible]	[illegible]	[illegible]	[illegible]	117,[illegible]	[illegible]	144,[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12.00	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												

+**San Francisco, Calif.**—The Turkish Government has awarded a contract for the construction of a pavilion on the Exposition grounds to the NORTHWEST CONSTRUCTION CO., Merchants Exchange Bldg., at $40,000.

Edward T. Foulkes, Arch., Crocker Bldg., is preparing plans for the erection of a three-story hotel to be erected at Baker and Lombard Sts., at an estimated cost of $350,000.

+The Ohio State Commission to the Panama-Pacific International Exposition has awarded a contract to LANGE & BERGSTROM, of San Francisco, at $43,980 for the construction of the Ohio State pavilion on the Exposition grounds.

+The Board of Panama-Pacific Managers for Massachusetts has awarded a contract for the erection of a pavilion on the exposition grounds to W. D. HENDERSON at $52,978.

+**Fort William, Ont.**—The contract for the erection of the Drew school building, has been awarded to SEAMAN & PENNIMAN, at $76,684.

Winnipeg, Man.—The Ancient Order of Foresters will erect a lodge building at Winnipeg. The estimated cost is $100,000.

Edmonton, Alta.—Bids are being received by Magoon & McDonald, Archs., Tegler Block, for the erection of a club and apartment block on Second and Victoria Ave. The estimated cost is $250,000.

Medicine Hat, Alta.—Bids will be received until 4 p.m., July 6, by R. C. Desrochers, Secy., Dept. of Public Works, Ottawa, Ont., for the erection of additions and alterations to public building.

Prince Rupert, B. C.—Bids will be received until 4 p.m., July 6, by R. C. Desrochers, Secy., Dept. of Public Works, Ottawa, Ont., for the erection of a public building.

The Sullivan Machinery Co., of Chicago, announces that J. C. West has been transferred from the San Francisco office to the general office at Chicago, and that R. P. McGrath, of the Boston office, has been appointed district manager at San Francisco.

The Chicago Steel Tape Co., 6229 College Ave., Chicago, announces that it has opened a downtown office at 900 Lytton Bldg., Jackson Road and State Sts., which is in charge of H. D. Nelson.

Mr. George C. Isbester, for the past three years attached to the New York office of the Rail Joint Co., has been placed in charge of the Chicago office, 215 Railway Exchange.

CONTRACT PRICE

Intercepting Sewer—Newark, N. J.—Bids were received June 16, by the Passaic Valley Sewerage Commissioners for constructing Section No. 17, southerly portion, from (A) The Whiting-Turner Construction Co., Baltimore, Md.; (B) Beaver Engineering & Contracting Co., New York, N. Y.; (C) Merrill-Ruckgaber Co., New York, N. Y.; (D) Bruno & Petitti, Belleville, N. J.; (E) New York & New Jersey Construction Co., New York, N. Y.; (F) Harrison & Craig Co., Newark. The item bids were as follows:

Jos. H. Wallace & Co., Industrial Engineers, Temple Court Bldg., New York, announce that they have found it necessary to open an office at Montreal, Que., to take care of Canadian business. This office will be in charge of two members of the firm, Jos. Perry and P. R. H. Murphy.

The Industrial Works, Bay City, Mich., will handle business of the Chicago territory from the main office in Bay City. In the near future a sales office will be opened in Chicago under the name of the Industrial Works.

The Terry Steam Turbine Co., Hartford, Conn., informs us that business has been more satisfactory than in several months, and in order to take care of the increase, additional tools have been installed increasing the capacity of the shop approximately 25%.

The Trussed Concrete Steel Co. has moved its general offices to Youngstown, Ohio. This step was taken to bring the selling and manufacturing organizations in closer communication. At the same time, an office will be maintained in Detroit to take care of the sales inquiries originating in that territory. The Publicity Department of the company will remain in Detroit.

CATALOG NOTICES

The Pelton Water Wheel Co., San Francisco, Calif. Catalog. Waterwheels. Illustrated, 102 pp., 6x9 in.

The Baldwin Locomotive Works, Philadelphia, Penn. Record No. 78. Locomotives for industrial and contractors' service. Illustrated, 32 pp., 6x9 in.

The Kindling Machinery Co., Milwaukee, Wis. Catalog. Squeegee and sand spreader. Illustrated, 40 pp., 6x9 in.

The Yuba Construction Co., San Francisco, Calif. Catalog. Yuba ball tread tractor. Illustrated, 24 pp., 7x10 in.

Buckeye Engine Co., Salem, Ohio. Bulletin No. 111-B. Buckeye-mobile. Illustrated, 16 pp., 8x10 in.

National Transit Ct., Oil City, Penn. Catalog. Gas engines. Illustrated, 16 pp., 9x12 in.

The Brown Hoisting Machinery Co., Cleveland, Ohio. Catalog P. Brownhoist overhead hand traveling cranes. Illustrated, 36 pp., 6x9 in.

Ingersoll-Rand Co., 11 Broadway, New York. (Form No. 4020. Leyner-Ingersoll water drills. Illustrated, 32 pp., 6x9 in. Form No. 8011. "Little David" riveting hammers. Illustrated, 8 pp., 6x9 in. Form No. 8011-1. Rivet set retainer for "Little David" riveters. Illustrated, 4 pp., 6x9 in.

Tropenas Converter Co., 5 Church St., New York. Tropenas converters for the manufacture of steel castings. Illustrated, 48 pp., 6x9 in.

The Lufkin Rule Co., Saginaw, Mich. Catalog No. 9. Measuring tapes and rules. Illustrated, 110 pp., 6x9 in.

Alberger Pump & Condenser Co., 140 Cedar St., New York. Bulletin No. 19. Expansion joints. Illustrated, 16 pp., 6x9 in.

INTERCEPTING SEWER, NEWARK, N. J.
Section No. 17—Southerly Portion

	A	B	C	D	E	F
4800 lin.ft. earth excavation for 65-in. sewer	$26.20	$26.00	$26.00	$16.00	$22.00	$16.00
10,000 cu.yd. rock excavation	1.80	0.01	0.01	4.50	0.01	3.00
3600 cu.yd. concrete masonry	8.14	9.00	9.00	8.50	9.00	8.50
100 cu.yd. brick masonry in manholes	16.00	20.00	15.00	18.00	15.00	18.00
Totals	$174,664	$159,300	$158,800	$154,200	$139,600	$139,200

CONTRACT PRICE

+**Sewage Treatment Plant**—Canton, Ohio—Bids were received May 26, by the Board of Public Service for the construction of a sewage treatment plant from (A) J. C. Devine Co., Alliance, Ohio; (B) R. H. EVANS & CO. and E. J. LANDOR, Canton, Ohio (awarded contract); (C) Ule & Loewensohn, Kent, Ohio; (D) Municipal Engineering & Construction Co., Chattanooga, Tenn.; (E) John T. Walbridge Engineering Co., Chicago, Ill. The item bids were as follows:

R. B. Ober, M. Am. Soc. C. E., Consulting Civil Engineer, announces the removal of his offices to 1112 Alaska Building, Sattle, Wash.

The Kauffman Construction Co., Syndicate Bldg., Oakland, Calif., announces that it has bought all the interests of N. M. Price, a member of the Kauffman Price Construction Co., and that the new firm will carry on all business originating in the future, as well as look after old contracts.

SEWAGE TREATMENT PLANT, CANTON, OHIO

	A	B	C	D	E
33,480 cu.yd. earth excavation	$0.70	$0.60	$0.70	$0.53	$0.65
200 cu.yd. rock excavation	1.50	3.00	3.00	2.50	4.00
6235 cu.yd. rolled embankment	0.15	0.10	0.30	0.50	0.20
3950 sq.yd. gravel roadways	1.00	1.10	1.75	1.03	1.50
Parking (lump sum)	2800.00	3000.00	3500.00	4267.00	2000.00
Screen and grit chamber (lump sum)	3000.00	1939.00	2000.00	1895.00	2900.00
Sedimentation tanks (lump sum)	45,000.00	36,015.85	50,302.00	38,842.00	57,000.00
Concrete flumes (lump sum)	1000.00	1407.40	1986.00	1526.00	2100.00
Contact beds (lump sum)	57,000.00	71,482.52	70,312.00	53,900.00	68,500.00
58,000 cu.yd. filtering material (crushed slag)	1.25	1.20	1.18	1.60	1.35
3370 cu.yd. filtering material (gravel)	1.40	1.50	1.75	1.75	1.50
1000 cu.yd. filtering material (sand)	1.25	1.50	1.50	1.50	1.00
Controlling apparatus (lump sum)	8000.00	7000.00	7000.00	7230.00	8000.00
Sludge drying beds (lump sum)	19,000.00	17,500.00	12,802.00	14,946.00	18,000.00
14 tons c.i. piping	85.00	68.00	110.00	90.00	50.00
Concrete outfall pipe and by-pass (lump sum)	1100.00	1730.82	2037.00	1465.00	2500.00
Manholes (lump sum)	500.00	1094.00	1101.00	552.00	300.00
2500 lin.ft. vitrified pipe, 18-in.	0.70	0.65	0.69	0.50	0.65
870 lin.ft. vitrified pipe, 12-in.	0.40	0.33	0.41	0.28	0.35
200 lin.ft. vitrified pipe, 8-in.	0.35	0.20	0.23	0.20	0.30
1000 lin.ft. vitrified pipe, 6-in.	0.25	0.16	.018	0.15	0.20
21,500 lin.ft. vitrified pipe, 6-in.-(channel)	0.12	0.12	0.12	0.10	0.12
220 lin.ft. vitrified pipe, 4-in.	0.15	0.125	0.12	0.10	0.10
1200 lin.ft. farm tile, 6-in.	0.15	0.05x	0.08	0.14	0.10
3510 lin.ft. farm tile, 4-in.	0.08	0.04	0.07	0.10	0.08
50 cu.yd. rip rap	3.00	4.00	4.50	3.00	2.00
Additional concrete for contact beds, per cu.yd.	10.00	12.00	12.50	7.50	15.00
Additional concrete for sedimentation tanks per cu.yd.	12.00	12.00	15.00	8.00	25.00
Additional concrete for all other structures per cu.yd.	10.00	12.00	12.50	7.75	15.00
Additional reinforcing steel, per lb.	0.01	0.0275	0.04	0.035	0.04
Sheeting and shoring, per M. ft. b.m.	40.00	45.00	28.00	50.00	40.00
Totals	$251,721	$249,403	$267,217	$256,795	$281,981

Contracts to Be Let

Bids received until July 8, 1914.

Sewage Screen

WEST [illegible] ST SEWAGE TREATMENT WORKS
CONTRACT NO. 2

Cleveland, Ohio

[illegible] proposals will be received at the office of the Commissioner of [illegible] and Supplies, No. 113 City Hall, until [illegible] July 8, 1914 for furnishing and installing a [illegible] self-[illegible] screen.

[illegible] of plans and specifications and blank proposals can be [illegible] at the office of the Commissioner of Engineering [illegible] No. [illegible] and No. 417 City Hall, after June 27.

The time [illegible] to complete the work is an essential part of this [illegible].

[illegible] must contain the full name of the party or parties [illegible] the same and all persons interested therein, and [illegible] accompanied by a certified check for Five Hundred [illegible] Dollars, payable to the City of Cleveland on a [illegible] that if the bid be accepted a contract will be entered into and the performance of it properly secured.

No proposal will be entertained unless made on the blanks [illegible] by the Commissioner of Engineering and delivered at the office of the Commissioner of Purchases and Supplies, No. [illegible] City Hall, previous to 12 o'clock M. on the day [illegible].

The City reserves the right to reject any or all bids.

A. R. CALLOW,
Commissioner of Purchases and Supplies.

Bids received until July 20, 1914.

Steel and Concrete Bridge

Perth Amboy, N. J.

Sealed proposals will be received by the Board of Chosen Freeholders at their room in the County Record Building at New Brunswick, N. J., on MONDAY, JULY 2[illegible], 1914, at 2:30 o'clock for the construction of a Steel and Concrete bridge across the [illegible] or crossing of the Lehigh Valley Railroad at Convery Place in the City of Perth Amboy, according to plans and specifications on file at the office of Thomas H. Hagerty, County Collector, New Brunswick, N. J., and at the office of Alvin R. Fox, Perth Amboy, N. J.

A deposit of Ten Dollars ($10.00) will be required for copies of plans which will be refunded upon the return of same in good condition.

Each bid must be accompanied by a certified check in the amount of $500.00 payable to the order of Thomas H. Hagerty, County Collector, without any conditional endorsements, which check shall be forfeited should the successful bidder fail to enter into contract and bond within ten days from the award of the bid.

The Board reserves the right to reject any or all bids if in their opinion it is to the best interest of the County so to do.

A. J. GERHARDT, Director.
Attest: ASHER W. BISSETT, Clerk.

Bids received until July 22, 1914.

Water Improvements and Repairs

Hudson, N. Y.

[illegible] will be received until 7:30 P. M., July 22, 1914, by the [illegible] of the Commissioners of Public Works, of the City of Hudson, N. Y., for furnishing material and labor [illegible]

[illegible]

M. [illegible]

[illegible]

Bids received until July 23, 1914.

Equipment for Sale

Sealed proposals will be received by the director of public service of the city of Columbus, Ohio, at his office in City Hall Building, until 12 o'clock noon, standard time, of July 23, 1914, when they will be publicly opened and read at that hour, for the following equipment, located in what is known as the West Side Pumping Station, on West Spring Street and the Olentangy River, Columbus, Ohio, in accordance with the specifications on file in the office of the superintendent of the division of water, City Hall Building, from whom copies may be obtained.

[illegible]

Two Holly [illegible]

[illegible]

E. A. KINNEAR,
Director of Public Service.
Attest: PAUL H. [illegible], Clerk.

Bids received until July 13, 1914.

Pipe, Valves, etc.

[illegible], Texas

[illegible]

Bids received until July 23, 1914.

Filtration Plant, Contract No. 2

[illegible]

The City reserves the right to reject any or all bids.

Construction News

★ Denotes work advertised in ENGINEERING NEWS.
✚ Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

ENCOURAGEMENT IN THE BUILDING OUTLOOK

Figures have just been completed showing that in 22 cities of the country the plans filed in June this year called for an expenditure of $64,800,000, compared with $62,200,000 in the same month last year. A gain of nearly $3,000,000 was recorded in Eastern cities in June. This is by far the most favorable showing of the year, for it is a gain of 12%. For the first six months there was a falling off of 3.5%, showing a complete reversal of the trend.

In the West the outlook was good, but not as favorable as in the East. In 21 cities in the Middle West there was a gain in June of this year compared with last year of $800,000, or 2.5%. For the first six months of the year there was a decrease of 0.5%.

In eight cities in the Southern states there was a falling off of $1,166,000 in June, or 23%. For the half-year the decrease was less in proportion, amounting to $3,628,000, or 15.7%

For the entire country from which figures are available at this writing, including 51 cities, the building operations for the half year from plans filed with building inspectors amounted to $322,000,000, compared with $332,000,000 in the corresponding six months last year. The falling off of $10,000,000 is rather small, amounting to only 3%.

In the accompanying table is given the official figures representing the estimated cost of new buildings from plans filed with the building inspectors for June, 1914, and June, 1913. The table also includes the figures covering the first six months of this year and a similar period of last year.

EASTERN STATES

	Month of June		First Six Months of Year	
	1914	1913	1914	1913
Albany, N. Y.	$860,685	$165,615	$3,984,460	$1,869,265
Baltimore, Md.	2,983,082	746,567	6,765,186	5,381,404
Boston, Mass.	574,225	749,910	12,596,850	11,513,555
Bridgeport, Conn.	640,486	212,318	2,172,138	1,461 319
Buffalo, N. Y.	2,569,000	2,302,000	6,564,000	6,486,243
Elizabeth, N. J.	132,453	193,181	708,933	1,437,831
Hartford, Conn.	658,672	333,680	2,373,371	2,146,545
Hoboken	58,375	115,000	561,902	238,142
Jersey City	395,162	758,545	1,957,253	3,636,648
Newark, N. J.	586,220	1,089,772	4,072,237	8,223,991
New Haven, Conn.	440,271	341,776	1,978,410	2,096,612
New York, N. Y.				
Manhattan	3,393,350	4,423,575	26,276,740	35,053,135
Bronx	2,700,000	2,352,015	13,952,603	15,371,756
Brooklyn	5,298,550	2,927,450	22,604,150	16,539,551
Queens	2,530,655	1,151,838	10,800,167	9,188,456
Paterson, N. J.	186,326	84,524	848,911	757,619
Philadelphia, Penn.	3,557,895	4,204,795	21,105,720	21,339,270
Pittsburgh, Penn.	2,450,281	3,750,072	9,340,936	9,221,016
Reading, Penn.	67,575	25,350	910,200	425,675
Rochester, N. Y.	1,026,327	1,444,103	5,028,524	5,386,359
Scranton, Penn.	108,303		585,309	751,808
Springfield, Mass.	560,735	614,015	2,741,064	2,748,422
Syracuse, N. Y.	181,020	477,655		2,094,055
Worcester, Mass.	674,056	540,973	2,640,688	2,728,615
Totals	$32,525,391	$29,004,729	$160,570,352	$166,097,692
	Gain 12%		Decrease 3.2%	

MIDDLE WEST

	Month of June		First Six Months of Year	
	1914	1913	1914	1913
Akron, Ohio	$398,325	$496,700	$1,973,070	$2,830,915
Chicago, Ill.	9,538,300	10,653,900	44,859,200	51,333,637
Cincinnati, Ohio	1,081,395	1,392,625	4,988,770	4,960,606
Cleveland, Ohio	3,126,545	1,803,805	14,689,365	9,820,840
Columbus, Ohio	625,650	567,791	3,220,855	2,696,803
Dallas, Tex.	588,945	936,015	3,483,563	5,160,105
Detroit, Mich.	2,639,745	3,471,580	16,566,995	16,335,875
Des Moines, Iowa	193,475	230,350		
Duluth, Minn.	251,205	145,284	1,680,582	2,716,144
Evansville, Ind.	133,159	141,025	818,169	968,957
Grand Rapids, Mich.	203,227	362,707	2,306,508	1,447,315
Indianapolis, Ind.	814,238	952,025	4,956,405	5,110,907
Kansas City, Kan.	125,893			
Kansas City, Mo.	1,632,700	904,375	7,000,875	5,268,476
Milwaukee, Wis.	899,989	1,481,575	5,510,777	6,279,992
Minneapolis, Minn.	1,604,195	1,808,645	9,773,595	5,930,700
Omaha, Neb.	404,025	339,650	2,866,693	2,055,023
St. Louis, Mo.	1,374,798	2,196,415	7,818,052	9,366,577
St. Paul, Minn.	1,987,250	1,060,530	7,918,688	4,664,394
Salt Lake City, Utah	232,600	249,748	1,396,314	1,149,738
San Antonio, Tex.	240,090	160,002		
Toledo, Ohio	881,113	404,651	3,843,638	2,833,327
Totals	$29,659,398	$28,850,969	$142,930,331	$143,672,114
	Gain 2.5%		Decrease 0.5%	

SOUTHERN STATES

	Month of June		First Six Months of Year	
	1914	1913	1914	1913
Atlanta, Ga.	$419,654	$656,189	$2,999,797	$3,109,157
Birmingham, Ala.	572,189	577,189	1,882,611	4,395,335
Chattanooga, Tenn.	60,145	132,715	633,440	630,875
Louisville, Ky.	517,540	367,780	2,557,855	2,287,510
Memphis, Tenn.	283,012	715,643	2,014,882	2,512,024
New Orleans, La.	364,599	643,264	1,427,990	2,496,700
Richmond, Va.	172,539	152,778	2,099,821	2,068,670
Washington, D. C.	942,325	1,253,315	5,647,819	5,492,073
Totals	$3,332,003	$4,498,873	$19,264,215	$22,992,344
	Decrease 23%		Decrease 15.7%	

RAILWAYS

New York—Buffalo, Lockport & Rochester Ry.—This company plans to extend its line from Lockport, N. Y., to Niagara Falls, N. Y. H. C. Prather, Rochester, N. Y., is Gen. Mgr.

Pennsylvania—Pennsylvania R.R.—The Public Service Commission, June 19, approved the proposed lease of the railroad and other property and franchises of the Northern Central Ry. Co. to the Pennsylvania R.R. Co., and also approved the petition for a certificate of valuation authorizing an increase in the capital stock of the Northern Central Ry. from $9,342,550 to $27,079,600. A certificate will not be issued in either case, however, until the commission's accountant has investigated the financial statements made to the commission concerning this matter.

The Northern Central Ry. extends from Baltimore, Md. to Sunbury, Penn., and has 450 miles of track.

✚Gleasonton & Paddy's Run R.R.—This company has awarded the contract to PETER CILLO, Williamsport, Penn., for grading and track-laying on its proposed line out of Gleasonton, Penn. The contract for bridge work has been awarded to the AMERICAN BRIDGE CO. E. C. Wakefield, Gleasonton, is Ch. Engr.

Maryland—Pennsylvania R.R.—See item under Pennsylvania.

✚**Virginia**—Southern Ry.—This company has awarded contracts for 19 miles of double-track work on its Washington Division between Amherst and Elma, Va., as follows: From Amherst to Tye River, eight miles, to C. W. LANE & CO., Atlanta, Ga.; from Tye River to Elma, 11 miles, to H. J. DUNAVANT & CO., Chattanooga, Tenn.

Florida—White Springs & Suannee River R.R.—It is reported that financial arrangements have been made to construct this company's proposed line from Live Oak, Fla., to White Springs, Fla., 20 miles. A. E. Glass, Pensacola, Fla., is interested.

Alabama—Nashville, Chattanooga & St. Louis Ry.—This company, it is reported, is having surveys made for a line from Guntersville, Ala., to Huntsville, Ala., 30 miles. H. McDonald, Nashville, Tenn., is Ch. Engr.

Bay City, Lynn Haven & Northern Ry.—This company has been organized for the purpose of constructing a line from Chipley, Ala., to Hartford, Ala., 28 miles. The Chamber of Commerce of Montgomery, Ala., is interested.

Mississippi—Nashville, Shiloh & Corinth R.R.—See item under Tennessee.

Tennessee—Nashville, Shiloh & Corinth R.R.—The citizens of Hardin County have voted to issue $240,000 in bonds to aid this company to construct its proposed line from Nashville, Tenn., to Corinth, Miss. C. C. Thoms, Corinth, Miss., is interested. Noted Apr. 9 and May 28.

Tennessee—Gulf & Bay Ry.—This company has been incorporated for the purpose of constructing a railroad from Embreeville, Washington County, Tenn., to the state line between the states of North Calorina and Tennessee at a point in Unicol County, via Erwin Unicol County, Tenn. The incorporators are William A. Roberts, J. F. Torey, R. M. Barry, I. R. Roberts, J. L. Tucker, I. R. Love, J. D. S. Rybcon and N. T. Tucker.

Indiana—Wabash R.R.—This company plans to start work soon on proposed track elevation work at Taylor St. and Thompson Ave., Fort Wayne, Ind. A. O. Cunningham, St. Louis, Mo., is Ch. Engr.

Montana—The construction of a railroad from Rimini, Mont., to the porphyry dike, Helena, Mont., is under consideration. James Breen, Helena, is interested.

Missouri—Terminal R.R. Association of St. Louis—This company has been authorized by the State Public Service Commission to issue $1,000,000 in bonds for improvements. A. S. Johnson, St. Louis, Mo., is Supt.

Missouri—Chicago, Rock Island & Pacific Ry.—This company has been granted permission to issue $1,216,000 in bonds for general betterment work. J. W. Waber, Carlisle, Iowa, is Engr. Const.

Arkansas—Missouri, Arkansas & Southwestern R.R.—This company has been organized to construct a railroad from Hot Springs, Ark., to Mena, Ark., 65 miles. The construction work will include two one-span bridges over the Caddo River and one four-span bridge over the Quachita River. W. E. Womble, Womble, Ark., is interested. Noted July 2.

Texas—See item under Miscellaneous: Terminal—Dallas, Tex.

Texas—Missouri, Kansas & Texas Ry.—This company, which is building terminals at San Antonio, Tex., will extend its lines from San Antonio to a point along the Rio Grande. G. A. Webb, Austin, Tex., is Gen. Mgr.

Altus, Lubbock & Roswell R.R.—It is reported that construction work on this company's proposed line will soon be resumed. The line was recently sold by Edward Kennedy and associates to a syndicate which is composed of O. L. Slayden and F. E. Wheeler of Lubbock, Tex., and J. M. West, E. C. Noble and Carey Shaw, of Houston, Tex. The road is

[illegible] Wellington, Tex. [illegible] Tex., [illegible] miles, is practically [illegible] for the rails.

Idaho—[illegible] R.R. & Navigation Co.—This company [illegible] the construction of a line from [illegible] miles. J. R. Holman, Portland, [illegible] is Ch. Engr.

Idaho—[illegible] Lumber Co.—This company has [illegible] miles of its proposed line into the Boise [illegible] Minneapolis, Minn., is Vice-Pres. and [illegible] Noted Apr. 16.

+Washington—[illegible] Washington R.R. & Navigation Co. [illegible] Portland, Ore., recently awarded the contract [illegible] for constructing its line from [illegible] Station, Wash., to Olympia, Wash., have sublet [illegible] to the [illegible] FORBERT & WINTERS CONSTRUCTION CO. Noted [illegible]

California—T. S. [illegible] San Jose, Calif., is interested in the construction of an [illegible] standard-gage railroad from [illegible] Calif., to San Jose, Calif.

[illegible] R.R.—This company has been incorporated for the purpose of constructing a railroad from Ocean Beach [illegible] Calif. Capital, [illegible] The offices of the company will be located at San Diego, Calif.

Preliminary surveys have been made and plans outlined [illegible] from Pasadena, Calif., to Los Angeles, Calif., [illegible] miles. T. D. Allin, Commr. Pub. Wks. of Pasadena, is interested. Noted June [illegible]

California—Southern Pacific Co.—This company plans to [illegible] in reconstructing its terminal system at San Francisco, Calif. William Hood, San Francisco, is Ch. Engr.

+Quebec—Quebec Central Ry.—This company has awarded the contract to P. J. WOLFE, Sherbrooke, Que., for constructing the first section of [illegible] miles on its extension from [illegible] Bellechasse County, Que., northeast to Lac Le [illegible] Montmagny County, 25 miles. Five miles of the [illegible] have been completed. The work calls for one steel bridge. Noted May [illegible]

British Columbia—Canadian Northern Ry.—This company has [illegible] plans for its proposed tunnel from Burrard Inlet to [illegible] Creek, B. C. [illegible] Estimated cost, [illegible] H. H. [illegible], Winnipeg, Man., is Gen. Mgr. and Ch. Engr.

ELECTRIC RAILWAYS

Worcester, Mass.—The Worcester Consolidated Street Ry. Co. is considering plans for the construction of a one-mile extension to its line from June and Chandler Sts. to Park Ave. and Chandler St. H. C. Page, Worcester, is Gen. Mgr.

Providence, R. I.—The City Council has granted a franchise to the Rhode Island Co. for the construction of an electric railway on Mount Pleasant Ave., from Chalkstone to [illegible] Ave., in Providence. A. E. Potter, Providence, is Pres. and Gen. Mgr.

Schenectady, N. Y.—The Schenectady Ry. Co. is preparing plans for the extension of its lines to the Grand Boulevard section and to South Schenectady. James F. Hamilton, Schenectady, is Gen. Mgr.

Lebanon, Penn.—The Ephrata & Lebanon Street Ry. Co. has been incorporated to construct and operate an electric railway from Ephrata to Lebanon. The incorporators are [illegible], Charles D. [illegible], Henry O. Evans and E. T. [illegible]

New Oxford, Penn.—Preliminary arrangements are being made by the Hanover & McSherrystown Street Ry. Co. for the construction of its proposed electric railway from Conewago Chapel to New Oxford, about four miles. Robert E. [illegible] Hanover, is Gen. Mgr. and Pur. Agt.

+Uniontown, Penn.—The Uniontown Radial Street Ry. Co. has awarded the contract for the construction of an electric railway from [illegible] to Uniontown to REAGAN, LYNCH & CO.

Overlea, Md.—The Public Service Commission has ordered [illegible] Gas & Electric Co. to extend its line on Belair Road from Overlea to [illegible], about three miles. T. A. [illegible] is Vice-Pres. and Gen. Mgr.

Philippi, W. Va.—The Philippi & Clarksburg Traction Co. has been incorporated to construct and operate an electric railway from Philippi to Clarksburg. The incorporators are [illegible] H. [illegible], F. Talbott, Henry B. [illegible] [illegible] all of Philippi. Noted Mar. [illegible]

Wilmington, N. C.—The Wilmington-Carolina Beach Ry. [illegible] construction of an electric railway to [illegible] with Wilmington and Carolina Beach [illegible] Wilmington, is interested.

Hattiesburg, Miss.—Plans are being prepared by the [illegible] for the extension of its line to the [illegible] Hattiesburg. [illegible] Stevens, Hattiesburg, is Gen. Mgr.

Alexandria, La.—[illegible]

Taylorsville, Ky.—[illegible]

Kendallville, Ind.—[illegible]

Murphysboro, Ill.—[illegible]

Cedar Rapids, Iowa—[illegible]

Wichita, Kan.—The North & South Ry. Co. has been incorporated to construct an electric railway to connect Wichita, [illegible] and Washington, Kan., about [illegible] miles.

Brookfield, Mo.—Plans are being prepared for the construction of an electric railway to connect Brookfield, Marceline, Randolph Springs, Wien and other towns in that vicinity.

Corpus Christi, Tex.—Preliminary arrangements are being made by the Corpus Christi Street & Interurban Ry. Co. for the improvement of its railway lines in Corpus Christi. V. S. [illegible], Corpus Christi, is Secy. and Gen. Mgr.

Dallas, Tex.—Plans are being considered for the construction of a [illegible] interurban railway from Dallas to Wichita Falls via Denton, about [illegible] miles. Joseph A. Kemp, Wichita Falls, and J. L. [illegible], Dallas, are interested.

The Court of County Commissioners has granted a franchise to D. [illegible] to construct and operate an electric railway from the [illegible] Heights line through the Lakewood Addition. Noted July 2.

Galveston, Tex.—The Galveston Electric Co. has applied to the City Council for a franchise to construct an extension to its line on Ave. [illegible] and for several other short extensions in Galveston. Harry H. Sewell, Galveston, is Gen. Supt.

Victoria, Tex.—The construction of an electric interurban railway from Victoria to Houston is contemplated. John T. Lard, Secy. Chamber of Commerce, Victoria, is interested.

Pasadena, Calif.—Preliminary surveys have been made for the construction of a municipal electric railway from Pasadena to Los Angeles. Estimated cost, [illegible] Lewis E. Smith is City Engr. Noted June 4.

San Diego, Calif.—Preliminary arrangements are being made by the Point Loma Ry. Co. for the extension of its line to the wireless station and to Fort Rosecrans. R. M. Warner, San Diego, is Gen. Supt. Noted July 2.

San Francisco, Calif.—(Official)—Bion J. Arnold is engaged in the appraisal of the Oakland, Antioch & Eastern R.R., which operates an electric railway from San Francisco to Sacramento.

LIGHT HEAT AND POWER

+Holyoke, Mass.—The Holyoke Street Ry. Co. has awarded a contract to the CASPER RANGER CONSTRUCTION CO. for the construction of the additions to its power plant on Berkshire St.

Greenwich, Conn.—The Greenwich Citizens Gas Co., which was recently organized with a capital of [illegible], will build a gas plant at Cos Cob consisting of a gasometer of [illegible] cu. ft. capacity and four buildings, [illegible] ft., [illegible] ft., [illegible] ft. and [illegible] ft., respectively, all of reinforced concrete.

***Albany, N. Y.**—(Official)—Bids will be received by the Trustees of Public Buildings, Executive Chamber, Capitol, until 2 p.m. July 20, for electric wiring for book stacks for the State Education Building, Albany. Lewis F. Pilcher is State Arch.

***Albany, N. Y.**—(Official)—Bids will be received by the Trustees of Public Buildings, Executive Chamber, Capitol, until 2 p.m. July 20 for lighting fixtures, etc., for the State Capitol building. Lewis F. Pilcher is State Arch.

Belmar, N. J.—The Board of Public Utility Commissioners has granted permission to the Coast Gas Co. to issue bonds for $131,[illegible], to be used to make extensions of its system to Sea Girt, Villa Park and Bay Head and for additions and improvements at its local plant.

Camden, N. J.—The Public Service Electric Co. plans to install an underground conduit system to replace its overhead lines. The improvement is estimated to cost [illegible] and will be made at the rate of [illegible] per year. [illegible], Newark, is Gen. Mgr.

Barboursville, W. Va.—The City Council contemplates the installation of a municipal electric-light plant. Estimated cost, [illegible]

Reynolds, Ga.—Plans are being prepared by the J. B. McCrary Co., Atlanta, for the construction of a municipal electric-light plant in Reynolds. [illegible] is Clk. Noted June 11.

St. Martinsville, La.—Plans are being considered for the installation of an electric-light plant at St. Martinsville.

Catawba, Ohio—A transmission line will be constructed [illegible] An electric-light system will be established at Catawba.

Cincinnati, Ohio—[illegible] for the construction of a new [illegible] and will make extensive improvements to the two existing plants.

Dennison, Ohio—[illegible]

Troy, Ohio—[illegible]

Decatur, Mich.—[illegible]

Ashland, Ill.—[illegible]

Havana, Ill.—[illegible]

Joliet, Ill.—[illegible]

Denison, Iowa—[illegible]

Lorimor, Iowa—Gilbert Johnson, Osceola, has been granted a franchise by the City Council to construct and operate an electric-light plant at Lorimor.

Bagley, Minn.—J. F. Druar, Consult. Engr., Commercial Bldg., St. Paul, Minn., is preparing plans for the reconstruction of the municipal electric-light plant at Bagley.

Bird Island, Minn.—The Renville County Electric Co. plans the construction of a transmission line to Buffalo Lake. J. H. Yarnell is Mgr.

+Little Fork, Minn.—S. S. Chapelle has awarded a contract for the construction of an electric-light plant at Little Fork to H. E. DUDREY, Moorhead, Minn.

Alton, Kan.—(Official)—See item under "Water Supply and Irrigation."

Canton, Kan.—The city will install a substation to furnish current for the street-lighting system. Philip R. Dunton, McPherson, is Engr.-in-Charge.

Neligh, Neb.—Plans have been prepared for the improvement and enlargement of the local electric-light plant. J. Y. Spirk is Egr.

Parker, S. D.—Plans are being prepared by J. F. Druar, Engr., Commercial Bldg., St. Paul, Minn., for the installation of a municipal electric-light plant at Parker.

Westby, N. D.—The installation of an electric-light plant in Westby is under consideration.

Fort Benton, Mont.—Plans are being considered by the City Council for the expenditure of $17,000 for the purchase of the electric-light plant and the improvement of the same.

Glendive, Mont.—E. T. Williams and R. B. Morrison have been granted a franchise by the city for the installation of a gas plant at Glendive.

Hamilton, Mo.—True D. Parr and C. A. Martin were granted a franchise to construct an electric-light and power plant at the recent election at Hamilton.

St. Joseph, Mo.—The City Council is considering plans for the enlargement and improvement of the municipal electric-light plant. W. E. Gorton is Supt.

Childress, Tex.—The electric-light plant, which was recently destroyed by fire, will be rebuilt at a cost of about $30,000.

Corpus Christi, Tex.—George M. Kennedy and associates have applied to the City Council for a franchise to use the streets for a natural-gas distributing system which they propose to lay. The gas will be brought from the White Point field, which is seven miles from Corpus Christi.

Marble Falls, Tex.—The Colorado River Power Co., which is headed by C. H. Alexander, Dallas, is preparing to construct a dam and hydro-electric plant on the San Saba River. The company is building a dam and hydro-electric plant on the Colorado River at Marble Falls.

Napier, Tex.—The Northeast Electric Co., of Texas, has been organized for the purpose of constructing an electric-light and power plant at Napier.

Antonio, Colo.—B. Desman, Salida, contemplates the construction of an electric-light plant at Antonio. Estimated cost, $10,000.

Seattle, Wash.—The City Council has made an appropriation of $10 000 to be used in the construction of a 76-in. penstock from the dam of the Cedar River power plant to the power house. This work is planned to strengthen and improve the power plant, and eventually the new penstock will replace the present wooden pipe lines, which are 48- and 68-in. ducts.

+Mapleton, Ore.—Richard Clow, who was recently granted a light and power franchise, has awarded to C. A. ELKINS and FRANK SHELL, Eugene, the contract for the erection and installation of a hydro-electric plant near Mapleton, for the generation of electric light and power. The dam will be of concrete, and a 12-in. pipe line, 2000 ft. long, will be laid. Noted June 25.

San Francisco, Calif.—The Contra Costa Gas Co. has been organized with a capital of $250,000 to install gas plants in Centra Costa County. J. E. Rodgers, Martinez, Calif., in interested.

Chatham, Ont.—The City Council will install an electric-lighting system along the river bank. W. G. Merritt is City Clk.

St. Catherines, Ont.—J. S. Campbell, Comr., will have plans prepared and call for bids for a new electric-lighting system to cost $18,000.

Simcoe, Ont.—The Town Council has passed a bylaw to provide $40,000 for the construction of a plant for street and commercial lighting. W. C. McCall is Town Clk.

Rossland, B. C.—The West Kootenay Power & Light Co. is preparing plans for the construction of a new electric-lighting system at Rossland.

+Victoria, B. C.—The SOUND CONSTRUCTION & ENGINEERING CO., Seattle, Wash., has been awarded a contract for the construction of a power plant for the Royal Jubilee Hospital at Victoria. Estimated cost, $26,200.

BRIDGES

+Lewiston, Maine—The contract has been awarded to the WATSON MFG. CO., Paterson, N J., for constructing a railroad bridge in Lewiston at $43,000.

Boston, Mass.—The following bids have been received by the Metropolitan Park Commission for reconstructing Wellington foot-bridge to take the place for a time of the one recently burned: Rendle & Stoddard, Boston, $32,568; H. P. Converse Co., Boston, $33 628; H. P. Nawn Contracting Co., Boston, $36,993; Wm. H. Ellis & Sons Co., $37,726; Holbrook, Cabot & Rollins Corporation, $40,080; Wm. L. Miller & Co., $44,100; Lawler Bros., $47,420; H. S. & S. T. Rendle, $48,024. No award is to be made until an appropriation is available. J. A. Rablin, 15 Beacon St. is Ch. Engr. Noted June 11.

+New York, N. Y.—The New York Central & Hudson River R.R. Co. has awarded the contract to R. P. JOHNSON, 149 Broadway, New York, for constructing the superstructures, including timber work, concrete work, paving and all incidntal work for 12 overhead bridges, one overhead bridge and one railroad bridge on the Hudson River Division.

Burlington, N. J.—A civic commission has been organized to arrange for the construction of a bridge between Burlington and Bristol, to be known as the John Woolman Memorial Bridge. E. E. Mount, Mayor of Burlington is Chn.

+Burlington, N. J.—The FERRO CONCRETE CO., Harrisburg, Penn., has been awarded the contract for a reinforced concrete arch bridge over Pensauken Creek, at Five Points, by the Burlington County Board of Chosen Freeholders.

Gleasonton, Penn.—See item under Railways: Pennsylvania-Gleasonton & Paddy's Run R.R.

+Hollidaysburg, Penn.—(Official)—Bids were opened, June 30, by the County Commissioners, of Blair County, Hollidaysburg, for constructing 11 reinforced concrete bridges in various parts of the county. Contracts were awarded to E. H. BRUA, Hollidaysburg; CURWENSVILLE CONSTRUCTION CO., Curwensville, Penn., FOGEL & CO., Hollidaysburg; LOOMIS & KING, Altoona, Penn.; VIPOND CONSTRUCTION CO., Altoona.

+Philadelphia, Penn—The contract has been awarded to STACEY REEVES & SONS, 2011 Market St., Philadelphia, for the erection of two steel bridges at Delaware Ave. and Morris St., for the John T. Bailey Rope Works. Peuckert & Wunder are Engrs.

Pittsburgh, Penn.—The city is considering the reconstruction of the Sylvan Ave. Bridge at a cost of $130,000. Robert Swan is City Engr.

+Uniontown, Penn.—The West Penn Rys. Co., June 22, awarded the contract to the PENN BRIDGE CO., Beaver Falls, Penn., for constructing a 195-ft. bridge over the Pennsylvania R.R. tracks at Uniontown. J. L. Fritsch is Ch. Engr., West Penn Rys.

Lonaconing, Md.—Bids will be received until July 10, by the city for constructing a bridge over Georges Creek. Estimated cost, $8000. William Harvey is City Engr. Noted May 21.

Leesburg, Va.—(Official)—Bids will be received until noon, July 16, by P. St. J. Wilson, State Highway Comr., Richmond, at the office of the Clerk, Leesburg, for constructing a reinforced concrete bridge over Crouch's Creek in Loudoun County; also for a reinforced concrete bridge over Horse Pen Creek, same county.

Bids will be received at the same place as above until noon, July 26, for constructing a reinforced concrete bridge over Broad Run., Loudoun County.

Petersburg, Va.—The plans of R. D. Budd, City Engr., for a bridge over the Appomattox River have been approved by the War Department. Estimated cost $55,000.

Mount Holly, N. C.—The Commissioners of Mecklenburg County, Charlotte, N. C., in conjunction with the Commissioners of Gaston County, will construct a bridge over the Catawba River at Mt. Holly. Estimated cost, $20,000.

Charleston, S. C.—The Carolina, Atlantic & Western R.R. plans to construct a bridge across Goose Creek, Charleston.

Arcadia, Fla.—Bonds for $350,000 have been voted by District No. 5 of De Soto County for constructing bridges and roads. H. E. Anschutz, Arcadia, is Highway Engr.

Batesville, Miss.—Bids will be received by R. W. Draper, County Clk., Batesville, for constructing a 1420-ft. steel trestle on Belmont Levee.

Meridian, Miss.—The city, the Meridian Lt. & Ry. Co., and the Alabama Great Southern R. R. Co., June 23, adopted plans for the proposed bridge to be constructed over the railroad tracks at 22nd Ave. T. A. McCaskill is City Clk.

Bowling Green, Ohio—Bids will be received until 1 p.m., July 27, by the County Commissioners, Bowling Green, for the construction of a reinforced concrete arch bridge in Washington Township. C. E. Stinebaugh is County Audr.

Caldwell, Ohio—(Official)—Bids will be received until 11 a.m., July 11, by M. C. Jones, County Audr., Caldwell, for constructing eight bridges in various parts of the county. Estimated cost, about $7500.

Cincinnati, Ohio—The County Commissioners of Clermont and Hamilton Counties have awarded contracts for the Miamiville and Remington Bridges as follows: Superstructures for both bridges, to the ROCHESTER BRIDGE CO., Rochester, Ind., at $18,620 each; substructure of Miamiville Bridge, to PETER PRAECHTER, Cincinnati, at $36,070; substructure of Remington Bridge, to CHARLES STAAB, Cincinnati, at $10,344.

Cincinnati, Ohio.—Bids will be received until noon, July 31, by the County Commissioners, Cincinnati, for constructing two concrete bridges on the Van Zandt Road. Albert Reinhardt is Clk.

Cleves, Ohio—The County Commissioners, Cincinnati, June 27, approved an estimate of $6188 for the approaches of the bridge over the Big Miami River at Cleves.

Covedale, Ohio—The Chesapeake & Ohio Ry. plans to construct a viaduct over its tracks at Ferguson Rd., Covedale. F. I. Cabell, Richmond, Va., is Ch. Engr.

Linn, Ohio—Chester & Fleming, Consult. Engrs., Pittsburgh, Penn., have completed plans for the bridge to be constructed at Pine St.

Miamisburg, Ohio—Bids will be received until July 11 by the Montgomery County Commissioners, Dayton, for constructing the substructure of the Linden Ave. Bridge. Victor Smith, Dayton, is County Surv. Noted July 2.

+Indianapolis, Ind.—The Board of Public Works, June 24, awarded the contract to the CENTRAL STATES BRIDGE CO. for constructing the superstructure of the proposed bridge across Pleasant Run at Minnesota St., at $7385.

✦Manistee, Mich.—The [illegible] has awarded the contract to the CONTINENTAL BRIDGE CO., Chicago, Ill., for constructing [illegible] bridge at Manistee at $[illegible].

✦Metropolis, Ill.—[illegible]—The contract has been awarded to the UNION BRIDGE & CONSTRUCTION CO., [illegible], Kansas City, Mo., for [illegible] seven [illegible] for a [illegible] bridge over the Ohio River at Metropolis, Ill. The bridge is being built by the Paducah & Illinois R.R., [illegible] of the Chicago, Burlington & Quincy R.R. and the Nashville, Chattanooga & St. Louis R.R. [illegible]. The contract [illegible] about $[illegible]. The finished bridge will cost about $[illegible]. The total length of the bridge [illegible] the approaches, will be [illegible] ft. The [illegible] of the [illegible] ft., three [illegible] ft. There will be approx. [illegible] in the seven piers. Work is [illegible] to be put on pile [illegible] will be constructed by the railroad company [illegible]. The steel spans are to be of the [illegible] type of [illegible] the longest being [illegible] ft.; [illegible] will be [illegible] ft. and [illegible] center to center of piers. C. H. Cartlidge is [illegible] for the company. C. E. Fowler will be [illegible] Engr. [illegible] will represent the contractor during the construction of the bridge.

✦Genderay, Wis.—The city has awarded the contract to the WAUKESHA ALLEN CO., Milwaukee, Wis., for constructing [illegible] reinforced concrete bridges.

✦Eau Claire, Wis.—The contract has been awarded the [illegible] CONSTRUCTION CO., Eau Claire, for the construction of the [illegible] reinforced concrete bridge over Otter Creek between Eau Claire and [illegible], Wis.

Muscatine, Iowa.—The City Council June 18 instructed [illegible] City Engr., to prepare plans and specifications for a bridge to be constructed over Mad Creek at East [illegible] St. Estimated cost, about $[illegible].

✦Bemidji, Minn.—[illegible]—The county has awarded the contract to [illegible] W. CLIFFORD for constructing [illegible] bridges at $[illegible]. Bids were opened June 26. Noted [illegible].

Le Sueur, Minn.—The city is receiving bids for the construction of [illegible] steel bridge. J. A. Morgan is City Clk.

St. Paul, Minn.—The City Council June 21 approved plans for [illegible] to be constructed over the tracks of the [illegible] Milwaukee & St. Paul Ry. tracks.

Winona, Minn.—The city plans to construct a bridge to [illegible]. H. [illegible] is City Engr.

Worthington, Minn.—Bids will be received until 2 p.m. [illegible] County Audr., Worthington, for constructing bridges in [illegible] and [illegible] Townships.

Atchison, Kan.—The Atchison, Topeka & Santa Fe Ry. Co. and the Missouri Pacific R.R. Co. have agreed to construct a [illegible] over their tracks in West Atchison.

Grantville, Kan.—W. J. [illegible], Topeka, Kan., Shawnee County Engr., is preparing plans for a bridge to be constructed over the Kansas River, near Grantville, to connect [illegible] and Jefferson Counties.

Hays City, Kan.—Bids will be received at the office of [illegible], County Clk., Hays City, until noon, July [illegible], for the construction of two bridges in Ellis County.

✦Kansas City, Kan.—Bids will be received until July 27 by the Wyandotte County Commissioners, Kansas City, for constructing a high-line bridge across the Kaw River known as [illegible] Estimated cost $[illegible]. Frank [illegible] is County Clk. Noted June 18.

Salina, Kan.—[illegible] & Zeile, Engrs., Salina, have been commissioned by the County Commissioners to prepare plans and specifications for the proposed bridge at Iron Ave., [illegible]. Estimated [illegible]. Noted Apr. [illegible].

Salina, Kan.—The [illegible] will construct a new steel girder bridge over [illegible] Hill River. H. C. Smith [illegible] is Engr.

Hughs, N. D.—Bids will be received until July 21 by [illegible] County Audr., [illegible], for constructing a reinforced concrete bridge.

✦Kansas City, Mo.—Bids were opened by the County [illegible] for constructing the approaches to the bridge [illegible] over the tracks of the Missouri Pacific Ry. The [illegible] was awarded to [illegible] PHILLIPS & WINFREY at $[illegible]. Noted June [illegible].

Angleton, Tex.—Bids will be received until July [illegible] by [illegible], County Judge, Angleton, for constructing [illegible] bridges [illegible] Hoskin's Ferry and Churchill's Ferry.

Dallas, Tex.—See item under Miscellaneous Structures—[illegible].

Lockhart, Tex.—Bonds will be issued by the city to construct a bridge on North [illegible] St.

✦Rockport, Tex.—[illegible]—We are advised by [illegible] [illegible]

✦San Antonio, Tex.—The city June [illegible] awarded the contract to the [illegible] CONSTRUCTION CO., Denver, for constructing the proposed bridge over Alazan Creek, at West [illegible].

✦Yuma, Ariz.—The contract has been awarded to the [illegible] for constructing a steel bridge over the Colorado River near Yuma, at $[illegible].

✦Aberdeen, Wash.—The County Court of Chehalis County has awarded the contract for the construction of a reinforced concrete bridge near here to BAILEY & O'CONNOR, [illegible], Wash., at $[illegible].

Ellensburg, Wash.—Bids will be received until noon July [illegible] by the County Commissioners, Ellensburg, for constructing three concrete bridges.

✦Everett, Wash.—The contract has been awarded to GEORGE H. GRIFFIN, Seattle, for the steel bridge to be constructed over the Skykomish River, at [illegible]. The bridge will have three steel spans, with concrete abutments, and will be [illegible] ft. long.

The County Commissioners, Everett, plan to construct four bridges and a roadway to cost $[illegible].

Walla Walla, Wash.—E. B. [illegible], Engr., Walla Walla, is preparing plans for a bridge to be constructed across the Touchet River, known as the Dell [illegible] Bridge, recently destroyed. Estimated cost, about $[illegible].

✦Astoria, Ore.—The County Court of Clatsop County has awarded the contract for the construction of five steel bridges to the PORTLAND BRIDGE CO., Portland, Ore., at $[illegible].

Portland, Ore.—Bids will be received by W. L. Malvey, County Clk., Multnomah County, until July [illegible] for the construction of the Bear Creek bridge, near Newby. [illegible] were to have been opened June [illegible], but the time was extended.

Portland, Ore.—Plans for the viaduct over [illegible] to be built by the Oregon-Washington R.R. & Navigation Co. and the Southern Pacific Co. jointly, have been prepared by the City Department of Highways and Bridges. The structure will be of steel and will cost about $[illegible]. The [illegible] plans replace those previously prepared by the railway companies, but rejected by the city. John R. [illegible] is City Engr.

Esparto, Calif.—The County Surveyor, Woodland, Calif., has completed a survey for a bridge to be constructed across [illegible] Creek north of Esparto. Estimated cost, $[illegible].

Sacramento, Calif.—[illegible]—Bids will be received until 2 p.m., July 20, by the California Highway Commission, Sacramento, for constructing the Yolo [illegible] Viaduct. [illegible] opened June 8 for this work were rejected. [illegible] Fletcher, State Highway Engr., has estimated the cost at $[illegible]. Noted Feb. 25, Mar. [illegible], Apr. [illegible] and June [illegible].

San Jose, Calif.—Bids will be received by the Board of Supervisors of Santa Clara County until July [illegible] for the construction of a reinforced-concrete bridge over [illegible] Creek on Martin Ave., San Jose.

Sonora, Calif.—Bids will be received by the County Supervisors, Sonora, until Sept. 7 for constructing a [illegible]-ft. concrete bridge with an [illegible]-ft. roadway over Sullivan Creek. Estimated cost, $[illegible]. [illegible] Newell is County [illegible].

✦McTaggart, Sask.—The Provincial Government Board of Highway Commissioners has awarded the contract to the PARSONS CONSTRUCTION & ENGINEERING CO., LTD., Regina, Sask., for constructing a reinforced concrete bridge and dam near McTaggart at about $[illegible].

WATER SUPPLY—IRRIGATION

West Pownal, Maine.—Bids will be received until July [illegible] for the construction of a concrete reservoir at the Maine School for Feeble Minded. Arthur [illegible], [illegible] St., Portland, is the Engr. Carl J. [illegible] is the Supt.

✦Lewiston, Maine.—[illegible]—The contract for installing new pumps at the water works has been awarded by C. J. Callahan, Clk., to the DEAN STEAM PUMP CO., Holyoke, Mass. Y. B. Langley is Supt. Noted June [illegible].

Beverly, Mass.—The city will lay water mains in [illegible] St. at an estimated cost of $[illegible].

Boston, Mass.—Bids will be received by the Public Works Department until July [illegible] for laying and relaying [illegible] ft. of [illegible]-in. water pipe in Columbus Ave., Roxbury District. L. K. Rourke is Comr.

The Metropolitan Water [illegible] plans to erect a stand pipe in West Roxbury district costing $[illegible]. Dexter Brackett is Ch. Engr., Metropolitan Water [illegible].

Fall River, Mass.—The Watuppa Water Commission has had plans prepared for the construction of [illegible] along the west shore of the North Watuppa Pond. Estimated cost, $[illegible].

Haverhill, Mass.—See item under "Sewers."

Lowell, Mass.—The Commissioner of the Water Department has recommended the erection of a [illegible] plant to cost $[illegible]. [illegible] L. [illegible] is City Engr.

Webster, Mass.—On June [illegible] bonds for $[illegible] for the construction of a concrete reservoir with a capacity of [illegible] gal. were voted. A concrete conduit [illegible] will be constructed at [illegible]. [illegible] is Supt. of Water Dept. Noted [illegible].

Albany, N. Y.—A bond issue of $[illegible] for the extension of the water mains has been authorized. Noted June [illegible].

✦Bedford Hills, N. Y.—[illegible]—Bids will be received by [illegible] of the [illegible] of Mgrs., New York State Reformatory for Women, until [illegible] p.m., July [illegible], for constructing a water system and for [illegible] Plans are on file with Lewis F. Pilcher, Capitol, Albany.

Canajoharie, N. Y.—The [illegible] contemplate spending $[illegible] for the extension of the water system.

Gilbertsville, N. Y.—[illegible]—Bids will be received by [illegible] until [illegible] p.m., July [illegible], for constructing [illegible] earth dam, diversion channel and [illegible] lines.

New York, N. Y.—[illegible]—Bids will be received by the Commissioner of Water Supply, Gas and Electricity, Municipal Bldg., until [illegible] p.m., July [illegible], for laying water mains in

the Borough of the Bronx, for installing dock hydrants and for laying water mains in the Borough of Brooklyn. William Williams is Comr.

+Harrisburg, Penn.—The contract for laying c.-i. water pipe has been awarded by the Department of Public Safety to the JOHNSON CONSTRUCTION CO., at \$0.22 per ft. Bids opened June 15. Noted June 11.

Johnstown, Penn.—The Johnstown Water Co. will construct two reservoirs in the near future.

Mahonoy City, Penn.—The Mahonoy City Water Co. will enlarge its Lofty reservoir to double its present capacity.

Morgantown, Penn.—The Morgantown Water Co. recently incorporated, will construct a water system at Morgantown. Stephen H. Mast is one of the incorporators.

+Reading, Penn.—(Official)—The contract for repairing and reconstructing the Antietam Dam has been awarded by Charles Marks to WILLIAM H. DECHANT, Baer Bldg., Reading, at about \$16,000. Bids opened July 1. Noted June 25.

Richland, Penn.—Bids will be received by the Borough Council until July 13 for c.i. water pipe, valves, etc. F. H. Shaw, Lancaster, is Consult. Engr.

+Crisfield, Md.—The contract for extending the water system has been awarded by the City Council to CHARLES OWENS, Bridgeville, Md., at \$6994. Bids opened June 15. Noted June 11.

Kensington, Md.—Bids will be received until 8 p.m., July 13, for \$50,000 water and sewer bonds. H. W. Hatton is Consult. Engr.

Wilmington, N. C.—The citizens contemplate spending \$25,000 for the installation of a water system. T. D. Meares is City Clk.

Manchester, Ga.—Press reports state that the City Council contemplates constructing a water works and sewer system.

Dade City, Fla.—Bonds for \$20,000 for the construction of a water system were recently voted. Noted June 11.

Perry, Fla.—See item under Sewers.

Seabreeze, Fla.—The citizens contemplate constructing a water system at Seabreeze.

Collinsville, Ala.—The citizens recently voted \$16,000 for the installation of a waterworks system.

Jackson, Ala.—The installation of a water system and electric-light plant to cost \$15,000 is being considered by the city. C. W. Boyles is Mayor.

Columbia, Tenn.—The Solomon-Norcross Co., Candler Bldg., Atlanta, Ga., has been engaged by the city of Columbia to prepare plans for the construction of a water system.

Lawrenceburg, Ky.—According to press reports the city will build a new pumping station on Salt River for its water system.

Providence, Ky.—The installation of a water system is contemplated by the citizens of Providence.

Winchester, Ky.—The city contemplates constructing a pumping station on the Kentucky River in connection with its water system.

Cincinnati, Ohio—The Service Director has been authorized to lay a 36-in. water main in Spring Grove Ave. near Winton Pl. and in Deerfield Road and Eastern Ave. The estimated cost is \$47,000 and \$53,000 respectively. Philip Fosdick is Dir.

Clyde, Ohio—Bids will be received by the Clerk, Board of Trustees, Public Affairs, until July 21 for improving the water system.

Dayton, Ohio—A bond issue for about \$80,000 for extensions and improvements to the water system has been authorized by the City Commission. Noted Apr. 2.

Toledo, Ohio—(Official)—The W. J. Sherman Co., Nasby Bldg., Toledo, has been retained by the city of Toledo to prepare plans for the construction of a high-pressure system. Noted Dec. 4 and June 11.

Tell City, Ind.—Bids will be received by the City Clerk until July 14 for furnishing new equipment for the city water works. Robert M. Cass, 318 American Central Life Bldg., Indianapolis, is Consult. Engr.

Highland Park, Mich.—Bids will be received by the Village Clerk until July 13 for constructing a 30-in. c.i. supply main from Lake St. to Highland Park.

Wyandotte, Mich.—The citizens have authorized the expenditure of \$40,000 for the improvement of the municipal water system.

★Summit, Ill.—(Official)—Bids will be received until 8 p.m., July 23, for installing machinery, constructing a concrete reservoir and pipe for the water system. Plans are on file with J. W. Cook, 237 South La Salle St., Chicago, Ill. is Engr.

Troy, Ill.—The city contemplates installing a water system. F. H. Garnet is City Clk.

Albany, Wis.—Bids will be received by F. E. Graves, Village Clk., until 7:30 p.m., July 15 for furnishing one duplex or triplex pump with a capacity of 200 gal. per minute and a gasoline engine. W. G. Kirchoffer, Madison, Wis., is Engr. Noted Feb. 19.

Muscatine, Iowa—The municipal water system will be enlarged and extended in South Muscatine. William Molis is Supt. of the Water System. Noted Feb. 19.

Rockwell City, Iowa—The Town Council contemplates spending \$30,000 for the extension of the water and sewer systems.

+Buhl, Minn.—The contract for sinking a 700 ft. well has been awarded by the Village Council to IVER OLSON, Buhl, at \$8400.

Alton, Kan.—(Official)—Bids will be received by F. C. Search, City Clk., until 8 p.m., July 15 for installing a water system and an electric-light plant. The estimated cost is \$30,000. Tollins & Co., 420 Midland Bldg., Kansas City, Mo., are the Engrs. Noted June 4.

Arkansas City, Kan.—Bids will be received by Burns & McDonnell, Kansas City, until July 21 for making improvements to the water system. Noted June 18.

Arma, Kan.—The citizens contemplate spending \$10,000 for the improvement and extension of the water system and electric-light plant. H. C. Mahon is City Clk.

Belpre, Kan.—The citizens contemplate installing a water system.

Douglas, Kan.—The city contemplates issuing \$15,000 in bonds for the construction of a distribution system. C. A. Ogg is City Clk. Albert C. Moore, Bartlett Bldg., Joplin, Mo., is Engr.

Havelock, Neb.—The City Council has authorized the preparation of plans for the extension of the water system.

Wayne, Neb.—Bonds for the extension of the water system have been voted. J. M. Cherry is Clk.

Choteau, Mont.—Plans have been prepared by Sweringen & McCulloh for the installation of a municipal water system. Noted Feb. 19.

Harlowtown, Mont.—An expenditure of \$15,000 for the installation of a water system is contemplated by the City Council.

Kansas City, Mo.—Press reports state that the Board of Fire and Water Commissioners will spend \$150,000 for the installation of new pumps at the Turkey Creek pumping station. Burton Lowther is Ch. Engr.

Rockport, Mo.—The city contemplates spending \$12,000 for extensions to the water works. John T. Wells is City Clk.

Benton, Ark.—See item under Sewers.

+Alta Loma, Tex.—The contract for drilling two wells has been awarded to LAYNE & BOWLER, Houston, at \$13,080. Noted May 21.

+Beaumont, Tex.—Contracts for the construction of a water system were awarded by the city to BRASH & GRAY, Joplin, Mo., for settling basin, at \$24,290; and to the AMERICAN CAST-IRON PIPE CO. for pipe, at \$5000.

Ennis, Tex.—At an election June 23 bonds for \$197,500 were voted for the installation of a water system, street paving, a city hall and a sewer system.

+Fort Bliss, Tex.—The contract for extending the water system has been awarded to MAYFIELD & SHAW at \$15,000.

Livingston, Tex.—Plans are being prepared by Brown & Wilder, Houston, for the construction of a water system for Livingston.

Pecos, Tex.—The Pecos & Toyo Lake Irrigation Co. has filed application with the State Board of Water Engineers for the appropriation of water from the Pecos River for the irrigation of 6000 acres of land.

San Benito, Tex.—The City Council has granted a 50-year franchise to S. A. Robertson, trustee, to furnish the town with water, light and telephone service. The franchise will be transferred to a syndicate of Eastern capitalists, which will take over the plant of the San Benito Water Co. It is planned to install new machinery and make other improvements.

Lehigh, Okla.—Bonds for \$40,000 for the extension of the water system have been voted.

Denver, Colo.—Bids will be received by the Public Utilities Commission until July 20 for \$8,000,000 of bonds for the purchase of the water works. Noted July 18.

Bancroft, Idaho—Bids will be received by the Village Trustees, until July 10, for installing a water system. About two miles of pipe and a reservoir will be required. T. H. Humphreys, Logan, Utah, is Engr. Noted June 18.

Beaver, Utah—At a recent election, bonds for \$30,000 for the installation of a municipal water system were voted.

Bingham Canyon, Utah—Bids will be received by the Town Board until 2 p.m., July 22, for furnishing 220 tons of 6- and 8-in. c.i. water pipe and 4000 lb. of special castings. Francis W. Quinn is Town Clk.

Salt Lake City, Utah—The city will build a reservoir on the Fort Douglas military reservation on 5th S. St., near 15th E. St. Sylvester Q. Cannon is City Engr.

Glendale, Ariz.—Bonds for \$50,000 for the purchase of the water system have been voted. New machinery will be installed and extensions made at an estimated cost of \$25,000

Seattle, Wash.—Meacham & Babcock submitted the lowest bid to the Board of Public Works for the construction of a water main tunnel under Lake Washington Canal at 7th Ave. N. E. The bid for a concrete lined tunnel was \$183,511, and for brick lining, \$193,449.

Molalla, Ore.—The City Council has authorized the expenditure of \$10,000 for the installation of a water system. Noted Apr. 2.

Eureka, Calif.—The city will buy the Eureka Water Co. and will make improvements. G. A. Strand is City Engr.

Hanford, Calif.—The East Side Irrigation Co. has been organized to construct irrigation canals at an estimated cost of \$20,000. J. W. Barbour, Mack Lovelace and S. Richardson, Crocker Bldg., San Francisco, are interested.

Modesto, Calif.—Plans have been prepared by R. A. Edwards, 2080 Green St., San Francisco, for new flumes, fills and canals for the Modesto Irrigation District. The estimated cost is \$600,000. Noted Apr. 16.

+Pasadena, Calif.—The contract for constructing a 4,000,000-gal. concrete lined reservoir has been awarded by the William Allin Estate to ROBERT YOUNG, 601 El Centro St., South Pasadena, at \$12,800.

Riverbank, Calif.—The Riverbank Water Co. will construct a steel tank with a capacity of 50,000 gal. on a 50-ft. tower. B. W. Hobart is Mgr.

★Montreal, Que.—(Official)—All bids received May 19 for the installing of two 12,000,000-gal. pumps have been re-

[illegible] The [illegible] will be readvertised and bids received about July [illegible] [illegible] is Secy. Noted May 7.

✦New Toronto, Ont.—[illegible] for furnishing hydrants and valves [illegible] steel tank have been awarded to the CANADIAN [illegible] CO., Toronto, at $11,-[illegible] for hydrants and valves and to the CANADA BRIDGE & IRON Co., [illegible] at $[illegible] for the steel tank. Noted June [illegible].

SEWERS

✦Boston, Mass.—The contract for constructing sewers in [illegible] Sts., West Roxbury, [illegible] has been awarded to JAMES DRISCOLL & SON CO. at $[illegible]. [illegible] Anthony [illegible] Martin De Matteo, $[illegible]; West [illegible], $[illegible]; [illegible], $[illegible]; Antony [illegible], $[illegible]; [illegible] M. H. Keliher, $[illegible]; [illegible] Walsh, $[illegible]; Michael Meehan, $[illegible]. [illegible] is Comr. of Pub. Wks. Noted June [illegible].

Fitchburg, Mass.—[illegible] will be received by the [illegible] until [illegible] p.m., July 14, for constructing [illegible] and about [illegible] ft. of 72-in. storm sewer. [illegible] A. Hartwell is Chief Engr.

Haverhill, Mass.—The city contemplates constructing sewers [illegible] to protect the watershed at Kenoza Lake. The estimated cost is $[illegible].

✦New Bedford, Mass.—The contract for building and erecting [illegible] superstructure and [illegible] for the [illegible] house of the intercepting sewer system has been awarded to the F. F. WOOD ROLLER Co. at $[illegible]. [illegible] from the New Bedford Boiler & Machine Co., $[illegible]; New England Structural Co., $[illegible].

Warren, R. I.—The City is considering installing a sewer [illegible] at an estimated cost of $[illegible].

✦Middletown, Conn.—(Official.)—The City Council received bids for constructing the sewerage system [illegible] the western [illegible] of the city from A. BRAZOS & SON, Middletown, Conn., $[illegible] (awarded contract); Frank Arrigoni & Bro., Middletown, Conn., $[illegible]; Lepardi [illegible] & Tommasette, Meriden, Conn., $[illegible]; [illegible] Engineering & Contracting Co., Hartford, Conn., $[illegible]; Young & [illegible] Inc., New York, N. Y., $[illegible]. Bids for constructing the sewage disposal plant were received from Silvestro Masotti, Middletown, Conn., $[illegible]; FRANK ARRIGONI & BRO., Middletown, Conn., $[illegible] (awarded contract); Suburban Engineering Co., New York, N. Y., $[illegible]; A. Vignola & Co., [illegible], N. Y., $[illegible]; Young & [illegible] Inc., New York, N. Y., $[illegible]; Pierson Engineering & Contracting Co., Hartford, Conn., $[illegible]. J. M. Lacey is City Engr. Plans were prepared by Alexander Potter, [illegible] Church St., New York, N. Y. Noted June 18.

✦West Haven, Conn.—(Official.)—The contract for constructing about [illegible] miles of vitrified pipe sewers from [illegible] in diameter has been awarded to ROBERT BAILEY & F. F. MAHER, New Haven, at $[illegible], and the contract for constructing the pumping station and sewage disposal plant to the ATLANTIC CONSTRUCTION CO. & CALDWELL-WINGATE Co., at $[illegible]. The above figures differ from the [illegible] totals as printed in the issue of July 2.

✦West Haven, Conn.—The contract for furnishing the [illegible] pipe for the sewer system has been awarded to the [illegible] Co., [illegible] State [illegible] St., New Haven, Conn. [illegible] ft. of [illegible] pipe will be required. [illegible] St., New York, N. Y., is Engr. Noted [illegible] 25, June [illegible], July 2.

✦Albany, N. Y.—(Official.)—The contract for constructing the sewage disposal works has been awarded by the Board of Contract and Supply to the RIVERDALE CONTRACTING Co., New York, N. Y., at $[illegible] [illegible]. Other bids were from [illegible], Rochester, N. Y., $[illegible]; [illegible] Construction Co., New York, N. Y., $[illegible]; [illegible], Chicago, Ill., $[illegible]; Mason, Hanger & Co., [illegible]; [illegible] Co., New York, N. Y., $[illegible]. Noted Apr. [illegible] and June 11.

Bedford Hills, N. Y.—Bids will be received by [illegible] of [illegible] N. Y. State Reformatory for Women, for building, additions and alterations to sewerage and sewage disposal plant [illegible] for water supply [illegible] of [illegible].

New York, N. Y.—[illegible] bids will be received by [illegible] of the Borough [illegible] for the [illegible] in the [illegible] 111th St. between [illegible] and [illegible] Aves.

Oneida, N. Y.—[illegible]

✦Syracuse, N. Y.—[illegible]

Jersey City, N. J.—[illegible]

Newark, N. J.—[illegible]

✦[illegible]

✦Aliquippa, Penn.—[illegible]

Hazleton, Penn.—[illegible]

✦Lebanon, Penn.—The contract for constructing the second unit of [illegible] sewerage has been awarded as follows: For two sections, J. A. FLETCHER, at $[illegible] and $[illegible], respectively, and to BENNETT & RANDALL at $[illegible], for the third section. Noted June 4.

Laurel, Md.—The City Council has commissioned Harry Stevens, Washington, D. C., to prepare plans for installing water works, filtration plant and a complete sewage disposal plant. The estimated cost is $[illegible].

Petersburg, Va.—The city will construct a 36-in. concrete sewer, estimated to cost $[illegible]. The work will be done by day labor. [illegible] Budd is City Engr.

Kinston, N. C.—The City has voted $[illegible] in bonds for sewer and other improvements. F. I. Sutton is Mayor. Noted May 27, [illegible].

Clearwater, Fla.—The city contemplates the construction of a sanitary sewer, estimated to cost $[illegible].

Leesburg, Fla.—The City Contemplates the installation of a sewer system.

Perry, Fla.—The city will construct a sewer system and water works. Plans have been prepared. C. L. Brandon is City Clk.

Memphis, Tenn.—Bids were received by the Board of City Commissioners for constructing the storm sewer on Keel Ave. from F. D. Harvey & Co., $[illegible]; Koehler Bros. & Fowler Construction Co., $[illegible]; Noll Construction Co., $[illegible]; George O. White & Co., $[illegible]; Pouncey Paving & Construction Co., $11,17[illegible].

Paducah, Ky.—The Aetna Engineering Co., Chicago, Ill., is preparing plans for a trunk sewer system. Bids will be received about Aug. 1. L. A. Washington is City Engr.

✦Akron, Ohio—It is reported that the contract for building a portion of the work on the sewage disposal plant has been awarded to DUQUESNE CONSTRUCTION CO., Pittsburgh, Penn. The following are the item bids: Removing earth excavation, at $[illegible]; rock excavation, $[illegible]; rolled embankment, $[illegible]; parking, $[illegible]; and macadam roadways, $[illegible]. Noted July 2.

Amherst, Ohio—Bids will be received by C. G. Aschenbach, Village Clk., until noon, July 21, for [illegible] ft. of sanitary sewers in Woods, East, North and South Hazel Sts.

Cleveland, Ohio—Bids will be received by A. R. Callow, Comr. of Purchases and Supplies, until noon, July 16, for constructing a sewer in Eastern Boulevard.

✦Sandusky, Ohio—The contract for constructing the South [illegible] sewer system has been awarded to J. C. CARLAND & CO., Toledo, Ohio, at $[illegible].

✦Steubenville, Ohio—The contract for constructing a sewer in Spring Ave. has been awarded to Harry M. Bates, Steubenville, at $[illegible]. T. M. Kennedy is Clk.

Westerville, Ohio—Bids will be received by the Village Council until noon, July 1[illegible], for extending and improving the sanitary sewer system. R. D. [illegible] is Village Clk.

Greencastle, Ind.—The city will construct a sewer system estimated to cost $[illegible]. Vitrified pipe [illegible] will be used. [illegible] is City Engr.

New Albany, Ind.—The city contemplates constructing a trunk sewer.

✦Grand Rapids, Mich.—The contract for constructing the Madison Ave. sewer has been awarded to RICHARD FICKETT, at $[illegible].

Traverse City, Mich.—The city plans to construct sewers and a disposal works. Bonds for $[illegible] have been voted.

Herwyn, Ill.—Bids will be received by the Board of Local Improvements until [illegible] July [illegible], for constructing a sewer in 16th St. Plans are on file with Arthur [illegible], [illegible] State St., Chicago, Ill. [illegible] is Secy. of the Bd.

Chicago Heights, Ill.—(Official.)—Bids will be received by the Board of Local Improvements until [illegible] p.m., July 11, for installing a sanitary sewer system. [illegible]

Farmer City, Ill.—[illegible]

✦Freeport, Ill.—[illegible]

Geneva, Ill.—[illegible]

Springfield, Ill.—[illegible]

Elkhorn, Wis.—[illegible]

+Aledo, Iowa—It is reported that the contract for constructing sewers has been awarded to DALTON BROS., Wilmette, Ill., at $5316.

Clarion, Iowa—Bids will b received by F. W. Walker, City Clk., until July 21, for constructing a sewer system.

Keota, Iowa—Plans are being prepared by the Iowa Engineering Co., 123 Sixth Ave., Clinton, for constructing a sewer estimated to cost $30,000.

Rockwell City, Iowa—See item under "Water Supply and Irrigation."

Wapello, Iowa—Bids will be received by the City Recorder until July 9, for constructing either vitrified brick or concrete pipe sewer, Sub-Sewage District, No. 3. The Central States Engineering Co., Muscatine, is Engr.

Waterloo, Iowa—Bids will be received by the City until 7:30 p.m., July 13, for constructing 8-, 10-, 12-, 15- and 30-in. sewers, also a pump house. C. A. Roby is City Engr.

Staples, Minn.—Bids will be received by the City Clerk until July 14, for constructing a sewage disposal plant.

Carthage, Mo.—Bids will be received by the City Council until 5 p.m., July 28, for constructing a trunk sewer, estimated to cost $25,000. James B. Lloyd is City Clk.

Benton, Ark.—Press reports state that bids will be received about Nov. 1, for constructing sewer and water works systems, estimated to cost $60,000. E. A. Kingsley, Little Rock, Ark., is Engr.

Dallas, Tex.—The City will construct a 12-, 15- and 18-in. sanitary sewer in Fitzhugh Ave. R. R. Nelms is City Water and Sewer Comr.

Eagle Pass, Tex.—The City Council contemplate the installation of a sewer system.

Ennis, Tex.—The City has voted $30,000 in bonds for constructing a sewer system. W. D. Farris is Mayor.

+San Antonio, Tex.—The following contracts have been awarded by the City Council; for sewers in Seventh Ward, TRUEHART & JACKSON, $13,070; Peach St. District, BAILEY & REEDER, $16,003 Degnowity Hill District, SAN ANTONIO ENGINEERING & CONSTRUCTION CO., $5432. Noted June 4.

Palouse, Wash.—Bids will be received by the City Clerk, until July 14, for constructing a sewer system in Local Improvement District No. 2. J. M. McCaw is City Engr.

+Seattle, Wash.—The contract for constructing a sewer in East 56th St. has been awarded by the Board of Public Works to A. M. FIORITO at $7545. Noted June 11.

+Portland, Ore.—The contract for constructing a vitrified pipe sewer in Rhine St. has been awarded to WILLIAM LIND at $108,599.

Azar & Co. at $7679 submitted the lowest bid for constructing a sewer in East 55th and East Oak St. Noted June 25.

Long Beach, Calif.—Bids will be received by the Board of Public Works until noon, July 22, for constructing a complete sewer system. Bonds for $340,000 have been voted. Noted June 11, and June 25.

Los Angeles, Calif.—Bids will be received by the Board of Public Works until July 13, for constructing a brick and monolithic concrete storm sewer in Santa Monica Boulevard Madison Ave. and in 15 other streets. Homer Hamlin is City Engr.

Stege, Calif.—It is reported that the city has sold $75,000 bonds for installing a sewer system.

Vancouver, B. C.—It is reported that bids will be received by the Joint Sewage Commission, Greater Vancouver, until July 18, for installing lateral sewers to connect with trunk mains, now installed. The estimated cost is $300,000.

STREETS AND ROADS

+Augusta, Maine—Contracts for highway construction work have been awarded as follows: R. G. MILLER, Hartford, Conn., $30,440 for 5.61 miles, at Norridgewack; FORGIONE & ROMANO, South Portland, $18,085 and $19,284 for 3.64 miles at Farmington and 3.41 miles at Strong, respectively; WISEMAN & McPHAIL, Smyrna Mills, $30,533 for 9.23 miles at Whiting; C. M. THOMPSON, Kingman $9995 for 1.59 miles at Newport, and J. G. FLEMING, Lincoln, $16,107 for 2.70 miles at Etna.

Concord, N. H.—Bids will be received by S. Percy Hooker, State Supt. of Highways, until 1 p.m., July 13, for improving parts of roads in Petersborough, Auburn, Amherst, Winchester, Derry, Madison and Merrimack Townships.

Boston, Mass.—Bids will be received until July 13 for bituminous macadam roadway on Denton Terrace and St. Rose St., West Roxbury District. L. K. Rourke is Comr.

+Holyoke, Mass.—A contract for laying roman road pavement on Northampton and Dwight Sts. has been awarded to DANIEL O'CONNELL'S SONS at $1.45 per sq.yd.

Woburn, Mass.—The City Council has appropriated $20,500 for macadam work on Main, Washington, Pine and Green Sts. W. Henchey is Mayor.

Hartford, Conn.—Bids for state road work were received by the State Highway Commission, June 30, as follows:

Brooklyn Township, 4850 lin.ft. native stone macadam construction on the Wauregan Road: Frank Arrigoni & Bro., Middletown, $9472; Ahern Construction Co., Willimantic, $9458; Goodman & Trumbull Co., Litchfield, $8448; John deMichiel & Bro., Torrington, $9069.

Manchester Township, about 3425 lin.ft. plain concrete (a) or reinforced concrete (b) on Chapman Road: Piersen Engineering & Contracting Co., Hartford, (a) $13,228, (b) $14,041; Goodman & Trumbull Co., Litchfield, (a) $18,031, (b) $18,640; Connecticut Hassam Paving Co., New Haven, (a) $11,559; Bristow Bros. & Knowles Corporation, Narragansett Pier, R. I., (a) $12,035, (b) $12,170; Olmstead & Olmstead, East Hartford, (a) $16,090, (b) $16,619; A. C. Sternberg Jr. Contracting Co., West Hartford, (a) $11,865, (b) $12,611.

Westborok Township, about 4365 lin.ft. native stone macadam (a) or native resurfacing (b) on the Essex Road: Kellogg & Gregory Co., Danbury, (a) $9168, (b) $5971; John deMichiel & Bro., Torrington, (a) $8097, (b) $5482; Leonardo Suzio, Meriden, (a) $9259, (b) $6013; Robert G. Miller Contracting Co., Hartford, (a) $9004, (b) $6214; Piersen Engineering & Contracting Co., Hartford, (a) $10,502, (b) $7318; Godman & Trumbull Co., Litchfield, (a) $9011, (b) $6242; Bristow Bros. & Knowles Corporation, Narragansett Pier, R. I., (a) $8929, (b) $6714; A. Brozos & Sons, Middletown, (a) $9781, (b) $6898; Frank Arrigoni & Bro., (a) $8992, (b) $5246; Olin T. Benedict, Pittsfield, Mass., (a) $8815, (b) $5991; John Arborio, New Haven, (a) $8601, (b) $5685.

Salisbury Township, about 4040 lin.ft. graded construction on Smith Hill: E. B. Alfred, New Hartford, $4246; B. D. Pierce Jr. Co., Bridgeport, $4773; Beacco & Co., Stockbridge, Mass., $5101; Curran Corporation, Middletown, $4450; Cæsar A. Rossi, Torrington, $3765; Porcaro Construction Co., Willimantic, $4513; Joseph Mascetti, Torrington, $4220; Kellogg & Gregory Co., Danbury, $4490; John deMichiel & Bro., Torrington, $3307.

Putnam Township, about 6307 lin.ft. native stone bitiminous macadam (a) or trap rock bituminous macadam (b) on Woodstock Ave.: A. Vito Construction Corporation, Thompson, (a) $13,492, (b) $16,727; A. D. Bridge's Sons, Inc., Hazardville, (a) $13,916, (b) $13,351; Frank Arrigoni & Bro., Middletown, (a) $17,509, (b) $19,180; Oscar W. Rackle, Providence, R. I., (a) $14,001, (b) $18,234; Piersen Engineering & Contracting Co., Hartford, (a) $14,934, (b) $16,048, Goodman & Trumbull Co., Torrington, (a) $14,360, (b) $16,031.

Essex Township, about 12,000 lin.ft. trap rock (a) or native stone (b) resurfacing on the Westbrook Road: Olin T. Benedict, Pittsfield, Mass., (a) $5810, (b) $4710; Piersen Engineering & Contracting Co., Hartford, (a) $6930; Curran Corporation, Middletown, (a) $4779, (b) $4569; A. Brazos & Sons, Middletown, (a) $5289, (b) $3710; Frank Arrigoni & Bro., Middletown, (a) $7126, (b) $3585; Goodman & Trumbull Co., Litchfield, (a) $5390, (b) $4010; Bristow Bros. & Knowles Corporation, Narragansett Pier, R. I., (a) $5570, (b) $4990; Robert G. Miller Contracting Co., Hartford, (a) $6930, (b) $3960; John deMichiel & Bro., Torrington, (a) $5138, (b) $4210; Kellogg & Gregory Co., Danbury, (a) $5165, (b) $3625; Leonardo Suzio, Meriden, (a) $6373, (b) $4799.

Hartford City, about 4035 lin.ft. amiesite (a), warrenite (b), bituminous concrete (c), plain concrete (d) or reinforced concrete (e) on Albany Ave.: Southern New England Contracting Co., Hartford, (c) $11,834; Edward Balf Co., Hartford, (c) $11,619; Warren Bro. Co. ,Boston, Mass., (b) $13,206; Connecticut Hassam Paving Co., New Haven, $10,243; Piersen Engineering & Contracting Co., Hartford, (d) $12945, (e) $13,732; A. D. Bridge's Sons, Inc., Hazardville, (c) $13,733; A. C. Sternberg Jr. Construction Co., West Hartford, (d) $10,671, (e) $11,538; Connecticut Good Roads & Construction Co., New Britain, (d) $16,074, (e) $17,035; Connecticut & Rhode Island Co., Meriden, (a) $10,788.

Watertown Township, about 6450 lin.ft. trap rock macadam (a), native stone macadam (b) or gravel (c) construction on the Thomaston Road: John deMichiel & Bro., Torrington, (a) $12,810, (b) $12,766, (c) $9255; Olin T. Benedict, Pittsfield, (a) $13,327, (b) $14,764, (c) $12,281; Connecticut Good Roads & Construction Co., New Britain, (c) $10,540; B. D. Pierce Jr. Co., Bridgeport, (b) $14,453, (c) $11,564; Louis Loughi & Bro., Torrington, (a) $14,426, (b) $15,290, (c) $10,436; Edward B. Reilly, Waterbury, (a) $17,623, (b) $18,453, (c) $13,980; Piersen Engineering & Contracting Co., Hartford, (a) $15,359, (b) $16,511; Cæsar A. Rossi, Torrington, (a) $14,928, (b) $14,063, (c) $10,536; Goodman & Trumbull Co., Litchfield, (a) $15,754, (b) $15,411; Kellogg & Gregory Co., Danbury, (a) $15,197, (c) $12,423. Noted Jun. 25.

New Haven, Conn.—Bids are being received by Frederick L. Ford, City Engr., for paving sections of Church St. and Winchester Ave. with creosoted wood blocks.

★Albany, N. Y.—Bids were received by the State Highway Commission, 55 Lancaster St., July 6, for the construction of public highways by state aid as follows:

Road No. 1198, Albany-Glenmont, Albany County, 1.25 miles: Joseph Walker Construction Co., Albany, $26,795; William P. McDonald Construction Co., New York, $23,526; Robert I. Gleason, Albany, $26,764; P. Camillo & Co., Schenectady, $26,486; Olin T. Benedict, Pittsfield, Mass., $28,464; Roger B. Kennedy, Albany, $27,822.

Road No. 5499, Albany-Bethlehem Center, Albany County, 4.36 miles: Joseph Walker Construction Co., Albany, $34,583; William P. McDonald Construction Co., New York, $33,402; Richard Hopkins Co., Troy, $35,389; Olin T. Benedict, Pittsfield, Mass., $35,881.

Road No. 1199, Cohoes City, Vliet Ave., Albany County, 1.03 miles: Ballard & Maher, Oneida, $31,178; John W. Flynn, Waterford, $31,111; Robert I. Gleason Albany, $31,846; Parker-Hassam Paving Co., Worcester, Mass., $31,888.

Road No. 5502, Andover-Alfred Station-Almond, Allegany County, 12.06 miles: John Johnson Construction Co., Buffalo, $154,380; Woods Construction Co., Syracuse, $145,170; Maguire & Fahey, Hornell, $145,734; Cold Spring Construction Co., Buffalo, $152,785; Swank & McIntyre, Hornell, $151,504; Frank J Foote, Nunda, $141,300; I. M. Ludington & Sons, Inc., Rochester, $149,384, and two others.

Road No. 5475, Plattsburgh City—Peru and Charlotte Sts., Clinton County, 0.30 mile: Hilleem Construction Co., Plattsburgh, $21,121; James Conway, Plattsburgh, $21,111; Boynton & McNally, Keeseville, $18,833; Gifford Construction Co., Jamaica, $17,726.

Road No. 5489, Poughkeepsie City—South Ave. and Washington St., Dutchess County, 0.73 mile: Joseph Johnson & Sons, West New Brighton, $52,949; Bridgeport Construction Co., Poughkeepsie, $51,436; Samuel Beskin Co., Inc., Beacon, $51,075; Abner M. Harper, Newburgh, $51,645; Gruner & Hallenbeck, Harriman, $54,252; John I. McDonald Contracting Co., Mt. Vernon, $50,942; James Carafano & Sons, Mt. Vernon, $52,835, and one other.

Road No. 1197, Carthage-Naumburg, Part 1, Jefferson County, 1.81 miles: Dana W. Robbins, Inc., New York, $20,022; B. F. S. Co., Herkimer, $19,816; Thomas O'Brien, Watertown, $20,984; Joseph Mascetti, Torrington, Conn., $19,376; Valley Construction Co., Sidney, $20,487.

Road No. 1203, Baldwin-Oceanside, Nassau County, 1.56 miles: Evergreen Construction Co., Long Island City, $20,190; Frank Arrigonni & Bro., Middletown, Conn., $20,998; John De Michael & Bro., Torrington, Conn., $19,896; Gifford Construction Co., Jamaica, $20,432; E. H. Brown, Hempstead,

[illegible] H. J. Mullen Contracting Co., Jamaica, $1,[illegible]; [illegible] & [illegible], Long Island City, $[illegible],767, and three others.

Road No. [illegible], [illegible] Turnpike, Nassau County, [illegible] Arrigoni & Bro., Middletown, [illegible]; W. J. [illegible], New York, $[illegible]; [illegible]; [illegible] Construction Co., [illegible]; John De [illegible] & Bro., Torrington, Conn., $[illegible]; John J. Hart, Peekskill, $[illegible],110; E. H. Brown, Hempstead, $[illegible], and four others.

Road No. [illegible], [illegible] Hamilton St., Ontario County, [illegible] Construction Co., Inc., Rochester, $[illegible]; [illegible] Co., Rochester, $[illegible]; Brooks & Jolley, Rochester, $[illegible]; Morrison & Quinn, Rochester, $61,41[illegible]; [illegible] Construction Co., Geneva, $[illegible]; Robert W. [illegible], $[illegible]; John Johnson Construction Co., [illegible], $[illegible], and four others.

Road No. [illegible], [illegible], Part 1, Steuben County, [illegible] Bros., Elmira, $[illegible]; Frank J. Foote, [illegible]; [illegible] & [illegible], Corning, $[illegible]; [illegible] Co., Rochester, $[illegible]; Joseph Weaver, Buffalo, $[illegible]; Chambers & Barnes, Rochester, $[illegible]; [illegible] & [illegible], $[illegible].

Road No. [illegible], [illegible], Part [illegible], Steuben County, [illegible] Bros., Elmira, $[illegible]; J. W. [illegible] Construction Co., Geneva, $[illegible]; Brooks & Jolley, Rochester, $[illegible]; Patrick Murray & Son, Elmira, $[illegible]; [illegible] & [illegible], Syracuse, $[illegible]; [illegible]-Holter Co., Rochester, $[illegible]; Chambers & Barnes, Rochester, $[illegible], and two others.

Road No. [illegible]-A, Watkins-Yates County Line, Schuyler and Yates Counties, [illegible] miles, [illegible] Construction Co., Highland Mills, $[illegible]; J. W. Brown Construction Co., Geneva, $[illegible]; J. [illegible] W. [illegible] Watkins, $[illegible]; John J. McDonald Construction Co., Mt. Vernon, $[illegible]; Woods Construction Co., Syracuse, $[illegible]; Peter F. Connolly Co., Waverly, $[illegible]; Sumner Bros., Watertown, $[illegible], and four others.

Road No. [illegible], Williamson-Sodus, Wayne County, [illegible] miles, Geo. H. [illegible], Syracuse, $[illegible]; Frank V. Brotsch Co., Rochester, $[illegible]; E. H. Brown, Hempstead, $65,717; Whitmore-Rauber-Vicinus, Rochester, $[illegible]; Greene Construction Co., Rochester, $[illegible]; Chambers & Barnes, Rochester, $[illegible]; J. M. Ludington & Sons, Inc., Rochester, $[illegible], and five others.

Road No. [illegible], Ontario Center-Williamson, Part 2, Wayne County, [illegible] miles, J. M. Ludington & Sons, Rochester, $[illegible]; Geo. H. [illegible], Syracuse, $[illegible]; John Johnson Construction Co., Buffalo, $[illegible]; E. H. Brown, Hempstead, $[illegible]; Greene Construction Co., Rochester, $[illegible]; Whitmore-Rauber-Vicinus, Rochester, $[illegible]; Frank V. Brotsch Co., Rochester, $[illegible], and five others.

Road No. [illegible], [illegible] Village, Westchester County, [illegible] miles, John J. Hart, Peekskill, $[illegible]; William F. McDonald Construction Co., New York, $[illegible]; Bruce & Tripp, White Plains, $[illegible]; Samuel Beattie, Rye, $[illegible]; Bridgeport Construction Co., Poughkeepsie, $[illegible]; William F. McGahe Construction Co., White Plains, $[illegible]; Joseph Johnson Construction Co., West New Brighton, $[illegible], and one other.

The following bids were received by the State Commission of Highways July 6 for the repair of public highways by state aid:

Repair Contract No. [illegible], [illegible] County: Richard Hopkins, Troy, $[illegible]; James Gerelson & Son, Mt. Vernon, $[illegible]; [illegible], $[illegible]; Gromer & [illegible], Harriman, $[illegible].

Repair Contract No. [illegible], [illegible] County: Thomas J. [illegible], $[illegible]; James F. Donohue, New York, $[illegible]; Gromer & [illegible], Harriman, $[illegible]; [illegible]; [illegible], Pittsfield, Mass., $[illegible]; [illegible], Troy, $[illegible]; James Gerelson & Son, Inc., Mt. Vernon, $[illegible], and one other.

Repair Contract No. [illegible], Livingston County: McCarthy & [illegible], Mt. Morris, $[illegible]; Morrison & Quinn, Rochester, $[illegible]; Brooks & Jolley, Rochester, $[illegible]; [illegible] Contracting Co., Rochester, $[illegible]; Patrick Murray & Son, Elmira, $[illegible]; [illegible] Co., Utica, $[illegible]; [illegible]-Holter, Rochester, $[illegible].

Repair Contract No. [illegible], [illegible] County: [illegible]; [illegible], Syracuse, $[illegible]; [illegible], Syracuse, $[illegible].

Repair Contract No. [illegible], [illegible] County: [illegible]; James F. Donohue, New York, $[illegible]; [illegible] Construction Co., Highland Mills, $[illegible]; [illegible]; Gromer & [illegible], Harriman, $[illegible]; James Gerelson & Son, Mt. Vernon, $[illegible].

Repair Contract No. [illegible], [illegible] County: [illegible] & [illegible], $[illegible].

Repair Contract No. [illegible], [illegible] County: [illegible]; [illegible]; [illegible] Construction Co., New York, $[illegible]; [illegible], New York, $[illegible]; James Gerelson & Son, Inc., Mt. Vernon, $[illegible]. Noted June [illegible].

Ithaca, N. Y.—Bids will be received by [illegible] until [illegible] July [illegible] for paving Thurston Ave. from [illegible] Creek Bridge to [illegible] Ave. with [illegible].

New York, N. Y.—[illegible]

[illegible]

[illegible]

✦Yonkers, N. Y.—Contracts have been awarded by the [illegible] to [illegible] Co., at $[illegible], for paving [illegible] and Riverdale Ave. with sheet asphalt and small block, and to MICHAEL NOLAN, at $21,637, for paving Ashburton Ave. with [illegible].

✦Hackensack, N. J.—The contract for improving the Paterson Plank Road has been awarded to E. C. HUMPHREY.

✦Jersey City, N. J.—The Board of City Commissioners has awarded the following paving contracts: Passaic Ave., LESTER FELLOWS CO.; Belmont Ave., UVALDE ASPHALT CO.; repairs to asphalt paved streets, CLINTON CONTRACTING CO.; Bowe Place, UVALDE ASPHALT CO.

✦Newark, N. J.—(Official.) The contract for resurfacing the [illegible] Turnpike, from Bloomfield Ave. to the [illegible] County line, has been awarded to the STANDARD BITULITHIC CO., [illegible] Church St., New York, N. Y., at $[illegible]. Other bids were: Union Building & Construction Co., $[illegible]; Francisco Bros., $[illegible]; Newark Paving Co., $[illegible]; [illegible] & Marsella Co., $[illegible]. Noted June [illegible].

✦South Orange, N. J.—The Board of Trustees has awarded the contract for the improvement of Grove Road and Grove Terrace to LEPRE & MEGLIARA at $[illegible] and $[illegible], respectively.

Woodlynne, N. J. (Camden Post Office).—The Borough Council contemplates paving and repairing a number of streets.

✦Carrick, Penn.—(Pittsburgh Post Office.)—The contract for grading, curbing and paving the Parkway has been awarded to the THOS. CRONIN CO. at $[illegible],410.

Deemston, Penn.—(Beallsville Post Office.)—Bids will be received by the [illegible] until [illegible] p.m., July [illegible], for completing the L. E. [illegible] and Fredericktown Roads. F. L. Hastings is Pres.

Dormont, Penn.—(Official.)—Bids will be received by the Borough Council until [illegible] p.m., July [illegible], for improving [illegible] Ave. from [illegible] Salle to [illegible] Ave.

Edgewood, Penn.—Bids will be received by the Borough, Municipal Bldg., Swissvale Ave., until 5 p.m., July [illegible], for constructing [illegible]000 sq.yd. of concrete sidewalk.

Greensburg, Penn.—Bids will be received by John S. [illegible] until noon, July [illegible], for improving the Salina-Avon[illegible] County Road in Bell Township.

Lebanon, Penn.—(Official.)—Bids will be received by the Mayor and Council until [illegible] p.m., July [illegible], for paving Cumberland St. from Ninth to Fifth St. and Eighth St. from Chestnut St. to the P. and R. R.R.

McKeesport, Penn.—The City Engineering Department is preparing plans for the improvement of Sylvan, Queen, Ash and Willow Sts.

Newport, Penn.—Bids will be received by the Board of Commissioners until 7:30 p.m., July 23, for improving certain streets. W. O. Davis is Secy.

Pittsburgh, Penn.—Bids will be received by the County Comptroller until July [illegible] for improving various roads and highways in Allegheny County. E. M. Bigelow is State Highway Commr.

✦Pottsville, Penn.—(Official.)—Bids will be received by the City Council until [illegible] p.m., July [illegible], for grading, curbing, paving and improving Market and [illegible] Sts. For particulars see advertisement under "Contracts To Be Let."

✦Baltimore, Md.—Contracts have been awarded by the State Roads Commissioners, [illegible] Garrett Bldg., Baltimore, for the construction of road in Caroline County, from [illegible] to Greensboro, 3.[illegible] miles of 14-ft. macadam, at $[illegible], to the JUNIATA PAVING CO., Philadelphia, Penn.; Northeast along Old Post Road, [illegible] miles of [illegible] in Cecil County, at $[illegible] to H. B. SPOLL CONTRACTING CO., Peekskill, N. Y.; Belair Road from Kingsville to Harford County line, 2.1[illegible] miles of macadam, $[illegible] to LUCK CONSTRUCTION CO., [illegible]; [illegible] Queen Anne's County Line to [illegible] in Caroline County, [illegible] miles concrete construction, to HOLT CONSTRUCTION CO., Easton, $[illegible]; Harvey's to Allegheny County line in Washington County, [illegible] miles of macadam, to J. G. ROBINSON, Hancock, $[illegible]; Frederick to Jefferson, Frederick County, [illegible] miles of 14-ft. macadam, [illegible], to M. J. GROVE LIME CO., Lime Kiln, at $[illegible]; [illegible] through [illegible], in Montgomery County, to C. H. Hoyt, Washington, D. C., at $[illegible].

✦Greensboro, N. C.—A contract for paving [illegible] to [illegible] has been awarded to the LAWRENCE BUILDING CO., High Point, at $[illegible] per sq.yd.

Arcadia, Fla.—See item under Bridges.

Fernandina, Fla.—Bids will soon be received by the County Commissioners for completing unfinished portions of the [illegible] Highway. [illegible] W. [illegible] is Clk.

Athens, Ala.—Bids will be received until July [illegible] for improving the [illegible]-Athens Road. W. S. Keller is State Highway Engr.

Birmingham, Ala.—The city contemplates paving North [illegible] St. from [illegible] to [illegible]th Ave., at an estimated cost of $[illegible]. Julian Kendrick is City Engr.

Bids will be received until [illegible] a.m., July [illegible], for grading, [illegible], curbing, gutters and sidewalks on [illegible] Ave. from [illegible] St. to the street railroad. The estimated cost is $[illegible]. Julian Kendrick is City Engr.

Savannah, Tenn.—An election will be held Aug. [illegible] to vote on the proposition to issue $[illegible] of bonds for road construction.

✦Lexington, Ky.—A contract for paving [illegible] has been awarded to the [illegible] CONSTRUCTION CO. Noted June [illegible].

Akron, Ohio.—See item under Sewers.

Le Roy, Ohio.—Bids will be received by J. W. Campbell, Village Clk., until July [illegible], for paving High School Front and [illegible] with asphalt block. The estimated cost of the work is $[illegible].

Lorain, Ohio.—Bids will be received by County Commissioners until [illegible] a.m., July [illegible], for grading, draining and [illegible] Amherst Road. F. L. [illegible] is Clk.

Marion, Ohio—Bids will be received by County Commissioners until noon July 1 for resurfacing the Morral-Brush Ridge Pike Road. V. Perle Garfield is Clk.

New Lexington, Ohio—(Official)—Bids will be received by T. B. Skinner, Village Clk. until noon, July 27, for improving Maple Heights St. from Mill to First St.

+Nova, Ohio—(Official)—The contract for improving 4¾ miles of bituminous bound macadam road has been awarded to E. F. DOWNS & CO., at $38,081. Noted June 25.

+Portsmouth, Ohio—(Official)—The contract for paving 15th St. with brick has been awarded to KELLEY BROS. at $9814. The contract for paving Gallia St. was not awarded. Noted June 18.

+Sandusky, Ohio—The contract for paving Adams, Meigs, Wayne and Van Buren Sts. has been awarded to the ANDREWS ASPHALT CO., Hamilton, at $51,677.

Springfield, Ohio—It has been recommended to award the contract for improving Ludlow Ave. from High St. to Sheridan Ave. to M. J. Hannon at $19,006.

+Tiffin, Ohio—The City Council has awarded the following paving contracts: Minerva St., to the ASPHALT BLOCK & PAVING CO., Toledo at $13,435; Schonhardt, Scott and Jackson Sts. to JOHN KING at $7122, $3029 and $6982 respectively. Noted June 11.

+Youngstown, Ohio—The contract for paving Ryatt St. has been awarded to CHARLES HARRIS at $5314.

Connellsville, Ind.—(Official)—Bids will be received by M. A. Starr, Treas. of Fayette County until 2 p.m., July 21, for the sale of $17,160 of highway improvement bonds.

Indianapolis, Ind.—(Official)—Bids will be received by the Board of Park Commissioners until 10 a.m., July 17 for constructing concrete sidewalks on Maple Road Blvd.

Ontonagon, Mich.—Bonds for $9800 have been sold the proceeds of which will be used for the improvement of highways in Ontonagon County.

+Bloomington, Ill.—The contract for paving University Ave. between Main and Clinton Sts. has been awarded to I. D. LAINN at $15,019.

+Edwardsville, Ill.—The contract for constructing the Alton Road has been awarded to ALBERT J. FAHRIG at $9050. Other bids were: John Adams $11,600; Parham Construction Co. $10,050; Robert Hyten, $13,500 and Dunn-Dippold Construction Co., $10,520.

Elgin, Ill.—(Official)—Bids will be received by the city of Elgin until 10 a.m., July 14, for the construction of 7846 sq.yd. asphaltic concrete pavement on Hill Ave. and 6436 sq.yd. asphaltic concrete pavement on Addison St.

+Evanston, Ill.—The contract for paving Ingleside Place has been awarded to M. FOLEY CO., at $6891.

Freeport, Ill.—See item under Sewers.

Metamora, Ill.—Henry Beasley, Engr., Peoria is preparing plans for the paving of the public square with pproximately 9500 sq.yd. of brick. The estimated cost is $17,000.

Springfield, Ill.—(Official)—Bibs will be received by the State Highway Commission until noon July 15 for State Aid work in Cass, Menard, Crawford and Kane Counties.

(Official)—Bids will be received at the office of the Illinois Highway Commission Springfield until noon, July 22, for the following proposed State Aid work. All concrete to be furnished by the State. Cook County, Route 38, Section B, 7111 lin.ft.; Cook County, Route 32, Section A, 2623 lin.ft.; Cook County, Route 3, Section C, 24,000 lin.ft.; Cook County, Route 29, Section E, 19,442 lin.ft.; Woodford County, Route 1, Section A, 7300 lin.ft.; Iroquois County, Route 7, Section B, 13,306 lin.ft.; Clark County, Route 1, Section A, 4506 lin.ft.; Franklin County, Routes 1A and 1, Section A, 4378 lin.ft.; Schuyler County, Route 5, Section A, 5400 lin.ft.; Bond County, Route 7, Section A, 1575 lin.ft.; Vermilion County, Route 2, Section A, 16,100 lin. ft.

Wateska, Ill.—The Iroquois County Commissioners contemplate building a six-mile concrete road out of this city. The estimated cost is $9000 per mile.

Waukegan, Ill.—Bids will be received by the Board of Local Improvements until 8 p.m., July 13 for 10,830 sq.yd. of asphaltic concrete paving on 5 in. concrete base and 6000 ft. combined curb and gutter. M. J. Douthitt is City Engr. Noted Feb. 26.

Clintonville, Wis.—Bids will be received by the City Clerk until July 20 for paving New London St. with either concrete or asphalt.

Madison, Wis.—The Board of Public Works will receive bids until July 16 for paving and improving Jefferson, Gilman, Henry Sts. and Van Hise and Atwood Aves. O. S. Norsman is City Clk.

Reedsburg, Wis.—Bids are being received by G. F. Post, County Highway Cmr, Baraboo, Wis., for improving two miles of road at Hilbersleben and one mile on Gifford Hill.

+Marshalltown, Iowa—The contract for grading North Third Ave. has been awarded to J. H. C. WILLIAMS & SON, Florence, at $7400.

Bids will be received by J. J. Wilson, City Clk., until 9 a.m., July 13, for paving North Second St. with concrete.

+Hubl, Minn.—A contract for paving 20,000 yd. with bitulithic has been awarded to the GENERAL CONTRACTING CO. at $1.81 per yd.

+Glenwood, Minn.—(Official)—The contract for improving Road No. 25 has been awarded to D. B. DOUGHERTY, Willmar at $10,992. Noted June 18.

Omaha, Neb.—Bids will be received until July 14 for 100,000 yd. of paving of all materials. T. J. Flynn is City Clk.

Herold, S. D—Bids will be received by J. H. Starkey, Audr. Hughes County until 2 p.m., July 11, for grading a road.

Sioux Falls, S. D.—Bids will be received by Walter C. Leyse, City Audr., until 9 a.m., July 13, for paving 21st St from Phillips to Seventh Sts. S. B. Howe is City Engr.

+Helena, Mont.—The contract for paving the West Main St. District has been awarded to ADAMI BROS. at $5917

Harrisonville, Mo.—Bids will be received until July 11 for 5000 yd. of paving. Fred Mayer is City Clk.

Sikeston, Mo.—(Official)—Bids will be received by H. A. Smith, City Clk. until 8 p.m., July 13, for constructing about 3400 sq.yd. of concrete paving. Benjamin L. Parker is City Engr.

+Hot Springs, Ark.—The contract for building the Little Rock - Hot Springs Highway has been awarded to W. MURPHY at between $15,000 and $20,000.

+Beaumont, Tex.—The contract for constructing a highway to connect Beaumont with Orange has been awarded to the LAKE DREDGING CO. at about $6500.

Ennis, Tex.—See item under "Water Supply and Irrigation."

Oakville, Tex.—An election will be held in August to vote on the proposition to issue $100,000 of road and bridge bonds.

★+San Antonio, Tex.—Contracts have been awarded for paving as follows:

Lakeview Ave. from Smith St. to Cameron St. to the BEEBE CONSTRUCTION CO. at $39,894.

Romana St. from the river to Augusta St. to UVALDE ROC KASPHALT CO. at $8353.

Augusta St. from Romana St. to Richmond Ave. to the UVALDE ROCK ASPHALT CO. at $1866.

Richmond Ave. from Augusta St. to Main Ave. to the UVALDE ROCK ASPHALT CO. at $11,498.

West Laurel St. from North Flores St. to Pecos St. to the UVALDE ROCK ASPHALT CO. at $10,017.

Josephie St. from Jones Ave. to river to the WESTERN PAVING CO. at $8016.

McCullough Ave. from Dewey Place to Woodlawn Ave. to the TEXAS GRANITOID CO. at $15,976.

Belknap Pl. from Dewey Pl. to King's Highway to the TEXAS GRANITOID CO. at $34,519.

Macon St. from Main Ave. to Jones Ave. to the EUREKA PAVING CO. at $18,109.

Pecan St. from St. Mary's St. to Navarro St. to the WESTERN PAVING CO. at $3226.

Pecan St. from Jefferson St. to Avenue C to the WESTERN CONSTRUCTION CO. at $2445.

Martin St. from Third St. to St. Mary's St. to the TEXAS GRANITOID CO. at $9243.

St. Mary's St. from Travis St. to the river to the ROACH-MANIGAN PAVING CO. at $12,653.

Taylor St. from Martin St. to Fourth St. to the ROACH-MANIGAN PAVING CO. at $5103.

Bonham St. from Nacogdoches St. to Commerce St. to the ROACH-MANIGAN PAVING CO. at $4367.

Arsenal St. from Laredo St. to the river to the TEXAS GRANITOID CO. at $15,299.

Aransas St. from South Flores St. on block east to the ROCKASPHALT CO. at $8353.

Las Moras St. from San Fernando St. to Saunders Ave. to the ROACH-MANIGAN CO. at $4876.

Military Plaza, east side, including Dolorosa St. intersection, to the ROACH-MANIGAN CO. at $11,755.

Bowie St. from Nacogdoches St. to Commerce St. to the EUREKA PAVING CO. at $9668.

Hays St. from Chestnut St. to New Braunfels Ave. to the WESTERN PAVING CO. at $19,886.

Hackberry St. from Commerce St. to Grayson St. to the BEEBE CONSTRUCTION CO. at $73,282.

Starr St. from Chestnut St. to Pine St. to the STANDARD ROOFING CO. at $22,024.

New Braunfels St. from Vann Ness St. to Grayson St. to the STANDARD ROOFING CO. at $14,520.

Burnet St. from Hackberry St. to Chestnut St. to M. A. SWATEK & CO. at $14,080.

Sycamore St. from Commerce St. to North St. to RUSHMORE & GOWDY at $9676.

Santa Clara Ave. from Lafitte St. to Plum St. to RUSHMORE & GOWDY at $2230.

Moyer Boulevard from Hackberry St. to Cherry St. to ROACH-MANIGAN at $5387.

Carolina St. from Cherry St. to South Presa St. to RUSHMORE & GOWDY at $13,083.

Hackberry St. from Denver St. to Commerce St. to the BEEBE CONSTRUCTION CO. at $50,128.

Woodlawn Ave. from Belknap St. to Fredericksburg Road to the TEXAS BITULITHIC CO. at $61,556.

Plum St. from Santa Clara Ave. to Gollad St. to the STANDARD ROOFING CO. at $13,432.

Wyoming St. from Plum St to Walnut St. to the STANDARD ROOFING CO. at $3429.

Labor St. from Carolina St. to Goliad St. to the BEEBE CONSTRUCTION CO. at $26,853.

Camargo St. from Labor St. to South Presa St. to the BEEBE CONSTRUCTION CO. at $15,719

Water St. from Lavaca St. to Commerce St. to the BEEBE CONSTRUCTION CO. at $20,617.

Presa St. from River to Alamo St. to the ROACH-MANIGAN CO. at $16,718.

Pereida St. from Garden St. to South Alamo St. to the UVALDE ROCK ASPHALT CO. at $7060.

Johnson St. from Alamo St. to River Ave. to the UVALDE ROCK ASPHALT CO. at $5634

Beauregard St. from river to South Alamo St. to the UVALDE ROCK ASPHALT CO. at $7588.

Garden St. and Roosevelt Ave. from Pereida St. to Eads Ave to the TEXAS GRANITOID CO. at $85,644.

Eads Ave. from Roosevelt Ave. to Presa St. to the ROACH-MANIGAN CO. at $1240.

East Nueva St. from Garden St. to Alamo St. to the UVALDE ROCK ASPHALT CO. at $3632.

Temple St. from Adams St. to Garden St. to the UVALDE ROCK ASPHALT CO. at $4462.

Mitchell St. from Roosevelt Ave. to South Presa St to the ROACH-MANIGAN PAVING CO. at $7556.

Gembler St. from South Presa St. to Garden St. to the ROACH-MANIGAN CO at $1240.

Third St. from Avenue C to Avenue B to the UVALDE ROCK ASPHALT CO. at $14,286.

North Laredo St. from Morales St. to North Flores St to the STANDARD ROOFING CO. at $20,393.

Cameron St. from Commerce St. to extension of Morales St. to the STANDARD ROOFING CO. at $17,945.

Jefferson St from Pecan St to Martin St. to the UVALDE ROCK ASPHALT CO. at $2286.

[illegible] St. from [illegible] to [illegible] St. to the [illegible] [illegible] ASPHALT [illegible] at $[illegible] [illegible] St. [illegible] to the WESTERN [illegible] at $[illegible] Noted Jan. [illegible]

+Phoenix, Ariz.—The contract for improving [illegible] St. [illegible] has been awarded to the [illegible] ASPHALT PAVING CO., at $[illegible]

+Olympia, Wash.—[illegible]—The contract for [illegible] National Park Highway has been awarded to [illegible] BROWARD, Brooklyn, at $[illegible] Other bids were: [illegible] Construction Co., [illegible], $[illegible] [illegible] & [illegible] $[illegible] Noted Jan. [illegible]

+Shelton, Wash.—The contract for constructing [illegible] has been awarded to [illegible] KENT, DAVID [illegible] Shelton, at $11,[illegible] Other bids were: [illegible] $[illegible] Allred & Jones, $[illegible] [illegible] & [illegible] $[illegible] Construction Co., $16,[illegible] August [illegible] $[illegible] Noted Jan. 25.

+Walla Walla, Wash.—The contract for graveling Highway No. 6 has been awarded to HENRY [illegible] at $11,[illegible]

+Falls City, Ore.—The City Council has awarded a contract for [illegible] streets in the downtown district to [illegible] R. STEVENS at $[illegible]

+Lebanon, Ore.—[illegible] T. MORGAN, 716 Broadway Bldg., [illegible] has been awarded the contract for laying 1[illegible] sq.yd. of 6-in. concrete pavement on [illegible] St.

+Seaside, Ore.—WARREN CONSTRUCTION CO., Portland, has received the contract for hard surface pavement on [illegible] St., from Broadway to 12th Ave., about one mile.

Hemet, Calif.—The city contemplates paving Florida Ave. between [illegible] and Buena Vista, between Buena Vista and San Jacinto and between Gilbert and Alessandro; State St. between Florida and Central; Harvard St. between Florida and [illegible]; [illegible] Ave. between Harvard and Florida; Kingston Ave. between State and Harvard, and alleys between Harvard and [illegible] Carmalita with concrete.

+Los Angeles, Calif.—GEORGE R. CURTIS has been awarded the contract for improving Bunker Hill Ave. at $[illegible]

The FAIRCHILD-GILMORE-WILTON CO. has been awarded the contract for improving Tenth St. at $[illegible]

[illegible] H. OSWALD has been awarded the contract for [illegible] Grand Ave. from Jefferson to Flower St. at $[illegible]

Pomona, Calif.—Bids will be received by F. R. Trotter, City Clk., until [illegible], July 13, for paving a number of streets with concrete. [illegible] F. [illegible] is City Engr.

+San Francisco, Calif.—The Panama-Pacific International [illegible] has awarded a contract for the construction of asphalt surface [illegible] roadways in the Exposition site to the [illegible] [illegible] CO., at $[illegible]

+Santa Ana, Calif.—THE CONNER CONSTRUCTION CO. has been awarded the contract at $[illegible] for improving [illegible] of [illegible] and Section [illegible], Bay City Road.

+Verdun, Que.—[illegible]—A contract for paving has been awarded to QUINLAN & ROBERTSON, LTD., [illegible] at [illegible] Montreal, at $[illegible]

+Berlin, Ont.—The contracts for paving Victoria St., about [illegible] sq.yd. and [illegible] St., about [illegible] sq.yd., have been awarded to the CANADA CREOSOTING CO. at $[illegible] per sq.yd. and to the WARREN BITUMINOUS CO. at $[illegible] per sq.yd., respectively.

+Winnipeg, Man.—The contract for constructing asphalt [illegible] on Notre Dame Ave. has been awarded to H. GALBRAITH at $[illegible]

+Moose Jaw, Sask.—The contract for constructing 1[illegible] sq.yd. of No. [illegible] concrete [illegible] has been awarded to the NATIONAL PAVING & CONTRACTING CO., [illegible] at $[illegible]

Swift Current, Sask.—Bids will be received until July 1[illegible] for constructing concrete sidewalks. [illegible] is City Engr.

Revelstoke, B. C.—The City Council has voted to [illegible] [illegible] sidewalks at estimated cost of $[illegible]

INDUSTRIAL WORKS

+Athol, Mass.—[illegible]

Clinton, Mass.—[illegible]

+Hopedale, Mass.—[illegible]

Lowell, Mass.—[illegible]

+Springfield, Mass.—[illegible]

Ithaca, N. Y.—[illegible]

+Mt. Vernon, N. Y.—[illegible]

New York, N. Y.—(Borough of Manhattan)—[illegible]

[illegible]

+(Borough of the Bronx)—William Vincent Astor, 23 West [illegible]th St., has awarded a contract to the GILLIES-CAMPBELL CO., 101 Park Ave., for a two-story brick and [illegible] factory, to be built on the Bronx River and 1[illegible]0th St. The cost will be $[illegible]

+(Borough of Brooklyn)—T. L. Neff's Sons, Inc., 1[illegible] Meyer St., has awarded a contract to JOHN AUER & SONS, [illegible] Lexington Ave., for a two-story, [illegible]-ft. brick factory, at $10,[illegible] Frank J. Berlenbach, 260 Graham Ave., is the Arch.

(Borough of Richmond)—The American Dock Co., 17 State St., New York, N. Y. (Borough of Manhattan), is receiving bids for a seven-story, 120x1[illegible]-ft. storage warehouse, to be built in Tompkinsville, S. I. The cost will be about $175,[illegible] The Concrete Steel Co., 32 Broadway (Borough of Manhattan), is the Arch.

+New York, N. Y.—(Borough of Manhattan)—[illegible] & Co. has awarded a contract to the TURNER CONSTRUCTION CO., 11 Broadway, New York, N. Y., for a ten-story [illegible], to be built at 16[illegible] Front St. The cost will be $[illegible]

+Schenectady, N. Y.—Jonathan Levi & Co. has awarded a contract to BROWN & LANE for a five-story, [illegible]-ft. concrete warehouse.

Harrison, N. J.—The Driver-Harris Wire Co. will build a one-story, [illegible]x120-ft. addition to its plant. The structure will cost about $13,[illegible]

+Harrison, N. J.—The General Electric Co., Schenectady, N. Y., has awarded a contract to the SALMOND BROS. CO. for a three-story addition to its local plant.

Jersey City, N. J.—Vietmeyer Bros. will build a three-story, brick building, and a [illegible]-story addition on Sherman Ave.

Trenton, N. J.—The United & Globe Rubber Mfg. Co. will spend $50,000 in building additions to its plant.

Altoona, Penn.—The Pennsylvania R.R. plans to build an $[illegible] spring annealing plant, as an addition to its local shops.

+Homestead, Penn.—The [illegible] Mfg. Co. has awarded a contract to the NICHOLS CONSTRUCTION CO. for a two-story, [illegible]x228-ft. factory and warehouse. The cost will be $[illegible]

+Oil City, Penn.—The Carnahan Storage Co. has awarded a contract to TAUPET, [illegible] & CONLEY, for a reinforced concrete building, at $13,[illegible]

Philadelphia, Penn.—The Quaker City Rubber Co. will build a four-story, [illegible]x50-ft. factory at Comly and Milnor Sts. Ballinger, Perrott & Perrott are the Archs.

The Dunlap Silk Co. will build a [illegible]x198-ft. weaving shed.

Joseph R. Foster & Sons plan to build a two-story, [illegible]x141-ft. dye house, at Second and Lippincott Sts.

+Philadelphia, Penn.—The Pennsylvania Sugar Refining Co. has awarded a contract to the GUERNSEY O'MEARA CONSTRUCTION CO., North American Bldg., for a 125x[illegible]-ft. warehouse at Delaware Ave. and Shackamaxon St. The cost will be $200,000.

Philadelphia, Penn.—The [illegible] Mfg. Co. will build a two-story, 51x[illegible]-ft. factory on [illegible] Ave.

Philadelphia, Penn.—John T. [illegible] & Bros., Aramingo Ave., will build a three-story, [illegible]x1[illegible]-ft. factory.

Zelienople, Penn.—W. C. [illegible] will build a [illegible]-ft. carriage factory.

+Baltimore, Md.—The [illegible] Belting Co. has awarded a contract to the TUFTS CONSTRUCTION CO. for a six-story, 171x141-ft. factory, at $12[illegible] Noted June [illegible]

The City Dairy Co. is reported to be planning a $[illegible] plant to be built at Maryland Ave. and 2[illegible] St. Joseph Evans Sperry is the Arch.

Baltimore, Md.—The [illegible] Co. will build a [illegible]-story brick warehouse on Stockholm St.

Atlanta, Ga.—The Coca Cola Co. plans to build a $[illegible] plant at [illegible] and [illegible] Sts.

Eufaula, Ala.—The Eufaula Oil Mills Co. plans to build a [illegible]

+Cincinnati, Ohio.—The Victor Auto Parts Co., [illegible] Ave., has awarded the following contracts for a four-story, [illegible]-ft. addition to its plant: [illegible] NOLTE, [illegible]; [illegible] MEYER & CO., roofing; D. MEMKEN, carpentry; [illegible] SCHILL[illegible] & SONS, sheet-metal work. Noted June [illegible]

Cleveland, Ohio.—The Victor Oil Co. has filed plans for a [illegible]-ft. addition to its plant at [illegible] St. Clair St. George F. [illegible] is the Arch.

+Youngstown, Ohio.—The Youngstown Iron & Steel Co. has awarded a contract to [illegible] KENNEDY, Pittsburgh, Penn., for three open hearth furnaces of [illegible] tons each, a [illegible] mill and a [illegible] mill. The cost will be $[illegible]

Detroit, Mich.—The [illegible] Co. plans to build a [illegible] factory [illegible] are the Archs.

Detroit, Mich.—The [illegible] Motor Co. plans to erect seven [illegible] buildings as additions to its [illegible] plant. About $[illegible] will be spent.

Chicago, Ill.—The [illegible] Co., [illegible] South [illegible] St., will erect a six-story factory, estimated to cost $[illegible] [illegible] West Randolph St. is the Arch.

The [illegible] Co., [illegible] South [illegible] St., has [illegible] for a [illegible] brick factory [illegible]

Chicago, Ill.—[illegible] will build a [illegible]-ft. garage and repair shop at [illegible] to cost $[illegible] [illegible] North La Salle St. is the Arch.

Mackinaw, Ill.—The [illegible] Furniture Co. plans to build a [illegible]-story and basement [illegible]-ft. factory.

Kenosha, Wis.—The [illegible] Mfg. Co. will build a $[illegible] addition to its factory.

Kansas City, Kans.—The [illegible] Co. plans to build a [illegible] refinery. [illegible] Jr. is Pres.

Miles City, Mont.—The [illegible] Brewing Co. will build a $[illegible] [illegible]

+Oxford, Mont.—The Farmers' Elevator Co., Judith Gap, Mont., has awarded a contract to the BURRELL ENGINEERING & CONSTRUCTION CO., Spokane, Mont., for a 30,000 bu. elevator.

Morrilton, Ark.—The Morrilton Cotton Warehouse Co. will build a 220x350-ft. cotton warehouse.

San Antonio, Tex.—The Brown Cracker & Candy Co. has purchased a site at Medina and El Paso Sts., on which it will build a two-story, 164x222-ft. factory.

Fallon, Nev.—The Churchill Creamery Co., Winnemuca, Nev., will build a creamery and cheese factory. The estimated cost is $12,000. C. J. Heisley is Mgr.

+Seattle, Wash.—The Port Commission has awarded a contract to the BUTLER CONSTRUCTION CO., Central Bldg., for the concrete foundations of a $300,000 grain elevator.

Walla-Walla, Wash.—The Oregon-Washington R.R. plans to build a ten-stall concrete roundhouse.

+Easton, Calif.—C. FREDERICK KOHL has been awarded a contract for a one-story, reinforced-concrete garage, to cost about $14,000.

Fresno, Calif.—The Fresno High School is to have a $25,000 addition built to its machine shop. C. C. Starr is secy. of the Bd. of Education.

Los Angeles, Calif.—The Davies Warehouse Co., 411 East Second St., plans to build two warehouses, each five-story, of reinforced concrete. The cost is estimated at $125,000.

San Francisco, Calif.—O'Brien Bros., Archs., Clune Bldg., will soon award a contract for a one-story commercial garage, for the Bishop Estate. Jackson St., near Van Ness Ave. The cost will be $25,000.

Bertgier, Que.—The Milcher Gin Co. plans to build a $60,000 distillery. Saxe & Archibald, Beaver Hull Hill, Montreal, Que., are the Archs.

St. Johns, Que.—The Canadian Hart Accumulator Co. plans to build a $70,000 factory. Septimus Warwick, Guarantee Bldg., Montreal, Que., is the Arch. Noted Sept. 25.

Brantford, Ont.—The Canada Glue Co. plans to build a $50,000 plant. Paul Kreisman, 44 William St., is the Arch.

Sarina, Ont.—The Mueller Brass Co. plans to build a $25,000 foundry. O. B. Mueller is Mgr.

+Toronto, Ont.—The general contract for the erection of the warehouse for the J. R. Watkins Medical Co., has been awarded to HAGLIN & STAHR, 228 Lumber Exchange Bldg., Minneapolis, Minn. The estimated cost is $80,000.

New Westminster, B. C.—The St. Wingo Cold Storage Co. plans to build a $40,000 plant.

Vancouver, B. C.—The British Columbia Electric Co. has filed plans for car barns to be built at 14th Ave. and Main St. The cost will be $275,000.

FEDERAL GOVERNMENT WORK

Building, Wharf, Retaining Wall, Etc.—Boston, Mass.—Bids were received June 25, for the construction, of the wharf, retaining wall, and approaches, of the U. S. immigration station at Boston, as follows: The Conners Bros. Co., Lowell, Mass., $296,810, H. P. Converse & Co., 88 Broad St., Boston, Mass., $316,000; George A. Fuller Co., 131 State St., Boston, Mass., $249,000; C. S. Cunningham & Sons Construction Co., 7 Water St., Boston, Mass., $273,288; M. Yaeger & Son, Danville, Ill., $311,825; The Charles McCaul Co., Philadelphia, Penn., $279,828; Wells Bros. Co., New York, Riggs Bldg., Washington, D. C., $313,000; Woodbury & Leighton, 185 Summer St., Boston, Mass., $304,940; George B. Long, Worcester, Mass., $295,000; The Norcross Bros. Co., Worcester, Mass., $294,968; P. J. Carlin Construction Co., 1123 Broadway, New York, $307,000. Noted May 28.

★Dredging—Providence, R. I.—Bids were received June 30, by Col. John Millis, Corps Engrs., U. S. A., for dredging about 2,000,000 cu.yd. in Providence River, R. I., as follows: J. S. Packard Dredging Co., Providence, R. I., 0.0798c. per cu.yd., Bay State Dredging Co., Boston, Mass., 0.139c.; Eugene Breymann, Toledo, Ohio, 0.095c.; Maryland Dredging & Contracting Co., Baltimore, Md., 0.0993c.; Morris & Cumings Dredging Co., New York, N. Y., 0.0819c.; Canal Construction Co., New York, N. Y., 15c.; E. J. Dineen, Ogdensburg, N. Y., 0.085c. Noted June 4.

★+Electrical Fixtures—Governors Island, N. Y.—The contract for rewiring and furnishing new electrical fixtures in various buildings on Governors Island, has been awarded to T. FREDERICK JACKSON, Inc., New York, at $12,843. Noted June 4.

★+Hanger and Guard House—Governors Island, N. Y.—The contract for constructing the hanger has been awarded to the CONCORD CONSTRUCTION CO., Brooklyn, N. Y., at $4492; and the NATIONAL CONCRETE & CONSTRUCTION CO., New York, at $1255 for the guardhouse. Noted May 21.

Buoys and Appendages—Tompkinsville, N. Y.—Bids will be received until 2 p.m., July 29, by the Light-House Inspector, Third District Tompkinsville, for furnishing buoys and appendages for 1915.

+Dredging—Philadelphia, Penn.—The contract for dredging in the reserve basin at the navy yard, Philadelphia, has been awarded to the AMERICAN DREDGING CO., 308 Chestnut St., Philadelphia, Penn., at $9075. Noted May 21.

+Water Tube Boilers—Philadelphia, Penn.—The contract for furnishing two water tube boilers has been awarded by Lieut. Col. Cyrus S. Radford, to the HEINE SAFETY BOILER CO., St. Louis, Mo. at $8332. Noted Feb. 26.

Jetty Work—Wilmington, Del.—The lowest bidder for furnishing and placing stone for repairs to jetties, Cold Spring Inlet, N. J., was the Conger Duncan Construction Co., New York, at $2.92 per ton. Noted June 11.

Switchboard—Washington Barracks, D. C.—Bids will be received until 11 a.m., July 23, by Lt. Col. Joseph E. Kuhn, Corps Engrs., U. S. A., for furnishing one direct-current switchboard of 16 panels.

Dredging—Norfolk, Va.—Bids were received June 23, by Lt. Col. E. Eveleth Winslow, Corps Engrs., U. S. A., for dredging inland waterway from Norfolk, Va., to Beaufort Inlet, N. C., as follows: Bowers Southern Dredging Co., Galveston, Tex., 0.059c., per cu.yd. total $100,300; Atlantic Gulf & Pacific Co., New York, 0.0623c., $105,910; Sanford & Brooks Co., Baltimore, Md., 0.0685c., $116,450; Maryland Dredging & Contracting Co., Baltimore, Md., 0.07c., $119,000; Norfolk Dredging Co., Norfolk, Va., 0.1025c., $174,250; Southern Dredging Co., Mobile, Ala., 0.0685c., $116,450; Home Dredging Co., 0.08c.; $136,000. Noted May 28.

Poiree Trestles, Etc.—Wheeling, W. Va.—Bids were received June 18, by Maj. J. P. Jervey, Corps Engrs., U. S. A., for furnishing and delivering poiree trestles and recess engine pit covers for Dams Nos. 19 and 28, Ohio River, as follows: (a) 129,200 lb. metal work for Dam No. 19, (b) 223,800 lb. metal work for Dam No. 28; American Bridge Co. of New York, Pittsburgh, Penn., (a) $3010, (b) $6445, (c) total, $9456; King Bridge Co., Cleveland, Ohio, (a) $3036, (b) $7050, (c) $10,086; W. N. Kratzer & Co., Pittsburgh, Penn., (a) $3385, (b) $6177, (c) $9562; Union Foundry & Machine Co., Pittsburgh, Penn., (a) $3552, (b) $6638, (c) $10,190; Penn Bridge Co., Beaver Falls, Penn., (a) $2842, (b) $5931, (c) $8773 (recommended for acceptance); Henry Vogt Machine Co., Inc., Louisville, Ky., (a) $3715, (b) $8952, (c) $12,667; J. E. Moss Iron Works, Wheeling, W. Va., (a) $5491, (b) $9512, (c) $15,003. Noted May 28.

Levee—Vicksburg, Miss.—Bids will be received until 11 a.m., July 13, by Maj. J. R. Slattery, Corps Engrs., U. S. A., for about 7500 cu.yd. of levee work.

+Building—New Orleans, La.—The contract for the erection of the radio building at the naval station, has been awarded to HENRY MONK, Pensacola, Fla. at $5780. Noted June 25.

Repairs to Buildings—New Orleans, La.—The date of receiving bids for repairs to buildings, Naval Station, New Orleans, has been extended from 11 a.m., July 6 to 11 a.m., July 18, by H. R. Stanford, Chief Bureau of Yards and Docks, Navy Dept., Washington, D. C. Noted June 11.

Repairs to Wharf—New Orleans, La.—The date of receiving bids for repairs to wharf at New Orleans, has been extended from 11 a.m., July 6, to 11 a.m., July 18, by H. R. Stanford, Chief, Bureau of Yards & Docks, Navy Dept., Washington, D. C. Noted June 11.

Riprap Stone—Memphis, Tenn.—Bids will be received until 11 a.m., July 27, by Maj. E. M. Markham, Corps Engrs., U. S. A. for furnishing about 40,000 tons of riprap stone, rail delivery.

+Post Office—Winchester, Tenn.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post office at Winchester to ALGERNON BLAIR, Montgomery, Ala., at $45,219.

★Buildings—West Point, Ky.—Bids will be received until 11 a.m., July 31, by Maj. J. C. Oakes, Corps Engrs., U. S. A., for constructing four brick dwellings at Dam No. 43, Ohio River, four miles below West Point, Key.

Building—Cincinnati, Ohio—Bids were received by the Secretary, Dept. of the Interior, for the erection of a two-story and cellar brick cement building for the weather bureau at Cincinnati, Ohio as follows: De Riso Co., Union, N. J., $18,228; McLennen Bros., Cincinnati, Ohio, $16,261; Charles Griffith & Sons Co., Cincinnati, Ohio, $17,750; Samuel Hurr, Cincinnati, Ohio, $16,000; Ohio Building & Construction Co., Cincinnati, Ohio, $15,900; William Miller & Son, Cincinnati, $16,927. Noted June 18.

Elevators—Dayton, Ohio—Bids were received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the installation of two electric passenger elevators, three hydraulic lifts, and a pumping plant in the U. S. post office and courthouse at Dayton as follows: The Ohio Elevator & Machine Co., Columbus, Ohio, $14,000, Faunt Le Roy Elevator Co., Baltimore, Md., $12,432; Kaestner & Hecht Co., Chicago, Ill., $13,794; Otis Elevator Co., Washington, D. C., $13,763. Noted June 11.

River Bulkhead—Alpena, Mich.—Bids were received for Alpena, follows: Jenkins & Davison, Alpena, Mich., at $6350; John Monaghan, Alpena, Mich., $4925; Riley & Monkman, Alpena, $12,930. Noted June 11.

★Breakwater—Chicago, Ill.—Bids will be received until 10 a.m., July 23, by Lieut.-Col. W. V. Judson, Corps Engrs., U. S. A., for constructing timber breakwater at Chicago Harbor, Ill.

+Building—Great Lakes, Ill.—The contract for constructing a two-story brick building at the naval station, Great Lakes has been awarded to C. W. PENCE, Waukegan, Ill., at $14,515. Noted June 4.

+Towers—Great Lakes, Ill.—The following bids were received by the Chief, Bureau of Yards & Docks, Navy Dept. Washington, D. C., for constructing foundations for two 100 ft. steel towers at the Naval Training station: C. W. PENCE, 231 North St. James St., Waukegan, Ill., $2480; (a) excavation $1 per cu.yd., (b) concrete $10 cu.yd. (awarded contract) M. E. Baldwin Construction Co., 140 South Dearborn St., Chicago, Ill., $4195; M. McCugo, Waukegan, Ill., (a) $1.50, (b) $14; R. F. Wilson & Co., 154 West Randolph St., Chicago, Ill., $4020, Pittsburgh Des Moines Steel Co., 886 Curry Bldg., Pittsburgh, Penn., $3500; John Jeffrey, 127 North Dearborn St., Chicago, Ill., $2975. Noted July 2.

★+Steel Work and Cable—Ashland, Wis.—The contract for furnishing 11,000 ft. of submarine armored cable for the Ashland light station, has been awarded to the STANDARD UNDERGROUND CABLE CO., at $2739. Noted May 28.

★Gates, Etc.—Great Falls, Mont.—Bids will be received until 2 p.m., Aug. 4, by F. H. Newell, Dir. U. S. Reclamation Service, Great Falls, for furnishing structural steel and stands and accessories, for projects in the northern division.

★Metal Flumes—Great Falls, Mont.—Bids were received for furnishing and delivering f. o. b. manufacturer's plant, metal flumes as follows: (a) 97 lin. ft. of 5 ft. 9 in. flumes, (b) 32 lin. ft. 5 ft. 9 in flumes, (c) 6 ft. 4¼ in. (d) 7 ft., (e) 10 ft. 10 in., (f) 10 ft. 10 in. (curved), (g), 11 ft. 5½ in.

[illegible] West Colfax Ave., Denver, Colo. [illegible] Calvert & F[illegible] [illegible] Kramer Mfg. Co. [illegible] Noted [illegible]

Levee Work—[illegible] All bids received June 4 by [illegible], U. S. A., Vicksburg, Miss., for [illegible] levee on [illegible] River have been rejected. Noted [illegible]

✦Electric Lighting System—Fort [illegible], Tex.—The [illegible] electric lighting system at Fort [illegible] has been awarded to the NATIONAL TELEGRAPHONE [illegible] Co., [illegible], Tex. Noted May 28.

●Pipe—[illegible], Colo.—Bids will be received until 2 p.m., [illegible] by F. H. Newell, Dir., U. S. Reclamation Service, [illegible] for constructing approx. [illegible] ft. of [illegible] wood stave pipe for the [illegible] South Dakota, the Uncompahgre Valley Project, Colo., and the North Platte Project, Nebraska.

Post Office—[illegible], Colo.—Bids were received as follows, June [illegible] by Oscar Wenderoth, Supervising Archt., Treasury Dept., Washington, D. C., for the construction of a post office [illegible] (a) limestone, (c) sandstone, (e) white Colorado marble, (f) white marble other than Colorado. J. H. Wiese, [illegible], Neb., (a) $[illegible], (c) $127,[illegible], (d) $117,[illegible]. R. J. [illegible], Colo., (a) $[illegible], (f) $146,[illegible], (e) $166,[illegible]. [illegible], Pasadena, Calif., (a) $[illegible], (h) $[illegible]. [illegible] & Wenzel Construction Co., Wichita, Kan., (a) $[illegible], (f) $[illegible], (c) $[illegible], (d) $118,[illegible]. George [illegible] Co., Chicago, Ill., (a) $[illegible], (c) $127,20[illegible], (d) $[illegible]. F. H. [illegible], Denver, Colo., (e) $165,[illegible], (h) $[illegible], (c) $[illegible]. One-story and basement building with [illegible] stone [illegible] ft. ground area, fireproof construction. Noted May 28.

●Bridge—Boise, Idaho—Bids will be received until 2 p.m., [illegible] by F. H. Newell, Dir., U. S. Reclamation Service, Boise, for erecting one [illegible]-ft. span steel highway bridge over the spillway channel, Arrowrock Dam, Boise project, Idaho.

Turbine Exciter—Puget Sound, Wash.—Bids will be received until [illegible] July [illegible] by H. R. Stanford, Chief Bureau of Yards & Docks, Navy Dept., Washington, D. C., for furnishing and installing one [illegible]-kw. turbine-driven exciter in the central power plant at the Navy Yard, Puget Sound, Wash. Noted [illegible] July [illegible].

Post Office—Medford, Ore.—Bids will be received until 3 p.m. Aug. [illegible] by Oscar Wenderoth, Supervg. Archt., Treasury Dept., Washington, D. C., for the construction complete (including mechanical equipment except elevators) of the U. S. post office at Medford, Ore.

Boilers and Accessories—[illegible]—Bids will be received until 11 a.m. July [illegible] by H. R. Stanford, Chief Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing and installing four [illegible]-hp. water tube boilers, with accessories, in the central power plant, naval station, [illegible].

MISCELLANEOUS

Dredging—Boston, Mass.—[illegible] Bids will be received [illegible] July [illegible] by the State Board of Harbor and Land Commissioners [illegible] for dredging in [illegible] Harbor. The work calls for [illegible]. [illegible] F. Williams is Ch. Engr.

Breakwater—[illegible]

●Museum Cases—Albany, N. Y.—[illegible]

Dredging, Etc.—[illegible]

Dock, Coal Pockets, Etc.—[illegible]

●Subway—[illegible]

●Borings—New York, N. Y.—[illegible]

●Subway—New York, N. Y.—[illegible] two-track railroad in the Borough of Manhattan, connecting the Broadway Subway with the Queensboro Bridge and extending from Seventh Ave. to Fifth Ave., where the two tracks diverge, one continuing through [illegible]th and the other through [illegible]th St. to Second Ave.

Dikes—Redfield, N. Y.—The State Conservation Commission, Albany, has granted permission to the Salmon River Power Development Co. to construct dikes along the east side of Stillwater Reservoir at Redfield.

Channel Work—Rochester, N. Y.—The city plans to deepen the Genesee River at a cost of $[illegible]. F. T. [illegible] is City Engr.

Dock Work—Keansburg, N. J.—The Keansburg Steamboat Co. will enlarge its dock, now about one-half mile long, to accommodate new trucks of the Jersey Central Traction Co.

Fire Apparatus—Orange, N. J.—The City Commission plans to purchase two motor trucks and two motor hose wagons. D. F. Minahan is City Clk.

Harbor Work—Trenton, N. J.—J. R. Fell, Jr., City Engr., has completed plans for the proposed basin to be constructed in connection with the channel now being dredged. It will be [illegible] ft. Plans for the municipal harbor terminus at Fair and Federal Sts. have also been completed.

Stable—Pittsburgh, Penn.—B[illegible] Bros., [illegible] Ave., Pittsburgh, have submitted the lowest bid to the Department of Charities for constructing a new stable at about $[illegible]. The building will be two stories high.

✦Barns—State College, Penn.—Pennsylvania State College will construct three dairy barns to cost $[illegible].

Fire Station—Wilkes-Barre, Penn.—Bids will be received until noon, July 14, by F. H. Gates, City Clk., for constructing a fire station.

Wharves—Augusta, Ga.—Bids are being asked by the Augusta Barge Line Co., Augusta, for constructing wharves at the foot of Fifth St. The structures will be of steel.

✦Levee—Augusta, Ga.—The city has awarded the contract to A. J. TWIGGS & SONS, Augusta, for constructing levee between Sixth St. and East Boundary, at about $[illegible].

✦Ditches—Senatobia, Miss.—The Senatobia Creek Drainage Commission has awarded the contract to A. C. MILLER, Walnut Ridge, Ark., for constructing two main ditches.

✦Levee Work—New Orleans, La.—The State Board of Engineers, New Orleans, has awarded the contract to HELGASON BROS., Vicksburg, Miss., for levee work, at [illegible] per cu. yd. The work calls for [illegible] cu. yds.

Drainage—Jackson, Tenn.—Madison County has sold $[illegible],000 of drainage bonds, and will soon award a contract for the construction of a drainage canal 11 miles long, [illegible] ft. wide and 11 ft. deep.

Subway—Cincinnati, Ohio—At the election in November the citizens will vote on the proposition to issue $[illegible] in bonds for the construction of the proposed [illegible] subway. Frank Krug is Ch. Engr.

Elimination of Grade Crossings—[illegible]—The city is arranging to spend $[illegible] for the elimination of the grade crossings of the New York, Chicago & St. Louis Ry. from Fulton Road S. W. to West [illegible] St. Robert Hoffman is City Engineer.

✦Pier Work—Chicago, Ill.—The contract has been awarded by the city, it is reported, to E. L. SCHEIDENHELM, for constructing the superstructure of the proposed municipal pier, at $[illegible].

Grandstand—Ames, Iowa—The Iowa State University, Ames, plans to construct a concrete grandstand and fence. Estimated cost, $[illegible].

Drain—[illegible], Iowa—Bids will be received until 1 p.m. July 11 by C. E. R[illegible] at the [illegible] State Bank, for constructing [illegible] Drain in Harrison Township. Estimated cost, $[illegible].

✦Ditch—[illegible], Minn.—The county has awarded the contract to the NORTHWESTERN DRAINAGE CO., Thief River Falls, Minn., for constructing Ditch [illegible] at [illegible] per cu. yd.

✦Ditch—[illegible], Minn.—The contract has been awarded by the county to WILSON BROS., Cromwell, Minn., for Ditch [illegible] at [illegible] per cu. yd., or $[illegible].

Ditch—Marshall, Minn.—Bids will be received until July [illegible] by [illegible], County Audr., Marshall, for constructing Ditch No. [illegible]. Estimated cost, $[illegible].

Lake Protection—St. Joseph, Mo.—Residents of St. Joseph are considering spending $[illegible] to protect Lake Contrary from the encroachments of the Missouri River. Charles [illegible] is City Engr.

✦Metal Cases—Little Rock, Ark.—The State Capitol Commission has awarded the contract to the [illegible] & LITHOGRAPHING Co., Little Rock, for metal vault cases and shop cases for the state capitol at $[illegible].

✦Terminal—Dallas, Tex.—The contract for constructing the union station and terminals has been awarded to JOHN W. [illegible], of [illegible], Mo., at about $[illegible]. In addition to the new station building, the contract includes [illegible] of terminal tracks and a [illegible] across the Trinity River. All the railroads entering Dallas [illegible] the new station and terminals, and the work is being paid for by those roads. The lines interested are the Texas & Pacific, the Missouri, Kansas & Texas Ry., St. Louis Southwestern Ry., [illegible], Chicago, Rock Island & Pacific Ry., Atchison, Topeka & Santa Fe Ry., Southern Pacific Co. and the Trinity & Brazos Valley Ry.

Wharves—Houston, Tex.—The citizens of Harris County will soon vote on the proposition to issue $[illegible] in bonds for wharves along the Houston Ship Channel.

Drydock—Port Arthur, Tex.—A drydock [illegible] ft. long and [illegible] ft. wide will be built at Port Arthur. Estimated cost, $[illegible]. [illegible], Port Arthur, is interested.

+Harbor Work—Seattle, Wash.—The W. T. BUTLER CONSTRUCTION CO., Central Bldg., Seattle, has been awarded the contract by the Seattle Port Commission for main elevator foundations, East Waterway terminals, at $25,180. The contract includes 62,000 lin.ft. of piling, as well as foundations. Other bids were: Weymouth Construction Co., $26,272; Franklin Engineering Co., $26,696; alternate bid $25,322; H. Brandt Construction Co., $26,910; Graff Construction Co., $27,243; Washington Construction Co., $28,308; M. J. Hursen Co., $28,600; Puget Sound Bridge & Dredging Co., $28,835; Harrington-Peters Co., $28,940; alternate bid, $27,700; Nettleton-Bruce-Eachbach Co., $30,605; Jahn Constructing Co., $31,540; McRae Bros., $31,697; Sound Construction & Engineering Co., $21,718; C. F. Martin, $32,492.

Comfort Stations—Seattle, Wash.—The city is considering the construction of public comfort stations and rest platforms. Estimated cost, $25,000.

+Dock Superstructure—Seattle, Wash.—The Port of Seattle Commission has awarded the contract to HARRINGTON-PETERS CO., Seattle, for constructing the superstructure of the Hanford St. Dock, at $87,000. Noted July 2.

Dikes—Tacoma, Wash.—The County Commissioners of Pierce County, Tacoma, will establish a diking district outside the city limits of Tacoma, to reclaim between 1500 and 1900 acres of land.

+Lumber—Los Angeles, Calif. — The Harbor Commission has awarded the contract to the SAN PEDRO LUMBER CO., for 1,500,000 ft. of lumber to be used in connection with the improvement of the inner harbor.

CONTRACT PRICE

+Bridge Construction—Tiffin, Ohio—Bids were received by the Board of County Commissioners, May 23, for the construction of three concrete bridges across the Sandusky River at Market, Huss and Ella Sts., Tiffin, from (A) VANG CONSTRUCTION CO., Cumberland, Md. (awarded contract for Market St. bridge); (B) J. H. & LEWIS JONES, Fostoria, Ohio and Kansas, Ohio (awarded contract for Huss St. bridge); (C) Wynkoop, McGormley Co., Toledo, Ohio; (D) N. R. Porterfield, 17 Battery place, New York, N. Y.; (E) A. SCHECKELHOFF & SON, Fremont, Ohio (awarded contract for Ella St. bridge); (F) Walter S. Newhall Co., Citizens' Bldg., Cleveland, Ohio; (G) Fritz-Rumer-Cook-Grant Co., Eberly Bldg., Cleveland, Ohio; (H) I. D. Tuttle Co., Bushnell Bldg., Springfield, Ohio; (I) Morse-McGorriam & Bassett, Cleveland, Ohio. The item bids were as follows:

+Ferry Boat—Oakland, Calif.—The San Francisco-Oakland Terminal Rys. Co. has awarded the contract for the construction of a 230-ft. ferry-boat to the MOORE & SCOTT IRON WORKS, Oakland, at $305,000.

+Granite Work—Oakland, Calif.—The City Council has awarded the contract for granite work on the municipal auditorium to the CALIFORNIA GRANITE CO., San Francisco, Calif., at $71,857.

Dry Dock—San Francisco, Calif.—The Union Iron Works will ask for bids soon for the construction of a dry-dock to cost about $2,500,000. John A. McGregor, 2567 Green St., San Francisco, is Pres.

★Tunnel—San Francisco, Calif.—Bids will be received by the Board of Public Works until Aug. 19 for the construction of the Twin Peaks Tunnel. It will be 12,000 ft. long, 30 ft. wide, 28 ft. high and will be lined with concrete. Estimated cost, $3,300,000. Frederick J. Churchill is Secy. Bd. Noted May 21.

Plans and specifications are on file at the office of Engineering News, 505 Pearl St., New York.

Dams and Canals—San Francisco, Calif.—The Department of the Interior has given Leland & Myers, San Francisco, Calif., authority to proceed with reclamation work in Modoc County. About $80,000 will be expended in constructing dams and canals.

Pavilion—San Francisco, Calif.—A National Committee has been formed for the purpose of building a British-American pavilion at the Panama-Pacific International Exposition, San Francisco. This body will work in coöperation with the British Committee formed for the same purpose in London, whose members, it is expected, will contribute funds for the purpose and send an exhibit. This plan has no bearing on the arrangements already made for the British competitive exhibitions in the various industrial sections. Estimated cost, $300,000. The British California Association, San Francisco, is interested.

Foundations for Dam — Santa Barbara, Calif. — S. M. Kerns, 625 West Ocean Ave., Long Beach, Calif., was the lowest bidder at $39,360 for the construction of the foundation for the Gibraltar Dam at Santa Barbara. The work will require approximately 980 cu.yd. of excavating rock on abutments, 6540 cu.yd. of material from the river bed, and placing 5635 cu.yd. of concrete. Noted May 28.

BRIDGE CONSTRUCTION, TIFFIN, OHIO

Market St. Bridge

	A	B	C	D	E	F	G	H
3500 cu.yd. earth excavation	$ 0.73	$0.70	$0.50	$0.60	$0.70	$0.57	$1.25	$0.80
550 cu.yd. rock excavation	3.00	5.00	3.40	3.50	3.00	4.00	4.00	4.00
1300 cu.yd. earth fill	0.40	0.50	0.50	0.50	0.40	0.75	0.50	0.40
1200 cu.yd. stone fill	1.25	1.50	1.80	1.25	0.50	1.00	2.00	2.00
1300 cu.yd. concrete, Class A	7.00	7.00	8.00	8.70	8.94	9.50	8.00	8.00
1100 cu.ydl concrete, Class B	9.00	10.00	11.54	12.75	10.00	10.50	12.00	13.40
55 tons reinforcing steel	60.00	50.00	50.00	50.00	53.00	50.00	60.00	60.00
20 tons old bridge reinforcing steel	60.00	25.00	20.00	15.00	10.00	25.00	30.00	60.00
15,500 sq.ft. waterproofing	0.10	0.09	0.10	0.12	0.14	0.11	0.11	0.15
600 lin.ft. 9x20-in. concrete curb	0.50	0.50	0.65	0.45	0.50	0.50	0.60	0.65
5600 sq.ft. 4-in. concrete sidewalk	0.15	0.12	0.12	0.10	0.15	0.12	0.14	0.15
516 lin.ft. concrete railing	4.00	3.50	3.50	2.00	8.00	2.00	3.50	4.00
8 light posts and brackets	40.00	40.00	40.00	40.00	60.00	20.00	25.00	50.00
1300 sq.yd. 6-in. concrete base	1.15	1.25	1.35	0.70	1.50	1.50	1.10	1.00
500 sq.yd. 4-in. concrete base	0.95	0.85	0.90	0.50	1.00	1.00	0.87	0.70
1300 sq.yd. brick pavement	2.00	1.80	1.35	1.25	1.75	3.00	1.00	1.50
500 sq.yd. brick pavement (relaid)	1.25	1.00	1.00	0.60	0.75	1.50	1.20	1.00
400 lin.ft. stone curb taken up and reset	0.15	0.40	0.25	0.25	0.20	0.25	0.60	0.05
50 lin.ft. 4-in. sewer pipe	0.15	0.15	0.13	0.25	0.15	0.20	0.12	0.20
200 lin.ft. 3-in. farm tile	0.10	0.05	0.05	0.02½	0.08	0.10	0.05	0.15
60 lin.ft. 2-in. gas pipe railing	0.80	0.50	0.50	0.75	0.15	0.75	0.20	0.80
100 lin.ft. 2-in. fibre conduit	0.30	0.30	0.20	0.15	0.25	0.25	0.05	0.25
1 old trestle bridge (to be paid to county)	50.00	100.00	1000.00	10.00	500.00	200.00	48.00	100.00
Extended Totals	$40,109	$40,520	$41,038	$41,854	$43,612	$45,119	$45,970	$47,712

Huss St. Bridge

	A	B	C	D	E	F	G	H
1300 cu.yd. earth excavation	$0.73	$0.70	$0.50	$0.60	$0.40	$0.75	$1.25	$1.75
250 cu.yd. rock excavation	3.00	4.00	3.40	4.00	3.00	4.00	4.00	5.00
1700 cu.yd. earth fill	0.40	0.50	0.50	0.50	0.25	0.75	0.50	1.50
900 cu.yd. stone fill	1.25	1.50	1.80	1.00	0.40	1.00	2.00	2.00
800 cu.yd. concrete, Class A	7.00	6.00	7.30	7.40	8.44	9.50	8.00	8.50
675 cu.yd. concrete, Class B	9.00	9.50	10.00	10.25	9.44	11.00	12.00	14.50
30 tons new reinforcing steel	60.00	45.00	50.00	45.00	53.00	55.00	60.00	60.00
10 tons old bridge reinforcing steel	60.00	12.00	25.00	15.00	10.00	25.00	30.00	60.00
7500 sq.yd. waterproofing	0.10	0.09	0.12	0.12	0.14	0.11	0.11	0.15
330 lin.ft. 6x12-in. concrete curb	0.40	0.50	0.50	0.25	0.40	0.25	0.60	0.45
1155 sq.ft. 4-in. sidewalk	0.15	0.12	0.12	0.10	0.13	0.12	0.14	0.15
972 sq.yd. 6-in. concrete pavement	1.15	1.50	1.50	1.25	1.50	1.50	1.10	1.50
25 lin.ft. 4-in. sewer pipe	0.15	0.20	0.14	0.25	0.15	0.20	0.12	0.20
100 lin.ft. 3-in. farm tile	0.10	0.03	0.06	0.02½	0.08	0.10	0.05	0.15
40 lin.ft. 2-in. gas pipe railing	0.80	0.50	0.30	0.75	0.15	0.75	0.20	0.80
652 lin.ft. concrete railing	4.00	1.50	3.00	1.45	4.00	2.00	3.00	4.50
8 trolley posts	40.00	15.00	40.00	15.00	50.00	15.00	32.00	50.00
300 sq.yd. 4-in. concrete base	0.95	0.90	1.00	0.50	1.25	1.00	0.87	0.75
Extended Totals	$23,011	$20,625	$23,569	$21,436	$23,060	$25,348	$26,618	$33,378

Ella St. Bridge

	A	B	C	D	E	F	I
1400 cu.yd. earth excavation	$0.73	$0.70	$0.50	$0.60	$0.47	$0.90	$0.75
100 cu.yd. rock excavation	3.00	5.00	4.00	4.50	4.00	4.00	4.00
500 cu.yd. earth fill	0.40	0.50	0.50	0.35	0.25	0.75	0.65
550 cu.yd. stone fill	1.10	1.50	1.90	1.25	0.40	1.00	2.75
600 cu.yd. concrete, Class A	7.50	7.00	8.00	8.45	8.19	9.50	7.75
450 cu.yd. concrete, Class B	9.50	10.00	13.00	14.00	10.19	11.50	11.00
18 tons new reinforcing steel	60.00	50.00	50.00	45.00	53.00	55.00	70.00
8 tons old bridge reinforcing steel	60.00	25.00	25.00	15.00	10.00	25.00	40.00
4300 sq.ft. waterproofing	0.10	0.09	0.15	0.12	0.12	0.11	0.12
290 lin.ft. 6x12-in. concrete curb	0.40	0.40	0.90	0.25	0.40	0.25	0.30
870 sq.ft. 4-in. sidewalk	0.15	0.12	0.12	0.10	0.13	0.12	0.12
485 sq.yd. 6-in. concrete pavement	1.25	1.50	1.50	1.25	1.50	1.50	1.02
25 lin.ft. 4-in. sewer pipe	0.15	0.20	0.14	0.25	0.15	0.20	0.25
60 lin.ft. 5-in. farm tile	0.10	0.05	0.06	0.02½	0.08	0.10	0.15
40 lin.ft. 2-in. gas pipe railing	0.80	0.50	0.50	0.75	0.15	0.75	1.25
580 lin.ft. concrete and 3-in. railing	1.10	1.00	0.80	1.25	1.00	1.50	1.50
Extended Totals	$14,425	$14,298	$16,371	$16,497	$14,004	$16,728	$16,925

Dredging—Ottawa, Ont.—Bids will be received by R. C. Des[illegible], Sec'y Dept. Pub. Wks., Ottawa, for the dredging required at Kincardine, Bruce Mines, Port Hope or Little Detroit, Ont.

+Wharf—Ottawa, Ont.—(Official)—The Department of Public Works, Ottawa, has awarded the contract to WILLIAM [illegible] FAWCETT, Temperance Vale, N. B., for constructing a wharf at [illegible] Point.

Park Improvements—Port Arthur, Ont.—The city plans to spend $[illegible] for park improvements.

+Dredging—Port [illegible]well, Ont.—(Official)—The Department of Public Works, Ottawa, Ont., has awarded the contract to the [illegible] DREDGING & CONSTRUCTION CO., 17½ [illegible] St. East, Toronto, Ont., for the dredging required at Port [illegible]well.

+Sluiceway—[illegible]g, Sask.—The Government Board of Highway Engineers has awarded the contract to the PARSONS CONSTRUCTION & ENGINEERING CO., LTD., Regina, Sask., for constructing a reinforced concrete sluiceway near Langenburg.

Wharf—Sidney, B. C.—The Victoria & Sidney Ry. Co. plans to construct a wharf to replace its present wharf at Sidney. Estimated cost, $10,000. F. Van Sant, Victoria, B. C., is Supt.

Wall—Victoria, B. C.—The Department of Public Works, Ottawa, Ont., will receive bids until July 27 for the construction of a concrete retaining wall at Songhees Point, Victoria, B. C. Estimated cost, $250,000. The work includes a large amount of dredging.

BUILDINGS

+Boston, Mass.—The contract for building an apartment house at Commonwealth Ave. and Commonwealth Terrace, Brighton District, has been awarded to the McDONALD & JOSLIN CO., 161 Devonshire St. The building will be of brick and stone, 125x160 ft., four stories, estimated to cost $1[illegible]. Berry & Davidson, 2[illegible] Central St., are the Archs.

Boston, Mass.—John C. Stafford, Arch., 15 Beacon St., is preparing plans for a three-story apartment, 42x127 ft., for Theodore F. Monroe, Tremont Bldg.

Boston, Mass.—Notman & Abrams, 11 Tetlow St., will build a four-story apartment [illegible]x60 ft., on Worthington St. The estimated cost is $6[illegible].

Holyoke, Mass.—The directors of the Knights of Columbus have received bids for a new building, but have not yet awarded the contract. They are considering the bids of Daniel O'Connell's Sons, at $82,412 and Louis Carrean & Sons, at $74,47[illegible].

Hyde Park, Mass.—The Littlefield Trust Co. will build an $[illegible] business block, including a theater. Harry M. Ramsey is the Arch.

Northampton, Mass.—The municipality will spend $110,000 in school improvements. An addition to one building will cost $[illegible] and alterations to two others will cost $25,000 each. W. H. Feiker is Mayor.

Pittsfield, Mass.—McCormick & Joyce are having plans prepared for a three-story apartment block, 102x132 ft., to be erected on South St., at a cost of $75,000.

Pittsfield, Mass.—Plans are being prepared by J. MacA. Vance, Pittsfield, for an addition to the Dawes school. The estimated cost is $[illegible].

+Springfield, Mass.—Meekins, Packard & Wheaton, Hillman St., have awarded a contract to F. R. LEY & CO. for a six-story, [illegible]x1[illegible] ft. building. B. Hammett Leahery is the Arch.

CONTRACT PRICE

Milltown, N. J.—Bids were received June 15 for sewers from (A) [illegible] & [illegible], New Brunswick, (B) Morgan & [illegible], New Brunswick, (C) Frank [illegible], Paterson, (D) [illegible] Engineering & Contracting Co., Norwich, Conn., (E) [illegible] Kelley, Newark, (F) F[illegible]brown Taylor Co., 1 Broadway, New York, N. Y., (G) Atlantic Contracting & Supply Co., Atlantic City, (H) Kelly, McFeeley & Co., Camden, (I) [illegible] & [illegible] Co., Ocean City, (J) John J. Hart, Peekskill, N. Y., (K) Joseph Johnson & Sons, New York, N. Y. [illegible], 50 Church St., New York, N. Y., is Engr. The item bids are as follows:

Worcester, Mass.—John P. Casey has purchased a site at 94 Lincoln St., on which he will build a seven-story, brick apartment.

Pawtucket, R. I.—J. F. O'Malley, 75 Westminster St., Providence, is preparing plans for a brick and concrete office and store building for the Broad St. Power Co. The estimated cost is $1[illegible].

Providence, R. I.—Bids were received by the Board of Contract and Supply for making alterations to the City Hall from Horton-Hemingway, $1[illegible],361, Norcross Bros. Co., $86,126, Gilbane Bldg. Co., $111,217, J. W. Bishop Co., $99,317, the Connors Bros. Co., $84,83[illegible], Charles R. Maguire Co., $91,5[illegible]3. Noted June 18.

Providence, R. I.—Plans are being prepared for a school for the Mount Pleasant District, estimated to cost $100,000. Mayor Gainer is Chn. of the School Comn.

+Woonsocket, R. I.—The contract for constructing the business block for James M. McCarthy has been awarded to the CRUISE & SMILEY CONSTRUCTION CO., Pawtucket, R. I. The building will be six stories, of brick and steel, 60x1[illegible] ft. McClintock & Craig, Springfield, Mass., are the Archs.

+New Haven, Conn.—The National New Haven Bank has awarded a general contract to HIGGISON BROS., 7 East 44th St., New York, N. Y., for a two-story and basement, steel, brick and limestone building, costing $200,000. Theodore C. Visscher, 239 Madison Ave., New York, N. Y., is the Arch.

+Buffalo, N. Y.—The R. C. Church of the Assumption, Amherst and Reservation Sts., has awarded a contract to CHARLES E. EVERETT, White Bldg., for a $175,000 church. Carl Schmidt, Prudential Bldg., is the Arch.

Buffalo, N. Y.—The St. Marks R. C. Church will erect a stone church at Woodward Ave. and Amherst St. to cost about $50,000.

+Jamestown, N. Y.—The contract for erecting the First Baptist Church has been awarded to JAMESTOWN CONSTRUCTION CO. The estimated cost is $75,[illegible].

Rochester, N. Y.—The Garfield Real Estate Co. will build a five-story and basement, 66x9[illegible] ft. addition to the Wilder Arcade Bldg., Main and Aqueduct Sts. The cost is estimated at $12[illegible]. J. Foster Warner is the Arch.

Jersey City, N. J.—John T. Rowland, Arch., is preparing plans for the new Lincoln High School to be erected by the Board of Education. The cost is estimated at $150,000.

Newark, N. J.—The Parkway Realty Co. plans to build a 65x70 ft. brick apartment, costing $40,[illegible]. Edward V. Warren is the Arch.

CONTRACT PRICE

Intercepting Sewer—Newark, N. J.—Bids were received by the Passaic Valley Sewerage Commissioners, June 2[illegible], for constructing part of Section 9 of the Main Intercepting Sewer, from (A) Oscar Daniels Co., Woolworth Bldg., New York, N. Y., (B) Bruno & Petitti, Belleville, N. J., (C) New York & New Jersey Construction Co., 30 East 42d St., New York, N. Y., (D) Phoenix Construction Co., 41 Park Row, New York, N. Y., (E) P. H. & J. Conlan, Newark, (F) Merritt-Ruckgaber Co., 50 Church St., New York, (G) Caldwell-Wingate Co., 381 Fourth Ave., New York. The item bids were as follows:

INTERCEPTING SEWER, NEWARK, N. J.

Part of Section 9

	A	B	C	D	E	F	G
Excavation for 10-in. sewer, Venturi meter structures, conduits, etc.	$128,[illegible]	$133,[illegible]	$[illegible]	$110,973	$21[illegible]	$[illegible]	$[illegible]
[illegible] cu. yd. rock excavation	5.00	5.00	2.00	2.00	6.00	2.00	2.50
[illegible] cu. yd. concrete masonry	20.00	17.00	[illegible]	18.00	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.00	2.00	[illegible]
[illegible] sq. yd. granite block paving	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Extended totals	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]

SEWERS, MILLTOWN, N. J.

	A	B	C	D	E	F	G	H	I	J	K
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Extended totals	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$97,177

Princeton, N. J.—The Board of Trustees of Princeton University has accepted the plans prepared by Klauder & Day, Archs., for the proposed dormitory building. The structure is estimated to cost $200,000.

+Vauxhall, N. J.—The Board of Education has awarded the contract for the erection of a new school to EDWARD M. WALDRON & CO. at $42,626. Noted Apr. 30.

+Boyertown, Penn.—The contract for erecting the stone bank building for the National Bank has been awarded to FINK & SEIDEL, Reading at about $40,000.

McKeesport, Penn.—Plans for the high school are being prepared by Vrydaugh & Wolf, Pittsburgh. The estimated cost is $200,000.

Reading, Penn.—H. L. Stevens & Co., 519 Hammond Bldg., Detroit, Mich., is preparing plans for a seven-story and basement hotel, 75x165 ft. for the Perry Square Hotel Co. The estimated cost is $450,000.

Ridley Park, Penn.—Plans are being prepared by Rankin, Kellogg & Crane, 1012 Walnut St., Philadelphia, for an adifice for Ridley Park Presbyterian Church. The estimated cost is $40,000.

+Wilmington, Del.—The contract for building the addition to Delaware Hospital has been awarded by the Board of Trustees to the A. S. REED & BRO. CO., 815 Shipley St., at about $60,000.

CONTRACT PRICE

+Waterworks Improvements—Moline, Ill.—Bids were recenved May 12 by the Board of Local Improvements for the improvement of the water system in the East End Water Main District, from (A) Public Service Construction Co., Omaha, Neb.; (B) Dunnegan & Masters, Shenandoah, Iowa; (C) E. R. Harding Co., Racine, Wis.; (D) Gray-Robinson Construction Co., Manitow, Wis.; (E) Moline Heating & Construction Co., Moline, Ill.; (F) T. C. BROOKS SONS, Jackson, Mich.; (awarded contract); (G) Dearborn Construction Co., Waterloo, Iowa. The item bids were as follows:

+Baltimore, Md.—The contract for erecting the four-story brick building at 214 North Charles St., for the Fidelity & Deposit Co. of Maryland, has been awarded to MORROW BROS., at about $40,000. Baldwin & Pennington are the Archs.

+Petersburg, Va.—The contract for constructing the five-story apartment on Sycamore Ave. for the Centre Hill Apartments, Inc., has been awarded to E. A. BROWN, Richmond, Va., at about $75,000.

Spartanburg, S. C.—The Spartanburg Hotel Co. will construct a hotel on the site of the Spartanburg Inn. J. B. Cleveland is interested. The estimated cost is $250,000.

+Bessemer, Ala.—The contract for erecting the five-story brick building at 19th St. and Third Ave. has been awarded to AGER & CLINE, Birmingham, at $67,000.

+Birmingham, Ala.—The contract for constructing an apartment at Highland Ave. and Cleveland St., for I. M. Barnett, has been awarded to the JOY-MARRIOTT CONSTRUCTION CO., at $40,000.

Birmingham, Ala.—The Birmingham Athletic Club will erect a 10-story brick building at Fifth Ave. and 20th St. Estimated cost, $350,000. Edward B. Anderson is Pres.

New Orleans, La.—John Minot, at $74,000, submitted the lowest bid for the construction of the combined police station and city criminal court.

Nashville, Tenn.—The Realty Construction Co. will build a seven-story office building.

Louisville, Ky.—Henry Wolters, Board of Trade Bldg., is preparing plans for a seven-story reinforced concrete office building to be erected by the Knights of Pythias, to cost about $100,000. Bids will be received about Aug. 1.

Alliance, Ohio—Plans have been prepared by L. W. Thomas, Arch., 303 Pythian Bldg., Cleveland, for the erection of a three-story 60x100-ft. city hall at Alliance. The estimated cost is $65,000.

WATERWORKS IMPROVEMENTS, MOLINE, ILL.

	A	B	C	D	E	F	G
12,170 lin.ft. 12-in. watermain	$1.75	$3.90	$1.90	$1.85	$1.78	$1.71	$1.81½
5600 lin.ft. 10-in. watermain	1.40	1.50	1.55	1.58	1.46	1.32	1.50
13,000 lin.ft. 8-in. watermain	1.18	1.20	1.20	1.20	1.21	1.10	1.13
33,800 lin.ft. 6-in. watermain	0.82	0.95	0.90	0.90	0.89	0.85	0.88
4300 lin.ft. 4-in. watermain	0.60	0.70	0.70	0.67	0.72	0.75	0.64
11 12-in. gate valves	42.50	45.00	45.00	43.00	40.00	35.00	40.00
12-in. gate valves	38.50	40.00	50.00	43.00	40.00	38.00	40.00
12-in. gate valves	40.50	38.25	47.00	41.00	40.00	39.00	40.00
6 18-in. gate valves	35.00	35.00	35.00	35.00	34.00	28.00	30.00
6 10-in. gate valves	32.00	30.00	38.00	35.00	34.00	38.00	30.00
6 10-in. gate valves	32.50	25.25	36.00	34.00	34.00	28.00	30.00
15 8-in. gate valves	24.50	25.00	23.00	23.50	22.00	20.00	21.00
15 8-in. gate valvee	22.00	20.00	28.00	24.00	22.00	22.00	81.00
15 8-in. gate valvss	·21.50	17.15	24.00	23.00	22.00		21.00
44 6-in. gate valves	16.00	17.00	15.00	16.00	15.00	13.00	15.00
44 6-in. gate valves	13.00	12.00	19.00	16.50	15.00	15.00	15.00
44 6-in. gate valves	13.00	11.00	16.25	15.75	15.00	16.00	15.00
9 4-in. gate valves	9.50	14.00	10.00	9.50	9.50	10.00	9.00
9 4-in. gate valves	8.00	9.00	12.00	9.50	9.50	11.00	9.00
9 4-in. gate valves	7.50	7.30	11.00	8.50	9.50	11.00	9.00
85 concrete valve boxes	25.00	23.00	24.00	25.00	25.00	25.00	25.00
11 8-in. fire hydrants	52.50	50.00	50.00	52.00	52.00	38.00	50.00
11 8-in. fire hydrants	42.50	45.00	55.00	53.00	52.00	46.00	50.00
11 8-in. fire hydrants	50.00	38.50	52.00	50.00	52.00 52.00	48.00	50.00
126 6-in. fire hydrants	35.00	35.00	35.00	35.00	35.00	30.00	33.00
126 6-in. fire hydrants	32.00	30.00	39.00	36.00	35.00 35.00	32.00	33.00
126 6-in. fire hydran	32.00	26.40	36.00	34.50	35.00	34.00	33.00
5 4-in. fire hydrants	34.00	33.00	35.00	34.00	34.50 34.50	28.00	27.50
5 4-in. fire hydrants	32.00	28.00	38.00	35.00	34.50	30.00	27.50
5 4-in. fire hydrants	32.00	26.40	36.00	33.50	34.50	30.00	27.50
1 12x12x8x8-in. cross	25.00	25.00	27.00	27.00	23.30	18.00	19.10
1 12x12x6x6-in. eross	24.00	24.00	26.00	26.50	23.00	17.00	18.00
1 12x12x10x10-in. cross	26.00	26.00	28.00	27.00	24.00	20.00	20.20
3 12x12x12-in. tees	25.00	25.00	25.00	26.50	24.00	17.00	18.00
7 12x12x8-in. tees	21.00	20.00	24.00	24.00	22.00	16.00	16.60
14 12x12x6-in. tees	20.00	18.50	23.00	23.50	21.00	18.00	16.10
2 12-in.—45° bends	15.00	15.50	15.00	18.09	16.00	9.00	12.80
1 12-in. plug	3.00	2.50	3.00	3.00	3.00	2.00	2.50
2 10x10x10-in. tees	20.00	18.00	20.00	21.00	19.00	14.00	13.85
15 10x10x6-in. tees	17.00	15.00	17.00	19.00	18.00	12.00	12.35
1 10x10x6x6-in. cross	20.00	20.00	21.00	23.00	20.00	14.00	14.25
2 10x10x10-in. Y branches	20.00	20.00	22.00	23.00	21.00	16.00	15.20
1 10x10x6-in. Y branches	20.00	18.00	20.00	20.00	19.00	16.00	14.25
1 12-in. to 10-in. reducer	13.00	13.00	12.00	14.50	14.50	10.00	9.15
16 8x8x8-in. tees	14.50	12.00	15.00	14.50	15.00	11.00	10.30
21 8x8x6-in. tees	14.00	11.50	15.00	15.00	14.00	9.00	9.50
1 8x8x4-in. tees	13.50	12.00	15.00	14.00	15.00	10.00	8.95
4 8x8x8x8-in. crosses	18.00	18.00	20.00	21.00	19.00	13.00	13.00
2 8x8x6x6-in. erosses	18.00	15.00	19.00	19.00	18.00	12.00	11.40
1 12 to 8-in. reducer	12.00	11.00	12.00	12.50	12.50	9.00	8.10
3 8 to 6-in. reducer	7.50	8.00	8.00	8.50	8.00	6.00	5.00
3 8-in.—45° bends	8.00	7.50	10.00	10.00	9.50	6.00	5.25
1 6 to 8-in. increaser	7.25	7.50	6.00	8.50	8.50	6.00	5.25
10 8-in. plugs	2.00	2.00	2.50	2.50	2.00	1.00	1.35
92 6x6x6-in. tees	10.00	11.00	12.00	12.50	11.00	7.00	9.00
6 6x6x4-in. tees	9.50	10.00	11.00	11.00	10.00	7.00	7.75
2 6x6x6-in. Y branches	10.00	11.00	12.00	12.00	11.00	8.00	6.35
5 6x6x6x6-in. crosses	14.00	15.00	15.00	15.50	14.50	9.00	9.00
1 12 tn 6-in. reducers	9.75	10.00	11.00	11.50	11.50	7.00	7.65
1 10 to 6-in. reducers	9.00	9.50	10.00	10.50	10.50	7.00	6.30
5 8 to 6-in. reducers	7.50	8.00	8.00	8.50	8.00	5.00	5.25
5 5 to 4-in. reducers	5.00	5.50	6.00	6.00	6.00	5.00	3.65
1 6 to 10-in. increaser	9.50	10.00	10.00	10.50	10.50	6.00	6.30
2 6-in.—45° bends	8.00	7.50	8.00	8.00	7.00	4.00	3.70
27 6-in. plugs	1.50	2.00	2.50	2.50	2.00	1.00	1.00
10 4x4x4-in. tees	6.50	7.00	9.00	8.00	7.50	5.00	5.80
1 10 to 4-in. reducer	7.50	7.50	8.00	8.50	8.50	7.00	5.70
2 4 to 6-in. increasers	6.50	8.00	8.00	8.50	8.00	5.00	3.65
5 4-in. plugs	1.00	1.00	1.00	1.50	1.50	1.00	0.75
Specinl fittings—not listed	0.06	0.05	0.60	0.05¼	0.03¼	0.03¼	0.01
2000 cu.yd. rock excavation	3.50	2.50	3.50	3.00	30 0	3.00	2.50
2000 cu.yd. earth backfill	0.40	0.50	0.90	0.50	0.60	0.50	0.50
75 sq.yd. pavement to replace	2.50	2.00	2.50	2.50	3.00	2.00	2.50
Extended totals	$94,914	$100,424	$102,237	$100,216	$98,397	$92,631	$94,882

✦[illegible]aton, Ohio—The contract for the erection of the [illegible] has been awarded to the W. [illegible] TRIMBLE CONSTRUCTION CO., Pittsburgh, Penn. The estimated cost is [illegible].

✦Cleveland, Ohio—The general contract for the erection [illegible] at Shaker Heights, has been awarded to the WALSH CONSTRUCTION CO., [illegible], Cleveland, Ohio. The estimated cost is [illegible].

✦The general contract for the erection of the mercantile [illegible] has been awarded to the NATIONAL CONCRETE FIREPROOFING CO., [illegible], Cleveland. The estimated cost is $14[illegible].

Plans are being prepared by [illegible] & Taylor, Archs., [illegible] for the erection of a five-story and basement [illegible] store building for M. D. [illegible]. The estimated cost is [illegible].

✦Cleveland, Ohio—The general contract for the erection [illegible] building [illegible] has been awarded to the CROW-[illegible] CONCRETE-LITTLE CO., [illegible] East [illegible]th St., Cleveland. The estimated cost is [illegible]. Noted June 11.

✦Columbus, Ohio—[illegible] The contract for the erection of the [illegible] Institution for [illegible] has been awarded to the DAWSON CONSTRUCTION CO., Pittsburgh, Penn., at [illegible]. Noted June 11.

✦Gallipolis, Ohio—[illegible] The contract for the erection of [illegible] at the [illegible] Hospital for Epileptics has been awarded to CHARLES [illegible] KIRCHER, Athens, Ohio, at [illegible]. Noted June 11.

✦Hamilton, Ohio—The contract for the erection of the [illegible] has been awarded to the ROCHE[illegible] CONSTRUCTION CO., Cincinnati, Ohio, at $218,594.

Kent, Ohio—Bids will be received until noon, July 18, by [illegible] A. M[illegible], Secy. Bd. of Trustees, Kent State Normal School, for the erection of an agricultural and training [illegible] at Kent.

Beech Grove, Ind.—Bids will be received until July 14, by [illegible] of [illegible], Beech Grove, for the erection of a [illegible]-story and basement school. The estimated cost is [illegible].

Indianapolis, Ind.—Plans are being prepared by Paul Cret, [illegible] and Zantzinger, Borie & Medary, Asso. Archs., [illegible] South [illegible] St., Philadelphia, for the erection of a [illegible] library. The estimated cost is $[illegible].

Joliet, Ill.—Bids will be received until 1 p.m., July 1[illegible], by [illegible], Bd. of [illegible] of the City Schools, for the erection of a school [illegible]. [illegible] is the Arch., [illegible] North Dearborn St., Chicago, Ill.

Detroit, Mich.—Bids will be received about July 21 by [illegible], Archs., [illegible] Moffat Bldg., for the erection of a three-story and basement high school at [illegible].

Plans are being prepared by C. Howard Crane, Arch., 2325 [illegible], Detroit, for the erection of a one- and [illegible]-story and basement hospital for F. H. Hill, [illegible] North [illegible] St., Chicago, Ill. The estimated cost is $1[illegible],000.

✦Kalamazoo, Mich.—The general contract for the erection of the three-story and basement store building for S. S. Kresge Co. has been awarded to A. W. LAUGE, Lawrence, [illegible], at [illegible]. Noted May 14.

✦Chicago, Ill.—The general contract for the erection of the 1[illegible]-story office building at [illegible] Madison St. has been awarded to the GEORGE A. FULLER CO., 1[illegible] South Dearborn St. The estimated cost is $1,[illegible]. Noted Jan. 29.

Quincy, Ill.—Bids will be received until 2 p.m., July 2[illegible], by J. [illegible], Arch., 2[illegible] South La Salle St., Chicago, Ill., for the erection of an armory at Quincy.

✦Riverside, Iowa—The contract for the erection of the Riverside school at North [illegible] has been awarded to COOMER & SMALL, at $1[illegible]. Other bidders were F. [illegible] Salsbach, $[illegible]; C. C. Ealey, $[illegible]; Alfred Johnson, $[illegible]; F. N. Fisher, $[illegible]; C. Johnson, $[illegible],377. Beuttler & Arnold, Security Bldg., are the Archs.

Wichita, Kan.—Bids will soon be received for the erection of a three-story and basement Y. W. C. A. building. The estimated cost is $[illegible].

Cameron, Mo.—Rose & Peterson, Archs., Kansas City, Kan., have completed plans for the erection of a school at Cameron. The estimated cost is $[illegible].

✦Kirksville, Mo.—Contracts for the erection of the three-story high school have been awarded as follows: General contract, L. W. [illegible]MAS CONSTRUCTION CO., [illegible]; structural iron, ILLINOIS STEEL & BRIDGE CO., Kansas City, Mo.; masonry, J. J. HOFFMAN, Milan, Mo.

✦Springfield, Mo.—Contracts for the erection of the two-story and basement school have been awarded as follows: General contract, [illegible] & [illegible], [illegible] North Campbell St.; structural iron, [illegible] IRON WORKS, St. Louis, Mo.; masonry, GEORGE C. SHARP, [illegible] [illegible] St.; cut stone, NESBIT & HIRSCHBERG.

✦Contracts for the erection of the 11-story office building for the Keet building [illegible] have been awarded as follows: General contract, [illegible]MAS CONSTRUCTION CO.; structural iron to CHRISTOPHER & SIMPSON, St. Louis; masonry, J. J. HOFFMAN.

St. Louis, Mo.—The [illegible] City Photoplay Co., recently incorporated, has had plans prepared for the erection of a three-story theater and office building at 11[illegible] North Sixth St., St. Louis. The estimated cost is $[illegible]. Hausler & H[illegible], [illegible] Bldg., are the Archs.

✦Dallas, Tex.—See item under Miscellaneous: Terminal—Dallas, Tex.

✦Falfurrias, Tex.—The contract for the erection of the county court house at Falfurrias has been awarded to WESTLAKE & MIZZELL, San Antonio, at $[illegible]. Noted Mar. 2[illegible].

Tulsa, Okla.—Bids will be received until July 2[illegible] for the erection of a five-story Y. M. C. A. building.

✦Ogden, Utah—The contract for the erection of the theater on [illegible] Ave. has been awarded to WILLIAM A. LARKINS at $[illegible]. Noted May 14.

✦Kingman, Ariz.—The contract for the erection of the Mohave County court house has been awarded to [illegible]FTUS COLLAMORE & SON, Little Rock, Ark. Noted July [illegible].

✦Seattle, Wash.—The contract for the erection of the four-story hotel at Yesler Way and Post St. for the Yesler Estate has been awarded to HANS PEDERSON, [illegible], Seattle.

The lowest bidder for the erection of the King County [illegible] was the Puget Sound Bridge & Dredge Co. at $[illegible].

Contracts for Dual System of Rapid Transit

FOR OPERATION BY NEW YORK MUNICIPAL RAILWAY CORPORATION

Broadway-Fifty-ninth St. Subway (In Manhattan)—Route No. 5

Section	Limits	Contractor	Contract Awarded	Amount of Contract	Date Bids Published in Engineering News
[illegible]	[illegible] to [illegible]	E. L. Crawford, 1[illegible] Montague St., Brooklyn	Sept. [illegible] 1912	$[illegible]	Sept. 1[illegible], 1912
[illegible]	[illegible] to [illegible]	E. L. Crawford, 1[illegible] Montague St., Brooklyn	Sept. [illegible] 1912	[illegible]	Sept. 1[illegible], 1912
[illegible]	[illegible] to [illegible]	Degnon Contracting Co., [illegible] St., N. Y.	[illegible]	[illegible]	[illegible] 1, 1912
[illegible]	[illegible] to [illegible]	O'Rourke Engineering Contracting Co., [illegible] 5th Ave., N. Y.	[illegible]	[illegible]	April 11, 1912
[illegible]	[illegible] to [illegible]	[illegible] and Foundation Co., [illegible] Broadway, N. Y.	Jan. 1[illegible], 1912	[illegible]	Jan. 1[illegible], 1912
[illegible]	[illegible]	[illegible] Co., [illegible], N. Y.	[illegible]	[illegible]	July 1[illegible], 1911
	Broadway (Manhattan)—[illegible]				
[illegible]	[illegible]	[illegible] Contracting Co., 1[illegible] Park Ave., N. Y.	[illegible] 1914	$[illegible]	Aug. [illegible]
[illegible]	[illegible]	[illegible] & [illegible] Co., 111 Broadway, N. Y.		$[illegible]	Mar. [illegible] 1914
Total				$[illegible]	
	[illegible]				
[illegible]	[illegible]	[illegible] & Foundation Co., [illegible] Broadway, N. Y.		$[illegible]	May [illegible] 1914
	[illegible]				
[illegible]				$[illegible]	
	[illegible] Subway—Route No. 11 [illegible] (In Brooklyn)				
[illegible]	[illegible]	Degnon Contracting Co., [illegible] St., N. Y.	[illegible]	$[illegible]	[illegible] 1912
[illegible]	[illegible]	Degnon Contracting Co., [illegible] St., N. Y.	[illegible]	[illegible]	[illegible] 1912
Total				$[illegible]	
[illegible]				[illegible]	
	[illegible]				
[illegible]				$[illegible]	
	[illegible]				
[illegible]	[illegible]	[illegible] & [illegible], [illegible] Ave., N. Y.	[illegible]	$[illegible]	Dec. [illegible]
	Route No. [illegible] Manhattan				
[illegible]	[illegible]	[illegible] & [illegible], [illegible] Broadway, N. Y.		$[illegible]	[illegible]
[illegible]	[illegible]	[illegible] & [illegible] and [illegible] Co.		$[illegible]	[illegible]

Tacoma, Wash.—Lundberg & Mahon, Archs., Provident Bldg., will receive bids about July 15, for the erection of the theater for William Virges. The estimated cost is $60,000.

Salem Ore.—The lowest bid for the erection of additions to buildings at the University was submitted by W. O. Heckatt, at $47,990. W. C. Salem is State Arch.

Berkeley, Calif.—Bids will be received until noon, July 20, by W. F. McClure, State Engr., Capitol Bldg., Sacramento, for the erection of a gymnasium building at Berkeley.

Oakland, Calif.—Frederick D. Boese, Arch., 45 Kearney St., San Francisco, has completed plans for the erection of a building for the Concordia College. The estimated cost is $40,000.

Sacramento, Calif.—Plans are being prepared by L. G. Burgren, Arch., Holbrook Bldg., for the erection of an eight-story and basement Class A hotel. The estimated cost is $225,000.

The Sacramento Lodge of Eagles will erect a lodge building. The estimated cost is $100,000.

San Francisco, Calif.—Edward T. Foulkes, Arch., Crocker Bldg., has completed plans for the erection of an exhibit building for the Canadian Pacific R.R. at the exposition.

Edward T. Foulkes, Arch., Crocker Bldg., is preparing plans for a number of concession buildings, which will include the "Creation," the 'Monitor and the Merrimac," "Vicksburg" and "Narea Palast."

Plans are being prepared by Edward G. Garden, Arch., Phelan Bldg., for the erection of a frame and plaster building at the Exposition for the Sperry Flour Co. The estimated cost is $100,000.

Montreal, Que.—Plans are being prepared by Marius Dufresne, Ontario St., Maisonneuve, for the erection of a fire and police station for the Town Council of Maisonneuve. The estimated cost is $70,000.

Niagara Falls, Ont.—Plans are being prepared by Bond & Smith, Archs., 15 Wilton Ave., for the erection of a store and office building at Queen and Ontario Sts., for the I. O. O. F.

Toronto, Ont.—A. A. Barthelmes, Arch., and Frederick Courtemanche, both of Toronto will erect a 10-story office building at Terauley and Albert Sts., Toronto. The estimated cost is $300,000.

Toronto, Ont.—Bids will be received until 4 p.m., July 13, by R. C. Desrochers, Secy., Dept. of Public Works, for the erection of postal station E.

+Winnipeg, Man.—The contract for the erection of an addition to St. Boniface hospital, has been awarded to J. H. TRAMBLEY CO., LTD., Winnipeg. The estimated cost is $300,000.

Regina, Sask.—Bids will soon be received by Tripp & Rowley, Archs., 51 Canada Life Bldg., for the erection of a three-story theater, 50x125 ft., for W. Milne., 2267 Smith St. The estimated cost is $65,000.

Red Deer, Alta—Bids will be received until 4 p.m., July 15, by R. C. Desrochers, Secy., Dept. of Pub. Wks., Ottawa. Ont., for the erection of a public building at Red Deer, Alta

Contracts for Dual System of Rapid Transit—Continued

FOR OPERATION BY INTERBOROUGH RAPID TRANSIT CO.

		Seventh Ave.-Lexington Ave. Subway—Routes Nos. 5, 19 and 22, 43, 16, 4 and 38, 9 and 48			
*6	26th St. to 40th St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	$3,634,213.50	Nov. 3, 1910
	* Work stopped on April 26, 1912, on account of change in routing of this branch.				
		Lexington Avenue Branch—Route No. 5			
7	43d St. to 53d St.	Rapid Transit Subway Construction Co., 165 Broadway, New York		$1,915,164 00	June 25, 1914
8	53rd St. to 67th St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	$3,369,484 20	Nov. 3, 1910
9	67th St. to 79th St.	P. McGovern & Co., 1 Madison Ave., N. Y.	Feb. 13, 1912	1,961,997 00	Dec. 14, 1911
10	79th St. to 93rd St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	3,253,072 80	Nov. 3, 1910
11	93rd St. to 106th St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	3,132,195.05	Nov. 3, 1910
12	106th St. to 118th St.	Oscar Daniels Co., Woolworth Bldg., N. Y.	Sept. 3, 1911	2,825,740 74	Nov. 3, 1910
13	118th St. to 129th St.	Bradley Contracting Co., 1 Madison Ave., N. Y. (Assigned to McMullen, Snare & Triest, Inc.)	Nov. 17, 1911	4,071,416.50	Nov. 3, 1911
14	129th St. to 135th St.	Arthur McMullen & Olaf Hoff, 149 Broadway, N. Y.	July 23, 1912	3,889,775 05	June 16, 1912
15	135th St. to 157th St.	Hagerty-Drummond Co., 48 Park Row, N. Y. (Assigned to Rogers & Hagerty)	Nov. 17, 1911	3,820,129 75	Nov. 3, 1910
Total				$26,323,811.09	
		Southern Boulevard Branch—Routes Nos. 19 and 22 (In the Bronx)			
1	138th St. to 147th St.	John F. Stevens Construction Co., 55 Wall St., N. Y (Assigned Oct. 23, 1913 to Richard Carvel Co., Inc., 401 West 59th St., N. Y.)	Oct. 22, 1912	$2,253,281.75	Sept. 26, 1912
1-A	147th St. to Bancroft St.	Rodgers & Hagerty, E. 152nd St. and Harlem River, N. Y.		$2,253,159 25	Dec. 11, 1913
Total				$4,506,441.00	
		Jerome Avenue Branch—Route No. 16—(In the Bronx)			
1	157th St. to 182nd St.	Oscar Daniels Co., Woolworth Bldg., N. Y	Dec. 31, 1913	$1,077,978.00	Dec. 11, 1913
2	182nd St. to Woodlawn Road	Cooper & Evans, 220 Broadway, N. Y.		$1,076,831.00	Feb. 19, 1914
		Seventh Avenue-Lexington Ave.—Routes Nos. 4 and 38			
1	Battery Park to Greenwich and Vesey St.	Rapid Transit Subway Construction Co, 165 Broadway, N. Y		$2,120,000 00	April 30, 1914
1-A	Connection from 7th Ave. Subway to present subway	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.		$474,244 00	June 18, 1914
2	Vesey to Beach St.	Degnon Contracting Co., 30 East 42nd St., N Y.	March, 1914	$3,059,522 00	Dec. 11, 1913
3	Beach St. to Commerce St.	Degnon Contracting Co., 30 East 42nd St., N. Y.	Dec. 31, 1913	$2,185,063 50	Nov. 20, 1913
4	Commerce St. to 16th St.	United States Realty & Improvement Co., 111 Broadway, N. Y.	Mar. 6, 1913	$1,837,726.00	Mar. 12, 1914
5	16th St. to 30th St.	Canavan Bros., N. Y.	Dec. 31, 1913	2,401,305.75	Nov. 20, 1913
6	30th St. to 43rd St.	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.	Dec. 31, 1913	2,292,000 00	Jan. 8, 1914
6-A	43rd St. to 45th St. Times Sq.	Holbrook Cabot & Rollins Corp., 331 Madison Ave. N. Y.		$421,566 00	May 28,1914
Total				$14,790,428 25	
		White Plains Road Line—Route No. 18—(In the Bronx)			
1	180th St. to Burke Ave.	Oscar Daniels Co., Woolworth Bldg., N. Y.	March 16, 1914	$914,400.00	Feb. 19, 1914
2	Burke Ave. to 241st St.	Alfred P. Roth, Broad St., N. Y.	Dec. 31, 1913	$958,484.00	Dec. 4, 1913
		†Woodside, Astoria and Corona Line—Routes Nos. 36 and 37—(In Queens)			
1	Queensboro Bridge Plaza	Soare & Triest, 143 Liberty St., N. Y.	Oct. 7, 1913	$884,859 00	Aug. 28, 1913
2	Astoria Line	Cooper & Evans, 220 Broadway, N. Y.	Mar. 11, 1913	860,743 50	Feb. 13, 1913
3	Corona Line	E. E. Smith Contracting Co., 101 Park Ave., N. Y.	Mar. 11, 1913	2,063,588 00	Feb. 13, 1913
Total				$3,809,190 50	
		Steinway Tunnel Extension—Route No. 50—(In Queens)			
	Van Alst Ave. to Queensboro Bridge	Degnon Contracting Co., 30 East 42nd St., N. Y	Dec. 1, 1913	$557,856 50	
		Route forty-eight			
3	Clark Tunnel	*Booth & Flinn Ltd., and O'Rourke Engineering & Contracting Co.		$6,469,916 00	June 4, 1919
		Lutheran Cemetery and Myrtle Ave. Connection			
2		Phoenix Bridge Co., 49 William St, N. Y.		$707,661 00	
		F. W Burnham, 30 East 42nd St., N. Y	Mar., 1914	$113,225 00	
		Reconstruction Steinway Tunnel-Route 26			
	42nd and Lexington Ave., under East River to Jackson and Alst Ave., L. I City	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.	Feb. 17, 1914	$383,911 00	Feb. 26, 1914
		Connection with Brighton Beach Line—Route 12			
1	St. Felix St. and Ashland Pl. to Hanson Pl.	Cranford Co., 190 Montague St., Brooklyn		$2,195,296 00	June 25, 1914
1-A	In Flatbush Ave., between St. Marks Ave., Prospect Park Plaza	Cranford Co., 190 Montague St, Brooklyn		$2,225,519 25	April 9, 1914

*Awarded two contracts jointly.
† Trackage rights also to New York Municipal Railway Corporation.

Contracts to Be Let

Bids received until July 28, 1914.

Barge Canal Improvements

STATE OF NEW YORK
OFFICE OF SUPERINTENDENT OF PUBLIC WORKS
Albany, July 29th, 1914

NOTICE TO CONTRACTORS—

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Tuesday, July 28th, 1914, at which place and hour they will be publicly opened and read, for improving the New York State canals pursuant to the provisions of Chapter 147 of the Laws of [illegible] and of the amendments thereto, as follows:

—1—

CONTRACT NO. 119
[illegible] Canal—Section 2

For furnishing and driving a quantity of steel sheet piling, extending the concrete apron and performing all incidental work connected therewith at Movable Dam Five at Rotterdam, N. Y.

Sheets 1 and 2.

—2—

CONTRACT NO. 120
Erie Canal—Sections 2 and 3

[illegible] of the superstructures of the following [illegible] dams over the Mohawk River:

Dam [illegible] at Rotterdam, Station 1662 + 45, Erie canal
Dam 6 at Cranesville, Station 1987 + 79, Erie canal
Dam [illegible] at Amsterdam, Station 2281 + 16, Erie canal
Dam [illegible] at Tribes Hill, Station 2413 + 17, Erie canal
Dam [illegible] at Yosts, Station 2[illegible] + 64, Erie canal
Dam 10 at Canajoharie, Station [illegible], Erie canal
Dam 11 at Fort Plain, Station 3[illegible]53 + 85, Erie canal

[illegible]

Plans [illegible] and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and [illegible] required and other information for proposers may be [illegible] at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, [illegible] Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the [illegible] at Albany, N. Y., upon payment [illegible]

[illegible]

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned, the interests of the State will be enhanced thereby.

DUNCAN W. PECK
Superintendent of Public Works

Bids received until July 20, 1914.

Sanitary Sewer, Special Manholes, Combined Sterilizing and Pumping Plant

Tarentum, Pa., June 27, 1914.

The Tarentum Borough Council will receive bids for the construction of approximately [illegible] ft of 12 inch sanitary sewer ranging in depth from 3 ft to 26 ft. Also 17 special manholes and a combined sterilizing and pumping plant, as per the plans drawn by [illegible], Consulting Engineer, 1210 House Bldg., Pittsburgh, Pa., up until July 20, 1914, at [illegible] o'clock P.M. The bids will be received on one or all of the three parts of the contracts, viz.: Part I. Sewer and manholes. Part II. Structural work and [illegible] with necessary piping, valves and mechanical equipment exclusive of the pumps and motors with their regulating devices. Part III. Motor driven centrifugal pumps. The motor driven centrifugal pumps may be bid separately, but completely installed by the firm furnishing [illegible] prepared by the Borough. Each proposal is to be presented sealed and addressed to Mr. W. A. [illegible], Borough Secretary, and plainly marked on the lower left hand corner "Proposal for sanitary sewer and manholes" or proposal for the part or parts bid upon. In the upper left-hand corner the name of the firm bidding is to be plainly written. Each proposal is to have [illegible] a certified check or bidders bond in amount equal to five (5) percent of the bid [illegible] the good faith of the bidder. The successful bidder will be required to give bond for one hundred (100) per cent of [illegible] for the faithful performance of the work. Plans and specifications may be obtained from the engineer.

Council reserves the right to reject any or all bids.

W. F. DENNY, President of Council.
W. A. [illegible], Borough Secretary.

[illegible], Consulting Engineer,
1210 House Bldg.,
Pittsburgh, Pa.

Contractors

[illegible]

[illegible]

PUBLIC SERVICE COMMISSION FOR THE FIRST DISTRICT
[illegible] Street, New York City

Construction News

★ Denotes work advertised in ENGINEERING NEWS.
✚ Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

THE HALF YEAR'S BUILDING RECORD ..

Recent reports from eight cities on the Pacific Coast complete the figures for the first half year's building operations in 59 of the largest cities. In June plans filed in these 59 cities called for an expenditure of $71,546,000 compared with $69,725,000 in the corresponding month in 1913. This is a gain for June of 2.6%, and is the first gain of any importance recorded this year. For the first six months plans filed called for an expenditure of $367,171,000 compared with $385,958,000 in the corresponding six months of last year. This loss of $18,000,000 was scattered throughout the Eastern States in the first few months of the year and later in the Southern and Pacific Coast States. In the Middle West there has been almost a consistent gain throughout the six months. The decrease expressed in terms of percentage leaves 59 cities in the half year with 4.7%.

In eight cities on the Pacific Coast, the figures for which are given in the accompanying table, the contemplated building operations from plans filed in June aggregated $6,030,000 compared with $7,373,000 in June of 1913. This is a loss of 13.2%. In the first six months the loss was even greater in proportion, amounting to 17%. A large portion of this is due to the filing of building plans in Los Angeles in 1913 but for the first six months San Francisco shows an enormous gain.

PACIFIC COAST STATES

	June 1914	June 1913	First six months of year 1914	1913
Los Angeles, Calif.	$1,682,796	$1,419,784	$8,106,024	$17,008,790
Oakland, Calif.	451,231	464,480	2,438,505	4,467,543
Portland, Ore.	834,435	960,135	4,180,910	7,399,895
Spokane, Wash.	83,025	411,785	545,662	2,187,824
San Diego, Calif.	426,390	1,018,700	1,786,680	4,080,352
San Francisco, Calif.	1,308,882	1,675,554	20,677,675	11,515,236
Seattle, Wash.	1,163,165	897,310	5,883,855	5,219,470
Tacoma, Wash.	80,611	525,884	788,098	1,318,400
Totals	$6,030,535	$7,373,632	$44,407,409	$53,197,510
	Decrease	13.2%	Decrease	17%

RAILWAYS

West Virginia—Morgantown & Wheeling Ry.—This company plans to construct a line from Blacksville, W. Va., to Wheeling, W. Va., 55 miles. G. C. Sturgiss, Morgantown, W. Va., is interested.

Florida—See item under Alabama.

Florida—Bay, City, Lynn Haven & Northern R.R. See item under Alabama.

Alabama—Alabama Great Southern R.R.—This company is asking for bids for second-track work from Birmingham, Ala., to Grasselli, Ala., 6.4 miles; York, Ala., to Cuba, Ala., 5.45 miles; Meridian, Miss., to Russell, Miss., 6.63 miles. C. Dougherty, Cincinnati, Ohio, is Ch. Engr.

Louisville & Nashville R.R.—This company, it is reported, plans to construct an extension from Lax, Ala., to Decatur, Ala., 14 miles. H. C. Williams, Louisville, Ky., is Engr. Const.

Alabama—The construction of a railroad from the coal fields of Alabama to the Atlantic Coast at Jacksonville, Fla., is under consideration. H. P. Reed, Birmingham, Ala., is interested.

Alabama—Bay City, Lynn Haven & Northern R.R.—This company is being organized by New York and Philadelphia capitalists for the purpose of constructing a railroad to connect Montgomery, Ala., and St. Andrews Bay, Fla. It is proposed to make the Birmingham, Columbus & St. Andrews Bay R.R. part of the route. This road is 38 miles long from Chipley, Fla., to St. Andrews Bay, and is now in the hands of a receiver. Construction immediately in prospect is from Chipley northward to Hartford, Ala., about 28 miles. From Hartford to Montgomery the projected route is via Enterprise and Troy, Ala. It is planned to build terminals at Southport, Fla., the southern end of the existing road, which will include docks, wharves and warehouses. A. D. Campbell, Chipley, Fla., is receiver of the B. C. & St. Andrews Bay R.R. Noted July 9.

Alabama Great Southern R.R.—This company plans improvements at Tuscaloosa to include track extension and depression. C. Dougherty, Cincinnati, Ohio, is Ch. Engr.

Mississippi—Nashville, Shiloh & Corinth R.R.—See item under Tennessee.

Mississippi—Alabama Great Southern R.R. — See item under Alabama.

Mississippi—Columbus Lumber Co.—This company plans to construct a railroad from Columbus, Miss., to Winfield, La. The line will pass through timber lands in Western Alabama recently purchased by the company. The offices of the company are located at Columbus, Miss.

Louisiana—Columbus Lumber Co.—See item under Mississippi.

Tennessee—Nashville, Shiloh & Corinth, R.R.—The citizens of Centreville, Tenn., have voted in favor of issuing bonds for $150,000 to aid this company to construct its proposed line from Nashville, Tenn., to Corinth, Miss. C. C. Thoms, Corinth, Miss., is interested.

Tennessee—Southern Ry.—This company, it is reported, is having surveys made for its proposed cut-off from Bulls Gap, Tenn., to either Newport or Leadvale, Tenn., 20 miles. W. H. Wells, Washington, D. C., is Ch. Engr. Const.

Kentucky—Paducah & Illinois R.R. — This company is making surveys for its proposed railroad from Paducah, Ky., to the site of the proposed bridge over the Ohio River at Metropolis, Ill. Charles Broadbeck, Paducah, is Ch. Engr.

Michigan—Lansing Connecting R. R.—This company has been incorporated to construct a railroad. G. E. Hutchinson, Lansing, is Secy.

Illinois—Paducah & Illinois R.R.—See item under Kentucky.

Wisconsin—Balsam Lake & Eastern R.R.—This company has been incorporated for the purpose of constructing a railroad from Balsam Lake, Wis., to Centuria, Wis., eight miles. Capital, $100,000. Among the incorporators are W. R. Taylor, J. W. Park and H. W. Radcliffe.

Kansas—Missouri Pacific R.R.—See item under Oklahoma.

✚**Nebraska**—Chicago, Burlington & Quincy R.R.—This company has awarded the contract to PETERSEN & CO., Omaha, Neb., for the construction of its proposed cut-off from Yutan, Neb., southeast to Chalco, Neb. The work calls for a 300-ft. trestle over the Elkhorn River and a 1700-ft. trestle over the Platte River. Noted June 4.

✚**Missouri**—Rolla, Ozark & Southern R.R.—This company has awarded the contract to J. E. WALKER, Rolla, Mo., for constructing its proposed line from Rolla to Anutt, Mo., 18 miles. Noted July 2.

Missouri—Kansas City, Mexico & Orient Ry.—A committee representing the bondholders of this company purchased the line, July 6, for $6,000,000. The receivership will end Sept. 1 and the road will be completed. William T. Kemper, of Kansas City, Mo., is amon gthose interested.

Texas—Gulf, Colorado & Sante Fe Ry.—This company has taken over the Concho, San Saba & Llano Valley R.R., the Texas & Gulf R.R., the Gulf & Interstate R.R. and the division of the Pecos & Northern Texas Ry. south of Sweetwater, Tex. F. Merritt, Galveston, Tex., is Ch. Engr.

Oklahoma—Missouri Pacific R.R.—The city of Buffalo, Okla., has voted to issue $100,000 in bonds to secure the extension of this company's line from Hardtner, Kan., to Buffalo. J. R. Stephens, St. Louis, Mo., is Ch. Engr.

Oklahoma—Clinton, Oklahoma & Western Ry.—This company has been taken over, it is reported, by Frank Kell, Wichita Falls, Tex., who plans to construct extensions. The line is 52 miles long and runs from Clinton, Okla., to Strong City, Okla.

✚**Idaho**—Intermountain R.R.—This company has awarded a contract to the OREGON BRIDGE & CONSTRUCTION CO., for constructing a portion of its proposed line in the Boise Basin. The company is a subsidiary of the Boise-Payette Lumber Co. Noted Apr. 16.

Washington—Northern Pacific Ry.—This company plans to construct a freight yard to have 15 tracks, at the head of Commencement Bay, Tacoma, Wash. Estimated cost, $197,000. W. L. Darling, St. Paul, Minn., is Ch. Engr.

Washington—Northern Pacific Ry. — This company will spend $375,000 for track improvements in Tacoma, Wash.

British Columbia—Canadian Northern Ry.—This company will start work this month on its Kamloops-Okanogan branch, in British Columbia. Length, about 148 miles. W. H. McLeod, Winnipeg, Man., is Gen. Mgr. and Ch. Engr.

Canadian Pacific Ry.—The Provincial Department of Railways has approved the plans of this company, providing for a further extension of its line on Vancouver Island, to Duncan Bay. F. W. Peters, Vancouver, B. C., is Supt. British Columbia Division.

ELECTRIC RAILWAYS

Elizabeth, N. J.—The Board of Trade is considering the establishment of an electric railway to connect Elizabeth, Rahway and Linden.

Girardville, Penn.—The Schuylkill Ry. Co. contemplates the extension of its lines into Delano and Lakeside. William S. Leib, Girardville, is Gen. Mgr.

Kane, Penn.—Plans are being prepared for the construction of an electric railway from Kane to St. Mary's, Johnsonburg and Ridgway, about 33 miles.

Rock Hill, S. C.—The Carolina Traction Co. is preparing to extend its line on Elm, Park and Crawford Sts. in Rock Hill. James S. White, Rock Hill, is Secy. and Mgr.

Albany, Ga.—The Albany Transit Co. contemplates the construction of a one-mile extension to its line. J. C. Fulford, Albany, is Secy. and Pur. Agt.

Savannah, Ga.—The City Council has granted a franchise to the Savannah Electric Co. to extend its line on Habersham St. to connect with the line at Chatham Crescent. A. L. P. Smith, Savannah, is Pur. Agt. Noted July 2

Columbus, Miss.—The Mississippi Electric Ry. Co has been incorporated to build an electric line from Columbus, Miss., to Memphis, Tenn. C. F. Sherrod, Columbus, is interested.

Nashville, Tenn.—The [illegible] Cumberland Valley & Interurban Electric [illegible] Co. is making preliminary arrangements for the construction of an electric railway to connect Nashville and Sparta, via Smithville, about [illegible] miles. W G Baird, Lebanon, is Pres.

Middlesboro, Ky.—W Godfrey Hunter, Middlesboro, is interested in the construction of a five-mile electric railway in Middlesboro and vicinity.

Ironton, Ohio.—Preliminary arrangements are being made by the Ironton Electric Light & Ry Co. for the extension of its line from Sc[illegible]ville to Hanging Rock. W W Magoon, Huntington, W Va, is [illegible] Mgr.

♦Hillsdale, Mich.—The Tri-State Ry Co has awarded a contract for the construction of its line from Hillsdale to [illegible] to A C LINSBACH & CO, Chicago, Ill. Noted June 11.

Beardstown, Ill.—The Western Illinois Ry Co is making preliminary surveys for the construction of an electric railway from Beardstown, Ill., to Burlington, Iowa. G T Cappel, [illegible], Ill., is interested.

Pekin, Ill.—(Official)—See item under Miscellaneous Drainage District Work—Pekin, Ill.

Madison, Wis.—The Janesville & Madison Traction Co has completed arrangements and will soon start work on the construction of its proposed electric railway to connect Madison and Janesville. Frank H Weston, Madison, is interested. Noted May 14.

Baxter Springs, Kan.—The Oklahoma-Kansas Ry Co. is considering plans for the construction of an electric railway to connect Newkirk, Ponca City, Arkansas City, Blackwell, Enid, Perry, Guthrie, Guedo Springs and Tonkawa. C F Lambert, Kansas City, is Ch Engr.

Salina, Kan.—The Council has granted a franchise to the Salina Street & Interurban Ry Co to extend its lines in Salina. H C Smither is Pres.

Wichita, Kan.—The Arkansas Valley Interurban Ry Co. is considering plans for extending its line from Newton to Salina and from Halstead to Wichita. O A Boyle, Wichita, is Vice-Pres and Gen Mgr.

Columbia, Mo.—F S Mordant, Chicago, Ill., is making preliminary arrangements for the construction of an electric railway from Fulton to Montgomery City and Columbia, where a city street car system will be established. Noted June 2[illegible].

Mansfield, Mo.—R S Wickersham, North Yakima, Wash., is interested in the construction of an electric railway from Mansfield, Mo., to Cotter, Ark.

♦Dallas, Tex.—The Eastern Texas Traction Co has awarded the contract for completing its interurban electric railway between Dallas and Greenville to the STONE & WEBSTER ENGINEERING CORPORATION, Boston, Mass.

El Paso, Tex.—Plans are being prepared by the El Paso Electric Ry Co for the extension of its lines in El Paso. H S Potter, El Paso, is Gen Supt.

Texas City, Tex.—The County Commissioners have granted a franchise to the Texas City Street Ry Co to extend its lines in Texas City. Thomas J Davis, Texas City, is Pres.

Oklahoma City, Okla.—C H Hale and J W Tippon are interested in the construction of a system of interurban electric railway lines in Oklahoma. The proposed railway will connect Oklahoma City, Sapulpa, Bartlesville, Tulsa, Muskogee, McAlester and various other Oklahoma cities.

Los Angeles, Calif.—The City Council has granted a franchise to the Pacific Electric Ry Co. to construct an elevated railway from the rear of the Pacific Electric Bldg to [illegible] St. The structure will be of steel. The plans were prepared a year ago and the cost is estimated at $[illegible]00,-[illegible]. J McMillan, Los Angeles, is Gen Mgr.

The Pacific Electric Ry Co contemplates constructing a [illegible] across [illegible] Lake Park from Hill St. It will be a portion of the subway to Santa Monica. J McMillan is Gen Mgr.

San Francisco, Calif.—The Bay View Improvement Club has petitioned the Board of Supervisors to extend the municipal electric railway on Potrero Ave to Hunter's Point dry [illegible].

San Lorenzo, Calif.—The City Council has granted a franchise to the San Francisco-Oakland Terminal Ry. [illegible] Co. to double track its line on Telegraph Road [illegible] San Lorenzo. [illegible] R. [illegible], Oakland, is Vice-Pres and Gen. Mgr.

Bridgeburg, Ont.—Surveys are being made for the construction of the proposed electric railway to connect Bridgeburg and Fort [illegible].

Ottawa, Ont.—The [illegible] & Ottawa Electric Ry Co is [illegible] for the construction of an electric railway from Ottawa to [illegible], about [illegible] miles. [illegible]

LIGHT, HEAT AND POWER

Hartford, Conn.—The Connecticut Co is preparing plans for the [illegible] and extension of its power plant on [illegible].

♦Norwalk, Conn.—The contract for constructing a [illegible] [illegible]

♦New York, N. Y.—[illegible]

Butler, N. J.—At a recent election bonds for $[illegible] were voted, the proceeds of which will be used for the construction of a municipal electric-light plant. Noted June 11.

Birdsboro, Penn.—The construction of a municipal electric-light plant is under consideration.

Lansford, Penn.—Plans are being prepared by Jacoby & Weishampel, Commonwealth Bldg., Allentown, for a brick and concrete power station for the Panther Valley Electric Light Co, at Lansford.

♦Marion, Penn.—JOHN P McSHAIN, 631 North 17th St., Philadelphia, has been awarded the contract for the construction of an addition to the power house at Marion for the Sisters of Mercy. F. Durang & Co are the Archs.

Hertford, N. C.—See item under "Sewers."

Milledgeville, Ga.—The Oconee River Mills contemplate the construction of a hydro-electric plant in Milledgeville.

Quitman, Ga.—The city is considering the proposition to issue bonds for $10,000, the proceeds of which will be used for the enlargement and improvement of the municipal electric-light plant. A W Knight is City Clk.

Gurley, Ala.—H A Smith, owner of the local electric-light plant, which was recently destroyed by fire, is considering plans for the reconstruction of the plant.

Winnsboro, La.—Carl Ship is interested in the construction of an electric-light plant at Winnsboro.

Hazard, Ky.—An electric power plant will be constructed by the Perry County Collieries Co, which will establish coal operations near Hazard. W J Von Borries, 110 South Seventh St., Louisville, Ky., is interested.

Hazel, Ky.—A committee has been appointed by the Commercial Club to investigate the feasibility of establishing an electric-light plant at Hazel.

♦Lexington, Ky.—The contract for the installation of an electric-light plant in the Transylvania University has been awarded to FRANK CORBIN, Lexington.

Archbold, Ohio—Plans are being prepared by the Archbold Electric Light & Power Co. for the construction of a 10-mile transmission line. R S Rodenhuis is Gen. Mgr.

Bluffton, Ohio—An expenditure of $20,000 is contemplated for the enlargement and improvement of the municipal electric-light plant and water system.

Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, City Hall, until noon, July 17, for erecting a power house for the Cleveland city hospital. W H Winans is Secy.

Fremont, Ohio—The Ohio Light & Power Co contemplates the enlargement and improvement of its plant at Fremont. Frank Espy, Tiffin, is Mgr.

Millersburg, Ohio—The Citizens Light & Power Co has been incorporated, with a capital stock of $35,000, to construct a light and power plant. The incorporators are G H Hillman, R. E Dreyer, W L Koch, F F Kavanaugh and C W Tolad.

Ridgeville, Ohio—The Ridgeville Light & Power Co will erect a transmission line from Ridgeville to Jewell. D D Douty, Defiance, Ohio, is interested.

Spencerville, Ohio—Bonds for $10,000 have been voted, the proceeds of which will be used for the reconstruction of the municipal electric-light plant.

Wyandotte, Mich.—Bonds for $40,000 have been voted, the proceeds of which will be used for the construction of a municipal electric-light plant and water system.

Morris, Ill.—According to press reports the Public Service Co. of Northern Illinois contemplates an expenditure of $1,000,000 for the construction of a power dam and plant on the Des Plaines River, about 10 miles from Morris. George H Lukes, Chicago, is Gen. Supt.

Wauwatosa, Wis.—L. G. Widule, County Clk., will receive bids at the Court House, Milwaukee, until July 2[illegible] for constructing a building and furnishing the equipment for the heating and power plant for the Milwaukee County Tuberculosis Sanitorium at Wauwatosa.

Nashua, Iowa—Plans are being considered by the Cedar Valley Power Co, which recently acquired the local electric-light plant, for the construction of a dam and the improvement of the plant.

Wyoming, Iowa—The Council recently granted a franchise to William G [illegible] and associates to construct and operate an electric-light plant at Wyoming.

Cottonwood, Minn.—R Cleland and F Hanson have been granted a franchise by the City Council to construct and operate an electric-light plant at Cottonwood.

Lake Benton, Minn.—J W [illegible] is interested in the installation of an electric-light plant at Lake Benton.

Slayton, Minn.—The Council has granted a franchise to Victor Klinger to construct and operate an electric-light plant in Slayton.

Kansas City, Kan.—The City is considering the proposition to issue bonds for $[illegible], the proceeds of which will be used for the construction of a municipal electric-light plant. George Little is City Clk.

Adams, Neb.—Johnson & Johnson, Consult Engrs, Falls City, are preparing plans for the construction of a municipal electric-light plant at Adams.

Crete, Neb.—Bonds for $[illegible] have been voted, the proceeds of which will be used for the installation of a municipal electric-light plant.

Baker, Mont.—A franchise has been granted to F G [illegible] to install and operate an electric-light plant at Baker.

Cabool, Mo.—The citizens recently voted to install a municipal electric-light plant.

Clarence, Mo.—Bonds for $[illegible] have been voted, the proceeds of which will be used for the construction of a municipal electric-light plant.

Palmyra, Mo.—(Official)—See item under "Water Supply and Irrigation."

Pattonsburg, Mo.—At a recent election bonds for $10,000 were voted, the proceeds of which will be used for the construction of a municipal electric-light plant.

Fort Smith, Ark.—The City Commissioners have instructed the City Electrician to prepare an estimate of the cost of constructing a municipal electric-light plant.

Mena, Ark.—The Century Engineering & Construction Co. is preparing plans for the installation of an electric-light plant in Mena.

Brenham, Tex.—J. J. Campbell and associates will extend their gas distributing system here and make other improvements to the plant.

Cisco, Tex.—The Cisco Gas & Electric Co. which has been organized here with a capital stock of $50,000 will construct an electric-light and power plant at Cisco. The incorporators are W. S. Michael, W. H. Tebbs and G. G. Ward.

Henrietta, Tex.—The Lone Star Gas Co., Fort Worth has increased its capital stock from $3,500,000 to $4,500,000 in order to provide funds for constructing a large gas compressor at Henrietta.

Marble Falls, Tex.—The proposition to issue bonds for the construction of a municipal electric-light plant and a waterworks system will soon be submitted to a vote of the taxpayers.

+Mexia, Tex.—The Mexia Water, Light & Power Co. has awarded the contract for the construction of a new power plant to CARL KAUHL. It is planned to spend about $25,000 in improvements.

Temple, Tex.—The Texas Power & Light Co. will install new machinery and make other improvements to its electric power plant at Temple. E. S. Fletcher, Temple, is Local Mgr.

Lordsburg, N. M.—The Eighty-five Mining Co. is constructing a new power plant at its mine near Lordsburg.

Monroe, Wash.—The plant, and franchise of the Monroe Water & Light Co. has been taken over by the Monroe Water Co., Seattle. Considerable improvements and extensions will be made to the plant. Sidney Marshall, Monroe, is Pres. and Gen. Mgr. of the new firm.

Santa Paula, Calif.—The State Railroad Commission has granted permission to the Ojai Power Co. to issue capital stock to the extent of $19,200 for improvements to the power plant. The proceeds are to be used for the purchase of additional electric equipment to cost $10,920, while $6200 will be expended on extensions and betterments, and $2080 used for the erection of new buildings.

BRIDGES

Buffalo, N. Y.—Plans and specifications for the bascule bridge to be constructed across the Buffalo River at Abbott Road have been completed. Francis G. Ward is Com. Pub. Wks.

+Paterson, N. J.—The Board of Chosen Freeholders of Passaic County has awarded the contract to the LOGAN CONSTRUCTION CO., 11 Broadway, New York, for constructing four highway bridges in Passaic County.

Cranford, N. J.—(Official)—Bids will be received until 2:30 p.m., July 24, by Jacob L. Bauer, County Engr., Elizabeth, N. J., for constructing a steel plate-girder bridge, 70-ft. span and 50 ft. wide, over the Rahway River at Springfield Ave., near Hampton St., Cranford.

★New Gretna, N. J.—(Official)—Bids will be received until 11.30 a.m., July 31, by the Board of Chosen Freeholders, Mount Holly, for constructing a reinforced concrete pile bridge with bascule span over Bass River at New Gretna. James Logan is County Engr.

Butler, Penn.—A viaduct, 741 ft. long, will be constructed over the tracks of the Baltimore & Ohio R.R. and the Bessemer & Lake Erie Ry. The cost will be divided among the city, the above railroads and the Butler Passenger Ry.

Forest City, Penn.—The County Commissioners plan to construct a viaduct on the new county road between Forest City, Penn., and Carbondale, Penn., over the tracks of the Erie R.R., Delaware & Hudson Co., and the New York, Ontario & Western Ry. Estimated cost, $70,000.

+Nanticoke, Penn.—(Official)—Bids were received, June 26, by F. R. Hendershot, County Controller, Wilkes-Barre, for constructing the proposed bridge between Nanticoke and West Nanticoke, over the north branch of the Susquehanna River. The contract has been awarded to the DRAVO CONTRACTING CO., Pittsburgh, Penn., at $278,500. Other bids were: D. M. Rosser Co., Kingston, Penn., $293,500; G. H. Beimard, Bloomsburg, Penn.; $289,500; Penn Bridge Co., Beaver Falls, Penn., $288,300; Whittaker & Diehl, Harrisburg, Penn., $283,847; James McLinden & Co., Anglesea, N. J., $281,835; Lathrop, Shea & Henwood, Scranton, Penn., $291,400; P. J. Carlin Construction Co., New York, N. Y., $281,500; engineer's estimate, $281,692.

Scranton, Penn.—The City Council, June 27, decided to construct the proposed Leggett's Creek Bridge. Estimated cost, $6000. J. D. Hayes is Dir. Pub. Wks. Noted July 2.

+York, Penn.—The County Commissioners, York, July 2, awarded the contract to G. A. & F. M. WAGMAN, Dallastown, Penn., for constructing a reinforced concrete bridge over Codorus Creek, at $5775.

Buckingham, Va.—(Official)—Bids will be received until noon, July 24, by G. P. Coleman, State Highway Comr., at Buckingham, for constructing a steel bridge over the Slate River, Buckingham County.

Lynchburg, Va.—The city, Amherst County, the Norfolk & Western Ry., Chesapeake & Ohio Ry. and the Southern Ry., it is reported have reached an agreement whereby a bridge will be constructed over the James River at Lynchburg.

Palmyra, Va.—(Official)—Bids will be received until noon, July 22, by G. P. Coleman, State Highway Comr., at the office of the Clerk, Palmyra, for constructing a steel bridge over Cunningham Creek.

Goldsboro, N. C.—The town is considering the construction of concrete bridges to cost about $20,000.

+Allisonia, Tenn.—The Louisville & Nashville R.R. Co. has awarded the contract to the MEACHAM CONTRACTING CO., Hopkinsville, Ky., for constructing a 60-ft. concrete bridge over its tracks near Allisonia.

+Brentwood, Tenn.—The Louisville & Nashville R.R. Co. has awarded the MEACHAM CONTRACTING CO., Hopkinsville, Ky., the contract for a 90-ft. reinforced concrete arch bridge, 75 ft. high, over its tracks near Brentwood.

+Townsend, Tenn.—The contract has been awarded by the Blount County Commissioners, Marysville, Tenn., to the LUTEN BRIDGE CO., York, Penn., for constructing a three-span reinforced concrete bridge over Little River, near Townsend, at $5000.

+Louisville, Ky.—(Official)—Bids were opened July 7 by the Board of Public Works for constructing the Ellison Ave. Bridge: GEORGE M. EADY, Louisville, $13,257 (awarded contract); Henry Bickel Co., $13,467; G. Robert Gregg, $15,409; Pierce Butler, $16,124; L. W. Hancock Co., $16,403; J. H. Cahill, $17,079. Noted July 2.

Dayton, Ohio—(Official)—Bids will be received until 10 a.m., July 18, by the County Commissioners, Dayton, for bridge work on the Boomershine Bridge. Walter H. Aszling is Secy.

Lebanon, Ohio—Bids will be received until 11 a.m., Aug. 3, by the Warren County Commissioners, Lebanon, for constructing a steel bridge at Nicholson Ford, over Todd's Fork, Washington Township. John M. Mulford is County Audr.

Marysville, Ohio—(Official)—Bids will be received until 1 p.m., July 27, by Charles A. Morelock, County Audr., Marysville, for constructing the Magnetic Springs Bridge.

Wapakoneta, Ohio—Bids will be received until 10 a.m., July 18, by F. W. Langhorst, County Audr., Wapakoneta, for constructing five bridges.

+Richmond, Ind.—(Official)—Bids were received, June 27, by the Commissioners of Wayne County for bridge repairs. Contracts have been awarded to ISAAC E. SMITH, Richmond, and the BURKE CONSTRUCTION CO., New Castle, Ind. Noted July 2.

+The contract for constructing the McGrew Bridge has been awarded to the PAN-AMERICAN BRIDGE CO., Newcastle, Ind., at $11,790.

Pekin, Ill.—(Official)—See item under Miscellaneous: Drainage District Work—Pekin, Ill.

+Boren, Wis.—The Wisconsin Highway Commission has awarded the contract to the IOWA BRIDGE CO., Des Moines, Iowa, for constructing a reinforced concrete bridge near Borea, at $5219.

+Rockville, Wis.—Klug & Smith, Mack Block, Milwaukee, Wis., have awarded the contract to PELETT & McMULLEN, Manitowoc, Wis., for a reinforced concrete highway bridge over the Sheboygan River at Rockville, town of Schleswig. The structure will be 80-ft. span. Bids were opened June 25. Noted June 18.

+Charlotte, Iowa—The Clinton County Supervisors, June 25, awarded the contract to the MARSH ENGINEERING CO., Des Moines, Iowa, for constructing a bridge at Charlotte, at $5078.

+Clinton, Iowa—The Clinton County Supervisors, June 25, awarded the contract to H. ANDERSON & SON, Maquoketa, Iowa, for bridge work, at $8266.

Davenport, Iowa—John Malloy, County Engr., has recommended the construction of four new bridges, repairs to 27 bridges and the construction of 46 culverts.

Iowa City, Iowa—The Board of Supervisors of Johnson County has retained B. J. Lambert, of the University of Iowa, Iowa City, to prepare plans for the proposed bridge to be constructed across the Iowa River at Burlington St. Estimated cost, $50,000. Noted June 25.

+Halleck, Minn.—The county has awarded the contract to HELSETH ISOK, Thief River Falls, Minn., for constructing eight bridges and 18 corrugated culverts.

Ivanhoe, Minn.—Bids will be received until July 22 by K. Hansen, County Audr., Ivanhoe, for constructing several bridges and culverts.

Atchison, Kan.—Plans are being prepared for a concrete bridge to be constructed over White Clay Creek at Fourth St. Estimated cost, $10,000. Frank Altman is City Engr.

Erie, Kan.—W. S. Gearheart, State Engr., Manhattan, Kan., is completing plans for four concrete bridges to be constructed in Neosho County, Kan. Noted July 2.

Salina, Kan.—Wilmarth & Zerbe, Engrs., have completed plans for a concrete bridge over Smoky Hill River, at Iron Ave. Estimated cost, $300,000. C. F. Dodds is Chn. City Comr. on Sts. and Alleys. Noted July 9.

Valley Falls, Kan.—The County Commissioners, Valley Falls, plan to repair bridges damaged by floods recently. Estimated cost, $20,000.

Marmouth, Mont.—The County Surveyor of Custer County, Miles City, Mont., is preparing plans for a bridge to be constructed over the Little Missouri River at Marmouth. Estimated cost, $15,000.

+White Sulphur Springs, Mont.—The contract has been awarded by the county to the HENNEPIN BRIDGE CO., Minneapolis, for constructing a bridge at White Sulphur Springs, at $10,000.

+Lake City, Ark.—The contract for constructing 10 steel bridges in connection with work in Drainage Districts 9 and 12, Craighead County, has been awarded to the VINCENNES BRIDGE CO., Vincennes, Ind. The St. Francis Valley Engineering Co., Osceola, Ark., is Engr.

Dallas, Tex.—Bids will be received until Aug. 1 by J. F. Witt, County Engr., Dallas, for constructing three bridges, one across the Trinity River, one across West Fork and one across Elm Fork. Estimated cost, $50,000.

Dallas, Tex.—The Gulf, Colorado & Santa Fe Ry. is considering constructing a viaduct over its tracks at South Merlin St. Estimated cost, $200,000.

+Junction, Tex. [illegible] Court of K[illegible] county has awarded the contract for constructing two steel bridges, one across the South Llano River and the other across the North Llano River, to the ALAMO CONSTRUCTION CO., San Antonio, Tex.

San Antonio, Tex. The San Antonio, Uvalde & Gulf R.R. has issued [illegible] in bonds. The proceeds will be used to construct bridges and make other improvements to the line. [illegible] Tex., is Ch. Engr.

+Buttes, Colo. The County Commissioners, Colorado [illegible], have awarded the contract to the PUEBLO [illegible] CO., Pueblo, Colo., for constructing a reinforced concrete bridge over the Fountain River near Buttes, at [illegible]. Noted July 2.

Santa Fe, N. M. James A. French, State Engr., Santa Fe, has been instructed by the County Commissioners to prepare plans and specifications for a concrete bridge to be constructed on the Santa Fe-Albuquerque Rd.

Seattle, Wash. Plans have been completed for two steel and concrete [illegible] ft. high and 17x24 ft. at the base, for the [illegible] bridge to be constructed over the Lake Washington Canal at Montlake Blvd. Estimated cost, [illegible].

+Dallas, Ore. The county has awarded the contract to the PORTLAND BRIDGE CO., Portland, for constructing a bridge at Dallas, at [illegible].

Portland, Ore. Bids were opened June 21 by the County Commissioners for constructing the Sandy River Bridge. The bids follow: The Construction Co., \$17,718; Portland [illegible] Co., [illegible]; F. W. Moore, \$19,656; Robert Wakefield, [illegible]; Coast Bridge Co., \$18,273; Globe Contracting Co., [illegible]; [illegible] Bridge Co., \$19,700; Elliott Construction Co., [illegible]; George H. Gilfin, \$17,967; C. W. Raynor, \$18,[illegible]; [illegible] Bridge Co., [illegible]; Illinois Steel Bridge Co., Spokane, [illegible]. All bidders are of Portland unless otherwise noted.

All of the above bids were rejected. New bids will be received.

Auburn, Calif. The Commissioners of Placer County, Auburn, plan to construct a bridge across the Bear River. Estimated cost, about \$20,000.

+Chico, Calif. The County Engineer, June 24, awarded the contract to the CHICAGO IRON WORKS, Chicago, for the steel work for the proposed [illegible]-ft. bridge to be constructed across Butte Creek.

De Luz, Calif. The Board of County Supervisors, Oceanside, Calif., plans to construct a bridge over the San Margarita River at De Luz. Estimated cost, \$7000.

+Los Angeles, Calif. The Board of Public Works has awarded the contract to the RUSSELL-GREEN-FOELL CO., Los Angeles, for constructing the Aliso St. Bridge, at \$9362.

Madera, Calif. The county has rejected all bids for constructing seven reinforced concrete girder bridges. Bids were opened June 2[illegible].

Rio Vista, Calif. Sacramento and Solano Counties plan to construct a bridge across the Sacramento River at Rio Vista. Estimated cost, \$120,000.

+Sacramento, Calif. The city has awarded the contract to the [illegible] CONSTRUCTION CO. for constructing the 13th St. bridge, at \$[illegible].

Sacramento, Calif. Bids will be received by W. F. McClure, State Engr., until noon, July 23, for the superstructure of two bridges to be constructed across the Trinity State Road, one bridge, [illegible]-ft. span, to be constructed over Mad River, and the other of two [illegible]-ft. spans, to be constructed over the South Fork of the Trinity River.

San Jose, Calif. Bids will be received until July 20 by the Board of County Supervisors, San Jose, for constructing a [illegible] highway bridge over Pacheco Creek, between San Benito and Santa Clara counties.

Santa Barbara, Calif. Frank F. Flournoy, County Surv., has estimated the cost of the bridges to be constructed along the route of the state highway will amount to \$[illegible]. Plans for these structures will be prepared at once and bids asked as soon as possible.

+Ottawa, Ont. The Dominion Government has awarded contracts for bridges to be constructed along the International Ry. as follows: To A. McLEACY, Prescott, Ont., for the [illegible] [illegible] bridges at \$[illegible]; to [illegible] HENDERSON, North Bay, Ont., for the [illegible] River [illegible] bridges at \$[illegible]; to W. B. PARTLETT, [illegible], N. B., for [illegible] River, [illegible] River, Black River and French River bridges at \$[illegible]; to [illegible] Stewart, [illegible], for the [illegible] River bridge at \$[illegible]; to [illegible], [illegible], N. B., for [illegible] River bridge, east crossing and west crossing, at \$[illegible].

Walkerton, Ont. Bids will be received until July [illegible] by the city for constructing a [illegible]-ft. extension to the [illegible] bridge. [illegible] Barber, [illegible] St. West, Toronto, Ont., is Engr.

+Vancouver, B. C. The Burrard Inlet Tunnel & Bridge Co. has awarded the contract to the [illegible] CO., Vancouver, for constructing the proposed bridge over the Second Narrows to connect Vancouver and North Vancouver, at \$[illegible]. Noted Jan. [illegible], Feb. [illegible], Apr. 16 and May [illegible].

Victoria, B. C. The City Council has approved plans for the proposed bridge to be constructed at Johnson St., at a cost of \$[illegible]. Noted July [illegible].

WATER SUPPLY AND IRRIGATION

Hawthorne, N. H. The town will purchase the [illegible] [illegible] [illegible]. An appropriation of \$[illegible] has been made for the purchase.

+Duxbury, Mass. (Official) Bids will be received by the Board of Water Commissioners [illegible] until [illegible] p.m., July [illegible], for constructing a water system. [illegible] is [illegible] of the Board.

North Adams, Mass. Bids will soon be received for the construction of the Beaman storage reservoir in the Notch District. Bonds for \$1[illegible],000 have been sold for the construction. Noted Apr. 23 and May 28.

+North Adams, Mass. (Official) Bids will be received by the Commissioner of Public Works until [illegible] p.m., July 27, for constructing an earth dam, reservoir and conduit. John Martin is Comr. Noted Apr. 23 and May [illegible].

+Albany, N. Y. The contract for furnishing 12[illegible]0 tons of c.-i. pipe has been awarded by the city to the WARREN FOUNDRY & MACHINE CO., New York, N. Y.

Lyons, N. Y. (Official) Bids will be advertised about July 17 for the construction of a pumping plant for the water works. The estimated cost is \$140,000. The J. F. Witmer Co., Buffalo, N. Y., is the Engr. Noted June 2[illegible].

+New York, N. Y. (Official) The contract for constructing the Ashokan bridge, Town of Olive, has been awarded by the Board of Water Supply to the TRANSIT CONSTRUCTION CO., Mt. Vernon, N. Y., at \$111,[illegible]. Noted June 4 and 2[illegible].

New York, N. Y. (Borough of Manhattan) (Official) Bids will be received by the State Hospital Commission, Capitol, Albany, until 3 p.m., July 27, for repairing the 1[illegible]-in. water main under the river at the Manhattan State Hospital, Ward's Island. J. H. B. Hanify is Secy.

Niagara Falls, N. Y. The Ultra Violet Ray Co. proposes to install a purification system at the municipal water works at an estimated cost of \$[illegible]2,000. If it is satisfactory after a year, the city will buy the system.

Belleville, N. J. (Official) Bids will be received by the Council until [illegible] p.m., July 28, for furnishing f.o.b. cars Belleville, 205 tons of 12-in. c.-i. water pipe, class B, and 6 tons of special castings. Edward E. Mathes is Town Clk.

Boyertown, Penn. Pugh & Hubbard, Engrs., have made surveys of the proposed water system for Boyertown. As soon as the State Health Department passes on the plans, work will be started.

Franklin, Penn. The city contemplates constructing a water system. Test wells are being drilled on the Young farm to determine the purity of the water.

Glenside, Penn. The Public Service Commission has been applied to by the citizens of Glenside for permission to install a water system.

Harrisburg, Penn. Bids will be received by H. F. Bowman, Comr. of Public Safety, until July 20 for laying water mains in Front St. between North and Paxton Sts., and in Market St. from Front St. to the subway.

Richmond, Va. The citizens of North Richmond, a suburb of Richmond, have petitioned the Committee on Public Buildings, Properties and Utilities to extend the water main to North Richmond.

Hertford, N. C. See item under "Sewers." Noted under "Water Supply and Irrigation," May 21.

+Washington, N. C. Bids were received June 17 by the Committee on Improvements for making improvements to the water works and electric-light plant. Low bidders are as follows: Tucker & Laxton, Charlotte, N. C., pumping station, power house and reservoir; Pittsburgh Filter Co., Pittsburgh, Penn., filter plant; Case & Cothran, Atlanta, Ga., sewage pumping station; Porter & Boyd, Charlotte, N. C., sewerage system. Gilbert C. White, Charlotte, is Engr. Noted May 2[illegible].

Winston-Salem, N. C. At a recent election, the citizens voted to spend \$[illegible],000 for the improvement of the water system, \$[illegible],000 for a sewage disposal plant and \$[illegible] for paving. G. F. Henshaw is City Engr.

Charleston, S. C. The Charleston Water & Light Co. will install, within the next two years, about [illegible] water meters. The estimated cost is \$[illegible].

Manning, S. C. The citizens contemplate spending \$[illegible] for the construction of a water system. The Mayor is in charge.

Daytona Beach, Fla. The date for receiving bids for the construction of a municipal water system has been postponed until further notice. J. B. McCrary Co., Atlanta, Ga., is the Engr. Noted June 11.

Key West, Fla. Press reports state that the Florida East Coast R.R. contemplates constructing a pipe line to supply water to the lower Florida Keys including Key West.

Tampa, Fla. The Tampa Water Co., according to press reports, will enlarge its present system by drilling wells and extending its mains.

Tuscaloosa, Ala. About \$[illegible] will be spent for the extension of the water system. Morris Knowles, Oliver Bldg., Pittsburgh, Penn., is the Engr.

New Tazewell, Tenn. The construction of a water system is being considered by the city.

South Pittsburg, Tenn. The South Pittsburg City Water Co. has been bought by the J. W. [illegible] Co. The system will be improved and meters will be installed.

Canal Dover, Ohio. [illegible] Winthrop Pratt, Cleveland, Ohio, has been retained by the council to cooperate with George E. [illegible], City Engr., in the preparation of a report regarding the present water works. The report will include recommendations for necessary changes and improvements.

Cincinnati, Ohio. (Official) Bids will be received by the [illegible] until noon, July 2[illegible] for furnishing c.-i. pipe and special castings for the water system. Noted July [illegible].

Coshocton, Ohio. The city contemplates constructing a [illegible] and reservoir and a water works. Elmer Smith, [illegible], and Andrew Fisher, City Engr., have prepared a report on the proposed water system.

Defiance, Ohio. The Civic Committee of the Chamber of Commerce contemplates obtaining a pure water supply from [illegible].

Middletown, Ohio — Pollard & Ellms, Engrs., Cincinnati, have been retained by the city to prepare plans for the construction of a new pumping plant or improving the old one. Noted June 18.

Westport, Ind.—The city will install a water system at an estimated cost of $5500.

Albion, Mich.—The City Council contemplates increasing the city water supply at an estimated cost of $25,000.

Alpena, Mich.—The water system will be improved by the addition of a filtration plant at an estimated cost of about $80,000. W. C. Hoad is Consult. Engr.

Canton, Ill.—Plans have been prepared for the installation of a water system to cost $20,552. M. F. Felix is Mayor.

Carlyle, Ill.—See item under "Sewers."

+Carrollton, Ill.—The contract for constructing a complete pumping station has been awarded to the ARROW ENGINEERING CO., Star Bldg., St. Louis, Mo., at $31,000. The Caldwell Engineering Co., Jacksonville, is the Engr.

★Chicago, Ill.—Press reports state that the Finance Committee of the Council has rejected all bids received for constructing the Wilson Ave. water tunnel. Noted July 2.

Little York, Ill.—The citizens voted at a recent election to install a water system. The cost will be about $5000.

+Rockford, Ill.—(Official)—The contract for drilling a well in Hulin Park has been awarded by the Water Department to S. B. GEIGER, Chicago, at $8990. Other bidders were W. H. Cater Contracting Co., $14,400; M. T. Peterson, $11,600 and J. P. Miller, $10,350. Ross P. Beckstrom is Supt. of the Water Works. Bids opened June 27. Noted June 25.

+Springfield, Ill.—The contract for installing a generator at the municipal water works and electric-light plant has been awarded to the WESTINGHOUSE ELECTRIC & MFG. CO., at $18,650.

Summit, Ill.—(Official)—Bids will be received by the President of the Board of Trustees until 8 p.m., July 23d for the construction of a water system. Plans are on file with Leslie Johnstone, Village Clk. James W. Cook, 237 South LaSalle St., Chicago, is the Engr.

Boyden, Iowa—A municipal water system will be installed by the town. Bonds for this purpose were voted recently.

★Dubuque, Iowa—(Official)—Bids will be received by the Board of Water Works Trustees until 10 a.m., July 29, for the construction of a concrete reservoir with a capacity of 7,500,000 gal. and laying about 2000 ft. of 24 in. c.-i. pipe. Charles Sass is Secy. Bd. of Water Wks. Trustees. Noted June 18.

Hamburg, Iowa—The water system will be extended at a cost of $15,000. Bonds for this purpose have been voted.

+Duluth, Minn.—The contract for installing a water system at the Minnesota State Experimental farm has been awarded to the WOODMANSE MFG. CO., Freeport, Ill.

Ironton, Minn.—A water system costing $15,000 will be installed at Ironton. Bonds for this purpose have been voted.

Enterprise, Kan.—Bids will be received until noon, Aug. 5, for laying 5500 ft. of 4-in. water mains. Ray E. Corbin is City Clk.

Kansas City, Kan.—An election will be held Aug. 25 to vote on the proposition of issuing $200,000 in bonds for the extension of the municipal water system. George Little is City Clk.

Palmyra, Neb.—(Official) — Bids will be received until noon, July 31, for $10,000 in bonds for a complete water system. W. E. Vaughan is Village Clk. Noted May 21.

Billings, Mont.—Bonds for $450,000 were voted by the citizens for the purchase of the Montana Water Co. The plant will be extended. Noted May 28.

+★Lewistown, Mont.—The contract for constructing a gravity pipe line has been awarded by the Council to A. M. HOLTER CO., Helena, Mont., at $63,000. Bids opened June 15. Noted May 28.

Melstone, Mont.—An election will be held July 20 to vote on a bond issue of $20,000 for the installation of a municipal water system. Noted Apr. 23.

Missoula, Mont.—The City Council will buy the Missoula Light & Water Co. and will make improvements.

Carsville, Mo.—Improvements to the water works to cost $6000 are contemplated.

+Kansas City, Mo.—The contract for furnishing 2500 water meters has been awarded by the Fire and Water Board to the BADGER METER CO., Milwaukee, Wis., at $5.25 each.

Monett, Mo.—The city contemplates spending $10,000 for the installation of a water system. The mayor has charge of the work.

Palmyra, Mo.—(Official)—Bonds for $26,000 for the extension of the water system and electric-light plant have been voted. Howard J. Smith, Palmyra, is in charge. Noted July 2.

+Clarendon, Ark.—Bids were opened June 21 and contracts awarded to McEACHIN & McEACHIN, McAlester, Okla., at $54,705 for the construction of a water works and sewer system. Noted June 4 and 18.

Dallas, Tex.—Bids will soon be received for furnishing 300 tons of six-in. and two tons of four-in. water pipe and 85 6-in., three-way and 15 four-in., three-way hydrants.

San Antonio, Tex.—Bids will be received by the San Antonio Water Co. until Aug. 3 for furnishing two 5,000,000 gal. pumps and steam turbine sand equipment. Noted June 25.

Waco, Tex.—The City Water Commission contemplates drilling an artesian well about 2000 ft. deep. John Davis is City Clk.

Grandville, Okla.—Bonds for $15,000 for a pipe line for the water system have been voted. Noted June 18.

Mannford, Okla.—The construction of a water system is being considered by the city. The Mayor is in charge.

Tahlequah, Okla.—The installation of a municipal water system costing $16,000 is being considered by the City Council.

+Mead, Colo.—(Official) — The contract for installing a water system has been awarded to the GORDON & TAYLOR CONSTRUCTION CO., Denver, at $8500. G. H. Sethman, Denver, is Engr. Noted June 25.

Bevill, Idaho—The citizens contemplate installing a water system at an estimated cost of $20,000. The plans include a concrete reservoir and steel mains.

Naco, Ariz.—The Bisbee-Naco Water Co. will reconstruct its water system at Naco. New machinery will be installed.

Seattle, Wash.—The City Council has authorized the laying of water mains in East Harrison St. The estimated cost is $42,474.

Spokane, Wash.—Plans are being prepared for the construction of an auxiliary water station at the pumping plant. The cost is estimated at $100,000.

Baker, Ore.—According to press reports the city will construct two pipe lines estimated to cost $98,000. The money for this work has been appropriated.

+Eugene, Ore.—The contract for furnishing pipe for the new system of water mains to connect the new reservoir with the old system has been awarded to the CRANE CO., Portland. The contract for laying the pipe has been awarded to the JAMES KENNEDY CO., Portland.

Portland, Ore.—Bids will soon be received for furnishing 20,000 ft. of 2-in. water pipe.

Plans have been prepared for the construction of a dam at Bullrun to enlarge the reservoir. The estimated cost is between $80,000 and $100,000.

+Los Angeles, Calif.—(Official)—The contract for constructing a water tank and tower has been awarded by the Board of Harbor Commissioners to the DES MOINES BRIDGE & IRON CO., Des Moines, Iowa, at $4090. Noted June 4.

Riverside, Calif.—The Indian Hill Water Co. will install a water system on the Alamo tract ,according to press reports. S. C. Evans, Riverside, is interested.

San Diego, Calif.—The Finance Department will soon receive bids for furnishing 9000 ft. of 16-in. c.i. water pipe. The sum of $16,000 has been apropriated for this purpose.

Englehart, Ont.—The city contemplates constructing a water works and sewer system. The costs is estimated at $40,000.

Orillia, Ont.—The date for receiving bids for the extension of the water system has been extended from July 13 to July 27, and for equipment of the water system from July 27 to Aug. 3. Noted July 2.

Winnipeg, Man.—Bids will be received about Sept. 19 by the Greater Winnipeg Water District for constructing 84 miles of the aqueduct of the Shoal Lake water project. The estimated cost is $8,729,000.

Banff, Alta.—Bids will be received by the Secretary, Department of the Interior, Ottawa, Ont., until July 27, for laying 13,000 ft. of 20-in. steel pipe for the water department.

Burnaby, B. C.—The city has apropriated $50,000 for the improvement of the water system.

Prince Rupert, B. C.—Bids will be received by the City Clerk until July 20 for laying 8000 ft. of 6- to 12-in. pipe.

SEWERS

Boston, Mass.—Bids will be received by the Department of Public Works until July 20, for constructing pipe sewers, and drains in Oakland St., Richmond Road, etc., Dorchester District. L. K. Rourke is Comr.

Milford, Mass.—Press reports state that plans have been adopted for the installation of a sewer system.

Hartford, Conn.—(Official)—The following bids were received by the Board of Contract and Supply for constructing an extension to the Homestead Ave. intercepting sewer (a) concrete, (b) reinforced concrete pipe, (c) vitrified clay block: C. H. Slocomb & Co., (a) $55,461, (b) $56,482, (c) $54,-408; Ryan Construction Co., (b) $73,093, (c) $72,838; Stobaugh Construction Co., (a) $88,496, (b) $90,579, (c) $85,509; O'Neil Bros., (c) $88,451; Pierson Engineering & Construction Co., (a) $107,825, (b) $110,051, (c) $110,051.

The following bids were received for constructing sewer in Westbourne Parkway and overflow sewer (a) reinforced concrete pipe, (b) vitrified clay block: C. H. Slocomb & Co., (a) $18,843, (b) $18,555; Ryan Construction Co., (a) $22,376, (b) $22,376; Pierson Engineering & Construction Co., (a) $24,320, (b) $25,408; O'Neil Bros., (a) $29,240. Roscoe N. Clark is City Engr. Noted July 2.

Buffalo, N. Y.—The City Council has ordered the construction of 36-, 33- and 30-in. tile sewers in Montrose and Kenmore Aves. and 18-, 15- and 12-in. tile sewer in Olive St.

Yonkers, N. Y.—The Board of Contract and Supply has awarded contracts for sewer construction as follows: For constructing a sewer in Yonkers Ave. from Vernon Ave. to Overhill Place to JOSEPH L. CUZZO, at $7162. Other bids were: F. A. Cianfaglione, $9927; Guiseppi Di Marco, $9164; O'Rourke Contracting Co., $9045; Pisano & Alexander, $8987; Frank J. Kelly, $8894; Coretsi & Merone, $8216; Joseph Canepi, $8160. For constructing a sewer in Tibbetts Road from McLean Ave. to the Bronx Valley easement to THOMAS GRADY at $7990. Other bids were: F. A. Cianfaglione, $10,-500; Joseph Canepi, $9400; Joseph Cianciulli, $8997; Nicholas Mengini, $9700; John L. Hayes, $8800; Frank J. Kelly, $8698; Joseph L. Cuzzo, $8653; John O. Weston, $9000; John Hanifin, $8569; O'Rourke Contracting Co., $8643; James J. Corbalis, $8087. For constructing a sewer in Lawton St. from McLean Ave. to Sherman Ave., and in McLean Ave. from Sherman to Central Aves., to JAMES J. CORBALIS at $26,400. Other bids were from: F. A. Cianfaglione, $36,000; Melloy & Murray, $35,944; Joseph Canepi, $32,000; Pisano & Alexander, $31,980; Frank J. Kelly, $31,787; Nicholas Mengini, $31,130; John L. Hayes, $30,947; Joseph L. Cuzzo, $30,720; O'Rurke Contracting Co., $30,174; John O. Weston, $28,500. For a sewer in Saw Mill Road to JOHN O. WESTON at $24,242

[illegible] bids were: F. A. [illegible], [illegible]; M[illegible] & Murray, [illegible]; Frank [illegible], [illegible]; [illegible] & Alexander, [illegible]; [illegible], [illegible]; Joseph L. [illegible], $27,4[illegible]; [illegible] Contracting Co., [illegible]; John L. [illegible], [illegible]; James J. [illegible], $24,3[illegible].

◆✦Newark, N. J.—Press reports state that the contract for constructing Section [illegible], northern portion of the main intercepting sewer, has been awarded by the Passaic Valley Sewerage Commissioners to the HARRISON & CRAIG CO., Newark, at $[illegible]. Noted June [illegible].

◆Plainfield, N. J.—(Official) Bids for constructing sanitary sewers were received by the City Council from: Di Napoli & [illegible] Construction Co., Hackensack, N. J., $26,-[illegible]; Kelley [illegible] Co., Camden, N. J., $[illegible]; T. Foster [illegible], N. J., $[illegible]; Charles A. Peterson, Plainfield, $[illegible]; [illegible] & [illegible], Plainfield, $[illegible]; Mohus [illegible], $[illegible]; John W. Heller, Newark, $[illegible]; L. S. F[illegible], Elmhurst, L. I., N. Y., $41,9[illegible]; James [illegible], Newark, N. J., $[illegible]. James T. MacMurray is City [illegible]. Noted June 18.

Summit, N. J.—Bids will be received by the Common Council until July [illegible], for constructing storm sewers. Alexander [illegible] is City Engr.

Harrisburg, Penn.—Press reports state that the lowest bid submitted for constructing the sewer in 136th St. was that of [illegible] W. [illegible], Inc., at $[illegible].

North Wales, Penn.—It is reported that plans have been prepared for a sewer system and sewage disposal plant. Noted Apr. 2[illegible].

✦Parsons, Penn.—The contract for installing the proposed sewer system has been awarded to [illegible] M. ROSSER, Wilkes-Barre, [illegible] as follows: First district, $17,199; second district, $[illegible]; third district, $[illegible].

York, Penn.—Bids will be received by the City Clerk until July [illegible] for constructing a sanitary outfall sewer and [illegible]. George A. W[illegible] is City Engr.

Wilmington, Del.—Bids will be received by the Board of Directors, Street and Sewer Department, until July [illegible], for furnishing the following materials, beginning Aug. 1, for a period of one year: Foreign and domestic portland cement, terra cotta pipes, castings, sewer bricks, bar sand, river paving sand and gravel.

Frederick, Md.—See item under "Streets and Roads."

Hertford, N. C.—J. B. McCrary Co., Atlanta, Ga., has been commissioned to prepare plans for sewer and water-works construction, also for paving and installing lights. The estimated cost is $[illegible].

Morehead City, N. C.—The city has commissioned the J. B. McCrary Co., Atlanta, Ga., to prepare plans for installing a sewerage system, estimated to cost $30,000.

◆Washington, N. C.—See item under "Water Supply and Irrigation."

Winston-Salem, N. C.—See item under "Water Supply and Irrigation."

✦Augusta, Ga.—The River and Canal Commission has awarded a contract to WILLIAM F. BOWE, at $10,[illegible], for constructing a reinforced concrete 40-in. sewer in Reynolds St. from [illegible] to 11th St.

Perry, Fla.—(Official) The item in the issue of July 9, stating that the city will construct a sewer system and water-works was incorrectly noted. The Town Council contemplates constructing an extension to the water main and sewer. [illegible] is Clk.

Birmingham, Ala.—The City contemplates the construction of about five miles of [illegible], 12- and 30-in. sewers in the [illegible] district. The estimated cost is $2[illegible]. Julian Kendrick is City Engr.

Bids will be received by the Board of Commissioners until [illegible], July [illegible], for the construction of sanitary sewers in East Birmingham at an estimated cost of $18,[illegible].

✦Mobile, Ala.—The contract for constructing storm sewers and curbs in Spring Hill Ave. from the city limits to Moffat Road has been awarded by the Board of Revenue and Road Commissioners to [illegible] & LYNCH, at $[illegible]. Other bids were: [illegible] & [illegible], (a) concrete pipe, $[illegible]66, (b) vitrified pipe, $[illegible]; C. M. Worthington, (a) $[illegible]; George A. Mathe, (a) $[illegible], (b) $[illegible]; Porter & Bailey, (a) $11,2[illegible], (b) $11,262; A. [illegible] Perry, (a) $11,741, (b) $11,[illegible].

✦Fayetteville, Tenn.—The contract for constructing a sewer system has been awarded to the GEORGIA ENGINEERING & CONSTRUCTION CO., Clayton, Ga., at $[illegible].

Akron, Ohio—Bids will be received by the County Commissioners until July [illegible] for constructing a sewer system and sewage treatment plant on the Tuberculosis Hospital site, [illegible], Summit County. R. Winthrop Pratt, Hippodrome Bldg., Cleveland, is Engr.

◆Canal Dover, Ohio—(Official) Bids will be received by the Director of Public Service until noon, July [illegible], for constructing a sewage treatment plant. Plans are on file with R. Winthrop Pratt, Hippodrome Bldg., Cleveland.

Cincinnati, Ohio—Bids will be received by the Director of Public Service until noon, July [illegible], for constructing sewers in the [illegible] between [illegible] Road and [illegible] Creek Road. [illegible] is [illegible].

Dayton, Ohio—Plans have been completed for constructing a storm sewer in East First St. The estimated cost is $[illegible]. [illegible] is City Engr.

Dover, Ohio—Bids will be received by the Director of Public Service until July [illegible] for constructing a sewage purification plant. R. Winthrop Pratt, Hippodrome Bldg., Cleveland, is Engr.

✦Madisonville, Ohio—The Director of Public Service has awarded the contract for constructing the sewer in [illegible] from [illegible] to [illegible] Ave. to the [illegible] CONSTRUCTION CO., at $[illegible]. Noted May [illegible].

Newark, Ohio—The lowest bids submitted for constructing sewers were from A. [illegible] as follows: Maple Ave. sewer, $[illegible]; [illegible] St., $[illegible]; [illegible] St., $2[illegible]. C. H. [illegible] is City Engr.

✦Painesville, Ohio—The contract for constructing the sanitary storm sewer in Liberty St. has been awarded to CHAPMAN & GROVER, at $11,7[illegible]. Noted June 18.

✦The contract for constructing the sanitary sewer in Richmond St. has been awarded to O. M. SEVERSON & CO., Erie, Penn., at $17,183.

Struthers, Ohio—Bids will be received by Jonah Richards, Village Clk., until noon, July 29, for constructing storm and sanitary sewers in Lowell Ave. from Bridge to Center St.

✦Fenton, Mich.—The contract for constructing about one mile of trunk sewers has been awarded by the City Council to WHALEY & EDWARDS, Milan, Mich., at $7137. Noted June 4.

Grand Rapids, Mich.—The lowest bid received by the Board of Public Works for constructing sewers in Buchanan Ave. and other streets was that of Ver Hey & Kloote, at $7206.

Carlyle, Ill.—Bids will be received by the Board of Local Improvements until July 18 for constructing a system of sewers and water mains in Sanitary Sewer District No. 2. F. A. Lietze is Engr.

Carrollton, Ill.—Bids will be received by the Board of Local Improvements until 9 a.m., July 21, for constructing a sanitary sewer system and a disposal plant. The Caldwell Engineering Co., Jacksonville, Ill., is Engr.

✦Elgin, Ill.—(Official) The contract for constructing about 37,000 lin.ft. of 6- to 15-in. sanitary sewers has been awarded to LOGAN & GIERTZ CONSTRUCTION CO., Elgin, at $22,770. Morgan H. Brightman is City Engr. Noted July 2.

Burlington, Wis.—Bids will be received by the Board of Public Works, until July 18, for constructing 8-in. sanitary sewers in several streets. J. G. Johann is Acting-Secy.

New Glarus, Wis.—(Official) Bids will be received by Frederick Ott, Village Clk., until July 23, for laying 33 ft. of 10-in., 1895 ft. 8-in., 66 ft. 6-in. and 960 ft. 5-in. vitrified pipe sewers, 5 manholes and 2 lampholes. Plans may be had at the Clerk's office, Madison, Wis. W. G. Kirchoffer, 31 Vroman Block, Madison, is Engr.

New London, Wis.—All bids received by the Common Council for constructing sewers and laterals have been rejected as they exceeded the appropriation. Work will be postponed until next year.

Portage, Wis.—(Official)—See item under "Streets and Roads."

✦Superior, Wis.—The contract for constructing seven sections of the Allouez sewer system has been awarded to RICHES & ANDERSON at $32,000.

✦Superior, Wis.—The contract for constructing a lateral sewer in the alley between Missouri and Maryland Aves. has been awarded by the Board of Public Works to PASTORET & CO., at $11,000. Noted July 2.

✦Montezuma, Iowa—The contract for constructing sanitary sewers in various streets has been awarded to M. TSCHIRGI, Cedar Rapids, at $[illegible]. R. A. Moreland is City Clk.

Webster City, Iowa—Bids will be received by the City Clerk until 7:30 p.m., July 21, for constructing 11,9[illegible] ft. of pipe sewers and a disposal plant. The Caldwell Engineering Co., Jacksonville, Ill., is Engr.

Deerwood, Minn.—(Official) Bids will be received by J. O. Hage, Village Clk., until 2 p.m., July 20, for constructing a sanitary sewer system requiring about [illegible] ft. of 15-, 12-, 10- and 8-in. vitrified sewer pipe, also for constructing a septic tank, dosing tank and accessories with and without sand filters. The Devar Claussen Engineering Co., Commercial Bldg., St. Paul, Minn., is Engr.

✦Stillwater, Minn.—(Official) The contract for constructing sewers in Maple and Elm Sts. has been awarded to WILLIAM DANFORTH, Hackney Bldg., St. Paul, Minn., at $[illegible]00. Other bids were: McGee & Nolan, Stillwater, $[illegible]; Doherty & Son, St. Paul, $61[illegible]. Charles A. Lanmers is City Clk. Noted July 2.

Gallatin, Mo.—Tuttle & Pike, Shubert Theatre Bldg., Kansas City, Mo., are preparing plans for a sewer system estimated to cost $[illegible].

Blytheville, Ark.—Bids will be received by the Board of Commissioners, District No. 1, until July [illegible], for constructing sewers. H. C. [illegible], Memphis, Tenn., is Ch. Engr.

Eufaula, Okla.—The lowest bid submitted for completing the sewer system was that of the Tonkawa Construction Co., at $[illegible], for constructing the sewer to the outlet into Oldtown Creek and $[illegible] for completing sewer to the river.

Olympia, Wash.—The City Council will construct a trunk sewer in Chestnut St. and in Central Ave. The estimated cost is $[illegible].

Seattle, Wash.—The City Council has decided to construct sewers in various streets. A. H. Dimock is City Engr.

Portland, Ore.—All bids received by the City Council for constructing a sewer in East [illegible]th and East Oak Sts. have been rejected. Bids for the work will be readvertised. Noted June [illegible] and July 9.

Long Beach, Calif.—(Official)—Bids will be received by the Board of Public Works until noon, July [illegible], for the construction of an outfall sewer system and sewage disposal plant. The estimated quantities are: [illegible] ft. of 1[illegible]-in. sewer, [illegible] ft. of 1[illegible]-in., [illegible] ft. of 1[illegible]-in., [illegible] ft. of [illegible]-in., [illegible] ft. of 22-in., [illegible] ft. of 24-in., 111[illegible] ft. of 27-in., 18,[illegible] ft. of 30-in., [illegible] ft. of [illegible]-in., [illegible] ft. of 42-in., 16[illegible] manholes, disposal tanks, pumps, 11[illegible] ft. of 36-in. c.-i. ocean outlet. F. [illegible] is Pres. of the Board.

✦Los Angeles, Calif.—(Official)—The contract for constructing the Alameda St. storm sewer, including paving the street, has been awarded to T. J. [illegible], 1[illegible] Oxford Ave., Los Angeles, at $[illegible]. Horace R. Ferris is Secy. Bd. of Pub. Wks. Noted June 11.

+Sacramento, Calif.—The contract for installing machinery at the sewer station has been awarded by the City Commission to the POWER EQUIPMENT CO., Rialto Bldg., San Francisco, at $38,400. M. J. Desmond is City Clk. Noted July 2.

GARBAGE

Clarksdale, Miss.—Bids will be received until July 23 by the City Commisioners for constructing a garbage incinerator capable of serving a population of 6000. M. W. Purnell is City Clk.

STREETS AND ROADS

Boston, Mass.—Bids will be received until July 17 by the Public Works Department for asphalt and bituminous pavement on Appleton, Chandler and Clarendon Sts. L. K. Rourke is Comr.

Bids will be received until July 21 by the Public Works Department for granite block paving on Shirley St., Roxbury District.

Bids will be received until July 21 by the State Highway Commission for the construction of 3200 lin.ft. of road in Saugus. Arthur W. Dean, 15 Ashburton Place, is Ch. Engr.

+The State Highway Commission has awarded the following contracts for road construction: For 4200 lin.ft. macadam road in Peabody to T. A. MOYNIHAN, Hamilton, at $10,409. Other bids were: D. Linehan & Sons, Beverly, $11,204; D. J. Sheehan, Lynn, $11,563; J. E. Watkins, Amesbury, $11,714; F. E. Ellis, Melrose, $12,457; Rowe Contracting Co., $11,620; J. Wagenbach & Sons, $12,683; Middlesex Contracting Co., Putnam, Conn. ,$12,958; J. A. Gaffey, Medford, $13,720; C. L. Hoffman & Son, Melrose, $13,920.

The work at Pittsfield was awarded to the LANE CONSTRUCTION CORPORATION at $18,795. Other bids were: Rowe Contracting Co., $18,230; Hyde, Crowe & Walsh, $19,870; Horne Lowe Co., $19,898; O. T. Benedict, $20,265; L. W. Menaquale, $20,965.

For 16,500 lin.ft. macadam road in Williamstown to L. C. CORCHIER, Boston, at $19,356. Other bids were: Middlesex Contracting Co., $20,696; R. W. Emerson, Pittsfield, $21,245; F. J. Mague, West Newton, $21,556; Lane Construction Corporation, Meriden, Conn., $21,773; Hyde, Crowe & Walsh, Pittsfield, $21,846; W. L. Camarco, Lee, $23,380; W. R. Pratt, Dalton, $24,446; O. T. Benedict, Pittsfield, $24,936; Way & Cellilli, Springfield, $26,417; Horne Lowe Contracting Co., Millbury, $26,609; Cordner, Montague & Co., $28,970.

For 6000 lin.ft. of gravel road at Sudbury, the bids were: Doherty & Sweeney, Somerville, $4587; B. Perini & Co., Ashland, $1823; Framingham Contracting Co., Framingham, $5911; J. A. Gaffey, Medford, $6121; F. J. Mague, West Newton, $6177; Rowe Contracting Co., Boston, $6188; William H. Ellis & Sons Co., East Boston, $6360; Beaver Construction Co., Boston, $7051. No award.

For 5000 lin. ft. of tar macadam road in Great Barrington the bids were: L. W. Menequa Co., Stockbridge, $6315; W. J. Peer, Great Barrington, $6662; N. E. Contracting Co., Worcester, $6725; Lane Construction Co., Meriden, Conn., $6830; O. T. Benedict, Pittsfield, $7625; Horne-Lowe Contracting Co., $7638; W. J. Donovan, Fitchburg, $7790; W. L. Camarco, $7890; O. W. Ruckle, Providence, R. I., $8000; Natale di Acco & Co., Gardner, $8156; W. R. Pratt, Dalton, $8190. No award.

★Greenwich, Conn.—(Official)—Bids will be received by the Highway Commission until 3 p.m., July 20, for laying about 30,000 sq.yd. of concrete pavement on parts of North St. and Hill Road. Charles T. Wills is Comr.

+Hartford, Conn.—Contracts for state road work have been awarded by the State Highway Commission as follows:

Essex Township, a section of native stone resurfacing on the Westbrook Road, to FRANK ARRIGONI & BRO., Middletown, at $3375.

Westbrook Township, a section of graded road and native stone resurfacing, to FRANK ARRIGONI & BRO., Middletown, at $8000.

City of Hartford, a section of amiesite paving on Albany Ave., to the CONNECTICUT & RHODE ISLAND CO., Meriden, at $10,413; also a section of reinforced concrete construction on Bloomfield Ave., to the A. C. STERNBERG JR. CONSTRUCTION CO., West Hartford, at $5620.

Putnam Township, a section of bituminous native stone macadam on Woodstock Ave., to A. D. BRIDGE'S SONS CO., Hazardville, at $8000.

Manchester Township, a section of reinforced concrete construction on Chapman Road, to the BRISTOW BROS. & KNOWLES CORPORATION, Narranganset Pier, R. I., at $10,828.

Salisbury Township, a section of graded construction on Smith Hill, to JOHN DE MICHIEL & BRO., Torrington, at $2902. Noted June 25 and July 10.

Brooklyn Township, about 4850 lin.ft. native stone macadam on the Wauregan Road, to GOODMAN & TRUMBULL CO., Litchfield, at $6589. Watertown Township, about 6450 lin.ft. trap rock macadam on the Thomaston Road, to JOHN DI MICHIEL & BRO., Torrington, at $11,687.

+New Haven, Conn.—(Official)—The contract for paving sections of Church St. and Winchester Ave. has been awarded to C. W. BLAKESLEE & SONS at about $10,000. Noted July 9.

★Albany, N. Y.—(Official)—Bids will be received by John N. Carlisle, State Highway Comr., until 1 p.m., July 27, for improving and repairing highways in various counties. For particulars, see advertisement under "Contracts to Be Let."

+Buffalo, N. Y.—The City Council has authorized the award of contracts to the GERMAN ROCK ASPHALT CEMENT CO. at $15,690 for paving Alsace Ave. with asphalt, and at $61,450 for paving Linwood Ave. with asphalt. The Council has also ordered the paving of Lester and Wick Sts and the repaving of Grider, Virginia and York Sts. Francis G. Ward is Comr. of Pub. Wks.

★+Corning, N. Y.—(Official)—The contract for paving Market and State Sts. has been awarded to BRADLEY & NOLAN at $39,944. Other bids were: Robert Henson, Geneva, $40,606; William H. Welch, Corning, $43,903; Arthur D. Osborne, Binghamton, $45,300; Drake & Dean, Buffalo, $42,154; Witt & Blades, Hornell, $42,552. Noted June 25.

Mount Kisco, N. Y.—(Official)—Bids will be received until 8 p.m., July 20, by the Board of Village Trustees for grading, macadamizing and otherwise improving Maple and Lexington Aves. and Green St. B. F. Darling, White Plains, N. Y., is Village Engr. George B. Cranston is Village Clk.

★+Poughkeepsie, N. Y.—(Official)—The Board of Public Works has awarded the contract for paving Garden St. to the SCHENECTADY CONTRACTING CO., Schenectady, at $22,794; the contract for paving Jefferson St. was awarded to the BRIDGEPORT CONSTRUCTION CO., Poughkeepsie, at $1516. Noted July 2.

+Troy, N. Y.—The Board of Contract and Supply has awarded the contract for paving Maple Ave. from Spring to Pawling Ave. with asphalt to WARREN BROS. & CO. at $5212.

Yonkers, N. Y.—The following bids have been received by the Board of Contract and Supply for surfacing the pavement on New Main St. from Nepperhan Ave. to the junction of South Broadway: John L. Hays, $12,810 for vitrified brick; F. A. Cianfaglione, $27,480 for standard granite block; the Harlem Contracting Co., $17,233 for asphalt block, and Kearns & Hart, $10,260 for sheet asphalt. The award was withheld for the Common Council to select the kind of pavement.

Bids will be received until Aug. 3 by the Board of Contract and Supply for widening Palisade Ave. from Getty Square to Elm St.

Camden, N. J.—(Official)—Bids will be received until 8 p.m., July 20, by Joshua C. Haines, Chn. of the Committee on Streets and Highways, for paving with Belgian block on a concrete foundation portions of Linden, Pine and Cooper Sts.

Linden, N. J.—(Official)—Bids will be received until 8 p.m., July 21, by the Borough Council for macadamizing the following streets: Curtis St., 1590 lin.ft.; Hussa St., 1330 lin.ft.; Lumber St., 633 lin.ft. W. Priestley and J. F. Jahn, Linden, are Engrs. Clarence H. Smith is Borough Clk.

+Metuchen, N. J.—(Official)—A contract for flagging about 15,000 lin.ft. with 2-in. blue stone has been awarded to the WILBERT BLUE STONE CO., Perth Amboy, at $8444. Noted June 4 and July 2.

Perth Amboy, N. J.—(Official)—Bids will be received until 8:30 p.m., July 22, by the City Council for the construction of an asphalt block pavement on Oak St. from Smith St. to New Brunswick Ave. George M. Adair is Street Comr.

Rahway, N. J.—Bids will be received until 8 p.m., July 20, by Harry T. Halliday, Street Comr., for the construction of sidewalks, curb and gutter in several streets.

+Trenton, N. J.—(Official)—Bids were received June 26 by the City Commissioners for street paving as follows: (a) Adeline St. with bituminous concrete, (b) Adeline St. with bituminous concrete and granite block, (c) Hart St. with vitrified brick, (d) Home Ave. with bituminous concrete, (e) Roebling Ave. with bituminous concrete, (f) Swan St. with vitrified brick, (g) Sanford St., Sutton & Corson, (a) $6674, (b) $5200, (c) $9545, (d) $8087, (e) $12,480, (f) $10,230, (g) $1858; CITIZENS CONSTRUCTION CO., (a) $6467, (b) $4844, (c) $7532 (awarded contract), (d) $7847, (e) $18,947, (f) $8097 (awarded contract, (g) $1921; Charles Reed & Co., (a) $6569, (b) $5248, (c) $7607, (d) $8240, (e) $12,557, (f) $8263, (g) $1659; NEWTON PAVING CO., (a) $5560 (awarded contract), (b) $4836 (awarded contract), (d) $6319 (awarded contract), (e) $9638 (awarded contract), (g) $1550 (awarded contract); Ginder Construction Co., (c) $7611, (f) $8164. Noted June 25.

Larksville, Penn.—(Official)—Bids will be received until 4 p.m., July 23, by the Borough Council for the improvement of Lawson and State Sts. Boyle & Howe are Borough Engrs. Thomas Anderson is Chn. of the Street Com.

+Penn Yan, Penn.—The Board of Trustees has awarded the contract for paving Seneca and Water Sts. to CHARLES N. KELLY at $12,900.

Philadelphia, Penn.—The Bureau of Highways will shortly ask bids for highway improvements estimated to cost $450,000. M. L. Cooke is Dir. Dept. of Pub. Wks.

Pittsburgh, Penn.—(Official)—Bids will be received until 10 a.m., July 31, by R. J. Cunningham, County Controller for the improvement of the Emsworth and Haysville Road, Haysville Borough.

Washington, Penn.—(Official)—Bids will be received until noon, July 29 by the Board of County Commissioners for the construction of seven sections of county road, including necessary culverts and small bridges. Bids will be received at the same time for the furnishing of paving brick or blocks for the above mentioned roads. Chaney & Armstrong, Washington, are County Engrs. H. R. Campbell is Ch. Clk.

Wilkes-Barre, Penn.—(Official)—Bids will be received until noon, July 21, by the City Clerk, for vitrified brick pavement on a concrete foundation on Hill and Moyallen Sts. Charles N. Loveland is Supt. Dept. of Streets and Pub. Improvements. Fred H. Gates is City Clk.

Wilmington, Del.—See item under "Sewers."

Frederick, Md.—(Official)—Bids were received July 7 by Lewis H. Fraley, Mayor, for 5500 sq.yd. of paving, 2005 lin.ft. curb, 850 lin.ft. 6- to 18-in. sewer pipe and accessories, as follows: C. H. Kilpp, $13,451; M. Applegate, $14,284, and the Whiting-Turner Construction Co., $16,479. Noted June 11.

+Washington, D. C.—(Official)—The Commissioners of the District of Columbia have awarded the contract to the CRANFORD PAVING CO. for repairing asphalt pavements for three years at unit prices. The estimated total cost of the contract is $300,000. Noted June 4.

Hertford, N. C.—See item under "Sewers."

Old Fort, N. C.—(Official)—Bids will be received by P. H. Washburn, Chn. Township Highway Commission, until 2 p.m., July 25, for improving approximately 9¾ miles of the Central Highway from Greenlee to Old Henry.

+Raleigh, N. C.—A contract for laying 10,000 lin.ft. concrete curb and gutter combined has been awarded to R. G. LASSITER at $8848.

Winston-Salem, N. C.—See item under "Water Supply and Irrigation."

Tampa, Fla.—(Official)—All bids received July 10 for the [illegible] were rejected by the County Commissioners as too high. W. P. [illegible] is Clk. Noted June 11.

Birmingham, Ala.—(Official)—Bids will be received until [illegible] by the Board of City Commissioners for paving [illegible] Ave. from [illegible] to 25th St. at an estimated cost of [illegible]. Bids will be accepted for asphalt, bitulithic, asphaltic concrete or bituminous concrete. Julian Kendrick is City Engr.

Mobile, Ala.—The contract for improving Spring Hill Ave. has been awarded to C. S. LINCH at $[illegible].

Seale, Ala.—Bids will be received by the Commissioners of Russell County until Aug. 3 for improving about nine miles of the [illegible] and Columbus Road. W. S. Keller is State Highway Engr.

London, Tenn.—The County Court of London County has [illegible] issue of $[illegible] for road construction. Bids will be asked as soon as the bonds are sold.

Memphis, Tenn.—The St. Louis & San Francisco R.R. has entered into an agreement with the city of Memphis, and will shortly award contracts for paving Kentucky St. with [illegible] and Kansas St. with Birmingham slag.

Bowling Green, Ohio.—C. F. Sinebaugh, County Audr., will receive bids until July 20 for furnishing and delivering stone and screenings and furnishing and applying bituminous binder on three roads, about 8000 cu.yd., and for 4500 gal. of bituminous binder.

Canal Dover, Ohio.—Bids will be received until noon, July 22, by Desmond Salmon, Dir. of Pub. Ser., for grading, curbing and paving with brick several streets. W. E. Sykes, Sr., is City Dir.

Cincinnati, Ohio.—The Board of Commissioners of Hamilton County has approved plans for the repair of Colerain Pike from the city limits of Cincinnati to the Great Miami River, at an estimated cost of $43,780.

Bids will be received until July 17 by the Board of County Commissioners for the improvement of the New Richmond Pike from Three Mile Road to the county line, Anderson Township.

(Official)—Bids will be received until noon, July 24, by the Board of County Commissioners for treating the Kilby Road with bituminous road surfacing material from Harrison Pike to Cilley's Corner, Whitewater and Harrison Townships.

(Official)—Bids will be received until noon, Aug. 7, by the Board of County Commissioners for repairing the Harrison and Brookville Turnpike under Specification No. 673. Fred E. Wesselman is Pres. of the Bd.

The Director of Public Service has awarded the contract for paving Lakeman St. with asphaltic concrete from Blue Rock St. to Chase Ave. to HENKEL & SULLIVAN at $7631, the contract for paving Middletown Ave. with wood block was awarded to the KIRCHNER CONSTRUCTION CO. at $[illegible].

(Official)—Bids will be received until noon, July 31, by the Board of County Commissioners for the improvement of Montauk Road, in Milford, Columbia Township, and for the improvement of Grooms Ave. from Cornell Ave. to Brecon Road, Sycamore Township. Albert Reinhardt is Clk. of the Bd.

Cleveland, Ohio.—(Official)—Bids will be received until 10 a.m., July 2[illegible], by the Board of Commissioners of Cuyahoga County, for the construction and repair of the Dunham Road.

(Official)—Bids will be received until 10 a.m., July 29, by the Board of County Commissioners for the improvement of Cedar Glens Road from Murray Hill Ave., in the city of Cleveland, to Overlook Road, in the village of Cleveland Heights. W. A. Stinchcomb is County Surv. E. G. Krause is Clk. of the Comrs.

Columbus, Ohio.—The State Highway Commissioner has awarded the contract for paving 1.10 miles of the [illegible] Road, Columbiana County, to MORGAN BROS., Ravenna, Ohio, at $[illegible]. The pavement will be of brick.

Bids will be received until 10 a.m., July 29, by the Board of Commissioners of Franklin County for the purchase of county bonds for $[illegible] to provide funds for road improvements. [illegible] is Clk. of the Bd.

Bids will be received until 2 p.m., Aug. 4, by the State Highway Commissioner for paving with [illegible] macadam about [illegible] of the [illegible] Road, Clinton Township, [illegible] County. Estimated cost, $8970.

Crescent, Ohio.—(Official)—Bids will be received by S. [illegible], until noon, July [illegible], for improving [illegible] Ave.

Defiance, Ohio.—Bids will be received until [illegible] p.m., Aug. 3, by the Board of Commissioners of Defiance County for grading, constructing and paving with waterbound or bituminous macadam [illegible] Road No. 1. [illegible] is Clk. of the Comrs.

Dover, Ohio.—Bids will be received until July [illegible] by the Director of Public Service for brick paving, grading and curbing on [illegible] Center and [illegible] Aves.

Jefferson, Ohio.—Bids will be received until July [illegible] by the Board of Commissioners of Ashtabula County for paving [illegible] road from [illegible] to the Jefferson [illegible]. [illegible] is Clk. of the Bd.

Old Fort, Ohio.—(Official)—Bids will be received until noon, July [illegible], by the Trustees of [illegible] Township, at the [illegible] of the Township Clerk, Old Fort, for improving [illegible] in the [illegible] Roads. J. H. [illegible] is Twp. Clk.

Toledo, Ohio.—(Official)—Bids will be received until 10:30 a.m., Aug. [illegible] by the Board of Commissioners of Lucas County for [illegible] grading, draining and macadamizing portions of eight county roads. [illegible] is County Audr.

Indiana.—(Official)—Bids will be received as follows for road construction in Indiana:

[illegible], until [illegible] a.m., August [illegible], by Commissioners of [illegible] County, for constructing a stone road in [illegible] Township. [illegible] is Audr.

Boonville, until 10 a.m., August 4, by Commissioners of Warwick County for constructing a rock road in Campbell Township. N. M. Spradley is Audr.

Bloomfield, until 2 p.m., August 7, by Commissioners of Greene County for constructing roads in Wright and Smith Townships. C. H. Jennings is Audr.

(Official)—A contract for constructing highways in Franklin Township has been awarded to HAMLYN BROS., Acton. Noted June 11.

Greencastle, Ind.—(Official)—The contract for constructing the J. W. Clodfelter Road has been awarded to SUTHERLIN & CLODFELTER at $13,000. Noted June 18.

Huntington, Ind.—(Official)—Bids will be received until 7:30 p.m., July 20, by the Board of Public Works for 10,100 sq.yd. paving on First St. Bids will be accepted for vitrified brick, sheet asphalt, wood block or bituminous concrete pavement. H. L. Young is City Clk.

Monticello, Ind.—(Official)—The contract for improving the Second and Hughes stone roads has been awarded to L. H. KENT, Brookston, at $[illegible]. Noted June 25.

Rensselaer, Ind.—(Official)—A contract for constructing a road in Carpenter Township has been awarded to EVANS & VAN NOTTA, Fowler, at $10,999. Noted June 11.

Detroit, Mich.—Contracts have been awarded by the Department of Public Works for paving Helen Ave. to T. F. CURRIE at $13,288, and Canton Ave. to the DETROIT ASPHALT PAVING CO. at $19,570.

Iron Mountain, Mich.—(Official)—The Board of Public Works has awarded the contract for paving Ludington St. with bituminous macadam to HICKS & BARBER, Vulcan, Mich., at $6000.

Pontiac, Mich.—The City Commission has awarded the contract for paving Auburn and Orchard Lake Aves. with asphaltic concrete to the GOOD ROADS CONSTRUCTION CO., Chicago, at $1.43 per sq.yd., the contract for paving Walnut St. with brick on a concrete foundation was awarded to WILLIAM F. RYAN, Lansing, at a price ranging from $1.71 to $1.80 per sq.yd.

Belleville, Ill.—The contract for paving the Forest Ave. district with concrete has been awarded to GASS BROS. at $15,139. Noted May 14.

Decatur, Ill.—The contract for paving North Main St. has been awarded to S. A. TUTTLE at $32,197.

Dolton, Ill.—(Official)—Bids will be received until 8 p.m., July 20, by Charles Dickelman, Pres. of the Bd. of Village Trustees, for about 4080 sq.yd. concrete paving on 144th Place, Irven Ave., Oak and Frederica Sts.

Galesburg, Ill.—The Board of Local Improvements has awarded the contract for paving Simmons St. to J. B. McAULEY, Galesburg, at $32,224. Other bids were: P. H. Tiernan, Macomb, Ill., $32,449, and the Burlington Construction Co., $32,501.

Peoria, Ill.—(Official)—Bids will be received until 2 p.m., July 20, by the Board of Local Improvements for about 7300 sq.yd. of paving on Bradley Ave.

The Board of Local Improvements has recommended the laying of new sidewalks on both sides of Perry Ave. from Hamilton to Abington St., and on Jefferson Ave. from Fayette to Abington St. at an estimated cost of $9783 and $9242, respectively. L. D. Jeffries is City Engr.

Springfield, Ill.—(Official)—Bids will be received until noon, July 22, by the State Highway Commission for the following road work: Vermilion County, Route 2, Section A, about 16,100 ft. of brick construction, estimated cost, $[illegible]; Peoria County, Route 4, Section A, 6[illegible] lin.ft. concrete construction, $12,651; Champaign County, Route [illegible], Section B, 6160 lin.ft. brick construction, $12,7[illegible]; Champaign County, Route 3, Section A, 6[illegible] lin.ft. brick construction, cost about $14,619. All cement to be furnished by the State. P. C. McArdle is Asst. State Highway Engr.

Springfield, Ill.—Bids were received July 1 by the State Highway Commission and contracts awarded for constructing public highways by state aid as follows: Sections A and B, Sangamon County, to R. F. [illegible]AN at $[illegible] and $[illegible], respectively; Sections B and C, Sangamon County, to HENRY WELCH at $9933; Section D, Sangamon County, to JOHN F. BRETZ at $[illegible]; Section A, Ogle County, to [illegible] & GRAHAM, Freeport, at $21,[illegible]; Section A, Iroquois County, to DAVID EWING CONSTRUCTION CO., Bloomington, at $17,[illegible]; Section B, Crawford County, to CAMPBELL & [illegible]SON, Bloomington, at $17,[illegible]; Sections A and C, DeKalb County, to C. W. JENSEN & CO., Chicago, at $[illegible] and $[illegible], respectively; Sections A and B, Edgar County, to ALLEN J. FARRISH, Paris, at $[illegible] and $[illegible], respectively, and Section A, Lake County, to H. G. GOERLITZ, Oak Park, at $[illegible]. Noted June [illegible].

Springfield, Ill.—(Official)—The State Highway Commission has awarded contracts for road construction to J. W. STILES & EDWARD S. HICKEY, Champaign, at $[illegible] for Section C, Route 7, Champaign County; to C. NICHOLSON & A. L. BOOTH, Gardner, Ill., at $[illegible] for Section A, Route 11, Livingston County. Noted July 2.

Delavan, Wis.—Bids are being received by W. R. Topping, City Clk., for the construction of concrete curb and gutter on [illegible] street.

Dodgeville, Wis.—Bids will be received until July 2[illegible] by J. P. [illegible], City Clk., for constructing about [illegible] sq.ft. of concrete sidewalk. Noted June 2[illegible].

Marinette, Wis.—Bids will be received by the Board of Public Works until July 21 for the construction of two concrete roadways, [illegible] ft. wide, on each side of a 2[illegible]-ft. parking strip, with concrete curb and gutter on [illegible] Ave., and for macadam paving with concrete curb and gutter on Chestnut St. A. H. [illegible] is Clk. Bd. of Pub. Wks.

Milwaukee, Wis.—The contract for the construction of an asphalt pavement on concrete foundation on National Ave. between the Milwaukee and the West Allis city limits has been awarded to the [illegible] CONSTRUCTION CO. at $[illegible].

Platteville, Wis.—Bids are being received by J. E. Kennedy, City Clk., for the construction of [illegible] sq.yd. of concrete pavement and [illegible] lin.ft. of curbing on Main St.

Portage, Wis.—(Official)—Bids will be received until noon, July 24, by Fred F. Goss, Acting City Clk., for the construction of 23,000 sq.yd. vitrified brick paving, 16,000 lin.ft. concrete curb and gutter and 4600 lin.ft. vitrified pipe storm sewer.

Sheboygan, Wis.—The County Highway Commission has rejected all bids received for the construction of the Sheboygan-Sheboygan Falls Road, and the County Clerk will soon call for new bids. The estimated cost is $30,000. Noted Apr. 23.

Manning, Iowa—(Official)—The contracts for 24,000 sq.yd. paving and 6600 lin.ft. artificial stone curbing, bids for which were received July 6, will be awarded early in January, 1915. P. H. Jones is Clk. Noted June 18.

+Mason City, Iowa—(Official)—The contract has been awarded to the BRYANT ASPHALT CO., Waterloo, Iowa, for 26,700 sq.yd. of paving at $1.60 per sq.yd., and for 14,300 lin.ft. curbing at 30c. per ft. Other bidders for the paving were: Des Moines Asphalt Co., Des Moines, at $1.83, and the Ford Paving Co., Fort Dodge, at $1.77 per sq.yd. Noted July 2.

Parsons, Kan.—The City Council has decided to pave 22d St. from Corning Ave. to Broadway with asphaltic concrete. Ray Wells is City Engr. T. B. J Wheat is Clk.

Omaha, Neb.—Bids will be received until noon, Aug. 1, by Frank Dewey, Clk. of Douglas County, for paving the road from Omaha to Benson with Colorado granite paving block and concrete curb. Louis E. Adams is County Engr.

Seward, Neb.—Plans are being prepared for about 30,000 sq.yd. of street paving at Seward. C. O. Martz, 416 First National Bank Bldg., Lincoln, Neb., is Engr. in Charge.

Lewistown, Mont.—It is reported that the City Council will pave Broadway at an estimated cost of $35,000.

+Lewistown, Mont.—The contract for improving Seventh Ave. Blvd. and Broadway has been awarded to L. W. SCHRUTH, Fargo, N. D., at $15,407 and $5500, respectively.

Kansas City, Mo.—Bids will be received until July 20 by the Board of Park Commissioners for grading Gladstone Blvd. at an estimated cost of $12,000. Thomas C. Herrington is Secy. of the Bd.

+Fort Smith, Ark.—(Official)—Contracts for paving 6000 sq.yd. with wood block and 8000 sq.yd. with brick have been awarded to BURKE BROS. at $2.36 per sq.yd. and W. W. FULLER at $1.89 per sq.yd., respectively.

Bastrop, Tex.—The taxpayers of Precinct No 1, Bastrop County, have voted in favor of a bond issue of $50,000 for the construction of roads.

+Hillsboro, Tex.—The contract for road construction in Precinct No. 1, Hill County, has been awarded to the ROACH-MANIGAN CO. Noted May 7.

Longmont, Colo.—The City Council has passed an ordinance for the improvement of Main St. at an estimated cost of $40,000.

Ogden, Utah—(Official)—The City Commission has awarded contracts for paving 24th St. between Grant and Washington, and Eccles Ave. from 25th to 26th St., to the J. P. O'NEILL CONSTRUCTION CO., at $6414 and $6798, respectively. Noted June 18.

Preston, Idaho—The City Council will shortly award contracts for the construction of concrete sidewalks to cost about $12,000.

+St. Maries, Idaho—The TWO MIRACLE CONCRETE CO., Kalispell, Mont., received the contract for grading, curbing and paving Main St. and College Ave., Improvement District No. 2, at $53,769. Noted June 4.

+Anacortes, Wash.—W. R. BURKE was awarded the contract for grading and concrete sidewalks on 26th St. at $5325.

+Bellingham, Wash.—The contract for asphalt paving in the business district has been awarded to G. C. BURNETT, Bellingham, at $74,000.

Olympia, Wash.—Bids will be received by the State Highway Board until 2 p.m., July 20, for clearing, grading and draining about 1.8 miles of the National Park Highway. William R. Roy is Secy.

+Olympia, Wash.—(Official)—The State Highway Board has awarded the contract for surfacing 13.5 miles of the Sunset Highway, in Douglas County, to the H. L. WILSON CO., Walla Walla, at $17,778. Pugh & Arenz, Montesano, Wash., bid $19,384. Noted July 2.

+Pasco, Wash.—(Official)—The Commissioners of Franklin County have awarded the contract for the construction of two miles of highway near Connell to the WARREN CONSTRUCTION CO., Portland, Ore., at $25,769. Noted July 2.

Seattle, Wash.—Bids will be received by the County Commissioners until 10 a.m., July 21, for constructing the Mercer Island Road. Byron Phelps is Clk.

South Bend, Wash.—Bids will be received by Charles H. Mills, City Clk., until 7.30 p.m., July 20, for constructing concrete pavement and sidewalks on Broadway.

Hood River, Ore.—An election will be held July 16 to vote on the question of issuing $75,000 in bonds for the construction of the Columbia River Highway through this section.

Los Angeles, Calif.—See item under Miscellaneous: Tunnel Work—Los Angeles.

+Los Angeles, Calif.—The contract for paving and draining the Third St. tunnel from Hill to Hope St. has been awarded to BRYANT & AUSTIN at $11,894.

(Official)—See item under "Sewers."

The Board of County Supervisors will shortly ask bids for the construction of oiled macadam paving in the following road districts: Road Improvement District No. 54, Norwalk and Puente Hills Road, three miles; District No. 60, Orr and Day Road, two miles; District No. 24 street improvement in the city of Rivera; District No. 23, Grand Ave. and San Bernardino Road, 2.5 miles; District No. 27, Lark Ellen Ave., two miles; District No. 28, Western Ave., two miles; District No. 29 Citrus Ave., 1.75 miles; District No. 30, 2.5 miles; District No. 61, Artesia St., 1.5 miles.

+Pasadena, Calif.—The contract for improving Oakdale St. has been awarded to H. E. COX at $7897.

+San Bernardino, Calif.—Contracts have been awarded to the HIGHWAY CONSTRUCTION CO. at $15,361 for improving Ninth St. from Arrowhead to G St., and at $17,008 for improving Seventh from D to I St.

+San Francisco, Calif.—The contract for paving and constructing sewers in San Bruno Ave. from Olmstead St. to Railroad Ave. has been awarded to the FAY IMPROVEMENT CO. at $52,790.

The following bids were received by the Board of Public Works for furnishing the mechanical equipment for the municipal asphalt plant: A. Schneider, $58,420; Union Machine Co., $32,320; the Power Equipment Co., $24,250; the Main Street Iron Works, $36,500 and the Davis Rogers Co., $31,795.

+Ottawa, Ont.—A contract for constructing asphalt pavements on various streets has been awarded to the OTTAWA CONSTRUCTION CO., Central Chambers, at approximately $95,000.

+St. Catherines, Ont.—Contracts for paving 15,000 sq.yd. with bitulithic and 20,000 sq.yd. with asphaltic concrete have been awarded to the WARREN BITUMINOUS PAVING CO., 103 Bay St., Toronto, at $40,000, and to FOLEY & GLEESON, Central Chambers, at $50,000, respectively.

South Vancouver, B. C.—It is reported that the City Council contemplates paving Tyn St. at an estimated cost of $70,000.

INDUSTRIAL WORKS

Gardner, Mass.—Abraham Rosenberg, North Main St., will build a two-story, 85x115-ft. garage.

Malden, Mass.—The Yale Knitting Co. plans to build a four-story, 50x100-ft. addition to its plant.

Salem, Mass.—George C. Vaughn has filed plans for two factories, to be built on Bridge and Boston Sts. One will be three-story, 45x250 ft. and the other two stories, 50x150 feet.

Allingtown, Conn.—The Narrow Fabric Co. will build a one-story, 120x200-ft. addition to its factory.

New Britain, Conn.—R. H. Erwin, will build a two-story, brick and steel, 80x100-ft. garage. George Zunner, Hartford, Conn., is the Arch.

New Britain, Conn.—The P. J. Flannery Co. Inc., Whiting St., is receiving bids for a one-story, 128x135-ft. addition to its plant. James Sweeney, 140 State St., New London, Conn., is the Arch.

Stafford Springs, Conn.—The Hudson Garage Co., will build a 55x140-ft. garage.

+Torrington, Conn.—The Coe Brass Co., subsidiary of the American Brass Co., has awarded a contract to the O'BRIEN CONSTRUCTION CO. for a 350x500-ft. shop.

Amsterdam, N. Y.—Shuttleworth Bros. Co. will build two four-story factory additions, one 62x235 ft. and the other 54x160 ft. E. W. Grieme is the Arch.

+Buffalo, N. Y.—The Springfels Mfg. Co. has awarded a contract to the NIEDERPRIEM BUILDING CO. for a two-story and basement, 40x80 factory.

Ellicottville, N. Y.—The Flickinger Bros. Co., Bradford, Penn., plans to build a foundry and a machine shop, each 80x120 ft.

New York, N. Y.—(Borough of Manhattan)—Katherine M. Sanders has filed plans for a one-story, 105x125-ft. brick garage, at 64th St. and Second Ave. The cost will be $20,000.

New York, N. Y.—(Borough of Manhattan)—The Yellow Taxicab Co., Eighth Ave. and 49th St., will build a two-story, 100x100-ft. garage. It will accommodate 600 cars.

+New York, N. Y.—(Borough of Brooklyn)—The American Vitagraph Co., 116 Nassau St. (Borough of Manhattan) has awarded a contract to the AMERICAN CONCRETE STEEL CO., 27 Clinton St., Newark, N. J., for a four story, brick and concrete factory, to be built at Liberty and Locust Sts. Noted July 2.

New York, N. Y.—(Borough of Manhattan)—The Eureka Auto Stations, St. Nicholas Ave. and 122nd St., has awarded a contract to FRYMIER & HANNA, 25 West 45th St., for a two-story, 100x100 ft., brick and steel garage. Frank Straus, 25 West 42nd St., is the Arch. The cost will be $25,000.

+Port Jervis, N. Y.—The Katterman & Mitchell Co., 300 Straight St., Paterson, N. J., has awarded a contract to the B. & W. CONCRETE CO., Ordway Bldg., Newark, N. J., for a two-story, 54x248-ft. factory. The cost will be $35,000.

Syracuse, N. Y.—A. J. Hoffman, 1527 South Salina St., is receiving bids on a two-story and basement, 60x125 ft. dry cleaning plant.

Jersey City, N. J.—The Colgate Co. will build a $500,000 factory on Greene Ave.

Newark, N. J.—James A. Bannister has purchased a 224x384-ft. site on Range St., on which he will build a shoe factory.

Newark, N. J.—Charles S. Cohen, 257 South St., will build a two-story, 48x150-ft. factory. Henry Bachlin is the Arch.

Passaic, N. J.—Paul Guenther, Dover, N. J., has purchased a 14-acre site on which he will build a four-story hosiery mill, costing $45,000.

Trenton, N. J.—The American Steel Co. will build a three-story brick and iron addition to its plant on Hamilton Ave., to cost $75,000.

Connellsville, Penn.—James Rappart plans to build a large, four-story furniture warehouse on North Prospect St.

Ebensburg, Penn.—William Mohler will build a 64x154-ft. garage at High and Julian Sts.

Middletown, Penn.—The M[illegible]letown Car Co. plans additions to its [illegible] and repair shops. The cost is estimated at $[illegible].

Pittsburgh, Penn.—The [illegible]dale Cemetery Co. will build a tw[illegible] garage, costing $1[illegible].

Washington, D. C.—Henry L. Brown will build a $[illegible]0 garage, [illegible] Ave. and 14th St.

+Washington, D. C.—W. M. Gr[illegible]ths has awarded a contract to HENRY M. SANFORD, 221 Oxford Bldg., for a garage and warehouse, to be built at [illegible]0 N. St. The cost will be $[illegible].

Norfolk, Va.—The American Peanut Corporation will build a five-story factory, to cost $[illegible].

Richmond, Va.—The Southern R. R. Co. will enlarge its [illegible] shop facilities. The work includes construction of warehouse, shops, roundhouse, etc.

Mayworth, N. C.—S. W. Cramer, Charlotte, N. C., will build three cotton mills.

Florence, S. C.—The Atlantic Coast Line R.R. will build shops, a roundhouse, a turntable, a planing mill and make various other improvements in its local yards. About $110,[illegible] will be spent.

Grantville, Ga.—The Grantville Hosiery Mills, plan to build a [illegible]-ft. addition to cost about $100,000. The Park A. Dallis Co., Atlanta, Ga., is the Arch.

+Porterville, Ga.—The Bibb Mfg. Co. has awarded a contract to SHAW BROS., Macon, Ga., for a warehouse to cost $21,[illegible].

Anniston, Ala.—The Anniston Yarn Mills will build a [illegible]-ft. addition, to cost $10,[illegible].

+Bessemer, Ala.—The American Tar Products Co. has awarded a contract to H. KOPPERS & CO., for a creosote plant. Over $1[illegible] will be spent.

Mobile, Ala.—The Kahn Mfg. Co., has filed plans for a three-story factory, to cost $12,[illegible]0.

Jackson, Tenn.—The Mobile & Ohio R.R. will spend $60,000 in the construction of shops at its Claymore yards.

Knoxville, Tenn.—The Fulton Co. will build three one-story additions to its plant, [illegible]x105 ft., 36x175 ft. and 50x125 ft. respectively. The cost will be $12,000.

Nashville, Tenn.—The Nashville Motor Co. will build a two-story, [illegible]-ft. garage, to cost $32,000. C. A. Ferguson is the Arch.

Cincinnati, Ohio.—Stewart & Stewart, Bell Block, are receiving bids for a two-story, [illegible]-ft. garage.

+Cleveland, Ohio.—The E[illegible]mel Products Co., Ivanhoe Road, has awarded a contract to the WILLIAM DUNBAR CO., [illegible] Cedar Ave., for a [illegible]-ft. factory.

Cleveland, Ohio.—The F. H. Stearns Co. plans to build a four-story, [illegible]-ft. and a one-story, 60x[illegible]0-ft. factory. George [illegible] & Co., [illegible] Century Bldg., is the Arch.

Elyria, Ohio.—The Kl[illegible]ervue Film Co. plans to build a $[illegible] plant.

Springfield, Ohio.—The [illegible]lus-Hackett Fruit Co. will build a [illegible] warehouse, to cost $65,[illegible]. Charles J. [illegible] is Arch.

Toledo, Ohio.—The T[illegible] Fish Co. will build a [illegible]-ft. warehouse at [illegible] Water St. The cost is estimated at $[illegible].

+Toledo, Ohio.—The Toledo Pipe Threading Machine Co. has awarded a contract to the SHAW & THORN CO., 413 [illegible] Bldg., for a two-story and basement, [illegible]x122-ft. factory, to cost $6[illegible].

Warren, Ohio.—The Western Reserve Steel Co., Pittsburgh, Penn., will build a six-mill sheet plant.

New Albany, Ind.—Conrad Hertlein will build a $10,[illegible]0 [illegible].

South Bend, Ind.—[illegible] W. Bishop will build a $1[illegible],[illegible]0 [illegible].

Flint, Mich.—The Walker-Weiss Axle Co. plans to build a [illegible]-ft. shop, costing $[illegible].

Saginaw, Mich.—[illegible] plans to build a two-story, [illegible] garage.

Chicago, Ill.—[illegible] & [illegible], Troop and [illegible] Sts., will build a [illegible]-ft. type foundry, costing $[illegible].

Oconomowoc, Wis.—The Pacific Coast Condensed Milk Co. will build [illegible].

Superior, Wis.—The [illegible] Elevator Co. [illegible].

Independence, Kan.—The [illegible] Co. will build [illegible].

Roundup, Mont.—The [illegible] Co. will build [illegible].

St. Louis, Mo.—The [illegible] Co. will build [illegible].

+Pine Bluff, Ark.—[illegible] has awarded a contract to [illegible].

Abilene, Tex.—The [illegible] & Cattle Co. has [illegible] a site on which it will build a [illegible].

+Dallas, Tex.—[illegible] has awarded a contract to [illegible].

Houston, Tex.—[illegible] & Co., Chicago, Ill., has [illegible] on which it will build a [illegible] plant with a [illegible].

Seattle, Wash.—It is reported that the Noble Metals Co. will build a $1,000,000 chemical plant and concentrator.

Seattle, Wash.—The Sears-Roebuck Co., Chicago, Ill., will erect a nine-story, reinforced concrete, fireproof addition to its plant in this city, costing about $850,[illegible]. This structure will be the largest concrete building on Pacific Coast. Plans are now being prepared, and bids will be asked soon.

Eugene, Ore.—D. L. Harlin, is interested in the erection of a building for the manufacture of drinking fountains. The estimated cost is $10,0[illegible]0.

Riddle, Ore.—The Nickel Mining & Smelting Co., Portland, Ore., has acquired a site here on which it will build a plant of 20 ton daily capacity to cost $1[illegible].

Fresno, Calif.—The Roeding Fig & Olive Co. will build a $25,000 packing house of brick and concrete.

Oakland, Calif.—The California Baking Co. will build a bakery to cost $100,000, exclusive of machinery. Louis L[illegible]h is Pres.

San Francisco, Calif.—The Board of Public Works is receiving bids for a municipal, reinforced concrete 14-track carbarn.

Levis, Que.—J. H. Hamilton plans to build a four-story, 30x130-ft. shoe factory. T. R. Peacock, Sherbrooke, Que., is the Arch.

London, Ont.—The McClary Mfg. Co. will build a $1[illegible],0[illegible]0 addition to its stone plant.

Sandwich, Ont.—The Canadian Alkali Co. is building a $500,0[illegible]0 addition to its plant.

FEDERAL GOVERNMENT WORK

+Building Wharf, Etc.—Boston, Mass.—The contract for the construction of the wharf, retaining wall and approaches of the U. S. immigration station at Boston has been awarded to the GEORGE A. FULLER CO., 131 State St., Boston, Mass., at $219,000. Noted July 9.

Oil Engine Machinery.—Boston, Mass.—Bids were received July 7, by the Light House Inspector, for repairs and installation of oil engine machinery, etc., on light vessel No. [illegible]4, as follows: Bath Iron Works, $37,61[illegible]; Lockwood Mfg. Co., $46,498; Bertelsen & Petersen Eng. Co., $46,922; U. S. Navy Yard, $48,909. Noted June 2[illegible].

+Heating Plant.—Chelsea, Mass.—The contract for installing heating system in the U. S. Naval Hospital, Chelsea, has been awarded to the J. W. DANFORTH CO., Buffalo, N. Y., at $37,2[illegible]7. Noted June 11.

+Building.—Fort Warren, Mass.—The contract for constructing bakery building at Fort Strong, Mass., has been awarded to MARR BROS. & STEWART CO., Boston, Mass., as follows: Construction, $7415; heating, $620; lighting, $1[illegible]. Noted May 28.

Alterations, Etc.—New York, N. Y.—Bids will be received until 3 p.m., July 20, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for general alterations and betterments for the accommodation of the U. S. courts, etc., in the U. S. Court House and Post Office, New York.

Buoy Bodies.—Tompkinsville, N. Y.—Bids will be received until 3 p.m., July 22, by the Light House Inspector, Third District, for furnishing two acetylene gas buoy bodies, type L.

+Post Office.—Burlington, N. J.—The contract for the construction of the post office at Burlington has been awarded to J. S. ROGERS CO., Moorestown, N. J., at $37,[illegible]. Noted May 21.

Post Office.—Orange, N. J.—Bids were received as follows July 11, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Orange, N. J.: Joseph [illegible], New York, $[illegible]; Charles McCaul Co., Philadelphia, Penn., $[illegible]; [illegible] Construction Co., New York, $[illegible]; [illegible] Corporation Builders, New York, $[illegible]; William H. [illegible] & Co., New York, $[illegible]; Edward M. Waldron, Inc., Newark, N. J., $[illegible]; William H. [illegible], New York, $[illegible]; A. F. Barrows Construction Co., New York, $[illegible]; Westchester Engineering Co., New York, $[illegible]; J. S. Rogers Co., Moorestown, N. J., $[illegible]; John Lowry, Jr., New York, $[illegible]; [illegible], Frostburg, Md., $[illegible]; Kelly & Kelly, Inc., Long Island City, N. Y., $[illegible]; [illegible] Iron Co., Lowell, Mass., $[illegible]; M. [illegible] & Son, [illegible], $[illegible]; Charles F. [illegible], Inc., [illegible], N. J., $[illegible]; [illegible] Co., [illegible], Penn., $[illegible]; Richard L. [illegible], Orange, N. J., $[illegible]. It will be a one-story and basement building, ground area [illegible] sq.ft., fireproof construction except [illegible] and roof, stone and brick facing and composition roof. Noted June 11.

Post Office.—[illegible], Penn.—Bids will be received until 3 p.m., [illegible] by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete of the U. S. post office at [illegible]. The building will be one-story and basement, with a ground area of approximately [illegible] sq.ft.

Removing Wreck.—Wilmington, Del.—Bids will be received until [illegible] by [illegible] U. S. A., Wilmington, for removing the wreck of barge [illegible], sunk in Atlantic Ocean off [illegible].

+Dredging.—[illegible] Creek, Md.—Bids will be received until [illegible] by [illegible] U. S. A., Baltimore, Md., for dredging in [illegible] Creek, Md.

+Dredging.—[illegible], Md.—The contract for dredging at [illegible] has been awarded to the MARYLAND [illegible] & [illegible] CO., Baltimore, Md., at [illegible] per cu.yd.

Alterations, Etc.—Washington, D. C.—Bids will be received until [illegible] by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for [illegible] alterations, repairs, etc., in the Auditors' [illegible], Washington, D. C.

+Cow Barns—Washington, D. C.—The contract for constructing cow barns at the Government Hospital for the Insane, has been awarded to J. L. MARSHALL, Washington, D. C., at $28,327. Noted July 2.

Engine—Washington, D. C.—Bids were received, June 29, by the Comr. of Lighthouses for furnishing one 100-hp. kerosene propelling engine for light vessel No. 98, as follows: Racine Truscott Shell Lake Boat Co., Muskegon, Mich., $5560; Gas Engine & Power Co. & Charles L. Seabury Co., Consolidated, Morris Heights, New York, $4800; Standard Motor Construction Co., Jersey City, N. J., $4885; Corliss Gas Engine Co., San Francisco, Calif., $4250; New London Ship & Engine Co., Groton, Conn., $6000; Meitz & Weise, New York, $7395; Blanchard Machine Co., Cambridge, Mass., $6250; Bolinders Co., 30 Church St., New York, $6000. Noted June 18.

Quarters—Washington, D. C.—Bids will be received until 3 p.m., July 28, by Oscar Wenderoth, Superv. Arch., Washington, D. C., for constructing quarters for Stamp Division, Internal Revenue Commissioners' Office, Auditors' Bldg.

★Sextants—Washington, D. C.—Bids will be received until noon, Aug. 6, by the Superintendent, Coast & Geodetic Survey, Washington, D. C., for furnishing 35 or 70 sextants, Ponthus and Therrode No. 808, or equal.

★+Sprinkler Equipment—Washington, D. C.—The contract for the installation of a sprinkler system in the Patent Office building, has been awarded to W. G. CORNELL CO., Washington, D. C., at $18,724. Bids for the sprinkler systems in the General Land Office and the Pension Office were rejected. Noted May 21.

★Table Alidades—Washington, D. C.—Bids will be received until 2 p.m., July 16, by the Superintendent, Coast & Geodetic Survey, Washington, D. C., for furnishing 12 to 24 plane table alidades.

Tubular Boilers—Washington Barracks, D. C.—Bids will be received until 11 a.m., Aug. 6, by Lieut. Col. Joseph E. Kuhn, Corps Engrs., U. S. A., for furnishing two 12-hp. return tubular boilers.

+Road Work—Fort Meyer, Va.—The contract for constructing heavy traffic road at Fort Meyer, has been awarded to R. E. BOISSEAU, Washington, D. C., at $4185.

+Dredging—Norfolk, Va.—The contract for dredging the inland waterway from Norfolk, Va., to Beaufort Inlet, N. C., has been awarded to the BOWERS SOUTHERN DREDGING CO., Galveston, Tex., at $100,300. Noted July 9.

Post Office—Wytheville, Va.—Bids will be received until 3 p.m., Aug. 4, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (including mechanical equipment, interior lighting fixtures and approaches) of the U. S. post office at Wytheville, Va. The building will be two stories and basement, ground area approximately 4100 sq.ft., brick facing tin and composition roof.

+Poiree Trestles, Etc.—Wheeling, W. Va.—The contract for furnishing and delivering poiree trestles, etc., at Dams Nos. 19 and 28, Ohio River, has been awarded to the PENN BRIDGE CO., Beaver Falls, Penn., at $17,546. Noted July 2.

+Post Office—Gastonia, N. C.—The contract for the construction of the post office at Gastonia has been awarded to WILLIAM J. BRENT CONSTRUCTION CO., Norfolk, Va., at $52,254. Noted May 14.

Repairing Tender—Charleston, S. C.—Bids were received July 6, by the Light House Inspector, for repairing light house tender "Mangrove," as follows: Skinner Shipbuilding & Dry Dock Co., Baltimore, Md., $2769 (recommended for acceptance); Wilmington Iron Works, $4664; Charleston Navy Yard, $6161; Merrill Stevens Co., $6924. Noted June 25.

+Cisterns—Fort Moultrie, S. C.—The contract for constructing six cisterns at Fort Moultrie, has been awarded to P. D. HAY, Charleston, S. C., at $4754.

+Post Office—Mobile, Ala.—The contract for the construction of the post office at Mobile, has been awarded to JOHN W. EMERY, 1524 Sansom St., Philadelphia, Penn., at $268,000. Noted Apr. 23.

+Post Office—Granada, Miss.—The contract for the construction of the post office at Granada, Miss., has been awarded to ALGERNON BLAIR, Montgomery, Ala., at $40,315. Noted June 25.

★Barge—New Orleans, La.—Bids will be received until 11 a.m., Aug. 12, by Maj. C. O. Sherrill, Corps Engrs., U. S. A., for constructing and delivering one steel barge.

★+Stone—New Orleans, La.—The contract for furnishing and placing 25,000 tons of stone at Southwest Pass, Mississippi River, has been awarded to LESTER F. ALEXANDER, New Orleans, La., at $106,000. Oother bids were: Oscar F. Barrot, Cincinnati, Ohio, $150,000; Will McFarlane, Birmingham, Ala., $138,750; George B. Christie, New Orleans, La., $111,250. Noted May 28.

★Towboat—New Orleans, La.—Bids will be received until 11 a.m., Aug. 3, by Maj. C. O. Sherrill, Corps, Engrs., U. S. A., for constructing and delivering the steel hull stern wheel towboat 'Charnette." Noted June 25.

Post Office—Georgetown, Ky.—Bids will be received until 3 p.m., Aug. 12, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete (including mechanical equipment, interior lighting fixtures and approaches) of the U. S. post office at Georgetown, Ky. It will be a two-story and basement building, ground area 4800 sq.ft., fire proof construction, stone facing, composition roof.

Scows—Cincinnati, Ohio—Bids were received July 2, by Lieut.-Col. H. Jervey, Corps Engrs., U. S. A., for constructing and delivering 10 steel dump scows as follows: (a) 6 scows delivered at Cincinnati, Ohio; (b) 4 scows delivered at Marietta, Ohio; (c) 10 dump scows delivered at bidder's shipyard: Jones & Laughlin Steel Co., Pittsburgh, Pa., (a) $11,685 each, (b) $11,570 each, (c) $11,435 each; Pittsburgh-Des Moines Steel Co., Pittsburgh, Penn., (a) $10,900, (b) $10,850, (c) $10,700; Dubuque Boat & Boiler Works, South Dubuque, Iowa, (a) $8944, (b) $8944 (c) $8744; Charles Hegewald Co., New Albany, Ind., (a) $10,349, (b) $10,399, (c) $10,299; American Bridge Co. of New York, Cincinnati, Ohio, (a) $8000, (b) $7900, (c) $7775; Hess Iron Works, Green Bay, Wis., (c) $6437. Noted June 4.

Building—Mackinac Island, Mich.—Bids were received, July 6, by the Gen. Supt., U. S. Life Saving Service, Washington, D. C., for constructing a life saving station house, launchway and accessories at Mackinac Island, Mich., as follows: Richard Collins, Alpena, Mich., $23,972; Sheboygan Mfg. Co., Sheboygan, Mich., $29,000; R. J. B. Newcombe, Manistee, Mich., $28,025. Noted July 2.

★+Post Office—Mount Vernon, Ill.—The contract for the construction of a post office at Mount Vernon has been awarded to the HERMAN CONSTRUCTION CO., St. Louis, Mo., at $59,593. Noted May 21.

Building—Milwaukee, Wis.—Bids will be received until 3 p.m., Aug. 14, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete of the U. S. Appraiser's stores, Milwaukee, Wis. The building will be two stories and basement.

★+Steel Dredge Hull—Dubuque, Iowa—The contract for constructing the dredge and snag boat "Dennison", has been awarded to the DUBUQUE BOAT & BOILER WORKS, Dubuque, Iowa, at $49,475. Noted May 7.

+Lavatory—Cheyenne, S. D.—The contract for constructing a lavatory annex to the dormitory at the Cheyenne and Arapahoe Indian school, has been awarded to GEORGE CLARK & SON, Enid, Okla., at $4764. Noted June 25.

★+Post Office—Casper, Wyo.—The contract for the construction of the post office at Casper has been awarded to C. R. INMANN, Casper, at $49,875. Noted Apr. 23.

+Canal—Milk River, Mont.—The contract for construction of the St. Mary Canal, Milk River Irrigation Project, has been awarded to CONDON & WILLIAMS, South Omaha, Neb., at $159,489.

+Post Office—Newport, Ark.—The contract for the construction of the post office at Newport has been awarded to A. B. ANDERSON, Newport at $40,733. Noted May 7.

+Shed and Trestle—Fort Logan, Colo.—The contract for constructing a coal shed and trestle at Fort Logan, has been awarded to the R. P. McDONALD CONSTRUCTION CO., Denver, Colo., at $6383.

+Earthwork—Grand Junction, Colo.—The contract for earthwork on the main canal of the Grand Valley Irrigation Project, has been awarded to WINSTON BROS., Minneapolis, Minn., at $387,483. Noted July 2.

Boilers, Etc.—Las Animas, Colo.—Bids were received July 11, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing and installing at the Naval Hospital, Las Animas, the following equipment: Four 100-hp. boilers with settings, a fan and motor, additional steel flue, heat insulation, piping, valves, fittings, gaskets and bolts, gages, thermometers and injectors, and all necessary foundations and concrete flooring: Babcock & Wilcox, Philadelphia, Penn., $17,066, (boilers only) $15,020; E. Keeler Co., Williamsport, Penn.; (boilers only) $11,285; Industrial Heating & Engineering Co., Milwaukee, Wis., $13,400. Noted June 25.

★Excavation, Etc.—Salt River, Ariz.—Bids will be received until 2 p.m., Aug. 17, by F. H. Newell, Dir., U. S. Reclamation Service, Phoenix, Ariz., for the construction of the Cave Creek cutoff of the Arizona Canal, Salt River project, Arizona, and the necessary laterals in connection therewith, involving approximately 131,000 cu.yd. of excavation and 300 cu.yd. of concrete in structures. The work is situated near the town of Glendale, Ariz. For further information see advertisement under "Contracts to be Let."

+Steel Highway Bridge—Yuma, Ariz.—The contract for constructing the steel highway bridge at the U. S. Indian Reservation, has been awarded to the OMAHA STRUCTURAL STEEL WORKS, Omaha, Neb., at $72,151. Noted June 25.

Post Office—Idaho Falls, Idaho—Bids were received as follows July 10, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Idaho Falls: Sound Construction & Engineering Co., Seattle, Wash., (a) $82,049, (b) $81,049, (c) $80,549; R. E. Campbell, Salt Lake City, (a) $84,452, (b) same; J. H. Wiese, Omaha, Neb., (a) $89,765; Welch Bros. & Hannaman, Oakland, Calif., (a) $94,716; Dieter & Wenzel Construction Co., Wichita, Kan., (a) $91,000, (b) $96,000; Palmberg & Mattson, Astoria, Ore., (a) $91,450, (c) $93,450; Fisher & Aitken, Idaho Falls, Idaho, (b) $96,000. The building will be two stories and basement, ground area 5525 sq.ft., first floor fireproof, stone and brick facing and composition roof. Noted June 11.

+Building—Fort Worden, Wash.—Contracts have been awarded for constructing buildings at Fort Worden, Wash., as follows: Four brick sets officers' quarters, general construction, ECKMAN & MAWATT, Seattle, Wash., $22,965, plumbing, $2474, heating, $2000, wiring and fixtures $800; two frame double sets non-commissioned officers' quarters, CARLSON & SON, Seattle, Wash., general construction, $8686, heating, $480, wiring and fixtures, $760.

★Machinery and Valves—Seattle, Wash.—Bids will be received until noon, Aug. 10, by Maj. J. B. Cavanaugh, Corps Engrs., U. S. A., for machinery and valves for Lake Washington Canal Locks. Noted July 2.

Naval Supply Base—Berkeley, Calif.—The U. S. Government is negotiating for 325 acres of land on the bay shore and tide lands between Gilman St. and Point Isabella, to erect a $10,000,000 naval supply base for the Pacific Coast. A refrigerating plant, docks, storehouses and warehouses are among the improvements.

+Post Office—Chico, Calif.—The contract for the construction of the post office at Chico has been awarded to B. J. DUFFY, Davis, Calif., at $76,980. Noted May 7.

+Post Office—Hanford, Calif.—The contract for the construction of the post office at Hanford has been awarded to FRANK GALLEGHER, 180 Jessie St., San Francisco, at $52,990. Noted May 14.

Lumber, Creosoted Ties, Etc.—Panama—Bids will be received until 10:30 a.m., July 24, by Maj. F. C. Boggs, Gen. Pur. Officer, Isthmian Canal Com., for furnishing lumber, creosoted ties, copper tubing, bolts, washers, galvanized wire, chisels, cable clips, twist drills, files, etc. at Panama.

+Steel Forgings—Philippine Islands—The contract for furnishing steel forgings for the Philippine Islands has been awarded to the BETHLEHEM STEEL CO., at $[illegible]. Noted Apr. [illegible].

Substations, Etc.—Panama—Bids will be received until [illegible] a.m., [illegible] by Maj F. [illegible] Boggs, Corps Engrs., U. S. A., Washington, D. C., for furnishing two 44,[illegible]-volt substations at [illegible] rien and Gamboa.

MISCELLANEOUS

+Shed—Everett, Mass.—The contract for a storage shed for the New England Gas & Coke Co., on Bea[illegible] St. has been awarded to the BERLIN CONSTRUCTION CO., Berlin, Conn., at $[illegible]. It will be of brick and reinforced concrete, [illegible] ft.

Repairing Pier—New York, N. Y.—(Borough of Manhattan)—The New York Submarine Contracting Co., Inc., 1[illegible] [illegible] St., New York, submitted the lowest bid, at $1[illegible], for [illegible] of the pier and approach at West 96th St., Manhattan. Bids were opened July 2.

Canal Terminal—Oswego, N. Y.—H. S. Kerbaugh, Inc., 6 [illegible] St., New York, has submitted the lowest bid to [illegible] W. Peck, State Supt. Pub. Wks., Albany, for constructing the Barge Canal terminal at Oswego, at $34[illegible],68[illegible].

Bath-House—Syracuse, N. Y.—The city plans to construct a bath-house to cost $1[illegible]. Bids will be asked soon by the Board of Contract and Supply. R. D. Roney is Secy. Bd.

+Stable—Utica, N. Y.—John C. Gregory, 127 Broad St., Utica, has awarded the contract to GRIFFITH & PIERCE, Utica, for constructing a stable to cost $10,0[illegible].

Fire Apparatus—Camden, N. J.—The City Council plans to issue $[illegible] in bonds to purchase motor-driven fire apparatus.

Park Improvements—Passaic, N. J.—The City Commissioners plan to improve the parks at a cost of $20,000. Colin R. Wise is City Engr.

+Boilers—Trenton, N. J.—(Official)—Bids will be received by the Comptroller, State House, Trenton, until noon, Aug. 4, for [illegible] two boilers in the State House. For details see advertisement under "Contracts To Be Let."

Fire Station—Lancaster, Penn.—The Borough plans to construct a fire station to cost $10,000. I. Carpenter is City Engr.

+Dam—Reading, Penn.—The city has awarded the contract to W. H. [illegible], Baer Bldg., Reading, for constructing Antietam Dam, at $16,[illegible]00.

Elimination of Grade Crossings—Scranton, Penn.—The Delaware & Hudson Co. has retained John I. Riegel, Engr., Scranton, to prepare plans for the elimination of grade crossings on its line in Scranton. Estimated cost, $1,000,000.

Wharves and Docks—Southport, Fla.—See item under Railways: Alabama-Bay City, Lynn Haven & Northern R.R.

+Wharf—Baton Rouge, La.—The Standard Oil Co. has awarded the contract to [illegible] & WILLIAMS, New Orleans, La., for constructing a [illegible]-ft. addition to its wharf at Baton Rouge.

Docks—New Orleans, La.—The Louisville & Nashville R.R., the Alabama Great Southern R.R., the New Orleans & Northeastern Ry., and the Illinois Central R.R. plan to construct coal docks at New Orleans. C. [illegible], Cincinnati, Ohio, is Ch. Engr., A. G. S. R.R.

+Levee Work—New Orleans, La.—The State Board of Engineers, New Orleans, has awarded contracts as follows: For constructing the Whiskey Chute Levee, [illegible] cu. yd., to R. L. LEONARD at 3[illegible] per cu. yd.; for constructing the [illegible] South Levee, 13[illegible] cu. yd., to H. T. VAN TASSEN, at 19.9[illegible] per cu. yd.

+Levee Work—New Orleans, La.—The Orleans Levee Board opened bids July 7 for levee work. The Fifth District work, Camp[illegible] to Aurora levee, 1[illegible] cu. yd., was awarded to the LOUISIANA CONSTRUCTION CO. at 1[illegible] per cu. yd. or about $2[illegible],0[illegible]. The Orleans work, 1[illegible] cu. yd. were awarded to J. M. SULLIVAN at 1[illegible] or about $2[illegible].

+Ditches—Jackson, Tenn.—Drainage District No. 1 of Madison County has awarded the contract to the SWAMP DREDGE CO., Tupelo, Miss., for constructing 12 miles of ditches. The work calls for 1,250,000 cu. yd. of excavation.

Drainage District No. 2 of Madison County plans to award contracts soon for 4½ miles of ditch work, and Drainage District No. 3 for 14 miles of ditch work. The Patton Engineering Co., Jackson, is in charge of the engineering work.

Harbor Development—Cleveland, Ohio—The city is considering the development of the outer harbor. Robert Hoffman is City Engr.

Park Buildings—Columbus, Ohio—J. A. Jones, Arch., Columbus, is preparing plans for shelter houses and recreation buildings for Franklin Park. Estimated cost, $2[illegible].

Fish Hatchery—Put-in-Bay, Ohio—The Agricultural Commission, Columbus, has approved plans for the proposed state fish hatchery at Put-in-Bay. Estimated cost, $1[illegible].

Wall—Indianapolis, Ind.—Bids will be received by the County Commissioners, Indianapolis, until July 17, for constructing a retaining wall along the south and east banks of Fall Creeek.

Park—Tipton, Ind.—Cooper & Dunn, Landscape Archs., State Life Bldg., Indianapolis, Ind., are preparing plans for the proposed new park in Tipton. F. R. Fox is Chn. Park Bd.

CONTRACT PRICE

Sewer—Chicago, Ill.—Bids were received by John McGillen, Clk., Sanitary District of Chicago, June 25, for constructing the North Shore Intercepting Sewer, under Contract No. 3, from (A) Nash Bros., Chicago; (B) Nash-McDowdle Co., Chicago; (C) Henry C. Ulen, Chicago; (D) Marquette Construction Co., Chicago. The item bids were as follows:

SEWER, CHICAGO, ILL., NORTH SHORE INTERCEPTING SEWER, CONTRACT NO. 3

	A	B	C	D
[illegible] lin ft sewer 36 in oval concrete	$11 [illegible]	$11.75	$11.00	$10 [illegible]
[illegible] lin ft sewer 36 in ovoid brick	11 5[illegible]	11 50	[illegible]	1[illegible]
[illegible] lin ft sewer 33 in oval concrete	9 15	13 [illegible]	9.20	9 [illegible]
[illegible] lin ft sewer 33 in ovoid brick	9 6[illegible]	12 [illegible]	[illegible]	9 [illegible]
[illegible] lin ft sewer 3[illegible] in oval concrete	[illegible]	15 [illegible]	8.90	9 [illegible]
[illegible] lin ft sewer 3[illegible] in oval brick	9 [illegible]	13 5[illegible]	[illegible]	9 [illegible]
[illegible] lin ft sewer 24 in circular vitrified tile concrete backing	1[illegible]	13 [illegible]	10.[illegible]	11 [illegible]
[illegible] lin ft sewer 24 in circular reinforced concrete pipe, concrete backing	1[illegible]	16 [illegible]	[illegible]	14 [illegible]
[illegible] lin ft sewer 18 in circular vitrified tile, concrete backing	[illegible]	[illegible]	8 75	11 [illegible]
[illegible] lin ft sewer 18 in circular reinforced concrete pipe, concrete backing	[illegible]	9 [illegible]	[illegible]	11 [illegible]
[illegible] lin ft vitrified tile pipe 12 in	3 75	5 [illegible]	3 75	9.1[illegible]
[illegible] lin ft vitrified tile pipe 9 in, with concrete backing	3 [illegible]	5 [illegible]	3 75	9 [illegible]
5 manholes concrete	1[illegible]5	9[illegible]	11[illegible] 00	7[illegible]
[illegible] manholes brick	115	[illegible]	11 [illegible]	7[illegible]
[illegible] lin ft manholes, concrete standard No 2	15	7[illegible]	15 [illegible]	6 [illegible]
[illegible] lin ft manholes brick, standard No 2	17	[illegible]	1[illegible]	[illegible]
Special manhole at Willow St., concrete (lump sum)	22[illegible]	1[illegible]	[illegible]	15[illegible]
Special manhole at Willow St. brick (lump sum)	3[illegible]	1[illegible]	[illegible]	1[illegible]
Special manhole at Pine St. concrete (lump sum)	35[illegible]	125	3[illegible]	15[illegible]
Special manhole at Pine St. brick (lump sum)	[illegible]	1[illegible]	[illegible]	1[illegible]
Special manhole at North Ave. concrete (lump sum)	35[illegible]	140	3[illegible]	1[illegible]
Special manhole at North Ave. brick (lump sum)	40[illegible]	14[illegible]	3[illegible]	135 [illegible]
Special manhole at Krieger St. concrete (lump sum)	3[illegible]	145	3[illegible]	1[illegible]
Special manhole at Krieger St. brick (lump sum)	35[illegible]	14[illegible]	3[illegible]	1[illegible]
Special manhole at Adams St. concrete (lump sum)	3[illegible]	1[illegible]	3[illegible]	1[illegible]
Special manhole at Adams St. brick (lump sum)	3[illegible]	14[illegible]	3[illegible]	1[illegible]
Special manhole at Milton Ave. concrete (lump sum)	5[illegible]	15[illegible]	[illegible]	2[illegible]
Special manhole at Milton Ave. brick (lump sum)	5[illegible]	1[illegible]	[illegible]	[illegible]
2 special manholes at Crescent Drive concrete (lump sum)	600	[illegible]	1[illegible]	2[illegible]
2 special manholes at Crescent Drive brick (lump sum)	6[illegible]	6[illegible] 00	1[illegible]	2[illegible]
Special manhole at [illegible] under Downing Ave. bridge, concrete (lump sum)	75	1[illegible]	[illegible] 00	12[illegible]
Special manhole at [illegible] under Downing Ave. bridge brick (lump sum)	75	1[illegible]	[illegible] 00	1[illegible]
Special manhole at [illegible] near Downing Ave. bridge concrete (lump sum)	215	1[illegible]	22[illegible] 00	13[illegible]
Special manhole at [illegible] near Downing Ave. bridge brick (lump sum)	215	1[illegible]	2[illegible]	1[illegible]
Special manhole on Sheridan Road opposite Downing Ave., concrete (lump sum)	[illegible]	1[illegible]	2[illegible]	13[illegible]
Special manhole on Sheridan Road opposite Downing Ave., brick (lump sum)	20[illegible]	1[illegible]	[illegible]	14[illegible]
Special manhole on Sheridan Road at Hazel Ave. concrete (lump sum)	1[illegible]	12[illegible]	175	143 [illegible]
Special manhole on Sheridan Road at Hazel Ave. brick (lump sum)	15[illegible]	1[illegible]	17[illegible]	15[illegible]
Special manhole at Hazel and Longwood Aves. concrete (lump sum)	1[illegible]	13[illegible]	1[illegible]	125 [illegible]
Special manhole at Hazel and Longwood Aves. brick (lump sum)	1[illegible]	11[illegible]	1[illegible]	1[illegible]
[illegible] lin ft [illegible] tile underdrains	1 [illegible]	0 [illegible]	[illegible]	[illegible]
Portable [illegible] wood construction (lump sum)	1[illegible]	125 [illegible]	[illegible]	2[illegible]
Portable [illegible] steel construction (lump sum)	[illegible]	13[illegible]	[illegible]	450 [illegible]
[illegible] cu yd additional excavation in open cut	[illegible]	0 75	[illegible]	0.75
[illegible] cu yd additional excavation in tunnel	[illegible]	2 [illegible]	2 [illegible]	2 00
[illegible] cu yd additional concrete, Class A	[illegible]	[illegible]	[illegible]	9 [illegible]
[illegible] cu yd additional concrete, Class B, open cut	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] cu yd additional concrete, Class B, in tunnel	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] additional brickwork	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] reinforcing steel	0 [illegible]	0 [illegible]	0 [illegible]	[illegible]
[illegible]	[illegible]	2[illegible]	[illegible]	2[illegible]
[illegible]	3[illegible]	26 [illegible]	23 [illegible]	2[illegible]
[illegible] rock excavation	3 [illegible]	3 [illegible]	3 [illegible]	2 [illegible]
Extended totals for concrete sewer	[illegible]	[illegible]	$34[illegible]	[illegible]
Extended totals for brick sewer	[illegible]	[illegible]	[illegible]	[illegible]

+Fire Apparatus—Detroit, Mich.—The city has awarded the contract to the AHRENS-FOX CO., Cincinnati, Ohio, for furnishing fire apparatus.

Fire Station—Gwynn, Mich.—The town plans to construct a fire station to cost $15,000. Charlton & Kuenzli, Camp Bldg., Milwaukee, Wis., are the Archs.

Pumps—Carrollton, Ill.—See item under "Water Supply and Irrigation."

+Ditches—Carrollton, Ill.—Hartwell Drainage & Levee District has awarded the contract to R. H. & G. A. McWILLIAMS, Steger Bldg., Chicago, Ill., for 208,000 cu.yd. of ditches, at $22,000.

Ditch—Gridley, Ill.—Bids will be received until 10 a.m., July 30, by Gridley Township Drainage District, Gridley, for a ditch calling for the excavation of 41,210 cu.yd. The Harman Engineering Co., Peoria, Ill., is Engr.

Levee Work—Jacksonville, Ill.—Bids will be received until July 29 by the Commissioners of Meredosia Lake Drainage and Levee District, at the office of the Jacksonville Engineering Co., Jacksonville, for constructing about 174,433 cu.yd. of levee and 1500 cu.yd. of ditches.

Drainage District Work—Pekin, Ill.—(Official)—Bids will be received until 11 a.m., July 24, by the Commissioners of Spring Lake Drainage and Levee District, at the office of J. M. Powers, Atty., Pekin, for the following work: (1) A marine railway for transferring boats across the drainage district levee, including the foundations, tracks, structural steel work and gasoline engine driven power plant; (2) a girder draw-bridge and an I-beam highway bridge; (3) a sheet piling spillway with brush and rock apron.

Park—St. Charles, Ill.—The citizens will vote July 23 on the proposition to issue $90,000 in bonds for a new park. John Olson is Mayor.

Ditches, Rock Excavation—Dancy, Wis.—Bids will be received until July 18, by H. M. Jones, Comr. Dancy Drainage District, for constructing 15 miles of ditches and for 8000 cu.yd. of rock excavation.

Stable and Silos—Oconomowoc, Wis.—Bids are being received by Fernekes & Cramer, Archs., Pabst Bldg., Milwaukee, Wis., for constructing a stable and two silos for Fred Pabst at Oconomowoc. Estimated cost, $20,000.

Drainage—Clinton, Iowa—The County Commissioners plan to drain 80 square miles of land in Clinton County.

Ditch—International Falls, Minn.—Bids will be received until 10 a.m., July 17, by the County Commissioners, International Falls, for constructing Ditch No. 12. The work calls for 175,983 cu.yd. of excavation. Estimated cost, $35,957.

Fire Station—Virginia, Minn.—Plans are nearly completion for the fire station for the city. It will be two stories and basement, 38x88 ft. Estimated cost, $10,000. James Stickney is Fire Chf.

Drainage Bonds—Cape Girardeau, Mo.—Little River Drainage District has sold $4,250,000 in bonds to complete the drainage of 500,000 acres of land in the district.

Drainage—Arkansas—Plans are being prepared by the St. Francis Valley Engineering Co., Osceola, Ark., for 60 miles of drainage ditches in Mississippi County, Ark. Estimated cost, $240,000.

Drainage—Judsonia, Ark.—(Official)—Bids will be received until noon, July 20, by the Commissioners of Overflow Drainage District of White County, at Judsonia, for drainage work involving 594,700 cu.yd. of excavation. C. M. Erganbright is Chn. Comrs.

+Ditches and Levee—Lake City, Ark.—The Commissioners of Drainage District No. 12 of Craighead County have awarded the contract to W. CRUMPECKER, Morehouse, Mo., for 498,000 cu.yd. of ditches, at 7.4c. per cu.yd., and 42,840 cu.yd. of levee, at 20c. per cu.yd.

Comfort Stations—Dallas, Tex.—The city plans to construct two underground comfort stations at the intersection of Ervay, Elm and Live Oak Sts.

+Storage Tanks—Sabine, Tex.—The Magnolia Petroleum Co. has awarded the contract to the WARREN CITY TANK & BOILER CO., Warren, Ohio, for constructing steel oil storage tanks of 55,000-bbl. capacity at Sabine.

Drain—Bellingham, Wash.—C. M. Adams, County Engr., Bellingham, has completed plans for the Ed Brown Drain. Estimated cost, $25,000.

Bulkhead—Seattle, Wash.—A. H. Dimock, City Engr., has submitted plans to the Board of Public Works for a bulkhead to be constructed along the east margin of the East Waterway. Estimated cost, $27,000.

+Dredging—Portland, Ore.—The city has awarded the contract to A. C. V. PERRY, Portland, for dredging about 100,000 cu.yd. at Dock No. 1.

+Coaling and Sand Station—Portland, Ore.—The Oregon-Washington R.R. & Navigation Co. has awarded the contract to T. W. SNOW & CO., Ellsworth Bldg., Chicago, Ill., for constructing a coaling and sand station, at $30,000.

+Tunnel Work—Los Angeles, Calif.—The Board of Public Works has awarded the contract for paving and draining the Third St. Tunnel to BRYANT & AUSTIN, Los Angeles, at $11,894.

+Road Rollers—Los Angeles, Calif.—The city has awarded the contract to the BUFFALO STEAM ROLLER CO., for three steam road rollers, at $10,500.

+Levee Work—Marysville, Calif.—The Trustees of Reclamation District No. 10 of Yuba County have awarded the contract to BAYLESS BROS., Gridley, Calif., for levee work to be done in Yuba County under the $100,000 bond issue.

Wharf—Monterey, Calif.—The City Council is considering the construction of a municipal wharf to cost $200,000.

Fire Apparatus—Napa, Calif.—The city is considering an issue of $12,000 in bonds for fire apparatus.

Vessels—Oakland, Calif.—The San Francisco & Oakland Rys. Co. has rejected the bids received for constructing two steamers. Moore & Scott, San Francisco, submitted the lowest bid at $305,000.

+Fire Apparatus—Sacramento, Calif.—The city has awarded the contract to the AHRENS-FOX CO., Cincinnati, Ohio, for furnishing fire apparatus.

Elevators—Sacramento, Calif.—Bids will be received by W. F. McClure, State Engr., until July 30, for the installation of elevators in the California State Library, Capitol Bldg., Sacramento.

+Levee Work—Yuba City, Calif.—The Directors of Reclamation District No. 1 have awarded contracts for raising the levee in the district as follows: Sect. 1, 90,000 cu.yd., to F. D. GROH, at 23c. per cu.yd.; Sect. 2, to H. W. HEIKEN.

Extension to Breakwater—Negropoint, N. B.—Bids will be received until Aug. 26 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing an extension to the breakwater at Negropoint.

CONTRACT PRICE

+Sewers and Sewage Disposal Works—West Haven, Conn.—Bids were received June 24 by the Board of Selectmen for constructing sewers and a sewage disposal plant from (A) CAULDWELL-WINGATE & ATLANTIC CONSTRUCTION & SUPPLY CO. (awarded contract for sewage disposal works); (B) ROBERT D. DAILY & THOMAS F. MAHER (awarded contract for sewers); (C) John W. Heller; (D) Connecticut Engineering & Contracting Co.; (E) Mason & Hilton; (E) B. D. Pierce & Co.; (G) Hanscom Construction Co. The item bids were as follows:

SEWERS AND SEWAGE DISPOSAL WORKS, WEST HAVEN, CONN.

	A	B	C	D	E	F	G
64,805 lin.ft. 8-in. vitrified sewer pipe 0-6 ft. deep	$0.47	$0.44	$0.45			$0 48	$0.52
70,150 lin.ft. 8-in. vitrified sewer pipe 6-8 ft. deep	0.51	0.54	0.55			0.58	0.60
5240 lin.ft. 8-in. vitrified sewer pipe 8-10 ft. deep	0 64	0.75	0.75			0.78	0.90
850 lin.ft. 8-in. vitrified sewer pipe 10-12 ft. deep	0.80	0.97	1.25			0 80	1.29
4540 lin.ft. 10-in. vitrified sewer pipe p-6 ft. deep	0.50	0.54	0 60			0.63	0.63
8645 lin.ft. 10-in. vitrified sewer pipe, 6-8 ft. deep	0.64	0.69	0 70			0 75	0.65
030 lin.ft. 10-in. vitrified sewer pipe 8-10 ft. deep	1.00	0.86	0 90			0 80	1 08
1960 lin.ft. 12-in. vitrified sewer pipe 0-6 ft. deep	0 60	0 61	0 67			0 65	0.77
1830 lin.ft. 12-in. vitrified sewer pipe 6-8 ft. deep	0.64	0.80	0 85			0 81	0 87
550 lin.ft. 12-in. vitrified sewer pipe 8-10 ft. deep	0.75	0.91	1.40			1 25	1 22
815 lin.ft. 15-in. vitrified sewer pipe 0-6 ft. deep	0.79	0.75	1 00			0 75	1 04
3620 lin.ft. 15-in. vitrified sewer pipe 6-8 ft. deep	0.95	0 90	1 10			1 02	1.15
3920 lin.ft. 15-in. vitrified sewer pipe 8-10 ft. deep	1.10	1 60	1 60			1 17	1 48
4630 lin.ft. 18-in. vitrified sewer pipe p-6 ft. deep	1 85	1,11	1.20			1 14	1 35
4455 lin.ft. 18-in. vitrified sewer pipe 6-8 ft. deep	1.92	1.30	1 40			1 20	1 50
4255 lin.ft. 18-in. vitrified sewer pipe 8-10 ft. deep	2.15	1.50	1 80			1.55	1 74
2350 lin.ft. 18-in. vitrified sewer pipe 10-12 ft. deep	2.31	1.78	2.25			1 65	2 06
790 lin.ft. 18-in. vitrified sewer pipe 12-14 ft. deep	2 72	2 20	3 00			2 25	2 29
2300 lin.ft. 24-in. vitrified sewer pipe 0-6 ft. deep	2.50	1 90	1 80			2 04	2 05
2140 lin.ft. 24-in. vitrified sewer pip,6-8 ft. deep	2 65	2 28	2 00			2 27	2 28
2115 lin.ft. 24-in. vitrified sewer pipe 8-10 ft. deep	2 79	2.43	2 40			2 81	2 54
1275 lin.ft. 24-in. vitrified sewer pipe 10-12 ft deep	2 90	2 63	2 75			3.00	2 90
24-in. vitrified sewer pipe 12-14 ft. deep	3.20	3 21	3 50			..	3 21
3000 deep house connections	0 20	0 15	0 30			0 10	0 20
50 cu.yd. concrete "A"	5 50	6 00	7 00	$8 00	$8 50	8 00	7 00
50 cu.yd. concrete "B"	9 00	17 00	8 50	19 00	12 00	10 00	0 00
2000 lb. steel	0 03½	0.05	0 04	0.03	0 04	0 07	0 05
100 fill	0 25	0 25	1 00			0 60	0 50
750 manholes	34 50	40.00	34 00			44 00	38.00
160 extra ft. manholes	4 00	3 92	5 00			4 00	4.50
1 pumping station (lump sum)	5490 00	9600 00	7060 00			6500 00	
1 disposal works (lump sum)	40,645 00	79,600 00	44,985.00	47,712 00	49,700 00		
1700 lin.ft. outfall	3 30	2.63	4 00			2 00	5.00
1000 piles	0.35	1.00	0 80	0 40	0 50	0.50	0.50
550 lin.ft. 6-in. c.i. force main	0 45	1 25	1 00			1.00	1.00
Extended totals for sewers	$184,970	$182,754	$184,534			$187,165	$191,040
Extended totals for sewage disposal works	$40,645	$79,600	$44,985	$47,712	$49,700		

+Dredging—[illegible]—The [illegible] has [illegible] [illegible] to [illegible], [illegible], Ont., for dredging [illegible], at $[illegible].

+Dredging Creek—[illegible], Ont.—The contract has been [illegible] by [illegible] Township to THOMAS FLEMING, [illegible], Ont., for dredging [illegible] miles of Finlay Creek.

+Harbor Improvements—Port Hope, Ont.—The Department of Public Works, Ottawa, Ont., has awarded the contract to T[illegible]KINS & CUNNINGHAM, Ottawa, for harbor improvements at Port Hope.

+Pile Protection—[illegible] River, Ont.—R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., has awarded the contract to SIMS & [illegible]NGHAM, Ottawa, for pile protection work at [illegible] River.

+Coal and Ash Handling Apparatus—Toronto, Ont.—(Official)—Bids will be received until noon, Aug. 18, by H. C. [illegible], Mayor and Chm. Bd. of Control for the installation of coal and ash handling apparatus at the main pumping station.

Subway—Weston, Ont.—Plans have been completed for the proposed 66-ft. subway to be constructed by the Toronto Suburban Ry. Co., the Grand Trunk Ry. Co. and the city of Weston. E. A. James, Weston, is Engr.

Jetty—Steveston, B. C.—Bids will be received until Aug. [illegible] by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing Sect. 2 of the jetty at Steveston.

BUILDINGS

+Amherst, Mass.—The Trustees of the State Agricultural College have awarded a contract for the erection of a [illegible] building to TYSON, WEALE & MARSHALL, Boston, Mass.

Boston, Mass.—The State Board of Education plans to [illegible] a [illegible] Normal Art Building. David Snedden is [illegible].

+Holyoke, Mass.—The contract for the erection of the Knights of Columbus building has been awarded to LOUIS CAR[illegible]EAN & SONS at $74,977. Noted July 9.

+Indian Orchard, Mass.—The contract for erecting the school on Myrtle St. has been awarded by the City Property Commission to D. W. MELLEN, at $85,547. Frank J. Downey is Clk.

New Bedford, Mass.—The Steiger-Dudgeon Co. has purchased additional land adjoining the site of its proposed [illegible] building, and plans are now ready for bids on a building [illegible] ft., four stories, instead of as noted in issue of May 29. George P. B. Alderman & Bro., Holyoke, Mass., are the Archs.

Pittsfield, Mass.—Plans have been prepared by Peter F. [illegible], Arch., for a three-story brick building, [illegible]x100 ft., for the Pittsfield Aerie of Eagles. The cost is estimated at $[illegible].

+Springfield, Mass.—The Reed Realty Trust Co. has awarded a contract to FREDERICK LEVY & CO. for a five-story, [illegible]x12[illegible]-ft. concrete apartment house. B. H. Seabury is Arch.

Worcester, Mass.—The City Council has approved of a $[illegible] appropriation for a four-room addition to the West [illegible] St. school and $62,000 for an eight-room addition to the Harlow St. school, from plans of John P. Kingston & [illegible], Archs. George C. Holcott, Supt. of Bldgs.

Wrentham, Mass.—Bids will be received until July 23 by the Trustees of the Wrentham State School for the erection of a hospital building. Albert L. Hardwood is Chn. Kendall, Taylor & Co., 93 Federal St., are the Archs.

Hartford, Conn.—From the plans prepared by A. Raymond [illegible], 86 Pearl St., bids will be received until noon, July [illegible], for an addition to the Hartford Hospital on South Hudson St. The addition will be [illegible] ft., four stories high, of [illegible] brick faced with brownstone, on a concrete foundation.

Middletown, Conn.—Bids will be received soon for constructing the Middletown National Bank on Main St. The building will be of granite and marble and is estimated to cost $[illegible]. Walter P. Crabtree, 272 Main St., New Britain, is the Arch.

+New Haven, Conn.—The contract for erecting the theater and business building at Temple and Crown Sts. for the [illegible] Amusement Co. has been awarded to the [illegible] CLARK CO., 164 Brewery St. The structure will be [illegible] ft., of brick and steel, four stories, and estimated to cost $[illegible]. [illegible], [illegible] St., Boston, Mass., is the Arch., with L. W. Robinson, New Haven, as Associate Arch.

+New Haven, Conn.—From bids which were received on [illegible], the Board of Education has awarded the general contract for the addition to the [illegible] school on York Square to the [illegible] CLARK CO., 164 Brewery St., New Haven, at $[illegible]. [illegible] W. Marlowe, New Haven, [illegible] [illegible]; [illegible], New York, N. Y., $[illegible]; [illegible], [illegible]; J. H. [illegible], New York, [illegible]. [illegible] & [illegible], Chamber of Commerce Bldg., New Haven, are the Archs. Noted Jan. [illegible].

Stamford, Conn.—Bids will be received until July [illegible] by the Board of Education for a school at [illegible] Ave. It will be [illegible] stories and basement and is estimated to cost $[illegible]. [illegible], [illegible] Bldg., [illegible], are the Archs. Noted May [illegible].

Albany, N. Y.—The Mayor has signed an ordinance appropriating $[illegible] for [illegible] to School No. [illegible], and [illegible] for an addition to School No. 15.

Glens Falls, N. Y.—The city has voted $[illegible] to [illegible] for the purchase of a site for a high school. Charles E. [illegible] is Clk. Board of Education.

New York, N. Y.—[illegible] of Manhattan—Plans have been filed for a [illegible]-story [illegible] studio building to be built at [illegible] St. and [illegible] Ave., to cost $[illegible]. [illegible] & [illegible], [illegible], are the Archs.

Syracuse, N. Y.—[illegible] & [illegible], Archs., are preparing plans for a [illegible], [illegible] to be erected by the [illegible] [illegible] [illegible], [illegible], the [illegible] [illegible] St. The estimated cost is $[illegible].

Utica, N. Y.—Agne, Rushmore & Jennison, 211 Arcade Bldg., are preparing plans for an addition to the high school estimated to cost $[illegible],000. P. J. Kelly is Clk. Bd. of Education.

Atlantic City, N. J.—The contract will soon be awarded for building a 1[illegible]-story addition to the Hotel Rudolph, at New Jersey Ave. and the Boardwalk. The estimated cost is $[illegible]00,000. Mann Henderer, Atlantic City, is Arch.

Flemington, N. J.—John N. Pierson & Son, Perth Amboy, have been commissioned to prepare plans for a high school, estimated to cost $[illegible]2,000.

Newark, N. J.—The lowest bid submitted to the Board of Education for building the addition to the North Seventh St. school was that of the Becker Construction Co., at $66,[illegible]83. Noted June 2[illegible].

+Erie, Penn.—The contract for erecting the Columbus and Gridley schools has been awarded to the E. C. GERHARD BLDG. CO. at $[illegible],712.

Hershey, Penn.—The Hershey Men's Club plans to erect a six-story concrete and brick building, 1[illegible]x2[illegible]0 ft., estimated to cost $1,000,000. J. M. Franklan is Mgr. Shattuck & Hussey, Chicago, Ill., Emlen Urban, Lancaster, and Paul Creigh, Philadelphia, are Associate Archs.

Lansdowne, Penn.—The Board of Education will receive competitive plans for building a 12-room addition, including a gymnasium, to the school, estimated to cost $60,000.

Scranton, Pa.—The East Scranton Civic and Social Club contemplates erecting a clubhouse to cost about $1[illegible],000.

+Wheeling, W. Va.—The contract for erecting the high school has been awarded to BELTZ & SONS CO. at $[illegible].

Berkeley Springs, W. Va.—The Old Dominion Academy, formerly of Reliance, Va., which was destroyed by fire, will be rebuilt at Berkeley Springs. About $[illegible]0,000 will be spent in new buildings.

+Miami, Fla.—The contract for constructing a residence for Charles Deering, Chicago, Ill., has been awarded to FREDERICK T. LEY & CO., INC., 193 Main St., Springfield, Mass. The estimated cost is $1,000,000.

+Bessemer, Ala.—The contract has been awarded to AGER & CLINE, Birmingham, for erecting the five-story brick building on 19th St. and Third Ave. The estimated cost is $67,000.

Pikeville, Ky.—Weber, Werner & Adkins, Cincinnati, Ohio, are preparing plans for a brick and stone school, to be erected for Pike County, at a cost of $50,000. A. W. Potter is Supt. of the Bd. of Education.

Canal Dover, Ohio—Bids will be received until July 3[illegible], by Howard & Merriam, Archs., Capital Trust Bldg., for the erection of a high school at Canal Dover. The estimated cost is $125,000.

Carthage, Ohio—(Cincinnati P. O.)—Bids will be received until noon, July 30, by Elsner & Anderson, Archs., 138 Ingalls Bldg., Cincinnati, for the erection of a building at the Longview Hospital, Carthage, Ohio.

+Cleveland, Ohio—The contract for the erection of the theater at Superior Ave. and East 1[illegible]3d St., for the Doan Square Realty Co., has been awarded to the R. A. CURRY CO. Richardson & Yost, 3[illegible]4 Rockefeller Bldg., are the Archs. Noted June 4.

Plans have been prepared by Morrow & Cross, Archs., 731 Garfield Bldg., Cleveland, Ohio, for the erection of a two-story [illegible]x100-ft. office building on Harvard Ave. for the Cleveland Ry. Co., Leader News Bldg., Cleveland, Ohio. The estimated cost is $[illegible].

Cleveland, Ohio—Frans C. Warner, Arch., 718 Prospect Hippodrome Bldg., is preparing plans for the erection of a three-story college building for the Western Reserve University. The estimated cost is $1[illegible].

+The general contract for the erection of the two-story and basement store and apartment building for the Ma[illegible]n Square Realty Co., [illegible] Plain Dealer Bldg., has been awarded to F. H. VOGEL, Ridge Road, Cleveland, Ohio. The estimated cost is $70,000.

Lick Run, Ohio—(Cincinnati P. O.)—Bids will be received until 3 p.m., Aug. [illegible], by Frederick S. Spiegel, Pres. Board of Hospital Commissioners, for the erection of the Isolation Hospital in Lick Run, Hamilton County.

Maumee, Ohio—Bids will be received until noon, Aug. 2, by R. A. Buck, Pres. Board of Education, for repairing the school at Maumee. Langdon & Hohly are the Archs., 1112 Nicholas Bldg., Toledo, Ohio.

+Toledo, Ohio—The general contract for the erection of the two-story and basement school at Toledo has been awarded to WALLS, [illegible] & KUHLMAN CO., [illegible] Nasby Bldg. The estimated cost is $[illegible]. Noted [illegible] 3[illegible].

Bessemer, Mich.—Charlton & Kuenzli, Archs., Camp Bldg., have completed plans for an addition to the [illegible] County Courthouse. It will be three stories and basement, [illegible] ft. The estimated cost is $[illegible].

Munising, Mich.—Charlton & Kuenzli, Archs., Camp Bldg., Milwaukee, Wis., are preparing plans for the erection of a Y. M. C. A. building at Munising. The estimated cost is $[illegible].

Ladysmith, Wis.—Bids will be received until Aug. 2, by [illegible] & [illegible], [illegible], Wis., for the erection of a brick and stone high school. Noted June 11.

+Madison, Wis.—The general contract for the erection of the addition to the Wisconsin Telephone Co. has been awarded to the [illegible] MASONRY CO., Manitowoc, Wis. The estimated cost is $[illegible].

Milwaukee, Wis.—Herman J. Esser, Arch., Camp Bldg., is receiving bids for the erection of a four-story and basement [illegible] ft. addition to the department store of Gimbel Bros. The estimated cost is $[illegible].

+Mineral Point, Wis.—The contract for the erection of the city hall, [illegible] and [illegible] has been awarded to EDWARD [illegible], [illegible], Wis.

Stevens Point, Wis.—Van Ryn & De Gelleke, Archs., Caswell Block, are completing plans for an addition to the State Normal School, at Stevens Point. The estimated cost is $60,000.

Superior, Wis.—Plans are being prepared by Ermien Ulrich, Arch., Euclid Bldg., for the erection of a two-story and basement asylum. The estimated cost is $80,000.

+Pittsburg, Kan.—The contract for rebuilding Russ Hall, has been awarded to J. M. LEEPER, Topeka, Kan., at $100,000.

+Great Falls, Mont.—The contract for erection of the four-story addition to the New Park Hotel, has been awarded to C. O. JARL, at $125,000. Noted Jan. 15.

+Seattle, Wash.—The contract for the erection of the King County courthouse, has been awarded to the PUGET SOUND BRIDGE & DREDGING CO., Seattle, at $806,903. Other bids were as follows: (a) Court house, (b) two additional stories. Puget Sound Bridge & Dredging Co., (a) $806,903, (b) $321,000; Brayton Engr. Co., (a) $872,000, (b) $342,000; Sound Construction & Engineering Co., (a) $873,614, (b) $371,928; Pierson Construction Co., (a) $875,719, (b) $312,536; Butler Construction Co., (a) $885,000, (b) $352,000; Hans Pederson, (a) $889,400, (b) $345,000; Nettleton-Bruce-Eschbach Co., (a) $906,955, (b) $345,600; McRae Bros., (a) $933,000, (b) $250,000. Noted July 9.

+The Metropolitan Building Co., has awarded to GRANT, SMITH & CO., the general contract for the erection of the 11-story building to be known as the Stuart Building. The estimated cost is $500,000.

Tacoma, Wash.—Charles B. Hurley will erect an apartment house at Tacoma to cost $100,000.

CONTRACT PRICE

+Sewage Disposal Works—Albany, N. Y.—Bids were received June 29 by the Board of Contract and Supply for constructing sewage disposal works from (A) RIVERDALE CONTRACTING CO., 37 East 28th St., New York; (awarded contract); (B) R. T. Ford Co., Rochester, N. Y.; (C) Phœnix Construction Co., 41 Park Row, New York; (D) Henry C. Ulen, Chicago, Ill.; (E) Mason Hilton & Co. and Merrill, Ruckgaber Co., New York. The item bids were as follows:

SEWAGE DISPOSAL WORKS, ALBANY, N. Y.

	A	B	C	D	E
16,500 cu.yd. excavation above elevation	$0.80	$1.00	$0.71	$1.30	$1.00
8900 cu.yd. excavation below elevation 3.0	1.70	1.50	1.35	1.30	2.00
Excavation for outfall conduit (lump sum)	6374.00	6000.00	4600.00	7000.00	7000.00
6000 cu.yd. filling ground outfall conduit (lump dum)	40.00	45.00	375.00	55.00	30.00
34,000 cu.yd. general embankment and filling	0.60	0.55	0.39	0.50	0.50
15,700 cu.yd. rolled embankment	0.80	0.60	0.625	0.75	0.75
5300 cu.yd. loam	0.55	0.60	0.81	0.70	0.50
5 acre seeding	30.00	45.00	100.00	70.00	40.00
540 sq.yd. sodding	0.30	0.30	0.60	0.35	0.30
300 cu.yd. gravel in walks	2.00	1.75	1.00	2.30	1.50
2500 cu.yd. filter material in sludge drying beds	2.30	1.75	2.50	2.50	1.50
950 cu.yd. concrete, Class A	15.00	12.00	11.75	15.00	15.00
350 cu.yd. concrete, Class B	16.80	14.00	18.00	17.00	25.00
2550 cu.yd. concrete, Class C	9.50	12.00	11.50	9.00	12.00
5450 cu.yd. concrete, Class D	8 50	10.00	11.00	8 50	12.00
2300 cu.yd. concrete, Class E	9 20	9.00	9 00	8 00	12.00
2500 cu.yd. concrete, Class F	7 50	7.40	8.50	7.50	10.00
6600 cu.yd. concrete, Class G	7.50	7.40	9.00	8.00	9.00
9200 sq.yd. plastering with cement mortar	0.40	0.60	0.50	0.40	0.50
510 sq.yd. concrete pavement	0.30	1.35	1.35	1.30	2.00
5600 lin.ft. 3-in. agricultural tile drain	0.05	0.07	0.05	0.07	0.10
380 lin.ft. 8-in. vitrified sewer pipe	0.25	0.30	0.50	0.25	0.40
500 lin.ft. 10-in. vitrified sewer pipe	0.35	0.35	0.60	0.30	0.50
150 tons c.i. pipe and spiral castings	30 00	35.00	41.00	32.00	40.00
40 tons bell and spigot spiral castings	60 00	55.00	84.00	75 00	70.00
15 tons flange special castings	60 00	75.00	144 00	90.00	100 00
8 4-in. gate valves	10.00	12.00	16 00	10 00	15 00
11 6-in. gate valves	15 00	18.00	20.00	15.00	20.00
2 8-in. gate valves	21.00	28.00	27.50	22.00	30 00
4 8-in. single seat gate valves with outside screw and yoke	21.00	40.00	30.00	25.00	35.00
64 8-in. single seat gate valves with outside boxes	30 00	30.00	36 00	30.00	30.00
4 8-in. check valves	20 00	35.00	30.00	25 00	40 00
21 valve boxes	7 00	6.00	6 00	6.00	7 00
7 fire hydrants	38 00	35.00	44 00	40.00	60 00
4 30-in. sluice gates	295 00	260.00	300 00	350 00	300.00
41 6-in. shear gates	10 00	12.00	12.00	12 00	15.00
32 10-in. slide gates	12 00	12.00	12.00	12.00	15.00
Small piping in settling tanks (lump sum)	6800 00	7685.00	6775 00	9000 00	4800.00
43,000 lb. iron castings	0 01	0.05	0.05	0.05	0.05
11,000 lb. miscellaneous steel work	0 01	0.05	0 06	0.06	0.06
560,000 lb. steel reinforcement bars	0 015	0.025	0 035	0.03	0 035
22,000 lb. tie rods and bolts	0 01	0.04	0 015	0 05	0 05
22,000 lin.ft. piling	0 40	0 30	0 25	0.60	0 15
7000M. ft. b.m. yellow pine lumber	65 00	60.00	60 00	70 00	75.00
200 stop planks (lump sum)	600 00	380.00	500 00	450 00	400.00
Each adjustable weirs	15.00	10.40	15.00	12.00	15.00
64 lin.ft. railroad track, steel ties, straight track	0 50	0.40	0 50	0.40	0.36
3100 lin.ft. railroad track, wood ties, straight track	0 75	0.90	0 75	0.50	0 60
1300 lin.ft. railroad track, wood ties, curved track	0 75	1.00	0 90	1 00	0 65
460 switches	25 00	23.25	32.00	30 00	25.00
38 tip cars	70 00	75.00	80.00	80 00	70.00
4 Royalty or settling tanks (lump sum)	3400 00	3400.00	3400 00	3400 00	3400.00
Extended totals	$284,302	$287,799	$208,888	$300,804	$331,54t

*Not official.

North Bend, Ore.—George Courtney, Portland, Ore., will erect a five-story brick hotel at North Bend. The estimated cost is $100,000.

Los Angeles, Calif.—The Pohlman Leasehold Co. will erect an office building at Seventh and Grand Aves.

Merritt & James will erect a seven-story and basement reinforced concrete loft and office building at 301 East Eighth St., to cost $110,000. Ralph M. Snyder, 602 Brockman Bldg., is the Arch.

Oakland, Calif.—Edward T. Foulkes, Arch., Crocker Bldg., has prepared plans for the erection of a two-story and basement theater at 14th and Franklin Sts. The estimated cost is $75,000.

Bassano, Alta.—Bids will be received until 4 p.m., July 22, R. C. Desrochers, Dept. Public Works, for the erection of a public building at Bassano, Alta.

CATALOG NOTICES

Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill. Bulletin 68A. Sullivan channelers for engineering work. Illustrated, 16 pp., 6x9 in.

Cement-Gun Co., 30 Church St., New York. Pamphlet. "The Cement-Gun." apparatus, process and product. Illustrated, 106 pp., 6x9 in.

Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill. Bulletin 66B. Rock drill mountings and accessories. Illustrated, 36 pp., 6x9 in. Booklet No. 113. "Core Drilling by Contract." Illustrated, 32 pp., 3½x5½ in. Bulletin 63M. Ironclad coal cutters, Longwall coal cutters. Illustrated, 36 pp., 6x9 in.

The Norbom Engineering Co., Denckla Building, Philadelphia, Penn. Catalog. Hydraulic dredges and accessories. Illustrated, 48 pp., 6x9 in.

The Duff Manufacturing Co., Pittsburgh, Penn. Catalog No. 102. Jacks. Illustrated, 144 pp., 6x9 in.

Power & Mining Machinery Co., Cudahy, Wis. Catalog No. 60. International concrete mixer, Globe type. Illustrated, 36 pp., 6x9 in.

H. K. Porter Co., Pittsburgh, Penn. Catalog. Compressed-air locomotives. Illustrated, 80 pp., 6x9 in.

Bury Compressor Co., Erie, Penn. Catalog No. 44. Noiseless air compressors. Illustrated, 40 pp., 6x9 in.

Lumen Bearing Co., Buffalo, N. Y. Pamphlet. "Lesoyl." A semifluid graphite lubricant. 3½x6 in.

Portsmouth Culvert Co., Portsmouth, Ohio. Catalog. Butt-joint nestable culvert. Illustrated, 22 pp., 6x9 in.

Hammond Engineering Co., Warren, Penn. Pamphlet. Sewage Disposal. Illustrated, 6x9 in.

O. M. Weand, Reading, Penn. Catalog. Reading sewage screen. Illustrated, 18 pp., 7x10 in.

Smooth-On Mfg. Co., 572-74 Communipaw Ave., Jersey City, N. J. Smooth-On Instruction Book No. 7. Iron cement for hardening, waterproofing and oilproofing concrete. Illustrated, 64 pp., 4½x6½ in.

CONTRACT PRICE.

+Sewer System—Middletown, Conn.—Bids were received June 22 by the City Council for the construction of a sewer system for the western portion of the city, according to plans prepared by Alexander Potter, 50 Church St., New York, from (A) A. BRAZOS & SON, Middletown, (awarded contract); (B) Frank Arrigoni & Bro., Middletown; (C) Berardino & Tomassetti, Meriden; (D) Piersen Engineering & Contracting Co., Hartford; (E) Young & Hyde, Inc., New York, N. Y. The item bids were as follows:

SEWER SYSTEM, MIDDLETOWN, CONN.

	A	B	C	D	E
1000 cu.yd. loose rock excavation	$0.85	$0.95	$1.25	$2.00	$2 30
400 cu.yd. solid rock excavation	2 00	2 48	2 50	4.00	4 50
600 cu.yd. quicksand	1.50	1 50	1.50	1.50	1 50
1368 lin.ft. 8-in. sewer 6 ft. deep	0.53	0 58	0 50	0 70	0 77
6847 lin.ft. 8-in. sewer 6-8 ft. deep.	0 67	0.66	0 69	0 80	0 85
2625 lin.ft. 8-in. sewer 8-10 ft. deep	0.79	0 98	0 80	0.95	1.07
455 lin.ft. 8-in. sewer 10-12 ft. deep	1 09	1 41	1 00	1.25	1.50
210 lin.ft. 8-in. sewer 12-14 ft. deep	1.45	2 04	1.50	1 50	1 80
5 lin.ft. 8-in. sewer 14-16 ft. deep.	2 00	2 77	2 00	2 00	2 70
1892 lin.ft. 10-in. sewer 6 ft. deep	0.74	0 73	0 61	0 75	0 90
293 lin.ft. 10-in. sewer 6-8 ft. deep.	0 85	0 75	0 72	1.00	1.05
257 lin.ft. 10-in. sewer 8-10 ft. deep	0 90	1 01	0 90	1.25	1 23
145 lin.ft. 10-in. sewer 10-12 ft.deep	1.34	1 50	1 25	2 00	1 72
100 lin.ft. 10-in. sewer 12-14 ft.deep	1 85	2 22	2 00	2.50	2 00
5 lin.ft. 10-in. sewer 14-16 ft. deep	2 25	2 86	2 25	3 00	3.00
495 lin.ft. 12-in. sewer 6 ft. deep	0 85	0 79	0 91	0 85	1 06
85 lin.ft. 12-in. sewer 6-8 ft. deep	1 00	0.87	1 00	1.10	1 22
13 lin.ft. 12-in. sewer 8-10 ft. deep	1.05	1 21	1 25	1 25	1 61
1142 lin.ft. 15-in. sewer 6 ft. deep	0.86	0 98	1 20	1 25	1 40
50 lin.ft. 15-in. sewer 6-8 ft. deep	1 00	1 06	1 50	2 00	1 67
47 manholes	49 00	52 00	60 00	45 00	58 00
7 flush tanks	76.00	84 00	80 00	70 00	120 00
100 T branches on 8-in. pipe	0.45	0 60	1.00	1 50	1 15
5 T branches on 10-in. pipe	0 75	0 90	1 00	2 00	1 60
500 lin.ft. gravel foundation	0.10	0 11	0 20	0 25	0 23
84 lin.ft. 8-in. c.i. culvert pipe	1 55	0 52	2 00	0 75	1 10
180 lin.ft. 12-in. c.i. culvert pipe	2 80	0 70	2 25	1.25	1 60
192 lin.ft. 14-in. c.i. culvert pipe	3.00	1 08	3 00	1 50	1.90
5 cu yd. concrete masonry	8 00	8 00	8 00	10.00	9 75
10,000 ft. b m. sheeting and timber foundation	30 00	30 00	30 00	30.00	30 00
Replacing 4620 lin.ft. macadam pavement	0.06	0 25	0 35	0 40	0 30
Replacing 1810 lin.ft. macadam pavement	0 06	0.25	0 35	0 40	0 30
Including tarvia finish	0 13	0.35	0 50	0.50	0 51
105 lin.ft. tunnel	0 13	0 35	0 50	0 50	0 51
105 lin.ft. tunnel	0 00	11.00	1 00	5 00	21 00
Expended totals	$20,196	$22,640	$23,512	$26,075	$29,781

+**Water System**—Valley Junction, Iowa—Bids were received May 11 for the construction of a water system, according to plans prepared by the Iowa Engineering Co., Clinton, Iowa, from (A) DES MOINES BRIDGE & IRON CO., Des Moines, Iowa (awarded contract); (B) Katz Construction Co., Omaha, Neb.; (C) T. C. [illegible] & Sons Co., Jackson, Mich.; (D) W. D. Lovell, Minneapolis, Minn.; (E) Alamo Engine & Supply Co., Omaha, Neb.; (F) Bush & Gray, Joplin, Mo.; (G) Rock Island Bridge & Iron Works, Rock Island, Ill.; (H) Inter-[illegible] Bridge & Construction Co., Tecumseh, Neb.; (I) J. W. Turner Improvement Co., Des Moines, Iowa; (J) C. W. Rowland Co., Des Moines, Iowa; (K) Moffatt Co., Des Moines, Iowa. The item bids were as follows:

The Wemlinger Steel Piling Co., McCormick Bldg., Chicago, announces that it has made arrangements with the Underpinning & Foundation Co., 290 Broadway, New York, to represent the latter exclusively in the middle west and south, and will endeavor to secure contracts especially for different foundation work.

The Strike—At the Westinghouse works has been called off by the workmen. They have been out about a month and go back without recognition of their order or increase in pay. The works are now running full time.

WATER SYSTEM, VALLEY JUNCTION, IOWA

	A	B	C	D	E	F	G	H	I	J	K
39[illegible] lin. ft. 10-in. c.-i. pipe	$1 10	$1 08	$1 17	$1 10	$1.13	$1 20	$1 09	$1 15	$1 25	$1 15	$1 25
[illegible] lin. ft. 8-in. c.-i. pipe	0 75	0 86	0 90	0 90	0 86	0 89	0 85	0 76	0 95	0 88	1.00
11,3[illegible] lin. ft. 6-in. c.-i. pipe	0 65	0 66	0.65	0 70	0 64	0.66	0 576	0 64	0 70	0.66	0 75
13,[illegible] lin. ft. 4-in. c.-i. pipe	0 52	0 54	0 53	0 60	0.475	0 55	0 505	0.54	0 54	0 50	0.56
22,[illegible] lb. specials	0 03	0 03	0 03	0 03	0 03	0.03	..	0 03	0 03	0.035	0 035
1 10-in. gate valve	25 00	25.00	24.00	30 00	26.00	22 50	24 00	25 00	30 00	26 00	23 50
4 8-in. gate valves	18 00	17 00	16 00	18.00	19.00	16 35	16 00	16 00	33 00	17 50	14 50
8 6-in. gate valves	10 00	12 00	10 50	10 00	12 00	11 50	11 00	13 00	15 00	11 00	10 [illegible]
14 4-in. gate valves	7 00	7 00	7 25	8 00	8 00	8 25	7.00	10 00	10 00	6 50	7 50
1 1[illegible]-in. gate valve	30 00	30 00	32 00	40 00	12.00	30 50	10 00	35.00	30 00	33 00	31 00
24 valve boxes	3 00	3 00	3 00	4 00	3 50	2 95	4 00	4 00	3 00	3 00	3 00
3[illegible] 6-in. hydrants	24 00	26 00	29.00	26 00	31.00	29.00	24 50	31 00	30 00	36 50	34 00
2[illegible] 4-in. hydrants	24 00	26 00	28.50	26 00	29.00	26 50	24 50	30 00	26 00	26 00	37 00
1[illegible]-gal. steel tank and tower (complete)	4,450 00	.....	4,350.00	.....	4,390 00	4,500.00	4,390 00	4,400 00	.....	4,800.00	.
Pump house (complete) (lump sum)	1,250 00	.....	.....	.....	1,200 00	.....	5,624 00	1,600 00	.....	4,510 00	..
Collecting well, including 2[illegible] ft. drive well (lump sum)	12,000 00	.....	.....	.....	.....	.....		3,000 00	.....	.....	7 00
16 cu. yd. concrete pump foundations	8 00	8.00	.....	.....	8 00	.....		10 00	.....		
1 5[illegible]-gal. triplex pump	.....	.....	.....	.....	1,650 00	.....	900 00	2,000 00	.....	2,350.00	39[illegible] 00
1 40-hp. motor	.....	.....	.....	.....	350 00	.....	516 00	.....	.....	.....	.....
Electrical apparatus for 40-hp. motor	.....	.....	.....	.....	198 00	.....	.	.	.....	.....	
Installing 40-hp. motor and apparatus	.....	.....	.....	.....	75 00	.	...		.....		
Totals	$32,154	$33,333	$33,600	$33,635	$34,090	$34,100	$34,115	$34,176	$34,200	$35,316	$35,600

The Murray Iron Works Co., Burlington, Ia., purchased the property formerly occupied by the McCosh Iron & Steel Works. The company now has about 10 acres in the city and in addition a foundry at West Burlington.

The Western Engineering Specialties Co. announces the removal of its office to 523 Boston Building, Denver, Colo. C. G. Burnite is manager.

The Chicago Branch of the Keuffel & Esser Co., of New York, N. Y., manufacturers of drawing materials, surveying instruments, etc., has been moved from 68 West Madison St. to the K. & E. Bldg., 516-520 South Dearborn St., Chicago, Ill.

CONTRACT PRICE

Water System—Farmington, Maine—Bids were received Apr. 16 by the village for the construction of a water system according to plans prepared by Green & Wilson, Engrs., Waterville, Maine, from (A) George Cuozzo Construction Co., Bangor, Maine; (B) Daniel DiPietro, Boston, Mass.; (C) John F. [illegible], Boston, Mass.; (D) L. E. S[illegible]ruton, Portsmouth, N. H.; (E) John Grady & Son, Bangor, Maine; (F) F. H. Marshall, South Portland, Maine; (G) Fales & Simmons, Rockland, Maine; (H) Thomas Bruno, Boston, Mass.; (I) John J. [illegible], Lawrence, Mass.; (J) H. P. Cummings Construction Co., Ware, Mass.; (K) R. W. Emerson, Pittsfield, Mass.; (L) James McGregor & Co., Rumford, Maine; (M) Light, Heat & Power Corporation, Boston, Mass.; (N) James H. Ferguson, Boston, Mass.; (O) James H. Kerr, Rumford, Maine; (P) Marshall Bros. Construction Co., South Portland, Maine; (Q) International Construction Co., Boston, Mass.; (R) Joseph [illegible]brook & Son, Brunswick, Maine; (S) Otto Nelson Co., Bangor, Maine; (T) Farglone & Romano, South Portland, Maine; (U) Lavorgne & DiPucchio, Rumford, Maine; (V) [illegible] & Campbell, Augusta, Maine; (W) Lorello & Profenno, Portland, Maine; (X) T. F. Moreau, Lewiston, Maine; (Y) Engineer's Estimate. The item bids were as follows:

CATALOG NOTICES

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Bulletin No. 153. "Chicago Gatling" drills. Illustrated, 24 pp., 6x9 inches. Bulletin No. 153. "Chicago Sinker." Illustrated, 20 pp., 6x9 inches. Bulletin No. 154. "Chicago Stoper." Illustrated, 24 pp., 6x9 inches.

Chain Belt Co., Milwaukee, Wis. Catalog No. 54. "Chabelco" steel chain belt. Illustrated, 32 pp., 7x10 in.

A. D. Granger Co., 90 West St., New York. Bulletin No. 2. "Oswego" internally fired water tube boilers. Illustrated, 12 pp., 8x10½ in.

Insley Mfg. Co., Indianapolis, Ind. Catalog No. 40. Contractors' equipment for handling materials in construction work. Illustrated, 48 pp., 6x9 in.

Electric Water Sterilizer Co., Scottdale, Penn. Catalog. Electric water sterilizer. Illustrated, 16 pp., 6¼x9¼ in.

Pennsylvania Metal Culvert Co., Warren, Penn. Catalog. American ingot iron "Armco" corrugated culverts. Illustrated, 24 pp., 7x10 in.

Simplex Wire & Cable Co., 201 Devonshire St., Boston, Mass. Booklet. Simplex steel taped cable. Illustrated, 16 pp., 6x9 in.

Mesta Machine Co., Pittsburgh, Penn. Bulletin N[illegible]. Air compressors and vacuum pumps. Illustrated, 8 pp., 6x9 in.

Link-Belt Co., Chicago, Ill. Section A, Catalog No. 110. Ewart detachable link-belt and sprocket wheels. Illustrated, 112 pp., 6x9 in.

Joseph T. Ryerson & Son, Chicago, Ill. Technical Library No. [illegible]. Concrete reinforcing. Illustrated, 16 pp., [illegible] in.

WATER SYSTEM, FARMINGTON, MAINE

	A	B	C	D	E	F	G	H	I	J	K	L
21,000 [illegible]	[illegible]	[illegible]	[illegible]	$0 18	$0 18	[illegible]	$0 15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	0 90	2 15	1 99	[illegible]	1 05	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1 20		0 17	[illegible]	0 17	0 17		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	0 11	0 21	0 18	0 18	[illegible]	0 18	[illegible]	0 15	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		0 14	[illegible]	[illegible]	0 18		0 12	0 17	[illegible]
[illegible]	[illegible]	0 14	[illegible]		0 13	[illegible]	0 16	0 17		[illegible]	0 15	[illegible]
[illegible]	[illegible]	[illegible]	0 11	0 16	0 12	[illegible]	[illegible]	0 18	0 16	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		0 11	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	1 50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals [illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
Totals [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals [illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]

	M	N	O	P	Q	R	S	T	U	V	W	X	Y
21,000 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Superstructures of Buildings—Baltimore, Md.—Bids were received June 17 by the Board of Awards for Water Contract No. 23, constructing superstructures of buildings, from (A) CONSOLIDATED ENGINEERING CO., INC., Baltimore (awarded contract); (B) Charles L. Stockhausen, Baltimore; (C) Henry Smith & Sons Co., Baltimore; (D) David M. Andrew Co., Baltimore; (E) Morrow Bros., Baltimore. The item bids were as follows:

SUPERSTRUCTURES OF BUILDINGS, BALTIMORE, MD.

Water Contract No. 23

	A $	B $	C $	D $	E $
Head house	35,400.00	36,187.00	38,500.00	36,500.00	34,738.00
Wash water building	17,900.00	18,067.00	18,500.00	19,000.00	17,755.00
Filter building	76,950.00	87,167.00	90,000.00	97,300.00	98,615.00
Pumping station	16,500.00	25,917.00	19,000.00	19,000.00	17,255.00
Aerator gate house	6,700.00	7,127.00	7,000.00	7,700.00	6,531.00
Center passage	9,890.00	10,067.00	10,200.00	10,200.00	10,515.00
Gate house No. 1 filtered water reservoir	1,550.00	1,567.00	1,700.00	2,000.00	2,433.00
Gate house No. 2 filtered water reservoir	1,800.00	1,875.00	1,600.00	2,000.00	1,912.00
Electrical equipment	10,500 00	11,235.00	13,000.00	10,200.00	10,900.00
Plumbing	2,600.00	2,370.00	2,750.00	2,200.00	2,453.00
Tile floors	825.00	937.00	1,100.00	1,000.00	770.00
Laboratory finish	1,350.00	1,70.00	1.000,00	1,000.00	1,768.00
Alberene tables and benches	1,475.00	1,580.00	1,000.00	700.00	812.00
Refrigerating plant	2,350.00	2,340.00	2,400.00	2,200.00	......
Freight elevator	2,250.00	2,300.00	2,400.00	2,200.00	2,299.00
Bucket elevator	2,300.00	1,950.00	2,900.00	2,500.00	2,100.00
Trolley system	3,000.00	2,940.00	3,500.00	2,300.00	3,870.00
Ventilating system	1,000.00	1,050.00	1,500.00	1,000.00	1,160.00
Vacuum cleaners	2,000.00	2,087.00	2,100.00	2,000.00	2,100.00
Lime tanks, troughs and screens	2,550.00	1,620.00	2,800.00	3,500.00	2,611.00
ω000 lin.ft. iron pipe railing, per lin.ft.	0.52		0.65	0.50	0.65
740 sq.yd. concrete walks, per sq.yd.	1.35		2.00	1.00	1.09
Concrete steps	150.00	270.00	200.00	350.00	160.00
Extended totals	$201,599	$223,643	$226,580	$227,090	$225,113

Unfilled Orders of Steel Corporation—A slight gain was made in the unfilled orders on the books of the United States Steel Corporation, according to the statement made July 10. The increase for June was 34,000 tons.

Period—	Unfilled tonnage	Period—	Unfilled Tonnage
May 31, 1914	3,998,160	Jan. 31, 1911	3,110,919
Apr. 30, 1914	4,277,068	Dec. 31, 1910	2,674,757
Mar. 31, 1914	4,653,825	Nov. 30, 1910	2,760,413
Feb. 28, 1914	5,026,440	Oct. 31, 1910	2,871,949
Jan. 31, 1914	4,613,680	Sept. 30, 1910	3,158,106
Dec. 31, 1913	4,282,108	Aug. 31, 1910	3,537,128
Nov. 20, 1913	4,396,347	July 31, 1910	3,970,931
Oct. 31, 1913	4,513,767	June 30, 1910	4,257,794
Sept. 30, 1913	5,003,785	Mar. 31, 1910	5,402,514
Aug. 31, 1913	5,223,468	Dec. 31, 1909	5,927,031
July 31, 1913	5,399,356	Sept. 30, 1909	4,796,833
June 30, 1913	5,807,817	June 30, 1909	4,057,939
May 31, 1913	6,324,322	Mar. 31, 1909	3,542,595
Apr. 30, 1913	6,978,762	Dec. 31, 1908	3,603,527
Mar. 31, 1913	7,468,956	Sept. 30, 1908	3,421,977
Feb. 28, 1913	7,656,714	June 30, 1908	3,313,876
Jan. 31, 1913	7,827,368	Mar. 31, 1908	3,765,343
Dec. 31, 1912	7,932,164	Dec. 31, 1907	4,642,553
Nov. 30, 1912	7,852,883	Sept. 30, 1907	6,425,008
Oct. 31, 1912	7,594,381	June 30, 1907	7,603,878
Sept. 30, 1912	6,551,507	Mar. 31, 1907	8,043,858
Aug. 31, 1912	6,163,375	Dec. 31, 1906	8,489,718
July 31, 1912	5,957,079	Sept. 30, 1906	7,936,884
June 30, 1912	5,807,346	June 30, 1906	6,809,584
May 31, 1912	5,750,983	Mar. 31, 1906	7,018,712
Apr. 30, 1912	5,664,885	Dec. 31, 1905	7,605,086
Mar. 31, 1912	5,304,841	Sept. 30, 1905	5,865,377
Feb. 29, 1912	5,454,200	June 30, 1905	4,829,655
Jan. 31, 1912	5,379,721	Mar. 31, 1905	5,579,560
Dec. 31, 1911	5,084,761	Dec. 31, 1904	4,696,203
Nov. 30, 1911	4,141,955	Sept. 30, 1904	3,027,436
Oct. 31, 1911	3,694,328	June 30, 1904	3,192,277
Sept. 30, 1911	3,611,317	Mar. 31, 1904	4,136,961
Aug. 31, 1911	3,695,985	Dec. 31, 1903	3,215,123
July 31, 1911	3,584,085	Sept. 30, 1903	3,278,742
June 30, 1911	3,361,058	June 30, 1903	4,666,578
May 31, 1911	3,113,187	Mar. 31, 1903	5,410,719
Apr. 30, 1911	3,218,704	Dec. 31, 1902	5,347,523
Mar. 31, 1911	3,447,301	Sept. 30, 1902	4,843,007
Feb. 28, 1911	3,400,543	June 30, 1902	4,791,993

Dyke—Greater Winnipeg Water District, Winnipeg, Man.—Bids were received by the Commissioners of the Greater Winnipeg Water District, May 15, for constructing a dyke for the Falcon River Diversion from (A) TOMLINSON & FLEMING, Toronto, Ont., (awarded contract); (B) Siems Carey Co., St. Paul; (C) C. W. Sharp & Son, Winnipeg; (D) Janse Bros., Boomer & Hughes, Calgary; (E) W. Newman Co., Winnipeg; (F) William Scott, Winnipeg; (G) P. G. Dunn, Moose Jaw; (H) Northern Construction Co., Winnipeg; (I) C. G. Anderson, Winnipeg. The item bids were as follows:

EXPANSION OF THE ELECTRICAL INDUSTRY

The present estimates are that $1,200,000,000 per annum, or $4,000,000 per working day, will be required to meet the increasing business of the gas, electric light and traction business of the United States, says W. H. Gardiner, of Henry L. Doherty & Co., New York, according to the Journal of Commerce, who adds:

"The public regulation of public utilities and common carriers by state commissions has grown to an extent perhaps not generally realized. In 15 states there are public service commissions having full jurisdiction over all utilities. In eight other states these commissions have full jurisdiction, except as to capitalization. In eight other states they have limited jurisdiction over railroads and some city utilities. In twelve other states they have supervision of carriers and of some telephone and telegraph companies, leaving only two states—Utah and Wyoming—without as yet any established form of state regulation of public utilities and carriers.

"For thirty-odd years the most plenipotentiary commission has existed in Massachusetts.

"The fundamental duties of the plenipotentiary public service commission are threefold, the impartial supervision and regulation of the public service corporations in all matters affecting the good of their present or prospective customers, their supervision in such matters as concern the interests of investors in public utility securities, and the sound and proper guidance of public opinion, through published reports and otherwise, of the real conditions affecting public service corporations.

"As each new commission has been inaugurated, the first above mentioned consideration has usually been most prominently in mind, but as each new commission gets deeper and deeper into its work, it realizes that in hitherto unappreciated ways the ultimate interests of the public served, and of the public service corporation, are parallel, if not identical, instead of being antagonistic.

"For instance, the demand on the part of the public for additional public service, such as gas, electric light and power, traction, etc., has more than doubled in this country during the past decade, and those most intimately conversant with the business expect that it will more than double on its present volume during the coming decade. But when the public demands more service, it means that more plant and distributing lines have got to be provided to furnish that service. This means that additional capital has got to be induced to invest in the business to furnish this additional equipment.

"The deepest students of the public utility situation today recognize that probably its most important problem is that of obtaining this additional capital at as reasonable terms as possible. For the gas, electric light and traction business of the United States, the present estimates are that this additional capital required amounts to about $1,200,000,000 per annum, or $4,000,000 per working day of new capital required during the next five years; incidentally, an amount equal to or greater than the total new capital requirements of all the railroads of the United States.

"The more advanced public service commissions and other students of this situation have for some time recognized that it is vastly more important in the interest of the public that the public service corporations get this additional capital required at as reasonable interest rates as possible than that the present rates for gas or electric light or traction service be reduced to their bare bone minimum, or that the capital situation of any public utility be standardized on any particular academic par value basis. They recognize this because they have imagination enough to realize what a tremendous public calamity it would be if the public utility companies were not able, because of overdrastic public regulation, to get ay of this additional capital required to meet the growing demand for service.

"What, for instance, would it mean to this country if from now on no new building could be furnished with electric light, and no new suburb could be served with new electric railways? Such a failure would be a vastly greater public loss than any present immediate public gain by a reduction of 5, 10 or 15% in the present rates for public service. In conclusion, it is obvious that a business which during the past decade has doubled its volume or grown twice as fast as the railroad business of the country has, a business which has maintained its earnings and dividends during the recent years of general depression, and which has such prospects of additional public demands for additional public service, is not only in a healthy internal condition, but is in the peculiar condition where the interests of the public in the immediate future will be best served by the continuance of this reasonable business prosperity, enabling the public utility operators to get the necessary moneys to keep their facilities up to public demands."

Aerial Tramway—A Spanish company, incorporated at Bilboa, Spain, with Canadian headquarters in Toronto, has obtained concessions from the Niagara Falls Power Commission to construct and operate an aërial tramway across the whirlpool rapids at Niagara Falls. The span across the gorge will be 1180 ft., the longest of its kind in the world, and will be utilized for passenger traffic. The car will be suspended by six huge cables The company already operates a similar tramway at San Sebastian, Spain.

DYKE, WINNIPEG, MAN.

Greater Winnipeg Water District

	A	B	C	D	E	F	G	H	I
7000 cu.yd. stripping	$0.30	$0.65	$0.20	$0.60	$0.75	$0.25	$0.50	$0.43	$0.60
233,100 cu.yd. material in dyke	0.27½	0.33	0.37	0.40	0.40	0.16	0.35	0.43	0.35
5200 cu.yd. dressing	0.50	0.33	0.45	0.90	0.80	0.50	0.85	1.00	0.40
10,300 cu.yd. rip-rap in place over slope	2.40	2.00	1.26	2.50	2.00	2.00	2.50	3.25	2.05
7500 cu.yd. rip-rap in place over brush	2.60	2.00	1.47	2.50	2.00	1.75	2.25	3.25	2.05
1280 sqs. of 100 sq.ft. brush mattress in place	4.10	3.75	2.50	2.00	10.00	3.00	1.50		4.50
5000 cu.yd. material excavated and loaded in cars	0.30	0.33	0.25	0.40	0.25	0.30	0.40	0.20	0.20
2000 cu.yd. material excavated and reserved	0.30	0.33	0.20	0.40	0.50	0.45	0.40	0.43	0.32
Extended totals	$96,205	$106,099	$104,615	$130,670	$125,500	$134,576	$118,055	$143,778	$110,020

Contracts to Be Let

Bids received until July 28, 1914.

Barge Canal Improvements

STATE OF NEW YORK
OFFICE OF SUPERINTENDENT OF PUBLIC WORKS
Albany, June 29th, 1914.

NOTICE TO CONTRACTORS—

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Tuesday, July 28th, 1914, at which place and hour they will be publicly opened and read, for improving the New York State canals pursuant to the provisions of Chapter 147 of the Laws of 1903, and of the amendments thereto, as follows:

—1—

CONTRACT NO. 119.
Erie Canal—Section 2.

For furnishing and driving a quantity of steel sheet piling, extending the concrete apron and performing all incidental work connected therewith at Movable Dam Five at Rotterdam, N. Y.

Sheets 1 and 2.

—2—

CONTRACT NO. 120.
Erie Canal—Sections 2 and 3.

Reinforcement of the superstructures of the following seven movable dams over the Mohawk River:

Dam 5 at Rotterdam, Station 1662 + 45, Erie canal.
Dam 6 at Cranesville, Station 1987 + 79, Erie canal.
Dam 7 at Amsterdam, Station 2201 + 46, Erie canal.
Dam 8 at Tribes Hill, Station 2413 + 17, Erie canal.
Dam 9 at Yosts, Station 2954 + 61, Erie canal.
Dam 10 at Canajoharie, Station 3270 + 50, Erie canal.
Dam 11 at Fort Plain, Station 3553 + 85, Erie canal.

Sheets 1 to 15 inclusive.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, [illegible] Exchange, Buffalo, N. Y.

Copies of [illegible] plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment [illegible] of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the City of Albany or New York, issued by a [illegible] state bank [illegible] within the state and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

[illegible]

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned, the interests of the State will be enhanced thereby.

DUNCAN W. PECK,
Superintendent of Public Works.

Bids received until Aug. 8, 1914.

Power House, etc.

NOTICE TO CONTRACTORS.—Sealed proposals for construction of Power House, including boiler plant piping and conduits, plumbing and electric work; construction, heating, plumbing and electric work for five cottages and dormitory; sewerage and sewage disposal plant and water supply works for the New York State School of Agriculture on Long Island near Farmingdale, N. Y., will be received by Dr. Franklin W. Hooper, Secretary of the Board of Trustees, 30 Lafayette Avenue, Brooklyn, N. Y., until 10 o'clock a.m. on Saturday, August 8, 1914, when they will be opened and read publicly. Bids will be received for each division of the work separately and no combination of bids will be considered. Proposals shall be submitted on the blank form and in sealed envelope addressed to the Secretary, furnished by the State Architect. This envelope shall also contain certified check in the sum of [illegible] of the amount of bid. Each contractor to whom an award is made will be required to furnish surety company bond in the sum of 50% of the amount of contract within thirty (30) days after official notice of award of contract and in accordance with the terms of specifications Nos. [illegible] The right is reserved to reject any or all bids. Drawings and specifications may be consulted and blank forms of proposal obtained at the office of Dr. Franklin W. Hooper, 30 Lafayette Avenue, Brooklyn, N. Y., at the office of Mr. A. A. Johnson, Director, Farmingdale, N. Y., and at the office of the State Architect. In applying for plans and specifications, each bidder must state which part of the work, such as construction, heating, plumbing and electric work, he intends to bid [illegible]

LEWIS F. PILCHER, State Architect.

Contractors

[illegible]

PUBLIC SERVICE COMMISSION FOR THE FIRST DISTRICT
[illegible] New York City.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

MORE TANGIBLE THAN "SUNSHINE"

Exceedingly optimistic is a circular letter sent out by J. G. White Engineering Corporation to the heads of public service corporations. The letter says in part:

"We believe that for some time past the design and construction of many projects have been deferred because of a feeling that general business conditions did not warant proceeding actively with them.

"But it is well worth considering, particularly at this time, the more important prospects of the immediate future:

"We are apparently assured of a splendid crop return.

"It is announced that before the close of the present Congressional session the Federal legislative programme for stabilizing business will have been completed.

"It is generally conceded that currency reform was of material benefit and that its effects should promptly follow the organization period of the Federal Reserve Board.

"The possibility of war with Mexico seems daily to become more remote.

"These considerations lead obviously to the conclusion that the general outlook is decidedly favorable.

"With this in mind we believed that it would be well to secure the advantages of present market conditions and apply them to construction projects which have been under previous consideration. We are convinced that the price of materials and of labor is much lower today than can reasonably be expected when business activity is quickened.

"We believe that right now is an exceptionally opportune time to go ahead with many deferred construction projects. If the work is new development there is a distinct advantage to be gained from being prepared to supply demand as soon as it occurs, instead of later on when the market may be 'stale' or else unprofitably competitive. If the work is extension or rehabilitation there should be prompt willingness under normal business conditions to furnish added or better service."

ADVANCING PRICES

The American Steel & Wire Co. advanced prices on wire products $1 per ton July 20. Several of the Independent manufacturers have already followed with similar advances.

Cement prices are 5c. per bbl. higher in the Middle West. The new prices per barrel in bulk are as follows. Chicago, $1.17; Minneapolis, $1.40; Pittsburgh, $1.15; Duluth, $1,38; Detroit, $1.24; St. Paul, $1.40; Cleveland, $1.35.

RAILWAYS

Pennsylvania—Pennsylvania R.R.—This company plans to eliminate its tracks in West Chester, Wilkinsburg and Edgewood, Penn. A. C. Shand, Philadelphia, Penn., is Ch. Engr.

Pennsylvania—Pittsburgh & Eastern R.R.—This company, it is reported, plans to construct its proposed extension from Towanda, Penn., to Oregon Hill, Penn. The offices of the company are located at Pittsburgh.

✚Virginia—Southern Ry.—This company has awarded the contract to ROBERT RUSSELL, Danville, Va., for constructing its proposed double-track line between Danville and Dry Fork, Va. The work calls for a bridge across Dan River.

South Carolina—The Chamber of Commerce of Rock Hill, S. C., is interested in the construction of a railroad from Rock Hill to connect with the Seaboard Air Line Ry. C. W. Roberts is Secy.

Georgia—Register & Glenville R.R.—This company is having surveys made for its proposed extension to Statesboro, Ga. B. K. Willingham, Hagan, Ga., is Supt.

Georgia—Moultrie Southwestern Ry.—This company has applied for a charter to construct a line from Moultrie, Ga, southwest to the Florida state line. It will pass through Colquitt, Mitchell, Grady and Decatur Counties. W. E. Ayrock, Moultrie, is interested.

Florida—Atlantic Coast Line R.R.—This company plans to extend its Carpenter-O'Brien Branch to Fort George Island. E. B. Pleasants, Wilmington, N. C., is Ch. Engr.

Florida—Export Phosphate Ry. & Terminal Co.—This company has been organized to construct a railway 50 miles long from the plant of the Export Phosphate Co., at Mulberry, Fla., to a phosphate drying plant near Tampa, Fla.

Florida—See item under Miscellaneous: Dock and Railroad Bonds—Pensacola, Fla.

Alabama—Illinois Central R.R.—This company is having surveys made for its proposed extension from Jackson, Miss., to Birmingham, Ala., about 200 miles. A. S. Baldwin, Chicago, Ill., is Ch. Engr.

Mississippi—Illinois Central R.R.—See item under Alabama.

Kentucky—Chesapeake & Ohio Ry.—This company has filed amended articles of incorporation providing for an extension from a point in Kentucky opposite Wheelersburg, Scioto County, Ohio, through the state of Ohio for a distance of 95 miles. The general office of the company is in Richmond, Va. F. L. Cabell is Ch. Engr.

Ohio—Chesapeake & Ohio Ry.—See item under Kentucky.

Wisconsin—Chicago & Northwestern Ry.—This company, it is reported, plans to construct an extension from Kolpenick, Wis., to Pearson, Wis. E. C. Carter, Chicago, Ill., is Ch. Engr.

Montana—Chicago, Milwaukee & St. Paul Ry.—This company plans to construct an extension soon from Great Falls, Mont., through the Cœur d'Alene District. C. F. Laneth. Chicago, Ill., is Ch. Engr.

✚Montana—Great Northern Ry.—This company has awarded the contract to GUTHRIE, McDOUGALL & CO., Portland, Ore., for work at Paola, Mont., to cost $250,000.

Missouri—Surveys are being made for the proposed railroad from Springfield, Mo., to Mountain Home, Ark., about 100 miles. E. C. McAfee, Springfield, is interested.

Texas—Bartlett Western Ry.—This company plans to improve its lines. T. E. Fowler, Bartlett, Tex., is Ch. Engr.

Delta Land & Lumber Co.—This company plans to construct a railroad 15 miles long from Conroe, Tex., to its timber lands. I. H. Fetty, Kansas City, Mo., is Gen. Mgr.

Texas—A standard gage railroad will be constructed between Brownsville, Tex., and Point Isabel, Tex. The Southwestern Engineering Co., Gunter Bldg., San Antonio, Tex., is in charge of the engineering work.

Texas—San Antonio, Uvalde & Gulf R.R.—The State Railroad Commission, July 10, approved an issue by this company of $750,000 in bonds for proposed extensions. E. R. Braker, San Antonio, Tex., is Ch. Engr.

Oklahoma—Clinton, Oklahoma & Western Ry.—This company has beeen purchased by Frank Kell, Wichita Falls, Tex. It is reported that an extension will be built to Chickasha.

Arizona—Mascott & Western Ry.—This company has been incorporated for the purpose of constructing an 18-mile railroad from Wilcox, Ariz., to the mines of the Mascott Copper Co. at Dos Cabezas. The incorporators are F. N. McCauler, D. S. Stevenson, Chas. V. Weston, J. A. Street, J. C. Knapp, C. M. Stoddard and M. A. Pickett. all of whom are identified with the Mascott Copper Co.

Oregon—Sutherlin, Coos Bay & Eastern Ry.—Contracts will probably be awarded soon by this company for constructing its proposed line from Sutherlin, Ore., east to the head of Calapooia River, about 27 miles. H. D. Haley, Sutherlin, Ore., is Engr.-in-Charge.

East Oregon Lumber Co.—This company is having surveys made for its proposed railroad from Enterprise, Ore., north. J. C. Edsall, Enterprise ,is Engr.-in-Charge.

Southern Pacific Co.—This company plans to reballast its line from Portland, Ore., to Springfield Junction, Ore. Estimated cost, about $150,000. W. Hood, San Francisco, Calif., is Ch. Engr.

California—Yosemite Valley R.R.—This company, operating 78 miles of railroad, plans to repair its roadbed. G. H. Nickerson, Merced, Calif., is Ch. Engr.

California—Richmond Belt Ry.—This company has filed articles of incorporation at Martinez, Calif. The company plans to construct a line from San Pablo Wharf to Richmond, Calif. Capital, $500,000. The directors are W. S. Terrs, Clinton Warden, H. A. Wakefield, J. V. de Laveage and Horace Pillsbury.

ELECTRIC RAILWAYS

Augusta, Maine—The Lewiston, Augusta & Waterville Street Ry. Co. plans to extend its lines in Augusta. Harry B. Ivers, Portland, is Gen. Mgr. and Pur. Agt.

Worcester, Mass.—Plans are being considered by the Worcester Consolidated Street Ry. Co. for the extension of its June St. line and for relocating its tracks on Pleasant St. H. C. Page, Worcester, is Gen. Mgr.

✚Milldale, Conn.—The Waterbury & Milldale Tramway Co. has awarded a contract to CHARLES A. BIANCI, South Framingham, Mass., for the grading and track laying on the final section of five miles from Hitchcock's Lake to Milldale. John H. Cassidy, 144 Bank St. ,Waterbury, is Secy. and Gen. Mgr. William G. Smith, 51 Leavenworth St., Waterbury, is Const. Engr. Noted Aug. 7, 1913, and Feb. 5, 1914.

New York, N. Y.—The Union Ry. Co. has purchased franchises for the construction of an electric railway from City Island Station to Belden Point. The company plans to start work at once. James Carrigan, Boston Road and 176th St., is Gen. Supt.

Port Jervis, N. Y.—Preliminary steps are being taken by the Port Jervis Light & Power Co. for the establishment of an electric railway from Port Jervis, N. Y., to Delaware Water Gap, Penn. D. R. Thomas, Port Jervis, is Vice-Pres. and Gen. Mgr.

New Castle, Penn.—The City Council has granted a franchise to the New Castle Electric Street Ry. Co. to extend some of its lines in New Castle.

New Hope, Penn.—The Bucks County Interurban Ry Co is making surveys for the extension of its system on North Main St. Gaylord Thompson, Trenton, N. J., is Vice-Pres. and Gen. Mgr. Noted May 28.

Wilmington, Del.—Plans are being prepared by the Wilmington & Philadelphia Traction Co. for the extension of

[illegible] Concord Ave. William A. Heindle, [illegible]

Brunswick, Md.—[illegible] arrangements are being [illegible] to connect Brunswick [illegible] Jefferson. Oscar B. Coblentz, Frederick, [illegible] May 7.

Blacksville, W. Va.—The Morgantown & Wheeling Ry. [illegible] the extension of its lines through Blacksville [illegible] Morgantown, is Gen. Mgr. and Pur. Agt.

Morgantown, W. Va.—The South Morgantown Traction Co. [illegible] extending its line to Fairmont, about 16 miles [illegible] Morgantown, is Secy.

Akron, Ohio.—Plans are being prepared by the Northern [illegible] Traction & Light Co. for extending several of its lines [illegible] Akron, is Pur. Agt.

Cleveland, Ohio.—The Cleveland Ry. Co. contemplates the [illegible] of a crosstown line on [illegible] St. from [illegible] to [illegible] Ave. George L. Radcliffe, Cleveland, is Gen. Mgr.

Sandusky, Ohio.—Charles Newell, Sandusky, is interested in the construction of a street car line on Monroe St. The [illegible] work will soon be started.

Toledo, Ohio.—The County Commissioners have granted a [illegible] to Charles Newell, Sandusky, and Philip S. Willis, Toledo, to construct and operate an electric railway from [illegible] to Willis Ave., about two miles.

Youngstown, Ohio.—Plans are being considered by the [illegible] & [illegible] Ry. & Light Co. for the extension of its line to West Austintown, about five miles. J. F. Wessel, Youngstown, is Gen. Mgr.

Linton, Ind.—The Coal Belt Traction Co. has been organized to construct an electric railway in Linton. Joseph Moss, George A. [illegible] and D. R. Scott are interested.

Lansing, Mich.—The Lansing Connecting Ry. Co. has been [illegible] to construct an electric railway in Lansing. [illegible] Hutchinson is Secy.

Chicago, Ill.—Plans are being considered by the Chicago [illegible] Co. for the extension of its lines on North Ave. and [illegible] St., about 1½ miles. Williston Fish, Chicago, is Gen. Mgr.

Ottawa, Ill.—The La Salle County Electric Ry. Co. is considering plans for the construction of an electric railway from Ottawa to Mendota.

✦Madison, Wis.—The Janesville & Madison Traction Co. has awarded a contract to M. M. DORAN, Madison, for grading the second division of the route for the proposed [illegible] line, consisting of the section between Edgerton and [illegible], Wis. Walter H. Sacket is Engr. Noted June 16.

Mitchell, S. D.—[illegible] Classem, Mitchell, has applied to the [illegible] for a franchise to construct a four-mile electric railway in the northern section of Mitchell.

Mandan, N. D.—According to press reports, plans are being [illegible] for the construction of an electric railway from [illegible] to Mandan.

Williston, N. D.—The Williston & Northern Electric Ry. Co. is preparing plans for the extension of its electric railway from Williston to [illegible].

Dallas, Tex.—John T. Jones and associates have filed a petition with the City Commission for a franchise for the construction of an electric railway from Kentucky St. to [illegible] Ave., [illegible] Ave., Carroll Ave. and Brooks St.

San Marcos, Tex.—The San Marcos Interurban Ry. Co., [illegible], will construct an electric interurban railway [illegible] San Marcos and vicinity. [illegible] C. Merritt is interested.

Port Townsend, Wash.—The City Council has granted a [illegible] to C. J. Erickson to construct an electric railway [illegible] Port Townsend and to connect with the Milwaukee system at Port Angeles.

South Bend, Wash.—The Willapa Electric Co. contemplates the reconstruction of its electric railway in South Bend from Water St. to Knob Mill. R. L. Fisher, Raymond, is Secy., Gen. Mgr. and Pur. Agt.

Lindsay, Calif.—The City Council has granted a franchise to [illegible] to construct and operate an electric railway in Lindsay.

Ocean Beach, Calif.—The Bay Shore Ry. Co. has been granted a franchise to construct an electric railway from Ocean Beach to [illegible]. Noted July 2.

Pomona, Calif.—The City Council has granted a franchise to the Pacific Electric Ry. Co. to construct and operate an electric railway from [illegible] to North Pomona. J. M. [illegible], Los Angeles, is Gen. Mgr.

Sacramento, Calif.—The Northern Electric Ry. Co. [illegible] expenditure of $[illegible] for the improvement of [illegible] from Sacramento to Chico. [illegible], San Francisco, is Pres.

Stockton, Calif.—The Stockton Electric Ry. Co. [illegible] the extension of its lines [illegible] San Francisco, is Gen. Mgr. [illegible]

Toronto, Ont.—The Ontario Railway Board has [illegible] the Toronto Ry. Co. to extend its line from [illegible] to [illegible]. R. J. Fleming, Toronto, is Gen. Mgr.

LIGHT, HEAT AND POWER

Amherst, Mass.—The [illegible] will construct a power plant [illegible] Amherst & Sunderland [illegible]. [illegible] is Gen. Mgr.

Gorham, Mass.—[illegible]

Greenfield, Mass.—The Greenfield Electric Light & Power Co. is preparing to extend its transmission line from [illegible] Falls to Shelburne Center and East Shelburne. G. W. Lawrence, Greenfield, is Mgr. and Supt.

West Springfield, Mass.—The Ramapogue Ice Co. will build a new dam and power house on the Westfield River.

Hotchkissville (North Woodbury Post Office), Conn.—The American Shear & Knife Co. contemplates the construction of a dam on the Pomperang River, from which power will be developed to run its factory at Hotchkissville. R. A. Clark is Pres.

New London, Conn.—Plans are being prepared by Ewing & Chappell, 101 Park Ave., New York, N. Y., for a central heat, light and power plant on Mohegan Ave. for the Connecticut College for Women.

✦Bedford Hills, N. Y.—(Official.)—Bids will be received by James Wood, Pres. Bd. of Mgrs., for a piping and conduit system for the new boiler plant at the New York State Reformatory for Women. Lewis F. Pilcher, Albany, is State Arch.

✦Farmingdale, N. Y.—(Official.)—Bids will be received by Franklin W. Hooper, Secy. Bd. of Trustees, 3[illegible] Lafayette Ave., Borough of Brooklyn, until 10 a.m., Aug. [illegible], for the construction of a power house for the New York State School of Agriculture, near Farmingdale. Lewis Pilcher, Albany, is State Arch.

✦Port Jervis, N. Y.—According to press reports, the Port Jervis Light & Power Co. has awarded a contract for the construction of a power dam to the GEORGE F. RAWLINS CO., Philadelphia, Penn., at about $10[illegible].

Waterloo, N. Y.—The Tracy Development Co. is making preliminary arrangements for the construction of a power plant at Waterloo. E. K. Baldwin is Secy.

✦Newark, N. J.—The Public Service Electric Co. has awarded a contract for the construction of a power plant at Point-No-Point, on the Passaic River, to the LINDE & GRIFFITH CO., Newark. Estimated cost, $1[illegible]. Noted July 2.

Paterson, N. J.—The Society of Useful Manufacturers has had plans prepared for a steam turbine power plant to be constructed at the Paterson Falls basin. The plant is estimated to cost $75,000.

✦Callensburg, Penn.—According to press reports, the Clarion River Power Co. has awarded a contract for the construction of three dams on the Clarion River to W. C. CHURCH, New York, N. Y. The first dam will be built near Callensburg. C. C. Crick, Kittanning, is Engr.-in-Charge of the power company. Noted June 11.

✦Tarentum, Penn.—The Borough Council has awarded a contract to J. W. WELSH, Pittsburgh, for the construction of a reinforced concrete power house. Noted June 2[illegible].

✦Venice, Penn.—The Pittsburgh Coal Co. has awarded a contract to D. T. RIFFLE, at about $[illegible], for the construction of two power plants at the Montour Mines, Nos. 1 and 2, near Venice.

✦Easton, Md.—The contract for the construction of a municipal electric-light plant has been awarded to the WILSON-MALTMAN CO., Baltimore, at $[illegible]. Noted June 11.

Winston-Salem, N. C.—According to press reports, bids will soon be received for the construction of a municipal electric-light plant. Bonds have been voted for the purpose. J. V. Turner is City Clk. Noted Apr. 2[illegible].

Atlanta, Ga.—The Georgia School of Technology will construct a power plant of reinforced concrete, steel and brick, to cost $2[illegible],000.

Canton, Ga.—Bonds for $[illegible] have been voted, the proceeds of which will be used for the construction of a municipal electric-light plant.

Olive Hill, Ky.—The [illegible] Electric Co. has been incorporated with a capital stock of $[illegible], and will establish an electric-lighting system and ice plant.

✦Cleveland, Ohio.—The contract for the construction of a new [illegible]-story, [illegible] ft. power plant at West [illegible] St. and Madison Ave., for the [illegible] Co., Cleveland, has been awarded the McCLINTIC-MARSHALL CO. Ernest McGeorge, [illegible] News Bldg., is the Arch.

Munising, Mich.—The Munising [illegible] Light & Power Co. is making preliminary arrangements to start work soon on the construction of its proposed new power plant.

Latrobe, Wis.—Plans are being prepared by the Wisconsin-Minnesota Light & Power Co. for the construction of a transmission line from Cedar Falls and Chippewa Falls to [illegible].

Aurelia, Iowa.—The construction of an electric-light plant at Aurelia is under consideration.

Denison, Iowa.—The city is making preliminary arrangements to start work soon on the improvement of the electric-light plant which was recently acquired. [illegible] is Supt. of the plant. Noted [illegible].

Des Moines, Iowa.—The Des Moines Electric Co. is making preliminary arrangements for the extension and improvement of its power plant on the river front to cost $[illegible]. W. O. [illegible], Des Moines, is Gen. Mgr.

Lyons, Iowa.—At a special election the citizens voted to issue bonds for the construction of a municipal electric-light plant.

Hastings, Minn.—The River Falls Power Co. has been granted permission by the Wisconsin Railroad Commission to issue bonds for $[illegible], the proceeds of which will be used for the construction of a transmission line from Hastings to River Falls. [illegible] is Pres.

Ladora, Iowa.—The Commercial Club is considering plans for the installation of an electric-light plant.

Thompson, Mont.—The [illegible] Power Co. has been incorporated by [illegible] and Andrew [illegible], all of this city, with a capitalization of $[illegible]. The company is [illegible] and will develop [illegible] water

power sites between this city and the Montana-Idaho Interstate line, on the Clark's Fork of the Columbia River. Announcement has been made that three power plants will be constructed, one near Belknap, another near the town of Front, and a third at Cabinet Gorge; it is reported a crew of engineers are already in the field making preliminary surveys for the work.

Drexel, Mo.—A. J. Steele, Adrian, has applied to the Council for permission to extend the transmission line from Adrian to Drexel.

Pilot Grove, Mo.—The construction of an electric-light plant at Pilot Grove is under consideration.

Cisco, Tex.—The Cisco Gas & Electric Co. has been organized for the purpose of constructing an electric-light plant at Cisco. The incorporators are W. S. Michael, G. G. Ward and W. H. Tebbs.

Gonzales, Tex.—The Gonzales Water Power Co., Austin, Tex., will construct a reinforced concrete dam across the Guadalupe River at Gonzales, to provide for a reservoir and hydro-electric plant to develop 100,000 hp., and to cost about $8,000,000.

Houston, Tex.—The Texas Southern Electric Power Co. has been incorporated to construct a power plant at Houston. The incorporators are Edwin B. Parker, Raymond Neilson and C. L. Carter.

Okemah, Okla.—The Canadian Power & Light Co., plans to construct a hydro-electric plant to develop 2000 hp. on North Canadian River, to cost about $500,00.

Aberdeen, Wash.—The Aberdeen Natural Gas Co., Inc. is planning to construct a gas plant in Aberdeen. Louis Burnett and Samuel Bean are interested.

Auburn, Wash.—The Auburn Gas Co. is preparing to install a gas distributing system.

Kalama, Wash.—The city is having estimates prepared for the construction of a semi-municipal light and power plant. The city to purchase power from some company other than the Washington-Oregon Corporation, and construct a city owned distributing plant.

Republic, Wash.—The County Commissioners have granted a franchise to Mahlon McCain and Fred M. Shields, to construct and operate transmission lines on various roads in Ferry County.

Seattle, Wash.—The City Council has passed an ordinance appropriating $125,000 to complete the first unit of the auxiliary steam plant that will cost $425,000. A. H. Dimock is City Engr.

Glendale, Ore.—The Oregon-California Electric Co. will extend the line from Glendale to Riddle and surrounding country, a distance of about 20 miles.

✚Portland, Ore.—The Portland Gas & Coke Co. has awarded a contract for the construction of a gasholder at Milwaukee and Clinton Sts. to the CAMDEN IRON WORKS, Camden, N. J., at approximately $30,000.

Oakland, Calif.—The Pacific Gas & Electric Co. plans to construct a new boiler house at First and Market streets. John A. Brittain, 445 Sutter St., San Francisco, is Gen. Mgr.

BRIDGES

Lawrence, Mass.—The State Senate has passed the bill authorizing the city of Lawrence to expend $800,000 for the construction of a bridge over the Merrimac River, in the central part of the city. The new bill takes the place of an old one which authorized the expenditure of $500,000. An additional expenditure of $300,000 is authorized under the present bill.

Barkhamstead (Pleasant Valley post office), **Conn.**—An appropriation of $35,000 has been voted by this town to rebuild the bridge over a branch of the Farmington River. Delos O. Hart is First Selectman.

Shelton, Conn.—The towns of Huntington and Stratford have each made an appropriation of $5000 for the construction of a concrete bridge over Far Mill River. Edward R. Allen is First Selectman of Huntington. Rollin A. Curtiss is First Selectman, of Stratford.

Lestershire, N. Y.—The taxpayers have voted in favor of constructing a bridge over Choconut Creek at West Main St. Estimated cost, about $5000.

Leyden, N. Y.—The citizens have voted in favor of issuing $6000 in bonds to construct a concrete arch bridge over the Sugar River.

✚New York, N. Y.—(Borough of Bronx)—The Department of Bridges, Borough of Manhattan, has awarded the contract to the RIVERSIDE CONTRACTING CO., 39 Cortlandt St., New York, for constructing Unionport Bridge, over Westchester Creek, at $9616. Noted June 18.

Oswego, N. Y.—The Town Boards of Oswego and Volney, N. Y., have voted in favor of constructing a bridge over the Oswego River at Oswego. E. A. Howard, Oswego, is County Supt. of Highways.

Camden, N. J.—See item under Miscellaneous: Elimination of Grade Crossing—Camden, N. J.

Keyport, N. J.—The Jersey Central Traction Co. and the Board of Chosen Freeholders will jointly construct a new bridge over Matawan Creek at West Keyport. The structure will be about 60 ft. wide, and will include a lift span.

✚Rahway, N. J.—The Board of Chosen Freeholders has awarded the contract for the construction of a reinforced-concrete, arch bridge over the Rahway River at St. George Ave. to the J. F. SHANLEY CO., Newark, N. J., at $18,167.

Doylestown, Penn.—The County Commissioners have approved plans for a reinforced concrete bridge over Iron Works Creek, Northampton, Township.

✚Guthsville, Penn.—The County Commissioners have awarded the contract to GEORGE H. HARDNER, Allentown, Penn., for constructing a concrete bridge over the Jordan River at Guthsville. Bids were opened July 9.

Nanticoke, Penn.—Bids were received, June 26, by F. R. Hendershot, County Controller, Wilkes-Barre, Penn., for constructing the proposed bridge between Nanticoke and West Nanticoke, over the north branch of the Susquehanna River. The bids follow: Penn Bridge Co., Beaver Falls, Penn., $323,000; Lathrop, Shea & Henwood, Scranton, Penn., $255,200; Thomas Sheehan, Hagerstown, Md., $347,051; Pennsylvania Steel Co., Steelton, $287,750; James McLinden & Co., Anglesea, N. J., $329,200; Whittaker & Deihl, Harrisburg, $292,000; C. H. Reimand, Bloomsburg, $299,500; D. M. Rosser, Kingston, $294,320. Noted June 25.

Somerset, Penn.—(Official)—Bids will be received until noon, July 30, by the County Commissioners, Somerset, for constructing six bridges.

Yukon, Penn.—Sewickley Township will erect a bridge over Little Sewickley Creek, near Yukon. Estimated cost, $5000.

Wilkes-Barre, Penn.—Plans have been submitted to the City and County Commissioners, Wilkes-Barre, for the bridge to be constructed at Market St.

Wilkes-Barre, Penn.—(Official)—Bids were received July 7 by the city for constructing the Butler St. viaduct. The lowest bid was submitted by the C. M. Neeld Construction Co., Pittsburgh, Penn., at $82,788.

Mount Holly, N. C.—The County Commissioners, Mount Holly, have approved plans prepared by the Victoria Bridge & Iron Co., Roanoke, Va., for the proposed bridge over the Catawba River. Estimated cost, $20,000. Noted July 9.

Winston-Salem, N. C.—The Forsyth County Commissioners, Winson-Salem, in conjunction with the Yadkin County Commissioners, plan to construct a steel bridge north of Conrad's Ferry. Estimated cost, $25,000.

Bowman, Ga.—(Official)—Bids will be received until Aug. 24 by the County Commissioners of Elbert and Madison Counties for the construction of a steel bridge to have three 80-ft. spans, and four piers and two abutments requiring 400 cu.yd. of concrete. The contract will be awarded at the bridge site at noon, on Aug. 24. Plans and specifications are on file at the office of the Good Roads Department, University of Georgia, Athens, Ga. Searcy B. Slack, Engr.

Fort Lauderdale, Fla.—The Dade County Commissioners, Miami, plan to construct a steel rolling lift bridge over the New River at Fort Lauderdale. It will be 170 ft. long. Estimated cost, $15,000.

Birmingham, Ala.—Bids will be received until July 25, by W. H. Courtenay, Ch. Engr., Louisville & Nashville R.R., Louisville, Ky., for the construction of a reinforced concrete viaduct on First Ave. from 26th St. to 32d St., Birmingham. Estimated cost, $350,000.

Lyons, Ala.—The County Commissioners, Lyons, have had plans prepared for the concrete bridge to be constructed over the Altamaba River. It will be 506 ft. long.

New Orleans, La.—The city opened bids, July 13, for constructing a lift bridge over the Old Basin at Broad St. The bids follow: Blodgett Construction Co., $30,990; Modern Steel Structural Co., $31,400; Penn Bridge Co., Beaver Falls, Penn., $26,800; Sterling Engineering Co., $25,985; Midland Bridge Co., $27,779. Bids were opened July 9.

✚Shreveport, La.—The contract has been awarded by the parish to the BLODGETT CONSTRUCTION CO., Kansas City, Mo., for the construction of a steel drawbridge across Twelve Mile Bayon, five miles north of Shreveport. J. T. Bullen is Parish Engr.

Memphis, Tenn.—Bids were received, July 7, by the Board of City Commissioners for constructing a reinforced concrete culvert across Front St. and the main outfall for Bayou Gayoso, as follows: Koehler Bros. and Fowler Co., $29,363; G. O. White, Memphis, $25,085; Thomas Harmon and Hickey Bros., $39,321; Noll Construction Co., $37,700. This work is in connection with the North Memphis Levee Project.

Rotherwood, Tenn.—The Sullivan County Court, Bristol, Tenn., July 6, appropriated $5000 for the construction of a steel bridge over the river at Rotherwood, on the Hawkins County line.

✚Sevierville, Tenn.—(Official)—The Sevier County Road Commissioners, July 17, awarded the contract to the LUTEN BRIDGE CO., Nashville, Tenn., for two concrete bridges, at about $5000. F. G. Phillips is Engr.

Whitesburg, Ky.—Plans are being prepared by the Central Steel & Iron Construction Co., Evansville, Ind., for five steel bridges to be constructed in Letcher County. Noted May 14.

Akron, Ohio—Joseph A. Gehres, City Engr., has estimated the cost of repairing the Mill St. Viaduct, at $6000.

✚Columbus, Ohio—The contract has been awarded to the CAPITOL CONSTRUCTION CO., Columbus, for flooring the Dodridge St. Bridge, at about $5000.

Fremont, Ohio—William Schepflin, County Surv, Fremont, hs completed plans for the Tindall Bridge, over the Sandusky River, south of Fremont. It will be 350 ft. long. Noted May 7.

Hamilton, Ohio—Bids are being received by the County Auditor, Hamilton, Ohio, for constructing a steel or concrete bridge over the Miami River at Woodsdale.

Lima, Ohio—The City Council has approved plans by Chester & Fleming, Engrs., Pittsburgh, Penn., for the bridge to be constructed at Pine St. Estimated cost, $30,000. Noted July 9.

Mount Gilead, Ohio—Bids will be received until noon, Aug. 7, by C. O. Higgins, County Audr., Mount Gilead, for constructing two bridges, one 108½ ft. long and 16 ft. wide in Chester Township and one 60 ft. long and 16 ft. wide in Washington Township.

✚New Philadelphia, Ohio—(Official)—Bids were received, July 13, by R. H. Missdorfer, County Audr., New Philadelphia, for constructing the 100-ft. concrete arch bridge at Welling's Crossing. Contracts have been awarded as follows: Superstructure, including floor, to the MASSILLON BRIDGE CO.,

[illegible] at [illegible] substructure to M WARDWELL, at [illegible] per cu yd for wet excavation; [illegible] per cu yd for [illegible] for [illegible] and [illegible] for embankment Noted June 18.

Salem, Ohio—The county [illegible] to construct bridges in [illegible], Fairview and Salem Townships, along the route of the [illegible] to be known as Governor Cox Main Market [illegible] No. 14.

Sciotoville, Ohio—The Chesapeake & Ohio Ry Co has [illegible] Sciotoville as the site for its proposed bridge across the Ohio River.

Boonville, Ind.—The County Commissioners, July 8, rejected all bids for the construction of 15 steel bridges in Warrick County. The lowest bid submitted was that of [illegible], Boonville, at [illegible]. Noted June 25.

New bids will be received by the County Commissioners, [illegible], until Aug. 4.

Elkhart, Ind.—The County Council, Goshen, Ind., has appropriated [illegible] for repairs to the North Main St Bridge in Elkhart.

+Indianapolis, Ind.—Bids were opened, July 10, by the County Commissioners for constructing the West Washington St Bridge. The contract has been awarded to the NATIONAL CONCRETE CO., Indianapolis, at $331,110. Noted July 2.

Macon, Ill.—[illegible], Supt of County Highways, Macon, has completed plans for the proposed county bridge in Maine Township. Estimated cost, [illegible].

Iowa City, Iowa—The Commissioners of Johnson County, [illegible], Iowa, plan to ask for bids soon for the proposed reinforced concrete bridge over the Iowa River at Burlington St, Iowa City. Estimated cost, [illegible]. Noted June 25.

Mason City, Iowa—Bids will be received until July 24 by the County Auditor, Mason City, for constructing a 90-ft. steel highway bridge in Falls Township.

+Coffeyville, Kan.—The County Commissioners have awarded the contract to the WESTERN BRIDGE CO., Harrisonville, Mo., for bridge repairs, at [illegible].

Lindsborg, Kan.—New bids are asked until Aug 12 by J [illegible], County Clk, McPherson, Kan., for constructing the proposed bridge over Smoky Hill River, at Lindsburg. Estimated cost $16,[illegible]. Noted June [illegible].

Independence, Kan.—Bids will be received until noon, July [illegible] by the Montgomery County Commissioners, Independence, for constructing 5[illegible] bridges and culverts. Gerald A. Otwell is County Clk.

Wichita, Kan.—The citizens, Aug 4, will vote on the proposition to issue $15,[illegible] in bonds to construct a concrete bridge between Central and South Riverside Parks. Bert C. Wells is City Engr.

Lexington, Neb.—The County Commissioners of Dawson and [illegible] Counties have rejected bids for the bridge across the Platte River at Lexington, in Dawson County, and for a bridge across the same river at [illegible], Dawson County. Estimated cost of each, $30,000. New bids will be asked. Noted June 11.

North Platte, Neb.—The citizens have voted to issue $12,000 in bonds to aid in the construction of a bridge over the North Platte River.

+Kalispell, Mont.—The county has awarded the contract to the MINNEAPOLIS BRIDGE CO., Minneapolis, for constructing the proposed steel bridge over Cut Bank River, at $[illegible]50.

Independence, Mo.—The County Court July 9, opened bids for the concrete approaches to the bridge on the Blue Ridge [illegible]. The lowest bid was submitted by A D Ludlow, at [illegible]. Noted May 28.

+Springfield, Mo.—The Green County Court, Springfield, has awarded the contract to [illegible] MEEKS for constructing 11 bridges in various parts of the county at $6136.

Denison, Tex.—The citizens have voted to issue $2[illegible],000 in bonds for the purpose of constructing a viaduct across the railroad yards.

Houston, Tex.—Plans are being prepared for the construction of two bridges, one over White Oak Bayou at [illegible] St, and one over Little White Oak Bayou at Wrightwood Ave. Estimated cost, [illegible] each. Frank L. Dormant is City Engr.

Tulsa, Okla.—The Commissioners of Tulsa County plan to [illegible] contracts in August for constructing [illegible] bridges in various parts of the county. Estimated cost, [illegible]. [illegible] is County Engr.

Alpine, Idaho—Bids are being received by the [illegible] Commissioners [illegible] of [illegible] County, Idaho, for constructing the proposed bridge over the south fork of the Snake River at Alpine.

Florence, Ariz.—The Commissioners of Pinal County, [illegible], plan to construct two bridges over the [illegible] River, one [illegible] ft long at [illegible], and one [illegible] ft long at [illegible].

Seattle, Wash.—The citizens have voted to issue bonds for constructing two of the five proposed bridges over Lake Washington Canal. [illegible]

McMinnville, Ore.—Bids will be received until July [illegible] [illegible]

Oregon City, Ore.—[illegible]

+St. Helen, Ore.—The county has awarded the contract [illegible]

Chico, Calif.—[illegible]

+Durham, Calif.—The Board of Supervisors of Butte County, Oroville, has awarded the contract for the construction of the bridge at Durham, Calif., to the CHICO IRON WORKS, Chico, Calif., at $12,[illegible].

Madera, Calif.—The Board of Supervisors of Madera County has adopted plans for nine steel and concrete bridges. Leonard & Day, Rialto Bldg., San Francisco, and Post & Thomas, Los Angeles, are Engs.

Marysville, Calif.—C. A. Trow, Engr., Marysville, has completed plans for the proposed bridge to be constructed by Yuba County across the Yuba River. Estimated cost, $125,000. Noted April 23.

Ottawa, Ont.—Bids will be received by the Secretary of the Board of Control until 4 p.m., July 28, for constructing the substructure of Billings Bridge. Archibald Currie is City Engr.

Virden, Man.—Bids will be received by William Whiteford, Sec'y-Treas., Virden, until 6 p.m., July 29, for constructing reinforced concrete bridges on North 14-11-29 and East 1[illegible]-11-29, and one rubble masonry bridge on East 2[illegible]-12-25, in the Rural Municipality of Wallace. Information may be obtained at the Highway Commissioners' office, Parliament Bldg., Winnipeg, Man.

WATER SUPPLY AND IRRIGATION

Amherst, N. H.—A bond issue for $25,000 for the construction of a water system was voted down at a recent election. The town has granted a charter to a company which is being formed for the installation of a water works.

★ Boston, Mass.—(Official)—Bids will be received by the Metropolitan Water and Sewerage Board, 1 Ashburton Pl., until 1.30 p.m., July 27, for constructing a steel tank [illegible] ft. in diameter and 11 ft. 3 in. high. Dexter Brackett is Ch. Engr. Noted July 9.

+Boston, Mass.—The contract for laying 7000 ft of 30-in. water main in Columbus Ave has been awarded by the Public Works Department to M DeSISTO, at $1[illegible],471. Other bidders: William Barrett Co, $18,[illegible]; Charles J Jacobs Co., $18,260; M Russo & Son, $1[illegible],21[illegible]; Anthony Baraffaldi, $1[illegible],311; Charles M Callahan, $20,150; M H Kelley, $[illegible]; Northern Construction Co., $23,117; John T Shea, Jr, $[illegible]; Caruso & Bruni, $2[illegible],327; John H Broderick, $[illegible],617; Hugh Nawn Contracting Co, $[illegible],675. Bids opened July 1[illegible]. L. K. Rourke is Comr of Pub Wks. Noted July 9.

(Official) Bids will be received by the Metropolitan Water and Sewerage Board until 1.30 p.m., July 27, for laying 12,000 ft of 24-in. c.i. water pipe in Boston, Quincy and Milton. Henry P. Walcott is Chn.

+Dalton, Mass.—The contract for laying about two miles of 12 and 14-in. water pipe has been awarded to DAVID DWYER, Dalton, at $[illegible]000.

Lenox, Mass.—The Lenox Water Co contemplates building a reservoir below the present one in Richmond. William D. Curtis is Pres.

West Springfield, Mass.—Estimates are being received on plans drawn by Bliss & [illegible], Springfield, for the construction of a dam on the Westfield River for the Ramposse Ice Co. A power house will also be built, in which three turbine water wheels will be set.

New Britain, Conn.—Plans have been prepared by Unkelbach & Perry, 16[illegible] Main St, for the construction of a water system at the plant of Landers, Frary & Clark. A concrete tank with a capacity of 2[illegible]0,000 gal and a brick pump house will be constructed.

★Gilbertsville, N. Y.—(Official)—Bids were received, July 15, by Joseph T Gilbert for constructing a diversion dam, a channel and a pipe line as follows: Bonner & Hamilton, Rochester, $21,[illegible] (low bid); Suburban Engineering Co, New York, $2[illegible]; J D Tuller, Auburn, $[illegible]; [illegible], Hempstead, $[illegible]; [illegible] Snell [illegible], $[illegible]; Oliver Hurst, Fort Hunter, $[illegible]; Charles Kiehm, Utica, $[illegible]; Mason-Hilton Co, New York, $[illegible]; [illegible] Brown-Tay[illegible] Co, New York, $[illegible]; John R Hester, Jr, Utica, $[illegible]; and J W Heller, Newark, N J, $[illegible]. Noted July 9.

Leicestershire, N. Y.—Bonds for the improvement of the water system have been voted by the citizens. S Firestone, Rochester, is the Engr. Noted June 4.

+Harrison, N. J.—The contract for furnishing c.i. water pipe and valves has been awarded to the UNITED STATES CAST IRON PIPE & FOUNDRY CO., New York, N. Y., at $[illegible]. Noted July 2.

Newark, N. J.—The Board of Freeholders has ordered the preparation of plans and specifications for the rebuilding of the filtration beds at the Overbrook Hospital. Noted May 21.

★Hazleton, Penn.—(Official)—Bids will be received by the Borough of [illegible] until [illegible] p.m., July 2[illegible], for laying [illegible] ft of 6-in. c.i. water pipe and [illegible] ft of [illegible] pipe with gates and hydrants. Robert H. [illegible] is Engr.

★Pittsburgh, Penn.—(Official)—Bids will be received by the City Controller, Municipal Hall, until 11 a.m., Aug. 4, for laying c.i. water pipe and appurtenances in the [illegible] section and in the Lawrenceville section. For details see advertisement under "Contracts To Be Let." Robert Swan is Dir., Dept of Pub Wk.

Punxsutawney, Penn.—The City Council will construct a municipal water system. Plans are now being prepared. Noted Apr 2.

+★Greensboro, Md.—The contract for constructing a water system has been awarded by the city to F J JONES & CO., [illegible], Del., at $[illegible]. Bids opened July 9. Noted July 2.

Washington, D. C.—Bids will be received by the District Commissioners until July [illegible] for furnishing [illegible] or more water meters.

Norfolk, Va.—Bids will be received by the Water Department until Aug. 1 for furnishing 5[illegible] meters.

Montgomery, Ala.—The City will soon be in the market for [illegible] of [illegible] water pipe, [illegible] and 15 four-in. [illegible] water [illegible].

★**Memphis, Tenn.**—Meers & Dayton, Dayton, Ohio, were low bidders at $91,976 for constructing a pumping station. Bids were opened July 14. Noted June 25.

Hazel, Ky.—According to press reports, Claude Orr, Crossland, Ky., will install a water system at Hazel.

Akron, Ohio—The low bidder for laying c. i. pipe under Contract No. 56, for which bids were opened July 3, was W. B. Smith, Cleveland, at $12,419. Noted July 2.

Bluffton, Ohio—Improvements will be made to the municipal water system and electric-light plant. The estimated cost is $20,000.

Columbus, Ohio—(Official)—Bids will be received by S. A. Kinnear, Dir. of Pub. Ser., until noon, July 28, for furnishing c. i. valve boxes, and for furnishing c. i. pipe and special castings.

London, Ohio—Bids will be received until July 25 for the construction of a water system for the new Ohio Penitentiary at London. R. Winthrop Pratt, 708 Hippodrome Bldg., Cleveland, is the Engr.

Norwood, Ohio—Bids will be received about Aug. 7 for rebuilding the water works and electric light plant. The estimated cost is $62,000. Plans have been prepared by G. W. Drach, Arch., and Walter G. Franz., Consult. Engr., Cincinnati.

+**Portsmouth, Ohio**—(Official)—Contracts for furnishing c.i. pipe, etc., have been awarded as follows: UNITED STATES CAST IRON PIPE & FOUNDRY CO., at $21.95 per ton on standard pipe, f.o.b. Portsmouth, 2400 ft. 8-in., 3000 ft. 6-in. and 12 ft. 16-in. DARLING PUMP & MANUFACTURING CO., all f.o.b. Portsmouth, one 12-in. bell gate at $30.50, six 8-in. bell gates at $16.90, six 6-in. bell gates at $11.20, and fifteen 4-in. bell gates at $7.20. JAMES B. CLEW & SONS, c.i. specials, 2¾c. per lb., f.o.b. Portsmouth. A. P. SMITH MANUFACTURING CO., four 24x8-in. combination sleeves at $57.20. THE BOURBON COPPER & BRASS CO., 21 hydrants, f.o.b. Portsmouth, at $24. STANDARD SUPPLY CO., 12,000 lb. of pig lead at 4½c., and 24 valve boxes at $2.73; and JAMES B. CLEW & SONS, one 30-in split sleeve, $75; one 24-in. split sleeve, $60; one 30-in. split sleeve, $38, bell piece; one 24-in. split sleeve, $34, bell piece. Bids opened July 9. Noted July 2.

St. Clairsville, Ohio—The installation of a water system is being considered by the City Council.

Grand Rapids, Mich.—John W. Bonnell contemplates installing a water system at Woodcliffe, at an estimated cost of $6000.

Port Huron, Mich.—Bids will be received by the City Clerk, until July 27, for constructing a new compound pumping engine.

Kewanee, Ill.—See item under "Sewers."

Lockport, Ill.—Bids will be received by the City Council until Aug. 3 for constructing a standpipe with a capacity of 100,000 gal.

Morrison, Ill.—Bonds for $8000 for making improvements and extensions to the water system were voted at a recent election.

★**Pekin, Ill.**—(Official)—Bids will be received by the Pekin Water Co., at the office of Alvord & Burdick, Engrs., Hartford Bldg., Chicago, until 10 a.m., Aug. 12, for removing the present steel tank from the supporting stone tower and constructing a new steel tank thereon. W. E. Lautz is Secy.

Woodhull, Ill.—Bids are being received for the extension of the municipal water system and for the construction of a new reservoir.

West Allis, Wis.—Bids will be received by the Board of Public Works until Aug. 12 for laying water mains with hydrants and connections in Worden and 53d Aves.

Albia, Iowa—The Council will construct a 4-in. pipe line from the public highway to Cedar Creek.

Charles City, Iowa—Plans have been prepared by W. S. Beattie for the erection of two pumping stations. The estimated cost is $7500.

Davenport, Iowa—According to press reports, bids are being received for furnishing a 6,000,000-gal. pump for the Rock Island water works plant.

Hinton, Iowa—The installation of a water system to cost $6000 is being considered by the Council.

+**Canton, Minn.**—The contract for installing a water system has been awarded to WILLIAM C. FRASER, Hackney Bldg., St. Paul, Minn., at $8400.

Hibbing, Minn.—Bids will be received by the Water and Light Board until July 28 for reconstructing and overhauling the water and lighting system. The work will cost about $20,000.

Marble, Minn.—See item under "Sewers."

Paynesville, Minn.—The contract has been awarded to the MINNEAPOLIS STEEL & MACHINERY CO., at $4869, for constructing a steel tower and water tank.

Arma, Kan.—(Official)—The citizens voted at a recent election to spend $8000 for extensions to the water system. Albert C. Moore, Bartlett Bldg., Joplin, Mo., is the Engr. Noted July 9.

McCune, Kan.—The city contemplates spending $25,000 for the installation of a water works. W. H. Gracey is City Clk.

+**Topeka, Kan.**—The contract for laying about one mile of four-in. water main has been awarded to GUSTAFSON & CO., at $4381. Noted Apr. 30.

Ansley, Nebr.—(Official)—Bids will be received until noon, Aug. 3, for constructing a pumping station at Ansley for the water works. The Martz Engineering Co., 416 First National Bank, Lincoln, is the Engr.

★**Bennet, Neb.**—Plans are being prepared by the Martz Engineering Co., 416 First National Bank Bldg., Lincoln, for the construction of a water system to cost $10,000.

Clatonia, Neb.—At a recent election the citizens voted to issue $9200 in bonds for the installation of a water system.

+**Herman, Neb.**—(Official)—Contracts for constructing a water system have been awarded to DRAKE WILLIAMS, for the stand pipe; to BRAMHALL & SON, for the pump house, and to the ELKHAM CONSTRUCTION CO. for the pipe line. Bids opened July 6. Noted June 25.

Wayne, Neb.—(Official)—Bids will be received until Aug. 1 by the Chairman of the Finance Committee for $7000 in water works bonds. J. M. Cherry is City Clk.

Winner, S. D.—(Official)—Bids will be received by Claude Maule, City Audr., until July 27, for constructing a water system. About 42,000 ft. of 8-in. wooden pipe, 5000 ft. of 4-in. wooden pipe will be laid, and eight wells driven.

+**Carrington, N. D.**—(Official)—Bids were received July 10 for extending the water and sewer systems. Contracts have been awarded to G. W. HAGGART CONSTRUCTION CO., Fargo, at $14,875, for laying water mains and $12,599 for laying sewer pipe. H. L. Winterer is City Audr. Noted July 2.

New England, N. D.—At a recent election the citizens voted to spend $7000 for the construction of a water system. Noted June 4.

+**Williston, N. D.**—(Official) — Bids were received June 22 for constructing a 750,000-gal. slow sand filtration plant. The contract has been awarded to G. I. HARDING, Williston, at $28,759. H. R. Evany is City Engr. Noted June 18.

Clydepark, Mont.—Plans have been prepared and bids will soon be received for the construction of a water system to cost $15,800. Noted June 25.

+**Helena, Mont.**—The contract for constructing canal C highline ditch has been awarded by the Montana Reservoir & Irrigation Co. to BOOMER & HUGHES, Spokane, Wash. The ditch is nine miles long. A new pumping plant will also be installed.

Three Forks, Mont.—According to press reports bids will soon be received for the construction of a water system. Bonds for $45,000 for this purpose have been sold. Noted May 14.

Butler, Mo.—Plans are being prepared by Harper & Stiles, Grand Ave. Temple, Kansas City, Mo., for extensions to the water works. The city recently bought the private water company for $32,500 and will spend $40,000 on extensions. Noted June 18.

Charleston, Mo.—The contract for laying six miles of c.i. water pipe has been readvertised. Bids will be received until 7 p.m., Aug. 6, by O. W. Joslyn, Mayor, for constructing a water system. Frank L. Wilcox, St. Louis, Mo., is the Engr. Noted June 25.

Neosho, Mo.—At an election held July 14 bonds for $60,000 for the extension of the water system were voted. Albert C. Moore, Bartlett Bldg., Joplin, Mo., is the Engr. Noted July 2.

+**Springfield, Mo.**—The contract for sinking two wells has been awarded by the Springfield Water Co. to P. L. CROSSMAN & SON, Carthage. The wells will be about 2000 ft. deep. Noted June 25.

Eureka Springs, Ark.—The Improvement Board has sold bonds for the construction of a dam and filtration plant for the water works. Albert C. Moore, Bartlett Bldg., Joplin, Mo., is the Engr.

Paragould, Ark.—Bids will be received by the Secretary, Board of Public Works, until July 30, for making extensions to the water system. The estimated cost is $28,000. Rollins & Westover, Kansas City, Mo., are the Engrs. Noted May 28.

Bison, Ark.—An improvement district has been organized and Albert C. Moore, Bartlett Bldg., Joplin, Mo., has been retained as engineer to design and supervise the construction of a municipal water works and electric light plant, to cost about $40,000.

Cotulla, Tex.—The citizens contemplate issuing bonds for $14,000 for the installation of a water system.

Edinburg, Tex.—The Valley Reserve Canal Co. and the La Lomite Irrigation & Construction Co. will construct an irrigation system to irrigate 20,000 acres of land in Hidalgo County. Fred Warner, Edinburg, is interested.

Livingston, Tex.—An election will be held Aug. 20 to determine whether or not the city will issue bonds for $25,000 for the construction of a water system. Noted Jluy 9.

New Boston, Tex.—Bids will be received by the City Council until Aug. 3 for installing a water system. Nagel & Petersen, Muskogee, Okla., are the Engrs.

Terrell, Tex.—The City Council is contemplating improving the water works and the water supply.

Tulsa, Okla.—The city contemplates constructing a pipe line 50 miles long to the Grand River for the water supply. The estimated cost is $1,000,000.

Boulder, Colo.—The City Council will construct a dam at Silver Lake, at an estimated cost of $50,000, for the city water supply.

Puyallup, Wash.—Bids will soon be received by the City Council for c.i. pipe to renew the greater portion of the water system at Puyallup.

Seattle, Wash.—Bids will be received by A. L. Valentine, Chn. Bd. of Pub. Wks., until Aug. 7, for furnishing from 5000 to 10,000 water meters.

The City Council contemplates laying water mains in 38th Ave. South, at a cost of $18,747.

+The contract for constructing a concrete lining of the water tunnel under Lake Union has been awarded by the Board of Public Works to MEACHAM & BABCOCK, Central Bldg., Seattle, at $193,449. Noted July 9.

Bend, Ore.—The Bend Water, Light & Power Co. contemplates making extensive improvements to its plant. A concrete reservoir with a capacity of 100,000 gal. will be erected.

Molalla, Ore.—Dennis & Christenson, at $6874, were low bidders for constructing a water system at Molallo.

Modesto, Calif.—(Official)—Bids will be received by R. A. Edwards, Engr., until July 31, for plans and specifications for a structure at Gasburg Crossing, on the Main Canal of the Modesto Irrigation District. A steel siphon of 16 ft.

[illegible]er, 7[illegible] ft long, or a steel or concrete flume structure, [illegible] length, will be the type of structure. Noted July 9.

✦**San Francisco, Calif.**—(Official).—The Board of Public Works has awarded a contract to the UTAH CONSTRUCTION CO., at $1[illegible] for constructing a road from Hog [illegible] to the [illegible] Hetchy dam site, in connection with the [illegible] Hetchy Project. M. M. O'Shaughnessy is City Engr.

✦**Turlock, Calif.**—The contract for constructing 1½ miles of [illegible] has been awarded by the Directors of the Turlock Irrigation District to A. CHATOM, at $1[illegible]. Noted June 18.

Dawson, Yukon Territory.—(Official).—The citizens at a recent election voted $[illegible] in bonds for the construction of a water system.

Montreal, Que.—Bids will be received July 31, by L. N. [illegible], Secy. [illegible] of Commrs., for installing a 24,000,000-gal. pump at the water works. Noted July 9.

Listowel, Ont.—The city contemplates installing a new [illegible], laying water mains for fire protection and making several improvements to the water system.

Ottawa, Ont.—Bids will be received by R. C. Desrochers, Secy. of the Dept. of Pub. Wks., Ottawa, until 4 p.m., Aug. [illegible], for the construction of steel gates, towers and operative machinery for regulating the dam, Big Chaudiere Falls, French River, Ontario.

✦**Edmonds, B. C.**—The contract for furnishing 30,000 ft. of 4-in. pipe has been awarded to [illegible], GODSON & CO. at $[illegible].

Vancouver, B. C.—The Water Works Committee contemplates [illegible] extensions to the present water system at an estimated cost of $[illegible].

SEWERS

Boston, Mass.—(Official).—Bids for furnishing 60-in. cast iron and special castings for Section 43 of the Metropolitan Sewerage Works were received by the Metropolitan Water and Sewerage Board, as follows: U. S. Cast Iron Pipe & Foundry Co., Morris Bldg., Philadelphia, Penn., $1[illegible]; [illegible] Iron Works, Camden, N. J., $17,671; Warren Foundry & [illegible] Co., 11 Broadway, New York, N. Y., $16,437. Charles [illegible] is Chief Engr.

✦**Boston, Mass.**—The contract for the sewer construction in [illegible] Road and in a private section of land, West Roxbury District, was awarded to ANTONY CEFALO, at $[illegible]. Other bids were: Martino De Matteo, $[illegible]; William [illegible], $[illegible]; [illegible] Lefortezza, $[illegible]; Frank Drinkwater, $[illegible]; Louis Hallwell, $[illegible]; M. De Sisto, $[illegible]; John Guarino, $[illegible]; West Roxbury Trap Rock Co., $6,[illegible]; James Driscoll & Son Co., $[illegible]; McCarthy & Walsh, $[illegible]; A. M. Cusick, $[illegible]. L. K. Rourke is Comr.

Boston, Mass.—Bids will be received by the Department of Public Works, until July 27, for sewer construction in [illegible] St., West Roxbury. L. K. Rourke is Comr.

✦**Boston, Mass.**—The contract for constructing sewers in [illegible] St. has been awarded by the Department of Public Works to WILLIAM L. DOLAN, at $6340. Noted June 11.

Maynard, Mass.—The city has commissioned F. A. Barbour, [illegible] Boston, to prepare plans for a sewer system.

Warren, R. I.—The town has decided to install a sewer system, at an estimated cost of $16,000. Charles Y. Chase, 75 Westminster St., Providence, is Engr.-in-Charge. Richard W. [illegible] is Town Clk. Noted July 9.

New Haven, Conn.—Bids will be received until July 27 by Frederick L. Ford, City Engr., for the construction of sewers in Atwater and [illegible] Sts.

Binghamton, N. Y.—The city is considering the construction of storm water and sanitary sewers in the Sixth Ward. John A. [illegible] is City Engr.

✦**Buffalo, N. Y.**—The contract for constructing a 9[illegible]-ft. brick trunk sewer in Hertel Ave. has been awarded by the Board of Public Works to JOSEPH F. STABELL, at $[illegible]. Noted June 11 and June [illegible].

Buffalo, N. Y.—The City Council has ordered the construction of a [illegible]-ft. [illegible]-in. sewer in [illegible] St., from Mineral Spring Road to the Pennsylvania R.R.

✦✦**Glen Cove, L. I., N. Y.**—(Official).—The Glen Cove Sewer Commission has awarded to JOSEPH R. [illegible] & CO., New York, N. Y., the contract for completing the construction of the sewer system and disposal works. Johnson & Fuller, [illegible] St., are Consulting Engrs. Noted May 21.

✦**Goshen, N. Y.**—Press reports state that the contract for constructing a sewer system and sewage disposal plant has been awarded to the [illegible] KILL CONSTRUCTION CO., [illegible], N. Y. Noted May [illegible].

✦✦**Medina, N. Y.**—(Official).—The contract for constructing an addition to the sewer system has been awarded by the Board of Sewer Commissioners to FREDERICK A. GOTT, [illegible], N. Y., at $[illegible]. Frank J. Kearney is Clk.

Mohawk, N. Y.—The citizens have voted to issue bonds for $[illegible] for the purpose of extending the system of sewers.

New York, N. Y.—(Borough of Queens).—The lowest bid received by Maurice E. Connolly, Borough Pres., for constructing a [illegible] drain from the present sewer at [illegible] to [illegible] Cove was that of Clancy & Van [illegible], at $[illegible].

New York, N. Y.—(Borough of Manhattan).—(Official).—Bids will be received by Marcus M. Marks, Pres. of the Borough of Manhattan, until [illegible], July 2[illegible], for constructing [illegible] and [illegible] sewers in various streets.

Niskayuna, N. Y.—Press reports state that the Town Board has decided to construct sewers in [illegible] district.

Belleville, N. J.—Bids will be received by the Town Council until July [illegible] for constructing sewers with house connections in various streets. Frank T. [illegible] Essex Bldg., Newark, is Town Engr.

✦**Newark, N. J.**—(Official).—Bids were received by the [illegible] Valley Sewerage Commissioners for constructing [illegible] of [illegible] of the main intercepting sewer as follows: [illegible] Co., New York, N. Y., $[illegible]; Castlegate Co., New York, N. Y., $213,792; Fusco Construction Co., Newark, N. J., $155,[illegible]; Merrill-Ruckgaber Co. & Mason, Hilton & Co., New York, N. Y., $163,33[illegible]; James S. Frazer, New York, N. Y., $13[illegible],520; J. F. Shanley Co., Newark, N. J., $129,[illegible].

✦**Erie, Penn.**—The City Council has awarded contracts to WILLIS BANCROFT, JR., and JOSEPH McCORMICK & BRO., for constructing storm sewers in South Erie. The estimated cost is $16,41[illegible].

Baltimore, Md.—Bids will be received by the Board of Awards, City Hall, until July 29, for the construction of sewage treatment plant. The work includes the construction lateral sewers and house connections in District No. 13-B, under sanitary contract No. 137, requiring 57,000 lin. ft. of vitrified pipe sewer, 8-in. to 18-in. in diameter, and 47,[illegible] lin. ft. of vitrified pipe connections. Plans are on file at the office of the Sewerage Commission. Ira Remsen, 904 American Bldg., is Chn.

✦**Dade City, Fla.**—The contract for installing a sewerage and water works system has been awarded by the City Council to the J. B. McCRARY CO., Atlanta, Ga. Noted June 11.

✦**Birmingham, Ala.**—The contract for constructing sanitary sewers in the East Lake District has been awarded by the Board of Commissioners to JORDAN & PHILLIPS, Birmingham, at $11,1[illegible]. Julian Kendrick is City Engr. Noted May 28.

✦The contract for constructing sanitary sewers in Owenton District has also been awarded to JORDAN & PHILLIPS, at about $[illegible].

Belzoni, Miss.—Bids will be received by the Mayor and Board of Trustees until Aug. 4 for constructing three miles of vitrified pipe sewers, 8 to 12 in., including manholes, etc.

Lewisburg, Tenn.—See item under "Streets and Roads."

Oakdale, Ky.—The City Council plans to spend $[illegible],000 in sewer improvements. Ray Burks is Engr.

✦**Akron, Ohio.**—(Official).—Bids will be received by the Director of Public Service, until noon, Aug. 11, for constructing a sewage treatment plant. The work includes the construction of a concrete screen and grit chamber, concrete sedimentation tanks, pumps, pump house and well, concrete filters, sludge press house, sludge tank chambers, sludge drying beds, main sewer extension, controlling apparatus, sluice removal apparatus, and pipe laying. This is a readvertisement of bids opened on June 16. Ira A. Priest is Clk. Noted May 28.

Conneaut, Ohio.—Bids will be received by the Grandview Allotment Co., Conneaut, until July 2[illegible], for constructing a sewer system. R. Winthrop Pratt, 708 Hippodrome Bldg., Cleveland, is Engr.

Cuyahoga Falls, Ohio.—Bids will be received by the City until July 25, for constructing a sewage disposal plant. R. Winthrop Pratt, Hippodrome Bldg., Cleveland, is Engr.

Lima, Ohio.—The City Council has decided to install a sewage disposal plant. Plans have been prepared.

Miamisburg, Ohio.—Bids will be received by the Village Clerk until Aug. 1 for constructing storm water sewers in parts of Sugar, 10th, Fourth, Pearl and Second Sts.

✦**Sandusky, Ohio.**—The contract for constructing sewers in the West End Sewer District has been awarded to the CLASER & HETRICK CO., Oak Harbor, at $[illegible]. Noted June 25.

Sandusky, Ohio.—J. C. Devine, Alliance, Ohio, submitted the lowest bid, at $73,926, for installing a sewage treatment plant.

Toledo, Ohio.—Bids will be received by the Commissioners of Lucas County, Court House, Toledo, until noon, July [illegible], for constructing a sanitary sewer in sub-district No. 1. Charles J. Sanzenbacher is Audr.

Xenia, Ohio.—The city has commissioned the W. J. Sherman Co., 813 The Nasby, Toledo, to prepare plans for the proposed sewage purification plant.

Traverse City, Mich.—(Official).—The item in the issue of July 9, stating that $40,000 bonds had been voted for sewer construction is an error. Bonds for the work were voted down.

Chicago, Ill.—(Official).—Bids will be received by John M. Gilben, Clk. of the Sanitary District, until noon, July [illegible], for the following: Installing electrical equipment in the [illegible]th St. pumping station, installing steam and water piping in the 39th St. pumping station for a [illegible]-kw. turbine unit, constructing a concrete tank annex to the terminal station at 31st St. and Western Ave.; for installing electrical equipment in the terminal station annex; for delivering power transformers, for delivering four duct insulated lead-covered cable.

✦**Champaign, Ill.**—The contract for constructing the storm water sewer system has been awarded by the Board of Local Improvements to ARTHUR BIRT, Decatur, at $[illegible].

Evanston, Ill.—Press reports state that the Town Council has decided to construct a system of sewers running west through the city and emptying in the west branch of the canal. A pumping station will also be built.

✦**Kewanee, Ill.**—The Board of Local Improvements has awarded a contract to ALBRECHT BROS., Kewanee, at $1[illegible], for constructing vitrified pipe sewer and laying [illegible]-in. cast-iron water pipe. H. G. Stevens is City Engr.

✦**Springfield, Ill.**—(Official).—The contract for constructing the [illegible]-ft. single ring brick sewer has been awarded to WILLIAM [illegible] & SON, Springfield. John S. Schnepp is Mayor. Noted July 9.

New Glarus, Wis.—(Official).—The date for receiving bids for sewer construction has been extended until 7.30 p.m., Aug. 3. Fredrick Ott is Village Clk. Noted June 18.

✦**South Superior, Wis.**—The contract for constructing various lateral sewers has been awarded to WILLIAM DENS[illegible], at $[illegible].

✦**West Allis, Wis.**—The contract for building an addition to the sewage disposal plant has been awarded to the KRAU[illegible] & KOENIG CONSTRUCTION CO., at $12,[illegible]. Noted June 18.

West Allis, Wis.—Bids will be received by the Board of Public Works until Aug. 1, for constructing lateral sewers in 13 streets. A. R. Obert is City Engr.

+Bettendorf, Iowa—The contract for constructing about three miles of sewers has been awarded by the City Council to the INDEPENDENT CONSTRUCTION CO., at $22,097.

Guthrie Center, Iowa—(Official)—All bids received by the city for constructing sewers and a sewage disposal plant have been rejected. New bids will be received until Aug .1. S. B. Weeks is Clk. Noted June 4.

+Wapello, Iowa—(Official)—The contract for constructing sewers in Sub-Sewage District No. 3 has been awarded to the D. E. KEELER CO., Davenport, Iowa, at $15,707. The Central States Engineering Co., Muscatine, is Engr. Noted July 9.

+Marble, Minn.—The contract for extending the sewer and water system has been awarded to BOYLEN & CO., Virginia, Minn., at $6066.

St. Paul, Minn.—The lowest bid received for constructing the sewer in Park Ave., between South and Maryland Sts., and in a section of Maryland St. was that of O'Neill & Preston, at $5240.

+Topeka, Kan.—The contract for sewer construction in three districts has been awarded by the City Commissioners to JAMES A. PRINGLE, Carthage, Mo., at $86,876. Noted June 18.

Omaha, Neb.—According to press reports ,the city has voted bonds for $44,500 for the purpose of constructing five miles of sewers and for disposal plants.

Carrington, N. D.—(Official)—See item under "Water Supply and Irrigation."

+Carrington, N. D.—The contract for constructing 10,650 lin.ft. of 8-in. sanitary sewers and 26 manholes has been awarded to the HAGGART CONSTRUCTION CO., Fargo, N. D., at $12,599. G. W. Heinmiller is City Engr. Noted July 2.

Charleston, Mo.—Bids will be received by O. W. Joslyn, Mayor, until 7 p.m., Aug. 6, for constructing a sewer system, sewage treatment works and water works. Frank L. Wilcox, Syndicate Trust Bldg., St. Louis, is Engr. Noted June 25.

Hannibal, Mo.—Bids will be received by the City Clerk until Aug. 3 for constructing sewers in Sewer District No. 300. B. F. Smiley is City Engr.

St. Louis, Mo.—Bids will be received by the Board of Public Works until July 24 for constructing sewers in South Gravois Ave. and in the Glaise Creek Sewer District No. 11. William T. Findly is Secy.

Argenta, Ark.—Lund & Hill, Little Rock, Ark., are preparing plans for the proposed sewer system at Argenta.

Austin, Tex.—The City Commissioners are considering the construction of a sewage disposal and incineration plant, estimated to cost $100,000.

Denver, Colo.—The Board of Public Works is considering the construction of sanitary sewers in various streets to cost about $20,000.

Bellingham, Wash.—The lowest bid submitted for constructing lateral sewers in King, Lincoln and other streets was that of Peterson, Webel & Hawkins, at $5982.

Enterprise, Ore.—The city has voted to issue bonds for $20,000 for the purpose of extending the sewer system. The work includes the construction of a septic tank, outlet and main trunk sewer.

Eugene, Ore.—The City Council has ordered the construction of several lateral sewers in various streets.

Portland, Ore.—The city has decided to construct a sewer to be known as the Fulton Park and Carson Heights trunk sewer, and estimated to cost $47,706.

Portland, Ore.—The Sewer Department has had plans completed for sewer construction in two sections of the Montaville District. The estimated cost is $78,000. John H. Hanson is City Engr.

+Burlingame, Calif.—Press reports state the contract for constructing a sewer system has been awarded by the City Council to A. C. HOSE, at about $10,000.

Riverside, Calif.—(Official)—The city will construct a sewer in the Arlington District, to cost about $30,000.

+Sacramento, Calif.—The contract for constructing the reinforced concrete sewage pumping station on the Riverside Road has been awarded by the City Commission to TEICHERT & AMBROSE, Ochner Bldg., at $49,480. Noted July 2.

+San Francisco, Calif.—The Board of Public Works has awarded the contract for sewering and paving of San Bruno Ave., from Olmstead St. to Rahway Ave., to the FAY IMPROVEMENT CO., at $52,790.

Toronto, Ont.—Bids will be received by the Chairman of the Board of Control, until Aug. 4, for constructing Section 4 of the Garrison Creek storm sewer and Division No. 2 of the West Toronto sewer.

+Whitby, Ont.—The following contracts have been awarded in connection with the installation of a sewer system: R. B. STEWART, the excavation and laying of sewers, at $53,443; F. F. FRY, Toronto, the sewage disposal works, at $24,912; ONTARIO SEWER PIPE CO., Mimico, for furnishing the sanitary sewer pipe, at about $13,000; and the BLAIR CO., Woodstock, for furnishing the reinforced concrete pipe, at $12,575.

Winnipeg, Man.—Press reports state that the City Council has decided to spend about $70,000 for constructing sewers, sidewalks and pavements.

Nanaimo, B. C.—The city has voted $30,000 in bonds for extending the sewer system.

GARBAGE

Birmingham, Ala.—The Board of City Commissioners plans to construct a crematory in the West End section of the city. Estimated cost, $5000. H. S. Ryall is City Clk.

Bartlesville, Okla.—The citizens will vote in August on the proposition to issue $7500 in bonds for an incinerating plant.

Mimico, Ont.—The City Council is considering the construction of a garbage incinerator.

Stratford, Ont.—The City Council is making arrangements to secure a site on St. Patrick St. for the proposed garbage incinerator.

+Swift Current, Sask.—The contract has been awarded to the A. H. REID INCINERATOR CO., Toronto, by the city for constructing a 15-ton garbage incinerator.

STREETS AND ROADS

+Concord, N. H.—(Official)—The State Superintendent of Highways has awarded the following contracts for road improvements: In Winchester, Amherst and Merrimack Townships, to L. HOFFMAN & SON, Melrose, Mass.; Madison Township, JAMES W. TYLER, Silver Lake, N. H.; Auburn Township, B. PIRINI, Ashland, Mass.; Derry Township, LOUIS DAVIS, Sunapee, N. H. Noted July 9.

Boston, Mass.—Bids will be received until July 24 by the Public Works Department for the construction of bituminous macadam pavement on Kitredge St., West Roxbury District. L. K. Rourke is Comr. of Pub. Wks.

Pittsfield, Mass.—The Board of Aldermen has made an appropriation of $97,000 for the improvement of Waconah St., and one of $4000 for work on Fourth St. A. B. Farnham is City Engr.

+The contract for paving a section of Fenn St. with vitrified brick has been awarded to CROWE & WALSH at $2.90 per sq. yd. Other bids were: George W. Van Vranken, Schenectady, N. Y., $2.97; Ralph Emerson, $2.99; Edward S. Roberts, $3.27.

Hartford, Conn.—Bids were received by the State Highway Commission, July 14, as follows:

Westport Township, about 5840 lin.ft. warrenite (a), amiesite (b), plain concrete (c), reinforced concrete (d) or hassam (e) pavement on the "Old Highway"—Warren Bros. Co., Boston, Mass., (a) $29,710; Charles T. Eastburn Co., Mount Vernon, N. Y., (b) $30,001; Louis Longhi & Bro., Torrington (c) $20,026, (d) $21,036; Connecticut Hassam Paving Co., New Haven, (e) $20,159; B. D. Pierce, Jr., Co., Bridgeport, (c) $20,583, (d) $21,674; A. D. Bridge's Sons, Inc., Hazardville, (c) $20,646, (d) $21,050. (No guarantee in the last bid.)

City of Norwalk, about 4050 lin.ft. warrenite (a), amiesite (b), plain concrete (c), reinforced concrete (d) or hassam (e) pavement on Winfield St.—Warren Bros. Co., Boston, Mass., (a) $18,026; Charles T. Eastburn Co., Meriden, (b) $17,820; Louis Longhi & Bro., Torrington, (c) $12,734, (d) $13,434; Connecticut Hassam Paving Co., New Haven, (c) $11,734; B. D. Pierce Jr. Co., Bridgeport, (c) $12,535, (d) $13,292; A. D .Bridge's Sons, Inc., Hazardville, (c) $12,303, (d) $12,583. (No guarantee in the Bridge's bid.)

Huntington Township, about 5750 lin.ft. native stone macadam (a) or gravel (b) construction on the Huntington Center Road—H. Sanford Osborn, Redding Ridge, (a) $13,184, (b) $7817; John Arborio, New Haven, (a) $10,183, (b) $7641; Bennett N. Beard Co., Shelton, (a) $10,873, (b) $8971; B. D. Pierce Jr. Co., Bridgeport, (a) $12,128, (b) $9309; Louis Longhi & Bro., Litchfield, (a) $10,899, (b) $8050; Goodman & Trumbull Co., Litchfield, (a) $11,314; John de Michiel & Bro., Torrington, (a) $11,866, (b) $8090; A. Brazos & Sons, Middletown, (a) $13,156; Elbert N. Clarke, Milford, (a) $16,653, (b) $12,892. Also about 6750 lin.ft. trap rock macadam (a), native stone macadam (b) or gravel (c) construction on the River Road—A. Brazos Sons, Middletown, (b) $15,798; John Arhorio, New Haven, (a) $11,812, (b) $11,979, (c) $9749; Bennett N. Beard Co., Shelton, (a) $12,001, (b) $13,291, (c) $10,806; Goodman & Trumbull Co., Litchfield, (a) $14,628, (b) $15,088; H. Sanford Osborn, Redding Ridge, (a) $13,831, (b) $15,306, (c) $11,374; Olin T. Benedict, Pittsfield, Mass., (a) $12,212, (b) $13,404; John de Michiel & Bro., Torrington, (a) $14,473, (b) $14,378, (c) $10,238; Elbert N. Clarke, Milford, (b) $20,459, (c) $16,764; Louis Longhi & Bro., Torrington, (a) $12,549, (b) $13,909, (c) $11,209; B. D. Pierce Jr. Co., Bridgeport, (b) $14,557 (b) $11,585.

City of Bridgeport and Fairfield Township, about 2235 lin.ft. amiesite (a), warrenite (b), bituminous concrete (c), or asphalt (d) pavement on Brooklawn Ave.—Charles T. Eastburn Co., Mount Vernon, N. Y., (a) $11,215; Warren Bros. Co., Boston, Mass., (b) $10,317, (c) $10,988, (d) $10,719.

Cornwall and Goshen Townships, about 19,150 lin.ft. of native stone macadam (a), 13,550 lin.ft. resurfacing (b) and 2700 tons trap rock in piles (c) on the turnpike—John di Michiel & Bro., Torrington, (a) $14,218, (b) $4553, (c) $4065; Goodman & Trumbull Co., Litchfield, (a) $18,134, (b) $6097, (c) $3794: A. B. Cadwell, New Britain, (a) $19,814; Pocaro Construction Co., Willimantic, (a) $13,145, (b) $2574, (c) $1219; Kellogg & Gregory Co., Danbury, (a) $16,030, (b) $5013, (c) $4065; Caesar A. Rossi, Torrington, (a) $16,143, (b) $5962, (c) $4065; Louis Longhi & Bro., Torrington, (a) $14,962, (b) $7723, (c) $5555; Blacco & Co., Stockbridge, Mass., (a) $16,999, (b) $3387, (c) $2656; A. Brazos & Sons, Middletown, (a) $21,010, (b) $5962, (c) $4742; Wall & Valli, Torrington, (a) $18,599, (b) $5420, (c) $4742.

★Norwalk, Conn.—(Official)—Bids will be received until 2 p.m., Aug. 5, by the Secretary of the Bridge Construction Committee, People's Trust Co. Bldg., for paving the Washington St. Bridge and its approaches with vitrified brick or wood block. A. F. Beard is Chn. of the Bridge Com. J. E. Greiner, .Fidelity Bldg., Baltimore, Md., is Consult. Engr.

+Albany, N. Y.—The Board of Contract and Supply has awarded the following contracts for street improvements: Repaving State St. from Capitol Place to Lark St. with asphalt, to JOHN W. DAVITT, at $29,977; improving Glenwood, Oakwood, Maplewood, Parkwood and Erie Sts. from New Scotland to Fairlawn Ave. to ROBERT I. GLEASON, at $43,973; First Ave., from South Pearl to Krank St., to B. F. MULLARKEY, at $21,966; a portion of Liebel St., and Lark St. from Dana to Myrtle Ave., to KENNY & DUMARY, at $4344 and $7239, respectively.

+Buffalo, N. Y.—The Common Council has awarded the contract for paving Downing St. with brick to the ERIE CONTRACTING CO., at $28,000; the contract for paving Elmwood Ave. with asphalt from the Delaware Park Bridge to Amherst St. was awarded to the HENRY P. BURGARD CO., at $18,540.

The Council has ordered the repaving of Lafayette Ave. and Huron St.Francis G. Ward is Comr. of Pub. Wks.

New York, N. Y.—(Official)—Bids will be received until 2 p.m., July [illegible], by the Department of Bridges, Municipal Bldg., for repairs during the present year to asphalt pavements on the bridges over the Harlem River. F. J. H. Kracke is Comr. of Bridges.

New York, N. Y.—Borough of Brooklyn—(Official)—Bids will be received until 11 a.m., July 2[illegible], by Lewis H. Pounds, Pres. of the Borough of Brooklyn, for improving portions of Fulton, East 16th, [illegible]th and [illegible]th Sts., Nassau Ave. and [illegible] Place.

Borough of Manhattan)—(Official)—Bids will be received until [illegible] p.m., July [illegible], by Cabot Ward, Pres. of the Park Bd., Dept. of Parks, Municipal Bldg., for paving and repaving with rock asphalt mastic the walks of Central and other parks in the Borough of Manhattan.

♦Penn Yan, N. Y.—The contract for paving [illegible] and [illegible] Sts. has been awarded to CHARLES N. KELLY, at $12,[illegible]. Erroneously noted July 16 as Penn Yan, Penn.

Camden, N. J.—The City Council has passed an ordinance providing for the paving of Rose St., from Pear to Everett St., with asphalt. L. E. Farnham is City Engr.

Jersey City, N. J.—The Board of City Commissioners will [illegible] Fleet St. with brick. Charles A. Van Keuren is City Engr.

♦Newark, N. J.—The Board of Freeholders has received the following bids for the improvement of Pompton Turnpike, from [illegible] Ave. to the Passaic County line, with warrenite pavement and soft strips of bitulithic on each side on all grades: STANDARD BITULITHIC CO., $93,806 (awarded contract); Union Building & Construction Co., $95,069; Newark Paving Co., $97,238; Francesco Bros., $96,932; Osborne-Marsellis Co., $98,[illegible]. Noted June 25.

♦New Brunswick, N. J.—The following bids were received by the Board of [illegible] Freeholders for the construction of the [illegible] section of the Roosevelt-Woodbridge Road: Conrad Schutt, $[illegible]; T. H. RIDDLE, $7,[illegible]03 (awarded contract); [illegible] Bros., $11,[illegible]; Liddle & Pfeiffer, $12,279; Thomas F. [illegible], $11,[illegible]; Abraham Jelin, $9,627. Noted July 2.

Newton, N. J.—The citizens of Warrington Township have voted a bond issue of $[illegible] to be used for road improvements.

♦Paterson, N. J.—The Board of Freeholders has awarded the contract for paving the Hamburg-Paterson Turnpike, between the [illegible] and [illegible] Bridges with bituminous [illegible], to GEORGE F. BRACKETT, at $16,615. Noted June [illegible].

•Rahway, N. J.—(Official)—Bids will be received until [illegible] p.m., Aug. 4, by the Common Council for paving Irving St. and Milton Ave. Franklin Marsh is City Engr. For particulars, see advertisement under Contracts to Be Let.

Woodbridge, N. J.—(Official)—Bids will be received until [illegible] p.m., July 2[illegible], by the Township Committee of the Township of Woodbridge for [illegible] about 452 lin.ft. of [illegible] St. at [illegible]. Andrew Keyes is Township Clk.

Connellsville, Penn.—The County Court of Fayette County, [illegible], has approved an order for paving Isabella Road from [illegible] Alley to Newmyer Ave., at an estimated cost of $11,[illegible]. Fayette County will pay one-half the cost of the work, while the city of Connellsville will bear the other half and keep the street in repair. J. Q. Van Swearingen is County Judge.

Norristown, Penn.—(Official)—Bids will be received until 1[illegible] a.m., July [illegible], by the Commissioners of Montgomery County for resurfacing a portion of the Conshohocken Pike. About [illegible] tons of stone will be required. John N. Jacobs is County Controller.

Spangler, Penn.—(Official)—Bids will be received until 8 p.m., July [illegible], by [illegible] W. [illegible], Borough Secy., for grading, paving and curbing [illegible] Ave. from North First to North Fourth St. and from North 16th to North 17th St., and for improving North 17th St. from [illegible] to Crawford Ave.

Baltimore, Md.—Bids will be received until Aug. 4, by O. E. Weller, Chn. State Roads Commission, 601 Garrett Bldg., for the following road construction: Near Cumberland to [illegible], 1.71 miles resurfacing in Allegany County; Cathedral and Liberty Sts. from near Monument to [illegible], Baltimore City, sheet asphalt and granite block; Cambridge to Church Creek Road, [illegible] miles, macadam or concrete, Dorchester County; road through Middletown, 1.[illegible] miles of macadam or concrete, Frederick County; Meadows to Camp Springs, 1.[illegible] miles of macadam, concrete or gravel, Prince George's County; St. Mary's City to [illegible], [illegible] miles gravel resurfacing; Leonardtown to [illegible], 1.[illegible] miles of gravel surfacing, St. Mary's County; [illegible] to [illegible], [illegible] miles of macadam or concrete, Somerset County; Licking Creek to Millstone, [illegible] miles macadam or concrete, Washington County; Millstone to [illegible], [illegible] miles of macadam or concrete, Washington County.

♦The Board of Awards has awarded the contract for paving [illegible] St. from [illegible] to [illegible] St., with sheet asphalt, to the UNION PAVING CO., Schenectady, N. Y., at $[illegible].

Towson, Md.—(Official)—The Commissioners of Baltimore County have received the following bids for road improvement [illegible] Mill Road: Allen Engineering & Construction Co., $[illegible] for concrete or $[illegible] for a macadam road; [illegible] W. Andrews & Co., $[illegible]; [illegible] Bros., $[illegible]; [illegible], $[illegible]; [illegible] & Co., $[illegible]. All bids were referred to the State Roads Commission. Noted July [illegible].

Princeton, W. Va.—(Official)—Bids will be received until [illegible], July [illegible], by the Clerk of the Mercer County Court for the following road construction: [illegible] West Virginia State [illegible] from [illegible] to [illegible], about [illegible] miles; [illegible] to [illegible], about eight miles; Princeton to [illegible], about [illegible] miles; [illegible] to the mouth of [illegible], about [illegible] miles. W. I. Lee [illegible] of the [illegible] Road Construction.

Graham, N. C.—(Official)—Bids will be received until July [illegible] by the [illegible] Commission for grading, [illegible] or otherwise [illegible] the streets of the town as far as may be done with the proceeds of a [illegible] bond issue of $[illegible]. [illegible]

Ward is Chn. of Street Comn. J. N. Ambler, Winston-Salem, N. C., is Consult. Engr.

♦Birmingham, Ala.—The Board of City Commissioners has awarded the contract for asphalt paving under Improvement Ordinance No. [illegible]31-C to the SOUTHERN ASPHALT & CONSTRUCTION CO., Birmingham, at $[illegible].

♦The Board of City Commissioners has awarded the contract for grading and macadamizing Pike Ave. from Byrne St. to the street railway to PAUL RICHTER, cost, about $5000; the contract for paving North 2[illegible]th St. from 12th to 1[illegible]th Ave. was awarded to the SOUTHERN BITULITHIC CO., at $15,[illegible]. Noted July 9.

Hattiesburg, Miss.—(Official)—Bids will be received until noon, Aug. 4, by the Highway Commissioners of Beats 1 and 3, Forrest County, for improving [illegible] miles of streets and roads. J. K. Denham is Secy. of the Comrs. F. T. Myers is Engr.

Laurel, Miss.—(Official)—Bids will be received until noon, Aug. 3, by T. C. McCallum, Chn. of the Bd. of Commissioners of District No. 2, Jones County, for the construction of 11 miles of streets and roads, gravel surface. F. T. Myers is Engr.

Clarksville, Tenn.—(Official)—Bids will be received until noon, Aug. 7, by the Road Commissioners of Montgomery County for the construction of about 7[illegible] miles of macadam road, involving about [illegible] cu.yd. of excavation and 16,[illegible] cu.yd. of broken stone. D. T. Foust is Engr.

Lewisburg, Tenn.—Bids will be received until July 25 by the Mayor and Board of Aldermen for the construction of about 11,000 sq.yd. of bituminous macadam, 10,[illegible]0 sq.yd. plain macadam and 120[illegible] lin.ft. storm sewer. J. A. Loyd is Mayor. R. C. Fergus is City Engr.

♦Akron, Ohio—(Official)—The Board of County Commissioners has awarded the contract for improving the Loyal Oak Road to the PORTAGE ENGINEERING CO., Akron; the contract for improving the Arlington Road was awarded to McLONAN BROS., Akron. Noted July [illegible].

♦Cincinnati, Ohio—(Official)—The Board of County Commissioners has awarded the contract for repairing the Harrison and New Haven Pike, Crosby Township, to E. FAGALY, Harrison, Ohio, at $4215. Noted June 2[illegible].

Cincinnati, Ohio—(Official)—Bids will be received until noon, July 27, by the Board of Park Commissioners, [illegible] Gilbert Ave., for about 22[illegible] cu.yd. of broken stone on Sect. 5 of the Bloody Run Parkway, between Woodburn and Asmann Aves. William Hodgkinson is Secy.

(Official)—Bids will be received until noon, Aug. 7, by the Board of County Commissioners for repairing the Muddy Creek Pike from the Bridgetown Pike to the Muddy Creek Road, Green Township. Albert Reinhardt is Clk. of Comrs.

Cincinnati, Ohio—(Official)—Bids will be received until noon, July 27, by the Director of Public Service for brick paving on portions of the following streets: Brewster Ave., Thill, Rice and East Pavilion Sts. Philip Fosdick is Dir. of Pub. Ser. Parke S. Johnson is Secy.

Cleveland, Ohio—Bids will be received until July 31, by the Commissioner of Purchases and Supplies, [illegible]13 City Hall, for furnishing tarvia or other road preparation for the division of Parks.

♦Cleveland, Ohio—(Official)—The Village of Shaker Heights has awarded the contract for the improvement of East 12[illegible]th St. to the ASPHALT BLOCK PAVEMENT CO., Toledo, at $14,000. Noted June 2[illegible].

Cleveland, Ohio—(Official)—Bids will be received until 10 a.m., Aug. 1, by the Board of Commissioners of Cuyahoga County for the improvement of [illegible] Road from Euclid to East Lake Road, Euclid Township. [illegible] G. Klauss is Clk. of the Comrs. W. A. Stinchcomb is County Surv.

Columbus, Ohio—(Official)—Bids will be received until 2 p.m., Aug. 4, by James R. Marker, State Highway Comr., for the construction of the Cleveland-Wooster Road, Cuyahoga County, of which [illegible] miles is to be paved with waterbound macadam, and 0.1[illegible] mile with brick. The estimated cost is $[illegible]276.

Bids will be received until 2 p.m., Aug. 4, for paving with waterbound macadam Sect. No. [illegible] of the Marion-Delaware Road, Marion and Pleasant Townships. Estimated cost, $[illegible]70.

♦Columbus, Ohio—The State Highway Commission opened bids on July 7 for the following road improvements:

Portsmouth-Columbus Road, Franklin County: D. F. Sullivan & Son, Columbus, $[illegible]; GEORGE GEIGLE & SON, Columbus, $20,[illegible] (contract awarded).

Columbus-Marysville Road, Franklin County: D. F. SULLIVAN & SON, $[illegible] (contract awarded); W. M. Graham, Columbus, $[illegible]; J. M. [illegible], Columbus, $[illegible].

[illegible] Station Road, Geauga County: J. W. BURNETT, Chagrin Falls, $[illegible] (contract awarded).

Bryan-Defiance Road, Williams County: Rolla M. Myers, [illegible], $[illegible]; KELLY CONSTRUCTION CO., Bryan, $9120 (contract awarded).

Athens-McArthur Road, Vinton County: KUEHNER & KING, McArthur, $[illegible] (contract awarded).

Columbus-Marysville Road, Union County: L. L. Allen, La Rue, $1[illegible]; Union Construction Co., Bellefontaine, $[illegible]; [illegible] & Wale, Columbus, $[illegible]; [illegible] Construction Co., Marion, $[illegible]; J. M. [illegible], $[illegible] (contract awarded).

Youngstown-Cleveland Road, Trumbull County: Sherman [illegible], Youngstown, $[illegible]; [illegible] Bros., Ravenna, $[illegible]; H. D. [illegible], Ravenna, $[illegible]; J. C. DEVINE, Alliance, $[illegible] (contract awarded); W. F. [illegible], Kent, $[illegible], and six others.

Dayton-Greenville Road, Montgomery County: CLIFTON & [illegible], Dayton, $[illegible] (contract awarded); Gephart & Klein, Dayton, $[illegible].

Dayton-Troy Road, Montgomery County: Gephart & Klein, $[illegible]; GRAHAM & KINNEAR, Columbus, $[illegible] (contract awarded).

Zanesville-Dresden Road, Muskingum County: Ira [illegible], [illegible], $[illegible]; M. F. MURPHY CO., Columbus, $[illegible] (contract awarded).

Oak Harbor-Geneva Road, Ottawa County, Modern Construction Co., Fremont, $30,500; Hezlip-Seaton Co., $30,600; Barnes & Alnerdinger, Rocky Ridge, $30,949.

Newark-New Lexington Road, Perry County, LAMB & NEIL, Thornville, $14.503 (contract awarded).

McConnellsville-New Lexington Road, Perry County, LAMB & NEIL, $4890 (contract awarded).

Eaton-Richmond Road, Preble County, H. W. Curry & Co., Eaton, $36,999; FOSTER CONSTRUCTION CO., Richmond, Ind., $36,180 (contract awarded).

Columbus-Chillicothe Road, Ross County, J. F. PERRY, Chillicothe, $15,120 (contract awarded); W. H. Reynolds Sons Co., Chillicothe, $15,182; McCoy Bros. & Keller, Jackson, $15,475.

Columbus-Chillicothe Western Road, Ross County, M. E. Murphy Co., $15,400; J. F. Perry, $14,964; S. M. DOUGHERTY, Frankfort, $14,697 (contract awarded); W. H. Reynolds Sons Co., $15,064.

Portsmouth-Columbus Road, Ross County, M. E. Murphy Co., $8300; Oather M. Junk, Chillicothe, $7899; J. F. PERRY, $7670 (contract awarded); McCoy Bros. & Keller, $8325; W. H. Reynolds Sons Co., $7965.

Lima-Kenton and Marion- Kenton Roads, Hardin County, HEZLIP-SEATON CO., Piqua, $25,462 (contract awarded); MacGledhill, Dalton, $25,990; Mustard Bros., Ada, $25,874; Union Contracting Co., $26,500; Lunsford Bros. & Co., Pedro, $25,987; Scott Bros., Marion, $25,656.

Logan-Lancaster Road, Hocking County, E. L. RAUDEBAUGH, Logan, $3099 (contract awarded); Houston & Henderson, Logan, $3120.

Cleveland-Sandusky Road, Lorain County, George B. Herring & Son, Cleveland, $68,250; Edmund Burke, Franklin, $67,347; M. E. MURPHY CO., $67,300 (contract awarded); Ohio Engineering Co., Lorain, $68,000; Modern Construction Co., $68,417; Degroot & Cochran, Cleveland, $67,550.

Dayton-Covington Road, Montgomery County, Gephart & Klein, $25,700; YOUNT & JACKSON, Dayton, $25,494 (contract awarded).

Chillicothe-Portsmouth Road, Ross County, McCoy Bros. & Keller, $6950; J. F. PERRY, $6521 (contract awarded); W. H. Reynolds Sons Co., $6700; Brewer, Tomlinson & Brewer, Chillicothe, $6773.

Sandusky-Clyde Road, Sandusky County, MODERN CONSTRUCTION CO., $46,497 (awarded contract); Lee Bros., Clyde, $48,500; Tinerger & Bennett, Conneaut, $49,000.

Akron-Kent Road, Summit County, Degroot & Cochran, Cleveland, $34,475; E. M. Shaffrey & Son, Akron, $34,377; DOOLITTLE & GARFORD, $33,974 (awarded contract); J. C. Devine Co., Alliance, $34,400.

Niles-Ashtabula Road, Trumbull County, M. E. MURPHY CO., $23,995 (awarded contract); James M. Caren & Sons, Youngstown, $23,996; B. F. Hewitt, Jefferson, $24,060.

+Easton, Ohio—The contract for paving Main and Cherry Sts. has been awarded to the ANDREWS ASPHALT CO., at about $50,000.

+Elmore, Ohio—The contract for paving Cheapside St. has been awarded to A. WITTE at $7000.

+Hicksville, Ohio—Contracts have been awarded to CLEMMER & JOHNSON, Defiance, Ohio, for brick paving, and to the JOHNSON CONSTRUCTION CO., Chicago, for asphaltic concrete block pavement on five streets of the village. The total cost of the work is estimated at $55,000.

Mount Gilead, Ohio—(Official)—Bids will be received until 11 a.m., Aug. 6, by the Board of Commissioners of Morrow County for the repair of the Westfield Road Improvement No. 2, near Bartlett's Bridge, Westfield Township. C. O. Higgins is County Audr.

Ottawa, Ohio—(Official)—Bids will be received until Aug. 11 by the Director of Public Service for the construction of 5851 sq.yd. of street paving. The Smith & Boulay Co., 322 The Nasby, Toledo, is Engr. in Charge.

+Pioneer, Ohio—(Official)—The Director of Public Service has awarded the contract for brick paving, with concrete curb and gutter, to G. H. HEFFNER & SONS, Celina, Ohio, at $33,813. Other bidders were: The Brooks Construction Co., $34,812; Freshwater & Sons, Cleveland, $35,019; Johnson & Pitry, Napoleon, Ohio, $38,322; Marsman & Green, Grand Rapids, Ohio, $35,536. Noted July 2.

+Toledo, Ohio—The Board of County Commissioners has awarded the contract for paving a mile of Clark Ave. between the river road and Detroit Ave. with bituminous bound macadam to J. B. RAYMER, at $12,000. Noted July 2.

+Versailles, Ohio—The contract for paving Main St. has been awarded to JOHN HENNESSEY & CO., at $35,000. The pavement will be of medal block and Berea stone. Noted June 18.

Youngstown, Ohio—(Official)—Bids will be received until noon, July 30, by the Director of Public Service, for grading the following: Pricetown Road, Milton Township, between the Milton Dam and the Jackson and Milton Road; Stewart Ave., from McGuffey to Bond St.; Palmyra Road, Milton Township, from the Jackson and Milton Road to the Jersey Road. H. C. Fox is Clk.

+Brownstown, Ind. — (Official)—The Commissioners of Jackson County have awarded a contract to GEORGE BEBOUT, Freetown, Ind., for the construction of a county line road, and a contract to SAMUEL B. SMALLWOOD, Ewing, Ind., for the construction of a gravel road in Owen Townahip. Noted June 18.

Corydon, Ind.—W. H. Rothrock, Seattle, Wash., one of the owners of Wyandotte Cave, has offered to give $10,000 for the construction of a macadam road from Corydon to Leavenwerth, by way of the cave, providing that the residents along the proposed line will raise a similar amount.

+Fort Wayne, Ind.—The Commissioners of Allen County have awarded the contract for the construction of about five miles of the Bluffton Road to J. T. O'CONNOR & SONS, at $49,090; the contract for the construction of approximately three miles of the Taylor St. Road was awarded to the ERIE STONE CO., at $14,000. Noted June 11.

Gary, Ind.—Bids will be received until July 27 by the Board of Public Works for the following street work: Massachusetts Ave., 3721 sq.yd. macadam, 2491 ft. curb, estimated cost, $5092; 25th Ave., 7011 sq.yd. macadam, 4883 sq.yd. sidewalks, 10,301 ft. curb, 6257 cu.yd. grading, estimated cost, $21,162; Sixth Ave., 9245 sq.yd. asphalt, 542 sq.yd. concrete, 9245 sq.yd. old surface dressed, estimated cost $15,843. W. J. Fulton is City Engr.

Bids received on July 13 for paving Sixth Ave. were as follows: M. D. Heiny, Gary, $15,346; Sugwald Moe, Gary, $15,753; Rankert & Eggleston, Mishawaka, Ind., $18,851. The contract is readvertised because of error in the first advertisement. Bids for the improvement of 11th Ave. were received from: M. D. Heiny, $7245; Sugwald Moe, $7113; Gary Construction Co., Gary, $7071. Noted July 1.

+Peru, Ind.—The City Council has awarded the contract for asphalt paving on West Main and Third Sts. to the WESTERN CONSTRUCTION CO., Lafayette, Ind., at approximately $125,000.

+South Bend, Ind.—(Official)—The Commissioners of St. Joseph County have awarded the contract for the construction of a gravel road in Union Township to C. H. DEFREES, oSuth Bend, at $17,200. Noted July 2.

+Vincennes, Ind.—The Commissioners of Knox County have awarded the contract for the construction of one mile cf concrete road near Vincennes to MANNING & O'DONNELL, Vincennes, at $14,271. There were six other bidders on the work. This is the first concrete road to be built in Knox County.

Plymouth, Mich.—Bids will be received until 7 p.m., July 27, by Roderick C. Cassidy, Village Clk., for the construction of concrete pavement on Liberty St. from Oak to Mill St., and Penniman Ave. from Main to Harvey St.

★Sturgis, Mich.—(Official)—Bids will be received until 7 p.m., Aug. 3, by the City Council, for the construction of 22,075 sq.yd. of brick or asphalt block pavement and 11,300 lin.ft. combined curb and gutter. Gerald E. Swihart is City Clk. See advertisement under Contracts to Be Let.

+Allison, Ill.—(Official)—Contracts have been awarded for the construction of gravel roads to P. W. LENAHAN, Vincennes, Ind., at $8395, and ISAAC DAINES, Vincennes, at $3090. Noted July 2.

Bloomington, Ill.—The Board of Local Improvements has received the following bids far paving Washington St.: Pronger & Fletcher, Blue Island, $27,787; T. W. Keys, La Salle, Ill., $27,786; the Foley Construction Co., Chicago, and I. D. Lain, Bloomington, submitted their bids on a square yard basis, totals not given. The bids for paving Grove St. were: Pronger & Fletcher, $11,302; T. W. Keys, $11,517; I. D. Lain, $1.90 per sq.yd.; Foley Construction Co., $1.87 per sq.yd.

+Granite City, Ill.—The Board of Local Improvements has awarded the contract for the construction of sidewalks in Improvement District No 23, to the GRANITE CITY LIME & CEMENT CO., at $6038.

+Kankakee, Ill.—The Board of Local Improvements has awarded the contract for paving North Schuyler Ave. with brick from Court St. to the tracks of the Chicago, Indiana & Southern R.R. to PRONGER & FLETCHER, Blue Island, Ill., at $27,217. The contract for paving three blocks of Schuyler Ave. north of the railroad tracks, was awarded to HARRY McMULLEN, Kankakee, at $13,262.

+Monmouth, Ill.—The Board of Local Improvements has awarded the contract for paving South Sixth St. to the BURLINGTON CONSTRUCTION CO., at $11,898. Other bidders were: Cameron Joyce & Co., Keokuk, Iowa, at $12,000 and J. B. McAuley Galesburg, Ill., at $11,967.

+Normal, Ill.—The Board of Local Improvements has awarded the contract for the construction of brick block pavement on Clinton Place and Central Ave., in the Cedar Crest Addition, to ROY L. WILLIAMS at $6790.

+Princeton, Ill.—The Board of Local Improvements has awarded the contract for brick pavement on South Main St. to PRONGER & FLETCHER, Blue Island, at $13,444. Other bids were: William Kissick Co., $14,045; the Gund Graham Co., $14,270; the Illinois Gravel Co., $12,572.

+Quincy, Ill.—The Board of Local Improvements has awarded the contract for paving Jersey St., from 12th to 14th St., to ROEDER & GREENMAN, at $6450. Other bidders were: Peter Simons, $6597, and Joseph Eiff & Son, $6482.

★+Rockford, Ill.—(Official)—The Board of Local Improvements has awarded the cuntract for constructing about 14,277 sq.yd. of brick pavement and 7300 lin.ft. concrete curb and gutter to A. E. RUTLEDGE, Rockford, at $31,200. Noted July 2.

+Rock Island, Ill.—The Board of Local Improvements has awarded the contract for brick paving on Second Ave., from Seventh to Ninth St., and on Seventh St., from Second to Fourth Ave., to the TRI-CITY CONSTRUCTION CO., at $2.19 per sq.yd. for paving and 43c. per ft. for curbing. The Independent Construction Co. bid $2.20 and 43½c.

Springfield, Ill.—(Official)—Bids will be received until 11 a.m., July 28, by the State Highway Commission for the following road improvements, all cement to be furnished by the State: Coles County, Route 8 and 15, Sect. A, 6000 lin.ft. brick construction, estimated cost $14,122; Scott County, Route 4, Sect. A, 1890 lin.ft. concrete, cost $3000; Stephenson County, Route 9, Sect. A. 3000 lin.ft. brick, cost $13,035; Logan County, Route 7, Sect. B, cost $5689; Logan County, Route 8, Sect. C, 3600 ft. concrete, cost $5172; Logan County, Route 13, Sect. D, cost $5812; Tazewell County, Route 9a, Sect. A, cost $7765; Tazewell County, Route 10, Sect. B, cost $7398; Tazewell County, Route 11, Sect. C, cost $2852. P. C. McArdle is Asst. Highway Engr.

(Official)—Bids will be received until 11 a.m., July 28, for the following State aid work, all cement to be furnished by the State: Lee County, Route 5, Sect. A, 900 lin.ft. concrete, estimated cost, $17,015; Menard County, Route 7, Sect. A, 2400 lin.ft. concrete, cost, $4862; Cook County, Route 19, Sect. D, 16,235 lin.ft. concrete, cost, $35,107.

Waukegan, Ill.—(Official)—The following bids were received by the Board of Local Improvements for the construction of 10,830 sq.yd. of asphaltic concrete pavement and 6000 lin.ft. combined curb and gutter: Western Improvement Co., Racine, Wis., $22,584 (low bidder); H. P. Streicher, Chicago,

[illegible] $14,149, M. McCaga, Waukegan, [illegible] Wells [illegible] Co., Milwaukee, Wis., [illegible] [illegible] & Mohan Co., [illegible] $[illegible]. Noted July 9.

Green Bay, Wis.—[illegible] will be received until Aug. 12, by [illegible], City Clk., for grading and paving [illegible] Mason St. Asphalt [illegible] foundation will be used. [illegible] is City Engr.

La Crosse, Wis.—Bids will be received until Aug. 11 by the Board of [illegible] for the construction of [illegible] sq.yd. [illegible] pavement with concrete curb and gutter on St. Andrews St. [illegible] J. Fries is City Comptroller.

✦Madison, Wis.—(Official)—The Board of Public Works has awarded the following contracts for street improvements [illegible] for improving Atwood Ave., to the [illegible] IMPROVEMENT CO., Racine, Wis., at $26,944. [illegible] to the H. P. STREICHER CO., [illegible], at $[illegible]. [illegible] paving contracts were awarded [illegible] JOHN T. [illegible], at $[illegible], for Jefferson St.; JOHN E. [illegible], at $[illegible], for Van Hise Ave., and to JOHN [illegible], at $[illegible], for concrete work on Atwood Ave. Noted [illegible].

✦Sheboygan, Wis.—The contract for the construction of a concrete road between Sheboygan and Sheboygan Falls has been awarded to J. [illegible] & SONS, Oshkosh, Wis., at $[illegible]. The cement will be furnished by the contractor, and will cost about $[illegible]. Noted July 16.

✦Watertown, Wis.—(Official)—The Board of Public Works has awarded the contract for improving North Second St. to [illegible] BARTLETT, Watertown, Wis., at $12,717. Other bidders were: Lehman Bros., $12,924; George Welch, $14,216. Noted June 2.

✦Des Moines, Iowa.—The City Council has awarded the contract for paving 28th St., from Grand Ave. to Kingman Blvd., to the DES MOINES ASPHALT CO., at $1.92 per sq.yd.; the contract for paving Dean Ave. from 16th to 18th St. was awarded to JAMES HORRABIN, at $2.09 per sq.yd.

Marshalltown, Iowa.—(Official)—Bids will be received until [illegible], July 27, by J. J. Wilson, City Clk., for improving parts of West Church, South 12th and North Second Sts. [illegible] sq.yd. of concrete paving and 7000 lin.ft. of curbing will be required.

✦Waterloo, Iowa.—The City Council has awarded the contract for paving Mullan Ave. and the Mullan Ave. Bridge with asphalt to the BRYANT ASPHALT PAVING CO. at $[illegible] per sq.yd.

Alexandria, Minn.—(Official)—The Commissioners of Douglas County have rejected all bids received July 17 for the construction of State Road No. 1. E. J. Brandt is County Audr. Noted July 2.

Hibbing, Minn.—Bids will be received until July 28 by the City Council for about [illegible] sq.yd. paving on Fifth Ave. and [illegible] St. Bids will be accepted for creosoted block, bitulithic, sheet asphalt or Donnellite pavement.

✦Ivanhoe, Minn.—(Official)—The Commissioners of Lincoln County have awarded the contracts for grading and gravelling State Road Highway No. 51 to NELS UTOFT, Tyler, Minn., HENRY ENKE, Lake Benton, Minn., and CARL INGVALDSEN, [illegible], Minn. Noted July 2.

✦Red Lake Falls, Minn.—(Official)—The Commissioners of Red Lake County have awarded the contract for the construction of [illegible] miles of road to LOUIS LIEFF and W. P. SEE. Noted June 25.

Worthington, Minn.—(Official)—The Commissioners of Nobles County have awarded the contract for various road improvements in the county to JOSEPH SAMPSON, Sioux Falls, S. D. Noted June 25.

Abilene, Kan.—Paving bonds for $60,000 have been sold, and bids will soon be asked for the work.

Arma, Kan.—(Official)—Bids will be asked soon for various street improvements, plans for which have been prepared by Albert C. Moore, Consult. Engr., Bartlett Bldg., Joplin, Mo.

Douglass, Kan.—(Official)—Plans are being prepared by Albert C. Moore, Bartlett Bldg., Joplin, Mo., for various street improvements, including curbing and crossings.

✦Horton, Kan.—(Official)—The City Council has awarded the contract for [illegible] of asphaltic concrete paving to [illegible] PAVING CO., Topeka, Kan., at $[illegible]. Other bidders were: [illegible] Construction Co., $[illegible]; [illegible], $[illegible]; [illegible], $[illegible]; J. B. [illegible], $[illegible]; [illegible], $[illegible]. Noted June 18 and 25.

✦Sioux Falls, S. D.—(Official)—The contract for paving [illegible] has been awarded to the [illegible] PAVING CO., Watertown, S. D., at $[illegible]. Asphaltic concrete will be used. Other bidders were: [illegible] & [illegible], St. Paul, Minn., $[illegible]; Ford Paving Co., [illegible], Iowa, $[illegible]; Warren Bros., Boston, Mass., [illegible] pavement. Noted July 9.

Butte, Mont.—It is reported that the City Council has [illegible] about $[illegible] for street paving and [illegible] in the [illegible] part of the city.

Jefferson City, Mo.—[illegible], State [illegible], has [illegible] $[illegible] to Missouri counties for the construction of roads.

✦Kansas City, Mo.—The County Court has awarded a contract for [illegible] to DAVID [illegible], at $[illegible] per [illegible]. The contract will [illegible].

St. Louis, Mo.—Bids will be received until July [illegible] by the [illegible] for the improvement of a [illegible] estimated cost of $[illegible]. [illegible] is [illegible] of the Bd.

✦Lonoke, Ark.—(Official)—The Board of Commissioners of [illegible] County has awarded the contract for the [illegible] of [illegible] miles of [illegible] highways in the [illegible] to the [illegible], Little Rock, Ark., at $[illegible]. Other bidders were: [illegible], $[illegible]; [illegible], Little Rock, $[illegible]; George [illegible] & Co., [illegible], $[illegible]; [illegible], Little Rock, $11,6[illegible]; W. [illegible], Little Rock, $[illegible]. Noted June 18.

Trinity, Tex.—(Official)—Bids will be received until 5 p.m., July 27, by George M. Waller, Chm. of the Bd., for the construction of about 35 miles of sand clay roads in Road District No. 2, Trinity County. The work includes clearing, grubbing, grading and culverts.

Salt Lake City, Utah.—The City Engineer has recommended to the City Commission that the contract for paving Eighth West St. from Second South to Tenth South St. and for Fourth South St. from Second West to Eighth West St. with [illegible] stone filled [illegible] asphalt, be awarded to P. J. Moran, at approximately $[illegible].

Colville, Wash.—Bids will be received until July 27 by Charles A. Burr, Aud. of Stevens County, for clearing, grubbing, grading, draining, bridging and surfacing with crushed stone about 16,[illegible] lin.ft. of the Colville-Myers Falls Permanent Highway.

✦Seattle, Wash.—The contract for paving Second Ave., from Pike St. to Yesler Way, has been awarded to T. J. RYAN, Seattle, at $[illegible].

✦Seattle, Wash.—The contract for improving 27 miles of the Sunset Highway has been awarded to the BRUCE-NETTLETON-ESCHBACH CO., Seattle, at $141,170. Other bids were: Hans Pederson, $162,400, and the Washington Construction Co., $171,6[illegible]. Noted June 25.

Jacksonville, Ore.—It is reported that the State Highway Commission, Salem, is receiving bids for [illegible] five miles of road between Jacksonville and Ashland, at an estimated cost of $[illegible].

✦St. Helen, Ore.—The County Court of Columbia County has awarded the contract for the construction of the Mist-Clatskanie and the Upper and Lower Nehalem Roads to the ELLIOTT CONSTRUCTION CO., Portland, Ore., at $39,918.

✦Oroville, Calif.—The City Trustees have awarded the contract for paving the downtown district to the CLARK-HENERY CO., Sacramento, Calif., at $36,322.50.

Sacramento, Calif.—Bids will be received until Aug. 10 by the State Highway Commission, Forum Bldg., for road construction as follows: Mendocino County, about 11.4 miles to be graded, and a portion to be paved with concrete.

Humboldt County, from Miranda to Dyerville, about 12.8 miles to be graded.

Santa Clara County, from Santa Clara to San José, about 1.9 miles of concrete with asphaltic wearing surface, from the northerly county boundary to San José, about 6.8 miles of concrete.

Contra Costa County, from San Pablo Creek to Pinole, about 3.6 miles to be graded.

Humboldt County, from Shively to Jordan Creek, about five miles of concrete.

Santa Barbara County, from El Capitan Creek to Alcatraz, about 9.3 miles to be graded.

Orange County, from Galligan to Irvine, about 9.4 miles of concrete.

Imperial County, from Meyers Creek to Coyote Wells, about six miles of concrete.

Sacramento, Calif.—The State Highway Commission has awarded contracts for highway work as follows: Construction of 11.7 miles from Woodland to southerly boundary of Yolo County, to M. BLUMENKRANZ, Stockton, at $[illegible]; about 10.3 miles in Santa Cruz County, from Glenwood to Santa Cruz, to the OCCIDENTAL CONSTRUCTION CO., Los Angeles, at $54,761; about 1[illegible] miles in San Luis Obispo County, from Arroyo Grande to San Luis Obispo, to RODGERS BROS., Los Angeles, at $66,986; about 1[illegible] miles in Ventura County, from Newbury Park to Springville, to LEIGH G. GARNSEY, Los Angeles, at $96,121. Noted June 25.

San Francisco, Calif.—See item under Miscellaneous Grading—San Francisco.

San Francisco, Calif.—See item under "Sewers."

✦San Mateo, Calif.—The Board of Supervisors of San Mateo County has awarded a contract for county highway work to the CLARK-HENERY CO., Sacramento, at $[illegible].

✦San Rafael, Calif.—The Board of City Trustees has awarded the contract for paving Petaluma Ave., Fourth and H Sts. to the CLARK-HENERY CO., Sacramento, at $[illegible].

Tulare, Calif.—The opening of bids for paving work has been postponed until Aug. [illegible] by the City Trustees. E. [illegible] is City Clk. The cost of the work is about $[illegible]. Noted July 2.

Winnipeg, Man.—See item under "Sewers."

✦Swift Current, Sask.—(Official)—The City Council has awarded the contract for the construction of concrete sidewalks to the GILLSTROM CONTRACTING CO., Swift Current. Other bidders were: Jesse [illegible], [illegible], Sask., $11,[illegible]; Crown Paving & Construction Co., Calgary, Alta., $11,512; C. C. Potter & Co., Medicine Hat, Alta., $11,9[illegible]; Rawlins [illegible] Moose Jaw, Sask., $[illegible]; [illegible] Clark and [illegible] Wiren, Swift Current, $13,[illegible]. Noted July 9.

✦Nanaimo, B. C.—The City Council has awarded the contract for paving on 11 streets to [illegible] J. KEITH, Vancouver, B. C., at $[illegible]. Asphaltic concrete will be used.

INDUSTRIAL WORKS

Old Town, Maine.—The Old Town Canoe Club will build a five-story, [illegible]-ft. addition to its plant on Middle St.

✦Derby, Vt.—The [illegible] Twist Drill Co., Athol, Mass., has awarded a contract to HENRY T. [illegible]MAN for a $[illegible] addition to its [illegible] plant. Noted June [illegible].

✦Boston, Mass.—The Thompson Norris Co. has awarded a contract to the NATIONAL FIREPROOFING CO., 201 Devonshire St., for a [illegible]-story, [illegible]-ft. building.

✦Clinton, Mass.—The Clinton Wire Cloth Co. has awarded a contract to the FRANK [illegible]TER CONSTRUCTION CO., Providence, R. I., for an [illegible]-ft. brick addition to its plant, at $[illegible]. Noted July 9.

Springfield, Mass.—The [illegible] Needle Co., Boylston St., will build a $[illegible] addition to its plant.

Springfield, Mass.—The Chapin Realty Trust Co. has filed plans for a four-story, 71x168-ft. garage. H. T. Sprague is the Arch.

Pawtucket, R. I.—The Philips Insulated Wire Co. plans to build a three-story, 200x200-ft. addition to its plant.

+Providence, R. I.—The State Board of Control and Supply has awarded a contract to the P. E. HARDING CO., for a laundry, at $18,918, to be built at the State Hospital for the Insane. The contract for a heating plant is still unawarded.

+Meriden, Conn.—The Bradley & Hubbard Mfg. Co., Hanover St., has awarded a contract to the H. WALES-LINES CO., 134 State St., for a four-story, 40x100-ft. warehouse.

Norwich, Conn.—The American Strawboard Co. will build a one-story, 100x200-ft. brick warehouse.

Belmont, N. Y.—The Pennsylvania Lock & Hardware Co., Columbia, Penn., will build a brick and concrete 40x150-ft. factory. A. Haldeman is Pres.

Buffalo, N. Y.—The International Ry. Co. will build a brick and steel addition to its car storage house at Military Road and Hertel Ave., to cost $25,000.

+Buffalo, N. Y.—The Niagara Coke Corporation has awarded a contract to the OTTO COKING CO., 6 Church St., New York, N. Y., for a $1,000,000 plant.

The Wickwire Steel Co. will erect a steel mill which will cost from $2,000,000 to $5,000,000.

Canandaigua, N. Y.—The Sisk Mfg. Co. is receiving bids for a 100x200-ft. addition to its plant. Leon Stern, Rochester, N. Y. ,is the Arch.

Dunkirk, N. Y.—The Continental Heating Co., recently organized, is having plans prepared for a $35,000 plant.

New York, N. Y.—(Borough of Manhattan)—Austin, Nichols & Co., 61 Hudson St., will build a 200x250-ft. warehouse and wharf at 129th St. and Second Ave.

(Borough of Manhattan)—James A. Murphy will build a four-story garage at 161 West 132d St. The cost will be $20,000.

(Borough of Brooklyn)—The Advance Machine Works, 254 Van Bruit St., plans to build an eight-story, reinforced concrete factory, costing $100,000.

New York, N. Y.—(Borough of Brooklyn)—The Ford Motor Co., Detroit, Mich., has purchased a site at Bedford Ave. and Sterling Place. It is reported that a six-story building will be erected.

+New York, N. Y.—(Borough of Brooklyn)—The Metropolitan Iron Foundry has awarded a contract to JOSEPH KIST, 938 Metropolitan Ave., for a one and two-story, 50x200-ft. brick foundry, at $25,000.

Edgewater, N. J.—The Aluminum Co. of America, Mellon National Bank Bldg., Pittsburgh, Penn., has puchased 118 city lots at Edgewater. It is reported that a $2,000,000 plant will be built.

+Trenton, N. J.—The Crescent Pottery Co. has awarded a contract to BURTON & BURTON, American Mechanics Bldg., for a 3½-story steel and brick warehouse, to cost $30,000.

Ebensburg, Penn.—William Mohler will build a 64x154-ft. garage at High and Julian Sts.

Philadelphia, Penn.—Borzner & Wood, 721 Walnut St., are preparing plans for a six-story, 20x60-ft. reinforced concrete factory, to be built at 709 Filbert St

Philadelphia, Penn.—C. Vogt will build a one-story, 26x103-ft. machine shop at Croskey and Cambria Sts. The coat will be about $12,000.

Philadelphia, Penn.—Chester A. Asher, 5605 Germantown Ave., will build a three-story, 35x54-ft. bakery.

+Pittsburgh, Penn.—(Official—The East Liberty Wholesale Grocery Co. has awarded a contract to TOUPET, BEIL & CONLEY, INC., 1428 Oliver Bldg., for a reinforced concrete warehouse, at $35,000.

Baltimore, Md.—The Reliable Furniture Co., has purchased a site on Wilkins Ave., on which it will build a $100,000 factory.

Baltimore, Md.—The United States Woolen Mills Co. will build a seven-story, 70x158-ft. factory, to cost $200,000.

Washington, D. C.—Averill & Adunis are having plans prepadre for a ten-story, 30x105-ft. warehouse, to be built at 1331 G. St. The cost will be about $60,000.

Atlanta, Ga.—The Southern Wire & Iron Co. has purchased a site and plans the construction of a three-story factory.

Tampa, Fla.—The Export Phosphate Co., Mulberry, Fla., plans to build a plant here, to cost about $500,000.

Birmingham, Ala.—Solon Jacobs will build a 75x150-ft. garage, to cost $10,000. William C. Weston is the Arch.

Gadsden, Ala.—The Dixie Pipe Co., newly organized by Robert Campbell, has purchased an eight-acre site on which it will build a 120x254-ft. building.

New Orleans, La.—The Universal Film Co. will build a $500,000 plant. Herman Fichtenberg is Pres.

Knoxville, Tenn.—The Appalachian Mills will build two new additions to its plant, to cost $50,000. Noted May 28.

Memphis, Tenn.—The Yazoo & Mississippi Valley R.R., Memphis, Tenn., will erect car building and locomotive repair shops.

Greenville, Ky.—The S. E. Rice Tobacco Co. will build a three-story, 60x100-ft. factory, of concrete and iron sheeting.

Louisville, Ky.—The Aston Fisher Tobacco Co. will build a five-story, reinforced concrete warehouse, to cost $50,000.

+Cleveland, Ohio—The Reliance Gauge Column Co., 5902 Carnegie Ave., has awarded a contract to the C. N. GRIFFIN CO., 1812 East 12th St., for a four-story, 50x125-ft. factory. The cost will be $47,000.

Cleveland, Ohio—The Herold Bros. Co. plans to build a four-story, 50x125-ft. building at 62 Public Square. A. C. Wolf, 403 Swetland Bldg., is the Arch.

Cleveland, Ohio—The Freed-Keller-Kohn Co., 1233 West 9th St., will build a three-story, 94x160-ft. factory.

Lima, Ohio—The Buckeye Machine Co., East Wayne St., plans to build a 60x150-ft. shop at Atlantic Ave. and the Erie R.R.

Martin's Ferry, Ohio—William Lippincott plans to build a plant for the manufacture of enamelware novelties, large enough to employ 200 men.

+New Philadelphia, Ohio—The Belmont Stamping & Enameling Co. has awarded a contract to the UNION LUMBER CO. for a 192x211-ft. brick and steel warehouse.

Salem, Ohio—The P. A. Field Shoe Co. has had plans prepared for a four-story addition to its plant.

Detroit, Mich.—The Banner Cigar Co. plans to build a four-story, brick and steel factory at Mitchell and Warren Sts.

Detroit, Mich.—The Banner Laundering Co., Brooklyn and Plum Sts., has completed plans for a three-story, brick addition to its plant.

Detroit, Mich.—The Horlick Malted Milk Co., Racine, Wis., has purchased twenty acres in Detroit, on which it will build a factory to employ about 400 hands.

Detroit, Mich.—The Detroit Legal News Co., West Congress and First Sts., will build a three-story, brick and steel printing plant.

Detroit, Mich.—The Wagner Baking Co. will build a four-story, brick and steel bakery, at Grand River and Brooklyn Aves.

Flint, Mich.—The Walker-Weiss Axle Co. plans to build a two-story 50x300-ft. shop, to cost $30,000.

Saginaw, Mich.—A. Schirmer plans to build a two-story, 80x120-ft. brick garage.

Chicago, Ill.—The Vienna Sausage Mfg. Co., 722 West 12th Place, has filed plans for a three-story addition to its plant, to cost $11,000.

Green Bay, Wis.—The John Hoeberg Co. will build a three-story, 40x180-ft. addition to its paper manufacturing plant. Frank A. Haeberg is Pres.

+Neenah, Wis.—The Kimberly-Clark Co. has awarded a contract to the IMMEL CONSTRUCTION CO., Fond du Lac, Wis., for a $25,000 addition to its plant.

Oconomowoc, Wis. — The Pacific Coast Condensed Milk Co. will build a tin can factory at a cost of about $250,000.

Des Moines, Iowa—The Green Foundry & Furnace Works plans to build a $200,000 foundry. F. O. Green is Pres.

Dubuque, Iowa—The Becker-Hazleton Co., 545 Main St., has purchased a site on Iowa st., on which it will build a seven-story and basement, 40x150-ft. building.

Minneapolis, Minn.—The Northeastern Knitting Co., 267 Lyndale Ave., will erect an eight-story brick factory, 103x298 ft., at North Minneapolis. John Wunder is the Arch. The estimated cost is $100,000.

St. Paul, Minn.—Local press reports state that the Northern Pacific R.R. will build a roundhouse and locomotive repair shop, costing $500,000.

Little Rock, Ark.—The Little Rock Compress Co. is the name of the enterprise noted May 28, which plans to build an $80,000 cotton compress.

+Texas City, Tex.—The Texas City Transportation Co. has awarded a contract to the HOUSTON STRUCTURAL STEEL CO. for a 163x880-ft. steel and sheet iron warehouse, at $110,000.

Houston, Tex.—The Houston Lighting & Power Co., will build a $11,000 garage and storehouse.

Ridgefield, Wash.—F. N. Griffith will build a 40x85-ft. and 25x40-ft starch factory, to cost $10,000.

Spokane, Wash.—Sherman, Clay &Co., Kearny and Sutter Sts., San Francisco, Calif., have commissioned Albert Held, Arch., to prepare plans for a piano factory to be erected here. The cost is estimated at $50,000. Leander S. Sherman is Pres.

Spokane, Wash.—Michem Bros. have purchased a site at Broadway and Nelson St., on which they will build a $25,000 packing plant.

St. Johns, Ore.—The Western Cooperage Co. will spend about $50,000 in building a new plant.

Southport, Ore.—The North Star Iron Works has purchased a site on which it will build a large factory and iron foundry.

Bakersfield, Calif.—T. J. Cornish, owner. of the Cornish Baking Co., plans to build a bakery, estimated to cost $15,000.

Oakland, Calif.—The Nevada Mineral Paint Co., 835 O'Farrell St., plans to construct a one-story factory and warehouse at Oakland, to cost about $10,000.

Los Angeles, Calif.—The Collins Commercial Co., 211 Pacific Electric Bldg., will erect a commercial garage and machine shop on West Third St., to be 100x110 ft. and estimated to cost $20,000. Dennis & Hewitt, 619 Fay Bldg., Los Angeles, are the Archs.

Riverside, Calif.—W. Horace Austin, Arch., Long Beach, Calif., is preparing plans for a commercial garage and machine shop for William L. Peters, Riverside, Calif. The building will be 50x250 ft. and is estimated to cost $10,500.

+Brantford, Ont.—The Niagara Silk Co. has awarded a contract to BENNETT & BOWDEN for a factory, at $35,000.

Sarnia, Ont.—The Mueller Manufacturing Co. plans to build a brick factory to cost about $25,000.

Toronto, Ont.—The National Iron Works, Ltd., is having plans prepared for a new pipe foundry, to cost about $50,000.

Windsor, Ont.—J. T. Wing & Co., 61 Sandwich St., is receiving bids for a four-story, 100x135--ft. brick and steel

[illegible] The [illegible] will be $16,[illegible] J C [illegible] Bell [illegible]

Moose Jaw, Sask—The Moose Jaw Abattoir Co has secured [illegible] abattoir, to cost about [illegible]

Fort George, B C—The [illegible] River Brewing & Malting Co [illegible] brewery Wilson & Wilson, 332 Granville St, Vancouver B C, are the Archs

FEDERAL GOVERNMENT WORK

+Oil Engine—Boston, Mass—The contract for furnishing one oil engine for propelling purposes in light vessel No 51, has been awarded to AUGUST MEITZ, 128 Mott St., New York, at [illegible] Noted July 2

Building, Etc.—Chatham Mass—Bids were received for constructing a life saving station house, barn and accessories at Chatham, Mass, as follows Elnathan Kelly, East Dennis, Mass, $[illegible] McDonald & Kivell, 155 Milk St., Boston, Mass., $14,142 Frank A Davis & Sons, 353 Commercial St., Provincetown, Mass $14,420 George W Wines, East Quogue, N Y, $[illegible] W H Fissell & Co 1133 Broadway, New York, $[illegible] W H Glover, Rockland, Maine, $15,400

++Dredging—Providence, R I—The contract for dredging in Providence River and Harbor, R I, has been awarded to the PACKARD DREDGING CO, Providence, R I, at $175,-[illegible] Noted July 9

+Breakwater Extension—Cape Vincent, N Y—Bids will be received by Col J G Warren, Corps Engrs, U S A, Federal Bldg, Buffalo, until 11 a m, Aug 14, for constructing a timber crib concrete breakwater extension at Cape Vincent Harbor

+Change in Bulkhead Lines—New York, N Y—A public hearing will be given by New York Harbor Line Board, Army Bldg, at 10 a m, July 30, to consider change in the bulkhead lines for English Kills, above Metropolitan Ave. Bridge, Boroughs of Brooklyn and Queens.

Derrick—Tompkinsville, N Y—Bids will be received until July 31, by the Light House Inspector, Third District, Tompkinsville, N Y, for furnishing a one-ton hand-power derrick

Induction Motors—Tompkinsville, N Y—Bids will be received until July 27, by the Light House Inspector, Third District, for furnishing two single-phase 25-hp alternating-current induction motors, 110 to 220 volts, 1750 r p m, respectively, 60 cycle and 25 cycle

+Jetty Repairs—Wilmington, Del—The contract for placing stone for repairs to jetties at Cold Spring Inlet, N J, has been awarded to the CONGER, DUNCAN CONSTRUCTION Co, New York, N Y, at $11,600 Noted July 9

Alterations, Etc.—Washington, D C—Bids were received, July 13, for alterations, repairs, etc. in the Auditor's Bldg., Washington, D C, as follows Caylor & Snyder, $16,490; W F Basin, $9622 George E Wyne, $16,870 J L Marshall, $11,62[illegible] Skinker & Garrett, $8997, William E. Mooney, $11,685. All bidders of Washington, D C

+Memorial—Washington, D C—Bids will be received until 11 a m, Aug 3[illegible], by Wm. Hartz, Executive Office, 1729 New York Ave, Washington, D C, for the erection of the Memorial to Women of the Civil War, at Washington, D C

Post Office—Covington, Va—Bids were received as follows July 14 by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, for the construction of a post office at Covington (a) limestone (b) sandstone J S Rogers Co, Moorestown, N J, (a) $40,2[illegible]0, (b) $40,260 Westchester Engineering Co, White Plains N Y, (a) $39,890 (b) $41,900, Otis Carlock, Frostburg, Md, (a) $38,900 (b) $39,800 Christ Kastler & Son, Evansville, Ind, (a) $44,833, (b) $45,000

+Sale of Engine—Jacksonville, Fla—Bids will be received until noon, Aug 17, by Maj W B Ladue, Corps Engrs, U S A, Jacksonville, Fla, for purchasing triple expansion engine [illegible] 24-in by 26-in centrifugal pump and other machinery removed from dredge "Barnard"

Post Office—Tupelo, Miss—Bids will be received until 3 p m, Aug 18 by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, for the construction complete of a one-story, mezzanine and basement stone and brick faced building of [illegible] sq ft ground area, at Tupelo, Miss

Buildings and Wharf—New Orleans, La—Bids were received as follows July 1[illegible], by the Bureau of Yards and Docks, Navy Dept, Washington, D C, for repairing certain buildings at the Naval Station, New Orleans, La, (1) net price for work complete, (2) amount to be deducted if all interior painting, etc, be omitted in five of the buildings, (3) amount to be deducted if all exterior painting in the same buildings be omitted, (4) amount to be deducted if roof work in [illegible] of the buildings be omitted; also for repairs to wharf for landing [illegible] at the naval station Lewis M [illegible] (1) $[illegible] (2) $[illegible], (3) $[illegible] (4) $[illegible] wharf, $[illegible] [illegible] on repairs to buildings [illegible] John F [illegible] (1) $[illegible] (2) $[illegible] (3) $[illegible] (4) $[illegible] wharf $[illegible] [illegible] (1) $[illegible] (2) $[illegible] [illegible] Lester F [illegible] (1) $[illegible] (2) [illegible] wharf $[illegible] Henry Mock, [illegible] wharf $[illegible] John [illegible] wharf, $[illegible] Jefferson [illegible] (1) $[illegible] (2) $[illegible] (3) $[illegible] (4) $[illegible] [illegible] Williams wharf $[illegible] All bidders of New Orleans except Henry Mock Noted July 9

Stone—[illegible] Bids received June 20 by [illegible] Corps Engrs, U S A, for furnishing [illegible] Noted May [illegible]

Lift Bridge—[illegible], Ky—Bids were received July 1[illegible] by [illegible] Corps Engrs, U S A, for furnishing and [illegible] bridge [illegible] Canal at [illegible] as follows American Bridge Co [illegible] Bridge Co, Beaver Falls, Penn, $[illegible] [illegible] Bridge [illegible] Steel Construction Co [illegible] & Co, Inc, [illegible] Noted June [illegible]

+Building—Cincinnati, Ohio—The contract for the erection of [illegible] at Cincinnati has been awarded to the OHIO BUILDING & CONSTRUCTION CO., Cincinnati, Ohio, at $15,900. Noted July 9.

+Scows—Cincinnati, Ohio—The contract for constructing and delivering 10 steel dump scows has been awarded to the AMERICAN BRIDGE CO, Cincinnati, Ohio, at $7775 each Noted July 16

Lumber—Detroit, Mich—Bids will be received until 2 p m, July 25, by the Light House Inspector, Detroit, for furnishing lumber for cribs and forms for piers in Livingstone Channel, Detroit River, Mich

Building—(Mackinac Island, Mich)—All bids have been rejected by the General Superintendent of the U S Life Saving Service, Washington, D C, for constructing the life saving station at Mackinac Island, Mich Revised plans are being prepared for this work Noted July 16.

Building—Port Austin, Mich—Bids were received, July 13, by the General Superintendent of the U S Life Saving Service, for constructing a boathouse and accessories for the Port Austin life saving station, from Frame & Mihlethaler, Harbor Beach, Mich, at $14,838 August Tildemann, Ludington, Mich, $13,522 Noted July 2

Breakwater—Calumet River, Ill—Bids were received July 6, by Lieut-Col W V Judson, Corps Engrs, U S A, for repairing with timber, superstructure of the breakwater at Calumet Harbor, Ill, as follows Robert Love & Son, Muskegon, Mich, $30,278, Burke, Smith & Nelson, Muskegon, Mich, $34,743, Byrne Bros D & E Co, Chicago, Ill, $36,81[illegible] Great Lakes Dredge & Dock Co, Chicago, Ill, $29,13[illegible] (recommended for acceptance) Noted June 11

Post Office—Delavan, Wis—Bids were received as follows, July 16, by Oscar Wenderoth, Superv, Arch, Treasury Dept, Washington, D C, for the construction of a post office at Delavan, (a) limestone, (b) sandstone, Northern Construction Co, Milwaukee, Wis, (a) $41,371, (b) $41,850, General Construction Co, Milwaukee, Wis, (a) $42,075, (b) $42,568, American Construction Co, Milwaukee, Wis, (a) $48,900, (b) $49,200, H H Shields, Danville, Ill, (a) $41,380, J P Cullen Construction Co, Janesville, Wis, (a) $43,129, (b) $43,800 Building to be two stories and basement, approximately 3580 sq.ft. ground area, brick facing, composition roof and first floor of fireproof construction. Noted June 11

Stone—Milwaukee, Wis—Bids were received May 2[illegible], by the Lighthouse Inspector, for furnishing and delivering 3600 tons of stone riprap at White Shoal light station, Lake Michigan, from T L Durocher, Sault Ste Marie, Mich, $5400, Sturgeon Bay Stone Co., Sturgeon Bay, Wis, $72[illegible]. Noted May 14.

Steel Boat—Duluth, Minn.—Bids will be received until noon, Aug 10, by Maj E D Peek, Corps Engs, U S A, for constructing the steel hull, steam survey boat "General C. B. Sears"

Levee—St. Louis, Mo—Bids will be received until 11 a m, Aug 11, by Maj. Clarke S. Smith, Corps Engrs, U S A, International Life Bldg, St Louis, Mo, for constructing about 130,000 cu.yd. of earthwork in the Shy Island drainage district, Ill

+Dredging—Port Arkansas, Tex—Bids will be received until noon, Aug 12, by Lieut. Col. C S Riche, Corps Engrs, U S A, Galveston, Tex, for dredging at Port Arkansas, Tex

+Roads, Walks, Etc.—Fort Bliss, Tex—Bids will be received until 11 a m, Aug. 13, by Capt Wm E Hunt, Depot Quartermaster, El Paso, Tex, for constructing roads, walks, gutters and drains at Fort Bliss, Tex

+Riprap, Etc—Galveston, Tex—Bids will be received until noon, Aug. 15, by Lieut-Col C S Riche, Corps Engrs, U S A, Galveston, for placing riprap and sill with sand at Federal Quarantine Station, Galveston, Tex

Wharf—San Diego, Calif—It has been decided to abandon the project for a timber and pile wharf at San Diego. Noted June 18.

+Dredging—San Francisco, Calif—The contract for dredging in the San Joaquin River has been awarded to the STANDARD AMERICAN DREDGING CO, San Francisco, Calif, at $11,118 Noted June 11

Centrifugal Pumps, Etc.—Panama—Bids will be received until 10:30 a m, Aug 3, by Maj F C Boggs, Gen Pur Officer, Isthmian Canal Comn, for furnishing centrifugal pumps, cast-iron pipe fittings, venturi meters, fuse panels, electric cable, galvanized conduit, etc, at Panama.

+Steel Castings—Philippine Islands—Bids will be received until noon July [illegible], by Col S [illegible] Roessler, Corps Engrs, U S A, Army Bldg, New York, N Y, for furnishing steel castings for the Philippine Islands Noted July 16

MISCELLANEOUS

Dredging—Boston, Mass—Bids will be received until 11 a m, July [illegible], by the Board of Harbor and Land Commissioners, State House, Boston, for dredging a channel and basin, [illegible] ft deep at mean low water, at Catawmet Harbor and [illegible] requiring the dredging of about [illegible] cu yd of material

+Fire Station—South Wallingford, Conn—The city has awarded the contract to DOYLE & MURPHY, [illegible] Main St, Wallingford, Conn, for constructing a two-story fire station [illegible] ft, at about $[illegible] It will be of brick and steel

++Barge Canal Terminals—Albany, N Y—Bids were received July [illegible] by [illegible] W [illegible] State Supt Pub Wks, Albany, for constructing barge canal terminals at Gowanus Bay, Brooklyn, N Y, and on Lake Ontario, Oswego, N Y The bids follow Gowanus Bay Terminal: GEORGE W [illegible] & CO, INC, [illegible] Broadway, New York, $[illegible] (awarded contract) Maryland Dredging & Contracting Co, [illegible], N Y, $[illegible] Eugene Bregmann, New York, $[illegible] P J Carlin Construction Co, New York, $[illegible] [illegible] Construction Co, New York $[illegible] Phoenix Construction Co, New York, $[illegible] United States Realty & Improvement Co, New York, $[illegible] John Monks & Sons, New York, $[illegible] Oswego Terminal H S KERBAUGH INC, [illegible] St, New York, $[illegible] (awarded contract) D L Taylor

Medina, N. Y., $371,978; Great Lakes Dredge & Dock Co., Buffalo, N. Y., $374,257. The item regarding the Oswego Terminal was noted July 16. Noted June 11.

Canal Work—Albany, N. Y.—Bids will be received by Duncan W. Peck, State Supt. Pub. Wks., Albany, until noon, Aug. 11, for Contract 1-A, Champlain Canal, Sect. 2, for completing the construction of the canal from Crocker's Reef to Fort Edward; length 4.45 miles; engineer's estimate, $90,-811. For constructing certain highways adjacent to the Hinckley Reservoir, Herkimer and Oneida counties, Sects. 2, 3, 4, 5, 7, 8, 9, 10 and 14, and completing the work on or before Jan 1, 1915; engineer's estimate, $99,120. For Terminal Contract No. 34, for constructing a dockwall on the east bank of the Hudson River at Thomson, near the Northumberland Dam; engineer's estimate, $18,857.

★**Lockers**—**Albany, N. Y.**—(Official)—Bids will be received by Franklin W. Ward, Secy. of the State Armory Comn., until 4 p.m., Aug. 10, for lockers for state armories.

✚**Dredging**—Buffalo, N. Y.—The city has awarded the contract to the GREAT LAKES DREDGE & DOCK CO., Buffalo, for dredging and widening the Buffalo River from Abbott Rd. to Seneca St., at $380,000. Incorrectly noted July 9 as $38,750.

★**Refrigeartion Equipment**—Comstock, N. Y.—(Official)—Bids will be received by John B. Riley, Supt. State Prisons, Capitol, Albany, until noon, Aug. 6, for the installation of refrigeration equipment in the storehouse, for the mess hall and kitchen building at the Great Meadow Prison, Comstock.

Elimination of Grade Crossing—(Viaduct)—Camden, N. J. —The Pennsylvania R. R. Co. plans to construct a viaduct at White Horse Pike and Ferry Ave. to eliminate the grade crossing at that point. Estimated cost, $140,000.

Dock—Trenton, N. J.—The Board of City Commissioners has approved plans for a 500-ft. municipal dock. Estimated cost, $50,000. J. R. Fell, Jr., is City Engr.

✚**Comfort Station**—Baltimore, Md.—The contract has been awarded by the city to P. J. CUSHEN, 217 St. Paul St., Baltimore, at $15,780, for the construction of a comfort station at Louisiana Ave. and Jasper St. It will be of semi-fireproof construction. Plans and specifications were prepared by Thomas C. Kennedy, Arch., 211 North Calvert St., Baltimore.

Retaining Wall—Easton, Md.—Bids will be received, until Juyl 28, by the Talbot County Commissioners, J. B. Harrington, Clk., for the construction of retaining wall for a distance of 366 ft. along the Miles River at the Easton approach the Miles River. Plans and specifications are at the offiec of the State Roads Commissioners, Baltimore, Md.

Dock and Railroad Bonds—Pensacola, Fla.—The City Commissioners will receive bids until Aug. 14 for $400,000 of municipal dock and belt railroad bonds.

Drainage Bonds—Tallahassee, Fla.—Bids will be received until Aug. 20 by the Secretary of the Board of Drainage Commissioners, Tallahassee, for $1,000,000 of drainage bonds.

Canal—Marks, Miss.—The Morgan Engineering Co., Memphis, Tenn., has recommended the construction of a drainage canal in Tazoo Coldwater Drainage District, from Marks, Miss., to Askew, Miss. Estimated cost, $600,000.

Drainage—Donaldsonville, La.—The Commissioners of Smoke Bend Drainage District of Ascension Parish have voted to issue $10,500 in bonds for drainage work.

Levee Work—New Orleans, La.—(Official)—Bids will be received until 4 p.m., July 28, by the Board of Levee Commissioners of the Orleans Levee District, New Court Bldg., New Orleans, for constructing levees from the Parish Line to Canal St. Ferry, from Canal St. Ferry to Algiers Saw Mill, and the Beka Levee. The work calls for 197,000 cu.yd. of earthwork and 4500 sy.yd. of concrete facing or paving. C. J. Donner is Secy.

✚**Vessel**—Memphis, Tenn.—The Lee Line has awarded the contract to JOHN ROHAN & SONS, St. Louis, Mo., for constructing an all-steel steamer to ply between Memphis, Tenn., and St. Louis.

Fire Apparatus—Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, Room 513, City Hall, until noon, July 24, for furnishing and delivering apparatus for the department of fire. Thomas L. Sidlo is Dir. Pub. Safety.

✚**Retaining Wall**—Youngstown, Ohio—The city has awarded the contract, it is reported ,to CAMPBELL BROS. for constructing a retaining wall along the park drive, at $66,394.

Ditch—Warren, Ohio—Bids will be received until Aug. 4 by the County Auditor, Warren, for ditch work aggregating 46,562 cu.yd. of excavation.

✚**Drainage**—Kankakee, Ill.—The Commissioners of Little Beaver Drainage District, Kankakee, awarded the contract, July 1, to the NATIONAL DRAIN TILE CO., for drainage improvements to cost $63,000. Noted June 25.

✚**Ditches**—Janesville, Wis.—Bass Creek Drainage District has awarded the contract to the WARNER DREDGE CO., Valley Junction, Wis., for constructing drainage ditches aggregating 164,700 cu.yd., at $14,193.

Docks and Warehouse—Milwaukee, Wis.—Schnetzky & Son, Archs., Germania Bank Bldg., Milwaukee, will ask for bids soon for the construction of docks and a warehouse at the foot of Erie St.

✚**Drain**—Fort Dodge, Iowa—Contracts for Drain 191 have been awarded by the county as follows: Labor, to SARGENT TILE DITCHER CO., Fort Dodge, at $5526; material, to the LEHIGH SEWER PIPE & TILE CO., Fort Dodge, at $13,732.

Ditch—Slayton, Minn.—The County Commissioners, July 7, received bids for constructing Ditch No. 29. The contract has been awarded to P. B. Jennings, Wanda, Minn., at $22,-769.

✚**Tunnel**—Paola, Mont.—See item under Railways: Montana-Great Northern Ry.

Park Work—Corpus Christi, Tex.—A bid was received July 7 by the city for improving Bluff Park, from Davis Bros., Houston, Tex., at $10,998.

Levees—Austin, Tex.—Arthur Stiles, State Reclamation Comr., Austin, plans to construct a system of levees for flood protection in Fannin, Woods, Dallas, Ellis and Navarro Counties.

✚**Grandstand**—Galveston, Tex.—The Executive Committee of the Racing Association, July 1, awarded the contract to M. C. DOWDEN, Galveston, for constructing the proposed new grandstand. It will be 618 ft. long.

Natatorium — Seattle, Wash. — J. Merrill Brown, Arch., Seattle, has been commissioned by Erwin Baruch, 1621 Summit Ave., Seattle, to prepare plans for a natatorium to be constructed at Western Ave. and Virginia St., at a cost of $100,000.

Coal Handling Equipment—Astoria, Ore.—Bids will be received until Aug. 15 by the Port of Astoria Commission for coal handling equipment. Estimated cost, $50,000. F. J. Walsh is Sh. Engr. Comn.

Barn—Portland, Ore.—Bids will be asked by the city in August for constructing the proposed fireproof barn at 16th and Jefferson Sts. Estimated cost, $50,000.

Dock—Portland, Ore.—The Oceanic Dock, owned by the city, will be rebuilt at once. The dock was destroyed by fire recently. Estimated cost, $150,000.

Drainage—Knights Landing, Calif.—The residents of the Knights Landing Drainage District have completed financial arrangements for the construction of a ditch to drain 72,000 acres between the Yolo Bypass and Colusa Basin. The work is estimated to cost $800,000. P. A. Haviland, Oakland, Calif., is Engr. Noted July 2.

Shipyard and Drydock—Los Angeles, Calif.—The Harbor Commissioners, July 7, decided to have plans prepared for a municipal shipyard and drydock. Estimated cost, $1,000,-000. Homer Hamlin is City Engr.

Levees—Sacramento, Calif.—The State Reclamation Board, Sacramento, has decided to construct the east levee of the Sutter bypass, the north levee of the Tisdale bypass and the west levee of the Sutter bypass. Estimated cost, $1,000,000

Levees—Sacramento, Calif.—The state plans to spend $50,00 to strengthen the bank levees of the Sacramento and San Joaquin Rivers.

✚**Pier**—San Francisco, Calif.—The following bids have been received by the State Harbor Commissioners for constructing Pier 25: Clinton Fireproofing Co., $455,800; F. A. Koetz, $480,00; San Francisco Bridge Co., $414,937; HEALY-TIBBITTS CONSTRUCTION CO., San Francisco, $368,300 (awarded contract); Dunnavant-Houghton-Van Sant Co., $560,000.

✚**Ferry Slips**—San Francisco, Calif.—Bids have been received as follows by the State Harbor Commissioners for passenger ferry slips Nos. 9 and 10: F. A. Koetz, $127,500; San Francisco Bridge Co., $102,850; Thomson Bridge Co., $96,315; HEALEY-TIBBITTS CONSTRUCTION CO., San Francisco, $91,700 (awarded contract). Noted June 25.

Ferry Annex—San Francisco, Calif.—Plans have been prepared by the engineers of the State Harbor Commissioners for a one-story ferry building annex.

✚**Grading**—San Francisco, Calif.—The Board of Public Works has awarded a contract for grading the civic center site to T. W. McCLENAHAN & CO., San Francisco, at $54,860; also a contract for grading the 17th St. car barn site to DANIEL O'DAY & CO., San Francisco, at $34,850.

Bath-house—Santa Barbara, Calif.—H. Alban Reeves, Arch., Chamber of Commerce Bldg., Los Angeles, is completing plans for the bath-house to be constructed for the Southern California Edison Co. It will be two stories, 200x80 ft., of brick and concrete. Estimated cost, $50,000.

Seawall—Santa Barbara, Calif.—George P. Robinson, City Engr., has completed plans for the seawall to be constructed along the west boulevard. It will be of reinforced concrete. Estimated cost, $72,414.

Fire Station—South Pasadena, Calif.—The town plans to construct a fire station to cost $10,000.

Wharf—Mochelle, N. S.—Bids will be received until July 31, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing a wharf at Mochelle. It will be 520x20 ft.

Harbor Work, Wharf Extension—Windsor, N. S.—Bids will be received until July 31 by R. C. Descrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for harbor improvements at Windsor, including the extension of the government wharf.

Cable—Toronto, Ont.—Bids will be received until July 30 by the Toronto Electric Commissioners for lead-covered cables.

Subway—Montreal, Que.—Bids will be received until noon, July 30, by the Board of City Commissioners for constructing a subway in Park Ave. J. E. Vanier, Beaver Hall Sq., Montreal, is Engr.

Steel Gates, Etc.—Ottawa, Ont.—Bids will be received by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, for steel gates, towers and operating machinery for the regulating dam, Big Chaudiere Falls, French River, Ont.

✚**Canal**—Ottawa, Ont.—The Canadian Government has awarded the contract to the RANDOLPH MacDONALD CO., Toronto, Ont., for constructing Sect. 3 of the Trent Canal, at $901,141.

★**Ash and Coal-Handling Apparatus**—Toronto, Ont.—(Official)—Bids will be received by H. C. Hocken, Mayor and Chn. Bd. of Control, until noon, Aug. 18, for the installation of ash- and coal-handling apparatus at the main pumping station. For details see advertisement under "Contracts To Be Let."

Ditches—Dauphin, Man.—Bids will be received by J. A. Gorby, Clk., Rural Municipality of Dauphin, until noon, July 25, for ditching in parts of Township 26, Range 19, and parts of Townships 27 and 28 in Ranges 18 and 19, in Dauphin

Wall—Kamloops, B. C.—Surveys have been completed for the proposed retaining wall to be constructed along the bayshore, west of the Second St. dock.

BUILDINGS

Adams, Mass.—C. T. [illegible]ett, F. R. Shaw and L. A. [illegible] are interested in erecting a $[illegible] theater.

✦Boston, Mass.—The contract for erecting the business [illegible] at [illegible] St. and Franklin Ave., Roxbury District, has been awarded to the NATIONAL FIREPROOFING CO. The building will be of brick, two stories, 13x250 ft. Ar[illegible] [illegible], 41 Bromfield St., is the Arch.

The contract for building the apartment on St. Luke's [illegible], [illegible], for Mary C. [illegible], has been awarded to [illegible] T. M. GOODE, 352 Kenrick St., Newton. The building will be of [illegible] and limestone and is estimated to cost $[illegible]. Louis P. McCarren, 240 Howard St., Brookline, is the Arch.

Leonardo Scalliaciotti, 120 North St., will build a five-story brick business and apartment building at North and Clark Sts. E. L. Dawson, 6 Beacon St., is the Arch.

✦Cambridge, Mass.—The B. P. O. E. has awarded a contract for building a three-story brick, stone and terra cotta building, 9[illegible] ft., to JOHN C. BYRNE, at about $90,000. C. R. [illegible]rew is the Arch.

Exeter, Mass.—The Trustees of Phillips-Exeter Academy have decided to rebuild the administration building, recently destroyed by fire. The estimated cost is $100,000. Ralph A. [illegible], 1[illegible] Beacon St., is the Arch.

Holyoke, Mass.—T. Beaudoin, 3[illegible]2 Chestnut St., will build a five-story brick apartment at Appleton and Walnut Sts. Oscar Beauchemin is the Arch.

✦South Hadley, Mass.—The contract for constructing the Alumnae Bldg. for Mount Holyoke College has been awarded to the CASPER RANGER CONSTRUCTION CO., Holyoke. The estimated cost is $[illegible]. Walter F. Price, 731 Walnut St., Philadelphia, Penn., is the Arch.

Springfield, Mass.—The Odd Fellows contemplate constructing a $[illegible] building. James L. Shannon is Chn. of the Bldg. Comm.

Springfield, Mass.—W. F. A. Engel is interested in the building of a studio on Broadway, to cost about $10,000. E. C. & G. C. Gardner, with H. L. Sprague, are preparing the plans.

West Newton, Mass.—The West Newton Savings Bank will erect a brick and stone building at Washington and High and Sts. Thomas M. James, 15 Ashburton Place, Boston, is the Arch.

Worcester, Mass.—Bids will soon be asked by the Trustees of Worcester Academy for building a brick gymnasium at Penn and Union Sts., to cost about $100,000. Peabody & Stearns, 53 State St., are the Archs.

Pawtucket, R. I.—The lowest bid submitted to the School Committee for constructing the 12-room school in the Darlington Section was that of the Frank E. Rowley Co., Pawtucket, at $64,675.

Pawtucket, R. I.—Plans have been completed by R. C. N. Monahan, Arch., Westminster St., Providence, for constructing the three-story and basement school on Abbott St.

Hartford, Conn.—It is reported that Merry & Boomer, Hotel Taft, New Haven, plan the erection of a hotel in Hartford, to cost about $2,000,000. Warren & Wetmore, New York, N. Y., are the Archs.

✦Greenwich, Conn.—The contract for constructing the three buildings for Mrs. Nathaniel Witherell, who will present them to the Young Men's Christian Association, has been awarded to JACOB A. ZIMMERMAN & CO., 18 East 41st St., New York, N. Y., at about $200,000. The buildings will be of brick and artificial stone. M. L. & H. G. Emery, Bible House, New York, N. Y., are the Archs.

✦New London, Conn.—The contract for building three buildings at the Connecticut College for Women, on Mohegan Ave., has been awarded to the NORCROSS BROS. CO., New York, N. Y.

Stratford, Conn.—Bids will be received until 5 p.m., Aug. [illegible], by [illegible] H. Beckwith, Arch., 16 P. O. Arcade, Bridgeport, Conn., for the erection of a school on Nichols Ave. and building an addition to the Washington School. The buildings will be [illegible] ft. of brick and stone, two stories and basement. Noted July 2.

Buffalo, N. Y.—The Church of the Immaculate Conception is having plans prepared for erecting a church, estimated to cost $[illegible]. [illegible] is Rector.

✦Buffalo, N. Y.—Frederick [illegible], Mutual Life Bldg., has awarded a contract to GEORGE SCHAEFER & SONS, [illegible] St., for building a theater to cost about $[illegible]. The building will be of steel, brick and terra cotta. [illegible] C. [illegible], Mutual Life Bldg., is Arch.

✦New York, N. Y.—(Borough of Manhattan)—The contract for erecting [illegible] store and office building at [illegible] for the [illegible] Co., has been awarded to the [illegible] CONSTRUCTION CO., 111 [illegible]. The building will cost about $[illegible]. Starrett & Van Vleck, [illegible] Bldg., are the Archs.

✦[illegible], N. Y.—The general contract for erecting the [illegible] and basement bank and office building for the [illegible] has been awarded to the [illegible], [illegible] Broadway, New York, N. Y. [illegible] & [illegible], [illegible] St., New York, N. Y., are the Archs.

[illegible], N. Y.—[illegible] & [illegible], Inc., [illegible], submitted the lowest bid at $[illegible] for constructing [illegible] buildings at the [illegible] Memorial [illegible]. Noted [illegible].

Utica, N. Y.—Bids will be received by [illegible] & Wicks, [illegible] St., Buffalo, for constructing two theaters for [illegible]. The buildings are estimated to cost [illegible]. [illegible] is [illegible] of the [illegible].

✦Newark, N. J.—The [illegible] has [illegible] the contract for the erection of a [illegible] to the [illegible] CONSTRUCTION [illegible].

Newark, N. J.—The Board of [illegible] has granted the [illegible] of $[illegible] for the construction of a new ad[illegible].

Newark, N. J.—Dunn Bros. will build a seven-story brick and concrete office building 76x100 ft. at 22 Clinton St. to cost about $[illegible].

West Hoboken, N. J.—(Official)—Bids will be received by the Board of Education until noon July 28, for constructing the West Hoboken High School. The estimated cost is $1[illegible]. Ernest Sibley, Edgewood Lane and Bluff Road, Palisade, N. J., is Arch.

✦Columbus, Ga.—(Official)—The city has awarded the contract for erecting and completing the City Hospital to the SOUTHERN FERRO CONCRETE CO., [illegible] Trust Co. of Georgia Bldg., Atlanta, Ga. Bids are desired by the contractor for furnishing materials and for sub-contracts.

✦Memphis, Tenn.—The contract for erecting the theater on Main St. for J. R. Snowden has been awarded to JAMES ALEXANDER CONSTRUCTION CO., Memphis Trust Co. Bldg., at about $63,000.

✦Berea, Ohio—The general contract for the erection of the two-story and basement high school has been awarded to F. C. WOLFE, Elyria, Ohio. The estimated cost is $60,000.

Cincinnati, Ohio—Bids will be received until noon, Sept. 1, by George O. Deckebach, Secy., of the Courthouse Building Commission, for the erection of the courthouse and county jail at Cincinnati, Ohio. Rankin, Kellogg & Crane, 1012 Walnut St., Philadelphia, Penn., are the Archs.

✦Cincinnati, Ohio—The contract for the erection of the exhibit building for the Merchants & Manufacturers' Permanent Exhibit has been awarded to the ELLENBERGER CONSTRUCTION CO., Chicago, Ill.

Cleveland, Ohio—Bids will be received about July 20, by Walker & Weeks, Archs., 1900 Euclid Ave., Cleveland, for the erection of a three-story, 193x108-ft. high school, on Lee Road. The estimated cost is $200,000.

Cleveland, Ohio—Bids will be received until Aug. 18, by the City Clerk, for the erection of the city hall. The estimated cost is $1,000,000.

Hubbell & Benes, Archs., Citizens' Bldg., Cleveland, are preparing plans for the erection of a reinforced concrete market building, at Lorain Ave. and West 25th St. The estimated cost is $39,950.

Cleveland, Ohio—Bids will be received until noon, Aug. 3, by Frank G. Hogen, Dir. of Schools, Rockwell Ave. and East Sixth St., for the erection of a building at Empire and Parmelee Aves.

Medina, Ohio—Plans are being revised by Kregelius & Robinson, Archs., Leader-News Bldg., Cleveland, for the erection of the two-story and basement home building for the Pythian Sisters of Ohio. The estimated cost is $1[illegible].

✦Indianapolis, Ind.—The contract for the erection of the eight-story department store building for L. S. Ayres & Co. has been awarded to the BEDFORD STONE & CONSTRUCTION CO. The estimated cost is $300,000.

Indianapolis, Ind.—Plans are being prepared by Brookie & Weginnis, Archs., Indianapolis, for the erection of a four-story hotel at Meridian St. and Fall Creek, for the Fall Creek Realty Co. The estimated cost is $600,000.

✦Lafayette, Ind.—The general contract for the erection of the building for the Lafayette Lodge B. P. O. E. has been awarded to ALVA E. KEMMER, Lafayette, Ind., at $46,000.

✦Ann Arbor, Mich.—The general contract for the erection of the four-story and basement hall building for the Newberry Estate, 1224 Ford Bldg., has been awarded to G. R. CHRISTMAN, South Bend, Ind. The estimated cost is $100,000.

✦Detroit, Mich.—The general contract for the erection of the one-story and basement theater for E. H. Hill has been awarded to FRANK FARRINGTON, Scherer Bldg., Detroit. The estimated cost is $160,000. Noted July 2.

Hamtramck, Mich.—Bids will be received until 7 p.m., July 2[illegible], by Charles A. Fields, Secy. Bd. of Education, Hamtramck, for the erection of a high school at Hamtramck. George J. Haas, 3[illegible]7 Moffat Bldg., Detroit, is the Arch.

✦Pekin, Ill.—The general contract for the erection of the court house at Pekin, has been awarded to ENGLISH BROS., Champaign, Ill. The estimated cost is $[illegible].

Urbana, Ill.—Bids will be received until 11 a.m., July 25, by the State Arch., 29 South La Salle St., Chicago, for an addition to the chemistry building at the University of Illinois, Urbana.

✦Milwaukee, Wis.—The contract for driving piles to be used in the construction of the addition to the department store of Gimbel Bros. has been awarded to the GREAT LAKES DREDGE & DOCK CO. The estimated cost is $500,[illegible]. Noted July 16.

[illegible] & [illegible], Archs., [illegible] Wisconsin St., are completing plans for the erection of the three-story [illegible] building for the [illegible] State Investment Co. The estimated cost is $[illegible].

[illegible] & [illegible], Archs., 111 [illegible] St., are preparing plans for the erection of a three-story office building at Ninth and Wells Sts. The estimated cost is $[illegible].

[illegible] & [illegible], Archs., [illegible] Jefferson St., have completed plans for the erection of the Milwaukee County House of Correction, at North Milwaukee. It will be a group of 12 buildings, two story and basement. The estimated cost is $[illegible]. [illegible] O. [illegible] is County Clk.

✦Dubuque, Iowa—The contract for the erection of the building for the B. P. O. E. has been awarded to ANTON [illegible], Dubuque, at $1[illegible].

✦Barnesville, Minn.—The general contract for the erection of the school at Barnesville has been awarded to the [illegible] CO., [illegible], Minn., at $[illegible]. Noted June 11.

Flandreau, S. D.—Bids will be received until July 2[illegible], by [illegible], Secy. of High School Commission for the erection of the high school. Joseph [illegible], S. D., is the Arch.

✦Madison, S. D.—The contract for the erection of the high school at Madison has been awarded to the GARNER CONSTRUCTION CO., Madison, at $[illegible].

Kansas City, Mo.—Bids will be received until July 27, by Charles A. Smith, Arch., Finance Bldg., for the erection of an addition to the Emerson School, on Tracy Ave. and Pacific St.

Webster Groves, Mo.—Bids will be received until 8 p.m., Aug. 1, by F. E. Miller, Sec., Bd. of Directors, School District of Webster Groves, for constructing a school on Gray Ave. M. P. McArdlo, 1104 Chemical Bldg., St. Louis, is the Arch.

+Dallas, Tex.—The contract for the addition to the Brown School has been awarded to J. M. BROWN, at $31,135.

San Antonio, Tex.—Giles & Murphy, Archs., F Bldg., have prepared plans for the erection of a county poorhouse. The estimated cost is $45,000.

Boillot & Lauck, Archs., Scarritt Bldg., Kansas City, Mo., are preparing plans for the erection of an apartment house and store building at San Antonio. The estimated cost is $120,000.

Eugene, Ore.—The University of Oregon will erect an administration building at Eugene. Bids will be received about Aug. 1.

North Bend, Ore.—J. E. Tourtellotte, Arch., Rothschild Bldg., Portland, has prepared plans for the erection of a four-story hotel at Montana St. and Sherman Ave. The estimated cost is $60,000.

Alhambra, Calif. — Norman F. Marsh, Arch., Broadway Central Bldg., has completed plans for the erection of high school buildings at Alhambra. The estimated cost is $100,000.

+Los Angeles, Calif.—The contract for the erection of the tnree-story Class C brick building at Los Angeles and 16th Sts., for the College of Dentistry, has been awarded to the HUNTTSBERGER REED CO., Van Nuys Bldg.

Norwalk, Calif.—Plans are being prepared by George B. McDougall, State Arch., Sacramento, for the erection of the State Hospital for the Insane at Norwalk. The estimated cost is $160,000.

San Fernando, Calif.—Austin & Pennell, Archs., Wright & Callender Bldg., are completing plans for the erection of the school at San Fernando. It will be a one-story and basement, 176x78-ft. structure. The estimated cost is $50,000.

Stockton, Calif.—Bids will be received until noon, July 28, by W. F. McClure, State Engr., Capitol Bldg., for the erection of dairy buildings at the State Hospital at Stockton.

Santa Cruz, Calif.—Bids were received for constructing the Santa Cruz school as follows: R. O. Summers, $51,872; William Bros. & Henderson, $46,162; Boyd, Kerr & McLean, $50,604; Schnebly, Hostrawser & Pedgrift, $53,829; Sound Engineering & Construction Co., $52,000; H. A. Klyce, $45,300; Graham & Jensen, $49,522; Peterson & Wilson, $43,000, plus 4% on all sub-contracts not awarded to them, which will bring their bid to approximately $43,800.

Van Nuys, Calif.—Allison & Allison, Archs., Hibernian Bldg., are completing plans for the erection of a high school at Van Nuys. The estimated cost is $150,000.

Ventura, Calif.—Plans are being prepared by George B. McDougall, State Arch., for the erection of the State Reform School for Girls. The construction will be of frame and plaster. The estimated cost is $75,000.

+Toronto, Ont.—The Toronto Terminals Ry. Co. has awarded the contract for the erection of the union passenger station at Toronto to the PETER LYALL CO., Montreal, Que. The estimated cost is $3,000,000.

Elkhorn, Man.—Bids will be received until 4 p.m., July 31, by H. E. Matthews, Lindsay Bldg., Winnipeg, Man., for the erection of a public building at Elkhorn.

Oak Lake, Man.—Bids will be received until Aug. 4, by R. C. Desrochers, Secy., Dept. of Pub. Wks., for the erection of a public building at Oak Lake.

Winnipeg, Man.—V. W. Horwood, Arch., 261 Frost St., has prepared plans for the erection of an engineering building for the University of Manitoba. The estimated cost is $250,000.

Qu'Appelle, Sask.—Bids will be received by the Director of Contracts, Dept. of Militia & Defense, Ottawa, Ont., for constructing a drill building at Qu'Appelle, Sask.

+Edmonton, Alta.—The contract for the erection of the addition to the Royal Alexandria Hospital has beeen awarded to OLSEN & JOHNSON CO., Missoula, Mont. The estimated cost is $175,000.

CONTRACT PRICE

Bridge—Nanticoke, Penn. — Bids were received by F. R. Hendershoot, Controller, Luzerne County, Wilkes-Barre, for the construction of a reinforced concrete bridge across the North branch of the Susquehanna River, between Nanticoke and West Nanticoke, from (A) P. J. Carlin Construction Co., 1123 Broadway, N. Y.; (B) D. M. Hosser Co., Kingston, Penn.; (C) G. H. Beimard, Bloomsburg, Penn.; (D) Penn Bridge Co., Beaver Falls, Penn.; (E) Dravo Construction So., Pittsburgh, Penn; (F) Whittaker & Diehl, Harrisburg, Penn.; (G) James McLinden & Co., Anglesea, N. J.; (H) Lathrop, Shea & Henwood, Scranton, Penn. The item bids were as follows:

BRIDGE, NANTICOKE, PENN.

	A	B	C	D	E	F	G	H
Rock excavation, per cu.yd.	$5 00	$2.00	$3 00	$3.50	$4 00	$5.75	$5.00	$3.50
Wet excavation, per cu.yd.	3.00	1.00	2.50	1.95	2.50	2.00	2.25	1.95
Dry excavation, per cu.yd.	0.50	0.75	1.50	0.95	1 00	0.75	1.25	0.95
Creosoted piles, per lin.ft.	0.45	0.50	0.96	0.55	0.60	0.50	0.65	0.60
Hardwood piles; per lin.ft.	0.35	1.00	0.75	0.50	0.40	0.45	0.55	0.50
Concrete piles, per lin.ft.	2.00	3.00	2.00	2.50	1.45	1.35	2.50	1.50
Pedestal piles, per lin.ft.	1.50	4 00	2.25	2 20	1.45	2.75	2.25	2.20
Simplex piles, per lin.ft.	1.50	4.00	2.25	2 20	1.35	1.27	...	2.30
Concrete, Class A, per cu.yd.	11.00	12 00	12.48	12.00	11.00	11.75	15.00	12.00
Concrete, Class B, per cu.yd.	10.00	10.00	7.65	8.95	6.50	8.75	14 00	8.40
Concrete, Class C, per cu.yd.	9.00	7 00	6.75	6.95	6.00	7.50	12.00	6.95
Structural steel, per lb.	0.045	0.05	0.045	0.039	0 036	0.045	0.045	0.045
Reinforcing rods, per lb.	0.04	0 03	0.045	0.035	0.0275	0.03	0.04	0.035
Concrete sidewalk, per sq.ft.	0 16	0.20	0.20	0.20	0.15	0.20	0.20	0.15
Creosoted "Lug" block, per sq.yd.	2.75	3.50	2.40	2.60	2.50	2.65	3.00	2.60
Other creosoted block, per sq.yd.	2.25	3.75	2 40		2.35	2.75		2.60
Vitrified block, per sq.yd.	2 50	2.00	2.75	2.80	3.00	2.55	2.80	2.00
Belgin block, per sq.yd.	2.75	3.50	3.25	3.50	3.25	3 00	3.50	3.00
Wainwright steel curb, per ft.	0.25	0 20	0.45	0.25	0.25	0.40	0 35	0.25
Extended totals	$281,500	$293,500	$289,500	$288,300	$278,500	$283,847	$281,835	$291,400

The Independent Pneumatic Tool Co., Chicago, has leased a two-story building at 334 St. James St., Montreal, Que., and will open a branch store, where Canadian business will be transacted after Aug. 9. A complete line of Thor pneumatic tools, electric drills, accessories and spare parts will be carried in stock for immediate delivery on orders in Canada. **W. H.** Rosever will have charge of the new office.

Sewers—Plainfield, N. J.—Bids were received by the city, July 6, for constructing sewers, from (A) Di Napoli & Toriello Construction Co., Hackensack; (B) Kelley-McFeeley Co., Camden; (C) T. Foster Callahan, Elizabeth; (D) Charles A. Petersen, Plainfield; (E) Burke & Bonham, Plainfield; (F) Mobus Sabocher Co., Plainfield; (G) John W. Heller, Newark; (H) L. S. Fulton, Elmhurst, N. Y.; (I) James J. Fusco, Newark. The item bids were as follows:

SEWERS, PLAINFIELD, N. J.

	A	B	C	D	E	F	G	H	I
120 lin.ft. 15-in. vitrified sewer	$0 65	$0.62	$0 75	$0.70	$1.25	$1 10	$1 00	$1 30	$1.00
385 lin.ft. 24-in. vitrified sewer	1 25	1 25	1.35	1.50	1.50	1 50	2 00	1 20	1 50
980 lin.ft. 27-in. vitrified sewer under 6 ft. deep	2 05	2 25	1 98	2 70	2 46	2 00	2.55	3.10	2 77
1085 lin.ft. 27-in. vitrified sewer 6 to 8 ft. deep.	2 20	2 69	2 31	2 90	2 56	2 40	2 85	3.20	3 27
956 lin.ft. 27-in. vitrified sewer 8 to 10 ft. deep.	2 35	2 80	2.72	3.15	2.81	2 80	3 20	3 40	3 77
1283 lin.ft. 27-in. vitrified sewer 10 to 12 ft. deep.	2 56	3 18	3.17	3 50	3 47	3 20	3 70	3.75	4 13
1265 lin.ft. 27-in. vitrified sewer 12 to 14 ft. deep	2 76	3 72	3.52	3 90	3.86	4 00	4.20	4 20	4 50
1157 lin.ft. 27-in. vitrified sewer 14 to 16 ft. deep	2 85	3 93	3 82	4 40	4 64	4 40	4 80	4 95	5 00
295 lin ft. 27-in. vitrified sewer 16 to 18 ft. deep.	3 00	4.16	4 12	4 90	5 00	4 80	5 50	5.50	7 00
470 lin.ft. 24x27-in. reinforced concrete sewer	3 65	2 97	3 00	2 35	3 71	4 00	3 00	6.30	8 75
960 lin.ft. 16-in. c.i. sewer	2 78	2 30	2 75	3 00	3 56	2 50	2 50	4 75	3 25
9 manholes, less than 6 ft. deep.	38 00	47 47	45 00	40.00	45 00	50 00	45 00	47 50	50 00
7 manholes, more than 6 ft. deep	50 00	63 05	50 00	60.00	55 00	60 00	60 00	55 00	75 00
5 special manholes.	60 00	75 79	85 00	40 00	60 00	120 00	70 00	65 00	75 00
48 4-in. T branches on 27-in. sewer	2 50	6 50	6 50	3 00	3 75	7 50	3 00	5 00	10 00
24 extension connections	1 50	2 42	3 00	3.00	1 27	2 00	4 00	12 50	7 00
1020 lin.ft. 4-in. c.i. pipe house connections	0.99	0 70	1 00	0 80	0 45	1 10	0 75	0 75	1 00
300 cu.yd. concrete foundation for 27-in. sewer	3.00	3 13	7 00	2 50	4 00	8 00	7 00	8 75	10 00
1 5x8 ft. metal screen	40 00	30 73	60 00	50.00	45 00	25 00	50 00	50 00	35 00
1 connection with septic tank	15 00	25.00	18 00	10 00	10 00	20 00	100 00	15 00	100 00
2 concrete chambers on 24-in. sewer.	40 00	45 00	25 00	28 00	25 00	40 00	50 00	35 00	200 00
1 concrete gate chamber at screen tank.	20 00	95 00	25 00	35 00	30 00	60 00	75 00	35 00	200 00
2 27-in. connections with screen tank.	7 00	25 00	10 00	7 00	20 00	22 00	75 00	10 00	75 00
2 24-in. openings made in screen tank walls	10 00	25 00	10 00	5 00	20 00	18 00	25 00	10 00	25 00
1 opening in screen tank, enlarged	5.09	25 00	10 00	5 00	10 00	18 00	50 00	10 00	250 00
1 inlet chamber at siphon.	300.00	310 00	350 00	225 00	179 00	250 00	200 00	450 00	1500 00
1 outlet chamber at siphon	700 00	1158 00	900 00	860 00	650 00	750 00	500 00	275 00	1700 00
1 connecting manhole at Grant Ave.	90.00	379 00	350 00	125 00	175 00	190 00	75 00	185 00	150 00
Extended totals	$26,896	$32,003	$32,349	$33,562	$34,130	$34,776	$36,127	$41,956	$47,191

Contracts to Be Let

Bids received until July 28, 1914.

Barge Canal Improvements

STATE OF NEW YORK
OFFICE OF SUPERINTENDENT OF PUBLIC WORKS
Albany, June 29th, 1914

NOTICE TO CONTRACTORS.—
Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Tuesday, July 28th, 1914, at which place and hour they will be publicly opened and read for improving the New York State canals pursuant to the provisions of Chapter 147 of the Laws of 1903, and of the amendments thereto, as follows:

—1—
CONTRACT NO. 119
Erie Canal—Section 2

For furnishing and driving a quantity of steel sheet piling, extending the concrete apron and performing all incidental work connected therewith at Movable Dam Five at Rotterdam, N. Y.
Sheets 1 and 2.

—2—
CONTRACT NO. 120
Erie Canal—Sections 3 and 3.

[illegible] of the superstructures of the following [illegible] over the Mohawk River:
Dam 5 at Rotterdam, Station 1663 + 15, Erie canal.
Dam 6 at Cranesville, Station 1987 + 79, Erie canal.
Dam 7 at Amsterdam, Station 2281 + 16, Erie canal.
Dam 8 at Tribes Hill, Station 2143 + 17, Erie canal.
Dam 9 at Yosts, Station 2854 + 64, Erie canal.
Dam 10 at Canajoharie, Station 3370 + 50, Erie canal.
Dam 11 at Fort Plain, Station 3573 + 85, Erie canal.
Sheets 1 to 17 inclusive.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the [illegible] Division at Rochester, N. Y., and at the canal office, [illegible] Exchange, Buffalo, N. Y.

Copies of printed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment [illegible] of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for each work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the City of Albany or New York issued by a national or State bank in good credit within the state and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

[illegible]

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned, the interests of the State will be enhanced thereby.

DUNCAN W. PECK,
Superintendent of Public Works.

Bids received until Aug. 8, 1914.

Power House, etc.

NOTICE TO CONTRACTORS.—Sealed proposals for construction of Power House, including boiler plant piping and conduits, plumbing and electric work, construction, heating, plumbing and electric work for five cottages and dormitory, sewerage and sewage disposal plant and water supply works, for the New York State School of Agriculture on Long Island near Farmingdale, N. Y., will be received by Dr. Franklin W. Hooper, Secretary of the Board of Trustees, 39 Lafayette Avenue, Brooklyn, N. Y., until 10 o'clock a.m. on Saturday, August 8, 1914, when they will be opened and read publicly. Bids will be received for each division of the work separately and no combination of bids will be considered. Proposals shall be submitted on the blank form and in sealed envelope addressed to the Secretary, furnished by the State Architect. The envelope shall also contain certified check in the sum of 5% of the amount of bid. Each contractor to whom an award is made will be required to furnish surety company bond in the sum of 50% of the amount of contract within thirty (30) days after official notice of award of contract and in accordance with the terms of specifications Nos. 1930, 1931, 1932, 1933, 2810, 2812, 2814, 2813, 2815, 1901 and 1902. The right is reserved to reject any or all bids. Drawings and specifications may be consulted and blank forms of proposal obtained at the office of Mr. A. A. Johnson, Director, Farmingdale, N. Y., and at the office of the State Architect. In applying for plans and specifications, each bidder must state which part of the work, such as construction, heating, plumbing and electric work, he intends to bid. On and after July 14, 1914 drawings and specifications and blank forms of proposal may be obtained at the office of the State Architect upon deposit of a certified check (or cash) in the sum of ten dollars ($10.00), made payable to the State of New York, for each part of the work, which check or cash will be returned if plans and specifications are sent back in good order to the State Architect.

LEWIS F. PILCHER, State Architect.

Bids received until August 12, 1914.

Elevated Water Tank

Sealed bids will be received up to 10:00 A.M., August 12th, 1914 by the Pekin Water Works Company, Pekin, Ill., at the office of the Engineers in Chicago, for removing the present steel tank from the supporting steel tower and constructing and erecting thereon a new steel tank.

Specifications may be obtained at the office of the Engineers.

PEKIN WATER WORKS COMPANY,
W. S. [illegible], Secretary.

ALVORD & BURDICK, Engineers,
Hartford Bldg., Chicago.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS

Maine—Bangor & Aroostook R.R.—This company plans to spend $350,000 for improvements to its line. M. Burpee, Houlton, Maine, is Ch. Engr.

Florida—Memphis & Pensacola R.R.—See item under Tennessee.

Alabama—Alabama, Tennessee & Northern Ry.—This company plans to construct a 25-mile extension from Reform, Ala., to a connection with the Frisco Lines and the Illinois Central R.R. William Toxey, Mobile, Ala., is Ch. Engr.

Mississippi—New Orleans, Mobile & Chicago R.R.—This company has secured the right-of-way for its proposed branch line to connect with the Louisville & Nashville R.R. A. F. Church, Laurel, Miss., is Supt.

Tennessee—Memphis & Pensacola R.R.—This company plans to issue $14,000,000 in bonds for completing its proposed line from Memphis, Tenn., to Pensacola, Fla. N. Buck, 1401 Borland Bldg., Chicago, Ill., is interested. Noted Sept. 18, 1913.

Tennessee — Nashville, Shiloh & Corinth R.R.—Wayne County, Tenn., it is reported, has voted in favor of issuing $150,000 in bonds to aid this company in the construction of its proposed line. Waynesboro, Tenn., is the county seat of Wayne County.

Kentucky—Forman-Earl Co.—This company plans to construct a 25-mile standard-gage railroad from Ida May, Ky., to Buffalo, Ky. T. C. Feller, Lexington, Ky., is interested.

Ohio—Pittsburgh, Cincinnati, Chicago & St. Louis Ry.—The Ohio State Utilities Commission has authorized this company to issue $3,500,000 in bonds to provide for proposed improvements. W. C. Cushing, Pittsburgh, Penn., is Ch. Engr. M. W.

Ohio—Chesapeake & Ohio Northern R.R.—This company, a subsidiary of the Chesapeake & Ohio Ry., was authorized, July 23, by the State Utilities Commission, Columbus, Ohio, to issue $50,000 in bonds for the initial expense of securing rights-of-way for its proposed line from Columbus, Ohio, to Portsmouth, Ohio. F. I. Cabell, Richmond, Va., is Ch. Engr. Noted June 11.

Indiana—Chicago, Indianapolis & Louisville Ry.—This company plans to make improvements to its lines. A. S. Kent, Chicago, Ill., is Ch. Engr.

Wisconsin—Chicago & Northwestern Ry.—This company plans to construct a branch from Kingston, Wis., northeast to Cranden, Wis. E. C. Carter, Chicago, Ill., is Ch. Engr.

South Dakota—Greenville & Southeastern Ry.—This company, July 14, filed articles of incorporation for the construction of a railroad from Rosholt, S. D., to Greenville, S. D. George F. Anderson, Veblen, S. D., is interested.

Montana—Chicago, Milwaukee & St. Paul Ry.—Arrangements for electrifying 140 miles of this company's main line between Three Forks, Mont., and Deer Lodge, Mont., have been completed. Contracts are being awarded for immediate delivery of constructive materials. The division named will be operated by electricity after June 1, 1915. One year later the second division and two years later the third division will be operated by electricity, the three divisions covering 440 miles of mountain line between Avery, Idaho and Lewistown, Mont. Estimated cost, $8,000,000. C. W. Loweth, Chicago, Ill., is Ch. Engr.

Texas—International & Great Northern Ry.—The State Railroad Commission, July 15, approved a bond issue by this company of $245,000 for betterments to its lines. O. H. Crittenden, Houston, Tex., is Ch. Engr.

New Mexico—New Mexico Central R.R.—The bondholders of this company plan to reorganize and construct extensions to Roswell, N. M., and Salt Lake City, Utah. H. A. Coomer, Santa Fé, N. M., is Gen. Mgr.

✚Denver & Rio Grande R.R.—This company has awarded the contract to C. WELLS, Denver, Colo., for grading a 16-mile narrow-gage line from Caliente, Taos County, N. M., to La Madera, to connect with the lumber line of the Hallack & Howard Lumber Co., of Denver, Colo. J. G. Gwyn, Denver, Colo., is Ch. Engr.

Idaho—Emerald Creek Ry.—This company has been incorporated for the purpose of constructing a 25-mile railroad along Emerald Creek. The offices of the company are located at Wallace, Idaho.

Idaho — Chicago, Milwaukee & St. Paul Ry. — See item under Montana.

Utah—New Mexico Central R.R.—See item under New Mexico.

Nevada—Nevada Copper Belt R.R.—This company, it is reported, will be taken over by the Southern Pacific Co. and extended southward. A. J. Oren, Ludwig, Nev., is Gen. Supt.

Washington—Goodyear Lumber Co. — This company located at Port Angeles, Wash., plans to construct a logging road, nine miles long, from Clallam Bay, Wash., to its timber holdings.

✚**California**—The Board of Public Works of San Francisco, Calif., has awarded the contract to the UTAH CONSTRUCTION CO., Ogden, Utah, for constructing a nine-mile railroad and wagon line to the Hetchy-Hetchy dam site.

California—San Diego & Arizona Ry.—This company, it is reported, plans to issue $10,000,000 additional in bonds for proposed extensions. E. J. Kallright, San Diego, Calif., is Ch. Engr. Noted June 18 and June 25.

Quebec—Bids will be received until noon, Aug. 4, by the Commissioners of the Transcontinental Ry. for constructing a "Y" track at Cap Rouge, Que., at a point about 2½ miles west of Quebec Bridge and for completing the St. Malo line. P. E. Ryan, Ottawa, Ont., is Secy. Comrs.

Ontario—London & Lake Erie Ry. & Transportation Co.—This company plans to extend its line. A meeting of directors and shareholders will be held at London, Ont., Aug. 18 to vote on the proposition to issue bonds for the proposed work.

Alberta—Calgary & Fernie R.R.—See item under British Columbia.

British Columbia—Calgary & Fernie R.R.—The Railway Commission of Canada has approved the application of this company to construct a 174-mile line from Fernie, B. C., through Kananaskis Pass and Elbow Pass, thence along the south branch of the Sheep river, through the oil fields and through the Scarcee Reserve into Calgary, Alta. J. R. Lawreyn, S. S. Manahan, Victoria, B. C., and A. Mutz, Fernie, B. C., are interested. Noted July 24, 1913 and Mar. 19, 1914.

ELECTRIC RAILWAYS

Franklin, Mass.—The Dedham & Medway Street Ry. Co. has applied to the City Council for a franchise to construct an electric railway on Main St., from Emmons St. to the Medway line. Noted June 25.

Raritan, N. J.—The Board of Public Utility Commissioners has granted the Jersey Central Traction Co. permission to maintain and operate an electric railway line in Raritan Township. Samuel Barnes, Keyport, is Gen. Mgr. and Pur. Agt.

Parkersburg, W. Va.—Plans are being considered by the Parkersburg, Marietta & Interurban Ry. Co. for the extension of its line on Second St. H. H. Archer, Parkersburg, is Gen. Mgr. and Pur. Agt.

Wilmington, N. C.—The Wilmington & Fort Fisher Ry. Co. has been incorporated to construct and operate an electric railway from Wilmington to Fort Fisher, about 18 miles. The incorporators are H. A. Kure, Lawrence Kure and William L. Kure.

Macon, Ga.—The Macon Ry. & Light Co. contemplates making improvements and extensions to its lines in Macon. L. S. Boggs, Macon, is Gen. Mgr.

Tampa, Fla.—The Export Phosphate Ry. & Terminal Co. has been incorporated to construct and operate an electric interurban railway through Hillsboro and Polk Counties. The incorporators are E. L. Blood, E. A. Pierce and H. E. Capewell.

Donaldsonville, La.—The right-of-way has been obtained from Donaldsonville to Lockport for the construction of the proposed electric railway which will connect Donaldsonville and the Gulf. Alfred Picot, Thibodaux, is interested.

Nashville, Tenn.—The City Council has granted a franchise to the Tennessee & Kentucky Interurban Electric Ry. Co. to construct and operate an electric railway along White's Creek Pike in Nashville. This is part of a proposed line which will connect Nashville, Tenn. and Franklin, Ky. Noted Jan. 15.

East Liverpool, Ohio—The East Liverpool Traction Co. contemplates the extension of its Pleasant Heights line. B. J. Jones is Mgr.

Springfield, Ohio—The Springfield Ry. Co. has applied to the council for permission to extend its line on East High St. between Burnett Road and the Detroit, Toledo & Ironton R.R.

Grand Rapids, Mich.—The Crescent Heights Citizens' Association has petitioned the Grand Rapids Ry. Co. to extend its Plainfield line from Ann to Knapp St. W. E. Livingston, Grand Rapids, is Pur. Agt.

Fort Wayne, Ind.—Plans are being prepared by the Fort Wayne & Northern Indiana Traction Co. for double-tracking its line on Calhoun St. Samuel W. Greenland, Fort Wayne, is Gen. Mgr. and Pur. Agt.

Lafayette, Ind.—The Lafayette & Northwestern Traction Co. has been granted a franchise by the County Commissioners to construct and operate an electric railway through Tippecanoe County. G. J. Thompson is interested. Noted May 28.

Amboy, Ill.—The Northern Illinois Ry. has been purchased and the name changed to the Lee County Central Electric Ry. Co. The new owners plan to extend the line to Rochelle or Ashton. Andrew Aschenbrenner, Amboy, is interested.

Freeport, Ill.—The City Council has granted a franchise to the Freeport Ry. & Light Co. to extend its lines to the southern and western portions of the city. N. H. Pengra, Freeport, is Supt. Noted June 18.

★**Pekin, Ill.**—The only bid received July 6 by the City Clerk for the rehabilitation and equipment of about 3½

[illegible] of [illegible] electric railway in Pekin was that of the [illegible] Construction Co., Peoria, Ill., at $54,000. Noted July 2.

Peoria, Ill.—The Peoria Electric Ry. Co. has been granted a franchise to double-track its line on Main St. from Elizabeth to Western Ave. R. W. Bailey, Peoria, is Gen. Supt.

Quincy, Ill.—The Quincy Ry. Co. is preparing plans for the extension and improvement of its lines to cost about $[illegible]. H. E. Chubbuck, Peoria, is Gen. Mgr.

Mayville, Wis.—The Dodge County Electric Ry. Co. has been incorporated to construct and operate an electric railway in Mayville and vicinity. Charles R. Roberts is interested.

Iowa City, Iowa.—The Iowa City Electric Ry. Co. is planning to extend its lines into the southern section of the city. J. O. Schulze, Iowa City, is Pres., Gen. Mgr. and Pur. Agt.

Bonner Springs, Kan.—Plans are being considered by the Kansas City, Kaw Valley & Western Ry. Co. for the extension of its line from Bonner Springs to Lawrence. J. D. Waters, Bonner Springs, is Pres.

Hutchinson, Kan.—Preliminary arrangements have been completed and work will soon be started by the Hutchinson & Northern Ry. Co. on the construction of its proposed line to connect Hutchinson and Burrton, about 14 miles. George Theis, Jr., is Pres. Noted Feb. 12.

Olathe, Kan.—Plans are being prepared by the Missouri & Kansas Interurban Ry. Co. for the extension of its interurban line from Olathe to Ottawa. W. B. Strang, Overland Park, is Pres.

Billings, Mont.—The Billings Traction Co. is preparing plans for the extension of its line from Billings to Laurel. John Johnstone, Billings, is Supt., Pur. Agt. and Ch. Engr.

Springfield, Mo.—The Springfield Traction Co. plans to extend three of its lines in Springfield and to construct a line to connect with various towns in the vicinity of Springfield. Charles H. Gunkel, Springfield, is Gen. Mgr.

Brownsville, Tex.—Preliminary arrangements are being made by the Brownsville Street & Interurban Ry. Co. for the extension of its lines in Brownsville.

Temple, Tex.—The Southwestern Traction Co. is preparing to extend its street railway in Temple and Belton. W. G. Haag, Temple, is Gen. Mgr. and Pur. Agt. Noted June 18 and 25.

Baker, Ore.—Joseph Kries and John B. Yeon, Portland, are interested in the construction of an electric railway to connect Baker and Eagle Valley, about 4[illegible] miles.

Bruneau, Idaho.—The Electric Light & Power Co. is making preliminary arrangements for the construction of an electric railway from Bruneau to Glenns Ferry. W. Wallace is Gen. Mgr.

Healdsburg, Calif.—Alfred D. Rowen contemplates the construction of a 12-mile electric railway through Dry Creek Valley. He has applied for a franchise.

Los Angeles, Calif.—The Montecito Ry. Co. has been incorporated to construct and operate an electric railway to connect Griffin Ave., Ave. 43 and Mount [illegible], about 2½ miles. W. D. Lawrence, E. T. Wright and Ross Welch are the incorporators.

San Francisco, Calif.—The Board of Supervisors is considering the extension of the municipal street railway through Golden Gate Park from Tenth Ave. in the Richmond district to the south side of the park, and the Potrero Ave. line into the [illegible] Hill section. J. J. O'Shaughnessy is City Engr.

LIGHT, HEAT AND POWER

North Adams, Mass.—The [illegible] Cotton Mills, North Adams, will soon begin construction work on a new power plant, the first unit of its new manufacturing plant.

Bridgeport, Conn.—Bids are being received by the United Illuminating Co. for [illegible] and alterations to Station B, [illegible] Congress Ave. The cost is estimated at $[illegible].

✦New Haven, Conn.—A contract for the erection of a boiler house and the installation of the boilers for a heating plant at the City Hall has been awarded to JOHN A. [illegible], [illegible] Ave., New Haven, at $[illegible]. Other bidders: [illegible]

Syracuse, N. Y.—The [illegible] County Tuberculosis Sanitarium [illegible] the construction of a [illegible] house. [illegible] is Engr. Frank N. Wood is Pur. Agt.

Jersey City, N. J.—The Public Service Electric Co. has [illegible] to install a new [illegible] station on [illegible] Ave., to be used in connection with a new [illegible] for [illegible] Newark Ave.

National Park, N. J.—The [illegible] Gas Co. has been [illegible] by the Board of Public Utility Commissioners to build a gas plant and distributing system in National Park.

Greenville, Penn.—The [illegible] County Light, Heat & Power Co., Greenville, will build a new power plant to be located near the [illegible] end of the [illegible] Bridge over the [illegible] River.

Pottsville, Penn.—[illegible]

Wilkes-Barre, Penn.—[illegible]

Ocean City, Md.—It is reported that the City Council is considering the installation of a municipal electric-light plant [illegible]

Fort Defiance, Va.—The Fort Defiance Milling Co. is considering the establishment of a hydro-electric plant to furnish energy to Fort Defiance and New Hope [illegible]

Logan, W. Va.—Press reports state that the Logan Electric Co. is having plans prepared for the construction of a new power station. F. R. Weller, Hibbs Bldg., Washington, D. C., is Engr.-in-Charge. C. W. Poling, Logan, is Mgr. of the Logan Electric Co.

Georgetown, S. C.—The Santee-Cooper Development Co., Georgetown, plans to construct a canal from the Santee River to the Cooper River, with the ultimate intention of establishing a hydro-electric plant on the Cooper River, to develop 18,000 hp. The energy will be transmitted to a number of neighboring towns. The canal will be about 2[illegible] miles long.

Rock Mart, Ga.—An election will be held on Aug. 6 to submit to the voters the question of a $[illegible] bond issue for extending the municipal electric-lighting system.

Miami, Fla.—The Miami Gas Co. has issued $200,000 in bonds for improvements to its system, including additional pipe lines and a container of 3[illegible]-cu.ft. capacity.

Degraff, Ohio.—Bonds for $7[illegible] have been issued for improvements and additions to the municipal electric-light plant. J. T. Scott is Supt.

Norwood, Ohio.—Bids will be received until Aug. 7 for the reconstruction of the electric-light plant and waterworks system for the town of Norwood. Walter G. Franz, 17[illegible] Union Trust Bldg., Cincinnati, is Consult. Engr.

Youngstown, Ohio.—Plans have been completed by the Westinghouse, Church, Kerr Co., 37 Wall St., New York, for an electric-light plant for the Mahoning County Light Co. The estimated cost of the plant is $1,[illegible].

Indianapolis, Ind.—The Chief Engineer of the City Hospital has petitioned the Board of Health to make improvements and extensions to the power plant of the hospital at a cost of $17,000.

Detroit, Mich.—The Utility Power Co. will install a power plant in its new factory, for which plans have been prepared by Preston, Brown & Walker, 1925 Dime Bank Bldg. The building will be of reinforced concrete, four stories, 95x600 ft.

Bloomington, Ill.—The Bloomington & Normal Ry. & Light Co. contemplates making improvements to cost from $20,[illegible] to $2[illegible],000. M. G. Linn, Bloomington, is Gen. Supt.

✦Urbana, Ill.—The contract for the construction of the new addition to the power house of the University of Illinois has been awarded to FREEMAN & BROOKS, Champaign, Ill., at $44,5[illegible]0. The new equipment will consist of two 500-hp. Babcock & Wilcox water tube boilers, fitted with Greene stokers.

White Hall, Ill.—The City Council is considering the question of installing a municipal electric lighting plant in White Hall.

Estherville, Iowa.—(Official)—See item under "Water Supply and Irrigation."

Iowa Falls, Iowa.—The Iowa Ry. & Light Co., Cedar Rapids, is seeking a site for its new power plant in Iowa Falls. The company recently secured a franchise. Robert S. Cook, Cedar Rapids, is Pur. Agt. of the Iowa Ry. & Light Co.

Bagley, Minn.—(Official)—Bids will be received until 1[illegible] a.m., Aug. 5, by Oscar F. Stenwick, Secy. Water and Light Commission, for the construction of a frame power building, 35- and 60-hp. fuel oil motor, spirits or kerosene oil engines, with generators for the same, a 3[illegible]-gal. pump and switchboard. J. F. Druar, 312-314-316 Commercial Bldg., St. Paul, Minn., is Consult. Engr. Noted July 9.

Eveleth, Minn.—It is reported that the City Council has offered the Home Electric & Heating Co. $13[illegible] for its plant. The city plans to take over the property and operate a municipal plant.

Kansas City, Kan.—An election will be held Aug. 3[illegible] for the citizens to vote on the question of a bond issue of $6[illegible] for improvements and extensions to the municipal electric light and water systems. C. H. Little is City Clk.

Salina, Kan.—The Salina Light, Power & Gas Co. plans to improve its electric-light plant. J. E. Hersh is Mgr.

Miles City, Mont.—The City Council has under consideration the establishment of a heating plant, to cost about $[illegible] on either Main or Eighth St. It is proposed to operate the plant in connection with the [illegible] light and power plant.

Palmyra, Mo.—At an election held July [illegible], the citizens voted in favor of a bond issue of $[illegible] for improvements to the municipal electric-light and water systems. J. L. [illegible] is Mgr.

Billings, Okla.—Bonds for $[illegible] have been voted for the establishment of a municipal electric-light plant in Billings.

Reno, Nev.—The [illegible] Power Co. has been incorporated by A. D. Ayres, E. C. [illegible] and D. C. [illegible] to supply electrical current for lighting, heating and power purposes.

Drain, Ore.—Plans are being prepared for the installation of a municipal electric-light plant to cost about $[illegible]. Noted May 7.

Sandy, Ore.—The City Council has granted a franchise to the Portland Railway, Light & Power Co., Portland, to supply light and power to the city. A power transmission line will be constructed from [illegible] to the [illegible] power plant and a transformer station will be erected.

Los Angeles, Calif.—The Pacific Light & Power Corporation will spend $[illegible] for constructing additional distributing lines and making other improvements in southern California. About $[illegible] will be spent in the vicinity of Los Angeles and $[illegible] for Ventura County work. A substation to cost about $[illegible] will be built at [illegible] and Arrowhead Ave., San Bernardino. F. B. Davis, Los Angeles, is Mgr.

Porterville, Calif.—It is reported that R. B. Young will construct and operate an electric-power plant to supply the town of [illegible] and vicinity.

Tulare, Calif.—The Mount Whitney Power & Electric Co., Visalia, Calif., will build a new substation at Tulare, to cost about $[illegible]. H. A. Kimegel is Ch. Engr.

+Lachine, Que.—Bids were opened, July 24, by the City Council for conduits for electric wires. The contract has been awarded to DIETRICH, LTD., Montreal, Que., at $51,000.

Dresden, Ont.—The ratepayers have voted in favor of a bylaw for the establishment of a hydro-electric plant. The City Clerk has been instructed to call for bids for equipment for the system.

London, Ont.—The Hydro-Electric Commission contemplates the installation of some new equipment in the power station. H. J. Glaubitz is Mgr.

Regina, Sask.—The County Council will build a new power plant, and extend its distributing system at a total cost of about $380,000. A. E. Chivers is Clk.

Saskatoon, Sask.—The ratepayers have approved a bylaw appropriating $15,000 for the purchase of a site for a new power house.

BRIDGES

★+Cambridge, Mass.—(Official)—Bids were opened July 13 as follows by the city for constructing the Walden St. bridge over the tracks of the Fitchburg R.R.: NEW ENGLAND STRUCTURAL CO., $5923 (awarded contract); Boston Bridge Works, $7200; Cousins Bridge Co., $7989. Noted July 2.

(Official)—Bids will be received until 11 a.m., Aug. 3, by the Board of Commissioners of Middlesex County for the construction of a road and concrete bridge in the towns of Medfield and Sherborn. F. H. Kendall is County Engr. Levi S. Gould is Ch. of Comrs.

+Albany, N. Y.—The contract for the construction of the viaduct over Normanskill Creek at Bethlehem, Albany County, has been awarded to the PENN BRIDGE CO., Beaver Falls, Penn., at $58,234. Noted July 2.

★See item under Miscellaneous: Barge Canal Work—Albany, N. Y.

★Norwich, N. Y.—(Official)—Bids will be received by the town until 1:30 p.m., Aug. 5, for constructing a reinforced concrete arch over the Chasawacta Creek at South Broad St. Irving D. Tillman is Town Clk.

★+Perth Amboy, N. J.—(Official)—Bids were opened July 20 by the Board of Chosen Freeholders, New Brunswick, for constructing a reinforced concrete bridge at Convery Place. The contract has been awarded to H. W. SCHRIMPF, at $33,679. There were 13 bidders. Noted July 2.

+Trenton, N. J.—The Board of Chosen Freeholders has awarded the contract for the reconstruction of the bridge over Shabaconk Creek, on the Lawrenceville Road, to the GINDER CONSTRUCTION CO. Noted June 25.

Doylestown, Penn.—(Official)—Bids will be received until 11 a.m., Aug. 3, by the Commissioners of Bucks County for the construction of a reinforced concrete bridge near Richlandtown, Richland Township. A. D. Martin is County Engr. W. Cadwallader is Clk. of Comrs.

Easton, Penn.—(Official)—Bids will be received until 11 a.m., July 31, by the Commissioners of Northampton County for the construction of County Bridge No. 180 over Monocacy Creek, Moore Township. It will be of reinforced concrete. George F. P. Young is County Controller.

Wilkes-Barre, Penn.—(Official)—Bids will be received until 2 p.m., Aug. 11, by F. R. Hendershot, County Controller, for the construction of a bridge over the North Branch of the Susquehanna River, connecting Eighth St., Wyoming Borough, and the county road in Jenkins Township. David A. Keefe, Athens, Penn., is Engr.

★Baltimore, Md.—(Official)—Bids will be received by the State Roads Commission, until noon Aug. 13, for constructing the Hanover St. bridge. For details see advertisement under "Contracts to Be Let."

+Lonaconing, Md.—The Cty Council has awarded the contract for the construction of a reinforced concrete bridge over Georges Creek on Union St. to WHITTAKER & DIEHL, Harrisburg, Penn., at $5374. Other bids were: F. L. Fredlock, $5655; L. G. Dinterman, $7600; Farris Bridge Co., $7400; Luten Bridge Co., $6638; Brady Bros., $6800; Fuller Bros., $5580. Noted May 21 and July 9.

Floyd, Va.—(Official)—Bids will be received until noon, Aug. 4, by the Clerk of the Circuit Court of Floyd County for the construction of a steel bridge with concrete substructure over Burk's Fork. G. P. Coleman, Richmond, Va., is State Highway Comr.

Lynchburg, Va.—The Common Council has appointed a commission composed of J. P. Pettyjohn, Ernest Williams and William King, to supervise the construction of a $350,000 reinforced concrete bridge over the James River at Lynchburg. The city will contribute $50,000 toward the cost of the bridge, and the remainder will be borne by the Norfolk & Western Ry., the Chesapeake & Ohio Ry. and the Southern Ry. Noted July 16.

+Parkersburg, W. Va.—The Parkersburg-Ohio Bridge Co. has awarded the contract for the construction of the Belpre Bridge across the Ohio River at Parkersburg to HERMAN LAUB, Lewis Bldg., Pittsburgh, Penn., at $430,000. Noted Aug. 14 and Dec. 18, 1913.

Biltmore, N. C.—The Board of Commissioners of Buncombe County, Asheville, has voted an appropriation of $6000 for the construction of a new bridge over the Swannanoa River on the Biltmore Road, provided the Biltmore estate will give $2500 and the Asheville Power & Light Co., $3500 for the same purpose.

Milton, Fla.—It is reported that the Commissioners of Santa Rosa County have decided to build a bridge to connect Santa Rosa and Escambia Counties.

+Batesville, Miss.—The Board of Supervisors of Panola County has awarded the contract for the construction of a 1400-ft. trestle on Belmont Levee to the MEMPHIS BRIDGE CO., Memphis, Tenn., at $15,250. Noted July 9.

+Memphis, Tenn.—The City Commissioners have awarded the contract for the construction of a reinforced concrete culvert at Front and Saffarans Sts. to GEORGE O. WHITE, Scimitar Bldg., Memphis, at $25,085. List of bidders noted July 23.

Trezevant, Tenn.—It is reported that the County Court of Carroll County will soon award contracts for the construction of two steel bridges over the Obion River near Trezevant.

Louisville, Ky.—Bids will be received until 2 p.m., July 31, by the Board of Public Works for the construction of a reinforced concrete bridge over Beargrass Creek on Dupuy St. between Kentucky and Page Sts. D. R. Lyman is City Engr. Noted Apr. 16.

+Akron, Ohio—The Board of County Commissioners has awarded the contracts for the construction of the Pleasant Valley Bridge over the Tuscarawas River to the BELLEFONTAINE BRIDGE CO., Bellefontaine, Ohio, for the superstructure, and to C. A. WHITE & CO., Conneaut, Ohio, for the substructure. Noted June 25.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Aug. 21, by the Board of Commissioners of Hamilton County for the repair of a bridge over Sycamore Creek, Symmes Township. Albert Reinhardt is Clk. of the Bd. of Comrs.

Cleveland, Ohio—The lowest bid received by the Board of County Commissioners for the construction of the Brooklyn-Brighton Bridge was that of T. P. McCort, Akron, Ohio, at $450,000. The Engineer's estimate was $600,000. Noted June 25.

+Dayton, Ohio—The Board of Commissioners of Montgomery County has awarded the contract for the construction of the substructure of Bridge No. 241, Miami Township, to the HEZLEP-SEATON CO., Cleveland, at $36,103.

Delaware, Ohio—(Official)—Bids will be received until noon, Aug. 3, by the Board of County Commissioners, W. V. Aldrich, Audr., for the following bridge construction: Superstructure of Home Bridge over the Scioto River, Concord Township; superstructure of Multzer Bridge over Olentangy River, Liberty Township, and substructure of the east abutment of the Africa Bridge, Orange Township.

Hamilton, Ohio—(Official)—Bids will be received until 10 a.m., Aug. 12, by W. W. Crawford, Audr. of Butler County, for the construction of the substructure and superstructure of a reinforced concrete bridge at the Butterfield Farm, Ross Township.

Marietta, Ohio—(Official)—Bids will be received until noon, Aug. 7, by the Commissioners of Washington County, Marietta, for constructing 16 bridges. All but four will be of reinforced concrete. W. P. Mason, Marietta, is County Engr.

Marion, Ohio—(Official)—Bids will be received until noon, Aug. 7, by the Board of Commissioners of Marion County for the construction of the superstructure of a bridge over the Whetstone River on Retterer Pike, Richland Township. It will consist of one steel span, 175 ft. long and 16 ft. wide. The estimated cost is $6885.

Bids will be received until noon, Aug. 8, by the County Commissioners for building the substructure of a bridge over Willow Swamp Ditch, near the farm of J. Riley, Green Camp Township. V. Perle Garfield is Clk. of Marion County Comrs.

New Lexington, Ohio—The Board of Commissioners of Perry County is considering the construction of a steel bridge in Glenford Township, to cost about $10,000. Bids will be received about Aug. 15. The Commissioners are also contemplating the construction of a bridge over Jonathan Creek, on Main Road, to cost about $7000. Bids will be asked about Sept. 1. Clyde M. Foraker is Audr. of Perry County.

+Toledo, Ohio—(Official)—The Board of Commissioners of Lucas County has awarded contracts for the construction of two bridges over the Miami and Erie Canal, one at Maumee and one at Waterville, to the TOLEDO BRIDGE & CRANE CO. at $9931 and $10,217 respectively. Noted July 2.

Toledo, Ohio—(Official)—Bids will be received until 10 a.m., Aug. 21, by the Board of Commissioners of Lucas County for the construction of five culverts over various streams, and a rip-rap protection wall along the Bay Shore Road on the north bank of County Ditch No. 147, Oregon Township. Charles J. Sanzenbacher is County Audr.

Youngstown, Ohio—Bids will be received by the city until Aug. 7 for constructing a concrete bridge across Andrews Hollow at Fifth Ave. The structure will be 300 ft. long, 75 ft. wide, and calls for about 2200 cu.yd. of concrete. F. M Lillie is City Engr.

Cairo, Ill.—Press reports state that the Mobile & Ohio R.R. has set aside the sum of $5,000,000 for the construction of a bridge across the Ohio River at Cairo. B. A. Wood, Mobile, Ala., is Ch. Engr. Up to the present time, the Mobile & Ohio R.R. has used the bridge of the Illinois Central R.R at this point.

+Pontiac, Ill.—A contract for the construction of the Corrigan Bridge, Amity Township, Livingston County, has been awarded to NELSON BROS., Dwight, Ill., at $6700. The bridge will be of reinforced concrete, two spans. Noted Apr. 30.

Chariton, Iowa—(Official)—Bids will be received until 2 p.m., Aug. 3, by the Auditor of Lucas County for the construction of a concrete deck girder bridge. L. A. Hollingshead is County Engr.

Fort Dodge, Iowa—The Board of Supervisors of Webster County is receiving bids for the construction of 15 bridges in the county at an estimated cost of $17,793.

Muscatine, Iowa—The Interstate Bridge & Terminal Co., Muscatine, has petitioned Congress for permission to construct a bridge across the Mississippi River at Muscatine, connecting Illinois with that city. The present bridge is a toll bridge, and the farmers of Illinois desire free access to Muscatine.

Brown Valley, Minn.—Bids will be received until Aug. 6 by L. C. Bigelow, Village Recdr., for the construction of a bridge, 60-ft. span. Plans were prepared by the State Highway Engr., St. Paul.

Little Falls, Minn.—Bids will be received until Aug. [illegible] by [illegible] Aud. of [illegible] County, for the construction of [illegible] bridges Nos. [illegible] and [illegible].

Mankato, Minn.—[illegible] Bids will be received until 2 [illegible] by [illegible] Ketter, County Audr., for the construction of [illegible] reinforced concrete bridges, ranging from [illegible] to [illegible] ft. long.

✦Springfield, Mo.—The County Court of Greene County has awarded the contract for the construction of two large and nine small bridges in the county to the CANTON BRIDGE CO., Kansas City, Mo., at $[illegible]. F. L. Meeks, who was noted July [illegible] as having been awarded this contract at $6436, was allowed to withdraw his bid.

Caldwell, Tex.—The Commissioners Court of Burleson County plans to construct a steel bridge over Goodwin Bayou west [illegible].

Corpus Christi, Tex.—It is reported that bids will be received until Aug. 17, by the Commissioners of Nueces County for the construction of a concrete causeway, about [illegible]00 ft. long, across Nueces Bay, connecting the mainlands of Nueces and San Patricio Counties. The estimated cost is $165,000. Bartlett & Harvey, San Antonio, are Consult. Engrs. Noted [illegible] and Mar. 26, 1914.

✦San Antonio, Tex.—The Commissioners Court of Bexar County has awarded the contract for building three bridges in the county to the ALAMO CONSTRUCTION CO. at $16,551.

Fort Collins, Colo.—Bids will be received until 11 a.m., Aug. [illegible] by the Commissioners of Larimer County for the construction of [illegible] bridges, eight to be of concrete, and two larger ones of steel. The estimated total cost is $5500.

Mora, N. M.—(Official) Bids will be received until noon, Aug. 3, by the Board of Commissioners of Mora County for the construction of the following bridges: Bridge over the [illegible] River at Watrous, one over the Mora River at Weber Crossing, one over the Ocate Creek near Colmor and a bridge over Coyote Creek at Lucero. John Gandert is Chn. of the Bd. of Comrs. Tito Melendez is Clk.

✦Pocatello, Idaho—The Bridge Commission has awarded the following contracts for the construction of steel and timber bridges in Bannock, Bingham, Bonneville, Fremont, Jefferson, Madison and Twin Falls Counties: IDAHO BRIDGE [illegible], $28,576; H. W. PERHAM, St. Anthony, Idaho, $[illegible]; HELMER & MULL, Twin Falls, $4515; OMAHA STRUCTURAL STEEL WORKS, Salt Lake City, Utah, $4200. For the construction of concrete bridges, contracts were awarded to IDAHO BRIDGE CO., $57[illegible]; H. W. PERHAM, $[illegible]; HELMER & MULL, $7694; MANGUM & SON, $[illegible]098.

Bellingham, Wash.—Bids will be received until Aug. 4 by the Commissioners of Whatcom County for the construction of a bridge across the Middle Fork of the Nooksack River. W. D. W[illegible] is County Audr.

Buckley, Wash.—It is reported that the Commissioners of King and Pierce Counties will build a steel bridge of two 100-ft. spans over the White River between Buckley and Enumclaw. The estimated cost is $16,[illegible], and each county will pay one-half the cost. Noted Feb. 5 and Apr. 16.

Franklin, Wash.—(Official)—Bids will be received until 2 p.m., Aug. 11, by the Board of Commissioners of King County, Seattle, for the construction of a bridge at Franklin. Byron [illegible] is [illegible] of the Bd.

Ione, Wash.—The Board of Commissioners of Pend Oreille County, Newport, has granted permission to M. Haupt, Ione, for the construction of a [illegible]-ft. wooden pile bridge across the Pend Oreille River at Ione.

Tacoma, Wash.—Press reports state that the Oregon-Washington R. R. & Navigation Co. is having plans prepared for a [illegible] from [illegible] Ave. to the tide [illegible]. It will be about half a mile long and will cost from [illegible] to $[illegible].

✦Carlton, Ore.—The Yamhill County Court, M. M[illegible], was awarded the contract for the construction of a 1[illegible]5-ft. steel bridge across the Yamhill River at Carlton to the COAST [illegible] [illegible]

✦Oregon City, Ore.—The Clackamas County Court has awarded the contract for the construction of two bridges [illegible] Noted July 2 under [illegible].

Modesto, Calif.—[illegible]

San Francisco, Calif.—The Board of Public Works [illegible]

✦Santa Barbara, Calif.—[illegible]

✦Santa Cruz, Calif.—The Board of Supervisors of Santa Cruz County [illegible]

✦Tacoma, Wash.—(Official)—[illegible] "Contracts To Be Let." [illegible]

Regina, Sask.—The City Council has appropriated $35,-[illegible] for constructing an overhead bridge across the Canadian Pacific Ry. tracks at Hamilton St. Estimated cost, $[illegible]4,262.

WATER SUPPLY—IRRIGATION

Portsmouth, N. H.—Plans have been prepared by the Board of Public Works for the extension of the Peverly Brook water system.

✦Arlington, Mass.—The contract for constructing a water system has been awarded to the DES MOINES BRIDGE & IRON WORKS, Des Moines, Iowa, at $1[illegible],3[illegible]0.

Boston, Mass.—Bids will be received by the Metropolitan Water and Sewerage Board, until July 31, for Contract 361, constructing a foundation for the steel reservoir on the summit of Bellevue Hill, West Roxbury District.

✦Lowell, Mass.—The city has authorized the construction of a filtration plant to cost $190,000. William L. Vennard is City Engr. Noted July 9.

★Hartford, Conn.—(Official)—Bids will be received by the Board of Water Commissioners, until 3 p.m., Aug. 9, for Nepaug Reservoir Contract No. 7, constructing a gravel surface road south of the Nepaug Reservoir. C. M. Saville is Ch. Engr.

✦Albany, N. Y.—The Board of Contract and Supply has awarded the general contract for the construction of the Quackenbush water station to J. C. NOLAN, at $38,700.

North Tonawanda, N. Y.—The Board of Public Works contemplates increasing the pumping capacity of the water system.

★Schenectady, N. Y.—(Official)—Bids will be received by the Board of Contract and Supply until 2.30 p.m., Aug. 5, for constructing a 30,000,000-gal. covered reservoir on B[illegible] Hill, in Niskayuna. For details see advertisement under "Contracts To Be Let." Noted May 21.

Sidney, N. Y.—Plans for constructing a municipal waterworks system have been prepared by Henry W. Taylor, 100 State St., Albany, and have been submitted to the State Conservation Commission for approval. Estimated cost, $125,000. Julius Hall is Chn. of the Water Bd.

✦Waterford, N. Y.—The contract for making improvements to the water system has been awarded to the NEARY BROTHERS CONSTRUCTION CO., Cohoes, at $7375.

★Blairsville, Penn.—(Official)—Bids will be received by the Town Council until 8 p.m., Aug. 11, for a pumping engine. H. R. Wiley is Secy. For details see advertisement under "Contracts To Be Let."

East Stroudsburg, Penn.—Plans have been approved by the City Council for the construction of a dam to cost $5[illegible], on the Van Why farm.

✦Harrisburg, Penn.—(Official)—Bids were received July 20, by H. F. Bowman, Comr. of Pub. Safety for laying water main in Front and Market Sts. The contract has been awarded to M. F. SAUL, Harrisburg, at $[illegible]. Other bidders were, the Johnson Construction Co., $6314 and Henry Opperman, $7307. Noted July 16.

✦Philadelphia, Penn.—(Official)—Contracts for constructing the Belmont Pumping Station, under Contract No. [illegible], have been awarded as follows: Boilers, to the WICKES BOILER CO., at $55,761; piping, to WILLIAM ANDERSON, at $20,150; blast fans and turbines, to the KERR TURBINE CO., at $31[illegible]; centrifugal pumps, to the DRAVO-DOYLE CO., at $[illegible],750; miscellaneous pumps, to the EARLE GEAR & MACHINE CO., at $[illegible]00; water softening tanks, to JOHN BAIZLEY, at $[illegible]; and hydraulic lift, to ROBERT WETHERILL CO., at $22[illegible]2. Noted Apr. 16.

★Shippensburg, Penn.—(Official)—Bids will be received by John F. Coffey, Secy. Borough Council until 8 p.m., Aug. [illegible], for 19,100 lin. ft. of 10-in. c.-i. water pipe with valves, blow-offs and special castings.

Charleston, S. C.—Bonds for $30[illegible]0 have been voted, the proceeds of which will be used for the extension of the water system.

Walterboro, S. C.—At a recent election bonds for $15,[illegible] were voted, the proceeds of which will be used for the installation of a water system.

Winnsboro, S. C.—An election will be held Aug. 4 to vote on the proposition of a bond issue of $[illegible] for the installation of a water system.

Woodruff, S. C.—On July [illegible] bonds for $[illegible] for the installation of a water and a sewer system were voted. J. E. [illegible] is Clk. Noted June 1[illegible].

Knoxville, Tenn.—[illegible] of the Tennessee [illegible] has made an investigation of the water plant and advised the Board of Commissioners to have the storage reservoir enlarged and to increase the pumping facilities.

Columbus, Ohio.—Bids will be received by the City [illegible] Aug. [illegible] for installing an [illegible] with the water system. J. [illegible] is Supt. of Water Wks.

Bellе, Ohio.—Bids will be received by the village [illegible] Aug. 1[illegible] for the extension of the water system.

Ironton, Ohio.—Plans for the construction of a [illegible] [illegible] to the State Board of Health for its approval.

Lowellville, Ohio.—James J. [illegible] has received a franchise from the City Council and will construct a water works [illegible] Noted May [illegible].

Norwood, Ohio.—See Item under Light, Heat and Power.

Mishawaka, Ind.—The city will purchase water meters at an estimated cost of $[illegible].

Rochester, Ind.—Bids will be received by W. C. Miller, County Audr., until [illegible] Aug. [illegible] for installing a pneumatic [illegible] water system at the poor farm.

East Peoria, Ill.—[illegible]—The Village Council has authorized the construction of a water system. [illegible] M. Morgan, [illegible], Chicago, is the Engr.

Little York, Ill.—(Official)—Bids will be received by W. H. Brown, Village Clk., until Aug. 15, for drilling a well with a capacity of 40 gal. per minute. Noted July 16.

Quincy, Ill.—Plans are being considered by the Citizens Water-Works Co. for the construction of a c.i. intake pipe for the water system. Estimated cost, $25,000. W. R. Geiston is Supt.

Rock Island, Ill.—Bids will be received by W. Treichler, City Engr., until Aug. 10, for a 6,000,000-gal, centrifugal pump for the water system.

Stoughton, Wis.—Bids will be received by the city, until Aug. 2, for the construction of a reinforced concrete reservoir. L. C. Currier is City Clk.

Estherville, Iowa—(Official)—Bids will be received until 9 a.m., Aug. 11, for constructing additions to the present water works system and to the electric-light plant. The estimated cost of the work is $60,000. The work consists of a distribution pipe-line system, 500,000-gal. steel stand-pipe a 900-gal, centrifugal fire pump and a steam electric-light plant. J. F. Druar, Commercial Bldg., St. Paul, Minn., is Consult. Engr. N. B. Egbert is City Clk. Noted Apr. 23.

Hinton, Iowa—At a recent election the citizens voted bonds for $6000, the proceeds of which will be used for the construction of a water system.

★Knoxville, Iowa—(Official)—Bids will be received by the city until 8 p.m., Aug. 5, for c.-i. pipe and specials for the extension of the water system. W. E. Rinehart is City Clk. David G. Fisher & Co., Davenport, Iowa, are Engrs.

Lake City, Iowa—Bids will be received by J. M. Fickel, City Clk., until Aug. 3, for laying water mains.

+Winfield, Iowa—The city has awarded the contract for the construction of a water system to the DES MOINES BRIDGE & IRON WORKS, Des Moines, Iowa, at about $15,000. Noted June 25.

Alton, Kan.—Bids will be received by the city until Aug. 6 (readvertisement) for the construction of a water system. Rollins & Co., Midland Bldg., Kansas City, Mo., are the Engrs. Noted July 9.

Barnard, Kan. — Plans are being prepared by Henrici, Kent & Lowry, Engrs., Reserve Bank, Bldg., Kansas City, Mo., for the construction of a water system at Barnard.

Cuba, Kan.—The citizens contemplate an expenditure of $20,000 for the installation of a water system.

McCune, Kan.—Henrici, Kent & Lowry, Engrs., Reserve Bank Bldg., Kansas City, Mo., are preparing plans for the installation of a water system at McCune. Noted June 23.

Strong City, Kan.—Bonds for $26,000 have been voted, the proceeds of which will be used for the improvement and extension of the water system.

Palmyra, Neb.—(Official)—Bids will be received by the village until 7 p.m., Aug. 14, for constructing a water system. The Martz Engineering Co., First National Bank Bldg., Lincoln, is Engr. W. E. Vaughan is Village Clk. Noted July 18.

+Humboldt, S. D.—The contract for installing a water system has been awarded to the DES MOINES BRIDGE & IRON WORKS, Des Moines, Iowa, at $9389. Noted June 25.

Ipswich, S. D.—Bids will be received by the City Auditor, until Aug. 3, for c.i. water pipe and hydrants. Easton & Wells, Aberdeen, are Engrs.

Havre, Mont.—The installation of a filtration plant in connection with the water system is under consideration.

Lewistown, Mont.—All bids received June 15 for constructing a gravity pipe line water system have been rejected, as they were above the appropriated amount. The city will do the work with its own forces. Noted May 28.

Birch Tree, Mo.—W. J. Duffield has been granted a franchise to construct and operate a water system and an electric-light plant in Birch Tree.

Clarence, Mo. — Plans are being prepared by Henrici, Kent & Lowry, Reserve Bank Bldg., Kansas City, for the construction of a water system at Clarence.

+Arkansas City, Ark.—(Official)—Bids were received July 21 by Burns & McDonnell, Engrs., Kansas City, for the improvement of the water system at Arkansas City, as follows: ARROW ENGINEERING CO., St. Louis, Mo., $86,816 (awarded contract); T. C. Brooks & Sons, Jackson, Mich., $86,991; Eby Construction Co., Wellington, Kan., $88,601; Katz Construction Co., Omaha, Neb., $88,880; James Staunton, Leavenworth, Kan., $89,500; N. S. Sherman Machine & Iron Works, Oklahoma City, $90,990; Commercial Construction Co., Kansas City, Mo., $91,500; Texas Construction Co., San Antonio, Tex., $91,586; Public Service Construction Co., Omaha, Neb., $93,000; Everett & Burt, Hutchinson, Kan., $93,200. Noted July 9.

Brenham, Tex.—Bonds for $30,000 have been voted, the proceeds of which will be used for the improvement of the water and sewer systems. Noted June 18.

+Dallas, Tex.—The contract for 1000 water meters has been awarded by the city to the NEPTUNE METER CO., 90 West St., New York, N. Y., at $6.50 each. Noted June 11.

New Boston, Tex.—Bids will be received by O. B. Pirkey, Mayor, until Aug. 3, for installing a water system. Nagel & Petersen, Muskogee, Okla., are Engrs.

Sherman, Tex.—The City Council contemplates an expenditure of $40,000 for the improvement of the water system.

Durango, Colo.—The City Council has approved plans for changing the route of the city water-pipe line. Estimated cost, $7462. An additional $10,000 will be spent for new pipe.

Dexter, N. M.—(Official)—Bonds for $12,000 have been sold the proceeds of which will be used for the construction of a water system. Noted June 25.

Fort Sumner, N. M.—The Union Lake, Land & Water Co. will construct water-storage dams and pumping plants near Fort Sumner, at a cost of $1,775,000, for the purpose of irrigating about 80,000 acres of land. M. A. Otero is interested in the project.

Ogden, Utah—The Davis & Webster Counties Canal Co. contemplates an expenditure of $110,000 for increasing the water supply of the East Creek reservoir.

Wickenburg, Ariz.—Plans are being prepared for the construction of two dams near Wickenburg for storing water for irrigation purposes. Pumping plants will also be installed in connection with the project. Elanor C. Whitman, Morristown, N. J., is interested.

Hoquiam, Wash.—The City Council is negotiating with the Council of Aberdeen for the construction of a joint water system to serve both cities.

Kirkland, Wash.—The County Commissioners have granted the city permission to lay a water pipe line along the county road. Estimated cost, $15,000.

Toppenish, Wash.—An expenditure of $30,000 for the extension of the water system is under consideration.

Nehalem, Ore.—Bonds for $12,500 have been voted to purchase the local water system and construct a reservoir.

Anderson, Calif.—The Anderson-Cottonwood Irrigation District has been formed to construct irrigation canals at an estimated cost of $350,000. F. Moore, Anderson, is interested.

El Centro, Calif.—The Holton Power Co. has applied to the State Railroad Commission for permission to issue bonds for $20,000. A water system to cost $24,456 and an ice-storage house to cost $48,940 will be installed at El Centro.

Los Angeles, Calif.—The Canadian Investment Co. has acquired a site in the Deer Creek District on which to construct a pumping plant to irrigate about 160 acres of land.

Madera, Calif.—The City Council will soon hold an election to vote on the proposition to issue bonds for $100,000 for municipal improvements, including the extension of the water and sewer systems.

Fall River Mills, Calif. — The Fall River Valley West Side District contemplates the construction of a pumping plant to cost about $15,000. J. R. Creighton, J. A. Rogers and G. P. Wardell are interested in the project.

Napa, Calif.—The Napa City Water Co. will extend its water mains to Alta Heights.

San Fernando, Calif.—The city contemplates the construction of a municipal water system to cost about $112,819. S. G. Chamberlain is City Engr.

Bedford, Que.—The installation of a water system is under consideration.

Hull, Que.—Bids will soon be received by the City Council for the extension of the water system. Estimated cost $14,330.

Parry Sound, Ont.—The Town Council contemplates an expenditures of $10,000 for the extension of the water system. E. E. Armstrong is Town Clk.

Tilbury, Ont.—The improvement of the water system is contemplated. W. H. Hutton is Town Clk.

Assiniboia, (Winnipeg post office) **Man.**—See item under "Sewers."

★Winnipeg, Man.—(Official)—Bids will be received by S. H. Reynolds, Chn. Comrs. Greater Winnipeg Water District, until noon Sept. 19 for constructing about 85 miles of concrete aqueduct in five sections.

Canora, Sask.—Chipman & Power, Engrs., Winnipeg, have prepared plans and will receive bids until Aug. 18, for constructing a new pump house and steel water tower, installing fire hydrants and c.-i. mains.

Prince Albert, Sask.—Bids will be received by J. B. Brown, City Clk. until 1 p.m., Aug. 15 for two pumps with motors and one Venturi meter for the water system.

+Saskatoon, Sask.—The City Commissioners have awarded contracts for one steam driven centrifugal boiler feed pump and two 4,000,000-gal. motor-driven centrifugal pumps to ESCHER, WYSS & CO., Montreal, Que.

Athabaska, Alta.—Bids will soon be received for the construction of a reservoir and filtration plant. C. L. Huff is Town Engr.

Taber, Alta.—The City Council contemplates the extension of the water system. George C. Millar is Secy.-Treas.

SEWERS

Boston, Mass.—Bids will be received by the Department of Public Works until July 31, for constructing sewers in Rutledge Road, Hyde Park. L. K. Rourke is Comr.

+Boston, Mass.—The contract for constructing sewers in Oakland St., Richmond Road, etc., Dorchester District, has been awarded to CHARLES LATORELLA at $13,085: Other bids were, Antony Cefalo, $13,332; William L. Dolan, $13,453; Louis Balboni, $13,870; George M. Bryne, $13,992; M. De Sisto, $14,244; William J. Barry, $14,323; Martino De Matteo, $14,398; George J. Regan, $14,563; Anthony Baruffaldi, $15,087; John Guarino, $16,131; M. J. McGawley, $17,273. L. K. Rourke is Comr, of Pub. Wks. Noted July 16.

+Fitchburg, Mass.—The contract for constructing lateral connections and about 800 ft. of 72-in. storm sewer has been awarded by the Sewage Disposal Commission to FRANK A. GAMMINE at $37,880. Other bids were: McCarthy & Walsh, Boston, Mass., $38,453; W. J. Donavan, Fitchburg, $40,611; C. E. Trumbull Co., Boston, $42,934; Long & Little, Leominster, Mass., $45,429; D'Onfro Broe., $49,621. David A. Hartwell is Ch. Engr. Noted July 9.

+Bridgeport, Conn.—The contract for constructing sewers in Marion and Wayne Sts. has been awarded by the Paving and Sewer Commissioners to PETROSSI BROS., Hartford, at $9269. Noted July 2.

★Bridgeport, Conn.—(Official)—Bids will be received by the Paving and Sewer Commission until 8 p.m., Aug. 10, for sewer construction. Bernard Keating is Secy. For details see advertisement under "Contracts To Be Let."

+Hartford, Conn.—The Board of Contract and Supply has awarded a contract to C. H. SLOCOMB & CO., Hartford, for constructing the overflow sewer in Granby St. and West-

[illegible] Parkway, also the extension to the Homestead Ave. Intercepting Sewer. Noted July 2 and July 16.

Oneonta, N. Y.—It is reported that bids will be received by the City Clerk until Aug. 1, for constructing storm and sanitary sewers to cost about $[illegible]0. F. M. Gurney is City Engr.

Watertown, N. Y.—The city contemplates the construction of a sanitary sewer to cost $15,[illegible].

New Brunswick, N. J.—Bids will be received by the Common Council until Aug. 3 for constructing a sewer in Carman St. from [illegible] to [illegible] St. and in Welton St. from Throop to [illegible] Ave. John J. Carren is Street Comr.

Newton, N. J.—The Borough Council contemplates the installation of a sewer system, estimated to cost $[illegible],000.

+Plainfield, N. J.—The contract for constructing sanitary sewers has been awarded by the City Council to the KELLEY-McFIELD CO., Camden, N. J., at $32,003. Noted June 18 and July 16.

Mt. Pleasant, Penn.—See item under "Streets and Roads."

South Renovo (Renovo post office) **Penn.**—Bids will be received by Ambrose [illegible], Clk. of the Council, until Aug. 1, for constructing 1½ miles of sewer.

Wilkes-Barre, Penn.—The city contemplates an expenditure of $21,[illegible] for sewer construction. E. K. Finch is City Engr.

★Washington, D. C.—(Official)—Bids will be received by the District Commissioners until 2 p.m. Aug. 5 for sewer construction. Oliver P. Newman, Frederick L. Siddons and Chester Harding are the Comrs.

Williamson, W. Va.—See item under Streets and Roads.

Walterboro, S. C.—The city has voted $112,000 in bonds for installation of a sewer system.

Paintsville, Ky.—Bids will be received by the Board of Trustees until noon, Aug. 1, for constructing a system of sewers and for paving with brick certain streets. Claude Buckingham is Clk.

Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, until noon, Aug. 6, for constructing sewers in various streets. Robert Hoffman is City Engr.

Columbus, Ohio—Bids will be received by Samuel A. Kinnear, Dir. of Pub. Ser., until noon, Aug. 5, for constructing storm water sewers in Olentangy Park, from Olentangy River to High St. Paul B. Kemper is Clk.

Coshocton, Ohio—The City Council has commissioned Chester & Fleming, Engrs., Pittsburgh, to prepare plans for a sewage disposal plant.

Dayton, Ohio—A septic tank for sewage disposal will be installed by Eckhart Bros. in the new suburb of Dayton which they are developing.

+Marion, Ohio—The contract for constructing a sanitary sewer in Greenwood St. has been awarded by the Board of Control to HARRY G. KOHBARGER at $6,763.

New Lexington, Ohio—The City Council contemplates the construction of a sewer system and sewage disposal plant. T. P. S[illegible] is City Clk.

Indianapolis, Ind.—Bids will be received by the Board of Public Works until 10 a.m., Aug. 3, for constructing a main sewer in Tacoma Ave. B. J. T. Jeup is City Engr.

+Terre Haute, Ind.—The Board of Public Works has awarded a contract for constructing a sewer in North 19th from Third to Maple Ave. to J. I. UNISON at $10,792 and for a sewer in South Sixth St., from Idaho to Voorhees St., to P. [illegible] & SONS at $6329.

+Zeeland, Mich.—The contract for constructing a sewer system and sewage disposal plant has been awarded to [illegible] GEB[illegible]K, Owosso, Mich., at $16,[illegible]. Rumsey & [illegible], Grand Rapids, Mich., are Engrs. Noted Mar. 12 and May 14.

+Carrollton, Ill.—(Official)—The contract for constructing a [illegible] sewer system and a disposal plant has been awarded by the Board of Local Improvements to DRISCOLL & [illegible], Decatur, Ill., at $2[illegible],[illegible]47. Oscar McFarland is Secy. of the Bd. Noted July 16.

+Geneva, Ill.—(Official)—The contract for constructing [illegible] sewers has been awarded by the Board of Local Improvements to the [illegible] CO., Joliet, Ill. Other bids were: [illegible]

+Pontiac, Ill.—The Board of Local Improvements has [illegible]

[illegible]

Charlton, Iowa—(Official)—Bids will be received by G. J. Gittinger, City Clk., until 2 p.m., Aug. 14, for constructing a sewer system. The work calls for about 1½ miles of 8 to 3[illegible]-in. sewers and four disposal plants. The Iowa Engineering Co., Clinton, Iowa, is Engr.

Dyersville, Iowa—Bids will be received by W. C. Loosbrock, Town Clk., until 8 p.m., Aug. 4, for constructing about 6320 ft. 6, 8 and 10-in. vitrified pipe sewers. M. Tschirgi & Sons, Cedar Rapids, Iowa, are Engrs.

+Mason City, Iowa—The contract for constructing about 7221 ft. of 15-, 20- and 30-in. vitrified pipe sewers has been awarded to S. R. BROWN, Mason City.

+Muscatine, Iowa—The contract for extending the sewer system has been awarded by the City Council to D. E. KEELER, Davenport, Iowa, at $15,707.

+Webster City, Iowa—The contract for constructing storm and sanitary sewers in Elm St. has been awarded to ZITTERELL & SULLIVAN, at $[illegible]782. W. W. Crittenden is Clk. Noted July 16.

Brainerd, Minn.—Bids will be received by the City Council until Aug. 3 for constructing sewers, requiring about 4714 ft. of 8 to 18-in. sewer pipe. C. D. Peacock is City Engr.

Rochester, Minn.—Plans are being prepared for constructing 1½ miles of 10- to 15-in. sanitary sewers in various streets. T. O. Sullivan is City Clk.

+St. Paul, Minn.—The City Council has awarded the contract for constructing the Park Ave. and Maryland St. sewer to O'NEIL & PRESTON, at $5218. Noted July 23.

+Stanton, Neb.—The contract for constructing about [illegible]00 lin. ft. of 8- to 18-in. sewers has been awarded to BRIGGS & COREY, Shenandoah, Iowa, at $6213. Noted June 11 and June 18.

Huron, S. D.—The City Commissioners have ordered the construction af lateral sewers in various streets.

+Chouteau, Mont.—The contract for constructing 3.2 miles of sanitary sewers and a sewage disposal plant has been awarded to the F. E. EVANS CONSTRUCTION CO., Great Falls, Mont. Noted June 18.

St. Louis, Mo.—Bids will be received by the Board of Local Improvements until Aug. 5, for the construction of sewers in District No. 1, and until Aug. 7, for constructing the Florissant Ave. sewer. William T. Findly is Secy. of the Bd.

+Dallas, Tex.—The contract for constructing a sanitary sewer in East Dallas has been awarded to C. W. OLCOTT at $17,213. Other bids were: F. M. Long, $19,[illegible]22; Ennison & McCord, $25,453; Winslett-Eldridge Co., $22,567; Dallas Lime & Gravel Co., $17,507.

★San Antonio, Tex.—(Official)—Bids will be received by Frederick Fries, City Clk., until 4 p.m., Sept. 7, for constructing about 15,000 lin. ft. of 72-in. sanitary sewers.

+San Antonio, Tex.—The following contracts have been awarded for sewer construction: Cherry St. sanitary sewer to EUGENE CAMPBELL, Waco, at $17,677; to W. G. SCHUWIRTH & CO., Grove Ave. storm sewer at $17,689, also the Cherry St. intercepting sewer and storm sewer at $34,608 and $79,934 respectively.

+Seattle, Wash.—The contract for constructing sewers in East 10th and other streets has been awarded by the Board of Public Works to V. RAMAGLIA, at $12,189. Noted Mar. 2[illegible].

South Bend, Wash.—The city contemplates extending the sewer system in the Blake and Riverview Sections. The estimated cost is $21,000.

Astoria, Ore.—The city will construct a sewer system estimated to cost $100,000.

Portland, Ore.—Plans have been completed for extending the Holgate St. sewer at an estimated cost of $[illegible].

Los Angeles, Calif.—The lowest bid received by the Board of Public Works for constructing the Madison-Virgil storm drain was that of John Ralph, at $136,998. Homer Hamlin is City Engr. Noted July 9.

Madera, Calif.—The city plans to spend $2[illegible] for extending the sewer system.

+Vallejo, Calif.—The contract for extending the sewer system has been awarded to MICHAEL M[illegible], at $[illegible].

Assiniboia (Winnipeg post office) **Man.**—Frank Ness, Kirkfield Park, Manitoba, is preparing plans for sewers and waterworks to cost about $[illegible].

Calgary, Alta.—The City Council has authorized the preparation of plans for extending the sewer system at an estimated cost of $[illegible].

GARBAGE

Bellevue, Penn.—Bids will be received until [illegible] Aug. [illegible] [illegible] for the collection of garbage and refuse for [illegible] five years.

Petersburg, Va.—The City Council has appropriated [illegible] for [illegible] garbage [illegible].

New Orleans, La.—Bids will be asked soon by the city for a garbage incinerator. J. H. [illegible] is Comr. Pub. [illegible].

Frankfort, Ky.—The city plans to construct a garbage plant. [illegible]

Akron, Ohio—[illegible]

Sioux City, Iowa—W. R. Wright [illegible] Wright [illegible] offered to construct a garbage plant to cost [illegible] without cost to the city if the city will grant him a franchise to operate the plant for a period of [illegible] years.

STREETS AND ROADS

Concord, N. H.—Bids will be received by S. Percy Hooker, Supt. of Highways, until Aug. 3, for improving Derry Road, in Chester Township, and Concord Road, in London Township.

Boston, Mass.—Bids will be received until Aug. 4 by the State Highway Commission for the construction of 9400 lin.ft. of road at Shelburne, 2400 lin.ft. in Northbridge, 6900 lin.ft. in Dedham and 7300 lin.ft. in Buckland. Arthur W. Dean, 15 Ashburton Pl., is Chief Engr.

Cambridge, Mass.—See item under Bridges.

Hartford, Conn.—See item under Water Suply—Irrigation.

+Hartford, Conn.—Contracts for state road work have been awarded by the State Highway Commission as follows:

Norwalk City, about 5840 lin.ft. hassam pavement on Winfield St. and 1675 lin.ft. on East St., to the CONNECTICUT HASSAM PAVING CO., New Haven, at approximately $22,000.

Westport Township, a section of hassam pavement on the Old Highway, to the CONNECTICUT HASSAM PAVING CO., New Haven, at $8000.

Bridgeport City, a section of asphalt pavement on Brooklawn Ave., to the WARREN BROS. CO., Boston, Mass., at $3758.

Fairfield Township, a section of asphalt pavement on Brooklawn Ave., to the WARREN BROS. CO., Boston, Mass., at $5226.

+Meriden, Conn.—(Official)—The contract for paving several streets has been awarded to L. SUZIO at $207,000. Noted June 11.

Albany, N. Y.—Bids were received by the State Highway Commission, July 27, for the construction of public highways by state aid, as follows:

Road No. 5501, East Berne-New Salem, Part 1, Albany County, 2.86 miles: Richard Hopkins, Troy, $33,811; Lane Construction Corporation, Meriden, Conn., $34,816; Joseph Walker Construction Co., Albany, $34,995; St. Lawrence Construction Co., Albany, $32,234; Joseph P. Scanlon, Delmar, $33,613.

Road No. 1204, Plattsburg City, Broad St., Clinton County, 0.80 mile: Bluff Point Stone Co., Plattsburg, $10,024; Boynton & McNally, Keeseville, $10,212; Gifford Construction Co., Jamaica, $10,514; Dana W. Robbins, New York, $9984; James Conway, Plattsburg, $10,565.

Road No. 1035-A, Holland-Glenwood, Part 1, Erie County, 3.13 miles: Serviss & Mackey, Youngstown, $53,516; Ribstine-Holter Co., Rochester, $53,707.

Road No. 5500, Jay-Lake Placid, Part 2, Essex County, 7.15 miles: W. F. Boughton Co., Hudson Falls, $80,782; Richard Hopkins, Troy, $84,757; St. Lawrence Construction Co., Albany, $81,122; J. L. Richmond, Little Falls, $84,321; Beede Bros., Keene Valley, $85,490; Gruner & Hallenbeck, Harriman, $81,671; Rumpf & Stevens, Lake Placid, $85,663, and two others.

Road No. 468, Little Falls-Fairfield, Herkimer County, 5.55 miles: H. Ward Dickison, Syracuse, N. Y., $52,519.

Road No. 5435, Pittsford Village, Monroe and South Main St., Monroe County, 0.92 mile: James F. Leary, Rochester, $27,842; Ribstine-Holter Co., Rochester, $27,316; Morrison & Quinn, Rochester, $27,859; Schroeder-Hicks Contracting Co., Rochester, $27,355; J. B. Hurley, Inc., Fredonia, $26,524; Whitmore-Rauber-Vicinius, Rochester, $27,585, and ten others.

Road No. 5505(Wheatley-East Norwich, Part 1, Nassau County, 2.93 miles: Federal Asphalt Corporation, New York, $47,601; Municipal Asphalt Co., New York, $46,285; Murray & Gardner, Inc., Center Moriches, $48,233; McDonald Contracting Co., New York, $46,861; Price & Tripp, Inc., White Plains, $48,091; H. J. Mullen Contracting Co., Jamaica, $45,614; Samuel Beskin, Beacon, $46,580, and three others.

Road No. 1136, Pulaski Village, Mill St., Oswego County, 0.90 miles: A. J. Rockwood, Rochester, $12,348; Ripton & Murphy, Rochester, $13,034.

Road No. 5504, Dykes Crossing. Rockland County, 0.39 miles: Paul G. Sanger, Mumsey, $7618.

Road No. 5496, Scotia Village, Ballston Ave., Schenectady County, 0.90 mile: W. L. Lawton, Glens Falls, $43,367; Scheneetady Contracting Co., Schenectady, $39,608; C. B. Dean, Albany, $41,621; Brooks & Julian, Rochester, $41,251; John Johnson Construction Co., Buffalo, $43,450; Ballard & Maher, Oneida, $41,578; William G. Fox, Saratoga Springs, $43,664.

Road No. 1206, Sag Harbor Village, Suffolk County, 1.56 miles: A. N. Garthwaite, Yonkers, $23,616; E. H. Brown, Hempstead, $22,690; H. J. Mullen Contracting Co., Jamaica, $22,628; Murray-Gardner, Inc., Center Moriches, $24,811; N. W. McVeigh, Long Island City, $25,346; Samuel Beskin, Beacon, $23,840; McDonald Contracting Co., New York, $22,705, and three others.

Road No. 1208, East Islip-Smithtown Branch, Suffolk County, 9.57 miles: H. J. Mullen Contracting Co., Jamaica, $115,929; Thomas F. Shaughnessy, Albany, $115,898; William F. McCabe Construction Co., White Plains, $11,7488; E. H. Brown, Hempstead, L. I., $111,200; Parker-Hassam Paving Co., Worcester, Mass., $117,198; A. C. Sternberg Jr. Construction Co., West Hartford, Conn., $115,076; Eastern Asphalt Paving Co., New York, $108,943, and six others.

Road No. 1207, Croton-on-Hudson, Riverside Ave., Westchester County, 1.28 miles: E. T. Eggleston, Yonkers, $36,119; Price & Tripp, Inc., White Plains, $36,272; William F. McCabe Contracting Co., White Plains, $35,927; John J. Hart, Peekskill, $34,395; Samuel Beskin, Beacon, $36,187; Joseph Johnson & Sons, West New Brighton, S. I., $35,205; McDonald Contracting Co., New York, $36,854, and four others.

Road No. 1205. Dresden-Pen Yan, Yates County, 5.18 miles: J. W. Brennan Contracting Co., Geneva, $51,682; Ribstine-Holter Co., Rochester, $54,055; I. M. Ludington Sons Co., Rochester, $53,327; Frank V. Brotsch, Rochester, $51,599; Brooks & Julian, Rochester, $53,969; Richard Hopkins, Troy, $54,818; Atlanta Construction Co., Atlanta, $50,201, and two others.

The following bids were received by the State Commission of Highways, July 27, for the repair of public highways by state aid:

Repair Contract No. 677, Montgomery County: J. J. Malloy, Schnectady, $1341; Harry W. Roberts, Utica, $1249; Lane Construction Corporation, Meriden, Conn., $1369; Richard Hopkins, Troy, $1372; John P. Dugan & Co., Amsterdam, $1094; R. D. Cooper, Little Falls, $1276.

Repair Contract No. 678, Montgomery County: R. D. Cooper, Little Falls, $414; E. H. Brown, Hempstead, $4752; Lane Construction Corporation, Meriden, Conn., $4791; Harry W. Roberts & Co., Utica, $4270; Champlain Construction Co., Saratoga Springs, $3995; Richard Hopkins, Troy, $4706; John P. Dugan & Co., Amsterdam, $3937.

Repair Contract No. 679, Montgomery County: R. D. Cooper, Little Falls, $2531; John P. Dugan & Co., Amsterdam, $2163; Richard Hopkins, Troy, $2757; J. J. Malloy, Schenectady, $2445; Lane Construction Corporation, Meriden, Conn., $2405; Harry W. Roberts & Co., Utica, $2489.

Repair Contract No. 680, Montgomery and Fulton Counties: R. D. Cooper, Little Falls, $6374; John P. Dugan & Co., Amsterdam, $5822; J. J. Malloy, Schenectady, $6599; Champlain Construction Co., Saratoga, $5349; Harry W. Roberts & Co., Utica, $6187; Flood & Van Wirt Co., Hudson Falls, $6361; Lane Construction Corporation, Meriden, Conn., $6656.

Repair Contract No. 676, Oneida County: Phelan & Sullivan, Utica, $10,463; E. H. Brown, Hempstead, L. I., $10,996; H. Ward Dickison, Syracuse, $10,987; Ballard & Maher, Oneida, $10,441; William F. Cogley, Utica, $10,545; Nash & Griffin, Norwich, $10,415; C. D. Dean, Albany, $10,422, and three others. Noted July 16.

Newburgh, N. Y.—Bids will be received by D. J. Coutant, City Clk., until 5 p.m., Aug. 4, for improving William St. from Broadway to Renwick St. W. J. Blake, Jr., is City Engr.

+North Tonawanda, N. Y.—The contract for paving Oliver St. has been awarded to the CONSTANTINE CONSTRUCTION CO., Buffalo, at $31,839.

Schenectady, N. Y.—Bids will be received by the Board of Contract and Supply, until Aug. 5, for paving a number of streets.

Plainfield, N. J.—The city will issue $16,000 in bonds for paving several streets with macadam.

+Westfield, N. J.—The Town Council has awarded the contract for improving Lenox Ave. to CHARLES LENTZ.

Crafton, Penn.—(Official)—Bids will be received by F. J. Huffman until 8 p.m., Aug. 4, for grading, curbing and paving Elmwood St.

+Glassport, Penn.—The contract for paving Ohio Ave. from Seventh to Ninth has been awarded to BOWMAN BROS. CO., McKeesport, at $11,009.

Greensburg, Penn.—(Official)—Bids will be received by the Borough Council until 8 p.m., Aug. 3, for grading, curbing and paving the following streets: Liberty St., St. Clair Ave., Truby St. J. F. Beatty is Secy. of the Council.

+Harrisburg, Penn.—(Official)—Bids were received July 21, by the State Department of Highways, as follows: (a) amiesite, (b) asphalt bituminous macadam, penetration method, (c) warrenite, (d) filbertine, (e) unionite:

Bucks County, Bristol Township, 5524 ft. (alternate bids)—Frank McInerney, Easton, (a) $17,752; George C. Souder, Lancaster, (b) $17,504, (a) $20,311; Manwaring & Cummins, Philadelphia, (b) $16,650, (a) $17,553; W. C. Evans, Ambler, (b) $19,361, (a) $21,366, (c) $24,876; Edward L. Bader, Philadelphia, (a) $20,797; Charles T. Eastburn Co., Yardley, (b) $19,350, (a) $18,848, (c) $22,859; B. F. Richardson, Philadelphia, (e) $23,098; Union Paving Co., Philadelphia, (d) $18,047; J. F. SHANLEY CO., Philadelphia, (b) $15,623, (a) $16525 (awarded contract).

Bucks County, West Rockhill Township and Telford Borough, 12,065 ft. (alternate bids)—Neff, Horn & Co., Slatington, (b) $35,386, (a) $45,038, (c) $46,111; Edward L. Bader, Philadelphia, (a) $40,881; William C. Evans, Ambler, (b) $33,758, (a) $39,121, (c) $47,057; Charles T. Eastburn Co., Yardley, (b) $40,445, (a) $39,158, (c) $47,953; B. F. Richardson, Philadelphia, (e) $46,919; Union Paving Co., Philadelphia, (d) $35,617; FRANK McINERNEY, Easton, (a) $34,808 (awarded contract).

Venango County, Jackson Township, 2796 ft. brick block paving: G. W. Ensign, Inc., Harrisburg, $13,723; Simpson & Metz, Erie, $12,365; NORTHWESTERN CONSTRUCTION CO., Franklin, $12,991 (awarded contract).

Tioga County, Blossburg Borough, 10,907 ft. brick block paving: William C. Evans, Ambler, $70,476; McNerney Construction Co., Canton, $64,172; Empire Contractors' Material & Equipment Co., Newark, N. J., $60,314; Monroe Paving Co., Langhorne, $74,360; Hassam Paving Co., Worcester, Mass., $67,927; B. H. Coryell, Williamsport, $68,988; N. Horn & Co., Slatington, $74,533; Sou_h Shore Construction Co., Erie, $68,327; Simpson-Mitchell-Crosby Co., Punxsutawney, $63,754. Contract not awarded.

Greene County, Franklin Township, 15,063 ft. brick block paving: John Dandrea & Co., Patton, $60,828; John W. Hallam, Washington, $67,222; Bell-Bockel Co., Inc., Altoona, $62,596; Frederick Robinson, Waynesburg, $64,088; W. F. Blair & Son, Waynesburg, $64,896. Contract not awarded.

Elk County, Ridgway Borough, 6111 ft. brick block paving: B. H. Coryell, Williamsport, $27,821; Charles T. Eastburn Co., Yardley, $30,066; Barrally & Ingersoll, Rochester, $29,517; John Dandrea & Co., Patton, $29,635; Simpson & Metz, Erie, $28,595; J. B. Hurley, Inc., Fredonia, N. Y., $27,902. Contract not awarded.

Westmoreland County, Allegheny Township, 15,450 ft. water-bound macadam: M. Bennett & Sons, Indiana, $54,396; BELL-BOCKEL CO., INC., Altoona, $52,544 (awarded contract); William C. Evans, Ambler, $56,475; Samuel Gamble Co., Carnegie, $60,274; R. H. Cunningham & Sons, Turtle Creek, $57,085; John L. Elder, Ebensburg, $65,130; Neelen & Daly, Pittsburgh, $66,068; Duquesne Contracting Co., Pittsburgh, $61,116.

Somerset County, Summit Township, 5256 ft. asphaltic bituminous macadam (penetration method): Somerset Contracting Co., Somerset, $24,479; Hoblitzell & Price, Meyersdale, $20,774; WILLIAM C. EVANS, Ambler, $19,507 (awarded contract); J. C. McSpadden, Rockwood, $24,199.

Somerset County, Milford Township, 5000 ft. (alternate bids) (a) water-bound macadam, (b) asphaltic bituminous macadam, penetration method: Somerset Contracting Co., Inc., Somerset, (a) $15,362, (b) $19,273; Hoblitzell & Price, Meyersdale, (a) $19,948, (b) $21,085; William C. Evans, Ambler (a) $16,411, (b) $17,976; J. C. McSpadden, Rockwood, (a) $18,641, (b) $20,066. Contract not awarded. Noted July 2.

Midland, Penn.—Bids will be received by M. C. Donohoe, Secy. of Council, until 8 p.m., Aug. 3, for improving Beaver, Penn and Ohio Aves. R. R. Owens is Borough Engr.

Mt. Pleasant, Penn.—Bids will be received by J. E. Criswell, Borough Secy., until 8 p.m., Aug. 3, for constructing a sewer and grading, curbing and paving Depot St. with vitrified brick.

✦Washington, Penn.—(Official)—The Commissioners of Washington County have awarded the following contracts for resurfacing roads: To the COLLINS-GORDON CONTRACTING CO., Pittsburgh, Penn., for two miles of the Dry Run Road with brick, concrete curb, at approximately \$28,321; to the same company, for 1500 ft. of the Taylorstown Road with Kentucky rock asphalt, at \$[illegible]982; to WILLIAM HICKETT & CO., Washington, Penn., for one mile of the McClanes-Bridge-Meadowlands Road with concrete, at \$9171.

Cumberland, Md.—Bids will be received by the Allegany County Commissioners, until Aug. [illegible], for the construction of one mile of road from Ocean-Midland Section of the Legislative Road, also two miles of the Pekin-Barton Section of the same road, also from Barton-Phoenix Section, two miles, to be of concrete or macadam construction. J. T. Edwards is Pres.

✦Easton, Md.—A contract for constructing 20,000 sq.yd. of streets with concrete has been awarded to the McGUIRE CONSTRUCTION CO., Norfolk, Va., at \$1.39 per sq.yd. Noted June 3.

✦Williamson, W. Va.—(Official)—Bids will be received by the city until 8 p.m., Aug. 10, for about 50,000 sq.yd. of brick, bituminous macadam and concrete paving, also for about 51,000 lin.ft. of curbing and 5000 lin.ft. of sewers.

Arcadia, Fla.—(Official)—Bids will be received by A. L. Durrance, Clk. of Circuit Court, until 2 p.m., Sept. 8, for the sale of \$170,000 of bonds for improving roads and bridges in District No. 5. Noted under Bridges July 9.

Miami, Fla.—Bids will be received by the City Council until Aug. 6 for 95,000 sq.yd. of paving.

Tampa, Fla.—Bids will be received by the County Commissioners until Aug. 6 for improving the following roads: Tampa-Plant City, Harney-Thonotassa, Riverview and Port Tampa Roads. James Riddle is Engr. of Roads.

✦The contract for paving Buffalo and Florida Aves. has been awarded to the EDWARDS CONSTRUCTION CO., at \$37,9[illegible].

Eutaw, Ala.—Bids will be received by the County Commissioners of Green County, Court House, until 11 a.m., Aug. 17, for improving a part of Eutaw and Clinton Road. Estimated cost is \$7000.

✦Hayneville, Ala.—The contract for graveling the Hayneville-Mt. Willing Road has been awarded to the NIXON CONSTRUCTION CO., at \$6712. Noted July 2.

Nicholasville, Ky.—(Official)—Bids will be received by the Board of Councilmen until 3 p.m., Aug. 1, for improving Main St. from Depot to South Cross St.

Paintsville, Ky.—See item under "Sewers."

Cincinnati, Ohio—(Official)—Bids will be received by the County Commissioners until noon, Aug. 14, for grading Mill Road. Albert Reinhardt is Clk. of Comrs.

✦Cincinnati, Ohio—The contract for improving the New Richmond Pike has been awarded to the VAN CAMP BROS., at \$[illegible]16[illegible]. Noted June 25.

Cleveland, Ohio—Bids will be received by E. G. Krause, Clk. of the Bd. of Commissioners, until Aug. 15, for the improvement of the Solon and Richmond Road.

Columbus, Ohio—(Official)—Bids will be received by the State Highway Commission until 2 p.m., Aug. 4, for constructing 33 roads at an approximate cost of \$2,500,000, and for repairing eight roads at an estimated cost of \$185,000.

Defiance, Ohio—Bids will be received by Clayton M. Rath, Dir. of Pub. Ser., until Aug. 11, for improving East Second St. and Ottawa Ave.

Lima, Ohio—Bids will be received by H. J. Lawlor, Clk. of the Bd. of Comrs., until Aug. 11, for the construction of 14,[illegible] sq.yd. of concrete roadway near Spencerville.

Lorain, Ohio—Bids will be received by F. L. F[illegible]enberger, Clk. of the Bd. of Comrs., until Aug. 5, for repairing the Town Line and Cotton Road.

New Lexington, Ohio—(Official)—Bids will be received by T. H. [illegible]er until noon, Aug. 17, for the improvement of [illegible].

✦New Philadelphia, Ohio—The contract for paving East [illegible] and [illegible] Sts. has been awarded to [illegible] A [illegible] at \$[illegible].

Olmsted Falls, Ohio—Bids will be received by the Board of Trustees until Aug. [illegible] for improving highways. The estimated cost of the work is \$[illegible]. F. R. Gallagher is Township Clk.

✦Perrysburg, Ohio—(Official)—The contract for paving [illegible] has been awarded to MARSMAN & GREEN, [illegible], at \$[illegible]. The only other bidder was [illegible] & [illegible], at \$[illegible]. Noted July 2.

✦Portsmouth, Ohio—The city has awarded the contract to [illegible] & [illegible] for paving the following streets: [illegible] Broadway, [illegible]. Noted June 1[illegible].

✦Tiffin, Ohio—The contract for [illegible] one mile of the [illegible] has been awarded to H. H. [illegible].

Toledo, Ohio—Bids will be received by D. J. [illegible], [illegible] of Lucas County, until [illegible] a.m., Aug. [illegible], for improving a number of roads.

Uhrichsville, Ohio—Bids will be received by H. O. [illegible], [illegible] Clk., until noon, Aug. [illegible], for grading, draining and paving a number of streets.

✦Van Wert, Ohio—Bids will be received by [illegible], [illegible], until noon, Aug. [illegible], for constructing [illegible] of [illegible] streets [illegible] one-half [illegible] of [illegible].

Indiana—(Official)—Bids will be received as follows for road improvements in Indiana:

New Albany, until 10 a.m., Aug. 7, by Commissioners of Floyd County, for constructing roads in Wright and Smith Townships. Julian T. Miller is Audr.

Valparaiso, until 2 p.m., Aug. 9, by the Commissioners of Porter County, for constructing roads in Portage and Center Townships. C. A. Blachly is Audr.

Brazil, until 10.30 a.m., Aug. 5, by Commissioners of Clay County, for constructing a stone and gravel road in Van Buren Township. E. A. Staggs is Audr.

Greencastle, until 2 p.m., Aug. 1[illegible], by Commissioners of Putnam County, for constructing three macadam roads in Greencastle Township. C. L. Airhart is Audr.

New Albany, until 10 a.m., Aug. 11, by Commissioners of Floyd County, for constructing a road in Greenville Township. Julian T. Miller is Audr.

Warsaw, until 10 a.m., Aug. 31, by Commissioners of Kosciusko and Fulton Counties, for constructing a county line gravel road. V. D. Mock is Audr. of Kosciusko County, W. C. Williams is Audr. of Fulton County.

Bloomfield, Ind.—(Official)—Bids will be received by John W. Johnson, Treas. of Greene County, until 2 p.m., Aug. 3, for the sale of \$12,400 and \$11,000 of highway bonds.

English, Ind.—(Official)—Bids will be received by A. H. Flanigan, Treas. of Crawford County, for the sale of \$7500 of bonds for highway improvement.

Indianapolis, Ind.—(Official)—Bids will be received by the Board of Public Works until 1[illegible] a.m., Aug. 5, for improving the following streets: Comar Ave. from Shelby St. to Boyd Ave., Irving Pl. from Fletcher Ave. to Lexington Ave., Fulton St. from Ohio St. to Michigan St., and Martindale Ave. from Roosevelt Ave. to 18th St.

✦La Porte, Ind.—A contract for constructing a macadam road has been awarded to LOUIS MARTIN at \$7094.

Monticello, Ind.—(Official)—Bids will be received by O. C. Middlestadt, Treas. of White County, until 10 a.m., Aug. 1, for the sale of \$6000, \$12,000, \$5[illegible]00 and \$8000 of highway bonds.

✦Terre Haute, Ind.—The contract for constructing a reinforced concrete pavement on 25th St., from Wabash Ave. to Elm St., has been awarded to EWING SHIELDS, at \$10,930.

✦Edwardsville, Ill.—Bids will be received by the City Council until 2.30 p.m., Aug. 5, for paving a number of streets with asphalt.

✦Elgin, Ill.—Contracts for constructing 7846 sq.yd. of asphaltic concrete pavement on Hill Ave. and 6436 sq.yd. of asphaltic concrete pavement on Addison St. have been awarded to the WESTERN CONSTRUCTION CO., Racine, Wis., at \$26,874. Noted July 9.

✦Kankakee, Ill.—The contract for paving Washington Ave. from Court St. to the river has been awarded to the ILLINOIS HYDRAULIC STONE & CONSTRUCTION CO., at \$15,377.

✦Pontiac, Ill.—The contract for paving South Locust St. has been awarded to LOGG & SON, at \$17,1[illegible]0.

Springfield, Ill.—(Official)—Bids will be received until 11 a.m., Aug. 4, by the Illinois Highway Commission for the following concrete road construction, all cement to be furnished by the State: Carroll County, Route 3, Sect. A, about 7200 lin.ft., estimated cost, \$11,16[illegible]; Moultrie County, Route [illegible], Sect. A, about 6300 lin.ft., estimated cost, \$8127; Macoupin County, Route 1, Sect. A, about 11,200 lin.ft., cost \$16,[illegible]; DuPage County, Route 1, Sect. A, about 10,800 lin.ft., cost \$20,995. P. C. McArdle is Acting Ch. Engr.

(Official)—Bids will be received until 11 a.m., Aug. 11, by the State Highway Commission for the following road work: Lawrence County, Route 5, Sect. A, 4680 lin.ft. of concrete construction, estimated cost \$10,139; Clark County, Route 1, Sect. A, 4200 lin.ft. of concrete construction, estimated cost \$6772; Franklin County, Route 1A-1, Sect. A, 4278 lin.ft. of concrete construction, estimated cost \$6611; Monroe County, Route 1, Sect. A, 1980 lin.ft. of concrete construction, estimated cost \$2978; Schuyler County, Route [illegible], Sect. A, [illegible]00 lin.ft. of concrete construction, estimated cost \$6766; Jefferson County, Route 3, Sect. A, [illegible] lin.ft. of concrete construction, estimated cost \$6257.

✦Clintonville, Wis.—The contract for paving New London St. has been awarded to the C. PETERSON CONSTRUCTION CO., at \$1[illegible]. Other bids were: Schuette Cement Construction Co., \$20,[illegible]5, and Larson Construction Co., \$1[illegible]. Noted July 9.

Eau Claire, Wis.—Bids will be received until 2 p.m., Aug. 5, for laying about 2700 sq.yd. of brick pavement on concrete base on [illegible] Ave. East. J. C. Flanne[illegible] is City Clk. A. R. [illegible] is City Engr.

✦Hurley, Wis.—The contract for paving Silver St. with vitrified brick has been awarded to FRED EUL, Menasha, at \$[illegible]2,197.

Monroe, Wis.—Bids will be received by the Committee on Streets and Sidewalks until noon, Aug. 13, for improving East George St. W. Dinnwiddie is City Clk.

Montello, Wis.—Bids will be received until Aug. 3 for street improvements. A. J. Berry is Village Clk.

✦Platteville, Wis.—The contract for paving Main St. has been awarded to T. B. WOMELEY [illegible]. Noted July 16.

Reedsburg, Wis.—Bids will be received by the City Clerk until Aug. [illegible] for constructing brick pavement on Pine and [illegible] Sts. and two sections of North Ave.

Corydon, Iowa—(Official)—Bids will be received by A. T. [illegible], City Clk., until Aug. 1[illegible], for [illegible] sq.yd. of brick, asphaltic concrete or concrete pavement. M. G. Hall, Centerville, is Engr. in Charge.

Marshalltown, Iowa—Bids will be received by J. J. Wilson, City Clk., until [illegible] a.m., Aug. [illegible], for concrete sidewalks.

✦Duluth, Minn.—The contract for improving Victoria St. has been awarded to A. N. NELSON, at \$[illegible]227. Other bids

were: J. A. Johnson, $11,327; Olson & Johnson, $11,488, and Rogers & McLean, $11,579.

+Virginia, Minn.—The contract for paving First and Fourth Sts. and Mesaba Ave. has been awarded to LAWRENCE McCANN, at $51,757.

+Dodge City, Kan.—The contract for paving the business section has been awarded to A. R. YOUNG, Lawrence, at $49,940.

Seward, Neb.—(Official)—Bids will be received until 8 a.m., Aug. 6, for 30,000 yds. of brick, asphalt or concrete pavement. The Martz Engineering Co., 416 First National Bank Bldg., Lincoln, Neb., is Engr.-in-Charge. C. L. Wasserman is City Clk. Noted July 16.

Minot, N. D.—Bids will be received by the Board of City Commissioners until 8 p.m., Aug. 3, for improving parts of Second St. Northwest, Third St. Northwest and Third Ave. Northwest. A. D. Hagenstein is City Audr.

Havre, Mont.—Bids will be received by City Clerk until Aug. 3 for constructing Improvement Districts Nos. 70, 71 and 72.

Jefferson City, Mo.—Bids will be received by the City Clerk until Aug. 3 for the construction of McCarty St. from Clark Ave. to Benton St. and from Locust to Clark. Phil C. Harding is City Engr.

+St. Joseph, Mo.—The contract for paving 26th St. from Messanie to Mary St. has been awarded to the YOUNG CONSTRUCTION CO.

St. Louis, Mo.—Bids will be received by the Board of Public Improvements until Aug. 7 for improving Oakland Ave. from Clayton to Skinner, at an estimated cost of $30,059, and for paving the 12th St. viaduct from Spruce to Chouteau, at an estimated cost of $27,400.

+Sikeston, Mo.—The contract for constructing about 3400 sq.yd. of concrete pavement and 1448 cu.yd. of excavation has been awarded to J. R. McKINNEY. Noted July 9.

Sheridan, Wyo.—(Official)—Bids will be received by M. W. Foy, City Clk., until 10 a.m., Aug. 3, for the sale of $267,700 bonds for street improvements in District No. 3.

+Cameron, Tex.—(Official)—The contract for constructing a system of improved highways in Road District No. 2, Milam County, has been awarded to HOWARD & TAYLOR, Belton, at $71,605. The only other bidder was B. L. Waggaman & Co., at $81,346. Noted June 25.

Dallas, Tex.—Bids will be received by the City Commission until Aug. 3 for paving the following streets: Jackson from Pearl to Preston, Bryan from St. Joseph to Munger Blvd., Broom from Lamar to Laws, Race from Elm to Main, Washington from San Jacinto to Ross, Carroll from Swiss to Reiger, Hall from Ross to Swiss and from Knight to Douglas, Hawkins from Commerce to Bryan, Lamar from Pacific to McKinney, and Crowdus from Elm to Commerce.

Houston, Tex.—(Official)—Bids will be received until 2 p.m., Aug. 3, for paving Webster Ave. from Main to Sherman St., at an estimated cost of $30,000, and Avondale Ave. from Baldwin to Hopkins St., at an estimated cost of $30,000. E. E. Sands is City Engr.

Moscow, Idaho—The City Engineer is preparing plans for paving 10 blocks.

+Twin Falls, Idaho—The SLICK BROTHERS CONSTRUCTION CO., Boise, received the contract for grading 41 miles of road in Twin Falls County, at $13,203.

+Anacortes, Wash.—The contract for improving 10th St. has been awarded to HERWIG & HAUG, at $20,454.

+Burlington, Wash.—The contract for paving parts of Anacortes and Orange Sts. has been awarded to the WASHINGTON PAVING CO.

+Hoquiam, Wash.—The contract for constructing permanent pavement on Aberdeen St. has been awarded to PUGH & ARENZ, at $15,881.

+Ashland, Ore.—The contract for constructing five miles of Pacific Highway has been awarded to CLARK HENERY CONSTRUCTION CO., Sacramento, at approximately $50,000.

+Los Angeles, Calif.—Contracts have been awarded for improving Park Terrace to WALTER OVERELL, at $8454; Monclair St. and Westmoreland Ave. to the FAIRCHILD-GILMORE-WILTON CO., at $7616 and $9175, respectively.

+Los Angeles, Calif.—B. F. FORD and F. H. STOUT have been awarded the contract at $12,078 for improving Santa Barbara Ave., between Vermont and Budlong.

+San Diego, Calif.—The contract for paving Utah St. between Balboa Park and University Ave has beeen awarded to the C. L. HYDE CONSTRUCTION CO., at $19,800.

Hull, Que.—According to press reports, bids will soon be received for constructing concrete sidewalks.

Quebec, Que.—W. D. Baillarge, 50 St. Louis St., is preparing plans for the construction of a promenade at an estimated cost of $85,000.

Weston, Ont.—Bids will be received until 8 p.m., Aug. 4, for improving Main St. J. H. Taylor is City Clk.

+Welland, Ont.—The contract for paving 6200 sq.yd. with creosoted wood block has been awarded to the CANADA CREOSOTING CO., 1 King East, Toronto, at $22,442.

+Fort Garry, Man.—The contract for paving the Pembina Highway with concrete has been awarded to R. MARCOUX, at $12,500.

+Revelstoke, B. C.—The contract for laying 25,000 sq.yd of bitulithic pavement has been awarded to the WARREN CONSTRUCTION CO.

INDUSTRIAL WORKS

+Everett, Mass.—The TURNER CONSTRUCTION CO., New York, N. Y., has been awarded the contract for the construction of a plant for the Bowker Insecticide Co., of this city. A three-story, 92x76-ft., reinforced concrete warehouse will be built. A. H. Nickerson is the Engr.

Salem, Mass.—The Naumkeag Steam Cotton Co. will rebuild its plant, recently destroyed by fire. The estimated cost is $3,500,000. Lockwood, Greene & Co., 93 Federal St., Boston, are the Archs.

West Groton, Mass.—The Groton Leather Board Co., whose plant was recently destroyed by fire, will rebuild. The estimated cost is $20,000. George H. Bixby is Mgr.

Bridgeport, Conn.—Albin E. Henkels has asked for estimates for the construction of a reinforced concrete factory, 80x200 ft. and three stories high. Samuel M. Greene Co., 318 Spring St., Springfield, Mass., is the Arch.

+New Britain, Conn.—The Rogers Sash & Door Co. has awarded contracts for an office and storehouse building on Chestnut St. to JOHN W. ALLEN & SON, 331 Chestnut St., and GEORGE S. CHATFELD CO., 73 Canal St., Waterbury. It will be three stories, 115x60 ft., and of brick construction. Unklebach & Perry, 162 Main St., New Britain, are the Archs.

Thomaston, Conn.—The Seth Thomas Clock Co. plans to construct additions to its plant which will cost about $100,000.

+Buffalo, N. Y.—The Balston Purina Co., St. Louis, has awarded the TURNER CONSTRUCTION CO., Buffalo, a contract to erect a concrete grain elevator and mill on Prenatt St. The work will cost $100,000.

Ilion, N. Y.—The Remington Arms Co. will erect a four-story, 40x128-ft. addition to its plant. Estimated cost, $60,000. W. E. Noaidle is Mgr.

Madrid, N. Y.—Bids will be received by the Madrid Bottling Co. for a two-story and basement bottling house. C. O. Sleegle is Gen. Mgr. G. Wilson, Ogdensburg, N. Y., is preparing plans.

New York, N. Y.—Plans have been filed for the erection of a twelve-story fireproof factory at 233 West 36th St., for the Holland Holding Co. The cost will be $200,000. Judson S. Todd, is Pres. Frederick C. Zobel is the Arch.

+New York, N. Y.—(Borough of Queens)—The Ford Motor Car Co., Detroit, Mich., has let a contract to FOUNTAIN & CHOATE, of 110 E. 23d St., New York, N. Y., for constructing an eight-story, 209x325-ft. factory at Long Island City, N. Y. The cost of the structure will be $800,000. John Graham, Detroit, Mich., is the Arch.

+Niagara, N. Y.—The contract for building a three-story and basement addition to the plant of the International Acheson Graphite Co. has been awarded to the TURNER CONSTRUCTION CO., 11 Broadway, New York. The estimated cost is $35,000.

Rochester, N. Y.—Foote, Hadley & Carpenter, Archs., have prepared plans for a factory to be constructed on West Ave. for the Ritter Dental Mfg. Co., 610 West Ave. Estimated cost, $26,000.

+Syracuse, N. Y.—The E. R. Caldwell & Son Brass Co. has awarded a contract to D. W. NICHOLSON for constructing a foundry and machine shop on West Fayette St. The estimated cost is $16,500.

Jersey City, N. J.—C. Heidt & Son, Inc., will build a two-story brick cooperage plant on Fairmount Ave., to cost about $40,000.

Newark, N. J.—The Celluloid Co., manufacturer of celluloid specialties, will build a two-story, 52x132-ft. addition to its plant on Ashbridge Ave., to cost about $15,000.

+Newark, N. J.—The AMERICAN CONCRETE STEEL CO. has been awarded the contract for the erection of a new four-story, reinforced-concrete warehouse for Wilkinson, Gaddis & Co., on Parkhurst Ave. The building will cost about $100,000.

Lebanon, Penn.—It is announced that the Valley Mold and Iron Co., of Sharpsville, will erect a big ingot mold plant here to supply the Eastern market. Plans for the new foundry are being prepared and it is said that an expenditure of $500,000 will be made.

+Philadelphia, Penn.—JAMES G. DOAK & CO., Crozier Bldg., have been awarded the contract for a three-story, 75x215 ft., brick and stone factory Bldb., for the Cameron Co., at N. St. and Glenwood Ave. Estimated cost, $65,000, Stearns & Caster, are the Archs.

+WILLIAM STEELE & SONS, INC., 1600 Arch St., were awarded the contract for erecting a storage building, 100x50-ft., at School Lane and Reading R.R., for the Powers-Weightman-Rosengarten Co.

Philadelphia, Penn.—The Industrial Tape Mills Co. is having plans prepared for a three-story, 74x207-ft. manufacturing plant, to be erected at Allegheny and Rosehill Sts. The cost will be $50,000.

Sharon, Penn.—Plans have been completed for the new benzol plant for the Carnegie South works, and construction will soon begin. Carl Still will be in charge of the work.

Charlestown, W. Va.—The C. L. Robinson Ice & Cold Storage Corporation will erect a large cold storage plant, to cost $50,000.

+Durham, N. C.—The First National Bank has awarded a contract to the GEORGE A. FULLER CO., of New York, N. Y., for the erection of an eight-story office building on the site now occupied by the bank. The cost will be $200,000.

Mobile, Ala.—The plant of the A. J. Spencer Lumber Co., recently destroyed by fire, will be rebuilt at a cost of about $30,000.

New Orleans, La.—The Interstate Distilling Co. will erect a distillery on Pine St., to cost about $24,000.

Chattanooga, Tenn.—The Queen & Crescent R.R. Co. will construct a station and warehouse, to cost $250,000.

+Akron, Ohio—The contract for constructing the six-story building at Mill and High Sts. has been awarded by the

[illegible] & [illegible] Real Estate Co. to the CARMICHAEL CONSTRUCTION CO., at about $[illegible].

+Cincinnati, Ohio—Contract for remodeling the Manischewitz bakery, [illegible] West Sixth St., has been awarded to DAVID GORDON, [illegible] West Seventh St., at $[illegible].

Cleveland, Ohio—The Ferry Cap & Set Screw Co., 2151 Scranton Rd., has filed plans for a three-story, 40x176-ft. addition to its plant. It will cost about $20,000.

Cleveland, Ohio—The Grabler Mfg. Co. will construct a three-story brick and steel machine shop, at 6565 Broadway. Christian, Schwarzenberg & Gaede are the Archs.

Martins Ferry, Ohio—A company reported to be connected with the Wheeling Corrugated Co. will soon erect a chemical plant at Martins Ferry. The plant will cover an area of two acres and will be of steel construction.

Newport, Ohio—Plans have been prepared for the construction of a $[illegible] addition to the plant of the Donaldson Lithographing Co.

Springfield, Ohio.—The Bowlus-Hackett Fruit Co. will construct a modern three-story, and basement, concrete, cold storage and commission warehouse, to cost $65,000. Charles J. Bowlus is Pres.

+Warren, Ohio—The Chicago-Cleveland Car Co. has awarded a contract to JAMES L. STUART, 915 Illuminating Bldg., Cleveland, for erecting a one-story, 140x300-ft. factory. The contract price is $80,000.

Youngstown, Ohio—The Fisher Fireproof Storage Co. plans to erect a warehouse to cost $75,000.

+Indianapolis, Ind.—The Federal Foundry Co. has awarded a contract to the McCLINTIC-MARSHALL CO., Pittsburgh, Penn., for the construction of a one-story, 180x400-ft. foundry. The contract price is $1[illegible]000. W. J. Carter, Rockefeller Bldg., Cleveland, Ohio, is the Arch.

Lansing, Mich.—D. B. Moore, Arch., 280 Tussing Block, is preparing plans for a three-story, 56x114-ft. factory for the Michigan Screw Co. Estimated cost is $10,000.

Chicago, Ill.—The U. Livingston Bakery Co., South Wabash Ave., will erect a two-story addition to its plant, to cost $[illegible]. J. Aschlager & Son are the Archs.

+Fond du Lac, Wis.—THE IMMEL CONSTRUCTION CO. has been awarded a contract to construct for the Kimberly-Clark Co. a two-story, [illegible]x100-ft. brick bleach plant and a one-story, [illegible]x[illegible]-ft. concrete brick and steel addition to the paper mills and offices. Estimated cost, $25,000.

St. Paul, Minn.—Local press reports state that bids will be received soon by the Northern Pacific R.R. Co., for the erection of a new roundhouse and locomotive repair shop. The cost to be about $[illegible]. Noted July 23.

The North American Oil Engine Co. will in a short time construct a $[illegible] factory in the Midway district for the manufacture of a new kerosene engine.

St. Louis, Mo.—The J. M. Dunham Co., Archs., St. Louis, are receiving bids for the erection of a seven-story, 95x128-ft. slow combustion factory, at Sixth and Spruce Sts., for the J. L. Howard estate of Brooklyn, N. Y. The building will be of reinforced concrete and red stock brick. The estimated cost is $11[illegible].

St. Louis, Mo.—The Landan Cabinet Co. will erect a three-story and basement addition to its plant, to cost $20,000.

Tulsa, Okla.—The Inez Manufacturing Co. will build a [illegible] costing over $2,000,000, at Sand Springs, a suburb of the city.

Seattle, Wash.—The entire plant of the Western Steel Corporation at [illegible], Wash., will be moved to Seattle and [illegible] by the Pacific Coast Steel Co., which took it over some months ago. The [illegible] plant has a capacity of 150 tons per day. T. [illegible] Clingan, Mgr. of the local concern, will take charge of the new enterprise.

Seattle, Wash.—The Commissioners of the Port of Seattle will receive bids until Aug. 1[illegible] for the construction of a reinforced concrete grain elevator to cost about $[illegible].

Portland, Ore.—The [illegible] Gas Co., Dayton, Ohio, will build a [illegible] here for the manufacture of oxygen and [illegible] to supply the local market. A site has been purchased and plans for the structure completed. Work on the new plant will start in the near future. E. A. [illegible] will be Mgr. of the Portland plant.

Fresno, Calif.—The [illegible] Co., San Francisco, will construct a [illegible] elevator, estimated to cost $[illegible]. [illegible] M. [illegible], [illegible] St., San Francisco, is [illegible].

San Francisco, Calif.—The [illegible] Chocolate Co. will erect a two-story and basement manufacturing plant to cost $[illegible] at [illegible] Point and Van Ness Ave. William [illegible] is Arch.

Hamilton, Ont.—[illegible] and Gamble, soap and perfume manufacturers, [illegible], Ohio, contemplate establishing a plant in Hamilton to cost $[illegible].

Niagara Falls, Ont.—The [illegible] Alloy Mfg. Co. will build an addition to its [illegible] on [illegible] St. [illegible] & Hudson, [illegible], N. Y., are preparing plans.

Port Dover, Ont.—The Port Dover Brick & Tile Co., whose plant was burned on July [illegible] at a loss of $[illegible], will rebuild at a cost of $[illegible]. W. [illegible], Port Dover, is Mgr.

New Westminster, B. C.—The plant of the Pacific [illegible] Co., recently burned at a loss of $[illegible], will be rebuilt.

Vancouver, B. C.—The [illegible] Nail & Wire Works are having plans prepared for a new $[illegible] factory.

Vancouver, B. C.—The Royal Crown [illegible] Ltd. will construct a large plant on the south shore of Burrard Inlet in [illegible]. The new development will cost about $[illegible].

FEDERAL GOVERNMENT WORK

Repairing Vessel—Boston, Mass.—Bids will be received until 2 p.m., Aug. 3, by the Light House Inspector, Boston, Mass., for repairs to light vessel No. 55.

+Repairing Vessel—Boston, Mass.—The contract for repairing light vessel No. 42, has been awarded to the NEW LONDON MARINE IRON WORK CO., New London, Conn., at $5118. Noted July 2.

Sale of Building—Boston, Mass.—Bids will be received until 2 p.m., Aug. 14, by the Light House Inspector, 19 Congress St., Boston, Mass., for the sale of the disused dwelling and fuel house on Spectacle Island, Boston Harbor, Mass.

Alterations, Etc.—New York, N. Y.—Bids were received July 20, by Oscar Wenderoth, Superv. Arch., Treasury Dept., for alterations and betterments at the U. S. post office and courthouse, New York, as follows: George A. Fuller Co., 111 Broadway, New York, $67,210; Marble Arch Co., 261st St. and Broadway, New York, $74,000; Concord Construction Co., Brooklyn, N. Y., $65,7[illegible]; E. H. Peterson Co., 1328 Broadway, New York, $63,890; William H. Egan, 147 East 12th St., New York, $85,700; Northeastern Construction Co., 225 Fifth Ave., New York, $62,231; Conners Bros. Co., 1[illegible]3 West Kingsbridge Road, New York, $67[illegible]; Neptune B. Smyth, 413 East 34th St., New York $[illegible],200. Noted July 16.

+Court House—New York, N. Y.—The contract for the alterations and betterments of the United States Courts in the United States Court House and Post Office Bldg., New York, has been awarded to NORTHEASTERN CONSTRUCTION CO., 225 Fifth Ave., New York, at $62,231. Noted July 16.

Conduit and Wiring—New York, N. Y.—Bids were received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for ventilation, electrical conduit and wiring, etc. in the U. S. post office and court house, New York, as follows: Evans Almirall Co., 7 Dominick St., New York, $11,950; Herrman & Grace Co., 683 Bergen St., Brooklyn, N. Y., $12,230; William J. Olvaney, 177 Christopher St., New York, $14,000.

Post Office—Camden, N. J.—Bids will be received until 3 p.m., Aug. 18, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for a conduit and wiring system, lighting fixtures, etc., at the U. S. post office at Camden, N. J.

++Sea Wall and Timber Groins—Philadelphia, Penn.—The contract for constructing sea wall and timber groins at Liston's Range Front light station, Delaware, has been awarded to LATTA & TERRY CONSTRUCTION CO., Philadelphia, Penn., at $2100. Other bidders were as follows: Henry L. Tatnall, Wilmington, Del., $2242; Concrete Engineer & Construction Co., Philadelphia, Penn., $[illegible]; Jones Construction Co., Wilmington, Del., $27[illegible]; E. Hart, Norfolk, Va., $3120. Noted May 28.

+Bulkhead—Wilmington, Del.—Bids will be received until 11 a.m., Aug. 1[illegible], by Maj. E. N. Johnston, Corps Engrs., U. S. A., for constructing pile and timber bulkhead at Christiana River, Del.

Repairing Vessel—Baltimore, Md.—Bids will be received until 2 p.m., Aug. 13, by the Light House Inspector, for sheathing the light house tender, "Laurel."

+Dredging—Broad Creek, Md.—Bids were received July 24, by Col. Lansing H. Beach, Corps Engrs., U. S. A., for dredging about 1[illegible] cu.yd. in Broad Creek, as follows: Sanford & Brooks Co., 24 Commerce St., Baltimore, Md., 9.[illegible]c. per cu.yd. (recommended for acceptance); McLean Contracting Co., Baltimore, Md., 1[illegible]c.; Atlantic, Gulf & Pacific Co., New York, N. Y., 1[illegible]c.; Maryland Dredging & Contracting Co., Baltimore, Md., 12[illegible]c.; [illegible] Dredging Co., Philadelphia, Penn., 12.5c.; W. H. French, Norfolk, Va., 10c. Noted July 16.

+Alterations to Building—Washington, D. C.—The contract for alterations, repairs, etc., to the soldiers' building, Washington, D. C., has been awarded to SKINKER & GARRETT, Washington, D. C., at $10,069. Noted July [illegible].

+Boilers—Washington, D. C.—The contract for furnishing 47 pumps for the new battleship has been awarded by the Navy Department to BLAKE & KNOWLES, Cambridge, Mass., at $66,[illegible].

+Post Office—Clarksdale, Miss.—The contract for the construction of a post office at Clarksdale has been awarded to CALLAHAN-MANDL CO., Chicago, Ill., at $[illegible]. Noted Feb. 5.

Post Office—Tupelo, Miss.—Bids will be received until 3 p.m., Aug. [illegible], by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete of a one-story [illegible] and basement stone and brick faced building, of [illegible] sq.ft. ground area, fireproof floor and roof, composition roof, for the U. S. post office at Tupelo, Miss.

Post Office—Jennings, La.—Bids were received as follows July [illegible], for the construction of a post office at Jennings: (a) [illegible], (b) [illegible]; Newport Contracting & Engineering Co., Newport News, Va., (a) $1[illegible], (b) $1[illegible]; [illegible] Co., St. Louis, Mo., (a) $[illegible]; Daniel T. McCarthy, Philadelphia, Penn., (a) $[illegible], (b) $[illegible]; J. F. [illegible] & Co., Ocala, Fla., (a) $[illegible], (b) $[illegible]; P. J. [illegible], New Iberia, La., (a) $[illegible], (b) $[illegible]; Algernon Blair, Montgomery, Ala., (a) $[illegible], (b) $[illegible]; William I. [illegible], Williamsport, Penn., (a) $[illegible], (b) $[illegible]; J. T. McKinney, Hallettsville, Tex., (a) $[illegible]. It will be two story and basement structure, [illegible] sq.ft. ground area, [illegible] fireproof, stone and brick facing, composition roof. Noted June 18.

Repairs to Wharf—New Orleans, La.—Bids were received July [illegible], for repairs to wharf for floating dry dock at the naval station, New Orleans, as follows: Lewis M. Dalgren, New Orleans, $[illegible]; John G. Altenhofer, New Orleans, $[illegible]; [illegible] F. Alexander, New Orleans, $[illegible]; [illegible] & Williams, New Orleans, $[illegible]; John Reese, New Orleans,

$21,290; Henry Monk, Pensacola, Fla., $14,736; Jefferson Construction Co., New Orleans, $29,815. Noted July 9.

★**Drilling for Foundation**—Nashville, Tenn.—Bids were received July 17, by Maj. H. Burgess, Corps Engrs., U. S. A., for drilling for subsurface investigations of foundations at Dam Sites, Nos. 2 and 3, Muscle Shoals, Tennessee River, as follows: J. A. Brennan Drilling Co., 30 Carsins St., Pittsburgh, Penn., $42,508, Giles & Clark, 30 Church St., New York, $69,170, H. R. Amelina Prospecting Co., Liggett Bldg., St. Louis, Mo., $103,374, T. A. Scott Co., Inc., New London, Conn., $105,301; Sprague & Henwood Inc., Scranton, Penn., $40,430; Sullivan Machine Co., 122 South Michigan Ave., Chicago, Ill., $110,335. Noted June 18.

Post Office—Fulton, Ky.—Bids will be received until 3 p.m., Sept. 2, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction, complete, of the U. S. post office at Fulton, Ky.

✚**Post Office**—Canton, Ohio—The contract for the construction of an extension to the post office at Canton has been awarded to FRANK M. WEAKLEY, Meridian, Miss., at $18,890. Noted June 4.

✚**River Bulkhead**—Alpena, Mich.—The contract for constructing a river bulkhead at the Alpena post office, has been awarded to JOHN MONAGHAN, Alpena, at $4925. Noted July 9.

Post Office—Holland, Mich.—Bids will be received until 3 p.m., Sept. 9, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete of the U. S. post office at Holland, Mich. It will be a two-story and basement building, ground area 6170 sq.ft., stone facing, partial fireproof construction.

Breakwater—Chicago, Ill.—Bids were received July 23, by Lieut.-Col. W. V. Judson, Corps Engrs., U. S. A., for constructing timber breakwater at Chicago Harbor, Ill., as follows: Burk, Smith & Nelson, Chicago, Ill., $168,832; United States Development Co., Chicago, Ill., $177,880; Byrne Bros. D. & E. Co., Chicago, Ill., $166,186; Edmund Gillen Dock Dredge & Engineering Co., Racine, Wis., $235,149; Great Lakes Dredge & Dock Co., Chicago, Ill., $139,535 (recommended for acceptance); Fitzsimmons & Connell Dredge & Dock Co., Chicago, Ill., $172,996. Noted July 9.

Post Office—Le Mars, Iowa—Bids were received July 27, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Le Mars, (a) limestone; (b) sandstone; from: Heman Construction Co., St. Louis, Mo., (a) $44,970; (b) $45,970. King Lumber Co., Charlottesville, Va., (a) $47,400; (b) $50,000. Noted June 18.

Post Office—Winfield, Kan.—Bids will be received until 2 p.m., Sept. 3, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete of a two-story and basement stone, terra cotta and brick faced building of 4400 sq.ft. ground area, fireproof except roof, for the U. S. post office at Winfield, Kan.

Post Office—Bozeman, Mont.—Bids were received as follows July 20 by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Bozeman, Mont., (a) limestone; (b) sandstone: M. L. Holliday, Greensboro, N. C., (a) $67,023; (b) $68,500. Leigland, Kleppe & Co., Great Falls, Mont., (a) $67,400; (b) $67,200. Deiter & Wenzel Construction Co., Wichita, Kan., (a) $69,989; (b) $71,600. George Hinchliff Construction Co., Chicago, Ill., (a) $71,000. Reynolds, Sypher & Shackleton, Butte, Mont., (a) $71,647; (b) $73,066. It will be a two-story and basement building, 4900 sq.ft., ground area, partially fireproof construction, stone and brick facing, composition roof. Noted May 28.

✚**Metal Flumes**—Great Falls, Mont.—The contract for furnishing metal flumes for the Milk River Irrigation project Montana, has been awarded to the HESS FLUME CO., Denver, Colo., at $5024. Noted July 9.

✚**Earthwork and Structures**—Great Falls, Mont.—The contract for earthwork and structures in connection with the St. Mary storage unit of the Milk River irrigation project, Montana, has been awarded to JAMES BROWN, Browning, Mont., at $5126. The work involves the excavation of 10,780 cu.yd. of material, the placing of 2500 cu.yd. of concrete and erecting in structures 113,000 ft. b.m. of lumber. Noted June 18.

✚**Drains**—Huntley, Mont.—Contracts for the construction of drains in connection with the Huntley Irrigation project, have been awarded as follows: Schedule 1, involving excavation, laying of tiling and back filling, to the HOWELL ATHERLY CO., Billings, Mont., at $8245. Schedule 2, for similar work to M. LINDSTROM, Billings, Mont., at $11,160. Noted May 28.

Repairing Wharf—Galveston, Tex.—Bids were received by the Custodian, U. S. Quarantine Station, Galveston, for repairs on wharf and dolphins, Galveston, as follows: Blodgett Construction Co., $8000; Charles Clarke & Co., $8900; Gracey & Avoy, $8875; O. E. Fischer Building Co., $9418; Charles Funk, $9800; Charles C. Ryals, $6450. All bidders of Galveston, Tex.

Elevator—Guthrie, Okla.—Bids were received July 18, for installing a passenger elevator in the U. S. post office and courthouse at Guthrie, as follows: Ohio Elevator & Machine Co., Columbus, Ohio, $7760, Kaestner & Hecht Co., Chicago, Ill., $5390, Kimball Bros. Co., Council Bluffs, Iowa, $6780, Otis Elevator Co., Washington, D. C., $5974. Noted June 25.

✚**Building**—Phœnix, Ariz.—The contract for constructing the brick industrial building at the Phœnix Industrial school has been awarded by the Commissioner of Indian Affairs, Washington, D. C., to CHARLES H. ODAM, Phœnix, Ariz., at $14,900. Noted June 18.

★**Canal**—Phoenix, Ariz.—Bids will be received by F. H. Newell, Dir., U. S. Reclamation Service, Phoenix, Ariz., until 2 p.m., Aug. 24, for constructing the Wallace Feeder Canal, Salt River Project, Arizona. For details see advertisement under "Contracts to Be Let."

Oil Burning Plant—Eureka, Calif.—Bids will be received until 3 p.m., Aug. 25, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for an oil burning plant for heating boiler in the U. S. post office and custom house at Eureka, Calif.

Coal Hoisting Tower—San Diego, Calif.—Bids will be received until 11 a.m., Aug. 29, by H. H. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., for a coal hoisting tower for the naval coal depot, San Diego, Calif.

Cutoffs—Stockton, Calif. — The U. S. Government has appropriated $249,000 for two cutoffs in the San Joaquin River.

Ice and Storage Plant—Pearl Harbor, Hawaii—Bids will be received until 11 a.m., Aug. 29, by H. R. Stanford, Ch., Bureau of Yards and Docks, Navy Dept., Washington, D. C., for building and equipping an ice making and cold-storage plant at the U. S. Naval Station, Pearl Harbor.

MISCELLANEOUS

★**Subway Station**—Boston, Mass.—(Official)—Bids will be received until noon, Aug. 4, by the Boston Transit Commission, 15 Beacon St., Boston, for constructing the Park St. station of the subway.

✚**Dredging**—Boston, Mass.—Contracts were awarded, July 21, by the State Harbor and Land Commissioners for dredging as follows: To the J. S. PACKARD CO., Providence, R. I., for dredging Duxbury Bay; to the BAY STATE DREDGING CO., LTD., Boston, for dredging a channel and basin in Scituate Harbor.

Bids were opened, July 21, by the State Harbor and Land Commissioners for dredging 20,000 cu.yd. from Mill River, as follows: Bay State Dredging Co., Ltd., 32c. per cu.yd. and $10, per cu.yd. for removing boulders; Eastern Dredging Co., Boston, 29.9c. and $8; John H. Gerrish, Boston, 28.3c. and $6.

Wharf—Charlestown, Mass.—The Pennsylvania Coal Co., Charlestown, plans to construct a wharf and buildings between the Terminal Stores and the city wharf on Medford St. Estimated cost, $150,000.

Fire Apparatus—Weymouth, Mass.—The town plans to spend $24,500 for fire apparatus. Robert S. Hogman is Chn. Fire Com. Town Council.

Fire Station—Darien, Conn.—N. E. Emmons, Arch., Stamford, Conn., has prepared plans for a fire station for the city.

✚**Barges**—Albany, N. Y.—The New York & Buffalo Barge Co., Albany, July 17, awarded the contract to the HAMILTON-CHAMBERS BARGE CO., 29 Broadway, New York, for constructing 30 barges to operate on the new state barge canal and the Hudson River. Estimated cost, $1,800,000.

★**Barge Canal Work**—Albany, N. Y.—(Official)—Bids were received July 21, by Duncan W. Peck, State Supt. Pub. Wks., Albany, for constructing bridges over the Mohawk River at (a) Crescent, N. Y., Barge Canal Contract 109, and at (B) Amsterdam, N. Y., Barge Canal Contract 118. The bids follow: (A) M. Fitzgerald, Hoosick Falls, N. Y., $205,026; Frank L. Cohen, Buffalo, N. Y., $183,694; Holler & Shepard, Rochester, N. Y., $180,618; Parker & Beebe, Waterford, N. Y., $195,150; Penn Bridge Co., Beaver Falls, Penn., $203,813; Lathrop, Shea & Henwood, Buffalo, $174,393; Scott Bros., Rome, N. Y., $174,576; John Monks & Sons, New York, $201,548; John M. Holler, Albany, $183,738; Lupfer & Remick, Buffalo, N. Y., $174,974; Larkin & Sangster, Seneca Falls, N. Y., $163,917; Oswego Construction Co., $188,139; Walsh Construction Co., Davenport, Iowa, $206,407; engineer's estimate, $190,244; (B) Penn Bridge Co., $164,568; Frank L. Cohen, $152,548; Larkin & Sangster, $163,463; John M. Holler, $157,604; Lathrop, Shea & Henwood, $147,408; Eastover Construction Co., Gloversville, N. Y., $192,635; Lupfer & Remick, Buffalo, N. Y., $158,093; Walsh Construction Co., $159,462; engineer's estimate, $153,093. Noted July 2.

★**Barge Canal Work**—Albany, N. Y.—Bids will be received until noon, Aug. 11, by Duncan W. Peck, State Supt. Pup. Wks., Albany, for constructing a bridge over the Erie Canal in the village of Yorkville, Oneida County, N. Y., and completing the same within 12 months from the date of the execution of the contract; engineer's estimate, $103,180; for constructing a lock and removing the existing tide gates in the Shinnecock and Peconic Canal, and completing the same within 12 months from the date of the execution of the contract; engineer's estimate, $40,996.

★Bids will be received until noon, Aug. 25, by Duncan W. Peck, State Supt. Pub. Wks., Albany, for Contract No. 46A¾, Erie Canal, Sect. 7, for completing the construction of the canal from Fox Ridge to the Montezuma Aqueduct; length 4.49 miles; engineer's estimate, $333,941; Contract No. 125, Erie Canal, Sect. 2, for constructing the substructure, superstructure and approaches of the Vischers Ferry Road Viaduct over the Troy-Schenectady branch of the New York Central & Hudson River R.R.; engineer's estimate, $45,885; and Contract No. 126, Champlain Canal, Sect. 1; for raising highway bridge at Mechanicsville, engineer's estimate, $8314.

✚Duncan W. Peck, State Supt. Pub. Wks., has awarded the contract for constructing the highway bridge over the Mohawk River at Amsterdam, (Barge Canal Contract No. 118), to LATHROP, SHEA & HENWOOD, Buffalo, N. Y., at $147,608.

Fire Escapes—Binghamton, N. Y.—The citizens will vote soon on the proposition to issue $22,000 in bonds for fire escapes. John A. Giles is City Engr.

★**Subway**—New York, N. Y.—(Borough of Manhattan)—Bids were received, July 24, by the Public Service Commission, 154 Nassau St., Borough of Manhattan, for the construction of Sect. No. 5 of Routes Nos. 4 and 36, a part of the Broadway-Fourth Ave. subway, a two-track railroad in the Borough of Manhattan, connecting the Broadway Subway with the Queensboro Bridge and extending from Seventh Ave. to Fifth Ave., where the two tracks diverge, one continuing through 59th and the other through 60th St. to Second Ave. The unofficial totals follow: Degnon Contracting Co., $2,808,661; Oscar Daniels Co., $3,103,419; Holbrook, Cabot & Rollins Corporation, $3,341,000; United States Realty & Improvement Co., $3,497,888; Smith, Hauser & McIsaacs, Inc., $3,662,000. All bidders are of New York.

Subway—[illegible] New York, N. Y.—[illegible] received July [illegible] by the Public Service Commission [illegible] Nassau St., Borough of Manhattan, for the [illegible] of station finish on Sections Nos. 1 and 2 of [illegible] a part of the [illegible] Broadway-Fourth Ave. [illegible] extending under Fourth Ave. [illegible] St. The stations to be finished are located at [illegible] St. [illegible], Bay Ridge Ave., 77th St. and [illegible]. The [illegible] Station Construction [illegible] Broadway, Manhattan, [illegible]; Myrtle [illegible] Co., [illegible]; [illegible] & Trust Co., [illegible]; F. J. [illegible] Construction Co., [illegible] Broadway, [illegible]; McKinley Engineering Co., [illegible] St., [illegible]; [illegible] Bros. Co., [illegible] West [illegible], [illegible]; Carpenter, [illegible] & Herrick, [illegible], Brooklyn, [illegible]; Thos. J. [illegible] Contracting Co., [illegible] Fifth Ave., [illegible]; Naston & [illegible] Contracting Co., [illegible] Douglas St., Brooklyn, $349,782; E. E. Smith Contracting Co., [illegible] Fifth Ave., $196,000.

Pier, Dredging—[illegible], N. J.—The Lehigh Valley R.R. [illegible] a pier [illegible] the Kill von Kull shore front [illegible] ft. [illegible] from the pier to the [illegible] channel of the Kill von Kull will be dredged. The company is also considering the erection of two unloading machines with a capacity of [illegible] tons each. A. L. Roberts, South Bethlehem, [illegible] is Mech. Engr.

Pier Work, Cranes—Hoboken, N. J.—The Hoboken Land & Improvement Co. has been granted permission by the New Jersey Harbor Commission to extend its pier at the foot of [illegible] St., Hoboken, [illegible] ft., double-deck the same [illegible] and [illegible] it, also to install a system of traveling cranes for freight handling. Estimated cost, $139,[illegible].

Stables—Newark, N. J.—Plans are being prepared by [illegible] & [illegible], Archts., Newark, for two stables to be constructed for the city, at a total cost of $2[illegible].

Park Work—Trenton, N. J.—The City Commissioners plan to improve Mahlon Stacy Park at a cost of $2[illegible]. J. R. [illegible] is City Engr.

++Piers—Philadelphia, Penn.—Bids were received July [illegible] by George W. Norris, Dir. Dept. Wharves, Docks and Ferries, for constructing the superstructures of Piers [illegible] and [illegible] in the Delaware River between Catherine and Christian Sts. The contract, it is reported, has been awarded to the [illegible] & TRUST CO., Woolworth Bldg., New York, at [illegible].

+Dredging—Baltimore, Md.—The [illegible] Co., July [illegible], awarded the contract to the MARYLAND DREDGING & CONTRACTING CO., Baltimore, for dredging a 3[illegible]-ft. channel [illegible] new concrete pier.

+Dock, Etc.—Charleston, S. C.—The Carolina [illegible] [illegible] Co. has awarded the contract to the MACARTHUR [illegible] CO., 11 Pine St., New York, for constructing its [illegible], and terminal foundation at Charleston.

Pier—[illegible], Ga.—The Bridges, Rivers and Wharves Committee of the City Council, July [illegible], awarded contracts for the proposed municipal pier as follows: Superstructure to D. A. HOWE, at [illegible]; substructure to the McKENZIE CONSTRUCTION CO., at [illegible]; building, to D. A. HOWE, at [illegible].

+Wharf—Savannah, Ga.—The city has awarded the contract to the BEASLEY CONTRACTING CO., Savannah, for [illegible] the wharf between Bull and Drayton Sts. Noted June [illegible].

Levee Work—Clarksdale, Miss.—Bids will be received until [illegible] by the Yazoo-Mississippi Levee Board, Clarksdale, for [illegible] of levee work in Coahoma and Tunica Counties.

Terminal—New Orleans, La.—St. Louis, Iron Mountain & [illegible] Ry. and Texas & Pacific Ry. The Missouri Pacific [illegible] July [illegible] [illegible] the [illegible] of these [illegible] to [illegible] $[illegible] to provide for terminal [illegible] New Orleans, La. [illegible] will be [illegible] J. R. [illegible] St. Louis, Mo., is Ch. Engr. [illegible] St. L. I. M. & S. [illegible] C. H. [illegible] Texas [illegible] Ch. Engr. T. & P. [illegible].

Levee Work—[illegible], La.—Bids will be received until [illegible] Aug. [illegible] by the Board of Commissioners of Caddo Levee District, Shreveport, for bank protection work [illegible] [illegible] ft. This is a readvertisement of [illegible] for which bids were opened July [illegible]. Noted July 2.

Drainage Work—[illegible] City, Tenn.—Bids will be received until [illegible] Aug. [illegible] by [illegible] [illegible] District [illegible] for [illegible] of [illegible] [illegible] of [illegible] work [illegible] [illegible] W. [illegible] is Engr.

Drainage—[illegible] Ark.—The [illegible] Drainage Co. [illegible] plans to drain a large tract of land near [illegible].

Levee—[illegible] Ohio.—The Cincinnati [illegible] Co. [illegible] the levee [illegible] the [illegible] [illegible] Park, [illegible] [illegible] at $[illegible].

Gymnasium—Cleveland, [illegible]—[illegible] Cleveland [illegible] plans to [illegible] a gymnasium [illegible] [illegible] Bldg., Cleveland, are Archts.

Creek Work—[illegible] Ohio.—The Commissioners of [illegible] [illegible] and [illegible] [illegible] Creek [illegible] [illegible] [illegible] County [illegible].

Fish Hatchery—[illegible] [illegible] bids will be received [illegible] [illegible] [illegible] [illegible] the construction of a fish hatchery at [illegible] [illegible]. Noted July [illegible].

+Retaining Wall—[illegible] [illegible] the contract to the [illegible] [illegible] [illegible] [illegible] Nos. [illegible] [illegible] [illegible] [illegible] the south and east [illegible] [illegible] [illegible] [illegible]. The wall will be [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] bids were opened July [illegible]. Noted [illegible].

+Greenhouse—La Fayette, Ind.—Purdue University, La Fayette, has awarded contracts for the proposed greenhouse to A. E. KEMMER, La Fayette, and the FOLEY GREENHOUSE MFG. CO., 3260 West 31st St., Chicago, Ill. Estimated cost, $13,[illegible].

+Cranes—Detroit, Mich.—The Department of Public Works has awarded the contract to ORTON & STEINBRENNER, Detroit, for two locomotive cranes, at $1[illegible].

+Head-House—Chicago, Ill.—(Official)—Bids will be received by the Harbor and Subway Commission until 11 a.m., Aug. 27, for constructing a head-house at Pier No. 2, in Harbor District No. 1. E. C. Shankland is Ch. of the Comn.

+Elimination of Grade Crossing (Subway)—Springfield, Ill.—The Department of Public Works has awarded the contract to IRA DUDLEY, Springfield, for constructing a subway at South Sixth St. under the tracks of the Wabash R.R. to eliminate the grade-crossing at that point, at about $7[illegible]. Noted June 1[illegible].

Fire Station and Hall—Weyauwega, Wis.—Bids will be received until noon, Aug. 1, by W. H. [illegible], Village Clk., for the construction of a fire station and village hall.

Drains—Fort Dodge, Iowa—Bids will be received until 1:30 p.m., Aug. 6, by J. L. Hanrahan, County Audr., Fort Dodge, for constructing Drains [illegible] and 17[illegible]. Estimated cost, $10,612.

Ditch—Aitkin, Minn.—(Official)—Bids will be received until 10 a.m., Aug. 1, by J. E. Lemire, County Audr., Aitkin, for constructing Ditch [illegible]. The work calls for [illegible] cu. yd. of excavation. Estimated cost, $1[illegible].

Creek Work—Duluth, Minn.—The city plans to improve Mission Creek at a cost of $[illegible]. John Wilson is City Engr.

Ditch—Fairmont, Minn.—Bids will be received until 1:30 p.m., Aug. 4, by H. C. Nolte, County Audr., Fairmont, for constructing Ditch 38. Estimated cost, $16,[illegible].

Ditch—Slayton, Minn.—Bids will be received until 10 a.m., Aug. 11, by W. A. [illegible], County Audr., Slayton, for constructing Ditch [illegible]. Estimated cost, $[illegible].

Ditch Work—York, Neb.—Bids will be received until Aug. 8 by H. F. Chapin, County Clk., York, for repairing the [illegible]-Payne Ditch.

+Bath-house—Hot Springs, Ark.—The contract has been awarded to J. W. SANFORD, Memphis, Tenn., for constructing a bath-house at Hot Springs, at about $[illegible].

Wharf and Dock Site Bonds—Beaumont, Tex.—Bids will be asked soon by Frank L. [illegible], City Clk., for $[illegible] of wharf and dock site bonds. Noted June 1[illegible].

+Levee Repair—[illegible], Tex.—Washington County Improvement District No. 1 has awarded the contract to C. NORDSTROM, [illegible], for repairing the Brazos River Levee, at about $1[illegible].

Park—[illegible], Ore.—The citizens will vote in August on the proposition to issue $[illegible] in bonds for a city park.

+Drainage—North Yakima, Wash.—Drainage District No. 3 has awarded the contract to HANS [illegible], [illegible] Block, Seattle, for constructing one of its [illegible] at $13,[illegible].

Ferry Slip—Port Townsend, Wash.—The Chicago, Milwaukee & St. Paul Ry. Co. plans to construct a ferry slip at Port Townsend.

+Dredging—Seattle, Wash.—The Public Docks Commission has awarded the contract to A. C. L. [illegible], Seattle, for dredging [illegible] cu. yd. for the proposed ferry [illegible] at the following prices: [illegible] cu. yd. at [illegible] per cu. yd.; [illegible] cu. yd. at [illegible].

Crane—Seattle, Wash.—Bids will be received [illegible] by the Port of Seattle Commission for a [illegible] crane. Estimated cost, $[illegible]. Noted June 1[illegible].

Vessels—Seattle, Wash.—[illegible] & [illegible], Naval Archts., Seattle, are preparing plans for two passenger boats for the Puget Sound Navigation Co. Estimated cost, $[illegible].

Refrigeration Equipment—Seattle, Wash.—Bids will be received by the Port of Seattle until Aug. 1[illegible] for refrigerating equipment for the cold storage plant at the foot of [illegible] St. Estimated cost, $[illegible]. [illegible] is Engr.

Athletic Field Bleachers—Berkeley, Calif.—John G. Howard, Archt., Berkeley, is preparing plans for concrete and [illegible] bleachers at the athletic field of the University of California, Berkeley.

Breakwater—El Segundo, Calif.—The Standard Oil Co. plans to construct a breakwater at El Segundo to cost $[illegible].

Levees—Fresno, Calif.—The [illegible] Reclamation District has been organized for the purpose of constructing levees near Fresno to reclaim land in that vicinity. Estimated cost, $[illegible].

+Park Work—Los Angeles, Calif.—The Board of Public Works has awarded the contract to W. A. [illegible], for improving the [illegible] at about $[illegible].

+Piling—Oakland, Calif.—The SAN FRANCISCO [illegible] Co. has been awarded the contract at $[illegible] for [illegible] driving and cutting [illegible] piles along [illegible] [illegible] from [illegible] to the foot of [illegible] St.

Shed—San Bernardino, Calif.—The [illegible] [illegible] [illegible] plans to construct a reinforced-concrete freight shed at San Bernardino. Estimated cost, $[illegible]. [illegible] Harris, Los Angeles, Calif., is Ch. Engr. Coast Lines.

Pier—[illegible], Calif.—The state plans to construct a [illegible] pier at the [illegible] Industrial [illegible] of [illegible]. W. E. [illegible], Sacramento, Calif., is State Engr.

Dredging Bonds—San Diego, Calif.—The city will vote [illegible] [illegible] the issuance of $[illegible] of dredging bonds. Alan H. Wright is City [illegible].

+Dock—San Francisco, Calif.—(Official)—Bids will be received until noon, Aug. [illegible], by the Board of State Harbor Commissioners for the construction of a dry dock at [illegible] Basin, San Francisco, [illegible] ft. long and [illegible] ft. wide. For details see our [illegible] [illegible] columns. [illegible] to be [illegible]. Noted July 9.

Fire Apparatus—Upland, Calif.—The city plans to spend $10,000 for fire equipment.

Breakwater—Northwest Cove, N. S.—Bids will be received until 3 p.m., Aug. 12, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing the Tancook Island breakwater.

Coaling Plant—Newcastle, N. B.—Bids will be received until Aug. 1 by L. K. Jones, Asst. Deputy Minister and Secy. Dept. Rys. and Canals, Ottawa, Ont., for the construction of a mechanical coaling plant at Newcastle.

Wharf—St. Stephens, N. B.—The Canadian Pacific Ry. Co. plans to construct a wharf along the St. Croix River near St. Stephens.

+Stadium—Montreal, Que.—The contract has been awarded to the L. A. OTTO CO., LTD., New Birks Bldg., Montreal, for constructing the proposed stadium at McGill University, Montreal, at about $100,000.

+Dredging—Fort William, Ont.—The Department of Public Works, Ottawa, Ont., has awarded the contract to the GREAT LAKES DREDGING CO., Port Arthur, Ont., for dredging at Fort William.

Wharf—Lindsay, Ont.—Plans have been completed for the proposed wharf to cost $35,000.

Repairs to Pier—Newcastle, Ont.—Bids will be received until Aug. 10, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for repairs to the pier at Newcastle.

Wharf Extension—Ottawa, Ont.—Bids will be received until 4 p.m., Aug. 10, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, for constructing an extension to the eastern wharf at Grosse Isle Quarantine Station, Montmaguy County, Que.

Fire Apparatus—Toronto, Ont.—Bids will be received until Aug. 11 by the Board of Control for motor-driven fire apparatus, fire-hose, etc.

Mausoleum—Calgary, Alta.—The Western Mausoleum Co., Calgary, plans to erect a mausoleum in Union Cemetery.

Fire Equipment—Esquimalt, B. C.—The County Council, Esquimalt, plans to spend about $10,000 for fire equipment. E. A. Ellis is Clk.

Jetty—New Westminster, B. C. — The Provincial Department of Public Works, Victoria, plans to ask for bids soon for constructing Section 2 of the north jetty at the mouth of the Fraser River. This section will be 7100 ft. long, of brush and rock.

+Wharf—West Vancouver, B. C.—The District of West Vancouver has awarded the contract to NAYLOR BROS., Vancouver, for constructing the wharf at 25th St., at $33,200.

BUILDINGS

Manchester, N. H.—The Board of Health has selected the plans of Wilfred E. Provost, of F. T. Provost & Co., Manchester, for the proposed two story brick isolation hospital, to cost about $50,000.

Beverly, Mass.—Herbert J. Winslow, 244 Cabot St., will build a store and office building at Cabot and Hale Sts. to cost about $50,000. Henry B. Alden, 15 Exchange St., Boston, is the Arch.

Boston, Mass.—The Massachusetts Trust Co. will build an office building, 66x105 ft., three stories of brick, steel and stone, on Huntington Ave.

+The contract for erecting the building for the New England Home for Wanderers has been awarded to WOODBURY & LEIGHTON, 185 Summer St. The building will be three stories of brick 40x103 ft., and is estimated to cost $80,000. Brainerd & Leeds, 89 Franklin St. are the Archs.

+Boston, Mass.—The contract for erecting the theater and office building for the Dartmouth Plaza Realty Trust has been awarded to FLERSCHMANN BROS., 507 Fifth Ave., New York, N. Y., Putnam & Cox, 6 Hancock Ave., are the Achs.

Cambridge, Mass.—Edward T. P. Graham, 20 Beacon St., Boston, is preparing plans for a school at Cushing and Lawn Sts. to cost about $55,000.

+Everett, Mass.—The contract for erecting the school at Broadway and High St. has been awarded to DANIEL L. SHEPARD, 46 Cornhill, Boston, at about $40,000. James E. McLaughlin, 111 Devonshire St., is the Arch.

Lynn, Mass.—The Methodist congregation will erect a church costing $45,000. Geo. H. Newton, 6 Beacon St., Boston, is Arch.

Pittsfield, Mass.—J. McArthur Vance, 24 North St., is preparing plans for enlarging a grammar school, at an estimated cost of $50,000.

Somerville, Mass.—Leonard B. Chandler, 45 Jacques St., will build a four-story apartment building of brick and terra cotta on Broadway. The estimated cost is $80,000, P. Varney, 25 Exchange St., Lynn, is the Arch.

Springfield, Mass.—The Y. M. C. A. will build a seven-story building to cost about $100,000.

Seymour, Conn.—Press reports state that about $50,000 will be spent in the erection of a new library. W. L. Ward is Pres. of the Board of Library Directors.

Buffalo, N. Y.—Plans are being prepared for a Medina stone and structural steel edifice for the Church of the Immaculate Conception, to cost $80,000. Rev. Thos. Donohue is Pastor.

Buffalo, N. Y.—Bids will be received by Frank T. Reynolds, Deputy Bldg., Comr., until Aug. 6, for a two-story and basement library and social building. The estimated cost is $10,000. Howard L. Beck is City Arch.

Ithaca, N. Y.—Lewis F. Pilcher, State Arch., has about completed plans for a drill hall to be erected at Cornell University. The estimated cost is $350,000.

Middletown, N. Y.—The Board of Managers of the Thrall Hospital contemplate the enlargement of the hospital at an estimated cost of $63,000.

+Rochester, N. Y.—The general contract for erecting the two-story brick and steel store building for the East Avenue Amusement Co. has been awarded to the GOERSLINE-SWAN CONSTRUCTION CO. The estimated cost is $100,000.

Bloomfield, N. J.—The Board of Education has commissioned William W. Rasmussen as Arch. for the two-story brick, stone and terra cotta school to be built on Grove St., at an estimated cost of $45,000.

Milville, N. J.—The Board of Education contemplates the construction of an 18-room school to cost $79,000.

+Newark, N. J.—The general contract for erecting the North Seventh St. school has been awarded to the BECKER CONSTRUCTION CO., 415 13th Ave., at $67,184. Noted July 16.

+Newark, N. J.—The Public Service Co. has awarded the contract for erecting a terminal building to the HEDDEN CONSTRUCTION CO., 1 Madison Ave. The building will be located on Park Place and will be a combination railway and terminal building. The cost is estimated at $4,500,000. George B. Post & Sons, 347 Fifth Ave., New York, N. Y., prepared the plans.

Nutely, N. J.—The Board of Education has commissioned Armstrong & De Galleke, Archs., New York, N. Y., to prepare plans for a school in the southwestern section of the city. The estimated cost is $48,000.

Trenton, N. J.—The local lodge of the Loyal Order of Moose will construct a building to cost about $100,000.

+Darby, Penn.—The contract for erecting the two-story brick and terra cotta school has been awarded to HENRY L. BROWN, 1714 Sansom St., Philadelphia, at $52,000. Folsom & Stanton, Philadelphia, are the Archs.

McKeepsport, Penn.—The F. A. Woolworth Co. will erect a 4-story brick and stone building on Fifth Ave. to cost $60,000.

New Brighton, Penn.—A site at Third Ave. and and Eight St. has been purchased for the erection of a Y. M. C. A. building, to cost $40,000.

+Philadelphia, Penn.—The contract for building two 4-story apartments at 39th and Ludlow Sts., has been awarded to ISAAC T. SHOEMAKER, Philadelphia, Penn., at about $75,000.

+Philadelphia, Penn.—The contract has been awarded to WILLIAM J. DOYLE for altering the bank at Juniper and Chesnut Sts., for the Pennsylvania Co. for Insurance: The estimated cost is $50,000. Edgar V. Seeler, Real Estate Trust Bldg, is Arch.

Pittston, Penn.—It is reported that bids will be received by the city for erecting a high school to cost about $175,000.

Scranton, Penn.—Plans are being prepared by E. H. Davis, Connel Bldg., for a 12-story Union Bank Building, to be erected at Washington and Lackawanna Ave.

Waynesburg, Penn.—The Y. M. C. A., has selected a site on North Potamac St. for a building to cost $165,000.

Baltimore, Md.—Archer & Allen, Archs., Central Savings Bank Bldg., are preparing plans for enlargeing the lavatory building, at Johns Hopkins Medical School. The estimated cost is $50,000.

Cumberland, Md.—Warren C. White, Henry J. Glick, and others, have commissioned C. M. Anderson, Arch., 324 North Charles St., Baltimore, to prepare plans for a hotel at Washington and Waters Sts. The estimated cost is $300,000.

Spartanburg, S. C.—Hoggson Bros., Archs, New York, N. Y., are preparing plans for a two-story bank building to be erected at West Main and Magnolia Sts. for First National Bank: cost about $50,000.

+Winchester, Ala.—The contract for erecting the court house has been awarded to the LITTLE CLECKLER CO., at about $70,000.

Clarksdale, Miss.—John Garsford, Memphis, Tenn., is preparing plans for a church for the First Methodist congregation to cost, $40,000.

Louisville, Ky.—Brinton L. Davis, Inter-Southern Bldg., Louisville, is preparing plans for an 11-story building for the Kentucky Athletic Club. The estimated cost is $100,000.

+Akron, Ohio—The contract for the erection of the Peoples Hospital has been awarded to the DAWSON CONSTRUCTION CO., Pittsburgh, Penn., at $69,000.

Plans are being prepared by Franz C. Warner, Arch., Clevland, for the erection of an office and terminal building at Federal and Main Sts., for the Northern Ohio Traction Co. The estimated cost is $250,000.

Canton, Ohio—Bids were received by the Board of Education for the construction of the Jackson St. school as follows: George H. White & Son, $58,395; Melbourne Bros., $46,200; Dawson Construction Co., Pittsburgh, Penn., $53,970.

+Kent, Ohio—The contract for the erection of the science building at the Kent State Normal School, has been awarded to EVANS & CO., Columbus, Ohio, at $143,000. Noted July 9.

+Lakewood, Ohio—The contract for the erection of the hospital at Lakewood, has been awarded to the HUNKIN CONKEY CONSTRUCTION CO., Cuyahoga Bldg. The estimated cost is $50,000.

+South Bend, Ind.—The general contract for the erection of the addition to the Oliver Hotel, has been awarded to O. W. ROSENTHAL, 80 East Jackson Blvd., Chicago, Ill. The estimated cost is $100,000.

+Bessemer, Mich.—The contract for the erection of the addition to the Gogebic County Court House has been awarded to HERMAN GUNDLAC, Houghton, Mich. Noted July 16.

+Detroit, Mich.—The general contract for the erection of the 10-story and basement store building for J L. Hudson & Co. has been awarded to A. A. ALBRECHT & CO., 829 Penobscot Bldg. The estimated cost is $460,000.

Plans are being prepared by F. Swirsky, Arch., 89 University Bldg., for the erection of a six-story and basement apartment building. The estimated cost is $160,000.

♦**Mount Pleasant, Mich.**—The general contract for the erection of the [illegible]-story and basement [illegible]x143-ft. school has been awarded to [illegible] H[illegible]TZ & SON, Grand Rapids, Mich. The estimated cost is [illegible].

♦**Standish, Mich.**—The general contract for the erection of the [illegible]-story and basement school at Standish has been awarded to C. S. WILCOX, Lansing, Mich. The estimated cost is [illegible].

♦**Chicago, Ill.**—The [illegible] contract for the three-story and basement apartment house has been awarded to JOHN F. [illegible], 1412 Farragut Ave.

Chicago, Ill.—B[illegible] & La[illegible]k, Archs., Scarritt Bldg., Kansas City, Mo., are preparing plans for the erection of an apartment house in Chicago. The estimated cost is $150,000.

♦**Chicago, Ill.**—The [illegible] contract for the [illegible] to be erected at [illegible] and Milard Ave. has been awarded to F. A. SIEBOLST & SON, 189 West Madison St.; [illegible] OLIVER SOLLITT CONSTRUCTION CO., [illegible] South [illegible] St. Noted Apr. [illegible].

♦**Quincy, Ill.**—The general contract for the erection of the [illegible] Theater has been awarded to HUERKIN & KAEMPEN at [illegible].

♦**Rock Island, Ill.**—The general contract for the erection of the six-story club building for the Order of Eagles has been awarded to HERMAN HANSEN, 1311 17th St. The estimated cost is $[illegible].

Milwaukee, Wis.—H. C. Koch & Son, Archs., Wells Bldg., are preparing plans for the erection of a store and office building for the Oxford Realty Co., at Jefferson and Oneida Sts. It will be three stories, 86x120 ft., of brick and stone.

♦**Des Moines, Iowa.**—The contract for the erection of the State Hospital has been awarded to W. F. KUCHARO & CO., Des Moines, at $19,38[illegible].

♦**Waterloo, Iowa.**—The general contract for the erection of the school at Waterloo has been awarded to LAURITZEN CONSTRUCTION CO., Waterloo. The estimated cost is $40,-000.

♦**Minneapolis, Minn.**—The general contract for the erection of the gymnasium for the University of Minnesota, has been awarded to CAMERON & CO., 625 Ryan Bldg., St. Paul, Minn. The estimated cost is $125,000.

♦The contract for the erection of the School of Mines building has been awarded to R. J. CHENEY & CO., 716 11th Ave. Noted June 18.

Wichita, Kan.—Bids will be received until Aug. 1, by R. S. Conrow, Arch., 812 Beacon St., for the erection of the Y. W. C. A. at Wichita. The estimated cost is $50,000.

Kansas City, Mo.—L. G. Middaugh, Arch., Kansas City Life Bldg., is preparing plans for the erection of a hotel at Hunter Ave. and Broadway, for the Clark Estate. The estimated cost is $2[illegible].

St. Louis, Mo.—The Missouri Athletic Association contemplates erecting a 10-story building at Fourth St. and Washington Ave. The estimated cost is $500,000.

♦**Webster, Mo.**—The general contract for the erection of the high school has been awarded to E. A. LAUMANN, 6402 Wells Ave., St. Louis, Mo. The estimated cost is $85,000.

Austin, Tex.—Plans are being prepared by John Eberson, Arch., Chicago, Ill., for the erection of a theater for Ernest Nealle, and associates.

Dallas, Tex.—The Dallas Chamber of Commerce and the [illegible] Club are making arrangements for the erection of a building at Commerce and [illegible] Sts. The estimated cost is $[illegible].

Silver City, N. M.—The Silver City Hotel Co. will erect a three-story hotel. The estimated cost is $100,000. A. S. Thomas, El Paso, Tex., is the Arch.

Phoenix, Ariz.—V. O. Wallingford, N. F. Marsh and J. F. [illegible], Archs., Phoenix, are preparing plans for the erection of a three-story market and hotel at Phoenix. The estimated cost is $[illegible].

♦**Tucson, Ariz.**—The general contract for the erection of the agricultural building at the University of Arizona has been awarded to the WINGET CONSTRUCTION CO., Grant Bldg., Los Angeles, Calif.; plumbing, heating and ventilating, to the ELLIOTT ENGINEERING CO., El Paso, Tex. Noted May [illegible].

Port Angeles, Wash.—Bids will be received until Aug. 1, by [illegible], Arch., [illegible] Bldg., Seattle, for the erection of a [illegible]-story and basement reinforced concrete [illegible].

Seattle, Wash.—Plans have been prepared by [illegible], Arch., [illegible] Bldg., for the erection of a ten-story hotel for the [illegible] Heat & Power Co. The estimated cost is $[illegible].

Seattle, Wash.—[illegible]

Tacoma, Wash.—[illegible]

♦**Tacoma, Wash.**—The contract for the [illegible] of the [illegible] Tacoma General Hospital has been awarded to [illegible]. Heath & [illegible] are the Archs.

Portland, Ore.—The First National Bank will erect a building at [illegible]. The estimated cost is $[illegible].

♦**Berkeley, Calif.**—[illegible] The contract for the [illegible] for the California [illegible] has been awarded to [illegible], San Francisco, Calif. Noted July 9.

♦**Fresno, Calif.**—The general contract for the erection of the theater at Fresno has been awarded to TREHITT & SHIELDS, Fresno, Calif., at $81,800.

Los Angeles, Calif.—The Knights of Pythias will erect a lodge building at Pico and Flower Sts. The estimated cost is $100,000.

♦**Pasadena, Calif.**—The contract for reconstructing the Maryland Hotel has been awarded to JOHN L. CONNER, [illegible] West 31st St., Los Angeles, Calif. The estimated cost is $[illegible].

Richmond, Calif.—The Board of Education is having plans prepared for the erection of a school at Richmond, Calif. The estimated cost is $52,000.

San Francisco, Calif.—W. H. Crim, Jr., Arch., 425 Kearney St., has prepared plans for the erection of a five-story steel hotel at Twelfth and Market Sts., San Francisco, for [illegible] Dehall, Los Angeles. The estimated cost is $90,000.

♦**San Francisco, Calif.**—The Irish Village Co. has awarded a contract for the construction of a group of buildings on the Panama-Pacific International Exposition to the LARSEN-SAMPSON CO., Crocker Bldg., at $[illegible].

San Francisco, Calif.—Plans are being completed by Righetti & Headman, Archs., Phelan Bldg., for the erection of a pathological ward at the San Francisco Hospital. The estimated cost is $75,000.

Assistant State Engineer Newman, Ferry Bldg., is completing plans for the erection of a two-story building to be used by the Harbor Post Office as the main mail distributing station for the city.

San Jose, Calif.—The Native Sons will erect a five-story and basement store and lodge building, on North First St. The estimated cost is $100,000. L. T. Lenzen is the Arch.

Guelph, Ont.—Dr. Creelman, Pres. of the Ontario Agricultural College, has prepared plans for the erection of a building at the college. The estimated cost is $50,000.

Powassan, Ont.—Bids will be received until Aug. 6, by Dir. of Contracts, Dept. Militia and Defense, Ottawa, for erecting a drill hall at Powassan.

Winnipeg, Man.—D. Aicheson, Arch., Trust & Lion Bldg., Winnipeg, is preparing plans for the erection of a hall and lodge building for the Ancient Order of Foresters. The estimated cost is $75,000.

Edmonton, Alta.—Adam Bros. will erect a four-story and basement 50x150 ft. reinforced concrete, brick and steel office building. The estimated cost is $150,000.

High River, Alta.—Bids will be received until 4 p.m. Aug. 11, by R. C. Desrochers, Secy., Dept. of Public Works, for the erection of a public building at High River, Alta. Leo Dowler, Calgary, Alta., is the Arch.

New Westminster, B. C.—Gardiner & Mercer, Archs., are preparing plans for the erection of an addition to the courthouse. The estimated cost is $70,000.

August Mietz, 128 Mott St., New York, informs us that the government has recently placed orders for Mietz & Weiss oil engines in a number of sizes. The orders include seven of the 15-hp. compressor unit and one 1[illegible]0-hp. direct-reversible marine engine.

H. A. Strauss, consulting engineer, Chicago, has been retained by the bondholders' committee of the Alton, Jacksonville & Peoria Electric Ry. to prepare a complete valuation of the property in connection with the proposed reorganization of the company.

Joseph T. Ryerson & Son, Chicago, announce the opening of a new warehouse in St. Louis, when the company will be able to ship immediately from stock, as it has taken over the plant, merchandise and equipment of the Douglas [illegible] Hager Iron Co.

The Hydraulic Pressed Steel Co., Cleveland, Ohio, has taken over the manufacture of the McKay pressed steel concrete forms. These forms are used in regular building construction and in the New York subway now under construction.

The Thurlow Steel & Forging Co., Chester, Penn., announces that the new forging plant of this company is now in operation, and is equipped for the manufacture of steel forgings weighing from 1 lb. to [illegible] lb. The forge shop [illegible] within its equipment a [illegible]-ton forging press. The heat-treatment plant consists of heating furnaces, oil tempering tanks and a machine shop equipped for both rough and finished machining. The plant is under the management of John [illegible] and [illegible] Faron.

The Railroad Valuation Co. has recently been organized with offices at [illegible] Broad St., New York, N. Y. It is believed that many of the railways will be glad to avail themselves of the services of experienced investigators in the matter of real valuation of railways. Under the Federal Valuation Act carriers are required to furnish [illegible] and other data and perform work which requires considerable detailed [illegible]. [illegible] A. [illegible] is [illegible] of the company.

Motion Picture Cameras, [illegible] simply built and designed to be operated by [illegible] are now on the market and enable permanent film records to be made of almost any operation or process. The near future will see [illegible] a great development in this line. Such a camera used in connection with a projecting machine offers a complete outfit for recording [illegible] field and shop operations for the purpose of instruction, as a matter of record and [illegible] agreement. Edward W. Robinson, Singer Bldg., New York, N. Y., is making a specialty of [illegible] picture [illegible] in the industrial and engineering fields and is placing on the market complete outfits at a comparatively low cost.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

PRICES OF ENGINEERING MATERIALS POSTPONED

The compilation of quotations on engineering materials, usually appearing in "Engineering News" in the first issue of the month, has been postponed. The rapid-changing trade and the unusual fluctuations in raw material make many quotations of small benefit. While it has not affected the iron and steel market as yet, it may possibly do so. The price of pig tin has doubled in the week, and it is almost impossible to secure supplies at any price. It is difficult to get trustworthy quotations on leather, because a great deal of the sole leather made in this country is from hides shipped from South America to Europe and then to the United States. The rubber market is likewise disorganized. It is expected that in another week some better index of mercantile conditions may be gathered and quotations published.

Construction work which has been started will be pushed to completion unless the return of low-grade labor to Europe temporarily postpones it. The subway work in New York, it is expected, will not be halted.

The combined forces of government officials and bankers have worked together to prevent any further exportation of gold and provide funds for carrying on work in this country. Fortunately, the commercial establishments of this country have been so thoroughly liquidated in the last year that there is no danger of disaster from causes within.

RAILWAYS

✚**Pennsylvania**—Pennsylvania R.R. — This company has awarded the contract to the LATTA & TERRY CONSTRUCTION CO., Philadelphia, Penn., for constructing an extension of the Sugar Camp Branch of its Tyrone Division in Pennsylvania. It will be 6½ miles long.

Pennsylvania—Delaware, Lackawanna & Western R.R.—This company, it is reported, plans to construct a cut-off between Pocono Summit, Penn., and Henryville, 10 miles. G. J. Ray, Hoboken, N. J., is Ch. Engr.

West Virginia—Baltimore & Ohio R.R.—This company plans to start work soon on eliminating curves and cutting down grades on its Ohio River Division. Work will be started near the city of Sistersville, W. Va. F. L. Stuart, Baltimore, Md., is Ch. Engr.

Georgia—Cairo, Pelham & Moultrie R.R.—This company has been incorporated for the purpose of constructing a railroad connecting Pelham, Cairo and Moultrie, Ga., 50 miles. D. B. Turner, Pelham, Ga., is interested.

Mississippi—New Orleans, Mobile & Chicago R.R.—This company will probably start work soon on its proposed line from Beaumont, Miss., to Waveland, La. A. F. Church, Laurel, Miss., is Supt.

Louisiana—New Orleans, Mobile & Chicago R.R.—See item under Mississippi.

Illinois—Chicago & Northwestern Ry.—This company plans to issue $6,000,000 in bonds for construction work on its lines. W. H. Finley, Chicago, Ill., is Ch. Engr.

Chicago & Alton R.R.—This company plans to spend $150,000 to enlarge its freight yard at Venice, Ill. H. T. Douglass, Jr., Chicago, Ill., is Ch. Engr.

✚**Wisconsin**—Chicago & Northwestern Ry.—This company has awarded the contract to PEPPARD & BURRILL, Minneapolis, Minn., for grading work on about seven miles of logging railroad in Wisconsin.

Minnesota—Minneapolis, Mille Lacs & Northern Ry.—It is reported that, due to insufficient financial support, this company has abandoned its project of constructing the proposed railroad from Anoka, Minn., north to Aitken, Minn. Marshall Roy, 3900 Washington Ave. North, Minneapolis, Minn., is Engr. Noted Feb. 19, Mar. 5 and June 11.

✚**Nebraska**—Chicago, Burlington & Quincy R.R.—The Edward Peterson Co., general contractor for this company's Chalco-Yutan cut-off, has awarded subcontracts to the following: ROBERTS BROS., 17 North La Salle St., Chicago, Ill.; G. W. CONDEN, Omaha, Neb.; PETERSON-BEEMAN CO., Omaha; JOHN MOSSEY, Omaha, and CRAIG & HESS, Omaha. Noted July 16.

South Dakota—South Dakota Central Ry.—This company plans to start work soon on its proposed 25-mile extension north from Watertown, S. D. J. L. Wagner, Sioux Falls, S. D., is Ch. Engr. Noted June 18.

Arkansas—Missouri, Arkansas & Southwestern Ry.—The Arkansas State Board of Railway Incorporation, July 25, granted a charter to this company to construct a 65-mile railway from Mena, Ark., to Hot Springs, Ark. The proposed line will cross Polk, Montgomery and Garland Counties. Capital, $2,500,000. H. Williams, Hot Springs, is interested. Noted July 2 and July 9.

Idaho—Milwaukee Lumber Co.—This company, located at St. Maries, Idaho, will construct a railroad into the Marble Creek lumber district of Idaho.

Washington—Chicago, Milwaukee & St. Paul Ry. — The City Council of Bellingham, Wash., has granted a franchise to this company to construct a line from its terminals in the city to a point on Lake Whatcom about 10 miles. C. F. Loweth, Chicago, Ill., is Ch. Engr.

Oregon—The citizens of Roseberg, Ore., will vote, Oct. 5, on the proposition to issue $300,000 in bonds for constructing a railroad from Roseberg to tidewater.

✚**California**—The ALTA CONSTRUCTION CO., Los Angeles, Calif., has been awarded the contract for constructing the proposed narrow-gage railroad from the Dairy Farm Mine to Sheridan, Calif.

Los Angeles & San Diego Beach Ry.—This company, operating a line between San Diego and La Jolla, Calif., has applied to the State Railroad Commission for permission to issue $750,000 in bonds for the electrification of its system. E. S. Babcock, San Diego, is Pres.

Ontario—Ontario, West Shore Ry.—Bids will be received until Aug. 13 for the purchase of this company's line. Charles Garrow, Barrister, Goderich, Ont., may be addressed for further information.

✚**Saskatchewan**—Canadian Northern Ry. — This company has awarded the contract to A. L. McKAY, Estevan, Sask., for grading the proposed branch from Bienfait, Sask., to Estevan.

Saskatchewan—Canadian Northern Ry.—This company plans to award grading contracts in the fall on the proposed extension of its Radville Branch toward Weyburn, Sask. M. H. MacLeod, Winnipeg, Man., is Gen. Mgr. and Ch. Engr.

ELECTRIC RAILWAYS

Augusta, Maine—The Lewiston, Augusta & Waterville Street Ry. Co. has been granted a franchise to extend some of its lines in Augusta. Harry B. Ivers, Portland, is Gen. Mgr. and Pur. Agt. Noted July 23.

Dover, N. H.—The Dover, Somersworth & Rochester Street Ry. Co. is considering plans for the extension of its line from Dover to Portsmouth, on the New Hampshire side of the river. Franklin Woodman, Haverhill, Mass., is Vice-Pres. and Gen. Mgr.

Buffalo, N. Y.—The City Council has granted a franchise to the Buffalo & Lake Erie Traction Co. to construct an electric railway on State St., from 12th St. to Turnpike, in Buffalo. A. R. Myers, Erie, Penn., is Gen. Mgr.

New York, N. Y.—(Borough of Queens)—The New York & Long Island Traction Co has applied to the Board of Estimate for a franchise to construct and operate an electric railway on Lawn Ave., from Liberty Ave. to Rockaway Road, in the Fourth Ward, Borough of Queens. This line will connect with the Brooklyn Rapid Transit elevated extensions of the Fulton St. line to Jamaica. W. O. Wood, Long Island City, is Vice-Pres., Gen. Mgr. and Pur. Agt.

Yardville, N. J.—The Trenton & Mercer County Traction Co. will extend its system from Yardville to Crosswicks, about 2½ miles. W. H. Hitchcock, Trenton, is Gen. Mgr.

✚★**Hershey, Penn.**—The Hershey Transit Co. has awarded the contract for the construction of an electric railway from Hershey to Elizabethtown, about 9 miles, to the KING, EVANS, RILEY CO., Pottsville, Penn. Noted June 11.

✚**Meadville, Penn.**—The Northwestern Pennsylvania Ry. Co. has awarded a contract to the ERIE STEEL & CONSTRUCTION CO. for re-laying its tracks from Cambridge Springs to Meadville.

Morrisville, Penn.—The Interurban Traction Co. has been granted permission to build an additional track on Trenton Ave.

Reading, Penn.—The Reading, Birdstown & Pottsville Trolley Co. is preparing plans for the construction of an electric railway from Reading to Pottsville, about 18 miles. William Abbott Whitman, Reading, is Gen. Mgr.

Frederick, Md.—The Hagerstown & Frederick Electric Ry. Co. has purchased the Frostburg Illuminating & Mfg. Co. This is the first step toward the proposed construction of an interurban electric railway to connect Johnstown, Frostburg, Cumberland and Hagerstown.

Andrews, N. C.—The Hiawassee Valley Ry. Co. is making preliminary arrangements for the construction of an electric railway to connect Andrews, N. C., and Hiawassee, Ga., about 35 miles. J. Q. Barker, Andrews, is interested. Noted Mar. 5.

Jesup, Ga.—M. Arlino, Jesup, is interested in the organization of a company for the purpose of constructing an electric railway from Jesup to Doctortown.

Miami, Fla.—The City Council has granted a franchise to the Miami Traction Co. to construct a 2½-mile electric railway in Miami.

Alexandria, La.—The Southern Traction & Power Co. has applied to the Council for a franchise to extend its lines on 13th and 16th Sts. to the city limits. Ernest Boehme, Alexandria, is Vice-Pres. and Gen. Mgr. Noted July 9.

Shreveport, La.—The Shreveport Traction Co. has been granted franchises to construct and operate an electric railway in Caddo Parish. W. A. Sullivan, Shreveport, is Gen. Mgr. and Pur. Agt.

Nashville, Tenn.—The Nashville Traction Co. has applied to the City Council for a franchise to construct an electric railway along Murfreesboro Pike in Nashville. A. E. Beasley, Nashville, is Pur. Agt.

Dayton, Ohio.—Plans are being prepared by the Dayton Street Ry. Co. for the extension of its line from Philadelphia Drive to Fort McKinley. W. I. Smith, Dayton, is Gen. Mgr. and Supt.

Hamilton, Ohio.—The Richmond & Hamilton Traction Co. has been incorporated to construct an electric railway from Hamilton, Ohio, to Richmond, Ind. The directors are F. C. Glenn, Eugene Partelle and E. Leslie Cole.

Pomeroy, Ohio.—The Ohio River Electric Co. has been incorporated to operate an electric railway. The incorporators are I. L. Oppenheimer, J. W. Wolfe, D. W. Hennessy, George Wenger and W. H. [illegible]

Springfield, Ohio.—The Springfield Street Ry. Co. contemplates the extension of its lines from Springfield to Ridgewood, a suburb. George C. Towle, Dayton, is Gen. Mgr.

Pontiac, Mich.—The Detroit, Pontiac & Owosso Ry. Co. has been organized to construct an electric railway to connect Pontiac, Owosso, Clarkston, Detroit and Fenton. Oliver Lee, Detroit, is interested.

Alton, Ill.—The Alton & Jacksonville Ry. Co. has been incorporated to construct and operate an electric railway from Alton to Jacksonville. The incorporators are R. P. Bergold, Louis W. McIntyre, James S. McClellan, Harry Okin, Jerome J. Cermak and Frank L. Butler.

Champaign, Ill.—Plans are being prepared by the Urbana & Champaign Ry., Gas & Electric Co. for the extension of its lines to the new shops of the Illinois Central Ry. Co., about two miles. H. J. Pepper, Champaign, is Gen. Supt.

Evanston, Ill.—The Evanston Ry. Co. contemplates the extension of its lines on the west side of the city. Charles F. Sewell, Evanston, is Vice-Pres. and Gen. Mgr.

Muscatine, Iowa.—Plans are being considered by the Interstate Bridge & Terminal Co. for the construction of an electric railway from Muscatine, Iowa, to Galesburg, Ill. The company will build a bridge across the Mississippi River.

Brenham, Tex.—S. D. W. Low and associates are interested in the construction of an interurban electric railway from Brenham to Independence. A power station will be constructed at Brenham.

Denton, Tex.—The Tarrant Traction Co., which was recently organized by the Stone-Webster interests, Boston, Mass., has applied to the City Council of Denton for a franchise for its proposed interurban electric railway in that city. The company will construct an interurban line between Fort Worth and Denton. Noted June 18.

Houston, Tex.—The City Council has passed an ordinance requiring the Houston Electric Co. to construct a double-track railway on Travis St., from Capitol to Dallas Ave., on Dallas Ave. from Travis to Fannin St., and on Fannin St. from Dallas to Franklin Ave., so that the company will have a continuous belt line through the business district of the city. [illegible] Daly is Gen. Mgr.

Twin Falls, Idaho.—An electric railway from Twin Falls to [illegible] and Hagerman is being projected by the Idaho [illegible] R.R. Co. A. L. Swim, Twin Falls, is Pres.

Salt Lake City, Utah.—The Salt Lake & Utah R.R. Co. is [illegible] the extension of its line from Salt Lake City to [illegible] Springs, Utah. E. M. Mitchell, Salt Lake City, is Pur. Agt.

Victoria, B. C.—The British Columbia Electric Ry. Co. has applied to the City Council for a franchise to double track its line on [illegible] Road from [illegible] to Catherine St. A. T. Goward, Victoria, is Local Mgr.

LIGHT, HEAT AND POWER

Boston, Mass.—The State Armory Commission has received the following bids for heating and ventilating and the electrical work in the armory to be erected in Allston. [illegible]

[illegible]

Holyoke, Mass.—[illegible]

Holyoke, Mass.—The Holyoke Street Ry. Co. [illegible]

West Springfield, Mass.—[illegible]

East Providence, R. I.—[illegible]

Providence, R. I.—[illegible]

Bridgeport, Conn.—The power house at the plant of the Farist Steel Co., 127 East Main St., will be rebuilt. The building will be of brick and steel, [illegible] ft.

★Albany, N. Y.—(Official)—Bids will be received until 3 p.m., Aug. 17, by the State Hospital Commission for the construction of a power house, boilers, equipment and steam conduit, plumbing, electric equipment and underground electric conduit at the Long Island State Hospital, Brooklyn, N. Y. J. H. R. Hanify is Secy. State Hospital Comn. For further details, see advertisement under Contracts To Be Let.

Canaan, N. Y.—The Lebanon Power & Lighting Co., Canaan, plans to build a power plant in Canaan, on the outlet of Queechy Lake, to supply energy to Canaan, New Lebanon Springs and West Lebanon. The equipment of the plant will include: One 225-hp. Atlas boiler, one 175-hp. Corliss engine, two Leffel water wheels (135-hp.), one 150-kw. General Electric and one 125-kw. Fort Wayne generator (each three phase, 60-cycle, 2300-volts), General Electric switchboard equipment and Duncan transformers. O. C. Schmeyer, Greenville, Penn., is Engr.-in-Charge.

✚Ithaca, N. Y.—The Ithaca Traction Corporation has awarded the contract for remodeling two electric plants to the WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburgh, Penn., at $87,000.

✚New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for additions and repairs to the electrical equipment of Public Schools, 106 and 181, Borough of Manhattan, has been awarded to the COMMERCIAL CONSTRUCTION CO., [illegible] Bridge St., New York, at $[illegible]

✚(Borough of the Bronx)—(Official)—The lowest bid for installing heating and ventilating apparatus in Public School 56, East 207th St., between Hull and Decatur Aves., Borough of the Bronx, was that of the E. Rutzler Co., at $[illegible]. The contract for installing temperature regulation in this building was awarded to the E. RUTZLER CO. at $[illegible]

✚(Borough of Queens)—(Official)—The lowest bid for installing heating and ventilating apparatus in new Public School 96, at Rockaway Road and Lincoln Ave., South Ozone Park, Fourth Ward, Borough of Queens, was that of the E. Rutzler Co., at $25,890. The contract for installing temperature regulation in School 96 was awarded to WELLS & NEWTON, Ave. B and 17th St., New York, at $21,[illegible]

The following are the lowest bids received for installing electrical equipment in various school buildings: School 56, Borough of the Bronx, T. Frederick Jackson, [illegible]; School 95, Borough of Queens, Eugene Frank, $6761; School 96, Borough of Queens, Matthew Construction Co., $[illegible]. For alterations and repairs to the heating and ventilating apparatus in Public School 12, Borough of Queens, the lowest bid was that of the James Curran Mfg. Co., at $2369.

(Boroughs of Brooklyn and Queens)—(Official)—Bids will be received until 2.30 p.m., Aug. 11, by the Department of Public Charities, Municipal Bldg., for the installation of new steam lines for carrying exhaust steam from the power house of the Kings County Hospital, Brooklyn. John A. Kingsbury is Commr. of Charities.

Palmyra, N. Y.—The Central New York Gas & Electric Co. is considering the extension of its transmission lines from Palmyra to Walworth to supply electricity in that village, and also to residents along the line. William Clark is Local Mgr.

Syracuse, N. Y.—It is reported that the power plant for the Onondaga County Tuberculosis Sanitarium will cost about $[illegible]. The equipment will include boilers, engines, heating apparatus, pumps, telephone switchboard, etc. Noted July 10.

Perth Amboy, N. J.—The City Council has authorized Samuel J. Mason, City Engr., to prepare an estimate of the cost of installing a municipal electric light plant in Perth Amboy.

Philadelphia, Penn.—Bids are being received by John T. Windrim, Arch., Commonwealth Bldg., Philadelphia, for the construction of a one-story brick and concrete power house at [illegible] St. and [illegible] Ave. for the Stephen Girard Estate. It will be [illegible] ft.

Oak Ridge, N. J.—It is reported that the Oak Ridge Institute [illegible] the installation of a power plant to furnish electricity for the institution, and also for the town.

Florence, S. C.—It is reported that the Florence Electric & [illegible] Co. will double its capacity for furnishing light and power. F. G. Godfrey is Mgr. and Gen. Supt.

Detroit, Fla.—The Detroit Ice, Light & Power Co., recently incorporated with $[illegible] capital, will build an electric light and power plant.

Ocala, Fla.—An election will be held [illegible] to vote on the [illegible] of a bond issue of $[illegible] for constructing and [illegible] a new electric light system.

Henderson, Ky.—The boiler house of the municipal electric light plant [illegible] to the extent of about $[illegible], will be rebuilt at once. [illegible]

✚Nottingham, Ohio.—The contract for the construction of a power plant for the [illegible] has been awarded to the C. A. [illegible] CO., [illegible] Cleveland, at about $[illegible]

Warren, Ohio.—The Trumbull Public Service Co. [illegible]

Battle Creek, Mich.—The Kellogg Toasted Corn Flakes Co. [illegible]

✚Flint, Mich.—The Board of Managers of Hurley Hospital has awarded the contract for the construction of a power plant to [illegible]. The power plant and [illegible] will occupy the same building. Noted June 1.

+Sault Ste. Marie, Mich.—The Edison Sault Electric Co. has awarded the contract for improvements to its power plant to MARSHALL N. HUNT at about $17,000. The work includes an addition to the power house and the installation of three new turbines, increasing the output by 1000-hp. Noted Apr. 2.

Sullivan, Ill.—The city has voted $35,000 in bonds for the improvement of the municipal electric-light plant and water works. Hugh Hoke is Supt.

El Dorado, Wis.—Plans are being prepared for the establishment of a hydro-electric plant for the Wisconsin Power, Light & Milling Co. at El Dorado. An auxiliary steam plant will be equipped. Oscar A. Huelsman, Fond du Lac, is Pres. of the company.

+Wauwatosa, Wis.—The contract for the construction of a new power plant for the Milwaukee County Tuberculosis Sanatorium at Wauwatosa has been awarded to the AMERICAN CONSTRUCTION CO. Noted June 18 and July 16.

Alvord, Iowa—The city has voted in favor of a bond issue for the construction of a municipal electric-light plant.

Aurelia, Iowa—An election will be held Aug. 17 for the purpose of voting for a bond issue of $7000 to be used for the construction of a municipal electric-light plant. J. C. Nelson is City Clk. Noted July 23.

Estherville, Iowa—Bids will be received until 9 a.m., Aug. 11, by N. G. Egbert, City Clk., for improvements to the municipal electric-light plant to include: A radial brick or reinforced concrete stack, 150 ft. high, 5 ft. in diameter; an industrial trolley coal car; 300-hp. boiler installation; mechanical stokers, 400-hp. engine; generator, switchboard, remodeling pole line and wiring system. J. F. Druar, Commercial Bldg., St. Paul, Minn., is Consult. Engr.

Barnesville, Minn.—Bids will be received until Aug. 15, by the Board of Education for all heating, plumbing, ventilation and electrical work in a new public school building in Barnesville. E. F. Broomhall, 710 Alworth Bldg., Duluth, Minn., is Arch.

Elk River, Minn.—It is reported that F. D. Waterman is considering plans for installing an electric lighting and power plant in Elk River.

Adams, Neb.—The citizens have voted to issue bonds for $13,500 to be used for the installation of a municipal electric-lighting system. Johnson & Johnson, Falls City, Neb., are Engrs.-in-Charge. Noted July 16.

Sidney, Neb.—It is reported that bids are being received for the installation of a municipal electric-lighting system and district steam-heating plant.

Green River, Wyo.—An election will soon be held for the purpose of voting on the question of issuing $20,000 in bonds, the proceeds of which will be used for the construction of a municipal electric-light plant.

Fort Benton, Mont.—Bids will be received until Aug. 17, by John F. Murphy, City Clk., for the purchase of $17,000 of bonds, the proceeds to be used for the construction of an electric-light plant. Noted July 9.

Excelsior Springs, Mo.—The Excelsior Springs Water, Gas & Electric Co. has applied to the Public Service Commission for permission to issue $52,000 in bonds for general improvements to its system. S. W. Henderson is Vice-Pres. and Mgr.

Montrose, Mo.—An election was held July 21, at which the question of a bond issue for the purpose of building a municipal electric-light plant was carried.

★Gonzales, Tex.—(Official)—Bids will be received until noon, Aug. 12, by Frank S. Taylor, Engr.-in-Charge, Austin, Tex., for the construction of a reinforced concrete dam on the Guadalupe River. See advertisement under Contracts T. Be Let.

+Longview, Tex.—(Official)—A contract has been awarded to the ROACH MANINGAN PAVING CO., Fort Worth, Tex., for the construction of a new power and generator house, installing the equipment and building the water tower at Longview.

Guthrie, Okla.—A special election will be held Aug. 11, to vote on the question of issuing $250,000 in bonds for the installation of a municipal electric plant. R. N. Dunham is City Clk.

Fort Collins, Colo.—The Great Western Granite Mfg. Co., For Collins, will probably ask bids in the early fall for the construction of a power plant, 32,000 ft. of 26-in. pipe line and a finishing plant.

Tempe, Ariz.—The City Council has engaged L. G. Knipe, Phœnix, Ariz., to prepare plans for the construction of a municipal lighting and power plant. Frank Thomas is City Clk.

Danville, Wash.—The Austin-McCain Co., Spokane, Wash., plans to construct a transmission line from Danville to Republic, Wash., a distance of 30 miles. The estimated cost is $30,000.

Oroville, Wash.—The Okanogan Valley Electric Co., has recently taken over the holdings of the Similkameen Power Co., including its electric-power site and plant at Similkameen Falls. The new company will make extensive improvements to the plant, including the installation of electrical machinery to develop 2000 hp.

Pe Ell, Wash.—The Central Power Co. plans to build a concrete dam at Pe Ell to cost about $18,000. L. A. Webb, Aberdeen, Wash., is Pres. and Mgr.

Hillsboro, Ore.—The plant of the Hillsboro Power & Investment Co. was recently destroyed by fire. A new plant, estimated to cost about $25,000, will be built. O. B. Gates, Hillsboro, is Gen. Mgr.

San Francisco, Calif.—The Pacific Gas & Electric Co. is having plans prepared by Frederick H. Meyer, Arch., 742 Market St., for the construction of a sub-station at 23rd and Georgia Sts. Estimated cost, $40,000.

Edmonton, Alta.—It is reported that Sanderson & Porter, Engrs., 52 William St., New York, N. Y., are interested in the development of a hydro-electric power plant on the Fraser River near Edmonton. About $3,000,000 will be spent.

BRIDGES

Ashland, N. J.—Bids will be received until 11 a.m., Aug. 10, by the Board of Chosen Freeholders of Camden County, Camden, for rebuilding the Eberts Bridge near Ashland. Fred W. Gercke is Chn. of the Bridge Com.

+Flemington, N. J.—The Board of Chosen Freeholders of Hunterdon County has awarded the contract for the construction of a bridge over the Rockaway River at Hall's Mills, on the Whitehouse-New Germantown Road to the DOVER BOILER WORKS at $4800.

Morristown, N. J.—Bids will be received until Aug. 10, by the Board of Chosen Freeholders of Morris County for the construction of two reinforced concrete bridges, one over the Rockaway River, and the other over a branch of the same river on the Denville and Pine Brook Road about one mile west of Pine Brook.

★+New Gretna, N. J.—(Official)—The Board of Chosen Freeholders of Burlington County, Mount Holly ,has awarded the contract for the construction of the Bass River Bridge at New Gretna to the RENNELL CONSTRUCTION CO., 30 Church St., New York, N. Y., at $16,350. Other bidders were: Kelley-McFeeley Co., Camden, $19,370; Bridgeton Construction Co., Bridgeton, $19,000; Penn Bridge Co., Beaver Falls, Penn., $18,800; Medford Concrete Co., Medford, $17,200; A. M. & H. Mathis, New Gretna, $17,400. Noted July 16.

★Butler, Penn.—(Official)—Bids will be received by H. O. Carson, City Engr., until noon, Aug. 25, for the construction of the Wayne St. Viaduct, across the tracks of the Baltimore & Ohio and Buffalo & Lake Erie railroads. For details see advertisement under Contracts to Be Let. Noted July 16.

+Easton, Penn.—(Official)—The Commissioners of Northampton County have awarded the contract for the construction of a reinforced concrete bridge over Monocacy Creek, Moore Township, to WILLIAM H. BARRALL, Bath, Penn. Noted July 30.

Greenville, Penn.—(Official)—Bids will be received until noon, Aug. 17, by the Commissioners of Mercer County, Mercer, for erecting the superstructure of a bridge over the Shenango River on College Ave., Greenville. H. G. Comstock is Clk. of the Comrs.

Mortonville, Penn.—Bids are being received by William Hunter, Ch. Engr., Philadlephia & Reading Ry., Reading Terminal, Philadelphia, for the construction of a reinforced-concrete bridge at Mortonville. The estimated cost is $15,000.

Norristown, Penn.—(Official)—Bids will be received until 11 a.m., Aug. 24, by the Commissioners of Montgomery County for the following: Construction of a reinforced-concrete bridge over Tacony Creek, Glenside; a three-arch stone bridge over Mingo Creek, Upper Providence Township; repairing the East Airy St. Bridge, Norristown, and repairing a bridge east of Gwynedd Valley Station, Lower Gwynedd Township. John N. Jacobs is County Controller.

Simpson, Penn.—The Commissioners of Lackawanna County, Scranton, the Scranton Ry. Co., the Delaware & Hudson Co., the Erie R.R. and the New York, Ontario & Western Ry. plan the construction of a viaduct in Simpson at the foot of what is known as "Turkey Hill." The viaduct is estimated to cost about $68,000, and the expense will be divided proportionately among the beneficiaries.

+Somerset, Penn.—(Official) — The Commissioners of Somerset County have awarded the contract for the construction of three small bridges to W. G. FERNER, Somerset, at a total of $4922, and $9 per cu.yd. for extra concrete; the contract for two bridges was awarded to WILLIAM ESCHERICK, Kimmelton, Penn., at $2830. The award of the Flougherty Run Bridge was held over until Aug. 3. Noted July 23.

Norfolk, Va.—(Official)—A franchise has been granted to the Norfolk-Berkley Bridge Corporation for the construction of a bridge over the Eastern Branch of the Elizabeth River, between Berkley and Norfolk. The estimated cost is $350,000. George Dodge, 321 Bank of Commerce Bldg., Norfolk, is Designing Engr. J. O. Wiggs is Chn. of Bridge Com.

Winston-Salem, N. C.—(Official)—Bids will be asked, as soon as plans are completed, for the construction of a bridge, 900 ft. long, north of Conrads Ferry. The cost is estimated at $25,000 and will be divided between Forsyth and Yadkin Counties. J. N. Ambler is Engr.-in-Charge. E. T. Mickey, Winston-Salem, is Chn. of Bridge Com. Noted July 23.

Augusta, Ga.—Plans are being prepared for the construction of a concrete bridge across Butler's Creek on the Louisville Road, replacing the present wooden one, which is 300 ft. long.

Jacksonville, Fla.—Bids will be received until Aug. 10 by the Committee on Public Works of the Board of Bond Trustees for the construction of a reinforced concrete bridge over Hogan Creek at Main St. George M. Powell is Chn. of the Bd.

Jacksonville, Fla.—The Board of Commissioners of Duval County has adopted a resolution providing for the engaging of engineers to prepare plans for the construction of a bridge over the St. Johns River starting from the Broad St. Viaduct, and running parallel to the bridge of the Florida East Coast Ry. The bridge will be about 60 ft. wide, and will have a draw span of at least 320 ft. Noted July 9.

+Selmer, Tenn.—The County Court of McNairy County has awarded the contract for the construction of 12 bridges to the LARIMER & BURGET CO., Memphis, and for 12 bridges to the MEMPHIS BRIDGE CO.

+Louisville, Ky.—The Fiscal Court of Jefferson County has awarded the contract for the construction of a reinforced-concrete bridge over Floyd's Fork to PIERCE BUTLER, at $12,972.

+Akron, Ohio—The City Council has awarded the contract for reflooring the Mill St. Viaduct to S. W. PARSHALL at $5300. Noted July 23.

Athens, Ohio—Bids will be received until Aug. 15, by the Board of Commissioners of Athens County, for the construc-

[illegible] of the superstructure of a bridge over Federal Creek, [illegible] Township.

Bucyrus, Ohio.—(Official)—Bids will be received until [illegible], Aug. [illegible], by the Board of Commissioners of Crawford County for the [illegible] of two concrete abutments [illegible] and [illegible] of the South Bridge over the [illegible] River, [illegible] Township. H. A. [illegible] is County Audr.

Caldwell, Ohio.—Bids will be received until Aug. [illegible], by M. [illegible], [illegible] of Noble County, for the construction of the superstructure of a [illegible]-ft. steel bridge over the west fork of [illegible] Creek.

Cleveland, Ohio.—Press reports state that T. P. McCourt, Akron, [illegible] the lowest bidder, at $115,000, for the construction of the [illegible]-[illegible] Bridge, has withdrawn his bid. Noted June [illegible] and July [illegible].

London, Ohio.—(Official)—Bids will be received until noon, Aug. [illegible], by the Joint Board of County Commissioners of Madison and Franklin Counties for the construction of the [illegible] steel superstructure and approaches of a bridge over [illegible] Creek on the Fuller Mill Road, on the line between the two counties. H. M. [illegible] is Audr. of Madison County. H. L. McCafferty is Secy. of Madison County. [illegible], Columbus, is Bridge Engr. of Franklin County.

Indianapolis, Ind.—Plans have been completed and bids will be asked at once for a steel arch across the White River at West New York St., for which an appropriation of $150,000 has been made. W. T. Patten is County Audr.

Lansing, Mich.—(Official)—Bids will be received until noon, Aug. [illegible], by Frank F. Rogers, State Highway Commr., for the construction of an 85-ft. concrete arch over the Michigamme River, Mansfield Township, Iron County. A. L. Burridge, Crystal Falls, is County Engr. of Iron County.

Chicago, Ill.—(Official)—Bids will be received until 11 a.m., Aug. [illegible], by Lawrence E. McGann, Commr. of Pub. Wks., for the construction of the superstructure of a double-leaf trunnion bascule bridge over the North Branch of the Chicago River at [illegible] Ave. Bids for the substructure of this bridge were received Aug. 5.

It is reported that Armour & Co., Union Stockyards, will build a steel viaduct to cost about $5000. R. C. Clark is Engr.

New London, Wis.—Bids will be received until Aug. 18 by the city for the construction of a concrete bridge over the Embarrass River.

Iowa City, Iowa.—(Official)—Bids will be received until 2 p.m., Aug. 21, by the Board of Supervisors of Johnson County for removing the old bridge and building a reinforced concrete structure over the Iowa River at Burlington St., Iowa City. W. J. Freeman is County Audr. For further details, see advertisement under Contracts To Be Let.

Keokuk, Iowa.—Press reports state that the rebuilding of the Keokuk and Hamilton Bridge will be begun as soon as the plans can be completed and the contracts awarded. Theodore Gilman is Secy. of the Keokuk & Hamilton Bridge Co. Noted May 28 and June 18.

+Marshalltown, Iowa.—The Board of Supervisors of Marshall County has awarded the contract for the construction of [illegible] bridges to the IOWA BRIDGE CO., Des Moines, at $[illegible], piling [illegible] per ft. and extra concrete at $11 per cu. yd.

+Mason City, Iowa.—(Official)—The Board of Supervisors of Cerro Gordo County has awarded the contract for the construction of a steel bridge in Falls Township to WILLIAM [illegible], Mason City. Noted July 23.

Atchison, Kan.—The City Clerk has been instructed to advertise for bids for the construction of a reinforced concrete bridge [illegible] over White Clay Creek, at [illegible] St. [illegible] is City Engr. Noted July 16.

Cottonwood Falls, Kan.—(Official)—Bids will be received until noon, Aug. [illegible], by the Board of Commissioners of Chase County for the construction of a reinforced concrete bridge over the Cottonwood River at Cottonwood Falls. [illegible] is Clk. of Comrs. W. [illegible] is County Clk.

+Independence, Kan.—(Official)—The Commissioners of [illegible] County have awarded the contract for the construction of bridges and culverts in the county to the [illegible], [illegible], Mo., at $[illegible]. [illegible] Noted July [illegible].

+Kansas City, Kan.—The Commissioners of Wyandotte County have awarded the contract for the construction of [illegible] on the Kansas side of the Kaw River to the KANSAS CITY [illegible] STEEL CO., at $[illegible]. Noted June [illegible] and July [illegible].

Neodesha, Kan.—[illegible] Township, Wilson County, has had plans prepared by A. [illegible], [illegible], for the construction of two bridges. The estimated cost is $[illegible].

+Bozeman, Mont.—The Commissioners of Gallatin and [illegible] Counties have awarded the contract for the construction of a bridge across the Jefferson River to the [illegible] [illegible] CO., at $[illegible].

Deer Lodge, Mont.—The Commissioners of Powell County [illegible] the construction of two steel bridges, one over the [illegible] River and the other over North Fork. [illegible] is Clk. of Comrs.

Glasgow, Mont.—Bids will be received until noon, [illegible], by the Commissioners of Valley County for the construction of two steel bridges, one over Willow Creek and the other over [illegible] Creek. [illegible] is County Clk. and Recdr.

+Lewistown, Mont.—The Commissioners of Fergus County have awarded the contract for the construction of a bridge over [illegible] Creek to the [illegible] BRIDGE CO., at $[illegible].

Malvern, Ark.—Bids have been asked by the County Court of Hot Spring County for the construction of a bridge across the [illegible] River, [illegible] miles south of [illegible], on the Brown Springs Road, and for several smaller bridges across [illegible] Creek, Trager Creek and [illegible] Bayou. The estimated total cost is $[illegible]. B. C. [illegible] is County Judge.

Searcy, Ark.—Bids will be received until Aug. 10 by the County Court of White County, Searcy, for the construction of four bridges. J. B. Mitchell is County Judge.

Houston, Tex.—(Official)—Bids will be received until 10 a.m., Aug. [illegible], by H. L. Washburn, Audr. of Harris County, for the construction of two concrete bridges on the Westheimer-Alief Road, and for the construction of two concrete culverts on the Washington County Road.

Lampasas, Tex.—At an election held July 18 the citizens of Lampasas County voted in favor of a bond issue of $[illegible] for building four bridges in the county.

Santa Fe, N. M.—Bids will be received until Aug. 29, by the State Engineer for the construction of a bridge over the Rio Grande River at Arrey. It will be 465 ft. long, pony truss, pile foundation.

Phoenix, Ariz.—Bids will be asked at once by Lamar Cobb, State Engr., for the construction of a concrete bridge, about 176 ft. long, over Canyon Diablo, Coconino County. Noted May 28.

Plans have also been prepared for concrete bridges over the Milky and Beaver dam washes in Apache County.

Buckley, Wash.—(Official)—Bids will be received until 2 p.m., Aug. 10, by the Board of Commissioners of King County, Seattle, for the construction of concrete piers for the Buckley Bridge. Byron Phelps is Clk. of the Bd. Noted July 30.

+Conconully, Wash.—The Commissioners of Okanogan County have awarded the contract for the construction of a draw bridge across the Okanogan River at Malott to D. S. GAMBLE, Brewster, Wash., at about $10,000. Noted Feb. 26, Apr. 9 and Apr. 16.

Ritzville, Wash.—(Official)—Bids will be received until Aug. 21, by the commissioners of Adams County for the construction of three reinforced concrete bridges, [illegible]-, [illegible]- and 30-ft. spans respectively. F. R. Hewett is County Const. Engr.

Snoqualmie, Wash.—Bids will be received until Aug. 17, by the Commissioners of King County, Seattle, for the construction of a bridge over Tokul Creek, near Snoqualmie. Byron Phelps is Clk. of Comrs.

+Portland, Ore.—The commissioners of Multnomah County have awarded the contracts for building a bridge across the Sandy River to GEORGE W. GRIFFIN, Seattle, Wash., for the foundation and erection of the superstructure at $10,6[illegible], and to the PORTLAND BRIDGE CO., Portland, to supply the steel at $10,1[illegible]0. Noted July 16.

Salem, Ore.—The Commissioners of Marion and Polk Counties are interested in a project to build a $[illegible] bridge. Henry L. Bowlby, State Highway Engr., will prepare plans and estimates for the work.

+Alhambra, Calif.—The City Trustees have awarded the contract for the construction of a reinforced concrete bridge over Mill Creek at Main St. between Alhambra and San Gabriel to MESMER & RICE, Story Bldg., Los Angeles, at about $10,000. Noted July 2.

+Madera, Calif.—The Board of Supervisors of Madera County has awarded the following contracts for bridge construction: To JAMES WILLISON, Rockaway Beach, Calif., at $[illegible] for bridge over Cottonwood Creek near Patterson, at $11,9[illegible] for bridge over Berenda Slough south of Chowchilla, and at $[illegible] for a bridge over Cottonwood Creek [illegible] miles northeast of Madera; to the PACIFIC COAST CONSTRUCTION CO., Fresno, at $11,641 for a bridge over Ash Slough at Chowchilla, at $[illegible] for a bridge over the slough south of Berenda, at $[illegible] for a bridge over Cottonwood Creek south of Borden, at $[illegible] for bridge over [illegible] Creek [illegible] miles northeast of Madera, and at $[illegible] for a bridge over Walker Creek [illegible] miles southeast of Madera. All these structures will be of reinforced concrete. Noted July 16 and [illegible].

Merced, Calif.—Bids will be received until [illegible], Aug. [illegible], by the Board of Supervisors of Merced County for the construction of a steel bridge, concrete floors and abutments over the Merced River. [illegible] is Clk. of the Bd.

Oroville, Calif.—The Butte County Board of Supervisors has [illegible] the construction of two concrete bridges across [illegible] Creek between this city and Marysville. M. C. [illegible] is County Engr.

+Palo Alto, Calif.—A contract has been awarded by the City Trustees of Palo Alto and the Board of Supervisors of San Mateo County for the construction of a concrete bridge on the Middlefield Road, to H. W. [illegible], San Jose, Calif., at $[illegible].

Riverside, Calif.—The Board of Supervisors of Riverside County has had plans prepared for the construction of a reinforced concrete bridge on the [illegible] Road. It will be about [illegible] ft. long.

Sacramento, Calif.—The following bids were received July [illegible] by the State Highway Commission for the construction of the Yolo Basin Viaduct: [illegible] Construction [illegible], San Francisco, $[illegible]; [illegible], San Francisco, $[illegible]; [illegible], Seattle, Wash., $[illegible]; Mahoney Bros., San Francisco, $[illegible]. Noted June [illegible] and July [illegible].

+The contract for the Yolo Basin Viaduct has been awarded to the [illegible] CONSTRUCTION CO., Seattle, Wash., at $[illegible], on condition that the State will furnish the material used in the construction work.

Walnut Grove, Calif.—Bids will be received until 2 p.m., Aug. [illegible], by the Board of Supervisors of Sacramento County, Sacramento, for the construction of a bridge across the Sacramento River at Walnut Grove. E. F. [illegible] is Clk. of the Bd.

+Yuba City, Calif.—The Board of Supervisors of Sutter County has awarded the contract for the construction of a reinforced concrete bridge across Butte Slough near Meridian to [illegible], at $[illegible]. Noted June [illegible].

+Toronto, Ont.—The Board of Control has awarded the contract for the construction of the Strachan Ave. Bridge to WILSON, TOWNSEND & SAUNDERS, 79 Spadina Ave., Toronto, at about $35,000. Noted June 4 and June 18.

St. Boniface, Man.—The joint bridge committee of the City Councils of St. Boniface and Winnipeg has recommended that the contract for the construction of the superstructure of the Provencher Ave. Bridge be awarded to the Manitoba Bridge & Iron Works, Winnipeg, at $253,004. A Strauss trunnion bascule type of bridge is recommended. Noted June 18.

WATER SUPPLY—IRRIGATION

+Henniker, N. H.—The contract for water pipe has been awarded to the U. S. PIPE & FOUNDRY CO., Bristol, Conn., at $22.60 per ton. The KENNEDY VALVE MFG. CO., was awarded the contract for valves and hydrants. W. S. Johnson, Boston, Mass., is the Engr. Noted July 16.

Boston, Mass.—The following bids were received July 28, by the Metropolitan Water and Sewerage Board, for laying 20- and 24-in. water-pipe in Boston, Milton and Quincy: John J. Evans, Lawrence, $15,202; Michael Russo & Son, Boston, $16,225; Andrew M. Cusack, Boston, $16,278; John E. Palmer, Boston, $16,584; John T. Shea, Jr., Boston, $16,664; John Guarino, Boston, $17,509; Joseph H. Ferguson, Boston, $18,-59; M. J. McCawley, Boston, $18,771; A. Baruffaldi, Somerville, $19,167; M. di Sisto & Co., Everett, $19,328; Thomas Bruno, Boston, $19,329; Moore & Co., Boston, $21,710; Daniel M. Riggs & Co., Boston, $22,010; C. J. Jacobs Co., Boston, $25,-758; H. Nawn Contracting Co., Boston, $27,890. Dexter Brackett, 1 Ashburton Place, is Ch. Engr. Noted July 25.

All bids received July 27 by the Metropolitan Water and Sewerage Board for the construction of a steel tank on Bellevue Hill have been rejected. New bids will be received until Aug. 7. Noted July 23.

+★Duxbury, Mass.—(Official)—The Water Commissioners have awarded contracts for the construction of a water system as follows: DONALDSON IRON CO., at $32,718, for furnishing c.i. pipe; LIGHT, HEAT & POWER CORPORATION, at $17,537, for laying pipe; ARTHUR H. BAILEY, at $3482, for constructing a pumping station; R. L. WHIPPLE CO., at $7115, for constructing a concrete reservoir. Bids were received July 23. Noted July 16.

+★North Adams, Mass.—(Official)—Bids were received July 27, by the Board of Public Works, for constructing an earth dam and reservoir, as follows: MIDDLESEX CONTRACTING CO., Putnam, Conn., $87,750 (awarded contract); Framingham Contracting Co., South Framingham, $88,406; Hanscom Construction Co., Boston, $103,717; W. T. Ryan Contracting Co., Hartford, Conn., $123,600; T. Stuart & Sons Co., Newton, $125,637; Davis & Brock, Brookline, $129,187; Mason, Hilton & Co., New York, $129,375; D. O'Connell Sons, Holyoke, $131,525; H. P. Converse & Co., Boston, $132,436; Light, Heat & Power Corporation, Boston, $149,207; P. J. Kennedy & Co., Holyoke, $159,675. Noted July 16.

★Webster, Mass.—(Official)—Bids will be received by the Board of Water Commissioners until Aug. 10 for furnishing and laying about 8000 ft. of 20-in. c.-i. pipe and about 5000 ft. of 10-, 8- and 6-in. pipe; also for constructing a covered reinforced concrete reservoir, having a capacity of 1,600,000-gal. F. L. Fuller, 12 Pearl St., Boston, is the Engr. Plans on file at the office of Engineering News. Noted July 9.

★Hartford, Conn.—(Official)—Bids will be received by the Board of Water Commissioners until 3 p.m., Aug. 19, for Contract 7, constructing a gravel surface road south of the Nepaug Reservoir. Caleb Mills Saville is Ch. Engr. Noted July 30.

Waterbury, Conn.—Plans are being prepared by Robert A. Cairns, City Engr., for the installation of a sterilizing system in connection with the water supply from the West Branch reservoir.

Albion, N. Y.—At a recent election the citizens voted to purchase the plant of the Albion Water Co. and to spend about $65,000 for the improvement of the plant and system.

★Auburn, N. Y.—(Official)—Bids will be received by the Water Board until Aug. 21 for two return-tubular boilers, 80- and 100-hp., respectively. J. W. Ackerman is Ch. Engr.

Barker, N. Y.—The installation of a water system is under consideration.

+★Gilbertsville, N. Y.—(Official)—The contract for the construction of an earth dam, diversion channel and pipe lines has been awarded to the SUBURBAN ENGINEERING CO., 15 West 38th St., New York, N. Y., at $23,958. List of bids noted July 23.

+★Hudson, N. Y.—(Official)—Bids were received by Henry M. James, City Clk., July 22, for water proofing the old wall and constructing a 6-in. reinforced-concrete cut-off wall on the upstream face of the storage reservoir dam at Churchtown, as follows: KEEPS-DRY CONSTRUCTION CO., 145 West 18th St., New York, N. Y., $11,554 (awarded contract); Thomson Wooster Co., Walden, $12,892; Drake & Deane, Inc., Buffalo, $12,914; A. M. Harper, Inc., Newburgh, $12,098; Barzaghi-Vought Co., New York, $13,955; Mason, Wilton Co., New York, $16,962. Noted June 25.

+Niagara Falls, N. Y.—The Water Board has awarded a contract to SHEPARD & CALLAHAN, at $41,355 for laying water mains in various streets.

North Tonawanda, N. Y.—The installation of a filtration plant, instead of a sewage disposal plant, has been recommended to the Board of Public Works by T. P. C. Barnard.

★Ogdensburg, N. Y.—(Official)—Bids will be received by the State Hospital Commission, Albany, until 3 p.m., Aug. 17, for the installation of a water softening plant at the St. Lawrence State Hospital, Ogdensburg. J. H. B. Hanify is Secy. of the Comn.

Trenton, N. J.—The Board of City Commissioners will receive bids until Aug. 12 for the installation of chlórine apparatus at the city filtration plant. Johnson & Fuller, New York, N. Y., are Consult. Engrs.

The Hillcrest Water Co. has applied to the Board of Public Utility Commissioners to issue stock for $50,000 for extensions to its system.

★Woodbury, N. J.—(Official)—Bids will be received by Arthur Starr, City Clk., until 7:30 p.m., Aug. 25, for constructing a pumping station and pumping main at Mantua Creek, in connection with the artesian well water supply system.

+Hauto, Penn.—WILLIAMSON & RICHARDSON, Scranton, have been awarded the contract by the Lehigh Coal & Navigation Co. for the construction of a reservoir at Hauto, at $150,000. The reservoir will, when completed, have a capacity of 7,000,000 gal.

Kittanning, Penn.—The proposition to issue $112,000 in bonds for the construction of a new water system is under consideration.

+Ligonier, Penn.—According to press reports the contract for laying about four miles of water mains has been awarded to WILLIAM JONES, Carnegie, at $10,500.

Limestone, Penn.—Bonds for $10,000 have been voted, the proceeds of which will be used for the construction of a water system.

Baltimore, Md.—The Baltimore County Water & Electric Co. has been granted permission to extend its water mains from Joppa Road at Sherwood to Ruxton.

Hurlock, Md.—The citizens recently voted to issue bonds for $45,000, the proceeds of which will be used for the installation of water and sewer systems.

Richmond, Va.—Arrangements are being made by the Superintendent of Water-Works for the extension of the 20-in. water main in Dance St.

Rockymount, Va.—Bids will be received by the Town Recorder until Aug. 15, for the sale of $40,000 of bonds, the proceeds of which will be used for the construction of water and sewer systems.

Huntington, W. Va.—It has been recommended that the Board of Public Works issue bonds for $500,000, the proceeds to be used for the construction of a water plant on the Ohio River.

Piedmont, W. Va.—The citizens contemplate an issue of bonds for $85,000 for municipal improvements, included in which is the extension of the water system.

Tryon, N. C.—Bids will soon be received for the sale of $20,000 in bonds, the proceeds to be used for the installation of a water system. E. Missildine is Mayor.

Manning, S. C.—At a recent election bonds for $30,000 were voted, the proceeds of which will be used for constructing a water system. Noted July 16.

+Lagrange, Ga.—The contract for constructing a water station, filters and extending the water system has been awarded to the MUNICIPAL ENGINEERING & CONSTRUCTION CO., Atlanta, and TUCKER & LAXTON, Charlotte, N. C. Noted July 2.

+Crystal Springs, Fla.—The contract for the installation of a water system has been awarded to the J. B. McCRARY CO., Atlanta, Ga., at about $40,000. Noted July 2.

Fort Meade, Fla.—An election will be held Aug. 21, at which the proposition to issue bonds for $7500 for the extension of the water system will be submitted to the voters.

+Memphis, Tenn.—Contracts for constructing the North Memphis pumping plant have been awarded to JAMES ALEXANDER CONSTRUCTION CO., at $126,421, for general construction; to CHAPMAN VALVE CO., at $10,810, for sluice gates; to ALLIS-CHALMERS CO., at $64,200, for pumping machinery, and at $62,730 for electrical machinery.

Nashville, Tenn.—The Lewisburg & Northern R.R. Co. will construct a water-pipe line, several miles long, to its yards at Nashville.

Monticello, Ky.—The Council contemplates an issue of bonds, the proceeds to be used for the construction of a water system.

Providence, Ky.—The installation of a water system is under consideration. L. Price is Clk.

Shelbyville, Ky.—The Shelbyville Water Co. will construct a reinforced-concrete dam across Clear Creek.

+Cleveland, Ohio—The Commissioner of Purchases and Supplies has awarded the contract for constructing a concrete coagulant house and a wash water reservoir to the JOHN F. CASEY CO., Pittsburgh, Penn., at $92,552.

Delta, Ohio—Bids will be received by the Village Clerk until Aug. 10 for extending the water system.

East Youngstown, Ohio—Plans are being prepared by Chester & Fleming, Engrs., Pittsburgh, Penn., for a new water supply system at East Youngstown.

Lorain, Ohio—In a report to the City Council, C. Arthur Brown recommends an expenditure of $125,000 for the improvement of the water system.

Maumee, Ohio—Bonds for $56,000 were recently voted, the proceeds of which will be used for the construction of a municipal water system. George Camp, The Nasby, Toledo, is the Engr.

Gary, Ind.—(Official)—An election will be held Aug. 26 to vote on the proposition to issue bonds for $75,000, the proceeds of which will be used for the construction of a water plant in the Ridge Road district. Noted Mar. 14.

Greendale (Lawrenceburg post office) **Ind.**—The Council has granted a franchise to A. D. Cook to construct a water system. Estimated cost, $25,000.

+Logansport, Ind.—The contract for installing three centrifugal pumps in the pumping station has been awarded to the DRAVO-DOYLE CO., Pittsburgh, Penn.

Bedford, Mich.—Bonds for $18,000 have been voted, the proceeds of which will be used for the installation of a water system.

♦**Detroit, Mich.**—Contracts for laying about [illegible] ft. of water mains from [illegible] to the Highland Park reservoir [illegible] to the INTERURBAN ENGINEERING & CONSTRUCTION CO. and WILLIAM BLANCK & J. [illegible]

Aurora, Ill.—Bids will be received by the Board of Public Works until [illegible] Aug. 14 for drilling a well in connection with the water system.

♦**Berwyn, Ill.**—The contract for water pipe, hydrants and [illegible] boxes has been awarded to T. IGLEHART, Chicago, at $[illegible]

Kansas, Ill.—Bids will be received by the Village Clerk until Aug. [illegible] for constructing a water system. Claude L. Jones, Mattoon, is the Engr.

Burlington, Wis.—Bids will be received by the Board of Public Works until Aug. 8 for the extension of the water mains consisting of 3-, 4- and 6-in. water pipe, with gates, hydrants, etc.

Ackley, Iowa.—The citizens contemplate the purchase and improvement of the local water plant and system.

♦**Knoxville, Iowa.**—(Official)—The date of receiving bids for the proposed water works extension has been postponed from Aug. [illegible] to [illegible] p.m., Aug. 11. For particulars, see advertisement under Contracts To Be Let, in the issue of July 3[illegible].

Randolph, Iowa.—Bonds for $1[illegible],000 were recently voted, the proceeds of which will be used for the extension of the water system.

St. Paul, Minn.—The construction of an addition to the pumping station at McCarron's Lake has been recommended to the Water Board. Estimated cost is $100,000.

Bids will be received by the City Clerk until Aug. 10 for about 2[illegible] ft. of water pipe.

Virginia, Minn.—Bids will be received by the Water and Light Commission until Aug. 10 for constructing a reinforced concrete reservoir to have a capacity of 1,000,000 gal.

Larned, Kan.—(Official)—Bids will be received by L. D. Burgess, City Clk., until 1:30 p.m., Aug. 14, for the construction of a water system and an electric-light plant. Worley & Black, Reliance Bldg., Kansas City, Mo., are Consult. Engrs. Noted Apr. 23.

Lawrence, Kan.—An election will soon be called to vote $[illegible] for new waterworks or to purchase the private plant and make improvements. F. D. Brooks is City Clk. Noted June [illegible].

Mulberry, Kan.—The city contemplates an expenditure of $[illegible] for the extension of water mains.

Wellington, Kan.—Plans are being prepared by the Benham Engineering Co., Oklahoma City, Okla., for the construction of about 1[illegible] miles of water mains. M. H. Kirk is Comr. Pub. Wks.

Bridgeport, Neb.—The citizens recently voted to extend the water and sewer systems.

Clatonia, Neb.—Plans are being prepared by the Martz Engineering Co., First National Bank, Lincoln, for constructing a water system at Clatonia. Estimated cost $9200. Noted July 2[illegible].

♦**Orchard, Neb.**—The Village Trustees have awarded a contract for the construction of a water system to the ALAMO ENGINE & SUPPLY CO., Omaha, at $16,115.

♦**Winner, S. D.**—(Official)—Bids were received July 2[illegible] by [illegible] City [illegible] for constructing a water system from the INTERMOUNTAIN BRIDGE & CONSTRUCTION CO., Tecumseh, Neb., $[illegible] (awarded contract); Des Moines Bridge & Iron Works, Des Moines, Iowa, $[illegible]; and Katz Construction Co., Omaha, $2[illegible]. Noted July 23.

Chinook, Mont.—An election will be held Sept. 10 to vote on the proposition to issue bonds for $[illegible] for the improvement of the water system. Noted June 1[illegible].

Great Falls, Mont.—Bids will be received by the City Clerk until Aug. [illegible] for a centrifugal pump, [illegible]-gal. capacity, for the pumping station.

Missoula, Mont.—The city plans to award a contract soon for the [illegible] of the water system. [illegible] is City Clk. Noted July 1[illegible].

Monett, Mo.—Bonds for $[illegible] have been voted, the proceeds of which will be used for the installation of a water system. Noted July [illegible].

Cotulla, Tex.—The citizens on Aug. [illegible] will vote on the proposition to issue bonds for $[illegible], the proceeds of which will be used for the construction of a water system. Noted July 1[illegible].

♦**Dallas, Tex.**—The city [illegible] has awarded the contract for [illegible] water pipe and two tons of [illegible] pipe to the AMERICAN CAST IRON PIPE & FOUNDRY CO., Birmingham, Ala., at $[illegible] per ton. Noted July [illegible].

Denison, Tex.—[illegible] Bids will be received by the [illegible] Board of Commissioners until [illegible] for the installation of a [illegible] plant. A. [illegible] is City [illegible].

Sulphur Springs, Tex.—[illegible]

Hudson, Colo.—[illegible]

La Salle, Colo.—[illegible]

[illegible]

Caldwell, Idaho.—Bonds for $[illegible] have been voted, the proceeds of which will be used for the construction of a [illegible] system.

Rigby, Idaho.—The city has voted bonds for $[illegible] for improvements to the water system. Noted July [illegible].

Shoshone, Idaho.—The city will vote Aug. 11, on the question of issuing $1[illegible],000 in bonds for the purchase and extension of the waterworks system owned by the Great Shoshone & Twin Falls Water Co. Harry W. Anderson is City Clk. Noted May 7.

Twin Falls, Idaho.—The construction of a new water system to cost $2[illegible],000 is considered by the City Council.

Toppenish, Wash.—Plans have been prepared and bonds for $3[illegible],000 have been voted for the construction of a steel water tower. Noted July [illegible].

Hermiston, Ore.—The Western Land & Navigation Co. contemplates an expenditure of $2[illegible] for the construction of a new dam and canals. A. Messner is Pres.

Klamath Falls, Ore.—Plans are being made to form a water district in Willow Valley to irrigate [illegible]00 acres. W. A. Duncan and R. F. Tuttle are among those interested.

Portland, Ore.—All bids received by the City Commission for [illegible]00 water meters have been rejected. New bids will soon be asked.

Glendale, Calif.—Bonds for $2[illegible],000 have been voted to purchase the local water system, extend and improve it.

Placerville, Calif.—The County Supervisors will construct a dam to impound the waters of Webber Creek for irrigating purposes.

Stettler, Alta.—The construction of a water system at a cost of $[illegible]000 is under consideration. Lewis C. Harry is City Secy.-Treas. Charles Donevan, Seattle, is Engr.

Burnaby, B. C.—The city has rejected all bids recently received for 10,000 ft. of steel water pipe. New bids will soon be asked by the City Clerk. Noted July 16.

Richmond, B. C.—Bonds for $40,000 have been voted, the proceeds of which will be used for the extension of the water system.

SEWERS

♦**Milford, Maine.**—(Official)—The contract for constructing about 6[illegible] ft. of sewer has been awarded by the Board of Selectmen to HOBART & RICHARDSON, Old Town, Maine. F. L. Holmes is City Engr.

Boston, Mass.—Bids will be received by the Department of Public Works, until Aug. 7, for constructing sewers in South Boston and in the Dorchester District, also until Aug. 10, for sewers in the Hyde Park District. L. K. Rourke is Comr. Pub. Wks.

♦**Swampscott, Mass.**—The contract for extending the sewer system has been awarded by the Sewer and Water Board to MICHAEL McDONOUGH, at $13,[illegible]. Other bids were: Abram French, $16,743; F. D. Mayo, $13,997; D. J. Sheehan, $15,[illegible]; J. T. Lyons, $15,337.

♦**Providence, R. I.**—The contract for constructing sewers in Lorimer, Ogden, Methyl and Eighth Sts. has been awarded to CHARLES CRANKSHAW, at $[illegible].

Binghamton, N. Y.—Plans are being prepared by John A. Giles, City Engr., for constructing an intercepting sewer in Conklin Ave. to cost about $1[illegible].

The Common Council contemplates the construction of a sewer along the east bank of the Chenango River.

♦**Niagara Falls, N. Y.**—The Board of Public Works has awarded the following contracts: REED-CODDINGTON CO., for constructing sewers in Niagara Rapids Boulevard, Main St. and Cliff St., at $37,[illegible], also in [illegible]th St. and Buffalo Ave., at $39,33[illegible]; to DOMINIC SPICHONNE, for sewers in 16th St., Osborne Court, 17th St., Fort St., Walnut Ave., in alley between 16th and 17th Sts., at $1[illegible]; in Welch Ave., to WILLIAM RUFRAN, at $[illegible]. Noted June 11.

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Pres. of the Borough, until 2 p.m., Aug. 10, for the reconstruction of a sewer in South St., from Oliver St. to Pier No. 26, East River, near Catherine St.

(Borough of Brooklyn)—(Official)—Bids will be received by Maurice E. Connolly, Pres. of the Borough, until 11 a.m., Aug. 12, for constructing sewers in various streets.

Oswego, N. Y.—Bids will be received by the Department of Public Works until Aug. 7, for constructing vitrified pipe sewers in various streets.

♦**Rochester, N. Y.**—(Official)—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., for constructing a sewage pumping station and installing additional laundry equipment at the Rochester State Hospital. J. H. [illegible] Hanify is Secy. of the Hospital Commission.

♦**Rochester, N. Y.**—The contract for constructing the storm and sanitary sewer in [illegible] Road has been awarded by the Board of Contract and Supply to LOUIS H. [illegible], at $6[illegible]. The contract for the Thomas Creek overflow sewer has been awarded to WHITMORE, RAUBER & VICINUS at $[illegible].

Suffern, N. Y.—Plans for a sewer system and sewage disposal plant for the Village Board are being prepared by Clyde Potts, 30 Church St., New York, N. Y. A. H. Rook is Village Clk.

♦**Syracuse, N. Y.**—(Official)—Bids will be received by the Syracuse Intercepting Sewer Board, City Hall, until [illegible] p.m., Aug. [illegible], for constructing a storm water sewer in the First and Second Wards. Henry I. Hamlin is Secy.

Watertown, N. Y.—The lowest bid received by the City Council for constructing the trunk sewer was from Burns Bros. & Haley, Watertown, at $[illegible].

Cranford, N. J.—James H. Fuertes, Engr., 140 Nassau St., New York, N. Y., is preparing plans for a sewage disposal plant estimated to cost $1[illegible],000. Edward Mosher is Town [illegible].

♦**Newark, N. J.**—The contract for constructing part of Section 1[illegible] of the Main Intercepting Sewer has been awarded by the Passaic Valley Sewerage Commissioners to the J. F. STANLEY CO., Newark, at $[illegible]. Noted July 2[illegible].

♦**Newark, N. J.**—(Official)—Bids were received by the Passaic Valley Sewerage Commissioners for constructing Section 14 of the Main Intercepting Sewers as follows: Fusco

Construction Co., Newark, N. J., $265,172; Cauldwell-Wingate Co., New York, N. Y., $253,500; New York & New Jersey Construction Co., Newark, N. J., $243,400; The Whiting-Turner Construction Co., Baltimore, Md., $214,327; Merrill-Ruckgaber Co., & Mason, Hilton & Co., New York, N. Y., $186,756; Beaver Engineering & Contracting Co., New York, N. Y., $179,966; Bruno & Petitti, Belleville, N. J., $172,180.

The following bids were received for constructing part of Section 27, crossing the Passaic River in compressed-air tunnel from Newark to Harrison. Fusco Construction Co., Newark, N. J., $191,305; Merrill-Ruckgaber Co., & Mason, Hilton & Co., New York, N. Y., $76,090; New York & New Jersey Construction Co., New York, N. Y., $75,325; Booth & Flinn Ltd., New York, N. Y., $59,965; Charles A. Haskin, Charlestown, Mass., $55,420. Noted July 9.

Trenton, N. J.—Bids will be received by the City Commission, until 2:30 p.m., Aug. 12, for constructing sewers in various streets. Frank Thompson is City Clk.

Manning, S. C.—The city has voted $10,000 in bonds for the purpose of installing a sewer system.

Woodruff, S. C.—The citizens have voted $60,000 in bonds for the construction of sewers and water works.

Brunswick, Ga.—The city has voted bonds for $16,500 for making extensions to the sewer system.

+Birmingham, Ala.—The contract for the construction of sanitary sewers in East Birmingham has been awarded by the Board of Commissioners to H. N. BOWDRY, Birmingham at $15,546. Julian Kendrick is City Engr. Noted July 1 6.

Bowling Green, Ohio—Bids will be received by the Secretary, Board of Trustees, Bowling Green State Normal School, until Sept. 1, for constructing a sewer to connect with the city's sewer system.

Cleveland, Ohio—The city has authorized the purchase of four acres near Edgewater Park as a site for the West Side sewage disposal plant.

Cleveland Ohio—See item under Miscellaneous: Excavation, etc.—Cleveland, Ohio.

+Dayton, Ohio—The contract for constructing a stormwater sewer extension in Salem Ave. has been awarded to BOYD & COOK, at $19,950.

Dayton, Ohio—(Official)—The city plans to construct additional storm sewers, to enlarge the present sanitary sewer system and construct sewage disposal plant.

Lowellville, Ohio—The City Council contemplates the construction of six miles of sanitary sewers.

Gary, Ind.—Bids will be received until Aug. 17, by the Board of Public Works for the construction of Local Sewer 39, incuding 1125 ft. 18-in., 1064 ft. 15-in., 610 ft. 12-in. vitrified tie sewer, 17 manholes, etc. The estimated cost is $6784. W. J. Fulton is City Engr.

+Berwyn, Ill.—(Official)—The contract for constructing a sewer in 16th St., has been awarded to T. H. IGLEHART & CHARLES M. PORTER CO., Chicago, Ill. Oscar N. Lindohl is Secy. Board of Local Improvements. Noted July 9.

+Chicago Heights, Ill.—The contract for constructing the sanitary sewer system has been awarded by the Board of Local Improvements to ROBERT NELSON, Racine, Wis., at $74,568. Other bids were: Carson Payson Co., Danville, $92,153; Chicago Drainage Construction $80,240; Green & Son Co., Streator, $75,518. Noted July 9.

La Salle, Ill.—The city will construct an extension to the sewer system, estimated to cost $40,000. Bonds for the work have been voted.

Mounds, Ill.—Bids will be received by the City Clerk, until Aug. 10, for constructing a sewer system, requiring 18,000 lin.ft. 8- to 15-in. pipe, manholes, septic tank, and filter beds.

Burlington, Wis.—Bids will be received by the Board of Public Works until Aug. 8, for the construction of sanitary and storm sewers, requiring 8- and 12-in. vitrified pipe sewers.

+Milwaukee, Wis.—The Department of Public Works has awarded a contract for the construction of a sewer in Hawley Road and Vliet St. to F. H. KAKIELSKI at $94,186. A contract has also been awarded to JOHN BOWLER for a relief sewer at Locust St., from North Pierce to Seventh St., at $45,313.

New London, Wis.—Bids will be received by the Common Council until Aug. 18 for constructing sewers in three streets.

★Racine, Wis.—(Official)—Bids will be received by the City Clerk until 10 a.m., Aug. 15, for constructing a sewer in 21st St. For further information, see advertisement under Contracts To Be Let.

Bedford, Iowa—The City Council contemplates the construction of a septic tank, estimated to cost $5000.

Burlington, Iowa—Bids will be received by H. G. Vollmer, City Engr., until Aug. 15, for constructing a concrete trunk sewer estimated to cost $92,000.

+Clarion, Iowa—The contract for constructing Sections 2, 3 and 4 of the sewer system has been awarded to GEORGE S. COLLINS, 448 Omaha National Bank, Omaha, Neb., at $37,043. Noted July 9.

+Deerwood, Minn.—(Official)—The contract for constructing a sanitary sewer system has been awarded to the PASTORET CONSTRUCTION CO., Duluth, Minn., at $7580. Other bids were: Magnus Johnson, Minneapolis, Minn., $9100; Ilstrup & Olson, Minneapolis, Minn., $8720; Lawrence-McCann Co., Eveleth, Minn., $8462; Tanner Bros., St. Paul, Minn., $8750; Greene Contracting Co., Albert Lea, $8850; F. A. Glass, Brainerd, Minn., $12,935. J. O. Hage is Village Clk. Noted July 16.

+Sleepy Eye, Minn.—The contract for constructing the sanitary sewer system, including the disposal plant and storm sewer outlet has been awarded to WILLIAM R. BOSWORTH, Ada, at $33,905. Other bids were G. E. Gilbertson, St. James, $36,589; Thornton Bros., St. Paul, $39,830; William Danforth, St. Paul, $37,158; Black Hawk Construction Co., $41,052; Lander & Gessner, Kansas City, $37,473; E. M. Ely, Kansas City, $33,907. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., prepared the plans.

Warroad, Minn.—Bids will be received by E. M. Heimpach, Village Clk., until Aug. 27, for constructing about 2060 ft. 10-in. sewer and about 1800 ft. 8-in., 10-in., and 12-in. sewers also a sewage disposal tank. Noted July 2.

Emporia, Kan.—The city will spend $25,000 for the construction of two sewage disposal plants. R. H. Hamer is Mayor.

Siloam Springs, Ark.—(Official)—An improvement district has been organized and a petition circulated calling for bonds to construct a sewer system to cost about $50,000. J. H. Perry is Mayor.

+Dallas, Tex.—The Board of City Commissioners has awarded the contract for constructing a storm sewer in Grigsby Ave. to the DALLAS LIME & GRAVEL CO., at $12,186. Other bids were: Winslett-Eldridge Co., $12,532; C. W. Olcott, $13,670.

Harrington, Wash. — The city contemplates the installation of a sewer system.

Seattle, Wash.—Bids were received by the City Council for constructing the 60-in. c.-i. pipe sewer, in the siphon tunnel of the North Trunk sewer. L. R. Ellis, $16,362; Washington Construction Co., $13,851; Part Contracting Co., $14,828; C. H. Keihl, $14,990.50; Wenzler & Ward, $14,920.

Seattle, Wash.—The following bids were received by the City Council for constructing the 46th St. sewer: L. Coluccio, $15,866; C. Cristfero, $14,519; H. Young, $14,694; John Alemand, $14,695; A. N. Fiorito, $14,193; G. W. Walker, $16,258; V. Ramaglia, $12,491; Sylliasen & Sando, $12,435.

Galt, Calif.—The city contemplates the construction of a sewer system to cost about $17,500. J. J. Rosenthal, State Housing and Irrigation Board, Sacramento, Calif. is preparing plans.

+Los Angeles, Calif.—(Official)—The contract for constructing an outfall sewer system and a sewage disposal plant, has been awarded by the Board of Public Works to JOHN BALCH, 588, 10th St., San Pedro, Calif., at $196,998. Other bids were: James Kennedy, $212,000; Benjamin Ford & Frederick H. Stout, $243,000; W. A. Taylor, $259,750. Noted July 9.

Napa, Calif.—The city has voted $10,000 in bonds for constructing storm sewers in North Napa.

San Francisco, Calif. — The Board of Supervisors has authorized the expenditure of $131,000 for the construction of the Baker's Beach outlet sewer, the Fulton Ave. sewer, the Glenn Park extension sewer and the Fifth St. outlet sewer. Frederick J. Churchill is Secy. Bd. of Pub. Wks.

Canora, Sask.—The city has voted to construct sewage and water works, estimated to cost $60,000. Bids will soon be called for the work.

+Sapperton, B. C.—The contract for constructing a sewer system has been awarded by the City Council to ROBERT McCLEAN & CO., Pacific Bldg., Vancouver, at $99,400.

GARBAGE

Philadelphia, Penn.—The city has rejected bids for the collection and disposal of garbage, and new bids will be received until Oct. 16.

★Akron, Ohio—(Official)—Bids were received, July 30, by the city for constructing garbage reduction plant buildings as follows: J. C. Devine Construction Co., Alliance, Ohio, $44,050; Masters & Mullen Construction Co., Cleveland, Ohio, $48,350; Pitt Construction Co., Pittsburgh, Penn., $52,460; Duquesne Contracting Co., Pittsburgh, $58,450; Carmichael Contracting Co., Akron, $61,277; Arthur G. McKee, $52,300 (informal).

Columbus, Ohio—E. H. Latham, Columbus, has submitted the lowest bid to the city for constructing the new incinerator plant, at $18,286.

STREETS AND ROADS

Boston, Mass.—Bids will be received until Aug. 10, by the Department of Public Works for bituminous macadam roadways in St. Francis de Sales St., Roxbury and in Clement Ave. and Pinehurst St. L. K. Rourke is Comr.

+A contract for constructing a road from Reading to Stoneham has been awarded to ROWE CONTRACTING CO. at $19,959. Other bids were: F. J. Mayne, West Newton, $20,379; J. E. Watkins, $20,527; James A. Gaffey, Medford, $24,034; D. J. Sheehan, Lynn, $28,379.

+Holyoke, Mass.—A contract for laying roman road pavement on Hampden St. has been awarded to DANIEL O'CONNELL'S SONS, at $1.23 per sq.yd.

Hartford, Conn.—Bids will be received by Charles J. Bennett, State Highway Commissioner, until 2 p.m., Aug. 18, for State road work as follows:

Griswold Township, about 5075 lin.ft. plain or reinforced concrete and 17,800 lin.ft. resurfacing on the Voluntown Road. Plans are on file at Selectmen's office, Jewett City.

Cromwell Township, about 2175 lin.ft. trap rock macadam or gravel construction on the Newfield Road. Plans are on file at Selectmen's office.

Bristol City, about 11,692 lin.ft. gravel or plain or reinforced concrete construction on Park St. Estimated quantities are 19,265 sq.yd. 8-in. gravel, 7770 sq.yd. grading, 19,265 sq.yd. steel reinforcement, and 800 ft. corrugated iron culverts. Plans are on file at City Engineer's office, Bristol.

Middletown Township, about 1690 lin.ft. trap rock or gravel construction on Newfield St. Estimated quantities, are: 1830 sq.yd. of macadam, 800 sq.yd. 4-in. macadam over telford or 2630 sq.yd. 8-in. gravel. Plans are on file at Selectmen's office, Middletown.

Manchester Township, about 6700 lin.ft. plain or reinforced concrete or bassam paving on Main St. Estimated quantities, 2330 cu.yd. concrete and 11,910 sq.yd. earth grossing. Plans are on file at Town Clerk's office, Manchester Center.

[illegible] Township: about [illegible] lin.ft. gravel construction on the [illegible] Road. Estimated quantities, [illegible] [illegible], 118 ft. corrugated [illegible]. Plans are on file at office of A. S. [illegible].

[illegible] Township: [illegible] lin.ft. gravel construction on the [illegible] Road. Estimated quantities, [illegible] grading, [illegible] lin.ft. corrugated iron culverts. Plans are on file at office of A. P. Curtiss, Norwich.

[illegible] Township: about [illegible] lin.ft. gravel [illegible] with [illegible] surface) construction on the [illegible] Road. Plans are on file at Selectmen's office, [illegible].

[illegible] Township: about [illegible] lin.ft. plain or reinforced concrete [illegible] or bituminous concrete construction. Plans are on file at office of Director of Public Works.

[illegible] Township: about 1137 lin.ft. trap rock macadam or gravel construction on [illegible] Lane. Estimated quantity, [illegible] sq.yd. [illegible]. Plans are on file at Town [illegible] Junction.

+Contracts for road work bids for which were received July 14 have been awarded by the State Highway Commission as follows:

[illegible] Township: about [illegible] lin.ft. gravel construction on Center St. for [illegible] and about 6710 lin.ft. gravel construction on the River Road for $9171 to JOHN ARBORIO, New Haven.

[illegible] and [illegible] Townships: about 10,170 lin.ft. native stone [illegible] for $11,6[illegible] and about [illegible] tons of native crushed stone [illegible] for $1[illegible] to the PORCARO CONSTRUCTION CO., Willimantic. Noted July 2 and 23.

+Albany, N. Y.—Bids were received July 27 by the State [illegible] and contracts were awarded for road improvement as follows:

Road No. [illegible], Albany County, 2.66 miles, ST. LAWRENCE CONSTRUCTION CO., Albany, $12,234.

Road No. 12[illegible], Chester County, 0.80 miles, DANA W. [illegible], New York, $[illegible].

Road No. 1[illegible]-A, Erie County, 3.13 miles, SERVISS & [illegible], [illegible]town, $1[illegible]16.

Road No. [illegible], Essex County, 7.16 miles, W. F. BOUGHTON CO., Hudson Falls, $[illegible].

Road No. [illegible], Herkimer County, [illegible] miles, H. WARD [illegible], Syracuse, $[illegible].

Road No. [illegible], Monroe County, 0.92 miles, J. B. HURLEY [illegible], Fredonia, $[illegible].

Road No. [illegible], Nassau County, 2.93 miles, H. J. MULLEN CONTRACTING CO., Jamaica, $1[illegible].

Road No. [illegible], Oswego County, [illegible] miles, A. J. ROCKWELL, Rochester, $12,[illegible].

Road No. [illegible], Rockland County, 0.39 miles, PAUL G. [illegible], [illegible], $7618.

Road No. [illegible], Schenectady County, 0.[illegible] miles, SCHENECTADY CONTRACTING CO., Schenectady, $[illegible].

Road No. [illegible], Suffolk County, 1.[illegible] miles, H. J. MULLEN CONTRACTING CO., Jamaica, $2[illegible].

Road No. 1[illegible], Suffolk County, [illegible] miles, EASTERN ASPHALT PAVING CO., New York, $10[illegible].

Road No. 1[illegible], Westchester County, 1.28 miles, JOHN J. HAVEY, [illegible], $[illegible].

Road No. [illegible], Yates County, [illegible] miles, ATLANTA CONSTRUCTION CO., Atlanta, $[illegible].

Bids were received by the State Commission of Highways for [illegible] of [illegible] highways by State Aid, July 27, as follows:

[illegible] Contract No. 6[illegible], Montgomery County, JOHN P. [illegible]AN & CO., Amsterdam, $[illegible].

[illegible] Contract No. 6[illegible], Montgomery County, JOHN P. [illegible]AN & CO., Amsterdam, $[illegible].

[illegible] Contract No. 6[illegible], Montgomery County, JOHN P. [illegible]AN & CO., Amsterdam, $[illegible].

[illegible] Contract No. [illegible], Montgomery and Fulton Counties, [illegible] CONSTRUCTION CO., Saratoga, $[illegible]350.

[illegible] Contract No. 676, [illegible] County. Contract not awarded. Noted July 16 and 2[illegible].

+Batavia, N. Y.—The contract for paving Walnut St. with brick has been awarded to the McKINNEY McGUIRE CONSTRUCTION CO., Niagara Falls, N. Y., at $13,[illegible]60.

+Buffalo, N. Y.—Contracts have been awarded for paving as follows: [illegible] St. to the HENRY P. BURGARD CO., at $[illegible]; [illegible] St. and [illegible] Ave., to the GERMAN ROCK ASPHALT & CEMENT CO., LTD., at $[illegible] and $[illegible], respectively; Marion Ave. to the ERIE CONTRACTING CO., at $[illegible].

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Pres. of the Borough of Manhattan, Room 2[illegible], Municipal Bldg., until 3 p.m. Aug. [illegible], for improving 1[illegible] St. from Audubon Ave. to [illegible] Ave.

(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Pres. of the Borough of Manhattan, until [illegible] p.m., Aug. [illegible], for repairing asphalt block pavements in the Borough of Manhattan on [illegible] streets where the guarantee of maintenance has expired or will expire [illegible] the year [illegible], and for [illegible] Madison Ave. from [illegible] St. to [illegible] St. [illegible] from [illegible] to Fort Washington Ave. [illegible] St. from Audubon Ave. to Wadsworth Ave.

(Borough of the Bronx)—(Official)—Bids will be received by the [illegible] Municipal Bldg. until [illegible] p.m., Aug. [illegible], for [illegible] gal. of refined coal tar and [illegible] [illegible] for parks in the Borough of the Bronx.

[illegible], N. J.—(Official)—Bids will be received by the [illegible] until [illegible] p.m., Aug. [illegible], for improving the following streets and roads: [illegible]

Hammonton, N. J.—Bids will be received by the Town Clerk until Aug. 8 for [illegible] sq.ft. of concrete sidewalks, 1[illegible] lin.ft. concrete curb and 7[illegible]00 sq.ft. of driveway.

New Brunswick, N. J.—Bids will be received by Common Council, [illegible] George St., until 8 p.m., Aug. 10, for improving Hussar, Oliver, John, Hartwell, [illegible] and Welton Sts.

+Passaic, N. J.—The contract for asphalt paving on Hope Ave. has been awarded to the UNION BUILDING & CONSTRUCTION CO. at $[illegible].

West New York (Weehawken Post Office), N. J.—Bids will be received by the Town Council until Aug. 11 for improving Sixth St. from Bergenline Ave. to Park Ave. and Park Ave. formerly known as Bulls Ferry Road from the southerly to the northerly limits.

Chester, Penn.—See item under Miscellaneous: Park Work—Chester, Penn.

+Greensburg, Penn.—(Official)—The contract for improving the Salina-Avonmore County Road has been awarded to JOHN HERMANN, Latrobe, Penn., at $11,[illegible]. Noted July 9.

+Homestead, Penn.—The contract for grading, curbing and paving Main St. has been awarded to the PROSSER CONSTRUCTION CO., Carnegie, at $7816.

Johnstown, Penn.—(Official)—Bids will be received by Harry W. Slick, City Treasury, until 2 p.m., Aug. 24, for the sale of $100,000 of bonds for highway improvement.

+Norristown, Penn.—(Official)—The contract for resurfacing a portion of the Conshohocken Pike has been awarded to D. J. LYNCH, at $2.05 per ton. About [illegible] tons of stone will be required. Noted July 23.

Philadelphia, Penn.—Bids will be received until Aug. 18 for completing the Northeast Blvd. The estimated cost of the work is $[illegible].

Philadelphia, Penn.—(Official)—Bids will be received by the Department of Public Works until noon, Aug. 12, for paving according to schedules "A," "B," "C," "D," "E," "F" and "G." For particulars see advertisement under "Contracts to Be Let."

Sharpsburg, Penn.—(Official)—Bids will be received by J. F. Barry, Borough Clk., 1111 North Canal St., until [illegible] p.m., Aug. 10 for improving Main St.

Baltimore, Md.—(Official)—Bids will be received by the Board of Awards until Aug. 12 to grade, curb and pave with vitrified block the following streets: Center St. from Washington Pl. to Courtland St., Courtland St. from Franklin St. to Center St., and St. Paul St. from Hamilton St. to Center St. R. Keith Compton is Consult. Engr.

+Princeton, W. Va.—(Official)—The contract for constructing roads has been awarded to CURTIS-WARD CO., Chicago, Ill., at $[illegible]2,924. Noted July 2[illegible].

Mooresville, N. C.—Bids will be received by the City Clerk until Aug. 24 for 9[illegible]00 sq.yd. of bituminous paving with a concrete base and curb.

Conway, S. C.—At a recent election the citizens of Floyd Township voted $25,[illegible] in bonds for road work.

Fort Meade, Fla.—An election will be held Aug. 21 to vote on the proposition to issue $[illegible] of bonds for street paving.

Miami, Fla.—(Official)—Bids will be received by the City Clerk until 7.30 p.m., Aug. [illegible], for paving certain streets. For particulars see advertisement under "Contracts to Be Let."

+Birmingham, Ala.—The contract for paving [illegible]th Ave. from [illegible]th to 2[illegible]th St. has been awarded to the SOUTHERN BITULITHIC CO. at about $[illegible]. Noted July 16.

Centerville, Ala.—Bids will be received by the County Commissioners until Aug. 1[illegible] for surfacing the Centerville and Blocton Road with chert. The estimated cost of the work is $10,512. W. S. Keller is State Highway Engr.

Marion, Ala.—Bids will be received by the County Commissioners until Aug. 1[illegible] for gravel road. The approximate cost of the work is $6[illegible].

Ashtabula, Ohio.—M. H. Turner, Dir. of Pub. Ser., will receive bids until Aug. 8 for improving [illegible] Ave. by grading and draining.

+Bellevue, Ohio.—The contract for improving [illegible] St. with a [illegible] ft. concrete pavement has been awarded to [illegible] BROS., Green Springs, at $6[illegible].

+Canal Dover, Ohio.—A contract for paving three streets has been awarded to [illegible] & MEYER, Wheeling, W. Va., at $[illegible].

Cincinnati, Ohio.—(Official)—Bids will be received by [illegible], Dir. of Pub. Ser., until noon, Aug. 1[illegible], for improving Jefferson Ave. from [illegible] St. to St. Clair St.

Columbus, Ohio.—(Official)—Bids will be received by the Board of County Commissioners until noon, Aug. 1[illegible], for the sale of $[illegible] of bonds for the improvement of certain roads. John Scott is Clk. of the Comrs.

Deerfield, Ohio.—(Official)—Bids will be received by James [illegible], Township Clk., until [illegible], Aug. [illegible], for the sale of $[illegible] of bonds for improving roads.

+Fort Recovery, Ohio.—The contract for paving West [illegible] St. with brick has been awarded to LOWRY, MANNIX & WAGNER, at $[illegible].

Grandview Heights (Columbus Post Office), Ohio.—(Official)—Bids will be received by W. W. [illegible], Village Clk., R. F. D. No. [illegible], Columbus, until noon, Aug. 1[illegible], for improving [illegible] Road between Third and Fifth Ave.

[illegible], Ohio.—Bids will be received by the Board of Public Service until Aug. 1[illegible] for improving Fifth, [illegible] and [illegible] Sts. by paving with brick on a concrete foundation.

La Rue, Ohio.—(Official)—Bids will be received by J. W. [illegible], Village Clk., until Aug. 1[illegible], for paving High, [illegible] and [illegible] Sts. The estimated cost of the work is $2[illegible]. Noted July [illegible].

+Logan, Ohio—The contract for paving Walnut and North Sts. with brick has been awarded to HOUSTON-HENDERSON CONSTRUCTION CO., at $30,000.

Martins Ferry, Ohio—The City Council has passed ordinances for the paving of Fifth, East Second and Douglas Sts. The City Engineer is preparing plans for the paving of Washington St. from Hopkins to William St. with bituminous macadam.

Marysville, Ohio—(Official)—Bids will be received by C. A. Morelock, Audr. of Union County, until 1 p.m., Aug. 15, for grading, draining and macadamizing the Vansant and Beaver Road in Claiborne Township.

Painesville, Ohio—W. Albert Davis, Clerk of the Bd. of Comrs. of Lake County, willl receive bids until Aug. 20 for grading, draining and paving with brick with concrete foundation the Ridge and Arnold Roads.

Richwood, Ohio—Charles A. Morelock, Audr. of Union County, will receive bids until Aug. 15 for grading and macadamizing a county road in Clairborne Township.

Uhrichsville, Ohio—Bids will be received by H. O. Snider until Aug. 15 for improving Newport Ave.

Waldo, Ohio—Bids will be received by O. H. Apt, Clk., until Aug. 13, for paving certain portions of Marion St. with vitrified brick or block on a concrete foundation.

Auburn, Ind.—(Official)—Bids will be received by the Commissioners of Dekalb County until 10 a.m., Sept. 15, for constructing a road on line between Butler and Jackson Townships. A. W. Madden is Audr.

Bloomington, Ind.—(Official)—Bids will be received by the Common Council until 7:30 p.m., Aug. 10, for the improvement of Kirkwood St. Horace Blakely is City Clk.

Danville, Ind.—(Official)—Bids will be received by the Commissioners, until 10 a.m., Sept. 8, for constructing roads in Eel and Brown Townships.

Fort Wayne, Ind.—(Official)—Bids will be received by the Commissioners of Allen County until 10 a.m., Aug. 24, for constructing a concrete road in Adams Township.

Frankfort, Ind.—(Official)—Bids will be received by E. M. Caldwell, Treas. of Clinton County, until 10 a.m., Aug. 10, for the sale of $38,320 of highway bonds.

+Gary, Ind.—The contract for improving Pennsylvania St. has been awarded to METZ & McVAY at $10,211. Noted July 2.

Milford, Ind.—(Official)—Bids will be received until 2 p.m., Aug. 24, for paving a mile of streets. Brick and concrete curb and gutters will be used. A. J. Forbing is Town Clk. Amandus M. Smith, Elkhart, is Engr.

+Richmond, Ind.—The contract for improving Ninth St. has been awarded to M. B. KELSEY, at $7921.

+East St. Louis, Ill.—The contract for improving Summit Ave., from Washington Pl. to 16th St., has been awarded to LOUIS RICH, at $7617.

+Peoria, Ill.—The contract for paving Bradley Ave. with asphalt has been awarded to J. W. BUSHNELL at $13,444. Noted July 16.

+St. Augustine, Ill.—The contract for paving Simmons St. has been awarded to J. B. McAULEY, at $32,224.

Springfield, Ill.—(Official)—Bids will be received by the State Highway Commission until 11 a.m., Aug. 11, for the following road work: Will County Route 2, Section A, 9300 lin.ft. concrete, estimated cost, $14,885; Will County, Route 13, Section B, 10,800 lin.ft. of concrete, estimated cost, $19,300; Warren County, Route 7, Section A, 5500 lin.ft. of brick, estimated cost, $12,316; Warren County, Route 12, Section B, 4000 lin.ft. of brick, estimated cost, $9530; Logan County, Route 7, Section B, 3600 lin.ft. of concrete, estimated cost, $5689; Kankakee County, Route 1G, Section A, 9200 lin.ft. of concrete, estimated cost, $17,712.

Springfield, Ill.—(Official)—Bids will be received until 11 a.m., Aug. 19, by the Illinois Highway Commission for the following road construction, all cement to be furnished by the state: Crawford County, Route 3, Section 8, 18,048 lin.ft. of concrete, estimated cost $19,584; Clay County, Route 5, Section A, 3300 lin.ft. of concrete, estimated cost $4763; Boone County, Route 1, Section A, 4500 lin.ft. of concrete, estimated cost $6452; Douglas County, Route 11, Section B, 2520 lin.ft. of brick, estimated cost $5313; Douglas County, Route 3, Section A, 4500 lin.ft. of brick, estimated cost $9146; McHenry County, Route 1, Section A, 2600 lin.ft. of concrete, estimated cost $4895; McHenry County, Route 11, Section B, 1500 lin.ft. of concrete, estimated cost $3066.

+Waukegan, Ill.—(Official)—The contract for grading and paving portions of Julian, Ash, First and Third Sts. has been awarded to the WESTERN IMPROVEMENT CO. at $18,019. Noted Feb. 26 and July 9.

Burlington, Wis.—Bids will be received by the Board of Public Works until Aug. 8, for approximately 6000 sq.yd. of paving on a 5-in. concrete base.

+Milwaukee, Wis.—The contract for paving 35th St. with brick has been awarded to W. T. McGOVERN CO., 100 Eighth St., at $5503.

+Portage, Wis.—A contract has been awarded to J. RASMUSSEN & SON, Oshkosh, Wis., for paving several streets with brick on concrete foundation at $48,000. Noted July 16.

Davenport, Iowa—(Official)—Bids will be received by Edward Collins, Scott County Audr., until 2 p.m., Aug. 10, for improving Section "D" of the Davenport-Cadda Road and part of Sections "G" and "H" of the Davenport-Princeton Road.

+Duluth, Minn.—The contract for paving St. Croix Ave. with brick has been awarded to the D. H. CLOUGH & CO. at $35,018.

+Hibbing, Minn.—(Official)—The contract for paving about 7000 sq.yd. on Fifth Ave. and McKinley St. has been awarded to the E. W. COONS CONTRACTING CO., at $28,000. Noted July 22.

Nashwauk, Minn.—(Official)—Bids will be received by the Village Council until 2 p.m., Aug. 8, for a concrete pavement on Second St. from Central Ave. to Pearson Ave. and Third St. from Central Ave. to Deering Ave. W. Sumi is Village Recdr.

St. Paul, Minn.—Bids will be received until 10 a.m., Aug. 10, for grading and improving Como Ave., west from Carter Ave. to Eustis St. August Hohenstein, Court House, is Purchasing Agent.

Arma, Kan.—A. C. Moore, Engr., Bartlett Bldg., Joplin, Mo., is preparing plans for street improvements.

Kearney, Neb.—An election was held and citizens voted in favor of issuing $15,000 in bonds to pave street intersections.

+Billings, Mont.—The contract for paving First Ave. North has been awarded to WARREN CONSTRUCTION CO. at $14,835. Noted July 2.

Terry, Mont.—Bids will be received until 8 p.m., Aug. 12, for constructing approximately 33,600 sq.ft. of concrete sidewalks. L. H. Braley is City Clerk.

Festus, Mo.—Bids will be received by J. C. Davidson, City Clk., until 8 p.m., Aug. 22, for the improvement of Third St. from Adams St. to Mill St.

Kansas City, Mo.—The county clerk will receive bids until Aug. 17, for grading and draining the Blue Mills and Sibley Road.

Bids will be received by the County Clerk until Aug. 20, for grading, draining and macadamizing Woodland Ave.

Bids will be received by the County Clerk until Aug. 24 for grading, draining and building culverts on the Grain Valley and Tarnsney Road.

+Denison, Tex.—(Official)—A contract for paving 3300 sq.yd. with brick has been awarded to the J. C. FEILD ENGINEERING CO., 105-8 Feild Bldg.

Fort Stockton, Tex.—(Official)—Bids will be received until 1 p.m., Aug. 13 for improving approximately 250 miles of Pecos County Highways. Howell Johnson is County Judge.

Houston, Tex.—Bids will be received by H. L. Washburn, County Audr., 10 a.m., Aug. 10, for grading three miles of "M" St., Precinct No. 1.

+Smithville, Tex.—The contract for graveling streets has been awarded to WALTER MOORE at approximately $15,000.

Sulphur Springs, Tex.—Bids will be received by the City Secretary until Aug. 20 for paving the public square, Church, Depot, Main and Jefferson Sts. A. D. Stivers is City Engr.

+Cœur d'Alene, Idaho—The contract for paving Second St. has been awarded to WEEKS & SEVERSON at $7500.

+Lehi, Utah—The contract for constructing 2½ miles of concrete sidewalks in District No. 6 has been awarded to FEATHERSTONE & HOLMSTEAD, Lehi.

Logan, Utah—(Official)—Bids will be received until 5 p.m., Aug. 11, for constructing concrete sidewalks is District No. 23.

Ogden, Utah—The City Commissioners have ordered sidewalks to be built in District No. 132. An approximate cost of the work is $10,000.

+Salt Lake City, Utah—The contract for paving Eighth West St. has been awarded to G. A. HERMAN at $121,998. Noted July 23.

Clifton, Ariz.—Bids will be received by the Board of Supervisors, until Aug. 17 for constructing three miles of road from Clifton to Solomonville. The approximate cost of the work is $45,000.

Seattle, Wash.—Bids will be received by the King County Commissioners until Aug. 10 for constructing the Redmond-Snoqualmie Road, Tokul Creek Branch.

Bids will be received by the Board of County Commissioners until 10 a.m., Aug. 17, for constructing the Mercer Island Road.

+Seattle, Wash.—The City Council has awarded contracts for grading and paving Melrose Ave., to the SPARGER CONCRETE CO., at $18,097; and East First St. to the ELLIOTT CONSTRUCTION CO., at $5398.

The contract for constructing Permanent Highway, No. 6, has been awarded to SLOANE BROS. at $48,500.

Oregon City, Ore.—The City Engineer is preparing plans for the paving of Main St.

+Los Angeles, Calif.—The contract for improving Lakeshore Ave. from Glendale Ave. to Reservoir St. has been awarded to the CALIFORNIA-ARIZONA CONSTRUCTION CO., Brockman, at $29,393.

+Pomona, Calif.—Contracts have been awarded for paving East Holt and South Garey, West Second and Oak Aves. and First St. to G. H. OSWALD at $83,053 and Lordsburg Road, North Gary and San Antonio Aves. to BUSHEAR BURNS CO. at $85,604. Noted July 9.

Red Bluff, Calif.—An election will be held, Aug. 25, to vote on the proposition of issuing $200,000 of bonds to construct roads and bridges in various parts of Tehama County.

Sacramento, Calif.—Bids will be received until Aug. 24, by the State Highway Commission, 515 Forum Bldg., for the following road construction: Colusa County, from Berlin to Colusa Junction; Sacramento County, from Folsom to the County boundary; Solano County, from Vacaville to Batavia; San Bernardino County, from Divide to Orcutt and from Stony Creek to El Capital; Kern County, from southerly boundary to Ross Station; San Louis Obispo County, from Atasoadero to Paso Robles; Orange County, from Irvine to Santa Ana, and Los Angeles County, from Castall School to Section 17. Wilson R. Ellis is Secy. of the Comn. Austin B. Fletcher is State Engr.

+San Diego, Calif.—Contracts have been awarded for paving Highland Ave. and other streets in the eastern part of the city to E. A. McALPIN, at $13,275.

Ottawa, Ont.—The contract for grading Section 2 of the Banff-Castle Highway and Section 4 of the Castle-Vermilion Highway has been awarded to B. J. REDDICK, Calgary, Alta.

✦**Vancouver, B. C.**—The contract for paving Columbia St has been awarded to the HASSAM PAVING CO. at [illegible].

INDUSTRIAL WORKS

Old Town, Maine.—The Old Town Canoe Co. will erect a five-story, [illegible]-ft addition to its factory. This will double its present capacity.

✦**Derby Line, Vt.**—The contract for the erection of two [illegible]-story brick buildings for the Union Twist Drill Co., of Worcester, Mass., was awarded to LOOMIS, DAKIN, LTD., Sherbrooke, Que. Frost & Chamberlain, States Bldg., Worcester, Mass., are the Archs.

✦**Chicopee, Mass.**—The Dwight Mfg. Co. has awarded a contract for additions to its mills to the CASPER RANGER CONSTRUCTION CO., Holyoke, Mass. The estimated cost is $[illegible].

Lowell, Mass.—The Hamilton Mfg. Co. plans to construct additions to its mills which will cost $500,000.

Norfolk Downs, Mass.—Means & Thatcher, 6 Custom House St., Boston, have plans in progress for building a three-story, [illegible]x167-ft. paint factory. C. Loising, 53 State St., Boston, is the Arch.

✦**Providence, R. I.**—The contract for the construction of a five-story reinforced-concrete warehouse for the Belcher & Loomis Hardware Co. has been awarded to NORCROSS BROS., Worcester. The estimated cost is $60,000. Eugene R. Waldo is the Arch.

Washington, R. I.—The Livingston Worsted Co. will erect a two-story, 6[illegible]x110-ft. mill addition, also a 56x200-ft., brick weaving factory.

New Haven, Conn.—The Kolynos Co., 180 Meadow St., has purchased a site on Bristol St. where a new factory will be erected.

New Haven, Conn.—The Winchester Repeating Arms Co. will build a $12,000 addition to its factory on Winchester Ave. It will be 21x15 ft., three stories high and of brick and steel. L. W. Robinson is the Arch.

Rockville, Conn.—The James J. Regan Mfg. Co. has had plans prepared for the construction of a four-story, 72x200-ft. mill at its Saxony plant. J. Harry McCray, 18 North Park Ave., is the Arch.

Buffalo, N. Y.—The Commercial Elevator Co. is having plans prepared for a grain elevator to be erected at the foot of Michigan St. on the outer harbor. The estimated cost is $[illegible]. Lupham & Moore, Chamber of Commerce Bldg., Buffalo, are the Archs.

Canandaigua, N. Y.—The Lisk Mfg. Co. will erect a one-story, [illegible]-ft. reinforced-concrete addition to its factory. Leon Stern, Rochester, is the Arch.

Dunkirk, N. Y.—The Continental Heating Co. is having plans prepared for the erection of a plant in this city which will cost $3[illegible],000.

✦**Gloversville, N. Y.**—S. Sanford & Sons, manufacturer of carpets, has awarded a contract to JOHN J. TURNER & SONS for the erection of a one-story, 60x100-ft. addition to its plant. The estimated cost is $10,000.

Mt. Vernon, N. Y.—The Benford Mfg. Co. will build a $[illegible] factory on Pearl St. Sigmund A. Guttenburg is the Arch. Estimated cost, $[illegible],000.

Schenectady, N. Y.—The General Electric Co. has had plans prepared for the erection of three factories at its plant in this city. One story, 64x115 ft., one story, 40x90 ft., two stories, 14x220 ft. The estimated cost is $56,000.

✦**Syracuse, N. Y.**—The E. R. Caldwell & Son Brass Co. has let a contract to D. W. NICHOLSON, [illegible] Turtle St., for building a brick factory and machine shop. The contract price is $16[illegible].

✦**Dover, N. J.**—The LACKAWANNA STEEL CO., Buffalo, N. Y., has been awarded the contract for supplying the structural steel to be used in rebuilding the plant of the Richardson & Boynton Co.

✦**Jersey City, N. J.**—H. D. BEST & CO., 220 Fifth Ave., New York, N. Y., has been awarded the contract for erecting a reinforced-concrete abattoir and packing plant at the foot of Communipaw Ave. at $171,[illegible].

McKeesport, Penn.—Local press reports state that the McKeesport Tinplate Co. has prepared plans which will double the capacity of its plant. The new plans call for 20 mills. The estimated cost is $2,[illegible],000.

✦**Newark, N. J.**—Samuel Jones & Co. have awarded a contract to [illegible] KILLAM, 13 State St., Newark, for the construction of a one-story, [illegible]x130-ft. brick and reinforced-concrete factory. Estimated cost, $10,000.

✦The [illegible] Co., 138 Ferry St., has awarded a contract to A. H. CLARK & SONS, Newark, for building a two-story, [illegible]-ft. factory. The estimated cost is $16,000. Noted July 15.

Nicetown, Penn.—The George W. Hishon Co. will receive estimates on a [illegible]-story, [illegible]-ft. reinforced-concrete building. Ballinger & Perrot, 1211 Arch St., Philadelphia, Penn., are the Archs.

Philadelphia, Penn.—[illegible] & [illegible], Archs., [illegible] Walnut St., are preparing plans and specifications for a [illegible]-story reinforced-concrete factory, to be erected at Seventh and [illegible] Sts. for [illegible].

Philadelphia, Penn.—Bids will be received by the Fairmount [illegible] Mfg. Co., [illegible] Pearl St., for the erection of a [illegible]-story, [illegible]-ft. factory, to be erected at 38th St. and [illegible] Ave. [illegible], [illegible] Bldg., is the Arch.

✦**Philadelphia, Penn.**—[illegible] Lewis & [illegible] Co., Lafayette Bldg., has awarded to the [illegible] CONSTRUCTION CO., Bourse, [illegible] Bldg., [illegible], the contract for erecting a [illegible]-story, [illegible]-ft. factory. The estimated cost is $[illegible].

Pittsburgh, Penn.—[illegible] Co. is having plans prepared for the construction of a [illegible]-story fireproof warehouse to be erected at [illegible] and [illegible] Alley. The cost will be $[illegible]. Hunting & [illegible], Farmers Bank Bldg., Pittsburgh, are the Archs.

Wilkes-Barre, Penn.—The Lehigh & Wilkes-Barre Coal Co. is having plans prepared for erecting colliery shops which will cost $300,000. Sturdevant & Poggi, Coal Exchange Bldg., are the Archs.

✦**Newport, Del.**—The Krebs Pigment & Chemical Co. has let the contract for building its new factory to the BENJAMIN F. BENNET BUILDING CO., Baltimore, Md. The estimated cost is $3[illegible],000.

Baltimore, Md.—The United States Woolen Mills Co. is having plans prepared for the erection of a seven-story reinforced-concrete factory, to be located at 511 West Fayette St. The estimated cost is $150,000. Louis Levi, Baltimore, is the Arch. Noted July 23.

Cambridge, Md.—Plans have been completed by Arthur Towne, 708 Linwood Ave., Tuxedo Park, Baltimore, for the construction of a two-story, [illegible]0x1[illegible]0-ft. factory for the Phillips Can Co. The plant will have a daily capacity of 2[illegible]0,000 cans.

✦**Charlotte, N. C.**—The contract for constructing a four-story, 100x600-ft. brick warehouse, for the Mercantile Development Co., has been awarded to the TRAVERS-WOOD CO., Richmond, Va. The cost of the building will be $225,[illegible].

Cleveland, Ohio.—The Burns-Howe Baking Co. has had plans prepared by Lehman & Schmidt, Garfield Bldg., Cleveland, for an addition to its plant at 2919 Clinton Ave., to cost $12,000.

✦The contract for the construction of a three-story, 66x110-ft. brick, bottling works on Davenport St., for the Gund Brewing Co., has been awarded to the GEORGE B. McMILLAN CO., 1791 East 5[illegible]th St., Cleveland.

The Warren Refining Co., Cleveland, has had plans prepared by Ernest McGurge, for a three-story, [illegible]x107-ft. factory to be erected on West St.

✦**Columbus, Ohio**—The Columbus Die & Tool Works has awarded a contract for building a one- and two-story machine shop addition to its factory at [illegible]5 Cleveland Ave., to J. C. DAVISON, Columbus. The improvement will cost $25,000. Noted July 2.

East Cleveland, Ohio—The F. B. Stearns Co., manufacturer of automobiles, is having plans prepared for the erection of two factories. One will be four stories, 7[illegible]x1[illegible]7 ft.; the other a five-story, 70x155-ft. reinforced concrete structure. The estimated cost of the buildings is $20,000. Albert Kahn and E. Wilby, Trussed Concrete Bldg., Detroit, Mich., are the Engrs.

✦**Warren, Ohio**—The contract for the construction of a three-story, 150x300-ft. factory at Warren, for the Cleveland, Chicago, Car Roofing Co., has been awarded to JAMES L. STUART, 1008, New England Bldg., Cleveland.

Youngstown, Ohio.—The directors of the Fisher Fireproof Storage Co. have announced that plans are being prepared for a warehouse to be erected in the North Hill section. The estimated cost is $75,000.

Detroit, Mich.—Strand Bridge & Conners will build a two-story, 90x110-ft. factory to cost $[illegible]. F. E. Britherton, 2301 East Grand Blvd., is the Arch.

The Utility Power Co. will receive estimates until Oct. 1, for the construction of a four-story, 98x6[illegible]-ft. factory to cost about $300,000. Preston, Brown & Walker, 1932 Dime Bank Bldg., Detroit, are the Archs.

Detroit, Mich.—Dodge Bros., automobile manufacturers, will make additions to its plant which will cost $1,0[illegible]. An assembling plant and a punch press building are the additions to be erected. A. L. Means is the Secy.

Lansing, Mich.—D. H. Moore, Arch., 20[illegible] Tussing Block, is preparing plans for a three-story, 56x111-ft. factory for the Michigan Screw Co. Estimated cost, $10,[illegible]0.

Milwaukee, Wis.—Bids will be asked for constructing and equipping three machine shop buildings for the Milwaukee County House of Correction, at North Milwaukee, Wis. In addition, the plans call for 12 reinforced-concrete structures. The construction work will cost $[illegible]. Louis G. Wille is County Clerk. Leenhouts & Guthrie, Milwaukee, are the Archs.

✦**Sioux City, Iowa.**—The Blue Valley Creamery Co. has let a contract to C. R. HOUN, Second and Water Sts., Sioux City, for building a four-story, 76x150-ft. addition to its creamery. The contract price is $25,000.

Fargo, N. D.—The Ford Motor Co., Detroit, Mich., contemplates building an assembling and distributing plant in this city.

Great Falls, Mont.—It is reported that the Anaconda Copper Mining Co., Anaconda, Mont., will install a new copper refinery at Great Falls, Mont., to handle part of the copper now being shipped to Perth Amboy, N. J. The plant will have a capacity of about [illegible] lb. of copper per month and is estimated to cost about $[illegible].

✦**Great Falls, Mont.**—The contract for the erection of the factory for the Frasier [illegible] Mfg. Co. was awarded to HENRY [illegible]. It will be 2 stories and basement of brick and will be located near Tenth Ave. and Fifth St. The estimated cost is $[illegible].

✦**Miles City, Mont.**—The Eastern Montana Brewery Co. has awarded to C. H. WESTERN the contract for constructing its plant in this city. The successful bid was $[illegible]0.

St. Joseph, Mo.—The National Spring Wheel Co. will erect a plant for the manufacture of motor car wheels at an estimated cost of $[illegible].

St. Louis, Mo.—The Superior Oxygen Co. has purchased a site and will erect a factory on Plum St. The estimated cost is $[illegible].

Galveston, Tex.—The O. K. Laundry Co., [illegible]th and Post Office Sts., will erect a two-story addition to its laundry to cost $[illegible].

Tulsa, Okla.—Local press reports state that the city of Tulsa will build a soap factory to cost $30,000.

Tucson, Ariz.—J. J. Garfield, will build a commercial garage and machine shop on Sixth Ave. Estimated cost, $19,000. H. O. Jaasted, Tucson, is preparing plans.

Seattle, Wash.—Otto Wendland, 2222 Eighth Ave., will build a steam laundry at 714 Broad St., estimated to cost $15,000. Carl Siebrand, Arcade Bldg., Seattle, is the Arch.

Seattle, Wash.—The Pacific Coast Pipe Co., has completed plans for constructing a reinforced concrete and steel addition to its plant. The estimated cost is $40,000. L. M. Grant is the Engr.

The Dalles, Ore.—Libby, McNeil & Libby, Chicago, Ill., plan to erect a canning plant at an estimated cost of $75,000. Henry A. Ellis, Sacramento, Calif., is representative.

Los Angeles, Calif.—Norman F. Marsh, Broadway Central Bldg., has been commissioned to prepare plans for the factory and community buildings for the Nomel Co., at South Pasadena. Martin M. Kallman is Pres.

Brockville, Ont.—The James Smart Mfg. Co. will replace the building recently burned. It will be of reinforced concrete and cost about $15,000.

Toronto, Ont. — Duncan Chisholm, a Toronto capitalist, has obtained a concession to erect a pulp and paper mill at Smooth Rock Falls, on the Metagami River. The daily capacity will be 150 tons. The estimated cost is $1,750,000.

FEDERAL GOVERNMENT WORK

Concrete Coal Pockets—Fort Williams, Maine—Bids were received, July 29, by Capt. C. O. Zollars, Constructing Quartermaster, for concrete coal pockets at Fort Williams, as follows: (a) 60x90 ft., (b) 50x90 ft. Simpson Bros. Corporation, (a) $14,603, (b) $13,000, and on their own plans at $10,430; Forgione & Romano, Portland, Maine, (a) $13,722, (b) $12,922; Sanders Construction Co., Portland, Maine, (a) $14,624, (b) $13,624; Small & Ingalls, Bar Harbor, Maine, (a) $19,513, (b) $17,135; Mahoney Bros., Boston, Mass., (a) $16,150, (b) $14,103; W. H. Ellis & Son Co., Boston, Mass., (a) $17,975, (b) $16,475; F. H. Marshall, South Portland, Maine, (a) $15,414, (b) $12,845; Guarantee Construction Co., New York, (a) $22,480, (b) $19,980.

Lighting Fixtures—Boston, Mass.—Bids will be received until 3 p.m., Aug. 21, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for furnishing and installing lighting fixtures in the U. S. custom house at Boston, Mass.

Buoy Service—Buffalo, N. Y.—Bids will be received until 2 p.m., Aug. 10, by the Light House Inspector, Buffalo, N. Y., for attendance, removal and replacing of all U. S. buoys in the St. Lawrence River and Lake Ontario from Aug. 15, 1914, to June 30, 1915.

Post Office—Port Jervis, N. Y.—Bids will be received until 3 p.m., Sept. 14, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete of the U. S. post office at Port Jervis, N. Y. It will be a one-story mezzanine and basement building, ground area 4800 sq.ft.; first floor fireproof; stone and brick facing with ornamental terra cotta cornice, etc.

+Post Office—Orange, N. J.—The contract for the construction of a post office at Orange has been awarded to JOSEPH DI BENEDETTO, 423 East 115th St., New York, N. Y., at $81,949. Noted July 16.

★Cables, Conduits, Manholes, Etc.—Washington, D. C.—Bids will be received until 2 p.m., Aug. 25, by the Secy., Dept. of the Interior, Washington, D. C., for installing cables, conduits, manholes, switches, circuit breakers, etc., and connecting same ready for use in F St. Northwest and in the old Post Office and Pension Office buildings, Washington, D. C.

★Pavements, Conduits, Manholes, Etc.—Washington, D. C.—Bids will be received until 2 p.m., Aug. 18, by the Secy., Dept. of the Interior, Washington, D. C., for the construction of cement pavements, conduits and manholes in the Seventh St. and G St. basement corridors of the Patent Office Building.

Switchboard—Washington Barracks, D. C.—Bids were received by Lieut. Col. Joseph E. Kuhn, Corps Engrs., U. S. A., for furnishing one direct current 16 panel switchboard as follows: General Electric Co., Schenectady, N. Y., $4419, Westinghouse Electric Co., Washington, D. C., $5772 and $5802, Walker Electric Co., Philadelphia, Penn., $3875, $4030, $4125, $4280, $3945, $4100, $4195 and $4350; F. Bissell Co., Toledo, Ohio, $4800, $5580 and $4965; Elliott Lewis Electric Co., Inc., Philadelphia, Penn., 5930; Taunton New Bedford Copper Co., New Bedford, Mass., $4355, $4715 and $4235; H. Krantz Mfg. Co., Brooklyn, N. Y., $3900; Albert and J. M. Anderson Mfg. Co., Boston, Mass., $4855; Le Baron B. Johnson 316 West 42nd St., New York, $5854 and $5399; Frank Adam Electric Co., St. Louis, Mo., $4245, $4538 and $5301, Pringle Electric Mfg. Co., Philadelphia, Penn., $5348 and $5016. Noted July 9.

+Boiler House—Fort Monroe, Va.—Contracts for the construction of a boiler house, etc., at Fort Monroe have been awarded as follows: Constructing boiler house and taking down old boiler house, etc., to ALEXANDER WESTON, Hampton, Va., at $3790, boilers, pumps, new heating system, etc., to W. G. MORRIS, Phœbus, Va., at $9820.

★Cement—Montgomery, Ala.—Bids will be received until Aug. 31, by Maj. Earl I. Brown, Corps Engrs., U. S. A., 910 Bell Bldg., Montgomery, for furnishing and delivering about 20,000 bbl. of American portland cement.

Post Office—Cookeville, Tenn. — Bids were received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., July 30, for construction of a post office at Cookeville, (a) limestone; (b) sandstone: William H. Fissell, New York, N. Y., (a) $72,200; (b) $73,000. Ragland-Baxter-Morford Co., Nashville, Tenn., (a) $73,970; (b) $74,470. James Devault, Canton, Ohio, (a) $76,500; (b) $77,900. Westchester Engineering Co., White Plains, N. Y., (a) $78,432; (b) $78,832. George W. Stiles Construction Co., Chicago, Ill., (a) $79,200; (b) $80,000. George Becking, Chattanooga, Tenn., (a) $79,241; (b) $80,241. N. H. Shields, Danville, Ill., (a) $79,660. M. Yeager & Co., Danville, Ill., (a) $79,923; (b) $81,423. J. S. Rogers Co., Moorestown, N. J., (a) $84,600; (b) $85,200. Christ Kanzler & Son, Evansville, Ind., (a) $84,911; (b) $85,400. Wise Granite & Construction Co., Richmond, Va., (a) $87,500; (b) $88,400. Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $87,517; (b) $88,117. The building will be three-story and basement, ground area, 5000 sq.ft., first floor fireproof, stone, ornamental terra cotta and brick facing, composition and slate roof. Noted June 25.

★+Drilling for Foundation—Nashville, Tenn.—The contract for drilling for subsurface investigation of foundations at Dam Sites, Nos. 2 and 3, Muscle Shoals, Tennessee River, has been awarded to SPRAGUE & HENWOOD, INC., Scranton, Penn., at $40,430. Noted July 30.

Post Office—Three Rivers, Mich.—Bids were received as follows by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Three Rivers, (a) limestone; (b) sandstone: A. W. Lane, Chicago, Ill., (a) $42,104; (b) $45,329. C. W. Hoertz & Son, Grand Rapids, Mich., (a) $44,449; (b) $44,800. J. S. Rogers & Co., Moorestown, N. J., (a) $47,500; (b) $47,840. Ralph F. Reed, Three Rivers, Mich., (a) $47,200; (b) $47,675. Thomas W. Cissell, Wooster, Ohio, (a) $50,000; (b) $51,000. General Construction Co., Milwaukee, Wis., (a) $44,760; (b) $45,159. It will be a two-story and basement building, stone and brick facing, 4000 sq.ft., ground area, fireproof first floor, composition roof. Noted June 25.

+Breakwater—Calumet River, Ill.—The contract for repairing with timber, superstructure of the breakwater at Calumet River, has been awarded to the GREAT LAKES DREDGE & DOCK CO., Chicago, Ill., at $29,132. Noted July 23.

+Stone—Milwaukee, Wis.—The contract for furnishing and delivering 3600 tons of stone riprap at White Shoal light station, Lake Michigan, has been awarded to T. L. DUROCHER, Sault Ste. Marie, at $5400. Noted July 23.

Lighting Fixtures—Minneapolis, Minn.—Bids will be received until 3 p.m., Aug. 21, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for furnishing and installing lighting fixtures in the U. S. post office at Minneapolis, Minn.

Post Office—Garden City, Kan.—Bids were received as follows, July 28, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Garden City, (a) limestone; (b) sandstone: Dieter & Wenzel Construction Co., Wichita, Kan., (a) $51,358; (b) $52,300. George A. Shaul, Seneca, Kan., (a) $51,365. Frank H. Latimer & Co., Kansas City, Mo., (a) $53,847. Hiram Lloyd Building and Construction Co., St. Louis, Mo., (a) $54,763; (b) $55,763. The building will be one-story and basement, ground area, 3800 sq.ft., first floor fireproof, stone and brick facing, with ornamental terra cotta cornices, and composition roof. Noted June 25.

★Highway Bridge—Jackson, Wyo.—Bids were received July 22, by F. H. Newell, Dir., U. S. Reclamation Service, Boise, for constructing a highway bridge, consisting of three 130-ft. steel truss spans and wooden trestle approaches, across the south fork of the Snake River, near Jackson, Wyo., as follows: (a) Jackson site, (b) Gros Ventre site, (1) total for regular schedules, (2) total for alternates—Omaha Structural Steel Works, Omaha, Neb., (1) (a) $35,778, (2) (a) $26,997, (b) $26,765; Central States Bridge Co., Indianapolis, Ind., (1) (a) $9711 for schedule No. 1 only, (1) (b) $9082 for schedule No. 1 only; Security Bridge Co., Billings, Mont., (1) (a) $36,115, (2) (a) $28,039, (1) (b) $29,189; Midland Bridge Co., Kansas City, Mo., (1) (a) $39,646, (2) (a) $28,056, (1) (b) $30,930; Minneapolis Steel & Machinery Co., Salt Lake City, Utah, (1) (a) $9163 for schedule No. 1 only, (b) $8478 for schedule No. 1 only. Noted June 25.

+Water and Sewer System—El Paso, Tex.—The quartermaster general has awarded the contract for a water and sewer system on government property at El Paso, to MAYFIELD & SHAW, at $15,160.

Stone—Galveston, Tex.—Bids will be received until noon, Aug. 15, by Lieut. Col. C. S. Riche, Corps Engrs., U. S. A., for placing riprap and soil with sod at federal quarantine station, Galveston, Tex.

Lighting Fixtures—Muskogee, Okla.—Bids will be received until 3 p.m., Aug. 21, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for furnishing and installing lighting fixtures in the U. S. courthouse and post office at Muskogee, Okla.

+Earthwork—Denver, Colo.—The contract for constructing the Selig Canal on the Uncompahgre Irrigation Project, has been awarded to MAURICE A. WOGAN, Denver, Colo., at $26,956. The work involves the excavation of about 144,000 cu.yd. of material.

+Post Office—Greeley, Colo.—The contract for the construction of a post office at Greeley has been awarded to J. H. WEISE, Omaha, Neb., at $99,315. Noted July 9.

Canal—Montrose, Colo.—Bids will be received until 4 p.m., Aug. 13, by Fred D. Pyle, Project Mgr., U. S. Reclamation Service, Montrose, Colo., for constructing the Cade Lateral, Laterals, Nos. 1 and 2 and the Garnet Mesa lateral of the Cade and the Union lateral, of the East Canal system, Uncompahgre Valley project, in the vicinity of Delta, Colo. This work involves the excavation of about 148,400 cu.yd. of material in open cut.

+Road Work—Fort Huachuca, Ariz.—The contract for road work at Fort Huachuca, has been awarded to R. C. SPARKS and J. H. FRITZ, Tucson, Ariz., at $9780.

+Road—Fort Stevens, Ore.—The contract for constructing roads and walks at Fort Stevens, Ore., has been awarded to OLAF BOREN, at $8200.

★Generator—Los Angeles, Calif.—Bids were received July 14, by F. H. Newell, Dir., U. S. Reclamation Service, Los Angeles, Calif., for furnishing one vertical alternating current generator for the Roosevelt Power plant, Salt River project, Ariz., as follows: General Electric Co., Schenectady, N. Y., $21,694; Westinghouse Electric & Mfg. Co., Los Angeles, Calif., $24,000, and $22,820; Allis Chalmers Co., Milwaukee, Wis., $23,160. Noted June 11.

Head Turbine—Los Angeles, Calif.—Bids were received July 11 by F. H. Newell, Dir. U. S. Reclamation Service, for furnishing a variable head turbine for the Salt River project, Arizona, as follows: (a) one variable head turbine with governor and synchronous by-pass, (b) one variable head turner with governor, synchronous by-pass and butterfly valve. S. Morgan Smith Co., York, Penn., (a) $18,185, (b) $2[illegible]; Pelton Water Wheel Co., San Francisco, Calif., (a) $26,060, (b) $2[illegible]. Noted June 11.

Lighting Fixtures—San Francisco, Calif.—Bids will be received until 3 p.m., Aug. 21, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for furnishing and installing lighting fixtures in the U. S. subtreasury at San Francisco.

Shell Hoists, Powder Hoists, etc.—Panama—Bids will be received until 10.30 a.m., Aug. 17, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Washington, D. C., for furnishing shell hoists, powder hoists, shell tables, motor driven pumps, and front switches for fortifications at Panama.

Building—San Juan, Porto Rico—Bids will be received until 2 p.m., Aug. 31, by the Lighthouse Inspector, San Juan, for furnishing and erecting three iron substructures on concrete piles, San Juan Harbor.

MISCELLANEOUS

Tunnel—Boston, Mass.—(Official)—Bids will be received until noon, Aug. 13, by the Boston Transit Commission for constructing Section D of the Dorchester Tunnel. The section is located in Dewey Sq. and Summer St., and will be 800 ft. long. For details see advertisement under "Contracts to be Let."

Dredging—Boston, Mass.—Bids were received July 28, by the State Harbor and Land Commissioners, Boston, for dredging at Cataumet Harbor and Squeteague Pond, about 100,000 cu.yd. The bids follow: J. S. Packard Dredging Co., Providence, R. I., Item (1), 34.29c. per cu.yd., Item (2), $9, Item (3), 26c.; Bay State Dredging Co., (1) 35.5c., (2) $9, (3) no bid; John R. Burke, (1) 26[illegible]c., (2) $10, (3) no bid; Eastern Dredging Co., (1) 37c., (2) $10, (3) 37c.

Elevators—Boston, Mass.—The State House Extension Committee has received bids for installing elevators. The lowest bid was submitted by the Portland Co., at $33,700.

✦Fire Apparatus—Boston, Mass.—The city has awarded contracts for fire apparatus as follows: To the ROBINSON FIRE APPARATUS CO., St. Louis, Mo., for one pumping engine, two tractors and one 65-ft. ladder truck, at $23,750; to the SEAGRAVE CO., Columbus, Ohio, for one aërial truck, at $11,[illegible]; to the AMERICAN & BRITISH MFG. CO., Providence, R. I., for a tractor and a deck gun, at $5600. John Grady is Fire Comr.

Park Work—Fall River, Mass.—A. A. Allen, Fall River, has submitted the lowest bid to the city for improving Lafayette Park, at $2[illegible].

✦Comfort Station—Bridgeport, Conn.—The city has awarded the contract to A. W. BLYCHER, 11 Davidson St., Bridgeport, for the construction of a comfort station at Beardsley Park. Noted Apr. 23.

Barge Canal Work—Albany, N. Y.—Bids were received June 2[illegible] by Duncan W. Peck, State Supt. Pub. Wks., Albany, for steel sheet piling, etc. (Contract No. 19), at the movable dam at Rotterdam, N. Y., and reinforcing the superstructure (Contract No. 12[illegible]) of the movable dams at Rotterdam, Cranesville, Amsterdam, Tribes Hill, Yosts, Canajoharie and Fort Plain, N. Y. The bids follow: Contract No. 119: Holler & Shepard, Rochester, N. Y., $58,073; Frank M. Skene, Brockport, N. Y., $82,212; Walsh Construction Co., Davenport, Iowa, $[illegible]; Lupfer & Remick, Buffalo, N. Y., $68,471; John M. Rogers, Tonawanda, N. Y., $70,610. Contract No. 120: Whitehead-Kales Iron Works, Detroit, Mich., $262,971; Lupfer & Remick, $[illegible]; Fort Pitt Bridge Works, New York, N. Y., $257,991; [illegible] Bridge Co., Beaver Falls, Penn., $268,926.

✦Dike—Binghamton, N. Y.—The Board of Contract and Supply has awarded contracts for the First Ward Dike as follows: Section 1 to H. W. FITZGERALD, Rochester, N. Y.; Section 2 to BARRELLY & INGERSOLL, Rochester. Estimated cost, [illegible]. Noted June 25.

Repairs to Pier—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until noon, Aug. 11, by the Department of Docks and Ferries for repairs to the pier at East [illegible]th St., Harlem River, Manhattan.

Subway—(Special Work)—New York, N. Y.—(Borough of [illegible])—(Official)—Bids will be received until 11 [illegible] p.m., by the Public Service Commission, 154 Nassau St., Manhattan, for special work on portions of the Broadway-Fourth Ave. rapid transit railroad, Brooklyn.

Street Signs—New York, N. Y.—(Borough of Manhattan)—[illegible]—Bids will be received until [illegible] p.m., Aug. [illegible], by George M. [illegible], Pres. Borough of Manhattan, for [illegible] street signs [illegible] frames and ornamental section to be of [illegible] with [illegible] of rolled steel [illegible] section and stamp to be of [illegible].

✦Subway—[illegible]

✦Subway—New York, N. Y.—(Borough of Manhattan)—[illegible]

Subway—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until Aug. 21, by the Public Service Commission, 154 Nassau St., Borough of Manhattan, for constructing Sect. No. 3 of Route 32, a part of the Broadway-Fourth Ave. and Seventh Ave.-Lexington Ave. rapid transit railroads. This section is a two-track railroad in the Borough of Brooklyn, with two branches, one branch connecting the Whitehall-Montague St. tunnel with the Fourth Ave. subway in Flatbush Ave. extension at Prince St.; the other connecting the Old Slip-Clark St. tunnel with the existing subway at Fulton and Willoughby Sts.

✦Fireproof Stairways—Poughkeepsie, N. Y.—(Official)—Bids will be received until 3 p.m., Aug. 10, by the State Hospital Commission, Albany, for fireproof stairways for Edgewood Building at the Hudson River State Hospital, Poughkeepsie. J. H. R. Hanify is Secy. Comn.

Dams, River Work—Rochester, N. Y.—Bids will be received until 11 a.m., Aug. 12, by F. X. Piper, Secy. Bd. Contract and Supply, for constructing movable dams and deepening the Genessee River.

Laundry Equipment—Rochester, N. Y.—(Official)—See item under "Sewers."

Bulkhead and Jetty—Stone Harbor, N. J.—The Borough Council plans to construct a bulkhead and jetty. Estimated cost, $65,000.

Park Work—Trenton, N. J.—The City Commission, July 29, rejected all bids for work in the city's section of Mahlon Stacy Park. New bids will be asked. Estimated cost, $20,000. J. R. Fell, Jr., is City Engr. Noted July 30.

✦Park Work—Chester, Penn.—The city has awarded the contract to JOHN HANNA & SONS, Chester, for park work at the Alfred O. Deshong Memorial Park, at about $22,[illegible]. The work calls for excavation at the lake, a concrete bridge and walks and drives.

✦Fountain—Pittsburgh, Penn.—The city has awarded the contract to VICTOR D. BRENNER, New York, for the proposed fountain to be erected to the memory of Mrs. Mary E. Schenley at the entrance to Schenley Park, at $5[illegible].

Elimination of Grade Crossing—Scranton, Penn.—The county, in conjunction with the Delaware & Hudson Co. and the Erie R.R. Co., plans to eliminate the grade-crossing at Turkey-Hill, Simpson Borough, by constructing a viaduct. Estimated cost, $68,000.

Pier—Rehoboth Beach, Del.—Robert Hinckley, Washington, D. C., is considering the construction of a pier at Rehoboth Beach, to cost $50,000.

Canals—Cambridge, Md.—Bids will be received by the Dorchester County Commissioners, Cambridge, for constructing several canals. Estimated cost, $60,000.

Ditches—Indianola, Miss.—Bids will be received until 2.30 p.m., Aug. 18, by the Drainage Commissioners of Sunflower County, Indianola, for nine miles of open ditches, calling for 275,000 cu.yd. of excavation. H. Lee Herring, Ruleville, Miss., is Atty. for the district.

Wire and Cable—New Orleans, La.—Bids will be received until Aug. 30 by the Sewerage and Water Board for Contract 64 D, which calls for furnishing wire and cable. This is an extension of time from July 30. George G. Earl is Gen. Supt. Bd.

✦✦Dredging—New Orleans, La.—(Official)—Bids were received, July 20, by the Commissioners of the Port of New Orleans, for dredging in the Mississippi River, filling and clearing site for cotton warehouses and terminal facilities between the Mississippi River and Leake Ave. and between Napoleon Ave. and Soulat St. The contract has been awarded to the LOUISIANA CONTRACTING CO., 612 Roumain Bldg., New Orleans, at about $15[illegible]. The work calls for 2,[illegible] cu.yd. of filling and 90 acres of clearing. O. O. Ogden, Treas.-Gen. Mgr. of the company, is in charge of the proposed work.

✦Levee—New Orleans, La.—The State Board of Engineers, New Orleans, has awarded the contract to GIBSON BROS., New Orleans, for constructing the Poydras-Goodwill Levee, at 18.3c. per cu.yd. The work calls for [illegible] cu.yd.

Canal and Road—St. Bernard, La.—The Police Jury has rejected the bid of Doullut & Williams, at $6,0[illegible], for constructing a navigable canal to connect Bayou Terre-aux-Boeuf and Lake Borgne, and for a shell road parallel to the canal. This firm was sole bidder. New bids will be asked.

Ditches—Henderson, Ky.—The Drainage Commissioners, Henderson, have decided to issue bonds for the purpose of constructing Double Dam Ditch and Swan Pond Ditch.

Stockyards—Louisville, Ky.—The Bourbon Stock Yards, recently damaged by fire, will be rebuilt of reinforced concrete. The estimated cost is $[illegible]. D. X. Murphy & Bro. are the Archs.

✦Barges—Paducah, Ky.—The Paducah & [illegible] R.R. has awarded the contract to the [illegible] KENTUCKY [illegible] Co., Paducah, for constructing six barges at about $[illegible].

Freight Terminal—Cleveland, Ohio—Plans have been prepared for a freight terminal to be erected at [illegible] Ave. and East Sixth St. for the New York, Chicago & St. Louis Ry. The estimated cost is $[illegible].

Excavation, etc.—Cleveland, Ohio—(Official)—Bids will be received until [illegible], Aug. 11, by A. B. [illegible], for furnishing [illegible] for excavating, transporting and disposing of all material necessary to prepare the present site for the construction of the proposed [illegible] sewage treatment works [illegible] No. 2. The approximate quantities follow: [illegible] [illegible] lin.ft. of [illegible] surface drain, furnishing and placing [illegible] lin.ft. of 6 to 12-in. [illegible] [illegible] cu.yd. of excavation, transportation and disposal of material, [illegible] tons of stone riprap.

Park Building—Columbus, Ohio—Bids will be received until [illegible], Aug. 2[illegible], by the Board of Commissioners of Franklin Park, for constructing a shelter and recreation building in Franklin Park. [illegible] is Secy. Estimated cost, $25,[illegible]. Noted July 16.

River Improvement—Dayton, Ohio—(Official)—The city will make river improvements in the fall, requiring about 1,200,000 yd. of earthwork.

Fire Apparatus—Tiffin, Ohio—The city plans to purchase motor-driven fire apparatus. Albert J. Hafley is Clk. of Council.

Ditch—Gary, Ind.—Bids will be received until Sept. 18 by the county for constructing the Burns Ditch. Estimated cost, $300,000. Guy Stinchfield, Valparaiso, Ind., is Engr.

Park—Gary, Ind.—The plans of Herbert Erickson, Arch., Gary, for a park at Fourth Ave. and Jackson St. have been accepted by the Board of Public Works. Estimated cost, $25,000.

Mausoleum—Richmond, Ind.—W. W. Zimmerman, Richmond, plans to construct a mausoleum in Earlham Cemetery. Estimated cost, $70,000.

+Ditch—Rochester, Ind.—The County Commissioners have awarded the contract to A. A. GAST & SON, Akron, Ohio, for constructing Clevenger Ditch, at about $10,000. Bids were opened July 7. Noted July 2.

Levee and Ditches—Terre Haute, Ind.—Bids will be received until 3 p.m., Aug. 7, by Greenfield Bayou Levee Association, Terre Haute, for 16 sections of levee and four sections of ditches.

+Levee Work—Jacksonville, Ill.—Bids were received, July 29, by the Commissioners of Meredosia Lake Drainage and Levee District, at the office of the Jacksonville Engineering Co., Jacksonville, for constructing about 174,433 cu.yd of levee and 1500 cu.yd of ditches. The contract has been awarded to the ESSEX CONSTRUCTION CO., 279 Hughes Ave., Buffalo, N. Y., at $22,590.

Natatorium—Milwaukee, Wis.—Bids will be received until Aug. 17 by the Department of Public Works for constructing a natatorium at Huron and Jackson Sts. Estimated cost, $100,000.

+Ditch—Adel, Iowa—The county has awarded the contract to W. G. BIRDSALL, Perry, Iowa, for constructing Ditch No. 30, at $11,142. Bids were opened July 7. Charles E. Wilson, Perry, is Engr.

+Ditch Work—Onawa, Iowa—The county has awarded the contract to the MULGREW-BOYCE CO., Dubuque, Iowa, for eight miles of ditches and laterals, at 12½c. per cu.yd.

Drainage—Forest City, Iowa—Bids will be received until 11 a.m., Aug. 7, by C. K. Nelson, County Audr., Forest City, for work in Drainage District No. 5, calling for 164,320 cu.yd. excavation, 110,269 ft. of tile and 21 bulkheads.

+Ditch—Blue Earth, Minn.—The county has awarded the contract to the ELMORE CEMENT & TILE CO., Elmore, Minn., for constructing Ditch No. 22, at $11,288. Noted June 18.

Stable—Duluth, Minn.—P. M. Olson, Arch., Sellwood Bldg., Duluth, is preparing plans for a stable to be constructed at Duluth for Barrett & Zimmerman, 1933 West University Ave., St. Paul. Estimated cost, $10,000.

Ditch—Duluth, Minn.—E. K. Coe, County Road Engr., Duluth, has estimated the cost of constructing Ditch No. 3 at $185,000.

Park—St. Charles, Mo.—The citizens have voted in favor of issuing $90,000 in bonds for a public park.

Dam—Marble Falls, Tex.—The city plans to construct a dam across the Colorado River, to cost $75,000.

Fire Alarm System—Port Arthur, Tex.—The citizens have voted in favor of issuing $10,000 in bonds for the installation of a fire alarm system.

+Skating Rink—Seattle, Wash.—The Seattle Arena Co., Inc., has awarded the contract to the FRANKLIN ENGINEERING CO., Hoge Bldg., Seattle, for constructing an ice skating rink at $60,000.

+Shed—Tacoma, Wash.—The Oregon-Washington R.R. & Navigation Co. has awarded the contract to O. F. LARSON, Tacoma, for constructing a one-story freight shed at Tacoma, at $50,000.

+Docks—Portland, Ore.—The contract for the construction of two docks for B. M. Lombard, each 400x120 ft., has been awarded to the ELLIOTT CONSTRUCTION CO., at about $140,000.

Cement—Portland, Ore.—Bids are being received by the City Purchasing Agent for 8000 bbl. of portland cement. John R. Hanson is City Engr.

Stockyards—Portland, Ore.—The Portland Union Stockyards Co. plans to enlarge its yards at Portland. Estimated cost, $50,000.

+Pipe Line—Bakersfield, Calif.—The Valley Pipe Line Co. has awarded the contract to the LLEWELLYN IRON WORKS, Los Angeles, for constructing a pipe line through the Coalinga and Midway oil fields, at about $70,000.

Harbor Improvement—Berkeley, Calif.—An election will be held Sept. 12 to vote on the proposition to issue $500,00 in bonds for harbor improvements.

Oil Tanks — Chico, Calif. — The Associated Oil Co. plans to install an oil-distributing station, to cost $12,000. G. Sheridan, Wells Fargo Bldg., San Francisco, Calif., is Secy.

+Pier and Wharf—Oakland, Calif.—The San Francisco-Oakland Terminal Rys. has awarded a contract at about $475,000 for the construction of a trestle mole and wharves to the SAN FRANCISCO BRIDGE CO., San Francisco, Calif., at the following prices: Creosoted piles, 52.33c. per lin.ft.; untreated lumber, $28.18 per M. ft.; creosoted timber, $61.12 per M. ft.

Oil Tanks—Richmond, Calif.—The Standard Oil Co. plans to construct 16 oil-storage tanks, at an estimated cost of $320,000.

Riprap—Sacramento, Calif.—The State Engineering Advisory Board will shortly call for bids for riprap work on the San Joaquin River, near Stockton, to cost about $34,700. Austin B. Fletcher is State Engr.

+Barges—San Francisco, Calif.—Henry Peterson has awarded a contract for the construction of seven barges to the UNION IRON WORKS, San Francisco, at $87,000.

+Civic Center Work—San Francisco, Calif.—The city has awarded the contract to T. W. McCLENAHAN, San Francisco, for improving the plaza in the civic center, at $54,860.

+Canal Work—Montreal, Que.—The Department of Public Works, Ottawa, has awarded the contract to the GENERAL IMPROVEMENT & CONSTRUCTION CO., Montreal, Que., for dredging in connection with protection works at the upper entrance of the Soulanges Canal.

+Wall—Burlington, Ont.—The Department of Public Works, Ottawa, Ont., has awarded the contract to D. G. STEWART, Ottawa, for constructing the revetment wall at Burlington, at about $90,000.

Canal—Ottawa, Ont.—Bids will be received by L. K. Jones, Asst. Deputy Minister and Secy. Dept. Rys. and Canals, Ottawa, until Aug. 17, for constructing the Bobcaygeon Section of the Trent Canal.

+Canal Work—Thorold, Ont.—The Department of Railways and Canals, Ottawa, Ont., has awarded the contract to A. T. BRADLEY, St. Catherines, Ont., and DAVID WALKER, Thorold, for stone protection necessary on the summit levee of the Welland Canal between Thorold and Port Colborne, Ont.

Coal- and Ash-Handling Plant—Winnipeg, Man.—Bids will be received until noon, Aug. 10, by C. H. Dancer, Deputy Minister Pub. Wks., Ottawa, Ont., for a mechanical coal- and ash-handling plant at the central power house at Winnipeg.

+Dredging—Vancouver, B. C.—The Department of Public Works, Ottawa, Ont., has awarded the contract to the BRITISH COLUMBIA GRANITOID & CONSTRUCTION CO., Vancouver, for dredging in connection with the proposed wharves and docks to be built at Vancouver.

BUILDINGS

+Bangor, Maine—The contract for erecting the three-story concrete, brick, granite and steel building on Harlow St., for Charles W. Morse, has been awarded to CYR BROS., Waterville, at $75,000.

+Boston, Mass.—The contract for the construction of the business block at 1126 Boylston St. has been awarded to the BOYLSTON CONSTRUCTION CO., at about $125,000. The building will be of brick and stone seven stories, 87x90 ft. T. J. Reardon, 85 Commonwealth Ave., is owner.

Springfield, Mass.—B. H. Seabury, Besse Bldg., has prepared plans for a four- and five-story brick and stone apartment on Pearl St.

+Pawtucket, R. I.—The contract for constructing the 12-room school in the Darlington Section has been awarded to the FRANK E. ROWLEY CO., Pawtucket, at $64,675. Noted July 23.

Providence, R. I.—The National Realty Trust will build a theater at Worcester and Clemence Sts., to cost about $40,000. H. Williams is Mgr.

Bridgeport, Conn.—The Bridgeport Trust Co. has awarded the general contract for constructing the bank on State St. to the T. J. STEIN CO., 30 Church St., New York, N. Y., at about $75,000. The structure will be 40x100 ft. of brick, marble and granite. G. A. Freeman, 311 Madison Ave., New York, N. Y., is the Arch.

Bids will be received by Henry A. Bishop, Pres., Brooklawn County Club for constructing a stone and wood clubhouse, 100x100 ft. estimated to cost $60,000. F. Burrall Hoffman, 15 East 40th St., New York, N. Y., is the Arch. Noted Feb. 5 and June 25.

East Hartford, Conn.—Bids will be received until Aug. 20, by the Board of Education for a two-story brick school, 65x80 ft. A. R. Sharpe, 762 Main St., Willimantic, Conn., is the Arch.

Hartford, Conn.—Bids will be received about Aug. 15 for rebuilding the railroad station of the New York, New Haven & Hartford R.R. Co., at Asylum St. and Union Place. It will be of brick, brownstone and reinforced concrete, one and three stories, and is estimated to cost $220,000.

+Stamford, Conn.—The following bids were received for the construction of a school on Adams Ave.: Barzaghi Co., $66,458; O'Connor Concrete Construction Co., $64,950; Genovese Bros., $59,936; Harris Construction Co., $58,800; Spelke Construction Co., $57,900; VUONO CONSTRUCTION CO., $56,-640 (awarded contract). Noted July 16.

Chatham, N. Y.—The city has voted to build a high school to cost $75,000.

Dunkirk, N. Y.—It is reported that bids will be received until Aug. 8 by the Board of Education for constructing a school in the Fourth Ward, estimated to cost $10,000.

Ithaca, N. Y.—Day & Klauder, 925 Chestnut St., Philadelphia, Penn., are preparing plans for two 2-story dormitories for Cornell University.

New York, N. Y.—(Borough of Richmond)—Bids will be received by the President of the Borough until Aug. 25, for the general construction of a courthouse at St. George.

+Elizabeth, N. J.—The contract for building the school in Ripley Place has been awarded to JOHN H. LOWRY, JR., New York, N. Y., at $45,928.

+Merchantville, N. J.—The contract for altering the school building has been awarded to GEORGE W. SHANER, Palmyra, N. J., at about $40,000. H. A. Macomb, Philadelphia, Penn., prepared the plans.

Morristown, N. J.—The citizens have voted to spend $68,-000 for the construction of a high school at Early St. and Altho Ave.

+Morristown, N. J.—The contract for erecting the parish house for St. Peter's Episcopal Church has been awarded to ANDREW J. ROBINSON CO., New York, N. Y., at about $100,000.

+Roebling, N. J.—The contract for constructing the new school has been awarded by the Florence Township Board of the BERRY-GOODWIN CO., Philadelphia, Penn., at $60,950. Klemann & Fowler, Trenton, N. J., are the Archs.

West Hoboken, N. J.—The Kelly Construction Co., Yonkers, N. Y., submitted the lowest bid for the construction of a high school at $192,328. Noted July 23.

Bellevue, Penn.—Bids will be received by James W Graham, Sec'y School Bd., until 8 p.m. Aug 18, for the construction of a high school on Lincoln Ave. W J Shaw, Fulton Bldg., Pittsburgh, Penn., is Arch

McClellandtown, Penn.—Andrew P Cooper, Uniontown, has been commissioned to prepare plans for the German Township high school. The building will be two stories, of brick, terra cotta and stone, and is estimated to cost $65,000

✚**Oil City, Penn.**—The contract for building the three-story brick and stone building for the United Natural Gas Co., on Seneca St., has been awarded to the WESTERN BUILDING CO., Buffalo, N Y, at about $77,000

Philadelphia, Penn.—Bids will be received by J. Horace Cook, Supt of School Bldgs., until Aug 14, for the construction of the South Philadelphia High School for girls at Broad and Jackson Sts. The estimated cost is $900,000.

Philadelphia, Penn.—Bids will soon be called for by the Board of Education for erecting the Frankford High School in the northeast Section, at an estimated cost of $650,000.

✚**Pittsburgh, Penn.**—It is reported that the contract for erecting the six-story steel frame and terra cotta fireproof clubhouse for the Loyal Order of Moose has been awarded to WILLIAM MILLER & SONS CONSTRUCTION CO., 530 Fernando St., at $116,766

✚The contract has been awarded to the HERNDON-HETTRICK ENGINEERING CO., 1702 Empire Bldg., Birmingham, for erecting the four-story reinforced-concrete Walker Building, at First Ave and 21st St., to be occupied by the Railway, Light & Power Co. The estimated cost is $75,000. William C Weston, Birmingham, is the Arch

✚**State College, Penn.**—The contract for building the three-story brick and limestone chemistry building for State College has been awarded by the Board of Trustees to JACOB MYERS SONS CO., Witherspoon Bldg., Philadelphia. Day & Klauder prepared the plans

✚**Wilmington, Del.**—(Official)—Bids will be received by the New Castle County Building Commission and the Wilmington Building Commission, until 11 a.m., Aug 11, for the concrete work in the construction and completion of the county building for New Castle county and of the municipal building for the city, at French and Tenth Sts. Thomas F Gormley is Sec'y

✚**Columbus, Ga.**—The contract for the construction of a $65,000 hospital for the city has been awarded to the SOUTHERN FERRO-CONCRETE CO., Atlanta, Ga

Clarksdale, Miss.—Charles O Pfiel, Memphis, Tenn., is preparing plans for a five-story office building on Delta Ave., to cost $100,000

Greenville, Miss.—Plans are being prepared by Mahan & Broadwell, Memphis, Tenn., for a four-story reinforced-concrete department store and office building, to be erected by Charles Hafter. The estimated cost is $60,000

CONTRACT PRICE

✚**Rapid Transit System**—New York, N Y—Bids were received July 31 by the Public Service Commission for constructing Section 5, Routes 4 and 36 of the Broadway-Fourth Ave. subway, from (A) DEGNON CONTRACTING CO. (awarded contract), 60 Wall St., New York; (B) Oscar Daniels Co., Woolworth Bldg., New York; (C) Holbrook, Cabot & Rollins Corporation, 331 Madison Ave., New York; (D) United States Realty & Improvement Co., 111 Broadway, New York; (E) Smith, Hauser & McIsaac, Inc., 18 East 41st St., New York. The unit bids were as follows:

Mount Sterling, Ky.—H Clay McKee will build a six-story hotel at an estimated cost of $75,000.

✚**Cincinnati, Ohio**—The contract for the construction of additions and remodeling the Little Sisters of the Poor Home, on Florence Ave., has been awarded to LAWRENCE J CASEY. Noted May 21

Cleveland, Ohio—Plans have been completed by the Ralph M Hulett Co., Arch., 474 Lennox Bldg., Cleveland, for the erection of a three-story and basement brick clubhouse for the German Club. The estimated cost is $50,000

E. J Schneider, Arch., Cuyahoga Bldg., has completed plans for the erection of a stone church at Lawn Ave. and West 67th St., for the St Coleman Parish. The estimated cost is $100,000

✚The general contract for the erection of the two-story and basement commercial building for the Associated Investors Co. has been awarded to the CROWELL LUNDOFF LITTLE CO., 1951 East 57th St., Cleveland.

✚The contract for remodeling the Second Presbyterian Church, at East 30th and Prospect Sts., has been awarded to the DOODS PAGE CO., Cleveland, Ohio.

✚**Columbus, Ohio**—The contract for the erection of the building at Broad and Fifth Sts., for the B P O E, has been awarded to ROBERT H EVANS & CO., Columbus, Ohio, at $105,307. Noted May 22

Hudson, Ohio—Bids will be received until Aug 15, by J W C Corbusier, Arch., 309 Lennox Bldg., Cleveland, Ohio, for the erection of a high school at Hudson

Lakewood, Ohio—J W Chrisford, Arch., Highland Ave., Lakewood, has completed plans for the erection of a four-story, 65x130-ft. masonic temple at Andrews and Detroit Aves., Lakewood. The estimated cost is $100,000. Noted May 21

✚**St. Clairsville, Ohio**—The contract for the erection of the high school at St Clairsville has been awarded to FETZER & WINGER, Pittsburgh, Penn., at $47,000

Wooster, Ohio—Bids will be received until noon, Aug 20, by the Agricultural Commission of Ohio, State Capitol, Columbus, for the erection of a building at the Ohio Experiment Station, Wooster, Ohio

✚**Noblesville, Ind.**—The contract for the erection of a masonic temple at Ninth and Hannibal Sts. has been awarded to LESLIE COLVIN, Anderson, Ind. Don Graham, Indianapolis, Ind., is the Arch

Terre Haute, Ind.—Plans are being prepared by George McLucas & Fitton, Archs., 1121 Lemcke Annex, Indianapolis, Ind., for the erection of a building at Mulberry Ave. and Sixth St., for the State Normal College. The estimated cost is $150,000

✚**Detroit, Mich.**—Contracts for the erection of the Northern High School at Detroit have been awarded as follows: Masonry, C A SAUER & CO., 311 Buhl Bldg.; iron work, LEWIS & HALL CO., Perry and Robey Sts. The estimated cost is $100,000. Noted July 9

✚**Detroit, Mich.**—The general contract for the erection of the one-story and basement bank building for the Peoples State Bank has been awarded to FULLER & CO. The estimated cost is $250,000

(Buildings continued on Page 102)

RAPID TRANSIT SYSTEM NEW YORK N Y

Section 5 Routes 4 and 36

	A	B	C	D	E
[illegible] earth excavation above elevation 12[illegible]	$4 80	$1 80	$6 63	$6 44	$6 [illegible]
[illegible] earth excavation below [illegible] mean high water	4 [illegible]	[illegible]	6 63	6 44	6 [illegible]
[illegible] earth excavation below mean high water	4 [illegible]	[illegible]	6 63	6 [illegible]	6 [illegible]
[illegible] earth excavation for sewers	4 [illegible]	[illegible]	6 63	[illegible]	6 [illegible]
[illegible] rock excavation	5 5[illegible]	[illegible]	6 63	[illegible]	[illegible]
[illegible] rock excavation for sewers	5 [illegible]	[illegible]	6 63	[illegible]	[illegible]
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[illegible] Central Park stone wall	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Hotel [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Park & T[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] New [illegible] Apartment and Hotel [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible] buildings other than [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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RAPID TRANSIT SYSTEM, NEW YORK, N. Y.—(Continued)

Section 5, Routes 4 and 36

150 lin.ft. drain pipes, 10-in. c. i.	2.00	1.60	1.25	1.50	2.50
50 lin.ft. 3-in. c.-i. pipes and fittings	1.00	0.60	1.00	1.00	2.00
500 lin.ft. 4-in. c.-i. pipes and fittings	1.25	0.75	1.25	1.50	2.25
150 lin.ft. 6-in. c.-i. pipes and fittings	1.50	1.10	1.50	2.00	2.50
150 lin.ft. 8-in. c.-i. pipes and fittings	2.00	1.50	2.00	2.50	3.00
192,200 duct ft. tunnel ducts	0.10	0.10	0.10	0.10	0.13
47,000 duct ft. railroad ducts	0.15	0.14	0.12	0.20	0.20
1560 tons steel, riveted	72.00	65.00	70.00	75.00	72.00
1870 tons steel, beams	67.00	58.00	60.00	60.00	65.00
190 tons steel, rods and bars	60.00	60.00	60.00	65.00	70.00
25 tons miscellaneous castings	60.00	65.00	60.00	75.00	100.00
6 tons miscellaneous iron furnishings	60.00	65.00	60.00	75.00	115.00
1000 lb. wire forms	0.10	0.15	0.10	0.10	0.11
4560 lin.ft. 1¾-in. oak hand rail	1.00	0.20	0.25	0.40	0.16
3120 sq.ft. steel gratings	1.50	1.75	1.25	1.50	1.60
115 sq.ft. vault lights	1.50	1.30	1.25	1.40	1.60
3000 sq.yd. street surface restored (sidewalk)	2.00	2.50	1.50	2.50	3.00
10,850 sq.yd. asphalt pavement restored	2.50	4.80	2.50	2.00	3.50
2150 sq.yd. granite-block pavement restored	3.50	2.50	1.75	3.50	3.00
2200 sq.yd. asphalt-block pavement restored	3.50	4.80	2.50	3.50	3.50
150 lin.ft. new bluestone curb in place	1.50	1.00	1.00	1.50	2.00
150 lin.ft. new 8-in. granite curb	1.75	1.10	1.50	1.50	3.50
1850 sq.yd. park surface restored	2.00	2.00	2.00	1.00	2.00
2560 lin.ft. electric conduits, ¾-in. w. i.	0.25	0.15	0.15	0.30	0.22
1040 lin.ft. electric conduits, 1½-in. w. i.	0.40	0.30	0.20	0.40	0.40
440 lin.ft. electric conduits, 2-in. w. i.	0.60	0.40	0.25	0.60	0.55
1040 lin.ft. electric conduits, 1-in. w. i.	0.30	0.20	0.20	0.30	0.35
204 c.-i. outlet boxes	1.00	1.00	0.70	1.00	1.60
320 lin.ft. 6-in. c.-i. pipe and fittings	1.50	1.10	1.50	2.00	3.00
285 lin.ft. 3-in. c.-i. pipe and fittings	1.00	0.70	1.25	1.00	2.00
200 lin.ft. sewer pipe, 12-in. vitrified	5.00	2.50	3.00	2.50	3.00
1240 lin.ft. sewer pipe, 15-in. vitrified	5.50	2.80	3.50	2.00	3.50
870 lin.ft. sewer pipe, 18-in. vitrified	6.00	3.25	4.00	2.00	3.75
480 lin.ft. sewer pipe, 20-in. vitrified	6.50	3.75	4.50	2.50	4.00
910 lin.ft. sewer pipe, 24-in. vitrified	7.00	4.50	5.50	3.50	5.50
12 tons c.-i. straight sewer pipe	60.00	38.00	40.00	50.00	80.00
6 tons special castings for c.-i. sewer pipe	100.00	67.00	80.00	75.00	120.00
490 lin.ft. egg-shaped sewer masonry, 3 ft. 6 in. by 2 ft. 4 in	10.00	5.50	5.75	5.00	9.00
100 lin.ft. egg-shaped sewer masonry, 4 ft. 0 in. by 2 ft. 8 in	12.00	6.50	9.00	10.00	14.00
210 lin.ft. 4 ft. 0 in. circular sewer	12.00	7.00	6.50	10.00	12.00
130 lin.ft. 5 ft. 0 in. circular sewer	16.00	9.00	20.00	15.00	18.00
700 lin.ft. 5 ft. 6 in. by 5 ft. 6 in. special section sewer	20.00	11.00	13.00	12.00	25.00
470 lin.ft. 6 ft. 6 in. by 6 ft. 3 in. special section sewer	22.00	13.00	18.50	22.00	30.00
480 lin.ft. 7 ft. 0 in. by 7 ft. 0 in. special section sewer	25.00	19.00	29.00	30.00	30.00
5700 lin.ft. street surface R.R., maintaining electric R.R., single track	12.00	13.00	15.00	5.00	15.50
2 elevated R.R. columns supported entirely on structure	1,000.00	750.00	1,200.00	1,000.00	1,200.00
2 elevated R.R. columns supported partly on structure	1,000.00	900.00	1,000.00	1,000.00	1,200.00
Protection of subsurface R.R. in Park Ave. (lump sum)	20,000.00	11,000.00	60,000.00	50,000.00	75,000.00
100 lin.ft. water pipes, 4-in	0.75	0.75	0.60	1.00	0.75
900 lin.ft. water pipes, 6-in	1.00	1.00	0.75	1.50	1.50
100 lin.ft. water pipes, 10-in	1.25	1.40	2.00	1.25	2.00
400 lin.ft. water pipes, 12-in	1.50	1.75	2.25	1.75	3.00
100 lin.ft. water pipes, 20-in	1.75	2.50	4.35	3.50	4.00
100 lin.ft. water pipes, 30-in	2.00	3.50	9.00	6.00	7.00
100 lin.ft. water pipes, 36 in	2.25	4.50	12.00	8.00	10.00
200 lin.ft. water pipes, 48-in	2.50	6.00	16.00	10.00	12.00
40 water service restored	10.00	15.00	50.00	4.00	20.00
100 lin.ft. gas pipes, 4-in. c. i.	0.50	0.75	0.65	1.00	0.75
1400 lin.ft. gas pipes, 6-in. c. i.	0.75	1.00	1.15	1.00	1.50
600 lin.ft. gas pipes, 8-in. c. i.	1.00	1.25	1.25	1.50	1.75
100 lin.ft. gas pipes, 10-in. c. i.	1.25	1.40	1.75	1.75	2.00
400 lin.ft. gas pipes, 12-in. c. i.	1.50	1.75	2.75	1.75	2.00
200 lin.ft. gas pipes, 16-in. c. i.	1.60	2.20	3.50	2.25	3.50
500 lin.ft. gas pipes, 20-in. c. i.	1.75	2.50	4.35	3.00	4.00
300 lin.ft. gas pipes, 30-in. c. i.	2.00	3.50	9.00	4.00	7.00
2900 lin.ft. 6-in. w.-i. bypassing pipes, below street	2.00	3.50	3.60	3.00	4.00
6800 lin.ft. 8-in. w.-i. bypassing pipes, below street	2.50	4.00	5.60	4.00	5.00
2300 lin.ft. 12-in. w.-i. bypassing pipes, below street	3.00	5.50	9.70	7.00	6.50
200 lin.ft. 16-in. w.-i. bypassing pipes, below street	3.50	8.50	16.00	10.00	7.50
1200 lin.ft. 12-in. w.-i. bypassing pipes, above street surface	3.00	4.00	9.70	7.00	8.00
1400 lin.ft. 16-in. w.-i. bypassing pipes, above street surface	3.50	7.25	16.20	10.00	9.00
750 lin.ft. 30-in. w.-i. bypassing pipes, above street surface	4.00	9.00	30.00	12.00	15.00
100 lin.ft. 8-in. w.-i. bypassing pipes, above street surface	2.50	2.75	5.60	5.00	6.00
2300 lin.ft. trestle to support bypassing pipes	1.00	4.50	5.00	3.00	5.00
400 lin.ft. 6-in. w.-i. gas pipe	1.00	0.75	3.00	2.00	0.65
100 lin.ft. 8-in. w.-i. gas pipe	1.00	1.00	4.00	3.00	1.10
300 lin.ft. 10-in.w.-i. gas pipe	1.50	1.25	5.00	3.50	1.25
65 service connections for gas pipes	10.00	15.00	25.00	6.00	20.00
75 tons new c.-i. hub and spigot straight pipe	40.00	29.00	30.00	35.00	80.00
100 lin.ft. 6-in. new standard weight w.-i. gas pipe	0.60	0.75	1.00	1.50	1.00
100 lin.ft. 8-in. new standard weight w.-i. gas pipe	0.80	1.10	1.25	1.10	1.80
100 lin.ft. 10-in. new standard weight w.-i. gas pipe	1.00	1.60	1.50	2.50	2.60
50 tons new c.-i. hub and spigot pipe special castings	60.00	62.00	60.00	50.00	100.00
2000 lb. new malleable-iron gas-pipe fittings	0.05	0.20	0.15	0.10	0.20
100 lin.ft. high-pressure water 8-in. spigot and groove pipe	1.00	2.00	1.95	2.00	3.00
200 lin.ft. high-pressure water 12-in. spigot and groove pipe	1.50	3.00	3.50	4.50	4.00
100 lin.ft. high-pressure water 16-in. spigot and groove pipe	2.00	4.00	6.35	6.00	6.00
4 tons new c.-i. spigot and groove straight pipe	40.00	36.00	30.00	45.00	90.00
8 tons new c.-i. spigot and groove pipe special castings	60.00	72.00	75.00	75.00	110.00
100 lin.ft. steam pipe, 4-in	1.00	0.60	15.00	2.00	15.00
100 lin.ft. steam pipe, 10-in	5.00	1.00	25.00	5.00	20.00
100 lin.ft. steam pipe, 15-in	7.50	1.75	27.00	8.00	25.00
200 lin.ft. steam pipe, 20-in	10.00	3.50	35.00	10.00	30.00
50 lin.ft steam pipe, 24-in	12.00	4.50	50.00	18.00	35.00
10 service connections for steam pipes	25.00	25.00	100.00	8.00	50.00
100 lin.ft. new steel welded flanged 10-in. steam pipes	2.00	1.60	10.00	6.00	8.00
100 lin.ft. new steel welded flanged 15-in. steam pipes	2.50	4.90	17.00	8.00	10.00
100 lin.ft. new steel welded flanged 20-in. steam pipes	3.00	9.50	26.00	10.00	12.00
100 lin.ft. new 4-in. steam pipes	1.50	0.75	5.00	2.00	2.00
50 lin.ft. new 24-in. steam pipes	3.50	12.60	40.00	18.00	20.00
100 lin.ft. 4-in. air pipe, in place	0.50	0.60	0.50	2.00	2.00
100 lin.ft. new 4-in. air pipe, in place	0.50	0.75	1.00	2.00	2.00
100 lin.ft. 8-in. mail tube	3.50	2.00	5.00	2.50	10.00
50 lin.ft. new 8-in. mail tube straight pipe	2.50	2.00	10.00	2.50	8.00
50 lin.ft. new 8-in. mail tube curved pipe	4.00	4.00	25.00	4.00	10.00
30,000 duct ft. electric ducts and conduits, in place	0.50	0.25	0.75	0.40	0.60
500 lin.ft. w.-i. pipes as ducts and conduits, 2½-in	0.50	0.30	0.60	0.50	0.50
7500 lin ft. w.-i. pipes as ducts and conduits, 3 in	0.50	0.30	0.70	0.60	0.60
200 lin.ft. w.-i. pipes as ducts and conduits, 3½-in	0.50	0.30	0.75	0.70	0.80
400 lin.ft. w.-i. pipes as ducts and conduits, 4-in	0.50	0.30	0.80	0.80	1.00
200 lin.ft. 2-in. Edison conduit	1.25	0.30	1.00	0.50	0.75
200 lin.ft. 2½-in. Edison conduit	1.25	0.30	1.25	0.55	1.00
200 lin ft. 3-in. Edison conduit	1.25	0.30	1.50	0.70	1.25
50 service connections for electric ducts	10.00	10.00	25.00	5.00	26.00
Extended totals	$2,819,511	$3,103,420	$3,340,887	$3,497,888	$3,660,541

(Buildings continued from Page 100)

Grand Rapids, Mich.—Osgood & Osgood, Archs., Herald Bldg., Grand Rapids, have prepared plans for the erection of a six-story and basement temple for the Masonic Temple Association. The estimated cost is $[illegible],000. Noted May 21.

Oakwood, Mich.—Bids have been rejected for the school to be erected at Oakwood. New bids will be received. The estimated cost is $[illegible],000. Noted June 11.

✦Saginaw, Mich.—The general contract for the erection of the one-story and basement theatre for J. H. Kirby has been awarded to A. GELINAS & SONS, Chase Block, Saginaw, Mich. The estimated cost is $[illegible].

Chicago, Ill.—Harmat B. Norlund, 1[illegible]5 South La Salle St., will erect an 18-story office building at 101-19 South La Salle St. The estimated cost is $360,000. C. S. Frost, 105 South La Salle St., is the Arch.

Elgin, Ill.—Bids will be received until 10 a.m., Aug. 19, by the State Board of Administration, Springfield, for the erection of a building at the Elgin State Hospital. James B. Dibelka is the State Arch., 29 South La Salle St., Chicago, Ill.

Milwaukee, Wis.—Martin Tullgren & Sons, Archs., 123 Second St., are receiving bids for the erection of a three-story and basement, 28x150-ft. store and office building at Ninth and Wells Sts. The estimated cost is $50,000. Noted July 23.

H. J. Esser, Arch., Camp Bldg., is receiving bids for the masonry and concrete work for the addition to the store building of Gimbel Bros. The estimated cost is $400,000. Noted July 23.

The Milwaukee Northern Ry. Co. contemplates the erection of a terminal station at Fifth and Wells Sts. W. A. Walker is Pres.

✦Stevens Point, Wis.—Contracts for the erection of the addition to the Normal School have been awarded as follows: General contract, J. P. CULLEN CONSTRUCTION CO., Janesville, Wis., $[illegible]; heating, HARRY SOHNS, Racine, Wis., $[illegible]; tile and marble, GRANT MARBLE CO., Milwaukee, Wis., $3184. Noted July 16.

✦Waterford, Wis.—The contract for the erection of the high school at Waterford has been awarded to MATT REWALD, Burlington, Wis., at $55,000. Noted July 2.

✦Flandreau, S. D.—(Official)—The contract for the erection of the high school at Flandreau has been awarded to O. H. OLSON, Stillwater, Minn. Noted July 23.

CONTRACT PRICE

Barge Canal Work—Albany, N. Y.—Bids were received July 21 by Duncan W. Peck, Supt. of Pub. Wks., for Barge Canal Contracts, No. 109 and 118, for constructing the substructures, superstructure and approaches of the Crescent Highway bridge, Erie Canal Section 2, and constructing a highway bridge over the Mohawk River, at Amsterdam, Erie Canal, Section 3, respectively, from (A) Penn Bridge Co., Beaver Falls, Penn., (B) Frank L. Cohen, Buffalo, (C) Larkin & Sangster, Seneca Falls, (D) John W. Holler, Albany, (E) Lathrop, Shea & Henwood, Buffalo, (F) Eastover Construction Co., Inc., Gloversville, (G) Lupfer & Remick, Buffalo, (H) Walsh Construction Co., Davenport, Iowa, (I) M. Fitzgerald, Hoosick Falls, (J) Holler & Shepard, Rochester, (K) Parker & Beebe, Waterford, (L) Scott Bros., Rome, (M) John Monks & Sons, New York, (N) Oswego Construction Co., Fulton. The item bids were as follows:

Billings, Mont.—The lowest bid received for the erection of the office building for the Montana Power Co. was that of Nelson & Pederson, Butte, at $72,500. Link & Haire are the Archs. Noted Feb. 12.

El Paso, Tex.—H. M. Bentell, Jr., Arch., 404 Caples Bldg., is preparing plans for a six-story hotel at San Francisco and David Sts., for George Look and associates. The estimated cost is $[illegible],000.

Temple, Tex.—The Gulf, Colorado & Santa Fe R.R. is having plans prepared for an addition to its hospital. The estimated cost is $50,000.

Salt Lake City, Utah.—Plans have been completed for the erection of a hotel for the Newhouse Realty Co. The estimated cost is $1[illegible]0,000.

Seattle, Wash.—The Seattle Trust Co. will erect a building for a Home for the Aged and the Poor. The estimated cost is $150,000.

Seattle, Wash.—Louis Baeder, Arch., White Bldg., has prepared plans for the erection of a 7-story apartment house, for the Amos Brown Estate. The estimated cost is $200,000.

✦Walla Walla, Wash.—The Northern Pacific R.R. Co. has awarded the contract for the erection of a railroad station at Walla Walla to M. J. HURSON, Globe Bldg., Seattle, Wash., at $40,000.

Astoria, Ore.—R. F. Wassell will erect a five-story apartment house at Astoria. The estimated cost is $100,000.

Eugene, Ore.—Bids are being received by W. C. Knighton, State Arch., Salem, Ore., for the erection of an administration building at the State University. The estimated cost is $100,000.

Portland, Ore.—Camp & DuPuy, Archs., 426 East Alder St., are preparing plans for the erection of a four-story apartment building at East 13th and East Alder Sts., Portland. The estimated cost is $90,000.

Bakersfield, Calif.—Bids will be received until 10 a.m., Sept. 8, by the Board of Supervisors, for the erection of a two-story auditorium at Bakersfield. The estimated cost is $60,000.

Fresno, Calif.—George William Kelham, Arch., Sharon Bldg., San Francisco, is preparing plans for the erection of a bank building at Fresno. The estimated cost is $100,000.

Los Angeles, Calif.—Arthur G. Lindley, Arch., 412 Hollingsworth Bldg., has prepared plans for the erection of a five-story and basement hotel on Gladys Ave. The estimated cost is $100,000.

Frank Relter, 1039 Manzanita St., will erect an apartment house on Sunset Blvd. and Manzanita St. The estimated cost is $75,000.

✦Los Angeles, Calif.—The general contract for the erection of the 12-story bank and office building at Fifth and Spring Sts., for the Commercial Fireproofing Co., has been awarded to the F. O. ENGSTROM CO., Fifth and Seaton Sts. Parkinson & Bergstrom, Security Bldg., are the Archs.

Norwalk, Calif.—George B. McDougall, State Arch., Sacramento, has prepared plans for the erection of a state hospital at Norwalk. The estimated cost is $160,000.

San Diego, Calif.—The Bonita Investment Co. will erect a three-story hotel at Cape May and Abbott Sts., Ocean Beach.

BARGE CANAL WORK, ALBANY, N. Y.

Contract 109

	A	B	C	D	E	G	H	I	J	K	L	M	N
[illegible] cu yd excavation	$0.75	$0.65	$0.55	$0.60	$0.65	$0.55	$0.75	$0.67	$0.65	$0.75	$0.75	$0.75	$0.74
[illegible] cu yd [illegible]	1.50	1.50	1.50	1.50	1.50	1.50	1.80	1.50	1.50	1.70	1.50	1.75	1.80
[illegible] cu yd second-class concrete	9.50	9.00	7.10	7.40	9.00	9.50	9.00	9.00	7.80	9.00	9.00	9.00	9.00
[illegible] cu yd first-class reinforced concrete	12.00	14.10	12.00	11.00	10.00	11.00	11.00	13.00	11.50	13.00	12.00	14.40	14.40
[illegible]	2.00	2.00	2.00	2.00	2.00	2.00	2.50	2.00	2.00	2.40	2.25	2.30	2.40
[illegible]	60.00	60.00	60.00	60.00	70.00	60.00	60.00	50.00	60.00	60.00	60.00	60.00	72.00
[illegible] structural steel	0.042	0.04	0.039	[illegible]	0.038	0.037	0.04	0.0425	[illegible]	0.04	0.0375	0.039	0.04
[illegible] metal reinforcement	0.029	0.036	0.03	0.03	[illegible]	0.0325	0.035	0.03	[illegible]	0.035	0.03	0.035	0.036
[illegible]	0.2[illegible]	[illegible]	0.25	0.25	0.25	0.25	0.30	0.28	0.25	[illegible]	0.30	0.28	0.30
[illegible] railing	1.75	1.75	2.10	2.00	1.75	1.75	1.75	2.00	1.75	1.00	[illegible]	1.90	2.10
[illegible]	0.30	0.30	0.30	0.30	0.30	0.30	[illegible]	[illegible]	0.30	0.30	0.30	0.32	0.36
[illegible]	15.00	15.00	15.00	15.00	15.00	15.00	15.00	22.00	15.00	15.00	15.00	18.00	15.00
Cofferdam [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3000.00	[illegible]	[illegible]	[illegible]	3000.00	3000.00	[illegible]	3000.00
Cofferdam [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Maintaining [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible] totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$201,[illegible]	$166,130

Contract No. 118

	A	B	C	D	E	F	G	H
Cofferdams [illegible]	[illegible]	$17,[illegible]	$10,000.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1.50	1.50	[illegible]	1.50	[illegible]	1.50	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

CHAOTIC TRADE CONDITIONS

The machinery built up through more than a hundred years practice to conduct the foreign trade of the United States has broken down, and conditions are now so unusual that trade abroad is practically impossible, at this writing, even if there were vessels to convey the merchandise. All this occurs through the breaking down of foreign exchange, and for the time being, any trading which is carried on will have to be done more or less by barter.

Such a catastrophe as a general foreign war, involving all of Europe, was scarcely dreamed of. To be plunged into it in less than a week and then have European investors unload securities acquired here for a couple of generations, would have caused immeasurable suffering in this country and the wiping out of competence and fortunes. For this reason, the closing of the principal exchanges in the United States, the resort to clearing house certificates and emergency currency was the measure of protection, not because of alarming conditions in the United States, but to prevent the general European panic from spreading here. Business activity in the United States will resume its normal status, after the lapse of a few months, but in a more restricted way, particularly if the European nations continue their conflict for any great length of time thus requiring the issue of an enormous bulk of new securities. This will raise the interest rate of the world and will make it difficult for municipalities and geographical divisions to secure money at the old rate of interest.

The Comptroller of the City of New York has announced that subway work now under construction would go forward and that the remaining contracts would be let, permitting the rounding out of the system. This is as it should be. Some other work will be postponed, such as the $12,000,000 circular court house which will be a structure of beauty. It is likely that the lavish expenditures by American railways for elaborate passenger terminals will be checked for many years, but ordinary construction will go on with very little hindrance.

The fact that the American farmers are harvesting a great crop, which they will eventually sell to the people of Europe at a higher price than in time or peace, will mean much for the agricultural and financial prosperity of the country. The crop report of Aug. 1, however, was much less satisfactory than was expected.

Prices of materials are difficult to quote. There is always hand-to-mouth buying by some consumers who must have supplies. The U. S. Steel Corporation announced on Aug. 5 that all quotations had been withdrawn on Aug. 4. This means that there is no standard price for steel products. One reason why the steel trade is unable to take contracts for forward delivery is the shortage of ferro-manganese. This material, which comes from Russian ore, for the most part, is practically indispensable in the present process of steel manufacture. Some manganese ore comes from South America, but for the present there is no way of knowing when it will be possible to secure supplies.

A spectacular advance in pig tin doubled the price in less than a week, leather is scarcely quoted, while the rubber market is demoralized. Within a month trade conditions as far as the U. S. is concerned, should settle down and become more or less normal.

Comparative Prices—The wild movement in the price of commodities is shown in the accompanying table. Some of the quotations given are of course only of academic interest to readers of the paper but they serve to show the startling changes in a few weeks .

Wholesale Prices	July 1	Aug. 10
Pig Tin per lb.	$0.31	$0.64
Solder per lb.	0.20	0.38
Antimony per lb.	0.07½	0.16
Rubber (up river) Para fine per lb.	0.60	1.20
Quicksilver per flask	35.00	85.00
Sugar 100 lb.	4.40	6.00
Flour per bbl	4.50	5.85
Corn bu. (Chicago)	0.55	0.72
Wheat bu. (Chicago)	0.77	0.98

LABOR

Most of the Labor Bureaus in New York are of the opinion that there will be no shortage of contract laborers. The general opinion is that there will be a surplus of laborers, particularly of this class, in the very near future. The mobilization of Austrians, Germans, and men of the Balkan provinces in this country, has practically ceased, owing to the inability to secure transportation; and most of these will be looking for work. There has also been a great rush of foreigners to get naturalization papers. Most of the construction work has been carried on by immigrants from the south of Italy, and the Italian immigration has made up nearly 25 per cent. of the total immigration coming into this country. In the accompanying table, taken from the immigration report for May, 1913, the United States Department of Labor, is shown the total permanent immigration. The temporary, or non-immigrant arrivals being given in a different part of the report and not published. Unofficial figures for May and June are also available, the total immigration for May numbering 107,796, while for June the number was 71,728, Italian immigration, alone, falling off about 14,000.

IMMIGRATION, FROM U. S. DEPARTMENT OF LABOR BULLETIN

Races	Years ended June 30— 1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	July, 1913, to May, 1914
African (black)	2,386	3,598	3,786	5,235	4,626	4,307	4,966	6,721	6,759	6,634	7,387
Armenian	1,745	1,878	1,895	2,644	3,299	3,108	5,508	3,092	5,222	9,353	7,555
Bohemian and Moravian	11,911	11,757	12,958	13,554	10,164	6,850	8,462	9,223	8,439	11,091	9,338
Bulgarian, Servian, Montenegrin	4,577	5,823	11,548	27,174	18,246	6,214	15,130	10,222	10,657	9,087	14,286
Chinese	4,327	1,971	1,485	770	1,263	1,841	1,770	1,307	1,608	2,022	2,169
Crotian and Slovenian	21,242	35,104	44,272	47,272	47,826	20,181	39,562	18,982	24,366	42,499	35,819
Cuban	4,811	7,259	5,591	5,475	3,323	3,380	3,331	3,914	3,155	3,099	3,151
Dalmatian, Bosnian, Herzegovinian	2,036	2,639	4,568	7,393	3,747	1,888	4,911	4,400	3,672	4,520	4,949
Dutch and Flemish	7,832	8,198	9,735	12,467	9,526	8,114	13,012	13,862	10,935	14,507	11,782
East Indian	258	145	271	1,072	1,710	337	1,782	517	165	188	160
English	41,479	50,865	45,079	51,126	49,056	39,021	53,498	57,258	49,689	55,522	47,573
Finnish	10,157	17,012	14,136	14,860	6,746	11,687	15,736	9,779	6,641	12,756	11,923
French	11,557	11,347	10,379	9,392	12,881	19,423	21,107	18,132	18,382	20,652	16,996
German	74,790	82,360	86,813	92,936	73,038	58,534	71,380	66,471	65,343	80,865	74,055
Greek	12,625	12,144	23,127	46,283	28,808	20,262	39,135	37,021	31,566	38,644	42,841
Hebrew	106,236	129,910	153,748	149,182	103,387	57,551	84,260	91,223	80,595	101,330	127,938
Irish	37,076	54,266	40,959	38,706	36,427	31,185	38,382	40,246	33,922	37,023	31,312
Italian (north)	36,699	39,930	46,286	51,564	24,700	25,150	30,780	30,312	26,443	42,534	43,069
Italian (south)	159,329	186,390	240,528	242,497	110,547	165,248	192,673	159,638	135,830	231,613	242,600
Japanese	14,382	11,021	14,243	30,824	16,418	3,275	2,798	4,575	6,172	8,302	8,134
Korean	1,907	4,929	127	39	26	11	19	8	33	64	134
Lithuanian	12,780	18,604	14,257	25,884	13,720	15,254	22,714	17,027	11,078	24,647	19,874
Magyar	23,883	46,030	44,261	60,071	24,378	28,704	27,302	19,996	23,599	30,610	41,530
Mexican	447	227	141	91	5,682	15,591	17,760	18,784	22,001	10,954	12,435
Pacific Islander	41	22	13	3	2	7	61	12	3	11	1
Polish	67,757	102,437	95,835	138,033	68,105	77,565	128,348	71,446	85,163	174,365	115,830
Portuguese	6,338	4,855	8,729	9,648	6,809	4,606	7,657	7,469	9,403	13,566	8,625
Roumanian	4,364	7,818	11,425	19,200	9,629	8,041	14,109	5,311	8,329	13,451	23,039
Russian	3,961	3,746	5,814	16,807	17,111	10,038	17,294	18,721	22,558	51,472	42,667
Ruthenian (Russniak)	9,592	14,473	16,257	24,081	12,361	15,808	27,907	17,724	21,965	30,588	34,608
Scandinavian	61,029	62,284	58,141	53,425	32,789	34,996	52,037	45,859	31,601	38,737	33,264
Scotch	11,483	16,144	16,463	20,516	17,014	16,446	24,612	25,625	20,293	21,293	17,277
Slovak	27,940	52,368	38,221	42,041	16,170	22,586	32,416	21,415	25,281	27,234	24,336
Spanish	4,662	5,590	5,332	9,495	6,636	4,939	5,837	8,068	9,070	9,042	10,406
Spanish-American	1,666	1,658	1,585	1,060	1,063	890	900	1,153	1,342	1,363	1,358
Syrian	3,653	4,822	5,824	5,880	5,520	3,668	6,312	5,444	5,525	9,210	8,465
Turkish	1,482	2,145	2,033	1,902	2,327	820	1,283	918	1,336	2,015	2,639
Welsh	1,820	2,531	2,367	2,754	2,504	1,699	2,244	2,248	2,239	2,820	2,359
West Indian (except Cuban)	1,942	1,548	1,476	1,381	1,110	1,024	1,150	1,141	1,132	1,171	1,276
Other peoples	668	351	1,027	2,058	1,530	1,537	3,330	3,323	3,660	3,038	3,586
Total	812,870	1,026,499	1,100,735	1,285,349	782,870	751,786	1,041,570	878,587	838,172	1,197,892	1,146,752

AN EXCITED METAL MARKET

[illegible] the New York [illegible] market [illegible] such violent [illegible] United States sales have been made below 11 cents. Lead and [illegible] but the markets are nervous.

Pig Tin—[illegible] the tin market was excited but no sales for [illegible] were made [illegible]. On the following day with the [illegible] of the London metal exchange, the New York Stock Exchange and the New York Metal Exchange [illegible] of international credit, the inability to [illegible] were more or less chaotic [illegible] Since that time markets for small lots of tin in New York have been represented by the following [illegible] Aug. 1, [illegible] Aug. 3, 50 to [illegible] Aug. 4, [illegible] Aug. 6, 61 [illegible] Aug. 7, 61 [illegible]

Most of the tin used in the United States comes from [illegible] and is shipped direct to London. From there it is shipped on the Atlantic Transport Line, the only [illegible] from London to the United States. The [illegible] in this country is [illegible] tons a week. When the [illegible] there were in the United States 13[illegible] tons of tin in [illegible]. Of course, the tinplate companies [illegible]. With the embargo on shipping and the refusal of the British government to permit the exportation of [illegible] metals, the price jumped rapidly and the [illegible] has arrived since that time in consequence [illegible] on Monday aggregating 365 tons. There is [illegible] high seas for American ports about [illegible] tons. What the tin market will do is a question. Suggestions have been made that the U. S. Steel Corporation will [illegible] of its vessels to Singapore to secure tin. [illegible] Then, too, there is a possibility that the [illegible] be [illegible] up and shipping in English and neutral bottoms be resumed on the high seas. This will [illegible] crash in the price. As far as the metal itself is concerned, it affects mostly the tin plate trade, but [illegible] other arts that its advance is [illegible] many lines not ordinarily known to be [illegible]

Copper—Approximately [illegible] of the copper produced in this country is consumed in Europe. Manufacturing has [illegible] on the continent and will in England in the near future [illegible] the price of copper has dropped to [illegible]. It is probable that a round lot could be purchased [illegible] even 12[illegible]. At present the market is represented by a quotation of 12.7[illegible], but this is [illegible]. Producers have taken steps to restrict the output and it will undoubtedly soon be adjusted to consumption. In the meantime the reports of the Copper Producers' Association will not be issued.

Lead—The market is steady and shows no change, being quoted at 3.[illegible] New York, and 3.[illegible] East St. Louis.

Spelter—The war has had no effect on the spelter market as yet, but it [illegible] will in the near future [illegible] metal to [illegible]. Prime Western sells at 4.90 to [illegible] New York and [illegible] East St. Louis.

Antimony—This metal, which is used to a limited amount in the making of anti-friction metals and in various compositions, has [illegible] advanced beyond all limits. Special [illegible] which a week ago were sold at 7[illegible], now command [illegible] per pound, and ordinary antimony is selling at 11 to [illegible]. Most of this metal comes from Germany. It is [illegible] in the manufacture of shrapnel and munitions of war.

IRON AND STEEL

[illegible]

Pig Iron—[illegible]

Steel Rails—[illegible]

Structural Materials—[illegible] angles 3 to 6 in., and tees 3 in. and over. Other quotations are on practically the same basis, subject to the usual charge for extras.

Plates—The general market is represented by a quotation of 1.1[illegible] to 1.15c. f.o.b. Pittsburgh. Chicago mill deliveries are 1.30 to 1.[illegible], and plates from store there are 1.75 to 1.[illegible]. In New York mill shipments are 1.31 to 1.3[illegible]c. The plate business should improve due to a demand for shipping.

Pipe—The market for pipe, which was one of the brightest of [illegible] in the steel market, has suddenly [illegible] and there is practically no business. The oil producers have been obliged to tie up all their cargo ships. The price of crude oil [illegible] declined, therefore there is no demand for pipe. Quotations are unchanged, but there is very little business at these figures.

Sheets—The price of sheets advanced from $1 to $2 per ton. Stocks at the mills are very [illegible] and it is believed that most of the business on the books of manufacturers will be delivered promptly. There seems to be a little improvement in the demand for galvanized sheets. No advance has been made for sheets from New York stock. The following quotations are correct for large lots from Pittsburgh and small lots from store New York and Chicago:

	Cents per pound			
	Carload lots, Pittsburgh		Small lots, Chicago	
Nos.	Black	Galv.	Black	Galv.
10 and 11	1.[illegible]	1.[illegible]	2.1[illegible]	[illegible]
12	1.[illegible]	1.[illegible]	2.[illegible]	[illegible]
13 and 14	1.6[illegible]	1.95	[illegible]	[illegible]
15 and 16	1.6[illegible]	[illegible]	[illegible]	[illegible]
17 to 21	1.[illegible]	2.2[illegible]	[illegible]	3.1[illegible]
22 and 24	1.70	2.[illegible]	[illegible]	[illegible]
25 and 26	1.7[illegible]	[illegible]	[illegible]	[illegible]
27	1.80	2.6[illegible]	[illegible]	3.[illegible]
28	1.85	[illegible]	[illegible]	3.[illegible]

Old Materials—The market is so unsettled that it is useless to quote any prices at present.

Coke—The market has not been affected [illegible] the other and furnace coke is [illegible] at $1.7[illegible] to $2 per net ton at oven for contract, most [illegible] being at the [illegible] and prompt shipments at $1.7[illegible]. For 72-hr. foundry coke $2.2[illegible] to $2.[illegible] is quoted.

Steel Shapes—Prices are unchanged from last month, but the market is very [illegible]. The quotations are from warehouse New York as follows:

	Cents per lb.
Refined iron:	
1 to 1½ in., round and square	[illegible]
1½ to 4 in. x ⅜ to [illegible] in.	[illegible]
1½ to 4 in. x ¼ to [illegible] in.	2.[illegible]
Norway bars	[illegible]
Burden's bar iron	3.15
Soft steel:	
¾ to 3 in., round and square	[illegible]
1 to 6 in. x ⅜ to 1 in.	[illegible]
1 to 6 in. x ¼ and [illegible] in.	[illegible]
Rods—⅝ and [illegible] in.	[illegible]
Bands—1½ to 6 x [illegible] to No. [illegible]	2.10
Beams and channels—3 to [illegible] in.	[illegible]
Angles:	
3 in. x ¼ in. and larger	[illegible]
3 in. x [illegible] in. and ¼ in.	[illegible]
1½ to 2½ in. x [illegible] in. and thicker	[illegible]
1½ to 2½ in. x ⅛ in.	2.[illegible]
1 to 1¼ in. x [illegible] in.	[illegible]
1 to 1¼ in. x ⅛ in.	2.1[illegible]
[illegible]	
1½ to 2½ x ¼ [illegible]	[illegible]
1½ to 2½ x [illegible]	2.1[illegible]
3 in. and larger	1.[illegible]0

Rubber—Prices have doubled in the last week and some grades are almost unobtainable. The London market is closed and the embargo of Continental ports prohibits shipping from Europe. The presence of rival fleets in the Mediterranean makes that shipments from the Far East will be suspended [illegible]. American manufacturers of rubber goods hope the Panama Canal may be used for vessels from the East bringing rubber. Prices are as follows: [illegible]

[illegible]

Portland Cement—The market has held well. Cement manufacturers feel that [illegible]

An Announcement by Walter Wood, [illegible]

COUNTRYWIDE GAIN IN BUILDING

For the first time in many months, the reports of building inspectors, relative to the contemplated building from plans filed, show a gain in all parts of the country. In the East, where the depression has been particularly marked heretofore, there is a gain of 19% in the 21 cities. Expressed in dollars, this amounts to $4737. For the first seven months of the year there was a trifling loss.

In 21 cities in the Middle West there was a gain of $1,600,000, or 7.7%, in July. For the first seven months of the year, the gain amounted to $5,769,000, or 3.8%.

The returns for seven Pacific Coast cities show an increase of $340,000, or less than 1%. The gain, slight as it is, shows a turning point, for the loss in the first seven months amounted to $4,200,000, which is about 7.3%.

An excellent gain of over one million dollars in seven Southern cities shows an increase of about 56%, while the figures for the first seven months of the year also show a gain.

EASTERN STATES

	Month of July		First Seven Months of Yr.	
	1914	1913	1914	1913
Albany, N. Y.	$692,005	$315,770	$4,676,465	$2,185,035
Baltimore, Md.	1,577,601	394,089	8,339,787	5,775,493
Boston, Mass.	298,500	1,112,550	12,895,350	12,413,405
Bridgeport, Conn.	313,945	193,727	2,486,083	1,655,046
Buffalo, N. Y.	985,000	908,000	7,549,006	7,394,243
Elizabeth, N. J.	179,190	183,883	888,123	1,621,714
Hartford, Conn.	311,985	970,055	2,685,356	3,116,600
Hoboken, N. J.	166,109	14,090	728,002	252,142
Jersey City, N. J.	460,592	347,304	2,417,845	3,983,952
Newark, N. J.	1,172,043	1,307,089	5,244,280	9,531,080
New Haven, Conn.	427,215	364,186	2,405,625	2,461,098
New York, N. Y.				
Manhattan	4,605,350	7,807,500	30,882,090	42,860,635
Bronx	2,123,465	1,143,650	16,076,068	16,515,406
Brooklyn	3,314,700	2,574,760	25,918,850	19,114,311
Queens	2,339,662	1,311,488	13,139,829	10,499,944
Paterson, N. J.	229,546	253,599	1,078,457	1,011,209
Philadelphia, Penn.	4,661,850	3,446,965	25,767,570	24,786,235
Pittsburgh, Penn.	1,510,212	777,128	10,851,148	9,998,144
Reading, Penn.	103,600	81,425	1,013,800	507,100
Rochester, N. Y.	1,067,101	511,733	6,095,625	5,898,092
Scranton, Penn.	167,155	133,510	752,464	885,318
Springfield, Mass.	795,835	274,236	3,536,899	3,022,658
Syracuse, N. Y.	753,095	263,165	1,772,100	2,357,220
Worcester, Mass.	477,764	385,999	3,118,452	3,114,614
Totals	$29,733,511	$24,996,102	$190,319,268	$190,940,694
	Gain 19%		Loss trifling	

SOUTHERN STATES

	1914	1913	1914	1913
Atlanta, Ga.	$495,902	$434,943	$3,495,699	$3,544,100
Chattanooga, Tenn.	116,370	53,690	749,810	684,565
Louisville, Ky.	482,390	348,980	3,040,245	2,636,490
Memphis, Tenn.	333,006	304,266	2,347,888	2,861,290
Richmond, Va.	461,949	147,435	2,561,770	2,216,105
Tampa, Fla.	92,545	110,183	814,640	856,668
Washington, D. C.	1,192,883	708,160	6,820,702	6,200,233
Totals	$3,175,045	$2,107,657	$19,830,754	$19,154,451
	Gain 56%		Gain trifling	

PACIFIC COAST STATES

Los Angeles, Calif.	$2,100,451	$3,324,214	$11,889,271	$20,333,004
Oakland, Calif.	430,665	660,583	2,869,170	5,128,131
Portland, Ore.	870,745	851,805	5,051,655	8,251,700
Spokane, Wash.	229,635	168,765	775,297	2,356,589
San Francisco, Calif.	2,068,537	1,415,819	22,746,212	12,931,055
Seattle, Wash.	2,520,590	1,414,620	8,404,445	6,634,090
Tacoma, Wash.	884,649	529,599	1,572,747	1,847,999
Totals	$9,105,272	$8,765,410	$53,308,797	$57,482,568
	Gain 1%		Loss 7.3%	

MIDDLE WEST

Akron, Ohio	$382,015	$707,265	$2,355,085	$3,538,180
Chicago, Ill.	468,385	6,035,000	45,227,585	57,368,637
Cincinnati, Ohio	1,055,230	582,430	6,044,000	5,543,036
Cleveland, Ohio	2,532,050	2,746,310	17,221,415	12,567,150
Columbus, Ohio	503,351	421,945	3,724,206	3,118,748
Dallas, Tex.	941,580	806,250	4,425,143	5,966,355
Denver, Colo.	222,223	254,670	1,686,803	1,811,845
Des Moines, Iowa	140,690	131,164	1,158,364	1,193,284
Duluth, Minn.	266,259	236,413	1,946,841	2,952,557
Evansville, Ind.	128,645	122,990	946,814	1,091,947
Grand Rapids, Mich.	169,855	242,782	2,476,303	1,690,097
Indianapolis, Ind.	1,140,000	1,120,566	6,096,405	0,231,473
Kansas City, Kan.	188,005	52,942	779,125	761,518
Kansas City, Mo.	8,013,930	857,475	15,013,930	6,125,951
Milwaukee, Wis.	887,889	1,737,067	6,398,666	8,017,059
Minneapolis, Minn.	1,326,095	1,055,770	11,099,690	6,986,470
Omaha, Neb.	402,605	392,525	3,209,298	2,417,548
St. Louis, Mo.	1,287,859	1,045,730	9,105,911	10,412,307
St. Paul, Minn.	1,053,100	933,655	8,971,788	5,598,049
Salt Lake City, Utah	238,750	149,740	1,635,064	1,299,478
Toledo, Ohio	569,579	671,605	4,413,217	3,504,932
Totals	$21,918,094	$20,304,294	$153,995,713	$148,226,621
	Gain 7.7%		Gain 3.8%	

CATALOG NOTICES

The Waterproofing & Construction Co., 35 Wall St., New York. Pamphlet. Cement Waterproofing. Illustrated, 4x9 in.

C. E. Hunter Co., 2208 South Wabash Ave., Chicago, Ill. Catalog. McGuire garbage incinerator. Illustrated, 7x10 in.

National Tube Co., Pittsburgh, Penn. Bulletin No. 13A. N. T. C. Iron body brass mounted wedge gate valves. Illustrated, 12 pp., 8½x11 in.

RAILWAYS

New York—Carthage & Copenhagen R. R.—This company, it is reported, plans to construct an extension from Copenhagen, N. Y., to connect with the Lehigh Valley R.R., at Camden, N. Y. F. D. Barlow, Carthage, N. Y., is Gen Mgr.

North Carolina—Durham & Southern Ry.—This company plans to construct an extension from Dunn, N. C., to Mount Olive, N. C., 50 miles. J. E. Stagg, Durham, N. C., is Vice-Pres.

Georgia—Chattahoochee Valley Ry.—This company plans to construct an extension out of McCulloh, Ga. J. T. Barker, West Point, Ga., is Gen. Mgr.

Moultrie Southern Ry.—This company has been incorporated for the purpose of constructing a railroad from Moultrie, Ga., to a point near Decatur, Ga., about 85 miles. W. E. Ayrock, Moultrie, is interested. Noted July 23.

+Florida—St. Andrews Bay Ry. & Terminal Co.—This company has awarded the contract to J. M. WILLIS, St. Andrews Bay, Fla., for constructing a five-mile extension. E. L. Wood, St. Andrews Bay, is Ch. Engr.

Florida—Atlantic Coast Line R. R.—This company, it is reported, plans to construct an extension from Sehring, Fla., south to Big Cypress Swamp. E. B. Pleasants, Wilmington, N. C., is Ch. Engr.

Seaboard Air Line Ry.—This company plans to construct an extension 20 miles long from Bartow, Fla., in a southeasterly direction. W. D. Faucette, Norfolk, Va., is Ch. Engr.

Alabama—Birmingham & Southeastern Ry—This company has made financial arrangements for the construction of its proposed extension from Eclectic, Ala., to Birmingham, Ala. W. M. Blount, Union Springs, Ala., is Pres.

Louisiana—Texas & Pacific Ry.—This company, it is reported, plans to double-track its line from New Orleans, La., to Alexandria, La., 194 miles. C. H. Chamberlin, Dallas, Tex., is Ch. Engr.

Ohio—Chesapeake & Ohio Ry.—This company plans to spend $100,000 for additional tracks at its yards at Logan, Ohio. F. I. Cabell, Richmond, Va., is Ch. Engr.

Indiana—Pennsylvania Lines West of Pittsburgh—See item under Illinois.

Illinois—Pennsylvania Lines West of Pittsburgh—This company has secured the right of way for a third track between Chicago, Ill., and Logansport, Ind. Thomas Rodd, Pittsburgh, Penn., is Ch. Engr.

Illinois—La Salle Terminal Ry.—Isham Randolph & Co., Chicago, Ill., Consult. Engrs., have completed the final surveys for this company's proposed line from La Salle to Oglesby, Ill., and have turned the determinations over to the promoters of the proposition who are behind the Chicago, St. Louis & Gulf Transportation Co., which has inaugurated a large freight service on the Illinois & Michigan Canal, to Illinois and Mississippi River points. The railway project calls for a connecting belt line tapping the large cement plants in the La Salle District and other industries in the vicinity. Measures will be taken soon looking toward the construction of an interurban line connecting La Salle, Peru and Sterling, Ill., tapping a rich section of country unserved by adequate transportation. It is expected that this project will be fostered by the leading industries in the territory. The La Salle Terminal Ry. will require a number of steel structures over intersecting steam lines, including a swing-span over the Illinois River south of La Salle. The line has been located with a view to handling a large share of the traffic originating in the vicinity in addition to transfer business. Noted July 3.

Minnesota—Minneapolis, St. Paul & Sault Ste. Marie Ry.—This company is acquiring right of way for its proposed Thief River and International branch line. C. N. Falls, Minneapolis, Minn., is Ch. Engr.

+North Dakota—Northern Pacific Ry.—This company has awarded the contract to COOK CONSTRUCTION CO., Gilfallan Block, St. Paul, Minn., for grading for the proposed line south of Beach, N. D. Noted June 25.

Montana—Great Falls Western Ry.—This company has been incorporated in Montana to construct a 115-mile railroad from a point in Cascade County to a point in Powell County. C. L. Whiting, Lewistown, Mont., is interested.

Texas—Gulf, Texas & Western Ry.—The State Railroad Commission has granted the application of this company to issue $470,000 in bonds for improvements. B. B. Cain, Dallas, Tex., is Vice-Pres. and Gen. Mgr.

Texas—The State Railroad Commission, July 28, Austin, Tex., approved plans for the proposed interlocking system to be installed in connection with the terminals of the Union Terminal Co., at Dallas, Tex.

Oregon—Roach Timber Co.—This company will award the contract soon for the construction of 14¾ miles of railroad east from Sutherlin, Ore. The company's offices are located at Sutherlin.

California—Niland-Blythe R. R. Association—This association has been formed for the purpose of constructing a railroad from a point near Blythe, Calif., to Midland, Calif. A. E. Hull, Vanl Nuys Bldg., Los Angeles, Calif., is interested.

Ontario—Erie & Ontario R. R.—This company has been incorporated with a capital of $500,000, to construct a line from Port Maitland on the Toronto Hamilton & Buffalo Ry. and from Port Maitland east to Port Colborne, an additional 20 miles. Surveys are being made. J. N. Beckley, Rochester, N. Y., Pres. of the Toronto Hamilton & Buffalo Ry., is Pres. of the above company.

Finishing the Water Works at Panama—The contract for furnishing the pipe and some of the fittings required for the new water main to be laid from the south end of the Panama R. R. bridge at Gamboa, to the aeration basin on the hill above the Miraflores spillway, has been awarded to The United States Cast Iron Pipe & Foundry Co., 71 Broadway, New York, N. Y.

ELECTRIC RAILWAYS

Niagara Falls, N. Y.—[illegible] of the right-of-way has [illegible] by the Frontier Electric Ry. for the construction of an electric railway to connect Niagara Falls, Buffalo, Tonawanda and North Tonawanda. James S. Simmons, Niagara Falls, is Gen Mgr.

Camden, N. J.—The [illegible] Service Ry. Co. has applied to the City Council for permission to double-track its line on the White Horse Pike. R. E. Danforth, Newark, is Gen Mgr.

Lancaster, Penn.—According to press reports the Conestoga Traction Co., the Fair Association and the North [illegible] Co. are taking steps toward the construction of an electric railway from Lancaster to the fair grounds.

Waynesville, N. C.—The Waynesville & Canton Electric Ry. Co. will not construct its proposed 12-mile extension to connect Hazelwood and Canton, due to inability to secure financial backing. Henry T. Sharp, Asheville, is interested.

Pelham, Ga.—The Cairo, Pelham & Moultrie Ry. Co. has been recently incorporated with $[illegible] capital by J. J. Hill, and D. Farris, Pelham, and others and will construct an interurban railway from Pelham to Moultrie, about [illegible] miles.

Clearwater, Fla.—The City Council has granted a franchise to G. H. Freis, Clearwater, to construct an electric railway in Clearwater.

Charlotte, Mich.—A. B. Woods, Corunna, Mich., is reported to be interested in the construction of an electric railway from Charlotte to Albion, about 30 miles.

Bonner Springs, Kan.—The Kansas City, Kaw Valley & Western Ry. Co. will soon commence construction on the extension of its line from Bonner Springs to Lawrence. J. W. Richardson, 3[illegible] Delaware St., Leavenworth, Kan., is Gen Supt.

Casper, Wyo.—The Casper Street Ry. Co., recently incorporated with $[illegible] stock, will build an electric railway in Casper from Burlington depot to the southern boundary. James Fleming, Casper, is Pres.

Cotter, Ark.—N. V. Leiba, Mountain Home, Ark., is interested in the construction of an electric railway from Cotter, Ark., to Mansfield, Mo.

Blue Ridge, Tex.—The Greenville & Whitewright Interurban Co., which has completed the construction of an interurban electric railway between Anna and Blue Ridge, is preparing to extend the line to either Whitewright or Greenville.

Dallas, Tex.—William Doran of the Business Men's Committee of Dallas has retained Frederick A. Jones Co., Dallas, to make surveys for the proposed interurban electric railway, to be constructed between Dallas and Wichita Falls.

Palestine, Tex.—W. F. Brashier, of Corpus Christi, is preparing to construct a street railway system at Palestine. He will soon make application to the City Council for the necessary franchise for the use of certain streets.

San Antonio, Tex.—It is announced by W. B. Tuttle, Vice-Pres. of the San Antonio & Austin Traction Co., that the project of constructing an interurban electric railway between San Antonio and Austin has been temporarily abandoned due to unsatisfactory business conditions in the country, as a result of the European war.

Phoenix, Ariz.—R. W. Martin of New York and associates have purchased the franchise and other holdings of the Salt Valley Electric Co. and will construct an interurban electric railway between Phoenix and Mesa via Tempe, a distance of 18 miles. An electric power station will be built in connection with the project.

Everett, Wash.—The Everett Ry. Light & Water Co. will extend its tracks from the depot to the main part of the town. Stone & Webster, 147 Milk St., Boston, Mass., are the Mgrs.

Portland, Ore.—The Portland & Oregon City Ry. Co. has received a franchise from the City Council to construct an electric railway through the eastern section of the city to connect with the line being built from Oregon City to Portland. Noted Apr. [illegible]

Niland, Calif.—The Niland-Blythe Railroad Association has been organized for the purpose of constructing an electric railroad from Niland to Blythe. Arthur E. Hull, Los Angeles, is Pres.

Orange, Calif.—Preliminary surveys are being made by the Pacific Electric Ry. Co. for the construction of an electric railway from Orange to Brea. J. McMillan, Los Angeles, is Gen Mgr.

Redwood, Calif.—The Redwood Harbor Co. contemplates the construction of an electric railway to connect the foothills country with the waterfront.

LIGHT, HEAT AND POWER

◆Bedford Hills, N. Y.—The following bids were received July [illegible] by the Board of Managers of the New York State Reformatory for Women, for a power plant, piping and [illegible] system: [illegible] T. Ford Co., Rochester, $[illegible]; Wall Engineering & Construction Co., Inc., New York, $[illegible]; [illegible], New York, $[illegible]; the W. H. Armstrong Co., [illegible], $[illegible]; [illegible], New York, $[illegible]. [illegible]

Westfield, N. Y.—At an election held July [illegible], the citizens voted in favor of a bond issue of $[illegible] for the purpose of remodeling and extending the municipal electric-lighting system. [illegible] is Supt.

[illegible], N. J.—The Public Service Electric Co. has made an offer to the city to place all wires underground at an expenditure of $[illegible] [illegible] until the work is completed.

Bordentown, N. J.—The City Commission is considering the installation of a municipal electric lighting plant, estimated to cost about $[illegible].

Camden, N. J.—The Public Service Electric Co. has made an agreement with the city to place all of its wires underground. [illegible] [illegible]

Elizabeth, N. J.—It is reported that the Singer Mfg. Co., manufacturer of sewing machines, will build a new power station at its plant at Elizabethport.

◆Newark, N. J.—The Board of Education has awarded the contract for the installation of heating and ventilating apparatus at the North Seventh St. School to JOHN H. COONEY, Harrison, N. J., at $21,787.

South Amboy, N. J.—The Middlesex & Monmouth Light, Heat & Power Co. has applied to the Board of Chosen Freeholders of Middlesex County, New Brunswick, for permission to construct a transmission line from South Amboy to Whale Creek.

Gettysburg, Penn.—The Town Council has adopted a resolution providing for the establishment of a municipal electric-light plant. An engineer will be engaged at once to prepare plans and estimates for the plant.

Philadelphia, Penn.—The Philadelphia Electric Co. has awarded the contract for the construction of a power house on Christian St., near Schuylkill Ave., to the FIDELITY CONSTRUCTION CO. The plant will cost about $1,[illegible], and the equipment will include two turbo-generators of 30,000 and 3[illegible] hp. respectively. It will furnish power to operate the Pennsylvania R.R. from the Broad St. Station to Paoli, Penn.

Kinston, N. C.—It is reported that Gilbert C. White, Charlotte, N. C., has been engaged to supervise the reconstruction of the municipal electric-light plant.

Fort Meade, Fla.—An election will be held Aug. 21 to vote on the question of a bond issue of $2[illegible] for the purchase or construction of a municipal electric-light plant.

Mabou, Miss.—The Board of Aldermen has granted a franchise to F. H. Mudd for the establishment of an electric-light plant in Mabou. It is expected to have the plant in operation within three months.

Cave City, Ky.—The Cave City Ice Co. contemplates the installation of an electric-light plant in connection with its present equipment.

Louisville, Ky.—Bids will be received until Aug. 19, by S. D. Jones, Business Mgr. of the Board of Education, for the installation of heating and ventilating equipment in the Flat Lick School.

Cincinnati, Ohio.—(Official)—Bids will be received until noon, Sept. 1, by the New Courthouse Building Commission of Hamilton County for heating and ventilating, electrical work, elevator equipment and a power plant for the new Courthouse and County Jail. Rankin, Kellogg & Crane, 1012 Walnut St., Philadelphia, Penn., are the Archts. James A. Green is Pres. of the New Courthouse Bldg. Comn.

Cleveland, Ohio.—Bids will be received until noon, Aug. 21, by the Commissioner of Purchases and Supplies, City Hall, for the construction of the Walworth Ave. substation for the municipal electric-light system. The building will be of brick and reinforced concrete, two stories, 47x1[illegible] ft. It will cost about $30,000. F. W. Ballard is Comr. of Light and Heat.

Hamilton, Ohio.—It is reported that another unit will shortly be added to the municipal electric-light plant at a cost of about $[illegible],000. Joseph Myers is Dir. of Pub. Ser.

Mason, Ohio.—Plans have been completed for the establishment of a municipal electric-light plant, for which $14,000 in bonds have been issued.

Sycamore, Ohio.—Bids will be received until Aug. 14, by the Board of Trustees of Public Affairs, O. J. Niebel, Clk., for improvements and repairs to the municipal electric-light plant and water-works. George Champe, 610 Nasby Bldg., Toledo, is Consult. Engr.

Gary, Ind.—The City Council has granted a 25-year franchise to Sigwald Moe, C. H. Maloney and Henry A. Vosser, all of Gary, for the construction and operation of a central heating plant. The initial cost will be about $2[illegible].

◆Tell City, Ind.—The contract for rebuilding the municipal electric-light plant has been awarded to the GENERAL ELECTRIC CO., Schenectady, N. Y., at $12,[illegible]. Noted July 2.

Escanaba, Mich.—The Escanaba Traction Co. will construct a third dam and hydro-electric plant on the Escanaba River. The power house will be located just below Chandler Falls, and will generate 1[illegible] hp. F. L. Utley is Secy. and Gen. Mgr. of the Escanaba Traction Co.

Saginaw, Mich.—(Official)—The city is considering the installation of a municipal electric lighting system, estimated to cost about $[illegible]. Herman H. [illegible] is City Engr.

◆Denison, Iowa.—The City Council has awarded the contract for the construction of a building for the municipal light plant to [illegible] & [illegible], Denison, at $[illegible]; the contract for the equipment of the plant was awarded to the McGRAW ELECTRIC CO., Omaha, Neb., at $22,9[illegible]. Noted July 9 and July 23.

◆Manilla, Iowa.—The City Council has awarded the contracts for the municipal electric-light plant to the MIDWEST ELECTRIC CO., Omaha, Neb., at $11,1[illegible] for the equipment of the building, to include a [illegible]-hp. Diesel oil engine and a [illegible]-kw. dynamo. The contract for overhead equipment was awarded to the STANDARD ELECTRIC CO., Waterloo, Iowa, at $[illegible]. Noted Apr. [illegible]

◆[illegible], Minn.—The contract for improvements to the municipal electric-light plant and water-works has been awarded to [illegible] WHITAKER & CO., St. Paul. The work will include building a new tank and smokestack and installing some new equipment.

Ceylon, Minn.—The City Council has engaged Earle D. Jackson, St. Paul, to prepare plans for the construction of a municipal electric-light plant, for which [illegible] in bonds have been issued. F. H. [illegible] is City Clk.

◆Owatonna, Minn.—The State Board of Control, Minneapolis, has awarded the contract for heating, [illegible] and plumbing in the State Public School at Owatonna to the [illegible] CO., Owatonna, at $[illegible].

Virginia, Minn.—Bids will be received until 7 p.m., Aug. 17, by the Water & Light Department, for the construction of a high-pressure gas plant. J. W. Murphy is Secy. of the Water and Light Comn.

Erwin, S. D.—The city is contemplating the installation of a municipal electric-lighting system.

Parker, S. D.—Bids will be received until Aug. 25, by C. L. Jones, City Audr., for the construction of a municipal electric-light, heat and power plant. The estimated cost is $20,000. The Oscar Claussen Engineering Co., Commercial Bldg., St. Paul, Minn., is Engr.-in-Charge. Noted June 11 and July 9.

Auxvasse, Mo.—M. R. Kennedy has made application to the Public Service Commission for permission to construct and operate an electric-light plant in Auxvasse.

Linn Creek, Mo.—Plans are being prepared for the construction of a hydro-electric plant on the Niangua River, near Linn Creek. It will include five dams of 40 to 50-ft. heads between Linn Creek and Bennett's Mills, and a steel tower transmission system to distribute electricity within a radius of 100 miles. L. C. Scott is interested. Noted Jan. 22 and Mar. 5.

Bogata, Tex.—Roy Riggs, Brownwood, Tex., is interested in the organization of a company to establish an electric-light and power plant in Bogata.

Paris, Tex.—The electric power plant which the Texas Power & Light Co. will build in Paris will be equipped with three 500-hp. improved Deisel engines with a full complement of electrical machinery. A transmission line will be built by the company from Paris to Bonham.

McLoud, Okla.—(Official)—Bids will be received by the Board of Trustees until 2 p.m. Aug 17, for the construction of transmission lines and a system of street-lighting. The Benham Engineering Co., American National Bank Bldg., Oklahoma City, is Eng. in Charge. Noted June 25.

Mangum, Okla.—At a recent election, the citizens voted in favor of a bond issue of $100,000, to be used for the purchase of the electric-light, water and ice plant.

Culdesac, Idaho—The City Council has granted a franchise to W. L. Marrs, Cœur d'Alene, to construct and operate an electric-light plant to serve the town and immediate vicinity. Construction work will begin shortly.

Tolchaco, Ariz.—F. G. Baum, San Francisco, Calif., and associates will construct a dam across the Little Colorado River near this point and will erect a hydro-electric plant to provide power for operating mines and other industries. It is proposed to construct transmission lines to Globe, Hayden and Ray, more than 175 miles distant from the proposed main power plant. The dam will impound 447,500 acre ft. of water and will afford a sufficient supply to irrigate a large tract of land. Mr. Baum has filed the plans for the work in the State Land Office at Phœnix.

Tucson, Ariz.—The Federal Light & Power Co. will spend $170,000 for improvements on the Tucson Rapid Transit Co. and the Tucson Gas, Electric Light & Power Co. About $100,000 will be used for power-house extensions, $40,000 for street-railway improvements, $10,000 for gas plant and $20,000 for the extension of transmission lines for irrigation pumping.

Hemet, Calif.—The Board of City Trustees is considering the installation of a municipal power plant to furnish electricity for light and power.

Bolton, Ont.—The ratepayers have voted to take over the plant of the Light, Heat & Power Co., and will spend about $10,000 for the installation of a new hydro-electric system.

St. Catherines, Ont.—(Official)—A new hydro-electric system is now under construction for the city, to cost, when fully completed, about $116,000. All contracts for the work have been awarded. J. S. Campbell is Chn. of the Hydro-Electric Comn. Noted July 9.

St. Thomas, Ont.—The City Council has appropriated $20,000 for extensions and improvements to the municipal gas plant.

+Shoal Lake, Man.—The City Council has awarded contracts for the construction of a municipal power plant to: E. R. SNIDER, Shoal Lake, for building; CANADIAN GENERAL ELECTRIC CO., Winnipeg, Man., to furnish generator, switchboard and pole line materials and construction; the REFRIGERATION & ENGINEERING CO., Winnipeg, for a Campbell oil engine. Total cost, $21,200. Noted May 14.

Moose Jaw, Sask.—Bids will be received until noon, Aug. 26, by the City Commissioners for furnishing high pressure steam pipes and appliances for a 3500-hp. plant. James Pascoe and W. F. Heal are Comrs.

Calgary, Alta.—The Western Canada Flour Mills, Ltd., has had plans prepared by Theodore Kipp, Union Trust Bldg., Winnipeg, Man., for the construction of a power house at its plant.

BRIDGES

Ashland, Mass.—Bids will be received until Aug. 15 by Charles T. Dearborn, Chn. of the Bridge Com., for the construction of a reinforced concrete bridge on Concord St.

+Cambridge, Mass. — (Official) — The Commissioners of Middlesex County have awarded the contract for the construction of a road and concrete bridge in the towns of Medfield and Sherborn to the CHARLES J. JACOBS CO., 107 Terrace St., Roxbury, Mass., at $10,238. Other bidders were: Hyde Park Construction Co., Boston, $10,960; H. d'Ippolite & Co., Wrentham, $11,906; Hapgood Frost Co., Wellesley, $12,693; Hancock Engineering Co., $12,720; B. Perini & Co., Ashland, $12,703. Noted July 30.

★Charlotte, N. Y.—(Official)—The following bids were received Aug. 6, by the Monroe County Building Commission, Rochester, for the construction of a bridge across the Genesee River at Charlotte: Double leaf bascule bridge, (a) Strauss double leaf bascule, (b) Scherzer double leaf bascule, (c) Rall double leaf bascule; Penn Bridge Co., (a) $231,940; Lupfer & Remick, (a) $255,002, (b) $240,008, or $233,708 with cylinders on west end; Strobel Steel Construction Co., (c) $244,962; McHarg-Barton Co., (a) $248,343 with concrete fixed superstructure, or $262,975 for official plans, (c) $245,496 with concrete fixed spans, or $260,078 with steel fixed superstructure; Seneca Engineering Co., (a) $262,466; R. T. Ford Co., (a) $275,684; P. J. Carlin Construction Co., (a) $276,749. For a single leaf bascule and swing bridge, the bidders were: (a) Bobtail swing bridge, (b) Strauss single-leaf bascule, (c) Rall single-leaf bascule; Penn Bridge Co., (a) $207,023 with plank floor, or $225,023 with pavement, (b) $226,457; Strobel Steel Construction Co., (a) $235,152; R. T. Ford Co., (a) $237,335 with plank floor, or $243,705 with pavement; Lupfer & Remick, $239,008 for Scherzer single-leaf with cylinders, $260,708 for Brown single-leaf with cylinders, or $266,308 for Brown single-leaf, official plan otherwise; McHarg-Barton Co., (c) $242,996 with concrete fixed superstructure, or $257,628 with steel fixed superstructure; Seneca Engineering Co., (b) $244,950, or $269,192 for straight swing bridge. The contract will probably be awarded on Sept. 2. Noted Dec. 11 and Dec. 25, 1913, Apr. 23 and June 11, 1914.

★Norwich, N. Y.—(Official)—The Town Board has rejected all bids received Aug. 5 for the construction of a reinforced concrete bridge over Chasawacta Creek, as exceeding the appropriation. New bids will be received until 1:30 p.m. Aug. 19. C. E. Harris, Sturdevant Blk., Norwich, is Engr. Irving D. Tillman is Town Clk. Noted July 30.

Syracuse, N. Y.—Plans are being prepared for the construction of a new bridge at Oxford St., for which there is an appropriation of $11,000, and for rebuilding the West Newell St. Bridge for which $10,000 is available. Both bridges will span Onondaga Creek, and will be of the box-girder type, with one roadway and two sidewalks. W. T. Wooley is City Engr.

Troy, N. Y.—The Troy & West Troy Bridge Co. is having plans prepared for the construction of a bridge across the Hudson River. Bids will be asked about Sept. 1.

+Yonkers, N. Y.—The Board of Contract and Supply has awarded the contracts for the construction of two bridges over the Bronx River between Yonkers and the Town of Eastchester to NICHOLAS FAGNANI, Tuckahoe, at $8416 for the bridge at Front Ave., and to WILLIAM M. KNOX, New York, N. Y., at $7945 for the bridge at Palmer Ave. Both bridges will be of reinforced concrete.

Bids will be received until Sept. 8 by the Board of Contract and Supply for the erection of a reinforced concrete bridge at Dewitt Ave.

Elizabeth, N. J.—The Boards of Chosen Freeholders of Union and Hudson Counties have instructed their engineers to prepare preliminary plans and estimates of the cost of a bridge across Newark Bay, connecting Elizabethport and Bayonne, the bridge to be built jointly by the two counties. Jacob L. Bauer, Elizabeth, is County Engr. of Union County. Noted Dec. 4, 1913.

Newark, N. J.—The Board of Chosen Freeholders of Essex County has instructed Frederick A. Reimer, County Engr., to prepare plans for a bridge over the Passaic River at Elwood Ave., connecting the Woodside section with Arlington. It will be of the lift type, 60 ft. wide, and about 3000 ft. long. The estimated cost is $800,000.

New Brunswick, N. J.—Bids will be received until Aug. 24 by the Board of Chosen Freeholders of Middlesex County for the construction of a concrete slab bridge over Deep Run on the South Amboy-Bordentown Turnpike. Alvin B. Fox, Perth Amboy, is County Engr.

Trenton, N. J. — The Board of City Commissioners has approved revised plans for the construction of bridges over the canal at Greenwood and at Hamilton Aves. J. R. Fell, Jr., is City Engr.

Butler, Penn.—(Official)—Bids will be received until noon, Aug. 20, by the Commissioners of Butler County for the construction of a reinforced concrete bridge over a branch of Buffalo Creek, Clearfield Township, and for a creosoted plank and block floor in the Bonnie Brook Bridge. W. B. Scott is Clk. of Comrs.

Philadelphia, Penn.—Bids will be received until Aug. 14 by Morris L. Cooke, Dir. Dept. of Pub. Wks., for the construction of a bridge at Warrington Ave., known as the 71st St. Bridge.

+Sunbury, Penn.—The County Controller and the Commissioners of Northumberland County have awarded the contract for the construction of a steel truss bridge over Shamokin Creek at Keefer's Station to REIMARD BROS., Bloomsburg, Penn., at $5280. Other bids were: Groten Bridge Co., $5900; C. L. Remsey & Peter Barr, $6113, and Whitaker & Diehl, $6237.

★Baltimore, Md.—(Official)—Bids will be received until noon, Sept. 15, (change of date from Aug. 13) by the State Roads Commission, Garrett Bldg., for the construction of the Hanover St. Bridge. For details, see advertisement under Contracts To Be Let. Noted July 30.

★Petersburg, Va.—(Official)—Bids will be received until noon, Aug. 17, by the Street Committee of the City Council for the construction of a steel bridge over the Appomattox River to Pocahontas. R. D. Budd is City Engr. Noted July 9.

Sussex, Va.—(Official)—Bids will be received until noon, Aug. 20 by the Circuit Court of Sussex County for the construction of three steel bridges, each 37 ft. long, across the Assomoosic Swamp, about six miles from Homeville. The Childrey Co., Richmond, Va., is Engr.-in-Charge.

Louisville, Ky.—The lowest bid received by the Board of Public Works for the construction of the Dupuy St. Bridge was that of J. H. Cahill at $13,855. There were seven other bidders. Noted July 30.

+Whitesburg, Ky.—(Official)—The Fiscal Court has awarded the contract for the construction of three bridges in Letcher County to the CHAMPION BRIDGE CO. at about $8500, using its own plans. Bidders on the state plans were: East St. Louis Bridge Co., $11,020; Empire Bridge Co., $10,890; Rochester Bridge Co., $11,040; Champion Bridge Co., $11,900 and the International Steel & Iron Construction Co., $11,650. Noted July 2.

Cincinnati, Ohio—[illegible] will be received [illegible] noon, Aug [illegible] by the [illegible] of Commissioners of Hamilton County for the [illegible] of [illegible] bridge on [illegible]ughman Road [illegible] is [illegible] of Commrs.

+Cleveland, Ohio—The [illegible] of Commissioners of Cuyahoga County has [illegible] the contract for the construction of the [illegible] Heights [illegible] bridge to the BATES & ROGERS CONSTRUCTION CO., 17 West Van Buren St., Chicago, at [illegible]. Noted June [illegible], July [illegible] and Aug 6.

Dayton, Ohio—As soon as the flood protection plans of the [illegible] District are completed, the city will construct [illegible] for [illegible] bridge, will build one new bridge over the Miami River and two over the Mad River. [illegible] is City Engr.

Hamilton, Ohio—The [illegible] of Commissioners of Butler County has received the following bids for the construction of [illegible] bridge over the Miami River at Woodsdale: (a) concrete, (b) steel. A. J. Yeager & Co., Indianapolis, (a) $84,126; Vang Construction Co., Cumberland, Md., (a) $91,741; Pan American Bridge Co., Greencastle, Ind., (a) $103,500, $94,400, (b) $63,600; [illegible]ler & [illegible]ter, Dayton, (a) $98,000, $74,000, $78,000, $78,749; [illegible] Construction Co., Indianapolis, Ind., (a) $[illegible]; [illegible]-White Construction Co., Chicago, (a) $77,977, $78,278, $[illegible]; [illegible] Bridge Co., (b) $59,000, $57,000, $56,000 and $[illegible]. Noted July 23.

Lima, Ohio—(Official)—Bids will be asked about Nov. 1, by the City Council for the construction of the Pine St. Bridge. Chester & Fleming, Union Bank Bldg., Pittsburgh, Penn., prepared the plans. The estimated cost is $30,000. Joseph Askins is Dir. of Pub. Ser. Noted July 23.

+Mount Gilead, Ohio—(Official)—The Board of Commissioners of Noble County has awarded the contract for the construction of a bridge in Chester Township to the OHIO CONCRETE SUPPLY CO., Fremont, Ohio, at $3950; the contract for a bridge in Washington Township was awarded to the BROOKVILLE BRIDGE CO., Brookville, Ohio, at $1867. Noted July 23.

+Youngstown, Ohio—(Official)—The City Council has awarded the contract for the construction of a reinforced concrete bridge across Andrews Hollow at Fifth Ave. to N. R. PORTERFIELD, 17 Battery Place, New York, N. Y., at $31,268. Noted July 30.

+Boonville, Ind.—(Official)—The Board of Commissioners of Warrick County has awarded the contract for the construction of 1[illegible] bridges in the county to the VINCENNES BRIDGE CO., Vincennes, at $7214. Other bidders were: Thomas Thompson, $[illegible]100; George Sober, $9548; Frank C. Hay, $[illegible]; Sullivan Bridge Co., $10,600 and C. C. Forum, $9862. Noted July 2 and July 16.

Fort Wayne, Ind.—(Official)—Bids will be received until 10 a.m. Aug. 1[illegible] by Calvin H. Brown, Audr. of Allen County, for repairing and painting bridges and constructing concrete arches in the county.

Indianapolis, Ind.—Bids will be received until 10 a.m. Aug. [illegible] by W. T. Patten, Audr. of Marion County, for the construction of a bridge across the White River at West New York St. Noted Aug. 6.

+Ecorse, Mich.—The Ecorse Township Board has awarded the contract for the construction of a bridge over Ecorse Creek at the south end of the village to the SCHERZER ROLLING LIFT BRIDGE CO., 53 West Jackson Blvd., Chicago, at [illegible].

De Pere, Wis.—The Common Council has instructed the City Engineer to prepare plans and estimates for the construction of a new bridge over the Fox River to replace the present structure, which has been condemned. The present bridge is [illegible] ft. long.

Chariton, Iowa—(Official)—All bids received on Aug. [illegible] by the Board of Supervisors of [illegible] County for the construction of a bridge were rejected, and new bids will be received until Aug. 1[illegible] by the Supervisors for the construction of an [illegible] and one [illegible]-ft. deck girder bridge. [illegible] is County Engr. Noted July [illegible].

+Creston, Iowa—The Board of Supervisors of Union County has awarded the contract for the construction of [illegible] bridges and culverts to the MARSH ENGINEERING CO., Des Moines; the contract for three bridges and culverts was awarded to the IOWA BRIDGE CO., Des Moines. Noted June [illegible].

+Little Falls, Minn.—(Official)—The Commissioners of [illegible] County have awarded the contract for the construction of State Bridge No. [illegible] to JOHNSON & PETERSON, Little Falls, at $[illegible]; the contract for Bridge No. [illegible] was awarded to the GREAT NORTHERN BRIDGE CO., Minneapolis, at $[illegible]. Noted July [illegible].

Kola, Kan.—Bids will be received until Aug. 21 by the Commissioners of [illegible] County for the construction of four bridges [illegible] ft. span.

[illegible] City, Kan.—[illegible]

Wichita, Kan.—[illegible]

[illegible]

Lexington, Neb.—[illegible]

Medora, N. D.—Bids will be received until Sept. 7, by the Commissioner of Billings County for the construction of a bridge over the Little Missouri River near Medora.

Roundup, Mont.—It is reported that the Commissioners of Musselshell County will soon call a special election for the purpose of voting on a bond issue of $75,000, to be used for the construction of five steel bridges over the Musselshell River.

+Choteau, Mont.—The Board of Commissioners of Teton County has awarded the contract for the construction of a bridge in the county to the UNITED STATES BRIDGE CO., Great Falls, Mont., at $9200.

+Dalton, Ark.—The Commissioners of Randolph County, Pocahontas, have awarded a contract for the construction of a bridge over the Eleven Point River at Dalton to the VINCENNES BRIDGE CO., Vincennes, Ind., at $6[illegible].

+Dallas, Tex.—The Commissioners Court of Dallas County has awarded the contract for the construction of three bridges over the Trinity River to HESS & SKINNER, Dallas, at $[illegible],250. Noted July 16.

McAlester, Okla.—Bids will be received until 10 a.m. Aug. 24, by J. M. Gannaway, City Clk., for the construction of a reinforced concrete bridge across Sandy Creek at Second St. J. L. Wood is Mayor.

Boise, Idaho—The lowest bid received by the Commissioners of Ada County for the construction of two steel bridges was that of the Missouri Valley Bridge & Iron Co., 1540 California St., Denver, Colo., at $4000.

+Challis, Idaho—The Commissioners of Custer County have awarded the contract for the construction of three bridges in the county to J. H. FORBES & CO., Coldwell, Idaho.

Moab, Utah—(Official)—Bids will be received until 5 p.m., Aug. 15, by the Commissioners of Grand County for the construction of a stiffened suspension bridge over the Grand River. The estimated cost is $18,600. Horace W. Sheley, 304 Dooley Bldg., Salt Lake City, Utah, is Consult. Engr.

+Salt Lake City, Utah—The State Road Commission has awarded the contract for the construction of seven State Road bridges to J. J. BURKE & CO., Salt Lake City, at $9643. There were six bidders, whose figures ranged from the successful bid to $13,341.

Phoenix, Ariz.—The State Board of Control has approved plans for the Cañon Diablo Bridge, Coconino County, to cost about $11,000, and for bridges across the Milky and Beaver dam washes, Apache County, costing about $14,000 for the two. Lamar Cobb is State Engr. Noted Aug. 6.

McMinnville, Ore.—The Coast Bridge Co., Railway Exchange Bldg., Portland, was the lowest bidder for the construction of two steel bridges across the Yamhill River at $13,707 for the Dayton Bridge, and $12,[illegible]24 for the McMinnville Bridge. The contract has not yet been awarded. Noted July 23.

St. Helen, Ore.—(Official)—Bids will be received until 2 p.m. Aug. 15, at the Court House, St. Helen, by the State Highway Commission for the construction of four bridges on the Nehalem Highway, Columbia County. H. L. Bowlby, Portland, is State Highway Engr.

Fall River Mills, Calif.—The Board of Supervisors of Shasta County, Redding, has advertised for bids for the construction of a bridge across the Pitt River at Winters Crossing, five miles below Fall River Mills. It will be a [illegible]-ft. span.

Needles, Calif.—Press reports state that a $[illegible] bridge will soon be built across the Colorado River at Topoc, near Needles. The Federal Government has appropriated $[illegible] toward its construction. San Bernardino County, Calif., and Mohave County, Ariz., will each contribute $[illegible]. L. V. Root, Needles, Calif., is interested.

+Pasadena, Calif.—The contract for the construction of a reinforced concrete arch, retaining walls and dam under the Colorado St. Bridge over the Arroyo Seco at Pasadena, has been awarded to the PUTNAM STONE CONSTRUCTION CO., Chamber of Commerce Bldg., Pasadena, at $[illegible].

Red Bluff, Calif.—The Board of Supervisors of Tehama County has called an election for Aug. [illegible] to vote on the question of a bond issue of $[illegible] for the construction of bridges on the State Highway through the county.

+San Jose, Calif.—The Board of Supervisors of Santa Clara County has awarded the contract for the construction of a steel bridge over Pacheco Creek to JOHN DOYLE, San Jose, at $[illegible]. Noted July 16.

Bids will be received until 11 a.m. Aug. 1[illegible] by the Board of Supervisors of Santa Clara County for the construction of a steel bridge over the Pajaro River at the Monterey road crossing between Santa Clara and San Benito Counties. J. H. McMillan is Secy. of Santa Clara County.

Watsonville, Calif.—The Board of City Trustees has decided to build a bridge over the Pajaro River. The estimated cost is $[illegible].

Quebec, Que.—The City Council is considering the construction of a steel cantilever bridge, about 1[illegible]0 ft. long, at [illegible] Road, Quebec. W. W. [illegible], 60 St. Louis St., is Engr.

+Ottawa, Ont.—(Official)—The City Council has awarded the contracts for the [illegible] Bridge to the DOMINION BRIDGE CO., [illegible] St., Ottawa, at $[illegible] for furnishing the steel and erecting the superstructure and to R. [illegible], [illegible] St., Ottawa, at $[illegible] for the substructure. Noted July [illegible].

Sudbury, Ont.—Bids will be received until Aug. 17, by W. [illegible], Town Clk., for the construction of four bridges over certain creeks within the town of Sudbury.

Tillsonburg, Ont.—Bids for the construction of a reinforced concrete arch at [illegible] St., Tillsonburg, are being received by the Engr. in Charge, J. A. Bell & Son, St. Thomas, Ont.

★**Calgary, Alta.**—(Official)—Bids will be received until 10 a.m. Aug. 26, by the City Commissioners for the construction of a reinforced concrete arch over the Elbow River in Calgary. George W. Craig is City Engr. See advertisement under Contracts To Be Let in issue of Aug. 6.

+**Vancouver, B. C.**—The Municipal Council has awarded the contract for the 25th St. Bridge, West Vancouver, to NAYLOR BROS., Bank of Hamilton Bldg., Vancouver, at $33,200; the contract for the Fifth St. Bridge, West Vancouver, was awarded to BRUCE BROS., 709 Dunsmuir St., Vancouver, at $5000.

WATER SUPPLY—IRRIGATION

+**Henniker, N. H.**—The contract for the construction of a reservoir, pumping station, a well and laying 12,000 ft. of water pipe has been awarded to SUSI & WILLIAMS, at $17,009. Other bidders were: John A. Broderick, $17,490; Felix Capobianco, $17,981; Thomas Bruno, $17,714; John E. Palmer, $19,208; Light, Heat & Power Corporation, $20,375; Hanscom Construction Co., $21,659; Newell, Dresser & Cavanaugh, $24,718; Marsano Traufaglia, $28,139; W. S. Johnson, 101 Tremont St., Boston, is Engr.

Adamsdale, Mass.—A committee consisting of F. White and A. A. Newell has been appointed by the Improvement Society to investigate a water supply for the city.

+**Boston, Mass.**—(Official)—The Metropolitan Water and Sewerage Board has awarded the contract for laying 20-in. water mains in Boston, to CHARLES R. GOW CO., West Roxbury, at $5007. Bids were received July 31.

+(Official)—Bids were received by the Metropolitan Water and Sewerage Board, July 31, for Contract 361, constructing a foundation for the steel reservoir on the summit of Bellevue Hill, West Roxbury District, from WALSH'S HOLYOKE STEAM BOILER WORKS, Holyoke, $19,397 (awarded contract); Chicago Bridge & Iron Works, $19,540; Petolem Iron Works, $19,870; Pittsburgh-Des Moines Steel Co., $20,900; Riter Conley Mfg. Co., $23,865. Noted July 30.

Mansfield, Mass.—Plans have been prepared for the construction of a reservoir on Foolish Hill. The basin will be oval, 200 ft. long and 89 ft. wide, with a depth of 16 ft.

+**Gilbertsville, N. Y.**—(Official)—The contract for constructing an earth dam, a diversion channel and an 8-in. pipe line, 1½ miles long, has been awarded by Joseph T. Gilbert to SUBURBAN ENGINEERING CO., New York, N. Y., at $23,957. Noted July 23.

Naples, N. Y.—According to press reports the citizens have voted to spend $18,000 for constructing a pipe line from the springs to the reservoir.

★**Riverhead, N. Y.**—(Official)—Bids will be received by the Board of Water Commissioners until 1:30 p. m., Aug. 25, for constructing a water system. Walter E. Sexton, Mineola, N. Y., in Engr. and William F. Flannigan,, Secy. of the Comn.

Jersey City, N. J.—The Board of City Commissioners has ordered the preparation of plans and specifications for the construction of new water pipe line under the Hackensack River for local service. Henry Byrne, Dir. Pub. Ser., will be in charge of the work.

+**Princeton, N. J.**—The Princeton Water Co. has awarded a contract for the erection of a new tower tank with capacity of 535,000 gals., to TIPPETT & WOOD, Phillipsburg, N. J.; MATTHEWS CONSTRUCTION CO., Princeton, has received the contract for a concrete pedestal foundation for the tank.

College Hill, Penn.—(Beaver Falls post office)—The Citizens Water Co. has purchased a site in White Township for the construction of a storage reservoir.

Ebensburg, Penn.—All bids recently received by the Council tor the construction of a new reservoir in connection with the water system have been rejected. The work will be done by the Borough.

McDonald, Penn.—Bids will be received by E. S. McWreath, Secy. Citizens Water Co., until noon, Aug. 15, for constructing a storage dam, filter foundations and filter building, in Robinson Township, Washington County. Douglass & McKnight, 1709 Union Bank Bldg., Pittsburgh, are the Engrs.

Reading, Penn.—Press reports state that about 3500 ft. of 30-in. pipe will be laid in 13th St. north to the city line.

+**Shippensburg, Penn.**—(Official)—Bids have been received for furnishing 20,000 ft. of 10-in. iron and wood water mains as follows: W. C. FRITZ CO., Essex Bldg., Newark, N. J., at $23,900 (awarded contract); Charles Dugan, $31,500; J. T. Dick, $32,875; W. H. Angle, $29,338; and Whiting-Turner Construction Co., $32,700. John E. Coffey is Boro. Clk. Noted May 14.

Wilmington, Del.—According to press reports the city contemplates the construction of a reservoir on the Weldin Farm, to have a capacity of 32,000,000-gal. and to cost $200,000.

Pollock, Md.—At a recent election bonds for $45,000 were voted for the construction of a water and a sewer system.

Raleigh, N. C.—Bonds for $75,000 have been voted for the improvement of the water system.

Atlanta, Ga.—W. Z. Smith, Mgr. of the water-works, has recommended to the City Council an expenditure of $200,000 for additional filter beds.

Royston, Ga.—Press reports state that the city has been authorized to issue bonds for $100,000 for the construction of a water works, sewer system and crematory.

Bay Minette, Ala.—Bonds for the construction of a water and a sewer system were voted at a recent election. Noted July 2.

Breaux Bridge, La.—Bids will be received until Aug. 20 for $12,000 in bonds for extending the water system and electric-light plant. C. C. Rees is Mayor.

Hodgenville, Ky.—The citizens plan to construct a waterworks system at Hodgenville.

+**Cincinnati, Ohio**—(Official)—Contracts for laying a 36-in. water main in Spring Grove Ave. and in Eastman Ave. and Deerfield Road have been awarded to the UNITED STATES CAST IRON PIPE & FOUNDRY CO., at $29,598 and at $112,000 respectively. Frank Krug is City Engr. Noted July 9 and 16.

Cleveland, Ohio—Bids will be received by Commissioner of Purchases and Supplies, room 513, City Hall, until noon, Aug. 19, for two air locks and medical locks for the West Side tunnel, also for the removal and re-erection of Woodland Ave. tower for the Department of Public Utilities, division of water. Charles F. Schultz, is Comr. of Water.

Dayton, Ohio—The city will issue bonds for $1,000,000 the proceeds of which will be used for the extension and improvement of the water system.

+**Fairport, Ohio**—(Fairport Harbor Post Office)—The contract for furnishing 17,500 ft. of c.-i. waterpipe has been awarded to CHAPMAN & GLOVER, Lorain, at $12,477. J. C. Ward is Village Engr.

+★**Frankfort, Ohio**—(Official)—The contract for the construction of a water system has been awarded to ROSSER, HARPER & STUART, Bremen, at $16,587. Other bids were Chillicothe Construction Co., $18,587; Seiverling & Fairbarn, $20,969. Bids were received July 21. Noted June 23.

Marysville, Ohio—Bids will be received by H. H. Shirer, Secy. Building Comn., until 2 p.m., Aug. 26, for constructing a well house, water softening plant, drilling wells, etc., at the Reformatory for Women at Marysville.

Maumee, Ohio—Bids will be received by Thomas N. Dowling, Village Clk. until Sept. 1, for the purchase of $56,000 in bonds for constructing a water system. Noted Aug. 6.

Sycamore, Ohio—Bids will be received by the Clerk, Board Trustees Public Affairs, until Aug. 14 for making improvements to the municipal water and light plants. George Champe, Toledo, is the Engr.

Zanesville, Ohio—Chester & Fleming, Engrs., Pittsburgh, Penn., have been retained to prepare plans for the construction of a filter estimated to cost $125,000.

+**Goodland, Ind.**—The contract for the construction of a water system has been awarded to the NATIONAL CO., South Bend, Ind. Noted Dec. 11, 1913.

La Porte, Ind.—The city contemplates the construction of a new well at the Kankakee pumping station, to cost, $6000.

Michigan City, Ind.—Bids were received by the Krehbiel Engineering Co., Chicago for the construction of a water system as follows: Section A, concrete work; section B, small pumps, etc.; section C, both A and B. M. W. Holben, Chicago, $4160, Section A. Reed and Reed, Michigan City, section A, $7100; section B, $13,950; section C, $19,250. Rich and Johnson, Chicago, section A and B, $18,000. Brady & Co., Chicago, section A, $8851; section B, $15,672; section C, $24,523. M. H. Crane Estate, Chicago, section B, $16,912. Noted June 4 and July 2.

Rochester, Ind.—(Official)—All bids received, Aug. 4, by W. C. Miller for installing a pneumatic or auto-pneumatic water system at the poor farm have been rejected. Noted July 30.

Muskegon Heights, Mich.—Bids will soon be received for the construction of a reservoir for increasing the water supply. Noted Feb. 12.

Ashton, Ill.—James H. Thompson, Engr., Chicago, is preparing plans for the construction of a water system. Bonds for this purpose have not yet been voted. Ralph J. Dean is Village Clk.

Champaign, Ill.—Bonds for the improvement of the water system have been voted.

East Peoria, Ill.—(Peoria post office)—Bids will be received until 8 p.m., Aug. 17, by George H. Walmsley, Pres. Board Village Council, care of. B. H. Neichelder, Clk. for laying c.-i. water pipe and setting hydrants and valves. Arthur Marshall Morgan, Haris Trust Bldg., Chicago is the Engr. Noted July 30.

Quincy, Ill.—According to press reports the city contemplates the installation of a pumping plant for the water system at Towhead Island, to cost approximately $70,000.

Sullivan, Ill.—Bonds for $35,000 have been voted by the citizens for the extension of the water system and for improvements to the light plant.

Villa Grove, Ill.—Bonds for $12,000 have been voted, the proceeds of which will be used for the installation of a water system.

Stoughton, Wis.—(Official)—All bids received Aug. 2 for constructing a reinforced concrete reservoir have been rejected. L. C. Currier is City Clk. Noted July 30.

★**Dubuque, Iowa**—(Official)—Bids were received July 29, by the Board of Water Works Trustees for constructing a reservoir to have a capacity of 7,500,000-gal., from J. J. Jobst, Peoria, Ill., $62,000; M. Hayes & Sons, Janesville, Wis., $64,000; Mid West Construction Co., Kansas City, Mo., $66,000; J. W. Turner Improvement Co., Des Moines, Iowa, $69,750; John T. Blake, Madison, Wis., $72,000; Nash Dowdle Co., Chicago, Ill., $75,217; Wodrick & Son, Dubuque, Iowa, $75,650; Anton Zwack, Dubuque, Iowa, $84,956; Byrone & Saul, Dubuque, Iowa, $86,000; Commercial Construction Co., Kansas City, Mo., $86,000; George W. Stiles Construction Co., 1036 Rookery-Chicago, $86,538; Tibey Bros., Dubuque, Iowa, $87,000; James Stewart & Co., Chicago, Ill., $106,790. Noted July 16.

Grand Mound, Iowa—(Official)—Plans for the reconstruction and extension of the waterworks have been prepared by Charles P. Chase, Consult. Engr., Clinton, Iowa.

Wheatland, Iowa—(Official)—Plans have been prepared by Charles P. Chase, Consult. Engr., Clinton, for reconstructing and extending the water system.

+**Alton, Kan.**—(Official)—The contract for the construction of a water system has been awarded to COMMERCIAL CONSTRUCTION CO., Reliance Bldg., Kansas City, Mo., at

[illegible] Lawrence Engineering and Construction Co., [illegible] & [illegible], [illegible] Engine & Supply Co., [illegible]. Noted July [illegible].

✦**Enterprise, Kan.**—[illegible]—The contract for laying [illegible] water mains has been awarded to CONNOR CONSTRUCTION CO., Kansas City, Kan. Ira E. Corbin is City Clk. Bids opened Aug. [illegible]. Noted July 16.

McLane, Kan.—(Official)—Bids for sinking a 1100-ft. well and for installing a pump will soon be received. Bonds for [illegible] for the installation of a water system were voted Aug. 6. [illegible], Kent & [illegible], Kansas City, Mo., are the Engrs. Noted July [illegible].

✦**Jamestown, N. D.**—The contract for the extension of the water system has been awarded to C. H. PORRITT, Fargo, at [illegible].

Butte, Mont.—The Little Missouri Land & Irrigation Co. is making preliminary arrangements for the installation of an irrigation system to irrigate about 24,600 acres in Fallon County. T. [illegible], Butte, is Secy.

Harlowton, Mont.—Bonds for $[illegible] for the improvement of the water system were voted at a recent election. S. K. Campbell is Town Clk.

✦**Charleston, Mo.**—(Official)—Bids were opened Aug. 6 for for the construction of a water system. The contract has been awarded to MURRAY CONSTRUCTION CO., Poplar Bluff, Mo. Noted July [illegible].

Rockport, Mo.—At a recent election the citizens voted to spend $[illegible] for extending the water works. John T. Wells is City Clk. Noted July [illegible].

Ashdown, Ark.—Bids will be received about Oct. 1, according to press reports, for constructing a water and a sewer system.

✦**Wills Point, Tex.**—The contract for constructing a storage [illegible] Wills Point has been awarded to W. R. PALMER, Wichita Falls.

Cañon City, Colo.—The City Council has authorized the [illegible] of the municipal filtration plant.

Buhl, Idaho.—Bids are being received by the City Clerk for the construction of a water system. H. S. Green, Paulsen Bldg., Spokane, Wash., is Engr. Noted July 16.

Fayette, Idaho.—The Council has authorized the expenditure of $[illegible] for the construction of a reservoir and a pipe line.

Pocatello, Idaho.—The City Council will hold an election, [illegible], for the purpose of voting on a $[illegible] bond issue, to be used in acquiring the local waterworks system, owned by the Pocatello Water Co., or for the construction of a new plant.

✦**Bingham Cañon, Utah.**—The contract for laying about [illegible] ft. of [illegible] water mains has been awarded to [illegible] DUNBAR, Salt Lake City. Noted July 9.

Portland, Ore.—The Water Bureau plans to increase the [illegible] in the [illegible] district by the construction of new [illegible] to cost approximately $113,000. Philip H. Dater is City Engr.

Warrenton, Ore.—(Official)—The time for receiving bids for $[illegible] in bonds for the construction of a gravity water system has been postponed at the bidders' request. John [illegible] is [illegible] Water Comm. Noted July 2.

Porterville, Calif.—The City of Porterville, the County and the [illegible] irrigation districts of the county will construct permanent protection work on the upper Tule River to protect the Porterville district against flood dangers. The estimated cost is $[illegible]. [illegible] Althouse, Porterville, is Engr.

San Francisco, Calif.—According to press reports the city will buy the plant of the Spring Valley Water Co. at $[illegible]. The citizens will soon be asked to vote bonds for the purpose.

San Francisco, Calif.—The San Francisco Water Co. recently [illegible] to furnish a water supply to a portion of [illegible]. James T. [illegible], [illegible] and [illegible] H. [illegible] are interested.

New Toronto, Ont.—Bids will soon be received by [illegible] for the erection of a [illegible] in connection with the water system. James, Loudon & [illegible], [illegible] East Toronto, are the Engrs.

✦**Prince Rupert, B. C.**—(Official)—The contract for [illegible] ft. of [illegible] water mains has been awarded to the [illegible] Co., Montreal, Que., at $[illegible]. Noted July 16.

Port Moody, B. C.—Bonds for $[illegible] were recently voted, the proceeds of which will be used for laying a [illegible] main from [illegible] Creek to supply water to the city. Noted [illegible].

SEWERS

Boston, Mass.—Bids will be received by the Board of [illegible] until Aug. [illegible] for constructing sewers in various streets. [illegible]. [illegible] is [illegible].

Boston, Mass.—Bids will be received by the Metropolitan [illegible] Board until Aug. [illegible] for the construction of a [illegible] sewer [illegible]. [illegible] is [illegible] of the Board.

Bedford Hills, N. Y.—The following bids were received by [illegible], Board of Managers, New York State [illegible], for [illegible] to the sewer system and sewage disposal plant: [illegible]. Noted July [illegible].

Gloversville, N. Y.—Bids will be received by the City [illegible] for constructing various sewers. Harry J. [illegible] is City Engr.

New York, N. Y.—(Borough the Bronx)—Bids will be received by Douglas Mathewson, Pres. the Borough, until Aug. 18, for constructing sewers in portions of [illegible] Crescent and Glovers Sts. and Westchester and [illegible] Aves.

Solvay, N. Y.—The city has voted $[illegible] in bonds on sewer and drainage improvements.

Camden, N. J.—The Highway Department plans to construct sewers in portions of Sycamore and 26th Sts. A. L. Sayers is Street Comr.

Newark, N. J.—According to press reports, bids for constructing Section 14, of the Main Intercepting Sewer were rejected by the Passaic Valley Sewer Commissioners as being too high.

✦The contract for constructing part of Section 27 has been awarded to CHARLES A. HASKINS, Charleston, Mass., at $[illegible]. Noted July [illegible] and Aug. 6.

Trenton, N. J.—Bids will soon be called for by the City for constructing the proposed sewage disposal plant. The estimated cost is $[illegible]. Noted Feb. [illegible].

Harrisburg, Penn.—Bids will be received by W. H. Lynch, Comr. of Pub. Improvements until Aug. [illegible], for constructing a sewer in Second St.

✦**Hazleton, Penn.**—The contract for constructing a section of the sewer system in Clay, Cranberry and Webster Aves., has been awarded to ARIO RUTH, at $11,612.

✦**Williamsport, Penn.**—(Official)—The contract for constructing a [illegible]-in. segment block sewer in Maynard Alley has been awarded to the CANTRELL CONSTRUCTION CO., Real Estate Trust Bldg., Philadelphia, Penn., at $[illegible]. Other bids were from Charles Dugan, $12,973; George W. Rockwell, $15,[illegible]; John Schrode, $15,[illegible]. For constructing a 48-in. segment block sewer in Washington St. the contract was awarded to E. C. WILLIAMS, $798[illegible]. Other bids were: Cantrell Construction Co., $[illegible]; Charles Dugan, $[illegible]; John Schrode, $9249; Geo. W. Rockwell, $[illegible]; Jos. McCadden & H. Benedict, $10,101. John R. Otto is Chief Engr.

York, Penn.—(Official)—The following are the bids received by the City Council for constructing the sanitary outfall sewer and syphon: Whiting Turner Construction Co., (a) for lock joint pipe with vitrified tile invert, $111,2[illegible]; (b) for brick sewer with vitrified brick invert, $11[illegible]; (c) for segment block sewer, $10[illegible]; (d) for lock joint pipe without the invert, $[illegible]. William M. McCarthy, (a) $110,508; (b) $10[illegible]; (c) $1[illegible]; (d) $[illegible]. Bruno [illegible], (a) $100,1[illegible]; (b) $10[illegible]; (c) $[illegible]; (d) $[illegible]; General Supply & Construction Co., (a) $[illegible]; (b) $[illegible]; (d) $88,221. Jones & McRoberts, (a) $[illegible]; (b) $[illegible]; (c) $74,197; (d) $74,197. H. C. Brookes Co., (a) $1[illegible]; (b) $1[illegible]; (c) $103,9[illegible]; (d) $87,275. S. W. [illegible], (a) $1[illegible]; (b) $[illegible]; (c) $95,[illegible]; (d) $[illegible]. G. W. Ensign & Co., (a) $11[illegible]; (b) $10[illegible]; (c) $108,703; (d) $1[illegible]. Cantrell Construction Co., (a) $101,613; (b) $94,7[illegible]; (c) $[illegible]; (d) $87,907. Ryan & Reilly, (a) $1[illegible]5,797; (b) $11[illegible]; (c) $1[illegible]; (d) $92,34[illegible]. E. H. Williams & Co., (a) $1[illegible]; (b) $1[illegible]; (c) $132,[illegible]; (d) $121,7[illegible]. Jas. Ferry & Sons, (a) $[illegible]; (b) $91,116; (c) $[illegible]; (d) $84,216. George A. Warner is City Engr. Noted July 16.

✦**York, Penn.**—(Official)—The contract for constructing a sanitary outfall sewer and syphon has been awarded to the GENERAL SUPPLY & CONSTRUCTION CO., York, Pa. Noted July 16.

✦**Baltimore, Md.**—The Board of Awards has awarded the contract to CARROZZA BROS. & CO., [illegible] East Preston St., at $17[illegible] for the construction of sanitary lateral sewers and house connections in Dist. No. 12-B requiring [illegible] lin. ft. of vitrified pipe sewer 8 to 18 in., and [illegible] lin. ft. of vitrified pipe house connections, under contract No. 137. Noted July 23.

Hurlock, Md.—The citizens have voted to install a sewer system, and water works to cost about $[illegible].

Royston, Ga.—See item under "Water Supply—Irrigation."

✦**Gadsden, Ala.**—The contract for the construction of about eight miles of sanitary sewers in West Gadsden has been awarded by the City Council to J. F. MORGAN & CO., Gadsden, at $14,367.

Newport, Ky.—Bids will soon be called for by the Commissioner of Public Works for repairing the [illegible] St. trunk sewer.

Paducah, Ky.—Plans are being prepared by the Aetna Engineering Bureau, Chicago, Ill., for constructing sewers in Sewer District No. 2. Bids for the work will be received about Aug. 14. Noted Mar. 26.

Canal Dover, Ohio.—Bids received by the [illegible] of Public Service for constructing the sewage disposal plant have been rejected. Noted June 18.

Centerburg, Ohio.—Bids will be received by the Village Clk. until Aug. 14, for constructing a sewer in a portion of Main St.

Cincinnati, Ohio.—(Official)—Bids received by Philip Foe[illegible], Dir. of Pub. Service for constructing sewers in the section between Madison Road and Duck Creek Road have been rejected.

Elyria, Ohio.—Bids will be received by M. M. Wilson, Dir. Pub. Serv., until Aug. 1[illegible], for constructing a 21-in. storm water sewer.

✦**Fairport** (Fairport Harbor Post Office) **Ohio.**—The contract for constructing [illegible] ft. of [illegible] and 10-in. sewers has been awarded to CHAPMAN & GLOVER, [illegible], at $[illegible].

✦**Kenmore, Ohio.**—The contract for constructing a sewage disposal plant has been awarded to [illegible] DIEFENDORF, [illegible], at $[illegible].

Martins Ferry, Ohio.—Bids will be received by George H. [illegible], [illegible] Pub. Ser., until Aug. 11, for constructing sewers in West Virginia and Eighth Sts.

Middletown, Ohio.—Bids will be received by the City Commission until noon, Aug. 11, for constructing tile sewers in various streets. [illegible] is City Clk.

Niles, Ohio.—The City Council has passed an ordinance authorizing the purchase of a site for the construction of a sewage disposal plant.

+Toledo, Ohio—(Official)—The contract for constructing main sanitary sewer No. 7 in sub-district No. 1, has been awarded by the Commissioners of Lucas County to JACOB N. BICK, 601 Nasby, Toledo. Charles J. Sanzenbacher is County Audr. Noted July 23.

Woodfield, Ohio—Bids will be received by the Mayor until Aug. 15, for constructing about 3000 ft. of 18-in. sewers.

Greencastle, Ind.—Bids will be received by the City Clerk, until Aug. 26, for constructing a sewer in Sewer District No. 1. A. A. Lane is City Engr. Noted July 9.

Grand Rapids, Mich.—The lowest bid received by the Board of Public Works for constructing the sewer in Criggs St., was that of McDermott & Cooper, at $10,937.

Racine, Wis.—(Official) — Bids will be received by the City Clerk, until 10 a.m., Aug. 15, for constructing sewers in 12th St. and Washington Ave., also in Augusta, Wolf, Layard and Douglas Aves.

+Guthrie Center, Iowa—(Official)—The contract for constructing sewers has been awarded by the city to the GUTHRIE CONSTRUCTION CO., Iowa City, Iowa, at $32,241, and for constructing the sewage disposal plant to F. H. CHRISTENSEN, Guthrie Center, at $7950. S. B. Weeks is Clk.

Independence, Iowa—Bids will be received by the City Council, until Aug. 17, for constructing sanitary sewers in various streets. Rufus Brewer is City Clk.

Keota, Iowa—(Official)—The Iowa Engineering Co., Charles P. Chase, Engr., Clinton, Iowa, is preparing plans for a sewer system at Keota.

Brainerd, Minn.—(Official)—All bids received by the City Council for constructing sewers have been rejected. The work will be re-advertised. C. D. Peacock is City Engr.

+Omaha, Neb.—The contract for constructing sewers in Sewer District No. 503 has been awarded to E. P. DONAHUE CO., at $5937. Noted July 23.

+Jamestown, N. D.—The contract for extending the sewer system has been awarded to C. H. PORRITT, Fargo, at about $9000.

Lidgerwood, N. D.—Bids will be received by F. W. Mashek, City Audr., until Aug. 17, for constructing a sewer system, including a septic tank. The estimated cost is $24,000. H. G. Lykken, Grand Forks is Engr.

Billings, Mont.—Bids will be received by the City Clerk, until Aug. 18, for constructing sewers to cost about $18,000. C. E. Durland is City Engr.

+Havre, Mont.—The contract for constructing sewers on Eighth, Ninth and 10th Aves. has been awarded by the City Council to GEORGE W. KEMPER, Minot N. D., at $41,500.

Helena, Mont.—The lowest bid submitted to the City Council for constructing a sewer in Beattie St. was that of Louis Johnson, at $5666.

+Charleston, Mo.—(Official)—The contract for constructing a sewer system and sewage treatment works has been awarded to the BELL-HUDSON CONSTRUCTION CO., Poplar Bluff, Mo. Roy D. Strickland is City Clk.

Gallatin, Mo.—(Official)—The item in the issue of July 16, stating that plans for constructing a sewer system were being prepared is incorrect. The matter of installing a sewer system is only under consideration.

St. Louis, Mo.—Press reports state that bids were received for constructing Section 1 of the Mill Creek Sewer from Bruin-Colnon Construction Co., and Mason & Hanger Co., at $1,936,484, and the Carter Construction Co., at $1,399,834. Noted June 25.

Argenta, Ark.—Bids will be received by the Clerk, Sewer District No. 1, until 10 a.m., Sept. 10, for constructing about 17 miles of reinforced concrete sewers. The estimated cost is $300 000. Lund & Hill, Little Rock, Ark., are the Engrs. Noted July 23.

Ashdown, Ark.—See item under "Water Supply—Irrigation."

+Galveston, Tex.—The contract for contracting lateral sewers has been awarded by the City Commission to HUNTER & HUNTER, at $7627. Noted June 25.

+Houston Heights, Tex.—Press reports state that the contract for constructing a system of sanitary sewers has been awarded by the City Council to HAMILTON BROS., at about $115,000. Noted June 25.

+Bellingham, Wash.—The contract for constructing a trunk sewer in Eldridge and Bartlett's Addition has been awarded by the City Council to J. Ager, at $8361.

Seattle, Wash.—The following bids were received by Board of Public Works for constructing a sewer in 42d Ave., S.W.: L. Coluccio, $23,958; C. Cristoforo, $22,706; John Allemandi, $22,384; George W. Walker, $28,211; W. G. Jones, $26,722; R. Young, $27,008; Dahlstrom & Rodal, $14,143; A. M. Florito, $26,642.

Seattle, Wash.—The City Council has decided to construct sewers in Lakeside Ave. at an estimated cost of about $30,000, also to improve South 38th Ave. by constructing watermains at an estimated cost of $18,700.

+The contract for constructing sewers in Third Ave. W., in the siphon tunnel of the North Trunk sewer, has been awarded to L. R. ELLIS, Central Bldg., at $13,362. Noted Aug. 6.

Astoria, Ore.—Bids will be received by the City Council until Aug. 15, for constructing about 24,000 ft. of 8- to 30-in. pipe sewers. The estimated cost is $50,000. L. C. Rogers is City Engr.

Dallas, Ore.—Bids will be received by the City Clerk until Aug. 17, for constructing a sewage treatment plant and intercepting sewer, estimated to cost $10,000. S. B. Taylor is City Engr.

Enterprise, Ore.—Bids will be received by W. F. Savage, City Recorder, until Aug. 25, for constructing a sewer system from plans prepared by C. H. Green Consult. Engr., Paulsen Bldg., Spokane, Wash. Noted July 23.

+McMinnville, Ore.—The contract for sewer construction has been awarded to V. R. DENNIS, Spalding Bldg., Portland, at $8252. Vitrified pipe will be used.

Etna, Calif.—The citizens have voted $21,000 in bonds for constructing a sewer system and disposal plant. E. W. Bathhurst is Pres. of the Town Board. D. Baker, 310 Sansome St. San Francisco, is Engr.

Long Beach, Calif.—The lowest bid received by the Board of Public Works for installing the proposed sewer system was that of the Arthur S. Bent Construction Co., Central Bldg., Los Angeles, at $277,193. Noted July 9.

+San Francisco, Calif.—The contract for constructing the Baker's Beach outlet sewer has been awarded to R. C. STONE at about $23,000.

Visalia, Calif.—The City contemplates an expenditure of $83,000 for constructing a sewer system, including a septic tank.

Brampton, Ont.—William M. Treadgold, Brampton, is preparing plans for sewers, estimated to cost $25,000. Bids for the work will soon be called.

Toronto, Ont.—Bids will be received by H. C. Hocken, Mayor, until noon, Aug. 18, for constructing sewers in ten streets.

+Regina, Sask.—Contracts for constructing storm and sanitary sewers have been awarded by the City Council to E. G. McVEAN at $26,356 and R. J. LECKY CO., at $50,068.

+Vancouver, B. C.—The following bids have been submitted to the Joint Sewerage Commission, Birkes Bldg., for construction of the Central Park extension to China Park Sewer: HODGSON, KING & McPHALEN, $309,052 (awarded contract); H. P. Peterson, $332,772; R. McLean & Co., $333,646; Moore & Pethrick, $340,100; Union Construction Co., $348, 546; Ledingham & Cooper, $376,789; John Gault & Co., $396,396. Noted July 9.

Vernon, B. C.—The city plans to make extensions to its sewer system, to include the construction of a disposal plant. The cost is estimated at $100,000.

GARBAGE

Royston, Ga.—See item under "Water Supply-Irrigation."

Biloxi, Miss.—The city is considering the construction of a garbage incinerator.

Coffeyville, Kan.—The citizens have voted in favor of constructing a garbage incinerator, to cost $4000.

Toronto, Ont.—The plan for garbage disposal was acted upon unfavorably by the Council, July 30.

STREETS AND ROADS

+Boston, Mass.—The contract for bitulithic pavement in Clarendon St. was awarded to WARREN BROS. CO., at $15,150. Other bids were: Warren Bros. Co. (asphalt), $15,253,-John F. Beatty (bitulithic), $15,262; James Doherty, $15,346 (asphalt), $15,287 (bitulithic); William J. Rafferty, $15,972, $15,972; Independent Coal Paving Co., $14,077; Central Construction Co., $14,892. Noted July 16.

Bids will be received until Aug. 18, by the State Highway Commission, for the construction of 4100 lin.ft. of road in Taunton. Arthur W. Dean, 15 Ashburton Pl., is Chief Engr.

+The contract has been awarded by the State Highway Commission for constructing 3200 lin.ft. of road in Saugus to FRAMINGHAM CONSTRUCTION CO., at $10,011. Other bids were: J. N. Gaffey, Medford, $10,107; D. J. Sheehan, Lynn, $10,110; J. E. Watkins, Amesbury, $10,136; Rowe Contracting Co., $10,311; M. H. McDonough, Swampscott, $10,313; J. B. Sweeney, Everett, $10,579; F. E. Ellis, Melrose, $13,223. Noted July 16.

+Contracts have been awarded by the State Highway Commission for 7300 lin.ft. of road in Buckland and 9400 lin.ft. of road in Shelburne to the LANE CONSTRUCTION CO., Meriden, Conn., at $5646 and $6290, respectively; 2400 lin.ft. of road in Northbridge to the HASSAM PAVING CO. Noted July 30.

Cambridge, Mass.—See item under Bridges.

+Greenwich, Conn.—Contracts have been awarded for paving North St. to W. J. MERTZ, Portchester, N. Y.; Hill Road to the PIERSON ENGINEERING CO., 868 Main St., Hartford, Conn. Noted July 16.

+Albany, N. Y.—Contracts have been awarded for improving North Pearl St., to JOHN W. DAVITT, at $17,295; Wilkins Ave., to KENNY & DUMARY, at $9080; Federal St., to ROBERT W. GLEASON, at $44,103.

+Rome, N. Y.—The contract for paving Spring St. with bitulithic has been awarded to WARREN BROS. CO., Boston, Mass., at $5582.

White Plains, N. Y.—(Official)—Bids will be received by George T. Burling, Treas. of Westchester County, until 10 a.m., Aug. 20, for the sale of $13,580 of highway bonds.

Bloomfield, N. J.—(Official)—Bids will be received by R. F. Davis, Town Clk. until 8 p.m. Aug. 17, for improving Section A and B.

Jersey City, N. J.—The Board of Commissioners will soon receive bids for the improvement of Boyd Ave., Golden and Fleet Sts. Michael I. Fagan is City Clk.

Millburn, N. J.—The Board of Chosen Freeholders plans the paving of Millburn Ave. with concrete, at an estimated cost of $17,000.

+Newark, N. J.—The Board of Works has awarded contracts to the STANDARD BITULITHIC CO. for paving Scheerer Ave., between Bergen St. and Osborne Terrace, at $13,937, and for Alexander St., between Lindsley Ave. and Bloemecke Alley, at $9705.

State Road Commissioners have rejected the bids recently received by the Board of Chosen Freeholders for paving Pompton Turnpike from Bloomfield Ave. to the Passaic County line, and canceled the contract awarded for the work to the Standard Bitulithic Co. at a cost of $93,806. New bids will soon be called for. Noted June 25 and July 23.

Perth Amboy, N. J.—The City Council will receive bids until Aug. 17 for constructing an asphalt block pavement on Amboy Ave., from New Brunswick Ave. to St. Mary's Cemetery. George M. Adair is Street Comr.

Plainfield, N. J.—[illegible] The following bids were received by Andrew J. [illegible], Street Comr., Aug. [illegible] for macadamizing [illegible] Sherrard, Melrose and Berkley Aves. and West Front St.: [illegible] & [illegible], $[illegible]; Weldon Contracting Co., [illegible], $[illegible]; Charles Lentz, Rahway, $2946 and [illegible] & Co., $[illegible]. Noted July [illegible].

Trenton, N. J.—The Board of City Commissioners has [illegible] an ordinance providing for the macadamizing of [illegible] Ave. between Hamilton and Greenwood Ave.

+Contracts have been awarded for paving Boudinot, General [illegible] Ave., [illegible] St. and Hancock St. to the NEWTON PAVING CO., at an estimated cost of $[illegible], $3150, $12,675 and $[illegible] respectively.

+Glen Lyon, Penn.—A contract for paving has been awarded to CARADOC REES at $62,700.

Pittsburgh, Penn.—(Official)—Bids will be received by the City Controller until 10 a.m., Aug. 11, for concrete sidewalks and foundations for roadway pavements on the Bloomfield [illegible] and its approaches. J. G. Armstrong is Mayor. Robert Swan is Dir. Pub. Wks.

Belair, Md.—Bids will be received by W. A. Wheeler, Clk. of the County Comrs., until noon Aug. 21, for constructing about three miles of the Hughes Mill Road.

Cumberland, Md.—Bids will be received by J. P. Gaffney, City [illegible], until Aug. 18 for grading, curbing and paving 34th street.

+Washington, D. C.—(Official)—Bids will be received by the Secretary of the Board of Commissioners until 2 p.m., Aug. 18, for paving various streets and avenues in the District of Columbia, with sheet asphalt and asphaltic concrete and asphalt-block. O. P. Newman, F. L. Siddons and Chester Harding are Coms. of the District of Columbia.

Gate City, Va.—Bids will be received by the Scott County Commissioners until Aug. 18 for constructing 36 miles of road in [illegible]stville District. G. P. Coleman is State Highway Comr.

+Richmond, Va.—The contract for paving Porter St. with concrete has been awarded to the ATLANTIC BITULITHIC CO., at approximately $8690.

+Elizabeth City, N. C.—The contract for paving Main St. has been awarded to GEORGE W. SWITZER & SONS at approximately $1[illegible],0[illegible].

Clarksville, Tenn.—(Official)—The following bids were received by the Commissioners of Montgomery County for constructing the Post Road in Montgomery County. Freeman & Robbins, Springfield, Tenn., $39,860; A. A. Smith, Mt. Pleasant, Tenn., $11,428; Peebles & McKitrick, Nashville, Tenn., $[illegible]491; Vaughn & Redd, Triune, Tenn., $10,460; Capitol City Construction Co., Nashville, $36,439. Ernest S. Alderman is U. S. Highway Engr.

+Houston, Miss.—(Official)—Bids will be received by the Road Commissioners of the Fourth District of Chickasaw County until noon, Aug. 18, for constructing approximately nine miles of graded and graveled roads. H. E. Brannon, Houston, Miss., is Chancery Clk.

Lexington, Ky.—Bids will be received by the City Council until Aug. 1[illegible], for constructing about four miles of streets. The approximate cost is $2[illegible]0,000.

Akron, Ohio—Bids will be received by the Board of Commissioners of Summit County until 11 a.m., Aug. 31, for the sale of $[illegible]7 in bonds for the improvement of the Manchester and Norton Centre Roads.

Bellefontaine, Ohio—(Official)—Bids will be received by the Board of Commissioners until 1 p.m., Aug. 18, for improving Section No. 3 of the North Ridge Road in Sheffield Township and Section No. 3 of the North Ridge and Case Roads in Avon Township. F. L. [illegible]lenberger is Clk. of the Comn.

Chicago Junction, Ohio—Bids will be received by E. K. McMurtie, Village Clk., until Aug. 22, for paving Spring St. with brick.

Cincinnati, Ohio—The City Council has passed an ordinance providing for the improving of Plum St. at an estimated cost of $[illegible].

Cincinnati, Ohio—(Official)—Bids will be received by the Board of County Commissioners until noon, Sept. 4, for the improvement of a section of the Brotherton Road. Albert [illegible] is Clk. of the Comrs.

+Cleveland, Ohio—The contract for grading and paving [illegible] and East 5[illegible]th St., under the Pennsylvania Railroad crossing, has been awarded to KELLEY [illegible], at $11,[illegible]0.

Cleveland, Ohio—Bids will be received by E. G. Krause, Clk. of the County Comrs., until 10 a.m., Aug. 26, for the sale of $[illegible] in highway bonds for the improvement of the [illegible]-Trask[illegible] and C[illegible] Roads.

Cleveland, Ohio—[illegible]—Bids will be received by the Board of Commissioners of Cuyahoga County until 11 a.m., Aug. [illegible], for the improvement of the [illegible] Road from [illegible] Center Road easterly to Miles Ave. No. 2, in [illegible] Township.

Columbus, Ohio—[illegible]—Bids will be received by the State Highway Commissioner until 2 p.m., Aug. 1[illegible], for constructing [illegible] roads at an approximate cost of $[illegible]3,691. James R. Marker is Comr.

Columbus, Ohio—[illegible]—Bids will be received by [illegible] until noon, Aug. 14, for [illegible] from [illegible] St. to Cleveland Ave., [illegible] Ave. from [illegible] Ave. to St. Clair Ave., [illegible] St. from [illegible] to [illegible] Ave., [illegible] Ave. and Third Ave. from Cleveland Ave. to St. Clair Ave., also the alley [illegible] and for constructing a concrete sidewalk on [illegible] St. [illegible] Park.

Jefferson, Ohio—(Official)—Bids will be received by the Board of County Commissioners until 1 p.m., Aug. 1[illegible], for the sale of $[illegible] in bonds for the improvement of the [illegible] Improvement Road No. 1.

+Kenton, Ohio—The contract for paving North Main St. has been awarded to the [illegible] CO., Toledo.

Lima, Ohio—(Official)—Bids will be received by the Director of Public Service until noon, Aug. 1[illegible], for grading, [illegible] and paving the central part of McKibben St., from [illegible] to Grand Ave.

+Lima, Ohio—The contract for paving Metcalf and Spring Sts. has been awarded to SUMMERS & HARDIN at $[illegible]0 and $7200, respectively.

McConnelsville, Ohio—(Official)—Bids will be received by the Village Council until noon Sept. 2, for improving the Barnesville Road. C. C. Morgan is Clk. of the Council.

Oak Harbor, Ohio—Bids will be received by L. L. Carstensen, Village Clk., until Sept. 4, for paving Locust St.

Springfield, Ohio—(Official)—Bids will be received by Charles E. Ashburner, City Mgr., until noon, Aug. 14, for the improvement of Madison Ave., from Woodlawn Ave. to Sycamore St.

West Park, Ohio—(Official)—Bids will be received by Fred Feughter, Village Clk., until noon Aug. 22, for improving the following streets: Trisket Road, Leland Ave., Lakota St., Vernon Ave. and Davisville Road.

+Worthington, Ohio—The contract for paving Main St. has been awarded to H. F. PATTERSON & CO., Columbus, at $35,000.

Zanesville, Ohio—(Official)—Bids will be received by the Director of Public Service until noon, Aug. 17, for the improvement of Convers Ave., from Maple to Sunset Ave.

Indiana—(Official)—Bids will be received as follows for the sale of road bonds in Indiana: Brazil, until 1[illegible] a.m., Aug. 17, by McLean Johnson, Treas. of Clay County, for $4900 and $16,800. Huntington, until 10 a.m., Aug. 15, by G. W. Gill, Treas. of Huntington County for $19,000 in bonds. Lawrenceburg, until 10 a.m., Aug. 17, by Andrew Burke, Treas. of Dearborn County, for $[illegible]3,600 in bonds for gravel roads. South Bend, until [illegible]1 a.m., Aug. 25, by F. W. Martin, Treas. of St. Joseph County, for $35,000 and $1[illegible].

+Boonville, Ind.—(Official)—The contract for constructing a rock road in Campbell Township has been awarded to W. MARTIN, Evansville, Ind., at $13,100. Noted July 16.

+Brookville, Ind.—The contract for building the Shebler Road, Franklin County, has been awarded to PUTMANN & CARR, at $9960.

+Gary, Ind.—Contracts have been awarded for paving 25th Ave., from Broadway to Grant St., to HENNING & McDERMETT, at $20,037, and 25th Ave., from Broadway to Prospect St., to M. D. HEINY, at $34,765. Noted July 22.

Goshen, Ind.—(Official)—Bids will be received by the Commissioners of Elkhart County until 2 p.m., Aug. 29, for the construction of a gravel road in Concord Township. John W. Brown is Audr.

+Greensburg, Ind.—(Official)—The contract for constructing a stone road in Washington and Clinton Townships has been awarded to the CRAIG CONSTRUCTION CO., at $7449.

Indianapolis, Ind.—(Official)—Bids will be received by the Board of Public Works until 10 a.m. Sept. 3, for improving the following streets: Washington and McCarty Sts., Broadway and Keystone Ave.

Indianapolis, Ind.—(Official)—Bids will be received by the Board of Public Works, until 10 a.m., Aug. 14, for the improvement of 18th St., from Montcalm St. to Gent Ave., and Oriental St., from Washington St. to P. B. R. tracks.

+Kentland, Ind.—(Official)—The contract for constructing a stone road in Beaver Township has been awarded to ALVA E. HERRIMAN, Kentland, Ind., at $91[illegible]. Noted July 16.

Muncie, Ind.—Bids will be received by John R. Kelly, City Clk., until 10 a.m., Aug. 15, for constructing concrete sidewalks on Ebright St.

+Noblesville, Ind.—(Official)—The contract for paving Conner St. has been awarded to T. E. RAMSEY, at $[illegible]1.

Vernon, Ind.—(Official)—Bids will be received by the Commissioners of Jennings County until 11 a.m., Sept. 7, for the construction of a road in Lovett Township. [illegible] J. Bernhardt is Audr.

+Moline, Ill.—The contract for paving 19th Ave. from 16th to 27th St. has been awarded to the WESTERN IMPROVEMENT CO., Racine, Wis., at $21,721.

Rock Island, Ill.—The Public Improvement Board has passed an ordinance to pave [illegible]th St. from Fifth to Seventh Ave.

+Eau Claire, Wis.—(Official)—The contract for laying about 3[illegible]0 sq. yd. of brick pavement on concrete base on Grand Ave. East, has been awarded to the CAST STONE CONSTRUCTION CO., at $[illegible]1. Other bids were: Andrew Larson, $[illegible]; Thomas W[illegible], $[illegible]. Noted July [illegible].

+Superior, Wis.—The contract for paving Tower Ave. with asphalt has been awarded to FIELDING & SHEPLEY, St. Paul, Minn.

+Grinnell, Iowa—A contract for seven miles of paving has been awarded to the IOWA ENGINEERING CO., [illegible], Iowa.

Anoka, Minn.—Bids will be received by the Board of County Commissioners until 2 p.m., Aug. [illegible], for road work.

Yankton, S. D.—Bids will be received by the City Auditor until Aug. 31, for paving portions of [illegible], [illegible] and [illegible] Sts., [illegible] and Douglas Ave. The work consists of [illegible] sq. yd. of pavement.

+White Sulphur Springs, Mont.—[illegible] at [illegible] received the contract for constructing concrete sidewalks on Main St.

+Trinity, Tex.—The contract for constructing about [illegible] miles of [illegible] roads in Road District No. 2, Trinity County, has been awarded to SMITH BROS., Crockett, at $[illegible]. Noted July [illegible].

Paris, Idaho—An election will be held Sept. 1 to vote on the proposition of issuing $[illegible] in bonds for the construction of [illegible] miles of roads.

+Cosmopolis, Wash.—A contract for constructing local improvement road No. 1 has been awarded to W. E. [illegible], [illegible], at $[illegible].

+Seattle, Wash.—The contract for [illegible] East Pike St. has been awarded to J. J. [illegible], at $21,[illegible].

+**Seattle, Wash.**—The contract for improving 27th Ave. N. E. has been awarded to SLOANE BROS. at $11,914.

+**Independence, Ore.**— VANCOUVER CONTRACTING CO., Vancouver, Wash., at $10,000, received the contract for hard surface paving on C. Street.

+**Oregon City, Ore.**—The Clackamas County Court has awarded a contract for the construction of one and a quarter miles of oil-burned macadam road from Clackamas station; to W. H. COUNSELL, Milwaukee, Ore., at $9000.

+**Portland, Ore.**—The contract for paving East Clay St. with asphaltic concrete on stone base has been awarded to the INDEPENDENT PAVING CO., at $37,319.

Sutherlin, Ore.—Bids will be received until Aug. 18, for the grading and paving of Central Ave. L. G. Hicks, Roseburg, is Engr. in Charge.

+**Azusa, Calif.**—The contract for improving Tenth Ave. has been awarded to E. A. SIMMONS, at $8103.

+**Los Angeles, Calif.**—The contract for improving Hillcrest Road, from Franklin Ave. to Virginia Terrace, has been awarded to D. D. CHAPMAN, at $6632.

+**Newport Beach, Calif.**—A contract for improving a number of streets has been awarded to E. M. CHALMERS, 819 East Seventh St., Wilmington, at $8146.

Sacramento, Calif.—(Official)—Bids will be received by the State Highway Commission, 515 Forum Bldg. until 11 a.m., Aug. 31, for the following road construction: Colusa County, from Berlin to Colusa Junction; Yuba County, from the southerly boundary of Yuba County to Morrison's Crossing; San Luis Obispo County from Atascadero Creek to Paso Robles; Kern County from the southerly boundary of Kern County to a point about 2.3 miles south of Rose Station; Orange County from Orvine to Santa Ana; Sacramento County from Epsom to the easterly boundary of Sacramento County; Solano County from Vacaville to Batavia; Santa Barbara County from Divide to Orcutt; Santa Barbara County from Stony Creek to El Captain Creek; Los Angeles County from Castaic School to Section No. 17.

+**Santa Monica, Calif.**—A contract for various street improvements has been awarded to DAVID JOY, Sawtelle, Calif., at $9000.

+**Willows, Calif.**—The City Trustees have awarded a contract for paving Tehama St. to CLARK & HENERY, Sacramento, Calif., at approximately $18,000.

★**Halifax, N. S.**—(Official)—Bids will be received by the Mayor until noon, Aug. 19, for the construction of granite block and sheet asphalt or bitulithic pavement. J. J. Hopewell is Clk. of the Bd. of Wks.

+**Peterboro, Ont.** — The contract for asphaltic concrete paving on concrete base has been awarded to FOLEY & GLEESON, Central Chambers, Ottawa, at $82,137.

Edmonton, Alta.—Plans are being prepared for the erection of a municipal paving plant at an estimated cost of $37,000. Bryce J. Saunders is in charge of the work.

+**Edmonton, Alta.**—Contracts have been awarded for paving 10,000 sq.yd. to the NATIONAL PAVING CO. and 11,000 sq.yd. to the CROWN PAVING CO.

INDUSTRIAL WORKS

Cambridge, Mass.—The Penn Metal Co. has purchased a site at Binney and Monroe Sts., Cambridge, and will erect a reinforced concrete manufacturing plant. Monks & Johnson are the Arch. G. A. Sagendorph is the Pres.

East Boston, Mass.—The United States Oxygen Co., has purchased a site on Orleans St., and plans to erect a 60x160-ft. reinforced-concrete factory. James Carlton is the Pres.

Franklin, Mass.—The Massachusetts Waste Co., has purchased a site and plans to erect a plant for the cleaning of cotton waste. The estimated cost is $75,000.

Milford, Mass.—The George Dodds Granite Co., Xenia, Ohio, plans to erect a factory in Milford.

North Adams, Mass.—Local press reports state that the Hoosac Cotton Mills plan to spend $1,000,000, in new buildings and machinery.

+**Springfield, Mass.**—The Chapin Realty Trust Co., 499 Main St., has awarded a contract to FRED T. LEY & CO., for the erection of a three-story, 71x168-ft., reinforced concrete and brick garage. The estimated cost is $50,000. H. L. Sprague is the Arch. Noted July 23.

+**Webster, Mass.**—The S. Slater & Sons Co., has awarded the contract for erecting a four-story, 78x92-ft. addition to its mill, to the TORRINGTON BUILDING CO., Torrington, Conn., at $35,000. Charles T. Main, 201 Devonshire St., Boston, is the Arch. Noted Dec. 11, 1913.

+**Worcester, Mass.**—The George E. Duffy Co., Cherry Valley District, has awarded a contract to E. D. WARD, 82 Foster St., for the erection of a five-story, 40x80-ft., brick factory.

Bridgeport, Conn.—Albin E. Henkel, manufacturer of laces, has had plans completed for a three-story, 80x200-ft. reinforced concrete factory. Samuel M. Green Co., Springfield Mass., is preparing the plans.

New Haven, Conn.—C. Cowels & Co., Water St., plans to erect a four-story, 42x79-ft. reinforced concrete addition to its factory. The estimated cost is $29,000. L. W. Robinson is the Arch.

+**New York, N. Y.**—(Borough of Brooklyn)—The Gretsch Mfg. Co., Brooklyn, has awarded a contract to the TURNER CONSTRUCTION CO., for building a seven-story, 73x143-ft. warehouse at Berry and South Fifth Sts. William Higgenson is the Arch.

+**Niagara Falls, N. Y.**—The International Acheson Graphite Co., has awarded a contract to THE TURNER CONSTRUCTION CO., Buffalo, for erecting a three-story addition to its plant at Buffalo Ave., and Portage St. The estimated cost is $35,000.

+**Niagara Falls, N. Y.**—The American Chain Co., Bridgeport, Conn., has awarded a contract for the construction of a 159x440-ft. reinforced concrete factory, to SAMUEL AUSTIN CO., Cleveland, Ohio. The plant will be used for the manufacture of Weed tire chains for the Canadian trade.

Arlington, N. J.—The Arlington Co., manufacturers of celluloid specialties, has acquired property adjoining its plant on Schuyler Ave., to provide space for an addition.

+**Newark, N. J.**—J. S. Mundy, manufacturer of gasoline engines and hoisting machinery, has awarded the contract for a new plant to be erected in Frelinghuyson St., to the DAVID HENRY BUILDING CO. The estimated cost is $41,000. Noted May 28.

Harrisburg, Penn.—Charles Bernheisel, Arch., Tristee Bldg., is preparing plans for a three-story, 92x185-ft. brick cigar factory for the Dauphin Cigar Co.

Lebanon, Penn.—The Valley Mould & Iron Co., has commissioned T. F. Edwards, Lebanon, to prepare plans for a group of the buildings which will be constructed in connection with its ingot mould plant. The estimated cost is $200,000. Noted July 30.

+**Manayunk, Penn.**—The Martin and William H. Nixon Co., paper manufacturer, has awarded a contract to BARCLAY-WHITE & CO., 1530 Chestnut St., Philadelphia, for the erection of its factory. The estimated cost is $65,000. Noted June 25.

Morganza, Penn.—Bids will be received by Supt. W. F. Penn., Pennsylvania Training School, Morganza, Penn., until 10 a.m., Aug. 17, for alterations and additions to its bakery building. T. E. Billquist, 3234 Fourth Ave., Pittsburgh, Penn., is the Arch.

+**Philadelphia, Penn.**—The contract for the construction of a four-story, 71x159-ft. factory on Tacony St., for the Quaker City Rubber Co., Philadelphia, Penn., has been awarded to the TURNER CONSTRUCTION CO. Ballinger & Perrot are the Archs. Noted July 9.

+John T. Lewis & Bros. Co., has awarded a contract to the UNIT CONSTRUCTION CO., for erecting a 66x128-ft. machine shop on Armingo Ave. The estimated cost is $30,000.

+**Pittsburgh, Penn.**—The Pittsburgh Foundry & Machine Co., 31st and Liberty St., has awarded a contract to the McCLINTIC, MARSHALL CO., for the construction of a 50x160-ft. foundry at 36th St., and the Baltimore & Ohio R.R.

+The Gem Mfg. Co., has awarded a contract to W. N. KRATZER & CO., Pittsburgh, for the construction of a 132x137-ft. factory on the North Side.

+**Wilkes-Barre, Penn.**—WILLIAM J. SMITH, 293 South Main St., was awarded a contract for erecting a three-story, 70x80-ft. warehouse, for the Wilkes-Barre Gas & Light Co.

+**York, Penn.**—The York Corrugation Co. has awarded a contract to SAMUEL GLATFELTER, York, for the erection of a 40x176-ft. warehouse addition. The estimated cost is $30,000.

+**Wilmington, Del.**—The Huber Baking Co. has awarded a contract to ELWOOD SHARPE, 1244 Elm St., Wilmington, for the erection of a 100x160-ft. brick bakery at Ninth and Union St. Philip Isaac, 1317 West St., Wilmington, is the Arch.

Baltimore, Md.—The Dix Mfg. Co. has purchased a site and will erect a 120x126-ft. factory and warehouse at Eager and Conrad Sts., to cost $125,000. Noted Mar. 26.

Belhaven, N. C.—The Peoples Gin Co., recently incorporated with $100,000, plans to establish a cotton gin.

Wilson, N. C.—Hackney Bros. have plans prepared for the erection of a buggy manufacturing plant of five sections, each 100x140 ft., to cost $50,000.

Barnesville, S. C.—The Big Salkehatchee Cypress Co. will erect a single-band mill with a daily capacity of 80,000 ft.

Charlestown, S. C.—The Southern Ry. Co. has purchased a tract of land on Cooper River, and is having plans prepared for the construction of a coal terminal.

Atlanta, Ga.—The Exposition Cotton Mills will erect a three-story, 93x100-ft. addition to its plant.

Hammond, La.—F. L. Pantall plans to erect a box and veneer factory.

Morgan City, La.—Eugene Pharr, Berwick, La., plans to erect a condensed milk factory.

New Orleans, La.—The Alden Knitting Mills will erect an addition to its plant, to cost $18,000.

Nashville, Tenn.—The Cumberland Tobacco Works, recently destroyed by fire with a loss of $50,000, plans to rebuild as soon as plans are prepared. J. F. Regan is the Mgr.

Ashland, Ohio.—The Malwurm General Aluminum Co. has had plans prepared fo rthe erection of a 40x75 ft. addition to its plant.

Cleveland, Ohio—The Cleveland Suit & Skirt Co., has completed plans for a two-story, 55x80-ft. reinforced concrete factory to be erected on East 25th St. The estimated cost is $12,000. Harry H. Cone, 1228 Schofitld Bldg., Cleveland, is the Arch.

The Willard Storage Battery Co., has completed plans for a one-story, 135x200-ft. factory to be built on East 131st St. The estimated cost is $35,000.

+The Cleveland Ry. Co., Leader News Bldg., has awarded a contract to the WILLIAM I. THOMPSON CO., 6110 Euclid Ave., Cleveland, for the construction of new car barns and shops on Superior Ave. The estimated cost is $150,000. Noted June 4.

+The Ford Motor Co., Detroit, Mich., has awarded a contract for the construction of an assembling and service plant to be erected at Euclid Ave. and East 117th St., to MORROW BROS., Baltimore, Md. Estimated cost, $50,000. John Graham is the arch.

+**Cleveland, Ohio**—The Star Baking Co., 3070 West 20th St., has awarded a contract to H. G. SLATMEYER, 203 Lakeside Ave., Cleveland, for the construction of a baking plant at Lakeview Ave. and Nickle Plate R. R. The estimated cost is $100,000.

Sandusky, Ohio—The Pittsburgh Plate Glass Co., has acquired control of the Enterprise Glass Co., of this city and will make a number of improvements to the buildings and equipment.

Toledo, Ohio—The Roberts-Toledo Auto Co. will erect a [illegible]-ft. reinforced-concrete repair shop at [illegible] and [illegible]th Sts.

Youngstown, Ohio—The [illegible] Oil Co. is having plans prepared for a [illegible]-ft. reinforced-concrete storage house to be erected on [illegible] Ave.

Youngstown, Ohio—Plans have been completed by the [illegible] Steel Co. for a [illegible]-ft. reinforced-concrete addition to its plant. [illegible] is the Mgr.

New Albany, Ind.—The Monon Ry., Chicago, Ill., plans to build a [illegible] concrete coal handling plant at an estimated cost of $[illegible].

Chicago, Ill.—J. F. Monhon, 6822 Loomis St., will build a two-story brick dairy to cost $13,[illegible]. R. W. Crow is the Arch.

Chicago, Ill.—The American Pattern & Model Co., 8057 [illegible] St., will erect a two-story brick factory, to cost $11,[illegible]. [illegible] & Lockwood are the Archs.

✦Cedar Falls, Iowa—The Iowa Gate Co. has awarded the contract for constructing its factory to G. L. SMITH, Waterloo, Iowa. The estimated cost is $5[illegible],000.

✦St. Louis, Mo.—The Bradbury Marble Co., 4165 Duncan St., has awarded the contract to the CHAPLINE CONSTRUCTION CO., for the erection of a two-story factory, to cost $1[illegible].

Sand Springs, Okla.—The Sand Springs Mfg. Co., recently organized with $[illegible] capital, will erect a plant for the manufacture of engines.

✦Ogden, Utah—The Utah Construction Co., has awarded the contract for furnishing the structural steel to be used in the construction of its $[illegible],000, machine shop, to JAMES BURKE & CO., Salt Lake City.

✦Tacoma, Wash.—The Oregon-Washington Ry. & Navigation Co. has awarded a contract for the erection of a freight building at Tacoma, to O. F. LARSON, Tacoma, at $50,0[illegible].

Seattle, Wash.—L. Inch, New York Bldg., will erect a [illegible] garage and machine shop at 2126 Third Ave., estimated to cost $11,000. J. L. McCauley, Mehlhorn Bldg., Seattle, is Arch.

Warrenton, Ore.—The Lighthouse Packing Co., will enlarge its [illegible] cannery at a cost of about $10,000. H. A. Sprague is Pres.

Los Angeles, Calif.—The Pacific Reduction Co., will erect a 3[illegible]x11[illegible]-ft. reinforced concrete plant at 2654 Lenard St. The estimated cost is $1[illegible],000. Henry [illegible] Dean is the Engr.

✦W[illegible]LDER & HARMISH, 112 Rose St., have been awarded the contract for the erection of a brick laundry for the Patton State Hospital, at $17,380.

Merced, Calif.—The Associated Oil Co., will erect four tanks and a warehouse on the extension of Fifteenth St. John H. Graham is local mgr.

✦San Diego, Calif.—N[illegible] Snyder has awarded a contract to [illegible] & DECEW, San Diego, for the construction of a [illegible]-ft. brick laundry on [illegible]th St., at $14,000.

Stockton, Calif.—The Holt Mfg. Co., manufacturer of harvesters and tractors, will erect an addition to its pattern shop and foundry, to cost $2[illegible].

Montreal, Que.—The Garth Co., 28 Craig St., brass founders and manufacturer of plumbers supplies, will soon ask bids for the construction of additions and alterations to its plant. H. C. Stone, 81 St. Francis Xavier St., Montreal, is Arch.

Bridgeburgh, Ont.—The Canadian Hardware Mfg. Co., recently incorporated with a capital of $1[illegible],000, has purchased a site where it is planned to erect a factory. Present offices Tonawanda and Wall Sts., Buffalo, N. Y.

North Edmonton, Alta.—The Great Northern Tannery Co., is having plans prepared for the construction of a three-story addition to its plant. The estimated cost is $[illegible],000.

Fort George, B. C.—Wilson & Wilson, Archs., Vancouver, B. C., have completed plans for the erection of a three-story [illegible] to be [illegible] by Vancouver interests.

Penticton, B. C.—The Kettle Valley Ry. plans the erection of a [illegible] warehouse which is to cost $2[illegible],000. James J. Warren is [illegible].

FEDERAL GOVERNMENT WORK

✦Locomotive Crane—[illegible], Mass.—The contract for installing a locomotive crane at the Boston Navy Yard, has been awarded to [illegible] & [illegible], [illegible] South [illegible] St., Chicago, Ill., at $6612. Noted June 18.

Roofing and Siding—Newport, R. I.—Bids will be received until 11 a.m., Aug. 29, by H. R. Stanford, Ch., Bureau of Yards & Docks, Navy Dept., Washington, D. C., for corrugated siding and roofing for addition to boathouse, naval training station, Newport, R. I.

Rewiring and Fixtures—New York, N. Y.—The contract has been awarded to [illegible] FREDERICK JACKSON, INC., New York, for rewiring and installing lighting fixtures in various buildings at [illegible] Island, New York, at $[illegible].

Dredging—[illegible], Del.—Bids will be received until 11 a.m., Aug. [illegible], by Maj. [illegible], Corps Engrs., U. S. A., [illegible] Maurice and Salem Rivers, N. J., and Little [illegible].

✦Dredging—[illegible]

Sale of Material—Baltimore, Md.—Bids will be received [illegible] by the Lighthouse Inspector, Baltimore, [illegible] steel [illegible] scrap [illegible].

✦Dredging—[illegible], Md.—The contract for dredging [illegible] has been awarded to [illegible] & [illegible]KS, [illegible], at $[illegible]. Noted July 1[illegible].

Revenue Cutters—Washington, D. C.—Bids will be received until 2 p.m., Sept. 1, by B. R. Newton, Asst. Secy., Treasury Dept., Washington, D. C., for constructing two revenue cutters to be known as Nos. 26 and 27.

✦Dredging—Rappahannock River, Va.—The contract for dredging in the Rappahannock River, has been awarded to the MARYLAND DREDGING & CONSTRUCTION CO., Baltimore, Md., at $31,0[illegible]. Noted June 18.

✦Dredging—Wilmington, N. C.—Bids will be received until noon, Sept. 8, by Maj. H. W. Stickle, Corps Engrs., U. S. A., Wilmington, for dredging in the waterway from Core Sound to Beaufort Harbor, N. C.

Steel Sheet Piling—Wilmington, N. C.—The lowest bid submitted to Maj. H. W. Stickle, Corps Engrs., U. S. A., Wilmington, for 1576 tons of steel sheet piling, was that of Gelsenkirchener Bergwerke, A. G., New York, at $51,997 f.o.b., Wilmington and $57,353, f.o.b., Elizabethtown, N. C.

✦Dikes—Savannah, Ga.—The contract for constructing dikes in the Savannah River, has been awarded to A. J. TWIGG & SON, Augusta, Ga., at $4472.

✦Post Office—Jennings, La.—Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., has awarded the contract to the NEWPORT CONSTRUCTION & ENGINEERING CO., Newport News, Va., for constructing the post office at Jennings, at $42,000. Bids were opened July 21. List of bidders noted July 30.

✦Dredge Arm and Spare Parts—New Orleans, La.—The contract for furnishing dredge arm parts and spare parts for the U. S. dredge New Orleans, has been awarded to the GRISCOM RUSSELL CO., New York, at $12,015. Noted June 11.

✦Repairs to Wharf—New Orleans, La.—The contract for constructing a wharf at the naval station, New Orleans, has been awarded to LOUIS M. DALGREN, 315 Carondolet St., New Orleans, at $14,168. Noted July 3[illegible].

✦Towboat—New Orleans, La.—The contract for constructing and delivering the steel hull stern wheel towboat "[illegible]mette," has been awarded to the HOWARD SHIP YARDS CO., Jeffersonville, Ind., at $19,125 delivered at New Orleans and $18,925 at yards. Other bids were Dubuque Boat & Boiler Works, Dubuque, Iowa, $2[illegible],575, Johnson Iron Works, New Orleans, $25,1[illegible]. Noted July 16.

✦Lift Bridge—Louisville, Ky.—The contract for furnishing and constructing a direct lift bridge over the Louisville and Portland Canal at 18th St., Louisville, has been awarded to the PENN BRIDGE CO., Beaver Falls, Penn., at $[illegible]9,47[illegible]. Noted July 23.

✦Forgings—Cincinnati, Ohio—The contract for furnishing and delivering forgings (horses and props) for Dams Nos. 15 and 20, has been awarded to the AMERICAN BRIDGE CO., Ambridge, Penn., at $27,3[illegible].

Post Office—Gary, Ind.—Bids were received as follows, Aug. 5, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Gary, (a) limestone, (b) sandstone, (c) marble: M. Yeager & Son, Danville, Ill., (a) $[illegible]3,7[illegible], (b) $91,[illegible], (c) $11[illegible]; Westchester Engineering Co., White Plains, N. Y., (a) $[illegible]360, (b) $92,000, (c) $115,[illegible]; George W. Stiles Construction Co., Chicago, Ill., (a) $[illegible], (c) $11[illegible]; J. E. and A. L. Pennock, Philadelphia, Penn., (a) $1[illegible], (b) $1[illegible]; [illegible]ners Bros. Co., Lowell, Mass., (a) $1[illegible]2,6[illegible]2, (b) $10[illegible], (c) $121,900; W. H. Fissell & Co., New York, N. Y., (a) $[illegible], (c) $116,390; Pain & Stevens, Gary, Ind., (a) $1[illegible]33[illegible]; [illegible] Kansler & Son, Evansville, Ind., (a) $113,[illegible], (b) $11[illegible], (c) $119,000; N. H. Shields, Danville, Ill., (a) $1[illegible], (c) $121,390; Barnes Bros., Logansport, Ind., (a) $11[illegible]; Dieter & Wenzel Construction Co., Wichita, Kan., (a) $[illegible], (b) $101,200, (c) $110,100. The building will be two stories and basement, ground area, 71[illegible] sq. ft., stone facing, composition roof and fireproof construction. Noted June 2[illegible].

✦Post Office—Urbana, Ill.—The contract has been awarded to the CALLAHAN & MANDL CO., [illegible] La Salle St., Chicago, Ill., for constructing the post-office at Urbana, at $64,1[illegible].

Pipe—Huntley, Mont.—The William B. Pollock Co., Youngstown, Ohio, submitted the lowest bid to the U. S. Reclamation Service, Huntley, for riveted steel pipe, St. Mary storage dam, at $41,260.

✦Drains—Huntley, Mont.—The U. S. Reclamation Service has awarded the contract to NOWELL, ATHERLY & CAMP, Billings, Mont., and to C. F. LINDSTROM, [illegible], for drains for the Huntley Irrigation Project, at $[illegible] and $[illegible] respectively.

✦Hospital—St. Louis, Mo.—The contract for making repairs to the U. S. Marine Hospital at St. Louis, has been awarded to the DUFFNER & STECKER CONSTRUCTION CO., St. Louis, Mo., at $[illegible].

✦Post Office—Idaho Falls, Idaho—The contract for the construction complete of the U. S. post office at Idaho Falls has been awarded to the [illegible] CONSTRUCTION & ENGINEERING CO., Seattle, Wash., at $[illegible]. Noted July 1[illegible].

Generator—Phoenix, Ariz.—The lowest bid submitted to the U. S. Reclamation Service, Phoenix, for a vertical [illegible] generator for the Roosevelt power plant, Salt River Project, Ariz., was that of the General Electric Co., Schenectady, N. Y., at $[illegible].

Canal—([illegible] Work)—Phoenix, Ariz.—Bids will be received by the U. S. Reclamation Service, Phoenix, for [illegible] aggregating [illegible] on the Wallace Feeder Canal, Salt River Valley Irrigation Project.

Post Office—Medford, Ore.—Bids will be received until 3 p.m., Aug. 22, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a three-story postoffice and court house at Medford.

Steel Pressure Pipe—Los Angeles, Calif.—Bids will be received until 2 p.m., Aug. 21, by O. H. Ensign, Ch. Electrical Engr., Los Angeles, for furnishing riveted steel pressure pipe for the [illegible] project.

Traveling Crane—Los Angeles, Calif.—Bids were received July 20, by the Director of the U. S. Reclamation Service, Los Angeles, Calif., for a traveling crane for the Salt River Project, Ariz., as follows: Northern Engine Works, Detroit, Mich., $3790; Manning, Maxwell & Moore, San Francisco, Calif., $3956; Niles Bement Pond Co., 111 Broadway, New York, $4000; Whiting Foundry Equipment Co., Harvey, Ill., $4100; The Cleveland Crane & Engineering Co., Wickliffe, Ohio, $4300; The Exeter Machine Works, Pittston, Penn., $4920; Toledo Bridge & Crane Co., Toledo, Ohio, $6400.

Steel Castings—Philippine Islands—Bids were received July 30 by Col. S. W. Roessler, Corps Engrs., U. S. A., Army Bldg., New York, N. Y., for steel castings for the Philippine Islands The lowest bid was submitted by the Federal Steel Foundry Co, Chester, Penn., at $8995.

MISCELLANEOUS

+Dredging—Boston, Mass.—The State Board of Harbor and Land Commissioners has awarded the contract to the BAY STATE DREDGING CO., Boston, for dredging Rockport Harbor, at $12,700. Noted July 2.

+Subway Station—Boston, Mass.—The Boston Transit Commission, Aug. 4, opened bids for constructing the Park St. station of the subway. The contract has been awarded to COLEMAN BROS., Boston, at $62,716. Noted July 30.

Seawall—Boston, Mass.—The Metropolitan Park Commission, Aug. 4, opened bids for constructing the concrete seawall at Revere Beach. M. J. McGAWLEY, Boston submitted the lowest bid, at $21,055 and was awarded the contract.

Dock Work, Etc.—Buffalo, N. Y.—The Buffalo Creek R. R. Co. will award contracts soon for the construction of dock and shoring work, aggregating 2200 ft., along the Buffalo River, between Hamburg Turnpike and the Lake Shore & Michigan Southern Ry. bridges. S. M. Kielland, Buffalo, N. Y., is Engr.

Recreation Pier—Buffalo, N. Y.—Plans for the proposed Bird Island recreation pier are being prepared by the engineering department of the Board of Public Works. F. G. Ward is Coms.

+Refrigeration Equipment—Comstock, N. Y.—Bids were received by John B. Riley, Supt. State Prisons, Capitol, Albany, N. Y., for installing refrigeration equipment in the mess hall and kitchen building at the Great Meadow prison, Comstock. The bids follow: Shipley Construction & Supply Co., Brooklyn, N. Y., $18,700; Cartondale Machinc Co., 50 Church St., New York, $16,300. Noted July 23.

★Pavilion Seats—Ithaca, N. Y.—(Official)—Bids will be received until 3 p.m., Aug. 24, by E. L. Williams, Treas., Cornell University, Ithaca, for seats in the stock-judging pavilion at the New York State College of Agriculture, Cornell University, Ithaca.

Fire Alarm Telegraph Extension—New York, N. Y.—Bids will be received until Aug. 17, by Robert Adamson, Fire Comr., Borough of Manhattan, for constructing an extension to the fire alarm telegraph system.

+Rapid Transit System—New York, N. Y.—New York Municipal Ry. Corporation (Brooklyn Rapid Transit Co.)—The Public Service Commission, 154 Nassau St., Borough of Manhattan, New York, N. Y., has approved a supplementary contract between the New York Municipal Ry. Corporation and GEORGE W. McNULTY, Inc., Brooklyn, for the reconstruction of the Sea Beach line. Under the contract of Oct. 6, 1913, only two tracks were to be laid and equipped for trolley operation, but under the supplementary contract, four tracks will be laid at once and be equipped with the third rail system. Under this arrangement the line will be ready for operation in connection with the Fourth Ave. Subway, between Fourth Avenue and New Utrecht Ave., on January 1, 1915, and as far as 86th St., by May 1, 1915.

The commission has been informed that the New York Municipal Ry. Corporation will receive the necessary consent to legalize the Jamaica Ave. elevated extension, and it is expected that bids for construction will be asked soon.

+Pier, Dredging—Bayonne, N. J.—The Lehigh Valley R. R. Co. has awarded the contract to HENRY STEERS, INC., 17 Battery Place, New York, for constructing its proposed 1200-ft. pier at Constable Hook, Bayonne. The contract for the necessary dredging has been awarded to G. H. BREYMANN & CO., Boston, Mass. Noted July 30.

Piers—Bayonne, N. J.—The Standard Oil Co. will build seven piers, 500-ft. long, along the shore of the Kill von Kull at its Constable Hook, Bayonne plant.

+Fire Station—Elizabeth, N. J.—The city has awarded contracts as follows for constructing fire station No. 5: brick masonry, to L. BELLUCIO & BRO., Elizabeth; carpentry, to C. A. CRAIG, Elizabeth; plumbing, to HOFFMAN & WACHTER, Elizabeth; and electrical work, to E. F. GUINE, Elizabeth. Estimated total cost, $20,000.

Bath-House—Newark, N. J.—The Common Council has approved plans for the erection of a bath house. James S. Pigott is Arch. George W. Knight, Engr. Bd. of Education, is Consult. Engr. Estimated cost, $120,000.

Fire Station—New Brunswick, N. J.—The city plans to construct a fire station to cost $16,000. Asher Atkinson is City Engr.

Fire Station—Union, N. J.—Bids are being received by Emil Bantz, Town Clk., Union Hill, for constructing a fire station to cost $18,000. It will be two stories, 80x25 ft.

+Stable—Philadelphia, Penn.—Carver & Moore, 1305 Diamond St., Philadelphia, have awarded the contract to JAMES R. DRISCOLL, Hale Bldg., Philadelphia, for constructing a two-story and basement stable, 26x120 ft., at about $18,000.

Subway—Cumberland, Md.—Plans are being prepared for the construction of a wagon, street-car and passenger subway under the tracks of the Baltimore & Ohio R. R. at Green Ct., Cumberland. James P. Gaffney is City Engr.

Fire Apparatus—Wheeling, W. Va.—The city plans to purchase motor-driven fire apparatus to cost $20,000. C. B. Cooke is City Engr .

Coal Terminal—Charleston, S. C.—The Southern Ry. Co. plans to construct a coal terminal at Charleston. A site of 114 acres has been purchased. B. Herman, Washington, D. C., is Ch. Engr. M. W. and Struct.

★Dredging Bulkheads—Jacksonville, Fla.—(Official)—Bids will be received until noon, Sept. 10, by the Port Commissioners for dredging in the St. Johns River at Jacksonville for municipal dock and terminal purposes; also for interlocking steel sheet piling bulkheads for municipal dock and terminal purposes. F. W. Bruce is Egr.

+Levee Work—New Orleans, La.—The following contracts for levee work were awarded by the State Board of Engineers, July 25: Carroll Levee, 78,000 cu.yd., to HEARIN & RYAN, at 14.98c. per cu.yd.; Roydraz Levee, 80,000 cu.yd., to GIBSON BROS., at 18.3c.; Algerra-Venice Levee, 22,000 cu.yd. earthwork and 8000 ft. of wood revetment, to SMITH BROS., at 20c. per cu.yd. for earthwork and 90c. per lin.ft. for revetment; Longwood Levee, 175,000 cu.yd., to WALKER & HILL, at 17.8c.; Mascot Levee, 170,000 cu.yd., to DONOVAN & DALY, at 19.4c.

The Orleans Levee Board July 28 awarded contracts as follows for levee work: Milliken's Bend Levee, 125,000 cu.yd., to CLARK & HARRIS, at 19.8c.; Cabin Teele Levee, 75,000 cu.yd., to LEONARD & CHESHISE, at 28c.; Duckport Levee, 125,000 cu.yd., to JOHN G. SESSIONS, at 15.42c.; Fairview Levee, 80,000 cu.yd., to CLARK & HARRIS, at 24.9c.; Paris-Line-Canal St. Ferry Levee, to the HERECULES CO. LTD., at 21.4c.; Beka New Levee, to DAMERON & WHITE, at 14c.; Canal St.-Algiers Sawmill Levee, to L. O. HOTARD, at 30c., for earthwork and 90c. per sq. yd. for concrete facing.

Drainage—Buena Vista, Tenn. — W. H. Gassiter, Buena Vista, is interested in the construction of a drainage district along the Big Sandy River.

Subway—Alliance, Ohio—Bids will be asked soon by the city for constructing the Arch Ave. subway. Wade Shindler is City Engr.

Iron Fence—Cincinnati, Ohio—Bids will be received until Aug. 25 by the Board of Hospital Commissioners for an iron fence with gate-houses at the grounds of the General Hospital. This is a readvertisement. Bids received July 14 were rejected as excessive. Samuel Hannaford & Sons, Hurlbert Block, Cincinnati, are Archs.

Fire Apparatus—Marion, Ohio—The city plans to purchase fire apparatus to cost $10,000.

Ditch—Valparaiso, Ind.—Bids are being received by the County Commissioners, Valparaiso, for constructing Calumet Ditch.

Fire Station, Etc.—Milwaukee, Wis.—Plans are being prepared for a fire station and a fire-boat station for the city. J. A. Mesiroff is City Engr.

CONTRACT PRICE

Viaduct—Wilkes-Barre, Penn.—Bids were received by the city, July 7, for constructing the Butler St. viaduct, from (A) Williams & Richardson, Scranton; (B) Bolton G. Coons Construction Co., Wilkes-Barre; (C) Whittaker & Diehl, Harrisburg; (D) D. M. Roser, Wilkes-Barre; (E) John Heller, Newark, N. J.; (F) Penn Bridge Co., Beaver Falls; (G) Neeld Construction Co., Pittsburgh; (H) McHarg Barton Co., New York, N. Y.; (I) Whiting-Turner Co., Baltimore, Md.; (J) Barzaghi Vought Co., New York, N. Y.; (K) Mason Hilton Co., New York, N. Y. The item bids were as follows:

VIADUCT, WILKES-BARRE, PENN.

	A	B	C	D	E	F	G	H	I	J	K
1400 cu.yd. excavation	$0.75	$0.70	$1.65	$0.50	$0.60	$0.50	$1.10	$0.50	$1 50	$0.70	$1.00
270 cu.yd. concrete "A"	6.80	8.00	8.80	6.50	6.00	6.50	4.93	5.00	6.20	7.00	6.00
1460 cu.yd. concrete "B"	8.80	8.00	11.00	7.50	6.90	8.00	7.56	8.00	20.00	10.00	10.00
1950 cu.yd. concrete "C"	16.00	17.00	27.50	15.00	18.50	12.50	14.47	16.00	20.00	15.00	14.00
2400 lin.ft. railings	1.95	2.50	2.00	2.00	2.50	2.50	1.40	2.00	3.50	1.50	1.50
14 lamp posts A	13.00	9.00	27.50	50.00	20.00	20.00	16.00	15.00	20.00	30.00	15.00
6 lamp posts B	13.00	13.00	22.00	60.00	20.00	15.00	21.00	20.00	25.00	40.00	12.00
13,200 sq.ft. granite finish	0.04	0.10	0.09	0.05	0.05	0.03½	0.048	0.05	0.05	0.07	0.04
3720 sq.yd. asphalt pavement	1.60	1.30	1.65	2.50	1.25	2.00	1.65	1.25	2.50	2.00	1.50
Hillside block pavement	1.60	1.35	2.50	2.00	2.00	....	1.95	1.50	2.50	3.00	1.50
2400 lin.ft. conduits, 2 in6	0.38	0.10	0.22	0.15	0.15	0.06	0.08	0.10	0.15	0.40	0.10
200 lin.ft. conduits, 1 in	0.22	0.10	0.11	0.10	0.12	0.05	0.08	0.10	0.15	0.30	0.10
24 outlet boxes	2.25	1.00	4.40	3.00	10.00	3.047	1.50	2.00	2.00	1.00	5.00
538,000 lb. structural steel	0.039	0.05½	0.05½	0.01½	0.05	0.047	0.0414	0.04½	0.04¼	0.05	0 052
116,500 lb. reinforced-steel bars	0.024	0.04	0.03½	0.03	0.04	0.03	0.0238	0.03¼	0 03	0.03	0.035
6500 lb. c.-i. drain	0.04	0.03	0.03½	0.03	0.05	0.03	0.03½	0.05	0.04	0.05	0.05
5500 cu.yd. filling	0.75	0.70	0.82	0.50	0.60	0.60	0.63	0.50	1.05	0.75	0.50
4 expansion joints	40.00	26.00	100.00	50.00	50.00	30.00	35.00	75.00	50.00	50.00	25.00
1 stairway	200.00	900.00	500.00	400.00	400.00	800.00	600.00	200.00	300.00	300.00	150.00
2550 lin.ft. protected curb	0.25	0.20	0.55	0.20	0.20	0.50	0.18	0.25	0.20	0.15	0.15
Extended totals...	$88.524	$100,423	$128,417	$90,687	$96,238	$87,479	$82,788	$87,887	$128,333	$96,115	$91,051

Drainage—[illegible], Iowa—The County Supervisors of [illegible] plan to establish a drainage district. C. N. [illegible], [illegible], is County Audr.

Drainage—Sac City, Iowa—Bids are being received by the County Supervisors, Sac City, for work in Drainage District No. [illegible]. [illegible] Neal, Sac City, is County Audr.

✦Ditch—[illegible], Minn.—The County has awarded the contract to [illegible] A. FOLEY & CO., for constructing Ditch 27, at [illegible].

✦Dam—[illegible], Minn.—[illegible] has awarded the contract to [illegible] NEILAND, [illegible], Minn., and SIVERT [illegible], [illegible], Minn., for constructing a dam at Osage. The [illegible] for [illegible] of concrete.

Ditch—Red Lake Falls, Minn.—The Supervisors of Red Lake County plan to construct [illegible] ditch No. 19. L. P. [illegible], Red Lake Falls, is County Audr.

Ditch—Roseau, Minn.—Bids will be received until 3 p.m., Aug. 16, by S. G. Bertilrud, County Audr., Roseau, for constructing Ditch No. 15. Estimated cost, $[illegible].

Bathing Beach—St. Paul, Minn.—The city plans to construct a bathing beach at Lake Phalen. Estimated cost, $[illegible]. [illegible] Claussen is City Engr.

Ditch Work—Walker, Minn.—Bids will be received until [illegible], Aug. [illegible], by I. P. Byhre, County Audr., Walker, for ditch work in Cass County.

Dams—Kirksville, Mo.—Adair Drainage District, Kirksville, has rejected all bids for constructing two dams across Chariton River in the district.

Natatorium—St. Louis, Mo.—Plans are being prepared by F. A. [illegible], Arch., City Hall, St. Louis, for a one-story natatorium to cost $[illegible].

Levee—Eagle Lake, Tex.—The state plans to construct levees along the Colorado River in Colorado County, below Eagle Lake. Estimated cost, $1[illegible]0,000. J. C. Nagle, Austin, Tex., is Chm. State Bd. Water Engrs.

Interlocking System—Dallas, Tex.—See item under Railways, Texas.

Wharves, Docks, Etc.—Houston, Tex.—The citizens of Harris County will vote soon on the proposition to issue $[illegible] in bonds for constructing wharves, docks and water terminals on the ship channel. Houston is the county seat. Noted July 9.

Wharf—Houston, Tex.—The International & Great Northern Ry. Co. plans to construct a wharf on the Houston Ship Channel. O. H. Crittenden, Houston, Tex., is Ch. Engr.

✦Comfort Stations—Salt Lake City, Utah—The City Commissioners, July 2[illegible], awarded the contract to JOHN SHAY, Salt Lake City, for constructing comfort stations at South Temple and Main Sts., at $13,323.

Seawall, Etc.—Seattle, Wash.—The Streets and Sewer Committee of the City Council has recommended the construction of a seawall from Washington St. to Madison St., and filling and paving Railroad Ave. with brick. Estimated cost, $2[illegible].

Bulkhead—Seattle, Wash.—A. H. Dimock, City Engr., has completed plans for the bulkhead to be constructed along East Waterway. Estimated cost, $25,000. Noted July 16.

Drainage District—[illegible], Wash.—The County Commissioners of Yakima County, North Yakima, Wash., in conjunction with landowners, have established a drainage district at [illegible]. Estimated cost of proposed work, $14,000.

Vessel—Wenatchee, Wash.—A company has been organized at Wenatchee to construct a passenger boat to ply between Bridgeport and Wenatchee, on the Columbia River. J. [illegible], Wenatchee, is interested.

✦Gymnasium—Berkeley, Calif.—The California School for the Deaf and Blind has awarded the contract to FRANK [illegible], Berkeley, for the construction of a gymnasium, at $[illegible].

Wharf Extension—Los Angeles, Calif.—The Harbor Commission will have plans prepared for the extension of municipal wharf No. 1, at a cost of about $[illegible],000. The structure is of concrete.

Fire and Police Alarm System—Los Angeles, Calif.—The city will ask for bids soon for the installation of a fire and police alarm system to cost $[illegible]. Homer Hamlin is City Engr.

Jetty—Newport Beach, Calif.—The city is considering the construction of a jetty at the mouth of the bay. Estimated cost, $[illegible].

✦Elevators—Oakland, Calif.—The H. C. Capwell Co., Oakland, has awarded a contract to the P. J. WALKER CO., San Francisco, Calif., for the installation of two elevators, at $[illegible].

Piling—Richmond, Calif.—The City Council has awarded a contract for placing piling for the bulkhead at the harbor entrance to the HEALY-TIBBITTS CONSTRUCTION CO., San Francisco, Calif., at $[illegible].

✦Walls—San Bernardino, Calif.—The Star Cement Co., Riverside, Calif., has been awarded the contract at $13,[illegible] for constructing three concrete blanket-protection walls in the Cajon Pass on the Atchison, Topeka & Santa Fe Ry.

✦Traveling Sidewalk—San Francisco, Calif.—The L. F. Myers Co., Chicago, Ill., has awarded a contract for the construction of a traveling sidewalk on the Exposition Grounds, at San Francisco, to the PACIFIC CAR EQUIPMENT Co., 625 Market St., San Francisco, at $11,[illegible]75.

Creek Work—San Jose, Calif.—Bids will be received by J. G. McMillan, County Audr., San Jose, for improving and straightening the channel of Campbell Creek.

Fire Apparatus, Bulkhead—Venice, Calif.—The city plans to purchase fire apparatus to cost $[illegible],000 and to repair the bulkhead at the canal entrance at Plaza del Rey at a cost of $2[illegible].

✦Wharf Extensions—Cheverie, N. S.—The Department of Public Works, Ottawa, Ont., has awarded the contract to MORTIMER PARSONS, Cheverie, for constructing wharf extensions at Cheverie.

Breakwater—Digby, N. S.—Bids will be received until 4 p.m., Aug. 31, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing a breakwater at Gulliver's Cove, Digby.

Breakwater—East Chezzetcook, N. S.—Bids will be received until 4 p.m., Aug. 31, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing an extension to the breakwater at Graff Beach, East Chezzetcook.

✦Dredging—Maquapit Lake, N. B.—The Public Works Dept., Ottawa, Ont., has awarded the contract to the NEW BRUNSWICK CONSTRUCTING CO., St. John, N. B., for the dredging required at Maquapit Lake.

✦Dredging—Beauport, Que.—R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., has awarded the contract to the W. J. POUPORE CO., LTD., McGill Bldg., Montreal, Que., for the dredging required at Beauport.

Fire Station—Lachine (Montreal post office), Que.—Bids are being received by Tellier & Dogart, Archs., Lachine, for the construction of a fire station to cost $15,000.

✦Conduits—Montreal, Que.—The Electrical Commission has awarded the contract to L. A. HERDT, Montreal, for underground conduits.

Elimination of Grade Crossing—(Subway)—Montreal, Que.—The city, Aug. 3, opened bids for constructing the Park Ave. subway under the tracks of the Canadian Pacific Ry. as follows: L. A. Ott & Co., Montreal, $176,176; Laurin & Leitch Co., $185,000; Edmond Belanger, $19[illegible],[illegible]0; Kennedy Construction Co., $203,131; Theodule Lessard, $2[illegible]7,900; T. L. MacBean, $225,000.

Grandstand—Quebec, Que.—Bids will be received in September by J. H. Dansnnault, Arch., Que., for the construction of a fire-proof grandstand at Quebec, to cost $[illegible].

Wharf Extension—Ste. Anne de Saguenay, Que.—Bids will be received until Aug. 31, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, for constructing an extension to the wharf at Ste. Anne de Saguenay.

Harbor Improvements—Hamilton, Ont.—Bids will be received until 4 p.m., Aug. 31, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for harbor improvements at Hamilton.

Wharf—Kensington, Ont.—Bids will be received until 4 p.m., Aug. 31, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing a wharf at Kensington.

Breakwater Extension—Kingston, Ont.—The Department of Public Works, Ottawa, Ont., plans to construct an extension to the breakwater at Kingston. R. C. Desrochers is Secy.

CONTRACT PRICES

Intercepting Sewer—Newark, N. J.—Bids were received July [illegible], by the Passaic Valley Sewerage Commissioners for constructing Section 11 and part of Section 27 of the main intercepting sewer, from: (A) [illegible] Construction Co., Newark; (B) Merrill-Ruckgaber Co. and Messrs. Hilton & Co., New York, N. Y.; (C) New York & New Jersey Construction Co., Newark; (D) Booth & Flinn, Ltd., New York, N. Y.; (E) Charles A. Haskins, Charlestown, Mass.; (F) Cauldwell-Wingate Co., New York, N. Y.; (G) Whiting-Turner Construction Co., Baltimore, Md.; (H) Beaver Engineering & Contracting Co., New York, N. Y.; (I) [illegible] & Tetitti, Belleville, N. J. The item bids were as follows:

INTERCEPTING SEWER, NEWARK, N. J.

Part of Section 27

	A	B	C	D	E		
[illegible]	$2[illegible]	$44.00	$55.00	$41.[illegible]	$4[illegible]	......	......
[illegible] air tunnel	[illegible]	[illegible]	1[illegible]	15.[illegible]	[illegible]	......	......
[illegible]	[illegible]	15.[illegible]	15.[illegible]	15.[illegible]	12.[illegible]	......	......
[illegible] for concrete reinforcement	[illegible]	[illegible]	0.03	[illegible]	0.0[illegible]	......	......
Estimated totals	$101,[illegible]	$74,[illegible]	$75,125	$50,045	$55,130	......	......

Section 11

	A	B	C	F	G	H	I
[illegible] trench for [illegible]	$57.00	$34.00	$50.00	$45.00	$27.00	$26.00	$30.[illegible]
[illegible] earth and rock, [illegible]	[illegible]	[illegible].50	[illegible]	119.00	9[illegible].00	52.00	60.[illegible]
[illegible] rock excavation	4.[illegible]	5.[illegible]	5.[illegible]	5.00	1.00	5.00	[illegible]
[illegible] concrete [illegible] in trench	[illegible]	[illegible]	[illegible]	[illegible]	[illegible].75	9.[illegible]	[illegible]
[illegible] concrete [illegible] in tunnel	1[illegible]	[illegible]	12.00	1[illegible]	[illegible].15	[illegible].00	1[illegible]
[illegible]	[illegible]	[illegible]	2[illegible].00	1[illegible]	1[illegible]	2[illegible]	2[illegible]
[illegible] for concrete reinforcement	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1.[illegible]	[illegible]	2.[illegible]	2.[illegible]	2.[illegible]	1.5[illegible]	2.[illegible]
Estimated totals	$[illegible]	$[illegible]	$21[illegible]	$212,5[illegible]	$11[illegible],227	$1[illegible]	$172,1[illegible]

+Dredging—Ottawa, Ont.—The Department of Public Works, Ottawa, has awarded the contract to the C. S. BOONE DREDGING & CONSTRUCTION CO., LTD., 17½ Adelaide St., Toronto, Ont., for dredging in Little Detroit River, Ont., at $12,000.

Drainage Work—Ottawa, Ont.—Bids will be received until noon, Aug. 20, by L. K. Jones, Secy. Dept. Rys. and Canals, Ottawa, for draining Clement's Gully, Soulanges Canal.

Cement—Ottawa, Ont.—Bids will be received until 10 a. m., Aug. 25, by L. K. Jones, Secy. Dept. Rys. and Canals, Ottawa, for 2,500,000 bbl. of portland cement for use in the construction of the Welland Canal.

+Ditch Work—Dauphin, Man.—The Rural Municipality of Dauphin has awarded the contract to H. M. THOMPSON, Dauphin, for 180,000 cu.yd. of ditch work, at 13c. per cuyd.

Park Work—Winnipeg, Man.—The Parks Board plans to spend $10,000 to improve Kildoan Park .

+Fire Alarm System—Winipeg, Man.—The City Council has awarded the contract to the GAMEWELL FIRE ALARM CO., New York, for installing a fire alarm system, at $30,980.

Cranes—Vancouver, B. C.—The Port Commission plans to purchase floating cranes for handling heavy cargoes.

BUILDINGS

Boston, Mass.—A. Snyder will build a $50,000 apartment house on Homestead St., Roxbury District.

+New Bedford, Mass.—The contract for erecting the bank building for the Merchants National Bank has been awarded to the J. W. BISHOP CO., Worcester, Mass., at about $300,000.

Pawtucket, R. I.—The Broad St. Power Co. will build a two-story store and office building on Broad St., to cost about $125,000. J. T Payne is Mgr.

Buffalo, N. Y.—Joseph J. Geigand, Arch., 346 Herman St. is preparing plans for a theater at High and Maple Sts. for Joseph Welte, 214 Locust St., to cost about $40,000.

Dunkirk, N. Y.—Bids will be received by John A. Weidman, Secy. Bd. of Education, until 7:30 p.m. Aug 14, for the erection of a school in the Union Free school district.

Lockport, N. Y.—The plans of William McNeil Smith, Arch., New York, N. Y., have been accepted by the Board of Education for building an addition to the high school, estimated to cost $85,000.

New York, N. Y.—(Borough of Manhattan)—Jackson, Rosencrans & Waterbury, 1328 Broadway, have prepared plans for a 13-story brick hotel on 30th St. near Eighth Ave. to cost about $185,000.

Plans have been completed by C. P. H. Gilbert, 1123 Broadway, for an 11-story apartment at 1066 Fifth Ave., estimated to cost $400,000.

+The contract for erecting the six-story limestone and marble residence for Mrs. E. B. Fischer, 7 East 79th St. has been awarded to M. REID & CO., 116 West 39th St. at about $250,000. H. Van Beuren Magonigle, 101 Park Ave., prepared the plans.

Niagara Falls, N. Y.—C. F. Obenback, Gluck Bldg., has prepared plans for a four-story city hall, 88x188 ft., estimated to cost $400,000. William Laughlin is Chn. of the Bldg. Comn.

+Rochester, N. Y.—(Official)—The contract for erecting the Y. M. C. A. building on Gibbs St. has been awarded to GEORGE ROSSELL, Rochester at about $385,000.

Troy, N. Y.—The Troy Gas & Electric Co., Troy Savings Bank Bldg., have approved of the plans of Louis N. Milliman, Troy, for the four-story brick and steel office building on Second St.

+Atlantic City, N. J.—The contract for building a 17-story addition to the Hotel Traymore has been awarded to CRAMP & CO., Philadelphia, Penn., at about $2,500,000.

Burlington, N. J.—Plans are being prepared by Oakley & Son, 284 North Broad St., Elizabeth, for an addition to the Masonic Bldg., estimated to cost $75,000.

Morristown, N. J.—The Trustees of the Memorial Hospital plan to build an addition to the hospital, to cost about $100,000.

Newark, N. J.—Hyman Rosensohn, Arch., has completed plans for a four-story brick building for William J. Underwood, estimated to cost $45,000.

Seabright, N. J.—Jackson, Rosencrans & Waterbury, Archs., New York, N. Y., are preparing plans for a hotel to replace the former Octagon Hotel. The estimated cost is $650,000.

Trenton, N. J.—The St. Regis Corporation, Philadelphia, has secured a site on East State St. and is having plans prepared for a theatre to cost about $110,000. Henon & Boyle, Philadelphia, are the Archs.

Erie, Penn.—W. P. Ginther, Akron, Ohio, is preparing plans for St. Andrew's Church at Seventh and Raspberry Sts., to cost about $80,000. Rev. W. F. Dwyer is Pastor.

+Philadelphia, Penn.—The contract for the construction of the six-story building on North Broad St., for Benjamin Alexander, has been awarded to CRAMP & CO., Philadelphia, at about $200,000. Charles E. Oelschlager is the Arch.

+Philadelphia, Penn.—The contract for erecting the four-story school at Germantown Ave. and Hugh St. has been awarded to THOMAS REILLY, 1616 Thompson St., at about $75,000.

Pittsburgh, Penn.—It is reported that bids will be received by the Board of Education for constructing the William H. McKelvey grade school, to cost about $224,000.

★Wilmington, Del.—(Official)—Bids will be received by the New Castle County Building Commission and the Wilmington Building Commission for completing the county building for New Castle County and the municipal building for the city, at French and Tenth Sts. Thomas F. Gormley is Secy. For further information see advertisement under "Contracts To Be Let." Noted May 28 and Aug 6.

+Baltimore, Md.—The contract for the construction of the Garden Theatre, at 114 West Lexington St., has been awarded to the GEORGE A. FULLER CO., New York, N. Y. The estimated cost is $165,000.

Kublitz & Stenson, Archs., have completed plans for a 12-story brick and reinforced concrete store and office building at 51 Liberty St. for Louis Applefeld.

The contract for erecting the theater for the Garden Theater Co. on Park Ave. and Clay St. has been awarded to J. HENRY MILLER, Baltimore, at about $200,000.

Baltimore, Md.—Louis Levi, Arch., American Bldg., is preparing plans for a brick and concrete building at 511 West Pratt St. for the United Woolen Mills. The estimated cost is $200,000.

Atlanta, Ga.—(Official)—The following contractors have been invited to submit bids for constructing the Connally office building, from plans prepared by W. L. Stoddard, 1023 Candler Bld., Atlanta, bids to be opened Aug. 26: Selden Breck Construction Co., St. Louis Mo.; Cauldwell Wingate Co., 381 Fourth Ave., New York, N. Y.; Wells Bros. Co., Washington, D. C.; George A. Fuller Co., Washington, D. C.; The Whitney Co., 1 Liberty St., New York, N. Y.; Norcross Bros. Co., 103 Park Ave., New York, N. Y.; Wilke & Hague, 418 Wrightwood Ave., Chicago, Ill.; Miles & Bradt, Atlanta, Ga.

+Griffin, Ga.—The contract for building the Union Passenger Station has been awarded to the GRESHAM MFG. CO., Savannah, Ga., at about $40,000.

+Fort Myers, Fla.—The Board of County Commissioners has awarded the contract for constructing the court house to F. B. HEIFNER, Fort Myers, at about $75,000.

Shreveport, La.—Thomas C. Barrett, Shreveport, is having plans prepared for a four-story brick and concrete hotel at Louisiana and Crockett Sts. to cost about $50,000.

Memphis, Tenn.—The congregation of the Children of Israel plant to build a temple, to cost $40,000.

Memphis, Tenn.—Jones & Furbringer, Archs., Memphis. are preparing plans for a 12-room school in the Prescott School District to cost about $55,000.

Louisville, Ky.—Bids will be received by the Business Director, Board of Education, until Aug. 19, for the erection of two schools. Joseph & Joseph, Great Southern Bldg., and Hutchings & Sons, Columbia Bldg., are the Archs.

+The contract for erecting the Cypress St. school has been awarded to the ALFRED STRUCK CO., at $81,999.

+Akron, Ohio—The contract for the erection of the O'Neill Bldg., on Main St. has been awarded to the CARMICHAEL CONSTRUCTION CO., at $140,000.

Cleveland, Ohio—E. F. Gibbons, 1900 Euclid Ave., is preparing plans for an eight-story reinforced-concrete building, to be erected on Prospect Ave., for the Belmont Realty Co.

Hudson, Ohio—Bids will be received by J. W. Corbusier, Lennox Bldg., Cleveland, until Sept. 1, for constructing a two-story brick school, including gymnasium.

Lakewood, Ohio—Bids will be received by W. H. Nicklas, 1900 Euclid Ave., until Aug. 17, for constructing a church on Clifton Blvd., for the Lakewood Congregational Organization. The estimated cost is $50,000.

Rittman, Ohio—Bids will be received until Aug. 14, by Engr. Daniels, of the National Engineering Co., 504 Marshall Bldg., for the erection of a high school at Rittman. The estimated cost is $40,000.

+Youngstown, Ohio—The contract for constructing the Hippodrome Bldg. has been awarded to the GEORGE A. FULLER CO., Pittsburgh, Penn. Knox & Elliott, Rockefeller Bldg., Cleveland, are the Archs.

Indianapolis, Ind.—It is reported that the Fraternal Order of Eagles plans to erect a lodge building at Illinois and Vermont Aves. to cost about $50,000.

+Detroit, Mich.—(Official)—Contracts for the erection of the three-story and basement high school at Detroit, have been awarded as follows: Masonry, C. A. SAUER & CO.; steel, LEWIS & HALL, carpentry, HARCUS & CO., heating and ventilating, ERNST BROS. Noted July 9.

+Grand Rapids, Mich.—The contract for erecting the building for the Knights of Columbus, has been awarded by the Council to HORNER & KELLY, Grand Rapids, at about $60,000. Noted Aug. 6.

Chicago, Ill.—George L. Berman will erect an office building at Cottage Grove Ave. and 47th St. The estimated cost is $100,000. H. R. Wilson is the Arch., 104 South Michigan Ave.

Streator, Ill.—Bids will be received by the Directors of the Y. M. C. A., until Aug. 17, for constructing a building estimated to cost $40,000. W. G. Foster, Streator, is the Arch.

+Urbana, Ill.—(Official)—The contract for the erection of the chemistry building at the University of Illinois, has been awarded to FREEMAN & BROOKS, Champaign, Ill. Noted July 23.

Ames, Iowa—It is reported that bids will be received by Sheldon & Munn, Ames, until Aug. 17, for constructing a four-story store and hotel, 100x100 ft. from plans prepared by Proudfoot, Bird & Rawson, Des Moines.

(Buildings continued on page 120)

CONTRACT PRICE

Rapid Transit System—New York, N. Y.—Bids were received July 23 by the Public Service Commission for constructing Sections 1 and 2, Route 11-B, from (A) Station Construction Co., 277 Broadway, New oYrk; (B) Marble Arch Co., Broadway and 216th St., New York; (C) Snare & Triest Co., Woolworth Bldg., New oYrk; (D) P. J. Carlin Construction Co., 1123 Broadway, New York; (E) Conners Brothers Co., 153 West Kingsbridge Road, New oYrk; (F) McKinly Engineering Co., 51 Chambers St., New oYrk; (G) Thomas J. Buckley Construction Co., 303 Fifth Ave., New York; (H) Carpenter, Boxley & Herrick, 375 Ovington St., Brooklyn, N. Y.; (I) E. E. Smith Contracting Co., 101 Park Ave., New York; (J) Norton & Gorman Co., 303 Douglas St., Brooklyn, N. Y. The item bids were as follows:

RAPID TRANSIT SYSTEM, NEW YORK, N. Y.

Section 1 and 2, Route 11-B

	A	B	C	D	F	E	G	H	I	J
[illegible]	$0 50	[illegible]	$0 50	$0 51	0.815	[illegible]	$0 46	[illegible]	[illegible]	[illegible]
[illegible]	1 30	1 50	1 10	1 40	1 46	1 41	1 41	[illegible]	1 75	[illegible]
[illegible]	1 33	[illegible]	1 10	1 25	1 36	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	83	1 00	1 10	1 00	1 33	90	1 73	[illegible]	1 00	[illegible]
[illegible]	71	60	.70	70	70	83	.67	80	[illegible]	[illegible]
[illegible]	1 26	1 00	1 40	1 00	1 31	95	1 22	1 00	1 00	[illegible]
[illegible]	1 23	[illegible]	1 40	1.35	1 37	[illegible]	[illegible]	1 04	[illegible]	[illegible]
[illegible]	13	1 00	.35	.20	14	17	14	10	15	[illegible]
[illegible]	1 10	1 20	1 10	1 10	1 10	1 15	1 14	1 11	1 75	1 40
[illegible]	1 21	1 20	1 20	1 10	2 90	1 15	1.04	[illegible]	1 75	1 40
[illegible]	1 21	1 20	2 00	1 10	1 10	1 15	1.04	3 50	1 75	[illegible]
[illegible]	1 21	1 20	1 40	1 10	2 90	1 15	1.04	[illegible]	1 75	1 60
[illegible]	1 20	1 60	1 30	1 35	1 10	1 30	1 00	[illegible]	1 00	1 40
[illegible]	1 30	[illegible]	1 40	[illegible]	30	1 40	82	1 17	1 75	1 60
[illegible]	[illegible]	1 50	1 80	1 60	[illegible]	1 78	[illegible]	1 98	[illegible]	[illegible]
[illegible]	2 15	[illegible]	5 00	[illegible]	[illegible]	6 15	8 00	6 87	7 50	[illegible]
[illegible]	[illegible]	[illegible]	6 00	17 00	18 90	11.60	[illegible]	[illegible]	15 00	[illegible]
[illegible]	22 00	[illegible]	30 00	24 00	24 77	27 85	24 00	31 50	[illegible]	[illegible]
[illegible]	[illegible]	20 00	28 00	20 00	21 00	[illegible]	[illegible]	24 00	27 50	[illegible]
[illegible]	[illegible]	12 50	[illegible]	20 00	21 15	10 86	23 00	12 00	11 50	12 18
[illegible]	11 00	12 00	20 00	18 00	19 12	10 10	[illegible]	11 80	12 50	[illegible]
[illegible]	.73	1 10	85	70	71	.75	1 30	75	90	[illegible]
[illegible]	.55	70	80	.75	.80	.85	1 20	80	1 00	80
[illegible]	.55	50	.80	.70	.61	.65	1 20	.68	80	1 15
[illegible]	.16½	.20	.20	[illegible]	.12	.10	.30	.20	33	[illegible]
[illegible]	.13	[illegible]	.12	.30	.47	.08	20	.31	.35	[illegible]
[illegible]	.15	.15	.12	16	.17	.15	20	17½	10	20
[illegible]	.12	.10	.12	.12	.10	.08	.12	11	11	11
[illegible]	.33	2 00	2 00	30	.13	2 20	12	[illegible]	2 75	20
[illegible]	1 00	90	1 00	1 10	.60	60	75	1 11	1 25	45
[illegible]	[illegible]	13 00	14 00	9 00	8 10	8 00	10 00	[illegible]	10 50	[illegible]
[illegible]	90	70	1 50	1 00	.96	70	50	91	1 40	50
[illegible]	.72	90	1 50	90	1 20	1 00	1 50	76	90	[illegible]
[illegible]	.50	60	1 00	60	.60	60	25	[illegible]	[illegible]	50
[illegible]	1 60	1 00	1 00	2 10	[illegible]	1 80	2 25	2 20	[illegible]	2 75
[illegible]	.65	25	.50	70	50	50	58	75	80	60
[illegible]	1 12	1.00	.60	1.30	1.60	1 10	1 60	1 10	1 00	1 75
[illegible]	15	25	.25	.50	12	30	30	52	50	60
[illegible]	1 25	.60	1 00	1 80	1.00	80	1 00	1 75	2 00	1 10
[illegible]	95	.50	.90	1 00	1.00	70	.65	1 12	[illegible]	[illegible]
[illegible]	28	.30	.44	50	.35	.25	.35	41	50	40
[illegible]	20	.30	.44	1 00	20	.44	.30	.82	90	40
[illegible]	17	.30	.20	.25	.11	.15	.10	.17	20	25
[illegible]	[illegible]	.60	50	.50	.60	.50	.60	.58	85	[illegible]
[illegible]	1 00	3 00	4 00	1 50	1 10	.90	2 00	87	1 75	1 50
[illegible]	30	.35	.44	.50	.45	.65	80	17	65	70
[illegible]	1 10	1 00	.90	70	70	60	2 00	76	.65	75
[illegible]	79	70	.48	60	60	.50	80	.53	.65	65
[illegible]	[illegible]	.50	33	55	50	60	1 00	41	65	55
[illegible]	17	60	80	50	60	40	1 00	1 16	1 00	75
[illegible]	775 00	900 00	800 00	1,110 00	790 00	1,225.00	800 00	1,362 50	1,500 00	1,250 00
[illegible]	900 00	1,000 00	1,000 00	1,000 00	907 50	1,200 00	1,000 00	1,110 00	[illegible]	1,200 00
[illegible]	800 00	[illegible]	650 00	600 00	682 50	765 00	500 00	820 00	1,000 00	750 00
[illegible]	1,000 00	1,200 00	1,150 00	1,150 00	1,181 25	1,285 00	500 00	1,100 00	1,500 00	1,280 00
[illegible]	75 00	80 00	80 00	75 00	[illegible]	97 00	70 00	82 00	90 00	73 00
[illegible]	100 00	130 00	140 00	135 00	110 70	135 00	110 00	132 00	175 00	140 00
1 Door, type [illegible]	90 50	150 50	100 00	130 00	113 00	135 00	190 00	137 50	180 00	143 00
[illegible] Doors, type [illegible]	60 00	74 00	90 00	80 00	90 30	80 00	80 00	85 00	100 00	90 00
[illegible] Doors, type [illegible]	50 00	50 00	50 00	55 00	52 50	52 00	50 00	58 00	70 00	60 00
3 Doors, type "J"	50 00	73 00	100 00	60 00	75 75	80.00	70 00	61 00	70 00	80 00
[illegible]	1 90	4 00	5.00	4 00	1 20	3 50	4 00	4 10	4 50	[illegible]
[illegible]	90	4 00	6 00	3 80	4 20	3 50	4 00	4 10	4 50	4 00
1 Door, type "M"	55 00	60 00	65 00	68 00	67 50	73 00	50 00	82 00	90 00	75 00
4 Door, type "P"	42 50	38 00	40 00	63 00	30 90	60 00	38 00	70 00	80 00	70 00
[illegible] Sq.ft. windows, [illegible]	1 50	2 00	1 40	3 00	1 60	3 50	1 00	3 50	4 00	4 00
[illegible] Sq.ft. windows, [illegible]	1 40	2 50	1 20	3 50	1 60	4 50	2 00	1 70	5 50	4 25
[illegible]	1 20	1 00	[illegible]	1 15	4 00	1 85	1 50	5 00	[illegible]	4 50

60 Door stops	2 15	2.00	2.00	2.25	2.10	3 25	2 25	3.20	3.50	3.00
6 Chains	1 10	1.00	1.00	1.25	1 05	1.50	1.25	1.58	1.80	1.50
12 Push plates	2.60	2.30	2.50	3.00	2.55	3.50	2.75	3.50	4.00	3.50
12 Pulls	4.13	3.60	4.00	4 15	3 90	4 80	4.00	4.90	5.50	4.50
12 Kick plates	7.43	6.50	8.00	7.50	7.10	9.00	7.25	9.25	10.50	9.00
325 Lin.ft. railings, low straight	3.41	3.25	5.00	3.50	5.50	5.25	5.00	5.25	4.00	5.16
710 Sq.ft. railings, high straight	.45	.50	1.20	.60	.90	.85	.75	.83	.50	.84
140 Lin.ft. railings, bevel	4.90	5.00	5.00	5.00	7.00	7.00	6.50	9.30	6.00	9.30
525 Sq.ft. railings, grill	1.21	1.25	1.00	1.50	3.15	1.75	2.00	1.93	1.50	1.92
25 Lin.ft. rialings, pipe	2.00	3.00	2.00	3.00	3 50	3.45	3.00	2.95	3.00	2.65
80 Lin.ft. low sliding gate	10.00	10.00	9.00	9 00	8.40	8 00	8.00	11.00	13.50	11.10
35 Lin.ft. folding gate	6.60	6.00	9.00	7.00	8.75	8 25	8.00	11.55	8.00	11.40
12 Lin.ft. swing gate	10.00	9.00	10 00	10 00	5.75	5.50	5.50	9.25	12.00	9.00
7 Turnstiles	145.00	150.00	280.00	200 00	231.00	215.00	250 00	350.00	175.00	1.50
10 Gate controls	8.25	10.00	30.00	30 00	37.80	37.50	20 00	38.50	10.00	39.60
6 Floor boxes	2.20	5.00	12.00	5.00	5.75	5.50	5 00	8.00	2.50	8.40
200 Lin.ft. 1¼-in. galvanized pipe	.14	.15	1.00	.25	.10	.35	.25	.60	.15	.80
50 Lin.ft. 1-in. square tubing	.16	.20	1.80	1.25	1.15	1 15	1.00	1.16	.20	1.60
50 Lb. C. I. fittings	.06	.10	.40	.09	.08	.10	.10	.29	.07	.80
16 C. I. gate posts	30.80	30 00	70.00	40.00	47.25	50.00	40.00	48.00	40.00	50.20
2C. I. vent posts	88.00	100.00	135.00	100.00	262.50	250.00	250.00	385.00	100.00	396.00
20 Illuminating sign frames	44.00	50.00	85.00	50.00	87.15	85.00	80.00	148.50	50 00	150.00
6 Sq.ft. sign for high railing	3.30	5.00	7.00	5.00	2.40	2 25	2.25	2.92	4.00	3.10
230 Lin.ft. reflectors	.77	1.00	2 30	3.00	7.25	7.00	6.00	5.20	1.00	4.80
410 Sq.ft. sign plates, enameled	.55	1.00	2 20	.65	.40	.70	.70	1.16	.70	1.00
7,150 Vert. in. copper letters	.10	.10	.12	.13	.12	.15	.20	.17	.12	.20
16 Street hoods, type "A"	850.00	900.00	900.00	900 00	1,410.00	1,400.00	1,300 00	1,520.00	1,200.00	1,500.00
2 Street hoods, type "C"	1,000.00	1,000.00	1,200.00	1,000.00	2,415.00	2,400.00	2,000.00	2,510.00	1,200.00	2,530.00
5 Street hoods, type "D"	550.00	700.00	700 00	600.00	997.00	950.00	1,000.00	1,167.00	750.00	1,170.00
15 Tread. lin.ft. steel ladders, etc	3.00	4.00	3.00	3.25	3.45	3.50	3.00	4.20	4.00	4.80
20 Sq.ft. steel ladders, platforms	1.50	2.00	4.00	2.15	2.35	2.25	2.00	4 20	2.00	4.80
4,000 Lb. shapes for lintels	.035	.03	.05	.04	.03½	.03	.05	.06	.04	.06
2,520 Lin.ft. wood band rails	.88	1.00	.50	1.00	1.70	1.70	1.60	1.70	1.10	1.65
19,200 Sq.ft. platform edge, safety treads	.10	.20	.70	1.10	.90	.80	.80	1.24	1.40	1.60
Rough plumbing (6 stations) lump sum	11,479.00	4,000.00	10,000.00	6,000 00	9,000 00	6,210 00	8,000 00	,6000.00	9,200.00	7,500.00
24 Water closet bowls	58.00	50.00	70.00	60 00	52.50	58.00	75 00	70.00	70.00	75.00
12 Toilet lavs	43.00	40.00	65.00	50 00	31.50	40.00	70 00	58.00	45.00	70.00
2 Signal tower lavs	43.00	60.00	125.00	60.00	59.75	65.00	130.00	64.00	75.00	68.00
12 Urinals	85.00	100.00	115.00	150.00	85.00	112.70	125.00	105.00	220.00	131.00
6 Slop sinks	80.00	80.00	55.00	35.00	79.00	93.00	60.00	93.50	100.00	120.00
21 Floor drains	33.00	15.00	20.00	16.00	15.50	18.00	25.00	23.50	18.00	20.00
550 Lin.ft. supply pipe, 1-in	.50	.40	.42	.16	1.00	.29	.50	.17		
575 Sq.ft. ¾-in. wainscot and trimming	1.10	1.25	1.40	1.10	1.00	1.50	1.25	1.40	2.50	1 20
1,120 Sq.ft. ¾-in P. C. partitions	1.37	1.75	1.70	1.80	1.90	1 80	1.75	1.80	3.00	1.98
50 Sq.ft. ¾-in. shelves	1.21	1 75	1.70	1 60	1 50	1.85	1.65	1.80	2.50	2.00
465 Sq.ft. ¾-in. stall partitions	1.93	1.75	1.60	1.80	1 70	2 85	1.75	1 70	3.00	1.98
55 Sq.ft. 1-in. floor slabs	1.90	1 75	5.00	1.70	1.50	3 00	1.65	5.80	2.50	1.90
230 Lin.ft. curves and angles	1.10	1 75	1.00	1.70	1 50	150 00	1.65	.94	4 00	1 85
55 Posts	11.00	8 00	17.00	8.00	3.20	25.00	12 00	17 50	15 00	10.00
165 Lin.ft. top rails	.75	.50	1.20	1.50	.60	1.15	2 00	1 75	1.25	1.00
35 C. I. wall flanges	2 00	.30	1.20	2.00	.25	9 00	2 00	5.85	2.50	1.00
8,370 lb. Steel angles, plates, etc., for supporting glass	.08	.05	.08	.05	04	10	.08	.17	.05	12
24 Hooks in toilets	.55	.50	3 00	10.00	1 00	1.00	1.25	.60	1.50	1.00
8,275 Lin.ft. electric conduits, ¾-in	.17	.15	.15	.20	.20	.20	.20	.20	.16	.27
1,455 Lin.ft. electric conduits, 1-in	.22	.20	.20	.22	.25	.30	.22	.22	.30	.36
7,750 Lin ft. electric conduits, 1½-in	.29	.25	.26	.30	.30	.35	.30	.28	.40	.46
1,870 Lin.ft. electric conduits, 2-in	.40	.35	.32	.35	.38	.50	.40	.36	.50	.71
100 Lin.ft. electric conduits, 2½-in	.54	.50	.45	.55	.55	.70	.60	.51	.90	.84
100 Lin.ft. electric conduits, 3-in	.70	.60	.60	.70	.73	.95	.80	.67	1.25	1.02
500 Lin.ft. electric conduit, ¾-in. flexible conduit	.15	.20	.20	.25	20	.30	20	.17	1.00	.29
715 C. I. outlet boxes	.88	1.00	1.00	.80	.80	1.00	1 00	.76	1.00	1.15
45 C. I. pull boxes, 6x6x6 in	1 65	3.00	3.00	3.50	1 60	5.85	1 75	3.85	2 00	7.00
50 C.I. pull boxes, 12x12x6 in	3.70	5.00	8 00	3.30	3 45	6.75	4 00	6.10	5.00	11.20
14 C. I. pull boxes, 18x12x6 in	5.50	8.00	12.00	5.50	5.25	11 25	6 00	8.90	8 00	16 60
6 C. I. pull boxes, 24x18x6 in	10.50	15 00	18.00	9 00	10.00	15.50	11 00	15.90	12 00	17.80
33C. I. heater boxes	18.00	15.00	6.00	16.00	16.80	30 00	20.00	13.90	15 00	30.00
2 Steel panelboard boxes 25x60x5½ in	26 00	25.00	25 00	26.00	25 00	30.00	30 00	18.50	15 00	40.00
5 Steel panel board boxes 25x48x5½ in	20.00	20.00	25.00	22.00	21.00	24.85	25 00	16.25	12.50	40.00
13 Steel panel board boxes, 25x36x5½ in	15.00	15.00	20 00	16.00	16.00	21.75	20.00	14 00	10 00	30.00
6 Steel switchboard boxes	50.00	50.00	25.00	60.00	58.00	57.50	60.00	32.70	18 00	60.00
37,400 Sq.ft. painting iron, steel, etc., 2 coat iron	.025	.02	.02	.02	.04	.02½	.03	.03½	.02¼	.025
108,350 Sq.ft. painting iron, steel, etc., 3 coat on iron	.033	.02½	.02½	.04	.05	.03½	.04	.05½	.03½	.035
350,120 Sq.ft. painting iron, steel, etc., 3 coat on plaster	.0275	.02½	.02½	.03	.03	.03¾	04.	.02½	.04	.035
820 Painting iron and steel, etc., letters and numbers	.22	.10	.50	.20	.20	.15	15	.15	1 00	.10
Extended totals	$351,134	$257,140	$271,246	$291,246	$298,206	$309,155	$334,451	$327,331	$378,103	$375,082

(Buildings continued from page 117.)

Waterloo, Iowa—[illegible] & [illegible], Chicago, Ill., are preparing plans for a [illegible]-story [illegible] building on [illegible] and [illegible]th Sts. for Mrs. C. O. Lamson. The estimated cost is $[illegible].

Philipsburg, Mont.—J. H. Ehlers, Sayers Bldg., Spokane, will erect a [illegible] hospital at Philipsburg. The estimated cost is $[illegible].

+St. Louis, Mo.—The contract for constructing the eight-story building on [illegible] St., for the Joseph Pulitzer Estate, has been awarded to JAMES STUART & CO., at about $[illegible].

Hot Springs, Ark.—The lowest bid submitted for erecting the [illegible] Methodist Church was from J. D. [illegible], Hot Springs, at $[illegible]. John Gaisford, Memphis, Tenn., is the Arch.

Prescott, Ariz.—The Supervisors of Yavapai County plan to erect a [illegible] to cost about $250,000.

Bellingham, Wash.—The Board of Education has had plans prepared by [illegible] F. [illegible], Arch., Sunset Block, for the erection of a brick and concrete school. The estimated cost is $[illegible].

+Port Angeles, Wash.—(Official)—The contract for constructing the two-story and basement brick courthouse has been awarded to the SOUND CONSTRUCTION & ENGINEERING CO., Seattle, at $[illegible]7,688. Francis W. Grant prepared the plans. Noted July 30.

+Seattle, Wash.—The contract for constructing the 10-story hotel for the Rainier Heat & Power Co., has been awarded to DITLEFSEN & GERRING, at $160,000. Noted July 3[illegible].

The city contemplates erecting an auditorium at Seattle. The estimated cost is $250,000.

Los Angeles, Calif.—Arthur [illegible], Hollingsworth Bldg., is preparing plans for a five-story hotel at Fourth St. and Glassell Ave. The estimated cost is $100,000.

Los Angeles, Calif.—Austin & Pennell, Archs., Wright & Callender Bldg., are preparing plans for the erection of a building on Wilshire Blvd., for the Marlborough School for Girls. The estimated cost is $60,000.

Oakland, Calif.—Bids will be received until noon, Aug. 20, by the City Council for completing of the municipal auditorium, including elevators, marble and tiling, cement finish, [illegible], plastering and electrical work. Frank M. Smith is City Clerk.

[illegible]gham & Polito, Archs., First National Bank Bldg., San Francisco, Calif., have been commissioned to prepare plans for a seven-story hotel for Blake & Moffitt, to cost about $[illegible].

+San Francisco, Calif.—The Panama-Pacific International Exposition Co. has awarded a contract for the construction of a Court of the Universe on the Exposition site to STREIB-[illegible] & PETERSEN, at $[illegible].

[illegible] & Lofquist, Archs., 742 Market St., are completing plans for a three-story brick school for St. Paul's Parish, estimated to cost $[illegible].

The Board of Public Works has had plans completed for the [illegible] High School, which is to cost $165,[illegible]. Bids will be called soon for the work.

+San Francisco, Calif.—The contract for erecting the six-story brick and steel store and apartment for the [illegible] [illegible] Co., at Jones and Ellis Sts. has been awarded to G. [illegible] W. JENSEN, [illegible] Market St. at about $120,000. J. R. Miller, [illegible] Bldg., prepared the plans.

G. A. Applegarth, Arch., Call Bldg., has completed plans for a [illegible]-story apartment at Stockton and California Sts. for [illegible]. The estimated cost is $[illegible].

[illegible] & [illegible], Newhall Bldg., have completed plans for a theater at Mason and Eddy Sts. for the [illegible] [illegible] Co. The building will be six stories of reinforced concrete and is estimated to cost $[illegible].

Montreal, Que.—Plans have been prepared by [illegible] & [illegible], Archs., for the erection of a school at Montreal. The estimated cost is $[illegible].

Shawville, Que.—Bids will be received until 4 p.m. Aug. [illegible], by [illegible], Dept. of Public Works, Ottawa, Ont., for the erection of a public building at Shawville.

Toronto, Ont.—Bids will be received until Aug. 2[illegible], by W. C. [illegible], Board of Education, for the erection of the [illegible] School of Commerce.

Walkerville, Ont.—C. H. [illegible], Arch., [illegible] Bldg., is preparing plans for the erection of a theater for the [illegible] Theatre Co., 63 [illegible] St., Walkerville. The estimated cost is $[illegible].

Edmonton, Alta.—E. W. [illegible], Arch., has completed plans for the erection of a four-story office building for [illegible]. The estimated cost is $[illegible].

[illegible] will erect a [illegible]-story office building on Jasper Ave. The estimated cost is $[illegible].

Flynt Building & Construction Co., of Palmer, Mass., has established a branch office at 136 A Congress St., Portland, Maine, with Frank M. Churchill, Mem. M. S. C. E., in charge.

The Compressed Gas Manufacturers' Association, 25 Madison Avenue, New York, would like to receive from manufacturers of valves, cylinders, recording gages, filling and weighing stands and all material and appliances which enter into the manufacture, transportation and sale of compressed gases their catalogs and prices. These will be kept on file at the office of the Association.

An Arcade in New York—The Standard Oil Co., New York, has announced that plans have been accepted and adopted for an Arcade at 50 Broadway, formerly occupied by the Tower Building.

It is to be observed that this busy section of Broadway, Broad St., Trinity Place, and William St., below Cortlandt, is poorly supplied with retail shops—it has been difficult for the merchants to "break in." Recognizing these conditions the Standard Oil Co., developed plans for a building which would meet the requirements of the merchants and at the same time be one which would provide great service to the public. Several of the present buildings facing on Broadway with the rear on New St., have passages that are much used by pedestrians as the lower part of the city is poorly supplied with cross streets. H. Craig Severance and William Van Alen have been employed as the architects.

The structure will be three stories on Broadway and four stories on New St. It will be 20x70 ft. with iron and glass walls between marble pilasters. The lighting and ventilation will be from a central court.

CONTRACT PRICES

Barge Canal Work—Albany, N. Y.—Bids were received July [illegible] by Duncan W. Peck, Supt. Pub. Wks., Albany, for Contracts Nos. 119 and 120 for steel sheet piling, etc., at the movable dam at Rotterdam, N. Y., and reinforcing the superstructure of the movable dams at Rotterdam, Cranesville, Amsterdam, Tribes Hill, Yosts, Canajoharie and Fort Plain, N. Y. from (A) Frank M. Skene, Brockport, N. Y.; (B) Lupfer & Remick, Buffalo, N. Y.; (C) Walsh Construction Co., Davenport, Iowa; (D) John M. Rogers, Tonawanda, N. Y.; (E) Holler & Shepard, Rochester, N. Y.; (F) Penn Bridge Co., Beaver Falls, Penn.; (G) Whitehead & Kales Iron Works, Detroit, Mich.; (H) Fort Bridge Works, 45 Broadway, New York, N. Y. The item bids were as follows:

BARGE CANAL WORK, ALBANY, N. Y.

Contract 119

	A	B	C	D	E
3,610 Cu.yd. excavation	$[illegible].50$	0.60$	0.62$	1.00$	0.55
2,250 Cu.yd. second-class concrete	7.25	8.40	7.00	9.50	7.00
20,120 Sq.ft. steel sheet piling	1.00	1.00	.05	1.00	.80
510 Cu.yd. removing riprap	1.00	1.00	1.10	1.00	.90
1,600 Cu.ft. chipping concrete	.80	.30	.50	.75	.75
330 Lin.ft. drilling holes in existing concrete	1.00	1.50	1.25	1.50	1.50
150 Cu.yd. grout	9.00	[illegible]	9.[illegible]	[illegible]	[illegible]
Cofferdams, pumping, etc., "A", lump sum	3,000.00	[illegible]	3,[illegible]	[illegible]	3,[illegible]
Cofferdams, pumping, etc., "B", lump sum	[illegible]	6,[illegible]	[illegible]	[illegible]	[illegible]
Cofferdams, pumping, etc., "C", lump sum	3,[illegible]	[illegible]	2,[illegible]	[illegible]	3,[illegible]
Extended totals	$[illegible]21[illegible]	$[illegible],471	$[illegible],981	$70,610	$[illegible]

Contract 120

	F	E	C	F
[illegible] lb. structural steel	$ [illegible]	$ [illegible]	$ [illegible]	$ [illegible]
[illegible] lb. reinforcing [illegible]	.11	[illegible]	[illegible]	[illegible]
[illegible] lb. new [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25 M.F.B.M. [illegible] lumber	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] replacing [illegible] bearings	[illegible]	[illegible]	[illegible]	[illegible]
23 [illegible] of new [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3,[illegible] lin.ft. [illegible]	1.[illegible]	1.[illegible]	1.[illegible]	1.[illegible]
1[illegible] [illegible] bearings	[illegible]	[illegible]	[illegible]	[illegible]
Extended totals	[illegible]	[illegible]	[illegible]	[illegible]

Water Supply Extension, North Adams, Mass.—Bids were received July 2[illegible] by the Commissioner of Public Works for the water supply extension including the construction of an earth dam reservoir and conduit from (A) [illegible] Contracting Co.; (B) Farmingham Contracting Co.; (C) Hanlon Construction Co.; (D) W. [illegible] Contracting Co.; (E) T. Stuart & [illegible] Co.; (F) Davis & [illegible]; (G) Mason, Hilton & Co.; (H) [illegible] O'Connell [illegible]; (I) H. P. Converse & Co.; (J) Light, Heat & Power Corporation; (K) P. J. Kennedy & Co. The item bids were as follows:

WATER SUPPLY EXTENSION, NORTH ADAMS, MASS.

[illegible]

	A	B	C	D	E	F	G	H	I	J	K
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Extended totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS

New York—Lehigh-Buffalo Terminal Co.—This company has been incorporated in New York. It will operate in connection with the proposed new union station to be constructed in Buffalo, N. Y., by the Lehigh Valley R.R. E. B. Ashby, New York, N. Y., is Ch. Engr. L. V. R.R.

North Carolina—Central Carolina R.R.—Various townships in the eastern part of North Carolina, have voted to issue $275,000 in bonds to aid this company in constructing its proposed 110-mile railroad. W. J. Edwards, Sanford, N. C., is interested. Noted June 18 and June 25.

North Carolina—Shelby Northern R.R.—This company plans to begin construction soon on its proposed line from Shelby, N. C., to Casar, N. C., about 20 miles. C. R. Poole, Rockingham, N. C., is interested. J. F. Thompson, Centerville, N. C., is Vice-Pres.

Florida—Suwanee River & White Springs R.R.—This company has started work on its proposed railroad from Live Oak, Fla., east to White Springs, Fla., a distance of 20 miles. A. E. Glass, Pensacola, Fla., is interested.

✚**Alabama**—Alabama Great Southern R.R.—See item under Mississippi.

Alabama, Tennessee & Northern Ry.—This company plans to construct a 25-mile extension north from Reform, Ala., to connect with the St. Louis & San Francisco R.R., and the Illinois Central R. R. William Toxey, Mobile, Ala., is Ch. Engr.

Alabama—Birmingham, Selma & Mobile, Ala.—This company will construct its proposed 17-mile line from Brent, Ala., to Marion, Ala., with its own forces.

✚**Mississippi**—Alabama Great Southern R.R. — This company has awarded contracts to M. M. ELKAN, Macon, Ga., for double track work from Meridian, Miss., to Russell, Miss., and from York, Ala., to Toomsuba, Ala., 21.8 miles.

Tennessee—Jellico, Capachine & Western R.R.—This company plans to construct a railroad from Jellico, Tenn., to Pine Knot, Ky., 30 miles. R. D. Beard, Jellico, is interested.

✚**Kentucky**—Paducah & Illinois R.R.—This company has awarded the contract to MORRIS, SHEPARD & DOUGHERTY, St. Paul, Minn., for grading on its proposed line from a point in Kentucky across the river from Metropolis, Ill., to Paducah, Ky., 13 miles. The work calls for 1,500,000 cu.yd.

Ohio—Cleveland, Cincinnati, Chicago & St. Louis Ry. — This company plans to construct a freight terminal in Monument St., Dayton, Ohio. George P. Smith, Cincinnati, Ohio, is Ch. Engr.

Illinois—Chicago, Rock Island & Pacific Ry.—This company plans to double-track its line between Peoria, Ill., and Bureau, Ill. C. A. Morse, Chicago, Ill., is Ch. Engr.

Nebraska—Interstate R.R.—This company has been incorporated for the purpose of constructing a railroad from Lincoln, Neb., to Webber, Neb. C. B. Calkins, Omaha, Neb., is interested.

South Dakota—George Schlosser, Sioux Falls, S. D., is interested in a project to construct a railroad from Sioux Falls, to Wheeler, S. D. Right-of-way is being secured.

Arkansas—Century Engineering & Construction Co.—This company has been incorporated for the purpose, it is reported, of constructing a railroad from Mena, Ark., to Hot Springs, Ark. H. Williams, Hot Springs, is interested. Noted July 2 and July 9.

✚**Texas**—Jefferson & Northwestern Ry.—This company has awarded the contract to C. H. FITTS, Greenville, Tex., for change of line calling for 15,000 cu.yd. excavation, 12,000 cu.yd. of embankment and four acres of clearing.

California—Atchison, Topeka & Santa Fé Ry.—This company plans to construct a line from Corona, Calif., to Elsinore, Calif., 20 miles. G. W. Harris, Los Angeles, Calif., is Ch. Engr. Coast Lines.

California—San Diego & Arizona Ry.—The Utah Construction Co., Ogden, Utah, it is reported, has submitted the lowest bid to this company for constructing its proposed line, 46.21 miles long, in San Diego County. Noted June 25.

San Pedro, Los Angeles & Salt Lake R.R.—This company plans to start work at once on its proposed line from San Bernardino, Calif., to Daggett, Calif. A. Maguire, Los Angeles, Calif., is Ch. Engr. Noted June 11.

British Columbia—Canadian Northern Ry.—The Minister of Railways of British Columbia has approved the general location plans for this company's proposed 8-mile branch from Mileage 222 on the main line from Victoria, B. C., to Duncan Bay, B. C., on Vancouver Island, B. C. H. H. MacLeod, Winnipeg, Man., is Gen. Mgr. and Ch. Engr.

ELECTRIC RAILWAYS

Skowhegan, Maine—The Skowhegan & Shawmut Electric Ry. Co. has had surveys made for its 12-mile line between Skowhegan and Shawmut.

Buffalo, N. Y.—The International Street Ry. Co. has applied to the Public Service Commission for permission to extend its lines into the Reusens Park section. J. A. McKenna, Buffalo, is Secy. Noted June 25.

Ithaca, N. Y.—The Ithaca Traction Co. has received a franchise for the construction of a line in Mitchell St. and College Ave., and will also double track its line in Eddy St.

Newton, N. J.—The Kingston & Delaware Electric Ry. Co. plans to extend its system from Branchville to Flatbrookville, by way of Culver's Gap. Stephen H. Sayer, Otisville, N. Y., is interested.

Butler, Penn.—Bonds for the construction of the Northwestern Pennsylvania Traction Co. are being sold. This line will be built from Butler to Slippery Rock.

Pottstown, Penn.—The Reading, Birdsboro & Pottstown Ry. Co. is having surveys made for the construction of an electric railway from Gibraltar to Pottstown. William Abbott Witman is Gen. Mgr.

Danville, Va.—The Danville Traction & Power Co. has been granted a franchise by the Council for the extension of its lines in the eastern section of Danville. N. W. Berkeley, Danville, is Gen. Supt. and Purch. Agt.

New Orleans, La.—The New Orleans Ry. & Light Co. contemplates extending its line on St. Claude Ave. J. S. Pevear is Vice-Pres.

Evansville, Ind.—The Evansville & Indianapolis Light, Power & Electric Ry. Co. has had surveys made of its proposed line between Evansville and Indianapolis. Arthur C. Stone, Evansville, is Pres.

Evansville, Ind.—The Evansville, Chrisney & Eastern Ry. Co. will construct an electric railway between Boonville and Chrisney. Bonds for this purpose have been sold. J. P. Christney, Chrisney, is Pres.

Neodesha, Kan.—The Council has granted the Independence, Neodesha & Topeka Traction Co. a franchise to construct a 17-mile electric railway between Independence and Topeka. T. J. Booth, Independence, is Pres.

Bozeman, Mont.—Eugene W. Dawes, Bozeman; Charles L. Loomis, Kansas City, and others contemplate constructing an electric railway 150 miles long from Bozeman to the Yellowstone Park.

Bonham, Tex.—The Bonham-Paris Interurban Association has finished the survey for the proposed interurban electric railway to be constructed between Bonham and Paris. It is stated that financial arrangements for the construction of the road have been made.

Dallas, Tex.—The Dallas Consolidated Electric Ry. Co. will doubletrack its line on Lamar St. E. T. Moore is Mgr.

Terrell, Tex.—The City Council has granted a franchise to the Stone & Webster Engineering Corporation, Boston, Mass., for the use of certain streets for the proposed interurban electric railway that is to be constructed between Dallas and Terrell.

Benicia, Calif.—The Benicia Land & Terminal Co. is preparing to construct an electric railway from Benicia to Vallejo. A. D. Bowen is Pres.

San Diego, Calif.—The Bay Shore Railroad Co. was awarded a franchise for constructing and operating an electric line between Ocean Beach and Pacific Beach. The company, capitalized at $200,000, plans to construct not only the railway, but a large steel bridge and a highway and to establish a resort city along the beach front.

Transcona, Man.—According to press reports, bids are being received by J. H. Kern, Moose Jaw, Sask., for constructing an electric railway between Transcona and Winnipeg.

LIGHT, HEAT AND POWER

✚**Lisbon, N. H.**—The Lisbon Light & Power Co. has awarded the contract for the construction of a 40x130-ft. addition to its power house, to the H. P. CUMMINGS CONSTRUCTION CO., Ware, Mass.

★**Bath, N. Y.**—(Official)—Bids will be received until 11 a.m., Sept. 8, by Joseph A. Goulden, Pres. of the Board of Trustees, New York State Soldiers' and Sailors' Home, for two 125-hp. boilers. For further details, see advertisement under "Contracts To Be Let."

Geneva, N. Y.—The Central Gas & Electric Co., Geneva, has been granted permission by the Public Service Commission to issue $128,000 in bonds. The proceeds of $83,500 will be used for improvements and extensions to the electric department. A. V. Wainwright is Gen. Mgr.

✚**Syracuse, N. Y.**—The contract for the construction of a power house for the Onondaga County Tuberculosis Sanitarium has been awarded to CLYNES & LEAMY, at $49,516. Noted Aug. 6.

★**West Haverstraw, N. Y.**—(Official)—Bids will be received until 4 p.m., Sept. 5, by George Blagden, Pres. of the Board of Managers, New York State Hospital for Crippled and Deformed Children, for heating, plumbing and electric work for Solaria at the hospital. For further details, see advertisement under "Contracts To Be Let."

✚**Paterson, N. J.**—The Society of Useful Manufactures has awarded the contract for the construction of a steam turbine

power plant at the Paterson Falls basin to the JOHN W. FERGUSON CO., at $[illegible]. Noted July 2[illegible].

Cumberland, Md.—The City Council contemplates the purchase of a [illegible] generator for the municipal electric light plant. Joseph S. [illegible] is Water & Light Comr.

Wheeling, W. Va.—The Wheeling Traction Co. has taken out a permit for the construction of a new power plant on Water St. It will cost about $[illegible].

Charlotte, N. C.—Press reports state that the Southern Power Co. has secured options on a site to be used for the establishment of a steam turbine plant, to cost approximately $[illegible]. C. I. [illegible], Charlotte, is Engr.

Westminster, S. C.—Preliminary plans have been prepared by the J. B. McCrary Co., Atlanta, Ga., for the construction of a municipal electric lighting system, to be operated by steam power. An election will soon be held to vote on the question of a bond issue of $15,000 for the installation of the plant. H. H. [illegible] is Mayor.

Clarkesville, Ga.—It is reported that the town has secured a water power site about four miles away for the establishment of an electric light plant. Tentative plans have been prepared which include the erection of a steam plant for use during the building of the dam, and later in emergencies. W. T. Proctor and W. R. Polk, Elec. Engrs., Atlanta, are Engrs. in Charge.

Frostproof, Fla.—C. W. Brown and associates, Frostproof, are interested in the organization of a stock company to establish a hydro-electric plant to furnish light and power in the town.

Bay Minette, Ala.—The citizens have voted in favor of a bond issue of $[illegible], the proceeds of which will be used for the installation of a municipal electric light plant. Edgar B. Kay, Tuscaloosa, is Consult. Engr. Noted June 25.

Bowling Green, Ohio—The Board of Trustees of the Bowling Green State Normal College has approved plans for the construction of a power plant for the college.

Chillicothe, Ohio—The American Gas & Electric Co., New York, N. Y., has absorbed the Chillicothe Street R.R., Light & Power Co. It is reported that the local plant will be modernized.

Huntington, Ind.—The City Council has engaged Charles Brossmann, Union Trust Bldg., Indianapolis, Ind., to prepare plans and supervise the reconstruction of the municipal electric light plant, for which an issue of bonds was recently voted. Noted Apr. 16.

Muncie, Ind.—The Indiana Steel & Wire Co. will install another boiler unit in its plant, consisting either of two 2[illegible]-hp., two 300-hp., one 500-hp. or one 600-hp. single-unit water-tube boiler, to be equipped with stokers.

Elmwood, Ill.—Press reports state that the City Council has decided to install a municipal electric light plant, and will soon ask bids for its construction.

Superior, Wis.—The Superior Water, Light & Power Co. will issue $250,000 of additional stock for the purpose of making improvements and additions to its plant. W. H. Winslow is Gen. Mgr.

Sergeant Bluff, Iowa—Plans are being prepared for the installation of a municipal electric light plant. The estimated cost is $10,000.

Bigelow, Minn.—All bids received for the construction of a transmission and distribution system for the city have been rejected. Earle D. Jackson, Capital Bank Bldg., St. Paul, Minn., is Consult. Engr.

Adams, Neb.—It is reported that bids will be asked in about six weeks for the construction of the municipal electric light plant, a bond issue of $13,[illegible]00 having been voted for this purpose. The equipment will include two generators operated by oil engines, a two-panel switchboard, six transformers and material for four miles of overhead distribution lines. Johnson & Johnson, Falls City, Neb., are Engrs.-in-Charge. Noted July 16 and Aug. 6.

Havre, Mont.—The Havre Electric Co. is considering extensions and improvements to its plant to cost about $[illegible]0,000. F. W. McCarthy is Mgr.

Gladstone, Mo.—Plans are being prepared by Tuttle & Pike, Shubert Theater Bldg., Kansas City, Mo., for the construction of a transmission line from Gladstone to Armstrong, Mo. Bids will be asked in the near future.

Montrose, Mo.—E. T. Archer, New England Bldg., Kansas City, Mo., has been engaged by the City Council to supervise the construction of the municipal electric light plant, for which a bond issue of $6[illegible]00 was recently voted. Noted Aug. 6.

San Antonio, Tex.—Bids will be received until Aug. 24 by George W. West for the construction of an electric light plant and water-works system in George West, Tex. The estimated cost is $24,[illegible]. Bartlett & Ranney, 108 East Crockett St., San Antonio, are Engrs. in Charge.

Salmon, Idaho—The Salmon River Light, Heat & Power Co. has been incorporated at Salmon and will build a hydro-electric plant near this point. Contracts for the construction of the plant will be awarded as soon as plans are completed. C. L. [illegible] is Pres. and E. [illegible] is Gen. Mgr. of the company.

Salt Lake City, Utah—The city has granted a franchise to the [illegible] Power Co., which was organized for the purpose of constructing a central heating system for the district [illegible] by [illegible] Temple, Fifth South, [illegible] East and First West Sts. The franchise stipulates that the proposed system must be completed within three years.

Steilacoom, Wash.—Bids will soon be received by the Town Clerk for furnishing materials and [illegible] for the construction of a transmission line from the city limits of Tacoma to Steilacoom. [illegible] is Town Clk.

Hood River, Ore.—[illegible] and associates, of Hood River, have made application to the State Water Board for permission to build a hydro-electric plant on the Hood River near the town of Hood River. The [illegible] will develop [illegible] and will furnish energy for light and power for the farmers of the Hood River Valley.

Riddle, Ore.—Mendorfer & Kronemiller, representatives of the Oregon-California Power Co., have announced that the company plans to build a transmission line from Ferndale, Calif., to Riddle, at a cost of from $40,000 to $50,000. It is expected that the line will be extended into the Myrtle Hill district, and eventually as far north as Roseburg.

Porterville, Calif.—The question of establishing a municipal electric-light and gas plant in Porterville is under consideration.

BRIDGES

New London, Conn.—It is reported that the New York, New Haven & Hartford R.R. will soon call for bids for the construction of a new bridge in New London.

***Chappaqua, N. Y.**—(Official)—Bids will be received until noon, Sept. 8, by Nelson Sarles, Town Supt. of Highways of the Town of New Castle, Westchester County, for the construction of a concrete and masonry arch and approaches on the line of Mill St., in the village of Mount Kisco, Town of New Castle. For further details see advertisement under "Contracts To Be Let."

New Hartford, N. Y.—Bids will be received until 2 p.m., Aug. 24, by C. O. Podley, Town Clk., for the construction of a reinforced-concrete bridge over Sauquoit Creek.

✦Oswegatchie, N. Y.—The Town Boards of Oswegatchie and De Peyster have awarded the contract for a bridge across the foot of Black Lake to F. E. COLBY, Owego, N. Y., at $6800. Noted Oct. 23, 1913, under De Peyster, N. Y.

✦Cranford, N. J.—The Board of Chosen Freeholders of Union County, Elizabeth, has awarded the contract for the construction of a bridge on Springfield Ave., Cranford, to J. Z. GANO, Neshanic, N. J., at $682[illegible]. Noted July 16.

✦Morristown, N. J.—(Official)—The Board of Chosen Freeholders of Morris County has awarded the contract for the construction of two reinforced concrete bridges to F. W. SCHWIERS, JR. CO., 90 West St., New York, N. Y., at $3526 and $6139, respectively. Other bidders were: E. D. Blowres, $3853 and $6477; Ferro Concrete Co., $414[illegible] and $6649; Thompson Wooster Co., $9015 and $12,719; Fred Spatz, Jr., $49[illegible]0 and $6100. Noted Aug. 6.

Somers Point, N. J.—Press reports state that the Board of Chosen Freeholders of Atlantic County contemplates the construction of a reinforced concrete bridge at Somers Point, to cost about $[illegible]0,000. A. H. Nelson, Bartlett Bldg., Atlantic City, N. J., is Consult. Engr.

Trenton, N. J.—(Official)—Bids will be asked about Dec. 1 by the Pennsylvania R.R. for the construction of two lift bridges across the canal in Trenton. The estimated cost is $25,000 each. Noted Aug. 13.

Connellsville, Penn.—It is reported that the Baltimore & Ohio R.R. Co. is considering plans for a bridge over its tracks at Austin Ave., Connellsville. F. L. Stuart, Baltimore, Md., is Ch. Engr.

✦Factoryville, Penn.—The contract for the construction of a bridge over Tunkhannock Creek was awarded to the GROTON BRIDGE CO., Groton, N. Y., at $[illegible]298.

Lewistown, Penn.—The Borough Council has had plans prepared, and will soon call for bids for the construction of a reinforced concrete bridge estimated to cost $[illegible]0,000. C. C. Brown, Lewistown, is Engr. in Charge.

Meadville, Penn.—Bids will be received until Aug. 21, by the Commissioners of Crawford County, for the construction of the following bridges: One 3[illegible]-ft. span, South Shenango Township, one 35-ft. span in Summit Township, one 54-ft. span, Woodcock Township, and one 80-ft. span, Oil Creek Township. F. G. Altenburg is Clk. of the Comrs.

✦Mortonville, Penn.—(Official)—The Philadelphia & Reading Ry. has awarded the contract for the construction of a reinforced concrete bridge at Mortonville to ENOS L. SEEDS, 6314 Wissahickon Ave., Philadelphia. Noted Aug. 6.

✦Philadelphia, Penn.—(Official)—The Department of Public Works has awarded contracts for the construction of bridges to MONAGHAN & LOOSE, 214 South 12th St., Philadelphia, at $19,223 for the 71st St. Bridge; ENOS L. SEEDS, 6314 Wissahickon Ave., Philadelphia, at $10,2[illegible]0 for the Reed St. Bridge; M. & J. B. McHILL, 71[illegible] Commercial Trust Bldg., Philadelphia, at $3923 for the Warrington Ave. Bridge. Noted Aug. 13.

✦Wilkes-Barre, Penn.—(Official)—The Commissioners of Luzerne County have awarded the contract for the construction of a bridge over the North Branch of the Susquehanna River, connecting Eighth St., Wyoming, with the county road in Jenkins Township, to the PENN BRIDGE CO., Beaver Falls, Penn., at $1[illegible]. Other bidders were: R. G. Coon Construction Co., $22[illegible]; Dravo Contracting Co., $219,[illegible]; North Branch Engineering Co., $2[illegible]; Pennsylvania Steel Co., $[illegible]; James McLanden & Co., $2[illegible]; John Monks & Son, $21[illegible]; Lathrop, Shea & Henwood, $224,3[illegible]; F. J. Catlin Construction Co., $211,[illegible]; Whitaker & Diehl, $2[illegible]; D. H. Helmarth, $22[illegible]; B. M. [illegible], $219,[illegible]. Noted July 2[illegible].

Baltimore, Md.—The Pennsylvania R.R. Co. is having plans prepared by A. L. Carhart, [illegible] Bldg., Philadelphia, Penn., for the construction of a bridge known as the Edgar St. overhead bridge, east of the Falls way Viaduct, Baltimore.

*(Official)—Bids will be received until noon, Sept. 1[illegible], for the construction of a bascule span, Sect. [illegible] of the Hanover St. Bridge. [illegible] F. Weller is Ch. State Roads Comn. Noted Aug. 13.

*✦The following bids were opened Aug. 11 by the State Roads Commission, for the construction of Sections 1 and [illegible] of the Hanover St. Bridge: H. P. CONVERSE & CO., Boston, Mass., $[illegible] (awarded contract); Maryland Dredging & Contracting Co., Baltimore, $[illegible]; McLean Contracting Co., Baltimore, $[illegible]; McHarg, Barton & Co., New York, N. Y., $[illegible]; Robert Price Contracting Co., Pittsburgh, Penn., $[illegible]; Filbert Tufts Construction Co., Baltimore, $[illegible]; Thomas Fay & Co., Cleveland, Ohio, $[illegible]; Sanford & Brooks, Baltimore, $[illegible]. Noted July 1[illegible].

(Official)—Bids will be received until [illegible] p.m., Aug. 27, by

the State Roads Commission, for the construction of a reinforced-concrete bridge, of four 30-ft. spans, over the North Branch of the Patapsco River, along the Liberty Road. William L. Marcy is Secy. of the Comn.

Ellicott City, Md.—(Official)—Bids will be received until noon, Aug. 25, by the State Roads Commission, Garrett Bldg., Baltimore, for the construction of a reinforced-concrete bridge over the Patapsco River, at Ellicott City. The bridge will have one 72- and two 56-ft. arches. O. E. Weller is Chn. of the Comn.

Fort Lauderdale, Fla.—The Commissioners of Dade County, Miami, have rejected bids for the construction of a bridge across the New River at Fort Lauderdale as being above the estimate of $16,000. Noted July 23.

Gainesville, Fla.—(Official)—Bids will be received until 10 a.m., Aug. 31, by the Clerk of the Circuit Court of Alachua County, for the construction of a bridge across the canal between Sante Fe and Lake Alto, about four miles east of Waldo. C. C. Pedrick is Chn. Bd. of County Comrs.

Bids will be received until 11 a.m., Aug. 31, by the Commissioners of Columbia and Alachua Counties for the construction of a bridge across the Sante Fe River at what is known as Dunegan's Bridge. C. C. Pedrick is Chn. of Alachua County Comrs. R. W. Turner, Lake City, is Chn. Bd. of Comrs. of Columbia County.

✚**Birmingham, Ala.**—(Official)—The Louisville & Nashville R.R. has awarded the contract for the construction of the First Ave. Viaduct to the JEFFERSON CONSTRUCTION CO., New Orleans, La., at approximately $200,000. It will be of reinforced concrete. Noted Jan. 8, Apr. 16 and July 23.

Houston, Miss.—(Official)—Bids will be received until Sept. 7, by the Board of Supervisors of Chickasaw County for the construction of 10 steel bridges in various sections of the county. H. E. Brannon is Chancery Clk.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Aug. 24, by Philip Fosdick, Dir. of Pub. Ser., for the construction of a reinforced-concrete bridge on Roll Road, at West Fork. Parke S. Johnson is Secy. to Dir. of Pub. Ser-

✚**Marietta, Ohio**—(Official)—The Board of Commissioners of Washington County has awarded the contracts for the construction of the Indian Run and Winget Run Bridges to the MERYDITH CONSTRUCTION CO., Marietta, at $3596 and $1303 respectively. Noted July 30.

(Official)—Bids will be received until noon, Aug. 21, by the Board of Commissioners of Washington County for the construction of three concrete bridges. W. P. Mason is County Engr.

✚**Marion, Ohio**—The Board of Commissioners of Marion County has awarded the contract for the construction of a bridge over the Whetstone River on Retterer Pike, Richland Township, to the CENTRAL CONCRETE & CONSTRUCTION CO., Canton, Ohio, at $7967. The bridge will be 175 ft. long, and 16 ft. wide. There were six other bidders. Noted July 30.

Massillon, Ohio—Bids will soon be asked for the construction of the South Erie St. Viaduct, which will be about 900 ft. long. Stark County will pay $18,000, the Wheeling & Lake Erie R.R. $4000, the Baltimore & Ohio R.R. Co., $1600, and the city of Massillon, the remainder of the cost. Plans were prepared by Wilbur J. Watson & Co., Leader News Bldg., Cleveland, Ohio. Noted Apr. 9, Apr. 23 and Apr. 30.

Tiffin, Ohio—(Official)—Bids will be received until 1:30 p.m., Sept. 5, by the Board of Commissioners of Seneca County for the construction of a concrete arch across Willow Creek in the city of Tiffin, to be known as Riverview Park Bridge No. 341. The work will include grading and macadamizing the approaches of the bridge. J. E. Hershberger is County Audr.

✚**Elkhart, Ind.**—The County Commissioners have awarded the contract for reflooring the Main St. Bridge to the JENNER-WRIGHT CO., Chicago, Ill., at $5870. Noted July 23.

✚**Muncie, Ind.**—The Commissioners of Delaware County have awarded the contract for the construction of two bridges in Harrison Township to the INDIANA BRIDGE CO., at $4668 for the two.

Chicago, Ill.—(Official)—The following bids were opened Aug. 5 by the Commissioner of Public Works for the construction of the substructure of a double-leaf trunnion bascule bridge over the North Branch of the Chicago River at Belmont Ave.: Great Lakes Dredge & Dock Co., $108,970; Nash-Dowdle Co., $111,325; Byrne Bros. Dredging & Engineering Co., $113,377; Fitzsimons & Connell Dredge & Dock Co., $113,715; Standish & Allan, $119,670.

Bids for the superstructure of this bridge were received Aug. 7. (a) Construction of superstructure. (b) Deduction for roadway lights: Great Lakes Dredge & Dock Co., (a) $139,844, (b) $1500; Ketler-Elliott Construction Co., (a) $145,000, (b) $2000; Strobel Steel Construction Co., (a) $146,300, (b) $2700; Standish & Allan, (a) $149,000, (b) $2500; Modern Steel Structural Co., (a) $150,000, (b) $2000; Oscar Daniels & Co., (a) $156,980, (b) $50. Noted Aug. 6.

Morris, Ill.—(Official)—Bids will be received until 2 p.m., Aug. 22, by the Commissioners of Grundy County for the construction of a bridge in Maine Township. It will have two 60-ft. spans with a 16-ft. roadway. F. W. Stine is County Supt. of Highways. Noted July 23, under Mazon, Ill.

✚**Milwaukee, Wis.**—The Chicago & Northwestern Ry. has awarded the contract for the construction of a railway bridge at Milwaukee to PELLETT & McMULLEN, Manitowoc, Wis. It will cost about $180,000.

Charles City, Iowa—The Commissioners of Floyd County, Charles City, plan to build a bridge, costing $5000, near the fair grounds at Charles City, and one at Marble Rock to cost about $18,000.

✚**Fort Dodge, Iowa**—(Official)—The Board of Supervisors of Webster County has awarded the following contracts for bridge construction: MARSH ENGINEERING CO., Des Moines, Iowa, five bridges, $3005; DES MOINES BRIDGE & IRON WORKS, Des Moines, three bridges, $5968; THOMPSON & NEESE, Stratford, Iowa, four bridges, $3509; J. J. CAIN, Clare, Iowa, three bridges, $2100. Noted July 30.

Muscatine, Iowa—The United States Senate, on Aug. 7, passed the bill to permit the construction of a bridge over the Mississippi River at Muscatine. The bridge will be built by the Interstate Bridge & Terminal Co. Noted July 30.

Brown Valley, Minn.—(Official)—All bids received Aug. 4 for the construction of a 60-ft. bridge were rejected by the Village Board. L. C. Bigelow is Village Clk. Noted July 30.

✚**Lindsborg, Kan.**—(Official)—The Commissioners of McPherson County have awarded the contract for the construction of a bridge over the Smoky Hill River, at Lindsborg, to the MISSOURI VALLEY BRIDGE CO., Wichita, Kan., at $11,910. Noted June 25 and July 23.

Center, N. D.—Bids will be received until 3 p.m., Aug. 21, by F. J. V. Kiebert, Audr. of Oliver County, for the construction of a truss bridge.

Billings, Mont.—The Commissioners of Yellowstone County are considering the construction of a 600-ft. steel bridge over Yellowstone Rapids and a 50-ft. bridge over one of the up-country streams. B. F. Harris is Chn. of Comrs.

Townsend, Mont.—The Commissioners of Broadwater County contemplate the construction of a 500-ft. steel bridge over the Missouri River at Toston. John Hines, Sr. is Chn. Bd. of County Comrs.

Chillicothe, Mo.—Bids will be received until Aug. 22 by the Commissioners of Livingston County for the construction of several reinforced concrete bridges. Joseph Broaddus is Bridge Comr.

✚**Huntsville, Ark.**—The County Court of Madison County has awarded the contract for the construction of a bridge across War Eagle Fork at Withrow Ford, to P. J. BARRINGER, Fayetteville, at $6462.

Dallas, Tex.—The following bids were received Aug. 1 by the Commissioners Court for the construction of three bridges across the Trinity River: Austin Bros., $34,265; El Paso Bridge & Iron Co., $29,335; Hess & Skinner, $27,250; Missouri Bridge & Iron Co., $33,597; Missouri Valley Bridge & Iron Co., $31,376; Modern Structural Steel Co., $33,220; Midland Bridge Co., $38,400. Noted July 16 and Aug. 13.

Houston, Tex.—(Official)—The Commissioners Court of Harris County has rejected all bids for constructing concrete culverts on the Westheimer-Alief Road. Bids were received Aug. 10. Noted Aug. 6.

✚The City Commissioners have awarded the contract for the construction of the Wrightwood Ave. Bridge to W. L. PEARSON & CO., at $7200, exclusive of the approaches. An appropriation of $12,500 will be made to cover the total cost of the bridge. Noted July 23.

San Antonio, Tex.—The City Council has received the following bids for the construction of the Nueva St. Bridge: H. S. Warner & Co., $21,680; Alamo Construction Co., $16,000; Topeka Bridge & Iron Co., $12,950; Bexar Construction Co., $17,400; John O. Kelley, $13,709; Jones & Day, $18,743; H. C. Gass, $15,201; Warfield & Green, $14,750; J. H. Wagner, $21,992.

Colorado Springs, Colo.—The Commissioners of El Paso County will have plans prepared at once for a concrete bridge, 150 ft. long and 20 ft. wide, to replace the bridge over Fountain Creek at South Nevada Ave. The estimated cost is $12,000.

Colorado Springs, Colo.—Bids will be received until noon, Aug. 22, by the Clerk of the Board of Commissioners of El Paso County for the construction of two concrete girder bridges, one over Cattle Creek and the other over Fountain Creek, in Colorado Springs.

✚**Mora, N. M.**—(Official)—The Board of Commissioners of Mora County has awarded the contract for the construction of four bridges to the MISSOURI VALLEY BRIDGE & IRON CO., Denver, Colo., at $14,170. Other bidders were: Pueblo Bridge Co., Pueblo, Colo., $19,945, and the Midland Bridge Co., Kansas City, Mo., $16,175. Noted July 30.

Flagstaff, Ariz.—(Official)—Bids will be received until 2 p.m., Aug. 31, by the Board of Supervisors of Coconino County for the construction of a 136-ft. concrete arch over Cañon Diablo. The estimated cost is $10,000. Noted Aug. 6 and Aug. 13.

St. John, Ariz.—Bids will be received until Sept. 2 by the Board of Supervisors of Apache County for the construction of two concrete viaducts, on the State Highway, one at Milky Wash and the other at Beaver Dam Wash. Noted Aug. 6 and Aug. 13.

✚**Franklin, Wash.**—The Commissioners of King County, Seattle, have awarded the contract for the construction of a bridge at Franklin to C. G. HUBER, Seattle, at $26,569. Bids were opened Aug. 3. Noted July 30.

✚**McMinnville, Ore.**—The Commissioners of Yamhill County have awarded contracts for the construction of a bridge at Dayton to: C. W. RAYNOR, $11,385 for foundations, steel and erection; H. D. BOND, $799 for hardware and building approaches; SPAULDING LOGGING CO., $1945 for lumber for approaches. For the construction of the McMinnville Bridge, contracts were awarded to: AMBROSE-BIRDSALL CO., $6949 for foundations, steel and erection; H. D. BOND, labor, hardware and building approaches, SPAULDING LOGGING CO., $2595 for lumber. Noted July 23 and Aug. 13.

Los Angeles, Calif.—The Board of Public Works will soon ask for bids for the construction of a bridge over Hollenbeck Lake at Sixth St. Homer Hamlin is City Engr.

Marysville, Calif.—(Official)—Bids will be received until 11 a.m., Sept. 8, by the Board of Supervisors of Yuba County, for the construction of a reinforced concrete bridge and approaches across the Yuba River at D St., Marysville. W. J. Mellon is Chn. Noted Apr. 23 and July 23.

✚**Sacramento, Calif.**—(Official)—The State Department of Engineering has awarded the contract for the construction of two bridges on the Trinity State Road to the BERKELEY IRON WORKS, San Francisco, at $4400. Noted July 16.

Santa Ana, Calif.—It is reported that bids will be received until Sept. 2 by the Board of Supervisors of Orange County for the construction of a bridge over the Santa Ana River

[illegible] W. [illegible] Williams is County Clk. Noted Aug. [illegible] 1, Oct. 2 and Nov. 6, 1913.

Sunset Beach, Calif.—The South Coast Improvement Co., Central Bldg., Los Angeles, plans the construction of eight bridges across the [illegible] at Sunset Beach.

Brockville, Ont.—Plans have been prepared for the erection of a steel bridge to replace the present structure known as the Kingston Bridge. The estimated cost of a new bridge is $1[illegible].

Banff, Alta.—The Public Works Department has approved plans for the new Banff Ave. Bridge. It will be of concrete, and is estimated to cost $2[illegible].

WATER SUPPLY—IRRIGATION

+Boston, Mass.—The contract for constructing a concrete foundation for the steel water tank has been awarded by the Metropolitan Water and Sewer Board to JOHN E. PALMER, [illegible] South Bldg., Boston, at $[illegible].

Salem, Mass.—The citizens have voted $160,000 bonds to replace old water pipes, and increase supply in various sections of the city.

+•Schenectady, N. Y.—(Official)—Bids were received Aug. 5 by the Board of Contract and Supply, for constructing a [illegible] gal. reservoir on Bevis Hill as follows: SUTTON & CARSON CO., Ocean City, N. J., at $222,873 (awarded contract); State Highways Construction Co., $240,304; John J. Hart, $246,[illegible]; Shear & Wilson Corp., $247,809; Barzaghi-Vought Co., $24[illegible]; Brown & Lowe Co., $248,399; Sewage Disposal & Water Plant Co., Inc., $251,744; Won Engineering & Contracting Co., $2[illegible],030; J. F. Cogan Co., $273,1[illegible]; Mason-Hilton Co. and Merrill-Rackgaber Co., $2[illegible]7,655; John W. Heller, $2[illegible]2,[illegible]; Walsh Construction Co., $293,679; Buffalo Dredging Co., $2[illegible]3,6[illegible]; U. S. Realty & Improvement Co., $300,330, and Charles Ippolito, $3[illegible]6,877. Noted May 21 and July 30.

•Waverly, N. Y.—(Official)—Bids will be received by the Board of Water Commissioners until noon, Aug. 22, for raising the embankment of the upper reservoir. Plans are on file with the Board of Water Commissioners. Andrew Hilderbrand is Pres.

Belleville, N. J.—(Official)—Bids will be received by the Town Council until 9 p.m., Aug. 2[illegible], for laying water pipe in various streets. Edward E. Mathes is Town Clk.

West Orange, N. J.—The Town Council plans to increase the capacity of the water supply system.

Mauch Chunk, Penn.—The Mauch Chunk Water Co. will erect, it is reported, a 500,000 gal. reservoir at Thompson Springs. The cost is estimated at $50,000. Edgar T. Anderson, East Mauch Chunk, is Engr.

Hancock, Md.—At a recent election bonds for $30,000 for the construction of a water system were voted by the citizens.

Winnsboro, S. C.—At an election held Aug. 4, bonds for $10[illegible] for the installation of a water system were voted. Noted July 2[illegible].

Hartwell, Ga.—An election will be held Sept. 2 to vote on the proposition of issuing $33,000 in bonds for the installation of a water system.

Louisville, Ga.—The city contemplates spending $12,000 for the extension of the water works and sewer system.

Ochlocknee, Ga.—The town has been authorized to issue $1[illegible] in bonds for the installation of a water system.

Bradentown, Fla.—Bids will be received by S. C. Corwin, [illegible] Public Works, until 7 p.m., Aug. 21, for constructing a [illegible] gal. reinforced concrete reservoir.

Bay Minette, Ala.—Bids will be received until Sept. 29 by the Town Council for constructing a [illegible] water and sewer system. Bonds for this purpose have been voted. Noted Aug. 13.

Elba, Ala.—The city contemplates making improvements and extensions to the water system.

Vicksburg, Miss.—Bids will be received until Sept. 21 for the construction of a water system and filters. A. M. [illegible] is City Clk. and A. L. [illegible], Porter Bldg., Memphis, Tenn., is the Engr. Noted May 14.

Lecompte, La.—(Official)—Plans have been prepared by O. F. [illegible], Engr., for the installation of new oil engines and [illegible] for the water works. Bids will be received until Sept. 1 for this machinery.

Knoxville, Tenn.—[illegible] H. Moore, Hydraulic Engr., has submitted recommendations to the City Commission for improvements to the water plant, [illegible] the construction of a pumping station, and the installation of two 2[illegible] hp. [illegible] and two 10,000,000-gal. vertical triple expansion engines.

Columbus, Ohio.—All bids received June [illegible] for furnishing [illegible] were rejected. Noted July [illegible].

+Columbus, Ohio.—[illegible]

+Columbus, Ohio.—[illegible]

Huntington, Ind.—[illegible]

•Ford, Mich.—[illegible]

•Highland Park, Mich.—[illegible] will be received [illegible] for constructing a steel intake crib, constructing an 18 ft. diameter concrete well, [illegible] ft. deep and for trenching. For details see item under "Contracts To Be Let."

Galesburg, Ill.—Bonds for $100,000 have been authorized by the Council, the proceeds to be used for the extension of the water system.

Lake City, Ill.—Bids will be received by J. M. Fickel, City Clk., until Aug. 26, for laying water mains.

Leaf River, Ill.—The citizens voted bonds for $12,0[illegible]0, the proceeds of which will be used for the installation of a water system.

+Lockport, Ill.—The contract for constructing a 100,0[illegible]0-gal. water tank has been awarded to CHICAGO BRIDGE & IRON CO., at $[illegible]300. Bids opened Aug. 3. Noted July 23.

Westville, Ill.—The City Council contemplates installing a water system at Westville.

Appleton, Wis.—See item under "Sewers."

Milwaukee, Wis.—The Common Council appropriated $175,000 for the construction of a tunnel from the new lake intake to North Point pumping station. J. A. Mesiroff is City Engr. Noted June 18.

+West Allis, Wis.—(Official)—The contract for laying water mains with hydrants and connections in Worden Ave. and 53d Ave. has been awarded to ESAU-KRAENING CONSTRUCTION CO., Milwaukee, at $1.21 per lin.ft. Noted July 23.

+•Dubuque, Iowa—The contract for constructing a reservoir with a capacity of 7,500,000 gal. has been awarded by the Board of Water-Works Trustees to MID WEST CONSTRUCTION CO., Kansas City, Mo., at $66,000. List of bidders noted Aug. 13.

+Fergus Falls, Minn.—The contract for constructing a 600,000 gal. concrete reservoir at the State Asylum has been awarded to JOHN LAURITZEN, Fergus Falls, at $[illegible].

+Virginia, Minn.—(Official)—Bids were received by the Water and Light Commission, Aug. 10, for constructing a reinforced concrete reservoir as follows: RISBERG & MARWICK, Virginia, Minn., at $17,798 (awarded contract); F. P. Tims, $23,419; Lawrence & McCann, $27,536; C. C. Butler, $22,231, and Ward & Weighton, $21,512. J. W. Murphy is Secy. Noted Aug. 6.

+Arkansas City, Kan.—The contract for making improvements to the water system has been awarded to AMOW ENGINEERING CO., St. Louis, Mo., at $[illegible]. Burns & McDonnell, Kansas City, are the Engrs. Bids opened July 21. Noted July 9.

Fort Scott, Kan.—The Water Board contemplates installing a mechanical filtering plant at the water works. The estimated cost is $40,000.

Larned, Kan.—(Official)—All bids received Aug. 14 for the construction of a water system and electric-light plant have been rejected. The contract will be readvertised. L. D. Burges is City Clk. Noted Aug. 6.

+Dakota City, Neb.—The contract for installing a water system has been awarded to F. T. LEADER, Sioux City, Iowa, at $[illegible]93. The Alamo Engine & Supply Co., Omaha, are the Engrs.

Ewing, Neb.—The citizens contemplate spending $1[illegible]00 for the extension and improvement of the water system.

Wahpeton, N. D.—At a recent election bonds for $[illegible]00 for the improvement of the water works were voted. Lewis P. Wolff, St. Paul, Minn., is the Engr. Noted Oct. 9, 1913.

Forsyth, Mont.—Bids will be received until Aug. 22 by Dras D. Tull, City Clk., for the purchase of $[illegible] in bonds for the construction of a water system. Noted May 14.

Valier, Mont.—The Valier Mountain Land & Water Co. has been organized at Great Falls, Mont., with a capital of $1,[illegible]00,000, by Patrick Kelly, Conrad, Mont., A. E. Schwinger and others. The company will complete the Gary land project at Valier, which will cover 12[illegible] acres.

Birch Tree, Mo.—The Birch Tree Ice & Refrigeration Co. will construct a water system.

Webb City, Mo.—The Public Service Commission has ordered the Webb City Water Co. to comply within nine months with that feature of its franchise providing for the extension of certain water mains in Webb City.

Willow Springs, Mo.—Bids will be received by H. M. Shipley, Mayor, until 7 p.m., Sept. 1, for furnishing [illegible] ft. 6 in. and [illegible] ft. [illegible] in. [illegible] pipe for water mains.

Glenwood, Ark.—According to press reports the city contemplates issuing $[illegible] in bonds for the installation of a water and a sewer system.

+Paragould, Ark.—The contract for making extensions to the water system has been awarded by the Board of Public Works to [illegible] & CONNELL, [illegible] Montgall Ave., Kansas City, Mo., at $[illegible]. Bids opened July [illegible]. Noted July [illegible].

+Beaumont, Tex.—The contract for making improvements to the [illegible] of Beaumont has been awarded to NEW YORK CONTINENTAL JEWELL FILTER CO., at $[illegible].

Corpus Christi, Tex.—An election of tax payers will be held Sept. [illegible] to vote on the proposition of enlarging the water works plant. It is proposed to issue $[illegible] in bonds for the purchase of new machinery and extending the mains. A new main will be laid to a point on the Nueces River, [illegible] miles from the city, where the water supply will be obtained. A water [illegible] plant will also be installed.

Granbury, Tex.—The City Council has ordered an election of tax payers to be held Sept. [illegible] to vote on the proposition of issuing $[illegible] in bonds for the construction of a water-works plant and [illegible] system.

San Antonio, Tex.—Bids will be received by Bartlett & [illegible], [illegible] Engrs., [illegible] St., until Aug. [illegible], for constructing a water works, sewer system and electric light plant at [illegible] West. The estimated cost is $[illegible].

Timpson, Tex.—The City Council is preparing to construct a water works plant and distributing system at Timpson.

Guthrie, Okla.—On Aug. 11 the citizens voted $25,000 in bonds, the proceeds to be used for the improvement of the water works.

Rigby, Utah—Bonds for $7500 have been voted by the citizens, the proceeds to be used for the extension of the water system.

Pe Ell, Wash.—Bobo & Shepard, Pe Ell, have applied to the Council for a franchise to construct a water system.

Sultan, Wash.—County Commissioners of Snohomish County have granted a franchise for a pipe line to carry water from the city water system across the Skykomish River to residents outside of city limits.

Tacoma, Wash.—The Metropolitan Park Board is considering the advisability of issuing $100,000 in bonds the proceeds to be used for the installation of a water system in Point Defiance Park.

Eugene, Ore.—Bids were received for the construction of a deep reservoir on College Hill, as follows: Collier & Stevenson, Salem, $11,770; Barney & Johnson, Portland, $7665, and A. C. Mathews, Eugene, $8150.

Portland, Ore.—The Green Hills Water Co. has been formed to furnish water to Green Hills and Ziontown, suburbs of Portland.

Bakersfield, Calif.—Press reports state that W. W. Kays and James Arp, Bakersfield, will construct a dam near Mojave to impound water for irrigation purposes. The dam will be 92 ft. high and 1096 ft. long.

Calexico, Calif.—The city contemplates installing a pipe line or conduit from the main line canal to Calexico to supply better water facilities for the city. H. E. Foster is Engr.

Otay, Calif.—Bids will soon be received for the construction of a filtration plant to have a capacity of 12,000,000 gal. per day. H. A. Whitney, San Diego, is Engr.

✚**San Diego, Calif.**—The contract for constructing 16,700 ft. of concrete conduit along Cottonwood Creek, east of the Barrett dam site has been awarded to D. L. BISSELL, East San Diego, at $40,978.

Orillia, Ont.—Bids will be received until Aug. 29 by the Town Council for furnishing machinery and supplies under sections E, F and G of the waterworks specifications. W. K. Greenwood is Engr. Noted July 16.

SEWERS

Boston, Mass.—Bids will be received by the Board of Public Works until Aug. 21, for constructing sewers in Chestnut St. and Museum Road. L. K. Rourke is Comr.

Boston, Mass.—The following bids were received by the Public Works Department for constructing pipe sewers and drains in Vose Ave., Metropolitan Ave., Milton Ave., Washington Place and Glenwood Place, Hyde Park: Anthony Baruffaldi, $4900; Timothy Coughlin, $4955; M. De Sisto, $5253; Thomas H. Corrigan, $5291; Louis Balboni, $5366; John Guarino, $5435; Antony Cefalo, $5493; Martino De Matteo, $5594; T. J. O'Connell Co., $5642; John F. Lynch, $5695; William L. Dolan, $5889; R. Cartullo, $6506. Noted Aug. 6.

Bids will be received by the Public Works Department, until Aug. 24, for sewer construction in 16 streets in Roxbury and West Roxbury Districts. L. K. Rourke is Comr.

Hartford, Conn.—(Official)—Bids will be received by the Board of Contract and Supply until 11 a.m., Aug. 25, for the construction of Sections D, E and F, of the Maple Ave. sewer system. The work requires 512 ft. of 51-in., 600 ft. of 42-in., 563 ft. of 36-in. and 552 ft. of 30-in. concrete sewers, 1205 ft. of 10-in., 18-in. and 20-in. tile sewers on Section B; 6650 ft. of tile sewers from 8- to 24-in. on Section E; and 9600 ft. of tile sewers from 8- to 24-in. on Section F. J. A. Gleason is Assist. Secy.

Hartford, Conn.—(Official)—Bids will be received by the Board of Contract and Supply until Aug. 25 for constucting an extension to the Maple Ave. sewer system. The work requires 2200 ft. of 30-, 36-, 42-, and 51-in. concrete sewers and 17,450 ft. of 8- to 24-in. tile sewers. R. N. Clark is City Engr. W. S. Brewer is Div. Engr. in charge of sewers.

New York, N. Y. (Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Pres. of the Borough, until 2 p.m., Aug. 26, for constructing sanitary sewers in various streets.

New York, N. Y.—(Borough of Queens)—The following are the bid sreceived by Maurice E. Connolly, Pres. of the Borough for constructing sewers: (a) Atlantic Ave., Fulton St., Walnut St., Briggs Ave., Church St., Lefferts Ave., Fourth Ward, Borough of Queens; (b) Toledo St. with temporary dry weather flow connections at Maurice Ave., Horton and Ivy Sts., Second Ward, Borough of Queens; Palno Bros., 684 Degraw St., Brooklyn, (a) $16,894, (b) $31,210; Leo E. Kelly, Inc., (a) $24,507, (b) $30,898; Peace Bros. (a) $18,969, (b) $25,540; Green Contracting Co., (a) $19,751, (b) $23,142; Clancy & Van Alst. 401 Broadway, Long Island City (a) $21,176, (b) $20,213; Evergreen Contracting Co., (a) $20,306; Joseph L. Sigretto, (a) $19,240; King Bros., (a) $22,047, (b) $27,807; Amanna & Sullivan, (a) $25,957; Oak Engineering & Contracting Co., (b) $30,376.

The following bids were the lowest bids received by the President of the Borough for constructing sewers: Atlantic Ave., Palno Bros., $16,894; Ridge St., Peace Bros., $12,096; Ashland St., Palno Bros., $6107; Payntar Ave., Peace Bros., $5982; Toledo St., Clancy & Van Alst, $20,213.

✚**Oneonta, N. Y.**—(Official)—The contract for constructing storm and sanitary sewers has been awarded by the City Council to GEORGE SEROFINI, 10 Fayette St., Binghamton, N. Y., at $4673. Other bids were: Ingalls Stone Co., Oneonta, N. Y., $6569; S. G. Puccio, Oneonta, $6376; R. F. Itelly, St. Johnsville, N. Y., $6536. S. H. Close is City Clk.

★**Patchogue, L. I., N. Y.**—(Official)—Bids will be received by Edward B. Woodruff, Village Clk., until Sept. 1, for constructing a storm water sewer, and curb and gutter. Emmett F. Smith is Engr.

Syracuse, N. Y.—The Intercepting Sewer Commission has directed Glenn D. Holmes, Chief Engr., to prepare plans for the proposed sewage disposal plant.

Gloucester City, N. J.—It is reported that bids will be received by the City Clerk, until Sept. 3, for constructing a 12-in. terra cotta pipe sewer in South Fillmore St.

Verona, N. J.—(Official)—Clyde Potts, Consult. Engr., 30 Church St., New York, N. Y., and Frank Crane, Borough Engr., Verona, are preparing plans for sewerage and sewage disposal works, estimated to cost $130,000. Thomas E. Brooks is Borough Clk.

North Wales, Penn.—Remington & Vosburg, Camden, are completing plans for the proposed sewer system and disposal plant. Theestimated cost is $40,000. Ralph Schafenarker is Borough Clk.

Williamsport, Penn.—Bids will be received until noon, Aug. 21, by John G. Reading, Secy. Brandon Park Commission, Trust Bldg., for constructing 690 ft. 33-in. segment block stone sewer.

✚★**Washington, D. C.**—(Official)—The contract for sewer construction has been awarded by the District Commissioners to W. F. CUSH & WARREN F. BRENIZER CO., Washington. Warren E. Garges is Chief Clk. Noted July 30.

Atlanta, Ga.—The City Council contemplates the construction of a sanitary sewer in the tenth ward, to cost about $8000.

✚**Anniston, Ala.**—The contract for constructing sanitary sewers has been awarded by the Board of Aldermen to L .O. SCRUGGS, Birmingham, at about $8000.

✚**Belzoni, Miss.**—The contract for constructing about three miles of sanitary vitrified pipe sewers, 8- to 12-in., including manholes, etc., has been awarded by the Mayor and Board of Trustees, to BASH & GRAY, Joplin, Mo., at about $17,000. Noted July 23.

✚**Oakdale, Ky.**—The contract for constructing a reinforced concrete sewer has been awarded by the City Council to the MIDDLETOWN CONSTRUCTION CO., Middletown, Ky., at $18,099. Noted July 23.

Cleveland, Ohio.—Bids will be received by the Commission of Purchases & Supplies until noon, Aug. 27, for constructing sewers in East 152d St., School Ave., Whitcomb Ave. and Coit Road. Robert Hoffman is City Engr.

Greenville, Ohio—The City Council contemplates the construction of a sewage disposal plant to cost about $40,000.

Newark, Ohio—The lowest bid submitted for constructing the storm sewer on South William St. was from Henderson Bros, at $6338.

Salem, Ohio—The City Council will construct sanitary sewers in Evans and Union Sts.

Toledo, Ohio—The Public Improvement Commission has authorized Herbert McKechnie, City Engr., to prepare plans for an intercepting sewer to be constructed along the south bank of Ten Mile Creek.

Zanesville, Ohio—Bids will be received by the Board of Public Service, until Aug. 24, for constructing a storm and sanitary sewer in Lake Drive. H. J. Voll is City Clk.

Indianapolis, Ind.—The Board of Public Works contemplates the construction of a sewer in Central Ave., from 38th St. to 50th St., estimated to cost $157,000.

Carlyle, Ill.—Bids received by the Board of Local Improvements for constructing sewers in District No. 2 have been rejected. The work will be readvertised. Noted July 16.

Winnetka, Ill.—(Official)—The following bids were received by the Village Council for constructing the Northeast Storm Sewer: William Heggie, Joliet, Ill., $53,862; William Davidson, 738 10th St., Wilmette, Ill., $53,881; E. R. Harding & Co., Racine, Wis., $57,280; Nash-Dowdle Co., Chicago, Ill., $57,794; C. T. Bartlett, 827 Greenleaf St., Evanston, Ill., $60,718. Windes & Marsh are Engrs.

✚**Appleton, Wis.**—The contract for constructing sewer extensions in Story and Commercial Sts. has been awarded to JOHN DETTMAN CO.

✚**Burlington, Wis.**—(Official)—The contract for constructing sanitary and storm sewers has been awarded to C. E. REED, Burlington, Wis. J. C. Johann is City Clk. Noted Aug. 6.

✚**Chippewa Falls, Wis.**—The contract for constructing sewers in Mansfield and Willow Sts. has been awarded to the CAST STONE CONSTRUCTION CO., Eau Claire, Wis., at about $5000.

✚**West Allis, Wis.**—(Official)—The contract for constructing lateral sewers in 13 streets has been awarded to A. H. PITZ, Manitowoc. E. G. Orbert is City Engr. Noted July 23.

Algona, Iowa—(Official)—Bids will be received by S. W. Crowell, City Clk., until Aug. 24, for constructing sanitary sewers in various streets. Theodore S. De Lay, Creston, is Engr. in Charge.

✚**Centerville, Iowa**—(Official)—The contract for constructing sewage filters, dosing chamber, etc., has been awarded to J. W. MANSON, Centerville, at $12,932. The only other bid was from B. S. Staley, at $14,932. P. A. White is City Clk. Noted July 30.

✚**Chariton, Iowa**—(Official)—The contract for constructing the sewer system has been awarded by the City Council to the J. W. TURNER IMPROVEMENT CO., Des Moines, Iowa, at about $110,000. The work calls for about 18½ miles of 8- to 30-in. sewers and four disposal plants. G. J. Gittinger is City Clk. Noted July 30.

✚**Clarion, Iowa**—The contract for constructing the sewer system has been awarded to GEORGE COLLINS, Omaha, Neb., and ZITTERELL & SULLIVAN, Webster City, Iowa. Noted July 9.

Creston, Iowa—(Official)—The city contemplates the construction of sewers in various streets. J. F. Golden is City Clk. Theodore S. De Lay is City Engr.

✚**Dyersville, Iowa**—The contract for constructing the extension of the sewer system has been awarded to J. R. DANIELS, Dubuque, Iowa, at $5016. M. Tshirgi & Sons are the Engrs. Noted July 30.

♦**Ada, Minn.**—The contract for sewer construction has been awarded to WILLIAM R. BOSWORTH, at $33,[illegible]. Burns & [illegible] are Engrs.

♦**Rochester, Minn.**—(Official)—The contract for constructing [illegible] of 12- to 18-in. sanitary sewers has been awarded to WILLIAM C. FRASER, St. Paul, Minn. William [illegible] is City [illegible]. Noted July 30.

♦**St. Cloud, Minn.**—The City Commission has awarded the contract for constructing a sewer in the North End to the THILL, MANNING & WHALEN CO., La Crosse, Wis., at $[illegible].

Warren, Minn.—Bids will be received until 8 p.m. Aug. 2[illegible], [illegible], for constructing an extension to the sewer system and building Imhoff tanks and filter beds.

Benson, Neb.—It is reported that bids will be received by the City Clerk until Aug. 24, for constructing a main sewer and sewage disposal plant. P. A. Edquist, Omaha, Neb., is Engr.

Ravenna, Neb.—(Official)—Bids will be received by C. [illegible], City Clerk, until Aug. 31, for constructing a sanitary sewer system. Grant & Fulton, Second Mutual Bldg., Lincoln, are the Engrs.

Helena, Mont.—Plans are being prepared by William Jordan, Jr., City Engr., for constructing 8- and 30-in. vitrified pipe sewers, to cost about $1[illegible].

♦**Hannibal, Mo.**—The contract for constructing sewers in Sewer District No. [illegible] has been awarded to FRANK L. HALL, at $[illegible]. R. F. Smiley is City Engr. Noted July 23.

Higginsville, Mo.—The city contemplates the construction of two septic tanks and sewers in various streets.

♦**St. Louis, Mo.**—According to press reports, the Board of Local Improvements has awarded the following sewer contracts: For constructing South Gravois sewer No. 1, HOGAN CONTRACTING CO., $1[illegible],194, also Steins St. point district sewer, at $[illegible],913; Florissant Ave. sanitary sewer, WILLIAM F. RILEY CONSTRUCTION CO., $12,668, and Clifton Heights sewer No. 1, KAMP ENGINEERING & CONSTRUCTION CO., at $12,6[illegible]6. Noted July 23 and July 30.

♦**St. Louis, Mo.**—The contract for constructing Sec. 1 and 2 of the Mill Creek sewer has been awarded to the CARTER CONSTRUCTION CO., 42 Broadway, New York, N. Y., at about $1,[illegible] and $1,672,000, respectively. Noted Aug. 3.

Glenwood, Ark.—See item under "Water Supply and Irrigation."

♦**Fort Bliss, Tex.**—The contract for constructing the sewer and water system has been awarded to MAYFIELD & SHAW, El Paso, at $1[illegible],160.

San Antonio, Tex.—(Official)—Bids will be received by Frederick Fries, City Clerk, until 4 p.m., Sept. 7, for constructing sanitary sewers. The work calls for about 30,000 lin. ft. of 8-in., 1800 ft. of 12-in., 2460 ft. of 18-in., 2610 ft. of [illegible] sewers.

♦**Seattle, Wash.**—It is reported that the contract for constructing sewers in 12d Ave. has been awarded to DAHLSTROM & RODAL, 2137 West 56th St. Noted Aug. 13.

♦**Seattle, Wash.**—The contract for constructing sewers in Seventh Ave. North has ben awarded to JOHN ALLEMANII, at $616[illegible].

Fairfax, Calif.—Fairfax Park is being surveyed for subdivision, and streets, sidewalks and sewers to cost about $1[illegible] will be constructed. E. J. Morser, Monadnock Bldg., San Francisco, is Engr. in charge.

♦**Long Beach, Calif.**—The contract for constructing a sewer system has been awarded by the Board of Public Works to the ARTHUR S. BENT CONSTRUCTION CO., Central Bldg., Los Angeles, Calif. Noted July 9 and Aug. 13.

Richmond, Calif.—H. D. Chapman, City Engr., has completed plans for extending the sewer system in the western section of the city. The estimated cost is $[illegible]0,000.

San Diego, Calif.—The city will construct a sewer along the east slope of Point Loma, to cost about 10,000.

San Francisco, Calif.—According to press reports the Board of Public Works has ordered the construction of sewers in [illegible] Ave. between Balboa and Cabrillo Sts., Irving St., between 17th and 18th Aves., and Seventh Ave., between Kirkham and Lawton St.

♦**San Francisco, Calif.**—(Official)—The contract for constructing the Baker's Beach outlet sewer has been awarded to [illegible] STORRIE & CO., San Francisco, at $23,660. Noted incorrectly in issue of Aug. 13. Noted Aug. 6.

Vallejo, Calif.—Bids were received by the City Council for extending the sewer system under Harbor Project No. 2, from Michael Murphy at $[illegible] and A. W. Cary at $33,72[illegible].

GARBAGE

New York, N. Y.—(Official)—Bids will be received until noon Aug. [illegible] by J. T. Fetherston, Comr. of Street Cleaning, Municipal Bldg., Borough of Manhattan, for the removal of snow and ice during the winter season of 1914-15 in the boroughs of Manhattan, Brooklyn and the Bronx.

♦**Columbus, Ohio.**—The city has awarded the contract to [illegible] LATHAM, [illegible], for the construction of an incinerator, at $[illegible].

Neenah, Wis.—The city [illegible] to construct a garbage [illegible].

Santa Cruz, Calif.—The City Commissioners, July [illegible], opened bids as follows for a garbage incinerator: [illegible] $[illegible]; Universal Engineering Co., $[illegible]; Z. O. Field, $[illegible].

STREETS AND ROADS

♦**Boston, Mass.**—The contract for constructing an asphalt [illegible] in [illegible] Ave., West Roxbury District, has been awarded to the [illegible] TRAP ROCK CO., [illegible] [illegible] [illegible] $[illegible], Thomas F. [illegible] [illegible]. Noted Aug. 6.

Bids will be received by the State Highway Commission until Aug. 2[illegible], for constructing 4200 lin. ft. of road in Uxbridge. Arthur W. Dean, 15 Ashburton Pl., is Chief Engr.

Norwalk, Conn.—Bids will be received by Charles J. Bennett, State Highway Comr., until 2 p.m., Aug. 24, for constructing a section of amiesite and brick pavement.

Norwalk, Conn.—An appropriation of $11,0[illegible]0 has been voted by the City Council for paving South St. between Meadow St. and the Washington St. Bridge with wood blocks.

♦**Windsor, Conn.**—A contract for constructing about eight miles of concrete walks has been awarded to BAKER & LASHER, INC., New Britain, Conn., at approximately $17,000.

♦**Albany, N. Y.**—(Official)—Bids will be received by John N. Carlisle, State Highway Comr., until 1 p.m., Sept. 1, for improving and repairing highways in various counties. For particulars, see advertisement under "Contracts to Be Let."

Albany, N. Y.—Bids were received by the the State Highway Commission, 55 Lancaster St., Aug. 17, for the construction of public highways by State Aid as follows:

Road No. 5483, Wellsville Village, Allegheny County, 0.76 mile—Lawrence Schultz, Fredonia, $29,467; Ballard & Nolan, Oneida, $29,305; John Johnson Construction Co., Buffalo, $27,741; Sullivan Construction Co., Syracuse, $29,195; Robert W. Hessen, Geneva, $28,332; McLaughlin & Burchill, Syracuse, $29,746, and six others.

Road No. [illegible]491, Prattsville-Ashland, Greene County, 5.1[illegible] miles—John I. McDonald Contracting Co., Poughkeepsie, $[illegible]2,861; Joseph Walker Costruction Co., Albany, $49,1[illegible]; Gruner & Hallenbeck, Harriman, $48,324; H. L. Baker, Cambridge, $52,739; Samuel Beskin, Beacon, $47,982; Catskill Construction Co., Catskill, $47,8[illegible]; De Graff & Hogoboom Inc., Kingston, $52,012, and two others.

Road No. 5210, Middletown-Bloomingburg, Orange County, 0.18 mile—Schunnemunk Construction Co., Highland Mills, $2236; Jackson Bros., Cuddebackville, $[illegible].

Road No. 5318-A, Camillus-Fairmount, Part 1, Onondaga County, 0.15 mile—E. H. Brown, Hempstead, $[illegible]; Phelan & Sullivan, Utica, $3,689; Charles E. Hovey, Camillus, $4298; J. W. Brennen Construction Co., Inc., Geneva, $[illegible]42; Gaffey & Byrnes, Syracuse, $4135.

Road No. 5352-B, Arkport-Dansville, Steuben County, 0.[illegible]1 mile—Atlanta Construction Co., Atlanta, $217[illegible]; Schroeder-Hicks Contracting Co., Rochester, $[illegible]; Kennedy Construction Co., Albany, $2755.

Road No. 5253-B, Jasper-Addison, Steuben County, [illegible] miles—Gaffey & Burns, Syracuse, $2[illegible]; Schroeder-Hicks Contracting Co., Rochester, $26,401; William F. Woods Construction Co., Syracuse, $24,904.50; L. M. Luddington Sons Inc., Rochester, $25,896; Atlanta Construction Co., Atlanta, $26,981; J. W. Brennan Construction Co., Geneva, $26,926, and one other.

Road No. 5253-D, Jasper-Addison, Steuben County, 6.9[illegible] miles—William F. Woods Construction Co., Syracuse, $1[illegible]; Atlanta Construction Co., Atlanta, $43,634; Kennedy Construction Co., Albany, $38,171; J. W. Brennen Construction Co., Inc., Geneva, $42,721; T. H. Gill Co., Laceyville, Pa., $42,[illegible].

Road No. 5709, Winthrop-North Lawrence, St. Lawrence, 5.81 miles—Spellman-Oliver Co., Chateaugay, $[illegible]; E. T. Eggleston, Yonkers, $87,343; Richard Hopkins, Troy, $[illegible]; Weed & Walsh, Mechanicville, $87,061; Ross, Hallenbeck Construction Co., Copenhagen, $89,543; A. J. Rockwood, Rochester, $91,089; E. H. Brown, Hempstead, $89,93[illegible].

Road No. 5508, Old Post, Part 4, Ulster Co., 4.[illegible] miles—Samuel Beskin, Beacon, $77,965; S. R. Van Wagenen Inc., Rondout, $76,678.50; Carania Construction Co., Troy, $[illegible]; Price & Tripp, Inc., White Plains, $[illegible].50; King Bros., New York City, $76,054.76; Henry McNamee, Eddyville, $[illegible], and six others.

Road No. 5363, Peekskill Village, Westchester County, brick, 0.94 mile—John J. Hart, Peekskill, $32,6[illegible]; Joseph Johnson Sons, New Brighton, $34,413; Ballard & Mahar, Oneida, $34,225; Gifford Construction Co., Jamaica, $32,408; C. D. Dean, Albany, $31,969; William F. McCabe Construction Co., White Plains, $31,[illegible]70, and three others.

Road No. [illegible]332-A, Lowville-Carthage, Jefferson County, 0.76 mile—Thomas O'Brien, Watertown, $21,1[illegible]; E. H. Brown, Hempstead, $20,512; Ballard & Mahar, Oneida, $19,[illegible]0; John Davis, Syracuse, $20,23[illegible].

Road No. 1165, Theresa-Philadelphia, Part 1, Jefferson County, [illegible] miles—E. H. Brown, Hempstead, $[illegible]; Richard Hopkins, Troy, $[illegible]; Monroe Roads Co., Pittsford, $[illegible]; Thomas O'Brien, Watertown, $16,[illegible].

Road No. 1181, Adams Village, Railroad St., Jefferson County, 1.15 miles—A. J. Rockwood, Rochester, $18,021; Thomas Murray, Leroy, $18,931; E. H. Brown, Hempstead, $1[illegible].

The following bids were received by the State Highway Commission, Aug. 17, for the repair of public highways by State Aid:

Repair Contract No. [illegible], Road No. [illegible], Rhinebeck-Hyde Park, Dutchess County—Henry McNamee, Eddyville, $[illegible]; Bridgeport Construction Co., Poughkeepsie, $[illegible]; Thomas J. Martin, Beacon, $[illegible]; DeGraff & Hogoboom, Kingston, $[illegible]; William Doyle, Saugerties, $[illegible]; James J. Donohue, New York City, $[illegible]; James L. Kehoe, Newburgh, $[illegible], and two others.

Repair Contract No. [illegible], Road No. [illegible], Red Hook-Rhinebeck, Dutchess County—M. W. McVeigh, Long Island City, $[illegible]; James L. Kehoe, Newburgh, $[illegible]; Crowe & Walsh, Pittsfield, Mass., $[illegible]; Thomas J. Martin, Beacon, $[illegible]; William Doyle, Saugerties, $[illegible]; Henry McNamee, Eddyville, $[illegible], and four others.

Repair Contract No. [illegible], Road No. [illegible], Crown Point-Point Henry, Essex County—Defiance Corporation, Ticonderoga, $[illegible]; Richard Hopkins, Troy, $[illegible]; Flood & Van Wirt, Hudson Falls, $[illegible]; Jas. F. [illegible], Delmar, $[illegible]; James [illegible], Plattsburgh, $[illegible].

Repair Contract No. [illegible], Road No. [illegible], Ticonderoga-Crown Point, Part 1, Essex County—James P. [illegible], Delmar, $12,[illegible]; Defiance Corporation, Ticonderoga, $[illegible]; James [illegible], Plattsburgh, $[illegible]; Flood & Van Wirt, Hudson Falls, $[illegible]; Richard Hopkins, Troy, $[illegible].

Repair Contract No. [illegible], Essex County—[illegible] & [illegible], [illegible], $[illegible]; W. L. Lawton, Glens Falls, $[illegible]; Flood & Van Wirt Co., Hudson Falls, $[illegible].

Repair Contract No. [illegible], Road No. [illegible], Mayfield-Northville

Part 2, Fulton County; Road No. 5065, Northville Village-North; Road No. 362, Northville-Chapman's Corners—R. D. Cooper, Little Falls, $18,085; H. W. Roberts & Co., Utica, $18,527; Hines Bros. & Welsh, Gloversville, $18,403; John P. Duggan & Co., Amsterdam, $17,467; Champlain Engineering and Construction Corporation, Saratoga Springs, $17,115.

Repair Contract No 486, Road No. 853, Batavia-Elba, Genesee County—Arthur J. Shaw, Batavia, $13,304; Casey & Thompson, Batavia, $12,868; Wood & Tompkins, Hilton, $14,139; Schroeder-Hicks Contracting Co., Rochester, $12,930; Bonney & Hamilton, Rochester, $14,013.

Repair Contract No. 575, Road No. 796, Greeneville-Coxsackie, Part 1, Greene County—Crowe & Walsh, Pittsfield, Mass., $10,935; DeGroff & Hogoboom, Kingston, $10,762; James P. Donohue, New York City, $18,939; Catskill Construction Co., Catskill, $11,573.

Repair Contract No. 683, Noad No. 6, Ridge, Part 1, Monroe County—C. D. Dean, Albany, $21,580; John Johnson Construction County, Buffalo, $21,170; Frank V. Brotsch Co., Rochester, $20,825; Morrison & Quinn, Rochester, $20,050; Whitmore, Rauber & Vicinius, Rochester, $21,150; Ribstein-Holter Co., Inc., Rochester, $21,275, and three others.

Repair Contract No. 687, Road No. 6, Kerr St.-Subway & approaches, Monroe County—Whitmore, Rauber & Vicinius, Rochester, $16,425; Morrison & Quinn, Rochester, $15,691; John Johnson Construction Co., Buffalo, $16,433; Frank V. Brotsch Co., Rochester, $16,242; Ribstein-Holter Co., Inc., Rochester, $16,644; Schroeder, Hicks Contracting Co., Rochester, $16,191, and one other.

Repair Contract No. 671, Road No. 641, Schenectady-Rotterdam Junction, Schenectady County—John P. Duggan & Co, Amsterdam, $13,034; John H. Gordon, Albany, $11,633; Patrick H. Murray, Troy, $12,358; J. J. Malloy, Schenectady, $11,957; J. P. Scanlon, Delmar, $12,199; Ford & Greene, Schenectady, $12,494, and one other.

Repair Contract No. 689, Road No. 625, Theresa-Antwerp, Part 1, Jefferson County—Burns Bro. & Halley, Watertown, $14,565; Thomas O'Brien, Watertown, $13,095; Ballard & Mahar, Oneida, $12,309; Ruddy-Saunders Construction Co., Troy, $14,509.

Repair Contract No. 684, Road Nos. 86, 88, 627, 628,6054. Class of work: sweeping, furnishing and applying high-carbon tar, Erie County—Richard Hopkins, Troy, per sq.yd., $0.0294; Defiance Corporation, Ticonderoga, per sq.yd., $0.027; De Barber & Hill, Fulton, per sq.yd., $0.11.

Middletown, N. Y.—Street improvement bonds for $10,000 were sold Aug. 5.

Bayonne, N. J.—Bids will soon be received for improving Avenue A from North St. to 31st St.

Jersey City, N. J.—The City Commissioners will soon receive bids for repaving Jewett Ave.

✚Newark, N. J.—The contract for paving Broad St., from South St. to Poinier St., with asphalt block has been awarded to the HASTINGS PAVEMENT CO., at about $38,908.

West Hoboken, N. J.—The Town Council will soon receive bids for paving Palisade Ave. from the Patterson Plank Road to Weehawken St.

✚West Hoboken, N. J.—The contract for the improvement of Angelique St., West Hoboken was recently awarded to NOLAN & HORNUNG, 711 DuBois St., West Hoboken.

✚West New York (Weehawken Post Office), **N. J.**—Contracts for improving 19th St., from Hudson Ave. to Park Ave., and Sixth St., from Bergenline Ave. to Park Ave., have been awarded to the CLINTON CONSTRUCTION CO., West Hoboken, N. J. Noted Aug. 6.

Berwick, Penn.—(Official)—Bids will be received by the Borough Council until 8 p.m., Aug. 24, for improving Market St. from Front St. to Cemetery St. F. N. Ritter is Secy.

✚Duryea, Penn.—The contract for paving Main St. has been awarded to O'BRIEN BROS., at $44,900.

Harrisburg, Penn.—(Official)—Bids will be received by the Department of State Highways until 10 a.m., Sept. 1, for reconstruction work in the following counties: 5806 lin.ft. in Galeton Borough, Porter County; 4257 lin.ft. in New Eagle Borough, Washington County; 17,820 lin.ft. in Union Township and Finleyville Borough, Union County; 15,063 lin.ft. in Franklin Township, Greene County; 18,272 lin.ft. in South Hanover and Derry Townships, Dauphin County; 1393 lin.ft. in Duryea Borough, Luzerne County; 8552 lin.ft. in West Berwick Borough, Columbia County; 5200 lin.ft. in Bigler Township, Clearfield County. Edward M. Bigelow is State Highway Comr.

✚Spangler, Penn.—The contract for paving portions of Bigler Ave. and North 17th St. from Bigler to Crawford Ave. has been awarded to POLO AZZARA, Barnesboro, at $8164. Other bids were: J. A. Lord, Hastings, $8376; John Dandrea & Co., $9373; C. F. Wilson & Co., $11,899.

Union City, Penn.—(Official)—Bids will be received by City Council until 8 p.m., Aug. 26, for grading, curbing and paving a portion of West High St. with brick.

Wheatland, Penn.—Bids will be received by F. L. Hutchison, Secy. of the Borough until noon, Aug. 25, for grading and improving Mercer Ave and Church St.

Baltimore, Md.—Bids will be received by the Board of Awards, at the City Register's office, City Hall, until Aug. 26, for the construction of No. 1 Road, contract 32, improvement of Gunpowder Supply, consisting of 1.4 miles macadam or concrete road surfacing.

Bluefield, W. Va.—(Official)—Bids will be received by the Board of Affairs until noon, Aug. 25, for paving Fourth, Third, Chestnut and South Mercer Sts. with bituminous macadam, on concrete base and constructing concrete curbs and gutters.

✚Birmingham, Ala.—A contract for grading and macadamizing Avenue N, Ensley, on the South Ensley Highlands, has been awarded to TONY & LAWLER, at about $10,000.

Linden, Ala.—Bids will be received by the County Commissioners until Aug. 24, for grading, draining and surfacing 2½ miles of road.

✚Bay St. Louis, Miss.—A contract for delivering and placing 300,000 bbl. of shells has been awarded to A. J. McLEOD, Kiln, Miss., at $0.08 per bbl.

Tupelo, Miss.—The citizens recently voted to issue bonds for $40,000, the proceeds of which will be used for street improvements.

Port Allen, La.—The citizens of West Baton Rouge parish wil vote Sept. 10 on the proposition of issuing $75,000 in bonds to construct roads in District No. 1.

Louisville, Ky.—Bids will be received by the Board of Public Works until Aug. 24, for paving portions of Preston, Second, Ninth and several other streets.

✚Louisville, Ky.—The contract for constructing Coral Ave. has been awarded to the AMERICAN STANDARD ASPHALT CO., Luisville.

★Nicholasville, Ky.—The contract for reconstructing Main St. has been awarded to the CAREY-REED CONSTRUCTING CO., Lexington. Noted Aug 6.

Canal Dover, Ohio—Contracts have been readvertised and bids will be received by W. E. Sykes, Dir. of Pub. Ser., about Aug. 31, for paving Second St., Slinguff and Arnold Aves.

Cincinnati, Ohio—(Official)—Bids will be received by the Board of Park Commissioners until noon, Aug. 24, for grading Section 3 of the Bloody Run Parkway.

(Official)—Bids will be received by Phil Fosdick, Dir. Pub. Ser., until noon, Aug. 24, for paving St. James Ave. from Curtis St. to Windsor St., with brick.

Cincinnati, Ohio—(Official)—Bids will be received by Philip Fosdick, Dir. of Pub. Ser., until noon, Aug. 24, for improving Burnett Ave., from Elland Ave. to Goodman St.

Cleveland, Ohio—(Official)—Bids will be received by the Board of Commissioners of Cuyahoga County until 10 a.m., Sept. 2, for the improvement of a portion of the Cook Road. E. G. Krause is Clk. to the Board.

✚Columbus, Ohio—The State Highway Department awarded contracts as follows:

Ashtabula County—Niles-Ashtabula Road, concrete, T. P. FITZGERALD, Ashtabula, $78,862.

Auglaize County—Sect. B, Piqua-St. Mary's Road, waterbound macadam, G. W. COWLEY, Celina, $14,000.

Butler County—Sect. 3, Hamilton-Middletown Road, brick, JOHNS & SON, Trenton, $38,191.

Carroll County—Canton-Steubenville Road, waterbound macadam, WISE BROS., Canton, $18,900.

Clark County—Springfield-Washington C. H. Road, waterbound macadam, GRAHAM & KINNEAR, Columbus, $26,548.

Clermont County—Cincinnati-Batavia Road, award withheld.

Clermont County—Ohio River Road, award withheld.

Clermont County—Cincinnati-Chillicothe Road, award withheld.

Clermont County—Bethel-Chilo Road, award withheld.

Clermont County—Cincinnati-West Union Road, award withheld.

Columbiana County—Unity-Salem Road, award withheld.

Crawford County—Sect. 1, Bucyrus-Tiffin "C" Road, brick, L. R. McMICHAEL, Bucyrus, $19,790.

Crawford County—Sect. 1, Bucyrus-Plymouth Road, brick, L. R. McMICHAEL, Bucyrus, $20,900.

Crawford County—Sect. "E," Bucyrus-Crestline Road, brick, L. R. McMICHAEL, Bucyrus, $21,990.

Delaware County—Sect. 1, Columbus-Wooster Road, brick, GILL & ROOF, Sunbury, $4399.

Delaware County—Sect. 1, Delaware-Mt. Gilead Road, brick, CHARLES W. RIDDLE, Delaware, $4913.

Delaware County—Sect. 1, Sunbury-Mt. Gilead Road, waterbound macadam, MACK GLEDHILL, Galion, $25,300.

Fayette County—Sect. "E," Springfield-Washington Road, brick, MACK & VAN GUNDY, Washington Court House, $16,655.

Fayette County—Sect. "D," Washington-London Road, brick, MARK & VAN GUNDY, Washington Court House, $16,499.

Fulton County—Toledo-Wauseon Road, bituminous macadam, PETER H. DRUM, Swanton, $36,974.

Fulton County—Wauseon-Morenci Road, waterbound macadam, NATIONAL LIME & STONE CO., Carey, $8975.

Fulton County—Archbold-Fayette Road, waterbound macadam, JONATHAN NOFZIGERM, Wauseon, $11,650.

Gallia County—Gallipolis-Ironton Road, brick, JONES & MILLER, Patriot, $15,605.

Geauga County—Cleveland-Meadville Road, concrete, SHERMAN DEGROODT, Youngstown, $35,000.

Geauga County—Cleveland-Meadville Road, concrete, DAVID LOENSOHN, Kent, $29,950.

Greene County—Dayton-Springfield Road, no bids.

Guernsey County—Sect. "D," Cambridge-Coshocton Road, concrete, MALLERNEE & KELLEY, Freeport, $10,900.

Guernsey County—National Road, brick, award withheld.

Hancock County—Findlay-Bowling Green Road, waterbound macadam, GRAY BROS., Bowling Green, $14,700.

Hancock County—Findlay-Carey Road, waterbound macadam, O. A. PARKER, Van Lin, $9900.

Harrison County—Dennison-Cadiz Road, concrete, no bids.

Hardin County—Roundhead-McGuffey Road, concrete and brick, no bids.

Henry County—Sect. 1, Holgate-Kelfersville Road, waterbound macadam, WESTRICK & LINE, Holgate, $17,100.

Hocking County—Chillicothe-Logan Road, waterbound macadam, no bids.

Hocking County—Logan-New Lexington Road, waterbound macadam, E. C. RADEBAUGH, Logan, $12,472.

Holmes County—Sect. 5, Millersburg-Canal Dover Road, waterbound macadam, no bids.

Huron County—Plymouth-Norwalk Road, concrete, McGERRY & SPARKS, Lansing, Mich., $12,100.

Huron County—Monroeville-Chicago Junction Road, concrete, MODERN CONSTRUCTION CO., Fremont, $16,863.

Huron County—Ashland-Norwalk Road, concrete, award withheld.

Jackson County—Jackson-Ironton Road, waterbound macadam, McCOY BROS. & KELLER, Jackson, $29,416.

Knox County—No. 1 "F" Mt. Vernon-Coshocton Road, brick, E. N. TURNER, Logan, $23,600.

Lawrence County—Ohio River Road, concrete, JOHN M. CAPPER, Kitts Hill, $12,240.

[illegible] County—Sect 1 [illegible] Road, waterbound macadam, award withheld

[illegible] County—Sect 2, [illegible] Sta Ext Road, waterbound macadam, [illegible]MEYER BROS, Newark, $[illegible]26

Logan County—Sect C, Bellefontaine-Kenton Road, waterbound macadam, LUNSFORD & EVANS, Pedro, $15,9[illegible]7

Logan County—Bellefontaine-Richwood "A" Road, waterbound macadam, DALLY, BELL & CONKLETON, West Mansfield, $16,2[illegible]

Logan County—Urbana-Bellefontaine Road, waterbound macadam, LUNSFORD & EVANS, Pedro, $16,300

Lorain County—Oberlin-Norwalk Road, concrete, J C McCARDY CO, Baltimore, Md, $10,5[illegible]0

Mahoning County—Akron-Youngstown Road, waterbound macadam, GALLAGHER & AARON, Youngstown, $25,946

Mahoning County—Sect 1, North Lima-Palestine Road, brick, KENNEDY BROS, Youngstown, $[illegible]2,043

Marion County—Sect 2, Marion-Delaware Road, waterbound macadam, C S OWENS, Owens, $[illegible]750

Marion County—Sect 1, Marion-Galion Road, waterbound macadam, J M HAMILTON, Marion, $19,300.

Marion County—Sect "E," Marion-Kenton Road, waterbound macadam, A J BRADY, Marion, $34,998

Medina County—Barberton-Greenwich Road, brick, H F GREEN, Ravenna, $12,726

Medina County—Barberton-Greenwich Road, concrete, GROVER C WOODS, Lodi, $8929.

Medina County—Barberton-Greenwich Road, concrete, ELYRIA CONCRETE CO, Elyria, $8995

Meigs County—Sect "K," Pomeroy-Marietta Road, brick, GEORGE BAUER, Pomeroy, $16,700

Meigs County—Sect "J," Athens-Pomeroy Road, brick, GEORGE BAUER, Pomeroy, $15,500.

Monroe County—Sect "F," Woodsfield-Sistersville Road, brick, HASTINGS & PATTON, Woodsfield, $27,485.

Morrow County—Sect 3, Mt Gilead-Delaware Road, waterbound macadam, SCOTT BROS, Marion, $26,662

Muskingum County—Sect C, South River Road, bridge, BROOKVILLE BRIDGE CO., Brookville, $2184

Muskingum County—Sect 1, Zanesville-Otsego Road, brick and concrete, ALBERT ADAMS & SON, Zanesville, $17,750

Ottawa County—Fremont-Pt Clinton Road, waterbound macadam, GRAY BROS, Bowling Green, $19,970.

Paulding County—Paulding-Woodburn Road, waterbound macadam, HENRY G ZELLER, Swanton, $25,425.

Perry County—Newark-New Lexington Road, brick, SWANK & McINTYRE, Dayton, $139,000

Perry County—Sect 1, Lancaster-New Lexington Road, brick, BEATRICE KIENER, Moxahala, $24,812

Pickaway County—Circleville-London Road, concrete and waterbound macadam, OATHER M JUNK, Chillicothe, $23,-6[illegible]

Pike County—Hillsboro-Piketon Road, concrete and waterbound macadam, no bids

Portage County—Sect 1, Painesville-Ravenna Road, concrete, MORGAN BROS, Ravenna, $22,744

Preble County—Dayton-Indianapolis Road, concrete and surface-treated macadam, H M CURRY & CO, Eaton, $17,-4[illegible]

Richland County—Sect J, Mansfield-Shelby Road, concrete and cinders, J W RUST CONSTRUCTION CO, Mansfield, $13,[illegible]

Richland County—Sect 2, Mansfield-Norwalk Road, waterbound macadam, J W RUST CONSTRUCTION CO, Mansfield, $1[illegible]

Scioto County—Ohio River Road, brick, S MONROE & SON [illegible], Portsmouth, $20,798

Seneca County—Sect 2, Lima-Sandusky Road, waterbound macadam, KNEPPER & YUNDT, Tiffin, $13,173

Seneca County—Tiffin-Republic Road, waterbound macadam, [illegible] BROS, Clyde, $[illegible]70[illegible]

Seneca County—Lima-Sandusky Road, waterbound macadam, [illegible] & [illegible], Fostoria, $[illegible]650

Seneca County—Fostoria-Carey Road, waterbound macadam, KNEPPER & YUNDT, Tiffin, $[illegible]

Seneca County—Upper Sandusky-Bellevue Road, waterbound macadam, KNEPPER & YUNDT, Tiffin, $16,[illegible]

[illegible] County—Cleveland-East Liverpool Road, brick, no award

Trumbull County—Youngstown-Cleveland Road, brick, award withheld

Trumbull County—Sect 2, Cleveland-Youngstown Road, brick, [illegible], Kent, $[illegible]

Trumbull County—Sect 1, Youngstown-Sharon Road, brick, KENNEDY BROS, Youngstown, $[illegible]

Trumbull County—[illegible] Falls-Green[illegible] Road, waterbound macadam, no bids

Van Wert County—Van Wert-[illegible] Road, waterbound macadam, [illegible] BROS, [illegible], $[illegible]

Van Wert County—Van Wert-[illegible] Road, waterbound macadam, [illegible] BROS, [illegible], $[illegible]

Washington County—Sect [illegible], Ohio River Road, concrete, [illegible] & [illegible], Marietta, $[illegible]

Williams County—Sect [illegible], West Unity-Montpelier Road, waterbound macadam, [illegible] CONSTRUCTION CO, [illegible]

Wood County—Sect [illegible], Toledo-Perrysburg Road, brick, [illegible] CONSTRUCTION CO, [illegible], $[illegible]

Wyandot County—Sect [illegible], Upper Sandusky-Marion Road, waterbound macadam, [illegible], $[illegible]

Cuyahoga County—Cleveland-Wooster Road, waterbound macadam and brick, [illegible] PAVING CO, Cleveland, $[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Marion County—Sect F, Columbus-Sandusky Road, repaving with waterbound macadam, SCOTT BROS, Marion, $11,-7[illegible]3

+**Defiance, Ohio**—The contract for paving Second St has been awarded to the ASPHALT BLOCK PAVING CO., Toledo, at $32,0[illegible]0 Noted July 30.

+**East Liverpool, Ohio**—The contract for paving a wharf has been awarded to RINEHARDT BROS at approximately $9000.

+**Ottawa, Ohio**—(Official)—A contract for paving 5851 sq yd with medal wire cut block, concrete foundation and concrete filler has been awarded to H S ENCK, Lima, at $14,631 Noted July 23.

+**Piqua, Ohio**—The contract for improving North Caldwell and [illegible] Sts. has been awarded to the OHIO MARBLE CO.

Steubenville, Ohio—(Official)—Bids will be received by the County Commissioners until noon, Aug 2[illegible], for constructing about one half mile of brick road in Smithfield Village.

+**Youngstown, Ohio**—(Official)—Contracts have been awarded for grading Princeton Road to S H DeGROODT, at $47,000, Palmyra Road to L FLETCHER, Kent, at $72,0[illegible]0, Stewart Ave. to A. TRIPO, Youngstown, at $5200. Noted July 23.

Bloomington, Ind.—(Official)—Bids will be received by the Common Council until 7 30 p m, Sept 1, for improving 13th St. Horace Blakely is City Clk

Gary, Ind.—Bids will be received by the Board of Public Works until Sept 7, for improving 36th Ave from Broadway to Georgia St W J Fulton is City Engr

+**Gary, Ind.**—Contracts have been awarded for paving 2[illegible]th St, from Broadway to Grants Ave, to HENNING & MACDERMUT, at $20,057, Sixth Ave from Washington to Tyler St., at $18,698, 25th Ave, from Broadway to Prospect Ave, at $31,765. Noted July 2

+**Greencastle, Ind.**—(Official)—Contracts have been awarded for constructing the following roads in Greencastle Township: John McFarline Road, to ALLEN & SWEET, at $17,220, J E Bicknell Road, to A G DAY, at $17,1[illegible]4, George Landes Road, to JAMES MAHONEY, at $6360 Noted July 30

+**Valparaiso, Ind.**—(Official)—Contracts for constructing roads in Portage and Center Townships have been awarded to RAY DEMOSS, Chesterton, Ind, at $7470, and GREENE & CAPLIN, Chesterton, Ind., at $6200. Noted July 3[illegible].

Springfield, Ill.—(Official)—Bids will be received by the State Highway Commission until 11 a m., Aug 25, for State Aid work in Boone and Jackson Counties All cement to be furnished by the State. P. C. McArdle is Asst. State Highway Engr

+**Marinette, Wis.**—The contract for constructing concrete pavement on Chestnut St has been awarded to CARLIN BROS, at $21,000. Noted July 16

+**La Crosse, Wis.**—The contract for about 6000 sq yd of asphaltic macadam pavement with concrete curb and gutter on St Andrews St, has been awarded to THOMAS F WOOLEY, at $9735 Noted July 23

+**Corydon, Iowa**—(Official)—A contract for constructing 31,0[illegible]0 sq yd. of pavement has been awarded to JAMES HORRAHIN, Des Moines, at $62,000 Noted July 3[illegible]

Waterloo, Iowa—According to press reports, bids will be received until Aug 24 for paving Wellington, Oak Lawn and Randall Sts. Approximately 15,000 sq yd of asphaltic concrete will be required

Benson, Minn.—Bids will be received by D P Carney, County Audr, until 1 p m, Aug 2[illegible], for constructing [illegible] lin ft of turnpike in Pillsbury

Fairmount, Minn.—Bids will be received until 11 a m, Aug 2[illegible], for work on the following state roads: Nos 3, 5, 7, 8, 9, 12 and 13

Hanska, Minn.—Bids will be received by the Town Board until Aug 27 for grading 36[illegible]0 lin ft of road

Minneapolis, Minn.—Bids will be received by A P Erickson, County Audr, until 11 a m, Aug 31, for paving Road No 3 with concrete in West Minneapolis Village

+**Pipestone, Minn.**—A contract for grading and concrete paving has been awarded to the WIDELL CO, Mankato at $13,114

+**Aurora, Neb.**—A contract for paving [illegible] sq yd has been awarded to O F CHAPIN Hastings, Neb at $1.[illegible] per sq yd

+**Seward, Neb.**—(Official)—A contract for paving [illegible] yds has been awarded to J W TURNER, Seward Noted July 16 and 3[illegible]

Rapid City, S D.—Bids will be received by J [illegible], County Audr, until noon, Sept [illegible], for grading the [illegible] [illegible]k Gap Road

+**Great Falls, Mont**—The contract for paving Third St has been awarded to [illegible] & SONS at $[illegible]

+**Helena, Mont**—The contract for paving Fuller Ave has been awarded to [illegible] JOHNSON, Helena, at $[illegible] The only other bid was from D C Sweeney, $11,[illegible]70

+**Lewistown, Mont**—The contract for paving Broadway has been awarded to [illegible] MAQUIRE, at about $[illegible] Noted July 16

+**Terry, Mont**—(Official)—A contract for constructing approximately [illegible] sq ft of concrete sidewalks has been awarded to L W [illegible]ITH, Fargo, N D, at $[illegible] Noted Aug 6

+**St Louis, Mo**—Contracts have been awarded for paving [illegible] Ave to the [illegible] CONSTRUCTION CO, at $[illegible] and the [illegible] to the [illegible] CONSTRUCTION CO, at $[illegible] Noted July [illegible]

+**Wharton, Tex**—A contract for constructing roads in [illegible] has been awarded to [illegible] BAILEY & [illegible].

+**Tulsa, Okla.**—A contract for paving 35 blocks with asphaltic concrete has been awarded to F. P. McCORMICK, Tulsa, at $1.34 per sq.yd.

Pocatello, Idaho—A special election will be held Aug. 25 to vote on the proposition of issuing $20,000 in bonds, the proceeds of which will be used for grading and paving streets and alley intersections throughout the city.

+**Portland, Ore.**—The contract for paving East 15th St., from Shaver to Prescott, has been awarded to the OREGON-HASSAM PAVING CO., at $8972.

+**Seattle, Wash.**—Contracts have been awarded for paving California Ave. to F. McLELLAN, at $109,820; First Ave. South to A. J. BAUMGARTNER, at $12,855; Auburn Pl., to the PARK CONTRACT CO., at $3278.

Fairfax, Calif.—See item under "Sewers."

+**Los Angeles, Calif.**—Contracts have been awarded for improving Alvarado St. to H. A. TAYLOR, at $10,780; 16th St. to B. F. Ford & F. H. STOUT, at $13,410; E St. to the FAIRCHILD-GILMORE-WILTON CO., at $38,845; Folsom St. to D. D. CHAPMAN, at $7548.

+**Newport Beach, Calif.**—A contract for improving a number of streets has been awarded to E. M. CHALMERS, Willmington, at $8146.

+**Richmond, Calif.**—The City Council has awarded contracts for the improvement of Pullman Ave. to the MUNICIPAL IMPROVEMENT CO., at $54,593; for the improvement of Clinton Ave. to L. L. PAGE, at $16,193, and for the paving and sewering of Cutting Blvd., to G. W. CUSHING, at $88,450.

+**Sacramento, Calif.**—The California State Highway Commission awarded contracts Aug. 11 for highway work as follows: Alameda County, between Greenville and Livermore, to PAROTT BROS., Salt Lake City, Utah, at $20,779; Santa Clara County, between San José and northerly boundary, to JOHN W. McDONALD, JR., of San José, at $36,696; Mendocino County, from Hopkins to Ukiah, to HARD BROS., Sacramento, at $68,385; Santa Clara County, from Santa Clara to San José, to the RANSOME-CRUMMEY CO., Oakland, at $30,664; Contra Costa County, from Pinole to San Pablo Creek, to J. H. FALCONER, Escalon, at $14,443; Humboldt County, from Dyerville and Miranda, to FAIRBANKS & BAECHTEL, Willits, at $120,893; Santa Barbara County, from El Capitan Creek to Alcatraz, to T. K. BEARD, Modesto, at $82,168. All bids for road construction between Shivley and Jordan Green in Humboldt County were rejected. Noted July 23.

+**Stockton, Calif.**—The City Council has awarded a contract for the construction of streets, gutters, curbs and sidewalks in the Oaks tract to the FEDERAL CONSTRUCTION CO., Monadnock Bldg., San Francisco, Calif., at $80,381.

INDUSTRIAL WORKS

Boston, Mass.—The W. H. McElwain Co., Hall Rd., plans the erection of a two-story, 24x84-ft. addition to its tannery. The estimated cost is $16,000. Hubbard & French, 88 Pearl St., are the Archs.

+**Framingham, Mass.**—The Dennison Mfg. Co. has awarded the contract for the construction of a four-story, 70x160-ft. reinforced concrete factory, to the ALBERTAN CONSTRUCTION CO., 8 Beacon St., Boston. Monks & Johnson, 78 Devonshire St., Boston, are the Archs.

Worcester, Mass.—The Worcester Felt Shoe Co. has acquired property on Middle River Rd., where it plans to erect a factory in the near future.

East Springfield, Conn.—The W. H. Miner Chocolate Co. has purchased a site where it plans to build a factory.

Greenville, Conn.—The Shetucket Co. is having plans prepared for a two-story, 57x356-ft. brick weave-shed. C. W. Praray, Tunes Bldg., New Bedford, Mass., is the Engr.

New Haven, Conn.—The Kolynos Co., manufacturer of dental goods, is having plans prepared for a four-story, 80x120-ft. reinforced-concrete factory. McClintock & Craig, Springfield, Mass., are the Archs. Noted Aug. 6.

Norwalk, Conn.—S. Seam & Sons, brass finishers., plans to build a factory in Day St., to be 34x80-ft.
H. Jacobs & Sons have plans under consideration for the erection of a factory estimated to cost $40,000.

Waterbury, Conn.—The Pilling Brass Co. plans the erection of a one-story, 52x111-ft. factory on Watertown Ave. Griggs & Hunt are the Archs.

Windsor Locks, Conn.—The Anchor Paper Mills has been purchased by a new concern which plans the manufacture of a different line of paper; $25,000 will be expended in improvements and equipment.

Buffalo, N. Y.—The Buffalo Forge Co., Broadway and Mortimer St., will receive bids for additions to its foundry. The estimated cost of the improvements is $500,000. William F. Wendt is the Pres. Noted Apr. 9.
The Bison City Table Co., whose plant was recently destroyed by fire, plans to rebuild in the near future.

Little Falls, N. Y.—The Jacob Zoller Packing Co. will ask for bids for the construction of additions to its packing plant. The improvements will be a two-story, 37x57-ft. packing house and a one-story, 28x84-ft. office building. Carl Hang & Sons have prepared the plans.

Jersey City, N. J.—Joseph T. Ryerson & Sons, 30 Church St., New York, N. Y., have bought a factory site on West Side Ave., where they plan to erect a large plant.

+**Allentown, Penn.**—Frank C. Kolb, Fourth and Elm St., has awarded a contract to W. A. STEIN & CO., Allentown, for the erection of a three-story, 110x160-ft. bakery. Charles Balderston, 411 Walnut St., Philadelphia, Penn., is the Arch. Noted June 25, July 2.

Dubois, Penn.—The Kane Motor Car Co., agents for the Hudson car in western Pennsylvania, has purchased a site on North Brady St., Dubois, where a garage will be erected. Plans are also under consideration for the erection of service stations in Bradford and Altoona.

+**Nicetown, Penn.**—George W. Blabon & Co. has awarded the contract for the construction of a five-story, reinforced concrete factory to WILLIAM STEEL & SONS, 1600 Arch St., Philadelphia, at $500,000. Ballinger & Perrot, 1211 Arch St., Philadelphia, are the Archs. Noted Aug. 6.

Philadelphia, Penn.—The Keystone Lantern Co. plans the construction of a four-story, 68x113-ft. factory at Cottman and Tacony St.

+**Baltimore, Md.**—The Varsity Underwear Co. has awarded the contract for the construction of its factory to DEVERELL, SPENCE & CO. The estimated cost is $30,000. Layton F. Smith is the Arch. Noted June 25.

Suffolk, Va.—The Virginia Mfg. Co., manufacturer of boxes, crates, etc., plans the erection of a new factory, replacing the one recently destroyed by fire.

Titusville, Fla.—The Palmetto Products Co., New York, N. Y., plans to erect a plant for the manufacture of palmetto leaf rugs.

Haleyville, Ala.—The Haleyville Oil & Fertilizer Co has had plans prepared for the construction of a cottonseed oil mill. The estimated cost is $27,000.

Chattanooga, Tenn.—The Ford Motor Co., Detroit, Mich., plans the erection of a garage and show room to cost $30,000.

Memphis, Tenn.—W. P. Brown & Co., whose warehouse was recently destroyed by fire, has announced that plans will be prepared immediately for a larger warehouse, to be erected on the old site.

Fulton, Ky.—Harrison Bros., Union City, Tenn., plan to establish a factory for the manufacture of rainproof cloth.

Louisville, Ky.—The Louisville Soap Co. is having plans prepared for a factory addition estimated to cost $50,000. Frederick Erhart, Louisville, is the Arch.

Arrolton, Ohio—M. F. Albright & Bro., East Liverpool, Ohio, plans to build a pottery here at an estimated cost of $100,000.

+**Cleveland, Ohio**—The Kaynee Co., 6925 Ætna Rd., Cleveland, has awarded the contract for the construction of a three-story, 60x140-ft. factory, to the FATH CONSTRUCTION CO., 440 Perkins Ave., Cleveland, at $50,000. Christian, Schwarzenberg & Gaede, Euclid Bldg., Cleveland, have prepared the plans.

Cleveland, Ohio—Emanuel Rhibal, 6601 Morgan Ave., Cleveland, plans to build a one-story, 16x88-ft. brick foundry, to cost $10,000. Frank Sureas is the Arch.

Piqua, Ohio—The Wood Shovel & Tool Co. is having plans prepared for two factories, 60x120 ft. and 60x130 ft., each one story. The estimated cost is $35,000. Devore & McGormley, Nasby, Toledo, are the Engrs.
The Gramm Berstein Co. will receive bids for the construction of a one-story, 50x70-ft. addition to its factory on East Wayne St. McLaughlin & Hulsken, 610 Savings Bldg., Lima, are the Archs. Noted Apr. 23.

Toledo, Ohio—Harbauer & Co., manufacturer of vinegar and pickles, will receive bids for the construction of a three-story, 55x100-ft. factory. The estimated cost is $40,000. Devore & McGormley, 304 Nasby, Toledo, are the Engrs.

Vermilion, Ohio—The Wakefield Brass Co. will receive bids for the construction of a one-story, 60x90-ft. factory. Devore & McGormley, Toledo, are the Engrs.

Youngstown, Ohio—The Distilled Water Ice Co. has had plans prepared for a new plant, to be erected on West Federal St. The estimated cost is $100,000. William Winsworth is the Mgr. Noted Mar. 12.

LaFayette, Ind.—The Fort Wayne & Northern Indiana Traction Co., Fort Wayne, Ind., is having plans prepared for a one- and two-story car barn and repair shop. The estimated cost is $20,000. Devore & McGormley, Toledo, are Engrs.

Bay City, Mich.—The North American Construction Co., makers of portable houses, has had plans prepared for the erection of a factory, which will have 100,000 sq.ft. of floor space.

+**Detroit, Mich.**—The Telfer Coffee Co. has awarded a contract to DeLISLE & COOKER, 37 Campan Bldg., Detroit, for the construction of a three-story, 30x150-ft. warehouse, at $40,000. Joseph E. Mills & Son, 510 Washington Arcade, have prepared the plans.

Carbondale, Ill.—The Carbondale Bottling & Ice Cream Co. has purchased a site on South East and Walnut St. where it plans to erect a new plant.

Chicago, Ill.—T. C. Dennely, furniture manufacturer, has had plans prepared for the erection of a brick furniture factory at 81 East Van Buren St. The estimated cost is $118,000. F. A. Perkins is the Arch.

Chicago, Ill.—Morris & Co., 1455 West 44th St., Chicago, meat packers, has had plans prepared and will erect a two-story brick factory to cost about $40,000. F. A. Fielder is the Arch.

Peoria, Ill.—The Kise Electric Co. plans the erection of a 50x200-ft. factory.

Madison, Wis.—The Heibel Bottling Co. is having plans prepared for a two-story, 54x100-ft. bottling works, to be constructed on North Fairchild St., at an estimated cost of $15,000. F. L. Kronenberg, Slichter Bldg., Madison, is the Arch.

Manitowoc, Wis.—The Aluminum Specialty Mfg. Co. plans to build a one-story, 60x200-ft. factory, with provision for additional stories. Emil Krug is the Pres.

Milwaukee, Wis.—The Chicago, Racine & Milwaukee R.R. will receive bids for the erection of a 112x130-ft. reinforced concrete warehouse at the foot of Erie St. The estimated cost is $100,000. Archs., Schnetzky & Son, have prepared the plans. Noted June 4.

Rockton, Wis.—The Great Northern Mfg. Co., manufacturers of [illegible] has acquired a site where it is planned to erect a new factory.

Des Moines, Iowa—[illegible] & Strathers, [illegible] Sixth Ave., are having plans prepared for the construction of a two-story, [illegible]-ft [illegible] factory to cost [illegible]. Proudfoot, Bird & Rawson, [illegible] Bldg., are the Archs.

Marshalltown, Iowa—The [illegible] Furnace Co. has had its plans [illegible] and will receive bids for the construction of a two-story [illegible]-ft factory. The estimated cost is [illegible]. W. S. [illegible] Co., [illegible] Euclid Bldg., Cleveland, Ohio, has prepared the plans. Noted July [illegible], 1913, Feb. 26.

Sioux Falls, S. D.—The Manchester Biscuit Co., Sioux Falls, plans to build a seven-story, [illegible]x120-ft factory. Joseph Schwarz, Sioux Falls, is the Arch.

Kansas City, Mo.—C. M. Beachy and associates, of Wichita, Kan., have organized the [illegible] Ice Co., and will build a plant with a daily capacity of [illegible] tons. The estimated cost is [illegible]. Plans by the McCandish Engineering Co., Kansas City.

St. Joseph, Mo.—The Chicago, Burlington & Quincy R.R. Co. plans to erect a grain elevator of [illegible] bu. capacity. The estimated cost is [illegible].

♦**St. Louis, Mo.**—The Interstate Printing Co., 39 Laclede Ave., has awarded the contract for the construction of a one-story printing plant to L. W. PETERS, St. Louis, at [illegible].

Earle, Ark.—The Planters [illegible] & Gin Co. plans to erect and equip a plant here, estimated to cost [illegible].

Rochester, Nev.—The Rochester Mines Co., Humboldt County, Nev., plans to erect an all-slime cyaniding plant, estimated to cost [illegible]. John F. Cowen is Pres.

Biggs, Calif.—The California Rice Milling Co. plans to enlarge its plant at an estimated cost of about $10,000. J. B. Hayes is in charge.

Chico, Calif.—The Associated Oil Co. has purchased a tract of land in Chico Vecino, bordering the Southern Pacific R.R., where it plans to erect a distributing station, to cost $12,[illegible].

Colton, Calif.—The California Portland Cement Co. plans to build [illegible] to its plant which will raise its capacity to [illegible] bbl.

Los Angeles, Calif.—The Harbor Commission plans to erect a seven-story, [illegible]x[illegible]-ft reinforced-concrete warehouse opposite [illegible] Island wharf. The estimated cost is $1[illegible].

Oakland, Calif.—The R. M. [illegible] Co., Los Angeles, Calif., plans to build a fiber-box plant estimated to cost about [illegible].

South Pasadena, Calif.—The [illegible] Co., [illegible] South San Pedro St., is having plans prepared for a group of new factory additions. [illegible] F. Marsh, Broadway Central Bldg., Los Angeles, is the Arch.

♦**Montreal, Que.**—The Canadian Pacific Ry. Co., Montreal, has awarded the contract for additions to its Angus shops to [illegible] CO., LTD. Sub-contract for furnishing the piles was let to the RAYMOND CONCRETE PILE CO., LTD., Montreal. Noted Sept. [illegible].

Fort William, Ont.—The M. M. Patterson Co. plans to erect a [illegible]-bu. capacity grain elevator.

♦**Hamilton, Ont.**—The National Steel Car Co. has awarded the contract for the construction of the addition to its passenger car plant to the HAMILTON BRIDGE CO.

Selkirk, Man.—The [illegible] Paper & Pulp Mills, Ltd., [illegible] St., plans the construction of a new mill to cost [illegible].

♦**Medicine Hat, Alta.**—The [illegible] Sanitary [illegible] Co. has awarded the general contract for the construction of its factory to [illegible], Spokane, Wash., at [illegible]. [illegible], is the Pres.

FEDERAL GOVERNMENT WORK

Steel and Wire—[illegible]

Steel Work—[illegible]

Breakwater Extension—[illegible]

Paving—[illegible]

Rotary Converters—[illegible]

♦**Bulkhead**—[illegible]

Street Work—[illegible]

♦**Post Office**—Covington, Va.—Oscar Wenderoth, Supervising Arch., Treasury Dept., Washington, D. C., has awarded the contract to OLIN GERLACH, Frostburg, Md., for constructing the proposed post office at Covington, at $39,9[illegible].

Post Office—Georgetown, Ky.—Bids were received as follows, Aug. 12, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Georgetown, (a) limestone, (b) sandstone: James Devine, [illegible], Ohio, (a) $6[illegible], (b) $[illegible]; Westchester Engineering Co., White Plains, N. Y., (a) $6[illegible], (b) $7[illegible]; M. Yeager & Sons, Danville, Ill., (a) $67,9[illegible], (b) $71,867; George W. Stiles Construction Co., Chicago, Ill., (a) $6[illegible]; W. H. Fissel & Co., New York, N. Y., (a) $6[illegible],33, (b) $66,733; [illegible] Lumber Co., Lexington, Ky., (a) $[illegible]; Volney [illegible] Taylor, Huntington, W. Va., (a) $61,[illegible], (b) $71,[illegible]; N. H. [illegible], Danville, Ill., (a) $61,[illegible]; J. S. Rogers Co., Moorestown, N. J., (a) $66,00[illegible], (b) $68,0[illegible]; G. H. Munnelley Co., Georgetown, Ky., (a) $[illegible], (b) $[illegible]; George Hocking, Chattanooga, Tenn., (a) $61,812, (b) $61,81[illegible]. The building will be two-story and basement, ground area [illegible] sq.ft., fireproof construction, stone facing and composition roof.

♦**Post Office**—Delavan, Wis.—The contract for the construction of the post office at Delavan has been awarded to the NORTHERN CONSTRUCTION CO., [illegible] Milwaukee St., Milwaukee, Wis., at $43,939. The building is to be completed in 15 months.

Building—Milwaukee, Wis.—Bids were received as follows, Aug. 11, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a building for Appraiser's Stores at Milwaukee, (a) limestone, (b) sandstone: Northern Construction Co., Milwaukee, (a) $89,822, (b) $90,122; General Construction Co., Milwaukee, (a) $94,3[illegible], (b) $[illegible]; American Construction Co., Milwaukee, (a) $95,900, (b) $[illegible]6,500; F. W. Tadley & Son, Milwaukee, (a) $91,300, (b) $91,800; the Rauf Co., Milwaukee, (a) $[illegible], (b) $[illegible]7,300; Coddington Engineering Co., North Milwaukee, (a) $128,938. The building will be two stories and basement, 7200 sq.ft. ground area, pile foundations, fireproof construction, brick facing, composition roof.

Post Office—Winfields, Kan.—Bids will be received until Sept. 3, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for constructing the post office at Winfield.

Post Office—Mandan, N. D.—Bids will be received until 3 p.m., Sept. 21, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for constructing a post office at Mandan.

Post Office—Uvalde, Tex.—[illegible]—Bids will be received until 3 p.m., Oct. 6, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for constructing the post office at Uvalde. The building will be one story and basement and will have a ground area of [illegible] sq.ft.

Steel, Etc.—Oklahoma City, Okla.—Bids will be received until Sept. 2, by the State Capitol Commission, for [illegible] tons of reinforcing steel, 10,[illegible] bbl. portland cement, 3[illegible] cu.yd. of sand, 6[illegible] cu.yd. of rock and [illegible] M. ft. of lumber.

Wood Stave Pipe—Denver, Colo.—The following have been recommended for award by the U. S. Reclamation Service, Denver, for wood-stave pipe for the Belle Fourche Project, S. D., the Uncompahgre Project, Colo., and the North Platte Project, Neb.: Washington Pipe & Foundry Co., Tacoma, at $[illegible]; Pacific Tank & Pipe Co., Portland, Ore., at $[illegible].

Canal—Phoenix, Ariz.—Bids will be received until 2 p.m., Aug. [illegible], by the U. S. Reclamation Service, Phoenix, for constructing the Wallace Feeder Canal, Salt River Project, Ariz.

Riprap—Washington—Bids will be received until Aug. [illegible], by the Lighthouse Inspector, Portland, Ore., for riprap work at Robinson Point, Browns Point, [illegible] Point and Point Wilson light stations, Wash.

Buildings—Hawaii—Bids were received as follows by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., Aug. 1[illegible], for the construction of five buildings at the naval station at Pearl Harbor, Hawaii, (a) paint shop and rigging loft, [illegible] ft., (b) pattern shop, [illegible] ft., (c) steel storehouse, [illegible] ft., (d) metal and lumber storehouse, [illegible] ft., (e) boat storehouse, [illegible] ft.: [illegible] Planing Mill & Lumber Co., Honolulu, Hawaii, (a) $1[illegible], (b) $[illegible], (c) $[illegible], (d) $[illegible], (e) $13,[illegible], total $[illegible]; Lord-Young Engineering Co., Honolulu, Hawaii, (a) $[illegible], (b) $[illegible], (c) $[illegible], (d) $[illegible], (e) $[illegible], total $[illegible]; [illegible] Construction Co., San Francisco, Calif., (a) $1[illegible], (b) $[illegible], (c) $[illegible], (d) $[illegible], (e) $1[illegible], total $[illegible]; W. N. [illegible] Co., San Francisco, Calif., (a) $1[illegible], (b) $[illegible], (c) $[illegible], (d) $[illegible], (e) $1[illegible], total $[illegible].

MISCELLANEOUS

Dredging—Boston, Mass.—Bids will be received until Aug. [illegible], by the Directors of the Port for [illegible] cu.yd. of dredging in Dorchester Bay. Frank W. Hodgdon is Ch. Engr.

♦**Dredging**—Boston, Mass.—The State Board of Harbor and Land Commissioners has awarded the contract to JOHN [illegible], Boston, for dredging [illegible] Harbor, at [illegible] [illegible]

♦**Dredging**—Boston, Mass.—The Directors of the Port [illegible] Frank W. Hodgdon, Boston, is Ch. Engr.

Tunnel—Boston, Mass.—The Boston Transit Commission [illegible]

Barge Canal Work—Albany, N. Y.—Bids were received Aug. 11 by Duncan W. Peck, State Supt. Pub. Wks., Albany, for (a) Contract No. 1-A; (b) Contract No. 34; (c) for highways adjacent to the Hinckley Reservoir; (d) for bridge over the Erie Canal at Yorkville, Oneida County; (e) for highway change, Road N, adjacent to Contract No. 19; (f) for Hinmansville highway change; (g) for highway bridge over the canalized Mohawk River at Movable Dam 5. The lowest bids follow: (a) Holler & Shepard, Rochester, N. Y., $120,459; (b) Champlain Engineering and Construction Corporation, Saratoga Springs, N. Y., $16,843; (c) J. L. Richmond, Little Falls, N. Y., $93,981; (d) Scott Bros., Rome, N. Y., $94 582; (e) W. L. O'Day, 263 Norwood Ave., Buffalo, N. Y., $4455 (sole bidder); (f) I. M. Ludington Sons Co., Rochester, $2505; (g) Lupfer & Remick, Buffalo, $42,976.

★**Lavatories**—Albany, N. Y.—(Official)—Bids will be received until 2 p.m., Aug. 26, by the Trustees of Public Buildings, Executive Chamber, Capitol, Albany, for new lavatories for the state capitol. Lewis F. Pilcher, Albany, is State Arch.

Shipyard—Albany, N. Y.—The New York & Buffalo Barge Co. plans to construct a ship yard at Albany.

✚**Concrete Pile Foundations**—New York, N. Y.—(Official)—Contracts for the concrete pile foundations of the following structures have been awarded to the MacARTHUR CONCRETE PILE & FOUNDATION CO., 11 Pine St., New York: Grain bins and elevator, Stanard Tilton Milling Co., Alton, Ill.; bakery for Ward Baking Co., East Orange, N. J., Cramp & Co., general contractors, New York, C. B. Comstock, Arch., 110 West 40th St., New York; weave shed, Salt's Textile Mfg Co., Bridgeport, Conn.; Dowling & Bottomley, general contractors, Bridgeport.

Playground—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 10:30 a.m., Aug. 28, by the Public Recreation Commission, Municipal Bldg., Borough of Manhattan, for constructing the Betsey Head memorial playground in Brownsville, Brooklyn.

Subway—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 12:15 p.m., Sept. 11, by the Public Service Commission, 154 Nassau St., Borough of Manhattan, for constructing Route 29, a part of the Eastern Parkway rapid transit railroad.

Fire Apparatus—Jersey City, N. J.—Frank Hague, Dir. Pub. Safety, is considering the addition of the following equipment for the Fire Department: Two motor-driven pumping engines, estimated cost $20,000;. two new motor tractors for fire engines, estimated cost $8500; two aerial trucks ,estimated cost $22,000; and the installation of new fire alarm boxes to cost about $2500.

✚**Coal Conveyor**—Jersey City, N. J.—The Public Service Corporation has awarded contracts as follows, for constructing its proposed coal conveyor: Foundations, to STILLMAN-DELAHANTY-FERRIS CO., 16 Exchange Place, Jersey City; superstructure to R. D. COOMBS & CO. Estimated cost, $12,000.

★**Dock**—Newark, N. J.—(Official)—Bids will be received until 3:15 p.m., Aug. 27, by the Board of Street and Water Commissioners for the construction of a dock approximately 4500 ft. long along the northerly side of the city channel now being dredged near the mouth of Peddie St. Ditch in Newark Bay.

The work will be divided into two sections. Sect. No. 1, approximately 2500 ft. long, being that portion inshore from the present shore line westerly. Sect. No. 2, approximately 2000 ft. long, is that section from the present shore line out in the bay following the line of the channel now being dredged. Although the dock will be a continuous construction it will be divided into two sections in the contract as they differ somewhat in the form of construction and the contractor will be required to start his work at the easterly end of Sect. No. 1 and complete at least 1000 ft. of this section before Dec. 1, 1914. The completion of Sect. No. 2 will depend upon the completion of the bulkhead or cribbing in the bay which will form the northerly side of this section.

The estimated quantities of materials to be furnished under this contract and upon which unit prices are asked for in the bids are the following: 405,500 lin.ft. creosoted short leaf yellow pine piles; 78,850 lin.ft. untreated short leaf yellow pine piles; 90,000 lin.ft. white oak piles—fender and snubbing; 3,319 M. ft. B. M. sawed creosoted long leaf yellow pine lumber; 4,025 cu.yd. concrete; 143,900 lb. reinforcing steel concrete; 4500 lin.ft. of standard gage railroad track, 100 lb. rails; 4,500 lin.ft. 10-ft. gage derrick track, 150 lb. rails; 150 snubbing cleats, cast-iron, in place; 32,000 tons, riprap; (ton of 2000 lb.).

The plans and specifications for this work are on file in the office of Morris R. Sherrerd, Ch. Engr.

✚**Coal Breaker**—Highland, Penn.—C. B. Markle & Co. have awarded the contract to WHEELER & RILEY, Wilkes-Barre, Penn., for constructing a coal breaker at Highland, at $80,000.

✚**Stable**—Wilmington, Del.—The Hauber Baking Co. has awarded the contract to ELWOOD SHARP, Wilmington, for constructing a two-story stable, 40x100 ft.

Drainage—Goldsboro, N. C.—W. K. Allen, Consult. Engr., Wilmington, N. C., has been retained by Wayne County Drainage District to prepare plans and specifications for a district of 6000 acres. It is planned to issue $90,000 in bonds for the proposed work.

Levee Work—Shreveport, La.—The Caddo Levee District Board has rejected all bids opened Aug. 5 for levee work, aggregating 15,000 ft. along the right bank of the Red River.

✚**Wharf**—Danville, Tenn.—The Louisville & Nashville Ry. Co., has awarded the contract to the MECHAM CONTRACTING CO., Hopkinsville, Ky., for constructing a reinforced concrete wharf at Danville, at $40,000.

Drainage—Selmer, Tenn.—F. M. Patten, Consult. Engr., Jackson, Tenn., has made surveys for a drainage system for Big Snake Creek Drainage District.

Stadium—Cincinnati, Ohio—The University of Cincinnati will ask for bids soon for a stadium to seat 13,000.

☆**Excavation, Etc.**—Cleveland, Ohio—Bids were received Aug. 13, by A. R. Callow, Comr. Purchases and Supplies, for excavating, transporting and disposing of all material necessary to prepare the present site for the construction of the proposed South Side sewage treatment works. The lowest bid was submitted by Charles Fath & Co., Cleveland, at $86,078 for Division 1 and $94,288 for Division 2. The approximate quantities follow: Engineer's office, complete; 2900 lin.ft. of surface drain; furnishing and placing 3850 lin.ft. of 6- to 15-in. vitrified pipe; 316,000 cu.yd. of excavation; transportation and disposal of material; 1800 tons of stone riprap.

Levees—Dayton, Ohio—The earthwork contract calling for about 1,200,000 cu.yd. will be under way this fall. This is a river improvement, which will result in the reclamation of a large area of low ground within the city limits. G. C. Cummin is City Engr.

★**Creek Improvement**—Greenville, Ohio—(Official)—Bids will be received until 11 a.m., Aug. 22, by J. L. Morgan, County Audr., Greenville, for the Stillwater Creek Improvement. For details see advertisement under "Contracts to Be Let."

✚**Dock and Wall**—Detroit, Mich.—The Department of Public Works has awarded the contract to JOHN GINZEL, Buhl Block, Detroit, for constructing a concrete dock and retaining wall along the river front, at $13,823.

Drainage—Clintonville, Wis.—Farmers plan to drain 10,000 acres of land in the vicinity of Clintonville. E. R. Jones, Soil Expert, College of Agriculture, University of Wisconsin, Madison, Wis., is in charge.

✚**Mausoleum**—Marshfield, Wis.—W. D. Conroy plans to erect a mausoleum at Marshfield. The contract for the marble required has been awarded to the HARRISON GRANITE CO., New York, at $20,000.

Fire Apparatus—Milwaukee, Wis.—Bids will be received until 10:30 a.m., Aug 21, by the Department of Public Works for two automobile combination pumping engines and hose wagons.

Bath-house—Milwaukee, Wis.—The city plans to construct a bath-house at McKinley Park Beach. Estimated cost, $25,000. C. J. Pinney, Supt. Bridges and Bldgs., is in charge.

✚**Ditches**—Stevens Point, Wis.—The Daney Drainage District has awarded the contract to the ROOD CONSTRUCTION CO., Grand Rapids, Wis., for constructing about 16 miles of ditches, at about $30,000.

Ditches—Forest City, Iowa—C. K. Nelson, County Audr., has rejected all bids opened for ditch work in District 35. New bids will be received until Sept. 22.

Drains—Nevada, Iowa—Bids will be received until 1:30 p.m., Aug. 25, by C. A. Batman, County Audr., Nevada, for constructing drains in Indian Creek Township.

Barn—Sioux City, Iowa—The Sioux City Stockyards Co. will ask for bids soon for a barn to cost $22,000. It will be two stories, 200x200 ft. W. L. Steele, Sioux City, is Arch.

Wall—Waterloo, Iowa—C. A. Roby, City Engr., is preparing plans for a flood protection wall to be constructed along the east bank of the Cedar River and opposite the waterworks plant.

✚**Ditch**—Fairmount, Minn.—The County Supervisors, Aug. 4, awarded the contract to W. C. MARKLAND & CO., Fairmount, for constructing Ditch 39, at $39,990.

Ditch—Slayton, Minn.—W. A. Seeman, County Audr., Slayton, has rejected all bids for constructing Ditch No. 2.

★**Cement**—Kansas City, Mo.—(Official)—Bids will be received until 2 p.m., Sept. 11, by the City Purchasing Agent, for furnishing and delivering asphaltic cement for the use of the municipal asphalt plant for a period of one year. Estimated amount, 1500 tons. Specifications may be had of Clark R. Mandigo, Asst. City Engr.

Drainage—Davenport, Ark.—Davenport Drainage District has been organized to reclaim about 13,120 acres. Bonds for $75,000 will be issued.

Levees—Melana, Ark.—The property owners in the Bottom Belt Levee District, July 29, authorized a bond issue for $350,000 to complete proposed levees. John Quarles, Helena, Ark., is Ch. Engr.

✚**Drainage**—Judsonia, Ark. — Little Red River Drainage District has awarded the contract to McGREG & FOSTER, Cotton Plant, Ark., for drainage work calling for about 300,000 cu.yd., at 14.45c. per cu.yd. The first 100,000 cu.yd. has been sublet to JOHNSON & WAGGON, Judsonia.

✚**Drainage**—Judsonia, Ark.—Bids were opened, July 20, by the Commissioners of Overflow Drainage District of White County at Judsonia, for drainage work calling for 594,700 cu.yd. of excavation. Contracts have been awarded as follows: 18,000 cu.yd., F. O. WHITE, Bald Knob, Ark., at 16c. per cu.yd.; 576,700 cu.yd., to E. J. HAHN, Little Rock, Ark., at 9.4c. per cu.yd.

Levee Work—Caldwell, Tex.—Burleson county has voted to issue $136,000 in bonds to repair and enlarge the levee along the Brazos River, in the eastern part of the county.

Pier—Redondo Beach, Calif.—The city plans to construct a recreation pier to cost $121,000.

Cement—Seattle, Wash.—Bids will be received until Aug. 27 by the Port of Seattle Commissioners for 7500 bbl. of portland cement to be used in grain elevator construction.

Dam—Seattle, Wash.—The Board of Public Works will award the contract soon for constructing Cedar River Dam. Estimated cost, $150,000.

Dock—Seattle, Wash.—The Grand Trunk Pacific Ry. plans to construct a reinforced concrete dock to replace the structure recently destroyed by fire, with a loss of $350,000. S. P. Lucas, Harbor Engr. for the company, is in charge of the proposed work.

Dock Work—Portland, Ore.—The Port of Portland Commissioners has authorized the sale of $150,000 of bonds, part

of the [illegible] to be used to improve the docks in the east and west sections of the city.

Fire Hose—Portland, Ore.—Bids will be asked soon by the City Purchasing Agent for 14,650 ft. of fire hose.

Number Plates—Sacramento, Calif.—Bids will be received by F. A. McClure, State Engr., Sacramento, for 120,000 pairs of automobile number plates, etc.

Mausoleum—Riverside, Calif.—The California Mausoleum Co., [illegible], Calif., will construct a reinforced-concrete and marble mausoleum in Riverside, to cost about $80,000.

Levee Work—Sacramento, Calif.—Bids will be asked at once by the state for levee work to cost $300,000. J. C. Boyd, Sacramento, is Engr.

Ferry Slips—San Francisco, Calif.—The state has had plans prepared for two ferry slips to be constructed at the south end of [illegible] Ferry. Estimated cost, $125,000. W. F. McClure, Sacramento, Calif., is State Engr.

Seawall—Santa Barbara, Calif.—(Official) The city has awarded the contract to the MERCERAU BRIDGE & CONSTRUCTION CO., Los Angeles, Calif., for constructing the seawall on west boulevard, at $16,392, for Type "E" wall. Other bidders were: Mesmer & Rice, Los Angeles, $61,099; [illegible] & Munoz, Los Angeles, $58,812; Russell-Green Foell Co., Los Angeles, $64,300; Beatty Construction Co., Santa Barbara, $59,374; Ashton-Bridgeman Co., San Francisco, $59,4[illegible]; T. J. Shea, Berkeley, $63,323. Engineer's estimate, $65,[illegible]47. It will be 17.5 ft. high and 1876 ft. long. George Robinson is City Engr.

Bank Protection—Stockton, Calif.—The state plans to spend $3[illegible] and the State Engineering Board $20,000 for bank protection work at Stockton. W. F. McClure, Sacramento, Calif., is State Engr.

Harbor Improvements—Haileybury, Ont.—The Public Works Department, Ottawa, Ont., is preparing plans for harbor improvements at Haileybury to cost about $10,000.

Drydock—Owen Sound, Ont.—The city plans to construct a drydock. F. F. Pitts, Niagara Falls, Ont., is Engr.-in-Charge.

BUILDINGS

✚Lewiston, Maine—Jones & Barnabee, Boston, Mass., are preparing plans for the theater on Main and Middle Sts. The estimated cost is $75,000. The contract for the foundation has been awarded to GEORGE W. LANE, Lewiston.

✚Barre, Vt.—The contract for erecting a hotel at Barre has been awarded to the W. SHELTON SWALLOW CO., 10[illegible] West [illegible]th St., New York, N. Y. The building will be of brick and stone, six stories, 37x130 ft., and is estimated to cost $7[illegible]. George N. Bartlett, 103 Park Ave., New York, N. Y., is the Arch.

✚Barre, Vt.—The contract for building the addition to the high school was awarded to W. E. JACKSON, Montpelier, Vt. The building will be of brick, two stories, [illegible]x122 ft., and will cost $48,000. F. A. Walker, 43 State St., Montpelier, and Brainerd & Leeds, 8[illegible] Franklin St., Boston, Mass., are the Archs. Alfred S. Kellogg, [illegible]3 State St., Boston, is the Engr.

Boston, Mass.—The city contemplates the construction of an industrial school for boys, estimated to cost, including site, $[illegible]. Richard A. Lynch is Supt. of School Bldgs.

✚Boston, Mass.—The contract for constructing the six-story brick building at 29 Edinboro St., for Daniel C. Collins, has been awarded E. STODDARD & SONS CO., 85 Purchase St.

Fall River, Mass.—E. I. Marvell, 57 North Main St., is preparing plans for a school on Tucker St., to cost about $80,000. The building will be two stories, of brick.

✚Springfield, Mass.—The contract for constructing the six-story brick and reinforced concrete business building for [illegible], Pickard & Wheat, has been awarded to FREDERICK T. LEY & CO. B. Hammett Seabury is Arch.

West Springfield, Mass.—Hiles & Lavalle, Springfield, Mass., are preparing plans for a three-story and basement brick school at Park and Elm Sts.

✚Winchester, Mass.—The contract for the construction of [illegible] station has been awarded to F. C. ALEN [illegible] The estimated cost is [illegible] K. Jewett is the Bldg. Comm. Edward [illegible] Cornhill, Boston, is the Arch.

✚Worcester, Mass.—The contract for constructing the brick [illegible] the Dodge estate has been awarded to the [illegible] Co., Worcester, at about $[illegible]. Noted July [illegible].

New Britain, Conn.—Bids will be received by [illegible] Hartford, Conn., for the construction of two buildings on [illegible] Court for the Y. W. C. A. [illegible] stories, [illegible] ft., the other two stories, [illegible] ft.

New London, Conn.—Plans are being prepared by [illegible] for a three-story and basement building for [illegible]. The estimated cost is $[illegible]

Buffalo, N. Y.—[illegible] Harvey St. has completed plans for a two-story and basement [illegible] at [illegible] and [illegible] Ave. [illegible]

Bids will be received by [illegible] until Aug. [illegible] for building an addition to Public School No. [illegible] Green & Wicks, 110 [illegible] St., prepared the plans. The estimated cost is $[illegible]

New York, N. Y.—[illegible]

Rochester, N. Y.—Joseph H. Oberlies, Granite Bldg., is preparing plans for a three-story and basement school at Lake Ave., for Nazareth Academy, to cost about $150,000.

✚Utica, N. Y.—The contract for erecting the six-story and basement building for the Mayro Realty Corporation, Inc., has been awarded to R. RICHARDS & SONS. L. Kinne is Arch.

Bayonne, N. J.—The Bayonne City Hall Building Commission will soon call for bids for erecting the new city hall. The cost will be about $250,000. Noted Jan. 15.

Jersey City, N. J.—The Board of Education will build an addition to Public School No. 25, to cost about $120,000.

Newark, N. J.—The Board of Freeholders has commissioned John F. Capen, Arch., to prepare plans for an addition to the Overbrook Hospital, to cost about $200,000.

The Board of Freeholders also contemplate the erection of a sanitarium at Soho Hospital.

✚Elizabethtown, Penn.—The contract for erecting the station has been awarded to the TITZEL CONSTRUCTION CO., Lancaster, at about $40,000. Zantzinger, Borie & Medary, Philadelphia, prepared the plans.

✚North Philadelphia, Penn.—The contract for making alterations to the passenger station has been awarded to the KEYSTONE STATE CONSTRUCTION CO., Pennsylvania Bldg., Philadelphia. The cost is about $70,000.

✚Philadelphia, Penn.—The contract for constructing the one story theater, 26x194 ft., on 17th St., for William I. Greenfield, has been awarded to GEORGE HOGG, Philadelphia, at about $15,000.

✚Thomasville, Ga.—The contract for constructing the school on Mallette Heights has been awarded to the T. E. AMASON & CO., Thomasville, at $12,000.

Lamoille, Fla.—Bids will be received by the Consolidated School District Commissioners until Sept. 1, for constructing a two-story and basement brick and stone school from the plans prepared by A. T. Reimer, Arch., Marshalltown.

Walthall, Miss.—Bids will be received by the Chancery Clerk, until Sept. 8, for constructing a court house, estimated to cost $40,000. Overstreet, Spencer & Paine, Merchants Bank Bldg., Jackson, are the Archs. Noted May 28.

Alexandria, La.—Favrot & Livaudais, Archs., New Orleans, are preparing plans for a school to cost $125,000.

Louisville, Ky.—Joseph & Joseph, Louisville, are preparing plans for alterations and additions to the Great Southern Bldg., Fifth and Walnut Sts. The estimated cost is $150,000.

Louisville, Ky.—J. Earl Henry, Arch., Board of Education, is preparing plans for an eight room school at 34th and Market Sts. The estimated cost is $75,000.

✚Pikeville, Ky.—The contract for constructing the three-story school has been awarded to O. P. RAYMOND, Cynthiana, at about $10,000. A. W. Potter is Supt. of the Board of Education. Noted July 16.

Cleveland, Ohio—Lehman & Schmitt, Garfield Bldg., are preparing plans for a three-story apartment to cost $40,000.

A. F. Janowitz, Permanent Bldg., is preparing plans for a four-story and basement theater for A. M. Gordon, Illuminating Bldg. The cost is estimated at $80,000.

Cleveland, Ohio—Starrett & Van Vleck, 4[illegible] East 17th St., New York, N. Y., are preparing plans for a six-story store for the Best Corporation, Williamson Bldg., Cleveland. The estimated cost is $200,000.

✚The contract for building the two-story and basement railway station for the Cleveland R.R. Co., Leader News Bldg., has been awarded to the W. J. THOMPSON SON CO., 6110 Euclid Ave., Cleveland, at about $[illegible].

William Brown, New Castle, Penn., contemplates the erection of an office building, estimated to cost $1,000,000.

Cleveland, Ohio.—Harry A. Cone, Arch., Schofield Bldg., is preparing plans for a three-story and basement theater [illegible]x110 ft., for V. C. Antoinette, Murry Hill Road. The cost is estimated at $60,000.

Columbus, Ohio—Bids will be received by the Secretary of the Columbus A. C. until about Aug. [illegible], for the construction of a clubhouse, to cost about $3[illegible].

Findlay, Ohio—It is reported that bids will be received by the B. P. O. E. Lodge, until Sept. [illegible], for erecting a two-story and basement lodge building, [illegible]x125 ft., to cost about $60,000. McLaughlin & Hulsken, Savings Bank Bldg., Lima, are preparing plans.

Detroit, Mich.—C. Howard Crane, Dime Bank Bldg., Detroit, is preparing plans for a two-story and basement theater for John H. Kunsky and associates, Dime Bank Bldg. The estimated cost is $[illegible].

✚Grand Rapids, Mich.—The contract for erecting the Grand Rapids City Trust & Savings Bank building on Campau Square has been awarded to OWENS & AMES, Grand Rapids, at about $11[illegible]. The steel contract was awarded to the DETROIT BRIDGE & STEEL CO., at $[illegible].

Detroit, Mich.—[illegible] & R[illegible] Bldg., Detroit, are preparing plans for a three-story and basement building for [illegible], 141 Woodward Ave. The estimated cost is $[illegible].

Grand Rapids, Mich.—[illegible] & [illegible], [illegible] Bldg., Grand Rapids, are preparing plans for a four-story and basement building, [illegible] ft., for the Grand Rapids National City Bank. The estimated cost is $[illegible].

✚Jackson, Mich.—The Board of Education has awarded a contract for the erection of a school to H. D. CONWAY, Jackson, at about $[illegible]. J. W. [illegible] is Secy. of the Board.

Owosso, Mich.—The Free and Accepted Masons contemplate the construction of a four-story and basement temple, estimated to cost $[illegible].

[illegible], Lansing, Mich., is preparing plans for a two-story and basement armory, [illegible] ft., for the city. The estimated cost is $1[illegible].

✚Joliet, Ill.—The contract for constructing the reinforced-concrete and stone school has been awarded to J. W[illegible] [illegible], [illegible], Ind., at $[illegible].

Cedar Rapids, Iowa—The Roman Catholic congregation plans to erect a church costing $50,000.

✚**Marcus, Iowa**—The contract for erecting the church has been awarded to EDWARD McLEAN, Dubuque. The estimated cost is $60,000. William L. Steele, Sioux City, prepared the plans.

✚**Watertown, S. D.**—The contract for erecting a stone church has been awarded to the WISCONSIN CONSTRUCTION CO., Chippewa Falls, at about $65,000.

Grand Forks, N. D.—The Board of Education contemplates the erection of a high school, to cost about $200,000.

Cameron, Mo.—The city has voted $52,000 in bonds for the construction of a school. The previous bond issue was declared illegal. Noted July 9.

Kansas City, Mo.—The contract for erecting the Christian Church hospital has been awarded to the HELLINGER CONSTRUCTION CO., Kansas City. The estimated cost is $200,000.

San Antonio, Tex.—The city and county contemplate the construction of a hospital to cost about $250,000.

✚The contract for building the addition to the courthouse has been awarded to the H. N. JONES CONSTRUCTION CO., at $59,975.

Waco, Tex.—W. T. Watt will erect a hotel to cost about $600,000. Plans have been prepared.

Boise, Idaho—The city has sold $600,000 in school bonds.

✚**Eugene, Wash.**—The contract for erecting the high school has been awarded to A. C. APPLEWHITE at $58,984. Noted June 4.

✚**Lynden, Wash.**—The contract for building the high school has been awarded to JAMES TRAPMAN, Lynden, at about $54,000.

✚**Vancouver, B. C.**—The School Board has awarded the contract for constructing the school to McDONALD & WILSON, at $66,871.

CONTRACT PRICE

Bridge Substructure—Chicago, Ill.—Bids were received Aug. 5 by the Commissioner of Public Works for the construction of the substructure of a double- leaf trunnion bascule bridge over the North Branch of the Chicago River at Belmont Ave., Chicago, from (A) Great Lakes Dredge & Dock Co.; (B) Nash-Dowdle Co.; (C) Byrne Bros. Dredging & Engineering Co.; (D) FitzSimons & Connell Dredge & Dock Co.; (E) Standish & Allan. The item bids were as follows:

Engineering Work at Duluth, Minn.—There is considerable engineering work in progress at Duluth, Minn., this season. The city is doing a large amount of paving, and will construct two miles of concrete road to the new model town of Morgan Park, noted below.

A portland-cement plant is being built by the Universal Portland Cement Co., and adjacent to this the Minnesota Steel Co. is erecting a large steel plant, which probably will be completed next season. This latter company is also constructing a "model town" known as Morgan Park. This work includes building about 140 residences, a hospital, store building, school house, etc; also complete sewer and water supply systems and concrete paving for the principal streets. All of the above work is within the city limits of Duluth.

Not to Build a Non-Union Factory—J. D. Butts, superintendent of construction, for the Ford Motor Co., at Long Island City, denied there was any truth in the rumor that the Ford Co. had declared a policy against the employment of union labor on its new factory addition at Long Island City.

"The entire responsibility," he said, "lay with the contractor. When a contract is awarded the Ford Company is concerned only about its competition and does not attempt to dictate whether the work shall be done by union or non-union labor. However, in the last six months, all contracts which have been let have contained a clause which requires a contractor to keep his work going by the employment of non-union men if the union labor then employed call a strike."

The Terry Steam Turbine Co., Hartford, Conn., announces that it has appointed Fidanque Bros. & Sons, New York and Panama, with main offices at 15 Whitehall St., New York, its representative for the Republic of Panama and the Canal Zone. The Cleveland office of the Terry Turbine Co., in charge of L. G. Finlay, has been removed from 710 New England Bldg. to 503 Union Bldg.

At the Shipyards of the Polson Iron Works, Toronto, Ont., the launching took place recently of the third lighter built there for the Department of Railways and Canals of the Canadian Government. It is intended for service in the development of the Hudson Bay terminals. It is 120 ft. long, 21½ ft. beam and 11 ft. draft, and is of the single-screw type. Its power equipment includes a 250-hp. Clyde boiler. The lighter will be steam heated and electrically lighted. The deck equipment includes two 30-ton winches in addition to stem windlasses and capstan. The machinery and engines were placed in the hull previous to launching.

The Union Fiber Co., Winona, Minn., has opened a branch office at 711 Empire Bldg., Atlanta, Ga., in charge of A. J. McArthur, Southern representative. To facilitate deliveries and to give small buyers the benefit of carload freight rates, the company is keeping on hand in Atlanta a good stock of linofelts, fibrofelts, union corkboard, waterproof lith, pipe coverings and other cold-storage insulation products.

SUBSTRUCTURE OF BELMONT AVE. DOUBLE LEAF TRUNNION BASCULE BRIDGE, CHICAGO

	A	B	C	D	E
Removing obstructions, lump sum	$1,000 00	$1,500.00	$2,000.00	$2,300.00	$3,000.00
Maintaining temporary bridge, etc., lump sum	2,400.00	2,500.00	1,500.00	1,900.00	1,500.00
Coffer-dams, lump sum	23,500.00	24,780.00	23,500.00	24,000.00	27,000.00
4 piles, driving test piles	25 00	40.00	25.00	25.00	25.00
8000 cu.yd. excavation	0.90	1.00	1.00	1.00	1 10
1500 cu.ft. removal sub-piers—limestone	0.15	0.50	0.37	0.35	0.40
100 cu.ft. removal sub-piers—boulders	0.15	1.00	0.75	0.35	0.40
3800 cu.yd. portland concrete piers, etc.	6.50	6.30	7.25	6.50	5 90
250 cu.yd. portland cement mortar	14.00	12.00	13.00	13.00	10.00
9000 cu.ft. sub-piers under main piers	0.70	0 70	0.40	0.55	1.00
2500 cu.yd. concrete in retaining walls	7 25	6.60	7.00	7.50	6.75
270,000 lb. steel reinforcing rods	0.025	0.025	0.03	0.025	0.03
16,500 lb. structural steel	0.05	0.04	0.04	0.04	0.03
80,000,lin.ft. handling steel furnished	0.005	0.01	0.015	0.015	0 0075
8000 lin.ft. creosoted oak piles delivered	0.35	0.35	0.40	0 40	0.45
14,000 lin.ft. Norway-pine-cypress piles delivered	0 13	0.165	0.14	0 17	0.25
17,500 lin.ft. driving piles	0.13	0.12	0.12	0.12	0.15
37 M. ft. b.m. creosoted oak timbers in place	75.00	75.00	75 00	85.00	65 00
75 lin.ft. diverting and extending 7 ft. sewer	12.00	20.00	17.5	18.00	30 00
40 lin.ft. diverting and extending 15-in. sewer	3.00	5.50	5.50	5.00	5 00
6,000 cu.yd. filling on west approach	0.20	0.25	0.25	0 25	0.45
1360 lin.ft. gas pipe railing on approach	1.50	1.75	2 00	2.00	1.00
Extended totals	$108,970.00	$111,325.00	$113,377.00	$113,715.00	$119,670 00

Intercepting Sewer—Newark, N. J.—Bids were received, July 14, by the Passaic Valley Sewerage Commissioners for constructing a part of Section 12 of the Main Intercepting Sewer, from (A) Oscar Daniels Co., Woolworth Bldg., New York; (B) Cauldwell-Wingate Co., New York; (C) Fusco Construction Co., Newark; (D) Merrill-Ruckgaber and Mason, Hilton & Co., New York; (E) James S. Frazer, New York; (F) J. F. Shanley Co., Newark. The item bids were as follows:

The Gade Excavating Co., Iowa Falls, Iowa, has designed an excavating machine of light construction which it states will do the wor kof the heavier type and eliminate the expense and trouble of transporting, etc. The excavator is described and illustrated in a catalog recently issued by the company, giving details of construction, operation, power and method of transportation. Views showing the excavator in actual operation are also shown. The Economy excavator is a 12-ton machine, 35 ft. wide and 24 ft. long, all steel, set on four large wheels. The power is furnished by a gasoline engine and is so arranged that the operator can sit in the middle of the machine and operate the shovel from any point.

INTERCEPTING SEWER, NEWARK, N. J.

Part of Section 12

	A	B	C	D	E	F
Earth excavation and refilling for 120-in. sewer (lump sum)	$131,600.00	$139,000.00	$117,000 00	$111,000 00	$65,000 00	$71,371 86
10 cu.yd. rock excavation	5.00	6 00	5.00	6 00	5 00	4 00
3700 cu.yd. concrete masonry	14.00	10 00	10 00	8 00	9 00	9 00
80,000 lb. steel for concrete reinforcement	0.05	0 01	0 05	0.03	0 01	0.05
1100 tons rip rap	2.50	4 00	3.00	3 00	3 50	2 50
15 sq.yd. granite block paving	5 00	3 50	5.00	5.00	5 00	3 50
60,000 lin.ft. timber piles	0 50	0 50	0.40	0 28	0 50	0 30
5 cu.yd. brick masonry in manholes	15.00	16 00	20 00	20 00	15 00	15 00
Extended totals	$220,350	$213,792	$185,525	$163,335	$135,550	$129,589

INDUSTRIAL NOTES

The MacArthur Concrete Pile & Foundation Co., 11 Pine St., New York, N. Y., has been awarded a contract for the construction of the foundation of a gas holder for the Portland Gas Light Co., Portland, Maine. It will consist of 576 pedestal concrete piles and a 12-in. concrete mat. The Bartlett Hayward Co., Baltimore, Md., is the general contractor for the work.

Contracts to Be Let

Bids received until Aug. 29, 1914.

Construction of an Intake Crib, 36 Inch Cast Iron Intake Main and Concrete Shore Well

Proposals will be received at the office of the Village Clerk of Highland Park, Wayne County, Michigan, until 10 o'Clock A.M., Saturday, August 29th, 1914, for

(A) Furnishing and Placing a Steel Intake Crib.

(B) Furnishing, Trenching, Laying and Backfilling about 2800 feet of 36 inch cast iron water main, from a Steel Intake Crib located about 2500 feet off shore in 16 feet of water, to a well 200 feet in shore from Lake St. Clair, at the Water Works Pumping Station of the Village of Grosse Pointe Farms.

(C) Constructing an 18 ft. diameter Concrete Well, 39 ft. deep.

The right is especially reserved by the Village to reject any or all bids and to accept such proposal as will be to the best advantage of the Village.

Plans and Specifications may be seen after Wednesday, August 12, 1914, at the office of the Clerk of the Village of Highland Park, at the office of Gardner S. Williams, Consulting Engineer, Ann Arbor, Michigan, or will be forwarded upon request to the latter office upon the deposit of a certified check in the amount of $10.00, which sum will be refunded upon the return of the Plans and Specifications in good condition.

Bids received until Sept. 15, 1914.

Hanover Street Bridge

STATE OF MARYLAND STATE ROADS COMMISSION
NOTICE TO CONTRACTORS

SEALED PROPOSALS for building a bascule span section IV of Hanover Street Bridge as follows. Bascule bridge having a clear span between fenders of not less than 150 feet, a clear roadway of 50 feet, and two sidewalks with a width of 8 feet in clear of railings, will be received by the State Roads Commission, at its offices, 601 Garrett Building, Baltimore, Maryland, until 12 M. on the 15th day of September, 1914, at which time and place they will be publicly opened and read.

Bids must be made upon the blank form contained in the book of specifications. Specifications and plans will be furnished by the Commission upon application and cash payment of $1.00, as hereafter no charges will be permitted.

No bids will be received unless accompanied by a certified check for the sum of Twenty-five Hundred ($2500) Dollars, payable to the State Roads Commission.

The successful bidder will be required to give bond, and comply with the Acts of the General Assembly of Maryland, respecting contracts.

The Commission reserves the right to reject any and all bids.

BY ORDER of the State Roads Commission this 6th day of August, 1914.

WM. L. MARCY, Secretary. O. E. WELLER, Chairman.

Bids received until Sept. 8, 1914.

Boilers

NOTICE TO CONTRACTORS. Sealed proposals for two 125 H.P. boilers at the New York State Soldiers & Sailors Home, Bath, N. Y., will be received by Hon. Joseph A. Goulden, President of the Board of Trustees, New York State Soldiers & Sailors Home, Bath, N. Y., until September 8th, 1914, at 11:00 o'clock A.M., when they will be opened and read publicly. Proposals shall be accompanied by a certified check in the sum of five per cent. of the amount of bid, and the contractor to whom the award is made will be required to furnish surety company bond in the sum of fifty per cent. of the amount of contract within thirty days after official notice of award of contract and in accordance with the terms of specification No. 1731. The right is reserved to reject any or all bids. Drawings and specifications may be consulted and blank forms of proposal obtained at the New York State Soldiers & Sailors Home, Bath, N. Y., at the Department of Architecture, Capitol, Albany, N. Y., and at the New York office of the Department of Architecture, Room No. 1121, Woolworth Building, New York City, upon deposit of a certified check or cash in the sum of $[illegible], made payable to the State of New York, which check will be returned if plans and specifications are sent back in good order to the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

WILLIAM H. NICHOLS,
Secretary.

Bath, N. Y., August 14, 1914.

Bids received until Aug. 22, 1914.

Reservoir Improvements

NOTICE TO CONTRACTORS

SEALED PROPOSALS will be received by the Board of Water Commissioners of Waverly, N. Y., until 12 o'clock, noon on the 22nd day of August, 1914, for raising the embankment of their upper reservoir with all its accessories as shown on the plans, or called for in the specifications.

Plans can be seen and specifications obtained at the office of the Board.

The said Board hereby reserves the right to reject any and all bids, or accept any that in their judgment will be for the best interest of the Village.

A bond satisfactory to said Board in amount and sureties will be required of those to whom the contract may be awarded.

Cash or certified check, made payable to the order of the President of said Board to the amount of $[illegible].00 must be deposited by each bidder and accompany his bid as a guarantee that in case the contract is awarded him, he will, within seven (7) days thereafter, execute said contract.

Bids must be sealed and addressed to said Board of Water Commissioners, Waverly, N. Y., and marked on the outside of the envelope enclosing them, "Proposals for Reservoir Improvements."

ANDREW HILDEBRAND, President.

EDGAR D. [illegible], Clerk.

Bids will be received until Sept. 10, 1914.

Dredging

ENGINEER OFFICE OF THE PORT COMMISSIONERS OF JACKSONVILLE, FLA.

Room 218, Realty Building, Jacksonville, Florida.

Sealed proposals for dredging in the St. Johns River at [illegible] for Municipal Dock and Terminal purposes will be received at this office until noon, September 10th, 1914, and then publicly opened.

Information [illegible] with maps of the locality and a [illegible] of the [illegible] may be had at this office.

F. W. BRUCE, Engineer.

Bids will be received until Sept. 10, 1914.

Bulk-Heads

ENGINEER OFFICE OF THE PORT COMMISSIONERS OF JACKSONVILLE, FLA.

Room 218, Realty Building, Jacksonville, Florida.

Sealed proposals for the construction of interlocking steel sheet piling bulk-heads for Municipal Dock and Terminal purposes, will be received at this office until noon, September 10th, 1914, and then publicly opened.

Information may be had and plans of the proposed project may be seen, together with maps of the locality at this office.

F. W. BRUCE, Engineer.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS

New Jersey—Pennsylvania R.R.—This company has notified the Board of Chosen Freeholders of its intention of elevating its tracks at the City Line and White Horse Pike, subject to proper arrangements with the City Council of Camden, N. J., which is now considering the matter. The improvement is estimated to cost $100,000.

Pennsylvania—See item under West Virginia.

✚**Virginia**—Southern Ry.—This company has awarded the contract for second-track work from Charlottesville, Va., to Arrowhead, Va., to W. W. BOXLEY & CO., Roanoke, Va. The work involves a slight revision of grade.

West Virginia—It is reported that the completion of the railroad from Wheeling, W. Va., via Uniontown, Penn., to Pittsburgh, Penn., is under consideration. Officials of the Baltimore & Ohio R.R. Co., it is stated, are interested.

West Virginia—Hamlin & Guyandotte R.R.—This company has been incorporated in West Virginia with $50,000 capital to construct a railroad from a point at or near Hamlin, W. Va., to a point on the Guyandotte River, near West Hamlin, in Lincoln County. The incorporators include L. R. Sweetland, J. S. Pridemore, L. M. Thacker and A. F. Morris, Hamlin; J. W. Dingess, of Huntingon, and George E. McComas, of Milton.

North Carolina—Southern Ry.—This company plans to award contracts soon for 30 miles of second-track between Pelham and Greensboro, N. C. W. H. Wells, Washington, D. C., is Ch. Engr. Const.

Georgia—Georgia & Florida Ry.—This company plans to construct an extension into Savannah, Ga. D. F. Kirkland, Augusta, Ga., is Gen. Mgr.

✚**Tennessee**—Cincinnati, New Orleans & Texas Pacific Ry.—This company has awarded the contract to DUNN & McCARTHY, Chicago, Ill., for second-track work from New River, Tenn., to Sunbright, Tenn., 8.8 miles.

✚**Kentucky**—Illinois Central R.R.—This company has awarded the contract for the extension of its freight yards at Fulton, Ky., to H. W. NELSON, Fulton. The improvement consists of the extension of the old tracks a distance sufficient to accommodate 80 additional cars and the building of new tracks. Estimated cost, $75,000.

Indiana—Chicago & Eastern Illinois R.R.—This company has purchased 70 acres of land at Terre Haute, Ind., as a site for yards, to cost $150,000. L. C. Hartley, Chicago, Ill., is Ch. Engr.

Illinois—Illinois Central R.R. and Baltimore & Ohio Southwestern Ry.—These companies plan to construct a belt line at Springfield, Ill., to divert freight traffic. A. S. Baldwin, Chicago, Ill., is Ch. Engr.

South Dakota—South Dakota Central Ry.—This company plans to award contracts soon for grading its proposed extension from Waterloo, S. D., in a northerly direction. J. C. Wagner, Sioux Falls, S. D., is Ch. Engr. Noted June 18 and Aug. 6.

Arkansas—The construction of a railroad from Hoxie, Ark., to Guion, Ark., 55 miles, is under consideration.

Ashley, Drew & Northern R.R.—This company plans to construct an extension from Monticello, Ark., to Little Rock, 85 miles. R. O. Roy, Crossett, Ark., is Pres. and Gen. Mgr.

Texas—Missouri, Kansas & Texas R.R.—This company has applied to the City Council of San Antonio, Tex., for a franchise to construct a terminal system of tracks. A. M. Acheson, Dallas, Tex., is Ch. Engr.

Delta Land & Lumber Co.—The construction of a 15-mile railroad from Conroe, Tex., into its timber tract, is contemplated by this company. I. H. Fetty, Kansas City, Mo., is interested.

M. J. Healey and associates are interested in the construction of a railroad from Big Spring, Tex., to Texico, N. M., about 175 miles.

California—Los Angeles & San Diego Beach Ry.—This company has applied to the State Railroad Commission for permission to issue bonds for $825,000 for the purpose of electrifying its line. Raymond B. Talbot, San Diego, Calif., is Vice-Pres. and Gen. Mgr.

ELECTRIC RAILWAYS

Franklin, Mass.—The City Council has granted a franchise to the Dedham & Medway Street Ry. Co., to construct and operate an electric railway on Main and Lincoln Sts. Noted July 30.

Springfield, Mass.—The Springfield Street Ry. Co. is considering plans for the extension of its line from Chestnut St. to connect with the electric railway on Page Boulevard. J. F. McCabe, Springfield, is Gen. Mgr.

Buffalo, N. Y.—The Public Service Commission has granted permission to the International Ry. Co. to extend its line through Tracy St. to connect the Grant and Elmwood lines. J. C. Sheldon, Buffalo, is Pur. Agt.

Paterson, N. J.—The Public Service Ry. Co. has applied to the Council for permission to construct an electric railway on Broadway west of Mulberry St. R. E. Danforth, Newark, is Gen. Mgr.

Brownsville, Penn.—The Monongahela Southern Traction Co. has been incorporated to construct and operate an electric railway from Brownsville to California, Penn. The incorporators are C. L. Snowden, F. B. Snowden and C. S. Story, Brownsville, Linn V. Phillips, Uniontown, and J. P. McKelvey, Pittsburgh.

Finleyville, Penn.—According to press reports the Pittsburgh Rys. Co. contemplates the construction of an electric railway from Finleyville to Bentleyville. P. N. Jones, Pittsburgh, is Gen. Mgr.

Waycross, Ga.—Plans have been prepared by the Waycross Street & Suburban Ry. Co. for the extension of its line from Johnson Ave. to Hebardville. N. B. Rhoads, Waycross, is Gen. Mgr. and Pur. Agt.

Columbus, Miss.—The Mississippi Light & Ry. Co. is making preliminary arrangements for the construction of an electric railway from Memphis, Tenn. to Columbus, Miss. F. W. Crisby, Columbus, is interested. Noted July 16.

Lockport, La.—The Louisiana Ry., Light & Power Co. is being organized to construct an electric railway from Lockport to Donaldsville. Walter Ohlmeyer, Plattenville, is interested. Noted July 9.

Dayton, Ohio—The Dayton Street Ry. Co. contemplates the relocation of its tracks on several streets in Dayton. W. L. Smith, Dayton, is Gen. Mgr. and Supt.

Monticello, Ind.—The County Commissioners have granted a franchise to the Lafayette & Northwestern Traction Co., to construct an electric railway through White County. This is part of a proposed line to connect White, Newton, Jasper and Benton Counties. Noted May 28.

Pana, Ill.—According to press reports preliminary arrangements are being made for the construction of an electric interurban railway to connect St. Louis, Mo. and Pana, Ill. H. R. Budd, Bunker Hill, is interested.

Lincoln, Neb.—The Lincoln Traction Co. is preparing plans for the extension of its lines in Lincoln. F. M. Millson, Lincoln, is Pur. Agt.

St. Joseph, Mo.—The St. Joseph Ry., Light, Heat & Power Co. contemplates the extension of its 24th St. line on Prospect Ave., from Market to Third St. Fred E. Henderson, St. Joseph, is Pur. Agt.

Dallas, Tex.—The Fred. A. Jones Co., Dallas, has started preliminary surveys for the construction of an electric railway to connect Dallas and Wichita Falls. William Doran, Dallas, is interested.

Palestine, Tex.—The City Council has granted a franchise to W. H. Brashier, Corpus Christi, to construct and operate an electric railway in Palestine. Noted Aug. 13.

Everett, Wash.—The Everett Ry., Light & Water Co. contemplates the extension of its lines on Maple and First Sts. D. C. Barnes, Everett, is Mgr.

Snohomish, Wash.—The City Council has granted a franchise to the Everett Ry., Light & Water Co., to construct an electric railway from the Northern Pacific R.R. station to Cedar St. D. C. Barnes, Everett, is Mgr.

Dixon, Calif.—The City Council has granted a franchise to the Sacramento Valley Electric Ry. Co. to construct an electric railway in the southern section of the city.

Los Angeles, Calif.—The Pacific Electric Ry. Co. has been granted a franchise to construct an electric railway on Maubert Ave., from Sunset Boulevard to Griffith Park. J. McMillan, Los Angeles, is Gen. Mgr.

LIGHT, HEAT AND POWER

Attleboro, Mass.—The Attleborough Gas Light Co. has purchased a site of 18 acres, upon which it proposes to construct new works.

✚**New London, Conn.**—The Board of Trustees of the Connecticut College for Women has awarded the contract for electric wiring and fixtures in the first group of buildings to the NEW ENGINEERING CO., New London. The cost will be between $8000 and $10,000. Noted July 23.

★**Albany, N. Y.**—The following bids were received Aug. 17, by J. H. B. Hanify, Secy. of the State Hospital Commission, for the construction of a power house, boiler equipment and conduit, and plumbing for the same at the Long Island State Hospital, Brooklyn: Construction of power house, Barnet Bros., New Rochelle, $46,956; A. Winternitz, New York, $47,800; Peter Keeler Building Co., Albany, N. Y., $45,833; W. H. Egan, New York, $32,935. Boiler equipment and conduit, E. Rutzler Co., New York, $74,941; A. Winternitz, $66,000; Blake & Williams, New York, $69,859; W. B. Armstrong Co., Albany, $69,447. Plumbing work, Peter Keeler Building Co., $3150. Noted Aug. 6.

Minetto, N. Y.—The Columbia Mills Co., manufacturer of shade cloths, will build a power plant of 12,000-hp. capacity in connection with the additions to its plant now under construction at a cost of about $500,000.

Burlington, N. J.—The Board of Public Utility Commissioners [illegible] to the Riverside Traction Co [illegible] for [illegible] for the construction of a new [illegible] power plant.

+Butler, N. J.—[illegible]—Bids will be received until 8 [illegible] the Lighting Committee of the Borough Council [illegible] construction of a municipal electric light plant [illegible] Butler. [illegible] & Carey [illegible] Broad St., Newark, are [illegible] in Charge. George J Fritz is Borough Clk. For particulars, see advertisement under Contracts To Be Let, in issue of Aug [illegible]

+Trenton, N. J.—The Princeton Worsted Mills, Trenton, have awarded the contract for the construction of a two-story power house, [illegible] ft., to BURTON & BURTON, Trenton.

Lewistown, Penn.—The Borough Council has passed an [illegible] for a bond issue of $70,000, the proceeds of which will be used for the construction of a municipal electric-light plant. A [illegible] election will be called for the citizens to vote on the question.

+Philadelphia, Penn.—The contract for the electrical work [illegible] South Philadelphia High School has been awarded to [illegible] & SHEPARD, Philadelphia, at $26,[illegible]

Chatham, Va.—[illegible] F W Bryant of the Chatham Light & Power Co., and associates, have incorporated the Pittsylvania Power Co with a capital stock of $[illegible]0,000, and will construct a hydro-electric plant on the Banister River at White Falls to develop 1[illegible]0-hp. About 13 miles of transmission lines will be constructed to furnish electricity in Chatham, Gretna and neighboring towns. The estimated cost of the work is $[illegible]

Clarksville, Va.—The construction of a municipal electric light plant, to cost from $5000 to $10,000, is reported to be under consideration.

Winnsboro, S. C.—See item under "Sewers."

Rock Mart, Ga.—The citizens, on Aug 6, voted in favor of a bond issue of $[illegible] for the enlargement and improvement of the municipal electric light plant. Noted July 30.

Florence, Ala.—The West Florence Corporation will organize with a capital of $1,000,000 for the purpose of developing waterpower on Cypress Creek.

Pineville, La.—The State Board, Baton Rouge, is having plans prepared by Favrot & Livaudais, New Orleans, for the construction of a new power plant at the State Insane Asylum at Pineville.

Flemingsburg, Ky.—The Flemingsburg Light & Ice Co has increased its capital stock from $8000 to $12,000, for the purpose of enlarging and improving its plant. J L O'Bannon is Secy and Mgr.

Olive Hill, Ky.—J A Maddox has secured a franchise for electric lighting in the town, and will install a plant at once.

Defiance, Ohio.—It is reported that the Auglaize Power Co., Defiance, will issue $666,000 in bonds, the proceeds of which will be used to purchase flowage lands for a hydro-electric plant, build an auxiliary steam reserve station, and make additions and extensions to district transmission lines. W P Wallace is Vice Pres and Gen. Mgr of the company.

Loveland, Ohio.—The Loveland Light & Water Co has been organized with [illegible]0,000 capital stock by Stanley Matthews, J A Bechtel, A W Jones and associates. The company will take over and reorganize the local electric light system and water works.

Huntington, Ind.—Bids will be received until Aug 31 by the Board of Public Works for equipment for the municipal electric light and waterworks plant. H I Young is City Clk. Charles Brossman, Merchants' Bank Bldg., Indianapolis, Ind., is Consult Engr. Noted Apr 16 and Aug 20.

Kalamazoo, Mich.—Bids will be received until Aug 31, by Fred L Keeler, Secy State Board of Education, Lansing, Mich., for the construction of a boiler house and tunnel for the Western State Normal School at Kalamazoo. E W Arnold, Battle Creek, Mich., is Arch.

Prairie du Rocher, Ill.—(Official)—Bids will be received until Sept 1 for the installation of an electric light plant and waterworks in the Village of Prairie du Rocher. W F DeFrenne is Village Clk.

Alvord, Iowa.—(Official)—Bids will be received until Sept [illegible] by the City Council for the construction of a municipal electric light plant. Noted Aug 6.

Dayton, Iowa.—At a recent election the citizens voted in favor of granting a franchise to the Central Light & Power Co., [illegible], Iowa, for the establishment of an electric light plant in Dayton.

+Bagley, Minn.—The Water and Light Commission has awarded the contracts for the reconstruction of the municipal electric light plant, which was burned several months ago, to [illegible] & [illegible], at $1[illegible] for the building, and to the NORTHWESTERN ELECTRIC EQUIPMENT CO., St. Paul at $[illegible] for new equipment. Noted July 9 and July [illegible]

Topeka, Kan.—It is reported that bids will be asked about [illegible] by the city for the installation in the municipal electric light plant of a [illegible]-kva., [illegible]-cycle three-phase 23[illegible]-volt turbo-alternator with exciter. [illegible] Stahl is Supt.

North Bend, Neb.—The citizens have voted in favor of a bond issue of $[illegible] for the [illegible] of a municipal electric lighting system.

Parker, S. D.—[illegible]—Bids will be received until 10 [illegible] [illegible] from Aug [illegible] by C L Jones, [illegible] for the construction of an electric light plant to include power station, [illegible] generators, pole line and wiring for street lighting system. J F [illegible], [illegible] Bldg., St. Paul, Minn., is Consult Engr. Noted June [illegible], July [illegible] and Aug [illegible]

Marmarth, N. D.—[illegible] are interested in the establishment of an electric light plant in Marmarth. Application for a franchise has been made to the Village Board.

Glenwood, Ark.—John H [illegible], Hot Springs, Ark., who was recently granted a franchise to construct and operate an electric light plant in Glenwood, will begin building at once.

Guthrie, Okla.—At an election held Aug 11, the citizens defeated the bond issue of $2[illegible]0,000 to be used for the purchase of the electric light and power plant. Noted Aug 6.

+McLoud, Okla.—(Official)—The Board of Trustees has awarded the contract for the construction of a high tension transmission line and electric lighting system in the town of McLoud to the MATER ELECTRIC CO., Guthrie, Okla., at $60[illegible]. Other bidders were: Shawnee Electric Co., $6[illegible]; Oklahoma Electrical Supply Co., $6496; Staley & Fees, $6661; Bushong Electric Co., $6729 and the Kennedy Mercantile Co., $6783. Noted June [illegible] and Aug 13.

Salt Lake City, Utah.—The Salt Lake Light & Traction Co. has been organized with a capital of $1,[illegible]0 to establish power plants and distributing systems. O. J Salisbury is Pres.

Merced, Calif.—It is reported that the San Joaquin Light & Power Co will double the capacity of its gas plant at Merced, and will install new generating machinery. A G. Wishon, Fresno, is Gen Mgr.

New Glasgow, N. S.—The Canadian Provincial Power Co., recently incorporated at New Glasgow, is considering the construction of a hydro-electric plant on the East River at Sheet Harbour, N. S., and about 42 miles of transmission lines to supply the towns of New Glasgow, Stellartown, Westville and Trenton.

Collingwood, Ont.—The Water and Light Commission plans to improve and extend the present system at a cost of about $2[illegible],000. John Chamberlain is Chn. of the Comn.

BRIDGES

New London, Conn.—(Official)—Plans for the construction of a bridge over the Thames River, to be built by the New York, New Haven & Hartford R R Co, are only in the preliminary stages. Edward Gagel, New Haven, is Ch Engr. Noted Aug 20.

Bloomsburg, Penn.—The following bids were received Aug 15, by the Commissioners of Columbia County, for the construction of a concrete bridge over Fishing Creek, near Orangeville: G W Ensign, Inc, Harrisburg, $402[illegible]; Pennsylvania Steel Co, $4[illegible]0; Bender Construction Co., $41[illegible]; Standard Engineering Co, $4838; John Gorrey, $4[illegible]0; J S McIlvaine & Co, $4994; Farris Bridge Co., $4[illegible]0; Reinhard Bros., $[illegible]260.

+Greenville, Penn.—(Official)—The Board of Commissioners of Mercer County, Mercer, has awarded the contract for the construction of the superstructure of a bridge over the Shenango River, at College Ave., Greenville, to the CANTON BRIDGE CO., Canton, Ohio, at $1[illegible],0[illegible]. Other bidders were: Farris Bridge Co, Pittsburgh, Penn., $1[illegible]; T F Hungiville, Smethport, Penn., $10,266; Penn Bridge Co., Beaver Falls, Penn., $10,795; F S Wilson, Kittanning, Penn., $10,180. Noted Aug 6.

New Castle, Penn.—(Official)—Bids will be received until 11 a m, Sept 15, by the Board of Commissioners of Lawrence County, for the construction of a concrete arch over Hettenbaugh Run, Hickory Township. It will be a 50-ft span with a 20-ft roadway. Thomas A Gilkey is Engr. James R Lamoree is Clk of County Comrs.

Scranton, Penn.—The City Council will soon ask for bids for the construction of the Myrtle St Bridge, cost $7[illegible], and the Washington Ave Bridge, cost $21,[illegible]00. William Schenk is City Engr.

+The Commissioner of Public Works has awarded the contract for the construction of the Leggett's Creek Bridge to M STIPP, Scranton, at $5270. Noted July 16.

Washington, D. C.—D E McComb, Engr of Bridges for the District of Columbia, is preparing plans for a viaduct over Benning Road, at the intersection of the Baltimore & Ohio and the Pennsylvania R R. An appropriation of $110,[illegible]00 has been made for its construction.

+Buckingham, Va.—The State Highway Commission has awarded the contract for the construction of a bridge over the Slate River, in Buckingham County, to C R SANDERSON & S W PARKER, at $4[illegible]39. Noted July 16.

+Norfolk, Va.—(Official)—The Norfolk-Berkeley Bridge Corporation has awarded the contract for the construction of a bridge over the eastern branch of the Elizabeth River between Berkeley and Norfolk to the McCLINTIC-MARSHALL CO., Pittsburgh, Penn. It will cost about $350,000. Noted Aug 6.

+Petersburg, Va.—(Official)—The Street Committee of the City Council has recommended the acceptance of the bid of the Virginia Bridge & Iron Co., Roanoke, Va., at $47[illegible], for the construction of a steel bridge over the Appomattox River to Pocahontas. The Canton Bridge Co bid $6133. P G Hunting is Clk of the Com. Noted Aug 13.

+Bluefield, W. Va.—The Norfolk & Western Ry. has awarded the contract for the construction of two bridges across the Tug River to [illegible] & CO., Roanoke, Va., at about $12[illegible],000.

Farmington, W. Va.—The Commissioners of Marion County, Fairmont, are having plans prepared and will soon ask for bids for the construction of a 100-ft. steel bridge at Farmington. P G Wilfong, Fairmont, is Engr., and J. F Philips is Clk of the Comrs.

+Weston, W. Va.—The Commissioners of Lewis County have awarded the contract for the construction of three concrete arches over [illegible] Run, Leading Creek and West Fork River to J D ATKINSON & JOHN DOLAN, Weston, at $[illegible]

+Mount Holly, N. C.—The Commissioners of Gaston and Mecklenburg Counties have awarded the contract for the construction of a bridge over the Catawba River, at Mount Holly, to the VIRGINIA BRIDGE & IRON CO., Roanoke, Va., at $[illegible]. Noted July 9.

Bay Minette, Ala.—(Official)—Bids will be received until noon Sept [illegible], by the Board of Revenue and Road Commissioners of Baldwin County, for the construction of a reinforced-concrete bridge over Hall's Creek, on the Stockton and Tensas Road. [illegible] & Hume, Mobile, Ala., are Engrs-in-Charge.

Greenville, Miss.—Bids will be received until noon, Sept. 7, by the Board of Supervisors of Washington County for the construction of two 100-ft. bridges across Granicus Bayou, on Roads Nos. 205 and 206. W. W. Miller is Chancery Clk. B. B. Gordon is Consult. Engr.

Winona, Miss.—Bids will be received until Sept. 7, by the Supervisors of Montgomery County, for the construction of several bridges. John Harvey is Chancery Clk.

+Louisville, Ky.—(Official)—The Board of Public Works has awarded the contract for the construction of the Depuy St. Bridge to the J. H. CAHILL CONTRACTING CO., Logan and Kentucky Sts., Louisville, at $13,855. Other bidders were: J. W. O'Shea, $13,947; G. R. Gregg, $14,554; L. W. Hancock, $14,705; George M. Eady, $15,146; Henry Bickel Co., $15,426. Noted July 30 and Aug. 13.

Ashland, Ohio—Bids will be received until noon, Sept. 5, by the Board of Commissioners of Ashland County for the construction of two concrete bridges, a riveted truss bridge and repairs to the abutments of several other bridges. H. R. McGuire is Clk. of Comrs.

Cleveland, Ohio—(Official)—Bids will be received until 10 a.m., Sept. 19, by the Board of Commissioners of Cuyahoga County for bridge work, Reports Nos. 3313, 3328 and 3359. E. G. Krouse is Clk. of Comrs.

Delaware, Ohio—(Official)—Bids will be received until noon, Sept. 2, by W. V. Aldrich, Audr. of Delaware County, for the construction of the superstructure of the Home Bridge over the Scioto River, Concord Township, and the superstructure of the Multzer Bridge, over the Olentangy River, Liberty Township. Noted July 30.

Bids will be received until noon, Sept. 10, by the Board of Commissioners of Delaware County, for the construction of the superstructure of the Beiber Bridge, Liberty Township. The bridge will be 340 ft. long, with a 16-ft. roadway.

Fremont, Ohio—(Official)—Bids will be received until 11 a.m., Sept. 12, by P. J. Hasselbach, Audr. of Sandusky County, for the construction of the substructure and superstructure of the Tindall Bridge, across the Sandusky River, Ballville Township. It will be 336 ft. long, concrete piers and abutments, three steel spans. William F. Schepflin is County Surv. Noted May 7 and July 23.

+London, Ohio—(Official)—The Joint Board of County Commissioners of Madison and Franklin Counties has awarded the contract for the construction of a bridge over Big Darby Creek, on the Fuller Mill Road, on the line between the two counties, to the FRITZ-ROMER-COOKE-GRANT CO., Columbus, Ohio, at $12,664. Noted Aug. 6.

Massillon, Ohio—(Official)—Bids will be received until 10 a.m., Sept. 9, by the Board of Commissioners of Stark County, Canton, for the construction of the South Erie St. Viaduct. It is estimated that the superstructure will require 523,000 lb. of steel, while the estimated quantities for the substructure are as follows: Excavation, 600 cu.yd.; No. 7½ concrete, 155 cu.yd.; No. 9 concrete, 64 cu.yd.; No. 3 concrete, 1100 cu.yd.; floor slab and curb, concrete, 219 cu.yd.; roadway finish concrete, 2200 sq.yd.; reinforcing bars, 182,000 lb.; setting pipe railing and posts, 1020 lin.ft. C. L. Stoner is Clk. of Comrs. Noted Aug. 20.

Norwalk, Ohio—(Official)—Bids will be received until 10.30 a.m., Sept. 15, by the Board of Commissioners of Huron County, for the construction and repair of several bridges. L. C. Herrick is County Engr. Charles E. Bloomer is County Audr.

+Portsmouth, Ohio—The Ohio Valley Traction Co., which is controlled by the Portsmouth Street R.R. & Light Co., has awarded the contract for the construction of eight steel bridges and viaducts between Sciotoville and Hanging Rock to the MOUNT VERNON BRIDGE CO., Mount Vernon, Ohio, at about $17,000.

Indianapolis, Ind.—Bids will be received until Sept. 22 (change of date from Aug. 25) by the Board of Commissioners of Marion County for the construction of a bridge over the White River, at West New York St. The previous call for bids was declared irregular. An appropriation of $150,000 has been made for this bridge. W. T. Patten is County Audr. Noted Aug. 6 and 13.

Salem, Ind.—Bids will be received until 1:30 p.m., Sept. 12, by the Commissioners of Washington County, for the construction of four concrete bridges. F. S. Munkelt is County Audr.

+Crystal Falls, Mich.—(Official)—The State Highway Commission, Lansing, has awarded the contract for the construction of a bridge over the Michigamme River, Mansfield Township, Iron County, to McGRATH & SONS, Green Bay, Wis., at $7087. A. L. Burridge is County Audr. Noted Aug. 6 under Lansing, Mich.

+Freeport, Ill.—The City Council has awarded the contract for repairing the Stephenson St. Bridge to W. H. SOHNS, Freeport, at $6600. Other bidders were: Illinois Bridge Co., Chicago, $8333; Northern Steel & Concrete Co., Freeport, $7500; Joliet Bridge & Iron Co., Joliet, $6965.

+Galesburg, Ill.—The Bridge Committee of the Board of Supervisors of Knox County has awarded the conntract for the construction of seven reinforced-concrete bridges, four in Indian Point Township and three in Orange Township, to the DECATUR BRIDGE CO., Decatur, Ill., at $5165.

Chetek, Wis.—The Common Council is endeavoring to secure State and County aid for the construction of a new bridge at this point to cost about $30,000. George R. Hirst, Madison, Wis., is State Highway Engr.

Gordon, Wis.—Bids will be received until Aug. 29, by William Wilkinson, Chn. of the Town Board, for the construction of a reinforced-concrete bridge over the Eau Claire River.

New London, Wis.—(Official)—The construction of a bridge over the Embarass River, bids for which were received on Aug. 18, has been held over for further consideration. It is probable that some changes will be made in the plans. C. J. Thompson is City Clk. Noted Aug. 16.

+Chariton, Iowa—(Official)—The following bids were received by the Board of Supervisors of Lucas County, on Aug. 17, for the construction of (a) an 80-ft. pony truss and (b) a 40-ft. deck-girder bridge: FEDERAL BRIDGE CO., Des Moines, (a) $4795 (awarded contract); IOWA BRIDGE CO., Des Moines, (b) $2820 (awarded contract); Des Moines Bridge Co., (a) $5135; Missouri Construction & Ballast Co., (a) $5800, (b) $2990; Thor Construction Co., (b) $2895; Marsh Engineering Co., (a) $4999, (b) $2834; Parson Construction Co., (a) $3125, of concrete (b) $5059. Noted July 30 and Aug. 6.

+Atchison, Kan.—(Official)—The following bids were received Aug. 17 by the City Council for the construction of a bridge over White Clay Creek at Fourth St.: Leavenworth Bridge Co., $9730; Martin Carroll Co., $9725; L. F. BINS, $9423 (contract awarded); Williams & Sample Construction Co., $10,731; J. J. O'Heron Co., $10,615; Olson & Schmitz, $10,509; Joseph O'Neill Construction Co., $10,701. Noted July 16 and Aug. 6.

Salina, Kan.—Press reports state that bids for the construction of the concrete bridge over the Smoky Hill River, at Iron Ave., will be asked in December. Bids will be received by the Commissioners of Saline County. Wilmarth & Zerbe, Consult. Engrs., prepared the plans. Noted Apr. 30, July 9 and July 16.

Wichita, Kan.—Preliminary plans for the new Woodman Bridge in Riverside Park have been completed by the City Engineer. Final plans will not be drawn until it is known whether the street railway company will pay part of the cost. If built by the city alone, the bridge will cost $15,000 and will have an 18-ft. roadway and two 5-ft. sidewalks. If the railway company will contribute, the bridge will cost $22,500, and there will be a 33-ft. roadway and two 5-ft. sidewalks. Bert C. Wells is City Engr. Noted July 23 and Aug. 13.

Fargo, N. D.—Bids will be received until 10 a.m., Sept. 5, by Addison Leech, Audr. of Cass County, for the construction of two concrete bridges in Raymond Township, and for one reinforced-concrete bridge in Harmony Township.

+Corpus Christi, Tex.—(Official)—The Commissioners of Nueces County have awarded the contract for the construction of a concrete causeway across Nueces Bay, connecting Nueces and San Patricio Counties, to W. L. PEARSON & CO., Houston, Tex., at $88,296. Other bidders were: J. H. Richardson, Houston, $92,994; H. C. Gass, Houston, $101,477; the Richland Concrete Co., Corpus Christi, $105,273. Noted Sept. 18 and Dec. 25, 1913, and Mar. 26 and July 30, 1914.

Marble Falls, Tex.—See item under "Water Supply and Irrigation."

Palestine, Tex.—The Commissioners Courts of Anderson and Cherokee Counties plan the construction of a steel bridge across the Neches River, between the two counties.

+San Antonio, Tex.—The City Council has awarded the contract for the construction of a bridge at Nueva St. to JOHN O. KELLEY, at $13,379. List of bidders noted Aug. 20.

+Tulsa, Okla.—The Commissioners of Tulsa County have awarded the contract for the construction of four bridges on the Sand Springs-Wekiwa Road, northwest of Tulsa, to the OKLAHOMA IRON WORKS, at $7380; the contract for two bridges on the same road was awarded to the CANTON BRIDGE CO., at $1920. Bids for the construction of a bridge on the Bird Creek Road, to cost about $12,000, were held in abeyance. It is not probable that the bridge will be built this year. Noted July 23.

Colorado Springs, Colo.—It is reported that the City Commissioners have authorized the Department of Public Works and the Park Commission to proceed with the reconstruction of the Bijou Viaduct, at an estimated cost of $75,000, and to repair the Huerfano St. Bridge. F. F. Mailon is City Engr.

+Moab, Utah—(Official)—The Commissioners of Grand County have awarded the contract for the construction of the Dewey suspension bridge over the Grand River to the MIDLAND BRIDGE CO., Kansas City, Mo., at $20,350. There were three other bidders. Noted Aug. 13.

Seattle, Wash.—Bids will be received until Sept. 5, by the City Comptroller, for the sale of $829,500 in bridge bonds, the proceeds of which are to be used for the construction of two bridges over Lake Washington Canal. Noted July 23.

Walla Walla, Wash.—The lowest bids for the construction of the Dell Sharp Bridge over the Touchet River were those of Charles G. Huber, Seattle, at $8697 for a steel bridge, or $9890 for one of reinforced concrete. E. B. Shilley, Walla Walla, is Engr. in Charge. Noted July 16.

Portland, Ore.—The City Council has made an appropriation of $11,910 for the redecking of the Grand Ave. and Union Ave. Bridges. The Portland Ry., Light & Power Co. will add $1430 to this amount for paving between the car tracks. Work will be begun at once.

+Chico, Calif.—The City Trustees and the Board of Supervisors of Butte County have awarded contracts for the construction of a bridge across Big Chico Creek, and one at Angels Slough, to the CHICO CONSTRUCTION CO., at $4941 and $3965, respectively. Noted July 23.

Corona, Calif.—Bids will be received until 10 a.m., Sept. 9, by A. B. Pilch, Clk. of the Bd. of Supervisors of Riverside County, Riverside, for the construction of a bridge across the Santa Ana River, on North Main St., near Corona.

+Eureka, Calif.—The Board of Supervisors of Humboldt County has awarded the contract for the construction of a bridge across the Eel River, at Fort Seward, to the MERCER-FRASER CO., at $29,700. Other bidders were: Frank H. Green, $29,900; F. L. Smith, $31,000, and Elsmore & Jacobs, $31,650. Noted May 28.

Bids will be received until Sept. 15 by the Board of County Supervisors for the construction of four bridges: One at Ballou's Ford over the Salt River, and three over the Mattole River. The estimated cost of the four is approximately $15,000.

Los Angeles, Calif.—Bids will be received until 11 a.m., Sept. 2, by the Board of Supervisors of Los Angeles County, for the construction of a reinforced-concrete bridge across

[illegible] Creek on the Los Alamitos Road. It will have two 3[illegible]-ft. spans and will require about 350 cu.yd. of concrete, [illegible] lb. of steel and wood piles.

The Board of Public Works has approved plans prepared by the City Engineer for the construction of a bridge over the Arroyo Seco at Ave. Forty-three. Homer Hamlin is City Engr.

Red Bluff, Calif.—(Official)—Bids will be received until 1[illegible] a.m., Sept. 1[illegible], by the Board of Supervisors of Tehama County, for the construction of a bridge across Willow Creek, in Road Dist. No. 1. H. G. Kuhn is Clk. of the Bd. of Supervisors.

♦San Diego, Calif.—The San Diego & Arizona Ry. Co. has awarded a contract aggregating about $[illegible],000, to the LLEWELLYN IRON WORKS Co. for furnishing steel for bridges.

♦San Jose, Calif.—The Board of Supervisors of Santa Clara County has awarded the contract for the construction of a reinforced-concrete bridge over Walnut Creek, to G. H. FIELD, San Jose, at $[illegible].

Stockton, Calif.—Press reports state that the Secretary of War has approved plans for two bridges, to be built over the San Joaquin River, on the new Borden Road between Stockton and Oakland. They will be of steel, each 53[illegible] ft. long and 26 ft. wide, with draw spans of 260 ft. and approaches 13[illegible] ft. long.

♦Ventura, Calif.—A contract for the construction of 600 ft. of concrete pile trestle has been awarded to the McCREARY BRIDGE & CONSTRUCTION CO., Pacific Electric Bldg., Los Angeles, at $20,27[illegible].

St. Catherines, Ont.—The ratepayers, Aug. 19, voted in favor of a by-law for the construction of a steel viaduct over the old Welland Canal, at Shipman's Gore, to Western Hill. The estimated cost is $[illegible]20,000, of which the Grand Trunk Ry. has agreed to pay $20,000 and the Dominion Government will give $[illegible]0,000.

WATER SUPPLY—IRRIGATION

●Gardiner, Maine—(Official)—Bids will be received at the office of the Gardiner Water District, until 3 p.m., Sept. [illegible], for constructing a covered slow sand filter with appurtenances. For details, see item under "Contracts to Be Let."

West Pownal, Maine—Bids will be received by Carl J. Hedin, Supt. Maine School for Feeble Minded, until Sept. 1, for constructing a concrete tank, filter, pumping station, furnishing pumps, and laying water mains. Arthur B. Fels, [illegible] Union St., Portland, is Engr.

Williamstown, Vt.—The installation of a water system is under consideration. Surveys have been made by Fred S. Dudley, Randolph.

Pittsfield, Mass.—The General Electric Co. plans to construct a new reservoir at Perinne Ave., to cost $110,000.

●Hartford, Conn.—(Official)—Bids were received by the Board of Water Commissioners, Aug. 19, for constructing a gravel surface road south of the Nepaug Reservoir under Contract 7 as follows: Louis Longhi & Bro., Torrington, Conn., $2[illegible],32[illegible]; Archie B. Cadwell, New Britain, Conn., $24,100; A. V[illegible] Construction Co., Thompson, Conn., $24,415; and 12 others. C. M. Saville is Ch. Engr. Noted Aug. 6.

Waterbury, Conn.—The Board of Works has been authorized to proceed with the tapping of the Thomaston Ave. water main. The water will be carried to the proposed pumping station on [illegible] St. and then to Burnt Hill, where a reservoir will be constructed.

Niagara Falls, N. Y.—The city contemplates purchasing the plant of the Western New York Co. W. D. Robbins, [illegible], has been retained by the city to estimate the value.

●Ogdensburg, N. Y.—Bids were received, Aug. 17, by the State Hospital Commission, Albany, for constructing a water softening plant at the St. Lawrence State Hospital: William [illegible], $6775; and [illegible] Booth Co., Jersey City, N. J., $[illegible]. Noted Aug. 6.

●Atlantic City, N. J.—(Official)—Bids will be received by the Board of Commissioners until Sept. 10, for increasing the [illegible] of the lower Doughty Pond. For details see advertisements under "Contracts To Be Let."

Avon by the Sea, N. J.—The Board of Public Utility Commissioners [illegible] recommendations to the Monmouth County Water Co. to make extensions in its system in [illegible] Neptune Township.

Collingswood, N. J.—The Borough Council has applied to the New Jersey State Public Utilities Commission for permission to install a municipal water system.

Stewartsville, N. J.—A water company is being organized [illegible] Stewartsville [illegible].

Aspinwall, Penn.—The council contemplates [illegible] for the improvement of the water system.

♦●Blairsville, Penn.—(Official)—The contract for furnishing a pumping engine for the water works [illegible] to A. B. CAMERON STEAM PUMP WORKS, Pittsburgh, Penn., at $[illegible]. Noted July [illegible].

Grove City, Penn.—The citizens contemplate issuing $[illegible] in bonds, the proceeds to be used for the improvement of the water system.

Newville, Penn.—At a meeting of the Town Council it was voted to issue bonds for the purchase and improvement of the water system.

Philadelphia, Penn.—Bids will be received by the Director of Public Works until Aug. [illegible] for furnishing pumping machinery [illegible] and the boiler house and other improvements.

[illegible], Penn.—The [illegible] Water Co. has been given a franchise to construct a water system in [illegible].

Ocean City, Md.—The city will construct a standpipe 1[illegible] ft. high in connection with the water supply.

Jonesville, Va.—Press reports state that Robert L. Pennington, Pres. Powell Valley National Bank, will construct waterworks systems in two towns. He is in the market for machinery.

Clinton, N. C.—Bids will be received until Sept. 15, for the construction of a municipal water system. A. B. Crumpler is Mayor and William M. Piatt, Durham, N. C., is Engr.

Manchester, Ga.—The J. N. Hazlehurst Co., Engr., Atlanta, has been retained by the city to make surveys for the water and sewer systems. Noted July 9.

♦Panama City, Fla.—The contract for extending the water system has been awarded to WALTON & WAGNER, Atlanta, Ga., at $12,00[illegible]. F. A. Black is City Clk.

Birmingham, Ala.—An election will be held Sept. 21 to vote on the proposition of issuing $[illegible],000,000 in bonds the proceeds to be used for the construction of a water system. Julian Kendrick is City Engr.

Plaquemine, La.—An election will be held Sept. 16 to vote on the proposition of issuing $12,000 in bonds for the extension of the water system and for installing a fire alarm system. Noted Dec. 18.

Erwin, Tenn.—A franchise has been granted to the Erwin Water Co. to construct a water system estimated to cost $15,000. About 15,000 ft. of c.i. pipe with valves, pumps and tanks of 250,000 gal. capacity will be installed. C. H. Jenks is Engr.

Friendship, Tenn.—The Business Men's League contemplates establishing a water system and electric light plant. Dr. D. A. Walker is Pres.

Midway, Ky.—The installation of a water system is being considered.

Cincinnati, Ohio—(Official)—Bids will be received by the Director of Public Service until noon, Aug. 31, for installing steam piping, fittings and valves for the Western Hills Pumping Station. Philip Fosdick is Dir.

Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, Room 513 City Hall, until noon, Sept. 3, for constructing a drain at the site of the clear water reservoir for the filtration plant at Division Pumping station. Plans and specifications are on file with Charles F. Schultz, Comr. of Water.

♦Cleveland, Ohio—Contracts have been awarded for a 500-hp. boiler with equipment, to BABCOCK & WILCOX CO., at $7424 and for lead pipe to GIBSON & PRICE CO., Cleveland, at $5245.

Continental, Ohio—Press reports state that bids will be received by the Village Council, until Aug. 2[illegible], for enlarging and extending the water system.

Lima, Ohio—(Official)—Bids will be received until noon, Sept. 14, by the Board of County Commissioners for installing a water supply system in the Allen County Court House, Lima. H. J. Lawlor is Clk. of Bd.

Steubenville, Ohio—The reservoirs, according to press reports, will be covered and lined at an estimated cost of $40,000. T. M. Kennedy is City Clk.

Xenia, Ohio—Pollard & Ellms, Engrs., Cincinnati, have been engaged by the city to investigate a new water supply.

Huntington, Ind.—Bids will be received by the Board of Public Works, until Aug. 31, for repairing the water system and electric light plant. Charles Brossman, Merchants Bank Bldg., Indianapolis, is Consult. Engr. Noted Aug. 2[illegible].

Red Bud, Ill.—(Official)—An election will be held Sept. 5 to vote on the question of issuing $15,000 in bonds the proceeds to be used for the construction of a water system. Wilford A. Thompson, [illegible] Ch[illegible] Bldg., East St. Louis, Ill., is the Engr.

Prairie du Rocher, Ill.—See item under Light, Heat and Power.

Sears, Ill.—The Board of Village Trustees has authorized the construction of a water system.

Muscoda, Wis.—Bids will be received until Aug. 31 for laying water mains in Water St., including hydrants, valves, etc. [illegible] Viele is Village Clk.

Oconomowoc, Wis.—The Common Council contemplates constructing another water works intake into Lake La Belle. C. H. Schroeder is City Clk.

Ackley, Iowa—The citizens voted at a recent election to purchase the water plant. The system will be improved. Noted Aug. 6.

Estherville, Iowa—Bids will be received by the City Auditor until 8 p.m., Aug. [illegible], for laying water mains and installing hydrants.

♦Humeston, Iowa—The contract for installing a water system has been awarded to [illegible] CONSTRUCTION CO., Kansas City, Mo., at $[illegible]. Noted Jan. [illegible].

♦[illegible]ville, Iowa—(Official)—Bids were received Aug. [illegible], for extending the water system and for furnishing [illegible] pipe and fittings. The contract for furnishing pipe was awarded to AMERICAN CAST IRON PIPE CO., Kansas City, Mo. All bids received for the general contract were rejected [illegible] of exceeding the engineer's estimate. [illegible] were later advertised and the contract was awarded to COMMERCIAL CONSTRUCTION CO., Kansas City, Mo., at $[illegible]. David G. Fisher & Co., Davenport, are the Engrs. Noted July [illegible].

Morning Sun, Iowa—At an election held Aug. 1[illegible] the citizens voted to issue bonds for the construction of a water system. Harper & Stiles, Grand Ave. Temple, Kansas City, Mo., are the Engrs. Noted July [illegible].

Rockwell City, Iowa—Bonds for $1[illegible] for the extension of the water system have been voted. Noted July 9.

Sioux Rapids, Iowa—Bids will be received until 2 p.m., Sept. [illegible], by Fred Burke, City Clk., for constructing a 7[illegible]-gal. steel water tank. Plans are on file with M. J. Evinger, Ames.

+St. Paul, Minn.—The contract for furnishing about 20,000 ft. of water pipe has been awarded by the city to AMERICAN CAST IRON PIPE CO., Birmingham, Ala.

Virginia, Minn.—Plans have been prepared by Frederic Bass, Consult. Engr., Minneapolis, for the construction and equipment of a pumping station for the water system. E. F. Johnson is City Engr.

Wellington, Kan.—Bids will be received until 2 p.m., Sept. 8, for furnishing about 61,000 ft. of water mains, with the necessary valves and special castings and for constructing a 500,00 gal. elevated tank and tower. The Benham Engineering Co., 435 American National Bank Bldg., Oklahoma City, Okla., is the Engr. Noted Aug. 6.

+Palmyra, Neb.—(Official)—Bids were received Aug. 14 and contract awarded to ALAMO ENGINE & SUPPLY CO., Omaha, at $9492, for installing a water system. C. O. Martz, Lincoln, is the Engr. Noted July 30.

Parker, S. D.—(Official)—Bids will be received by C. L. Jones, City Audr., until 10 a.m., Sept. 4, for improving the water system. J. F. Druar, 316 Commercial Bldg., St. Paul, Minn., is Consult. Engr. Noted Mar. 5.

Wahpeton, N. D.—Bids will be received by S. H. Murray, City Audr., until 8 p.m., Sept. 8, for installing a mechanical gravity filter plant with a capacity of 1,000,000 gal. Lewis P. Wolff, St. Paul, Minn., is Engr. Noted Oct. 9, and Aug. 20.

Three Forks, Mont.—See item under "Sewers."

Excelsior Springs, Mo.—The Excelsior Springs Water, Gas & Electric Co. plans to spend about $50,000 for the extension of its plant and pumping station. S. W. Henderson is Mgr.

+St. Louis, Mo.—The contract for waterproofing Settling Basin No. 7 has been awarded by the city to HEMAN CONSTRUCTION CO., St. Louis, at $19,251.

Arkansas Pass, Tex.—Bonds for $5000 for the extension of the water system have been voted.

Harlingen, Tex.—The land owners of the Harlingen Irrigation District have voted $750,000 in bonds for the purpose of taking over the irrigation system of Lon C. Hill and associates and to improve and extend the works and also to construct a system of drainage for the district. Noted May 28.

Lufkin, Tex.—An election will be held Sept. 10 to vote on the proposition of issuing $25,000 in bonds for the extension of the water system and for installing a filtration plant. C. N. Humason is Mayor.

Magnolia Park, Tex.—(Houston post office)—The citizens contemplate spending $150,000 to construct a water system and for paving.

Marble Falls, Tex.—An election will be held Sept. 5 to vote on the proposition of issuing bonds for the construction of a water system, street paving and constructing a new bridge.

New Boston, Tex.—All bids received Aug. 3 for installing a water system have been rejected. The contract will be readvertised. Nagel & Petersen, Muskogee, Okla., are the Engrs. Noted July 30.

Talihina, Okla.—The citizens have authorized the expenditure of $15,000 for the extension of a water system to Talihina. A. B. Shibley is Mayor. Noted July 16.

Florence, Ariz.—John M. Williams, Bisbee, Ariz., and associates will construct pumping plants and shallow wells to irrigate about 1500 acres of land near Florence.

Ellensburg, Wash.—At a recent election the citizens voted to install an auxiliary pump for the municipal water system. Noted May 14.

Toppenish, Wash.—Bids will be received by C. A. Wyckoff, City Clk., until 8 p.m, Sept. 7, for constructing a 75,000-gal. tank, 105 ft. above ground and for laying 15,000 ft. of c.i. water mains. Noted Aug. 6.

Janesville, Calif.—John B. Christie, Ray Doyle and Frank Dicious will construct an irrigation system in Lassen County. The estimated cost is $70,000.

Oakdale, Calif.—An election will soon be held to vote on the proposition of issuing $40,000 to complete the Oakdale Irrigation system. Noted July 2.

San Diego, Calif.—Bids will soon be received for the installation of a new filter plant for the water system. H. R. Fay is Supt. of Water and H A. Whitney is Hydraulic Engr.

+The contract for installing a 4-stage centrifugal type pump and motor has been awarded by the city to SOUTHERN FOUNDRIES CO., 1970 India St., San Diego, at $7911.

San Diego, Calif.—The Cuyamaca Water Co., plans to construct a pipe line along the state highway between East San Diego and La Mesa to carry water from the wells to the University Heights reservoir.

SEWERS

Boston, Mass.—(Official) The following bids were received by the Metropolitan Water and Sewerage Board for constructing the cast-iron outflow sewer on Nut Island and in Boston Harbor: J. H. Ferguson, 22 Parkman St., Dorchester, $$69,400, H. P. Converse & Co., $51,340; McCarthy & Walsh, 154 Saratoga St., East Boston, $41,670; G. M. Bryne, 166 Devonshire St., Boston, $42,100; The T. A. Scott Co., Inc., 282 Pequot Ave., New London, Conn., $39,350; John H. Gerrish, 101 Tremont St., Boston, $38,810; Roy H. Beattie, Inc., 247 Atlantic Ave., Boston, $36,310; W. H. Ellis & Co., 37 Condor St., Boston, $37,790. Charles D. Smith, 1 Ashburton Pl., is Chief Engr. Noted Aug. 13.

Boston, Mass.—Bids will be received by the Public Works Department, until Aug 31, Sept. 2 and Sept. 4, for sewerage construction in various sections of the city. L. K. Rourke is Comr.

+Boston, Mass.—The contract for sewer construction in Rowe St., West Roxbury, has been awarded by the Department of Public Works to ANTHONY CEFALO, at $7432. L. K. Rourke is Comr. Noted July 23.

Ansonia, Conn.—The Board of Sewer Commissioners has authorized the preparation of plans for a one mile extension of the sewer system. V. B. Clarke is City Engr.

Wallingford, Conn.—(Official)—Bids will be received by the Warden and Court of Burgesses, until Sept. 8, for constructing about 3200 ft. of 18- to 24-in. vitrified pipe sewers; also for first quality vitrified pipe tile.

Gates, N. Y.—Bids will be received by M. J. Magin, Town Clk., until Aug. 28, for constructing vitrified pipe sewers in Emerson and McNaughton Sts.

+Oswego, N. Y.—(Official)—The contract for constructing vitrified pipe sewers in various streets has been awarded to SAMUEL BONN, Syracuse, at $12,400. Charles W. Linsley is Comr. Pub. Wks. Noted Aug. 6.

+Rochester, N. Y.—The contract for constructing sewers as follows has been awarded by the Board of Contract and Supply to JOHN PETROSSI: In Field St. and Thurston Rd., at $17,491; in Chili Ave., at $3907, and in Genesee Park Blvd. and Brooks Ave., at $4264.

Syracuse, N. Y.—(Official)—The following bids were received by the Syracuse Intercepting Sewer Board, on Aug. 20, for constructing a storm water sewer in the First and Second Wards: C. T. Hookway Construction Co., Syracuse, $57,721; John Young, Syracuse, $64,726; Cantrell Construction Co., Philadelphia, Penn., $66,365; Gaffey & Burns, Syracuse, $72,085; Marnell & Bonn, Syracuse, $78,160; Samuel Bonn, Syracuse, $79,276; Bruno Pizzimenti, Seneca Falls, N. Y., $88,208; James Ferry & Sons, Baltimore, Md., $90,111; Whiting Turner Construction Co., Baltimore, $93,571. Glenn Holmes is Chief Engr. Noted Aug. 6.

Newark, N. J.—The Board of Public Works will construct a sewer in Rodwell Ave., to connect with the sewer system in Vailsburg.

Paterson, N. J.—Bids will be received by the Board of Public Works, until Sept. 1, for constructing sewers in various streets. H. J. Harder is City Engr.

Perth Amboy, N. J.—Bids will be received by the City Council, until Sept. 7, for constructing sewers in the Brace Ave. Section. George M. Adair is Street Comr.

Port Reading, N. J.—The Township Committee has decided to construct vitrified pipe sewers in various streets, to connect with the sewer system in Woodbridge, N. J. Andrew Keyes is Township Clk.

+Trenton, N. J.—The City Commission has awarded the contract for constructing sewers in the 11th ward to ANTONIO DE LUCIA, 55 Butler St., Trenton, at $10,048.

West Orange, N. J.—The lowest bid submitted to the Board of Freeholders for constructing sewer in Northfield Ave. was from J. T. Boylan, at $6448.

+Carbondale, Penn.—It is reported that the contract for constructing the sewer in West Carbondale has been awarded by the City Council to MATHIAS STIPP, at about $50,000.

North Wales, Penn.—Bids will be received by the Borough Council, until Sept. 5, for constructing a sewer system and sewage-disposal plant. Remington & Vosburg, 601 Market St., Camden, N. J., are Consult. Engrs. Noted Aug. 20.

Union City, Penn.—Bids will be received by Homer D. Johnson, Borough Clk., until Sept. 2, for constructing sewers in various streets.

Pollock (Federalsburg Post Office), **Md.**—The citizens have voted $45,000 in bonds for constructing a sewer system and water-works.

Winnsboro, S. C.—The citizens have voted $100,000 in bonds for constructing sewers, water-works and for enlarging and improving the electric-lighting plant.

Manchester, Ga.—The city has commissioned the J. N. Hazelhurst Co., Atlanta, Ga., to make a survey for constructing a sewer system and water-works.

★Savannah, Ga.—(Official)—Bids will be received by the Mayor and Aldermen, until noon, Sept. 1, for the construction of sanitary and storm water sewers. For further information see advertisement under "Contracts to Be Let."

Baton Rouge, La.—The lowest bid received by the Mayor and Common Council for constructing vitrified pipe sewers, flush tanks, etc., was from E. M. Shellow, Houston, Tex., at $19,700. Noted Aug. 2.

+Paintsville, Ky.—The contract for installing the storm and sanitary sewer system has been awarded by the Board of Trustees to SAMUEL COLLIER, Ashland, Ky., at about $5000.

Canton, Ohio—Bids will be received by the Director of Public Service until noon, Aug. 28, for constructing storm sewers in various streets. W. E Sarver is City Engr.

Cincinnati, Ohio—Bids will be received by Philip Fosdick, Dir. of Pub. Service, until Aug. 31, for constructing sewers in various streets.

Cincinnati, Ohio—(Official)—The following bids were received by Philip Fosdick, Dir. of Pub. Service, for constructing sewers in the ravines between Madison Road and Duck Creek Road: Thomas Maloney, Cincinnati, (a) brick and vitrified pipe, $26,389; (b) reinforced-concrete pipe and vitrified pipe, $33,785; (c) concrete and vitrified pipe, $24,940; John Demsey, Norwood, Ohio, (a) $31,055, (b) $43,880, (c) $34,763; M. J. McCarthy, Cincinnati, (a) $31,249, (b) $41,232, (c) $15,650; John B. McClane & Co., Newport, Ky., $33,918, (b) $32,313, (c) $42,995; Welling & Franz, Cincinnati, (a) $32,668, (b) $36,319, (c) $36,959; James Luff Construction Co., Cleveland, Ohio, (a) $33,492, (c) $33,104; Connelly Construction Co., Cincinnati, (a) $33,116, (b) $48,564, (c) $38,564; Kirchner Construction Co., Cincinnati, $33,724, (b) $39,008, (c) $39,008; Thomas P. Strack, Cincinnati, (a) $34,205, (b) $36,114, (c) $71,684; Cannell-Ames Construction Co., Columbus (a) $40,166, (b) $38,261, (c) $40,166. Noted Aug. 13

Cleveland, Ohio—The lowest bid [illegible] for [illegible] necessary to prepare the [illegible] for construction of permanent works of [illegible] treatment works was from John F. [illegible], at $[illegible]. Noted Aug 6

✦**Cleveland, Ohio**—The contract for the construction of a [illegible] at Newburg Heights has been awarded to CHARLES FATH & CO., [illegible] Bldg., Cleveland, at $[illegible]. Robert Hoffman is City Engr

Coshocton, Ohio—Chester & Fleming, Consult. Engrs., Pittsburgh, [illegible], have been commissioned by the City Council to prepare plans for constructing the proposed sewage-disposal plant, also additional sewers in various streets

✦**Dayton, Ohio**—The contract for constructing a sewer in East First St has been awarded to BOYD & COOK, Dayton, at $[illegible]

Findlay, Ohio—Bids will be received by the Director of Service until [illegible], Sept [illegible], for constructing a combined storm and sanitary sewer. Joseph Page is Clk

Kenton, Ohio—The City Council has decided to construct a sewer in the eastern section, also to improve and extend sewers in the western section of the city. Charles E. Hutchison is City Engr

Marion, Ohio—The City Council has adopted a resolution providing for the construction of a trunk sewer and drain from the Church St sewer. The estimated cost is $21,041. Thomas E. [illegible] is City Engr

Sandusky, Ohio—The lowest bid received by the City Council for constructing the intercepting sewer in the South [illegible] District was from the J. C. Carlin Co., Toledo, at $19,[illegible] for brick, $2[illegible],280 for concrete and $32,730 for cast iron, on first section and $40,131 for brick, $38,208 for concrete and $77,813 for cast iron on second section

Gary, Ind.—The following bids were received by the Board of Public Works for constructing Local Sewer No. 39: M. W. Hoben, Gary, $6163; Shea & Co., Hammond, $6189; John Kavanaugh, Gary, $6[illegible]; M. D. Heney, $6757. A. J. Fulton is City Engr. Noted Aug 6

✦**Freeport, Ill.**—The contract for constructing about 2½ miles of sanitary sewers has been awarded by the City Council to the GUND & GRAHAM CO., Freeport, at $16,912

Lincoln, Ill.—The city contemplates the installation of a sewer system to cost about $60,000

Lake Mills, Wis.—Bids will be received until Aug 29, for constructing sanitary sewers in Grant and Franklin Sts. W. G. Kirchoffer, Madison, is Engr. W. E. Penn is Mayor

✦**Racine, Wis.**—The contract for constructing sanitary sewers in Augusta, Wolff and Geneva Sts and Layard and Douglas Aves has been awarded to the HARDING CO., Racine, at $89,108. The same company was also awarded the contract for constructing sewers in 12th St and Washington Ave., at $[illegible],088, requiring 7[illegible]- and 75-in. brick sewer, manholes and catchbasins and concrete outfall

✦**Sheboygan, Wis.**—The contract for constructing 10-in. sewers in South 17th St and Georgia Ave has been awarded to the DAVID VAN STELLA CO. J. Donohue is City Engr

✦**Burlington, Iowa**—(Official) The contract for constructing a concrete trunk sewer has been awarded by the City Council to the YOUNG & BUESCHER CONSTRUCTION CO., 7[illegible] South Seventh St., Burlington, at $76,120. Other bids were: Burlington Construction Co., $18,[illegible]00; Nash-Dowdle Co., $[illegible]; O'Hagan & Lake, $78,100; Western Construction Co., $81,180; Grimm & Gehrie, $80,080. H. G. Vollmer is City Engr. Noted Aug 6

Council Bluffs, Iowa—Bids will be received by Charles J. [illegible], City Clk., until [illegible] p.m., Aug 31, for constructing sewers in various streets. The work calls for about [illegible] ft 6-in., [illegible] ft [illegible]-in., [illegible] ft 10-in. and 1685 ft 12-in. sewer pipe

✦**Dyersville, Iowa**—(Official) The contract for constructing [illegible] and 1[illegible]-in. vitrified pipe sewers has been awarded to J. A. [illegible], Dubuque, at $[illegible]. W. C. Loosbrock is Town Clk. Noted July [illegible]

Holstein, Iowa—Bids will be received by A. G. Merkley, [illegible], until Sept [illegible], for making the improvements to its sewage treating plant, consisting of three intermittent sand filters, a sludge tank, three alternating sewage siphons and other miscellaneous appurtenances

✦**Sioux City, Iowa**—The contract for constructing the [illegible] sewer system has been awarded to the [illegible] CONSTRUCTION CO., Waterloo, Iowa, at about $[illegible]

North Bend, Neb.—The citizens have voted $16,000 in bonds for constructing sewers

Fort Benton, Mont.—The lowest bid received by the City [illegible] for constructing the sewer system was from [illegible], at $[illegible]. Noted May [illegible]

Three Forks, Mont.—[illegible] & [illegible], [illegible], are preparing plans for extending the sewer and water systems

✦**Houston, Tex.**—[illegible]

Italy, Tex.—[illegible]

San Antonio, Tex.—Bids will be received by the City Clerk [illegible]

Seattle, Wash.—[illegible]

[illegible], Calif.—[illegible]

✦**Richmond, Calif.**—[illegible]

✦**Washington, D. C.**—(Official)—Bids will be received by the Commissioners of the District of Columbia, until 2 p.m., Oct 1[illegible], for the collection and disposal of garbage, ashes, miscellaneous refuse and dead animals in the District of Columbia

Charlotte, N. C.—(Official)—Bids will be received by A. H. Wearn, City Clk., until [illegible] p.m., Sept 14, for the construction of a garbage incinerator

Wellsville, Ohio—The city is considering the installation of a garbage-disposal plant

✦**Detroit, Mich.**—(Official)—Bids will be received by the Department of Public Works, until 10 a.m., Sept 21, for machinery and equipment for a garbage-disposal plant. For details see advertisement under "Contract to Be Let"

STREETS AND ROADS

✦**Boston, Mass.**—A contract for constructing 10[illegible]0 lin ft of state road in Taunton has been awarded to D. J. SHEEHAN, Lynn, at $8691. Other bids were: H. L. Thomas, Middleboro, $8690; D. W. Buckle, Providence, R. I., $1[illegible]; Horne-Lowe Construction Co., Millbury, $1[illegible],478; C. T. Alger, Taunton, $12,431; D. M. Riggs & Co., $12,[illegible]; Lane Paving Co., Hingham, $13,079; J. McCormick, East Providence, R. I., $13,797; F. E. Ellis, Melrose, $14,[illegible]; W. J. Donovan, Fitchburg, $14,431; James A. Gaffey, Medford, $14,461; William A. Murtfelt, $16,403. Noted Aug 13

Hartford, Conn.—Bids were received by Charles J. Bennett, State Highway Comr., Aug 18, for road work as follows:

Manchester Township, about 6[illegible]0 lin ft: (a) plain concrete with unwashed sand, (b) plain concrete with washed sand, (c) reinforced concrete with unwashed sand, (d) reinforced concrete with washed sand, (e) hassam. This work includes 11,910 sq yd of excavation and 233[illegible] sq yd of surfacing—Olmsted & Olmsted, Inc., East Hartford, (a) $16,771, (b) $17,470, (c) $17,677, (d) $18,356; Bristow Bros & Knowles Corporation, Narragansett Pier, R. I., (b) $17,717, (d) $18,682; A. C. Sternberg Jr Construction Co., West Hartford, (a) $14,454, (b) $16,784, (c) $17,735, (d) $18,06[illegible]; W. T. Ryan Construction Corporation, Hartford, (b) $18,71[illegible], (d) $19,910; Connecticut Good Roads and Construction Co., New Britain, (c) $18,253, (d) $19,069; Connecticut Hassam Paving Co., New Haven, (e) $20,538

City of Danbury, about 2[illegible]84 lin ft: (a) plain concrete with washed sand, (b) plain concrete with unwashed sand, (c) hassam, (d) warrenite, (e) amiesite, (f) bituminous concrete. This work includes 7[illegible]50 sq yd grading and [illegible] sq yd surfacing—Warren Bros Co., Boston, Mass., (d) $1[illegible],61[illegible], (f) $14,976; B. D. Pierce Jr Co., Bridgeport, (a) $1[illegible],6[illegible]8, (b) $1[illegible],322; Charles T. Eastburn Co., Mount Vernon, N. Y., (e) $1[illegible],636; Kellogg & Gregory Co., Danbury, (a) $[illegible]766, (b) $9188; Connecticut Hassam Paving Co., New Haven, (c) $1[illegible],6[illegible]; H. Sanford Osborne, Redding Ridge, (a) $11,[illegible], (b) $1[illegible]

Middlebury Township, about 5[illegible] lin ft gravel construction on the Southbury Road. This work includes 92[illegible] sq yd gravel surfacing, 1[illegible]0 ft corrugated iron-pipe culvert and 36[illegible]0 cu yd grading—Goodman & Trumbull Co., Litchfield, $[illegible]1[illegible]3; Kellogg & Gregory Co., Danbury, $[illegible]; A. R. Cadwell, New Britain, $8112; Olin T. Benedict, Pittsfield, Mass., $[illegible]; Connecticut Good Roads & Construction Co., New Britain, $[illegible]; Edward B. Reilly, Waterbury, $[illegible]33; [illegible] Loughi & Bro., Torrington, $[illegible]20[illegible]; John de Michiel & Bro., Torrington, $[illegible]649; B. D. Pierce Jr Co., Bridgeport, $[illegible]; Elbert N. Clarke, Milford, $[illegible]

Norfolk Township, about [illegible] lin ft graded construction on the Torrington Road—A. Brazos & Sons, Middletown, $6[illegible]; A. D. Bridges's Sons, Inc., Hazardville, $[illegible]1[illegible]; Kellogg & Gregory Co., Danbury, $[illegible]; Goodman & Trumbull Co., Litchfield, $[illegible]; A. D. Ambrosia, Hartford, $[illegible]; [illegible] Loughi & Bro., Torrington, $[illegible]; Caesar A. Rossi, Torrington, $[illegible]; Edmund P. Wall, Torrington, $[illegible]; [illegible] Corporation, Middletown, $[illegible]; John de Michiel & Bro., Torrington, $[illegible]; Olin T. Benedict, Pittsfield, Mass., $[illegible]; Edward R. Alfred, New Hartford, $[illegible]

Cromwell Township, about 21[illegible] lin ft trap rock macadam (a) or gravel (b) construction on the Newfield Road—Stafford & Mather, Hartford, (a) $[illegible], (b) $[illegible]; Olin T. Benedict, Pittsfield, Mass., (a) $1[illegible], (b) $1[illegible]; Frank Arcari & Bro., Middletown, (a) $1[illegible]779, (b) $1[illegible]617; [illegible] & Valeri, Middletown, (a) $[illegible], (b) $[illegible]; [illegible], Meriden, (a) $[illegible], (b) $[illegible]; Connecticut Good Roads & Construction Co., New Britain, (a) $[illegible], (b) $[illegible]; A. Brazos & Sons, Middletown, (a) $[illegible]; [illegible] Bros., Middletown, (a) $[illegible], (b) $[illegible]

Old Saybrook Township, about 1[illegible] lin ft trap rock macadam (a) or gravel (b) construction on [illegible] Road—A. Brazos & Sons, Middletown, (a) $[illegible]; [illegible] Bros., Middletown, (a) $[illegible], (b) $[illegible]; Connecticut Good Roads & Construction Co., New Britain, (a) $[illegible], (b) $[illegible]

North Canaan Township, about [illegible] lin ft [illegible] gravel (a) [illegible] [illegible]

[illegible]

Middletown Township, about 1[illegible] lin ft trap rock macadam (a) or gravel (b) construction on the Newfield Road—[illegible]

Olin T. Benedict, Pittsfield, Mass., (a) $10,950, (b) $10,575; A. Brazos & Sons, Middletown, (b) $17,136; Leonardo Suzio, Meriden, (a) $10,387, (b) $9953; Connecticut Good Roads & Construction Co., New Britain, (a) $10,681, (b) $9740, McDonald & Valeri, Middletown, (a) $12,226, (b) $11,811; Frank Arrigoni & Bro., Middletown, (a) $11,783, (b) $10,985; Curran Corporation, Middletown, (a) $9344, (b) $9613; Stafford & Mather, Hartford, (a) $7655, (b) $7140.

City of Bristol, about 11,692 lin.ft. of gravel (a), concrete with washed gravel (b), reinforced concrete with unwashed gravel (c), reinforced concrete with washed gravel (d), reinforced concrete with unwashed gravel (e), or hassam (f) construction on the Terryville Road. This work includes 7700 sq.yds. grading, 19,625 sq.yds. steel reinforcement, 800 lin.ft. corrugated iron pipe culverts and 2780 sq.yds. borrowed embankment—A. Brazos & Sons, Middletown, (a) $25,115; Connecticut Hassam Paving Co., New Haven, (f) $36,669; Leonardo Suzio, Meriden, (a) $20,781, (b) $32,568, (c) $33,144; Pierson Engineering & Construction Co., Hartford, (a) $17,731, (b) $30,481, (c) $31,021; Connecticut Good Roads & Construction Co., New Britain, (a) $17,381, (b) $30,530, (c) $32,690; Olin T. Benedict, Pittsfield, Mass., (a) $18,361; Bristow Bros. & Knowles Corporation, Narragansett Pier, R. I., (a) $21,748, (b) $36,352, (c) $37,252; Louis Loughi & Bro., Torrington, (a) $17,246, (b) $33,300, (c) $34,020; Charles H. Terry, Bristol, (a) $16,671, (b) $29,485, (c) $30,565, (d) $31,411, (e) $32,491; B. D. Pierce Jr. Co., Bridgeport, (a) $19,338, (b) $34,538, (c) $35,978; John de Michiel & Bro., Torrington, (a) $16,971, (b) $30,335, (c) $30,803, (d) $31,875, (e) $32,344; Thomas Kearney, Meriden, (a) $22,146, (b) $35,637, (c) $36,969. Noted Aug. 6.

Bristol, Conn.—(Official)—Bids will be received by the City Council until 7.30 p.m., Sept. 1, for constructing approximately 3000 ft. of concrete curb and 12,000 sq.ft. of concrete walk on Union St. Thomas B. Steele is City Clk.

Suffield, Conn.—At a special town meeting held Aug. 17, $15,000 was appropriated to complete the state road to Windsor Locks line. Edmund Halladay is Town Clk.

+Albany, N. Y.—Bids were received, Aug. 17, by the State Highway Commission and contracts were awarded for road improvement as follows:

Road No. 5483, Allegheny County, 0.71 mile—JOHN JOHNSON CONSTRUCTION CO., Buffalo, $27,744.

Road No. 5491, Green County, 5.18 miles—CATSKILL CONSTRUCTION CO., Catskill, $47,857.

Road No. 5210-B, Orange County, 0.18 mile—SCHUNNEMUNK CONSTRUCTION CO., Highland Mills, $2236.

Road No. 5318-A, Onondaga County, 0.15 mile—J. W. BRENNEN CONSTRUCTION CO., Inc.,

Road No. 5352-D, Steuben County, 0.91 mile—KENNEDY CONSTRUCTION CO., Albany, $2775.

Road No. 5253-B, Steuben County, 5.71 miles—All bids rejected.

Road No. 5253-D, Steuben County, 6.99 miles—KENNEDY CONSTRUCTION CO., Albany, $38,171.

Road No. 5509, St. Lawrence County, 5.81 miles—WEED & WALSH, Mechanicville, $87,061.

Road No. 5508, Ulster County, 4.80 miles—All bids rejected.

Road 5363, Westchester County, 0.94 mile—WILLIAM F. McCABE CONTRACTING CO., White Plains, $31,870.

Road No. 5332-A, Jefferson County, 0.76 mile—BALLARD & MAHAR, Oneida, $19,050.

Road No. 1165, Jefferson County, 3.53 miles—E. H. BROWN, Hempstead, $44,427.

Road No. 1166, Jefferson County.

Road No. 1181, Jefferson County, 1.45 miles—A. J. ROCKWOOD, Rochester, $16,921.

Contracts were awarded by the State Highway Commission for repair of public highways by State Aid Aug. 17, as follows:

Repair Contract No. 685, Dutchess County—WILLIAM DOYLE, Saugerties, $13,044.

Repair Contract No. 667, Dutchess County—CROWE & WALSH, Pittsfield, Mass., $9106.

Repair Contract No. 668, Essex County—JOSEPH F. SCANLON, Delmar, $7230.

Repair Contract No. 507, Essex County—RICHARD HOPKINS, Troy, $14,225.

Repair Contract No. 686, Essex County—W. L. LAWTON, Glens Falls, $14,088.

Repair Contract No. 682, Fulton County—CHAMPLAIN ENGINERING & CONSTRUCTION CORPORATION, Saratoga Springs, $17,115.

Repair Contract No. 486, Genesee County—CASEY & THOMPSON, Batavia, $12,868.

Repair Contract No. 575, Greene County—DE GROFF & HOGOBOOM, Kingston, $10,762.

Repair Contract No. 683, Monroe County—MORRISON & QUINN, Rochester, $20,050.

Repair Contract No. 687, Monroe County—MORRISON & QUINN, Rochester, $15,691.

Repair Contract No. 671, Schenectady County—JOHN H. GORDON, Albany, $11,633.

Repair Contract No. 689, Jefferson County—BALLARD & MAHAR, Oneida, $12,309.

Repair Contract No. 684, Erie County—DEFIANCE CORPORATION, Ticonderoga, $0.027. Noted Aug. 20.

Depew, N. Y.—(Official)—An election will be held Sept. 11 to vote on issuing $166,000 in bonds for paving Penora St., Transit Road and Olmstead, Sawyer and Burlington Aves.

+Little Falls, N. Y.—The contract for paving Gansevort St. has been awarded to WARREN BROS., at $30,406. Other bids were: R. D. Cooper, $33,156; Hallihan Bros., $33,594.

+Newburgh, N. Y.—The contract for improving William St., from Broadway to Renwick St., has been awarded to JAMES L. KEHOE, Newburgh, at $24,479. Noted July 30.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received by Maurice E. Connolly, Pres. of the Borough of Queens, until 11 a.m., Aug. 31, for improving Silver St. from Buchman to Anthon Ave.; Napier (Grant) Ave. from Chichester Ave. (University Pl.) to Jerome Ave. (Broadway); Clinton Ave. from Clermont Ave. to Broad St.; 48th (Grant) St. from Jackson to Astoria Ave.; North Morris (Morris) Ave. from Fulton Pl. (Fulton Ave.) to Jamaica Ave. For furnishing and delivering 400 tons of asphaltic concrete.

+Rochester, N. Y.—The contract for paving Arnett Blvd., with brick, has been awarded to THOMAS HOHAN, at $5970.

+Schenectady, N. Y.—The contract for paving the Rosa and Ardsley Roads and Foster Ave. has been awarded to the UNION PAVING CO., at $31,648.

+Syracuse, N. Y.—The Board of Contract and Supply has awarded the contract for paving Madison St., from Montgomery to Almont St., to the WARNER QUINLAN ASPHALT CO., at $14,780.

Avon by the Sea, N. J.—The City Council contemplates paving Main St. with brick. The approximate cost of the work is $40,000.

Elizabeth, N. J.—(Official)—Bids will be received by the City Council until about 8:30 p.m., Sept. 8, for paving a number of streets. Thomas E. Collins is City Engr.

+Hammonton, N. J.—A contract for constructing 49,080 sq.ft. of concrete sidewalks, 19,041 lin.ft. concrete curb and 7000 sq.ft. of driveway, has been awarded to H. K. SPEAR. Noted Aug. 6.

Jersey City, N. J.—The Board of Freeholders has authorized the issuance of bonds for $150,000 for the construction of a permanent roadway covering 3 miles of the Boulevard, from Newark Ave. to the Paterson Plank Road, and from Liberty Pl. to Weehawken. Frederick Dunham is Blvd. Comr.

Madison, N. J.—The Road Committee of the Borough Council plans for the construction of a new 4-in. macadam road on North St.

Newark, N. J.—The Board of Freeholders, Essex County, plans to resurface a portion of South Orange Ave., from the South Orange line.

Newton, N. J.—Surveys are being made for a new macadam road to be built from Ross Corner to Sussex Borough by the Board of County Freeholders. The proposed road will be about 6½ miles long. Harvey Snook is County Engr.

+Plainfield, N. J.—A contract for paving several streets with macadam has been awarded to BURKE & BONHAM. Noted July 30, and Aug. 13.

+Rahway, N. J.—The contract for paving portions of Irving St. and Milton Ave. has been awarded to the HASTINGS PAVING CO., at $2.61 per sq.yd. This amounts to about 6000 sq.yd. Noted July 23.

+Reading, Penn.—The contract for paving Franklin St. from Second St. to Third St., Eighth St. from Spring to Junction St., Second St. from Franklin to Chestnut St., with vitrified brick, has been awarded to JOHN E. WEIDNER, at $2.36 per sq.ft. The work consists of 7000 sq.yd.

Verona, Penn.—(Official)—Bids will be received by the Borough Council until 7:30 p.m., Aug. 31, for improving Center Ave.

West Newton, Penn.—(Official)—Bids will be received by A. M. Dick, Borough Clk., until 7 p.m., Sept. 1, for curbing and paving Vine, Water, Main and Second Sts.

+Baltimore, Md.—A contract for constructing pavement on portions of Eager, Madison, Monument, Division and other streets has been awarded to the SOUTHERN PAVING & CONSTRUCTION CO., at $87,211.

+Baltimore, Md.—A contract for paving approximately 4900 sq.yd. has been awarded to the BALTIMORE ASPHALT BLOCK & TIE CO., at $10,939.

Towson, Md.—Bids will be received by the Baltimore County Road Commissioners, until Sept. 3, for resurfacing two miles of the White Hill Road, in the Seventh District; one mile of the Sparrows Point Road, in the 15th District; ¾ of a mile of the Wise Ave. Road, in the 15th District; one mile of the Freeland Road, in the Sixth District; one mile of the Old Hanover Road, in the Fourth District, and the Ridge Road and the Black Rock Road to Falls Road, in the Fifth District; for grading Glen Ave., in the Third District; Chestnut Ave. and Washington Ave., in the Ninth District.

Washington, D. C.—Bids have been received as follows by the Commissioners of the District of Columbia for laying all asphalt block pavements and paving all streets and avenues with sheet asphalt and asphaltic concrete as may be provided for under the appropriations for the year ending June 30, 1915:

(1) Laying standard asphalt pavement (2½-in. asphalt surface, 2-in binder, before compression) with a 6-in. concrete base; (2) laying vitrified block with 6-in. concrete base; (3) laying asphaltic concrete paving (2-in. thick, after compression), on 6-in. concrete base; (4) laying same on broken stone base; (5) laying 2-in. asphalt block pavement on 6-in. concrete base; (6) allowance for broken stone from Occoquan workhouse, if furnished by the District at District Wharf; (a) natural pitch-lake asphalt; (b) using any asphalt conforming to specifications. Cranford Paving Co., Washington, D. C., (1a) $1.78 per sq.yd.; (1b) $1.72; (2) $1.35; (3a) $1.70; (3b) $1.66; (4a) 96c.; (4b) 93c.; (6) 90c. per cu.yd. White & Turner Construction Co., Baltimore, Md., on amiesite paving, (1) $1.75; (2) $1.35; (3) $1.75; (4) 93c.; (6) 83c. Washington Asphalt Block & Tile Co., Washington, D. C., (5) $1.76; (6) 69c. Noted Aug. 13.

+Lynchburg, Va.—The contract for improving Franklin St. has been awarded to W. T. H. JONES, at $7800.

Moundsville, W. Va.—(Official)—Bids will be received by O. B. Bonar, City Clk., until 4 p.m., Sept. 4, for improving Western Ave. from Seventh St. to the Corporation line.

Bartow, Fla.—An election will be held Oct. 6 to vote on the proposition of issuing $75,000 in bonds for street paving.

+St. Augustine, Fla.—The contract for paving Ribera and Cedar Sts. has been awarded to SETH PERKINS & SON.

Jasper, Ala.—Bids will be received by the County Commissioners Court until Sept. 14 for the sale of $88,000 in bonds for roads.

+Seale, Ala.—A contract for improving about nine miles of the Eufaula and Columbus Road has been awarded to W. A. VARNER, Rockford, at $11,212. Noted July 16.

+Clarksville, Tenn.—A contract for paving 7¾ miles of road in Montgomery County with macadam has been awarded to A. A. SMITH, Mt. Pleasant, at $34,428.

♦Nashville, Tenn.—The contract for paving Second Ave. from [illegible] St to [illegible] has been awarded to the SOUTHERN BITULITHIC CO., at $[illegible]

Louisville, Ky.—Bids will be received by the Board of Public Works until Sept 1, for paving Clark St from Maple to Howard, [illegible] from [illegible] to [illegible], and [illegible] St from Maple to the first alley north of Howard with vitrified brick.

Bids will be received by the Board of Public Works, until Sept. 1 for paving parts of the following streets with [illegible] Texas, Ray, Highland, Shelby and Deer Park.

Whitesburg, Ky.—Bids will be received by H T Day, County Judge, until Sept 1[illegible], for constructing a road from the mouth of the Bottom Fork River to the bridge at Kona. I N Lewis, Whitesburg, is Road Engr

Canton, Ohio—(Official)—Bids will be received by the Board of Commissioners of Stark County, until 10 a.m., Sept. 14, for the construction of the Waynesburg-Canton Road.

Cincinnati, Ohio—(Official)—Bids will be received by [illegible] Dir Pub Ser, until noon Aug 3, for improving [illegible] Ave.

♦Cincinnati, Ohio—(Official)—The contract for paving a portion of [illegible] St has been awarded to C. N. DANENHOWER, at $[illegible]. Noted July 23.

♦Columbus, Ohio—The State Highway Department awarded contracts as follows:

Crawford County—Sect. G, Galion-Bucyrus Road, brick, L. E. McMICHAEL, Bucyrus, $[illegible]

Crawford County—Sect. F, Bucyrus-Upper Sandusky Road, brick, FINKELSPACH & THOMAS, Fremont, $28,6[illegible]

Crawford County—Sect. H, Galion-Mansfield Road, brick, FINKELSPACH & THOMAS, Fremont, $28,000.

Darke County—Celina-Greenville Road, concrete, TRIPPE & SONS, Peru, Ind., $[illegible]

Fairfield County—Sect. B, Cincinnati-Zanesville Road, brick, WILSON & LOWER, Lancaster, $16,000.

Lawrence County—Ohio River Road, waterbound macadam, THE IRONTON TRANSFER & STORAGE CO., Ironton, $11,680.

Mercer County—Sect. D, Fort Recovery-Minister Road, concrete, WAGNER, LOWRY & MANNON, Fort Recovery, $[illegible]

Noble County—Caldwell-McConnelsville Road, brick, H. F. GREEN, Ravenna, $[illegible]

Noble County—Caldwell-Marietta Road, brick, H. F. GREEN, Ravenna, $[illegible]

Tuscarawas County—Cincinnati-Zanesville Road, waterbound macadam, PURDIN & SWARTZ, Shepherd, $13,400.

[illegible] County—Sect. F, Cincinnati-Zanesville Road, waterbound macadam, ARTHUR WEST, Hanover, $16,989.

Trumbull County—Sect. 2, Youngstown-Conneaut Road, waterbound macadam, McDERMOTT & HANSON, Niles, $1[illegible],500.

Vinton County—Sect. F, McArthur-Jackson Road, waterbound macadam, JOHN R. FREEVER, McArthur, $6,[illegible]21. Noted Aug. 1[illegible].

Bids will be received by James R. Marker, States Highway Commr, until Aug 3[illegible], for constructing three roads at an approximate cost of $[illegible]

Columbus, Ohio—Bids will be received by the Board of Commissioners of Franklin County until Sept 10, for the sale of $[illegible] in bonds to provide funds for the improvement of certain roads in Franklin County.

♦Hamilton, Ohio—The contract for paving East [illegible] St has been awarded to the ANDREWS ASPHALT PAVING CO. at $[illegible]

Lima, Ohio—[illegible]

♦[illegible]

[illegible], Ohio—[illegible]

[illegible], Ohio—[illegible]

Sebring, Ohio—[illegible]

Steubenville, Ohio—[illegible]

♦Toledo, Ohio—[illegible]

♦Toledo, Ohio—[illegible]

♦[illegible], Ohio—[illegible]

[illegible], Ohio—[illegible]

Indiana—[illegible]

[illegible] Decatur County for constructing a road in Washington Township. Linton W. Sands is Audr.

Lebanon, until 1 p.m., Sept. 1, by the Commissioners of Boone County for constructing a concrete road in Sugar Creek Township. D. M. Clark is Audr.

Kentland, until 2 p.m., Sept. 7, by the Commissioners of Newton County for constructing two macadam roads in Iroquois Township. S. R. Siselove is Audr.

Tipton, until 10 a.m., Sept. 7, by the Commissioners of Tipton County for constructing two gravel roads in Cicero and Madison Townships. J. H. Tranbarger is Audr.

Rensselaer, until 2 p.m., Sept. 7, by the Commissioners of Jasper County for constructing a stone road in Carpenter Township. J. P. Hammond is Audr.

Shoals, until 1 p.m., Sept. 7, by the Commissioners of Martin County for constructing a graded road in Baker Township and a macadam road in Perry Township. L. D. Haga is Audr.

Newport, until 10 a.m., Sept. 7, by the Commissioners of Vermilion County for constructing a gravel road in Vermilion Township. Roy Slater is Audr.

Hartford City, until 2 p.m., Sept. 7, by the Commissioners of Blackford County for constructing a road in Licking Township. James Cronin, Jr., is Audr.

Greencastle, until 2 p.m., Sept. 7, by the Commissioners of Putnam County for constructing a gravel road in Monroe Township. C. L. Alchart is Audr.

Vevay, until 1 p.m., Sept. 7, by the Commissioners of Switzerland County for constructing roads in Pleasant and Cotton Townships. John W. Smith is Audr.

Fowler, until 1 p.m., Sept. 7, for constructing a road in Hickory Road Township. Warren Mankey is Audr.

Brownstown, until 1 p.m., Sept. 8, by the Commissioners of Jackson County for constructing three stone and two gravel roads. Albert Leudtke is Audr.

Bloomington, until 2 p.m., Sept. 8, by the Commissioners of Monroe County for constructing a gravel road in Clear Creek Township. W. F. Kinser is Audr.

Martinsville, until noon, Sept. 8, by the Commissioners of Morgan County for constructing a gravel road in Brown Township. J. S. Whitaker is Audr.

Knox, until noon Sept. 8, by the Commissioners of Starke County for constructing a gravel road in Center Township. Chas. Weninger is Audr.

Marion, until 2 p.m., Sept. 8, by the Commissioners of Grant County for constructing two roads in Franklin Township. E. H. Kimball is Audr.

Bedford, until 1 p.m., Sept. 8, by the Commissioners of Lawrence County for constructing gravel or macadamized roads in Shawick Township and one in Bedford City. Ezra W. Edwards is Audr.

New Albany, Ind.—Bids will soon be received by the Board of Public Works for paving East Tenth St. from Spring to Market St. with vitrified brick.

♦Plymouth, Mich.—A contract for paving 2[illegible] sq. yd. has been awarded to VAN POPLIN & MUNLEY, Bay City. Noted July 23.

♦Galesburg, Ill.—The contract for paving New Henderson St. has been awarded to J. H. McALLEY at $1[illegible].[illegible]. Other bids were: P. H. Tiernan, $19,663; Burlington Construction Co., $19,772.

Springfield, Ill.—(Official)—Bids will be received by the State Highway Commission until 11 a.m., Sept. 1, for state-aid work in Scott, Williamson, Monroe, Schuyler and Whiteside Counties. All cement to be furnished by the state. F. C. McArdle is Asst. State Highway Engr.

Alma, Wis.—Bids will be received by the County Clerk, until Aug. [illegible] for constructing a state road in Alma and for improving the Fountain City-Winona Road. J. [illegible] is County Highway Commr.

♦Green Bay, Wis.—The contract for paving East Mason St. with asphalt has been awarded to the WHITE CONTRACTING CO., Milwaukee, at $[illegible]. Noted July 2[illegible].

Oconto, Wis.—The Common Council has voted to place a $[illegible] bond issue before the voters at the Sept. and Nov. elections. Main and other streets are to be improved. W. R. Hall is City Engr.

♦Sheboygan, Wis.—Contracts for paving North 11th St. and Jefferson Ave. have been awarded to the [illegible]-GRIFFITH CONSTRUCTION CO. at $[illegible] and $[illegible] respectively.

♦Superior, Wis.—(Official)—A contract for improving the [illegible] Road has been awarded to M. MURPHY & CO., Superior, at $[illegible]

The contract has been awarded to BAUM & JACOBS for paving [illegible] and [illegible] Aves.

Adel, Iowa—Bids will be received by the Town Council until 6 p.m., Sept. [illegible], for constructing approximately [illegible] sq. yd. of paving and [illegible] ft. of concrete curb on parts of [illegible] and [illegible] Sts.

♦Boone, Iowa—A contract for constructing sidewalks has been awarded to T. H. [illegible] & SON.

Council Bluffs, Iowa—(Official)—Bids will be received by the city council until [illegible] p.m., Aug. [illegible], for paving [illegible] sq. yd. and constructing [illegible] lin. ft. of combination curb and gutter on various streets.

♦Des Moines, Iowa—The contract for [illegible] has been awarded to [illegible]

♦Sioux City, Iowa—The contract for paving West [illegible] St. with concrete has been awarded to JENSON & KRAUSE.

Thief River Falls, Minn.—Bids will be received by [illegible] until [illegible] p.m., Sept. 1, for concrete sidewalk construction.

Russell, Kan.—(Official)—Bids will be received by W. A. [illegible], City Clk., until [illegible] p.m., Sept. [illegible], for improving parts of Washington Ave. and [illegible] and [illegible] Sts.

+**Omaha, Neb.**—The contract for paving 16th Ave. from H to Missouri Ave. has been awarded to the JAMES J. PARKS CO.

+**Yankton, S. D.**—(Official)—The contract for paving portions of Third, Cedar and Walnut Sts., Broadway and Douglas Ave. has been awarded to the FLYNN PAVING CO., Sioux City, Iowa, at $1.45 per sq.yd. The work consists of 23,621 sq.yd. of pavement. Other bids were: Monarch Engineering Co., $1.58½; J. S. McLaughlin, $1.64; Hanlon & Oakes, $1.52; C. H. Atkinson, $1.62; Shugart & Munson, $1.52½. Noted Aug. 13.

Poplar Bluff, Mo.—Bids will be received by H. H. Wilcox, City Clk., until 7:30 p.m., Aug. 31, for paving 2851 sq.yd. with 6-in. concrete, dolarway top or its equivalent. E. C. Thomas is City Engr.

+**Bolton, Tex.**—A contract for constructing roads in Bell County has been awarded to A. M. CLOPTON, at $105,000.

Magnolia Park, Tex.—(Houston post office)—See item under "Water Supply and Irrigation."

Lufkin, Tex.—An election will be held Sept. 10 to vote on the proposition of issuing $40,000 in bonds for street improvements.

+**Temple, Tex.**—The contract for paving Adams Ave. from the public square to the tracks of the Santa Fe R.R. has been awarded to O. C. CHAPIN, Kansas City, Mo.

Lewiston, Idaho—Bids will be received by the City Engineer until Sept. 8, for grading, curbing and constructing concrete sidewalks and installing a drainage system in Improvement District No. 9.

Pocatello, Idaho—Bids will be received by W. A. Samms, City Engr., until Sept. 3, for constructing standard pavements in Local Improvement Districts No. 6, 7, 8 and 9.

Ogden, Utah—(Official)—Bids will be received by F. O. Stanford, City Recdr., until 10 a.m., Sept. 8, for improving 24th St. from Van Buren to Harrison Ave.

+**Clifton, Ariz.**—(Official)—A contract for constructing three miles of road from Clifton to Solomonville has been awarded to CLAY & RUTH, Morenci, at $39,931. Other bids were: Aubrey Investment Co., Prescott, Ariz., $53,879; B. Vandercook, Clifton, Ariz., $52,497; O. J. Cotey, Clifton, Ariz., $45,678; A. J. Crockett, Belen, Tex., $42,501. Noted Aug. 6.

+**Lynden, Wash.**—A contract for paving certain streets with asphalt has been awarded to the WASHINGTON PAVING CO., Tacoma, at $31,000.

Port Townsend, Wash.—Bids will be received by the Board of County Commissioners until 2 p.m., Sept., for the construction of approximately two miles of Permanent Highway No. 2. Archibald C. Tweedie is County Audr.

+**Raymond, Wash.**—A contract for street work in Local Improvement District No. 92 has been awarded to WILLAPA CONSTRUCTION CO., at $20,124.

Seattle, Wash.—The following bids were received for paving Ewing St., by the Board of Public Works: P. J. McHugh, $159,92?; alternate, $169,081. Sparger Concrete Co., $172,677; alternate, $168,040. R. G. Stevenson, $169,940; alternate, $169,604.

The City Council has passed an ordinance providing for the paving of West Mercer St.

+**Claremont, Calif.**—The contract for paving Mesa Ave. has been awarded to L. FLEMING, Pomona, at $20,000.

+**Hollister, Calif.**—A contract for paving 13 blocks on Fifth and San Benito Sts. has been awarded to the GRANITE ROCK CO., at $30,000.

+**Los Angeles, Calif.**—A contract for paving Van Ness Ave. from 16th to Washington St. with asphalt has been awarded to the FAIRCHILD-GILMORE-WILTON CO., at $7023.

+**Pasadena, Calif.**—The contract for paving and constructing concrete sidewalks, curbs and gutters on Sierre Bonita Ave. has been awarded to J. E. HADDOCK, at $12,420.

+**Richmond, Calif.**—A contract for improving the Cutting Blvd., between Ashland Ave. and Tenth St., has been awarded to the MUNICIPAL IMPROVEMENT CO., at $123,194. The only other bid was from the Federal Construction Co., $125,405.

+**San Diego, Calif.**—The contract for paving 28th St. from Balboa Park to University Ave. has been awarded to the CALIFORNIA-ARIZONA CONSTRUCTION CO., Los Angeles, at $19,260.

Stockton, Calif.—(Official)—Bids will be received by the Board of Supervisors of San Joaquin County, until 10 a.m., for grading and graveling a part of McKinley Ave. Eugene D. Graham is Clk. of the Bd.

+**Wilmington, Calif.**—The contract for improving E St., from West First St. to West Seventh St., has been awarded to the FAIRCHILD-GILMORE WILTON CO., Los Angeles, at $38,845.

+**Contrecoeur, Que.**—A contract for constructing a macadam roadway has been awarded to ALBERT THIBAUDEAU at $9900.

+**Montreal, Que.**—The contract for constructing pavements on Church Ave., Wellington St. and LaSalle Road has been awarded to QUINLAN & ROBERTSON, LTD., 1680 St. Patrick St.

INDUSTRIAL WORKS

+**Lowell, Mass.**—The Middlesex Co., Warren St., has awarded the contract for the construction of the addition to its mills, to WILLIAM DRAPEAU, 7 Mt. Washington St., at $30,000. C. C. Hedrick, Dutton St., is the Arch. Noted July 9.

Salem, Mass.—The Dane Machine Co., whose factory was destroyed by fire, has purchased additional frontage on Boston St., to provide space for a larger plant.

Worcester, Mass.—The New England Corset Co. plans to erect a five-story addition to its factory on Green St.

Buffalo, N. Y.—The Robertson-Cataract Electric Co. has purchased a site on West Mohawk St., where a factory will be erected for the manufacture of electrical supplies.

Cohoes, N. Y.—The Starbuck Foundry Co., whose foundry was recently destroyed by fire, will rebuild as soon as plans are prepared.

Gloversville, N. Y.—The hair and wool mill of E. S. Parkhurst, recently destroyed by fire with a loss of $200,000, will be rebuilt on the same site early in the fall.

New Paltz, N. Y.—The New Paltz, Highland & Poughkeepsie Traction Co., is having plans prepared for the construction of a carbarn and office. Charles H. Higgins, 30 Church St., New York, N. Y., is the Engr.

+**Schenectady, N. Y.**—The Charles Friehofen Baking Co., 111 South Center St., has awarded a contract to the PHILLIPP HARBACH CONSTRUCTION CO. for the erection of a 72x171-ft. baking plant on Albany St. The estimated cost is $48,000. Charles Balderston, Philadelphia, Penn., is the Arch.

Syracuse, N. Y.—Bids will be received by Day & Zimmerman, 611 Chestnut St., Philadelphia, Penn., for the construction of two reinforced-concrete factories for the New Process Gear Corporation, Syracuse, N. Y.

+**Bloomfield, N. J.**—The Condensite Co. has awarded the contract for the concrete foundations, floors and roofs for its new plant to WRIGHT & KOWALSKI, Jersey City, N. J.

Newark, N. J.—Cyrus Currier & Sons, machinery manufacturers, will build a one- and two-story addition to the plant on Commerce St., to cost about $12,000. Arthur B. Miller is Arch.

Passaic, N. J.—The Villa, Stearns Co., manufacturer of silk dress goods, has acquired adjoining property, and will build an addition to its plant.

Perth Amboy, N. J.—Local press reports state that the Perth Amboy, N. J., Board of Trade has secured the location of a new industry in this city A New Jersey corporation has purchased a site on Ridgeley St., where it plans to erect a factory for the manufacture of cigars and cigarettes. J. K. Jenson is the Arch.

Ford City, Penn.—The Kittanning Face Brick Co. has purchased a site in Washington township, near here, where a brick plant will be erected.

Philadelphia, Penn.—The A. J. Cameron & Co. is having plans prepared for additions to its plant on East Glenwood Ave. A three-story, 65x214-ft. warehouse, and a 20x200-ft. wool storage house, are to be erected.

Philadelphia, Penn.—The Industrial Tape Mills Co. is having plans for its new factory revised. The plant will be erected at Allegheny Ave. and Rosehill St., at an estimated cost of $50,000. Noted July 30.

+The Keystone Lantern Co. has awarded the contract for the erection of its factory at Cottman St. and Tacony Rd., to J. RICHARD JACKSON, 6217 Jefferson St., Philadelphia, Penn. Noted Aug. 20.

+**Pittsburgh, Penn.**—Rosenbaum & Co. have awarded the contract for the construction of their warehouse at Duquesne Way and Evans Alley, to the NICOLA BUILDING CO. The estimated cost is $100,000.

+**Baltimore, Md.**—The contract for the erection of a four-story warehouse for Steuart, Knatz & Co. has been awarded to T. R. STANSFIELD & CO., Baltimore, at $20,000. Haskell & Barnes are the Archs.

Norfolk, Va.—The Old Dominion Tobacco Co. plans to erect a five-story reinforced-concrete factory for manufacturing tobacco.

The Arbuckle Coffee Co., whose plant was recently destroyed by fire, is planning to reconstruct in the near future.

Goldville, S. C.—The Banna Mfg. Co., has had plans prepared and $40,000 will be spent in additional machinery and buildings. The Shand Engineering Co., Columbia, S. C., has prepared the plans. Noted May 28.

Haleyville, Ala.—The Haleyville Oil & Fertilizer Co. has had plans prepared for the construction of a cottonseed-oil mill. The estimated cost is $27,000.

Baton Rouge, La.—Bids will be received by John J. Mundinger, City Engr., until Sept. 10, for constructing a municipal abbattoir.

New Orleans, La.—The Southern Automobile Mfg. & Supply Co. has purchased a site in St. Bernard parish, where it will erect a manufacturing plant to cost about $700,000.

Cleveland, Ohio—The Ohio File Renewing Co., Niles, Ohio, has removed its plant to Cleveland, where it will occupy the former building of The Comey-Johnson Co., at West 77th St. and Franklin Ave.

Cleveland, Ohio—The Cleveland Ry. Co., Leader News Bldg., will build improvements on East 49th St., which will cost $56,000. The buildings, all of which are to be one story, are: Storage house, 120x184 ft.; truck repair shop, 157x184 ft.; boiler house, 119x152 ft.; garage, 27x86 ft.

Cleveland, Ohio—Bids will be received by H. A. Cone, Arch., 1228 Schofield Bldg., Cleveland, for the construction of a factory for the Cleveland Suit & Skirt Co., 1401 West Ninth St. The estimated cost is $16,000. Noted Aug. 12.

+**Cleveland, Ohio**—The Prince-Wolf Co., manufacturer of cloaks, clothes etc., has awarded a contract to WILLIAM DUNBAR & CO., 8209 Cedar Ave., for the construction of its three-story, 50x170-ft. factory on Superior Ave. W. R. Powell, Hippodrome Bldg., is the Arch.

The Cleveland Seating Co., 550 Rose Bldg., manufacturer of church and school furniture, has purchased a site on East 152d St., where it plans to erect a factory and power plant. The estimated cost is $75,000.

Mansfield, Ohio—E. G. Slough, Secy. of the Chamber of Commerce, has announced that the plant of the Standard Chain Co. will be moved from St. Mary's to this city.

Middletown, Ohio—The United Paint Co., recently incorporated, has acquired a site in West Middleton where a four-story brick factory will be erected.

Springfield, Ohio—The [illegible] Co., Dayton, has [illegible] until Sept. 1[illegible], for the [illegible] factory, to be erected at Center and [illegible] Sts. The estimated cost is $1[illegible]. W. J. Fraser is [illegible].

Toledo, Ohio—The Toledo, Bowling Green & Southern Ry. [illegible] to its freight house on St. [illegible] of the [illegible]. The estimated cost is $12,[illegible].

✦Youngstown, Ohio—The Youngstown Iron & Steel Co. has awarded the contract for the construction of its open-hearth plant to the [illegible] CO., Pittsburgh, Penn. Noted [illegible].

Indianapolis, Ind.—The National Motor Vehicle Co. has purchased a site on Yandes St., where it plans to erect a [illegible] about September.

✦Lawrenceburg, Ind.—The J. R. STEVENS CO., Cincinnati, Ohio, has been awarded the contract for the erection of a [illegible] and grain elevator for W. P. Squibb & Co. The estimated cost is $[illegible]. The Greendale Distilling Co. has also awarded the same firm a contract for building a [illegible] house with a daily capacity of 20[illegible] bu. Noted Mar. 1[illegible].

Coldwater, Mich.—[illegible], McNeill & Libby, Chicago, Ill., has had plans prepared and will build a 112x2[illegible]6-ft. canning factory in this city.

Detroit, Mich.—The Detroit Lumber Co. plans to erect a two- and three-story reinforced concrete mill, to cost $45,-000.

Chicago, Ill.—The Western Paper Box Co., 172 North Green St., plans to build a two-story brick factory to cost $15,000. [illegible] & [illegible] are the Archs.

Marseilles, Ill.—The Marseilles Wrapping Paper Co., whose factory was recently destroyed by fire, is having plans prepared for a new plant.

Taylorsville, Ill.—The Taylorsville Utility Co., manufacturer of tile, plans to build additions to its plant which will double the present capacity.

Milwaukee, Wis.—The Michigan Quartz Silica Co. will receive bids for the construction of a three-story, 50x115-ft. brick and steel factory. Charlton & Kuenzli, Camp Bldg., Milwaukee, are the Archs.

Sheboygan, Wis.—The Cigar Box Lumber Co. is having plans prepared for the construction of a two-story, 60x140-ft. factory. C. F. Ringer & Sons, Milwaukee, are the Archs.

Sun Prairie, Wis.—The Continental Automatic Fire Alarm Co. plans the construction of extensive improvements.

Wauwatosa, Wis.—Emerson D. Hoyt plans to erect a two-story milk plant on North Main St. The estimated cost is $1[illegible]. Kirchoff & Rose, Milwaukee, are the Archs.

Austin, Tex.—The McDonald Concrete Co. plans to construct a plant here for the manufacture of concrete building material.

El Paso, Tex.—The International Brick Co., recently organized with a capital stock of $12[illegible]0,00, plans to construct a plant here for the manufacture of clay products.

Houston, Tex.—The City Commission plans to construct a [illegible] abattoir and bakery.

Marietta, Wash.—A. J. Z[illegible]ne plans to build a dairy, estimated to cost $2[illegible]. F. T. [illegible]an, Marietta, is preparing plans.

Seattle, Wash.—W. G. Barnes, Sixth Ave. and Pine St., plans to build a [illegible] garage and machine shop on [illegible] Ave., Seattle. The estimated cost is $[illegible].

✦El Segundo, Calif.—The Lambert Mfg. Co., Los Angeles, has awarded a contract to the EL SEGUNDO IMPROVEMENT CO. for the construction of a 6[illegible]x2[illegible]-ft. brick factory.

✦Los Angeles, Calif.—The [illegible] & [illegible] Co., 13[illegible] [illegible] St., has awarded the general contract for the construction of its [illegible] to the BROADWAY CONSTRUCTION CO., [illegible] Bldg. The contract for furnishing the structural steel was awarded to the UNION IRON WORKS.

Oakland, Calif.—The Jersey Milk Cream & Butter Co. will erect a [illegible] at [illegible] and Grove St., to cost $2[illegible].

Oakland, Calif.—Lewis P. [illegible] and Charles H. Cheney, [illegible], Calif., are preparing plans for a group of buildings for the [illegible] Wheat Co., [illegible] Falls, N. Y., to be located here. The buildings will be of reinforced concrete. Noted Apr. 23.

Oakdale, Calif.—The [illegible] Kessler Co. has acquired a site here and plans to build a factory for the manufacture of [illegible]. The [illegible] will include a [illegible] a [illegible] and a [illegible] mill.

San Francisco, Calif.—The Otis Elevator Co. will build a [illegible] at its plant on North Beach. The [illegible] will cost about $[illegible].

Sanger, Calif.—The California Associated Raisin Co. will [illegible]. The [illegible] will be [illegible] James H. [illegible], Fresno, Calif., is [illegible].

London, Ont.—The [illegible] Co. has had plans prepared for the construction of a building to cost $[illegible].

Stratford, Ont.—The [illegible] Co. has had plans [illegible] to its factory which will double the capacity.

FEDERAL GOVERNMENT WORK

Building—[illegible]

Wire Screen Partitions—New York, N. Y.—Bids will be received until [illegible], Aug. [illegible], by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for wire screen partitions in the [illegible] in New York, N. Y.

Wiring Post Office—Camden, N. J.—The following bids were received for conduit and wiring system, lighting fixtures, etc., in the U. S. post office at Camden, N. J.: J. F. Buchanan & Co., Philadelphia, Penn., $43[illegible]; Quaker City Engineering Co., Philadelphia, $41[illegible]; Wilson-Maltman Electric Co., Baltimore, Md., $4[illegible]; Lewis H. Woods, New York, N. Y., $4[illegible]; Penn Electric Co., Reading, Penn., $4[illegible]67; [illegible] Electric Co., Philadelphia, $46[illegible]4; Charles F. Brown, New York, N. Y., $4[illegible]74; Charles D. Silcox, Jr., Philadelphia, $[illegible]; E. S. Downs Co., Philadelphia, $[illegible]19[illegible]; Carroll Electric Co., Washington, D. C., $49[illegible]0. Noted July 3[illegible].

Bulkhead—Kearny, N. J.—Plans will be prepared by the Federal Government for the construction of a bulkhead, about 1[illegible]00 ft. long, in front of the Soldiers' Home at Kearny. The Board of Managers of the Home will have charge of its construction.

Dredging—Wilmington, Del.—Bids will be received until 11 a.m., Sept. 8, by Maj. E. N. Johnston, Corps Engrs., U. S. A., Wilmington, for dredging in Tuckerton Creek, N. J.

Engine—Washington, D. C.—The following bids were received, Aug. 17, by the Commissioner of Lighthouses, Washington, D. C., for furnishing one 1[illegible]-hp. propelling engine for light vessel No. 48: Blanchard Machine Co., Cambridge, Mass., $6250; New London Ship & Engine Co., Groton, Conn., $[illegible]; August Mietz, New York, N. Y., $64[illegible]; Bolanders Co., New York, N. Y., $[illegible]470; Gas Engine & Power Co. and Charles L. Seabury & Co., Morris Heights, New York, N. Y., $4[illegible]; Standard Motor Construction Co., Jersey City, N. J., $4[illegible] (informal).

✦Hopper Dredge—Washington, D. C.—The contract for the construction of the sea-going hydraulic hopper dredge "San Pablo," has been awarded to the SKINNER SHIPBUILDING & DRYDOCK CO., Baltimore, Md., at $81,970.

Ordnance—Washington, D. C.—The following bids were received Aug. 19, by the Bureau of Ordnance, War Dept., Washington, D. C., for cast-iron gun shell and mortar shell for the Army—(a) 700 six-in. cast-iron gun shell, (b) 100 eight-in. cast-iron gun shell, 315 lb., (c) 3[illegible]0 ten-in. cast-iron gun shell, 604 lb., (d) 600 twelve-in. cast-iron gun shell, 1046 lb., (e) 200 twelve-in. mortar shell, 700 lb., (f) 12[illegible]0 twelve-in. mortar shell, 1046 lb., (g) 2[illegible]0 fourteen-in. cast-iron gun shell, 1660 lb.: Mobile Stone & Pulley Mfg. Co., Mobile, Ala., (a) $14.50 each; Tredegar Co., Richmond, Va., (a) $11 each, (b) $19, (c) $[illegible], (d) $31.50, (e) $2[illegible], (f) $[illegible], (g) $51; C. H. Cowdray Machine Works, Fitchburg, Mass., (a) $14.93; Best Mfg. Co., Pittsburgh, Penn., (a) $9.12, (b) $17.73, (c) $20.07, (d) $30.77, (e) $24.34, (f) $30.77, (g) $[illegible]70; Bethlehem Steel Co., South Bethlehem, Penn., (a) $11, (b) $22, (c) $32.[illegible]0, (d) $3[illegible].2[illegible], (e) $3[illegible], (f) $33.75, (g) $[illegible]; American & British Mfg. Co., Bridgeport, Conn., (c) $[illegible].93, (d) $41.06, (f) $39.23.

Guardhouse and Revetment—National Soldiers' Home, Va.—Bids will be received until 1.30 p.m., Sept. 10 by F. F. Skinner, Treas. Southern Branch, N. H. D. V. S., National Soldiers' Home, Va., for repairs to the interior of the guardhouse and to timber revetment.

Post Office—Wytheville, Va.—Bids were received as follows, Aug. 18, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office building at Wytheville, Va. (postponed from Aug. [illegible]), (a) limestone, (b) sandstone: Westchester Engineering Co., White Plains, N. Y., (a) $4,000, (b) $[illegible]6,0[illegible]; J. S. Rogers Co., Moorestown, N. J., (a) $57,900, (b) $[illegible]9,0[illegible]0; J. L. Crouse, Greensboro, N. C., (a) $51,264, (b) $[illegible]1,764; Olin Gerlach, Frostburg, Md., (a) $[illegible]6,450, (b) $57,000; W. H. Fissell & Co., New York, N. Y., (a) $[illegible]0,8[illegible]3, (b) $[illegible]1,8[illegible]3; James Devault, Canton, Ohio, (a) $[illegible]2,60[illegible], (b) $[illegible]2,908; Newport Construction & Engineering Co., Newport News, Va., (a) $[illegible]170, (b) $[illegible]. The building will be two stories and basement, with ground area of 4100 sq. ft., brick facing, tin and composition roof, first floor fireproof. Noted July 16.

Dredging—Wilmington, N. C.—Bids will be received until noon Sept. 8, by Maj. H. W. Stickle, Corps Engrs., U. S. A., Wilmington, N. C., for dredging in the waterway from Core Sound to Beaufort Harbor, N. C.

Metal Work—Charleston, S. C.—Bids will be received until noon Sept. 7, by the Light House Inspector, Charleston, S. C., for furnishing metal work for light structures for Fort Sumter Range Front and St. Andrews Sound.

Repairing Post Office—Pensacola, Fla.—Bids will be received until 3 p.m., Sept. 1[illegible], by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for repairing and [illegible] the post office and courthouse at Pensacola.

✦Repairs to Buildings—New Orleans, La.—The contract for making repairs to various buildings at the Naval Station, New Orleans, has been awarded to HENRY MONK, Pensacola, Fla., at $[illegible]. Noted June 11, July [illegible] and July [illegible]3.

✦Steel Reinforcement—Ashtabula Harbor, Ohio—Bids will be received until [illegible] p.m., Sept. 1[illegible], by the Lighthouse Inspector, Buffalo, N. Y., for steel reinforcement for the base of Ashtabula West Breakwater Pierhead Light Station, Ashtabula Harbor, Ohio.

✦Post Office—Three Rivers, Mich.—The contract for the construction of the U. S. post office at Three Rivers has been awarded to A. W. LANE, [illegible] South LaSalle St., Chicago, Ill., at $[illegible]. It will be of limestone. List of bidders noted [illegible].

✦Post Office—Le Mars, Iowa—The contract for the construction of a post office at Le Mars has been awarded to [illegible] CONSTRUCTION CO., St. Louis, Mo., at $[illegible]. It will be of limestone. Noted June 1[illegible] and July 2[illegible].

Earthwork—[illegible]—Bids will be received until [illegible], Sept. 1[illegible], by Maj. Clarke S. Smith, Corps Engrs., U. S. A., [illegible], for [illegible] of earthwork in the [illegible] District, Illinois.

✦Post Office—Amarillo, Tex.—Bids will be received until [illegible], by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including [illegible] fixtures and approaches) of a [illegible] post office and courthouse at Amarillo. The building will have a ground area of [illegible] sq. ft., partly fireproof, stone facing, tile and copper roof.

Elevator—McAlester, Okla.—Bids will be received until 3 p.m., Sept. 4, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the installation of an electric passenger elevator in the U. S. post office at McAlester, Okla.

Timber Wharf, Wharf Shed—Bremerton, Wash.—Bids will be received until 11 a.m., Sept. 26, by H. R. Stanford, Chief Bureau of Yards and Docks, Washington, D. C., for the construction of a wharf and wharf shed at the Puget Sound naval torpedo station, Bremerton, Wash.

Officers' Quarters—San Francisco, Calif.—Bids will be received by the Constructing Quartermaster, Fort Mason, until 11 a.m., Sept. 8, for the construction of officers' quarters, including plumbing, heating and electrical work. Lieut.-Col. George McK. Williamson is Const. Quartermaster.

Apparatus, Steelwork, Etc.—Panama—Bids will be received until 10:30 a.m., Sept. 8, by Maj. F. C. Boggs, Gen. Pur. Officer, Panama Canal, for furnishing chemical control and mixing apparatus for a purification plant, steelwork for four gangways, brass clips, expansion bolts, paper and lumber.

★Structural Steel—Panama—Bids will be received until 10.30 a.m., Sept. 21, by Major F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., for furnishing and erecting structural steel for the wharf structure of the Cristobal coaling plant.

✚Yellow Pine and Oak Lumber—Panama—The General Purchasing Officer of the Panama Canal has awarded contracts to W. R. GRACE & CO., Washington, D. C., at $17,930, for yellow-pine lumber, and to the J. G. RAINWATER LUMBER CO., New Orleans, La., at $38,854 for white-oak freight-car timbers.

MISCELLANEOUS

✚Tunnel—Boston, Mass.—The Boston Transit Commission has awarded the contract for the construction of Section D of the Dorchester Tunnel to the HUGH NAWN CONTRACTING CO., Boston, at $673,780. List of bids noted in the issue of Aug. 20.

Dredging—Boston, Mass.—Bids were received, Aug. 21, by the Directors of the Port for 228,000 cu.yd. of dredging in Dorchester Bay as follows: Charles M. Cole, $52,555; Eastern Dredging Co., $55,525; John R. Burke, $55,697; J. S. Packard Dredging Co., $55,960; Bay State Dredging Co., $56,554; Eugene Breymann, $57,125. Noted Aug. 20.

★Stairways—Albany, N. Y.—(Official)—Bids will be received by the State Hospital Commission, Capitol Bldg., Albany, until 2:30 p.m., Sept. 4, for installing fireproof stairways in the Edgewood Building, at the Hudson River State Hospital, Poughkeepsie. J. H. B. Hanify is Secy.

River Improvement—Corning, N. Y.—Bids will be received by Duncan W. Peck, State Supt. of Pub. Wks., Albany, until noon, Sept. 3, for the improvement of a portion of the Chemung River in Corning.

Creek Improvement—Mohawk, N. Y.—Bids will be received by Duncan W. Peck, State Supt. of Pub. Wks., Albany, until noon, Sept. 3, for the improvement of Fulmer Creek in Mohawk.

Subway—New York, N. Y.—(Official)—Bids were received, Aug. 21, by the Public Service Commission, 154 Nassau St., Borough of Manhattan, for constructing Sect. 3, Route 33, a part of the Broadway-Fourth Ave. and Seventh Ave.-Lexington Ave. rapid transit railway, as follows: Flinn-O'Rourke Co., Inc., $3,395,152; Smith, Hauser & MacIsaac, Inc., $3,611,767; Oscar Daniels Co., $3,934,506; Underpinning & Foundation Co., $3,949,264; Frederick L. Cranford, Inc., $4,173,310; Bradley Contracting Co., $48,199,616; Rapid Transit Subway Construction Co., $4,600,930; Rodgers & Hagerty, Inc., $5,028,224. Noted Aug. 6.

✚Subway—New York, N. Y.—(Borough of Manhattan)—The contract for constructing Sec. 1-A of Route No. 4 and 38 of the Seventh Ave. subway in Manhattan, has been awarded to RAPID TRANSIT SUBWAY CONSTRUCTION CO., at $474,244.

Pig Lead—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until 2 p.m., Sept. 1, by William Williams, Comr. of Water Suply, Gas & Electricity, Municipal Bldg., Manhattan, for 50,000 lb. of pig lead for the boroughs of Manhattan and The Bronx, and 15,000 lb. of pig lead for Richmond Borough.

Flood Prevention Work—Rochester, N. Y.—R. T. Ford Co., Rochester, was low bidder at $284,100 for deepening the channel between Central Ave. dam and a point south of the aqueduct. T. A. Gillespie Co., at $389,290 was low bidder for deepening of the channel north of the Central Ave. dam and for constructing a movable dam.

Creek Work—Towanda, N. Y.—Plans for improving Ellicott Creek have been approved. Bids will be asked at once. F. P. Williams, Rochester, N. Y., is Engr.

★Lighting Standards—Atlantic City, N. J.—(Official)—Bids will be received by the Board of Commissioners until Sept. 10, for furnishing 250 c.i. lighting standards. John W. Hackney is City Engr.

★Dredging—Newark, N. J.—(Official)—Bids will be received by the Board of Street and Water Commissioners until 3:30 p.m., Sept. 3, for dredging about 7000 lin.ft. of the channel now being dredged by the City of Newark in Newark Bay. For particulars see advertisement under "Contracts to Be Let"

Bulkhead—Trenton, N. J.—Bids will be received by the City Commission until Sept. 4, for the construction of a concrete bulkhead and necessary dredging, on the Delaware River, near Ferry St. Frank Thompson is City Clk.

Piling—Gretna, La.—The LaFourche Basin Levee Board, New Orleans, will soon receive bids for driving round piles on the levee line in Gretna.

Tunnel—Pittsburgh, Penn.—The County Commissioners, Pittsburgh, it is reported, have retained A. N. Neeld, Hostetter Bldg., **Pittsburgh,** to prepare plans for a tunnel to the **South Hills.**

Elimination of Grade Crossings—Scranton, Penn.—The Delaware, Lackawanna & Western R.R. plans to spend $100,000 to eliminate the grade crossing at McHales Court and Court St. F. L. Wheaton, Hoboken, N. J., is Engr. Const.

Fill—Baltimore, Md.—Bids will be received until Sept. 1, by the Maryland State Roads Commission, for an earth fill, calling for 225,000 cu.yd., over the north branch of Patapsco River. O. E. Weller, Garrett Bldg., Baltimore, is Chn.

Dock—Norfolk, Va.—The cost of the proposed public dock has been estimated at $186,000. W. T. Brooke is City Engr.

✚Dredging—Jacksonville, Fla.—The contract has been awarded to the BOWERS SOUTHERN DREDGING CO., Galveston, Tex., for dredging a channel and filling a dock site in private property here. The work calls for 800,000 cu.yd.

Coal Docks—South Jacksonville, Fla.—The Florida East Coast Ry. Co. plans to construct coal docks, to cost about $1,000,000, in South Jacksonville. E. K. Barrett, St. Augustine, Fla., is Supt. Bridges and Bldgs.

✚Canal—Marksville, La.—The Commissioners of Avoyelles Drainage District No. 4 have awarded the contract to TASKER WATTS, Marksville, for constructing the Couldes Grues Canal at 17.9c. per cu.yd. for the upper portion and 19.76c. for the lower portion. The work calls for 150,000 cu.yd.

Fire Alarm System—Plaquemine, La.—See item under "Water Supply and Irrigation."

✚Drainage—Selmer, Tenn.—The contract for constructing the Lick Creek drainage canal in McNairy County has been awarded to the TUPELO DREDGING CO., Tupelo, Miss., at $16,000.

Bath-House—Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies until noon, Sept. 2, for the construction of the superstructure of the bath-house at Woodland and East 99th Sts.

Fire Apparatus—Girard, Ohio—The citizens have voted in favor of issuing $15,000 in bonds for fire apparatus.

Fire Stations and Apparatus—Indianapolis, Ind.—The city plans to issue $100,000 for new fire stations and for fire apparatus. B. T. P. Jeup is City Engr.

✚Ditch—Lagrange, Ind.—The contract has been awarded to CLYDE A. WELB, Lagrange, for constructing the Ginder Ditch in DeKalb County.

Drain—Newcastle, Ind.—Bids will be received until 1:30 p.m., Aug. 29, by C. E. Eyrket, Drainage Comr., at the County Surveyor's office, Newcastle, for constructing a drain.

Ditch—Rensselaer, Ind.—Bids will be received until Sept. 16 by the County Commissioners, Rensselaer, for constructing Marble Ditch. The work calls for 5,050,000 cu.yd. of excavation. C. J. Hobbs, Kersey, Ind., is Supt. of Const.

Ditch—Valparaiso, Ind.—Bids will be received until 1 p.m., Sept. 14, by Stephen P. Corboy, Const. Comr., Valparaiso, for constructing the Burns Ditch. The work calls for an expenditure of $270,000. G. F. Stinchfield, Valparaiso, is Engr.

Levee Work—Quincy, Ill.—The lowest bid opened by the Sny Island Levee District for 130,00 cu.yd. of levee work was that of the Bondurant Construction Co., Hickman, Ky., at 37c. per cu.yd.

✚Mausoleum—St. Charles, Ill.—Edward Baker has awarded the contract to the TRIGG MARBLE & GRANITE WORKS, Rockford, Ill., for constructing a mausoleum, at $12,000.

Subway—Eau Claire, Wis.—The Wisconsin Railroad Commission has ordered the Chicago, St. Paul, Minneapolis & Omaha R.R. Co., to construct a subway under its tracks at the Dewey St. crossing.

Ditch—Grand Rapids, Wis.—Bids will be received by Anton Brost, of the B. M. Vaughn Co., Grand Rapids, at Babcock, Wis., until Sept. 4, for constructing about 33 miles of new ditch and enlarging 18 miles of the present ditch of the Cranberry Creek Drainage District.

Drainage—Grand Rapids, Wis.—The Wood County Drainage District contemplates an issue of bonds for $40,000, the proceeds of which will be used for additional drainage improvements. B. G. Chandos is Secy.

✚Flood Channel—Burlington, Iowa—The contract for constructing the Market St. flood channel has been awarded by the city to YOUNG & BUESCHER, Burlington, at $77,000.

✚Drains—Forest City, Iowa—The Commission rs of Winnebago and Kossuth Counties have awarded contracts for drains in Joint Drain Districts 35 and 89, as follows: Labor, to the INTERSTATE DRAINAGE CO., Britt, Iowa, at 8c. per cu.yd.; tile work to B. F. SEBASTIAN, Webster City, Iowa, at $69,112.

Ditch—Albert Lea, Minn.—Bids will be received until Aug. 29 by C. E. Brainerd, County Audr., Albert Lea, for constructing a ditch to cost $16,500.

Motordrome—Hiawatha, Kan.—The Hiawatha Fair Association plans to construct a motordrome.

Drainage—Curtis, Neb.—(Official)—Bids will be received by the Board of Supervisors of Drainage District No. 1 of Frontier County, at the office of the Secretary, W. H. Latham, Curtis, until 5 p.m., Sept. 8, for constructing drainage ditches in the district. Approximately 42,000 cu.yd. of ditching will be required. D. O. Nelson is Chn. Bd. of Supervisors.

Levees—Poplar Bluff, Mo.—The Morgan Engineering Co., Memphis, Tenn., has prepared plans for drainage and protection work in Inter-River Drainage District. The work calls for about 58 miles of levees.

Ditches—Bay City, Tex.—Bids will be received until Sept. 12 by E. N. Gustafson, Engr., Bay City, for ditches for Dist. 5. The work calls for 255,000 cu.yd. of excavation.

Shelter House—Dallas, Tex.—Bids will be asked until Aug. 28, by the Park Board for constructing a shelter house. Estimated cost, $25,000. J. M. Preston is City Engr.

Coal Pier—Galveston, Tex.—The Clinchfield Fuel Co., Spartansburg, S. C., plans to construct a large coal pier at Galveston.

Canal Protection System—Harlingen, Tex.—Harlingen Canal District has voted to issue $[illegible] in bonds for improving its canal protection system.

Drainage—Houston, Tex.—The [illegible] Ditching Co. has been organized with a capital stock of $[illegible] for the purpose of constructing drainage systems. [illegible] Stewart is interested.

Drainage—Houston, Tex.—Howe & Wise, County Engrs., Houston, have been instructed by the County Commissioners to prepare plans and specifications for drainage work in the territory adjoining the Yale St. crossing, to White Oak Bayou.

+Levee Repair—[illegible]dale, Tex.—(Official)—Bids will be received by John H[illegible]ks, Mgr., M[illegible] County Improvement District No. 1, until 6 p.m., Sept. 2[illegible], for the repair of a dirt levee on Little River, in M[illegible] County.

Dredging, etc.—Seattle, Wash.—The lowest bid submitted to the [illegible] County Diver Commissioners for dredging Mar[illegible] cut-off was that of Cress, Rollins & Twelin, at $[illegible]. The work calls for [illegible] cu. yd. dredging, [illegible] ft. of piling, [illegible] ft. of lumber, 3[illegible] lb. iron and steel, 16 acres of clearing and 1[illegible] cords of fir brush in places.

Crane—Seattle, Wash.—Bids will be received until Sept. 16 by the Port of Seattle Commission, for a gantry crane. Noted June 11 and July 3[illegible].

Rink—Seattle, Wash.—The Franklin Engineering Co., Hoge Bldg., Seattle, will receive bids at once for various contracts covering the construction of the one-story ice-skating rink to be built by the Seattle Arena Co. at 11th Ave. and Jefferson St., at a cost of about $[illegible],000.

+Tower—Portland, Ore.—The Oregon-Washington R.R. & Navigation Co. has awarded the contract to the T. W. SNOW CONSTRUCTION CO., Chicago, Ill., for constructing a steel tower at the foot of Russell St., at about $17,000.

+Dock—Portland, Ore.—The Southern Pacific Co. has awarded the contract to the COWLITZ BRIDGE CO., Yeon Bldg., Portland, for constructing an open dock of pile and timber construction.

+Docks—Portland, Ore.—The contract has been awarded by [illegible] Lombard Co. to ELLIOTT CONTRACTING CO., at $[illegible] for constructing two reinforced-concrete docks.

+Steel Tower—Portland, Ore.—The Oregon-Washington Railway & Navigation Co. has awarded a contract for the construction of a steel tower for a coaling station at the foot of Russel St. to the T. W. SNOW CONSTRUCTION CO., Chicago, Ill., at approximately $17,000.

+Dock—Portland, Ore.—The contract for constructing a pile and timber dock, [illegible]x260 ft., has been awarded by the Spokane, Portland & Seattle Ry. Co. to COWLITZ BRIDGE CO.

Viaducts and Track Work—Portland, Ore.—The railroad tracks through Sullivan Gulch will be lowered and viaducts built at an estimated cost of $2[illegible]0,000. The cost will be borne by the city, the Portland Ry., Light & Power Co. and the Oregon-Washington Ry. & Navigation Co. The work will be under the supervision of the Department of Public Works.

Pier—Long Beach, Calif.—The lowest bid submitted to the [illegible] for constructing a single deck, reinforced-concrete pier at the foot of [illegible]th Place was that of Mesmer & Rice, Story Bldg., Los Angeles, Calif., at $[illegible]. John Schultz Wright & [illegible] Bldg., Los Angeles, is Engr.

Aerial Tramway—Placerville, Calif.—An aerial tramway [illegible] mile long will be constructed at the rock quarry of [illegible].

+Ferry Slips—San Francisco, Calif.—The contract for constructing ferry slips Nos. 6 and 7 has been awarded by the State Board of Harbor Commissioners to SAN FRANCISCO [illegible] Co., at $[illegible].

[illegible]

BUILDINGS

[illegible]

+Beverly, Mass.—The contract for the erection of a store and office building at Cabot and Hale Sts., for Herbert F. Winslow, 344 Cabot St., has been awarded to WILLIAM H. CANN. The building will be of brick and terra cotta and is estimated to cost $[illegible]. Noted July 3[illegible].

+Boston, Mass.—The contract for the erection of a bank and office building at 2[illegible] Huntington Ave. for the Massachusetts Trust Co. has been awarded to L. P. SOULE & SONS CO., 1[illegible] Central St. The building will be of stone, brick and steel, five stories, 66x105 ft. George N. Meserre, 95 Milk St., is the Arch.

Lawrence, Mass.—The School Committee contemplates the erection of a central school to cost about $[illegible].

New Bedford, Mass.—The contract for the erection of a mercantile building for the Steiger-Dudgeon Co. has been awarded to the J. W. BISHOP CO., Worcester. The building will be four stories, of brick and reinforced concrete. George P. B. Alderman & [illegible] are the Archs. Noted July 16.

+Pawtucket, R. I.—The contract for erecting the store and office building at Broad St. and Railroad Ave. for the Broad St. Power Co., has been awarded to the H. F. SMITH CONSTRUCTION CO., Pawtucket, at about $12[illegible],000. Noted Aug. 13.

Bridgeport, Conn.—Bids will be received by the Board of Education until Aug. 31 for building a brick addition to the Bryant School at Maplewood Ave. and Poplar St. C. T. Beardsley, Bridgeport Savings Bank Bldg., is the Arch.

Hartford, Conn.—Cadwell & Jones plan to erect a six-story building at 1082 Main St.

Hartford, Conn.—From revised plans by A. Raymond Ellis, 36 Pearl St., bids will be received for an addition to the Hartford Hospital on South Hudson St. Noted July 16.

Stamford, Conn.—Plans are being prepared for an apartment hotel on South St. for F. T. R[illegible], East Orange, N. J. The building will be of brick and reinforced concrete, [illegible]x115 ft., five-stories, and will cost about $1[illegible]0,000. Henry Pelton, [illegible] West 3[illegible]th St., New York, N. Y., is the Arch.

+Binghamton, N. Y.—The general contract for constructing the three-story and basement school for St. Mary's R. C. Church has been awarded to A. E. MADGLEY, at about $75,000. T. I. Lacy & Son, Jamestown, N. Y., prepared the plans.

Buffalo, N. Y.—A. A. Post, Brisbane Bldg., is preparing plans for a three-story brick and stone infants' home, to be erected at West Seneca St., for Our Lady of Victory R. C. Church.

+Jamestown, N. Y.—The general contract for building the four-story and basement Odd Fellow's Temple has been awarded to the JAMESTOWN CONSTRUCTION CO., Jamestown. The estimated cost is $6[illegible],000.

Little Falls, N. Y.—The city contemplates the construction of a city hall to cost $100,000.

Long Beach, N. Y.—Cross & Cross, Archs., 1[illegible] East 4[illegible]th St., New York, N. Y., have been retained to prepare plans for a hotel for the [illegible] Corporation, to cost about $2,[illegible]. Henry R. Winthrop is Pres.

Mechanicville, N. Y.—It is reported that the Delaware & Hudson and Boston & Maine railroads will build a union station to cost about $[illegible].

+Mooney, N. Y.—The general contract for constructing the three-story dormitory for the Children's Aid Society has been awarded to JOHN McKAY, Mahwah, N. J.

New York, N. Y.—(Borough of Bronx)—(Official)—The lowest bid received by C. B. J. Snyder, Supt. of School Bldgs., for constructing public school No. [illegible] on St. [illegible], was that of the [illegible] Contracting Co., [illegible] West [illegible]th St., New York. Bids were opened Aug. [illegible]. Noted Aug. [illegible].

New York, N. Y.—(Borough of Brooklyn)—Trowbridge & [illegible], Archs., 62 West [illegible]th St., New York, have completed plans for a three-story brick Y. M. C. A. building at [illegible] Place and [illegible] Place for the Y. M. C. A. [illegible]. The estimated cost is $[illegible].

[illegible]

New Brunswick, N. J.—Alexander Merchant, Chn. of Bldg. Com., Board of Education, will receive competitive plans for constructing a high school, to cost about $150,000.

Passaic, N. J.—It is reported that bids will be received by the Board of Education until Sept. 8, for constructing a three-story and basement school. John F. Kelly, Post Office Bldg., is the Arch.

✚**Forest City, Penn.**—The contract for building the two-story school has been awarded to the HOLT LUMBER CO., 61 North Main St., at about $40,000. Percival J. Morris, Burr Bldg., is the Arch.

Philadelphia, Penn.—The lowest bid submitted for the Girls High School, at Broad St. and Snyder Ave., was from Cramp & Co., at $518,518. Noted Aug. 6.

The "Friends Book Store" will build a six-story, 40x80-ft. steel and brick commercial building at 304 Arch St. Morris & Erskine are Archs.

✚**Pittsburgh, Penn.**—The general contract for erecting the William Penn hotel has been awarded to the GEORGE A. FULLER CO., Oliver Bldg. The building will be 20 stories, 130x216 ft., and is estimated to cost $3,000,000. Janssen & Abbott, Century Bldg., prepared the plans.

Plans are being prepared by Schmid & Holmes, 154 West Randolph St., Chicago, for a three-story and basement temple for the Syria Temple congregation. The estimated cost if $300,000.

Rochester, Penn.—The Board of Education contemplates the construction of a high school to cost about $100,000. George H. Karches is Secy. of the Board of Education.

Roanoke, Va.—Bids will be received until Sept. 15, by the city, for the construction of a city hall and court house, from plans by Fry & Chesterman, Roanoke. The building will be of granite, terra cotta and stone and is estimated to cost $280,000.

Sulphur Springs, Va.—The South Bluefield Land Co. and Bluefield-Graham Fair Association are reported interested in erection of a hotel near this place. A. B. Hahood, Bluefield, is Arch. The estimated cost is $150,000.

Greenville, Miss.—The School Board is having plans prepared for building a high school, to cost about $45,000.

Chattanooga, Tenn.—The citizens have voted $200,000 in school bonds and $100,000 in bonds for improving the Erlanger Hospital.

Chattanooga, Tenn.—R. H. Hunt, Chattanooga, has completed plans for a church and office building to be erected for the First Christian Church at Georgia Ave. and East Seventh St., to cost $260,000.

Mount Sterling, Ky.—Weber, Werner & Adkins, Mercantile Library Bldg., Cincinnati, Ohio, are preparing plans for a five-story and basement hotel for Henry C. McKee. The estimated cost is $85,000.

Clarksburg, W. Va.—Edward J Wood, Arch., Lowndes Bldg., is preparing plans for a two-story and basement hotel for Mrs. A. J. Coleman, Clarksburg. The estimated cost is $40,000.

Cleveland, Ohio—The Jewish Hospital Assn., Cleveland, is having plans prepared for the construction of a new building at Ansel Rd. and East 105th St. The estimated cost is about $400,000. George B. Post & Sons, New York, N. Y., have prepared the plans.

Mayor Newton O. Baker is reported to be in favor of a plan to build an auditorium, concert and dance hall at Gordon Park. The cost will be $50,000.

Western Reserve University is having plans prepared for a building to be used as the dental college. It will be four stories, 80x112 ft., and estimated to cost about $100,000. Franz C. Warner, 718 Prospect Hippodrome Bldg., is the Arch.

✚The contract for the erection of St. Colman's Church, at West 65th St. and Lawn Ave., has been awarded to ANDREWS BROS., Engineers' Bldg., Cleveland. The estimated cost is $250,000. E. J. Schneider, Cuyahoga Bldg., Cleveland, is the Arch.

Bids will be received by Ralph M. Hulett, Arch. and Engr., for the construction of the proposed German clubhouse, estimated to cost about $50,000.

The Hellman Realty Co. is having plans prepared for a six-story, 100x200-ft. store building, to be erected at 2037 East Ninth St. The estimated cost is $350,000. Robert D. Kohn, 56 West 45th St., New York, N. Y., is the Arch.

The New York, Chicago & St. Louis Ry. Co. is having plans prepared for a terminal building, two stories, 100x800 ft., and one story, 50x800 ft. The estimated cost is $350,000. E. E. Hart, 412 Hickory Bldg., Cleveland, is Ch. Engr.

Columbus, Ohio—Bids will close at noon, Aug. 28, for the construction of a five-story clubhouse for the Athletic Club of Columbus. The estimated cost is about $350,000. Richards, McCarty & Bulford, Hartman Bldg., are the Archs. M. D. Stouffer, 8 East Long St., is Secy. and Mgr.

Dayton, Ohio—The Cleveland, Cincinnati, Chicago & St. Louis Ry is said to be contemplating the erection of a terminal in this city, to cost about $200,000. George P. Smith, Cincinnati, is Ch. Engr.

Findlay, Ohio—$300,000 in bonds have been voted by the citizens for the erection of two schools.

Montpelier, Ohio—Bids will be received until Aug. 24, by Huber & Gamble, Archs., Toledo, for constructing the proposed high school. The estimated cost is about $60,000.

✚**Xenia, Ohio**—The Springfield Building & Loan Assn. has awarded the contract for the construction of its granite building to the GEORGE DODDS & SONS MARBLE & GRANITE CO., at $75,000.

Greencastle, Ind.—The Board of Education contemplates the erection of a two-story high school, to cost about $60,000. H. L. Bass & Co., 801 Hume-Mansur Bldg., Indianapolis, Ind., is the Arch.

Bay City, Mich.—Plans are being prepared for the construction of a three-story, 90x92-ft. Y. M. C. A. building, estimated to cost about $45,000. Clark & Munger, Bay City, Mich., are the Archs.

Detroit, Mich.—All bids for the construction of the Detroit Home of Detention have been rejected and new bids will be called for. The cost limit has been raised from $128,000 to $230,000. New bids shall include estimates for construction and furnishing in its entirety.

The Wayne County & Home Savings Bank has had plans prepared for a seven-story building, to be erected at Michigan and Griswold Sts. The estimated cost is $200,000. Donaldson & Meier, Detroit, are the Archs.

Menominee, Mich.—The Board of Education will receive bids until Aug. 30, for the construction of a three-story, 128x300-ft. school. Estimated cost, about $52,000. Derrick Huber, Menominee, is the Arch.

Nazareth, Mich.—The Nazareth Academy is having plans prepared for the construction of a three-story, 40x285-ft. school, estimated to cost about $75,000. C. A. Fairchild, 150 South Burdick St., Kalamazoo, Mich., is the Arch.

Chicago, Ill.—Auburn Park Lodge, No. 789, is having plans prepared for a four-story, 80x105-ft. Masonic Temple, estimated to cost $75,000. Robert M. Hyde, 110 South Dearborn St., is the Arch.

Freeport, Ill.—The Freeport Y. M. C. A. is ready to receive bids for the construction of a three-story building. The estimated cost is about $125,000. Shattuck & Hussey, 19 South La Salle St., Chicago, are the Archs.

✚**Joliet, Ill.**—The contract for the construction of the Joliet High School has been awarded to ALFRED WENBERG & SON, Joliet, at $33,000. Graham, Burnham & Co., 80 East Jackson Blvd., Chicago, are the Archs. Noted July 9.

✚**Peoria, Ill.**—The Illinois Traction Co. has awarded the contract for concrete foundation work on its terminal building to V. JOBST & SONS, Peoria. THE DECATUR BRIDGE CO. was awarded the contract for the steel work. The estimated cost of the building complete is about $450,000.

✚**Butternut, Wis.**—The general contract for the new high school, has been awarded to CHARLES BLOSS, Ashland, Wis. The estimated cost is about $60,000. Henry Wildhagen, Ashland, is the Arch.

✚**Madison, Wis.**—The contract for the erection of Christ Church has been awarded to T. C. McCARTHY. The estimated cost is about $70,000.

Marinette, Wis.—Bids will be received until Sept. 8, by A. Z. White, Secy. Bd. of Education, for the construction of the new high school. The estimated cost is $120,000. John D. Chubb, 109 North Dearborn St., Chicago, Ill., is the Arch.

Milwaukee, Wis.—The following bids were received for the construction of the $600,000 Milwaukee County House of Correction: Sterling Engineering Co., $173,750; Riesen Co., $234,693; Coddington Engineering Co., $235,600; Dahlman Construction Co., $304,355; Rauif Construction Co., $245,000; Monsted Construction Co., $258,159. Noted July 23.

Milwaukee, Wis.—Milwaukee County is planning to erect a new courthouse, to be 12 to 16 stories. The estimated cost is about $2,000,000. Bids on the site have been received. L. G. Widule is County Clk.

Oshkosh, Wis.—Bids will be received until Aug. 31, by C. R. Fiss, Secy. Bldg. Com., for the construction of the County Tuberculosis Sanitarium. Henry Auler is the Arch.

Ames, Iowa—The State Board of Education, Des Moines, plans to erect at the Iowa State College, an animal husbandry building to cost $80,000, and a bacteriology and zoölogy building to cost $65,000.

Burlington, Iowa—The Board of Education is having plans prepared for a two-story school, to be known as the Charles Elliott Perkins School. The estimated cost is $50,000. Eckland & De Arment, Moline, Ill., are the Archs.

Davenport, Iowa—The St. Luke's Hospital Board has purchased a site where a hospital will be erected at an estimated cost of $100,000.

✚**Minneapolis, Minn.**—The contract for the construction of a four-story school and dormitory building for the Catholic Orphan Asylum has been awarded to the HAGLIN-STAHR CO., at $52,000.

The City of Minneapolis is having plans prepared for the construction of a one-story, 35x90-ft. library. The estimated cost is $40,000. Edward L. Tilton, 32 Broadway, N. Y., is the Arch.; Chapman & Magney, 509 Essex Bldg., Minneapolis, Assoc. Archs.

Lincoln, Neb.—The Acme Amusement Co. will have its plans revised again for the construction of the Orpheum Theater. The estimated cost is about $60,000. Carl Boller, Gayety Theater Bldg., Kansas City, Mo., is the Arch.

Kansas City, Mo.—The Board of Education is having plans prepared for the construction of a one-story, 160x184-ft. school in Swope Park. Cost about $75,000. C. A. Smith, Finance Bldg., is the Arch.

St. Louis, Mo.—The Missouri Athletic Club contemplates the erection of a clubhouse at Fourth and Washington St., estimated to cost about $600,000.

✚**Austin, Tex.**—The contract for building the new home of the Austin Elks' lodge has been awarded to FISHER & LAMBIE, Austin. The estimated cost is $55,000. C. H. Page & Bro., are the Archs.

Dallas, Tex.—The Central Presbyterian Church has had plans prepared for a church to be known as the "City Temple," to be erected on North Akard and Burlington St. Estimated cost, about $200,000.

The Chain Belt Co., Milwaukee, Wis., has recently appointed the Ward Equipment Co., 331 Fourth St., Pittsburgh, as its agent in Pittsburgh and vicinity. The Ward Equipment Co. will handle the Chain Belt Concrete Mixer, the Chain Belt Paver and the Chain Belt Elevators, Conveyors and Distributing Systems.

The C. & C. Electric & Mfg. Co., Garwood, N. J., makers of electric motors, generators and electric arc-welding equipment, has opened a branch sales office at Minneapolis, Minn. This office will be in charge of R. L. Wells.

Contracts to Be Let

Bids received until Sept. 18, 1914.

Judicial Sale

of the Assets of

THE CANADIAN MINERAL RUBBER COMPANY, LIMITED

In the matter of the Winding-Up Act, being Chapter 144 of the Revised Statutes of Canada and Amending Acts, and in the matter of the Canadian Mineral Rubber Company, Limited.

Sealed tenders will be received addressed to "George O. Alcorn, Esq., Master-in Ordinary, Osgoode Hall, Toronto, Canada," and marked "Tenders in the matter of The Canadian Mineral Rubber Company, Limited" up to 2.30 p.m. of Friday, the 18th day of September, 1914, for the purchase of certain assets of the said Company consisting of —

PARCEL NO. 1—Located at Model City, adjoining Montreal, and at Sorel, Que.

Cummer asphalt paving plant, railroad type, and sundry accessories including rollers, concrete mixers, tank cars, tools, etc., etc.

PARCEL NO. 2—Located at Winnipeg, Manitoba.

Roofing and flooring material and equipment, paint, pipe-coating, office furniture, safe, etc., etc.

PARCEL NO. 3—Located at Calgary, Alberta.

Merriman asphalt paving plant, railroad type, and sundry accessories, including roller, stone crusher, concrete mixers, hoisting engine, tools, asphalt, cobbles, office furniture, etc., etc., together with a certain lease of dredging rights for sand and gravel, the liabilities under which must be assumed by the purchaser.

PARCEL NO. 4—Located at Vancouver, British Columbia.

Cummer asphalt paving plant, railroad type, and sundry accessories, including rollers, stone crusher, concrete mixers, hoisting engine, tools, asphalt, rock, office furniture, motor-cycle, etc., etc.

PARCEL NO. 5—Located at New Westminster, British Columbia.

Merriam asphalt paving plant, railroad type, and sundry accessories, tools, etc., etc.

PARCEL NO. 6—Located at Victoria, British Columbia.

Merriman asphalt paving plant, railroad type, and sundry accessories, including rollers, concrete mixers, graders, automobiles, tools, supplies, office furniture, etc., etc.

PARCEL NO. 7—Located in the State of Utah, U. S. A.

Certain claims and mining rights covering a deposit of practically pure bitumen (gilsonite) and bituminous limestone.

Possession: Immediate possession of parcels Nos. 1, 2, 3, 4, 5, and 7 can be given on completion of sale. Possession of parcel No. 6 cannot be given until certain paving at the City of Victoria, B. C., in which the Liquidator is at present engaged, is completed. If, before the completion of the sale, the purchaser requires possession of any parcel, of which possession can be given by the Liquidator, he may obtain same by giving security for the unmatured payments satisfactory to the Master in Ordinary of the Supreme Court of Ontario. Tenders must be made on the understanding that inability on the part of the Liquidator to deliver possession of, or transfer the title to any item shall operate as a cancellation of the sale in respect of such item only, and shall not operate as a cancellation of the sale as a whole. The amount of any allowance to be made in respect of any such item shall be determined by the Master-in-Ordinary of the Supreme Court of Ontario.

Tenders will be received for all parcels en bloc and for each parcel separately.

All rentals, taxes, insurance, water rates and similar items will be adjusted to the date of the acceptance of the tender.

Full information as to all parcels with inventories of parcels Nos. 1, 2, 3, 4, 5 and 6 and a schedule of the claims and mining rights included in parcel No. 7, and copies of the Lease referred to in Parcel No. 3 may be obtained from the Liquidator.

NATIONAL TRUST COMPANY, LIMITED, TORONTO, CANADA.

Terms of Payment: Ten per cent. of the amount tendered shall accompany each tender, 15% on the acceptance of the tender, and the remainder in 3 equal installments at 3, 6 and 9 months without interest. On receipt by the Liquidator of the final payment, the sale shall be completed. All tenders must be accompanied by an accepted cheque payable to the Liquidator for 10 per cent. of the amount of the whole tender, which cheque will be returned if the tender is not accepted, and forfeited if the tender is accepted, and purchase not completed by the tenderer.

The highest or any tender not necessarily accepted.

The purchaser shall, at his own expense, make whatever search of title he may deem necessary or expedient, and the Liquidator shall not be required to furnish any abstracts or produce any deeds, declarations, or other evidence of title except those in its possession. The purchaser shall have 15 days from the date of acceptance of tender within which to make any objections or requisitions in respect of the title and in case the purchaser shall, within such time make any objection or requisition which the Liquidator shall from any cause, be unable or unwilling to remove or answer, then the Liquidator may (notwithstanding any intermediate negotiations) rescind the sale, in which case the purchaser shall be entitled only to a return of the deposit money without interest, costs or compensation.

The other conditions will be the standing conditions of sale of the Supreme Court of Ontario, as far as applicable.

Tenders will be opened at the office of the Master-in-Ordinary, Osgoode Hall, Toronto, Can., at 2.30 p.m., on the 18th day of September, 1914, when all tenderers are requested to be present.

Dated at Toronto, this 10th day of July, 1914.

NATIONAL TRUST COMPANY, LIMITED,
Toronto, Ontario, Canada,
Liquidator.

✕

Bids received until Sept. 1, 1914.

State Highway Improvements

NOTICE TO CONTRACTORS—State of New York—Office of the State Commission of Highways, Albany, N. Y.—Pursuant to the provisions of chapter 30, 1909 as amended by chapter 646, Laws of 1911 and chapter 83, Laws of 1913, sealed proposals will be received by the undersigned at their office, No. 55 Lancaster street, Albany, N. Y., at 1 o'clock p. m. on Tuesday, the 1st day of September, 1914, for the improvement of the following highways:

County	Road No.	Name	Approx. Length
Allegany	5312 B	Cuba - Friendship, Part 2	0.17 Mi
Erie	1087 A	Gowanda Village	0.30
Essex	5170 A	Schroon Lake - No. Hudson Part 1	6.77
Nassau	1201	Huntington Town Line - Farmingdale, Part 2	0.41
Ontario	5311	[illegible] - Holcomb	5.67
Rockland	5582	New Jersey State Line - Nyack, Part 1 and 2	3.73
Rockland	5590	Haverstraw - West Haverstraw	1.56
St. Lawrence	[illegible] A	Morristown - Hammond, Part 2	1.99
Wayne	5541	[illegible] - Lyons, Part 3	2.[illegible]
Wyoming	5[illegible] A	Warsaw - [illegible]	0.49
Wyoming	9[illegible]8	Java Village - Wales	3.[illegible]

REPAIRS

Rep. Cont. No.	Class of work	Rd. No.	County	Name	Town
600	H. C. T. Cold Appl. No guarantee	5341	Allegany	Friendship-Belmont	Friendship and Amity
608	L. C. T. Hot and Cold Appl. No guarantee	[illegible]	Oswego	Central Square-[illegible] Square, Part 1	Hastings
6[illegible]1	[illegible] guaranteed	77	Rensselaer	Albia - Wynantskill	Brunswick and North Greenbush

Maps, plans, specifications, estimates and proposal forms may be obtained at the office of the Commission in Albany, and also at the office of the Division Engineer in whose division the work is to be done. The specifications and proposal forms contain all the terms under which bids are received.

The right is reserved to reject any or all bids.

JOHN N. CARLISLE,
Commissioner.

R. K. FULLER,
Secretary.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

CLEARING OF BUSINESS SKIES

Order is coming out of chaos and the financial storm, caused by the stupendous demand for gold from abroad, has abated. Conditions, although still highly sensitive, are improving. Exchange with Europe is obtained only at abnormal prices, but it is possible to do business. Domestic finance is in better condition. It will be many months before order, even in this country, is restored, but how usual values will be depreciated depends on the authorities. Certainly bankers are acting with far more skill and patriotism than they did seven years ago. Interest rates are extremely high. In New York, at least, trust companies refuse to make building loans.

The importation of foreign materials used by American consumers and manufacturers has been largely curtailed, but ocean traffic is gradually augmenting and trade with England, France, Italy and the far East will probably soon be restored. Some very severe competition is cut off for the present because Germany is unable to ship to this country.

Exports of food stuffs are resuming. It will not be long before other commodities also can be sent to foreign buyers. The cotton shipments, which in a large measure offset our unfavorable balance of trade each year are held up and must be caused by home bankers.

Domestic trade has slowed down appreciably. The cutting down of individual expenditures has had its effect in all lines. The buying of food stuffs in anticipation of higher prices has been a feature, and reducing lines of seasonable merchandise by drastic cuts is evident. Stocks, however, are not heavy in any line, neither has there been any marked expansion among disturbers.

The agricultural situation calls for closer observation now than it has in a number of years. The wheat crop is practically the largest on record, and the corn crop, while somewhat of a disappointment compared with that of 1911, is still well above the 10-year average. Those of other grains and hay are large. It must be remembered that grain raising has been abandoned in many localities for general farming, and while the output of corn in bushels may not be as great the food stuff raised for cattle is much larger than ever before and moreover it is evident that there are more cattle in the country now than a year ago. Wheat prices advanced rapidly the last two weeks of August, but since that time have eased off appreciably. It is possible that the highest prices will not be reached until next year.

Business Gains and Losses

New factories will come into being in many diversified lines. A leading importer of ball bearings is building a factory in Philadelphia to employ at least 1000 men to make ball bearings by automatic machinery; a Worcester, Mass., toy manufacturer has recently doubled the capacity of his plant; a Massachusetts engineering firm has taken an order for a coal-handling plant for Australia. American manufacturers of textiles are looking for some methed by which dyes can be produced in this country. Numerous additions to manufacturing plants must be made as a result of the European upheaval.

A few catalogs in English, some mimeograph letters in poor Spanish and a list of addresses from a New York mailing house will not bring trade from South America. The money and time that have been wasted in trying to make the people of South America step up and buy what American merchants want to sell is appalling. There is business there, but it's trade and not orders. To secure business of any kind it must be done the way the inhabitants in those countries are accustomed to doing it. Tools must be supplied for their units, not ours; their needs must be studied. It is a fertile field, rich in possibilities and will bring tremendous return to the few who are going to secure it but it is no bonanza and must be worked. It must be remembered that there are at least a dozen different firms, each with a capital of over $1,000,000 who have been trading in South America for a decade or more.

The railway rate decision was not what the railroads expected, or at least hoped. It, however, did grant them a grain of comfort. While three of the commissioners signed the report, two filed dissenting opinions. On the previous application of the railways for higher rates it was vetoed in toto by the entire commission.

Municipal work will be slow until there is more assurance about financing the bonds. The City of New York has decided to go ahead with the subway construction, or at least as much of it as will enable the parts under construction to be operated. There seems to be comparatively little difficulty in selling water-works bonds in the West to local banks or sinking fund commissions, but the number of highway bond applications turned down by bankers have been notable. The inclination of the investing public to buy municipal isues is one of the things which bears the most important watching.

Providing suitable laws are enacted, there is every renson to believe that a number of vessels now owned by American corporations will fly the American flag. The question of the government going into the ocean-carrying trade is one of great danger and to say the least it seems scarcely necessary for the Federal government to buy high speed palatial passenger vessels, designed for a lucrative traffic in the North Atlantic, when there is little possibility of much traffic of this character for several years to come. The mobility of shipping and the ability of one boat to carry more tons in a year due to the Panama Canal should not be lost sight of, but it is a notable fact in the history of this country that whenever better methods of transportation have been provided, the traffic has soon grown in proportion to the facilities.

Price Changes

Extreme fluctuation in tin has marked the course of that market during the month. Copper, early depressed in the failure of Europeans to buy recovered some of the loss. In spite of the shortage of ferro-manganese, there will be sufficient steel to meet the demand although prices are from $1 to $3 higher above the low level. No change was made in belting, but rubber is higher and all lines seem destined to go higher for the present.

CEMENT, LIME AND BRICK

Portland Cement—Prospects are brighter for a good winter business in cement than in many years. The Valparaiso docks will require half a million dollars worth of cement. Cable inquiries ar ecoming to American manufacturers, asking 'How soon can you ship 5000 bbl." Price is a secondary consideration. It is estimated that South America and the West Indies will require in the next year 15,000,000 bbl. of cement, which will take the surplus production of the Lehigh Valley District. Strenuous efforts are being made, not only to secure the business which is dropping into the laps of American manufacturers, but to put it on such a footing that it can be held for all time. Despite reports to the contrary, prices have not changed. In New York there is a falling off in the demand at present, with the feeling that trade during the winter will be exceptionally dull. This is scarcely true, however, for the subway work will go forward. Stocks on hand on July 1 were 10,000,000 bbl., compared with 11,200,000 at the end of December. This is larger than it should be, but not unusual. Production during the first half of the year, according to Government reports, showed a curtailment of 4,000,000 bbl. compared with the previous year, being 35,000,000 bbl. Practically half of the falling off was in the Lehigh Valley District, which produced in the first half of the year 11,000,000 bbl.

Quotations in the East are unchanged at $1.59 per bbl. for delivery within lighterage limits of New York. This is equivalent to $1.46 Jersey City, and 95c, per bbl. in bulk at the mill.

The quotations given below do not include the allowance of 40c. made for bags returned. These quotations are as follows, per bbl., f.o.b. the points named:

Boston, $1.32; Cleveland, $1.35; Duluth, $1.38; Minneapolis, $1.40; Pittsburgh, $1.15; Chicago, $1.17; Detroit, $1.24; Jersey City, 1.06; New York, 1.13; St. Paul, $1.40.

IRON AND STEEL

Pig Iron—New business in pig iron is not large, and cancellations of contracts or requests for deferred shipment are few. The cast-iron pipe interests bought up approximately 60,000 tons of Southern Foundry iron; prices have not changed, and trade is purely a waiting one. It is evident that there will be no strenuous foreign competition for some time, and on the other hand, there are likely to be some foreign inquiries. Production has not ben seriously curtailed. Business during August would undoubtedly have been small in any event, for July business was exceptionally large.

Quotations for lots of 100 tons and over are as follows at the points named: Cincinnati, Southern Foundry No. 2, $13.25 to 13.75; Northern Foundry No. 2, $14.25 to 14.75; Northern Foundry No. 3, $14.00 to 14.25. In New York, Northern Foundry No. 2X is $14.00 to 14.65, No. 2 plain, $14.25 to 14.50; and Southern Foundry No. 2 in New York market is $14.25 to 14.50. In Chicago, Northern Foundry No. 2 is $13.50 to 14.00. In Pittsburgh, bessemer is $14.90, and basic $13.90. These quotations include the 90c. freight rate from the valley to Pittsburgh. In Birmingham, Southern Foundry No. 2 is $10.00 to 10.25.

Steel Rails—Business has been extremely limited. None of the large railroads in this country have entered orders for any quantity of rails, and export business has been light. It is true that some orders have been taken for export but most of these were of light rails, and the tonnage involved is not large. Quotations for lots of 500 tons or over are given below. For smaller lots, somewhat higher prices are demanded.

Standard sections of bessemer rails, $28; open hearth rails, $30. These quotations are f.o.b. Pittsburgh. Girder rails in 30-ft. lengths are $36.40 per gross ton, and in 60-ft. lengths, $38.40, both f.o.b. New York. Standard open hearth rails are $1.34 per 100 lb., Pittsburgh; bessemer rails, $1.25; light rails, 25 to 45 lb. per yd. are $1.25, Pittsburgh or Chicago; 16 to 20 lb., $1.30; 12 lb, $1.35; 8 lb. $1.40. These quotations are f.o.b. both Pittsburgh and Chicago. Relaying rails are $23 to $24, Chicago, for standard section, and $21.50 to 22.50 for light section.

Track Supplies—Business has been extremely light, although some export inquiries have been received. The mills are running at less than 50% of capacity. Standard section angle bars in Pittsburgh and Chicago are 1.50; spikes in Pittsburgh are $1.40 to 1.45 for standard, and $1.50 to 1.60 for light, while in Chicago railroad spikes are at $1.50. Track bolts in Pittsburgh and Chicago are $2.00. All of these are per keg of 100 lb.

Structural Materials—[illegible] new business is practically [illegible]. The [illegible] have [illegible] and are not [illegible] except for strictly repair work. [illegible] in New York and other [illegible] have refused to make [illegible] there is no building work [illegible]. In the Middle West, business is slightly [illegible] a [illegible] of schools where small ton[illegible] are [illegible] orders have been [illegible] there has been some bridge work.

Quotations are higher, the base price being $1.30 to 1.35 [illegible] for [illegible] Channels 3 to 15-in. [illegible] and Z's [illegible] and over. For angles, $1.30 [illegible] for [illegible] over 15 in. H-beams over [illegible] and angles over 6 in. T's are $1.[illegible] to 1.[illegible]0. Channels [illegible] rail T's are $1.9[illegible] to 2.[illegible]0. Cutting [illegible] lengths is charged at the following rates. Under [illegible] ft. inclusive, [illegible] per 100 lb.; 3 ft. to 1 ft. inclusive, [illegible] cutting to lengths under 1 ft., $1.[illegible]. No charge is made for cutting to specified lengths over 3 ft.

Steel Shapes—Quotations from warehouse New York are as follows:

	Cents Per lb.
[illegible] iron	
1 to 1½ in. round and square	1.80
1½ to 4 in. x ⅜ to 1 in.	1.80
1½ to 4 in. x ¼ in. [illegible] in.	2.00
[illegible] bars	[illegible].20
[illegible] bar iron	2.1[illegible]
Soft steel	
¾ to 3 in. round and square	1.80
1 to 6 in. x ⅜ to 1 in.	1.80
1 to 6 in. x [illegible] and [illegible] in.	1.95
[illegible] ⅜ and [illegible] in.	1.90
[illegible]—1⅛ to [illegible] in. to No. 8	2.10
Beams and channels 3 to 15 in.	1.8[illegible]
Angles	
3 in. x ¼ in. and larger	1.8[illegible]
[illegible] in. x [illegible] in. and [illegible] in.	2.10
1½ to 2½ in. x [illegible] in. and thicker	1.95
1[illegible] to 2[illegible] in. x [illegible] in.	2.05
1 to 1¼ in. x [illegible] in.	2.0[illegible]
1 to 1¼ in. x [illegible] in.	2.10
1½ to 2½ x [illegible] in.	2.00
1[illegible] to 2[illegible] x [illegible] in.	2.10
3 in. and larger	1.90

REINFORCING MATERIALS

Bars, Concrete Reinforcing—Prices are higher, but there is very little new business. Quotations are as follows:

Size	Mill shipments Pittsburgh	Warehouse Pittsburgh	Delivered from warehouse New York
	Cents per pound		
[illegible] in. and larger	1.[illegible]0	1.70	2.30
[illegible]	1.[illegible]	1.[illegible]0	2.3[illegible]
[illegible]	1.[illegible]	2.0[illegible]	2.3[illegible]
[illegible]	1.[illegible]	2.10	2.50
[illegible]	1.[illegible]	2.35	2.[illegible]

Triangle Mesh—Quotations are without change as follows:

PRICE PER 1[illegible] SQ. FT.

Style No.	Cross-sec. area per ft. width	Plain material: Carload lots	Plain material: Less than car lots and over 1[illegible] sq. ft.	Galvanized: Carload lots	Galvanized: Less than car lots and over 15,000 sq. ft.
*4	[illegible]	$1.[illegible]	$1.22	$1.12	$1.24
5	[illegible]	[illegible]	[illegible]	0.89	1.[illegible]0
8	[illegible]	[illegible].81	[illegible]	0.71	0.[illegible]
*7	[illegible]	0.[illegible]	[illegible]	0.75	[illegible].66
*11	[illegible]	1.89	2.[illegible]5	1.[illegible]	2.[illegible]
[illegible]	[illegible]	1.[illegible]	1.[illegible]	1.83	1.92
[illegible]	[illegible]	1.2[illegible]	1.[illegible]	1.43	1.71
*[illegible]	[illegible]	1.[illegible]	1.12	1.[illegible]	1.55
*[illegible]	[illegible]	[illegible].96	1.1[illegible]	1.[illegible]7	1.24
[illegible]	[illegible]	[illegible]	[illegible].97	0.89	1.06
[illegible]	[illegible]	0.66	0.[illegible]	[illegible]	0.97
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
*[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.66

*[illegible] lengths in rolls are [illegible]

METALS

Copper—[illegible] copper did not fall below 12c. for electrolytic and the market is now 12.275c. It must be admitted that the demand for metal is extremely light.

Pig Tin—Price changes in pig tin for the first 15 days of August resembled betting at a horse race more than anything else. Prior to the declaration of war, tin sold in New York at 31[illegible]. By Aug. 3 the price had advanced to [illegible], while on Aug. 6, 6[illegible] was paid. As high as 67c. was paid for 5-ton lots, prior to the middle of the month, but on the 17th prices [illegible] and business was done at 3[illegible]. From this level quotations rapidly jumped back to [illegible], which was re[illegible] on the 18th. Since that time the market has settled down and been more or less orderly at from 37 to 42[illegible].

Lead—Business has scarcely been affected by the disturbance in Europe. Prices are slightly higher and in 5[illegible]-ton lots lead sells at 3.90@3.95c. per lb. New York, and 3.7[illegible]@3.80c. St. Louis.

Spelter—Most of the spelter used in Great Britain has previously been imported from Germany. This source of supply being cut off it was necessary to draw on America. Prices advanced fully 1c. per pound and as high as 6.12½c. was paid. It is estimated that between 1[illegible]0 and 1[illegible]000 tons of spelter were sold for export. The supply of spelter will shortly be increased by the importation of Mexican ore.

Antimony—The first fear of the war has subsided. Antimony which sold at [illegible] in July and [illegible] in August is now 1[illegible]c.

Aluminum—The domestic supply seems to be ample for present and possibility of new domestic competition is keeping prices down. Aluminum in ingots is quoted at [illegible]0@21c. per lb.

Copper Sheets—The price is lower at 1[illegible]c. per lb.

Miscellaneous Metals—Prices are low, and it is sometimes possible to shade even the quotations given below, which are for small lots:

Bismuth	$2.25
Brass tubes, iron-pipe sizes	
½-in.	.17
¾- to 3-in.	.16
3½-in.	.16
4-in.	.17
Brass rods	.15¼
Brass sheets	.15½
Solder, half and half guaranteed	.22
Zinc sheets	.08¼
Manganese bronze rods	.22½
Copper sheets, base	.18
Pig tin (five-ton lots, cash)	.[illegible]

Old Metals—The following quotations are for small lots delivered at buyer's warehouse:

	Cents
Copper, heavy and crucible	12.00
Copper, heavy and wire	11.[illegible]5
Copper, light and bottoms	10.[illegible]5
Brass, heavy	[illegible].[illegible]5
Brass, light	[illegible].[illegible]5
Heavy machine composition	1[illegible].[illegible]0
Composition turnings	9.[illegible]0
Lead, heavy	3.[illegible]
Lead, tea	3.1[illegible]
Zinc scrap	3.[illegible]

CLAY PRODUCTS

Sewer Pipe—Business has been less active. Many manufacturers are threatening to close their mills down earlier in the season than usual. Prices are slightly lower than last month, the revised discounts being as follows: 24 in. [illegible]; 2[illegible] and 20 in. 79[illegible]; 33- and 36 in. [illegible]. At these discounts the net prices per ft. in New York are as follows:

Size		Size	
3-in.	$0.[illegible]	18-in.	[illegible]
4-in.	0.[illegible]	20-in.	[illegible]
5 in.	[illegible]	22-in.	[illegible]
6 in.	[illegible]	24-in.	[illegible]
[illegible]	[illegible].11	2[illegible]-in.	[illegible]
10 in.	[illegible].18	30-in.	1.[illegible]
12 in.	0.[illegible]	33-in.	2.[illegible]
1[illegible] in.	0.27	36-in.	2.45

Flue Lining—Another revision has been made in the price of flue lining, and the new discount is [illegible] from list. At this discount, the net prices per foot for New York delivery are as follows:

	Weight in lb.	Price per ft.		Weight in lb.	Price per ft.
4½ x 8½ in.	11	$0.[illegible]0	[illegible] x 1[illegible] in.	1[illegible]	$0.132
[illegible] x 13 in.	[illegible]	0.[illegible]6	1[illegible] x 1[illegible] in.	1[illegible]	0.1[illegible]
[illegible] x [illegible] in.	1[illegible]	0.[illegible]	13 x 1[illegible] in.	[illegible]	0.23
[illegible] x [illegible] in.	1[illegible]	0.[illegible]6	1[illegible] x 1[illegible] in.	[illegible]5	0.34
[illegible] x 13 in.	[illegible]	0.11			

Comparative Prices—Movements in the prices of staples are less violent. The following comparison illustrates the [illegible] trend:

Wholesale Prices	July 1	Aug. 1[illegible]	Sept. 1
Pig tin, per lb.	$0.31	$[illegible]	$[illegible]
[illegible], per lb.	[illegible]	[illegible]	0.[illegible]
Antimony, per lb.	[illegible]½	[illegible].16	0.1[illegible]
[illegible] per lb.	[illegible]	[illegible]	[illegible]
Quicksilver, per flask	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Flour, per bbl.	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible].72	[illegible]
[illegible] (Chicago)	[illegible]	[illegible]	1.[illegible]

The Leadite Co., Inc., Philadelphia, Penn., has issued a [illegible] showing the [illegible] and cost of [illegible] joints with leadite and pig lead, based on the American Water Works Association standard bell and spigot cast iron pipe. [illegible] up to 18 in. the approximate quantity is [illegible] per joint [illegible]. For larger pipe the quantity of material used is [illegible] per inch of diameter.

RAILWAYS

+Pennsylvania—Pennsylvania R.R.—A. L. ANDERSON & BROS., INC., Altoona, Penn., has been awarded a contract by this company for constructing a 3½ mile extension of the Homer and Cherrytree branch of the Conemaugh division.

West Virginia—Charleston, Parkersburg & Northern Ry.—Preliminary arrangements are being made by this company to award contracts for the construction of a portion of its proposed railroad to connect Charleston, W. Va., and Parkersburg, about 75 miles. H. H. Archer is Pres. and K. B. Stephenson, Secy., both of Parkersburg, W. Va.

North Carolina—Southern Ry.—Bids are being received by this company for double-tracking its line from Craggy, N. C., to a point two miles east of Marshall, N. C., about 15 miles. W. H. Wells, Washington, D. C., is Ch. Engr. Const.

+North Carolina—Southern Ry.—A contract for constructing 30 miles of second track between Pelham and Greensboro, N. C., has been awarded by this company to the PARKER BROOKS CONSTRUCTION CO., Greenville, S. C., and to the MORROW CONTRACTING CO., Atlanta, Ga. Noted Aug. 20.

Central Carolina R.R.—According to press reports plans are being prepared by this company for the construction of a railroad from Lillington, N. C., to Swansboro, N. C., about 100 miles. W. J. Edwards, Sanford, N. C., and J. R. Baggett, Lillington, N. C., are interested.

South Carolina—Savannah Western Ry.—This company has been incorporated to construct a railroad from Estill, S. C., to St. Paul, S. C., about 90 miles. The incorporators are Virgil Walker and Adrian M. Rea, Newbern, N. C., and C. H. Milligan, Charleston, S. C.

South Carolina—According to press reports, C. D. Neal, Wilmington, N. C., is interested in the construction of a railroad from Hartsville, S. C., to Society Hill, S. C., about 18 miles.

Florida—Edge-Dowling Lumber Co.—The construction of a railroad from its lumber operations at Groveland, Fla., to Dade City, Fla.

Mississippi—Nashville, Shiloh & Corinth R.R.—See item under Tennessee.

Tennessee—Nashville, Shiloh & Corinth R.R.—The citizens of Davidson County will vote on the proposition to issue bonds for $1,000,000 for the purpose of assisting this company in constructing a railroad from Nashville, Tenn., to Corinth, Miss., about 165 miles. C. C. Thoms, Corinth, Miss., is interested. Noted July 16.

Indiana—Cincinnati, Indiana & Louisville R. R.—Surveys have been started by this company for the construction of a railroad to connect Aurora, Rising Sun, Patriot, Florence, Markland, Vevay and Lamb, Ind., where a connection with the Louisville & Beaver River R.R. will be made. L. S. Cook is Pres.

Kansas—Atchison, Topeka & Santa Fe Ry.—This company plans to spend $40,000 for the extension of its yards at Florence, Kan. R. A. Rutledge, Kan., is Ch. Engr. Eastern lines.

+Arkansas—Missouri, Arkansas & Southern R.R.—This company has awarded a contract for the construction of a railroad from Mena, Ark., to Hot Springs, Ark., about 80 miles, to the CENTURY CONSTRUCTION CO., Mena. George D. Thayer, Mena, is Ch. Engr. Noted Aug. 6.

Texas—Gulf, Freeport & Northern R.R.—Plans are being prepared by this company for the extension of its line from Freeport, Tex., to Rosenburg, Tex. C. L. Sharp, Freeport, is Gen. Mgr.

Idaho—Blackwell Lumber Co.—Plans are being prepared by this company for the construction of about five miles of logging road at Fernwood, Idaho.

Oregon—Teal Creek R. R.—This company has been incorporated to construct a logging railroad out of Fall City, Ore. The incorporators are F. J. Cobb, Zera Snow and Wallace McCamant.

California—Atchison, Topeka & Santa Fe Ry.—An expenditure of $300,00 is planned by this company for the improvement of the lines on its Los Angeles Division. F. M. Bisbee, Amarillo, Tex., is Ch. Engr. Western lines.

ELECTRIC RAILWAYS

Holyoke, Mass.—The Holyoke Street Ry. Co. plans to spend about $15,000 for laying new track from the Williamsett Bridge through Holyoke. Louis D. Pellissier, Holyoke, is Gen. Mgr. and Pur. Agt.

New Haven, Conn.—The Shore Line Electric Ry. Co. has been granted permission to extend its line from Backus Corner along Salem Turnpike. Samuel Anderson, Norwich, is Gen. Mgr.

Bayport, N. Y.—The Suffolk Traction Co. has applied to the Public Service Commission of the Second District for permission to construct an extension to its line from Bayport to Sayville. J. C. Brackenridge, 95 Liberty St., New York, N. Y., is Gen. Mgr. and Ch. Engr.

New Brunswick, N. J.—The Board of Chosen Freeholders has granted the Public Service Co. permission to extend its system in Highland Park. R. E. Danforth, Newark, is Gen. Mgr.

Washington, Penn.—The Borough Council has granted a franchise to the Monongahela, Ellsworth & Washington Ry. Co. to construct and operate an electric railway on certain streets in the borough.

York, Penn.—George B. Wilson, H. S. Williamson and Allen A. Herr are interested in the construction of an electric railway along the Harrisburg Pike to Long Park and the fair grounds.

Hagerstown, Md.—Plans are being considered by the Hagerstown & Frederick Ry. Co. for the extension of its line to the Country Club. Franz Von Schilling, Hagerstown, is Gen. Mgr.

Salisbury, Md.—The Salisbury Interurban Ry. Co. plans to start work soon on the construction of its proposed electric railway to connect Salisbury, Heron, Tyaskin, Bivalve and Nanticoke, about 30 miles.

Covington, Ga.—Preliminary arrangements are being made by the Covington & Oxford Street Ry. Co. for the construction of an electric railway from Covington to Oxford. Noted Jan. 22.

Hopkinsville, Ky.—R. E. Cooper has purchased a franchise from the city to construct and operate an electric railway in Hopkinsville. Noted Feb. 12.

Chauncey, Ohio—The Hocking-Sunday Creek Traction Co. contemplates a bond issue for $156,000, the proceeds of which will be used for the construction of an electric railway from Chauncey to Athens, about 7½ miles. E. B. Young, Nelsonville, Ohio, is Pres. and Gen Mgr.

Indianapolis, Ind.—Plans are being prepared by the Indianapolis Traction & Terminal Co. for the extension of its line on West Tenth St. from Holmes to Tibbs Ave. R. R. Smith, Indianapolis, is Pur. Agt.

Monroe, Mich.—The Toledo, Ottawa Beach & Northern Ry. Co. has been granted permission to extend its electric railway through Monroe. F. R. Coates, Toledo, Ohio, is Pres. and Gen Mgr.

Peoria, Ill.—The Peoria Ry. Co. has applied to the City Council for a franchise to double-track its lines on Pennsylvania Ave. from Jackson St. to Indiana Ave. R. W. Bailey, Peoria, is Gen. Supt.

Rock Falls, Ill.—The Rock Falls & Southern Traction Co. is considering plans for the construction of an electric railway to connect Sterling, Lass, Rock Falls, New Bedford, Tampico, Princeton, Setonville and Kewanee. Andrew S. Goodell, Rock Falls, is Secy.

New Duluth, Minn.—Plans are being considered by the Duluth-Superior Traction Co. for the construction of a two-mile extension to its line in New Duluth. Herbert Warren, Duluth, is Vice-Pres. and Gen. Mgr.

Kansas City, Mo.—Plans are being considered by R. A. Long and associates for the construction of an electric railway to connect Kansas City, Lees Summit, Pleasant Hill and Harrisonville.

Dallas, Tex.—The City Commission has granted a franchise to John T. Jones and associates to construct and operate an electric railway in East Dallas.

Salt Lake City, Utah—The City Commission has granted a franchise to the Utah Light & Ry. Co. for the construction of an electric railway on Fifth and Seventh South Sts. Joseph S. Wells, Salt Lake City, is Gen. Mgr.

Tacoma, Wash.—See item under Miscellaneous: Rails, Tacoma, Wash.

Milwaukee, Ore.—The City Council has granted a franchise to L. H. Campbell to construct and operate an electric railway in Milwaukee.

+Fresno, Calif.—The Fresno Interurban Ry. Co. has awarded a contract to MAHONEY BROS., San Francisco, for constructing the second unit of its line from Alvina Heights to Clovis. Noted June 18.

Stockton, Calif.—The Stockton Electric R.R. Co. has been granted franchises to construct double track extensions to its lines in San Joaquin County. Frank W. Webster, Fresno, is Gen. Mgr. and Pur. Agt.

Visalia, Calif.—The Visalia Electric R.R. Co. will construct a two-mile extension from Rose Station to Elderwood. Frank W. Webster, Fresno, is Gen. Mgr.

Edmonton, Alta.—The Tramways Co., Ltd., has recently been organized for the purpose of constructing an electric railway from Edmonton to Fort Saskatchewan, about 18 miles.

LIGHT, HEAT AND POWER

Albany, N. Y.—(Official)—Bids will be received until 2 p.m., Sept. 10, by the Trustees of Public Buildings, Capitol, Albany, for heating and ventilating apparatus, plumbing and electric wiring for rooms of the fifth floor of the New York State Capitol. Lewis F. Pilcher is State Arch.

Bath, N. Y.—Plans have been completed for the construction of a municipal electric light plant, at a total cost of $50,000 for the building and equipment. W. W. Babcock is Chn. Bldg. Com.

★Potsdam, N. Y.—(Official)—Bids will be received until noon, Sept. 5, by Thomas E. Finegan, Asst. Comr. for Elementary Education, Education Bldg., Albany, N. Y., for new boilers at the Potsdam Normal School. See advertisement under Contracts To Be Let.

Gloucester, N. J.—The City Council is considering an offer made by Councilman Lewis B. Reilly to install a municipal electric light plant at the city water works.

Perth Amboy, N. J.—The Perth Amboy Gas Co. is doubling the capacity of its gas plant at the foot of High St. The improvements, which include an addition to the condenser building and a new retort house, are estimated to cost $40,000.

Kittanning, Penn.—See item under "Water Supply and Irrigation."

Henderson, Ky.—(Official)—The Municipal Electric Light Station, L. P. Hite, Supt., will shortly ask for bids for the construction of a steel frame boiler room, 64x90 ft., to replace the one lately destroyed by a cyclone. Noted Aug. 6.

Irvine, Ky.—Clyde Gaines, Irvine, has made application for a franchise to establish and operate an electric light plant in Irvine. Noted Jan. 22.

Whitesburg, Ky.—K. U. Surman, representing the James Clark, Jr., Electric Co., Louisville, Ky., is interested in the organization of a company to build and operate an electric light plant in Whitesburg.

+Cleveland, Ohio—The Commissioner of Purchases and Supplies has awarded the contract for the construction of the Walworth Ave. substation for the municipal electric light system to the C. N. GRIFFIN CO., 1825 East 12th St., Cleveland. Cost, about $30,000. Noted Aug. 13.

Bids will be received until Sept. 21, by the Board of Education, for remodeling the electric wiring of the East High School. F. G. Hogan is Dir. of Schools.

Delcroft, Ohio—Plans are being prepared for the construction of a new [illegible] power plant to replace the one which was recently [illegible]. J T Scott is Supt. Noted July 3[illegible].

East Gary, Ind.—The Town Council has engaged George F Peterson [illegible] to supervise the construction of a transmission line and distribution system in East Gary.

Detroit, Mich.—Frank Van Tuyl, Arch., 1112 Union Trust Bldg, Detroit, is preparing plans for a power plant for the Detention Home in Detroit.

Pinconning, Mich.—Edward Jennings, owner of the Pinconning Light & Power Co., has sold the property and franchise to J J Tl[illegible], Bay City, Mich. It is reported that the new owner will [illegible] new equipment for the plant and will [illegible] the [illegible] system and will install meters.

Chicago, Ill.—Press reports state that the Commonwealth Edison Co. has purchased a site of 21 acres at 100th St and Ave N, and will erect a power plant to supply the manufacturers of South Chicago and [illegible]urnside with energy. William A Fox, Chicago, is Secy and Treas.

Joliet, Ill.—The Board of Education is contemplating the installation of an electric light plant in the High School in connection with the new heating and ventilating system.

Cedar Rapids, Iowa—The City Council is considering plans for the construction of a dam across the Cedar River to cost about $[illegible]. The Iowa Ry. & Light Co will pay a part of the cost of its construction. T. F. McCauley is City Engr.

Earlham, Iowa—It is reported that improvements, to cost about $[illegible], will be made to the municipal electric light and water plant. E. A Baker is Supt.

Estherville, Iowa—See item under "Water Supply and Irrigation."

Grundy Center, Iowa—The plant of the Grundy Center Electric Co. was recently damaged by fire at a loss of about $[illegible]. J P Calderwood is owner and Mgr.

Duluth, Minn.—The City Commissioners have adopted a resolution to offer to buy the property of the Duluth Edison Electric Co. at approximately $1,108,000. If the offer is refused the city may condemn the Edison plant, and build a new municipal plant, or install a distributing system, and purchase the necessary power from the Great Northern Power Co. C S Palmer is City Clk.

South Stillwater, Minn.—It is reported that the municipal electric light plant in South Stillwater was recently destroyed by fire at a loss of about $20,000. Paul Pracht is Mgr. and Supt. of the plant.

+Virginia, Minn.—The Water & Light Commission has awarded the contract for the construction of a municipal high pressure gas plant to the AMERICAN GAS CONSTRUCTION CO., Newton, Iowa, at about $[illegible],000. Noted Aug 13.

Tekling, Neb.—The Village Council is receiving bids for the construction of an electric light plant to cost about $7700, including a building, and a direct current, oil-engine driven plant with storage battery. V. L. Hollister, Lincoln, Neb., is Engr. in Charge.

Wessington Springs, S. D.—At a recent election, the citizens voted in favor of a bond issue of $20,000 for the establishment of a municipal electric light plant.

Gurdon, Ark.—The City Council has engaged Albert C Moore, Joplin, Mo., to prepare plans and supervise the construction of a municipal electric light plant.

Marshall, Ark.—The Town Council has granted a [illegible]-year franchise to A. R. and V. R Johnson, of the Marshall Milling Co., to build and operate an electric light plant in Marshall.

Gainesville, Tex.—The Texas Power & Light Co is building a new power plant to cost about $[illegible]. A system of transmission lines will be constructed from the plant. L. J Geer is Mgr.

Mexia, Tex.—The Southern Gas & Oil Co. plans to lay a pipe line from the Mexia natural gas field to Corsicana, a distance of about [illegible] miles and will install a distributing system in Corsicana. Mack Logan is Vice-Pres of the company.

Roaring Springs, Tex.—It is reported that plans are being prepared for the establishment of a municipal electric light plant and waterworks system for the town.

Hamne, Tex.—See item under "Water Supply and Irrigation."

Loveland, Colo.—At a special election on Aug. [illegible] the taxpayers voted in favor of establishing a municipal electric lighting system to cost about $[illegible]. [illegible] the Big Thompson [illegible] west of Loveland.

Lewiston, Idaho—The City Council has [illegible]

Plummer, Idaho—[illegible]

Nogales, Ariz.—[illegible]

Phoenix, Ariz.—[illegible]

Auburn, Wash.—[illegible]

Cathlamet, Wash.—[illegible]

+Seattle, Wash.—[illegible] dam, raising it to an elevation of 1600 ft. and increasing the horsepower, to the NETTLETON BRUCE ESHBACH CO. at $161,565.

+Pasadena, Calif.—The City Trustees have awarded the contract for a steam turbine electric generating unit for the municipal electric light plant to the ALLIS-CHALMERS CO., Milwaukee, Wis., at $36,67[illegible]; the contract for a condenser was awarded to the C. H. WHEELER CO. at $69[illegible].

San Francisco, Calif.—The Pacific Gas & Electric Co. has taken out a permit for work at its substation at 23d and Georgia St., to cost $2[illegible],000. Noted Aug 6.

BRIDGES

Boston, Mass.—The War Department has approved the plans prepared for rebuilding the Wellington Bridge which was burned on June [illegible]. It will be of concrete and is estimated to cost $11[illegible]. John R Rablin, 14 Beacon St., is Ch. Engr. of the Metropolitan Park Comrs. Noted June 11 and July 9. C

+Norwalk, Conn.—The Board of Selectmen has awarded the contract for the construction of a steel bridge at [illegible] to the BERLIN CONSTRUCTION CO., Berlin, Conn., at $1[illegible]. Noted July 1[illegible], 1913.

Buffalo, N. Y.—It is reported that the Board of Public Works will soon ask for bids for the construction of a steel lift bridge, about 160 ft. long, over the Buffalo River at Abbott Road. George H Norton is City Engr.

+New Hartford, N. Y.—(Official)—The Town Council has awarded the contract for the construction of a reinforced-concrete bridge over Sauquoit Creek to WILLIAM F. CONLEY, 301 Paul Bldg., Utica, N. Y., at $11,[illegible]. Charles O. Peller is Town Clk. Noted Aug. 20.

Jersey City, N. J.—(Official)—Bids will be received until 10.30 a.m., Sept. 9, by the Boulevard Commissioners of Hudson County for the construction of a concrete arch over the old Railroad Cut on the Hudson Boulevard East, Weehawken Township. J C Sweeney is Clk. of the Comrs.

Ellwood City, Penn.—Plans are being prepared by Thomas A Gilkey, Engr. of Lawrence County, for the construction of a reinforced-concrete bridge over the Connoquenessing River connecting Ellwood City with Hazeldell, which places have recently consolidated, taking the name of the former. The estimated cost of the bridge is $[illegible], and bids will probably be asked some time this fall.

Pittsburgh, Penn.—Bids will be received until 2 p.m., Sept. 4, by R J Cunningham, County Controller, for the construction of two reinforced concrete bridges over Pine Creek. J G. Chalfant, Room 3[illegible], Court House, is Engr. of Allegheny County.

Jacksonville, Fla.—The Board of Commissioners of Duval County has retained A F Harley, Consult. Engr., to prepare preliminary plans and estimates for the construction of a bridge over the St. Johns River. John H Patterson is Chn. of the Bd. of Comrs. Noted July 9 and Aug. 6.

Chattanooga, Tenn.—Final plans have been completed for the construction of the Market St. Bridge over the Tennessee River, connecting Chattanooga with Hill City. The total length will be 2470 ft., of which 21[illegible] ft. will be concrete construction and the remainder earth fill. There will be a steel lift span of 300 ft. It will cost about $[illegible]. Bids will probably be asked some time in September by the Tennessee River Bridge Committee, Theodore F King, Chn. B H Davis, 17 Battery Place, New York, N. Y., is Engr. in Charge. Noted Jan. [illegible], Mar. [illegible], and Apr. 16.

Canton, Ohio.—Bids will be received until 10 a.m., Sept. 11, by the Board of Commissioners of Stark County for the construction of a bridge in Perry Township, including 3[illegible] cu. yd. of concrete, [illegible] cu. yd. of excavation, and [illegible] lb. of steel. C L Stoner is Clk. of Comrs.

The County Commissioners will build a new concrete arch over Nimishillen Creek at Tuscarawas St. West, as soon as the widening and repaving of this thoroughfare, as planned by the City Council, is completed.

Cincinnati, Ohio.—(Official)—Bids will be received until noon, Sept. [illegible], by the Commissioners of Hamilton County for the construction of a concrete bridge over Eagle Creek on the Eagle Creek Road, [illegible] Township. Albert R[illegible] is Clk. of Comrs.

Cleveland, Ohio.—The question of building a third high-level bridge over the Cuyahoga River will be submitted to the voters of Cuyahoga County at the November election. The estimated cost of such a bridge, from plans already prepared by W. A. Stinchcomb, County Engr., is $[illegible]. Noted June 11.

Duncan Falls, Ohio.—Bids will be received until Sept. 14 by the Board of Commissioners of Muskingum County [illegible] for the construction of a reinforced concrete viaduct at the west end [illegible] of the Duncan Falls bridge [illegible]. It will be [illegible] ft. long with a 16-ft. roadway and a [illegible] ft. sidewalk. Fred C. Werner is Clk. of Comrs.

Petersburg, Ind.—(Official)—Bids will be received until [illegible] by the Board of Commissioners of Pike County for the construction of [illegible] steel bridges in various townships [illegible].

Winchester, Ind.—(Official)—Bids will be received until 11 a.m., Sept. [illegible], by the County Commissioners of Randolph and Wayne Counties for the construction of a [illegible] bridge over [illegible] Creek on the boundary line between the two counties. [illegible]

Escanaba, Mich.—(Official)—Bids will be received until [illegible] by the Board of County Road Commissioners of Delta County, [illegible], for the construction of an [illegible] bridge about [illegible] ft. long, with a [illegible] roadway, over the Escanaba River. R. P. Mason is County Engr.

Cairo, Ill.—Preliminary surveys have been begun for the construction of the bridge to be built over the Ohio River at

Cairo by the Mobile & Ohio R.R. W. H. Wells, Washington, D. C., Ch. Engr. of Const. of the Southern Ry., has charge of the work. Noted July 30.

Libertyville, Ill.—(Official)—Bids will be received until 2 p.m., Sept. 5, at the Town Hall, Libertyville, for the construction of the Oak Spring Bridge, Libertyville Township, Lake County. It will be of reinforced concrete, and is estimated to cost $4300. Charles E. Russell, Waukegan, is County Supt. of Highways.

Morris, Ill.—(Official)—All bids received Aug. 22 by the Commissioners of Grundy County for the construction of a bridge in Maine Township were rejected as too high, the lowest bid being $8287. New bids were received on Sept. 3. F. W. Stine is County Supt. of Highways. Noted July 23 and Aug. 20.

Quincy, Ill.—(Official)—Bids will be received until 2 p.m., Sept. 5, by Floyd V. Bell, County Supt. of Highways of Adams County, for the construction of the McCraney Creek Bridge, to be located between Payson and Richfield Townships, Adams County, and Barry and Kinderhook Townships, Pike County. Bids will be accepted for either a steel bridge, estimated cost, $5930, or for one of reinforced concrete, estimated cost, $6750.

✚**Milwaukee, Wis.**—(Official)—(A correction)—We are advised that the item in the issue of Aug. 20 stating that the Chicago & Northwestern Ry. had awarded the contract for the construction of a railway bridge at Milwaukee to Pellet & McMullen, Manitowoc, Wis., was an error, as the CLEARY-WHITE CONSTRUCTION CO., Chicago, Ill., has the contract for this bridge, and has sublet the pile-driving to the firm mentioned.

Carroll, Iowa—(Official)—Bids will be received until 2 p.m., Sept. 7, by the Board of Supervisors of Carroll County for the construction of 11 concrete culverts at an estimated cost of $9340, and for one steel bridge, estimated cost, $4000. George A. Poeppe is County Audr.

Keokuk, Iowa—(Official)—It is authoritatively stated that no contracts have been awarded, nor bids asked as yet for the reconstruction of the Keokuk and Hamilton Bridge across the Mississippi River between Keokuk and Hamilton, Ill. Ralph Modjeski, Orchestra Hall, Chicago, Engr. in Charge, is now at work upon the plans. Noted May 28, June 18 and Aug. 6.

Marshalltown, Iowa—The Supervisors of Marshall and Jasper Counties will build an inter-county bridge on the south line of Marshall County. It will be of reinforced concrete, about 50 ft. long and 16 ft. wide. The estimated cost is $4000.

Sioux City, Iowa—Press reports state that Sioux City has asked the State Highway Commission to prepare plans for the construction of a concrete bridge over the Big Sioux River, connecting Iowa and South Dakota. As planned, the bridge will be about 400 ft. long and 40 ft. wide. Sioux City will pay two-thirds of the cost, and Union County, South Dakota, the other third. Noted Dec. 4, 1913.

Concordia, Kan.—(Official)—Bids wil be received until noon, Sept. 24, by the Commissioners of Cloud County for the construction of six reinforced-concrete bridges, three in Colfax Township, one each in Nelson and Aurora Townships, and one between Nelson and Aurora Townships.

Erie, Kan.—(Official)—The Commissioners of Neosho County have rejected all bids received Aug. 17 for the construction of four bridges, two 20-, one 60- and one 75-ft. span. W. E. Neal is Clk. of the Comrs. Noted Aug. 13.

Manhattan, Kan.—Press reports state that bids will be received until Sept. 15 by the Board of Commissioners of Riley County for the construction of five concrete bridges. George H. Hungerford is County Clk.

Richland, Kan.—(Official)—Bids will be received until 1 p.m., Oct. 5, by the Commissioners of Morton County for the construction of a wood pile bridge, known as the Point of Rocks Bridge, over the Cimarron River near Elkhart. It will be 609 ft. long with a 16-ft. roadway.

Wichita, Kan.—(Official)—Bids will be received until noon, Sept. 21, by the Commissioners of Sedgwick and Sumner Counties for the construction of a reinforced-concrete bridge over Cowskin Creek on the county line. Edgar V. Moone, Wichita, is County Engr. of Sedgwick County. Noted Aug. 13.

Madison, S. D.—(Official)—Bids will be received until 10 a.m., Sept. 10, by the Commissioners of Lake County for the construction of two concrete bridges, one in Chester Township, and the other in Orland Township. M. D. McGillivray is County Audr.

✚**Deer Lodge, Mont.**—The Commissioners of Powell County received the following bids on Aug. 17 for the construction of two steel bridges: (a) 152-ft. bridge over the Big Blackfoot River; (b) 70-ft. bridge over the Little Blackfoot River. W. A. Adams & Co., (a) $8470, (b) $2980; Minneapolis Steel Co., (a) $9200, (b) $2900; J. F. HARRINGTON, (a) $6899 (awarded contract), (b) $1900; O. E. PEPPARD, (a) $6999, (b) $1900 (awarded contract); Security Bridge Co., (a) $8000, (b) $2800; Midland Bridge Co., (a) $7012, (b) $2620. Noted Aug. 6.

✚**Corpus Christi, Tex.**—The Commissioners of Nueces County have awarded Contracts Nos. 1 and 2 for the construction of the causeway across Nueces Bay to W. L. PEARSON & CO., Houston, at $88,290 and $47,000 respectively. List of bidders for Contract No. 1 noted Aug. 27.

Denison, Tex.—(Official)—Bids will be received until noon, Sept. 7, by the Mayor and City Council for the construction of a 6-ft. walkway bridge over the shops of the Missouri, Kansas & Texas Ry. Co., Denison. Alternate bids will be accepted for concrete slab- or wood plank flooring. T. McElvaney is Mayor. A. B. Clenny is City Engr.

Houston, Tex.—(Official)—Bids will be received until 2 p.m., Sept. 7, by the City Engineering Department for the construction of the Taylor St. Bridge. The estimated cost is $12,000. E. E. Sands is City Engr.

✚**Fort Collins, Colo.**—(Official)—The Commissioners of Larimer County have awarded the following contracts for bridge construction: To J. C. WHEDBEE, Fort Collins, at $3165 for five concrete bridges; to B. R. HOWE, Loveland, Colo., at $1372 for three concrete bridges; to the W. H. ROLLER CONSTRUCTION CO., Fort Collins, at $2565 for two steel bridges. James G. Edwards is County Engr. Noted July 30.

Aberdeen, Wash.—The Mayor and City Council are negotiating with the Oregon-Washington Ry. & Navigation Co. for widening the present walks of the railway bridge sufficiently to allow the passage of automobiles and other vehicles. The estimated cost of the work is $50,000, while an entire new bridge would cost about $150,000. Eugene France is Mayor.

Buckley, Wash.—The Commissioners of King County, Seattle, have rejected all bids for the construction of the piers for the Buckley Bridge as being above the estimate, and it is reported that the Comissioners of King and Pierce County plan to purchase the materials, and build the bridge by day labor. M. Roy Thompson is County Engr. of King County. Noted July 30 and Aug. 6.

Snoqualmie, Wash.—The lowest bid received by the Commissioners of King County, Seattle, for the construction of a bridge over Tokul Creek near Snoqualmie, was that of Charles G. Huber, Seattle, at $18,997. Noted Aug. 6.

Philomath, Ore.—The bridge of the Corvallis & Eastern R.R. over Mary's River, four miles east of Philomath, was entirely destroyed by fire recently. It was about 460 ft. long, and will be rebuilt at once. F. M. Siefer, Portland, Ore., is Ch. Engr.

✚**St. Helen, Ore.**—(Official)—The State Highway Commission, Salem, has awarded the contract for the construction of one 156-ft. bridge and three 125-ft. bridges on the Nehalem Highway, Columbia County, to the AMBROSE-BURDSAL CO., Portland, Ore., at $25,000. C. H. Purcell is State Bridge Engr. Noted Aug. 13.

Salem, Ore.—(Official)—No definite plans have been made yet by the Commissioners of Marion and Polk County for the construction of the proposed bridge between the two counties, but it is hoped to start the preliminary work during the winter. The present structure has been declared unsafe. Noted Aug. 6.

Vale, Ore.—Bids will be received until Sept. 7 by the Commissioners of Malheur County, for the construction of a 150-ft. steel bridge with two concrete abutments, over the Malheur River near Harper. John P. Houston is County Clk.

Chico, Calif.—(Official)—Bids will be received until 2 p.m., Sept. 10, by the Board of Supervisors of Butte County, Oroville, for the construction of a reinforced-concrete bridge, about 90 ft. long, over Chico Creek in Bidwell Park, near Chico. C. F. Belding is Clk. of the Bd.

✚**San Jose, Calif.**—(Official)—The Board of Supervisors of Santa Clara County has awarded the contract for the construction of a bridge over the Pajaro River between Santa Clara and San Benito Counties to the SECURITY CONSTRUCTION CO., Los Angeles, at $19,196. The bid of Mesmer & Rice was $19,635. Noted Aug. 13.

(Official)—Bids will be received until 11 a.m., Sept. 8, by the Board of Supervisors of Santa Clara County, for the construction of a reinforced-concrete bridge over Adobe Creek at Edith Ave., San Jose. Henry A. Pfister is Clk. of Supervisors.

✚**San Luis Obispo, Calif.**—The Board of Supervisors of San Luis Obispo County has awarded a contract for the construction of two reinforced concrete bridges to the MERCEREAU BRIDGE & CONTRACTING CO., Los Angeles, at $5909.

Walnut Grove, Calif.—The Board of Supervisors of Sacramento County has received bids for the construction of a bridge at Walnut Grove as follows: Jenkins & Wells, $77,650; Security Construction Co., $78,504; Ross Construction Co., $85,946; Mathews Construction Co., $88,000; Hyde, Harges & Co., $83,500; William Concannon, $89,900. E. F. Pfund, Sacramento, is Clk. of the Bd. Noted Aug. 6.

Woodbridge, Calif.—Plans are being prepared by F. E. Quail, County Surv. of San Joaquin County, for the construction of a steel bridge over the Mokelumne River at Woodbridge.

★**Santo Domingo, Dominican Republic**—(Official)—Bids will be received until 10 a.m., Oct. 15, by the Director General of Public Works for the construction of a steel highway bridge across the Ozama River at Santo Domingo City. See advertisement under Contracts To Be Let. Noted June 11.

WATER SUPPLY—IRRIGATION

Clinton, Mass.—Bids will soon be received for the purchase of $45,000 in bonds for the construction of the Heywood dam and basin.

Mansfield, Mass.—John Cashman & Sons, 247 Atlantic Ave., at $19,750 were low bidders for constructing the concrete reservoir at Foolish Hill.

✚**Great Bend, N. Y.**—(Official)—The contract for the construction of a gravity section concrete dam about 400 ft. long across the Black River for the Taggarts Paper Co. has been awarded to STEWART ENGINEERING CORPORATION, New York.

Lakewood, N. Y.—Bids will soon be received for making extensions to the water system. A pump house, 24x24 ft., two triplex pumps, 300 gal. capacity each, gasoline engine and piping will be required. Chapman & Graham, Jamestown, are the Engrs. S. C. Bryan is Pres. Village Bd.

Leicestershire, N. Y.—Bids will be received by the Water Works Commissioners, R. C. Lewis, Clk., until Sept. 14, for furnishing a 2000-gal. per minute cross compound crank and fly wheel condensing pumping engine. Noted July 23.

Liberty, N. Y.—(Official)—Bids will be received by the Board of Water Commissioners until 7 p.m., Sept. 10, for constructing a 500,000-gal. concrete reservoir. Robert Harby is Clk. Bd. Water Comrs.

Secaucus, N. J.—Bids will soon be received by the Board of Chosen Freeholders for concreting a reservoir at Snake Hill.

Irvington, N. J.—The Town Commission has authorized the Commissioner of Public Improvements to obtain data regarding the establishment of a municipal water system.

Rockaway, N. J.—The Town Council plans to increase the capacity of its water system.

Emlenton, Penn.—The Emlenton Water Co. will install an additional pump in the water works.

Kittanning, Penn.—At a recent election the citizens voted [illegible], the proceeds to be used for construction of a new water system and electric light plant. Noted Aug. 6.

Media, Penn.—Chester & Fleming, Engrs., Pittsburgh, have prepared plans for the installation of a $[illegible] filtration plant.

Pittsburgh, Penn.—Bids will be received by Robert Swan, [illegible], until 10 a.m., Sept. 4, for chimneys, economizers, [illegible] and appurtenances for the Brilliant Pumping Station.

Round Hill, Va.—The citizens have voted $12,000 in bonds for the installation of a gravity water system. N. Wilson [illegible] is Engr.

Columbus, Ga.—John C. Cook, Chn. Bd. Water Comrs., has had plans prepared for the improvement of the water system. The mains will be extended, a reservoir and settling basin constructed. J. L. Ludlow, Winston-Salem, N. C., is Engr.

Ridgecrest, N. C.—The Town Directors contemplate obtaining a water supply from a nearby watershed.

Jacksonville, Fla.—The Arlington Water & Electric Co. has been organized with $[illegible] capital. The company will lay water mains in Arlington Heights section. J. F. Zetzsche is Pres.

Elba, Ala.—The city will enlarge the water system by installing an electrically operated centrifugal pump, extending water mains and constructing a reinforced concrete reservoir. C. S. Allredd is Mayor. Noted Aug. 20.

◆Tuscaloosa, Ala.—The contract for furnishing water pipe has been awarded to UNITED STATES CAST IRON PIPE & FOUNDRY CO., at $15,000, by the City Commissioners. Noted July 16.

Shreveport, La.—At an election held Aug. 20 the citizens voted $[illegible] in bonds for the purchase of the Shreveport Water Works Co. or for the construction of a new system. Noted Feb. 26.

Coshocton, Ohio—Chester & Fleming, Pittsburgh, Penn., are preparing plans for the construction of a reservoir. Elmer Smith is Dir. Pub. Serv.

Sandusky, Ohio—Bids will be received by John J. Malter, Dir. of Pub. Serv., until noon, Sept. 22, for constructing a 42-in. intake pipe 1200 ft. long with concrete intake and crib and concrete well.

Gary, Ind.—At an election held Aug. 26, bonds for $76,000 were voted. The proceeds will be used for the construction of a water system for the Ridge Road District. W. J. Fulton is City Engr. Noted Aug. 6.

Lowell, Mich.—W. J. Sherman Co. has been retained by the village to appraise the privately owned water works with a view to municipal ownership.

◆Saranac, Mich.—The contract for installing a water system has been awarded, according to press reports, to GRAND RAPIDS HYDRAULIC ENGINEERING CO., Grand Rapids, at $[illegible]. Noted July 2.

◆Aurora, Ill.—(Official)—Bids were received Aug. 14 for drilling a well, as follows: S. B. GRIGER, 330 Old Colony Bldg., Chicago, at $13,700 (awarded contract); W. H. Gray & Bro., $[illegible], and W. H. Cater Contracting Co., $13,900. Noted Aug. 6.

Leland, Ill.—The citizens contemplate spending $7000 for the construction of a water system.

Prospect Heights, Ill.—(Peoria Post Office)—The Village Council contemplates laying water mains estimated to cost $[illegible]. Albert F. Davidson is Village Pres.

Walnut, Ill.—The citizens contemplate constructing a new well and pump house and laying additional water mains. John F. W[illegible] is Village Clk.

◆Winnetka, Ill.—The contract for laying c.i. water pipe, installing fire hydrants and gate valves and vaults has been awarded to WILLIAM DAVIDSON, 728 Tenth St., Winnetka, at $[illegible].

◆Appleton, Wis.—The contract for installing a [illegible] gal. steel [illegible] tower, has been awarded to CHICAGO BRIDGE & IRON WORKS, Chicago, Ill., at $[illegible].

Appleton, Wis.—Bids are being received, according to press reports, by [illegible] Williams, City Clk., for furnishing a motor driven centrifugal pump for the water works.

Fond du Lac, Wis.—A mile of new water main extensions has been [illegible] by the Water Commission. W. H. [illegible] is Supt.

Carroll, Iowa—[illegible] for [illegible] water [illegible].

Farnham, Iowa—See [illegible] "Light, Heat and Power."

◆Estherville, Iowa—[illegible] contracts have been awarded to [illegible] at $[illegible] for extending the water works and electric light plant and to [illegible] & [illegible] Works, Chicago, Ill., at $[illegible] for building standpipe. Noted July [illegible].

◆Chisholm, Minn.—The contract for installing a filter in the [illegible] has been awarded by the Water, Light, Power and Building Commission to [illegible] [illegible], Minneapolis, Minn., at $[illegible]. Noted June [illegible].

◆Hibbing, Minn.—The contract for furnishing [illegible] ft. of [illegible] and [illegible] c.i. pipe has been awarded by the Water and Light Board to UNITED STATES CAST IRON PIPE & FOUNDRY CO. Noted July [illegible].

◆Roseville, Minn.—The contract for constructing a reinforced concrete [illegible] the [illegible] has been awarded to [illegible] & Co., Roseville, at $[illegible].

Ogema, Minn.—(Official)—Bids will be received by H. M. [illegible], Village Recdr., until [illegible] p.m., Sept. [illegible], for installing a water system.

◆Triumph, Minn.—The contract for installing a water system has been awarded to [illegible] Co., at $[illegible].

◆Wabasha, Minn.—The contract for constructing a reservoir has been awarded to KIRSHER BROS., at $[illegible].

Cottonwood Falls, Kan.—Harper & Stiles, Engrs., Grand Ave. Temple, Kansas City, Mo., have been retained to prepare plans for the installation of a filtration plant at the city water works at an estimated cost of $[illegible].

Armour, S. D.—Bids will be received by J. C. Perkins, City Audr., until 8 p.m., Sept. 8, for constructing a reinforced-concrete septic tank.

Lemmon, S. D.—The city contemplates constructing a water system with gravity pressure mains. W. O. Bush, Minneapolis, Minn., is Engr.

Mitchell, S. D.—(Official)—Bids will be received by Thomas Eastcott, City Audr., until 8 p.m., Sept. 11, for constructing a reinforced-concrete reservoir with a capacity of 750,000 gal.

Great Falls, Mont.—Plans have been prepared by M. L. Morris, City Engr., for laying a 12-in. c.-i. water main in Third Ave. South.

Atlanta, Tex.—Bonds for the construction of additions to the municipal water works system have been voted.

Dallas, Tex.—The Brazos River Irrigation Co. has been granted a permit by the State Board of Water Engineers to appropriate water from the Brazos River to water [illegible] acres of land. The plant is estimated to cost $[illegible].

Floydada, Tex.—Bonds for $20,000 have been voted, the proceeds to be used for the installation of a water system. W. T. Montgomery is Mayor.

Granbury, Tex.—The City contemplates spending $[illegible] for the construction of a water system.

Kerens, Tex.—Bonds for $21,500 for the improvement of the water system will be issued.

Livingston, Tex.—Bonds for $25,000 for the construction of a water system have been voted. Brown & Wilder, Houston, are the Engrs. Noted July 23.

Niles City, Tex.—(Fort Worth Post Office)—The installation of a water system to supply water to Niles City and Diamond Hill is contemplated.

Pecos, Tex.—The Council will improve the water system. The construction of a new standpipe will be included.

Runge, Tex.—A new municipal water system and electric light plant will be constructed at Runge.

Shamrock, Tex.—Bonds for $15,000 have been voted by the citizens, the proceeds to be used for the construction of a water system.

Bovill, Idaho—Bids will be received by the City Clerk until 8 p.m., Sept. 1, for constructing a water system. The estimated cost is $12,000. Noted Aug. 13.

North Yakima, Wash.—The water users of the Union Gap Canal have approved plans for the irrigation district and have authorized the issuance of $30,000 in bonds, the proceeds to be used for making improvements to the distributing system. A half mile of canal will be cemented and wooden flume through Union Gap will be replaced with cement or metal flume.

Seattle, Wash.—A. M. Firolto, at $41,285, was low bidder for laying water mains in East Harrison St. Other bidders were L. Coluccio, $42,171; N. All, $44,168, and C. B. Kiehl, $4[illegible]. Noted July 16.

The City Council contemplates laying water mains in Graham St. from Beacon Ave. to 12d St. South.

Astoria, Ore.—The City Council will extend the high pressure water mains into Taylor's addition at an estimated cost of $50,000.

◆Eugene, Ore.—The contract for constructing a reservoir has been awarded by the Water Board to BARNEY & JOHNSON, Portland, at $7665. Noted Aug. 2[illegible].

Colton, Calif.—The installation of a new pump for the water system is under consideration. N. Davenport is City Clk.

Fort Bragg, Calif.—The water system will be purchased by the city. Improvements will be made.

Fullerton, Calif.—The Garden Grove Water Co. has been incorporated with a capital stock of $[illegible], to install pumping plants and develop and sell water. The directors are H. A. Lake, J. D. Price, J. T. McIlree, P. M. Jerrell and J. A. Knapp.

◆Pasadena, Calif.—The contract for furnishing [illegible] tons of pipe to the Water Department has been awarded to AMERICAN CAST IRON PIPE CO., at $[illegible].

Pomona, Calif.—The citizens contemplate [illegible] the plant of the Consolidated Water Co. and making improvements. C. F. Bigler is City Engr.

◆San Diego, Calif.—The contract for furnishing a deep well [illegible] pump for the Mission Valley wells has been awarded to STANDARD IRON WORKS, at $[illegible].

Dundas, Ont.—Plans are being prepared by [illegible] & [illegible], Engrs., Hamilton, for constructing a new storage reservoir and basin.

Ottawa, Ont.—Bids will soon be received for furnishing an auxiliary pump electrically operated for the pumping station.

◆Cannora, Sask.—(Official)—Contracts for constructing a water system have been awarded as follows: laying water mains to FLANAGAN & MURPHY, at $[illegible]; pump house and [illegible] to FLANAGAN & MURPHY, at $[illegible]; steel water tower to [illegible] Co., at $[illegible]; furnishing c.-i. water pipe and specials to CANADIAN IRON CORPORATION, at $[illegible], and for constructing well to FLANAGAN & MURPHY, at $[illegible]. Noted July [illegible].

Calgary, Alta.—The ratepayers have authorized the expenditure of $[illegible] for the extension of water system. [illegible] is Engr.

Prince Rupert, B. C.—Plans are being prepared by the City [illegible] for the construction of a reservoir to be located above the [illegible] River falls.

SEWERS

Fall River, Mass.—Bids will be received by James H. Kay, Chn. of the Reservoir Comn., until 10 a.m., Sept. 4, for constructing an intercepting drain near the west shore of Wattupa Ponds. H. K. Barrows, 6 Beacon St., Boston, is Consult. Engr.

+Bridgeport, Conn.—The Board of Contract and Supply has awarded a contract to the PIERCE MFG. CO. for constructing sewers in East Main St. and Linden Ave.

Hartford, Conn.—(Official)—The following are the bids received by the Board of Contract and Supply for constructing (d) Sect. D (e) Sect. E and (f) Sect. F of the Maple Ave. sewer system: H. Lambe, New Haven, (d) $19,445; (e) $24,553; (f) $20,742; O'Neil Bros., (d) $20,334; (e) $22,373; (f) $21,073; W. T. Ryan Construction Co., (d) $22,055; (e) $20,297; (f) $19,069; Amanno & Sullivan, (d) $25,854; (e) $21,775; (f) $20,173; Pierson Engineering & Construction Co., (d) $26,655; (e) $26,089; (f) $22,100; Moore & Co., Boston, Mass., (d) $26,906; (e) $24,317, (f) $28,994; John Mannochio & Co., (e) $24,631; (f) $23,713; B. Silvestri, (e) $26,876; (f) $22,279; Conti & Casciano, (e) $27,726; Petrossi Bros., (e) $32,937; (f) $27,794; Angelo Conti & Co., (f) $24,203. Roscoe N. Clark is City Engr. Noted Aug. 20.

+Gates, N. Y.—(Official)—The contract for constructing vitrified pipe sewers in Emerson and McNaughton Sts. has been awarded to MICHAEL FRANCIESCO, 466 Oak St., Rochester, at $5888. Other bids were: Petrossi Co., $8908; D. Sackioscua & Angelo, $8670; Whetmore, Rauber & Vicinus, $7169. Michael J. Magin is Town Clk. Noted Aug. 27.

Gloversville, N. Y.—Bids received by the City Clk., on Aug. 18, for constructing sanitary sewers, were rejected. The work will be done by day labor. H. J. Hanner is City Engr. Noted Aug. 13.

+Rochester, N. Y.—Edward B. Foote, Rochester, at $4300 submitted lowest bid to the State Hospital Commission for constructing the sewage pumping station and the American Laundry Machinery Co., New York, N. Y., at $5298, submitted lowest bid for furnishing laundry equipment. Noted Aug. 6.

Syracuse, N. Y.—(Official)—The contract for constructing the storm water sewer in the First and Second wards will not be awarded, as the city bonds for this work cannot be disposed of. H. J. Hamlin is Secy. of the Syracuse Intercepting Sewer Bd. Noted Aug. 6 and Aug. 27.

+Tonawanda, N. Y.—The contract for constructing the sewer system in the Highland Ave. District has been awarded to HAGER & GEORGE, Newark, N. J., at $23,500.

East Orange, N. J.—(Official)—Bids will be received until 8 p.m., Sept. 14, for constructing a sewer drain in Fourth Ave. and North 19th St. The work requires 380 ft. 33-in. reinforced-concrete pipe, 270 ft. 30-in. reinforced-concrete pipe, 250 ft. 24-in. vitrified pipe, 320 ft. 18-in. vitrified pipe, 275 ft. 15-in. vitrified pipe, 430 ft. 12-in. vitrified pipe, 265 ft. 8-in. vitrified pipe, 8 manholes, 17 catch basins. Lincoln E. Rowley is City Clk.

Elizabeth, N. J.—The City Council has commissioned James C. Harding, 170 Broadway, New York, N. Y., to prepare plans for repairing the intercepting sewer. The estimated cost is $25,000.

North Plainfield, N. J.—A sewer system will be constructed by the city, to cost about $300,000.

Canonsburg, Penn.—The Council will install a sanitary sewer system and sewage treatment plant.

Harrisburg, Penn.—The city will construct sewers in Cumberland, Cameron and Monroe Sts., at an estimated cost of $6000. M. B. Cowden is City Engr.

Montgomery, Penn.—The State Department of Health has approved of plans for the installation of a sewer system at Montgomery.

Parkesburg, Penn.—The citizens of Parkesburg will construct a sewer system and sewage treatment plant.

Washington, D. C.—(Official)—Bids will be received by the Commissioners, District of Columbia, until 2 p.m., Sept. 8, for constructing about 6250 cu.ft. of pipe sewer, 6- to 24- in. Oliver P. Newman, Frederick L. Siddons and Chester Harding are the Comrs.

Charleston, W. Va.—(Official)—Bids will be received by the Board of Affairs until 2 p.m., Sept. 10, for constructing a sewer system. G. S. Brown, Lowenstein Bldg., Charleston, is City Engr.

Dunbar, W. Va.—The Dunbar Land Co. will construct about 5000 ft. of 24-in. pipe sewers and about 15,000 ft. of lateral sewers.

Manning, S. C.—The Board of Sewerage Commissioners has retained J. Newton Johnston, Florence, S. C., to prepare plans for a sanitary sewer system. Noted Aug. 6.

+Anniston, Ala.—The contract for extending the sewer system has been awarded to GEORGE G ODIORNE, Anniston, at $8031. J. D. Hunter is Engr.

Elba, Fla.—The city will spend $11,000 in improving its sewer system.

Owensboro, Ky.—The town contemplates the construction of a sewer system in the southwestern section of the town.

Bucyrus, Ohio—Bids will be received by the city until Sept. 8, for constructing a sewer in East St. F. L. Neiderheiser is City Engr.

Cambridge, Ohio—Bids will be received until Sept. 10, by the Director of Public Service for sewer construction and paving, estimated to cost $50,000. Earl M. Cosgrove is City Engr.

Chillicothe, Ohio—The City Council has decided to complete the Honey Creek storm sewer at an estimated cost of $23,500. H. M. Redd is City Engr.

Coshocton, Ohio—Bids will be received by Elmer Smith, Dir. of Pub. Ser., until Sept. 8, for constructing sanitary sewers in various streets. Noted Aug. 27.

Fostoria, Ohio—The State Board of Health has approved of plans for a sewage disposal plant to cost about $17,000. Bids for the work will soon be asked. Charles Latshaw is City Engr.

Girard, Ohio—See item under Streets and Roads.

Lebanon, Ohio—(Official)—The city has commissioned the W. J. Sherman Co., The Nasby, Toledo, Ohio, to prepare plans for a sewage plant.

Port Clinton, Ohio—Bids will be received by William H. Williamson until Sept. 23, for constructing sewers in Ferry and Canal Sts.

Struthers, Ohio—Bids will be received by Jonah Richards, Village Clk., until noon, Sept. 16, for constructing a storm and sanitary sewer in Park Ave.

West Carrollton, Ohio—(Official)—The W. J. Sherman Co., The Nasby, Toledo, Ohio, has been commissioned by the city to prepare plans for a sanitary sewer system.

+Mounds, Ill.—The contract for constructing the sewer system has been awarded to the WILLIAM RILEY CONSTRUCTION CO., St. Louis, Mo., at $9641. Noted Aug. 6.

Peoria, Ill.—Specifications for the proposed sewer system in a section of the eighth ward have been completed. The estimated cost is $234,556. Leonard Jeffries is City Engr. H. E. Beasley, Peoria, is Consult Engr.

Milwaukee, Wis.—Bids will be received by the Sewerage Commission, City Hall, until Sept. 10, for constructing an electrolytic sewage treatment plant. J. F. Young is Secy.

+New London, Wis.—The contract for constructing sewers in three streets has been awarded by the Common Council to R. MIERSWA & SONS. Noted Aug. 6.

Sac City, Iowa—Bids will be received by W. F. Weary, City Clk., until 8 p.m., Sept. 7, for sewer construction in Hobbs and 13th Sts.

Austin, Minn.—Bids will be received by the Common Council, until 8 p.m., Sept. 4, for constructing a storm sewer in Kenwood Ave. The work requires about 3000 ft. of 10-, 12-, 15- and 18-in. pipe. Oscar F. Weissgerber is City Engr.

Virginia, Minn.—Lawrence & McCann, Eveleth, Minn., at $78,868, submitted the lowest bid to the City Council for constructing a septic tank.

Warroad, Minn.—(Official)—Bids received recently by the Village Clerk, for constructing sewers and sewage disposal plant, have been rejected. Noted July 2 and Aug. 6.

+Billings, Mont.—The contract for constructing sanitary sewers has been awarded by the City Council to E. LINDSTROM, Billings, at $19,518. Noted Aug. 13.

Carthage, Mo.—F. B. Newton, City Engr., is preparing plans for a sewer in the eastern section of the city, to cost about $25,000.

+Dallas, Tex.—The contract for constructing sewers has been awarded by the City Council to J. D. WINSLETT, JR., at about $25,000. The work requires about 2700 lin.ft. of 15-in., 30,500 lin.ft. 18-in., 10,000 lin.ft. of 8-in. and 8500 ft. 6-in. pipe.

Laredo, Tex.—The citizens have voted $24,000 in bonds for the construction of storm sewers.

+Sapulpa, Okla.—The contract for extending the sewer system from Thompson St. to Rock Creek, has been awarded to the W. J. Kennedy Co., Oklahoma City, at $59,850.

+Seattle, Wash.—The contract for constructing sewers in 18th Ave. has been awarded to C. CRISTOFARO, at $9208. Noted Aug. 27.

Vancouver, Wash.—The City Council has decided to construct sewers in various streets.

Astoria, Ore.—The lowest bid received by the City Council for constructing the sewer system was that of the James Kennedy Construction Co., Fargo, N. D., at $24,661. Noted July 30.

Portland, Ore.—Bids for constructing the first section of the Monteville sewer system were received by the City Council as follows; monolith concrete: John F. Shea, Portland: $104,188; Jeffery & Bufton, $104,725; James Kennedy Construction Co., $105,112; Giebisch & Joplin, $105,446; Consolidated Contract Co., $109,495; concrete pipe construction; Giebisch & Joplin, $95,124. Noted July 23.

The City Council has decided to construct sewers in East 74th St., Thornburn Ave. and other streets, at an estimated cost of $8000. Vitrified pipe or concrete sewers will be laid.

San Bernardino, Calif.—Bids will be received by the City Council until Sept. 21, for constructing sewers in K and Tenth Sts.

+Stockton, Calif.—The contract for constructing sewers in the Southeastern section of the city has been awarded by the City Council to F. C. McINTIRE, at $12,112.

London, Ont.—The City Council has decided to construct a sewage disposal plant to cost about $75,000. Willis Chapman, Mail Bldg., Toronto, is preparing plans.

Wingham, Ont.—The Town Council contemplates constructing 8-in. tile sewers in Edward and John Sts. J. F. Groves is Town Clk.

GARBAGE

New York, N. Y.—(Official)—Bids were received by J. T. Fetherston, Comr. of Street Cleaning, Municipal Bldg., Borough of Manhattan, for removing the snow and ice during the winter season of 1914-15.

(Borough of Manhattan)—Snow Contracting Co., 47c. per cu.yd.; Soracl Contracting Co., 64c. per cu.yd. for division by districts, Snow Contracting Co., Dist. No. 1, 48c.: Dist. No. 2, 50c.; Dist. No. 3, 48c.; Soracl Contracting Co., Dist. No. 1, 49.5c.

(Borough of Brooklyn)—Rosenthal Engineering Contracting Co., 35.4c. per cu.yd.; Robertson Constuction Co., 39.7c., Newman and Carey Co., 39.9c.; for division by districts, Rosenthal Engineering Contracting Co., Dist. No. 2, 29.7c.; Brooklyn Alcatraz Asphalt Co., Dist. No. 4, 33c.; W. H. Sherman, Dist. No. 4, 133.9c.; Thomas Calandriello, Dist. No. 2, 34.5c.; Norton & Gorman Contracting Co., Dist. No. 1, 39c.; District No. 4.

[illegible] Newman & [illegible] Co., Dist No 1 [illegible] Dist No 2 [illegible] Dist No [illegible] Dist No [illegible] Robertson Construction Co., Dist No [illegible] Joseph [illegible] Le Mont, Dist No [illegible] Harold [illegible] Jr, Dist No 1 [illegible] Dist No 2 [illegible] Dist No [illegible] Dist No [illegible] [illegible] Contracting Co., 39 [illegible] per [illegible] Daniel Rogge, 41 [illegible]c, Harold [illegible] Jr, [illegible] Thompson Bros Inc [illegible] [illegible] Contracting Co. [illegible] bids were opened Aug 21 Noted Aug 2[illegible]

Okmulgee, Okla.—Bonds for [illegible] have been voted, the proceeds of which will be used for the installation of a [illegible]

STREETS AND ROADS

✦Boston, Mass.—The contract for constructing 1200 lin ft of state road and a bridge [illegible] bridge has been awarded to T J QUINN [illegible] R I, at $1[illegible] Other bids were [illegible] Contracting Co, [illegible]bury, $11,361; N E Custer Co, Worcester, $11,[illegible]; O W Ruckle, Providence, R I, $11,[illegible] [illegible] & [illegible] $11,[illegible] Newell & Brook, Uxbridge $1[illegible] F E [illegible] Melrose, $12,913 H J Maguire, Worcester $1[illegible] Noted Aug 20

Bids will be received by the Department of Public Works until Sept [illegible] for artificial sidewalks on various streets in West Roxbury District L K Rourke is Comr

Holyoke, Mass.—Bids will be received until 2 p m, Sept 4 by the Board of Public Works, for paving a section of [illegible] St with vitrified brick or asphalt blocks

Pittsfield, Mass.—The City Council contemplates an expenditure of $1[illegible] for paving West St with vitrified brick J F Moore is Mayor

✦Hartford, Conn.—Contracts for state road work, bids for which were received by the State Highway Commissioner, Aug 18 have been awarded as follows

Middlebury Township a section of gravel construction on the Southbury Road to LOUIS LOUGHI & BRO, Litchfield, $6796

Cromwell Township a section of trap rock macadam construction on the Newfield Road, to STAFFORD & MATHER, Hartford, at $[illegible]

City of Norwalk a section of brick and amiesite pavement on the Westport Road to the CHARLES T EASTBURN CO, Mt Vernon N Y, at $[illegible]

Middletown Township a section of trap road macadam on the Newfield Road, to STAFFORD & MATHER, Hartford, at $[illegible]

Norfolk Township a section of graded construction on the Torrington Road, to JOHN DE MICHIEL & BRO, Torrington at $6924 Noted Aug 6 and 27.

✦Herkimer, N. Y.—The contract for paving a portion of Smith St has been awarded to the WARREN BROS. CO., Boston Mass

Bloomfield, N. J.—Bids were received, Aug 17, by R F [illegible], Town Clk, for paving North 18th St, Sect A, (a) bitulithic, (b) brick, (c) asphalt block Newark Paving Co, (a) $32,2[illegible], (b) $31,771, (c) $40,091. Barber Asphalt Paving Co, (c) $3[illegible] Northern Construction Co, (a) $30,597, Cestone Construction Co, (a) $31,742, (b) $32,771, (c) $36,313, Standard Bitulithic Co, (a) $32,262, W Alworth & Son, (a) $3[illegible] (b) $31,406, (c) $33,062 Hastings Pavement Co, (a) $[illegible],346

Sect B Standard Bitulithic Co, $11,410 Northern Construction Co, $11,[illegible] W Alworth & Son, $11,731 Cestone Construction Co, $11,241 Noted Aug 13

Jersey City, N. J.—Bids will be received by the Boulevard Commissioners Court House for repaving Jersey City and Weehawken sections of the Hudson Blvd with bituminous [illegible] laid on [illegible] or stone foundation

Newark, N. J.—According to press reports bids will be received by the Board of Street and Water Commissioners until Sept 1[illegible] for paving [illegible] with oblong granite block and repaving Ferry St with [illegible] granite

Newton, N. J.—The Town Council plans to pave Spring St with [illegible]

Perth Amboy, N. J.—Bids will be received by the City Council until Sept [illegible] for [illegible] New Brunswick Ave with [illegible] G M [illegible] is [illegible]

✦Ridgefield Park, N. J.—A contract for paving has been awarded to A W GILL, Spring Valley Ave, Hackensack, at $[illegible]

Roselle Park, N. J.—Bids have been received for [illegible] [illegible] from T Foster [illegible] $[illegible] Humphreys & [illegible], $[illegible] W H [illegible] $[illegible]

Clairton, Penn.—Bids will be received by H M Oates [illegible] until [illegible] Sept [illegible] for constructing [illegible] of concrete sidewalk

Connellsville, Penn.—[illegible]

Kingston, Penn.—[illegible] Bids will be received by W [illegible] [illegible] for [illegible] streets

Lewistown, Penn.—[illegible]

Mount Union, Penn.—[illegible]

Philadelphia, Penn.—[illegible]

✦Pittsburgh, Penn.—[illegible]

Pittsburgh, Penn.—(Official) Bids will be received by R J Cunningham, County Controller, until 10 a m, Sept 10, for improving Routes A and B of the Ingomar and Perrysville Road

Taylor, Penn.—The City Council has approved paving Union St with crushed stone tarred The estimated cost is $[illegible]600

✦Wilmington, Del.—Contracts have been awarded for constructing 3 [illegible] miles of road from Boyd Corner to the limits of St Georges Township, to STEWART & DONOHUE, Wilmington, at $32,[illegible], and a road leading from Blackbird to Blackbird Station, to JOHN A CLARK, at $[illegible]00

✦Baltimore, Md.—Contracts have been awarded by the State Roads Commissioners to M J GROVE, Lime Kiln, Md, for the construction of [illegible] mile of road near Middletown, at $3030, to LUCK CONSTRUCTION CO, Roanoke, Va, at $[illegible]6,613, for the construction of 6.2[illegible] miles of road from St Mary's City to Ridge, at $36,619, and at $2[illegible], for [illegible] miles of road from Leonardtown to Great Mills; to HUMPHREY & BENTLEY, Elizabeth, N J, for the construction of [illegible] miles of road from Cambridge to Church Creek, at $[illegible]9,103 to J WINSTON CO, New York, for 7.7 miles of road from Licking Creek to Hancock, at $1[illegible]; to V FULLER BROS, Frostburg, Md, for the construction of 1.46 [illegible] concrete road from Carlos Junction to Midland, at $2[illegible], and to BROTHEMARKLE & UHL, Lonaconing, Md, for 2.7 miles of concrete road from Barton to Phoenix Hill, at $41,[illegible]

✦The contract for paving portions of Centre, Courtland and St Paul Sts has been awarded to PATRICK F REDDINGTON & SONS, at approximately $14,[illegible]

Salisbury, Md.—Bids will be received by J T Parsons, City Clk, until 8 p m, Sept 7, for paving 12,[illegible]0 sq yd with vitrified brick, bituminous macadam or bitulithic pavement on a 5-in concrete base P S Shockley is Engr

Washington, D. C.—Bids were received as follows, Aug 28, by the Commissioners of the District of Columbia, for laying concrete sidewalks in the District during the period ending June 30, 1915 E G Gummel, Class A, 96c, Class B, $1.16 Cranford Paving Co, A, $1.11, B, $1.29 Harper & Voight Co, A, $1.63½, B, $1.23½ Warren F Brenizer Co, A, 97c, B, $1.18 Bernard S Boyle, Lanford, Penn, A, $[illegible] Also on Aug 31, for grading and improving suburban streets and avenues in the District for the period ending June 30, 1915 (1) grading, (2) setting 6x20-in granite or bluestone curb, (3) setting 8x5-in granite curb, (4) paving or repaving cobble or granite block gutters, (5) paving vitrified brick gutters on gravel base, (6) paving vitrified brick gutters on 3-in concrete base, (7) constructing concrete curb with concrete gutter, (8) constructing concrete curb without concrete gutter, (9) constructing 18-in concrete gutter, (10) constructing 24-in concrete gutter, (11) constructing concrete roadway, (12) furnishing and hauling bank gravel for roadway Warren F Brenizer Co, (1) 39c per cu yd, (2) 33c per lin ft (3) 35c per lin ft, (4) 38c per sq yd, (5) 60c per sq yd, (6) 80c per sq yd, (7) 40c per lin ft, (8) 49c per lin ft, (9) [illegible] per lin ft, (10) 38c per lin ft, (11) 83c per sq yd E G Gummel, (1) 37c, (2) 29c, (3) 3[illegible]c, (4) 39c, (5) 7[illegible]c (6) $1.1[illegible] (7) 95c, (8) [illegible]5c, (9) 4[illegible]c, (10) 5[illegible]c, (11) 90c, (12) $1.2[illegible] per cu yd G R Mullen, (1) 43c, (2) 30c, (3) 37c, (4) [illegible], (5) 74c, (6) $1.50, (7) 53c, (8) 50c, (9) 40c, (10) 45½c, (11) 94c, (12) 99c Cranford Paving Co, (1) 57c, (2) 30c, (3) 36c, (4) 45c, (5) 60c, (6) $1.10, (11) 93c Harper & Voight Co, (1) 31c, (2) 35c, (3) 3[illegible]c, (4) 43c, (5) 69c, (6) $1.1[illegible] (7) curb alone, 50c, (8) [illegible]5c, (9) 31c, (10) 42c, (11) [illegible] (12) 70c

✦Richmond, Va.—The contract for paving Broad St has been awarded to the WASHINGTON ASPHALT BLOCK & TILE CO at $[illegible]0,000

✦A contract for paving portions of Ryland and Meadow Sts has been awarded to the ATLANTIC BITULITHIC CO at approximately $10,00[illegible]

Mooresville, N. C.—No contract was awarded on bids received Aug 2[illegible] for [illegible] yd of bituminous paving with a concrete base and curb The work has been postponed Noted Aug 6

Brooksville, Fla.—Bids will be received by the County Commissioners, until Sept 1[illegible] for the sale of $[illegible] bonds for highway improvements

Clearwater, Fla.—An election will be held Oct 6 to vote on the proposition of issuing $1[illegible] in bonds for additional street paving

Luverne, Ala.—Bids will be received by the Judge of the Probate Court until Sept [illegible] for the sale of $[illegible] in road and bridge bonds

✦Marion, Ala.—A contract for [illegible] has been awarded to [illegible] at $[illegible] Other bids were W H [illegible] Marion, $[illegible] [illegible] Montgomery, $[illegible] [illegible] Construction Co, $11,[illegible]

Corinth, Miss.—Bids will be received by the Board of Supervisors of Alcorn County until Sept [illegible] for [illegible] roads

✦Nashville, Tenn.—[illegible]

✦Paintsville, Ky.—A contract for [illegible] has been awarded to [illegible]

Arlington Heights [illegible] **Ohio**—Bids will be received by [illegible] Orth, Village Clk, until Sept [illegible] for improving [illegible]

Brewster, Ohio—[illegible]

Cincinnati, Ohio—[illegible] West [illegible] St, was [illegible] [illegible] per cu yd Approximately [illegible] are to be graded Noted Aug [illegible]

+Cincinnati, Ohio—The contract for paving Jefferson Ave. with asphalt and granite has been awarded to the KIRCHNER CONSTRUCTION CO., 221 West Ninth St., at $32,526. Noted Aug. 6.

(Official)—Bids will be received by the Board of County Commissioners, until noon, Sept. 25, for improving a part of the Princeton Pike, in Springfield Township. Albert Reinhardt is Clk.

Girard, Ohio—The City Council contemplates improving West Liberty St., paving Prospect St., and constructing a 24-in. storm sewer in South Market St.

+La Rue, Ohio—The contract for paving Front St. with brick has been awarded to BREWER, TOMLINSON & BREWER, Chillicothe, at approximately $26,000. Noted July 9 and Aug. 6.

+Lima, Ohio—The contract for paving Haller St. has been awarded to HENRY S. ENCK at $6153.

Liverpool, Ohio—The City Council contemplates paving and curbing a number of streets.

London, Ohio—Bids will be received by J. W. Byers, Village Clk., until Sept. 11, for grading and paving Walnut St.

+Lorain, Ohio—The contract for draining, grading and paving Hamilton Ave. has been awarded to the OHIO ENGINEERING CO., at $9000.

Marble Cliff, Ohio—Bids will be received by C. Newhouse, Village Clk., until Sept. 19, for improving Cambridge Place Ave. by grading, draining and paving with macadam.

+Marysville, Ohio—The contract for grading, draining and macadamizing the Vansant and Beaver Road in Clairborne Township has been awarded to C. S. GRUNDEL, at $9644. Noted Aug. 6.

Napoleon, Ohio—Bids will be received by Harry C. Rich, Village Clk., until Sept. 10 for improving Hobson St.

+Springfield, Ohio—The contract for paving Madison Ave., from Woodlawn Ave. to Sycamore St., has been awarded to W. F. PAYNE, at $27,347. Noted Aug. 13.

Zanesville, Ohio—Bids will be received by A. J. Voll, Clk. of the Bd. of Pub. Ser., until Sept. 8, for improving Jefferson St. from Woodlawn Ave. to Muskingum Ave.

Indiana—(Official)—Bids will be received as follows for road improvements in Indiana:

Delphi, until noon, Sept. 8, by the Commissioners of Carroll County for constructing four macadam roads in Deer Creek Township. M. G. Haun is Audr.

Madison, until 1:30 p.m., Sept. 8, by the Commissioners of Jefferson County for constructing two gravel roads in Hanover Township and one in Republic Township. A. M. Toff is Audr.

Brazil, until 10:30 a.m., Sept. 8, by the Commissioners of Clay County for constructing a road in Posey Township. E. A. Staggs is Audr.

Rockville, until 11 a.m., Sept. 8, by the Commissioners of Parke County for constructing five gravel roads. James E. Elder is Audr.

Bloomfield, until 2 p.m., Sept. 1, by the Commissioners of Greene County for constructing a macadam road in Taylor Township. C. H. Jennings is Audr.

Winamac, until noon, Sept. 8, by the Commissioners of Pulaski County for constructing roads in Monroe and Tippecanoe Townships. W. E. Munchenburg is Audr.

Mt. Vernon, until 2 p.m., Sept. 8, by the Commissioners of Posey County for constructing a road in Harmony Township. Joseph R. Haines is Audr.

Shelbyville, until 11 a.m., Sept. 9, by the Commissioners of Shelby County for constructing a road in Van Buren Township. F. W. Fagel is Audr.

Lafayette, until 10 a.m., Sept. 9, by the Commissioners of Tippecanoe County for constructing a gravel road in Washington Township. George W. Baxter is Audr.

Bloomfield, Ind.—(Official)—Bids will be received by John W. Johnson, Treas. of Greene County, until noon, Sept. 7, for the sale of $52,300 in bonds for highway improvements.

Gary, Ind.—Bids will be received until Sept. 21, by the Board of Public Works, for the improvement of Alley 2, East Sect. I, 4001 sq.yd. brick pavement, 4490 lin.ft. of curb, 1731 cu.yd. grading, 986 sq.yd. sidewalk, etc. W. J. Fulton is City Engr.

Goshen, Ind.—(Official)—Bids will be received by W. A. Gray, Treas. of Elkhart County, until Sept. 8, for the sale of $102,000 in bonds for highway improvements.

Hartford City, Ind.—(Official)—Bids will be received by G. H. Newbauer, Treas. of Blackford County, until Sept. 7, for the sale of $6940, $39,000 and $60,000 in highway bonds.

Scottsburg, Ind.—(Official)—Bids will be received by the Town Trustees, until 1 p.m., Sept. 8, for constructing 1966 cu.yd. of vitrified brick pavement.

Southport, Ind.—(Official)—Bids will be received by the Town Trustees, until 7:30 p.m., Sept. 7, for constructing approximately 1000 ft. concrete sidewalks.

+Springfield, Ill.—The Illinois State Highway Commission awarded contracts, Aug. 19, for highway work as follows. Crawford County, Sect. B, Route 3, to F. W. McELROY, Robinson, $18,990; Douglas County, Sect. B, Route 11, and Sect. A, Route 3, to GOGGIN CONSTRUCTION CO., Arcola, at $5300 and $9100, respectively; Adams County, Sect. A, Route 5, to CAMERON, JOYCE & CO., Keokuk, Iowa, $13,899; Jersey County, Sect. A, Route 2, to M. M. HANES, Jerseyville, $1475; Clay County, Sect. A, Route 5, to F. C. NICHOLS, Flora, $4197; McHenry County Sect. B, Route 11, to LOGAN & GIERTZ CONSTRUCTION CO., Elgin, $2950; McHenry County, Sect. A, Route 1, to H. M. GARVEY, 3721 Cottage Grove Ave., Springfield, $4736. Noted Aug. 6.

+The contract for paving 11th St. from South Grand Ave. to Ash St has been awarded to HENRY NEICH & SON.

+Beaumont, Tex.—A contract for constructing a road connecting the Mansfield Ferry with the shell road has been awarded to JESSE W. STUART, at $11,500.

Waukegan, Ill.—(Official)—Bids will be received by the Board of Local Improvements, until 8 p.m., Sept. 7, for paving Washington St. The estimated cost is $42,000. M. J. Douthitt is City Engr.

+Cudahy, Wis.—The contract for paving Packard and Lipton Ave. has been awarded to D. M. SNEDDON & CO.

Madison, Wis.—(Official)—Bids will be received by O. S. Norsman, City Clk., until 2 p.m., Sept. 23, for improving Main St. from Carroll St. to Henry St., Washington Ave. from Broom St. to Bedford St., Frances St. from State St. to University Ave.

Oconto, Wis.—The City contemplates paving Main, McDonald, Park, Superior, Huron and Congress St.

+Reedsburg, Wis.—A contract for constructing 13,750 sq. yd. brick block paving with curbs and gutters has been awarded to SWEENEY BROS.

Sheboygan, Wis.—The Board of Public Works is receiving bids for grading and paving Indiana ave. from South 13th to South 17th St. with concrete.

+Erie, Kan.—The contract for rebuilding the rock roads east and north of Chanute was awarded Aug. 6 to JOSEPH RHODES, Humboldt.

Fort Scott, Kan.—C. O. Tallman, Comr. of Street and Pub. Impvt., will soon receive bids for vitrified brick paving on concrete base, also curbing and guttering of Wall St. from Broadway to Washington.

+Neodesha, Kan.—A contract for paving four blocks and alley was awarded, Aug. 24, to GREEN & CULLEN, Independence, Mo., at $37,925.

+Parsons, Kan.—A contract for paving with asphaltic concrete and curbing with carthage stone has been awarded to A. JAICKS CO., 115 American Bank Bldg., Kansas City. Noted July 16.

Sioux Falls, S. D.—Bids will be received by Walter C. Leyse, City Audr., until Sept. 14, for paving Ninth and Tenth St. and Summit Ave.

Ballinger, Tex.—The issuing of about $100,000 of bonds for the construction of good roads in different precincts of Runnels County is under consideration.

+Dallas, Tex.—Contracts have been awarded for paving parts of nine streets with wood block to the TEXAS BITULITHIC CO., and for three blocks with rock asphalt to the STANDARD ENGINEERING & CONSTRUCTION CO. Noted July 30.

+Houston, Tex.—Contracts have been awarded for paving Webster Ave. to the EUREKA PAVING CO., $14,400; Avondale Ave., to the UVALDE ROCK ASPHALT CO., $15,800; Dallas St., to the EUREKA PAVING CO., $15,000. Noted July 30.

San Antonio, Tex.—The San Antonio Automobile Club will construct an automobile toll road from a point on the Culebra Road to the Medina Dam. 6½ miles. The proposed road will cost about $35,000, and will shorten the distance between San Antonio and Medina Dam five miles.

Velasco, Tex.—Bids will be received by the Commissioners of Brazoria County, until Sept. 5, for constructing 12 miles of hard-surface roads in District No. 8.

Salt Lake City, Utah—The Board of City Commissioners has rejected all bids received for resurfacing Sixth East St. with bituminous macadam. Bids will be called for later.

Prescott, Ariz.—Bids will be received by the Supervisors of Yavapai County, until Sept. 16, for improving Section B of the Prescott-Flagstaff Highway.

Tuscon, Ariz.—Bids will be received by the Board of Supervisors until 2 p.m., Sept. 16, for constructing about seven miles of highway. Bertram L. Hitch is Clk.

Bremerton, Wash.—According to press reports, the City Council proposes to pave Washington Ave. and High St.

+Hoquiam, Wash.—The contract for improving Pacific Ave. has been awarded to PUGH & ARENZ, at $18,420.

The City Council has adopted an ordinance providing for the improvement of a section of Broadway with a rock and gravel roadway.

+Leavenworth, Wash.—A contract for street improvement in District No. 8 has been awarded to J. C. MASSIE, at $9518.

+Seattle, Wash.—The contract for constructing the Mercer Island Road has been awarded to FIRSCH & GLASS, at $51,491. Noted Aug. 6.

Bids will be received by the County Commissioners, until Sept. 8, for paving East 65th St.

+The contract for paving Ewing St. has been awarded to the SPARGER CONCRETE CO., at $168,041.

+The contract for constructing the Redmond-Snoqualmie Road has been awarded to the NETTLETON, BRUCE & ECHBACH CO., at $59,217. Noted Aug. 6.

+Astoria, Ore.—The Clatsop County Court has awarded a contract for the clearing and grading of nine miles of highway from Necanicum to the Tillamook County line to JEFFREY & BUFTON, Portland, Ore., at $56,000.

Eugene, Ore.—The City Council has passed an ordinance providing for the paving of Sixth Ave. West from Olive to Blair St.

+Portland, Ore.—The City Commission has awarded contracts for street paving as follows: Asphaltic concrete on Patton Ave., to the OREGON INDEPENDENT PAVING CO. at $1,614; asphaltic concrete re-dress on the Alameda, to GIEBISCH & JOPLIN, at $71,844; concrete on Market St. drive, to HARRY HOWARD, at $5734; asphaltic concrete on Eugene St., from Williams to Union Ave., to the OREGON INDEPENDENT PAVING CO., at $5633.

+St. Johns, Ore.—The City Council has awarded a contract for the construction of a road from the Willamette Blvd. to the Portland drydock to V. W. MASON, Portland, at approximately $5000.

+Sutherlin, Ore.—(Official)—The contract for grading and paving Central Ave. has been awarded to the ARENZ CONSTRUCTION CO., Salem, at $27,009. The only other bid was that of Cummings & Nutings, $29,820. Noted Aug. 13.

+Inglewood, Calif.—The contract for improving Severance St. and Manchester Ave. has been awarded to GEORGE R. CURTIS, 552 South St. Louis St., Los Angeles.

+Madera, Calif.—The contract for improving B St. has been awarded to M. HAYNES, Klagsburg.

Riverside, Calif.—Bids will be received by the County Supervisors [illegible] Sept. 11, for improving about [illegible] miles of the [illegible] Road, beyond [illegible] Spring grade. G. M. [illegible] is Chief Engr.

Santa Barbara, Calif.—According to press reports, bids will be received by the Board of County Supervisors, until [illegible] for grading and [illegible] ft. of the San Marcos Turnpike Road and [illegible] of the Fairview Road.

✦Yreka, Calif.—A contract for constructing the Shasta Springs [illegible] has been awarded to RUFUS BRAM, [illegible] at [illegible].

✦Chatham, Ont.—A contract for constructing 600 yd. of [illegible] has been awarded to the CARRITTE-PATERSON CO., St. John, N. B.

INDUSTRIAL WORKS

Chicopee, Mass.—The Knit Goods Specialty Co. plans to erect a [illegible] factory on [illegible] St.

Worcester, Mass.—The Heald & Knight Mfg. Co., Franklin St., is having plans prepared for a one-story, 11[illegible]x226-ft. reinforced-concrete factory and a two-story, 6[illegible]x226-ft. storage house. Cutting, Carleton & Cutting, 11 Front St., Worcester, are the Archs.

The [illegible] Sprinkler Co. plans to build a two-story, 11[illegible]x[illegible]-ft. factory on Harlem St. J. P. Ashley is the Mgr.

Fairfield, Conn.—The Max Ams Machine Co., New Rochelle, N. Y., has purchased [illegible] acres of land here, where it plans to erect a factory.

Torrington, Conn.—The Excelsior Needle Co. is having plans prepared for a three-story, [illegible]2x2[illegible]3-ft. factory to be erected on Field St. E. H. Waterbury is the Arch.

✦Buffalo, N. Y.—The Taber Pump Co., 262 Elk St., has awarded the contract for the construction of a 117x1[illegible]-ft. foundry, and [illegible]x1[illegible]-ft. machine shop to the WESTERN CONSTRUCTION CO., Iroquois Bldg., Buffalo.

The Buffalo Meter Co. is having plans prepared for the construction of a plant at Main St. and the Erie R.R. George R. [illegible] is Pres. Lockwood, Greene & Co., Engrs., Boston, Mass., are preparing the plans.

Frenchtown, N. J.—The Star Porcelain Co., manufacturer of electrical porcelain, plans to build a [illegible]0x1[illegible]0-ft. reinforced-concrete addition to its plant on Eighth St.

Jersey City, N. J.—The Hamilton Mfg. Co., Two Rivers, Wis., manufacturer of printers' furniture and wooden type, plans to erect a plant in this city. The estimated cost is $[illegible].

Newark, N. J.—The Simmer Faucet Co. plans to build a new factory on [illegible] St.

Allentown, Penn.—The Leicester Rubber Co., whose plant was recently destroyed by fire, is having plans prepared for a new factory. Rube & Lange, Allentown, are the Archs.

Philadelphia, Penn.—The Eastern Lamp Co. is having plans prepared for a [illegible]-story, 4[illegible]x125-ft. factory, to be erected at [illegible] St. and Eastwick Ave.

Pittsburgh, Penn.—The Fort Pitt Hotel Co. is having plans prepared for the construction of a warehouse and laundry on Liberty Ave. The estimated cost is $1[illegible],000.

Baltimore, Md.—Joseph Evans Sperry, Arch., has completed plans for the plant of the City Dairy Co., Baltimore. The building will be of the Spanish Moorish type, 100x[illegible]00 ft. The estimated cost is $[illegible]. Noted June 25.

Hagerstown, Md.—The [illegible] Knitting Co., whose plant was recently destroyed by fire, with a loss of $[illegible]0,000, plans to build a new factory.

The [illegible] Knitting Co., whose factory was recently destroyed by fire, has had plans prepared for the erection of a [illegible]x[illegible]2-ft. factory. The estimated cost is $[illegible],000.

Washington, D. C.—The Chapin Sacks Mfg. Co. plans to build [illegible] factory and cold storage plant which will include garage, repair shop and boiler plant. The estimated cost is $[illegible].

Rocky Mount, Va.—H. L. [illegible] plans to establish a factory for the manufacture of [illegible].

Marion, N. C.—Local press reports state that [illegible] Little, [illegible] in cooperation with New York financiers, plans to erect a cotton mill to cost $[illegible].

Atlanta, Ga.—The [illegible] Wheel Co., St. Louis, Mo., will erect a factory in Atlanta to cost $[illegible], and will equip it for the manufacture of cast iron car wheels.

Savannah, Ga.—[illegible] & [illegible], Baltimore, has had plans prepared for a [illegible] plant to be constructed this fall. The estimated cost is $[illegible].

New Orleans, La.—The [illegible] plans to build several [illegible] at Algiers. A plant for the manufacture of [illegible] will be erected. The estimated cost of the improvements is $[illegible]. [illegible] is preparing the plans.

New Orleans, La.—The [illegible] Tire & Rubber Co. plans to erect a [illegible] factory [illegible].

Chattanooga, Tenn.—The Chattanooga [illegible] Coal Co. [illegible] [illegible]

Memphis, Tenn.—The [illegible] Co. plans to establish a [illegible] to cost about $[illegible].

✦Cincinnati, Ohio.—The [illegible] Co. has awarded the contract for the [illegible] on its new [illegible] to the [illegible] CONSTRUCTION CO. [illegible]

✦Cincinnati, Ohio.—The Methodist Book Concern has awarded the contract for the construction of an addition to its publishing plant to the FERRO CONCRETE CO. The estimated cost is $3[illegible]0,0[illegible]. Samuel Hannaford & Sons, Hulbert Block, prepared the plans.

The Clifton Springs Distilling Co. plans to build car shops at [illegible] Ave. and the Baltimore & Ohio R.R. The estimated cost is $12,000. Ward Baldwin, 9[illegible]7 Commercial-Tribune Bldg., is Arch. and Engr.

Cleveland, Ohio.—The Landesman-Hirschheimer Co., 1[illegible]23 West Ninth St., plans to build a cloak and suit factory at Payne Ave. and East 24th St. The estimated cost is $2[illegible]0,000. Harry New is the Mgr.

The Cohn-Goodman Co., 1140 West Sixth St., plans to build a cloak factory at Payne Ave. and East 23d St. The estimated cost is $250,000.

Cleveland, Ohio.—The Ford Motor Co., Detroit, Mich., plans to erect a factory here to cost about $3[illegible]0,000.

The Cleveland Seating Co., 5[illegible]0 Rose Bldg., has purchased a site on East 152d St., where it is planned to erect a factory for the manufacture of school and church furniture. The estimated cost is $75,000.

✦Columbus, Ohio.—The contract for the construction of the dairy at the Wooster Experiment Station has been awarded to the BRIGHT CONSTRUCTION CO., Toledo, at $13,33[illegible]. Dawson & Holbrook, Columbus, are the Archs.

Columbus, Ohio.—The Welsbach Co., Philadelphia, Penn., according to local press reports, plans to erect a factory in this city.

Lima, Ohio.—The Stolzenbach Baking Co. has had plans prepared for a three-story, [illegible]0x50-ft. addition to its baking plant. The estimated cost is $15,000.

Toledo, Ohio.—The Toledo Ford Tire Co., manufacturer of tires, plans to erect a 60x2[illegible]0-ft. factory.

Youngstown, Ohio.—Local press reports announce that the United States Steel Corporation has made the final purchases to complete a 350-acre site in Youngstown. Ten bar mills and byproduct coke ovens are among the proposed improvements.

Marine City, Mich.—The Michigan Salt Co. plans to construct a two-story, 76x138-ft. salt works. The estimated cost is $65,000. C. L. Vivian, 120 East State St., Ithaca, N. Y., is the Arch.

✦Chicago, Ill.—T. Edward Wilder, 1034 Crosby St., has awarded the contract for a five-story addition to his factory, to the SUMNER SOLLITT CO., Chicago. The estimated cost is $48,000. J. C. Gardner, Chicago, is the Arch.

The Pure Carbonic Co., 2020 South Canal St., has awarded the contract for the construction of its factory addition to the UNION CONTRACTING CO., Chicago. The estimated cost is $20,000. Chatten & Hammond, Chicago, are the Archs.

The Western Foundry Co., 3112 West 37th St., is having plans prepared for the construction of a one-story machine shop to cost $11,000. M. Morehouse, Chicago, is the Arch.

Tilton, Ill.—The Danville Refractories Co., Danville, Ill., manufacturer of refractory brick, plans to erect a plant in this city. The estimated cost is $100,000. C. J. Crawford, St. Louis, Mo., is interested.

Marshfield, Wis.—The Felker Co., manufacturer of galvanized iron products, plans to erect a new factory.

Billings, Mont.—The Enterprise Sheet Metal Works, Inc., is having plans prepared for a one-story, [illegible]x13[illegible]-ft. addition for the manufacture of furnaces.

Houston, Tex.—The Texas Metal Co. has acquired a site, and will erect a factory on McKinney Ave. for the manufacture of metal products. J. J. Schuler is interested.

Paris, Idaho.—The Jenson Creamery Co., Salt Lake City, plans to erect a creamery in this city.

Ogden, Utah.—Bids will be received by the Manager for the construction of the plant of the Utah Cereal Food Co. The buildings to be erected are three-story [illegible]-ft. factory, power plant and a 3[illegible]x[illegible]-ft. warehouse. The estimated cost of the improvements is $70,000. Noted May 14.

Wickenburg, Ariz.—Edward Shumate and associates will install a dry concentrator and other equipment, also an ore crusher, at their Rich Hill mining property near Wickenburg.

Centralia, Wash.—The Hunker Shingle Co., whose plant was recently destroyed by fire, is having plans prepared for a factory to be erected on the former site.

Spokane, Wash.—The Hewitt Steel Corporation plans to erect a rolling mill on Chattaroy Creek at a cost of $[illegible], also a furnace to cost $[illegible]. Henry Hewitt and H. J. [illegible], Vancouver, Wash., are interested.

Portland, Ore.—The Fiske Rubber Co. will erect a three-story factory at Tenth and Burnside Sts.

Berkeley, Calif.—The Gillette Corset Co., New York [illegible], is contemplating the establishment of a factory [illegible]. The Berkeley chamber of commerce is negotiating for the industry.

Long Beach, Calif.—J. T. [illegible], 11[illegible] E. Tenth St., will erect [illegible] garage and [illegible] Ave. for [illegible]. The estimated cost is $[illegible]. [illegible], Long Beach, is the Arch.

Oakland, Calif.—The [illegible] Air Brake Co. has [illegible] that the plant will be removed from Salt Lake City to this city. A site for a factory, convenient to rail and water [illegible], is being sought.

Dorchester, N. B.—The [illegible] Mills [illegible] plans to [illegible] in this city. [illegible], [illegible], N. S., is interested.

Montreal, Que.—The [illegible] Co., [illegible] St., will receive bids in the near future for the [illegible] of [illegible] plant. The estimated cost is $[illegible]. [illegible] & [illegible], [illegible] Bldg., are the Archs.

Brockville, Ont.—The [illegible] Mfg. Co. has had plans prepared for a three-story [illegible]-ft. factory, to replace the plant recently destroyed by fire. J. B. [illegible], [illegible], N. Y., is [illegible]. Noted Aug. 6.

Toronto, Ont.—The William [illegible] Co., Chicago, [illegible], plans to build an addition to the plant which will cost $[illegible].

Dauntless, Alta.—The Dominion Harvester Co. has had plans prepared for the erection of a $75,000 factory.

Redcliff, Alta.—The Imperial Brass Mfg. Co., Chicago, Ill., plans to erect a 49x150-ft. factory here.

FEDERAL GOVERNMENT WORK

Paving—Springfield, Mass.—Bids will be received until Sept. 21, by the Commanding Officer, Springfield Armory, for paving with vitrified brick that portion of Pearl St. belonging to the United States; also for resurfacing a portion of Pearl St.

Air Compressor, Etc.—Watertown, Mass.—Bids will be received until noon, Sept. 24, by the Commanding Officer, Watertown Arsenal, for one Norwalk single air compressor, cylinder 20x24, six 2-in. stop valves and pipes, one oil receiver and two pressure gages.

★Post Office—Narragansett Pier, R. I.—Bids will be received until 3 p.m., Oct. 7, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction complete of the U. S. post office at Narragansett Pier, R. I. It will be a two-story and basement building, ground area of 4030 sq.ft., partial fireproof construction.

Post Office—Bedford, Penn.—Bids were received as follows Aug. 24, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Bedford, (a) limestone; (b) sandstone:
J. S. Rogers, Moorestown, Penn., (a) $56,460; (b) $59,460. Westchester Engineering Co., White Plains, N. Y., (a) $35,784; (b) $57,800. Olin Gerlach, Frostburg, Md., (a) $58,443; (b) $61,000. W. H. Fissell & Co., New York, N. Y., (a) $52,800; (b) $56,800. James Devault, Canton, Ohio, (a) $59,900; (b) $61,488. Daniel T. McCarthy, Philadelphia, Penn., (a) $57,439; (b) $59,539. Cottage Planing Mill Co., Everett, Penn., (a) $63,900; (b) $61,800. The building will be one story and basement, ground area, 4720 sq.ft., stone facing, first floor fireproof, composition roof. Noted July 16.

Converter Sets—Philadelphia, Penn.—Bids were received, Aug. 29, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for two 560-kw. rotary converter sets at the Navy Yard, Philadelphia, from the General Electric Co., Schenectady, N. Y., $13,908; Westinghouse Electric & Mfg. Co., Pittsburgh, Penn., $10,757. Noted Aug. 20.

Locomotive Cranes—Philadelphia, Penn.—Bids will be received until 11 a.m., Sept. 26, by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., for three 15-ton locomotive cranes for the Navy Yard, Philadelphia, and one 15-ton locomotive crane for the Navy Yard, Charleston, S. C.

Repairing Vessel—Baltimore, Md.—Bids will be received until 2 p.m., Sept. 15, by the Lighthouse Inspector, Baltimore, for repairing light vessel No. 45.

✚Gun Forgings—Washington, D. C.—The following contracts have been awarded from bids received July 29 for 55 sets of five-in. steel gun forging for the U. S. navy: MIDVALE STEEL CO., Nicetown, Philadelphia, Penn., 27 sets, $84,516; BETHLEHEM STEEL CO., South Bethlehem, Penn., 16 sets, $51,997; CRUCIBLE STEEL CO. of AMERICA, Pittsburgh, Penn., 12 sets, $36,532.

Mail Conveying Apparatus—Washington, D. C.—Bids will be received until 2 p.m., Sept. 15, by Cornelius Ford, Public Printer, Washington, D. C., for mechanical mail conveying apparatus to be placed in the Government printing office, Washington, D. C.

Steel Sash and Frames—Washington, D. C.—Bids will be received until 2 p.m., Sept. 9, by B. Sweeney, Asst. Secy. of the Interior, Washington, D. C., for 104 steel window sash and frames with wired glass and operating devices, for the Pension Office building, Washington.

Cable Hangers—Washington Barracks, D. C.—Bids will be received until 11 a.m., Sept. 8, by Lieut. Col. Joseph E. Kuhn, Corps Engrs., U. S. A., Washington Barracks, D. C., for furnishing 8000 No. 0 cable hangers with screws.

Refrigerating Apparatus—Washington Barracks, D. C.—Bids will be received until 11 a.m., Sept. 23, by Lieut. Col. Joseph E. Kuhn, Corps Engrs., U. S. A., Washington Barracks, D. C., for refrigerating apparatus having a daily capacity of six tons.

★Motor Boat—Wilmington, N. C.—Bids will be received until noon, Sept. 28, by Maj. H. W. Stickle, Corps Engrs., U. S. A., for the construction of the motor survey boat "Neuse."

Elevator Equipment—Atlanta, Ga.—Bids will be received until 10 a.m., Sept. 24, by F. H. Duehay, Supt. of Prisons, Dept. of Justice, Washington, D. C., for elevator equipment for the hospital building of the U. S. penitentiary at Atlanta, Ga.

Post Office—Tupelo, Miss.—Bids were received as follows, Aug. 26, for the construction of a post office at Tupelo, (a) limestone; (b) sandstone :
George W. Stiles Construction Co., Chicago, Ill.; (a) $47,350. Newport Contracting & Engineering Co., Newport News, Va., (a) $47,303; (b) $48,000. W. H. Fissell & Co., New York, (a) $44,979; (b) $46,116. The building will be one-story and mezzanine and basement stone and brick faced, 4000 sq.ft. ground area, composition roof. Noted July 23.

Plumbing and Lighting—Baton Rouge, La.—Bids will be received until 3 p.m., Sept. 21, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for alterations in the plumbing and lighting of the U. S. post office at Baton Rouge, La.

★Steel Barge—New Orleans, La.—The following bids were received by Maj. C. O. Sherrill, Corps Engrs., U. S. A., for the steel barge, (a) delivered at New Orleans, (b) at yards: E. J. Howard, Jeffersonville, Ind., (a) $8250, (b) $7800; Jones-Laughlin Steel Co., Pittsburgh, Penn., (a) $9585; (b) $8695; American Bridge Co., Pittsburgh, Penn., (a) $9500, (b) $8700; Pittsburgh-Des Moines Steel Co., Pittsburgh, Penn., (a) $9975, (b) $9000. Noted July 16.

✚Elevators—Dayton, Ohio—The contract for installing two electric passenger elevators, three hydraulic lifts, and a pumping plant in the U. S. post office and courthouse, Dayton, has been awarded to the FAUNT LE ROY ELEVATOR CO., Baltimore, Md., at $12,432. Noted June 11 and July 9.

Breakwater—Indiana Harbor, Ind.—Bids will be received until 10 a.m., Sept. 23, by Lieut. Col. W. V. Judson, Corps Engrs., U. S. A., Chicago, Ill., for constructing a rubble-mound breakwater at Indiana Harbor, Ind.

Gates and Gate-Stands—Great Falls Mont—Bids were received Aug. 4 for the construction of gates and gate-stands for the northern division, U. S. Reclamation Service, from: Fulton Engine Works, P. O. Box 296, Los Angeles, Calif., $34,229; Hinman Hydraulic Manufacturing Co., 1400 West Colfax Ave., Denver, Colo., $31,038; Minneapolis Steel & Machinery Co., Minneapolis, Minn., $32,993. Noted July 9.

✚Steel Pipe—Great Falls, Mont.—The contract for steel pipes for the St. Mary storage unit of the Milk River irrigation project has been awarded to the CHICAGO BRIDGE & IRON WORKS, Chicago, Ill., at $49,600.

✚Post Office—De Soto, Mo.—The contract for the construction of the U. S. post office at DeSoto, Mo., has been awarded to the HIRAM LLOYD BUILDING & CONSTRUCTION CO., Odd Fellows' Bldg., St. Louis, Mo., at $47,250.

Post Office—Longview, Tex.—All bids received May 12 for the construction of the U. S. post office at Longview, Tex., have been rejected. Noted Apr. 9 and May 21.

Post Office—Medford, Ore.—Bids were received as follows Aug. 24, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office, Medford (a) limestone; (b) sandstone:
J. L. Murphy & Sons, Charleston, Wash., (a) $108,680; (b) same. R. E. Campbell, Salt Lake City, Utah, (a) $88,600; (b) $88,400. King Lumber Co., Charlottesville, Va., (a) $100,000; (b) $99,400. John Almeter, Portland, Ore., (a) $87,277; (b) $87,177. A. W. Kutsche, Portland, Ore., (a) $75,645; (b) $75,445. Sound Construction & Engineering Co., Seattle, Wash., (a) $76,780; (b) $77,100. W. M. O'Neill Sons & Co., Faribault, Minn., (a) $99,741. Welsch Bros., Oakland, Calif., (a) $92,697; (b) same. Palmberg Mattson, Astoria, Ore. (a) $92,686; (b) same. Fred A. Ericson, Salem, Ore., (a) $100,882; (b) $99,882. The building will be three-story and basement, ground area 5500 sq.ft., first floor fireproof, stone, ornamental terra cotta and brick facing, composition roof. Noted Aug. 13.

Pile and Lumber Work—Mare Island, Calif.—Bids will be received until 11 p.m., Sept. 19, by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., for pile and lumber work for reconstructing the quay wall at the Navy Yard, Mare Island, Calif.

Coal-Hoisting Tower—San Diego, Calif.—Bids were received as follows, Aug. 29, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a coal hoisting tower, at the naval coast depot, San Diego: Mead-Morrison Co., Boston, Mass., $41,245. McMyler Interstate Co., Bedford, Ohio, $35,400. Robbins Conveying Belt Co., New York, $42,676. C. W. Hunt Co., Inc., New York, $44,837. Noted July 30.

Cold-Storage Plant—Pearl Harbor, Hawaii—Bids were received as follows, Aug. 29, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction and equipment of an ammonia ice-making and refrigerating plant: Vilter Mfg. Co., Milwaukee, Wis., $18,600. Mayer Ice Machine & Engine Co., Jersey City, N. J., $16,200. Frick Co., Waynesboro, Penn., $25,775. Noted July 30.

Buildings—San Juan, Porto Rico—Bids will be received until 11 a.m., Oct. 10, by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of radio building, concrete, and operators' quarters, wood construction, at the U. S. Naval Radio Station, San Juan, Porto Rico.

MISCELLANEOUS

✚Dredging—Boston, Mass.—The Directors of the Port have awarded a contract to CHARLES M. COLE, Fall River, at $52,555, for dredging in Dorchester Bay. Noted Aug. 27.

River Protective Work—Boston, Mass.—(Official)—Bids will be received by the Board of Harbor and Land Commissioners, State House, Boston, until noon, Sept. 8, for protective work on the easterly bank of the Connecticut River. William F. Williams is Ch. Engr. of the Comn.

Coal Pocket, Sea-Wall, Etc.—Boston, Mass.—(Official)—Bids will be received by the Trustees of the City Hospital, until noon, Sept. 9, for constructing a sea-wall and coal pockets and for installing coal-handling machinery and tower at the hospital. Frank H. Holt is Act. Supt.

Retaining Wall, Dredging, Etc.—Salem, Mass.—(Official)—Bids will be received by the Commissioners of Essex County, Salem, until 9:20 a.m., Sept. 10, for widening Merrimac St., in Lawrence, Mass. The work includes the construction of a 575-ft. retaining wall along the bank of the Shawsheen River, dredging the river channel to provide extra waterway and building an embankment to widen the highway. Moody Kimball, James C. Poor and J. M. Grosvenor, Jr., are the Comrs.

Barge Canal Work—Albany, N. Y.—(Official)—Bids were recived Aug. 25 by Duncan W. Peck, State Supt. Pub. Wks., for (a) Contract 46-A, constructing Erie canal from Fox Ridge to the Montezuma aqueduct, (b) Contract 125, Erie Canal, Sect. 2, constructing Vischers Ferry Road viaduct and approaches over the Troy-Schnectady branch of the New York Central R. R., and (c) Contract 126, Champlain Canal, Sect. 1, for raising a highway bridge at Mechanicsville, as follows: James Stewart & Co., Inc., 30 Church St., New York, (a) $196,133; Sherman Stalter Co., Cleveland, Ohio, (a) $293,951; New York State Dredging Corporation, Rochester, (a) $315,456; Great Lakes Dredge & Dock Co., Buffalo, (a) $236,066; Eastover Construction Co., Utica, (a) $239,981; Kinser Construction Co., East St. Louis, Ill., (a) $271,301; Maryland Dredging & Contracting Co., Baltimore, Md., (a) $291,110; Merrill-Ruckgaber Co., New York, (b) $47,462; (c) $8970; Frank L. Cohen, Buffalo, (b) $44,643; Drake & Dean Co., Inc., Buffalo, (b) $43,529; Walsh Construction Co., Davenport, Iowa, (b) $43,163; Whitehead & Kales Iron Works, Detroit, Mich., (b) $45,097. Ford & Green, Schenectady, (b) $43,216; State Highway Con-

[illegible] Co. [illegible] to [illegible] & [illegible] k, Buffalo [illegible] Keith & [illegible] Schenectady [illegible] F. [illegible] West Co. [illegible] Falls [illegible] Horseheads [illegible] Co. [illegible] lowest.

Grading and Razing Building—[illegible] N. Y.—(Official)—[illegible] will be received by [illegible] E. Freeman, Asst. Engr., [illegible] Albany, N. Y., until [illegible] for grading the grounds and razing the present [illegible] building of the State Normal School at Buffalo. Lewis [illegible] State Arch.

Harbor Improvement, Etc.—Easthampton, N. Y.—The State [illegible] plans for deepening Three Mile Harbor and constructing a [illegible] wall at its entrance. An appropriation of [illegible] is available for the work.

Subway—New York, N. Y.—(Official)—[illegible] will be received by the Public Service Commission, 154 Nassau St., [illegible] of Manhattan, until Sept. 15, for constructing Sect. [illegible] Route [illegible] Place, William and Clark St. subway, a part of the Seventh Ave.-Lexington Ave. rapid transit railroad.

Subway—New York, N. Y.—(Special Work)—The contract for special work [illegible] portions of the Broadway-Fourth Ave. rapid transit railroad, Borough of Brooklyn, has been awarded by the Public Service Commission to the PENNSYLVANIA STEEL CO., at [illegible]. Noted Aug. 6.

Laundry Equipment—Rochester, N. Y.—See item under [illegible].

Dams, River Work—Rochester, N. Y.—The Board of Contract and Supply has awarded contracts to T. A. GILLESPIE Co., New York, at [illegible] for constructing movable dams, and to [illegible] T. F. [illegible] Rochester at [illegible] for deepening the Genesee River. Noted Aug. 6.

Conduit—Jersey City, N. J.—The Pennsylvania R.R. has awarded a contract to WILLIAM J. McCLOUD & CO., Elizabeth, at [illegible] for constructing a multiple duct underground conduit along its line from Jersey City to Rahway.

Fire Truck—Erie, Penn.—The Safety Board has been authorized to spend [illegible] for the purchase of an aerial fire truck.

Tunnel—[illegible], Penn.—(Official)—Bids are being received by the Broad Top Coal & Mineral Co., Huntingdon, for the construction of a rock tunnel, 6x7 ft., 150 ft. long.

Excavating, Grading, Etc.—Pottsville, Penn.—Bids will be received by J. E. K[illegible], County Controller, Pottsville, until Sept. [illegible] for excavating, grading and improving the grounds at the hospital [illegible] at Schuylkill Haven.

Comfort Station—Baltimore, Md.—The city has awarded a contract to CHARLES HERBOLD, 2729 West North Ave., Baltimore, for constructing an addition to the comfort station at Centre Market Space and Lombard St.

Harbor Improvement—Baltimore, Md.—At an election to be held in November the proposition to spend $[illegible] for deepening the channel of the harbor will be submitted to the citizens.

Wall—Charleston, W. Va.—Bids will be received by the Board of Affairs until 2 p.m. Sept. 1[illegible], for constructing a retaining wall along the levee. J. F. [illegible] is Pres. of the Bd.

Terminal—Savannah, Ga.—The Ocean Steamship Co. contemplates an expenditure of [illegible] for the construction of a terminal at [illegible].

Sea-Wall—Green Cove Springs, Fla.—The Espiritu Santo Springs Co. [illegible] the construction of a [illegible] ft. sea-wall at Green Cove Springs.

Steel for Docks—Jacksonville, Fla.—The Port Commissioners have awarded a contract to the LACKAWANNA STEEL CO., Buffalo, N. Y., at [illegible] for furnishing steel for the municipal docks and terminals.

Extending Pipe Line—Alexandria, La.—The Standard Oil Co. is preparing to extend about [illegible] miles of its pipe line [illegible] near Alexandria.

Drainage—New Orleans, La.—Bids will be received by the [illegible] until Oct. 2 for making extensions to Drainage Station No. [illegible]. The work includes [illegible] St. Bernard Ave. and for valves, etc. [illegible] on file with [illegible] Earl, Gen. Supt.

Coaling Station—Hollow Rock Junction (Hollow Rock post office), Tenn.—The Nashville, Chattanooga & St. Louis Ry. will erect a steel coaling station costing between [illegible] and [illegible] at Hollow Rock Junction on the [illegible] & Nashville Division.

Fish Hatchery—[illegible]—The contract for [illegible] a new fish hatchery [illegible] of Ohio has been awarded to [illegible] A. [illegible] & [illegible] at [illegible]. Noted July [illegible].

Coal-Handling Plant—New Albany, Ind.—The Chicago, Indianapolis & Louisville Ry. Co. has awarded a contract to the [illegible], [illegible] South Michigan Ave., [illegible] for installing a coal-handling plant at New Albany.

Sea-Wall—[illegible], Ill.—The construction of a sea-wall along the [illegible] at [illegible] Island has been recommended by [illegible] to the City Council.

Natatorium—[illegible]—The low bidders for the construction of the new [illegible] Ward natatorium were [illegible] [illegible] [illegible] W. [illegible] [illegible]

Drains—[illegible] Iowa.—Bids will be received by [illegible] County Engr. [illegible] Sept. [illegible] for constructing drain [illegible]. The estimated cost is [illegible].

Coal Tipple and Concrete Wall—[illegible], Minn.—The [illegible] has obtained a permit and will [illegible] and a concrete retaining wall at [illegible] at an estimated cost of [illegible].

Drainage and Levees—[illegible] Board of [illegible] of the [illegible] District [illegible] Rivers has approved plans for drainage and flood protection prepared by Morgan Engineering Co., Memphis, Tenn. The work involves [illegible] miles of levees and the moving of 2,500,000 cu.yd. of earth.

Grain Elevator—St. Joseph, Mo.—The Chicago, Burlington & Quincy R.R. Co. will construct a grain elevator with a capacity of [illegible] bu. The estimated cost is $[illegible].

Levee—Caldwell, Tex.—The citizens of Levee Improvement District No. 1 of Burleson County contemplate issuing $[illegible] in bonds for the reconstruction of levees along the Brazos River which were destroyed by flood.

Comfort Stations—Dallas, Tex.—Plans are being prepared by J. Edward Overbeck, Arch., for the construction of two underground comfort stations at Elm and Ervay St. The estimated cost is $2[illegible],000. Noted July 18.

Drainage Bonds—Richmond, Tex.—Bids will be received by the County Judges until Sept. 14, for the purchase of $[illegible] in bonds for drainage.

Dike—Anacortes, Wash.—A. P. [illegible] Bldg., Seattle, [illegible] have awarded a contract to the JAMES EARL ENGINEERING & CONSTRUCTION CO., Seattle, at about $[illegible] for constructing a dike across the entrance to [illegible] Bay, near Anacortes.

Harbor Improvement—Seattle, Wash.—Low bids were received by the Commissioners of the Port, Aug. 2[illegible], for harbor improvement work, as follows: [illegible]-story grain elevator, [illegible] John Arnold Co., [illegible] Bldg., Portland, Ore., $[illegible]; excavation and slope protection of the East Waterway Terminal Wharf No. 2, Puget Sound Bridge & Dredging Co., Seattle, $[illegible]; removal of slab at same improvement, Harrington, [illegible] Co., Seattle, $33,[illegible]; wharf substructure in the East Waterway terminal, Butler Construction Co., Central Bldg., Seattle, at about $2[illegible].

Refrigeration Equipment—Seattle, Wash.—The lowest bids received for the installation of refrigerating equipment in the Central Waterfront Cold Storage warehouse were from the Utter Mfg. Co. at $31,37[illegible] using black iron, and the Harris Ice Machine Co. at $32,99[illegible] using galvanized iron.

Wharf—Seattle, Wash.—Engert & Ward at $[illegible] submitted the only bid for excavating and building substructure for wharf in front of the turning basin in the east waterway.

Retaining Walls—Seattle, Wash.—Bids will be received by the Port Commission until Sept. 1[illegible], for constructing retaining walls, dredging and filling on the property for the municipal docks, Seattle.

Dam—Seattle, Wash.—The contract for constructing the Cedar River Dam has been awarded by the Board of Public Works to NETTLETON, BRUCE & ESCHBACH CO., [illegible] Bank Bldg., at $[illegible]. Noted Aug. 1[illegible].

Ship Repair—Seattle, Wash.—The Pacific Alaska Navigation Co. is preparing to repair and remodel the steamer Admiral Watson at an estimated cost of $[illegible]. C. W. Wiley is Gen. Mgr. of the company.

Dredging—Tacoma, Wash.—All bids received by the County Commissioners of King and Pierce Counties for dredging Stuck River channel have been rejected. New bids will soon be readvertised.

Cut-Off—Tacoma, Wash.—According to press reports bids for constructing the Murphy cut-off on the [illegible]-King County river project were received by the County Commissioners from United Iron Works, Seattle, $[illegible] for [illegible] only; P. Mason, Stockton, $[illegible] for [illegible]; Todd, Coates & Stevens, Seattle, $114,97[illegible] for excavation, [illegible] lumber iron and clearing 16 acres; [illegible] & [illegible] Seattle, for dredge, excavation, piling and clearing [illegible]; [illegible] den & C. W. Marsh, $[illegible] for [illegible]; Tacoma Dredging Co., $[illegible] for excavation, piling [illegible].

Coal Handling Equipment—Astoria, Ore.—(Official)—The date for receiving bids for furnishing coal handling equipment has been indefinitely postponed. F. J. [illegible] is [illegible] Port of Astoria. Noted July [illegible].

Ditches—[illegible], Calif.—The [illegible] Co. [illegible] construct [illegible] ft. of ditches. [illegible] in some of the ditches. J. W. [illegible] is Mgr.

Wharf—Oakland, Calif.—Bids will be received by the City Council for the construction of a timber wharf. James [illegible] is the Engr.

Wharf—[illegible], Calif.—The City Council contemplates constructing a reinforced-concrete municipal wharf at the foot of [illegible] St. at an estimated cost of $[illegible].

Temporary Bulkhead—[illegible], Calif.—The Harbor Commission will build a temporary bulkhead [illegible] at an estimated cost of $[illegible].

Extension to Breakwater—St. John, N. B.—Bids will be received by R. C. Desrochers, [illegible] Public Works, Ottawa, Ont., until Oct. 2, for extending the breakwater at Negro Point, St. John. Noted Aug. [illegible].

Fire Stations—[illegible], Que.—Bids will soon be received by [illegible] Town [illegible] for the construction of two fire stations to cost $[illegible] each.

BUILDINGS

Sanford, Maine—The contract for erecting the Sanford National Bank has been awarded to the J. W. [illegible] Co., [illegible] Atlantic Ave., Boston. The estimated cost is $[illegible]. [illegible] M. James, [illegible], Boston, is the Arch.

Boston, Mass.—[illegible] at [illegible] Dorchester will build a three-story business block at Commonwealth Ave. and [illegible] Boulevard, [illegible]. The estimated cost is $[illegible]. [illegible] A. & F. [illegible] Warren St., are the Archs.

Everett, Mass.—[illegible] will erect a building on [illegible] to contain [illegible] apartments, etc., estimated to cost $[illegible]. [illegible] is Arch.

Springfield, Mass.—The contract for erecting the large building [illegible] for the [illegible] has been awarded to [illegible] at $[illegible]. Other bids were [illegible] & [illegible] [illegible] F. T. Ley, $[illegible].

Springfield, Mass.—Bliss & Lavalle, Archs., are preparing plans for a high school, to be erected in West Springfield. The building will be three stories, of brick.

Worcester, Mass.—Charles E. Sandberg will build a three-story brick and steel business block at Thomas and Commercial Sts. H. S. Demoorjain, State Mutual Bldg., is Arch.

Worcester, Mass.—The Strand Theatre Co., New York, N. Y., will build a theatre at Front and Mercantile St. Thomas W. Lamb is the Arch.

Providence, R. I.—Plans are being prepared for making improvements to the main building at Dexter Asylum. The estimated cost is $42,000.

Derby, Conn.—The following bids were received by the Board of Education for building the addition to the high school: M. A. Durrschmidt, Derby, $46,454; Eastern Engineering & Construction Co., Derby, $47,810; T. J. Pary Construction Co., Bridgeport, $48,511; Dowling & Bottomley Co., Bridgeport, $51,663; H. Wales Lines Co., Meriden, $48,984; Ebenezer Ritchie Shelton, $51,570.

+Hartford, Conn.—The New York, New Haven & Hartford R.R. Co. has awarded the general contract for the reconstruction of its station to the P. J. CARLIN CONSTRUCTION CO., 1123 Broadway, New York, N. Y. The building will be two and three stories, of brick, with brown stone trim. The cost is estimated at $220,000. Edward Gagel, New Haven, Conn., is Ch. Engr. Noted May 7 and Aug. 6.

+New Haven, Conn.—The contract for building the three-story brick and marble building for the New Haven Bank, at 809 Chapel St., has been awarded to HOGGSON BROS., New York, N. Y. The estimated cost is $100,000.

Buffalo, N. Y.—The lowest bids received by the Commissioner of Public Works for constructing School No. 66, on South Side Parkway, are as follows: Masonry, Charles H. Everett, $60,975; iron work, C. F. Ernst's Sons, $13,569; fireproofing, Crescent Concrete Co., $10,947; carpentry, A. F. Bournique, $11,593.

Delhi, N. Y.—The city will erect a brick and concrete school from plans of Pierce & Bickford, Archs., Elmira, N. Y. The estimated cost is $50,000.

+New York, N. Y.—(Borough the Bronx)—(Official)—The TURNER CONSTRUCTION CO. has been awarded the general contract by the C. Leicester Payne Estate for the construction of a three-story service building for the Austin Nichols Co., at 129th St., near Third Ave. The building will be 60x173 ft., of reinforced concrete and brick. Hopkins & McEntee are the Archs.

New York, N. Y.—(Borough of Manhattan)—Gaetano Ajello, West 34th St., has prepared plans for a 12-story brick store and apartment at 2321 Broadway, for the Paterno Construction Co. The estimated cost is $600,000.

Warren & Wetmore, Archs., 16 East 47th St., have completed plans for a four-story brick, stone and granite building at Lexington Ave. and 45th St., for the New York Central R. R. The estimated cost is $500,000.

(Borough of Manhattan)—Bids will be received by Delano & Aldrich, 4 East 39th St., until Sept. 8, for a six-story clubhouse at 62d St. and Park Ave., for the Colony Club. The estimated cost is $450,000.

(Borough of Manhattan)—Harold L. Young, 1204 Broadway, has completed plans for a six-story apartment at Riverside Drive and 161st St., for the Melvin Construction Co., 189 Broadway. The cost is estimated at $300,000

Frankfort & Kirschner, 830 Westchester Ave., have completed plans for the five-story apartment, 50x87 ft., on Academy St., for the Loyal Building Co., 391 East 149th St., to cost about $50,000.

Schwartz, Gross & Marcus, 347 Fifth Ave., have completed plans for the 12-story apartment at West End Ave. and 96th St., for the Essle Construction Co., 355 West End Ave. The cost will be about $600,000.

Plans have been completed by George F. Pelham, 30 East 42d St., for the 11-story apartment at Riverside Drive and 119th St., for the West Side Construction Co., 322 West 100th St., to cost about $425,000.

+(Borough of Bronx)—The contract for constructing Public School No. 55 has been awarded to the LIBMAN CONTRACTING CO., 126 West 46th St., at $293,800. Noted Aug. 27.

Belleville, N. J.—The Board of Education has adopted resolutions poviding for the construction of a combined grammar and high school on Washington Ave., to cost $106,000.

Jersey City, N. J.—Bids will be received by the Board of Chosen Freeholders, until Sept. 10, for building an addition to the Tuberculosis Hospital at Snake Hill.

Jersey City, N. J.—Bids will be received by the Board of Education, City Hall, until 8 p.m., Sept. 16, for the erection of School No. 5, on Merseles St., near Third St.

M. Sulzer will build a four-story building at 135 Magnolia Ave., to cost $50,000.

Newark, N. J.—The Board of Education has ordered the preparation of plans for a new sixteen-room school at Eighth Ave. and Factory St., to be known as the McKinley School.

The Charter Oak Realty Co. will build a four-story and basement brick and steel building, 139x160 ft., on Broad St., to be used as an addition to the department store of L. S. Plaut & Co. The estimated cost is $400,000.

Union Hill (Weehawken Post Office), **N. J.**—Thomas McClelland will build two four-story brick buildings on Bergenline Ave., to cost about $40,000.

West New York (Weehawken Post Office), **N. J.**—Arthur E. Dare, Jr., 650 Bergenline Ave., is preparing plans for a brick loft building for the Filmore Realty Co., at 17th St. and Filmore Place.

Bids will be received by James L. Wolfe, Town Clk., until Sept. 8, for erecting a municipal building at 16th St. and Harrison Place. William Mayer, Jr., 693 Bergenline Ave., is Arch.

Colver, Penn.—Press reports state that plans have been completed for a $40,000 hospital for the Ebensburg Coal Co.

Coraopolis, Penn.—W. G. Eckles, New Castle, Penn., is preparing plans for a stone church for the First Presbyterian congregation, to cost $60,000.

Grafton, Penn.—According to press reports, the lowest bid submitted for constructing the two-story brick school was that of Henry Busse & Co., at about $100,000.

+Hazleton, Penn.—The contract for erecting the steel, brick and stone church for the Italian Catholic congregation has been awarded to BARRETT BROS. CONSTRUCTION CO., at about $40,000.

Pittsburgh, Penn.—Thomas Hannah, Keenan Bldg., has completed plans for a group of buildings for the Western Theological Seminary, on Ridge Ave. The buildings will be of brick and stone and are estimated to cost $200,000.

Pittsburgh, Penn.—It is reported that bids will be received by the Board of Education for erecting the high school at Center Ave. and Grant Boulevard. The estimated cost is about $1,000,000.

Portage, Penn.—Bids will be received by the School Board, until Sept. 7, for erecting the high school. J. E. Adams, Lincoln Bldg., Johnstown, is the Arch.

+Uniontown, Penn.—The contract for erecting the Craig School has been awarded to P. W. FINN & CO., Altoona, at $45,761.

Wilkes-Barre, Penn.—Sturdevant & Paggi, Wilkes-Barre, are preparing plans for the Wilkes-Barre Private Hospital, to cost about $160,000.

Williamsport, Penn.—The following bids were received, Aug. 21, for erecting the school, from plans of Woodnutt & Schmohl, 150 West Fourth St.: A. C. Everhart, $42,712; Saumee Larrivee, $43,450; W. H. C. Huffman's Sons, $42,170; J. V. Bermett & Co., $40,841

York, Penn.—Bids received for erecting the Jackson and Madison schools have been rejected. Plans are being revised by Stair & Leber, York.

Frederick, Md.—John B. Hamme, Wiest Bldg., York, Penn., is preparing plans for a three-story dormitory for Hood College, to cost about $75,000.

Ridgely, Md.—The McIver Construction Co., Law Bldg., Baltimore, has completed plans for three buildings for St. Gertrude's Academy, to cost about $100,000.

Richmond, Va.—Bids will be received by the city, until Oct 10, for preparing plans for the municipal building. The building is to be in three sections, containing library, auditorium and five courts. Alfred C. Blossom, 366 Fifth Ave., New York, N. Y., is Consult. Arch.

+Bridgeport, W. Va.—The contract for erecting the Kirkwood School has been awarded to A. B. IMHOFF, Wheeling, at $48,000.

Wheeling, W. Va.—The Pennsylvania R.R. Co. plans to build a new train shed and make extensive alterations to its station.

Jacksonville, Fla.—Bids will be received by the County Commissioners, until Sept. 16, for erecting the county jail, jailer's residence and courthouse. H. J. Klutho, St. James Bldg., Jacksonville, is Arch.

Tampa, Fla.—It is reported that bids will be received by the Board of Public Works, until Sept. 15, for erecting the Carnegie Library. The estimated cost is $50,000.

Baton Rouge, La.—Bids will be received by Favrot & Livaudais, Ltd., Perrin Bldg., New Orleans, until noon, Sept. 12, for the construction of two 2-story brick dormitories, for the Southern University at Scotland Station.

Canton, Ohio—Local press reports state that bids will be received until Sept. 10, for the erection of the superstructure of the Y. M. C. A. Bldg. The estimated cost is $150,000. Shattuck & Hussey, 19 South LaSalle St., Chicago, are the Archs.

Cincinnati, Ohio—The New Courthouse Building Commission has decided to postpone indefinitely opening bids for the construction of the proposed courthouse, which were to be opened Sept. 1. Noted July 23.

Cleveland, Ohio—Bids on the new city hall have been opened. The unofficial totals on general contract were as follows: G. A. Fuller Co., New York, N. Y., $1,097,987; J. B. Pierce Co., $1,099,500; James L. Stuart Co., $1,120,562; William Dall, $1,127,500; John Gill & Sons, $1,157,000; W. B. McCallister Co., $1,253,661.

Columbus, Ohio—The Board of Education will receive bids until Sept. 18, for the construction of a three-story school. The estimated cost is $175,000. D. Riebel & Sons are the Archs.

Toledo, Ohio—Bids will be received until Sept. 10, by Mills, Rhines, Bellman & Nordhoff, Archs., Toledo, for the construction of an addition to the public library. The estimated cost is about $40,000.

Franklin, Ind.—H. W. Foltz, Arch., is preparing plans for a State Masonic Home. The estimated cost is about $150,000.

Gary, Ind.—The Illinois Improvement & Ballast Co., is having plans prepared for a four-story, 75x125-ft. store and office building. The estimated cost is $80,000.

+Indianapolis, Ind.—The contract for the construction of the building at Palmer and South Meridian St., for the Sacred Heart School, has been awarded to GEORGE CLEMENTS, Indianapolis. The estimated cost is $60,000. Herman J. Gaul, Chicago, is the Arch.

Terre Haute, Ind.—Bids will be received by the State Normal School Trustees for erecting a three-story, reinforced-concrete vocational and educational building. Estimated cost, $160,000. George, McLusac & Fitton, Indianapolis, are the Archs. Noted Aug. 6.

Ypsilanti, Mich.—Local press reports state that bids will be received in October for the construction of the proposed high school. It will be three-stories and 132x190-ft. The estimated cost is $110,000. Robinson & Campau, Grand Rapids, are the Archs.

+Chicago, Ill.—The Board of Education has awarded the contract for the construction of the school at 633 West Sixth St. to [illegible] CARTER CO. The estimated cost is $1[illegible]. A. [illegible] is the Arch.

The Willys-Overland Co., 2426 South Michigan Ave., has had plans prepared for the construction of a three-story, 165x[illegible]-ft. service building and show rooms to be erected at Armour Ave. and 24th St. The estimated cost is $300,000. C. A. [illegible], 3 North La Salle St., Chicago, is the Arch.

+The Chicago Hebrew Institute has awarded the contract for the construction of a gymnasium and natatorium to J. L. [illegible], 1[illegible] North La Salle St., Chicago. The estimated cost is $[illegible]. Ottenheimer, Stern & Reichert, 1[illegible]3 West [illegible] St., are the Archs.

+Urbana, Ill.—The University of Illinois has awarded the contract for the construction of the chemistry building to [illegible] & BROOKS, Champaign. The estimated cost is $[illegible]. Noted July [illegible].

Milwaukee, Wis.—The Board of Education is having plans prepared for the construction of a school in the village of East Milwaukee. The estimated cost is $300,000. R. Messmer & Bro., Milwaukee, are the Archs.

Racine, Wis.—Wisconsin and Fourth St. has been chosen as the site for the $17[illegible] building for the Young Men's Christian Association.

Superior, Wis.—The Loyal Order of Moose has plans under consideration for the construction of a hospital to cost $[illegible].

+Ames, Iowa.—Sheldon & Munn have awarded the contract for the construction of their hotel to W. J. ZITTERELL, Fort Dodge, Iowa, at $46,[illegible]. Proudfoot, Bird & Rawson, Des Moines, are the Archs. Noted Aug. 13.

St. Paul, Minn.—Watson P. Davidson is reported to be planning to erect a building on the site of the old Minnesota Club, Cedar and Fourth St. The estimated cost is $[illegible].

+Leavenworth, Kan.—The contract for the erection of new buildings for the Mount St. Mary's Academy has been awarded to JAMES McGONIGLE, Leavenworth. The estimated cost is $[illegible].

Lincoln, Neb.—The Eagles Club is reported as ready to receive bids for the construction of a three-story club house. The estimated cost is about $70,000. Raymond Frye is the Secy.

+Anaconda, Mont.—The Board of Education has awarded the contract for the construction of an addition to the Central School to JOHNSON & LAW, Anaconda, at $52,546. Noted May 21.

Glendive, Mont.—The County Commissioners plan to erect a hospital costing $[illegible],000.

Kansas City, Mo.—The Clark Estate plans to build a hotel to cost about $2[illegible]. L. G. Middaugh, Kansas City, is the Arch.

Galveston, Tex.—The City of Galveston has had plans prepared for a city hall, to be erected on Avenue H and 2[illegible]th St., at an estimated cost of $[illegible]. C. D. Hill & Co., Dallas, have prepared the plans. Noted Sept. 18.

Houston, Tex.—Joseph St. Mary, Galveston, has had plans prepared for the construction of a hotel on the site of the present [illegible] Hotel. The estimated cost of the building is $[illegible].

+Weatherford, Tex.—The Knights of Pythias have awarded the contract for the construction of the new home to C. H. [illegible] & [illegible].

+Tulsa, Okla.—The contract for the erection of the Y. M. C. A. building has been awarded to the BRICKNER-LAWS CONSTRUCTION CO., Tulsa, at $52,[illegible]. Noted July 9.

The [illegible] Property Commission is having plans prepared for a twelve-room school to be erected at Greenwood and [illegible] St. Estimated to cost about $75,000.

+Denver, Colo.—The Denver Union Terminal Railway Co. has awarded the contract for alterations and additions to the Union Passenger Station to STOCKER & FRASER, Denver. The estimated cost of the improvements is $100,000. [illegible] & Welch are the Archs.

Denver, Colo.—The Colorado National Bank will receive bids for the construction of a three-story [illegible]x12[illegible]-ft. bank building. W. E. and A. A. Fisher, Denver, are the Archs.

Mimbres, N. M.—The Mimbres Hot Springs Co., which has been organized with a capital stock of $100,000, will erect a hotel. [illegible] of Deming, N. M., is interested.

Tacoma, Wash.—Plans for the Elk's Temple have been submitted by architects from all over the state and the committee will make its choice in a short time. The building will be erected at Seventh and C St., and will cost about $[illegible]. Noted July [illegible].

Astoria, Ore.—The local Masonic Lodge plans to erect a temple to cost about $[illegible].

Eugene, Ore.—Bids will be received by J. H. Johnson, Secy. of the [illegible], until [illegible] for the construction of an [illegible] building at the University of Oregon. W. C. Knighton, [illegible] Bldg., Salem, Ore., is the Arch.

Brawley, Calif.—[illegible] of the [illegible] Co., Los Angeles, plans to erect a hotel here to cost $[illegible].

+Los Angeles, Calif.—The contract for the construction of the [illegible] Bldg. has been awarded to the [illegible] CONSTRUCTION CO. The estimated cost is $[illegible]. [illegible] are the Archs.

San Francisco, Calif.—The [illegible] Club is having plans prepared for a clubhouse, which will cost about $[illegible]. [illegible] is the Arch.

Ardmore, N. S.—Plans are nearly completed and bids will be asked for in a short time for the construction of a hospital. The estimated cost is $[illegible]. L. H. Fales, Ardmore, N. S., is the Arch.

+Ottawa, Ont.—J. R. Booth has awarded the contract for the construction of a four-story, 98x200-ft. theatre to ALBERT EWART, Ottawa. The estimated cost is about $15[illegible],000. C. Howard Crane, Dime Bank Bldg., Detroit, Mich., is the Arch.

Toronto, Ont.—The Excelsior Life Association plans to erect an 11-story office building at Adelaide and Toronto St. The estimated cost is $[illegible],000. E. L. Lennox is the Arch.

Winnipeg, Man.—Genser Bros., Sargent and Beverly St., plan to erect a three-story apartment block, to cost about $1[illegible],000.

Edmonton, Alta.—[illegible] W. Morehouse, Arch., has prepared plans for an office building to be erected at Jasper Ave. and Sixth St. The estimated cost is about $100,000.

Finances for Public Improvements—Announcement was made on Aug. 21 by the Comptroller of the City of New York, to C. A. Crane, Secretary of the General Contractors' Association, that contractors on the subway work need have no fear of payments being held up, nor of accepting script for the work. The financial position, as far as city improvements are concerned, is by no means as unfavorable as many have been lead to believe, particularly by the New York financial papers.

The "Commercial & Financial Chronicle," New York, makes a practice of printing information relative to city, state and county bond sales, week by week. In the issue of Aug. 22, there were noted sales for 48 separate issues of bonds, where the bonds had been actually sold, aggregating $1,693,000. In the same issue, 19 bond issues were reported as not sold, the aggregate of the issues being $[illegible]. There were postponed 7 issues, aggregating $1,081,0[illegible]. It will thus be seen that bond sales have been far more general than either postponements or failures, and in addition to the amounts mentioned, announcement was made that nearly a million dollars worth of bonds had been sold at Sacramento, Calif., over the counter, but this sale has been in process for a long time, and could not properly be included in the total given. Moreover, an issue of $31[illegible] bonds of Long Beach, Calif., offered without success May 1, was floated, and this issue is not included in the total. By including the two issues mentioned, the total bond sales aggregate approximately $3,000,000. It must be granted that many of the sales have been more or less forced, that is, they were taken by sinking fund commissioners, or local banks made arrangements to pay out the money as needed. This was true in Milwaukee, where the banks took $[illegible] of bonds, which had been previously offered without success. The largest issue reported unsold was $610,[illegible] for an irrigation project in California, and such bonds are not easily sold, even in ordinary times. There were also a number of road bonds in Ohio and Indiana which found no purchasers.

By the same authority, in the issue of Aug. 29, it is found that the total bond sales for the week aggregate $2,691,[illegible], and the bonds reported as not sold amounted to $2,61[illegible]. Postponements were much smaller, amounting to only $1[illegible],000. There were 43 separate issues which were reported sold, 39 issues not sold and two where they were postponed. The record is really better than is shown by this comparison, for Portland, Ore., had $6[illegible],000 [illegible] bonds [illegible] scarcely expect to sell a 4½% issue at such a time. Another large postponement was half a million dollars for California highways, bearing [illegible] interest, and $1[illegible] 4½% Youngstown, Ohio, pumping station. The Sinking Fund Commission at Richmond, Va., took $[illegible] bonds at [illegible].

THE MARKET FOR MUNICIPAL BONDS

Week ending	Sold	Not sold	Postponed
Aug. 22	$1,693,000	$[illegible]	$1,081,[illegible]
Aug. 29	2,691,[illegible]	2,61[illegible]	1[illegible]

Increasing South American Trade—The United States Consular Report says: "An appropriation of $[illegible] for promoting commerce in Central and South America, which for the first time is now fortunately available to the Bureau of Foreign and Domestic Commerce for the current fiscal year, is especially opportune in the present commercial emergency. This fund will be used promptly to reinforce the existing service for the development of Latin American trade. Much work has already been done in this field and a series of valuable reports, covering many branches of commerce, has been published. Now a number of new phases of the trade can be studied intensively in the countries in question by the special agents of the department.

"A trained agent, detailed from the Forest Service, will study markets for lumber products. Another agent will investigate markets for hardware, a third those for clothing, hats and similar articles, a fourth the special markets of the countries on the Gulf of Mexico and the Caribbean Sea. Cotton textiles and fruit products will also receive special attention. These field investigations will be actively in progress as soon as these men can reach their several districts in Central and South America.

"Moreover, the appropriation for commercial attachés of the bureau is also available and the appointees of this new class of trade promotion agents of the Government for Rio de Janeiro, Buenos Aires, Santiago and Lima will be promptly dispatched to their posts as soon as they are selected as a result of a recent examination.

"A Latin American Section is now established in the office in Washington to care for the details of this special work. The South American Trade Directory and other bulletins can be examined at the branch offices of the Bureau or can be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C. Reports of several bulletins on special subjects connected with Latin American commerce are now in press."

The Terry Steam Turbine Co., Hartford, Conn., announces that it has appointed Fabiano Bros. & Sons, 15 Whitehall St., New York, its representatives in the Republic of Panama and the Canal Zone. The company also announces that its [illegible] office, in charge of I. O. Finley, will move Aug. 1 to [illegible] Bldg.

Cement—Exports to South America—Rumors were current last week that insistent requests for cement had been coming from South America. One firm received a cable which read, "When can you ship 5000 bbl.?" However, there seems to be little disposition on the part of domestic concerns to give much attention to the South American patronage, since the credit arrangements have always proven very unsatisfactory, even in time of peace. H. S. Dudley, of the Atlas Portland Cement Co., outlines the situation in the current issue of "Printers' Ink." He said in part: 'The war has considerably opened up the South American market for our product, but in order to accept such business, it is likely that we would have to extend credits to a point not deemed prudent by us, and it is highly unlikely that a very great increase will be shown in cement produced in this country going to South Americans, unless they are more ready to coincide with moderate terms instead of the extremely long credits to which the field is accustomed. This does not apply to the cement business exclusively. It applies, we believe, to many lines where the margin of net profits is small. Manufacturers will refuse to bid for, as well as sell to, South American trade under these conditions. Only where margins justify long terms will there be, in my opinion, any considerable expansion of our trade with South America. Owing to the difficulty which must for a short time at least surround the movement of gold, it must be apparent to the thoughtful that a considerable extension of credit by American sources must result to secure the trade which must naturally be diverted in a larger imeasure to us. It seems important that American producers and financial interests generally should appreciate the necessity of a very thorough study of this factor, while at the same time extending every credit facility justified by the desire to be of assistance to those countries which must now have our foodstuffs and merchandise."

Increasing Passenger Rates—Pennsylvania's decision to increase the rate on passenger mileage books on October 1 from two cents per mile to two and a quarter cents is believed by railroad men to be the first of many passenger rate increases that will be announced within the next few months. Railway men pointed out to-day that such action would carry out one of the many suggestions made by the Interstate Commerce Commission in the five per cent. freight rate decision recently handed down.

While refusing the request of the Eastern roads for a five per cent. increase in freight rates, the Interstate Commerce Commission expressed the belief that the lines in question needed more revenue and could increase their earnings in a number of ways, one by increasing passenger rates. In that connection the Commission said:

"The information available indicates that not only is the operating rate of the passenger-train service much greater than that of the freight-train service, but that the ratio of property investment to gross earnings is much greater in the passenger service. Hence the ratio of capital charges, and usually also the ratio of the taxes attributable to passenger service, is much greater than the ratios attributable to the frieght service. Thus, on the Pennsylvania R.R., the estimated property investment per dollar of freight earnings was \$4.48 in 1910, \$4.16 in 1910, \$4.29 in 1911, and for each dollar of passenger-train earnings was \$7.60 in 1909, \$7.15 in 1910, and \$10.66 in 1911. In 1911 the property devoted to the passenger-train service earned much less than one-half of one per cent., while that devoted to the freight-train service earned \$7.09."

A Scouting Trip—Wishing to enlarge the market for the products of their clients, W. L. Rickard, of Rickard & Sloan, Inc., 20 Vesey St., New York, N. Y., will make an extended trip through South America, leaving New York the latter part of September. He will visit the principal cities on both coasts and will make a thorough investigation of the markets and the best method of selling machinery and mechanical materials and devices. In connection with this trip, Mr. Rickard made the following statement: "For some time past, several of our clients have been considering the advisability of entering the export field, particularly in South America. They have felt that the Latin-American countries offered a large market for their products, and we have been conducting a preliminary investigation in this field to ascertain the best way to reach it. Naturally, with the countries which have had the lion's share of this business at war, and their industries practically at a standstill, the question has been brought to our attention more forcibly than ever. In order that we may determine just what a manufacturer has got to do to obtain some of this business, we decided that a personal investigation was the only thing, and for that purpose I will visit the largest cities and make a thorough investigation for those of our clients who can profitably enter this field. I expect to be away between four and five months."

TUNNEL, BOSTON, MASS.

✚Bids were received by the Boston Transit Commission, Aug. 12, for constructing Sect. D of the Dorchester Tunnel from (A) Michael Meehan, Boston; (B) William J. Sheils, Boston; (C) Rowe Contracting Co., Boston; (D) James J. Coughlan Co., Boston; (E) Coleman Bros., Boston; (F) P. McGovern & Co., Boston; (G) HUGH NAWN CONTRACTING CO., Roxbury (awarded contract). The item bids were as follows:

	A	B	C	D	E	F	G
55,000 cu.yd. earth excavation, open cut	\$6.00	\$5.50	\$4.50	\$5.00	\$4.90	\$4.20	\$5.00
15,000 cu.yd. earth excavation, tunnel	10.00	6.50	7.50	6.50	6.00	7.00	5.00
500 cu.yd. concrete masonry, removed	10.00	12.00	7.00	7.00	10.00	7.00	10.00
4000 cu.yd. concrete base removed	6.00	0.75	0.60	0.75	0.50	0.75	0.60
10,000 cu.yd. concrete, open cut	12.00	2.50	11.50	11.50	11.00	11.80	11.00
6000 cu.yd. concrete tunnel	16.00	13.50	14.00	12.50	14.75	15.00	15.00
100 cu.yd. cinder concrete	7.00	7.00	8.00	7.00	7.00	8.00	8.00
100 cu.yd. cement mortar for joints	15.00	15.00	12.00	15.00	15.00	15.00	15.00
1200 cu.yd. concrete, ⅜- to ¾-in. stone	20.00	13.00	16.00	11.50	18.00	15.00	12.00
3500 sq.yd. granolithic for platforms	2.00	2.00	2.25	1.75	1.25	2.00	1.00
900 lin.ft. casing steel columns	20.00	1.50	2.00	1.60	1.50	1.50	1.50
200 cu.yd. brick masonry	20.00	20.00	16.00	18.00	17.00	18.00	20.00
100 lin.ft. 6- to 12-in. vitrified pipe	1.00	1.00	0.50	1.00	0.50	1.00	2.00
800 lin.ft. 4- to 8-in. vitrified pipe	1.00	1.00	1.00	1.00	0.50	1.00	1.50
100 lin.ft. 48-in. c.-i. pipe	4.00	5.00	7.00	10.00	4.00	6.00	10.00
650 tons reinforcing rods	12.00	10.00	15.00	12.00	12.00	14.00	8.00
1050 tons steel and iron	15.00	12.00	20.00	15.00	20.00	18.00	15.00
300 tons interlocking steel sheet piling	60.00	60.00	75.00	60.00	70.00	65.00	60.00
1000 sq.yd. portland-cement mortar	0.50	0.50	0.50	0.50	0.40	0.50	0.60
45,000 sq.yd. prepared textile and asphalt	0.75	0.60	0.80	0.55	0.50	0.70	0.60
5000 sq.yd. tarred felt and asphalt	0.75	0.30	0.60	0.45	0.30	0.40	0.50
Other work and risks not covered by other items	2,000.00	3,500.00	1,500.00	30 000.00	12,000.00	2,000.00	10,000.00
Supporting and protecting elevated columns	500.00	2,500.00	2,500.00	8000.00	2,500.00	1,000.00	3,500.00
21,000 sq.ft. 4-in. hard pine lagging	0.10	0.20	0.80	0.16	0.13	0.30	0.28
Extended totals	\$865,650	\$722,850	\$714,075	\$708,475	\$690,205	\$675,050	\$673,780

RESERVOIR, SCHENECTADY, N. Y.

✚Bids were received by the Board of Contract and Supply Aug. 5 for the construction of a 20,000,000-gal. reservoir on Bevis Hill from (A) SUTTON & CORSON CO., Ocean City, N. J. (awarded contract); (B) State Highways Construction Co., Beacon; (C) John J. Hart, Peekskill; (D) Shear & Wilson Corporation, Schenectady; (E) Barzaghi-Vought Co., New York; (F) Brown & Lowe Co., Schenectady; (G) Sewage Disposal & Water Plant Co., Schenectady; (H) Eon Engineering & Contracting Co., Long Island City; (I) J. F. Cogan Co., New York; (J) Mason-Hilton Co.-Merrill-Ruckgaber Co., New York; (K) John W. Heller, Newark, N. J.; (L) Walsh Construction Co., Davenport, Iowa; (M) Buffalo Dredging Co., Buffalo; (N) U. S. Realty & Improvement Co., New York; (O) Charles Ippolito, Schenectady. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
3200 lin.ft. fence	\$1.14	\$1.00	\$1.25	\$1.12	\$1.10	\$0.90	\$1.00	\$1.00	\$1.05	\$0.90	\$1.20	\$1.05	\$1.15	\$1.30	\$1.50
72,500 cu.yd. excavation	0.28	0.30	0.42	0.56	0.55	0.54	0.60	0.40	0.75	0.60	0.49	0.42	0.64	0.39	0.88
15,000 cu.yd. rolled embankment	0.62	0.70	0.15	0.30	0.20	0.22	0.60	0.40	0.35	0.50	0.30	0.28	0.48	0.40	0.50
12,000 cu.yd. plain concrete	6.00	6.00	7.50	6.98	6.50	7.85	7.50	8.25	7.00	9.00	7.65	7.85	8.63	7.80	9.25
5500 cu.yd. reinforced concrete	12.00	12.00	9.00	10.00	12.00	10.50	11.50	14.00	9.00	10.00	14.40	13.94	12.71	12.00	12.00
1,500,000 lb. steel reinforcement	0.02	0.0351	0.025	0.01875	0.021	0.019	0.02	0.015	0.035	0.025	0.035	0.025	0.02	0.04	0.035
7600 lin.ft. 4-in. tile drain	0.22	0.15	0.25	0.30	0.25	0.25	0.20	0.20	0.12	0.00	0.40	0.30	0.35	0.25	0.30
1400 lin.ft. 8-in. vitrified tile	0.30	0.30	0.40	0.32	0.50	0.33	0.20	0.30	0.20	1.50	0.60	0.81	0.11	0.35	0.50
250 lin.ft. 30-in. vitrified tile	4.00	2.50	4.25	3.75	5.00	2.00	3.00	5.00	3.50	5.00	3.50	3.50	3.11	6.50	2.75
15,100 sq.yd. waterproofing, Class A	0.08	0.04	0.50	0.50	0.45	0.20	0.06	0.20	0.18	0.50	0.45	0.45	0.11	0.45	0.50
15,100 sq.yd. waterproofing, Class B	0.41	0.15	0.75	0.75	0.60	0.62	0.12	0.60	0.65	0.65	0.50	1.80	0.80	1.50	1.75
9 manholes	164.15	50.00	75.00	200.00	75.00	40.00	100.00	40.00	50.00	200.00	50.00	55.00	181.00	175.00	65.00
Gate house (lump sum)	7892.50	8000.00	8000.00	6475.00	4800.00	6500.00	5500.00	4000.00	8000.00	5000.00	5000.00	8000.00	7000.00	6000.00	12,000
500 lin.ft. paving gutter	1.77	1.00	2.50	2.50	1.75	0.60	1.50	1.00	1.50	2.00	0.75	0.70	2.50	2.00	1.50
Extended totals	\$222,874	\$240,301	\$246,522	\$247,809	\$248,200	\$248,399	\$251,744	\$257,030	\$273,185	\$287,655	\$292,590	\$293,679	\$293,684	\$300,330	\$356,877

CONTRACT PRICE

RAPID TRANSIT SYSTEM, SECTION 3, ROUTE 33, NEW YORK CITY

Bids were received by the Public Service Commission Aug 21, for constructing Sect 3, Route 33, a part of the Broadway-Fourth Ave. and Seventh Ave.-Lexington Ave. rapid transit system from (A) Flinn-O'Rourke Co., Inc., New York, (B) Smith, Hauser & MacIsaac, Inc., 18 East 41 St., (C) Oscar Daniels Co., Woolworth Bldg., New York, (D) Underpinning & Foundation Co., 290 Broadway, New York, (E) Frederick L. Cranford, Inc., 177 Montague St., Brooklyn, (F) Bradley Contracting Co., 1 Madison Ave., New York, (G) Rapid Transit Subway Construction Co., 165 Broadway, New York, (H) Rodgers & Hagerty, Inc., Hudson River and 153d St., New York. The item bids are as follows:

	A	B	C	D	E	F	G	H
115,[illegible] cu yd earth excavation above mean high water	$5 00	$4 30	$6 20	$5 00	$4 20	$5 00	$6 50	$6 0[illegible]
47,[illegible] cu yd earth excavation below mean high water	5 00	4 50	7 00	10 00	5 00	8 00	6 50	6 00
7,[illegible] cu yd earth excavation above and below mean high water sewers	5 00	4 50	6 20	5 00	6 00	6 00	4 00	6 00
492 front ft underpinning buildings seven stories or more	120 00	150 00	50 00	200 00	350 00	200 00	250 00	300 00
Underpinning Brooklyn Borough Hall (lump sum)	15,000 00	20,000 00	50,000 00	20,000 00	25,000 00	[illegible]0,000 00	[illegible],000 00	5,600 00
56,[illegible] cu yd tunnel excavation above mean high water	8 00	9 00	11 00	12 00	16 10	12 5[illegible]	15 [illegible]	21 0[illegible]
14,[illegible] cu yd tunnel excavation below mean high water	8 00	9 00	12 00	12 00	16 10	17 50	15 00	21 0[illegible]
41,[illegible] cu yd concrete	9 00	9 50	10 50	11 00	9 00	12 50	12 [illegible]	10 00
1[illegible] cu yd rubble stone masonry	5 00	10 00	10 00	9 00	8 00	8 00	8 00	7 0[illegible]
1[illegible] cu yd dry rubble masonry	3 00	10 00	6.00	8 50	6 00	6 [illegible]	7 00	7 00
1[illegible] cu yd brick masonry	16 00	25 00	16 00	20 00	20 00	20 00	15 00	15 00
2[illegible] cu yd removal of concrete	12 00	25 00	12 00	27 00	30 0[illegible]	20 00	20 00	15 [illegible]
[illegible] cu yd hollow terra cotta brick or tile masonry)	15 00	20 00	16 00	25 00	12 00	20 00	15 00	15 00
4[illegible] bbl grout of portland cement	3 00	4 50	4 50	2 50	3 50	3 25	4 00	3 50
47[illegible] bbl grout of natural cement	1 75	3 50	4 00	2 00	3 00	2 75	2 00	3 [illegible]
1[illegible] lin ft timber piles	0 40	1 00	0.70	1 00	2 00	1 00	1 00	1 [illegible]
2 M ft b m timber foundations	100 00	100 00	70 00	50 00	75 00	70 00	75 00	8[illegible] 00
5[illegible] M ft b m tunnel timbering	100.00	90 00	70 00	150 00	150 00	100 00	100 00	[illegible]0 00
1[illegible] cu yd broken stone or gravel	3 00	3 00	3 00	3 00	3 00	3 [illegible]	2 50	3 00
[illegible] sq yd waterproofing, 1-ply	0 50	0 60	0 40	0.50	0 65	0 40	0 60	0 4[illegible]
1[illegible] sq yd waterproofing, 2-ply	0.65	0 85	0.75	0 90	0 75	0 65	0 75	[illegible] 65
13,2[illegible] sq yd waterproofing, 3-ply	1.25	1 20	1.10	1 20	0 85	1 65	1 00	1 00
1[illegible] sq yd waterproofing, 4-ply	1 40	1 20	1 40	1 70	0 95	1 25	1 50	1 25
1[illegible] sq yd waterproofing, 5-ply	1.60	1 50	1.70	2 10	1 05	1 60	1 75	1 5[illegible]
1[illegible] sq yd waterproofing, 6-ply	1 90	1 75	2 00	2 50	1 15	1 90	2 00	1 90
1[illegible] sq yd waterproofing, dry ply	0.30	0 40	0 40	0 50	0 50	0 20	0 60	0 35
12[illegible] cu yd brick in asphalt mastic	25 00	25 00	27 00	30 00	26 00	25 [illegible]	30 00	35 0[illegible]
2[illegible] duct ft tunnel ducts	0 12	0 12	0 12	0 16	0 12	0 15	0 12	0 15
26[illegible] tons riveted steel	75 00	72 00	75 00	75 00	75 00	80 00	75 00	80 00
1[illegible] tons steel beams and shapes	60 00	60 00	65 00	65 00	70 00	60 00	67 [illegible]	75 0[illegible]
12[illegible] tons steel rods and bars	60.00	60.00	70 00	100 00	65 [illegible]	50 [illegible]	[illegible]	65 00
22,1[illegible] tons c-i tunnel lining	45 00	45 00	43 00	40 00	42 00	47 50	50 00	55 [illegible]
4[illegible] tons steel bolts and washers	60 00	125 00	55 00	90 00	65 [illegible]	65 00	75 00	[illegible]
17 tons miscellaneous iron castings	55 00	100 [illegible]	70 00	100 00	75 [illegible]	70 [illegible]	65 00	70 0[illegible]
1 ton miscellaneous w[illegible] or c.i. for sewers	65 00	150 00	75 00	100 00	100 [illegible]	75 0[illegible]	70 00	100 00
15[illegible] lb special wire forms	0 15	0 12	0 20	0 20	0 15	0 15	0 10	0 15
12,15[illegible] lin ft wood hand rail	0 50	0 50	0 20	0 50	0 50	0 75	0 60	0 4[illegible]
3,[illegible] sq ft steel gratings for ventilation	2 00	1 50	2 00	1 6[illegible]	2 00	1 50	1 50	1 50
11[illegible] sq ft vault lights	1 25	1 50	1 50	1 25	1 50	1 25	1 50	1 50
2[illegible] sq yd restoration of sidewalks	2 50	2 00	2 50	2 70	2 25	2 5[illegible]	2 0[illegible]	2 5[illegible]
127[illegible] sq yd restoration of roadways—asphalt	3 00	2 50	4 00	3 50	3 00	3 00	3 00	2 5[illegible]
627[illegible] sq yd restoration of roadways—granite block	3 00	2 50	3 50	2 50	3 00	3 [illegible]	3 5[illegible]	3 0[illegible]
2[illegible] sq yd restoration of roadways—wood block	4 00	5 00	4 00	5 00	4 00	4 [illegible]	4 0[illegible]	4 [illegible]
1[illegible] lin ft new granite curb	1 00	2 00	1 50	2 50	1 7[illegible]	1 5[illegible]	2 0[illegible]	1 75
5[illegible] sq yd new cement sidewalk	2 25	3 00	2 00	2 00	1 [illegible]	2 2[illegible]	3 00	2 [illegible]
1[illegible] sq yd park surface restored	3 50	5 00	3 00	3 00	2 00	3 [illegible]	5 [illegible]	2 [illegible]
7[illegible] lin ft electric conduits ¾-in w i or steel	0 20	0 20	0 15	0 40	[illegible]	0 20	0 25	0 2[illegible]
1[illegible] lin ft electric conduits, 1½-in w i or steel	0 40	0 40	0 20	0 55	0 [illegible]	0 3[illegible]	0 4[illegible]	0 4[illegible]
1[illegible] lin ft electric conduits 2-in w i or steel	0 55	0 75	0 40	0 65	[illegible]	[illegible]	[illegible]	0 5[illegible]
[illegible] lin ft electric conduits 1-in w i or steel	0 25	0 30	0 20	0 50	[illegible]	0 [illegible]	0 20	0 2[illegible]
725 [illegible] outlet boxes	0 50	1 00	1 00	1 2[illegible]	2 [illegible]	1 [illegible]	1 00	1 75
2[illegible] c-i pull boxes	1 50	5 00	1 00	1 2[illegible]	4 0[illegible]	2 0[illegible]	2 00	2 [illegible]
1,[illegible] lin ft vitrified pipe sewer 12 in	1 50	2 50	2 50	5 00	[illegible]	[illegible]	[illegible]	[illegible]
2[illegible] lin ft vitrified-pipe sewer 15 in	2 [illegible]	3 00	3 00	5 10	3 5[illegible]	[illegible]	1 50	3 5[illegible]
21[illegible] lin ft vitrified pipe sewer 18 in	2 [illegible]	3 [illegible]	3 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1[illegible] lin ft vitrified-pipe sewer 2[illegible]-in	3 45	4 [illegible]	4 0[illegible]	[illegible]	5 [illegible]	[illegible]	4 25	4 [illegible]
23[illegible] lin ft vitrified-pipe sewer [illegible]	3 [illegible]	4 [illegible]	4 20	6 [illegible]	5 [illegible]	[illegible]	3 [illegible]	5 [illegible]
2[illegible] lin ft vitrified-pipe sewer, 24-in	3 [illegible]	4 [illegible]	4 [illegible]	6 [illegible]	6 [illegible]	4 [illegible]	3 [illegible]	[illegible]
1 ton c-i sewer pipe straight	25 [illegible]	6[illegible]	[illegible] 00	6[illegible]	40 [illegible]	7[illegible]	[illegible]	[illegible]
1 ton c-i sewer pipe special castings	75 00	1[illegible]	[illegible]	120 [illegible]	[illegible]	1[illegible]	75 [illegible]	[illegible]
2[illegible] lin ft brick or concrete sewer 3 ft 6 in by 3 ft 4 in	[illegible]	14 [illegible]	[illegible]	[illegible]	12 [illegible]	14 [illegible]	7 [illegible]	12 [illegible]
[illegible] lin ft brick or concrete sewer 4 ft 6 in by 3 ft [illegible]	[illegible]	[illegible]	[illegible]	12 [illegible]	12 [illegible]	[illegible]	9 [illegible]	16 [illegible]
[illegible] cu yd brick masonry in sewers	15 [illegible]	[illegible]	15 [illegible]	[illegible]	[illegible]	[illegible]	15 [illegible]	[illegible]
[illegible] cu yd concrete in sewers	10 [illegible]	30 [illegible]	17 [illegible]	1[illegible]	[illegible]	[illegible]	12 [illegible]	15 [illegible]
32[illegible] lin ft maintaining electric overhead trolley, single track, railroad	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15 [illegible]	[illegible]
[illegible] underpinning elevated railroad columns	[illegible]	1,[illegible]	[illegible]	[illegible]	1,[illegible]	[illegible]	1,[illegible]	1,[illegible]
Underpinning Brooklyn-Manhattan Rapid Transit [illegible] in Fulton St. (lump sum)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5,[illegible]
Underpinning Fourth Ave. Rapid Transit [illegible] (lump sum)	6,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] lin ft w i or steel [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] duct ft changing electric ducts and conduits	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible] The total [illegible]

[illegible]

Among the Contracts [illegible] awarded to the Raymond Concrete Pile Co., 140 Cedar St., New York, N. Y. are the following: Concrete piles and foundations for steel towers [illegible] Pittsburgh, Penn., concrete piles for the foundation of factory at [illegible] Toledo, Ohio, foundations for the building of the J. T. Lewis Co., Philadelphia, Penn., concrete piles for the foundation of warehouse for Edward Wagner, Wheeling, W. Va., concrete piles for the foundation of the plant for the National Casket Co., Long Island City, N. Y., concrete piling and foundations for the English Evangelical Lutheran Church of the Reformation, Baltimore, Md.

HOW EUROPE PREPARED THE WAR CHEST

Charles Arthur Conant, the economist, in the Sunday New York Times, discusses how Europe prepared her war chest for the present conflict. He says in part:

In Germany, the story was familiarly told that the Kaiser, near the end of the year 1913, inquired of the governor of the Imperial Bank if the German banks were equipped for war. Being told that they were not ready, he is said to have replied, "When I ask that question again, I want a different answer."

By maintaining a discount rate of 6% at the Imperial Bank from January 1 to October 27, 1913, by active bidding at the London gold auctions for the gold which arrived weekly from South Africa, and by several changes in monetary legislation, the gold was steadily piled up which might enable the governor of the bank to answer "yes" when again asked whether German finance was equipped for war.

From a gold fund of $184,000,000 on December 31, 1912, the Imperial German Bank increased its reserve to $336,000,000 on June 30, 1914. In addition, it gathered up for the Imperial government a sum of about $30,000,000 to be added to the same amount stored in the vaults of the Juliusturm at Spandau. This sum of $60,000,000 is rendered productive to the government in a sense by the distribution of an equal amount of government paper money in small denominations in the circulation. The government is under no pledge, however, to hold the gold against the notes in case of war, and if taxes and loans fail, or are slow in reaching the treasury, the gold can be employed to obtain necessary war supplies even from the hard-hearted foreigner who will accept no other form of payment.

France piled up her gold holdings in eighteen months from $616,000,000 to $792,000,000, and Russia, with a reserve already approximately $800,000,000, materially increased the amount.

Austria-Hungary has not undertaken, under the monetary reform of 1892, to pay gold freely in the redemption of notes, and her gold fund of approximately $250,000,000 has remained comparatively unchanged in amount. It was not surprising that, under pressure like this, the New York market should have been called upon to export about $84,000,000 in gold before the war cloud burst, during the first six months of the present year, and that it should have lost another sum of about $46 000,000 when Europe decided to throw over American securities at any price in order to convert her assets into money.

The entire gold production of the world during the eighteen months ended on June 30, 1914, was approximately $705,000,000. Of this amount about $200,000,000 is required for the arts and $150,000,000 went to British India. This left about $355,000,000 to be applied to monetary uses, and the whole of this amount was absorbed by the four great central banks of Germany, France, Russia, and Austria-Hungary.

What course Germany should pursue in respect to her monetary system in case of European war was the subject of considerable discussion in the special commission which was appointed in 1908 to consider the revision of the charter of the Imperial Bank. It was generally agreed that two steps were advisable—to permit the utmost accumulation of gold in the Imperial Bank, and to protect that gold against abnormal demands.

These two steps were, first, the issue of notes for small amounts, with the object of substituting notes for the gold in circulation; and, second, making the notes of the Imperial Bank legal tender throughout the empire. In 1906 the bank had already departed from its original policy of keeping the circulation saturated with gold coin by authorizing the issue of notes for 50 marks ($11.96) and 20 marks $4.76). The effort was at first made to limit the issue of notes of these denominations to 300,000,000 marks ($72,000,000) but early in 1912 this limit was passed, and within the next two years the issue of these two denominations of small notes rose to 681,822,000 marks, and their ratio to the total note circulation to about 26%.

The government of Russia had already reversed its original policy of 1897, of saturating the circulation with gold coin, and adopted the policy of issuing small notes. The notes of the smallest denomination, 1 ruble (51½c.) were indeed retired; but notes for 3 rubles, 5 rubles, and 10 rubles ($5.15) were steadily pumped into the circulation until, as early as 1909, they constituted 46.5% of the total amount of paper outstanding. Within the next five years the gold in the State bank was increased by about $170,000,000, which nearly covered the increase of the outstanding note issue by $209,430,000.

Belgium had for several years issued notes of small denominations to take the place of her disappearing gold and silver coin; but France reserved the power to issue notes below 50 francs ($9.65) until the need for them should be developed by the emergency of war. This foresight did not restrict great additions to her gold reserve, and gave her an opportunity to add materially to the resources of the Bank of France, when, on the outbreak of war, notes were promptly authorized for 20 francs ($3.86) and even for 5 francs (96½c.)

With the general suspension of gold payments at the central banks of Europe, except at the Bank of England, the banks are in a position to resist raids upon their gold and to lend their resources, as far as sound banking policy permits, to the struggle of their governments to maintain national independence. In England, while the bank is still paying gold for notes, the policy of keeping gold in circulation has been abandoned, and the old limit of note issue, which was £5 ($24.40), has been lowered to 10 shillings ($2.44) and £1 ($4.88).

It is not the purpose of any of the European powers, to carry on the war by issues of paper money. The suspension of gold payments at the banks and the issue of notes for small denominations, which are legal tender in domestic transactions, is for the purpose of husbanding the gold stock against needless runs and keeping it as a guarantee fund of national solvency. It is the course which was adopted by France at the time of the Franco-German war in 1870, but so prudently were the affairs of the Bank of France conducted that the paper never fell more than 2½% below its value in gold.

A similar policy of reserve will probably be pursued by the banks of France, Germany and Russia in the present contest. The government of France has raised the maximum limit of the note circulation of the bank by nearly $1,000,000,000, but the increase will not be used except as additional currency may be required, owing to the restriction in other forms of credit and the special demand for notes in the districts where the armies are gathered.

Contracts for Dual System of Rapid Transit

FOR OPERATION BY NEW YORK MUNICIPAL RAILWAY CORPORATION

Section	Limits	Contractor	Contract executed	Amount of Contract	Item Bids Published in Engineering News
		Broadway-Fifty-ninth St. Subway—(In Manhattan). Route No. 5			
1	Morris to Dey St.	F. L. Cranford, 177 Montague St., Brooklyn	Sept. 27, 1912	$1,222,269.20	Sept. 19, 1912
1-A	Dey St. to Park Pl.	F. L. Cranford, 177 Montague St., Brooklyn	Sept. 27, 1912	982,740.70	Sept. 19, 1912
2	Park Pl. to Walker St.	Degnon Contracting Co., 30 East 42nd St., N. Y.	Feb. 6, 1912	2,355,828.50	Feb. 1, 1912
2-A	Walker St. to Howard St.	O'Rourke Engineering Contracting Co., 345 5th Ave., N. Y.	July 17, 1912	912,351.60	April 11, 1912
3	Howard St. to Bleecker St.	Underpinning and Foundation Co., 290 Broadway, N. Y.	Jan. 19, 1912	2,295,096.50	Jan. 18, 1912
4	Bleecker St. to Union Sq.	Dock Contractor Co., 2 Rector St., N. Y.	Aug. 19, 1913	2,578,078.00	July 10, 1913
		Broadway (Manhattan)—Fourth Ave. (Brooklyn)—Routes Nos. 4 and 36			
1	Union Sq. to 26th St.	E. E. Smith Contracting Co., 101 Park Ave., N. Y.	Aug. 1, 1913	$2,056,702.50	Aug. 7, 1913
2	Broadway, 26th St. to 38th St.	United States Realty & Investing Co., 111 Broadway, N. Y.		$2,657,004.00	May 7, 1914
Total				$15,060,061.00	
		Canal St. Manhattan—Route twenty			
2	In Canal St. from Bowery to Broadway	Underpinning & Foundation Co., 290 Broadway, N.Y		$1,822,999.00	May 21, 1914
		Fourth Avenue Subway—(In Brooklyn)			
	Six sections, extending from Manhattan Bridge through Flatbush Ave. extension, Fulton St., Ashland Pl. and Fourth Ave. to 43rd St. Contracts let in May, 1908; approved by Board of Estimate and Apportionment in October, 1909, and work begun in November, 1909			$16,014,388.26	
		Fourth Ave. Extension Subway—Route No. 11-B—(In Brooklyn)			
1	43rd St. to 61st St.	Degnon Contracting Co., 30 East 42nd St., N. Y.	Oct. 4, 1912	$1,930,258.50	Sept. 26, 1912
2	61st St. to 89th St.	Degnon Contracting Co., 30 East 42nd St., N. Y.	Oct. 4, 1912	1,904,171.25	Sept. 26, 1912
Total				$3,834,429.75	
Total—Fourth Ave. line and extension				19,848,818.01	
		Brooklyn Loop Line (Centre Street)—Route No. 9-O—(In Manhattan)			
	Extending from the Manhattan terminus of the Brooklyn Bridge under Centre St. and Delancey St. extension to Williamsburg Bridge, with spur at Canal St. to the Manhattan Bridge (including real estate, but not engineering, etc.)			$12,767,732.07	
		New Utrecht Ave. Elevated Line—Route No. 39—(In Brooklyn)			
2	39th St. to Coney Is.	Post & McCord, Inc., 101 Park Ave., N. Y	Dec. 31, 1913	$1,672,190.00	Dec. 4, 1913
		Route No. 33—In Manhattan			
1	Trinity Place and Warren St. to South St	Booth & Flinn Ltd., 3785 Broadway, N. Y.		$2,059,182.00	April 23, 1914
2	Montague Tunnel	*Booth & Flinn Ltd., and O'Rourke Engineering & Contracting Co.		$5,074,869.00	June 4, 1914

A Yankee Merchant Marine—As steps in the development of the American Mercantile Marine the passing into law with the signing by President Wilson of the ship registry bill and the war risks insurance bill was welcomed yesterday by Philip A. S. Franklin, vice-president and general manager [illegible] of the International Mercantile Marine, according to the "Journal of Commerce," New York.

Mr. Franklin is a member of the special committee of the Chamber of Commerce appointed by President Seth Low on [illegible] of shipments during the European war. This committee urged the prompt passage of the American registry bill for such relief as it might bring and attended the conference held at the Treasury Department Aug. 14.

"The ship registry bill, in my opinion, goes a long way to help build up a mercantile marine by facilitating the transfer of ships from a foreign register to the American flag. Here is now the opportunity for American capital invested in shipping to place upon the national register the ships owned by it, and immediate relief should follow in increasing our tonnage to meet the lack of ships we suffered from at the outbreak of the war.

"As to the operation of the ships, the proclamation of the President, which he is authorized to make and which I understand he is likely to make at once, will place our ships in a better position to meet the competition of foreign-owned ships operated at less expense than our present laws permit us in carrying on the steamship business as a calling of its own.

"[illegible] of our ships may be transferred immediately under the new law.

"With regard to the war risks insurance bill, this is an emergency bill and its going immediately into effect on the President signing it will help the situation for this reason. There is not enough insurance available in the local market to cover the valuable cargo of a modern big ship. The Government assistance in this direction will practically release much cargo that is offered and has been held back by the high rates that have been exacted.

"There is the question of building ships for the American register. I have stated and repeat it that for the American Line the International Mercantile Marine is willing to build steamships to be always available for the Government's service as express mail carriers and for use as auxiliary cruisers when circumstances demand if the Government will bear a share of the cost, in the same way as that in which the "Mauretania" and "Lusitania" were built with the pecuniary assistance of the British Government."

A Cotton Warehouse at Pensacola—From a reliable source it has been learned that the Government has asked the Louisville & Nashville Ry. to make provision for the storage of 250,000 bales of cotton here this fall, and plans are under way to secure storage space in various other parts of the cotton belt. It is understood that this is one of the results of the movement inaugurated by the Government to aid in marketing the cotton crop as a result of the situation created by the European war. In addition to the storage facilities in the Louisville & Nashville warehouse it has already been announced that the Atlantic Compress Co. is prepared to store at least 150,000 bales of cotton this season.

Contracts for Dual System of Rapid Transit—Continued

FOR OPERATION BY INTERBOROUGH RAPID TRANSIT CO

		Seventh Ave.-Lexington Ave. Subway—Routes Nos. 5, 19 and 22, 43, 16, 4 and 38, 9 and 18			
6*	26th St. to 40th St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	$3,634,213.50	Nov. 3, 1910
* Work stopped on April 26, 1912, on account of change in routing of this branch.					
		Lexington Avenue Branch—Route No. 5			
7	43d St. to 53d St.	Rapid Transit Subway Construction Co., 165 Broadway, New York		$1,915,1[illegible]	June 2[illegible], 1911
8	53rd St. to 67th St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	$3,[illegible]	Nov. 3, 1910
9	67th St. to 79th St.	P. McGovern & Co., 1 Madison Ave., N. Y.	Feb. 13, 1912	1,961,997 [illegible]	Dec. 14, 1911
[illegible]	79th St. to 93rd St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	3,25[illegible]	Nov. 3, 1910
[illegible]	93rd St. to 106th St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	3,1[illegible]2,195 [illegible]	Nov. 3, 1910
[illegible]	106th St. to 118th St.	Oscar Daniels Co., Woolworth Bldg., N. Y.	Sept. 3, 1911	2,[illegible] 74	Nov. 3, 1910
[illegible]	118th St. to 129th St.	Bradley Contracting Co., 1 Madison Ave., N. Y. (Assigned to McMullen, Snare & Triest, Inc.)	Nov. 17, 1911	4,071,416.50	Nov. 3, 1911
[illegible]	129th St. to 135th St.	Arthur McMullen & Olaf Hoff, 149 Broadway, N. Y.	July 23, 1912	3,880,[illegible]	June 16, 1912
[illegible]	135th St. to 157th St.	Hagerty-Drummond Co., 48 Park Row, N. Y. (Assigned to Rogers & Hagerty)	Nov. 17, 1911	3,820,129.75	Nov. 3, 1910
Total				$[illegible],811.09	
		Southern Boulevard Branch—Routes Nos. 19 and 22 (In the Bronx)			
1	138th St. to 147th St.	John F. Stevens Construction Co., 55 Wall St., N. Y. (Assigned Oct. 23, 1913, to Richard Carvel Co., Inc., 401 West 59th St., N. Y.)	Oct. 22, 1912	$2,2[illegible],281.75	Sept. 26, 1912
[illegible]	147th St. to Bancroft St.	Rodgers & Hagerty, E. 152nd St. and Harlem River, N. Y.		$2,2[illegible] 25	Dec. 11, 1913
Total				$4,5[illegible]	
		Jerome Avenue Branch—Route No. 16—(In the Bronx)			
[illegible]	157th St. to 182nd St.	Oscar Daniels Co., Woolworth Bldg., N. Y.	Dec. 31, 1913	$1,07[illegible]	Dec. 11, 1913
[illegible]	182nd St. to Woodlawn Road	Cooper & Evans, 220 Broadway, N. Y.		$1,[illegible],831 [illegible]	Feb. 19, 1914
		Seventh Avenue-Lexington Ave.—Routes Nos. 4 and 38			
[illegible]	Battery Park to Greenwich and Vesey St.	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.		$2,120,[illegible]	April [illegible], 1914
[illegible]	Connection from 7th Ave. Subway to present subway	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.		$474,[illegible]	June [illegible], 1914
[illegible]	Vesey to Beach St.	Degnon Contracting Co., [illegible] East 42nd St., N. Y.	March, 1914	[illegible]	Dec. 11, 1913
[illegible]	Beach St. to Commerce St.	Degnon Contracting Co., [illegible] East 42nd St., N. Y.	Dec. 11, 1913	$[illegible]	Nov. 2[illegible], 1913
[illegible]	Commerce St. to 16th St.	United States Realty & Improvement Co., 111 Broadway, N. Y.	Mar. 6, 1913	[illegible]	Mar. [illegible], 1914
[illegible]	[illegible] St. to [illegible] St.	[illegible] Bros., N. Y.	Dec. 11, 1913	[illegible] 75	Nov. [illegible]
[illegible]	[illegible] St. to [illegible] St.	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.	Dec. 31, 1913	2,[illegible]	Jan. [illegible], 1914
[illegible]	[illegible] St. to [illegible] St. Times Sq.	[illegible] Cabot & [illegible] Corp., 431 Madison Ave., N. Y.		$421,[illegible]	May 2[illegible], 1914
Total				$14,7[illegible]	
		White Plains Road Line—Route No. 18—(In the Bronx)			
[illegible]	[illegible] St. to Burke Ave.	Oscar Daniels Co., Woolworth Bldg., N. Y.	March 18, 1914	$[illegible]	Feb. 19, 1914
[illegible]	Burke Ave. to [illegible] St.	[illegible]	Dec. 11, 1913	$[illegible]	Dec. [illegible], 1913
		[illegible] Astoria and Corona Lines—Routes Nos. [illegible] and [illegible] (In Queens)			
[illegible]	Queensboro Bridge Plaza	Snare & Triest, [illegible] Liberty St., N. Y.	[illegible]	$[illegible]	Aug. [illegible], 1913
[illegible]	Astoria Line	Cooper & Evans, [illegible] Broadway, N. Y.	Mar. 11, 1913	[illegible]	Feb. [illegible]
[illegible]	Corona Line	[illegible] Contracting Co., [illegible] Park Ave., N. Y.	Mar. 11, 1913	[illegible]	Feb. [illegible], 1913
Total				$[illegible]	
		[illegible] Tunnel [illegible]—(In Queens)			
	[illegible]	Degnon Contracting Co., [illegible]	Dec. [illegible], 1913	$[illegible]	
		[illegible]			
[illegible]	[illegible] Tunnel	[illegible] Engineering & Contracting Co.		$[illegible]	June [illegible], 1912
		[illegible]			
[illegible]		[illegible] Bridge Co., [illegible] William St., N. Y.		$[illegible]	
		F. W. [illegible], N. Y.	Mar. [illegible]	$[illegible]	
		[illegible]			
	[illegible]	Rapid Transit Subway Construction Co., [illegible] Broadway, N. Y.	Feb. [illegible], 1914	$[illegible],011.00	Feb. 26, 1914
		[illegible] Route 12			
[illegible]	[illegible]	[illegible], Brooklyn		$[illegible]	June 2[illegible], 1914
[illegible]	[illegible]	[illegible], Brooklyn		$[illegible]	April [illegible], 1914

[illegible]

[illegible] New York Municipal Railway Corporation.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

AUGUST BUILDING RETURNS

No effect of the war can be seen in the building returns for the month of August collected by this paper. In 19 cities in the eastern part of the United States there was a gain of approximately 15% in the estimated cost of the buildings from plans filed during August of this year compared with August of last year. For the first eight months of the year there was likewise a slight gain. In seven cities in the South there was a falling off of a small amount, both for the month of August and for the year. In the Middle West which, except for July, has showed a steady gain, month by month, there was a sharp falling off, amounting to $1,900,000. This, however, cannot be traceable to the war and is wholly accounted for in the falling off at Cleveland, Ohio. This really was not a falling off, but there were some large operations which appeared in the August, 1913, figures.

Practically all of these buildings for which plans were filed, such as the Public Service Building in Newark, have been planned and financed months ago and the formality of filing the plans only took place in August of this year. There were doubtless many corporations whose resources are ample to permit them to go ahead and build at any time they will take advantage of prevailing low prices.

EASTERN STATES

	August		First eight months of year	
	1914	1913	1914	1913
Albany, N. Y.	$479,685	$577,180	$5,156,150	$2,762,215
Baltimore, Md.	1,784,700	674,887	10,124,487	6,450,380
Bridgeport, Conn.	147,063	409,060	1,802,109	2,064,106
Buffalo, N. Y.	950,000	682,000	8,499,006	8,076,243
Hartford, Conn.	185,990	554,425	2,871,346	3,671,025
Hoboken, N. J.	2,725	144,000	730,727	366,142
Jersey City, N. J.	401,804	213,437	2,819,649	4,197,389
Newark, N. J.	3,196,000	1,814,638	8,440,280	11,345,718
New Haven, Conn.	500,567	258,693	2,906,192	2,719,791
New York, N. Y.				
Manhattan	3,608,950	3,769,400	34,491,040	46,630,035
Bronx	1,206,900	1,021,710	17,282,968	17,537,116
Brooklyn	3,974,000	2,270,375	29,892,850	21,384,686
Queens	903,716	1,099,212	14,043,545	11,599,156
Paterson, N. J.	221,958	49,730	1,300,415	1,060,939
Philadelphia, Penn.	2,642,810	3,718,750	28,410,380	29,504,985
Pittsburgh, Penn.	1,127,069	1,059,662	11,978,217	11,057,806
Reading, Penn.	29,400	107,600	1,043,200	614,700
Rochester, N. Y.	808,457	791,643	6,904,082	6,689,735
Scranton, Penn.	185,388	63,629	937,582	948,947
Springfield, Mass.	489,290	274,495	4,026,189	3,297,153
Syracuse, N. Y.	208,355	267,025	1,980,455	2,624,245
Worcester, Mass.	679,692	241,993	3,798,144	3,356,607
Totals	$23,744,519	$20,063,544	$199,439,280	$197,959,119
	Gain 17%		Gain 1%	

MIDDLE WEST

	August 1914	August 1913	First eight months 1914	First eight months 1913
Akron, Ohio	$555,120	$354,125	$2,910,205	$3,892,305
Chicago, Ill.	5,769,450	5,754,900	58,834,810	60,070,957
Cincinnati, Ohio	1,128,060	504,130	7,172,060	6,047,166
Cleveland, Ohio	2,318,470	4,041,970	19,539,885	16,609,120
Columbus, Ohio	647,325	495,140	4,371,531	3,613,888
Denver, Colo.	150,620	233,810	1,837,423	2,045,655
Des Moines, Iowa	111,150	88,775	1,269,514	1,282,059
Duluth, Minn.	238,023	158,960	2,184,864	3,111,517
Evansville, Ind.	76,495	171,375	1,023,309	1,263,320
Indianapolis, Ind.	472,436	700,768	6,568,841	6,932,241
Kansas City, Kan.	80,863	133,753	859,988	875,271
Milwaukee, Wis.	626,681	1,163,013	7,025,347	9,180,072
Minneapolis, Minn.	943,975	1,211,230	12,043,665	8,197,700
Omaha, Neb.	521,065	536,515	3,790,363	2,984,063
St. Louis, Mo.	797,165	1,082,947	9,903,076	11,495,254
St. Paul, Minn.	646,921	775,146	9,618,709	6,373,195
Salt Lake City, Utah	480,045	129,975	2,115,109	1,429,453
Toledo, Ohio	490,047	357,830	4,903,264	3,862,762
Totals	16,053,911	17,894,362	149,517,163	149,165,998
	Loss 10%		Gain trifling	

SOUTHERN STATES

	August 1914	August 1913	First eight months 1914	First eight months 1913
Atlanta, Ga	$372,033	$348,256	$3,867,732	$3,892,356
Birmingham, Ala.	314,519	333,385	2,665,515	5,008,037
Chattanooga, Tenn.	128,810	125,435	879,620	810,000
Louisville, Ky.	426,860	445,210	3,167,105	3,081,700
Memphis, Tenn.	175,661	321,116	2 523,549	3,182,406
Richmond, Va.	183,410	231,635	2,745,280	2,447,740
Washington, D. C.	191,576	627,472	7,312,278	6,827,705
Totals	$2,093,899	$2,432,509	$23,161,109	$25,249,944
	Loss 14%		Loss 7%	

RAILWAYS

✚Pennsylvania—Central R.R. of New Jersey—A contract has been awarded by this company to the CHARLES McDERMOTT ESTATE, Pennsylvania Bldg., Philadelphia, Penn., for the construction of a branch line from Hope Station, about five miles west of Easton, Penn., to Wilson Township, Penn.

Virginia—See item under Tennessee.

Florida—Seaboard Air Line Ry.—This company contemplates the construction of a spur from Broward, Fla., to the property of the Carpenter-O'Brien Co. W. D. Faucette, Norfolk, Va., is Ch. Engr.

Mississippi—See item under Tennessee.

Tennessee—F. B. Shirley, Nashville, Tenn., is interested in the construction of a railroad to connect Nashville, Tenn., Norton, Va., and Holly Springs, Miss.

Indiana—Cincinnati. Indiana & Louisville Ry.—Surveys have been started by this company for the construction of a railroad from Aurora, Ind., to Lamb, Ind., about 50 miles.

✚Illinois—Elgin, Joliet & Eastern R.R.—This company has awarded a contract to OLIVER & COSTELLO BROS., for about 50,000 cu.yd. of grading on its line through Georgetown, Ill.

✚Oklahoma—Beaver, Meade & Englewood R.R.—The contract for laying tracks on the main line of this company, from Beaver, Okla., to Forgan, Okla., has been awarded to JOHN L. LOVE, Oskaloosa, Iowa.

Oklahoma—Rosston, Grand Rapids & Protection R.R.—This company has been organized to construct a 12-mile railroad from a point on the Wichita Falls & Northwestern Ry. to Dohy Springs, Okla. L. A. Walton is Pres. and Gen. Mgr. and J. H. Butler is Secy.

Idaho—Marble Creek Valley Ry.—This company has been incorporated to construct a railroad from Clarkia, Idaho, to Poncono, Idaho, about 20 miles, and a line from the mouth of Buzwell Creek to a point on the Little North Fork of Clearwater River, about 25 miles. The incorporators are F. Horrick, E. B. Flagg and A. V. Barrick, all of Wallace, Idaho.

California—Minkler Southern Ry.—This company has been incorporated to construct a railroad from Minkler, Calif., to Exeter and Lindsay, Calif. The incorporators are A. G. Weld, L. J. Hibbard, J. J. Burne, E. W. Champ and H. Hotterhoff, all of Santa Fé, N. M.

ELECTRIC RAILWAYS

Holyoke, Mass.—The Board of Aldermen has granted a franchise to the Holyoke Street Ry. Co. to double-track and extend its line in Aldenville. Louis D. Pellissier, Holyoke, is Vice-Pres., Gen. Mgr. and Pur. Agt.

Longport, N. J.—William F. Wahl, Atlantic City, is interested in the construction of an electric railway to connect Longport, Margate, Ventnor Heights with a point of the main line of the Pennsylvania R.R. on the meadows.

Riverside, N. J.—The citizens of Riverside, Riverview and Muhlenberg Park are contemplating the construction of an electric railway to connect Riverside and Tuckerton.

Lynchburg, Va.—Preliminary arrangements are being made by the Lynchburg Traction & Light Co. for the extension of its College Hill line, along Fort Ave. J. W. Hancock, Lynchburg, is Gen. Mgr. and Pur. Agt.

Nashville, Tenn.—The City Commission has granted permission to the Nashville Ry. & Light Co. to double-track its line on West End Ave. from 21st St. to the city limits. F. W. Hoover, Nashville, is Vice-Pres. and Gen. Mgr.

Liberty, Ind.—The Commercial Club is interested in the construction of an electric railway from Richmond, Ind., to Hamilton, Ohio.

Kansas City, Mo.—The Kansas City Ry. & Light Co. contemplates the reconstruction of several of its lines in Kansas City. Frank Hagerman, Kansas City, is Vice-Pres.

Fort Worth, Tex.—The Northern Texas Traction Co. has been petitioned to extend its line through Niles City to Diamond Hill. The company will also build a one-mile extension to its Summit Ave. line in Fort Worth. George S. Clifford, Fort Worth, is Vice-Pres. and Mgr.

Phoenix, Ariz.—Plans are being considered by the Phoenix Ry. Co. for the extension of its Brill line. Samuel H. Mitchell, Phoenix, is Gen. Mgr. and Pur. Agt.

Falls City, Ore.—The Teal Creek Ry. Co. has been incorporated to construct and operate an electric railway from Falls City to a point in Polk County. The incorporators are Zera Snow, F. J. Cobbs and Wallace McCamant.

Pasadena, Calif.—The Pacific Electric Ry. Co. contemplates the construction of a second track on its line along North Lake Ave. J. McMillan, Los Angeles, is Gen. Mgr.

✚San Francisco, Calif.—The Board of Public Works has awarded a contract to EATON & SMITH, San Francisco, at $9779, for constructing the municipal electric railway through the Stockton St. tunnel.

The Board of Supervisors is considering a petition received from the North Beach Promotion Association, asking for the extension of the municipal electric railway to the Embarcadero.

Bridgeburg, Ont.—Surveys have been completed for the construction of the proposed hydro-radial railway from Bridgeburg to Dunnville, about 39 miles, and a branch line from Port Colborne to Welland, about eight miles.

Victoria, B. C.—The British Columbia Electric Ry. Co. is preparing plans for duble-tracking its line on Esquimalt Road from Dundas to Catherine St. A. T. Goward, Victoria, is Local Mgr.

LIGHT, HEAT AND POWER

Mount Vernon, Maine—The [illegible] electric light plant was recently burned, at a loss of about $1[illegible]. R H Jacobs is owner

Waterville, Maine—The Central Maine Power Co, Waterville, plans to build a new fireproof station to replace the one recently burned. It will be chiefly used as a substation to distribute electricity for the Waterville district and the system of the Waterville, Fairfield & Oakland Ry. F H Mason is Ch Engr

✦Ithaca, N Y—(Official)—Bids will be received until 2 p.m., Sept 1[illegible], by F L Williams, Cornell University, Ithaca, N Y, for the construction, heating and plumbing and electric work for the new drill hall for Cornell University

Atlantic City, N J—The Atlantic City Electric Co has secured a permit and will soon ask for bids for the construction of a power house to cost about $[illegible]

✦Philadelphia, Penn.—The contract for the construction of the addition to the power house of the Stephen Girard estate, at 2[illegible] St and Oregon Ave, has been awarded to [illegible]AK & Co, Philadelphia. Noted Aug 6

Aurelia, Iowa—At a recent election, the citizens voted in favor of a bond issue for the construction of a municipal electric light plant. The estimated cost is $7000. Noted July 23

Des Moines, Iowa—The Des Moines Electric Co. has secured the right-of-way and has been granted permission by the State Railroad Commission to construct a transmission line from Des Moines to Oskaloosa, with a branch to Knoxville. Small towns along the route will be supplied with electricity. The estimated cost of the work is $200,000. Noted June 18

Sioux City, Iowa—The citizens of South Sioux City recently voted to establish a municipal electric light plant to cost about $[illegible]

De Witt, Neb.—The City Council is considering plans for the establishment of a municipal electric light plant at a cost of about $1[illegible]

Harlem, Mont.—The City Council has granted a franchise to R J Moore, Glasgow, Mont, to furnish electric light and power to the city. Construction work will soon be begun on a power plant

Dallas, Tex.—The Texas Power & Light Co, Dallas, has recently leased the power plant at McKinney, Tex, and plans to build a new hydro-electric station on the Red River. It will build an extensive system of transmission lines. The company has recently contracted with the Texas Traction Co to furnish power for the operation of the traction company's lines for a term of 10 years

✦The Board of Education has awarded the contracts for installing heating apparatus in two public schools to KINNISON BROS, Dallas, at $[illegible], and in two other public schools to HAMILTON & CO, Dallas, at $12,[illegible]2

✦Gonzales, Tex.—The contract for the construction of a reinforced-concrete dam in the Guadalupe River has been awarded to H C GASS, Houston, Tex, at about $20,000. It will be about 16[illegible] ft long and [illegible] ft wide. Noted Aug 6

Carrizozo, N. M.—The Wild Cat Mining Co, White Oaks, N M, is considering the construction of an electric power plant and the building of a power transmission line to its mines in [illegible] and to Carrizozo. A R Graham, J H Falmer, Jr, and W H Tupper, all of Mishawaka, Ind, are interested in the company

Auburn, Wash.—The Auburn Gas Co, J L Veatch, Mgr, will soon award contracts for the construction of a gas plant to cost approximately $[illegible]0

Drain, Ore.—The Douglas County Light & Water Co will extend its power line from Oakland, Ore, to Drain, where a distributing system will be installed

Tulare, Calif.—The Mount Whitney Power Co will build a reinforced-concrete substation at once. H A Kluegel, Visalia, Calif, is Ch Engr

BRIDGES

✦Boston, Mass—The Public Works Department has awarded the contract for repairing the Charlestown Bridge to W [illegible] at $[illegible]. Other bidders were: W H Ellis & Son Co, $[illegible], and Lawler Bros, $[illegible]

It is reported that the [illegible] Ave Bridge will be rebuilt by the city, the [illegible] R R Co and the Boston & [illegible] R R. [illegible] is Comr of Pub Wks

Haverhill, Mass—[illegible] reports state that the Board of [illegible] is having plans prepared by [illegible] for the construction of a bridge over the Merrimac River to replace the present [illegible] bridge, which is reported to be unsafe. The new bridge will be of [illegible] and will have a [illegible] span. The estimated cost is $[illegible]

✦Albany, N Y—The State Department of Public Works [illegible]

Allentown, Penn—[illegible]

ship, repairing a stone bridge over Trout Creek at Mountainville, Salisbury Township, repairs to a stone bridge over Saucon Creek, at Lanark, Upper Saucon Township

Bloomsburg, Penn.—The Commissioners of Columbia County have awarded the contract for the construction of a concrete bridge over Fishing Creek above Orangeville to JOHN GORREY, at $1[illegible]0. Noted Aug 27

✦Butler, Penn.—(Official)—The Borough Council has awarded the contract for the superstructure of the Wayne St Viaduct, not including the lighting system nor the paving of the approaches, to the FORT PITT BRIDGE WORKS, Pittsburgh, Penn, at $1[illegible]7,79[illegible]. The contract for the substructure, using Raymond concrete piles, and for paving the approaches, was awarded to F M HARPER, Younkins Bldg, Butler, at $17,619 and $[illegible]1 respectively. The contract for the lighting system was awarded to the BUTLER LIGHT & MOTOR CO, at $91[illegible]. Noted July 16 and Aug. 6

Harrisburg, Penn.—(Official)—Bids will be received until 11 a.m., Sept 2[illegible], by Henry W Gough, Controller of Dauphin County, for rebuilding the following county bridges: Steel plate girder bridge over Swatara Creek between Middletown and Royalton, concrete bridge over Wiconisco Creek near Millersburg, and a concrete bridge over Kieffers Run about two miles east of Millersburg. Plans may be submitted at the same time for a new bridge over Swatara Creek between Middletown and Royalton

Lewistown, Penn.—(Official)—The design of the proposed bridge to be built by the Borough has not yet been decided upon, and construction work will not be started before spring. Charles C Brown is Engr in Charge. Noted Aug 20.

✦Scranton, Penn.—The Director of Public Works has awarded the contract for the construction of the South Washington Ave. Bridge to P F McGOWAN & SONS, Avoca, Penn, at $73[illegible]8 for the substructure, and to the NORTH BRANCH ENGINEERING CO, Pittston, at $[illegible]493 for the superstructure. Contracts for the Myrtle St Bridge were awarded to the BARRETT CONSTRUCTION CO, at $31[illegible] for the substructure and to MATTHIAS STIPP, at $3[illegible]5 for the superstructure. Noted Aug 2[illegible]

✦Gainesville, Fla.—(Official)—The Commissioners of Alachua County have awarded the contract for the construction of Dunegan's Bridge across the Santa Fe River, and for a bridge over the canal between Santa Fe and Lake Alto to the CONVERSE BRIDGE & STEEL CO, Chattanooga, Tenn, at $70[illegible]0 for the two. Noted Aug 20

Cincinnati, Ohio—The Board of Commissioners of Hamilton County has approved plans for the construction of a bridge over Mill Creek at Wayne Ave, to cost about $[illegible]1,290

Cleveland, Ohio—Bids will be received until noon, Sept 21, by the Commissioner of Purchases and Supplies for the construction of the substructure of the Clark Ave Viaduct from the tracks of the Baltimore & Ohio R R Co. to West 11th St. Robert Hoffman is City Engr

✦Fostoria, Ohio—The County Commissioners have awarded the contract for the construction of a bridge at Fostoria to BELGER & ANDERSON, Fostoria, at $1[illegible]

New Philadelphia, Ohio—(Official)—Bids will be received until 1 p.m., Sept 11, by the Commissioners of Tuscarawas County for creosoted wood block floor, and for painting and repairing the [illegible]town River Bridge, Goshen Township. R H Nussdorfer is County Audr

West Bend, Wis.—Bids are being received by Charles Johnson, Highway Comr of Washington County, for the construction of a reinforced-concrete bridge over the Milwaukee River in the town of Farmington

Bozeman, Mont.—The Commissioners of Gallatin County are having plans prepared by Fred F Willson & Co, Bozeman, for the construction of two bridges, one across Baker Creek, and the other over the Gallatin River near Manhattan

Townsend, Mont.—(Official)—No bonds have yet been issued by Broadwater County for the construction of a bridge across the Missouri River at Toston, and the bridge will not be built this year. John [illegible] is Chn of County Comrs. Noted Aug 20

✦Seattle, Wash.—The contract for the construction of reinforced-concrete piers for the county bridge over Lake Washington Canal at Montlake Blvd has been awarded to STILWELL BROS, Seattle, at about $[illegible]. Noted July 16

✦Esparto, Calif.—The Board of Supervisors of Yolo County, Woodland, has awarded the contract for the construction of a bridge, exclusive of earthwork, across Cache Creek, near Esparto, to the [illegible] CONSTRUCTION CO, Sacramento, at $[illegible]. Noted July 9

Los Angeles, Calif.—Bids will be received until [illegible] a.m., Sept 11, by H R Ferris, [illegible] Bd of Pub Wks, for the construction of a reinforced-concrete bridge about [illegible] ft long and [illegible] ft wide, over the Arroyo Seco at Ave [illegible]. Noted Aug [illegible]

✦Merced, Calif.—(Official)—The Board of Supervisors of Merced County has awarded the contract for the construction of a bridge over the Merced River to [illegible], Los Angeles, at $[illegible]. Other bidders were: [illegible], Merced, $[illegible]; [illegible], Tulare, $[illegible]; [illegible] Bridge Co, Kansas City, Mo, $[illegible]; [illegible] Wilson, [illegible], $[illegible]. Noted Aug 6

Needles, Calif.—[illegible]—As soon as the appropriations for the construction of a bridge across the Colorado River at Topock, Ariz, near Needles, are in the hands of the [illegible] of the [illegible], plans will be prepared, and bids [illegible]. The bridge is estimated to cost $[illegible], of which the Federal Government, San Bernardino County, Calif, and Mohave County, Ariz, will each contribute $[illegible]. [illegible], Needles, Calif, is interested. Noted Aug. 1[illegible]

Victoria, B C—It is reported that bids will soon be asked by the City Council for repairs to the Point Ellice Bridge at an estimated cost of $[illegible]

WATER SUPPLY—IRRIGATION

✦West Pownal, Maine—(Official)—Bids were received Sept 1 by the Maine School for Feeble Minded for constructing a water system as follows: JOHN F. PALMER, Boston, Mass, at $[illegible] (awarded contract); James H Ferguson [illegible]

$37,555; Marshall Bros., part, $22,185; John W. Gullivr, $30,-797; Snader Construction Co., part, $8488; Forgiona & Romans Co., $29,667; and Noyes-Campbell Co., $28,800. Carl J. Hedin is Supt. Noted Aug. 27.

Clinton, Mass.—Bids are being received for the construction of a concrete dam 250 ft. long and 25 ft. high. Plans are on file with the Water Commissioners.

✚**Mansfield, Mass.**—The contract for constructing a reservoir on Foolish Hill has been awarded by the Water Commissioners to JOHN CASHMAN SONS & CO., Boston, at $19,750. Noted Sept. 3.

Newburyport, Mass.—The Artesian Water Co. contemplates enlarging and improving the water system.

✚★**Webster, Mass.**—Contracts have been awarded to LIGHT, HEAT & POWER CORPORATION, Boston, at $20,424 for constructing a concrete storage reservoir and at $7642 for laying c.i. water pipe. Noted Aug. 6.

✚**East Providence, R. I.**—The contract for building a filter house for the East Providence Water Co. has been awarded to J. W. BISHOP & CO., Custom House St. Noted June 11.

★**Amsterdam, N. Y.**—Bids will be received by the Commissioner of Public Works, until Sept. 15, for making about 50 wash borings at Glen Wild. James P. Wilson is City Clk.

Newark, N. J.—See item under "Sewers."

Whippany, N. J.—The Normandie Water Co. contemplates extending its mains in Whippany.

Washington, D. C.—(Official)—Bids will be received by the Commissioner of the District of Columbia until 2 p.m., Sept. 15, for furnishing 1000 tons of 8-in. c.i. water pipe. Specifications are on file with the Purchasing Officer, Rm. 320 District Bldg., Washington.

Norfolk, Va.—Press reports state that the Council contemplates spending $390,000 for West Neck Creek water supply.

Huntington, W. Va.—An ordinance has been adopted by the City Commission providing for a bond issue of $500,000, the proceeds to be used for the construction of a water plant. Noted Aug. 6.

Hazlewood, N. C.—The citizens will spend $15,000 for the improvement of the water works and sewer system. J. B. Hoyle is Town Clk.

Louisville, Ga.—Bonds for $12,000 have been voted by the citizens of Louisville for the extension of the water and sewer systems. Noted Aug. 20.

Apopka, Fla.—The Council has been petitioned by M. T. Anderson for a franchise for the construction of a water system and electric light plant.

✚**Bradentown, Fla.**—The contract for constructing a 500,-000-gal. reinforced-concrete reservoir has been awarded by the Department of Public Works to W. P. PERKINS, Tampa, at $10,000. Noted Aug. 20.

Fort Meade, Fla.—The city will extend the water and sewer system at an estimated cost of $7500. Bonds for this purpose have been voted. M. A. Wilson is Mayor. Noted Aug. 6.

Homestead, Fla.—The city contemplates spending $50,000 for the construction of water and sewer systems and an electric light plant.

Macclenny, Fla.—The city contemplates installing a water system and electric light plant.

Dickson, Tenn.—At an election held Sept. 2 the citizens voted $5000 in bonds, the proceeds to be used for laying water mains.

Hodgenville, Ky.—Bonds for $14,300 have been voted, the proceeds to be used for the construction of a water system. Noted Aug. 13.

Providence, Ky.—The Providence Water & Utilities Co. has been organized with $100,000 capital by W. E. Hunter and associates. The company will construct a water system. Noted Aug. 6.

McComb, Miss.—Bids will be received by J. Dock Harrell, City Clk., until Sept. 29, for constructing a concrete reservoir. Xavier A. Kramer, Magnolia, is Engr.

✚**Bucyrus, Ohio**—The contract for installing a filtration plant for the city has been awarded to GEORGE B. HICKS, South Charleston, at $20,000.

✚**Cincinnati, Ohio**—The contract has been awarded by the Director of Public Service to AMERICAN STEEL & WIRE CO., Chicago, Ill., at $13,600, for furnishing sulphate of iron for the Water Department for the remainder of the year 1914.

Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, until Sept. 23, for furnishing three vertical triple expansion crank and fly wheel pumping engines for the division pumping station.

Coldwater, Ohio—Bonds for $40,000, the proceeds to be used for the installation of a water system, have been voted by the citizens.

Ironton, Ohio—Plans for a water system have been approved by the State Board of Health. J. F. Witmer Co., Buffalo, N. Y. is Engr. Noted July 30.

Sebring, Ohio—The City Water Works Co., Pittsburgh, Penn., has been instructed by the State Board of Health to install a purification plant.

Springfield, Ohio—The city will install a water system in the Ridgewood addition. Charles E. Ashburner is City Mgr.

✚**Youngstown, Ohio**—The contract for installing three engines and pumps at the new municipal pumping station has been awarded to KEItR TURBINE CO., Wellsville, N. Y., at $39,975.

Lansing, Mich.—The erection of an auxiliary pumping station for the water system is under consideration by the Water & Light Commission.

Audubon, Iowa—The council contemplates spending $8000 for extending the municipal water system. H. J. Mantz is Mayor.

Storm Lake, Iowa—The citizens contemplate installing a water system. A special election will be held to vote on the proposition.

Columbia Heights, Minn.—Bids will be received by C. R. Holstrom, Recorder until 8 p.m., Sept. 19, for extending the water system.

Cuyuna, Minn.—Bids will be received by G. F. Anderson, Village Clk., until 8 p.m., Sept. 14, for drilling three wells and making connections and for furnishing a 400-gal. electric pump.

✚**Wilmar, Minn.**—The contract for constructing a tank and tower for the water department has been awarded to DES MOINES BRIDGE & IRON CO., at $4475.

Kansas City, Kan.—At an election held Aug. 25 bonds for $200,000 were voted. The proceeds will be used to extend the water system. George Little is City Clk. Noted July 16.

Osawatomie, Kan.—Worley & Black, Consult. Engrs., Kansas City, Mo., have submitted a report showing the needed improvements of the water system, recommending a new plant estimated to cost $15,907, a distributing system, $15,580 and pumps $3900.

Bridgeport, Neb.—Bids will be received by the Board of Village Trustees, until Sept. 28, for furnishing f.o.b. Bridgeport 8000 ft. 4-in. c.i. water pipe, 4500 lb. special fittings, 10 four-in. gate valves, 12 fire hydrants, etc. Noted Aug. 6.

Chadron, Neb.—Bids will be received by G. E. Marriett, City Clk., until 6 p.m., Sept. 18, for constructing a water system.

Peever, S. D.—Bonds for $8000 for the construction of a municipal water system have been voted by the citizens.

Medicine Bow, Wyo.—Bonds have been voted by the citizens, the proceeds to be used for the installation of a water system.

Melstone, Mont.—At an election held recently bonds for $19,000 were voted by the citizens, the proceeds will be used for the installation of a municipal water system. Noted July 16.

Brownsville, Tex.—An election will be held Sept. 10 to vote on the proposition of issuing $30,000 in bonds the proceeds to be used for the installation of a water system.

Cotulla, Tex.—Bonds $14,000 the proceeds of which will be used for the installation of a water system, have been voted. Noted July 23 and Aug. 6.

Robstown, Tex.—The city will construct a water system to cost $19,000. J. D. C. Rylander is City Secy.

Hailey, Idaho—An election will soon be held to vote on the proposition of issuing $35,000 in bonds for the purchase and improvement of the local water system.

Midvale, Idaho—The Phelps Construction Co., Weiser, Idaho, has submitted a proposition to the City Council for the installation of a water system at Midvale.

Pocatello, Idaho—At an election held Aug. 25, bonds for $400,000 were voted. The proceeds will be used for the installation of a municipal water system. Noted Aug. 13.

Lovelocks, Nev.—A water distributing system will be installed by L. H. Taylor.

✚**Seattle, Wash.**—The contract for laying water mains in East Harrison St. has been awarded by the City Council to A. M. FIORITO, at $41,285. Noted Sept. 3.

✚**Seattle, Wash.**—The contract for completing the Cedar River dam to the elevation of 1600 ft. has been awarded by the Board of Public Works to NETTLETON, BRUCE & ESCHBACH, American Bank Bldg., Seattle, at $164,565.

Boston, Ore.—The City Council has sold $48,500 of bonds for the water system. Plans are now being prepared for the installation of the system.

La Grande, Ore.—Plans are being prepared for the construction of a reservoir with a capaclay of 2,250,000 gallons.

✚**Pasadena, Calif.**—The contract for furnishing a steam turbine electrical generating unit has been awarded to ALLIS-CHALMERS CO., Milwaukee, Wis., at $36,675.

Redding, Calif.—The Northern California Irrigation Association has been incorporated with a capital of $10,000 by M. T. Howell, George W. Thompson and others. Surveys are being made for a large irrigation system.

San Francisco, Calif.—Bids will soon be received by the Board of Public Works for aqueduct borings in connection with the Hetch-Hetchy municipal water system.

London, Ont.—H. J. Glaubitz, Engr., water works plant, is in the market for two water wheels, turbine, pumps and motors.

Welland, Ont.—A water pipe line costing $1,000,000 will be constructed according to press reports, by the Dominion Government. The line will carry water from Lake Erie to supply the towns of Welland, Merriton and Thorold, Port Robinson and Allanburg and the city of St. Catharines.

SEWERS

✚**Boston, Mass.**—The contract for constructing sewers in Mt. Hope St., Neponset Ave., Folsom St. and Jewett St., West Roxbury, has been awarded by the Public Works Department to ANTONY CEFALO, at $6345. Other bids were: Martino De Matteo, $6378; William L. Dolan, $6580; F. Drinkwater, $6691; M. De Sisto, $6812; John F. Lynch, $6874; Louis Balboni, $7061; Charles J. Jacobs Co., $7593; Anthony Baruffaldi, $7704; John Guarino, $7768; John H. Broderick, $7990; James Driscoll & Son Co., $8453; McCarthy & Walsh, $8907; James L. Brvne, $9898.

✚The contract for constructing sewers in Barbara, Edgemont and Houston Sts., and outlets in Montview, Rosecliff, Kittredge and Whitford Sts., Clarendon and Hillside Aves., West Roxbury, has also been awarded to ANTONY CEFALO,

at $7497. Other bids were: John F. Lynch, $8000, William L. Dolan, $[illegible], Charles J. J[illegible] Co., $[illegible], M. De Matteo, $[illegible], M. De S[illegible], $[illegible], James Driscoll & Son Co., $9919, Anthony Baruffaldi, $[illegible], John Guarino, $[illegible]36, Charles R. Gow Co., $1[illegible]16, James L. Byrne, $1[illegible]663.

The following bids were received for constructing sewers in Milton and Hamilton Sts.: A. Dadilario, $12,897, Anthony Baruffaldi, $1[illegible], West Roxbury Trap Rock Co., $13,980, James J. Conway, $13,781, J. H. Ferguson, $1[illegible]191, McCarthy & Walsh, $16,[illegible], Louis Balboni, $1[illegible],139. Bids were opened Sept. 4. Noted Aug. 27.

+Boston, Mass.—The contract for constructing a sewer in Mu[illegible] Road has been awarded by the Public Works Department to the J. J. O'CONNELL CO., at $[illegible]. Other bids were: A. [illegible]efalo, $[illegible]773, C. J. Jacobs Co., $[illegible]931, J. Guarino, $[illegible], C. R. Gow Co., $[illegible]11, M. de Matteo, $[illegible]29, McCarthy & Walsh, $[illegible]684, J. McC[illegible] Co., $6784, L. Balboni, $7127, G. J. Hegan, $[illegible]36. Noted Aug. 20.

Boston, Mass.—Bids will be received by the Public Works Department until Sept. 11, for constructing sewers in four streets in Hyde Park and Dorchester. L. K. Rourke is Comr.

Boston, Mass.—The city will construct sewers and drains in various streets at an estimated cost of $21,149. L. K. Rourke is Comr.

+The contract for constructing the [illegible] outflow sewer on Nut Island and in Boston Harbor has been awarded to W. H. ELLIS & CO., 37 Condor St., Boston, at $37,790. Noted Aug. 1[illegible] and Aug. 2[illegible].

+Fairhaven, Mass.—The contract for constructing sewers in Main and Sycamore Sts. and at the school, has been awarded to ALBERT B. COOK, New Bedford.

Newburyport, Mass.—The Artesian Water Co. contemplates installing a sewer system at Salisbury Beach.

+Hartford, Conn.—Contracts for the construction of the M[illegible] Ave. sewer system have been awarded by the Board of Contract and Supply as follows: Sect. D, H. LAMBE, New Haven, at $[illegible]; Sect. E and F, W. T. RYAN CONSTRUCTION CO., Hartford, at $[illegible]97 and $19,069 respectively. Joseph Buths is Secy. of the Board. Noted Aug. [illegible]0 and Sept. [illegible].

+Binghamton, N. Y.—Press reports state that the contract for constructing an intercepting sewer in Conklin Ave. has been awarded by the Board of Contract and Supply to FRANK STENTON, at $[illegible]. Noted Aug. 6.

Camden, N. J.—The City Council has decided to construct sewers in Stevens, [illegible], Fourth, Division and Ninth Sts. A. L. Sayers is St. Comr.

Jersey City, N. J.—The City Council contemplates the improvement of the Paterson Ave. outlet sewer. The estimated cost is $[illegible].

Newark, N. J.—Bids will be received by the Board of Street and Water Commissioners, City Hall, until Sept. 17, for [illegible] sewers in various streets. Morris R. Sherrerd is Chief Engr.

Newark, N. J.—Bids recently received by the Board of Public Works for constructing sewers in Lindsley and Stuyvesant Aves. have been rejected.

Newark, N. J.—According to press reports, the Passaic Valley Commission has filed plans for a pumping station to be erected on the Newark Meadows. The building will be of brick and steel, [illegible] ft., with a wing [illegible] ft. The estimated cost is $1[illegible].

Scranton, Penn.—Bids will be received by J. G. Hayes, Director Dept. of Pub. Works, until 11 a.m., Sept. 12, for constructing a lateral sewer in 11th Ave.

Tarentum, Penn.—[illegible] Hudson, City Engr., is preparing plans for a joint sewage disposal plant for Brackenridge and Tarentum.

Richmond, Va.—The Board of Administration will soon ask for bids for constructing a sewer system in the North[illegible] section of the city. Charles E. Bolling is City Engr.

[illegible]sville, Ga.—[illegible]—The city has accepted the plans of [illegible] for constructing a sewer system and extending the water system. Bids for the work [illegible].

Fort Meade, Fla.—The citizens have voted $[illegible] in bonds for extending the sewer system and water works. M. A. [illegible] is Mayor.

+Miami, Fla.—The city has awarded a contract to the [illegible] ASPHALT & CONSTRUCTION CO., Birmingham, Ala., for constructing sewers. H. H. [illegible] Bldg., Miami, is Engr. Noted June [illegible].

Orlando, Fla.—It is reported that the city will spend $[illegible] for constructing storm sewers.

Palm Beach, Fla.—The Town Council contemplates [illegible] in bonds for installing a sewer system.

Tampa, Fla.—The city will construct sewers [illegible].

New Orleans, La.—Bids will be received by the Sewerage and Water Board, City Hall, until [illegible] for extending the sewer and water systems. George G. Earl is Supt.

+Akron, Ohio.—The contract for the construction of a [illegible] plant has been awarded by the City [illegible] at $[illegible]. [illegible]

+[illegible], Ind.—The contract for constructing [illegible] sewer [illegible]. Noted Aug. [illegible].

+[illegible], Ind.—Press reports state that the contract for [illegible] sewer system has been awarded to the [illegible], Terre Haute, at $[illegible].

+[illegible]wood, Mich.—It is reported that the contract for [illegible] at $[illegible], with an allowance [illegible].

+Downers Grove, Ill.—[illegible]

+La Salle, Ill.—The contract for constructing an extension to the sewer system has been awarded to T. W. KEYS & CO., La Salle, at $39,599. Noted Aug. 6.

+Lemont, Ill.—(Official)—Bids will be received by John McGillen, Clk. of the Sanitary District of Chicago, until noon, Sept. 21, for the excavation and collateral work on Sect. 1 of the Calumet-Sag channel. For further information, see advertisement under "Contracts to Be Let."

Quincy, Ill.—Press reports state that bids for constructing the sewer in Fifth St. have been rejected by the Board of Local Improvemnts. The work will be readvertised.

Beloit, Wis.—(Official)—Bids will be received by the Board of Public Works, until noon, Sept. 18, for constructing sewers in various streets in Districts B and C. R. E. Wood is City Clk.

+Warren, Minn.—The contract for constructing an extension to the sewer system and building Imhoff tanks and filter beds has been awarded to the ROBINSON-VAN ALSTINE CO., Grand Forks, N. D., at about $10,000. Noted Aug. 20.

+Hutchinson, Kan.—The City Commission has awarded the contract to McLEOD & CRANDALL for constructing a lateral sewer, laying curbs on North Washington and West 14th Sts., and gutters on Sherman St.

+Benson, Neb.—The contract for constructing main sewers and five sewage-disposal plants has been awarded to ARTHUR A. DOBSON, First National Bank Bldg., Lincoln, at $36,661. Noted Aug. 20.

+Lidgerwood, N. D.—The contract for constructing a sewer, including septic tank, has been awarded to TANNER BROS., St. Paul, Minn., at $22,27[illegible]. Other bids were from L. W. Shruth, Fargo, at $23,648, and William Danforth, St. Paul, Minn., at $22,805. Noted Aug. 13.

+Sheridan, Wyo.—The contract for extending the sewer system has been awarded to A. C. EVANS, Sheridan, at $[illegible],377. The work requires about eight miles of 8- and 10-in. sewers. Noted June 18.

+Anaconda, Mont.—The contract for constructing a sanitary sewer outlet below the city has been awarded to R. M. BAUDSEN & CO., at about $40,000. Noted June 11.

Roundup, Mont.—The city has voted $20,000 in bonds for constructing a sewer system.

Siloam Springs, Ark.—Press reports state that the city will construct a sewer system. J. H. Perry is Mayor. Noted Aug. 6.

Anderson, Tex.—The city has commissioned Browne & Wilder, Engrs., Houston, to prepare plans for a sewer system.

Houston, Tex.—The City Council have approved of the plans for the storm sewer in Orleans Ave. from Harrisburg to German St. The estimated cost is $1[illegible],000.

Pocatello, Idaho.—Bids will be received by the City Clerk until Sept. 17, for constructing a storm water trunk sewer. Noted July 2.

Salt Lake City, Utah.—Bids will be received by the City Recorder, until Sept. 15, for constructing sewer extensions.

Anacortes, Wash.—The City Council has decided to construct a trunk sewer in T Ave. C. C. Temple is City Clk.

Bandon, Ore.—Plans are being prepared for a sanitary sewer in Wall St.

Portland, Ore.—The lowest bid submitted for constructing an extension to the Holgate St. sewer was that of the Asar Construction Co., at $1[illegible],[illegible]61, vitrified pipe to be used.

Chico, Calif.—Olmstead & Gillelen, Hollingsworth Bldg., have been commissioned to prepare plans for a sewer system.

Los Angeles, Calif.—The lowest bid submitted to the City Council for constructing the sewer in Brent St. was that of J. C. Wukojevich, at $14,[illegible].

+San Benito, Calif.—The contract for installing the sewer system in the northern section of the city has been awarded to L. T. McFADDEN, at $[illegible].

Berlin, Ont.—[illegible] Shape, City Engr., is preparing plans for a sewage filtration plant for the city.

GARBAGE

Manchester, N. H.—The city is considering an issue of $1[illegible] in bonds for the construction of a garbage crematory.

Amsterdam, N. Y.—Bids will be received, until Sept. 1[illegible], by the Board of Health for constructing a garbage crematory.

+New York, N. Y.—Contracts have been awarded as follows by [illegible] T. [illegible], Comr. Street Cleaning, for removing snow and ice during the winter season of 1914-15 in the boroughs of Manhattan, Brooklyn and the Bronx:

Borough of Manhattan—SNOW CONTRACTING CO., [illegible] Madison Ave., New York.

Borough of Brooklyn, First District—[illegible] & GORMAN CONTRACTING CO., [illegible], Brooklyn; second district, [illegible] CONTRACTING CO., [illegible] Hooper St., Brooklyn; third district, T. C. CALLEY, [illegible] Wallace St., Brooklyn; fourth district, [illegible] ASPHALT CO., [illegible] Hamilton Ave., Brooklyn.

Borough of the Bronx—[illegible] CONTRACTING CO., [illegible] Third Ave., The Bronx. Bids were opened Aug. 21. [illegible]

Philadelphia, Penn.—Bids will be received by the Bureau of Health [illegible] for the removal and disposal of garbage [illegible].

Richmond, Ind.—Fred Charles, City Engr., has been authorized by the City Council to prepare plans for the construction of an addition to the garbage crematory.

STREETS AND ROADS

★Nashua, N. H.—(Official)—Bids will be received by the Board of Public Works, until 4 p.m., Sept. 14, for the paving of Bridge St. from the junction of Bridge St. and East Hollis St. to Van Buren St.

Boston, Mass.—Bids will be received by the Department of Public Works, until Sept. 14, for constructing sidewalks and pavements in Brighton, Roxbury and Dorchester Districts. L. K. Rourke is Comr.

Pittsfield, Mass.—The City Council has voted to pave West St. The approximate cost is $25,000.

Springfield, Mass.—The Board of Street Supervisors has decided to pave Walnut St. with asphalt on a concrete base. The approximate cost will be $6000.

✚Hartford, Conn.—Contracts for state road work, bids for which were received by the State Highway Commissioner, Aug. 18, have been awarded as follows:

Danbury Township—About 2884 lin.ft. amiesite pavement on White St., to CHARLES T. EASTBURN CO., Mt. Vernon, N. Y., for approximately $12,457.

Manchester Township—About 6700 lin.ft. reinforced concrete (washed sand) on Main St., to the A. C. STERNBERG JR. CONSTRUCTION CO., West Hartford, for approximately $14,920.

Old Saybrook Township—About 1755 lin.ft. gravel construction on Dublin Lane, to DONAHUE BROS., Middletown, for about $2800.

Griswold Township—About 5075 lin.ft. reinforced concrete (washed sand) and 17,800 lin.ft. native stone resurfacing on the Voluntown Road, to F. H. GILBERT, Jewett City, for $18,314.

City of Bristol—About 4700 lin.ft. concrete pavement (washed sand) and 6992 lin.ft. gravel construction on the Terryville Road, to CHARLES H. TERRY, Bristol, for $23,347. Noted Aug. 6 and 27.

Bids will be received by the State Highway Commissioner until 2 p.m., Sept. 15, for state road work, as follows:

Harwinton Township—About 4161 lin.ft. native stone macadam construction on the Torrington Road. Estimated quantities, 5470 sq.yd. 7-in. macadam, 1000 sq.yd. 4-in. macadam, 1000 sq.yd. telford, 14,060 lb. steel reinforcement for a 6-ft. span concrete bridge and 220 lin.ft. corrugated iron pipe. Plans on file at Selectmen's office, Town Hall, Harwinton.

Ridgefield Township—About 11,796 lin. ft. native stone macadam or gravel construction on the Norwalk Turnpike. Estimated quantities, 4830 cu.yd. grading, 3115 cu.yd. rock excavation, 18,970 sq.yd. 7-in. macadam, 2000 sq.yd. 4-in. macadam, 20,970 sq.yd. gravel, and 540 lin.ft. corrugated iron pipe. Plans on file at office of George E. Smith, Div. Engr., New Milford.

Berlin Township—About 3580 lin.ft. trap rock macadam construction on the Cromwell Road. Estimated quantities, 5270 sq.yd. 7-in. macadam, 300 sq.yd. 4-in. macadam, 355 ft. corrugated iron pipe. Plans on file at Selectmen's office, Town Hall, Berlin.

Darien Township—About 5000 lin.ft. plain or reinforced-concrete pavement on Mansfield Ave. Estimated quantities, 1728 cu.yd. concrete, 8890 sq.yd. reinforcement, 320 lin.ft. corrugated iron pipe. Plans on file at Selectmen's office, Town Hall, Darien.

Washington Township—About 1500 lin.ft. native stone macadam road, in connection with a 50-ft. span reinforced-concrete bridge over the Shepang River at Woodville. This contract involves heavy work, the estimated quantities being, 4350 cu.yd. earth grading, 200 cu.yd. rock excavation, 250 cu.yd. wet excavation, 12,500 lb. steel reinforcement, 180 cu.yd. first class cement and 390 cu.yd. second class cement.

City of New Britain—About 4550 lin.ft. trap rock macadam or gravel construction on South Stanley St. Estimated quantities, 5490 sq.yd. 7-in. macadam, 2600 sq.yd. 4-in. macadam or 8090 sq.yd. gravel, 150 lin.ft. corrugated iron pipe. Also three sections, about 10,028 lin.ft., plain or reinforced concrete on Stanley St. Estimated quantities, 2842 cu.yd. concrete, in addition to which there will be 970 cu.yd. of concrete on railroad area, and 730 cu.yd. concrete for which the city will pay. Plans on file at office of Board of Public Works, City Hall. William Hall is City Engr.

New Milford Township—About 15,225 lin.ft. of gravel or lime stone road with trap rock or native stone macadam surface on the Danbury Turnpike. Also about 5740 lin.ft. same construction on East St. Estimated quantities, 1010 ft. corrugated iron pipe, 6170 cu.yd. earth grading, 3390 cu.yd. borrowed embankment, 4980 sq.yd. earth grading, 32,580 sq. yd. 7-in. macadam, 3900 sq.yd. 4-in. macadam over telford, 8000 B. F. grillage, 15,120 lb. steel reinforcement.

Norwich Township—About 5050 lin.ft. resurfacing on Norwich Ave. Estimated quantities, 8980 sq.yd. earth grading, 1720 tons trap road and 570 tons screenings in place.

Thompson Township—About 3754 lin.ft. plain or reinforced concrete on the North Grosvenor Dale Road. Estimated quantities, 6675 sq.yd. earth grading, 200 sq.yd. telford, 1298 cu.yd. concrete, 6675 lb. reinforcement.

Naugatuck, Conn.—Bids will be received, until Sept. 15, by George C. Ham, Borough Engr., 98 Church St., for the construction of a 3-in. sheet asphalt pavement on a 6-in. concrete base on Church St., from Maple St. to Rubber Ave. Approximately 4500 sqy.d. will be required.

✚Albany, N. Y.—Bids were received, Sept. 1, by the State Highway Commission and contracts were awarded for road improvement as follows:

Road No. 5312-B, Allegheny County, 0.17 mile—Bonney & Hamilton, Rochester, $3616.

Road No. 5179-A, Essex County, 6.77 miles—Boynton & McNally, Keeseville, $34,440.

Road No. 1037-A, Erie County, 0.39 mile—all bids rejected.

Road No. 1201, Nassau County, 0.61 mile—All bids rejected.

Road. No. 5511, Ontario County, 5.87 miles—Gaffey & Byrnes, Syracuse, $75,512.

Road No. 5512—New Jersey State Line-Nyack, Pts. 1 & 3, Rockland County, 3.75 miles—Eggleston & Garthwaite, Yonkers, $60,282.

Road No. 5389, Rockland County, 1.56 mile—Joseph Walker Construction Co., Albany, $29,497.

Road No. 970-A, St. Lawrence County, 3.89 miles—E. T. Eggleston & Co., Yonkers, $19,060.

Road No. 5503, Wayne County, 2.90 miles—W. J. Brennan Construction Co., Geneva, $29,381.

Road No. 5409-A, Wyoming County, 0.48 mile—Thos. F. Shaughnessy, Albany, $7435.

Road No. 976, Wyoming County, 3.52 miles—Thos. F. Shaughnessy, Albany, $23,380.

Contracts were awarded by the State Highway Commission for repair of public highways by State Aid, Sept. 11, as follows:

Repair Contract No. 688, Road No. 5250, Oswego County—R. D. Cooper, Little Falls, $10,179.

Repair Contract No. 651, Road No. 77, Rensselaer County—Murray Construction Co., Troy, $29,394. Noted Aug. 20.

★Amsterdam, N. Y.—Bids will be received by the Common Council until 8 p.m., Sept. 15, for paving Shuler, Prospect St. and Locust Ave. with Medina standstone block, and Wall, Grove, Bayard and Schuyler St. with brick. For particulars, see advertisement under "Contracts to Be Let."

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received by Maurice E. Connolly, Pres. of the Borough of Queens until 11 a.m., Sept. 14, for improving Metropolitan Ave., from Dry Dock Harbor Road to Fulton St.

Niagara Falls, N. Y.—The City Council contemplates paving Whirlpool Ave., from Bath to Chasm Ave. The approximate cost will be $24,275.

✚Utica, N. Y.—The contract for paving Dudley Ave. from James to Pleasant St. has been awarded to HARRY W. ROBERTS & CO., at approximately $10,000.

Hackensack, N. J.—Bids were received, Aug. 24, by the Board of Chosen Freeholders for improving the following streets and roads: (a) Terrace Ave., Hackensack, from Essex St. to the Hasbrouck Heights Borough Line, (b) Passaic St., Maywood, from the Hackensack line to the Saddle River Township line,(c) Paramus Road from Arcola to the Franklin Turnpike, (d) Kinderkamack Road from Anderson St., Hackensack, to the Emerson Borough line, (e) Fort Lee Road from Leonia Station to the Edgewater Borough line—Di Napoli Contracting Co., (a) $24,098; George M. Brewster Construction Co, Tenafly, (a) $29,030, (d) $143,411; E. C. Humphrey, (b) $22,093, (c) $80,266, (d) $144,704, (e) $176,745; Uvalde Asphalt Co., New York, (b) $22,246, (c) $80,748; Ernest Abrahams, (e) $175,533. Noted Aug. 6.

✚Newark, N. J.—The Board of Works has awarded the following contracts for paving: Shaw Ave., bitulithic, NEWARK PAVING CO., $14,806; Seymour Ave., bitulithic, STANDARD BITULITHIC CO., $7267; Gotthart St., and Berlin St., bitulithic, NORTHERN CONSTRUCTION CO., at $18,201 and $23,709, respectively; East Kinney St., asphalt block, HASTINGS PAVING CO., $6426.

New Brunswick, N. J.—The Board of Chosen Freeholders of Middlesex has authorized the improvement of the Highland Park-Metuchen road.

Plainfield, N. J.—The Common Council has authorized the construction of a concrete road on West Third St., from Plainfield Ave. to Liberty St.

Trenton, N. J.—Preliminary arrangements are being made to start work soon on the construction of the proposed new road from Heightstown to Princeton Junction. Edwin A. Stevens is State Road Comr.

The Board of Chosen Freeholders of Mercer County has authorized the improvement of the Mercerville Road. The Board also plans the rebuilding of the Yardville-Crosswicks Road.

The Board of Chosen Freeholders of Mercer County will macadamize Stuyvesant Ave., from the city limits to Wilburtha. The city officials also plan to macadamize this thoroughfare within the city limits.

Trenton, N. J.—The Board of City Commissioners has authorized the paving of Liberty St., from Chambers to Olden Ave., with macadam.

Dermont (Pittsburgh post office), **Penn.**—Bids will be received by D. C. Dorning, Clk. of the Borough Council, until 8 p.m., Sept. 16, for grading, curbing and paving Dell Ave.

✚Franklin, Penn.—A contract for paving has been awarded to E. H. BRUA, Hollidaysburg, at approximately $14,866.

Harrison, Penn.—Bids will be received by J. A. Seal, Township Clk., until 7:30 p.m., Sept. 21, for grading, curbing and paving Kuntz St. with brick.

McKeesport, Penn.—(Official)—Bids will be received by C. E. Soles, City Controller, until 2 p.m., Sept. 14, for improving Sylvan Ave., Queen St., Ash St., and Spring Alley.

✚Philadelphia, Penn.—Contracts have been awarded for paving portions of Howard St. to JOHN DEVLIN, JR., 1253 North Hancock St., at $38,410; Grant Ave. to the UNION PAVING CO., 30th and Locust St., at $17,853, and for resurfacing a portion of Southampton Ave. to the UNION PAVING CO., at $11,493.

✚Steelton, Penn.—A contract for paving 12,000 sq.yd. with warrenite has been awarded to the STANDARD BITULITHIC CO., New York, N. Y., at $2.10 per sq.yd.

Fairfax, Va.—The County Commissioners contemplate calling an election to vote on the proposition of issuing $80,000 in bonds for improving approximately 30 miles of highway.

Pulaski, Va.—The citizens have voted $80,000 in bonds for street improvements.

Richmond, Va.—Bids will be received by the City Council, until Sept. 15, for grading and paving certain streets. C. E. Bolling is City Engr.

✚Wheeling, W. Va.—A contract for macadamizing 23,000 yd. of roadway on Cherry Hill, Wheeling and Elm Grove Roads has been awarded to BALL ENGINEERING CO.

Hillsboro, N. C.—Bids will be received by the Orange County Commissioners, until Sept. 14, for grading five miles of road. R. T. Brown is Engr.

Wilmington, N. C.—The City Council contemplates improving Market St. from Tenth to 17th St. with bitulithic. The approximate cost will be $37,000.

Columbia, S. C.—The City Council has passed ordinances for paving certain streets and laying sidewalks.

Arcadia, Fla.—The citizens of De Soto County contemplate [illegible] bonds to construct roads.

Fort Meade, Fla.—The city [illegible] in bonds for street improvements. Noted Aug. [illegible]

✦Miami, Fla.—A contract for [illegible] sq. yd. of asphalt has been awarded to the SOUTHERN ASPHALT & CONSTRUCTION CO., Birmingham, Ala. Noted Aug. [illegible]

Pensacola, Fla.—The Board of Commissioners passed an [illegible] to pave Main St. from [illegible] Jefferson St. [illegible]

✦Birmingham, Ala.—Contracts have been awarded to the [illegible] CO., [illegible] for paving North [illegible] and North [illegible] Sts., respectively.

Gadsden, Ala.—The [illegible] County Commissioners contemplate calling an election to vote on the proposition of issuing [illegible] in bonds for road construction.

Dark, Ala.—The [illegible] County Commissioners contemplate [illegible] a road from [illegible] to Troy. The road will be a part of the [illegible] highway from [illegible] to Montgomery.

Gretna, La.—The Police Jury of Jefferson Parish is contemplating [illegible] for a [illegible] road from Jefferson Parish to [illegible]. The road is to be six miles long [illegible] surfacing. The approximate cost will be [illegible]

✦Dyersburg, Tenn.—A contract for paving a number of streets with [illegible] has been awarded to the WEST CONSTRUCTION CO., Chattanooga.

✦Knoxville, Tenn.—The contract for improving the Rutledge [illegible] has been awarded to J. L. BURKHART, Knoxville, at [illegible]

✦Pikeville, Tenn.—A contract for constructing [illegible] miles of road in [illegible] County has been awarded to FREEMAN & [illegible], at approximately [illegible]

Greenup, Ky.—An issue of bonds for [illegible], the proceeds of which will be used for road improvements, is contemplated by the Greenup County Commissioners.

✦Lexington, Ky.—(Official)—A contract for constructing about four miles of streets has been awarded to the CALEY [illegible] CONSTRUCTION CO., Lexington. Noted Aug. [illegible]

Louisville, Ky.—The city contemplates spending about [illegible] for street improvements this fall.

Middlesboro, Ky.—The City Council recently passed an ordinance providing for paving Cumberland Ave. from [illegible] to [illegible] St. with macadam asphalt.

Cleveland Heights (Warrensville post office) **Ohio.**—(Official)—Bids will be received by H. H. Canfield, Village Clk., until noon, Sept. 21, for the improvement of Lee Road.

✦Columbus, Ohio.—The State Highway Department awarded contracts as follows:

Carroll County—Sect. D, Carrollton-Salineville Road, waterbound macadam, E. H. COWAN, Cleveland, [illegible]

[illegible] County—Sect. [illegible], Unity [illegible] Road, brick, THE JONES CONSTRUCTION CO., Mt. Vernon, [illegible]

[illegible] County—Sect. [illegible], [illegible] Road, brick, THE JONES CONSTRUCTION CO., Mt. Vernon, [illegible]

Greene County—[illegible] Road, waterbound macadam, THE WILSON ENGINEERING & CONTRACTING CO., Xenia, [illegible]

Harrison County—Dennison-Cadiz Road, concrete, E. H. COWAN, Cleveland, [illegible]

Highland County—[illegible] Hillsboro Road, waterbound macadam, E. H. TERRILL, Highland, [illegible]

Highland County—Hillsboro-Piketon Road, waterbound macadam, EDWARD DEAN, [illegible], [illegible]

Pike County—Hillsboro-Piketon Road, waterbound macadam, E. H. COWAN, Cleveland, [illegible]

[illegible] County—Mansfield-Galion Road, waterbound macadam, E. H. COWAN, Cleveland, [illegible]

Franklin County—[illegible]-Washington C. H. road, W. V. [illegible], [illegible]

[illegible] County—National (East) Road, BARRETT [illegible], Cleveland, [illegible]

[illegible] County—National (West) Road, [illegible] H. [illegible]HAM, [illegible]

[illegible] County—Sect. F, Millersburg-Canal Lower Road, [illegible], Millersburg, [illegible]

[illegible] County—[illegible] McConnelsville [illegible], brick, [illegible] & [illegible], Zanesville, [illegible]

[illegible] County—Sect. [illegible], [illegible]-Washington C. H. Road, waterbound macadam, BREWER, THOMPSON & [illegible], [illegible]. Noted Aug. [illegible]

Bids will be received [illegible] of the Bd. of County Comrs. until Sept. [illegible] for constructing a part of the [illegible] and [illegible] Road, the [illegible]ville Road, and East Fifth Ave.

Hamilton, Ohio.—(Official)—Bids will be received by the [illegible] until noon, Sept. [illegible], for [illegible] a section of Maple Ave. [illegible], Clk. of the [illegible]

New Lexington, Ohio.—Bids will be received by [illegible], Village Clk., until Sept. [illegible], for paving High St. with brick.

Norwalk, Ohio.—(Official)—Bids will be received by the Board of County Commissioners until [illegible], Sept. [illegible], for [illegible] Road.

Port Clinton, Ohio.—Bids will be received by William H. [illegible], Village Clk., until Sept. [illegible], for paving [illegible]

✦Toledo, Ohio.—The contract for paving [illegible] has been awarded to [illegible] & [illegible], at [illegible]

Vernon ([illegible] post office), **Ohio.**—(Official)—Bids will be received [illegible] Township Clk., until [illegible], Sept. [illegible], for [illegible] a portion of the [illegible] and [illegible] Road.

✦Zanesville, Ohio.—The contract for paving [illegible] Ave. has been awarded to [illegible], at [illegible]

✦Evansville, Ind.—The contract for paving Main St. with brick has been awarded to REICHERT & STINCHFIELD CO., Evansville.

Lafayette, Ind.—(Official)—Bids will be received by the Commissioners of Carroll and Tippecanoe Counties until 10 a.m., Oct. 1, for the construction of a county line road. G. W. [illegible] is Audr. of Tippecanoe County.

•Lamont, Ill.—See item under "Sewers."

✦Anamosa, Iowa.—A contract for paving [illegible]0 yd. with vertical fiber [illegible] has been awarded to THOMAS CALY & SONS, Clinton.

Carroll, Iowa.—Bids will be received by the Board of Supervisors until Sept. 11 for grading about five miles of [illegible] road.

✦Cedar Rapids, Iowa.—The contract for paving Third Ave. from [illegible] St. to [illegible] Ave. with creosoted blocks has been awarded to the FORD PAVING CO.

Waterloo, Iowa.—Bids will be received by the City Clerk, until Sept. 11, for paving portions of East Tenth and Steely St.

✦St. Paul, Minn.—A contract for paving Case, York and [illegible] St. with brick has been awarded to the PURINGTON BRICK CO., Galesburg.

Hutchinson, Kan.—See item under "Sewers."

✦McPherson, Kan.—A contract for paving [illegible] sq. yd. with [illegible] concrete has been awarded to the STANDARD ROOFING CO., [illegible], Okla.

Marion, Kan.—Bids will be received by the City Council, until Sept. [illegible], for [illegible] sq. yd. of brick pavement and concrete curb and gutter. H. A. Rowland, McPherson, is Engr.

Billings, Mont.—C. E. Durland, City Eng., will receive bids until Sept. 1[illegible], for constructing [illegible] yd. of concrete alley pavement.

Bozeman, Mont.—Bids will be received by A. M. Brandenburg, City Clk., until 5 p.m., Sept. 17, for paving in District No. [illegible]

✦Cape Girardeau, Mo.—The contract for paving [illegible] St., from [illegible] to Independence St., has been awarded to HARMON LOEFFEL, at [illegible]

✦St. Joseph, Mo.—A contract for grading a section of the Noyes Blvd. has been awarded to OLSEN & CAMPBELL.

El Paso, Tex.—The County Commissioners have voted to construct an asphalt road from Valeta to Quadrilla, to cost approximately [illegible],000.

Saratoga, Tex.—The citizens of Saratoga and [illegible] District will hold an election, Sept. 1[illegible], to vote on issuing [illegible],000 in bonds for road improvement.

✦Texarkana, Tex.—The contract for paving Maple and State Sts. with rock asphalt has been awarded to the BURTON HAHN CONSTRUCTION CO., Dallas.

Talihina, Okla.—The citizens have voted [illegible] in bonds for road improvements.

✦Downey, Idaho.—A contract for constructing sidewalks has been awarded to WORTHEN BROS., at [illegible]

Ogden, Utah.—(Official)—Bids will be received by F. O. Stanford, City Recdr., until 10 a.m., Sept. 16, for street improvements in Dist. No. 13.

Anacortes, Wash.—The City Council passed ordinances for paving a part of Commercial St. with concrete.

✦Seattle, Wash.—WENZLER & WARD have been awarded the contract for paving Whatcom Ave.

Spokane, Wash.—The following bids were received for grading, curbing and paving Broadway, from Post to Monroe St.: Spokane Bitulithic Paving Co., bitumen on concrete base, [illegible]; Mitchell Bros., asphalt, [illegible]; General Contract Co., Hassam concrete paving, [illegible]; C. M. Payne, wood blocks, [illegible]

✦Voncalla, Ore.—A contract for paving has been awarded to SCHELL & SCHELL, Grants Pass.

Corona, Calif.—Bids will be received by the City Trustees, until [illegible], Sept. 1[illegible], for improving Sixth St. between East Grand Blvd. and Yerba St.

✦Covina, Calif.—The contract for improving [illegible] and College St. has been awarded to PEARSON & ANDERSON, Venice, at [illegible]

✦Oroville, Calif.—The Board of Supervisors of Butte County has awarded a contract for the paving of four blocks about the courthouse to the CLARK & HENERY CONSTRUCTION CO., [illegible], Calif., at [illegible]

Sacramento, Calif.—(Official)—Bids were received Aug. [illegible] by the State Highway Commission for constructing roads in the following counties: (a) Santa Barbara County, Sect. A, Division [illegible], Route [illegible]; (b) San Diego County, Sect. [illegible], Division [illegible], Route [illegible]; (c) Kern County, Sect. [illegible], Division [illegible], Route [illegible]. Arthur S. Bent Construction Co., Los Angeles (a) [illegible]; [illegible], Visalia (c) [illegible]; [illegible] Bros. Co., Los Angeles (a) [illegible]; [illegible] Construction Co., San Diego (b) [illegible]; [illegible] Construction Co., San Diego (b) [illegible]; [illegible] & [illegible], Los Angeles (c) [illegible]. Noted Aug. [illegible]

Sacramento, Calif.—Bids will be received by the State Highway Commissioners [illegible] until [illegible] p.m., Sept. [illegible], for the following road construction: Santa Barbara County, from [illegible] to Las [illegible]; Santa Clara County, from [illegible] to southerly boundary of Santa Clara County; [illegible] County, from [illegible] to Martinez; [illegible] County, from Williams to the southerly boundary of Glenn County; [illegible] County, from Wood to [illegible]

✦Santa Barbara, Calif.—The contract for improving [illegible] and other streets has been awarded to W. F. HEWITT CO., [illegible] West [illegible] St., Los Angeles, at [illegible]

South Pasadena, Calif.—Bids will be received by [illegible], City Clk., until [illegible] p.m., Sept. 14, for improving [illegible] St.

Stockton, Calif.—The Board of Supervisors of San Joaquin County has authorized the grading and graveling of a part of [illegible] Road. The work will cost about [illegible]

+Port Arthur, Ont.—The contract for widening the roadway on May St. has been awarded to the CANADIAN RESOURCES & DEVELOPMENT CO., LTD.

+Sandwich, Ont.—The contract for paving Bedford St. from End St. to the southerly limits of the town has been awarded to the CANADIAN DOLARWAY PAVINC CO., Windsor.

+Kerrisdale, B. C.—The contract for paving approximately five-eighths of a mile on Yew St. has been awarded to LEDINGHAM & COOPER, Vancouver, B. C., at approximately $13,000.

INDUSTRIAL WORKS

Holyoke, Mass.—The Eureka Ruling & Building Co. plans to erect a three-story, 100x115-ft. factory on Water St. Ellsworth & Howes, Holyoke, are the Archs.

+New Bedford, Mass.—The contract for the erection of the addition to the plant of the Taunton-New Bedford Copper Co. has been awarded to the B. F. SMITH CONSTRUCTION CO.

Salem, Mass.—The Marston Brooks Co., shoe manufacturer, whose factory was burned in the recent fire, will remove its plant to Hallowell, Maine.

+Auburn, N. Y.—Nye & Waite, carpet manufacturers, have awarded the contract to WILLIAM MOSLEY for the erection of a two-story addition to their factory.

Buffalo, N. Y.—The Lunan Porcelain Ware Co. has had plans completed for a factory to be erected at Northumberland and Cornwall Ave. It will be 85x100 ft. Colson & Hudson, 35 Dun Bldg., Buffalo, are the Archs.

Lockport, N. Y.—The Covert Motor Vehicle Co. plans to erect an addition to its plant on Lock St. The estimated cost is $50,000.

Seneca Falls, N. Y.—Rumsey & Co., Ltd., manufacturer of pumps and fire engines, will receive bids for the construction of two factories. The estimated cost is $150,000. G. W. Thompson, Syracuse, N. Y., is the Engr.

Camden, N. J.—The Victor Talking Machine Co. has revised the plans for its $300,000 addition. Noted June 25.

The Coosa Portland Cement Co. has increased its capital stock to $3,200,000, to provide for business extensions. John B. Stevenson is Pres.

Madison, N. J.—The Madison Mfg. Co., manufacturer of binders' board, will receive bids for the construction of a factory at Kings Road and Prospect St.

Newark, N. J.—James A. Coe & Co., iron and steel, plans to build a one-story, 50x115-ft. steel building, on Marshall St. Hughes & Backoff are the Archs.

Trenton, N. J.—The Ingersoll-Trenton Watch Co. plans to erect an addition to its plant for the manufacture of watch crystals.

Allentown, Penn.—The Rionor Silk Mill will build an addition to cost $25,000.

Bally, Penn.—The Bally Hosiery Co. has purchased a site and will erect a three-story, 30x100-ft. factory. Edward Grimm is the Pres.

+Philadelphia, Penn.—The Rebman Co. has awarded the contract for the construction of its three-story, 100x150-ft. factory, to the GEORGE KESSLER CO., Philadelphia.

Philadelphia, Penn.—The Fairmount Electric Co. is taking revised bids for the construction of its factory at 59th St. and Woodland Ave. Noted Aug. 6.

The T. A. Harris Co., owner of the Continental Dye Works, has purchased a site and is having plans prepared for a new factory.

+Philadelphia, Penn.—The Berg Co. has awarded the contract for the construction of a two-story, 75x130-ft. factory to ROBERT BEATTY & BRO. CO. The estimated cost is $25,000.

Pittsburgh, Penn.—The Lawson Mfg. Co. plans to erect a three-story brick factory at Lexington and McPherson St. The estimated cost is $60,000.

Washington, D. C.—John Leary is having plans prepared for the erection of a warehouse at South Capitol and I St., S. W. The estimated cost is $18,000. W. S. Plager is the Arch.

+Norfolk, Va.—The Old Dominion Tobacco Co. has awarded the contract for the construction of its factory at Randolph and Main Sts. to BAKER & BRINKLEY. Noted Aug. 27.

Morehead City, N. C.—It is reported that the Mayor & Loomis Co. will build a box factory and sawmill, to cost $100,000.

+Waycross, Ga.—The Atlantic Coast Line has awarded the contract for the construction of an addition to its shops to the HAYWOOD ROYAL ASHBY CONSTRUCTION CO., Rocky Mount, N. C. The estimated cost is $50,000.

Lexington, Ky.—R. L. Farman plans to establish a factory for the manufacture of a patented meat cutter.

Owensboro, Ky.—W. E. Franks and W. O. Haskins plan to establish a plant for the manufacture of motor-driven cultivators.

Toledo, Ohio—The Diamond Vial Co., recently incorporated with $600,000 capital, plans to erect a glass and bottle factory at Summit and Pontiac St., Toledo. P. MacNichol is the Pres.

+Indianapolis, Ind.—The Monon Ry. has awarded the contract for the construction of its roundhouse to HARDING & SLATTRY, Crawfordsville, Ind. The estimated cost is $50,000.

Tell City, Ind.—The Southwestern Furniture Co. is having plans prepared for a four-story factory to be erected adjoining the present plant on Seventh St.

Flint, Mich.—The Buick Enamel Co. plans to erect a two-story, 108x350-ft. plant, estimated to cost $100,000.

Belleville, Ill.—The McKinley Tractor Co., manufacturer of gasoline plows, plans to build a plant in this city.

Chicago, Ill.—The International Harvester Co. plans to build an addition to its plant on West Leavitt St. The estimated cost is $18,000. I. V. Netterstrom is the Arch.

+Chicago, Ill.—The Waterous Acme Co., 4401 South Western Blvd., has awarded the contract for the construction of its factory, to the E. W. SPROUL CO. The estimated cost is $100,000. S. Scott Jay is Arch.

Rockton, Ill.—The Universal Wheel Co. plans to erect a two-story, 60x100-ft. factory on the site of the old New England Hotel. The estimated cost is $11,000.

Delevan, Wis.—The Whitewater Brick & Tile Co. has had plans completed for the erection of a new plant.

Racine, Wis.—The Chicago, Milwaukee & Racine Boat Line plans to erect a warehouse to cost $100,000.

+Davenport, Iowa—The Purity Oats Co. has awarded the contract for the construction of a five-story corn plant and mill, to the McCARTHY IMPROVEMENT CO. The estimated cost is $150,000.

Minneapolis, Minn.—Armour & Co., Fifth St. N, meat packer, plans to erect a three-story, refrigerating plant. The estimated cost is $45,000.

Fort Scott, Kan.—The New England Cereal Co., South Norwalk, Conn., contemplates moving its plant to this city, according to press reports.

East St. Louis, Mo.—The Central Pinch Bar & Awl Co. will erect a factory at Louisiana Boulevard and Jefferson Ave., to cost about $10,000. John J. Sabo is Pres.

St. Louis, Mo.—Joseph T. Ryerson & Son, East Jackson Blvd., Chicago, manufacturer of steel products, will make additions and alterations in the plant, which will cost $30,000.

St. Louis, Mo.—The factory of the Brilliant Sign Co., 420 North Eighth St., recently destroyed by fire with a loss of $20,000, will be rebuilt in the near future.

Dallas, Tex.—D. H. Swartz plans to build a soap factory which will cost $50,000, including equipment.

Houston, Tex.—J. J. Shuler has secured a site at Milby St. and McKinney Ave., and will build a factory for the manufacture of metal beds.

+Albuquerque, N. M.—The Atchison, Topeka & Santa Fe Ry. has awarded the contract for the construction of a roundhouse to HENRY BENNETT & SONS, Topeka, Kan. The estimated cost is $90,000. Noted Sept. 4.

Nampa, Idaho—C. P. Jensma plans to erect a creamery estimated to cost $30,000.

Weiser, Idaho—The Weiser Meat Co. is having plans prepared for the erection of a packing plant. The estimated cost is $20,000.

Seattle, Wash.—The B. F. Sturdevant Co., Chicago, Ill., will build a 100x200-ft. factory. The estimated cost is $100,000.

+The Port Commission has awarded the contract for the construction of a 500,000 bu. capacity grain elevator to the BUTLER CONSTRUCTION CO., Central Bldg., at $181,900. Other bids were: Brayton Engineering Co., Portland, Ore., $193,000; Hans Pederson, Madison Block, $188,000; Sound Construction Co., $189,409. Noted July 30.

Berkeley, Calif.—The San Francisco Sulphur Co., 624 California St., San Francisco, plans to erect a sulphur refining and packing plant on West Seventh St. The estimated cost is $20,000.

Emeryville, Calif.—The Peterson Tallow Co. is having plans prepared for a reduction plant. The estimated cost is $12,500.

Emeryville, Calif.—The Merchants Calculating Co. is having plans prepared for a one-story, reinforced concrete factory. The estimated cost is $50,000. E. R. McManus, Bankers Investment Co. Bldg., San Francisco, is the Arch.

Los Angeles, Calif.—The Pacific Fruit Express Co. plans for the erection of a car repair shop at 1700 San Fernando St. The building will be 100x396 ft. and will cost about $10,000.

Oakland, Calif.—The Shredded Wheat Biscuit Co., Niagara Falls, N. Y., has had plans completed for the plant to be erected in this city. The estimated cost is $150,000. Noted Aug. 27.

Owen Sound, Ont.—E. D. Pitt, Arch., and Major Gillette, Consult. Engr., Philadelphia, Penn., are preparing plans for a drydock and ship building plant to cost $1,500,000.

St. Catharines, Ont.—Kremer & Griffin, Buffalo, N. Y., have secured a site on Carleston St., where a silk factory will be erected.

Dauntless, Alta.—The Dominion Harvester Co. has had plans prepared for a new factory to cost $100,000.

Lynn Creek, B. C.—The Dominion Shipbuilding & Drydock Co., North Vancouver, B. C., has, it is reported, secured a site of 140 acres. It will establish a plant estimated to cost about $5,000,000. Machine shops will be built first.

FEDERAL GOVERNMENT WORK

Partitions, Etc.—New York, N. Y.—The following bids were received on Aug. 28 for partitions, etc., for the U. S. post office, New York, N. Y.: Estey Bros. Co., Brooklyn, N. Y., $3700; F. P. Smith Wire & Iron Works, Chicago, Ill., $5238; Hopkins & Co., New York, 4900; E. H. Titchner & Co., Binghamton, N. Y., $4967; John Williams, Inc., New York, $3700; Keyless Lock Co., Indianapolis, Ind., $7000; Cincinnati Mfg. Co., Cincinnati, Ohio, $7373; Rudolph Gersmann, New York, $3485; Joshua Horrocks, Inc., Brooklyn, N. Y., $3290. Noted Aug. 27.

Paving—New York, N. Y.—Bids were received as follows, Sept. 5, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for wood block and granite block paving at the Navy Yard, New York: Item (1), price per sq.yd. of paving for preparing subgrade, laying concrete foundations, cushion and wood block pavement over those areas where foundation is not furnished by the governement; (2) price for similar work, using granite block; (3) same as item (2), using cinder base instead of gravel; (4) price for wood block

over [illegible] areas where foundation is provided [illegible] the govern[illegible] [illegible] price for [illegible], [illegible] (6) price per [illegible] ft, for [illegible] stone [illegible] and foundation, (7) price per [illegible] for resetting [illegible], (8) price per sq ft for [illegible] [illegible] Construction Co., [illegible] West [illegible] St, New York, (1) $[illegible], (2) $2[illegible], (3) $3.1[illegible], (4) $[illegible], (5) $[illegible] [illegible] P Allen Construction Co, [illegible] [illegible]th St N E, Washington, (1) $1 [illegible], (2) $[illegible], (3) $1 [illegible], (4) $[illegible], (5) $[illegible], (6) $1 [illegible], (7) [illegible]c, (8) 13[illegible]. [illegible] Asphalt Paving Co, [illegible] Broadway, New York, (1) $[illegible], (4) $1.66, (6) $[illegible], (7) [illegible], (8) [illegible]. Frank J Gallegher, [illegible] Park Place, Brooklyn, N Y, (2) $3 [illegible], (3) $3.6[illegible], (5) $1.6[illegible], (6) [illegible], (7) [illegible]. Franklin Construction Co, 1 Hudson St, New York, (1) $3 1[illegible], (2) $2 [illegible], (3) $3 21, (4) $2 17, (5) $2 [illegible]0, (6) [illegible], (7) [illegible], (8) [illegible]. [illegible] Construction Co, 20[illegible] Broadway, New York, (1) $[illegible], (2) $3[illegible], (3) $[illegible]26, (4) $2 64, (5) $2[illegible], (6) [illegible], (7) [illegible], (8) [illegible]. J Leopold & Co, 2[illegible] Broadway, New York, (1) $1 6[illegible], (2) $3 [illegible], (3) $3 [illegible], (4) $2 6[illegible], (5) $2 [illegible], (6) [illegible], (7) [illegible], (8) [illegible]. Noted Aug 20

Storehouses—Philadelphia, Penn—Bids will be received until 3 p m, Sept [illegible], by the Commanding Officer, Frankford Arsenal, Philadelphia, for the construction of a one-story brick and reinforced-concrete building, [illegible]x1[illegible]0 ft, for a metal storehouse extension, and a one-story brick and reinforced concrete building, about [illegible]x1[illegible] ft, for an artillery ammunition storehouse.

•Lock Gates, Etc.—Pittsburgh, Penn—Bids will be received [illegible] noon, Oct [illegible], by Lieut-Col. Francis R Shunk, [illegible] Engrs, U S A, for steel lock gates, valves and [illegible]operating machinery at Lock 4, Monongahela River.

Metal Vaults—Washington, D C—Bids will be received until [illegible] p m, Sept [illegible], by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, for metal vault equipment for the stamp vaults, Internal Revenue Commissioner's Office, Auditor's Building, Washington, D C

Shipbuilding Cranes—Washington, D C—Bids will be received until 11 a m, Oct 3, by H R Stanford, Chief Bureau of Yards and Docks, Navy Dept, Washington, D C, for shipbuilding cranes at the United States navy yards, Boston, Mass, and Philadelphia, Penn

Officers' Quarters—Fort Monroe, Va—Bids will be received until [illegible] a m, Sept 21 by the Quartermaster, Fort Monroe, for alterations and additions to the officers' quarters

✦Sheet Steel Piling—Wilmington, N C—The contract for furnishing about 1[illegible]76 tons of sheet steel piling and accessories, bids received July 10 was awarded to the LACKAWANNA STEEL CO, Lackawanna, N Y, at $[illegible]4,07[illegible]. Noted June 1[illegible] and Aug 1[illegible]

Mill Work—Atlanta, Ga—Bids will be received until 10 a m, Sept 2[illegible], by F H Duehay, Supt of Prisons, Dept of Justice, Washington, D C, for mill work for the hospital building of the U S Penitentiary, Atlanta, Ga

Boiler and Stack—Key West, Fla—Bids will be received until 11 a m, Sept 26, by H. R Stanford, Chief, Bureau of Yards and Docks, Navy Dept, Washington, D C, for one 200-hp water-tube boiler with setting stack and accessories, at the Naval Station, Key West, Fla

Officers' Quarters—Key West, Fla—All bids received Jan 17, for the construction of officers' quarters at Key West, Fla, have been rejected and the project abandoned. Noted Dec 2[illegible], 1913, and Jan 29, 1914

•Cement—Montgomery, Ala—The following bids were received Aug 31 for 2[illegible]0[illegible] bbl of American portland cement, delivered at Riverside, Ala: Montgomery Lime & Cement Co, Montgomery, Ala, $1 98 per bbl, Dixie Portland Cement Co, Chattanooga, Tenn, $1 98, Carolina Portland Cement Co, Birmingham, Ala, $1 4[illegible] (recommended for acceptance), Kirkpatrick [illegible] & Cement Co, Birmingham, Ala, $1 50, Atlas Portland Cement Co, New York, N Y, $[illegible]0, Southern States Portland Cement Co, Rockmart, Ga, $1 67. Noted Aug 6

Public Building—Jellico, Tenn—Bids will be received until [illegible] by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, for the construction (including mechanical equipment) of the U S public building at Jellico, Tenn.

Public Building—Shelbyville, Tenn—Bids will be received until Oct 13 by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, for the construction (including mechanical equipment) of the U S public building at Shelbyville, Tenn.

Post Office—Fulton, K[illegible]—Bids were received as follows on [illegible] by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, for the construction of a post office at Fulton: (a) limestone, (b) sandstone: [illegible] Canton, [illegible] (a) $[illegible], (b) $[illegible]. [illegible] New York, N Y, (a) $[illegible], (b) $[illegible]. J [illegible], N J, (a) $[illegible], (b) $[illegible]. [illegible], Ill, (a) $[illegible], (b) $[illegible]. George W Stiles Construction Co, Chicago, Ill, (a) $[illegible]. The building will be two stories and basement, [illegible] area, fireproof construction, [illegible] and [illegible] facing, and composition and slate roof. Noted [illegible]

Elevators—[illegible], Ohio—The following bids were received by Oscar Wenderoth, Superv Arch, Washington, D C, for installing an electric freight elevator in the post office and court house at [illegible]: [illegible] & [illegible] Co, [illegible], $[illegible], [illegible] Co, [illegible], Ill, $[illegible], [illegible], New York, N Y, $[illegible].

Survey Boat—[illegible]—Bids for the construction of [illegible] were received by Maj [illegible], Corps Engrs, U S A, [illegible] at plant, [illegible], $[illegible] at plant. Noted [illegible]

✦Post Office—[illegible] City, [illegible]—The contract for the construction of the U S post office (limestone) at [illegible] City has been awarded [illegible], [illegible], Kan, at $[illegible]. Noted June [illegible] and Aug 6.

Post Office—[illegible]—Bids were received as follows on Sept [illegible] by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, for the construction of a post office at Winfield: (a) limestone, (b) sandstone: Frank H Latimer, Kansas City, Mo, (a) $[illegible]7,70[illegible], George W Stiles Construction Co, Chicago, Ill, (a) $[illegible]3,0[illegible]0, H[illegible] Lloyd Building & Construction Co, (a) $[illegible]4,217, (b) $[illegible]1,747, Dieter & Wenzel Construction Co, Wichita, Kan, (a) $[illegible]0,800, (b) $[illegible]1,[illegible]00, Billi[illegible] & Fielding, Guthrie, Okla, (a) $[illegible]7,[illegible]4, (b) $[illegible], Vandenberg & Paisley, Wichita, Kan, (a) $[illegible]2,77[illegible], (b) $[illegible]3,000. Building to be a two-story and basement stone, terra cotta and brick faced building of 41[illegible]0 sq ft ground area, fireproof construction except roof, to be composition roof. Noted Aug [illegible]

•Canals and Dikes—Malta, Mont—Bids will be received until 2 p m, Oct 13, by the United States Reclamation Service, Malta, Mont, for the construction of the Nelson Reservoir outlet canals, dikes and controlling works. For particulars, see advertisement under "Contracts to Be Let"

Levee Work—St Louis, Mo—All bids received Aug 11, by the Mississippi River Commission, St Louis, for the construction of about 130,000 cu yd of earthwork in the S[illegible]y Island Levee Drainage District, Ill, were rejected. Noted July 23.

Levee Work—St Louis, Mo.—Bids will be received until 11 a m, Sept. 30, by Maj Clarke S Smith, Corps Engrs, U S A, 1311 International Life Bldg, St Louis, for the construction of about 47[illegible] cu yd. of earth work in the East Cape Girardeau and Clear Creek Drainage District, Ill

Painting and Repairs—St Louis, Mo—Bids will be received until 3 p m, Sept 2[illegible], by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, for painting and repairs at the U S. post office, St Louis, Mo.

✦Riprap and Sod—Galveston, Tex—The contract for placing riprap and soil with sod at the Federal Quarantine Station, Galveston, has been awarded to CHARLES CLARKE & CO., Galveston, at $31,242. There were no other bidders. Noted July 23

✦•Dredging—Port Arkansas, Tex—The contract for dredging at Port Arkansas, Tex, has been awarded to JOHN JACOBSON, Texas City, Tex, at $[illegible]740. The Bowers Southern Dredging Co. bid $9500. Noted July 23

Elevator—Muskogee, Okla—Bids will be received until 3 p m., Sept 29, by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D. C, for the installation of an electric passenger elevator in the U. S. post office and court house at Muskogee, Okla.

Repairing Light Vessel—San Francisco, Calif—The following bids were received for docking and repairing Blunt's Reef Light Vessel No. 83: United Engineering Works, San Francisco, $1028, MARE ISLAND NAVY YARD, Mare Island, Calif, $3977 (awarded contract), Moore & Scott Iron Works, San Francisco, $5083, Union Iron Works, San Francisco, $55[illegible], Ker Lloyd Iron Works, San Francisco, $5096.

Miscellaneous Supplies—Panama—Bids will be received until 10 30 a m, Sept 11, by Major F C Boggs, Gen Pur Officer of the Panama Canal, Washington, D C, for furnishing steel angles, plates, I-beams and channels, cold-rolled steel, tool steel, frogs, point switches, steel rails, track bolts, tie plates, nut locks, bolts, nuts, rivets, boat spikes, washers, reamers, pipe cutters, files, nails, wire rope, chain, locomotive tires, brass nuts and screws, corrugated roofing, bronze paint brushes, whitewash brushes, water coolers, [illegible] paper, sandpaper, manganese dioxide, potassium chlorate and switch ties.

MISCELLANEOUS

Dredging and Bulkheads—Lynn, Mass—Bids will be received, until Sept 1[illegible], by the State Board of Harbor and Land Commissioners, Boston, for dredging a channel in the Saugus River, and building timber bulkheads. William Williams is Ch. Engr.

✦Conduit—Webster, Mass—The contract for constructing the [illegible] Brook conduit has been awarded to the T F [illegible]LINAN CO, 4[illegible] Custom House St, Providence, R I, at $1[illegible]. Other bidders were C A Leary, Boston, $17,[illegible]; M J Kane, Worcester, $[illegible]0,[illegible]; Hancock Engineering Co, Boston, $16,[illegible]; A E Daddinee, Boston, $16,[illegible]10

Fire Station—East Greenwich, R I—Bids were received Aug [illegible], for the construction of a fire station as follows: [illegible] & Co, $1[illegible]; William [illegible], $1[illegible]; Alexander Martin, $1[illegible]; [illegible] & [illegible], $16,[illegible]1; [illegible] & Fischer, $11[illegible]; [illegible] C [illegible], $1[illegible]; [illegible] L Carlson, $16,[illegible]; [illegible], $13,[illegible]; [illegible] Lumber Co, $16,[illegible]; F C [illegible] & Co, $12,[illegible]66; [illegible] Bros, $11,[illegible]; Clinton E [illegible], $11,[illegible]

Guard Rail—Hartford, Conn—Bids will be received by the State Highway Commissioner until 2 p m, Sept 1[illegible], for about 36,1[illegible] ft of standard wood guard rail.

✦Barge Canal Work—Albany, N Y—Duncan W Peck, State Supt Pub Wks, has awarded the contract for Barge Canal Contract No 11[illegible], constructing a reinforced concrete highway bridge over the Mohawk River, at Movable Dam No [illegible], near [illegible], N Y, to [illegible] & REMICK, Buffalo, at about $1[illegible]. Noted Aug 6

•Wash Borings—[illegible]sterdam, N Y—Bids will be received until [illegible] by the Common Council, for making [illegible] wash borings at City Hall, such borings to be made at such points as designated by the Commissioner of Public Works and such work to be completed on or before Nov [illegible], 1914, according to plans and specifications on file in the office of the Commissioner of Public Works. James [illegible] [illegible] is City Clerk

River Improvement—Corning, N Y—Duncan W Peck, State Supt Pub Wks, Albany, received bids, Sept 2, for improving the Chemung River at Corning. The lowest bid was submitted by the [illegible] Construction Co, Inc, Utica, N Y, at $[illegible].

Dock—Dunkirk, N Y—W H Shelton, City Engr, has prepared plans for a municipal dock to cost $1[illegible]. The U S government has made an appropriation of $[illegible],000 for harbor improvement at Dunkirk contingent on the dock being built.

Plaza Reconstruction—New York, N. Y.—Bids will be received by the Park Board, Municipal Bldg., until 3 p.m., Sept. 10, for the reconstruction of the plaza at Fifth Ave., between 58th and 59th Sts. Cabot Ward is Pres. of the Bd.

Dock—Newark, N. J.—The two lowest bids received Aug. 17 by the Board of Works for the construction of a dock 4500 ft. long, on the Newark Bay front, were from O'Gara & McGuire, Newark, $449,398; and Spearin & Preston, New York, N. Y., $497,906. Noted Aug. 20.

+Boiler—Overbrook, N. J.—The contract has been awarded by the county to DAVID C. SEYMOUR, Newark, N. J., for installing a new boiler and apparatus at the Essex County Hospital, Overbrook, at $13,198.

Tunnel—Pittsburgh, Penn.—Plans are nearing completion for the proposed tunnel to be driven by the county under the Southside Hills. Estimated cost, $2,000,000. Noted Aug. 27.

Improving Grounds—Baltimore, Md.—H. N. Brannan submitted the lowest bid at $11,200 for improving the grounds in front of the Polytechnic Institute, Baltimore.

Fire Apparatus—Huntington, W. Va.—The City Commissioners plans to issue $195,000 in bonds, the proceeds of a part of which will be used to purchase fire apparatus.

Underground Crossing—Huntington, W. Va.—The City Commissioners plan to issue $195,000 in bonds. A part of the proceeds will be used to construct an underground crossing at the Chesapeake & Ohio Ry. tracks.

+Terminal—Savannah, Ga.—According to press reports the Ocean Steamship Co. has awarded a contract to the PHOENIX CONSTRUCTION CO., 41 Park Row, New York, N. Y., for the construction of a terminal at Savannah. Estimated cost $1,000,000.

Fire Boat and Equipment—Jacksonville, Fla.—The Fire Protection Committee has recommended to the City Council the purchase of a fire boat and equipment. Estimated cost, $100,000.

Drainage—Ripley, Miss.—Bids will be received, until Sept. 12, by the Tallahatchie Drainage Commissioners, of Dist. No. 1, care of M. L. Fryer, R. D. No. 1, Ripley, for constructing a drainage canal.

Levee Work—New Orleans, La.—Bids will be received by the Board of Levee Commissioners, Orleans Levee District, until 3 p.m., Sept. 15, for levee work in the Fifth District, Mississippi River. S. St. J. Eshlemann is Pres. Pro. Tem. of the Bd.

+Breakwater—Cleveland, Ohio—The Board of Control has awarded the contract to the AMERICAN CONSTRUCTION CO., Cleveland, for constructing a breakwater around the sewage disposal plant, at $102,950.

Conduits—Cleveland, Ohio—The Cleveland Telephone Co. plans to spend $35,000 for underground conduits.

+Shelter House—Columbus, Ohio—The contract for the construction of a shelter house in Franklin Park has been awarded to ADAM PITTS at $22,505.

Police Signal System—Mansfield, Ohio—Bids will be received by C. H. Hughes, Dir. Pub. Ser., until Sept. 23, for installing a police signal system in Mansfield.

Dredging—Toledo, Ohio—The Commercial Club has petitioned the Board of Public Service to expend about $10,000 for dredging Bay View Park lagoon.

+Head-house—Chicago, Ill.—The Harbor and Subway Commission has awarded the contract to the CHANEY-ARCHIBALD CO., Chicago, Ill., for the construction of a head-house on Pier 2, Harbor District No. 1, at $121,757.

★Channel Work—Chicago, Ill.—(Official)—Bids will be received by the Sanitary District of Chicago, until Sept. 24, for excavation and collateral work on Sect. 1, Calumet Sag Channel.

Dam—Galesburg, Ill.—All bids recently received by the City Council for the construction of a dam in the new city park, have been rejected as they exceeded the appropriated amount. Estimated cost, $13,000.

Drain—Algona, Iowa—Bids will be received until 2 p.m., Sept. 30, by D. E. Norton, County Audr., Algona, for constructing Drain 99.

+Dam and Bridge—Charles City, Iowa—The Commissioners of Floyd County, Charles City, it is reported, have awarded the contract to the GOULD CONSTRUCTION CO., Davenport, Iowa, for constructing a dam and concrete bridge across Shell Rock River at Marble Rock, Iowa, at about $35,000. Noted Aug. 20 under Bridges.

Ditch—Knoxville, Iowa—(Official)—Bids will be received by J. D. Schlotterback, Audr., Marion County, until 1:30 p.m., Oct. 5, for the construction of the Skunk River Ditch No. 2.

Ditches—Storm Lake, Iowa—Bids will be received until Sept. 15, by W. W. Bennett, County Audr., Storm Lake, for constructing three ditches.

Drain—Washington, Iowa—Bids will be received until noon, Sept. 14, by H. W. Benn, County Audr., Washington, for constructing Drain No. 5.

+Ditch—Grand Rapids, Minn.—The contract has been awarded to D. A. FOLEY for constructing Ditch No. 28, at $108,706.

+Ditch—Roseau, Minn.—The county has awarded the contract to the KOHLER CONSTRUCTION CO., Frazee, Minn., for constructing Ditch 18, at about $23,000.

Park Improvements—Aberdeen, S. D.—The Park Board has asked the City Commission to appropriate $14,000 for the improvement of the city parks.

Ditches—Beaumont, Tex.—Bids will be received until noon, Sept. 21, by the Commissioners of Drainage District No. 4, at the office of J. D. Wilkerson, Weiss Bldg., Beaumont, for constructing four ditches, calling for 628,000 cu.yd. of excavation.

Drainage Work—Beaumont, Tex.—The Attorney General, Austin, Tex., has approved a bond issue of $78,500 for drainage work in Jefferson County Drainage Dist. No. 4.

Drainage Improvements—Clodine, Tex.—Bids will be received by B. A. Everets, Chn. Drainage Comrs., until 10 a.m., Sept. 12, for drainage improvements in the Fort Bend County Drainage District No. 1. Clifton Race, Richmond, Tex., is Engr.

Levee—Eagle Lake, Tex.—Plans have been completed by J. C. Nagel and G. R. Abney, Engrs., both of Eagle Lake, for levee work to cost $67,000.

Jetty—Chehalis, Wash.—The County Commissioners, Chehalis, are considering the construction of a jetty to change the channel of the Cowlitz River.

+Wharf—Seattle, Wash.—The Port of Seattle Commissioner has awarded the contract to the BUTLER CONSTRUCTION CO., Central Bldg., Seattle, for constructing a wharf on the turning basin of East Waterway, at $67,971.

Foundations—Portland, Ore.—The Portland Bridge & Bldg. Co. submitted the lowest bid to the city for the foundations for a warehouse and dock, at $40,000.

Improving Playgrounds—Oakland, Calif.—The city is considering spending $81,000 for playground improvement.

+Mausoleum—Riverside, Calif.—The Granite Mausoleum Co., 810 South Flower St., Los Angeles, has had plans prepared for a community mausoleum to be erected in Olivewood Cemetery, Riverside. The structure will cost $85,000. The general construction work will be under the supervision of J. A. Mathis,3 36 West 31st St., Los Angeles, vice-pres. of the company. The grante work will be done by BLY BROS. & McGILLARD. C. E. Bly is Treas. of the company, and Fred E. Pierce of Pierce Bros., undertakers, is Pres.

Pier Work—San Francisco, Calif.—The lowest bid submitted to the Harbor Commission, Aug. 27, for reconstructing Pier 23, was that of Hyde, Hayes & Co., San Francisco, at $10,865.

Breakwater Extension—Goderich, Ont.—Bids will be received until Sept. 11, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing an extension to southwest breakwater, Goderich.

Drainage—Minto, Ont.—Bids will be received until Sept. 14, by W. D. McLellan, Harriston, Ont., for six miles of drainage work at Minto. Plans may be seen at the office of Mr. McLellan or at the office of C. D. Bowman, West Montrose, Ont.

+Wire—Ottawa, Ont.—The STEEL CO. OF CANADA, LTD., Montreal, Que., has been awarded the contract by the Department of Public Works, Ottawa, for 270,000 lb. of telegraph wire, delivered at Montreal, Que., and 342,000 lb. delivered at Vancouver, B. C.

+Cement—Winnipeg, Man.—The city has awarded the contract to the CANADA CEMENT CO., LTD., Herald Bldg., Montreal, Que., for from 20,000 to 30,000 bbl. of cement, at $2.40 per bbl.

+Tunnel—Juarez, Mexico—The Mexico Northwestern Ry. Co. has awarded the contract to WILLIAM ORR, El Paso, Tex., for reconstructing the Cumbra Tunnel.

BUILDINGS

Fall River, Mass.—Competitive plans will be received by the City Council, until Sept. 14, for constructing a police station on Bedford St. James H. Kay is Mayor.

Arlington, Mass.—The following bids have been received for the construction of the high school: Light, Heat and Power Corporation, $156,530; F. C. Alexander, $157,940; A. M. Gilbert, $159,950; Central Building Co., Worcerter, $162,400; Patrick Rich, $164,500; William Crane, Cambridge, $165,977; C. S. Sunningham & Sons Construction Co., $166,576; Marr Bros. & Stewart Co., $166,877; John W. Duff, Inc., $169,953; J. E. Locatelli Co., $171,111; Woodbury & Leighton Co., $173,415; E. T. Wilson, $176,000; J. Slotuck, Chelsea, $182,441. Noted April 23.

Holyoke, Mass.—Plans are being prepared by John W. Donahue, Springfield, Mass., for a building for the hospital of the Sisters of Providence, at Northampton St. and Westfield Road. The building will be three stories, of brick, and is estimated to cost $275,000.

Springfield, Mass.—Bliss & Lavalle, Archs., Springfield, are preparing plans for a three-story brick school in West Springfield.

+Springfield, Mass.—The "Woman's Shop" has awarded a contract to the CASPER RANGER CO., Holyoke, Mass., for the erection of a five-story business block on Main St., to cost $75,000. S. A. Cohen is Pres.

Providence, R. I.—The Board of Education has had plans prepared for a 19-room school on Mt. Pleasant Ave. and a 16-room school on Laurel Hill Ave. Noted July 9.

Middletown, Conn.—Bids will be received by Walter P. Crabtree, Arch., 272 Main St., New Britain, until Sept. 15, for erecting the 1½-story marble bank building for the Middletown National Bank. Noted July 16.

+Albany, N. Y.—The contract for rebuilding the brick and steel office building at State and Green Sts. has been awarded to the STEWART ENGINEERING CO., 17 Battery Place, New York, N. Y. W. J. Obenaus, 119 State St., Albany, is Arch.

Binghamton, N. Y.—The city has voted $233,000 in bonds for erecting two schools.

Buffalo, N. Y.—Green & Wicks, Archs., 110 Franklin St., are preparing plans for a stone residence at Delaware and Cleveland Sts. for Frederick Forman, Fidelity Trust Bldg. The estimated cost is $100,000.

+The general contract for constructing the brick and steel passenger and freight station at the entrance to the International Bridge, for the Grand Trunk Ry. has been awarded to METZ BROS., Builders Exchange, at about $100,000.

★Ithaca, N. Y.—(Official)—See item under Light, Heat and Power.

New York, N. Y.—(Borough of Manhattan)—Schwartz & [illegible] Ave., have completed plans for a [illegible]-story [illegible] West End Ave. and [illegible] St. for the [illegible] West End Ave. The building will cost about [illegible].

(Borough of [illegible]) [illegible] Ave., is preparing plans for a [illegible] at [illegible] and [illegible] Ave. [illegible] Co. [illegible] The cost is about [illegible].

(Borough of [illegible]) [illegible] Stone Ave., are preparing plans for a six-story tenement, [illegible] ft., on South [illegible] for the [illegible] Construction Co. [illegible] cost is about $[illegible].

[illegible] have completed plans for [illegible] ft. on [illegible] Place, for [illegible] St. [illegible] Levy is Pres. The building will cost about $[illegible].

Millville, N. J.—[illegible] 116 South Fourth St., [illegible] plans for a two-story school for the Board of Education, to cost about $[illegible].

+West Hoboken, N. J.—[illegible] The contract for [illegible] the Board of Education to the [illegible] CONSTRUCTION CO., Yonkers, N. Y. [illegible] Noted Aug. 6.

+Allentown, Penn.—The contract for erecting the three-story [illegible] school at [illegible] and Turner Sts. has been awarded to [illegible] H. HARTNEN, Allentown, at $171,-[illegible] Noted Aug. 26.

+Philadelphia, Penn.—The contract for the construction of a [illegible] building at [illegible] North Broad St., for the Loyal Order of Moose has been awarded to STACY REEVES & SONS, Philadelphia, at about $[illegible].

+Warren, Penn.—The contract for building the two-story addition to the [illegible] school has been awarded to WILLIAM [illegible] & SON, Warren, at $[illegible].

Cumberland, Md.—It is reported that bids will be received by [illegible] M. Anderson, Arch., [illegible] North Charles St., Baltimore, for erecting the five-story hotel for the Cumberland Hotel Association. The estimated cost is $150,000. Noted July [illegible].

+Frederick, Md.—LLOYD C. CULLER, Frederick, has been awarded the contract for the construction of a dormitory for Hood College, Frederick. The building will be four stories, [illegible] ft., and will cost about $60,000. John B. Hamme, York, Penn., is Arch.

+Towson, Md.—The contract for erecting the dormitories at the Normal School has been awarded to EDWARD BRADY & SONS, Baltimore, at $1[illegible]. Parker, Thomas & Rice, Baltimore, are the Archs. Noted Mar. [illegible].

Washington, D. C.—J. H. de Sibour, Hibbs Bldg., is preparing plans for a six-story apartment at [illegible] St. and Massachusetts Ave., N. W., to cost about $1[illegible]. Bids for the work will be called about Jan. 1, 191[illegible].

+Keyser, W. Va.—The contract for the construction of a dormitory for the Preparatory School of the West Virginia University at Keyser, has been awarded to SHRAKE SONS & CO., New Matamoras, Ohio, at about $40,000.

Martinsburg, W. Va.—Plans are being prepared by C. C. [illegible], for the construction of a five-story, [illegible]-ft. office and apartment building for O. M. Ramsey & Co. Estimated cost, $[illegible].

Parkersburg, W. Va.—Bids will be received by the Citizens [illegible] Fifth St., until Sept. 1[illegible], for erecting a Masonic Temple. W. T. [illegible] is Secy.

+Pensacola, Fla.—The contract for erecting the hospital for the Sisters of Charity, on North [illegible] St., has been awarded to EVANS BROS. CONSTRUCTION CO., Birmingham, Ala., at about $[illegible]. Noted April 2[illegible].

+St. Petersburg, Fla.—The contract for the erection of the depot for the Atlantic Coast Line Ry. has been awarded to [illegible] PARKER, Tampa, at $[illegible].

+Tampa, Fla.—The contract for erecting the four-story reinforced concrete and brick building for the Telephone Co. has been awarded to [illegible] & [illegible] CONSTRUCTION CO., Tampa, at about $[illegible]. Manfoey & Elliott, Tampa, are the Archs.

+Mobile, Ala.—The Southern Ry. Co. has awarded the contract [illegible] MOBILE [illegible] & HANCOCK, Mobile.

+Laurel, Miss.—The contract for erecting the Y. M. C. A. building has been awarded to W. M. [illegible], Laurel, at about $[illegible]. Noted May [illegible].

+Louisville, Ky.—Contracts for the addition to the [illegible] have been awarded as follows: [illegible] & [illegible], at $[illegible]; heating and plumbing, [illegible] & CO.

The contract for the erection of the [illegible] for the [illegible] Co. has been awarded to [illegible], Louisville, Ky., at $[illegible].

Cincinnati, Ohio.—[illegible] H. Hart [illegible] site [illegible] theater will be erected. J. [illegible], Boston, Mass., is the Arch.

Cleveland, Ohio.—The plans for the [illegible] building [illegible] The estimated cost is [illegible] is the Arch. Noted Aug. [illegible].

The [illegible] has awarded the contract for the construction of a six-story [illegible] CONSTRUCTION CORP. The estimated cost is $[illegible].

Cleveland, Ohio.—The [illegible] Realty Co. has had plans prepared and will erect a [illegible]-story [illegible] building at [illegible] Ave. and East Third St. The estimated cost is $[illegible]. [illegible] New York, N. Y., are the Archs.

Niles, Ohio.—[illegible] Sept. [illegible] $[illegible] bond issue [illegible] McKinley memorial. The building will cost $[illegible] and a statue to be placed in front of the building will cost $[illegible].

Willoughby, Ohio.—The Board of Education is having plans prepared for a high school to cost about $1[illegible]0,000. Frank C. Werner, Hippodrome Bldg., Cleveland, is the Arch.

+Youngstown, Ohio.—THE IRON CITY LUMBER CO. has been awarded the contract for the erection of the high school at $1[illegible].

Indianapolis, Ind.—The contract for the construction of a school at [illegible] and Walnut Sts. has been awarded to the [illegible] & [illegible] Co., Indianapolis. The estimated cost is $[illegible].

Detroit, Mich.—The [illegible] Realty Co. has had plans prepared for the Gratiot Central Market [illegible], to be erected on Gratiot Ave. The estimated cost is $[illegible]. [illegible] & Gratiot, Detroit, are the Archs.

+Grand Rapids, Mich.—The contract for the erection of the Masonic Temple has been awarded to CHARLES HORTON & SON, Grand Rapids, at $[illegible]. Noted May [illegible] and Aug. [illegible].

+Alton, Ill.—The following contracts have been awarded for work on the Alton State Hospital: General contract for erecting administration building, two reception cottages and cottage for untidy females, A. W. STOLLMAN, [illegible], at $1[illegible],274; general contract for nurses' home, A. W. STOLLMAN, at $6[illegible]; heating and plumbing in all buildings, JACKSONVILLE PLUMBING & HEATING CO., at $[illegible].

Decatur, Ill.—The Finn & Heimman Amusement Co., Chicago, has secured a site and will erect a theater to cost $1[illegible].

Milwaukee, Wis.—C. J. Pinney, Supt. Public Bldgs., is preparing plans for an isolation hospital to be erected at 14th Ave. and Mitchell St. The estimated cost is $1[illegible].

+Brainerd, Minn.—The contract for the erection of the city hall has been awarded to the HODGIN CONSTRUCTION CO., at $77,000.

Minneapolis, Minn.—St. Stephens R. C. Church plans to build a three-story brick parochial school at Clinton Ave. and [illegible] St. The estimated cost is $60,000.

Mitchell, S. D.—The Commercial Club has decided to build a corn palace for next year. Plans are now under consideration. The estimated cost will be about $90,000. T. J. Morgan is the Secy.

+Sioux Falls, S. D.—The Security National Bank has awarded the contract for the construction of its building to the HOLCOMBE CONSTRUCTION CO., Oklahoma City, Okla., at $161,000.

+Rock Springs, Wyo.—The contract for the construction of the high school has been awarded to E. H. COWLEY, Denver, Colo. The estimated cost is $[illegible].

+Glasgow, Mont.—The contract for the erection of the high school has been awarded to LEIGHLAND KLEFFE & CO., Great Falls, at $1[illegible],000.

Great Falls, Mont.—The Knights of Columbus have purchased a site and will erect a home. The estimated cost is $[illegible].

Tentative plans have been prepared for an addition to the Deaconess' Hospital. The estimated cost is $[illegible].

+Helena, Mont.—The Helena Investment Co. has awarded the contract for the construction of the four-story office building, to JACOBY & SONS. The estimated cost is $[illegible].

Springfield, Mo.—It is reported that bids will be received until Sept. [illegible], by Opel & Torbitt, Archs., for the construction of a five-story, 86x1[illegible]0-ft. department store.

El Paso, Tex.—The Hendricks Sanatorium Co. has had plans prepared for a sanatorium which will cost about $[illegible].

Houston, Tex.—The Western Electric Co. is having plans prepared for the erection of a building at Commerce and Jackson St. Estimated cost about $70,000.

San Antonio, Tex.—(Official) A. Caswell Ellis of the School Board, San Antonio, announces that bids will be received by the School Board until noon, Sept. [illegible], for constructing the manual arts high school at an estimated cost of $[illegible]. L. M. J. [illegible], [illegible] East Commerce St., San Antonio, is the Arch.

Waco, Tex.—W. T. Watt plans to erect a six-story hotel and office building, to cost about $[illegible].

+Seattle, Wash.—The PUGET SOUND BRIDGE & DREDGING CO., general contractors for the King County Courthouse, have awarded the contract for roofing and exterior metal trim, to the SEATTLE CORNICE WORKS, at $[illegible]. Noted Apr. [illegible], May [illegible], June 18.

Tacoma, Wash.—F. F. Champney, Arch., Seattle, has been commissioned to prepare plans for a [illegible]-story building for the Elks Club. The estimated cost is $[illegible]. Noted July [illegible] and Sept. 3.

+Eugene, Ore.—The contract for the erection of the high school has been awarded to A. C. [illegible]. The estimated cost is $[illegible]. Noted June [illegible].

La Grande, Ore.—The plans for the Elks Club are nearing completion. The building will be three stories and will cost $[illegible]. [illegible] & [illegible], Henry Bldg., Portland, are the Archs. Noted July [illegible].

Portland, Ore.—[illegible] & [illegible], Archs., [illegible] Trade Bldg., are preparing plans for a [illegible] Catholic church and convent to be erected at [illegible] and [illegible] St. The estimated cost is about $[illegible].

The First National and Security Savings & Trust banks are having plans prepared for a building to cost $[illegible]. [illegible] & Coolidge, Boston, Mass., are the Archs. Noted July [illegible].

Fresno, Cal.—[illegible], Arch., Forsyth Bldg., is preparing plans for the Washington School, to be erected at a cost of $[illegible].

Los Angeles, Calif.—[illegible] & [illegible], Archs., have completed plans for a [illegible] building to be erected at [illegible] Ave. and Seventh St. The estimated cost is $1,000,000. J. W. [illegible] is the owner.

[illegible] H. McDougall, State Arch., is preparing plans for a State Hospital for the Insane. The estimated cost is $1[illegible],000.

+Roseville, Calif.—The Board of School Trustees has awarded the contract for the construction of the Roseville high school to H. A. KLYCE, San Francisco, Calif., at $41,900.

+Toronto, Ont.—The following contracts have been awarded for work on the Registry Office Building by C. S. Cobb, Arch.: Steel, TORONTO STRUCTURAL STEEL CO., at $42,600; carpentry, JAMES A. BERRIDGE, at $19,984.

+Toronto, Ont.—The Excelsior Life Association, Adelaide and Toronto Sts., has awarded the contract for the construction of its office building to the PETER LYALL CONSTRUCTION CO., Montreal. The estimated cost is $500,000.

Edmonton, Alta.—J. H. Garthy plans to build a seven-story brick and terra cotta office building on Jasper Ave. The estimated cost is $200,000. Van Siclen & Macomber, Alexander Bldg., are the Archs.

Southern California Notes—Business conditions are beginning to pick up here, especially in the building line, and a general increase in the cost of materials is predicted.

The Exposition buildings at San Diego are rapidly nearing completion and make a very good showing. The exhibit will be in the nature of a "back-to-land movement," and the arrangements already made insure an interesting visit to the fair.

The reclamation of about 60 acres of water front along San Diego harbor, together with the municipal docks, is progressing rapidly, and plans are now being considered for extending the area of reclamation for a considerable distance to the north of the present contract.

The Los Angeles harbor improvements show considerable activity and will soon be in a position to handle the trade that will come from the Panama Canal.

Engineering Work in British Columbia

In British Columbia, as elsewhere in Canada, business was suffering a depression prior to the declaration of war in Europe. The war so precipitated matters that work, other than that which is absolutely essential, is at a standstill.

Notwithstanding assurances from the British Government to the effect that practically all shipping on the high seas is now safe, confidence has not been restored, and will not be until more definite information is received.

Remote as this may seem from the business situation in British Columbia, it is nevertheless considered most important.

The present situation might be termed hesitation rather than depression, for there is much important construction in abeyance. Underlying the untoward conditions, there is a current of optimism which looks for and forecasts a speedy resumption of business and a return to the nearer normal just as soon as money becomes easier through confidence restored.

It should be remembered that for big works—railway development and the like—British Columbia depends to a large extent upon London capital, which is just now impossible to secure.

Municipal and building activities should not be greatly hindered, for the backbone of British Columbia industry—fishing, lumber, mining, etc.—is, generally speaking, in a flourishing condition. Well established industries did not suffer greatly from the financial depression and should be a great aid to rapid adjustment.

The Government of the Dominion of Canada has stated that public works will proceed according to schedule, but the Provincial Government here seems disposed to curtail expenses. The science building of the British Columbia University, a government institution, is the first large contract award to be postponed indefinitely by them on account of the war.

The city of Vancouver has similarly intimated that it will do no more than necessary work. The local press is, at the time of writing, carrying the city's advertisement cancelling the call for tenders for the construction of sidewalks, and permitting contractors to withdraw bids already made.

On the other hand, the Board of Trade of the city of Vancouver, an influential body of British Columbia business men, intends to at once bring pressure to bear upon municipal and provincial governments to the end that public works will be carried on as extensively as possible. It is thought that this may result in activities which will insure more of this work being done than in each of the last two winters.

At New Westminster, work is progressing on the harbor improvement scheme, and it is expected that the new wharf of the city on Front St. will be finished in about three weeks. The total cost of this work, including the cost of the construction plant, is estimated at $19,283. Work done last month cost $30,000, leaving the sum of $180,716 to be still expended out of the half million dollar bylaw.

The award of contracts for the proposed soap works to be established by the Royal Crown Soap Works, Ltd., of Vancouver, B. C. (closely identified with Lever Bros., Port Sunlight, England), on the south shore of Burrard Inlet, near the Second Narrows, has been deferred on account of the war situation. Bids were closed nearly two weeks ago. The enterprise was to have been financed in London and the plans called for the expenditure of $250,000.

It is affirmed that there will be no cessation of construction on the new $5,000,000 plant of the Dominion Shipbuilding and Drydock Co., Ltd., at North Vancouver, B. C.

The Burrard Inlet Tunnel & Bridge Co., Ltd., has had no meeting since the war broke out. Plans for its $2,000,000 bridge have been taken under advisement and are now being adjudicated upon by Ralph Modjeski, at Chicago, Ill. Contracts will probably be let later. In the "Engineering News" of July 16, 1914, it was stated in error that this contract had been let to the Foundation Co.

The British Columbia Steel Co., Ltd., has completed plans for the establishment of a $200,000 steel plant at Bridgeport, B. C., and the stock is now on the market. The company states that it will shortly commence building operations. The head office of the company is at Vancouver, B. C., nd many prominent business men of the city, including Francis Leighton, general manager of the Vancouver Engineering Works, Ltd., are named as provisional directors.

Construction on the Pacific Great Eastern Ry. has not slowed up in the least and satisfactory progress reports are being continually published.

At a special meeting of the South Vancouver, B. C., Council, a communication was read from the Voters' League protesting against the Council's action in letting the contract for Victoria Road pavement to the Columbia Bithulithic Co., claiming that the work could be done cheaper by day labor. The Reeve replied that the company's tender was a good deal lower than the engineers' estimate.

At Fort Moody, B. C., the street improvement work on John and Clark Sts. was ordered proceeded with at the last meeting of the Council. Work will cost $45,000 and will be done as a local improvement. A letter was also read from a Toledo, Ohio, firm of bond buyers confirming the recent order of 92 net for water loan debentures of $80,000. It is therefore expected that the water system from Noon's Creek will be started at an early date.

The latest information available from the lumber mills shows that they expect to have to reduce their output on account of the temporary stagnation of the market.

Building has practically ceased, but in Vancouver city alone, buildings are projected none of which will cost less than $40,000, and aggregating in value over $12,000,000. Building in outlying districts is similarly situated. It is therefore expected that as soon as confidence is restored, building will proceed on a big scale.

The Prince Rupert, B. C., hydroelectric plant has been held up, due to the purchase of penstocks in Germany and their consequent non-arrival on account of hostilities.

A Royal Commission recently began hearings on trade conditions in Canada in connection with trade commissions in other parts of the British Empire. Its activities will not be discontinued, but on account of the outbreak of war it will limit its hearings for the present to the Maritime Provinces, in accordance wtih instructions received from London.

The wearing off of the novelty of the war will result in a partial resumption of business activity.

Permanent Trade Exposition in South America—The proposition for permanent expositions of American manufacturers in South American capitals is growing in favor throughout the United States.

Word was received in New York this week that Baltimore merchants are arranging to open an exhibition of their own in some capital.

Pittsburgh according to reports, will spend a million dollars in showing the Southern republics what it can do in the way of providing iron and steel and other manufactures.

Exporters, associations and chambers of commerce are receiving letters from merchants and manufacturers all over the country, urging that everybody combine in the permanent expositions.

The following statement was authorized this week by the National City Bank:

"Permanent exhibitions of American manufactured articles maintained at South American centers would undoubtedly prove of large value in the development of foreign trade with South America. The Commercial Association of the city of Chicago has maintained an exhibit at Buenos Aires for the last three years with a representative in charge of the exhibit.

"It would seem that a coöperative effort on the part of New York and New England manufacturers along these lines would be very beneficial.

"An effective plan for establishing such an exhibition would be for the chambers of commerce of the cities interested in developing the South American markets to combine to provide competent representatives and publicity agents at joint expense, meeting the expense in proportion to the number of members of the respective associations interested in the South American field. The individual exhibitors should be charged not to exceed $100 a year, and for this amount would receive a certain number of square feet for their exhibit.

"The general cost to the Association of Commerce of the City of Chicago for the exhibit maintained at Buenos Aires was in the neighborhood of $50,000 for the three and a half years that the exhibit has been there, and the individual cost to the exhibitors has been $100 a year for approximately 30 sq.ft. of space. In New York and the New England States there ought to be at least five hundred firms which would be willing to maintain an exhibit. The expense for each chamber of commerce would by coöperative effort be reduced to what would not amount to more than an ordinary advertising appropriation.

"The exhibit would serve as a center for American activities, where purchasers would be invited to inspect the goods, competent salesmen would represent the various lines, and in the case of machinery, skilled mechanics and demonstrators could be employed to point out the talking points in favor of American machinery.

"Where a number of competing firms should become members of the exhibit, an arrangement could be made for pooling the sales and dividing the profits.

"The purpose of the exhibit would be to introduce American goods, to create a demand for them and to demonstrate their superiority.

"Particular lines of goods could be featured on certain exhibition days, which days could be announced with appropriate advertising and circulars, and every effort could be made to keep the lines of American goods filled and thoroughly up to date. An exhibit of this kind would be one of the most practical means of directing the attention of South Americans to American products."

John Barrett, director of the Pan-American Union, summed up the commercial possibilities of trade with South America recently. The 20 South American countries in 1913 conducted a foreign commerce valued at $2,870,188,575. The imports were valued at $1,304,261,763, and the exports took up the remainder. This gave the combined countries a trade balance with the world of $261,655,049.

The American Manufacturers Export Association has sent out a "Warning to Exporters." It tells them to proceed very carefully in going into South American trade. They should acquire first an accurate and complete knowledge of conditions and requirements essential to the successful conduct of foreign trade.

Contracts to Be Let

Bids received until Oct. 22, 1914.

Market Street Bridge

NOTICE TO BRIDGE CONTRACTORS

Chattanooga, Tennessee
August 31st, 1914

Sealed proposals directed to the undersigned, and endorsed on the outside of the envelope "MARKET STREET BRIDGE BID," will be received at the Office of the County Judge, County Court House, until 10.00 A.M., October 22nd, 1914, for the construction of a bridge at Market Street across the Tennessee River at Chattanooga, Tennessee. The bridge will be fifty (50) feet in width by approximately 2000 Ft. in length and will consist of

(a) Nine (9) reinforced concrete girder spans, forty (40) Ft. each.

(b) Two (2) reinforced concrete arches, each (16?) One hundred and sixty five ft. span.

(c) Four (4) reinforced concrete arches, each (180) one hundred and eighty ft. span.

(d) One (1) three hundred (300) ft. steel span of the SCHERZER ROLLING LIFT DOUBLE LEAF BASCULE TYPE.

Bids for the construction of the above bridge, will be asked for as follows:

(a) For the masonry and the concrete portion of the bridge complete.

(b) On the steel portion of the Scherzer Rolling Lift Double Leaf Bascule complete with machinery installed and ready for use.

(c) Same as (b), except the machinery omitted.

(d) On the masonry and reinforced concrete and steel portion of the bridge including the Scherzer Rolling Lift Double Leaf Bascule complete.

The Tennessee River Bridge Committee reserves the right to let the reinforced concrete portion and the steel portion separately or to let the entire work to the lowest responsible bidder on one bid for the construction of the bridge complete.

The bonds for the construction of the above mentioned bridge at Market Street, amounting to Five Hundred Thousand ($500,000.00) Dollars have been issued and sold at a premium. The entire proceeds of the bond sale have been deposited in local banks, and is available for expenditure on the construction of this bridge.

Blank forms for proposals, contract and bond, plans and specifications may be seen at the Office of the County Engineer, County Court House, Chattanooga, Tennessee, and will be furnished on application on or after September 25th, 1914, at the Office of Mr. H. H. Davis, Consulting Engineer, Whitehall Bldg., New York City, N. Y. Said application, however, shall be accompanied by a deposit of Fifty ($50.00) Dollars which will be required for each set of plans and specifications for the masonry or reinforced concrete portion of the bridge and Twenty Five ($25.00) Dollars which will also be required for each set of plans and specifications of the steel portion of the bridge, i.e. Scherzer Rolling Lift Double Leaf Bascule. The above deposits for plans and specifications will be returned to all contractors submitting a bid upon the return of the above mentioned plans and specifications. The successful contractor will be required to execute an approved Surety Company bond, for [illegible] per cent of the estimated value of the work as determined from the bids to assure the faithful performance of the contract, and the payment for all labor and material, which may be used therein. Monthly estimates will be made of the work done and of materials of construction delivered at [illegible] showing the [illegible] and ninety (90) % of [illegible] on the 15th of [illegible]

[illegible] at all times and abutments and [illegible] to examine the [illegible] to be excavated and to familiarize themselves with the site and local conditions before submitting their proposals.

The right is reserved to reject any and all bids.

TENNESSEE RIVER BRIDGE COMMITTEE
Theo. F. King, Chairman,
L. B. Bryan, Secretary,
J. B. Ragon,
W. Cummings,
H. F. Lawrence.

Bids received until Sept. 28, 1914.

Construction, Structural Steel, Heating, Plumbing, etc.

NOTICE TO CONTRACTORS. Sealed proposals for construction, structural steel, heating, plumbing and electric work for the Drill Hall, Cornell University, Ithaca, N. Y., will be received by the Hon. E. L. Williams, Cornell University, Ithaca, N. Y., until Monday, Sept. 28, 1914, 4 P.M., when they will be opened and read publicly. Bids will be received for each division of the work separately and no combination of bids will be considered. Proposals shall be accompanied by certified check in the sum of five per cent of the amount of bids, and the contractors to whom the awards are made will be required to furnish surety company bonds in the sum of fifty per centum of the amount of contract, within thirty days after official notice of award of contract, and in accordance with the terms of the specifications Nos. 1965, 1966, 1967 and 1968. The right is reserved to reject any or all bids. Drawings and specifications may be consulted and blank forms of proposals obtained at the office of the Treasurer, Cornell University, at the Department of Architecture, Capitol, Albany, N. Y., at the New York Office of the Department of Architecture, Room 1221 Woolworth Building, New York City. Plans and specifications will be ready Tuesday, Sept. 8, 1914. In applying for plans and specifications each bidder must state which part of the work, (such as construction, structural steel, heating, plumbing and electric work) he intends to bid on. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon deposit of certified check in the sum of $15.00 for construction work or structural steel, and in the sum of $10.00 for each set of heating, plumbing or electric plans, which check will be returned if plans and specifications are sent back in good order to the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

Bids received until October 15, 1914.

Proposals for Steel Highway Bridge

Department of Public Works, Dominican Republic, Santo Domingo, Sept. 1, 1914.

Sealed proposals will be received at the office of the Director General of Public Works, Santo Domingo, R. D., until [illegible] o'clock a. m., October 15, 1914, for furnishing all labor and materials for the erection of a steel highway bridge across the Ozama River at Santo Domingo City, Dominican Republic, in strict accordance with the plans and specifications which may be examined at the office of the Director General of Public Works in Santo Domingo City or which may be had by making application in writing to the Strauss Bascule Bridge Co., Chicago, Ill., Consulting Engineers.

Bids received until Sept. 14, 1914.

Garbage Incinerator

NOTICE TO CONTRACTORS

Charlotte, N. C., Aug. 31, 1914.

Sealed bids are asked for and will be received until [illegible] P. M., Monday, 14th, September, 1914, by the City Clerk of Charlotte, N. C., for the construction of a Garbage Incinerator Building and 100 ft. [illegible] Brick Stack, each or all.

Copies of the Plans and Specifications, proposal forms, contract form, bond, etc., may be seen in the Office of the City Clerk, at the City Hall, Charlotte, N. C., or may be obtained from him by prospective bidders upon depositing $3.00, which sum will be refunded upon return of the Plans and Specifications in good condition. A certified check for at least 5% of the amount of the bid must accompany each bid.

A. H. WEARN,
City Clerk.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

AUGUST BUILDING RETURNS

The contemplated building operations in eight cities on the Pacific Coast from plans filed in August amounted to $5,467,005, compared with $9,111,144 in August, 1913, or a falling off of 40%. There was only a decrease of 14% in the first eight months of this year, compared with the figures of last year. The aggregate for eight months of 1914 was $61,142,030, and for 1913, $71,109,444.

PACIFIC COAST STATES

	Aug. 1914	Aug. 1913	First 1914	8 Mos. of Yr 1913
Los Angeles, Calif.	$1,285,597	$3,501,593	$13,174,868	$23,834,597
Oakland, Calif.	411,889	1,265,053	3,281,059	6,393,184
Portland, Ore.	409,390	1,168,245	5,461,051	9,419,945
Spokane, Wash.	31,455	110,929	806,752	2,467,518
San Diego, Calif.	208,408	716,481	2,574,646	5,232,213
San Francisco, Calif.	1,415,271	1,613,881	24,161,483	14,544,936
Seattle, Wash.	1,565,525	582,425	9,969,970	7,216,515
Tacoma, Wash.	139,460	152,537	1,712,207	2,000,536
Totals	$5,467,005	$9,111,144	$61,142,036	$71,109,444
	Loss	40%	Loss 14%	

RAILWAYS

New Jersey—Philadelphia & Reading Ry.—This company has completed surveys for eliminating the grade crossings at Willow, Calhoun, Marion and Prospect Sts., in Trenton, N. J. William Hunter, Philadelphia, Penn., is Ch. Engr.

West Virginia—The construction of a railroad from Holling Junction to Webster Springs, W. Va., is contemplated by the Baltimore & Ohio R.R. and the West Virginia Midland Ry. This line will connect with a line being built by the West Virginia Pulp & Paper Co.

Florida—South Florida & Gulf Ry.—This company plans to resume work at once on its proposed extension from Kenansville, Fla., to Bassenger, Fla., 35 miles.

Tennessee—Jellico Coal & R.R. Co.—This company has been organized for the purpose of constructing a railroad from a point near Pine Knot, Tenn., to Jellico, Tenn., 18 miles. D. C. Barker, Jellico, Tenn., is Consult. Engr. Noted Aug. 20.

Ohio—Pennsylvania R.R.—This company contemplates the construction of a three-mile branch to South Massillon, Ohio, to connect with the Fort Wayne line. Alexander C. Shand, Philadelphia, Penn., is Ch. Engr.

Indiana—Pennsylvania R.R.—Surveys are being made by this company to secure easier grades for its line to Madison, Ind. A. C. Shand, Philadelphia, Penn., is Ch. Engr.

North Dakota—Northern Pacific Ry.—This company, it is reported, has started work on its proposed line from Beach, N. D., to Baker, Mont. Noted Aug. 13.

Montana—Northern Pacific Ry.—See item under North Dakota.

Arkansas—Cache Valley R.R.—This company plans to construct an extension from Light, Ark., to Paragould, Ark., about 12 miles. A. D. Goldman, 112 South Main St., St. Louis, Mo., is Pres.

Texas—San Antonio, Uvalde & Gulf R.R.—This company will rebuild its tracks between Corpus Christi, Tex., and Odem, Tex., 17 miles, recently damaged by floods. E. R. Breaker, San Antonio, Tex., is Ch. Engr.

Texas—Delta Land & Lumber Co.—Preliminary arrangements are being made by this company for the construction of a 15-mile railroad from Conroe, Tex., to the timber lands. I. H. Fetty, Kansas City, Mo., is interested. Noted Aug. 27.

Houston & Texas Central R.R.—This company has secured about 100 acres of land in Texas and will improve and enlarge its yard facilities. F. M. Thomson, Ennis, Tex., is Asst. Engr.

✚**Texas**—Van Horn Valley Land & Ry. Co.—This company has awarded the contract for constructing a railroad from Van Horn, Tex., north to a point in New Mexico, to E. G. BEECHER and F. J. CUMMING. The line will be 80 miles long.

Idaho—Western Pacific Ry.—Plans are being prepared by this company for an expenditure of $10,000,000 for the construction of feeders. The company will make the construction of the Winnemucca Northern R.R. the first of its improvements. T. J. Wyche, San Francisco, Calif., is Ch. Engr.

Arizona—Magna Copper Co.—(Official)—This company contemplates the construction of about 30 miles of 36-in. gauge railroad from Superior to Webster, Ariz. W. C. Browning, Superior, Ariz., is Mgr. of the company. E. G. Dentzer is Asst. Ch. Engr.

✚**Oregon**—Sutherlin, Coos Bay & Eastern R.R.—This company has awarded a contract to McALLISTER & SON CONSTRUCTION CO., Portland, for constructing the first 28 miles of its line to Coos Bay, Ore. Noted July 23.

California—Atchison, Topeka & Santa Fé Ry. Co.—Plans are being prepared by this company for the construction of a single railroad spur track over certain streets in Upland, Calif. G. W. Harris, Los Angeles, Calif., is Ch. Engr.

✚**Quebec**—The Commissioners of the Transcontinental Ry. have awarded a contract to CAVICCHI & PAGANO for constructing a Y track at Cap Rouge, Que. and for completing the St. Malo line. Bids were received Aug. 4. Noted July 30.

ELECTRIC RAILWAYS

Skowhegan, Maine—According to press reports plans are being considered for the construction of an electric railway from Skowhegan to Shawmut.

Gardner, Mass.—The Northern Massachusetts Street Ry. Co. is preparing plans for the construction of an electric railway on Pleasant and Willow St. in Gardner. M. H. Merrill, Boston, is Pur. Agt.

Methuen, Mass.—The Massachusetts Northeastern Street Ry. Co. has applied to the City Council for a franchise to relocate its tracks on Jackson St. Clinton L. Bartlett, Haverhill, is Pur. Agt.

Willimansett, Mass.—The Holyoke Street Ry. Co. plans to double-track and extend its line in Willimansett. Louis D. Pellissier, Holyoke, is Vice-Pres., Gen. Mgr. and Pur. Agt.

Danville, Va.—The Danville Traction & Power Co. will extend its line on Lee St. from its present terminus to the railroad station on Craighead St. N. W. Berkeley, Danville, is Gen. Supt. and Pur. Agt.

Hamlin, W. Va.—The Hamlin & Guyandotte R.R. Co. has been incorporated to construct and operate an electric railway from Hamlin to West Hamlin, about five miles. L. R. Sweetland and A. F. Morris, Hamlin, are among the incorporators.

Morgantown, W. Va.—The Monongahela Traction Co. has secured the right-of-way for the construction of an electric railway from Riverville to Morgantown, W. Va. James O. Watson, Fairmount, is Gen. Mgr.

Clearwater, Fla.—A franchise has been granted to Charles H. Evans, and associates to construct and operate an electric railway in Clearwater.

Jacksonville, Fla.—Plans are being prepared by the Jacksonville Traction Co. for the construction of a second track on Hogan St. from Eagle to Cedar St. Hardy Croom, Jacksonville, is Local Mgr. and Pur. Agt.

Shreveport, La.—According to press reports, the Northern Louisiana Interurban Ry. Co. has awarded the contract for constructing its line from Shreveport to Monroe.

Nashvile, Tenn.—According to press reports H. H. Mayberry and associates are interested in the construction of an electric interurban railway from Nashville to Springfield and thence into Kentucky.

Hopkinsville, Ky.—Preliminary arrangements are being made by R. E. Cooper, Hopkinsville, for the construction of an electric railway in Hopkinsville. Noted Sept. 3.

Ashtabula, Ohio—The East Village & Harbor Traction Co. has been incorporated to construct an electric railway from Ashtabula to Ashtabula Harbor. Mark Copeland and W. S. Mitchell, Ashtabula, are interested.

Murphysboro, Ill.—Preliminary arrangements are being made by the Murphysboro & Southern Illinois Ry. Co. for the construction of its proposed electric railway from Murphysboro to Carbondale, about eight miles.

Hutchinson, Kan.—The Hutchinson & Northern Ry. Co. contemplates the construction of an electric railway from Hutchinson to Burrton and probably to Halstead, where a connection with the lines to Wichita will be made. George Theis, Jr., is Pres.

Red Lodge, Mont.—The Carbon & Stillwater Electric Ry. Co. is making preliminary arrangements for the construction of an electric railway from Red Lodge to Columbus, Mont., about 40 miles. William Larkin, Red Lodge, is interested.

Castroville, Tex.—Preliminary arrangements are being made for the construction of an electric interurban railway from Castroville to San Antonio and Medina Lake.

Fort Worth, Tex.—Plans are being considered by the Northern Texas Traction Co. for the construction of a one-mile extension to its line on Summit Ave. G. H. Clifford, Fort Worth, is Pres. and Mgr.

Greenville, Tex.—The charter of the Greenville, Whitewright & Northern Traction Co. has been amended and the name of the company changed to the Greenville Northwestern Ry. The route of the proposed electric railway has also been changed and will run from Greenville to Merit.

Salt Lake City, Utah—The City Council has granted a franchise to the Utah Light & Ry. Co. to extend its line from its terminus at Thirteenth St. East and Fifth St. South to connect with its line at Thirteenth St. East and Seventh St. South in Salt Lake City. Joseph S. Wells, Salt Lake City, is Gen. Mgr.

Los Angeles, Calif.—The Los Angeles Ry. Co. has secured the right-of-way for its line through Schuetzen Park and plans to start work soon on the construction. C. A. Henderson, Los Angeles, is Gen. Mgr. and Pur. Agt.

The Board of Harbor Commissioners has been granted permission to construct an electric railway from a point on the

[illegible] along [illegible] St. to the [illegible] of [illegible] St. with the northerly line of [illegible] Land [illegible] No. 1[illegible]

St. Johns, N. B.—Plans are being considered by the St. Johns Ry. Co. for the extension of its line through the [illegible] Falls section. H. M. Hopper, St. Johns, is Gen. Mgr. and Pur. Agt.

Hull, Que.—Preliminary plans are being prepared by the [illegible] Electric Ry. Co. for the [illegible] of its lines in Hull. C. [illegible], Hull, is Gen. Supt.

Three Rivers, Que.—The Three Rivers Traction Co. has applied to the City Council for a franchise to construct and operate an electric railway in Three Rivers.

Bridgeport, Ont.—The [illegible] & Northern Ry. Co. plans the extension of its line from Bridgeport to [illegible]dale. J. S. Anthes, [illegible], is Vice-Pres.

London, Ont.—The London & Lake [illegible] Ry. Co. contemplates the extension of its electric railway from London to Stratford. W. N. [illegible] is Gen. Mgr. and Pur. Agt.

Vancouver, B. C.—Plans are being considered by the British Columbia Electric Ry. Co. for the extension of its line [illegible] Victor to Keir [illegible]. George Kidd, Vancouver, is Gen. Mgr.

LIGHT, HEAT AND POWER

West Pownal, Maine.—Bids will be received until [illegible] Sept. [illegible] by [illegible] J. [illegible], Supt. of Maine School for Feeble-Minded, for the construction of a power plant and transmission line. Albert H. [illegible], [illegible] St., Portland, Maine, is Engr.-in-Charge.

Greensboro, Vt.—Plans have been prepared for a 200-hp. [illegible] to [illegible] at [illegible] $[illegible]. The plant will supply electricity to the villages of Greensboro, East Hardwick, [illegible] and Mill Village. M. L. Sanders, White River Junction, is Engr. in Charge.

Chelsea, Mass.—The East Boston Gas Co. has obtained a permit for the construction of a concrete gas tank on Auburn St., to cost about $[illegible].

+Norfolk, Mass.—The contract for the construction of a power house at the State Hospital has been awarded to A. H. SMITH, Walpole, Mass., at $[illegible]. It will be of brick, one story, [illegible] ft. Irwin F. Neff is Engr.-in-Charge. Kendall, Taylor & Co., [illegible] Federal St., Boston, prepared the plans.

Albany, N. Y.—The Municipal Gas Co. is having plans prepared by Thomas H. Murray, of the New York Edison Co., Irving Place and 15th St., New York, N. Y., for a two-story power house [illegible]x17[illegible] ft. Alexander Hamilton is Gen. Mgr.

See [illegible] under "Miscellaneous"—Barge Canal Work—Albany, N. Y.

Albany, N. Y.—The Trustees of Public Buildings opened the following bids on Sept. 10: Heating and ventilating apparatus in finishing rooms on the fifth floor of the State Capitol Building: W. H. Armstrong Co., Albany, $19,[illegible]; E. Joy Co., [illegible], $[illegible],616. Electric wiring and fixtures for the same: [illegible] & [illegible], Albany, $1717; Edward Joy Co., $197[illegible]; New York Construction Co., New York, N. Y., $1918. Plumbing for the same rooms: T. A. O'Malley, Albany, $1327; A. J. Eckert, Albany, $111[illegible]. Bids for finishing the rooms were received from: The [illegible] Keeler Building Co., Albany, $13,270; Callahan & Prescott, Keeseville, $15,260; the Feeney & Sheehan Building Co., Albany, $[illegible]716. Noted Sept. 3.

+Great Bend, N. Y.—Taggart's Paper Co., Watertown, N. Y., has awarded the contract for the construction of a concrete dam [illegible] ft. long across the Black River at Great Bend, to the STEWART ENGINEERING CO., 17 Battery Place, New York, N. Y. The work will include the construction of fore bay walls, sluice gates and improvements to the power house. J. M. [illegible], Watertown, is Ch. Engr.

+Ithaca, N. Y.—The Ithaca Traction Corporation has awarded the contract for the construction of a brick and steel [illegible] and alterations to its power house to FREDERICK T. LEY & CO., Springfield, Mass., at about $[illegible],000. Ford, Bacon & Davis, [illegible] Broadway, New York, N. Y., are Engrs.-in-Charge.

+Waterloo, N. Y.—The Trust Development Co., Waterloo, which has acquired most of the water rights along the Seneca River, has awarded a contract for the construction of a building for a power plant to the [illegible]KER CONSTRUCTION CO. at $[illegible]. This contract is exclusive of equipment.

+Newark, N. J.—The Board of Chosen Freeholders of Essex County has awarded the contract for a new boiler and equipment at the [illegible] Hospital to DAVID C. SEYMOUR, Newark, at $[illegible]. Other bidders were: [illegible] & Co., Newark, $[illegible]; [illegible], Newark, $11,2[illegible].

+Harrisburg, Penn.—The State Health Department, Harrisburg, has awarded the contract for the construction of two power [illegible] [illegible] ft. and [illegible] ft., respectively, for the State Hospital, to the EAST END LUMBER CO., [illegible], at about $[illegible].

Lewistown, Penn.—The Municipal Council is considering the establishment of a municipal electric-light plant in Lewistown, at an estimated cost of $[illegible]. The matter will be submitted to the voters at the November election.

Shamokin, Penn.—The Pennsylvania Lighting Co. [illegible] [illegible] [illegible] [illegible] [illegible] transmission line. [illegible] is [illegible] and Gen. Agt.

+Towson, Md.—The contract for the [illegible] [illegible] for the [illegible] of the Maryland State [illegible] [illegible] water-tube boilers [illegible] [illegible] was awarded to [illegible] & [illegible], Baltimore.

Washington, D. C.—[illegible] will be received until [illegible] [illegible] [illegible] Hospital [illegible]

refrigerators, kitchen and laundry equipment. See advertisement under "Contracts To Be Let."

+Richmond, Va.—The city has awarded the contract for three purifiers for the municipal gas plant to the STACEY MFG. CO., Elmwood, Cincinnati, Ohio, at $16,[illegible]0.

Cameron, W. Va.—J. H. Peabody and P. R. Fagan have made application for a franchise to build and operate an electric light plant.

Logan, W. Va.—The Logan County Light & Power Co., Logan, will build a new power building, of brick and steel, [illegible] ft. The equipment will include four [illegible]0-hp. boilers, two [illegible]-kw. turbines, pumps, condensers, etc. The company also plans to build 7[illegible] miles of transmission line to supply power to the Loganfield coal mines.

Walterboro, S. C.—An election will be held Oct. 8 to vote on the question of issuing $[illegible],000 in bonds, the proceeds of which will be used for the establishment of a municipal electric-light plant.

Fort Meade, Fla.—At an election held Aug. 21, the citizens voted in favor of a bond issue of $[illegible] for the construction of a municipal electric-light system. Noted Aug. 13.

Shreveport, La.—The Reserve Natural Gas Co. has been organized at Shreveport with a capital stock of $3,[illegible]. M. W. Bahan, Fort Worth, Tex., is Pres. The company is considering plans for the construction of a pipe line from the [illegible] fields to Shreveport, a distance of 51 miles.

Beattyville, Ky.—The Beattyville Utilities Co. is in the market for equipment for a lighting plant, including a 1[illegible]-hp. boiler, 100-hp. engine, 100-kw. generator, 2300-volt alternator, and a switchboard. H. S. Van Zant is Pres.

Cleveland, Ohio.—The Cleveland Seating Co. is having plans prepared by Briggs & Nelson, 669 Rose Bldg., Cleveland, for the construction of a power house. D. A. Grubb, [illegible] Rose Bldg., is Gen. Mgr.

Madison, Ind.—The Public Service Commission has granted permission to the Madison Light & Ry. Co. to issue $2[illegible] in bonds for extending and improving its system, to include new boilers, an engine and generator and extensions to its local lines. The company is now building a transmission line to Hanover to supply energy to the Hanover Light Co.

Rock Falls, Ill.—The Public Service Commission has granted permission to the Illinois Northern Utilities Co., Dixon, to purchase the electric plant and franchise of the Northwestern Barb Wire Co., at Rock Falls.

Aurora, Minn.—It is reported that the Town Council is considering the establishment of a municipal electric-light plant.

Kansas City, Kan.—At a recent election the citizens voted in favor of a bond issue of $[illegible] for enlarging and improving the municipal electric-light plant. It is reported that bids will soon be asked for new boilers, a 3[illegible]-kw. turbine, coal- and ash-handling machinery, superheaters, steam and water piping, at an estimated total cost of $[illegible].

Alexandria, S. D.—(Official)—Bids will be received until 8 p.m., Oct. [illegible], by H. M. Schumacher, City Audr., for the installation of a complete electric lighting system. K. S. Putnam, Huron, S. D., is Consult. Engr.

Sidney, Mont.—The Glendive Heat, Light & Power Co., Glendive, Mont., has made application to the City Council for a franchise to install and operate an electric light system in Sidney.

+Glasgow, Mo.—A contract for the construction of a transmission line from Glasgow to Armstrong, Mo., has been awarded to F. H. WHEELER, Omaha, Neb., at $[illegible]. Tuttle & Pike, Consult. Engrs., Kansas City, Mo.

Zapata, Tex.—W. A. Jennings has brought in a natural gas well, having a daily output of 15,000,[illegible] cu.ft., on his ranch near this place. It is planned to pipe the gas to the towns of this section.

Goodwell, Okla.—See item under "Water Supply and Irrigation."

Pondcreek, Okla.—The City Council has passed an ordinance authorizing the issue of $7[illegible]0 in bonds for the improvement of the electric light plant and water works system. F. J. Gentry is Mayor.

Cathlamet, Wash.—The City Council has taken preliminary steps toward installation of a municipal electric light plant. The estimated cost of the first unit is $[illegible]00, to be operated by a distillate engine, but the waters of the Elocaman River, about 10 miles distant, will be utilized eventually. Noted Sept. [illegible]

Puyallup, Wash.—The Mutual Electric Light & Power Co., recently incorporated with a capital stock of $[illegible], has been granted a franchise by the Commissioners of Pierce County to construct transmission lines between Puyallup and Tacoma to supply the farmers along the route with electricity.

Seattle, Wash.—The Board of Commissioners of King County has granted a 3[illegible]-year franchise to the municipal electric light and power plant for the construction and maintenance of a transmission line from Bryn Mawr to Renton.

Redwood City, Calif.—The Pacific Gas & Electric Co., San Francisco, will build a gas storage plant at Redwood City. E. W. [illegible] is Dist. Mgr.

San Francisco, Calif.—The Pacific Gas & Electric Co. has taken out a permit for the construction of a one-story power station [illegible] Eighth St.

Ukiah, Calif.—It is reported that the Snow Mountain Water & Power Co. plans to reconstruct its [illegible] plant. W. [illegible] is Mgr.

Comber, Ont.—The Town Council has passed a bylaw authorizing the construction of a new hydro-electric plant. The [illegible] has not yet been selected but plans will be prepared and bids will be asked for as soon as possible.

Merrickville, Ont.—The ratepayers of Merrickville have passed a bylaw authorizing the loan of $[illegible] to the Merrickville Electric Light & Power Co., to be used for the construction of an electric power plant. [illegible] Hall is Clk.

Peterboro, Ont.—The Hydro-Electric Commission plans to [illegible] and extend the hydro-electric system, at a cost of about $[illegible]. Work will soon be begun.

BRIDGES

Charlotte, N. Y.—It is reported that all bids received Aug. 6 for the construction of a bridge over the Genesee River at Charlotte have been rejected, and that new bids will be received by the Monroe County Building Commission, Rochester, until Oct. 1. The estimated cost is $230,000. Frederick S. Couchman is Chn. of the Comn. List of bids noted Aug. 13.

+Lestershire, N. Y.—The Town Board has awarded the contract for the construction of a bridge over Choconut Creek at West Main St. to the OWEGO CONCRETE CO., Owego, at $4437. There were three other bidders. J. J. Fenderson is Town Supt. Noted July 23.

★Norwich, N. Y.—(Official)—Bids were rejected on Aug. 19 for the second time for the construction of a reinforced-concrete bridge over Chasawacta Creek. The Town Board has not yet decided whether or not to advertise again for bids. C. E. Harris is Town Engr. W. D. Tillman is Town Clk. Noted July 30 and Aug. 13.

+Yonkers, N. Y.—(Official)—The Board of Contract and Supply has awarded the contract for the construction of a reinforced concrete bridge at Dewitt Ave. to NICHOLAS FAGNINI, Tuckahoe, N. Y., at $8990. Other bidders were: The O'Rourke Contracting Co., $9375; Casey, McLain & Newlands, $9800; Young & Hyde, Inc., $10,620; M. J. Nolan, $11,077. Noted Aug. 13.

Blairstown, N. J.—Bids will be received until Sept. 18 by the Board of Chosen Freeholders of Warren County, Belvidere, for the construction of a reinforced concrete bridge over Paulins Kill, Blairstown. F. W. Salmon, Blairstown, is County Engr.

New Brunswick, N. J.—Bids will be received until Sept. 21 by the Board of Chosen Freeholders of Middlesex County for the construction of a reinforced concrete culvert over a branch of Matchaponix Brook, Matchaponix, and for repairs to Bridge No. 47 on the Perth Amboy-Bound Brook Turnpike, Woodbridge. Alvin B. Fox, Perth Amboy, is County Engr.

Trenton, N. J.—The Board of Chosen Freeholders of Mercer County has had plans prepared for the construction of a bridge over Sanhican Creek at Lee Ave. Theodore Toblish is County Engr.

Trenton, N. J.—The lowest bid submitted to the Board of Chosen Freeholders of Mercer County for the construction of a 180-ft. reinforced concrete bridge over Stoney Brook, Trenton, was that of N. K. Bugbee, 206 East Hanover St., Trenton.

Ellwood City, Penn.—(Official)—Bids will be received until Oct. 8, by the Board of Commissioners of Lawrence County for the construction of a bridge at Ellwood City. It will be of steel, 645 ft. long, with a concrete arch of 35-ft. span at each end, with retaining walls at approaches. The roadway will be 32 ft. wide, with a 7-ft. sidewalk on each side. The roadway floor will be of reinforced concrete and wood block. Thomas A. Gilkey is County Engr. Noted Sept. 3.

+Pittsburgh, Penn.—The Department of Public Works has awarded the contract for the construction of approaches to the Bloomfield Bridge to M. O'HERRON & CO., Pittsburgh, at $19,879.

+Baltimore, Md.—The Pennsylvania R.R. Co. has awarded the contract for the construction of a reinforced-concrete viaduct at Eager St. and Fallsway to the BROWN-KING CONSTRUCTION CO., Harrison Bldg., Philadelphia. Noted Aug. 20.

Baltimore, Md.—See item under Miscellaneous: Excavation and Filling—Baltimore, Md.

+Ellicott City, Md.—The State Roads Commission, Baltimore, has awarded the contract for the construction of a reinforced-concrete bridge over the Patapsco River at Ellicott City to THOMAS, POOLE & HUNTER, Westminster, Md., at $8177. Noted Aug. 20.

Lawrenceville, Va.—(Official)—Bids will be received until 10 a.m., Sept. 28, by the Clerk of the Circuit Court of Brunswick County for the construction of three bridges: One, 54 ft. long over Sturgeon Creek, a 36-ft. span over Sandy Creek, and a 36-ft. bridge over Rose Creek. G. P. Coleman, Richmond, Va., is State Highway Comr. The Childrey Co., Richmond, is Engr.-in-Charge.

Moorefield, W. Va.—(Official)—Bids will be received until 10 a.m., Sept. 25, by the County Court of Hardy County for the construction of a bridge 135 ft. long with a 12-ft. roadway, over the Lost River above Miller's Ford. Alternate bids will be accepted for a steel superstructure with concrete abutments, or for a reinforced concrete arch. C. B. Welton is Clk. of the Court.

Clarkesville, Ga.—Habersham County plans the construction of several steel bridges, the largest of which will be over the Chattahoochee River. James A. Robertson is County Judge.

Chattanooga, Tenn.—(Official)—Bids will be received until 10 a.m., Oct. 22, by the Tennessee River Bridge Committee for the construction of a bridge over the Tennessee River at Market St., Chattanooga. The bridge will be about 2050 ft. long and 50 ft. wide, and will consist of: Nine reinforced concrete girder spans of 40 ft. each; two reinforced concrete arches of 165 ft. each; four reinforced concrete arches of 180 ft. each, and one 300-ft. steel span, Scherzer rolling lift double-leaf bascule type. The estimated cost is $500,000. B. H. Davis, Whitehall Bldg., New York, N. Y., is Consult. Engr. Theodore F. King is Chn. and L. B. Bryan is Secy. of the Bridge Com. Noted Oct. 2 and Dec. 18, 1913; Jan. 8, Jan. 22, Mar. 5, Apr. 16 and Sept. 3, 1914.

Harrodsburg, Ky.—It is reported that the town plans to build a concrete bridge over the creek at North Main St.

Ludlow, Ky.—The City Council has had plans prepared for a new concrete viaduct on Elm St. over the tracks of the Cincinnati, New Orleans & Texas Pacific Ry., replacing the present structure. The estimated cost is $18,000. It is reported that the question of a bond issue sufficient to pay for its construction will be submitted to the voters at the November election.

Canton, Ohio—(Official)—Bids will be received until 10 a.m., Sept. 25, by the Board of Commissioners of Stark County for the construction of the Levi Fultmore Bridge over the Hess Ditch, Perry Township. C. L. Stoner is Clk of the Comrs.

Cincinnati, Ohio—(Official)—The Director of Public Service has awarded the contract for the construction of a reinforced-concrete bridge on Roll Road at West Fork to RUNCK BROS., Cincinnati, at $6845. Noted Aug. 20.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Oct. 2, by the Board of County Commissioners for the construction of a concrete bridge over Millcreek on Wayne Ave., Springfield Township. Albert Reinhardt is Clk. of Comrs. Noted Sept. 10.

(Official)—Bids will be received until noon, Oct. 2, by the Board of Commissioners of Hamilton County for repairing the bridge over Sycamore Creek near Perin's place, Symmes Township. Fred E. Wesselman is Pres. Bd. of Comrs.

+Hamilton, Ohio—The Board of Commissioners of Butler County has awarded a contract for steel sheathing on the piers of the new High St. Bridge to the A. J. YAWGER CO., Indianapolis, Ind., at about $10,000. This award is in addition to the original contract.

Jefferson, Ohio—(Official)—Bids will be received until 1 p.m., Sept. 21, by the Board of Commissioners of Ashtabula County for the extension of a concrete arch over Hubbard Run, Ashtabula and Plymouth Townships. A. V. Hillyer is Clk. of the Bd.

+Massillon, Ohio—(Official)—The following bids were received Sept. 9 by the Board of Commissioners of Stark County for the construction of the South Erie St. Viaduct, Massillon. Bidders on the superstructure were: E. J. Landor, Canton, Ohio, $16,474; Central Concrete & Construction Co., Canton, $18,253; Massillon Bridge & Structural Co., Massillon, $16,474; Alliance Structural Co., Alliance, Ohio, $16,893; RIVERSIDE BRIDGE CO., Martins Ferry, Ohio, $16,422 (awarded contract.) Engineer's estimate, $18,305. The bidders for the substructure were: Fred Heisler, Massillon, $26,094; Hanneman Bros., Detroit, Mich., $25,168; T. B. Husband, Cleveland, Ohio, $25,219; Connolly-Cannon Co., Phillipsburg, N. J., $43,435; Luke & O'Brien, Canton, $25,276; Cullon-Friestedt Co., Chicago, Ill., $35,251; S. C. KISTNER & SON, Delaware, Ohio, $24,385 (awarded contract); Thomas Sheahan, Hagerstown, Md., $30,682; A. F. Wendling Co., Massillon, $31,229; L. A. Mullins & Co., Cleveland, $25,843; E. J. Landor, Canton, $29,877; Engineer's estimate, $27,893. Noted Aug. 27.

New Lexington, Ohio—Bids will be received until 10 a.m., Sept. 28, by Clyde M. Foraker, Audr. of Perry County, for the superstructure of a bridge over Jonathan Creek, Madison Township.

Ottawa, Ohio—(Official)—Bids will be received until noon, Sept. 29, by the Board of Commissioners of Putnam County for the construction of the substructure of the Riley Creek Bridge at the corner of Riley, Blanchard, Ottawa and Pleasant Townships. The substructure will consist of a stone pier of 804 cu.ft., and one concrete abutment of 2166 cu.ft., and 671 iron bars for reinforcement. John E. Roose is County Audr. J. S. Cartwright is County Surv.

Piqua, Ohio—(Official)—Bids will be received until 10 a.m., Sept. 29, by the Board of Commissioners of Miami County, Troy, for placing a creosote treated wood-block floor on the Ash St. Bridge, Piqua. Mahlon T. Staley is County Audr.

Youngstown, Ohio—(Official)—Bids will be received until 10 a.m., Sept. 30, by the Board of Commissioners of Mahoning County for rebuilding the floor of the bridge over the Mahoning River at Struthers. Frank H. Vogan is Clk. of the Comrs.

South Bend, Ind.—(Official)—Bids will be received until 11 a.m., Sept. 21, by the Board of Commissioners of St. Joseph County for the construction of two reinforced concrete culverts, and for repairing the Osceola Bridge, Penn Township. Clarence Sedgwick is County Audr.

Appleton, Wis.—All plans for the construction of a 350-ft. bridge over the Wolf River at Lawe St. are held in abeyance until spring. The estimated cost of the structure is $20,000. E. L. Williams is City Clk.

Chetek, Wis.—(Official)—Plans for the construction of a bridge at Chetek, to cost about $30,000, have not been completed, nor has any time been set for advertising for bids. M. W. Torkelson, Madison, Wis., State Bridge Engr., has charge of the work. Noted Aug. 27.

Milwaukee, Wis.—The question of a bond issue of $350,000 for the construction of a new viaduct across the Milwaukee River, replacing the present North Ave. Bridge, will be submitted to the voters at the November election. J. A. Mesiroff, City Engr., is preparing estimates of the cost of construction.

+Elkader, Iowa—(Official)—The Board of Supervisors of Clayton County awarded contracts on Aug. 28 for bridge construction as follows: PAUL N. KINGSLEY, Strawberry Point, Iowa, $19,335; C. E. WALKER, Calamus, Iowa, $6834; A. P. SCHWEIKERT, Elkport, Iowa, $3533; C. H. WILLIAMSON, Elkader, Iowa, $2345. E. B. Tourtellot is County Engr.

★Iowa City, Iowa—All bids received on Aug. 21 for the construction of the Burlington St. Bridge were rejected, as the Board of County Supervisors was unable to dispose of the bonds to pay for its construction. The lowest bid for its construction was that of the Western Construction Co., Iowa Ciy, at $54,500. Noted Aug. 6.

+Mankato, Minn.—(Official)—The Board of Commissioners of Blue Earth County has awarded the contract for the construction of four reinforced-concrete bridges, ranging from 50 to 70 ft. long, to the WIDELL CO., Mankato, at $10,831 Noted July 30.

+Kansas City, Kan.—The Commissioners of Wyandotte County have awarded the contract for the construction of the Southern Bridge over the Kaw River to the KANSAS CITY BRIDGE CO., Gloyd Bldg., Kansas City, Mo., at $85,750.

Columbus, Mont.—The Commissioners of Yellowstone County, Billings, are considering the construction of a 600-ft steel bridge at Columbus B. F Harris is Chn. of Comrs

Monticello, Ark.—The [illegible] of [illegible] County [illegible] a steel [illegible] [illegible] [illegible] the [illegible] a bridge over the [illegible] River on the [illegible] Road.

Warren, Ark.—Bids will be received until Oct 6 by T. [illegible] L. Tucker, Bridge [illegible], for the [illegible] of a steel bridge over the Saline River [illegible] miles from Warren. The estimated cost is $[illegible], of which the city of Warren and Bradley County will each pay one half.

Groveton, Tex.—The Commissioners of Road District No. [illegible], Trinity County, will shortly ask for bids for the construction of a [illegible]-ft. steel bridge with concrete abutments and wood floor. [illegible] & Wilson, Groveton, are Engrs in Charge.

♦Tunis, Tex.—The Commissioners Court of Burleson County, Caldwell, has awarded the contract for the construction of a bridge over the Old River near Tunis, to AUSTIN BROS., Dallas, Tex.

Sapulpa, Okla.—An election will be held Sept. 22 in Tiger Township, Creek County, to vote on the question of a bond issue of $[illegible] for the construction of a bridge over the [illegible] River. M. E. Sanders is Pres. of the Bd. of [illegible].

♦Colorado Springs, Colo.—The Commissioners of El Paso County have awarded the contract for the construction of a bridge over Kettle Creek on the Denver Road north of Colorado Springs to the MIDLAND CONSTRUCTION CO., Kansas City, Mo., at $[illegible]. Noted Aug. 20.

Alpine, Idaho.—It is reported that the State Bridge Commissioners have awarded the contract for the construction of a steel bridge over the Snake River at Alpine to the SECURITY BRIDGE CO., Billings, Mont., at $36,115. Noted July 23.

Hansen, Idaho.—The Commissioners of Twin Falls County, Twin Falls, are considering the construction of a bridge about [illegible] ft. high and [illegible] ft. long, over the Snake River just north of Hansen. The estimated cost of the structure is $[illegible].

♦Buckley, Wash.—The contract for the construction of the approaches to the Buckley Bridge has been awarded to BUCKLEY & [illegible]LLIS at $4180. Noted July 30, Aug. 6 and Sept. 3.

Colfax, Wash.—The Commissioners of Whitman County will soon ask for bids for the construction of steel bridges over the North Palouse River at Colfax and Elberton.

♦Ritzville, Wash.—(Official.) The Board of Commissioners of Adams County has awarded the contract for the construction of three reinforced-concrete bridges, one 100-, one 70- and one 3[illegible]-ft. span to CHARLES G. HUBER, 426 Central Bldg., Seattle, at $14,202. Other bidders were: O. H. Stratton, Spokane, $14,[illegible]; Omaha Structural Steel Co., $14,700; Illinois Steel Bridge Co. (1[illegible]-ft. span), $9450. F. R. Hewett is County [illegible] Engr. Noted Aug. 6.

Snoqualmie, Wash.—All bids received on Aug. 17 by the Commissioners of King County, Seattle, for the construction of a bridge over Tokul Creek were rejected, and the contract will be readvertised. Noted Aug. 6 and Sept. [illegible].

Glendale, Calif.—The City Trustees contemplate the construction of a reinforced concrete bridge over the channel in [illegible] Cañon.

♦New Glasgow, N. S.—The Municipal Council has awarded the contract for the construction of "Potters" Bridge to [illegible] GRAHAM, [illegible] St., at about $7500. It will be of reinforced concrete.

Quebec, Que.—Plans will soon be prepared for a 155-ft. concrete bridge over the Jacques Cartier River on the Montreal-Quebec Highway near [illegible] Village, Que.

♦Sudbury, Ont.—The Town Council has awarded the following contracts for the construction of reinforced bridges: [illegible] St. Bridge, CRISTIANA & [illegible]HETTO, $6100; [illegible] St. Bridge, JOHNSON & [illegible], $3[illegible]; Minto St. Bridge, [illegible]WOOD & SHERWOOD, $[illegible]. The contract for the [illegible] St. Bridge has not yet been awarded. Noted Aug. 13.

Toronto, Ont.—(Official.) Bids will soon be received by James [illegible] & [illegible], Engrs., [illegible] St. James Chambers, Toronto, for the construction of a concrete bridge to cost about $[illegible].

WATER SUPPLY—IRRIGATION

♦Gardiner, Maine.—Bids were received Sept. [illegible] for [illegible] a [illegible] sand filtration plant from [illegible] Construction Co., Ware, Mass., $[illegible], and YOUNG & [illegible], New York, N. Y., $[illegible] (awarded contract). Noted Aug. [illegible].

Mansfield, Mass.—Bids will be received by the Water Commissioners until Sept. [illegible] for laying [illegible] ft. of [illegible] water pipe. [illegible] is Clk. of Comrs. [illegible] is Consult. Engr.

Salisbury, Mass.—The [illegible] Water Co. contemplates [illegible] and sewer mains.

♦Providence, R. I.—The contract for furnishing [illegible] for the water department has been awarded by the Board of Contract & Supply to WILLIAM A. HARRIS [illegible] Co. at $[illegible].

Brewsville, N. Y.—The [illegible] contemplate spending $[illegible] for the construction of a water system.

Manchester, N. Y.—The [illegible] contemplate spending $[illegible] for the installation of a water system. Charles [illegible], [illegible], N. Y., is Consult. Engr.

East Orange, N. J.—Bids will be received until [illegible] p.m. Sept. [illegible] by the Board of Water Commissioners for furnishing [illegible] pipe and specials. A. A. [illegible] is Engr.

♦Philadelphia, Penn.—(Official.) The contract for making alterations and extensions to the [illegible] Filter plant has been awarded to [illegible], Philadelphia, at $[illegible]. Noted Aug. [illegible].

♦Philadelphia, Penn.—The contract for furnishing pump [illegible] for the [illegible] Pumping station has been awarded by the Department of Public Works to the SOUTHWARK FOUNDRY & MACHINE CO., 4th and Washington Aves., Philadelphia, at $[illegible].

Myersville, Md.—The Council contemplates installing a water system to cost $[illegible].

Beckley, W. Va.—Press reports state that the Beckley Utilities Co. contemplates constructing a water system. G. C. [illegible] is interested.

Athens, Ga.—Press reports state that the city contemplates extending the waterworks intake. The estimated cost is $[illegible]. J. W. [illegible] is City Engr.

Chatsworth, Ga.—The citizens voted $12,[illegible] in bonds the proceeds to be used for the installation of a water system.

East Lake (Atlanta post office), Ga.—An election will be held in October to vote on the proposition of issuing bonds for $[illegible], part of which will be used for the enlargement of the water system.

Hapeville, Ga.—Bonds for $2[illegible] were voted by the citizens Sept. 7, the proceeds of which will be used for the installation of a water system. Noted June 11.

Hartwell, Ga.—At an election held Sept. 2 bonds for $16,000 the proceeds of which will be used for the installation of water and sewer systems were voted. McAlpin Thornton is Mayor. Noted Aug. 2[illegible].

New Orleans, La.—Bids will be received by the Sewage and Water Board until Nov. [illegible] for making extensions to the water and sewer system. George G. Earl is Supt. of Water Wks.

Dickson, Tenn.—Bonds for $[illegible]00, the proceeds of which will be used for the construction of a municipal water system, have been voted.

Beattyville, Ky.—The Utilities Co. plans to construct a water system to be operated in connection with its proposed electric-light plant.

Louisville, Ky.—The Louisville Water Co. will construct a storage water plant estimated to cost $[illegible].

Brewster, Ohio.—Bids will be received by W. J. Sherman, County Engr., Toledo, until Oct. 1 for installing a water system estimated to cost $10,00[illegible]. Noted June 2[illegible].

Cleveland, Ohio.—Bids will be received by the Commissioner of Purchases and Supplies, City Hall, until noon Sept. 23 for furnishing about 5[illegible] ft. of [illegible]-in. steel pipe for the Water Department. Specifications are on file with Charles F. Schultz, Comr. of Div. of Water.

Bids will be received by the Commissioner of Purchases and Supplies until noon, Oct. 7, for three low-lift steam turbine reduction gear driven centrifugal pumps for the Water Department.

Fostoria, Ohio.—The city contemplates constructing a new reservoir estimated to cost $7[illegible],000. C. A. Latshaw is City Engr.

Greenville, Ohio.—Plans have been approved by the City Council for the installation of a purification plant for the water system. The estimated cost is $[illegible],600.

West Terre Haute, Ind.—The West Terre Haute Utilities Co. has been incorporated with $[illegible] capital to supply water to West Terre Haute. John Schwartz is interested.

Albion, Mich.—A water system costing $[illegible] will be constructed at Albion. Bonds for this purpose have been voted. Noted July 16.

♦Bancroft, Mich.—A contract has been awarded by the town to the GRAND RAPIDS HYDRAULIC CO., Grand Rapids, Mich., for the installation of a complete water system.

Orion, Mich.—The city contemplates installing a water system to cost $[illegible]. John Bagley is Village Clk. Smith & [illegible], Toledo, Ohio, are the Engrs.

Bluffs, Ill.—A water system will be installed by W. A. Fuller of Fuller Co., St. Louis, Mo., at Bluffs, according to press reports.

Normal, Ill.—Bids will be received until [illegible] p.m. Sept. [illegible] by the State Board of Administration, Springfield, for making improvements to the water system at the Soldiers' Orphans' Home at Normal.

♦Oglesby, Ill.—(Official.) Bids will be received until [illegible] p.m. Oct. [illegible] at the City Hall for the construction of an artesian well approximately [illegible] ft. deep. For details see advertisement under "Contracts To Be Let." John Cargnat is City Clk.

Peoria, Ill.—Bonds for $11,[illegible] have been voted, the proceeds of which will be used for the installation of pumps for the water works.

♦Prairie du Rocher, Ill.—The contract for constructing a water system and electric light plant has been awarded to MUNIE & DUNBAR, at $[illegible]. Noted Aug. [illegible].

West Allis, Wis.—The Board of Public Works plans to install two pumps and additional equipment at the water works.

♦Leatherville, Iowa.—(Official.) Bids were received Aug. [illegible] for constructing a pipe line for the water system. The contract has been awarded to the UNION MACHINE CO., St. Paul, Minn., at $[illegible]. Noted July [illegible].

♦Harlan, Iowa.—The Council has awarded the contract for laying water mains to LANA CONSTRUCTION CO.

Stanton, Iowa.—(Official.) Bids will be received until [illegible] p.m. Oct. 1 for constructing a water system. C. H. Carlson is Town Clk. T. [illegible], Creston, Iowa, is Consult. Engr. Noted June 1[illegible].

Brookston, Minn.—The Village Council contemplates spending $[illegible] for the construction of a municipal water works.

Mesaba, Minn.—The citizens voted bonds for $9300, the proceeds of which will be used for the installation of a water system. Noted Dec. 11, 1912.

Kansas City, Kan.—Press reports state that the Standard Oil Co. will construct a water system at its Sugar Creek refinery.

Little River, Kan.—Bids will be received about Nov. 1 for constructing a water system to cost $25,000. W. B. Rollins, Kansas City, Mo., is Consult. Engr. Noted June 4.

Natoma, Kan.—Bids will be received about Oct. 15 for the installation of a water system and electric light plant. The estimated cost is $27,000. W. B. Rollins, Kansas City, Mo., is the Consult. Engr. Noted June 4.

Mitchell, S. D.—(Official)—Bids will be received until 8 p.m., Sept. 24, by Thomas Eastcott, City Audr., for laying 1399 ft. of 8-in., 3386 ft. of 6-in. and 771 ft. of 4-in. water mains.

+Wahpeton, N. D.—(Official)—Bids were received Sept. 8, for installing a filter plant at the water works. The contract has been awarded to TANNER BROS., St. Paul, Minn., at $21,000. W. A. Baker is City Engr. Noted Aug. 27.

Billings, Mont.—The Board of Health contemplates installing a modern filtration plant in connection with the water system. The estimated cost is $135,000.

Melstone, Mont.—Bids will soon be received for the construction of a water system to cost $19,000. Noted Sept. 10.

Ryegate, Mont.—Arrangements are being made by Griggs Bros., St. Paul, Minn., for the construction of an irrigation project near Ryegate. The estimated cost is $300,000.

+Kansas City, Mo.—The contract for furnishing 1179 tons of 6-in., 8-in., 10-in. and 12-in. class C c.-i. pipe has been awarded by the Fire & Water Board to the UNITED STATES CAST IRON PIPE & FORGE CO., at $23.50 per ton. Other bids were: American Cast Iron Pipe Co., $23.65, Lynchburg Foundry Co., $23.90 and National Cast Iron Pipe Co., $23.65.

Rockport, Mo.—Bids will be received about Oct. 15 for the construction of a municipal water system estimated to cost $12,000 John T. Wells is City Clk. Noted Aug. 13.

Corpus Christi, Tex.—At an election held Sept. 3, the citizens voted to issue $300,000 in bonds the proceeds of which to be used for the improvements of the water system. H. A. Stevens is City Engr. Noted Aug. 20.

Doona, Tex.—Steps have been taken toward organizing an irrigation district which will embrace 40,000 acres. It is purposed to issue $800,000 of bonds for the purpose of taking over the existing pumping plant and irrigation system and to make improvements and extensions.

Goodwell, Okla.—Bids are being received by the State Board of Agriculture, Oklahoma City, for furnishing water works machinery, sewage disposal equipment and heating apparatus for the Panhandle Institute.

Okemah, Okla.—Bonds for $25,000 for the installation of additional water works equipment have been sold. Noted Jan. 29.

Ringling, Okla.—H. E. Foster, Ardmore, contemplates installing a water system, electric light plant and ice plant.

+Tulsa, Okla.—The contract has been awarded by the City Commission to LAYNE & BOWLER, Houston, Tex., for sinking a series of wells for the new water supply. Noted July 23.

Montrose, Colo.—Burns & McDonnell, Engrs., Scarritt Bldg., Kansas City, Mo., are preparing plans for the construction of a water system to cost $140,000.

+Bovill, Idaho—The contract for constructing a municipal water system has been awarded to C. H. GREEN CO., Spokane, Wash., at $11,000. George C. Eggers is Village Clk. Noted Sept. 3.

Shoshone, Idaho—Bonds for $18,000 the proceeds to be used for the purchase and improvement of the water system have been voted. Harry W. Anderson is City Clk. Noted Aug. 6.

Aberdeen, Wash.—Bids will soon be received by Peter F. Clark, City Clk., for furnishing 12,000 ft. of water pipe to be used in making extensions to the water system.

Seattle, Wash.—The City Council has authorized the laying of water mains in portions of West Kenyon, West Holden St. and Ninth Ave., S., W. A. H. Dimock is City Engr.

+Toppenish, Wash.—(Official)—The contract has been awarded by C. A. Wyckoff, City Clk., for constructing a 75,000 gal. tank, 105 ft. above ground and for laying 15,000 ft. of c.i. water mains, to C. H. GREEN CO., Spokane, Wash., at $28,418 in bonds. Noted Aug. 27.

+Portland, Ore.—The contract for furnishing 40,000 ft. of 2-in. galvanized iron pipe has been awarded to the CRANE CO., at $10.89 per 100 ft.

Redmond, Ore.—Bonds for $10,000 will be voted by the citizens, the proceeds of which will be used to make improvements to the water system.

Madera, Calif.—E. W. Chapman and others have incorporated the Madera Canal & Irrigation Co., Madera, with $400,000 capital and will construct an irrigation system.

Redding, Calif.—The Anderson-Cottonwood Irrigation District will construct a cement lined tunnel, 6x8-ft. and 2200 ft. long. A. T. Brown is Engr.

Sydney, N. S.—The Town Council is in the market for a centrifugal pump with a capacity of 4,000,000 gal. and motor with switchboard for the water system. Norman Hay is Engr.

Coquitlam, B. C.—Bids will soon be received by the Municipal Council for continuing the construction of the water system.

SEWERS

Boston, Mass.—Bids will be received by the Public Works Department until Sept. 18, for constructing sewers in Huntington Ave. and Lockwood St., Hyde Park. L. K. Rourke is Comr.

Fall River, Mass.—(Official)—The following bids were received by the Reservoir Commission for constructing the reinforced concrete intercepting drain and appurtenances: Hanscom Construction Co., Boston, Mass., $173,834; William H. Arthur, Stamford, Conn., $179,473; T. Stuart & Son Co., Newton, Mass., $193,787; Bruno & Petitti, Boston, Mass., $201,359; Mason Hilton & Co., New York, N. Y., $204,489; Frederick T. Ley & So., Inc., Springfield, Mass., $206,207; Leo E. Kelly, Inc., (Borough of Brooklyn) New York, N. Y., $216,597; Whiting, Turner Contracting Co., Baltimore, Md., $236,973; Chauncey H. Sears, Fall River, Mass., $239,963. Barrows & Breed, 6 Beacon St., Boston, are the Consult. Engrs. Noted Sept. 3.

Salisbury, Mass.—See item under "Water Supply and Irrigation."

+New York, N. Y.—(Borough of Bronx)—The contract for constructing a sewer in Wood Ave. between White Plains Road and Storrow St. has been awarded to the ANITA CONSTRUCTION CO., 2975 Marion Ave., at $10,999.

Suffern, N. Y.—Clyde Potts, Engr., 30 Church St., New York, N. Y., has completed plans for a sewer system and sewage disposal plant. Plans have been submitted to the State Board of Health for approval. A. B. Ronk is City Clk.

Hoboken, N. J.—Plans are being prepared by James H Fuertes, 140 Nassau St., New York, N. Y., for constructing main and lateral sewers on 11th and 15th Sts. Bids will be received about Mar. 1, 1915.

Newark, N. J.—Bids will be received by the Board of Street and Water Commissioners, City Hall, until Sept. 24, for constructing a sewer in Branford Place.

Plainfield, N. J.—George W. Fuller, Engr., 170 Broadway, New York, N. Y., has completed plans for a sewer system and sewage disposal plant to cost about $325,000. The work will be done jointly by Plainfield, North Plainfield and Dunellen.

Trenton, N. J.—Bids will be received by the City Commission, until Sept. 23, for constructing a sewer in Hamilton Ave. from the Municipal Hospital to the city line. Frank Thompson is City Clk.

Woodlynne (Camden post office), **N. J.**—(Official)—Clyde S. Potts, Engr., 30 Church St., New York, N. Y., has completed plans for a one- and two-story brick sewage disposal plant, estimated to cost $7000.

Archbald, Penn.—The following bids were received by the Borough Council for constructing the sewer in the Third Ward. Boland Bros., Carbondale, $10,450; O'Boyle Bros., Dunmore, $10,720; McConnville Co., Scranton, $11,997; Sweeney Bros., $11,078; J. P. Ryan, Scranton, $12,000; Dennis Lawler, $12,800; Frank J. Cawley, Scranton, $14,616.

Reading, Penn.—The city is having plans prepared for an additional sewage filter, covering one acre in area, in connection with the sewage disposal plant. The cost will be about $40,000. E. B. Ulrich is City Engr.

South Renovo (Renovo post office), **Penn.**—The Borough has decided to construct 1½ miles of sewers by day labor Ambrose Beck is Clk. of the Council. Noted July 30.

Washington, D. C.—Bids were received by the District Commissioners for furnishing about 200,000 red sewer bricks during the remainder of the year 1914, from Frederick Brick Works, Frederick, Md. (per 1000), $10; Layton Fire Brick Co., McKeesport, Penn. (per 1000), $14.80.

Norfolk, Va.—The Board of Control has decided to extend the sewer mains in the Seventh Precinct. W. T. Brooke is City Engr.

+Huntington, W. Va.—The contract for constructing the storm trunk sewer in the Fourth ward has been awarded to the SLUSS-BAKER CONSTRUCTION CO., at $75,500. A. B Maupin is City Engr. Noted Mar. 12.

Hapeville, Ga.—The citizens have voted $14,000 in bonds for constructing sewers.

New Orleans, La.—See item under "Water Supply and Irrigation."

+Covington, Ky.—The contract for reconstructing the sewer outlet on Monmouth St. has been awarded to J. B. McLANE & CO., at $5500.

Louisville, Ky.—The city will award a contract about Oct. 1 for laying about 1000 ft. 18- and 24-in. pipe sewers and constructing 1500 ft. of 30-, 33- and 39-in. concrete sewers.

+Press reports state that the contract for furnishing sewer pipe during the year has been awarded to P. BANNON & SON, at about $27,000.

Louisville, Ky.—The J. H. Hostetter Co. submitted the lowest bid for construcing sanitary sewers on nine streets.

Cincinnati, Ohio—Bids will be received by Phillip Fosdick, Dir. or Pub. Serv., until noon, Sept. 18, for constructing a sewer in Duck Creek Road, and until Sept. 24, for constructing sewers in Burnet, Wilson and Maple Aves.

Columbus, Ohio—Bids will be received by Samuel A. Kinnear, until Oct. 9, for making extensions to the sewer system.

Dayton, Ohio—The City Commission contemplates constructing sanitary sewers in District No. 6, at a cost of about $45,000.

Findlay, Ohio—(Official)—No bids were submitted to the Direction of Public Service on Sept. 5, for constructing the combined storm and sanitary sewer. H. A. Glathart is City Engr. Joseph Page is City Clk. Noted Aug. 27.

Fostoria, Ohio—(Official)—Bids will be received by E. K. Cunningham, Dir. of Pub. Ser. until noon, Oct. 9, for constructing a dam for reconstructing the screen chambers and enlarging the superstructure, remodeling one sewage reservoir into an Imhoff two-story tank; erecting and constructing a pump well together with superstructure, installing a water pressure system, constructing Imhoff tank effluent distributing well and sludge distributing well, Imhoff tank sewage effluent channel, sludge supply channel, gate valves, sluice gates, shear valves, connecting one unit with another of the plant, also installing the necessary motors, pumps, and machinery-control devices.

Evansville, Ind.—Bids will be received by the Board of Public Works until 8 a.m., Sept. 22, for constructing a main sewer in Franklin St. and New Harmony Road. Edward N. Frisse is Clk.

+Bay City, Mich.—The contract for constructing sewers in Sidney and Marquette Aves. has been awarded to COX & CO., at $9800. E. E. Prohazka is City Compt Henry C. Thompson is City Engr

Harbor Springs, Mich.—Bids will be received by the Village [illegible] for constructing sewers in Bay, Main, Third and State Sts. [illegible] is Village Clk.

Lincoln, Ill.—It is reported that the city has voted $68,000 in bonds for constructing the proposed sewer system. Noted Aug. [illegible]

Lockport, Ill.—Press reports state that the city will soon award a contract for installing the proposed sewer system, at an estimated cost of $[illegible]

Oconomowoc, Wis.—Bids will be received by the Board of Public Works until Sept. 2[illegible], for constructing sanitary sewers in various streets. The work requires 1[illegible]- and 24-in. sewer pipe. C. H. [illegible] is Supv.

Sheboygan, Wis.—The city plans to construct sewers in [illegible]. J. M. [illegible] is City Clk.

Atlantic, Iowa.—The City Council has decided to construct a sewer system in the Southeast section of the city.

Creston, Iowa.—(Official)—Bids will be received by J. F. [illegible], City Clk., until 8 p.m. Sept. 3[illegible], for constructing 6-, 8- and [illegible] sanitary sewers in various streets. Theodore S. Delay is City Engr.

✦**Guthrie Center, Iowa.**—Press reports state that the contract for installing the sewer system has been awarded to the WESTERN CONSTRUCTION CO., Iowa City.

Holstein, Iowa.—(Official)—There were no bids submitted on Sept. 7, to A. G. Merkley, City Recorder for making the improvements to the sewerage treating plant. Noted Aug. 27.

Sioux City, Iowa.—The City Council has decided to construct a sanitary sewer in Omaha St.

✦**Valley Junction, Iowa.**—According to press reports, the contract for extending the sewer system has been awarded to the GEORGE M. KING CONSTRUCTION CO., at $9326.

St. Paul, Minn.—The City Council has ordered the construction of [illegible] St. sewer in District No. 2, at an estimated cost of $31,417. O. Claussen is City Engr.

✦**Concordia, Kan.**—The contract for constructing an outlet sewer in Section A of District No. 3 has been awarded to the EBY CONSTRUCTION CO., at $26,265.

Bridgeport, Neb.—The city contemplates constructing 7- to [illegible]-in. sewers, at an estimated cost of $12,000. R. H. Willis is City Engr.

✦**Genoa, Neb.**—The contract for constructing a sewer system has been awarded to ALAMO ENGINE & SUPPLY CO., 1112 Farnam St., Omaha, at $11,402. W. J. McEathrow, Omaha, is Engr.

Granger, Tex.—The citizens have voted $15,000 in bonds for constructing a sewer system.

San Antonio, Tex.—(Official)—Bids will be received by Frederick Fries, until 4 p.m., Sept. 21, for constructing sanitary sewers. The works call for the approximate quantities as follows: Sect. No. 24, 10,900 ft. of 58- to 66-in. pipe. Sect. 25, 20,000 ft. of 26- to 56-in. pipe. Sect. 26, 10,000 ft. of 18- to 24-in. pipe. Sect. 27, 20,750 ft. of 8- to 30-in. pipe.

Goodwell, Okla.—See item under "Water Supply—Irrigation."

✦**Bremerton, Wash.**—The contract for constructing sewers in Sixth, Seventh and Eighth Sts. has been awarded by the City Council to W. O. PILLETTE.

Cathlamet, Wash.—It is reported that the city has had plans completed for installing a sewer system.

✦**Dallas, Ore.**—The contract for constructing the septic tank in connection with the sewage treatment plant has been awarded to [illegible] BROS., at $[illegible]00.

✦**Portland, Ore.**—The contract for constructing the Long Ave. extension to the Holgate St. sewer, has been awarded to the AZAR CONSTRUCTION CO.

Burlingame, Calif.—See item under San Mateo.

✦**Los Angeles, Calif.**—The contract for constructing a sewer in [illegible] St. has been awarded by the City Council to [illegible] WEKOJEVICH, at $[illegible]. Noted Sept. 10.

✦The contract for constructing the sewer in Minety Ave. has been awarded to JOHN RADICH, at $[illegible].

✦The contract for constructing a sewer in Vignes St. has been awarded to R. W[illegible], 19 [illegible] St., at $[illegible].

Napa, Calif.—Bids will soon be called for by the City Trustees for constructing sewers in Napa St. and [illegible].

Sacramento, Calif.—[illegible]

✦**San Francisco, Calif.**—[illegible]

San Mateo, Calif.—[illegible]

Ottawa, Ont.—[illegible]

✦**Esquimalt, B. C.**—[illegible]

STREETS AND ROADS

Boston, Mass.—[illegible]

HAN, Lynn, at $16,436. Other bids were: E. J. Rourke, Abington, $16,67[illegible]; H. L. Thomas, Middleboro, $16,707; Lane Quarry Co., Hingham, $17,[illegible]01; Horne-Lowe Construction Co., Millbury, $18,[illegible]; Charles T. Alger, Munson, $18,976; James H. Ferguson, Dorchester, $19,6[illegible]; Capito & Giovanni, $20,273.

The contract for constructing 9100 cu. ft. of gravel road at Groton has been awarded to J. F. WATKINS, Amesbury, at $10,044. Other bids were: D. Blakeley, Groton, $9711; P. Perini, Ashland, $10,0[illegible]; Capito & Giovani, $10,260; M. Toomey, Newburyport, $10,763; H. L. Thomas, Middleboro, $10,973; F. J. Maney, $11,171; D. J. Sheehan, Lynn, $11,194; R. J. McGuire, Worcester, $11,367; F. E. Ellis, Melrose, $11,500; A. Michelino, Reading, $11,656; James A. Gaffey, Medford, $11,729; Horne-Lowe Construction Co., Millbury, $12,1[illegible]; A. D. Bridges Sons, Inc., $12,[illegible]; Henry W. Tarbell, Lowell, $12,729; Newell & Brock, Uxbridge, $12,739; W. J. Donovan, Fitchburg, $13,21[illegible]; Joseph H. Ferguson, $14,27[illegible].

✦**Rochester, N. Y.**—The contract for paving Mill and McFarlin Sts. has been awarded to THOMAS HOLOHAN at $20,380 and $2080 respectively.

Elizabeth, N. J.—According to press reports bids will be received by the City Council, until Sept. 21, for paving Trumbull and Spencer Sts., and Palisade Road with concrete.

Fort Lee, N. J.—(Official)—Bids will be received by the Borough Council, until 8.30 p.m., Sept. 23, for improving Hudson Terrace from Main St. to the North Borough line. C. S. Lebright is Borough Clerk.

New Brunswick, N. J.—The Board of Chosen Freeholders of Middlesex County will receive bids, until Sept. 21, for resurfacing with bituminous concrete the Middlesex-Essex Road, from Highland Park to Metuchen. Alvin B. Fox, Perth Amboy, is County Engr. Noted Sept. 10.

Washington, N. J.—The Board of Chosen Freeholders will resurface the macadam road between Washington and Hackettstown, 10 miles. Bids will be advertised at once. The estimated cost is $6000.

✦**Berwick, Penn.**—The contract for paving Market St., from Front to Cemetery St., has been awarded to JOHN HEAVNER. Noted Aug. 20.

✦**Harrisburg, Penn.**—Bids were received Sept. 1, by the State Highway Commission and contracts awarded as follows:

Columbia County, West Berwick Borough, 5552 ft., brick block pavement, to McNERNEY CONSTRUCTION CO., Canton, at $40,438.

Greene County, Franklin Township, 1[illegible],036 ft., brick block pavement, to RIMONTI GALIARDI, Connellsville, at $60,16[illegible].

Washington County, Union Township and Finleyville Borough, 17,820 ft. asphaltic concrete and brick block pavement to BELL ROCKEL CO., INC., Altoona, at $103,[illegible]5.

Washington County, New Eagle Borough, 4,[illegible]57 ft. brick block pavement, to PARSON CONSTRUCTION CO., INC., Brownsville, at $21,996.

Luzerne County, Duryea Borough, 1391 ft. brick block pavement, to O'BRIEN BROS., Avoca, at $11,442.

Dauphin County, South Hanover and Derry Townships, 18,272 ft. asphaltic bituminous macadam, to M. BENNETT & SONS, INC., Indiana, at $51,913.

Clearfield County, Bigler Township, 5200 ft. brick block pavement to E. H. BRUA, Hollidaysburg, at $[illegible],130.

Potter County, Galeton Borough, 5806 ft. amiesite, to SIMPSON MITCHELL CROSBY CO., Punxsutawney, at $21,437. Noted Aug. 20.

✦**Lewistown, Penn.**—A contract for paving 18,000 sq. yd. with brick has been awarded to J. B. TREXLER, Reading, at $40,000.

✦**Philadelphia, Penn.**—Contracts have been awarded for improving Upsal St., from Germantown Ave. to Green St., to PAUL J. SNYDER & CO., Bailey Bldg., at $6793; 1[illegible]th St. from Chelten Ave. to 66th Ave. North, to D. WEBSTER ANDERS, Reed Bldg., at $[illegible]; Queen St., from Vaun to Fox St., to ESTATE of D. McMAHON, P. O. Bldg., at $1[illegible],303; Germantown Ave., from Susquehanna to Montgomery Ave., to J. JOSEPH McHUGH, 6[illegible]th St. and Angora Ave., at $[illegible]; Tyson Ave., from Boulevard to Torresdale, to JOHN McMENAMY, 413 Harrison Bldg., at $3[illegible],739.

Bids will be received by the Department of Public Works, until Sept. 1[illegible], for the following works: Schedule (A) grading streets; Schedule (B) paving streets with asphalt (assessment work); Schedule (C) paving streets with vitrified brick (assessment work); Schedule (D) repaving streets with asphalt; (Schedule (E) repaving streets with block; Schedule (F) surfacing country roads; (G) resurfacing country roads; Schedule (H) repaving and patching bituminous pavements.

Scranton, Penn.—(Official)—Bids will be received by J. [illegible] Hayes, Dir. Pub. Wks., until 1[illegible] a.m., Sept. 19, for laying flagstone sidewalks on a number of streets.

✦**Union City, Penn.**—The contract for paving East and West High St. has been awarded to SIMPSON & METZ, Erie, at $[illegible].

Baltimore, Md.—The Paving Committee has authorized the paving of portions of Greene and Saratoga St. with sheet asphalt.

✦**Chatonwood, Va.**—A contract for constructing three miles of graded road has been awarded to M. [illegible] DAVIS, [illegible].

Warrenton, N. C.—Bids will be received by the County Commissioners, until Oct. [illegible], for the sale of $[illegible] in bonds for [illegible] Township roads.

Morgan, Ga.—An election will be held Sept. [illegible] to vote on the proposition of issuing $[illegible] in bonds for road and bridge construction.

Ocala, Fla.—An election will be held Oct. 27 to vote on the proposition of issuing $[illegible] in bonds for street pavements.

Pensacola, Fla.—The Board of Commissioners has passed an ordinance providing for the paving of a portion of [illegible] St. with wood block.

Double Springs, Ala.—Bids will be received by the County Commissioners of Winston County, until Oct. [illegible], for grading, drainage and surfacing a part of the Haleyville and Double Springs Road [illegible]. The approximate cost is $[illegible]

+**Linden, Ala.**—A contract for constructing 2½ miles of road in Marengo County has been awarded to J. J. DUNNAVANT, Linden. Noted Aug. 20.

Montgomery, Ala.—Bids will be received by the Commissioners of Montgomery County, until Sept. 28, to grade a part of the Hanche Mill Road, gravel three miles of the Merriwether Trail and gravel a portion of the Federal Road.

Tuskegee, Ala.—The city has voted in favor of the proposition of issuing $15,000 in bonds for street improvements.

+**Knoxville, Tenn.**—The contract for macadamizing the Wright's Ferry Road has been awarded to DYKES & CO.

Maryville, Tenn.—The Commissioners of Blount County have ordered an election to be held for the purpose of voting on the proposition of issuing $300,000 in bonds for road construction.

+**Memphis, Tenn.**—The contract for grading and graveling Southern Ave. and constructing retaining walls along the roadway has been awarded to B. F. WILLIFORD, Memphis. The approximate cost is $30,000.

+**Hazard, Ky.**—A contract for constructing macadam streets has been awarded to J. C. CODELL, Winchester, at approximately $15,000.

Maysville, Ky.—Mason County plans to issue $100,000 in bonds for constructing roads.

+**Whitesburg, Ky.**—The contract for constructing six miles of roadway from Mayking to Kona has been awarded to MUNDAY & BARNES.

Bowling Green, Ohio—(Official)—Bids will be received by W. A. Mariner, Dir. Pub. Ser., until noon, Sept. 25, for improving Washington St.

Cincinnati, Ohio—(Official)—Bids will be received by the Board of County Commissioners, until noon, Oct. 9, for repairing the Springfield Pike from Wyoming to Glendale, in Springfield Township.

(Official)—Bids will be received by Philip Fosdick, Dir. Pub. Ser., until noon, Sept. 23, for the improvement of Plum St., from Eighth to Ninth St.

Cincinnati, Ohio—(Official)—Bids will be received by the Board of County Commissioners until noon, Oct. 2, for improving Park Ave., from Wooster Pike to Shawnee Run Road in Columbia Township. Albert Reinhardt is Clk. of the Bd.

Cleveland, Ohio—(Official)—Bids will be received by the Board of County Commissioners, until Oct. 3, for the improvement of the Kinsman Road. E. G. Krause is Clk. of the Bd.

+The contract for building a municipal paving plant has been awarded to F. D. CUMMER & SON, Cleveland, at $13,450.

Cleveland, Ohio—(Official)—Bids will be received by the Board of County Commissioners, until 10 a.m., Oct. 7, for improving the Usher Road. E. G. Krause is Clk.

Dayton, Ohio—(Official)—Bids will be received by the Board of County Commissioners, until 11 a.m., Sept. 21, for the sale of $24,000 in bonds for improving highway No. 62.

+**Defiance, Ohio**—The contract for paving the Canal Road with stone has been awarded to SCHNEIDER BROS., at $29,750.

East Liverpool, Ohio—(Official)—Bids will be received by E. J. Smith, Dir. Pub. Ser., until noon, Sept. 23, for improving Diamond and Dresden Aves.

+**Lorain, Ohio**—The contract for paving West 18th St. with stone filled asphalt has been awarded to the OHIO ENGINEERING CO., at $19,170.

+**Newark, Ohio**—The contract for paving Maple Ave., Seventh and Elizabeth Sts., has been awarded to R. H. NUTTER & CO.

Sandusky, Ohio—The County Commissioners will soon receive bids for a concrete and waterbound macadam road.

+**Sebring, Ohio**—The contract for improving South 15th St. has been awarded to GEORGE B. HERRING & SON, at $17,845. Noted Aug. 27.

Steubenville, Ohio—(Official)—Bids will be received by J. P. Gavin, Dir. Pub. Ser., until noon, Sept. 28, for grading, paving and curbing Hillary Square, Wilson Place, Belleview Blvd., Oak Grove and Arlington Aves., Pittsburgh and Carnegie Sts.

+**Bloomington, Ind.**—The contract for constructing the Waler Kechum pike road in Clear Creek Township has been awarded to BLAIR & KERR, at $7890. Noted Aug. 27.

+The contract for improving 13th St. has been awarded to STUART & STUART, Bloomington. Noted Aug. 20.

Brownstown, Ind.—(Official)—Bids will be received by the Commissioners of Jackson County until 1 p.m., Oct. 5, for constructing two roads in Driftwood Township.

+**Fowler, Ind.**—The contract for constructing a road in Hickory Grove Township has been awarded to L. W. ROOK, Fowler, at $11,345. Noted Aug. 27.

+**Gary, Ind.**—The contract for improving Alley 7W-Sect. 2 with brick on sand has been awarded to W. A. TRINLER, at $9009.

Lawrenceburg, Ind.—(Official)—Bids will be received by the Commissioners of Dearborn County until noon, Oct. 6, for constructing a gravel road in Lawrenceburg Township. W. S. Fagaly is Audr.

+**Rochester, Ind.**—The contract for constructing a gravel road in Fulton and Kosciusko Counties has been awarded to JOHN M. HATCH, Macy.

+**Detroit, Mich.**—(Official)—Contracts have been awarded for paving Military Ave., to E. PORATH & SON, at $4749; May Ave., to T. E. CURRIE, at $5599; Wilson Ave., to the CLEVELAND TRINIDAD PAVING CO., at $7213.

+**Grand Rapids, Mich.**—The contract for improving National Ave. has been awarded to HILDING & ROBIE, at $16,194.

+**Buckley, Ill.**—A contract for laying brick pavement has been awarded to H. C. FINLEY, Paxton, at $12,500.

+**Danville, Ill.**—The contract for paving Roselawn Ave. and Griffin St. with brick has been awarded to J. C. POLL, 19½ Walnut St.

+**Dixon, Ill.**—A contract for constructing 14,150 sq.yd. of brick paving and 3330 ft. of concrete curb and gutter on North Crawford St. has been awarded to RINK & SCHNELL.

+**Kankakee, Ill.**—The contract for paving Evergreen and Wildwood Ave. with asphaltic concrete has been awarded to F. P. CAUGHLIN.

+**O'Fallon, Ill.**—A contract for constructing 10,000 sq.ft. of sidewalks has been awarded to G. G. BUDINER & CO.

+**Peoria, Ill.**—The contract for paving Glen Oak Ave. with brick has been awarded to McELWEE & BUSHEL, at $10,734. Other bids were: John McAllister, $10,737; Barnewolt Construction Co., $11,698; A. D. Thompson, $10,820.

+**Princeton, Ill.**—The contract for paving Marion St. with concrete has been awarded to the ILLINOIS GRAVEL CO., at $6800.

+**Rockford, Ill.**—The contract for paving Ninth St. has been awarded to HART & PAGE, at $7500.

+**Burlington, Wis.**—The contract for paving and curbing Chestnut St. has been awarded to WILLIAM SOETEBIER.

Fond du Lac, Wis.—Bids will be received by the Board of Public Works, until Oct. 2, for grading and constructing a 10,575 yd. bituminous and 7900 yd. bituminous macadam pavement, 1320 yd. vitrified brick block pavement.

+**Madison, Wis.**—The contract for paving North Henry and West Gilman Sts. has been awarded to the STREICHER CO.

+**New Glarus, Wis.**—A contract for paving 6660 sq.yd. with reinforced concrete has been awarded to L. A. LARSEN, 104 Main St., Oshkosh, Wis.

Wauwatosa, Wis.—Bids will be received by the City Clerk, until Sept. 19, for improving portions of nine streets. The work includes 26,000 cu.yd. excavating, 20,000 cu.yd. filling, 8350 ft. combination curb and gutter, 7900 ft. curb and gutter, 10,575 yd. bituminous and 7900 yd. bituminous macadam pavement, 1320 yd. vitrified brick block pavement.

+**Nebraska City, Neb.**—A contract for paving 5300 sq.yd. with concrete has been awarded to JOHN BEEBE, Omaha.

+**Linneus, Mo.**—A contract for paving about 12,000 yd. with fiber brick has been awarded to the COLUMBIAN PAVING CO., Columbia, at $1.91 per yard.

+**St. Joseph, Mo.**—The contract for paving 22d and 23d with asphalt macadam has been awarded to the METROPOLITAN PAVING CO.

The City Engineer is preparing plans for the paving of Penn St. with asphaltic concrete.

+**Springfield, Mo.**—A contract for paving a number of streets has been awarded to E. L. MEEK.

+**San Antonio, Tex.**—The contract for improving the Rockport Road has been awarded to C. C. McRAE, at $10,943.

+**Fort Collins, Colo.**—A contract for grading State Highway No. 2, northeast of Wellington, has been awarded to O'DELL BROS.

+**Franklin, Idaho**—A contract for constructing four miles of concrete sidewalk has been awarded to LEROY HILL, Logan, Utah.

+**Wallace, Idaho**—The contract for paving Fifth, Bank and Hotel Sts. has been awarded to the WARREN CONSTRUCTION CO.

+**Salt Lake City, Utah**—A contract for laying sidewalks has been awarded to the PARROTT BROS. CO., at $25,596.

+**Aberdeen, Wash.**—The contract for paving Pacific Ave. has been awarded to L. G. HUMBARGER, at $10,924.

Centralia, Wash.—The Council has passed an ordinance providing for macadam paving on Sitka St., from State St. to National Ave.

Issaquah, Wash.—According to press reports bids will be received by the County Commissioners, until Sept. 29, for grading and graveling Falls City-Issaquah Road. The estimated cost is $80,000.

Pasco, Wash.—The Commissioners of Franklin County have voted to construct a highway to connect with the Riverview Road. The cost of this road will be about $16,000.

Port Angeles, Wash.—The City Council has ordered the improvement of Eighth and 10th Sts. by clearing, grubbing, grading, filling and paving.

+**Spokane, Wash.**—The contract for paving Broadway from Post to Monroe St. has been awarded to MITCHELL BROS., at $6999. Noted Sept. 10.

Walla Walla, Wash.—The City Council has passed an ordinance providing for the grading, paving and improving parts of Clinton, Terrace and Estelle Aves.

+**Bandon, Ore.**—The contract for paving Fourth St. and Grand Ave. has been awarded to the BANDON CONSTRUCTION CO.

Eugene, Ore.—The City Engineer has completed plans for opening 19th Ave., between Alder and Willamette Sts., and widening Eighth Ave. West of Blair Blvd. Also for macadamizing Kincaid St., from 13th Ave. East to 15th Ave. East.

+**Hillsboro, Ore.**—JEFFREY & CUFTON, Failing Bldg., Portland, at $18,698, received the contract for constructing the Capital Highway in Washington County.

+**Hood River, Ore.**—A contract for constructing the Columbia Highway has been awarded to the NEWPORT LAND & CONSTRUCTION CO., at $58,000. Noted July 16.

Yamhill, Ore.—The City Council has passed an ordinance providing for waterbound macadam pavement on Main St., from west line of city limits to east line of city limits, and on Third St., from south end of present pavement on Maple St. and road toward Carlton from Third St. to south line of city limits.

+**Los Angeles, Calif.**—The contract for improving Marathon St., from Hubbard to Coronado St., has been awarded to the FAIRCHILD-WILTON CO., at $5895.

Los Angeles, Calif.—[illegible] will be received by the County [illegible] Sept [illegible], for making improvements [illegible] Road Districts No [illegible] The approximate costs are $[illegible] respectively

National City, Calif.—The [illegible] contemplates improving D Ave. [illegible] St The approximate cost is $[illegible]

✦**Orange, Calif.**—The Board of Supervisors of Orange County has awarded a contract for highway construction to [illegible] at $[illegible]

Redwood City, Calif.—The Board of Supervisors of San Mateo County has rejected all bids for constructing a highway from [illegible] and will advertise for [illegible] The lowest bid was submitted by James Wilson, at $[illegible] The estimate of the County Surveyor was $[illegible]

Sacramento, Calif.—([illegible])—Bids were received Aug [illegible], by the State Highway Commission for constructing roads [illegible] as follows (a) Orange County, Sect [illegible] (b) [illegible] County, Sect B, Route [illegible] (c) Kern County, Sect A, Route [illegible] (d) Colusa County, Sect B, Route [illegible] (e) Santa Barbara County, Sect A, Route 2 (f) Sacramento County, Sect A, Route [illegible] (g) Yolo County, Sect A, Route 3 (h) Santa Barbara County, Sect G and I, Route [illegible] (i) Los Angeles, Sect B, Route [illegible] H F Cox, Pasadena, (a) $17,119 [illegible] Los Angeles (a) $17,[illegible], (b) $[illegible],183, [illegible] (f) $[illegible], O C Construction Co, Fullerton, (a) $16,[illegible] George Wiegand, La Manda Park, (a) $[illegible],611 [illegible] & Gaskill, Long Beach, (a) $37,936, Brashear-Burns Co, Los Angeles, (a) $[illegible], (h) $89,167, H L Peterson & A T [illegible], San Francisco, (b) $[illegible] Rogers Bros Co, Los Angeles, (b) $[illegible],462, (e) $19,[illegible] J W Calbeck, San [illegible], (h) $[illegible], (h) $[illegible], (i) $118,[illegible], A C McLean Construction Co, San Francisco, (c) $68,901, (h) $111,[illegible], (i) $[illegible], F [illegible], San Francisco, (c) $108,920, (h) $11[illegible],156, [illegible] McMillen, [illegible], (c) $[illegible] Shattuck [illegible] Co, San Francisco, (c) $[illegible], (h) $105,167, (i) $181,18[illegible] C L [illegible] Williams, (i) $67,119 Arthur Garrill, Oakland, (i) $[illegible] Joseph Lawrence, Roderick, (f) $41,498, E M Whitlock, San Francisco, (a) $21,301, Mahoney Bros, San Francisco, (h) $[illegible],611, (i) $1[illegible],1[illegible], C H Hudson, Los Angeles, (h) $[illegible], (i) $119,[illegible] Marsh Bros & Gardiner, Inc, San Francisco, (h) $1[illegible],91[illegible], (i) $1[illegible], P L Barr, San Francisco, (h) $[illegible] Lee Moore Contracting Co, Inc, Neenach, (i) $[illegible] John Monaghan, Yuma, Ariz, (i) $150,860 Rice & [illegible], Imperial, (i) $180,667 Toohey & Johnson, Phoenix, Ariz, (i) $[illegible] Noted Aug 13

Santa Cruz, Calif.—The Supervisors of Santa Cruz County have voted to construct a road from Pescadero to the State Highway The approximate cost will be $30,000

✦**Santa Maria, Calif.**—The contract for improving portions of [illegible] and Main St has been awarded to the ROADAMITE PAVING SUPPLY CO, Hellman Bldg, Los Angeles, at $[illegible]

✦**Kingston, Ont.**—The contract for paving a portion of [illegible] has been awarded to the KINGSTON CONSTRUCTION CO

✦**Perth, Ont.**—A contract for paving has been awarded to [illegible], Peterborough

✦**Winnipeg, Man.**—A contract for constructing sidewalks has been awarded to JACKSON & SONS

The Board of Control plans to pave Salter St with asphalt at an estimated cost of $[illegible],913

✦**Winnipeg, Man.**—The contract for paving Academy Road, [illegible], [illegible] Place, Greenwood Place, St John's [illegible] Ave, [illegible], Lefevre, Elgin, Lesle and [illegible] has been awarded to J W ASTLEY, at $13,69[illegible], $11,[illegible], $[illegible], $[illegible], $13,170, $[illegible], $[illegible], $1766 and $666, respectively

Edmonton, Alta.—The City Council contemplates paving [illegible]

INDUSTRIAL WORKS

Bridgeport, Conn.—The [illegible] Co plans to build an addition to its plant [illegible] ft It will be three stories [illegible] is the Arch

✦**Chester, Conn.**—[illegible] have awarded the contract to J H [illegible] & Co, Hartford for the construction of two additions to its plant Noted July [illegible]

✦**Torrington, Conn.**—The [illegible] Needle Co, Field St has awarded the contract to FRANK W FULLER for [illegible] an addition to its plant at $18,[illegible] Other bids [illegible] $[illegible] Lewis A Miller $[illegible] [illegible] $[illegible] H Wales Lines Co, $[illegible]

✦**Waterbury, Conn.**—The [illegible] has awarded the contract for the construction of its factory to [illegible] The estimated cost is $[illegible] [illegible] West Main St, are the Archs Noted Aug [illegible]

Buffalo, N Y—The [illegible] Co plans to erect a factory [illegible] The estimated cost is $[illegible]

New York, N Y—(Borough of Brooklyn)—[illegible] will receive bids for the construction of a [illegible]-story [illegible] factory, estimated cost $[illegible] [illegible] is the Arch

✦**Yonkers, N Y**—[illegible] has awarded the contract for the construction of a [illegible]-story [illegible] warehouse to the [illegible] CO, New York [illegible]

Bordentown, N J—[illegible] are having plans prepared for the construction of a [illegible] factory [illegible] is the Arch

Newark, N J—The [illegible] Chemical Co [illegible]

New Brunswick, N J—The [illegible] Tire & Rubber Co [illegible] plans prepared for a [illegible] factory [illegible] The estimated cost [illegible] is the Arch

Perth Amboy, N J—The Porto Rican-American Tobacco Co plans to erect a factory here The plant and equipment will cost about $[illegible] The general offices of the company are located at 17 Madison Ave, New York Noted Aug 27

Buena Vista, Penn.—A corporation to be known as the Williams [illegible] Tire & Rubber Co, capitalized at $[illegible], has purchased a site and plans to build a plant here for the manufacture of automobile tires and commercial rubber articles

Philadelphia, Penn.—The E G [illegible] Auto Body Co, has had plans prepared for the construction of a one-story [illegible]-ft factory at [illegible]th St and [illegible] Ave, Ballinger & Perrot are the Archs

✦Edward D Smith has awarded the contract for the construction of a two-story, [illegible]-ft factory, to CHARLES F [illegible] It will be erected on Cedar St The estimated cost is about $10,000

✦**Philadelphia, Penn.**—[illegible] Alexander has awarded the contract for the construction of a six-story warehouse at [illegible] North Broad St, to CRAMP & CO, Philadelphia The estimated cost is $[illegible]

Pittsburgh, Penn.—John [illegible] will erect a garage on Hooper St to cost $[illegible]

The Liberty Baking Co, Houston St, has had plans prepared for the construction of a seven-story [illegible]-ft bakery The estimated cost is $[illegible] C D [illegible] Co, Archs, Century Bldg, prepared the plans

Plymouth, Penn.—The Atwood Silk Co plans to erect a modern, fire-proof silk mill It will be three stories, [illegible] ft Lewis C Atwood and [illegible] Atwood, Plymouth are the owners

Point Breeze (Philadelphia post office) **Penn.**—The Philadelphia Rendering Co has had plans prepared for the construction of a one-story [illegible] ft factory

Reading, Penn.—Augustus W Arnold, [illegible] Washington St will receive bids for the construction of a three-story, [illegible]-ft factory The estimated cost is $16,[illegible] J [illegible], 119 South Fifth St, is the Arch

Baltimore, Md.—Townsend Grace Co, Fayette St, is having plans prepared for an eight-story addition Joseph Evans Sperry, 41[illegible] Calvert Bldg, is the Arch

Baltimore, Md.—Bids will be received, until Oct 1[illegible], by the United States Woolen Mills Co, [illegible] W Fayette St, for the construction of a building, [illegible] ft, six stories and basement Louis Levi, Philadelphia and Baltimore, is the Arch Estimated cost, $80,000

✦**Westport, Md.**—The Maryland Veneer & Basket Co, [illegible] East Falls Ave, has awarded the contract for the construction of three additions to its factory, to the FIDELITY CONSTRUCTION CO, 1709 West Lexington St, Baltimore

Benwood, W. Va.—The Wheeling Steel & Iron Co is having plans prepared for a one-story addition to its mills The estimated cost is $100,000 F H Bowers, Wheeling, W Va, is the Secy

Fayetteville, Tenn.—It is reported that the Elk Cotton Mills has decided to erect a No 2 mill which will cost $[illegible] including equipment

London, Tenn.—London Hosiery Mills is having plans prepared for a one-story [illegible]x168-ft addition to its plant The estimated cost is $1[illegible],000 H L Huntington, Chattanooga, is the Arch

Akron, Ohio.—The Mohawk Rubber Co plans to erect an addition to its plant on Second and River St The estimated cost is $[illegible]

Cincinnati, Ohio.—The [illegible] Ice Cream Co has acquired a site at [illegible] George St, where it plans to erect a three-story plant

H [illegible] & Son, manufacturer of iron forgings, West Sixth St, have bought the [illegible] plant on the south side of [illegible] St, and will move their foundry to the new location

✦**Cleveland, Ohio.**—The Warren [illegible] Co, 112[illegible] West Eleventh St, has awarded the contract for the [illegible] of its three-story factory, to PAUL BROS, [illegible] Bldg The estimated cost is $[illegible] [illegible], Leader-News Bldg, is the Arch

The National Telephone Supply Co is having plans prepared for the construction of a factory on Superior Ave and East 2[illegible]th St

✦The [illegible] Co has awarded the contract for the construction of additions to the MASTERS & MULLEN CONSTRUCTION CO, [illegible] Bldg, Cleveland The [illegible] Engineering Co prepared the plans

✦The [illegible] [illegible] Clark Ave, has awarded the contract for the construction of a two-story [illegible] ft addition to its plant to THE ANDERS CONSTRUCTION CO, [illegible] Champion Ave, Cleveland The estimated cost is $[illegible]

The [illegible] & Wire Co has had plans prepared for the construction of a warehouse at [illegible] Juniata Ave The estimated cost is $[illegible] The [illegible] Engineering Co prepared the plans

Coshocton, Ohio.—The [illegible] Co plans to erect a [illegible] addition to its factory

✦**Hamilton, Ohio.**—The [illegible] Co has awarded the contract for the construction of a three-story addition to the [illegible], Hamilton

Lakewood, Ohio.—The [illegible] Co has had plans prepared for a [illegible]-story [illegible] ft factory to be erected on [illegible] Ave The estimated cost is $[illegible] W [illegible], [illegible] Euclid Ave, Cleveland, is the Arch

Bay City, Mich.—The [illegible] Mfg Co, Chicago, Ill, has [illegible] to remove its plant to this city [illegible] will be prepared for a [illegible]-ft factory

Alton, Ill.—The Standard Oil Co plans to spend $1,[illegible] in extensions and improvements to its Wood River refining plant

Chicago, Ill.—The Albert A [illegible] Paper Box Co, [illegible] will receive bids for the construction of a [illegible] factory [illegible] South [illegible] are the Archs

The Central Mfg. Co., 1305 First National Bank Bldg., plans to build a five-story warehouse. The estimated cost is $250,000. S. S. Joy is the Arch.

George B. Limbert, has purchased a site at Fulton and Jefferson St., where a plant will be built.

B. Karoll, 768 Harrison St., plans to build a three-story factory on South Kedzie Ave., for the manufacture of metal specialties. The estimated cost is $30,000. D. S. Pentecost is the Arch.

Evansville, Ill.—The Midland Mirror Co., Salmanea, N. Y., plans to remove its plant to this city. William J. and Frank McGurk are interested.

Sterling, Ill.—The National Mfg. Co., will receive bids for the construction of a four-story, 48x90-ft. factory and office. Francis M. Barton, 178 West Jackson Blvd., is the Arch.

Des Moines, Iowa—The Green Foundry & Furnace Works has had plans prepared for a plant to be erected on a four-acre site in East Des Moines. The buildings to be erected are: Two-story, 66x200-ft. main building; one-story, 90x265-ft., foundry and machine shop; two-story, 40x120-ft. warehouse.

Minneapolis, Minn.—Bowman & Libby, Inc., distributors of Overland cars in the Northwest, plan to erect a three-story warehouse on Aldrich Ave., having a capacity of 1500 cars.

The Minneapolis Eastern Ry. Co. plans to erect a one-story roundhouse in this city.

Butte, Mont.—The Barnes-King Development Co. plans to erect a gold ore treatment plant on its Piegan-Gloster property.

+Seattle, Wash.—William G. Barnes has awarded the contract to the LONG BUILDING CO., for the construction of a garage on Eighth Ave. The estimated cost is $35,000. Noted Aug. 27.

Seattle, Wash.—The Elbert Motor Car Co., incorporated by L. H. Beamish, Vancouver, B. C.; N. F. Wilson, San Francisco. Calif., and L. W. O'Connell, Chicago, Ill., plans to erect a plant here for the manufacture of cycle cars.

Benicia, Calif.—Kullman, Salz & Co. plan to build a three-story addition, 85x125 ft., to their tannery. A. K. Salz is Pres.

Long Beach, Calif.—The South Coast Canning Co., plans to erect a packing plant 50x100 ft. on the south side of channel No. 2, Long Beach harbor, and a 50x400-ft. tuna cannery.

Los Angeles, Calif.—The Harbor Commission will construct two reinforced concrete warehouses at San Pedro Harbor. Each will be 150x160 ft. and four stories.

Orland, Calif.—J. A. Youngreen, J. Lundeen, H. H. Lundeen and G. C. Ladine plan erect a cheese factory in this city.

Niagara Falls, Ont.—Bids will be received for furnishing the roofing for the chain factory being erected by S. Austin & Sons, Cleveland, Ohio. The building will be two stories, 150x440 ft. and of reinforced concrete construction. The estimated cost is $150,000.

Windsor, Ont.—The Remington Arms Co. plans to build an addition to its plant estimated to cost $10,000.

FEDERAL GOVERNMENT WORK

+Raising Wreck—Buffalo, N. Y.—The Light-House Inspector of the Tenth District, Buffalo, N. Y., has awarded the contract for raising the wreck of light vessel No. 82 to the REID WRECKING CO., Port Huron, Mich., at $19,500.

Post Office—Port Jervis, N. Y.—Bids were received as follows by Oscar Wenderoth Superv. Arch. Treasury Dept. Washington, D. C., for the construction of a post office at Port Jervis, N. Y. (a) limestone; (b) marble. James Di Penedetti, New York, N. Y. (a) $47,329, (b) $47,329; Lewis P. Fluhrer, New York, N. Y., (a) $57,596, (b) $57,746; Westchester Engineering Co., White Plains, N. Y., (a) $52,000, (b) $53,000; Kelly – Kelly Inc., Long Island, N. Y., (a) $56,900, (b) $57,100. W. H. Fissel & Co., New York, N. Y., (a) $54,161, (b) $54,861; William H. Egan, New York, N. Y., (a) $48,613, (b) $49,073; Dunn & Sheridan, New York, N. Y., (a) $50,739; Harriman Industrial Coöperative Co., Harriman, N. Y., (a) $51,580, (b) $52,075. The building will be one story, mezzanine and basement, 4800 sq.ft. ground area, partial fire proof construction, tin and composition roof. Noted Aug. 6.

+Lock Gates—Troy, N. Y.—The contract for three sets of steel mica lock gates at the Troy lock, Hudson River, Troy, has been awarded to the KING BRIDGE CO., Cleveland, Ohio, at $21,382.

+Wiring Post Office—Camden, N. J.—The contract for a conduit and wiring system, including lighting fixtures, etc., for the U. S. post office at Camden, has been awarded to the QUAKER CITY ENGINEERING CO., Philadelphia, at $4159. Noted July 30 and Aug. 27.

+Post Office—Bedford, Penn.—The contract for the construction of the U. S. post office at Bedford, Penn., limestone, has been awarded to the W. H. FISSELL CO., 1133 Broadway, New York, N. Y., at $54,600. Noted July 16 and Sept. 3.

Locomotive Cranes—Philadelphia, Penn. — The following bids were received Sept. 12, by the Bureau of Yards and Docks for four 15-ton locomotive cranes, three for the Philadelphia Navy Yard, and one for the Navy Yard at Charleston, S. C.: Orton & Steinbrenner Co., Chicago, Ill., $23,812; Ohio Locomotive Crane Co., Bucyrus, Ohio, $23,922; the Industrial Works, Bay City, Mich., $25,000; McMyler Interstate Co., Bedford, Ohio, $25,160; Brown Hoisting Machinery Co., Cleveland, Ohio, $26,990; Exeter Machine Works, Pittston, Penn., $25,260; Browning & Co., Cleveland, Ohio, $23,995, plus $100 for radial arms; Link Belt Co., Chicago, $25,136, American Hoist Derrick Co., St. Paul, Minn., $30,078, alternate, $28,878.

Steel Sash and Frames—Washington, D. C.—The following bids were received Sept. 9 by the Assistant Secretary, Dept. of the Interior, Washington, D. C., for 104 steel window sash and frames with wired glass and operating devices for the Pension Office Building, Washington: Hecla Window Sill Co., 101 Park Ave., New York, N. Y., $9700; John A. Schneider Iron Co., Washington, D. C., $9050; Mesker Bros. Iron Co., St. Louis, Mo., $1977 additional for operators, 75c. per lin.ft.; David Lupton Sons & Co., Philadelphia, $2596; International Casement Co., Jamestown, N. Y., $6876; Detroit Steel Products Co., Detroit, Mich., $1769; Blake, Palm & Bro., Washington, D. C., $8890. Noted Sept. 3.

Sewage Plant—National Soldiers' Home, Va.—Bids will be received until 1:30 p.m., Sept. 24, by F. E. Skinner, Treas., Southern Branch, N. H. D. V. S., for the installation of a sewage purification plant.

★Bituminous Coal—Norfolk, Va.—Bids will be received until noon, Oct. 12 by Lieut.-Col. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk, Va., for furnishing about 2000 tons bituminous coal.

Boilers and Stack—Port Royal, S. C.—Bids will be received until 11 a.m., Oct. 3, by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., for two 50-hp. boilers, with steel stack, at the pumping station, Naval Disciplinary Barracks, Port Royal, S. C.

★Stone—New Orleans, La.—Bids will be received until 11 a.m., Oct. 14, by Maj. Edward H. Schulz, Corps Engrs., U. S. A., 325 Custom House, New Orleans, for about 65,000 tons of stone, to be placed on the jetties at Southwest Pass, Mississippi River.

Post Office—Portland, Ind.—Bids will be received until 3 p.m., Oct. 19, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction (including mechanical equipment, lighting fixtures and approaches) of the U. S. post office at Portland, Ind. It will be one story and basement, 4350 sq.ft. ground area, first floor fireproof, brick and stone facing and composition roof.

Post Office—Holland, Mich.—Bids were received Sept. 9 as follows, for the construction of the U. S. post office at Holland, Mich. (a) limestone, (b) sandstone: General Construction Co., Milwaukee, Wis., (a) $74,768, (b) $81,418; R. S. Moore, LaFayette, Ind., (a) $69,271, (b) $75,354; Dyke & Osting, Holland, Mich., (a) $85,000, (b), $88,000; M. Yeager & Son, Danville, Ill., (a) $69,475, (b) $75,975; W. H. Shields, Danville, Ill., (a) $65,000; Clark, Jonkman & Clark, Holland, (a) $70,368, (b) $72,868; John G. Unkfer & Co., Minerva, Ohio, (a) $65,540, (b) $69,040; George W. Stiles Construction Co., Chicago, Ill., (a) $65,138; A. W. Lane, Chicago, (a) $76,995; William O'Neil & Sons Co., Faribault, Minn., (a) $69,133; Charles Hoertz & Son, Grand Rapids, Mich., (a) $65,421, (b) $71,600. The building will be two stories and basement, stone facing, partial fireproof construction and composition roof; ground area, 6170 sq.ft. Noted July 30.

Elevator—McAlester, Okla.—Bids for the installation of an electric passenger elevator in the U. S. post office at McAlester, were received from the Kaestner & Hecht Co., Chicago, Ill., at $3800, and the Otis Elevator Co., New York, N. Y., at $3939. Noted Aug. 27.

+Boilers—Las Animas, Colo.—The contract for four 100-hp. water-tube boilers for the central power plant at Las Animas, Colo., has been awarded to the INDUSTRIAL HEATING & ENGINEERING CO., Milwaukee, Wis., at $13,400. Noted July 16.

Water Heater—Las Animas, Colo.—Bids will be received until 11 a.m., Oct. 3, by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., for a feed-water heater at the Naval Hospital, Las Animas, Colo.

Lumber—Seattle, Wash.—Bids will be received until 11 a.m., Sept. 24, by Col. George B. Davis, Depot Quartermaster Seattle, for furnishing at Seattle or Tacoma, Wash., or other Puget Sound ports, Portland, Ore., San Francisco, Calif., or other Pacific coast ports accessible to vessels of deep draft, or Manila, P. I., about 506,333 ft., b.m., of lumber.

+Portland Cement—Portland, Ore.—The Secretary of the Interior has authorized the Reclamation Service to award a contract for 10,000 bbl. of portland cement, f.o.b. cars, Irvin, Wash., to the INTERNATIONAL PORTLAND CEMENT CO., Irvin, Wash., at $1.15 per bbl., for use in the Umatilla irrigation project, Ore.

Coal Platform and Flume—San Diego, Calif.—Bids will be received until 11 a.m., Oct. 10, by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., for an extension to coal platform and flume at the Naval Coal Depot, San Diego.

Engines—San Francisco, Calif.—Bids will be received until 2 p.m., Sept. 29 by the Light House Inspector, San Francisco, for duplicate internal combustion engines, with direct-connected air compressors, about 30-hp each.

+Buildings—Pearl Harbor, Hawaii—The contract for the construction of five industrial buildings at the Naval Station, Pearl Harbor, has been awarded to the LORD-YOUNG ENGINEERING CO., Honolulu, H. T., at $60,975. List of bidders noted Aug. 20.

Steel—Philippine Islands—Bids will be received until noon, Sept. 28, by Col. S. W. Roessler, Corps Engrs., U. S. A., Room 707, Army Bldg., New York, N. Y., for furnishing structural steel for the Philippine Islands.

MISCELLANEOUS

Gymnasium—Worcester, Mass.—The Worcester Polytechnic Institute is having plans prepared for a gymnasium to cost $100,000. It will be three stories and basement.

Playgrounds—New Haven, Conn.—The city plans to construct playgrounds from Humphrey St. to Orange St., along Mill River. Bonds for $100,000 will be issued to purchase the site.

+Lock—Albany, N. Y.—Duncan W. Peck, State Supt. Pub. Wks., has awarded the contract to the RIVERSIDE CONTRACTING CO., 39 Cortlandt St., New York, for constructing a new lock in the Shinnecock-Peconic Canal, Suffolk County, at $38,366.

Barge Canal Work—Albany, N. Y.—Bids will be asked soon by Duncan W. Peck, State Supt. Pub. Wks., Albany, for power plants, electric equipment and machinery for operating and lighting Locks Nos. 1, 2, 3 and 4, Cayuga and Seneca Canal. Estimated cost, $176,087.

+Stable—Buffalo, N. Y.—The Crandall Horse Co., 949 William St., Buffalo, will construct a stable. It will be one story, 104x167 ft. Estimated cost, $15,000. H. P. Kehr, 315 Mutual Life Bldg., Buffalo, is Arch.

Barge Canal Terminal—Medina, N. Y.—Duncan W. Peck, State Supt. Pub. Wks., Albany N. Y., plans to award the

[illegible] in the fall for the proposed barge canal terminal at [illegible]

Dredging—New York, N. Y.—(Official)—Borough of Brooklyn. [illegible] will be received by L. H. Pounds, Borough Hall, [illegible] Sept. 17, for dredging a section of Newtown Creek and [illegible]. The work involves about [illegible],000 cu.yd. of dredging, scow measurement.

Subway—New York, N. Y.—(Borough of Brooklyn)—Bids will be received until Oct. 6, by the Public Service Commission, 154 Nassau St., Manhattan, for constructing the proposed subway section to connect the Lexington Ave. subway and the present Fourth Ave. subway.

♦**Subway**—New York, N. Y.—(Official)—Bids were received by the Public Service Commission, 154 Nassau St., Borough of Manhattan, on Sept. 15, for constructing Sect. 21, Route 18, the Park Place, William and Clark St. subway, a part of the Seventh Ave.-Lexington Ave. rapid transit railroad. The [illegible] totals are as follows: Smith, Hauser & McIsaac, Inc., New York, $[illegible]; Rapid Transit Subway Construction Co., 165 Broadway, New York, $2,268,000; Holbrook, Cabot & Rollins Corporation, $2,465,000; E. L. Cranford, Inc., $[illegible]; Underpinning & Foundation Co., New York, $2,[illegible]; Oscar Daniels Co., New York, $3,377,000.

Elimination of Grade Crossing—(Subway)—Rochester, N. Y.—The Board of County Supervisors, Rochester, plans to construct a subway under the tracks of the R. W. & O. Ry. to eliminate the grade crossing at Forest Lawn. Estimated cost, $[illegible].

Enlarging Pond—Atlantic City, N. J.—(Official)—Bids were received Sept. 10, by the city, for enlarging Doughty Pond. The bids follow: Sutton & Corson, $253,916; Atlantic Construction & Supply Co., $203,597; American Paving & Construction Co., $1[illegible],014; Charles L. Eastburn Co., $1[illegible],822; Merrill-Ruckgaber Co. (incomplete bid); E. L. Bader Co., Atlantic City, $1[illegible],501. The work calls for 30,000 cu.yd. of embankment, 24,1[illegible]0 sq.ft. of steel sheet piling, 20 cu.yd. cement grout, 24,100 lin.ft. of wood stripping, 1577 cu.yd. of concrete in spillway, 1000 lb. reinforcing steel, 59 expansion bolts, 1[illegible] cu.yd. concrete, wood stave collar; 2575 cu.yd. concrete in core wall, 13,000 ft. B. M. lumber, bridge from bank to intake, [illegible] lin.ft. of piling in spillway found., 9000 ft. B. M. lumber in spillway found., 27 acres (submerged) of cleaning, 250 acres of grubbing, 36,000 sq.ft. of concrete lining, new intake [illegible] chamber, 100 cu.yd. of concrete, not in plans; 100 cu.yd. of excavation, not in plans; 500 lb. of steel rods, not in plans; 5000 ft. B. M. lumber, not in plans.

♦♦**Dock**—Newark, N. J.—The contract has been awarded to O'GARA & McGUIRE, INC., by the city for constructing the proposed dock in the bayfront at the mouth of Peddie Ditch, at $[illegible]. Noted Aug. 20 and Sept. 10.

♦**Dredging**—Newark, N. J.—Bids were opened Sept. 3 by the Board of Street and Water Commissioners for dredging about 7[illegible]00 lin.ft. of the channel now being dredged by the city in Newark Bay. The Atlantic Gulf & Pacific Co., New York, submitted the lowest bid, at $121,452. Noted Aug. 27.

♦**Vault Equipment**—Trenton, N. J.—(Official)—Bids will be received until noon, Oct. 6, by Edward I. Edwards, State Controller, Trenton, for vault equipment in the office of the Secretary of State.

♦**Fire Station**—Union, N. J.—The town has awarded the contract to LIMOUZE BROS., 410 Park Ave., Union, for constructing a two-story fire station, at $15,000. Noted Aug. 13.

♦**Coal and Ash Plant**—Philadelphia, Penn.—(Official)—The contract has been awarded by the Bureau of Water, Dept. of Pub. Wks., to R. H. BEAUMONT, Drexel Bldg., Philadelphia, for a coal and ash handling plant at the Belmont Pumping Station, at $12,3[illegible].

♦**Iron Fence**—Philadelphia, Penn.—(Official)—The Bureau of Water, Dept. Pub. Wks., has awarded the contract to [illegible] BROS., Randolph and Wood Sts., Philadelphia, for constructing an iron fence around George's Hill Reservoir, at [illegible]c. per lin.ft.

Fire Station—Philadelphia, Penn.—Plans are being prepared by [illegible] A. Crane, City Arch., for the construction of a fire station. The building will be two stories and basement, [illegible] ft. Estimated cost, $40,000.

♦**Concrete Bins, Trestles**—Steelton, Penn.—(Official)—The Pennsylvania Steel Co., Steelton, has awarded the contract to the RAYMOND CONCRETE PILE CO., 140 Cedar St., New York, and 111 West Monroe St., Chicago, Ill., for the design and construction of concrete ore, coke and limestone bins, and ore and [illegible] trestles. The work calls for several thousand concrete piles and a large yardage of concrete construction.

Excavation and Filling—Baltimore, Md.—Bids for the excavation and filling [illegible] cu.yd. of earth at the approaches of the new Hanover St. [illegible] and along the Baltimore [illegible] where the [illegible] will run, were opened Sept. [illegible] by the State Roads Commission. There were [illegible] bids on the work. The lowest bidder was the Tuck Construction Co., [illegible], Va., at [illegible] per cu.yd., making a total of $[illegible]. The engineer's estimate was [illegible] per cu.yd., or a total of [illegible].

♦**Fountain**—Baltimore, Md.—The Board of Awards has awarded the contract to the DAVID M. ANDREW [illegible] [illegible] Ave., Baltimore, for constructing a fountain at [illegible] and Fallsway, at about $[illegible].

Stable—Baltimore, Md.—J. C. Spedden, Arch., 1840 Hanover St., Baltimore, is preparing plans for a stable for the [illegible] Co., [illegible], Baltimore. Estimated cost, about $[illegible].

Gymnasium—Lexington, Va.—Washington University, Lexington, is [illegible] for the construction of a gymnasium [illegible]. It will be three stories and basement, [illegible] ft. [illegible], Washington, D. C., are Archs.

Drydock, Etc.—Norfolk, Va.—The W. H. Thomas Co., Norfolk, plans to construct a floating drydock and marine railway. Estimated cost, $[illegible].

Wharves and Docks—[illegible], Fla.—The Southern Utilities [illegible] plans to construct wharves and docks at the foot of Ave. D.

Pier—Biloxi, Miss.—The city is considering the construction of a pier in the western section. Estimated cost, $10[illegible],000.

Fire Apparatus—Gulfport, Miss.—The city plans to purchase fire apparatus. E. W. Wells is City Clk.

♦**Levee Work**—Vicksburg, Miss.—The contract has been awarded to A. K. AMACKER, Lake Providence, La., for 1[illegible],000 cu.yd. of levee enlargement on Waxhaw Levee.

Levee—New Orleans, La.—The Orleans Levee Board will ask for bids soon for constructing a new levee in the vicinity of the Naval Station, calling for 1[illegible],000 cu.yd., also for levee enlargement, calling for 70,000 cu.yd., and clearing and cleaning a large section of the levee above the city.

♦**Walls**—Memphis, Tenn.—See item under Streets and Roads.

Fire Station—Akron, Ohio—The city is having plans revised for the construction of a central fire station. It will be three stories, 60x90 ft. Estimated cost, $40,[illegible]. Bids received recently were rejected. Fichter & Brooker, Second National Bank Bldg., Akron, are Archs.

Stable—Bellbrook, Ohio—Bids will be received until noon, Sept. 23, by the town for constructing a stable. W. Tate is Clk.

♦**Cement**—Cincinnati, Ohio—The PORTLAND CEMENT CO. has been awarded contract for 1[illegible],000 bbl. of portland cement to be used in the building to be erected by the Methodist Book Concern.

♦**Fencing**—Cincinnati, Ohio—The Hospital Commission have awarded the contract to the ENTERPRISE IRON WORKS, Indianapolis, Ind., for fencing around the hospital grounds on Burnet Ave., at $14,570.

♦**Revetment Wall**—Columbus, Ohio—John T. Miller, State Supt. Pub. Wks., Columbus, has awarded the contract to ARPP & SIMPSON, Middletown, Ohio, for constructing a revetment wall at Indian Lake.

Ship Canal—Geneva, Ohio—It is reported that surveys are being made for constructing the proposed canal from Lake Erie to the Ohio River.

Retaining Wall—Lebanon, Ohio—Bids will be received until 11 a.m., Sept. 21, by John M. Mulford, County Audr., Lebanon, for constructing a retaining wall with piling foundation and guard rail.

♦**Ore Docks**—North Randall, Ohio—The Erie R.R. Co. has awarded the contract to the PATTERSON & MORAN CO. for enlarging its ore dock at North Randall.

Equipment—Springfield, Ohio—Bids will be received until noon, Oct. 3, by F. L. Allen, Secy. Tuberculosis Hospital Trustees, Springfield, for refrigeration and laundry equipment.

♦**Grandstand**—Wooster, Ohio—The University of Wooster has awarded the contract to the HUNKIN-CONKEY CO., 321 Cuyahoga Bldg., Cleveland, for constructing a grandstand, 43x105 ft., at $50,000.

Fire Station—Bloomington, Ind.—The city plans to construct a fire station to cost $40,000. It will be two stories and basement. Horace Blakely is City Clk.

Natatorium—Chicago, Ill.—Bids will be received by the West Chicago Park Commissioners, until Sept. 22, for constructing a natatorium. James R. Wibelka, 29 South La Salle St., Chicago, Ill., is Arch.

Field House—Chicago, Ill.—Plans have been completed by the architect of the North West Side Park Commissioners for the construction of a field house. The structure will be of reinforced concrete, two stories and basement, 60x275 ft. Estimated cost, $50,000.

Bath-house—Chicago, Ill.—The South Park Board of Commissioners is having plans prepared for a bath-house to be constructed at 26th and Wentworth Aves. John F. Neil is Secy.

Road Machinery—Freeport, Ill.—O. G. Hinely, County Supt. of Highways, plans to purchase road machinery.

Levee Work—Naples, Ill.—The River and Lakes Commission has awarded the contract to P. J. MURPHY, Moberly, Mo., for raising and enlarging the levees in the vicinity of Naples, at 13.7c. per cu.yd.

♦**Fire Apparatus**—Milwaukee, Wis.—The city has awarded contracts as follows for fire apparatus: To the SEAGRAVE CO., Columbus, Ohio, for one combination pumping engine and hose wagon, at $9150; to the AHRENS-FOX FIRE ENGINE CO., Cincinnati, Ohio, for one combination truck, at $[illegible].

Retaining Wall—Davenport, Iowa—The Davenport Park Commission plans to construct a retaining wall along the riverfront. J. [illegible] Ryan is City Engr.

♦**Ditch**—Hampton, Iowa—The Commissioners of Hardin and Franklin Counties have awarded the contract to CHRIS HAGSTAD, Nevada, Iowa, for constructing joint ditch No. 4, at $[illegible]. The contract for tile work was awarded to the WHEET CLAY PRODUCTS CO., at $2[illegible].

Ditch—Slayton, Minn.—Bids will be received until 10 a.m., Sept. [illegible], by W. A. [illegible], County Audr., Slayton, for constructing judicial ditch No. 9. The work calls for 1[illegible] ft. of main ditch and [illegible] branches and laterals, aggregating 94,2[illegible] ft. Estimated cost, about $[illegible].

♦**Fire Station**—Virginia, Minn.—The city has awarded the contract to J. P. [illegible], Virginia, for constructing a fire station addition, at about $1[illegible]. It will be two stories, of brick. C. K. Shand, First National Bank Bldg., Virginia, is Arch.

Ditch—Talmage, Neb.—Otoe and Johnson Counties plan to construct a drainage ditch in Otoe and Johnson Drainage District No. 1. Shanton & Schwaner, Nebraska City, Neb., are Engrs.

Park Improvement—Aberdeen, S. D.—The Park Board plans to spend $1[illegible] to improve the parks.

Drainage District—East Waco, Tex.—The County Commissioners, Waco, have established a drainage district in East Waco.

Wharf—Houston, Tex.—The city plans to construct a wharf and warehouse at the turning basin. Estimated cost, $200,000. Frank L. Dormant is City Engr.

Ditches—Houston, Tex.—Bids will be received until 10 a.m., Sept. 21, by H. L. Washburn, County Audr., Houston, for constructing ditches along Lowell and 27th Sts., Houston.

Dock Extension—Orange, Tex.—The Southern Pacific Co. plans to extend its dock at Orange, 240 ft. William Hood, San Francisco, Calif., is Ch. Engr.

Dam—Salt Lake City, Utah—The City Engineer has submitted plans to the State Engineer for a dam 69 ft. high and 630 ft. long, to be constructed below Twin Lakes, at the head of Big Cottonwood River.

Fire Apparatus—Puyallup, Wash.—The city is considering an issue of $10,000 in bonds for the purchase of fire apparatus.

+Cement—Seattle, Wash.—Bids were received, Aug. 27, by the Port of Seattle Commission for 15,000 bbl. of cement. The contract has been awarded to the BALFOUR-GUTHRIE CO., Seattle, at $1.90 per bbl.

+Excavation, Etc.—Seattle, Wash.—The Port of Seattle Commission has awarded the contract to the PUGET SOUND BRIDGE & DREDGING CO., Central Bldg., Seattle, for excavation and slope protection for wharf No. 2, at about $75,000.

+Cold Storage Equipment—Seattle, Wash.—The Port of Seattle Commission has awarded to the VILTER MFG. CO., at $33,490 the contract for installing cold storage equipment in central water-front warehouse to be built here.

+Excavation and Rock Work—Seattle, Wash.—The PUGET SOUND BRIDGE & DREDGING CO., Seattle, at $79,000 have received the contract for excavation and rock work for the fruit wharf and warehouse on East Waterway.

Repairs to Vessel—Seattle, Wash.—The Canadian Pacific Ry. Co. has asked for bids for repairs to the steamship "Princess Victoria," damaged in a recent collision with the "Admiral Sampson." The work will cost about $20,000, and includes the renewing or removing, repairing and return to the steamer of eleven plates, and a new stem bar.

Vessel—Seattle, Wash.—The Inland Navigation Co. will build a 16-knot passenger vessel to ply between Kingston and Ludlow. The boat will cost $25,000. Bids will be asked soon.

Dredging—Seattle, Wash.—The Commissioners of Pierce County, Tacoma, and King County, Seattle, plan to dredge the Puyallup River seven feet deeper from Puyallup, Wash., to the city limits of Tacoma, Wash. Estimated cost, $125,000.

River Work—Tacoma, Wash.—All bids submitted for excavation in the Stuck River Improvement Project have been rejected by the County Commissioners of King and Pierce Counties. The work will be readvertised. Estimated amount, 3,000,000 cu.yd.

Oil Tanks—Hood River, Ore.—The Standard Oil Co. plans to construct oil tanks at Hood River.

Dredging—Portland, Ore.—The Port of Portland Commission plans to purchase a strip of Swan Island and dredge a channel 1000 ft. long and 30 ft. wide.

Barn—Portland, Ore.—C. C. Rich, City Arch., will ask fo bids soon for a $50,000 municipal barn to be erected at 15th & Jefferson Sts. The building will be two stories, of concrete and stone.

Waterfront Improvement—Alameda, Calif.—The city is considering water-front improvements to cost $200,000. George E. Plummer is interested.

Docks and Buildings—San Diego, Calif.—The Kelp Products Co., San Diego, plans to construct docks and buildings at San Diego. Percy T. Hannigan, U. S. Grant Hotel, San Diego, is local representative.

+Pier—San Francisco, Calif.—The Board of State Harbor Commissioners has awarded the contract to the HEALY-TIBBETS CONSTRUCTION CO., San Francisco, for constructing Pier 37, at $204,300. Bids were opened Sept. 3.

Snow Sheds—Truckee, Calif.—The Southern Pacific Co. plans to reconstruct 7000 ft. of snow sheds near Truckee. Estimated cost, $80,000. W. Hood, San Francisco, Calif., is Ch. Engr.

Pier—Venice, Calif.—The Maier Amusement Co. has been incorporated for the purpose of constructing an amusement pier at Venice. L. P. Collette, Venice, is interested.

Rink—Antigonish, N. S.—The St. Francis Xavier Athletic Association, Antigonish, will erect a skating rink. It will be two stories, 110x50 ft. Estimated cost, $35,000. C. W. West, Antigonish, is Arch.

+Wharf—Hatfield, N. S.—The Canadian Government has awarded the contract to W. R. FAWCETT, Temperance Vale, N. B., for constructing a wharf at Hatfield Point.

+Fire Apparatus—Toronto, Ont.—The city has awarded the following contracts for motor fire apparatus: To HUGH CAMERON & CO., Toronto, representing the Waterous Co., Brantford, Ont., for one pumping engine, at $10,500; two combined engines and hose wagons, to the WHITE CO., at $7674 each.

Docks—Winnipeg, Man.—Plans have been prepared for the construction of docks at River and Notre Dame Aves. Estimated cost, $200,000. H. M. Ruttan is City Engr.

Lighthouse—Bonilla Island, B. C.—Bids will be received until Sept. 21, by the Department of Marine and Fisheries, Ottawa, Ont., for constructing a lighthouse on Bonilla Island.

+Dikes, Etc.—Sea Island, B. C.—The contract has been awarded to J. W. PYKE, Sea Island, for constructing dikes and flood boxes for reclamation work on Sea Island, at $24,465.

The C. & C. Electric & Mfg. Co., Garwood, N. J., manufacturer of electric motors, generators and electric arc welding equipment, announces the removal of its Detroit offices from 144 Seyburn Ave., to 1111 Chamber of Commerce Bldg. Mr. R. K. Slaymaker will be in charge.

BUILDINGS

Boston, Mass.—Plans have been completed by J. J. Smith, Arch., for the one story theater and store building to be erected on School St. The cost is estimated at $80,000. Noted Sept. 3.

+Cambridge, Mass.—Contracts for the erection of the Germanic Museum, on Kirkland St., have been awarded as follows: General contract, W. H. & H. A. ROOT, 1 Beacon St., Boston, Mass.; structural iron, G W. & F. SMITH IRON CO., Gerard St., Roxbury, Mass.; reinforced concrete, SIMPSON BROS. CO., 166 Devonshire St.

+Plymouth, Mass.—Contracts for the erection of the three-story and basement, 56x145-ft. building, for the Jordan Memorial Hospital, have been awarded as follows: General contract, S. P. TROY CO., 88 Broad St., Boston, Mass.; fireproofing, PENN TILE CO.

Worcester, Mass.—Plans are being prepared by Hewitt & Brown, Archs., 716 Fourth Ave. S., Minneapolis, Minn., for the three-story and basement gymnasium for the Polytechnic Institute, Worcester. The estimated cost is $100,000.

+Contracts for the four-story and basement Y. M. C. A. building, to be erected on Main St., have been awarded as follows: General contract, NORCROSS BROS. CO., Worcester; heating, WALWORTH, ENGLISH & FLETT CO., 10 Pearl St., Boston, Mass.

Frost & Chamberlain, Archs., Slater Bldg., have completed plans for the building to be erected for the Worcester Boys Club.

Worcester, Mass.—(Office)—Bids will soon be received by George C. Halcott, Supt. of Pub. Bldgs., for constructing the 12-room school at Rice Square. The estimated cost is $60,000. John T. Simpson, Essex Bldg., Newark is the Arch.

Providence, R. I.—Plans have been completed by K. C. Richmond, Arch., for the Second ward police station, to be erected on Sessions and Wayland Ave. It will be three stories, of brick. J. H. Gainer, Mayor, is Chn. of Com. on Contract and Supply.

+Greenwich, Conn.—The general contract for the erection of the school at Hamilton Ave. has been awarded to H. E. SENFT; electric work, JUSTUS & RICH, both of Greenwich.

Albany, N. Y.—Bids were received by the Board of Contract and Supply for erecting schools as follows: School No. 18, Peter Keeler Building Co., $64,833, John Dyer Jr., $67,890, M. Kantrowitz, $68,000; school No. 16, J. B. Waldbillig, $44,564; W. S. Hamill Co., $46,000, M. L. Ryder Building Co., $46,695.

Buffalo, N. Y.—Clark, MacMullen & Riley, Engrs., 101 Park Ave., New York, are preparing plans for the erection of a brick and stone freight and passenger station. The estimated cost is $500,000.

Buffalo, N. Y.—Plans are being prepared by Louis R. J. Eckel, 191 York St., for a two-story and basement brick building for the Knights of Pythias. The estimated cost is $50,000.

+Deposit, N. Y.—The general contract for the erection of the three-story and basement high school, 139x125 ft., has been awarded to FORD & VAN NESS, Oswego, N. Y.; structural iron, to SHAPLEY & WELLS, Binghamton, N. Y. The estimated cost is $60,000.

New York, N. Y.—Plans are being prepared by Maynicke & Francke, Archs., 25 East 26th St., for the five-story store and loft building to be erected at 120 West 41st St. for the West 40th and 41st St. Realty Co. The estimated cost is $40,000.

(Borough of Brooklyn)—Plans have been completed by Montrose W. Morris, Arch., 234 Hancock St., for a six-story hotel at Dean St. and Bedford Ave. for Louis F. Seitz. The estimated cost is $300,000.

Rensselaer, N. Y.—Plans are being revised by Robert D. MacPherson, 207, Arkay Bldg., Albany, N. Y., for a three-story dormitory, at Lawrence and Herrick Sts., for the Convent of Mercy. The estimated cost is $50,000.

Rochester, N. Y.—The Delmar Garden Co. is having plans prepared for a one-story theatre on Culver Road. The estimated cost is $50,000. Rees & Ade, 344 East Ave., are the Archs.

+Schenectady, N. Y.—The contract for erecting a three-story building for the Delta Phi Fraternity, has been awarded to P. M. SIMMONS, Johnstown, N. Y.

Walden, N. Y.—F. E. Estabrook, Arch., 75 Second St., Newburgh, has completed plans for the erection of a three-story brick municipal building, 100x90 ft. The estimated cost is $55,000.

Bayonne, N. J.—John H. and Wilson C. Ely, Archs., Firemen's Bldg., Newark, have completed plans for the erection of a two-story stone city hall on Ave. C between 27th and 28th Sts. The estimated cost is $400,000. Noted Aug. 20.

Hackettstown, N. J.—William W. Rasmussen, Arch., 1133 Broadway, is preparing plans for an addition and remodeling the school, for the Board of Education. The estimated cost is $75,000.

Newark, N. J.—The lowest bids received by the Board of Education for the erection of the high school have been received as follows: Masonry, P. L. Mackinson, $50,365; carpentry, Trivett & Walters, $19,400; steel and iron, Beaver Engineering & Construction Co., $13,300; roofing, Newark Cornice & Sky Works, $1949; heating, E. G. Woolfolk & Co., Inc., $14,777.

Plainfield, N. J.—Plans have been completed by Wilder and White, Archs., 50 Church St., New York, for the erection of a school on Evergreen Ave. The estimated cost is $125,000.

+Chester, Penn.—The contract for the construction of the church for the Ridley Park Presbyterian Church has been awarded to the POMEROY CONSTRUCTION CO., at $40,000.

+Milton, Penn.—The contract for the erection of a school building at Milton, has been awarded to FINK & SEIDEL, Berks Trust Bldg., Reading, Penn. The estimated cost is $45,000.

+Philadelphia, Penn.—Contracts for the erection of the [illegible] school have been awarded as follows: General construction, EDWARD F. FONDELL, $[illegible]; heating and ventilating, S. [illegible] & [illegible], $[illegible]; electrical work, W. G. CORNELL CO., $[illegible]. Noted Aug. 6.

+Pittsburgh, Penn.—The contract for the erection of the [illegible] school at [illegible] Ave. and [illegible] St. has been awarded to the DAWSON CONSTRUCTION CO. Noted Aug. 13.

+Scranton, Penn.—The contract for the erection of a ten-story bank and office building for the [illegible] National Bank has been awarded to CHARLES T. WILLS, INC., 286 Fifth Ave. The estimated cost is $[illegible]. Noted July 30.

Warren, Penn.—Bids will be received until Oct. 1, by C. C. & A. L. T[illegible], Archs., New Castle, Penn., for an addition to the hospital at Warren. The estimated cost is $10,000.

Waynesboro, Penn.—[illegible] The Y. M. C. A. will erect a building to cost about $[illegible]. The Building Committee will soon call for bids on the work.

Wilmington, Del.—Bids have been received by the New Castle County and Wilmington Building Commissions, for the concrete work in connection with the construction of the municipal building at Tenth and French St. as follows: J. S. [illegible], A. $[illegible], B. $[illegible]; Hennings Meldens & Co., A. $[illegible], B. $[illegible]; Connors Bros. Co., A. $91,031, B. $117,031; [illegible] $[illegible]; J. H. Kelly, A. $74,117, B. $84,386; Talley & Syfrit, A. $[illegible], B. $[illegible]; [illegible] $[illegible]. Noted Aug. 13.

Washington, D. C.—Bids will be received about Oct. 1, by the District Commissioners, for the erection of a three-story and basement high school on First St. between N and O Sts., N. W. The estimated cost is $550,000.

Alexandria, Va.—Bids will be received until Sept. 24, by the Joint Commission on City Property and Schools, for the erection of a high school on Cameron and West Sts. The estimated cost is $[illegible].

Athens, W. Va.—Bids will be received until Oct. 8, by J. S. [illegible], Pres. State Bd. of Control, Charleston, W. Va., for the construction of an auditorium, and the installation of a heating plant at the Concord School. H. Rus Warne, Charleston, W. Va., is the Arch. Noted June 11.

+Wheeling, W. Va.—The contract for concrete piling for foundations of the building at Wheeling, for F. F. Faris, Wheeling, has been awarded to the RAYMOND CONCRETE PILE CO., 140 Cedar St., New York.

Savannah, Ga.—Plans are being prepared by H. W. Witcover, Arch., Savannah, for the erection of a ten-story hotel, [illegible] ft., for Robert M. Hicks. The estimated cost is $260,000.

+West Palm Beach, Fla.—(Official.) Bids will be received until Oct. 6 by R. H. [illegible], Chn., Palm Beach County Commrs., for a two-story and basement court house to be erected at West Palm Beach. The estimated cost is $150,000. W. H. [illegible] is the Arch., 3[illegible] St. James Bldg., Jacksonville. Noted [illegible].

Montevallo, Ala.—Bids will be received about Sept. 25, by William T. Warren, Arch., Empire Bldg., Birmingham, for the erection of a three-story [illegible] ft. science building for the Alabama Girls Technical Institute. The estimated cost is $[illegible]. Noted Aug. 13.

Meridian, Miss.—Bids will be received until Sept. 22, by [illegible], Arch., Meridian, for the city hall to be erected at Meridian. The estimated cost is $100,000.

Alexandria, La.—Bids will be received until Oct. 1, by D. B. [illegible], Secy. Bd. of [illegible] Parish, for a three-story school. The estimated cost is $[illegible],000. Favrot & Livaudais, New Orleans, La., are the Archs. Noted Aug. 20.

Memphis, Tenn.—Jones & Furbringer, Archs., Porter Bldg., Memphis, are completing plans for the temple of the Congregation of Israel. The estimated cost is $[illegible]. Noted Aug. 13.

The lowest bids received for the erection of the Prescott school were those of L. A. F[illegible], Memphis, at $[illegible], for the general construction, and F. D. Young & Son, Memphis, at $[illegible] for the mechanical construction. Jones & Furbringer are the Archs., Porter Bldg. Noted Aug. 13.

+Cleveland, Ohio.—The contract for the construction of the addition to the German Hospital, Franklin Ave., has been awarded the STRIMPLE CONSTRUCTION CO. Estimated cost about $[illegible].

Plans have been completed and bids will be received by W. S. Lougee, Marshall Bldg., Cleveland, for the construction of brick and tile office buildings and a boat terminal at the foot of East Ninth Ave. for the Detroit & Cleveland and the Cleveland & Buffalo Navigation Co. Estimated cost $[illegible].

Ironton, Ohio.—The Ironton Hotel Co. has had plans prepared for the construction of a hotel to cost about $[illegible]. Howard & Merriman, Columbus, are the Archs.

Bittman, Ohio.—All bids received Aug. 14 for erecting a high and grade school have been rejected. New bids will be called for in December. R. E. Fisher is Clk., Bd. of Education. Noted Aug. 13.

+Springfield, Ohio.—The Memorial Hall Commission has awarded the contract for the erection of the proposed building to A. BENTLEY & SONS, Toledo, at $138,[illegible].

Indianapolis, Ind.—Bids will be received, until Sept. 22, by Otto Wolf, Secy., Wigwam Hotel, 316 Indiana Trust Bldg., for the construction of an auditorium, Red Men's Lodge and hotel. The building will be eleven stories, 67x137 ft. Estimated cost, $250,000. Charles R. Weatherhog, Hamilton Bank Bldg., Fort Wayne, Ind., is the Arch.

Jeffersonville, Ind.—The Board of Education has approved plans submitted for a school to be erected at 12d and Hermine St. The estimated cost is about $75,000.

+The Board of Education has awarded the contract for erecting the school on Duncan St. to THOMAS & WHITTON, at $47,218.

Iron River, Mich.—Bids will be received about Sept. 15, by the City Clerk, for the erection of a town hall. The estimated cost is about $54,000. Allan & Curtis, Saginaw, Mich., are the Archs.

Chicago, Ill.—Kusel & Harris, 30 North La Salle St., are having plans prepared for a [illegible]-ft. office and hotel building. The estimated cost is $100,000. R. C. Harris, 30 North La Salle St., is the Arch.

Fond du Lac, Wis.—The State Board of Control, Madison, Wis., Ralph E. Smith, Pres., has secured a 2[illegible]-acre site for the State Women's Reformatory. Plans are being prepared for an administration building, $60,000; dormitories, $80,000; heating and power plant, $1[illegible],000, and laundry, $1[illegible]. A. D. Conover, Arch.

+Ottumwa, Iowa.—The First National bank has awarded the contract for the erection of its bank building to the BLACK HAWK CONSTRUCTION CO. The estimated cost is $65,000. E. Jackson Casse, 53 West Jackson Blvd., Chicago, Ill., is the Arch.

+Duluth, Minn.—The contract for the erection of the Harriet Beecher Stowe School has been awarded to JA[illegible]SON BROS., Duluth, at $54,7[illegible].

Moorhead, Minn.—The State Board of Control, [illegible] Mullen, Secy., St. Paul, will receive bids, until Sept. [illegible], for the erection of a library and class room addition to the State Normal School. The estimated cost is about $[illegible]. C. L. Pillsbury, Metropolitan Life Bldg., Minneapolis, is the Arch.

Windom, Minn.—The Southwestern Minnesota Tuberculosis Assn. has purchased a site in this town where it plans to erect a hospital to cost about $75,000.

Atchison, Kan.—The Alumni Association, St. Benedict's College, plans to erect a building to be known as W[illegible] Hall. The estimated cost is $[illegible],000.

Ashland, Neb.—The Nebraska National Guard plans to build an armory here for the seven companies of the state organization. The estimated cost is $[illegible],000.

+Norfolk, Neb.—The contract for the erection of the hospital for the insane has been awarded to W. J. CR[illegible]DON, Omaha, at about $[illegible].

Miller, S. D.—Preliminary steps are being taken for the erection of a court house to cost about $[illegible],000.

BARGE CANAL WORK, ALBANY, N. Y.

Bids were opened Aug. 27 by Duncan W. Peck, State Supt. Pub. Wks., for Barge Canal Contract 15 A, constructing the canal from [illegible] to the Montezuma Aqueduct, and Contract [illegible], [illegible] constructing Vienna[illegible] Ferry Road [illegible] over the Troy [illegible] branch of the New York Central R.R. from (A) James Stewart & Co., Inc., New York; (B) [illegible] Co., Cleveland, Ohio; (C) New York State Dredging Corporation, Rochester; (D) Great Lakes Dredge & Dock Co., [illegible]; (E) [illegible] Construction Co., [illegible]; (F) Kieser Construction Co., East St. Louis, Ill.; (G) Maryland Dredging & Contracting Co., Baltimore, Md.; (H) Merrill-Ruckgaber Co., New York; (I) Frank L. Cohen, Buffalo; (J) [illegible] & [illegible] Co., Inc., Buffalo; (K) Walsh Construction Co., Davenport, Iowa; (L) Whitehead & Kales Iron Works, Detroit, Mich.; (M) Ford & [illegible]; (N) State Highway Construction Co., Boston; (O) [illegible] & [illegible], Buffalo; (P) Keith & Guthrie [illegible]. The items [illegible] were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L
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*Estimated amount.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Sioux Falls, S. D.—The Board of Education has appropriated $47,000 for the erection of a school building on the East side.

St. Louis, Mo.—The following were the lowest bids for the construction of the Bryan-Mullanphy School at Kelm and Shaw Ave.: (General Contract) Murch Bros. Construction Co., $173,990. (Building complete.) Wharton Building & Supply Co., St. Louis, $232,400.

Rogers, Ark.—The Benton County Hardware Co. is having plans prepared for a four-story building to be erected at Second and Elm St. The estimated cost is $50,000

El Paso, Tex.—The El Paso School Board is having plans prepared for a high school to cost about $500,000. Trost & Trost, Mills Bldg., El Paso, are the Archs.

Colorado Springs, Colo.—The Board of Trustees, International Typographical Union, John C. Daley, Supt., contemplates building an addition to the Home. Estimated cost about $120,000.

+Denver, Colo.—The contract for the erection of the Colorado National Bank has been awarded to SEERIE BROS., Denver. The estimated cost is $500,000. Noted Sept. 3.

Plans are being prepared by Gove & Walsh, Archs., Denver, for the construction of a building for the Young Women's Christian Association, to cost about $150,000.

Seattle, Wash.—Sears, Roebuck & Co., First Ave., has had plans completed for a nine-story reinforced-concrete addition, estimated to cost about $850,000. G. G. Nimmons, Peoples Gas Bldg., Chicago, Ill., is the Arch.

Bids will soon be received for erecting the Ballard High School. Estimated cost, $300,000. Edward Blair is the Arch. Noted Feb. 12.

Tacoma, Wash.—Plans are being prepared by C. Frere, Arch., Henry Bldg., Seattle, Wash., for a four-story lodge for the Tacoma Elks' Hall Association, at an estimated cost of $100,000.

+La Grange, Ore.—The contract for the construction of a club house for the Elks' Club has been awarded to PALMER & ELLISON, Portland. Estimated cost $60,000. Noted July 2, Sept. 10.

+Los Angeles, Calif.—J. W. Robinson Co. has awarded the contract for the construction of the seven-story block at Seventh and Grand St., to C. J. KUBACH. The estimated cost is $1,000,000. Noonan & Richards are the Archs.

W. J. Pearson, Exchange Bldg., plans to erect a 13-story hotel at Tenth and Hope Sts. Estimated cost, $800,000. Train & Williams, 226 Exchange Bldg., are the Archs.

Monterey, Calif.—The B. P. O. E. plans to erect a $40,000 lodge in this city.

Santa Barbara, Calif.—Andrew Carnegie has given $50,000 toward a fund for the erection of a public library in this city.

Montreal, Que.—Warren and Westmore, Archs., New York, N. Y., have prepared plans and will receive bids in a few weeks for a station to be erected for the Canadian Northern Ry. Co. Estimated cost $250,000.

Guelph, Ont.—Bids will soon be received for erecting the building for the Physics Department at the Ontario Agricultural College. Estimated cost, $50,000. Dr. Creelman is Principal.

Hamilton, Ont.—Stewart & Wilton, 2 Hughson St., will receive bids for the erection of the Homewood School, until Sept. 17th. Estimated cost, $100,000.

+Toronto, Ont.—The contract for the masonry on the Central High School has been awarded to R. ROBERTSON & CO., Toronto, at $92,682. Noted June 11.

Vancouver, B. C.—It is reported that the Vancouver Civic Center Commission will receive plans, until Nov. 30, for the construction of a Civic Center building. The estimated cost is $1,000,000.

FOREIGN TRADE OPPORTUNITIES

Where addresses are omitted they may be obtained from the Bureau of Foreign and Domestic Commerce, Department of Commerce, and its branch offices.

No. 13627. Railway Material—A company organized by merchants in one of the principal cities in Asia desires catalogs from American manufacturers of railway material, according to a letter received at the Bureau of Foreign and Domestic Commerce from one of the foreign legations at Washington. This company was organized with a view to purchasing American goods direct.

No. 13631.. Motor Trucks—An American consul telegraphs from one of the European countries stating that an American located in his district desires prices immediately from reliable manufacturers in the United States for all available 1 to 3 ton motor trucks, delivered. Prices should be cabled to the address given in the report.

No. 13632.. Scientific Instruments—The Bureau of Foreign and Domestic Commerce is in receipt of a letter from a foreign legation in Washington stating that a company organized by merchants in a city of one of the Asiatic countries desires catalogs and other information from American manufacturers of all kinds of scientific instruments. This company is organized to purchase several lines of goods direct from the United States.

War Rates for New York Funds

War Rates for New York Funds—Early in the year, the City of New York voted to foreign financial interests about $100,000,000 in short-time securities. These were payable in gold in London and Paris to raise funds for paying the loan a syndicate of New York bankers bought new warrants bearing 6% interest.

A condition of the loan was that improvements authorized by the city during 1915, which are not self-sustaining, are to be paid for 25% from taxes and 75% by the issue of 1- to 15-yr. corporate stock. Improvements authorized during 1916 will be paid for 50% by sale of serial stock; during 1917 they will be met by 75% from the budget and 25% by serial stock, and in 1918 the full cost of such improvements will be met from taxes.

The securities to be issued by the city will be dated Sept. 1, 1914, and $57,000,000 in the form of corporate stock notes will mature Sept. 1, 1915; $43,000,000 in revenue warrants will mature, $18,000,000 Sept. 1, 1916, and $25,000,000 Sept. 1, 1917. They will be delivered to the subscribing banks at once and payment will be made to the city by crediting to its account the amount of the bank's subscription. Of the $57,000,000 one-year corporate stock notes, Comptroller Prendergast stated, $35,000,000, which are for self-sustaining improvements, will be refunded by 50-year stock, and the remaining $22,000,000 refunded by the new 1- to 15-year serial stock to be retired out of taxes at their maturity. The Comptroller said the only way the city could secure any gold at this time, to pay its maturing obligations, was to get all the banks to coöperate.

Mayor Mitchel said that he took measures to find out if gold could be secured by the city from the Federal Government, but found that it was impossible to get gold from that quarter. The Comptroller said this confirmed his earlier experience in the same matter. The Comptroller said he realized this plan will result in an increase in the tax rate and will restrict improvement work.

Henry P. Davison, of J. P. Morgan & Co., said: "I consider it a great thing that anybody should be able to raise $100,000,000 in times of stress like these. The success of the loan was due to the patriotism of the banks of the city."

A shipment of $5,000,000 in gold was made Sept. 13 by J. P. Morgan & Co., to the newly established branch of the Bank of England at Ottawa, Ont.

INTERCEPTING DRAIN, FALL RIVER, MASS.

Bids were received Sept. 4 by the Reservoir Commission for constructing a reinforced concrete intercepting drain and appurtenances from (A) Hanscom Construction Co., Boston, Mass.; (B) William H. Arthur, Stamford, Conn; (C) T. Stuart & Son Co., Newton, Mass.; (D) Bruno & Petitti, Boston, Mass.; (E) Mason, Hilton & Co., New York, N. Y.; (F) Fred T. Ley & Co., Inc., Springfield, Mass.; (G) Leo E. Kelly, Inc., Brooklyn, N. Y.; (H) The Whiting, Turner Contracting Co., Baltimore, M. D.; (I) Chauncey H. Sears, Fall River, Mass. The item bids were as follows:

	A	B	C	D	E	F	G	H	I
55,000 cu.yd. excavation, Classes A and B (top-soil and general earth)	$0.68	$0.50	$0.70	$0.90	$1.15	$0.67	$1.00	$1.70	$0.88
2000 cu.yd. excavation Class C (drain below subgrade)	1.00	0.60	1.00	1.50	1.25	1.17	0.75	2.00	1.20
4500 cu.yd. excavation, Class D (solid rock)	3.00	4.00	3.00	3.00	2.59	3.51	4.25	3.00	3.50
17,000 cu.yd. borrowed earth fill	0.15	0.40	0.40	0.60	0.60	0.41	0.20	0.53	1.00
800 cu.yd. crushed stone and gravel filling, in place	1.75	2.50	1.25	2.00	1.50	2.34	2.75	2.00	2.95
18,000 cu.yd. surface dressing	0.55	0.55	0.70	0.50	0.60	0.70	0.60	0.63	1.35
25 sq.yd. sodding	0.75	1.50	0.50	2.00	0.50	0.29	0.80	0.50	0.85
650 cu.yd. plain concrete masonry	8.00	7.00	6.75	7.75	7.00	9.36	8.00	8.50	6.50
7100 cu.yd. reinforced concrete masonry	8.00	10.50	10.50	8.75	9.00	11.18	9.00	8.50	11.98
10 cu.yd. brick masonry	20.00	15.00	15.00	15.00	15.00	11.04	18.00	15.00	12.00
22 cu.yd. ashlar masonry	30.00	20.00	24.00	30.00	25.00	17.55	40.00	60.00	10.00
50 cu.yd. rubble masonry and paving	6.00	7.50	5.00	1.59	7.00	5.85	8.00	6.50	6.00
30 cu.yd. rubble masonry and paving laid dry	5.00	5.50	3.59	3.00	5.00	1.08	6.00	3.00	4.00
1500 cu.yd. riprap, in place	4.00	3.00	1.25	2.00	2.00	2.93	1.00	2.50	3.00
100 lin.ft. granite curbing, in place	1.00	1.10	1.25	1.50	1.00	1.17	1.50	1.50	2.45
150 sq.yd. granite block paving	3.50	3.50	2.65	2.50	3.50	4.10	2.00	3.00	3.50
1930 lin.ft. vitrified pipe, in place; 24-in. pipe	1.15	0.85	1.15	2.00	1.50	1.17	2.50	1.20	1.98
50 lin.ft. vitrified pipe in place; 18-in. pipe	0.76	0.50	0.80	1.50	1.00	1.10	2.00	0.84	1.00
150 lin.ft. vitrified pipe, in place; 12-in. pipe	0.50	0.40	0.60	1.00	0.50	0.72	1.00	0.45	0.85
50 lin.ft. vitrified pipe, in place; 10 in. pipe	0.40	0.39	0.50	0.50	0.30	0.49	1.00	0.37	0.80
30 lengths vitrified pipe slants set into the drain, 12-in. pipe	1.00	1.00	1.25	2.90	2.00	1.75	3.00	1.41	1.65
10 lengths vitrified pipe slants set into the drain, 18-in. pipe	1.50	1.25	3.00	3.00	5.00	2.94	6.00	2.70	2.70
3 lengths vitrified pipe slants set into the drain, 24-in. pipe	2.50	2.50	5.00	4.00	9.00	4.80	10.00	2.30	4.50
560 lengths 3-in. tile drain pipe, set into drain	0.25	0.10	0.10	0.25	0.10	0.13	0.50	0.30	0.20
27,000 lb. w.i., c.i. and steel in place	0.04	0.04	0.05	0.05	0.04	0.058	0.0325	0.05	0.0285
890,000 lb. twisted or deformed steel reinforcing bars for concrete	0.03	0.025	0.035	0.035	0.03	0.035	0.05	0.03	03 0.00
12 M. ft. b.m. lumber, in place	60.00	50.00	50.00	30.00	50.00	46.80	35.00	60.00	45
1000 lin.ft. piles, driven in place	0.50	0.50	0.40	0.50	0.30	46.80	0.50	0.45	0.68
Cleaning up (lump sum)	500.00	2400.00	1000.00	5000.00	100.00	2340.00	10.00	10.00	1500.00
Extended totals	$173.834	$179.473	$193.787	$201.359	$204.480	$206.207	$216.507	$236.973	$239.903

Contracts to Be Let

Bids received until Sept. 21, 1914.

Garbage Reduction Plant

Sealed proposals for furnishing machinery and equipment for a Garbage Reduction Plant to be located near the City of Detroit, Michigan, addressed to the Department of Public Works of the City of Detroit, will be received at the office of the Commissioner, City Hall, Detroit, until 10:00 o'clock A.M. on the twenty-first day of September, 1914.

Separate proposals, in duplicate, shall be submitted for each of the following items:

- A. Boilers and Stokers
- B. Engines and Generators
- C. Boiler Feed Pumps
- D. Feed Water Heater
- E. Air Compressor
- F. Engine Room Crane
- G. Locomotive Crane
- H. Coal and Ash Handling Equipment
- I. Repair Shop Equipment
- J. Green Garbage Cranes
- K. Conveying Machinery
- L. Cooking and Pressing Equipment
- M. Grease Handling Equipment
- N. Evaporating Equipment
- O. Drying Equipment
- P. Percolating Equipment
- Q. Railroad Track Scales
- R. Railroad Garbage Cars

Bidders submitting a proposal including two or more items shall submit a proposal for each item.

Each bid shall be accompanied by a certified check in the sum of not less than ten (10) per cent. of the amount of the bid, payable on its face to the Department of Public Works of the City of Detroit, as surety for the acceptance of the contract.

The accepted bidder shall furnish two bonds each in a sum equal to the full amount of the contract.

Proposals shall be made in accordance with the specifications prepared by and on file in the office of Smith, Hinchman & Grylls, Consulting Engineers, 710 Washington Arcade, Detroit, Michigan. Copies of these specifications may be secured upon application to the Consulting Engineers.

The Commissioner reserves the right to reject any or all proposals.

GEO. H. FENKELL,
Commissioner.

Bids received until Oct. 6, 1914.

Vault Equipment

NOTICE TO CONTRACTORS

Trenton, N. J.

Sealed proposals will be received at the office of the Comptroller in the State House, Trenton, New Jersey, at twelve o'clock noon, October 6th, 1914, for furnishing [illegible] vaults in the office of the Secretary of State, in accordance with plans and specifications on file in the office of the Commissioner of Charities and Corrections, State House, Trenton, New Jersey.

Each bidder must accompany his proposal with a certified check for ten per centum of the amount of his proposal, payable to the State, properly endorsed, which will be returned to the unsuccessful bidder immediately following the award of the contract. The Commission reserves the right to reject any or all bids.

The successful bidder will be required to enter into a contract for the performance of the work with a bond of an approved security company for not less than one-half the amount of the contract price.

Proposals must be enclosed in envelopes sealed and marked "PROPOSALS FOR FURNISHING [illegible] VAULTS IN THE OFFICE OF THE SECRETARY OF STATE, TRENTON, NEW JERSEY" and addressed to the Comptroller, Hon. Edward I. Edwards, Secretary of the State House Commission.

Bids received until Sept. 28, 1914.

Construction, Structural Steel, Heating, Plumbing, etc.

NOTICE TO CONTRACTORS. Sealed proposals for construction, structural steel, heating, plumbing and electric work for the Drill Hall, Cornell University, Ithaca, N. Y., will be received by the Hon. E. L. Williams, Cornell University, Ithaca, N. Y., until Monday, Sept. 28, 1914, 4 P.M., when they will be opened and read publicly. Bids will be received for each division of the work separately and no combination of bids will be considered. Proposals shall be accompanied by certified check in the sum of five per cent. of the amount of bids, and the contractors to whom the awards are made will be required to furnish surety company bonds in the sum of fifty per centum of the amount of contract, within thirty days after official notice of award of contract, and in accordance with the terms of the specifications Nos. 1965, 1966, 1967 and 1968. The right is reserved to reject any or all bids. Drawings and specifications may be consulted and blank forms of proposals obtained at the office of the Treasurer, Cornell University, at the Department of Architecture, Capitol, Albany, N. Y., at the New York Office of the Department of Architecture, Room 1224 Woolworth Building, New York City. Plans and specifications will be ready Tuesday, Sept. 8, 1914. In applying for plans and specifications each bidder must state which part of the work, (such as construction, structural steel, heating, plumbing and electric work) he intends to bid on. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon deposit of certified check in the sum of $15.00 for construction work or structural steel, and in the sum of $10.00 for each set of heating, plumbing or electric plans, which check will be returned if plans and specifications are sent back in good order to the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

Contractors

BIDS OPENED OCTOBER 6, 1914

for the construction of Section No. 1 of Route No. 43 and Section No. 1 of Route No. 26, being the diagonal connection under 42nd Street between the existing subway and the Lexington Avenue subway.

Call or write concerning contract, plans and specifications.

PUBLIC SERVICE COMMISSION FOR THE FIRST DISTRICT,
154 Nassau Street. New York City.

Bids received until Sept. 19, 1914.

Boilers

NOTICE TO CONTRACTORS. Sealed proposals for new boilers at Potsdam Normal School, Potsdam, N. Y., will be received by Dr. Thos. E. Finegan, Asst. Commissioner for Elementary Education, Education Building, Albany, N. Y., until 12 o'clock noon on Saturday, September 19, 1914, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect and shall be accompanied by a certified check in the sum of five per cent. of the amount of bid and the contractor to whom the award is made will be required to furnish surety company bond in the sum of fifty per cent. of the amount of contract within thirty days after official notice of award of contract and in accordance with the terms of specification No. [illegible]. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the New York office of the Department of Architecture, Room 1224 Woolworth Building, at the office of the Department of Architecture, Capitol, Albany, N. Y., and at the Potsdam Normal School, Potsdam, N. Y. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon reasonable notice to and in the discretion of the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

A New Railway in Panama

Panama Canal Zone (By Cable)—R. W. Hebard & Co., Panama, has the concession for the Chiriqui R.R. All purchases will be made by J. M. Motley, 16 Exchange Place, New York.

The Chiriqui project consists of a line from Pedregal, on the Pacific, to David. From this point there will be two branches, one 20 miles to La Concepcion, and another, 33 miles, to La Boquet. The La Boquet branch presents some unusual features, as an elevation of 4000 ft. will have to be attained in a distance of 33 miles. The funds for the construction will be furnished by the Republic of Panama. This information was obtained by a special representative of "Engineering News," who is now in South America.

From the "Canal Record," issue of Sept. 2, we extract the following:

"Grading on the new railroad in the province of Chiriqui has been completed for a distance of about seven miles, four miles between the port of Pedregal and the city of David, and three miles on the La Concepción branch of the road. This branch line, extending from David to the village of La Concepción, a distance of about 18 miles, will be the first to be completed.

"About 25,000 Oregon pine creosoted ties have been delivered to date; these cost, laid down, about $1 each. The contractors, R. W. Hebard & Co., are preparing specifications and conditions under which native ties, delivered at any point on the line, will be purchased. It is anticipated that 25,000 native hardwood ties can be obtained locally. The contractors are purchasing from the Panama Canal all the old 70-lb. rail in good condition that can be spared, in addition to a miscellaneous lot of other equipment, including two small Porter locomotives, used in the construction of the canal locks."

American Machinery for Spain—The Spanish government has entered the American market for the immediate purchase $2,000,000 of contractors' machinery and machine tools.

This report, emanating from the Foreign Trade Bureau of the Philadelphia Commercial Museum, has been verified by a representative of "Engineering News."

George C. Gibson, Asst. Chief of the Foreign Trade Bureau, placed the correspondence relative to this statement at the disposal of our representative.

Of chief interest was a letter, dated Madrid, Aug. 20, from the Sociedad General de Representaciones, agents for machinery and accessories of all classes, industrial installations, and materials for railroads and tramways. In part it was as follows: "We have contracts to furnish the Spanish government with several million dollars' worth of machinery and supplies but the war has prevented our fulfilling these contracts since most of the orders were placed with German and French firms."

"As you know, the Spanish government has given orders to start important public works, and millions will be spent for this purpose. This firm is furnishing all the factories of the War and Navy Departments with machines and tools and manufacturers of the following lines are requested to enter into communication with us for the supply of machinery, to wit: sensitive and upright drilling machines, cold metal sawing machines, gear-cutting machines, punching and shearing machines, grinding and polishing machines and machines for the manufacture of automatic revising and refilling of cartridges for Mauser guns."

In an interview with George C. Newcomb, Spanish consul at Philadelphia, Monday morning, in regard to the status of this company, he said, "This firm is one of the largest and most responsible in Spain, however, beyond that I know of no specific contracts which they may be handling for the government."

Senor C. G. Salas, Spanish Consul General, New York, when questioned Monday afternoon regarding definite plans and appropriations on the part of the government, said: "Last year in the official budget there was made an appropriation of some $10,000,000 for improvements to extend over a period of ten years, but due to the problem of unemployed labor, I understand that steps have been taken to push the work along as rapidly as possible, so as to give employment to the idle men.

"The work which the government has undertaken includes new roads, electric power installation, railway and illumination, irrigation, the dredging of Cadiz harbor together with the building of quays and breakwaters at the same port, railways in Morocco and the improvement of the port of Melilla."

RAILWAYS

✚**Virginia**—Norfolk & Western Ry.—A contract has been awarded by this company to WALTON & CO. for clearing a tunnel on the Pocahontas division, which recently caved in. The company also contemplates the construction of an extension from Suiters to Cedar Bluff, about 22 miles. J. E. Crawford, Roanoke, Va., is Ch. Engr.

Georgia—Rocky Ford & Southwestern Ry.—Plans are being considered by this company for the construction of a railroad from Rocky Ford to Portal, Ga., about 12 miles. Henry B. Griffin, Rocky Ford, Ga., is interested.

North Georgia Mineral Ry.—This company is being organized for the purpose of constructing a railroad from Atlanta north through Fulton, Cobb, Cherokee and Bartoe Counties, about 50 miles. William J. Morrison and A. C. King are interested.

The construction of a railroad from Homer, Ga., to Lula, Ga., is contemplated by Zeigler & Jones Co.

Tennessee—See item under Miscellaneous — Interlocking plant, Chattanooga, Tenn.

Tennessee—Alabama Great Southern R.R.—Plans are being made by this company to spend about $80,000 for the improvement of the Belt Ry. in Chattanooga, Tenn., in connection with the double-track work on the line from Chattanooga to Wauhatchie. C. Dougherty, Cincinnati, Ohio, is Ch. Engr.

Kentucky—Chicago, Burlington & Quincy R.R.—Plans are being made by this company to resumè work on the construction of its line from Paducah, Ky. to Metropolis, Ill. C. H. Cartlidge, Chicago, Ill., is Ch. Engr.

Illinois—Chicago, Burlington & Quincy R.R. — See item under Kentucky.

✚**Wisconsin**—Chicago & Northwestern Ry.—A contract has been awarded by this company for the construction of a logging road from Kingston, Wis. to Cleary, Wis., about five miles, to WHITE & DUFFY, Chicago, Ill.

Montana—Great Falls Western R.R.—This company has been incorporated to construct a railroad through Cascade, Lewis and Clark and Powell Counties, about 110 miles long. The incorporators include A. C. Goodnow, Evanston, Ill., J. D. MacVicar, Great Falls and James O'Grady, Great Falls.

Arkansas—According to press reports the construction of a 70-mile railroad to connect Hoxie, Smithville, Poughkeepsie, Evening Shade, Melbourne and Calico Rock, Ark., is contemplated by the Arkansas Mining & Development Co. J. A. Gay, Poughkeepsie, Ark., is interested.

Texas—Quanah, Acme & Pacific Ry.—Surveys are being made by this company for the construction of a railroad from Roaring Springs, Tex. to Roswell, N. M., about 86 miles. Robert Gray, Quanah, Tex., is eGn. Mgr.

Oklahoma—Oklahoma Central R.R.—This company has been purchased by the Atchison, Topeka & Santa Fé R.R. Announcement has been made that the new owners contemplate improving the line in order to establish efficient service to handle the coal tonnage from Lehigh, Okla.

Arizona—Mascot & Western Ry.—Contracts will soon be awarded by this company for the construction of a 17-mile railroad from the mines of the Mascot Copper Co., near Dos Cabezos, Ariz. to Wilcox, Ariz. C. R. Weston is Gen. Mgr.

Oregon—Booth Kelly Lumber Co.—The construction of a railroad in Lane County, Oregon, to its timber holdings is contemplated by this company. The main office of the company is in Portland, Ore.

✚**California**—San Diego & Arizona Ry. Co.—ROBERT SHERER & CO., Pacific Electric Bldg., Los Angeles, have been awarded the contract for grading and constructing reinforced-concrete culverts on a portion of its right-of-way in California.

California—Western Pacific Ry. Co.—Plans are being prepared by John F. Stevens, Ch. Engr. of the Gould system, for the construction of feeder lines to Fairoaks, Orangevale and Folsom, to connect with the main line near Sacramento.

California Terminal Ry. Co.—This company has filed articles of incorporation to construct a railroad from San Francisco to Sacramento, about 95 miles with branch lines to Petaluma and Napa, making a total trackage of 118 miles. The capital is placed at $200,000. The directors are C. W. Conlisk, San Francisco and C. H. Lind and W. M. Rank, Alameda, Calif.

Alaska—The government engineers are making surveys for the proposed railroad in Alaska. Lieut. Fred K. Mears of the Alaska R.R. Comn. will be ready to submit a report on the route about Nov. 1.

ELECTRIC RAILWAYS

New Haven, Conn.—Plans are being prepared by the Connecticut Co. for the reconstruction of several of its lines in New Haven. F. P. Harlan, New Haven, is Mgr..of the New Haven Division.

Southington, Conn.—Preliminary arrangements are being made by the Waterbury & Milldale Tramway Co. for the construction of three miles of new track in Southington.

Du Bois, Penn.—According to press reports, the Jefferson Coal Co. contemplates the construction of an electric railway from Coal Glen to Falls Creek, to connect with the line of the Du Bois Traction Co.

Fairmont, W. Va.—The Monongahela Valley Traction Co. has secured the right-of-way for the extension of its line from Fairmont to Riverside. James O. Watson, Fairmont, is Gen. Mgr.

Owensport, W. Va.—The West Virginia Electric Ry. Co. is being organized to construct an electric railway from Owensport to Weston, about 50 miles.

Parkersburg, W. Va.—The Charleston, Parkersburg & Northern Ry. Co. will award contracts this fall for the construction of part of its 75-mile electric railway to connect Parkersburg, Sissonville, Guthrie, Ripley and Charleston. K. B. Stephenson, Parkersburg, is Sery

Florence, Ga.—The Central Carolina Electric Ry Co is being organized for the purpose of constructing an electric railway in Florence.

Waycross, Ga.—The Waycross Street & Suburban Ry Co is making arrangements for the construction of an extension to Hebardville.

Jacksonville, Fla.—The Jacksonville Traction Co will construct additional tracks on Hogan St from Bay to Eagle and Cedar Sts. Harry Cramer, Jacksonville, is Local Mgr and Pur Agt.

Campton, Ky.—The Mountain Central Ry Co has been organized for the purpose of constructing a 12-mile electric railway from Campton to Campton Junction. Floyd Day and J C M Day are interested.

Middlesboro, Ky.—W Godfrey Hunter has secured a franchise and is making preliminary arrangements for the construction of an electric railway from Middlesboro to the coal mines along Yellow Creek. The line will be seven miles long.

Middletown, Ohio.—Michael Klaiber, Jr, Reading, Ohio, is interested in the construction of an electric railway from Middletown to Norwood. Surveys have been started.

Muskegon, Mich.—The Muskegon Traction & Light Co has applied to the City Council for a franchise for the extension of its Allen St line in Muskegon. H S Nelson, Muskegon, is Pur Agt.

Aurora, Ill.—The Aurora & Mendota Electric Ry Co is securing the right-of-way for the construction of its proposed electric railway to connect Aurora, Plano, Yorkville and Sandwich.

Joliet, Ill.—The Joliet & Eastern Traction Co has been incorporated to construct and operate an electric railway to connect Joliet, New Lennox, Frankfort, Matteson, Chicago Heights, Hammond and Chicago. The incorporators include David F Rosenthal, Leo S. Kosetcheck, Jacob Schwartz and Edmund J Claasen.

Jefferson City, Mo.—H. W Knight, Chicago, Ill, is interested in the construction of an electric railway from Jefferson City, Mo, to Keokuk, Iowa.

San Antonio, Tex.—The San Antonio, San José & Medina Valley Interurban Ry Co., which has been organized for the purpose of constructing an interurban electric railway between San Antonio and Medina Dam, about 28 miles, will sooon begin the grading work. The company will also lay out a town site at the Medina Dam terminus of the line. Noted June 18.

St. George, Utah.—Surveys have been started for the construction of an electric railway from Lund to St. George. A B Christensen, Salt Lake City, is interested.

Phoenix, Ariz.—The Salt River Valley Electric Ry Co will construct an interurban electric railway system that will connect Phoenix with Scottsdale, Tempe and Mesa. It also has a franchise to lay a track on East Monroe St, in Phoenix.

Lynden, Wash.—Preliminary arrangements are being made by the Blaine-Lynden Electric Ry. Co to start work on the construction of its proposed line from Blaine to Lynden. J J Pinckney, Blaine, is Pres. Noted June 4.

Olympia, Wash.—The Olympia Light & Power Co. is considering plans for the extension of its Fourth St line to the city limits. L. R Faulkner, Olympia, is Treas. and Mgr.

Fresno, Calif.—The Fresno Interurban R.R is preparing to extend its electric line from Fresno Ave. to the Normal School, about 1½ miles. J. R Rogers is Mgr.

Los Angeles, Calif.—The Malabar Improvement Association and the residents of Boyle Heights are interested in the proposition to construct a crosstown electric railway from First St and Evergreen Ave to Wabash Ave, in Los Angeles.

Blenheim, Ont.—A company is being organized at Blenheim for the purpose of constructing a hydro-radial railway from St Thomas to Amherstburg.

Brantford, Ont.—The city has taken over the holdings of the Brantford Street Ry Co and of the Grand Valley Ry Co. An announcement has been made by the Street Railway Commission that no extensions will be made on the lines until next spring.

LIGHT HEAT AND POWER

Newton, Mass.—Bids will be received until Sept. 30 by Walter [illegible], Comm. of Pub. Bldgs., for the installation of heating and ventilating apparatus in the Claflin School buildings on Walnut St. Alfred [illegible] Kellogg, [illegible] State St, Boston, is Engr.

Reading, Mass.—Improvements and extensions to the municipal electric-light plant to cost about $[illegible] are contemplated by the Board of [illegible]. Arthur [illegible] is Mgr and Supt. of the plant.

Georgetown, Conn.—[illegible] & [illegible], Consult. Engrs., [illegible], are preparing plans for the construction of a power house at Georgetown for the Gilbert & Bennett Mfg. Co., manufacturer of wire goods. The building will be [illegible] ft., [illegible] ft. high, of brick [illegible] concrete tile roof, steel sash.

Poughkeepsie, N. Y.—The Central Hudson Gas & Electric Co. has been granted permission by the state Public Service Commission for the construction of two extensions to its [illegible] [illegible] Wappingers Falls [illegible] [illegible] Dutchess County.

Lebanon, N. J.—The City Council is considering the [illegible] of an electric [illegible] system. It is proposed to secure the current supply from the [illegible] & Power Co. [illegible]

Philadelphia, Penn.—The [illegible] Co. has had plans prepared for the construction of a boiler house, engine and pump house at [illegible], Philadelphia. The boiler house will be [illegible] [illegible] Carl [illegible], Penn. [illegible] Bldg., is Arch.

Vardley, Penn.—The New Jersey & Pennsylvania Traction Co is enlarging and improving its local power house. The company is [illegible] with further [illegible] in the plant.

Beckley, W. Va.—The Beckley Utilities Co. contemplates the construction of an electric-light plant to cost about $100,000. The details have not yet been determined. James Bowen, Charleston, W Va, is Consult. Engr.

✦Hutchinson, W. Va.—The Monongahela Valley Traction Co. has awarded contracts for the construction of an electric plant at Hutchinson to: The NICOLA BUILDING CO., Farmers Bank Bldg., Pittsburgh, Penn., for a building 72x 230 ft.; BETHLEHEM STEEL CO., for gas engines; GENERAL ELECTRIC CO., Schenectady, N. Y., for electric generators. The total cost of the plant will be $300,000.

Wallace, N. C.—J. L. Boney contemplates the installation of an electric lighting system for the town. A dynamo and several transformers will be required.

Quitman, Ga.—The city has voted $10,000 in bonds, the proceeds of which will be used to enlarge the electric-light plant and purchase new equipment for the same. J M Curtright is Supt.

Ocala, Fla.—An election will be held Oct. 27 to submit to the voters the question of a bond issue of $57,000 to be used for extensions and improvements to the municipal electric-light system.

Bay Minette, Ala.—(Official)—See item under "Water Supply and Irrigation."

Melville, La.—The city plans the installation of a municipal electric-light plant. W. L. Thompson is Engr.-in-Charge.

Dayton, Ohio.—The City Council is considering holding a special election to vote on the question of a bond issue of $[illegible],000, to be used for the construction of a municipal electric-light plant.

Norwalk, Ohio.—Bids will be asked about Oct. 1 for the construction of a municipal electric-light plant, to cost about $120,000. A. W. Carpenter is Dir. of Pub. Ser. The H. Whitford Jones Co., Citizens' Bldg., Cleveland, is Engr.-in-Charge. Noted Feb. 5 and May 21.

✦Norwood, Ohio.—The Board of Control has awarded the contract for two Corliss engines of 460-hp. each, to the HARRISBURG FOUNDRY & MACHINE WORKS, Harrisburg, Penn., at $10,049; the contract for two 355-kw. generators was awarded to the ALLIS-CHALMERS CO., Milwaukee, Wis., at $8700. Noted July 30.

Sandusky, Ohio.—The City Council has decided to submit to the voters the question of a bond issue of $200,000, to be used for the construction of a municipal electric-light plant. H. Whitford Jones & Co., 1303 Citizens Bldg., Cleveland, will be retained to prepare the plans if the plant is established.

Goshen, Ind.—The Hawks Electric Co., Goshen, is preparing to extend its lines, at a cost of about $20,000, to Waterford and New Paris. Eventually the company expects to extend its transmission system throughout Elkhart County and a portion of Kosciusko County. Owen C. Cover is Secy. and Mgr.

Mondovi, Wis.—It is reported that the Mondovi Electric Light & Power Co. will soon construct about 20,000 ft. of new transmission lines, and will purchase alternators, switchboards, oil engines, exciters, switches and a waterwheel governor. A. D. All is Secy. and Mgr.

Oelwein, Iowa.—The plant of the Oelwein Light, Heat & Power Co. was recently totally destroyed by fire at a loss of about $50,000.

Waconia, Minn.—The town is considering the installation of an electric lighting system.

Alliance, Neb.—Preparations are being made for the installation of an electric-light plant in Alliance. A. C. Arends is interested.

Whitefish, Mont.—It is reported that bids will soon be received for the construction of a municipal electric-light plant in Whitefish.

✦Palmyra, Mo.—It is reported that the contract for new equipment and rebuilding the electric-light plant and waterworks system has been awarded to the ARROW ENGINEERING CO., St. Louis, at $[illegible]. Noted May [illegible] and July 30.

✦San Antonio, Tex.—Bartlett & Ranney, Consult. Engrs., have awarded the contracts for public utility plants in the new town of George West as follows: A. M. LOCKETT & CO., LTD., New Orleans, La., for power plant machinery and pumps; MARTIN WRIGHT, San Antonio, for the installation of electrical equipment, machinery, pole lines and street lights; J. W. MOULTRIE & SONS CONSTRUCTION CO., Austin, Tex., for water mains and fire hydrants, sewage system and disposal plant; HECK MACHINERY CO., San Antonio, for a [illegible] gal. steel water tank and tower. Noted Aug. [illegible].

Tyrone, N. M.—It is reported that Phelps, Dodge & Co. will install a power plant at its mines at this place.

Montesano, Wash.—The Northwest Electric & Water Co., Montesano, plans to enlarge its power plant, and extend its transmission lines.

Seattle, Wash.—The city authorities are investigating various power sites available to the city, with a view of building a new hydro-electric plant, in order to take care of the anticipated increase of the demand for light and power for the next five years. A development of from [illegible] to [illegible]-hp. is proposed.

Portland, Ore.—The [illegible] Gas Co. will erect a gas plant at [illegible] and [illegible]th St. [illegible] is Local Mgr.

Pasadena, Calif.—The [illegible] Hospital will construct a new boiler room and purchase some new equipment at a total cost of about $12,000. [illegible], 731 [illegible] Bank Bldg., Los Angeles, is the Arch.

Redwood City, Calif.—The [illegible] Gas & Electric Co., San Francisco, will build a gas storage plant at [illegible] and Washington St.

San Francisco, Calif.—The Contra Costa Gas Co. plans the construction of a new gas plant to cost about $115,000.

Juneau, Alaska.—The [illegible] River Power Co. has received a grant from the [illegible] government and will shortly begin the construction of a [illegible] electric power and chemical plant. The company will supply light and power to this city and adjacent territory. F. [illegible] Kennedy, Seattle, is Pres.

Hamilton, Ont.—It is reported that the United Gas & Fuel Co. will build a coke and gas plant in Hamilton, estimated to cost $1,500,000.

BRIDGES

Portland, Maine—J. R. Worcester & Co., 79 Milk St., Boston, Mass., is preparing plans for a bridge connecting Portland and South Portland. It is reported that the Commissioners of Cumberland County will advertise for bids for its construction early in October. The cost will approximate $1,000,0000, of which the Portland Street R.R. Co. will pay $100,000, the Portland Terminal Co. about $400,000, and the City of Portland and Cumberland County the remainder.

Auburn, N. Y.—The Commissioners of Cayuga County plan to construct two new bridges in the Town of Conquest. J. Charles Dayton, County Supt. of Highways, will prepare the plans.

Troy, N. Y.—The following bids were received Sept. 10, by the Troy & West Troy Bridge Co., for the construction of the Congress St. Bridge, (a) superstructure, (b) bridge complete: Pennsylvania Steel Co., (a) $204,900; Great Lakes Dredge & Dock Co., (b) $499,000; King Bridge Co., Cleveland, Ohio, (a) $239,000; Holbrook, Cabot & Rollins, Boston, Mass., (a) $249,000, (b) $409,000; Phœnix Bridge Co., Phœnixville, Penn., (a) $187,068; American Bridge Co., New York, N. Y., (a) $249,000; P. J. Carlin Co., New York, N. Y., (a) $249,000, (b) $455,000. The contract has not yet been awarded, as some of the bids were incomplete. Noted Aug. 13.

Jersey City, N. J.—The lowest bid received for the construction of a bridge on the Hudson Blvd., East Weehawken Township, over the old railroad cut, was that of Curtis & Cavanagh, Hoboken, N. J., at $11,450. Noted Sept. 3.

The Boulevard Commissioners have rejected all bids for the bridge over the railroad cut, Weehawken Township, as exceeding the appropriation of $11,000. Modified plans have been prepared, and new bids will be received until Sept. 29.

Mays Landing, N. J.—The Federal Government has approved plans prepared by the Board of Chosen Freeholders of Atlantic County for the construction of a bridge over Mullica Creek.

✚Trenton, N. J.—The Board of Chosen Freeholders of Mercer County has awarded the contract for a truss bridge over Stoney Brook, and a new wing wall for a stone arch in Hopewell Township to the GINDER CONSTRUCTION CO., Trenton, at $19,784. Noted Sept. 17.

Mercer, Penn.—Bids will be received until Oct. 6, by the Commissioners of Mercer County, for the construction of the superstructure of the Gamble Bridge, over Otto Creek, Fairview Township.

Philadelphia, Penn.—Plans have been prepared by the Survey Bureau for a reinforced-concrete bridge to be built on the line of Glenwood Ave., north of Seventh Ave., over the tracks of the Richmond Branch of the Philadelphia & Reading Ry. The estimated cost is $40,000, and bids will be asked as soon as the plans are approved by the Public Service Commission and the Art Jury. M. L. Cooke is Dir., Dept. of Pub. Wks.

✚Pittsburgh, Penn.—The Commissioners of Allegheny County have awarded the contract for repairs and a creosoted wood block floor for Bridge No. 3 over the Youghiogheny River to F. F. SCHELLENBERG & CO., Oliver Bldg., Pittsburgh, at $46,000.

✚The Commissioners have awarded the contract for the construction of two bridges over Pine Creek to the DUQUESNE CONTRACTING CO., Pittsburgh, at $14,603 for Bridge No. 14, and to A. & S. WILSON, Pittsburgh, at $15,503 for Bridge No. 16. Noted Sept. 3.

Pittsburgh, Penn.—(Official)—Bids will be received until 10 a.m., Sept. 25, by the Department of Public Works, for removing the present bridge and building the substructure of the new Sylvan Ave. Bridge; for paving the roadway and sidewalk of the North Side Point Bridge over the Allegheny River; also, for repairs to the Forbes St. Bridge, the Shadeland Ave. Bridge, the Warrington Ave. Bridge, the Fulton St. Bridge and the Edgebrook Ave. Bridge. Robert Swan is Dir. Dept. of Pub. Wks.

★Baltimore, Md.—The State Roads Committee opened the following bids Sept. 15 for the construction of a 150-ft. draw span in the Hanover St. Bridge: Penn Bridge Co., Beaver Falls, Penn., $103,800; Strobel Steel Construction Co., Chicago, Ill., $86,430; Scherzer Rolling Lift Bridge Co., Chicago (three designs), $108,250, $106,850 and $103,850; H. P. Converse Co., Boston, $126,501, alternate bid, $119,000. Noted Aug. 20.

Washington, D. C.—Press reports state that D. E. McComb, District Engr. of Bridges, is preparing plans for rebuilding the Pennsylvania Ave. Bridge over the Anacostia River at an estimated cost of $10,000.

✚Parkersburg, W. Va.—The Commissioners of Wood County have awarded the contract for the construction of a bridge over Neal Run at Lauckport to the MERYDITH CONSTRUCTION CO., Marietta, Ohio, at $24,000. The structure will be 672 ft. long, concrete piers and foundations and a steel superstructure.

Elberton, Ga.—Bids will be received, until Sept. 28, by the Commissioners of Elbert County for the construction of a county line bridge over the Broad River. The estimated cost is $4500 for the reinforced concrete substructure and $7200 for the steel superstructure. Searcy B. Slack, Athens, Ga., is Engr. of Good Roads Dept.

Newton, Miss.—(Official)—Bids will be received until noon. Oct. 5, by the Board of Supervisors of Newton County, Decatur, for the construction of 18 small bridges in District No. 4, over streams on the Newton-Lawrence and Roberts Road, the Tanglewood Extension, Lake Hazel, and Newton and Garlandville Roads. All bridges to be of A-1 creosoted timbers. C. M. Wells, Decatur, is Clk. of the Bd.

Delaware, Ohio—The lowest bid received by the Commissioners of Delaware County for the superstructure of the Home Bridge was that of the Bellefontaine Bridge & Iron Co., at $9620, while the Capital Construction Co., Columbus, at $7449, was low bidder for the superstructure of the Multzer Bridge. Noted Aug. 27.

Delaware, Ohio—The Commercial Club is interested in the construction of a concrete bridge across the Olentangy River at Winter St. It will be about 300 ft. long, and 51 ft. wide. The estimated cost is $36,000. W. A. Morrison is Chn. of the Bridge Com.

✚Portsmouth, Ohio—The Commissioners of Scioto County have awarded the contract for repairs to the substructure of the Lucasville Bridge to J. C. SHIVELY, at $9880.

Anderson, Ind.—The following bids were received by the Commissioners of Madison County for the construction of an additional span of 140 ft. to the 12th St. Bridge over the White River: Indiana Bridge Co., Muncie, $7780; Elkhart Bridge Co., Elkhart, $7750; Burke Construction Co., Newcastle, $6149.

Crown Point, Ind.—The Board of Commissioners of Lake County has made an appropriation of $75,000 for a lift bridge over the Indiana Harbor Canal at 151st St., East Chicago, and an appropriation of $16,000 for a steel bridge over Plum Creek at Dyer. The Commissioners voted against the construction of a $90,000 bascule bridge on Forsythe Ave., Hammond, and a $25,000 steel bridge over the Deep River, East Gary.

Lawrenceburg, Ind.—The County Council of Dearborn County has decided to create a fund of $35,000 for rebuilding bridges destroyed by the flood of 1913. The money will be obtained by an increase in taxes. W. S. Fagaly is County Audr.

✚Petersburg, Ind.—The Commissioners of Pike County hav eawarded the contract for the construction of 13 bridges in the county to the VINCENNES BRIDGE CO., Vincennes, at $7393. Other bidders were: International Steel & Bridge Co., $7008; George Saller, $8445; Frank English, $8269. Noted Sept. 3.

✚Salem, Ind.—(Official)—The Commissioners of Washington County have awarded the contract for the construction of three bridges to the MONTGOMERY-PARKER CO., at $7200. Noted Aug. 27.

Grand Rapids, Mich.—Press reports state that the Michigan Ry. Engineering Co., Kalamazoo, Mich., will receive bids, until Oct. 1, for the construction of an 1100-ft. bridge at Grand Rapids.

Danville, Ill.—An election will soon be held to vote on the question of a bond issue of $120,000 for the construction of bridges at Bridge, Cleveland and William Sts. W. H. Martin is City Engr.

Harmon, Ill.—(Official)—Bids will be received until 10 a.m., Sept. 28, by the Town Clerk for the construction of the Clatworthy and Kimball Bridges, Harmon Township, Lee County, at an estimated cost of $2970 and $3000 respectively. They will be of steel with reinforced concrete abutments. L. B. Neighbour, Dixon, Ill., is County Supt. of Highways.

✚Libertyville, Ill.—The Commissioners of Lake County, Waukegan, have awarded the contract for the construction of the Oak Spring Bridge, Libertyville Township, to JOHN DARROW, Waukegan, at $4790. It will be of reinforced concrete. Noted Sept. 3.

✚Carroll, Iowa—The Board of Supervisors of Carroll County has awarded the contract for the construction of 11 culverts to the MARSH ENGINEERING CO., Des Moines, at $7580; the contract for a steel bridge was awarded to the STANDARD BRIDGE CO., Omaha, Neb., at $3344. Noted Sept. 3.

✚Marble Rock, Iowa—The Supervisors of Floyd County, Charles City, have awarded the contract for the construction of a bridge over the Shell Rock River at Marble Rock, to the GOULD CONSTRUCTION CO., Davenport, at $23,150. Noted Aug. 20.

Albert Lea, Minn.—Bids will be received until 2 p.m., Oct. 1, by C. E. Brainerd, Audr. of Freeborn County, for the construction of State Bridge No. 1536, eight miles north of Oakland.

Little Falls, Minn.—Bids will be received until 2 p.m., Oct. 6, by B. Y. McNairy, Audr. of Morrison County, for State Bridge No. 1529 in the town of Darling; State Bridge No. 1531, town of Two Rivers, and State Bridge No. 1541, town of Mount Morris.

Kansas City, Kan.—The Federal Court has ordered the Commissioners of Wyandotte County to at once rebuild the Central Ave. Bridge over the Kaw River, to conform to the requirements of the Kaw Valley Drainage Board and the War Department. Frank Holcomb is County Clk.

✚Lexington, Neb.—The Commissioners of Dawson County and the State of Nebraska have awarded the contract for the construction of a bridge over the Platte River at Lexington to I. E. DOTY, David City, Neb., at $39,790; the contract for a bridge across the Platte River at Overton was awarded to the same company at $37,780. Noted June 11, July 23 and Aug. 13.

North Platte, Neb.—The State Board of Control and the Platte Valley Bridge District will soon advertise for bids for an 800-ft. bridge at North Platte. It will be of reinforced concrete, and is estimated to cost $50,000. D. D. Price, Lincoln, Neb., is State Engr.

Medora, N. D.—The Board of Commissioners of Billings County has rejected all bids received Sept. 7 for the construction of a bridge over the Little Missouri River. Noted Aug. 13.

Kansas City, Mo.—The City Commissioners and officials of the Union Pacific R.R. and the Chicago, Rock Island & Pacific Ry. have agreed upon plans for a viaduct over the railway tracks in the yards at 18th St. The structure will be of steel and reinforced concrete, and will cost about $30,000.

✚Houston, Tex.—The City Commissioners have awarded the contract for the construction of a reinforced-concrete bridge over White Oak Bayou at Taylor St. to HORTON & HORTON, at about $21,000. Noted Sept. 3.

Bids will be received until 10 a.m., Sept. 28, by H. L. Washbur, Audr. of Harris County, for the construction of nine concrete bridges.

Fort Worth, Tex.—The Commissioners of Tarrant County have plans for a [illegible]-ft. bridge near Ten Mile Bridge. The estimated cost is $[illegible].

Oakville, Tex.—Live Oak County plans the construction of [illegible] pile trestle bridges [illegible] steel spans. The estimated total cost is $[illegible]. F. H. [illegible] is County Engr. Bartlett & [illegible], San Antonio, are Consult. Engrs.

Oklahoma City, Okla.—Bids will be received, until Oct. 6, by the Commissioners of Oklahoma County for the construction of a 6[illegible]-ft. steel or concrete bridge with concrete floor and abutments, repairing [illegible] bridges and for repainting several bridges. W. W. [illegible] is Clk. of the Comrs. H. C. Adams is County Engr.

✦Colorado Springs, Colo.—(Official.)—The Commissioners of El Paso County have awarded the contract for the bridge over [illegible] Creek to the MIDLAND BRIDGE CO., Kansas City, Mo., at $[illegible]; the contract for the bridge over Fountain Creek at Nevada Ave. was awarded to the PUEBLO BRIDGE CO., Pueblo, Colo., at $16,[illegible]. Noted Aug. 20 and Sept. 17.

Kellogg, Idaho.—Plans are being prepared for the construction of a wooden truss bridge over the South Fork of the Coeur d'Alene River at Kellogg. The probable cost will be about $[illegible], to be borne by the city and Shoshone County. George P. [illegible], Wallace, Idaho, is County Surv. Bids will soon be asked.

Provo, Utah.—The following bids were received Sept. 10 by the Commissioners of Utah County for the construction of two steel bridges, (a) over the Provo River at Pleasant View, (b) over the Jordan River near Lehi: Provo Foundry & Machine Co., (a) $[illegible], (b) $6100; James J. Burke Co., (a) $[illegible], (b) $[illegible]; Levy Construction Co., (a) $4679, (b) $5087; Midland Bridge Co., (a) $4020, (b) $4380; Minneapolis Steel & Machine Co., (a) $4144, (b) $4774; Parrott Bros. Co., (a) $[illegible].

Salt Lake City, Utah.—A concrete bridge, to cost about $[illegible], is to be built over the Jordan River, at 21st South St. The cost will be borne equally by the city and Salt Lake County. S. Q. Cannon is City Engr.

✦McArthur, Calif.—The Board of Supervisors of Shasta County, Redding, has awarded the contract for a steel bridge over the Pit River, at McArthur, to WILLIAM STEPHENS, Redding, at $10,995.

✦Marysville, Calif.—(Official.)—The Board of Supervisors of Yuba County has awarded the contract for the construction of the D St. Bridge across the Yuba River to the CLINTON FIREPROOFING CO., San Francisco, at $134,000. Charles A. [illegible], Marysville, is Engr. in Charge. Noted Aug. 20.

Nicolaus, Calif.—The Board of Supervisors of Sutter County, Yuba City, is considering the construction of a bridge over the Feather River, at Nicolaus, to cost about $150,000.

San Bernardino, Calif.—Bids will be received until 11 a.m., Sept. [illegible], by the Board of Supervisors of San Bernardino County, for the construction of a reinforced-concrete bridge over the west branch of Lytle Creek. Charles Post is County Clk.

✦Santa Ana, Calif.—The Board of Supervisors of Orange County has awarded the contract for the construction of a reinforced concrete bridge over the Santa Ana River, on the Anaheim-Olive Road to TRUNCE & STOECKER, Owl Drug Bldg., San Diego, at $20,[illegible]. Noted Aug. 13.

✦Stockton, Calif.—The Board of Supervisors of San Joaquin County has awarded a contract for the construction of a steel bridge near Stockton to JAMES MULCAHY, at $12,6[illegible].

WATER SUPPLY—IRRIGATION

Boston, Mass.—Bids will be received by the Metropolitan Water and Sewerage Commission until Sept. 2[illegible] for the construction of a brick [illegible] house at East Boston on Addison St. [illegible] 1 Ashburton Place, is Ch. Engr.

✦Clinton, Mass.—(Official.)—Bids were received Sept. 10 for the construction of a concrete dam, [illegible] ft. long, as follows: [illegible] NEWELL CO. and N. S. BRUCK, Uxbridge, Mass., [illegible] (awarded contract); Thomas A. Cassidy, $[illegible]; [illegible] Murphy & Hennessey, $[illegible]; [illegible] Corporation, $[illegible]; King Construction Co., $[illegible]; [illegible] & King, $[illegible]; Hancock Engineering Co., $[illegible]; [illegible] & Son, $14,67[illegible]; and Clinton Concrete Co., $[illegible]. Noted Sept. 17.

Newburyport, Mass.—(Official.)—The City Council has appropriated [illegible] $[illegible] for the water department, the proceeds of which will be used for the [illegible] in the upper Artichoke River. Lewis [illegible], Boston, is Engr. Noted Sept. 10.

✦Hartford, Conn.—(Official.)—Bids were received Aug. 1[illegible] by the Board of Water Commissioners for constructing a [illegible] Reservoir. The contract has been awarded to [illegible] & [illegible], Torrington, Conn., at $[illegible]. [illegible] is Ch. Engr., Water [illegible]. Noted Aug. [illegible].

Cohoes, N. Y.—The Board of Water Commissioners is having plans prepared by H. W. Taylor, [illegible] State St., Albany, for [illegible] to the water system. The estimated cost is $[illegible]. [illegible] Noted July [illegible].

Corning, N. Y.—The [illegible] Water Committee has recommended [illegible]. The estimated cost is $[illegible]. [illegible]

New York, N. Y.—[illegible]

✦[illegible], N. Y.—[illegible]

Atlantic City, N. J.—(Official.)—Bids will be received by the Board of Commissioners of Atlantic City until Oct. 1, for increasing the impounding area of the Lower Doughty Pond. Harry Bacharach is Dir. of Pks. and Pub. Property.

Belleville, N. J.—(Official.)—Bids will be received by the Town Council until 8 p.m., Sept. 29, for laying 6-, 8- and 12-in. water mains. Edward E. Mathes is Town Clk.

Madison, N. J.—The Board of Public Works plans to increase the water supply so as to increase the pressure in the higher sections of the town.

Trenton, N. J.—Bids will be received by Frank Thompson, City Clk., until 2.30 p.m., Sept. 2[illegible], for laboratory equipment for the filtration plant.

Altoona, Penn.—Press reports state that the Pennsylvania R.R. Co. will build a 1,[illegible],000-gal. reservoir at the headquarters of Tipton Run in Blair County. Permission has been granted by the State Water Commission to the Tipton & Blair Water Co., which is a subsidiary of the Pennsylvania R.R., to make this improvement.

Biglerville, Penn.—(Official.)—Plans have been prepared and approved for the construction of a gravity supply line and storage reservoir.

Grove City, Penn.—(Official.)—Plans have been approved by the State Board of Health for making extensions to the water system. Noted Aug. 27.

Mont Alto, Penn.—(Official.)—The citizens will construct a storage reservoir, gravity supply line and distributing system.

Royersford, Penn.—Plans are being prepared by William H. Dechant, Baer Bldg., Reading, for the construction of a pumping plant at Royersford for the Home Water Co.

Shippensburg, Penn.—(Official.)—The State Board of Health has approved plans for the construction of a gravity supply line and storage reservoir.

Sykesville, Penn.—Plans have been approved by the State Board of Health for the construction of a municipal water system at Sykesville.

Quitman, Ga.—According to press reports, bonds for the installation of a water system have been voted by the citizens. Noted July 2.

Bay Minette, Ala.—(Official.)—An acceptable bid has been made for the purchase of the Bay Minette bonds authorized for the construction of a water system, electric light plant and sewer system. Negotiations will not be completed and the cash will not be on hand by Sept. 30, the time for receiving bids. The bids will probably be called for early in October. Edgar B. Kay, Tuscaloosa, is Ch. Engr. Noted Aug. 20.

Hodgenville, Ky.—(Official.)—Bids will be received by W. M. Graham, City Clk., until 7.30 p.m., Sept. 26, for the purchase of bonds for $14,3[illegible], the proceeds of which will be used for the installation of a water system. H. F. Read is City Engr. Noted Sept. 10.

Scottsville, Ky.—The City Council will grant a franchise to a company to construct and operate a water system. The City Clerk has information regarding the company.

Sebree, Ky.—An election will be held Nov. 3 to vote on the proposition of issuing bonds for the installation of a water system.

Cleveland, Ohio.—Bids will be received by the Commissioners of Purchases and Supplies, City Hall, until noon, Sept. 30, for the removal and re-erection of the Woodland Ave. water tower. Plans are on file with Charles F. Schultz, Comr. of Water Dept.

Lakewood, Ohio.—An election will be held November 3 to vote on the proposition of issuing $[illegible] in bonds for the construction of a water system and filtration plant. Clayton W. Tyler is Mayor.

Lima, Ohio.—(Official.)—The W. J. Sherman Co., 613 Nicholas Bldg., Toledo, has been retained by the city for consultation work in connection with the proposed increase of the municipal water supply.

Marion, Ohio.—The city contemplates issuing bonds for the enlargement of the water works. P. [illegible] is Water Works Supt.

✦Highland Park, Mich.—(Official.)—Bids were received Aug. [illegible] by the Village Clerk for constructing a steel intake crib as follows: JOHN H. [illegible], Port Huron, at $[illegible] (awarded contract); M. [illegible] & Son Co., $[illegible]; [illegible] $[illegible]; T. L. [illegible], $[illegible]; [illegible] Muskegon Dock & [illegible] Co., $[illegible]; [illegible] Contracting Co., $[illegible]; Great Lakes Dredging & Dock Co., $[illegible]; [illegible] Dredging & [illegible] Construction Co., $[illegible]; Nash Dredge Co., $[illegible]; and John T. [illegible] Engineering Co., $11,[illegible]. [illegible] S. Williams, [illegible] Bldg., Ann Arbor, Mich., is Engr. Noted Aug. [illegible].

✦Joliet, Ill.—The contract for [illegible] for the city water works has been awarded to [illegible] RAND CO., Chicago, Ill.

Red Bud, Ill.—On Sept. [illegible] bonds for $[illegible] were voted by the citizens. The proceeds will be used for the construction of a water system. W. [illegible] Thompson, [illegible] Bldg., East St. Louis, Ill., is the Engr. Noted Aug. [illegible].

Westville, Ill.—At a recent election the citizens voted $[illegible] in bonds, the proceeds of which will be used for the installation of a water system. Noted Aug. [illegible].

✦Fond du Lac, Wis.—The contract for laying new water mains has been awarded to [illegible] CHRISTIANSON, at $[illegible]. Noted Sept. [illegible].

✦Madison, Wis.—The contract for laying water mains in the [illegible] has been awarded to T. H. [illegible], Chicago, Ill., at $[illegible].

Stoughton, Wis.—Bids will be received by L. C. [illegible], City Clk., [illegible] for constructing a concrete reservoir. Plans are on file with the City Clerk. Noted July [illegible] and Aug. [illegible].

Wabeno, Wis.—Bids will be received by Frank Mischo, Town Clk., until Oct. 1, for constructing a water system. N. H. Smith, Oshkosh, is Engr.

Carroll, Iowa—On Sept. 4 bonds for $25,000 were voted, the proceeds of which will be used for the construction of a water system. Noted Sept. 3.

Goldfield, Iowa—Bonds for $12,000 have been voted by the citizens the proceeds of which will be used for installation of a water system.

Grandmound, Iowa—(Official)—Bids will be received by R. C. Quinn, Town Clk., until Sept. 29 for erecting a 90-ft. steel tower, 50,000 gal. tank, pumping station, deep well pump and for laying about 400 ft. of 8-in. c.-i. water mains. Noted Aug. 13.

+**Sioux Rapids, Iowa**—(Official) — The contract has been awarded to DES MOINES BRIDGE & IRON CO., Des Moines. F. H. Diercks is Clk. Noted Aug. 27.

Summit, Iowa—The Council contemplates constructing a water system estimated to cost $8000.

Brookston, Minn.—The citizens have voted $6000 in bonds for the construction of a water system and electric-light plant. Noted Sept. 17.

+**Cuyuna, Minn.**—(Official)—The contract for drilling three wells, etc., has been awarded to PASTORET CONTRACTING CO., Duluth, at $5666. G. Anderson is Village Clk. Noted Sept. 10.

St. Paul, Minn.—Bonds for $100,000 have been authorized by the City Council, the proceeds of which will be used making improvements to the water system, including a pump house.

Medicine Lake, Mont.—Press reports state that bonds have been voted by the citizens the proceeds of which will be used for the installation of a water system.

+**Miles City, Mont.**—The contract for constructing an irrigation system for the Little Missouri Irrigation Co. has been awarded to TEBBS & TAGGERT, Glasgo, Mont.

+**Palmyra, Mo.**—The contract for reconstructing the water works and electric-light system has been awarded to ARROW ENGINEERING CO., St. Louis, Mo., at $28,500. Other bidders were: William A. Pope, $33,333 and L. K. Sherman Co., $34,297. Noted July 16.

El Paso, Tex.—Bids will be received by C. W. Fassett, City Clk., until Sept. 26, for water works machinery. F. H. Todd, 420 Mesa Ave., is Engr.

Lufkin, Tex.—(Official)—Bonds for $25,000 have been voted by the citizens, the proceeds of which will be used for the improvement of the water system including the installation of a filtration system. Noted Aug. 27.

San Antonio, Tex.—See item under Light, Heat and Power.

Roxburg, Idaho—The city contemplates making extensive improvements to its present water system. J. C. Wheeton, Garland, is Engr.

Reno, Nev.—The Lovelock Valley Irrigation District has been formed to construct a canal 20 miles long to drain the Humboldt Sink for irrigation purposes. The estimated cost is $40,000. Thomas Derby, San Jose, Calif., is interested.

Kamas, Utah—Harry S. Joseph has been granted a franchise to construct a water system at Kamas. The estimated cost is $15,000.

North Yakima, Wash.—The Selah Water Users' Association has decided to improve its canal by replacing the wooden flume with reinforced concrete. The estimated cost is $30,000.

Seattle, Wash.—L. Coluccio, Seattle, at $8248, was low bidder for laying water mains in 47th Ave. N. E.

Bandon, Ore.—Bonds for $49,250 have been sold. The proceeds will be used for the installation of a water system.

Burns, Ore.—The city contemplates constructing and water and a sewer system costing $100,000.

Portland, Ore.—Plans have been prepared by John R. Hanson, City Engr., for laying 14,280 ft. of water mains to the Vernon district. The estimated cost is $113,000.

Pasadena, Calif.—A bond issue of $289,000 has been recommended by M. H. Salisbury, Comr. of Pub. Utilities, the proceeds of which to be used for the improvement of the water system.

Santa Ana, Calif.—Bids will be received by the City Trustees, until 5 p.m., Oct. 5, for furnishing a pumping engine and a steam boiler for the water department. J. C. Burke is City Clk.

San Diego, Calif.—The City Council has authorized the construction of a pipe line to connect the Cuyamaca system with the Otay reservoirs. The line will be 30,000 ft. long and will be constructed of 24-in. pipe. The estimated cost is $102,000.

Joliette, Que.—The water system will be improved. Surveyor & Frigon are the Engrs. The estimated cost is $70,000.

+**Toronto, Ont.**—The contract has been awarded to TURBINE EQUIPMENT CO., Toronto, for two 24,000-gal. pumps for the pumping station. Noted May 21.

+**Winnipeg, Man.**—The contract for 5000 ft. c.i. pipe has been awarded by the Council to CANADA IRON CORPORATION, at $6284.

Regina, Sask.—Water mains and sewers will be laid by the City Council. The estimated cost is $20,000. F. McArthur is Engr.

SEWERS

Boston, Mass.—Bids will be received, until Sept. 24, for constucting sewers in Mt. Ida Road, Blue Hill Ave. and in Deering Road, Dorchester District. L. K. Rourke is Comr. of Pub. Wks.

+The contract for constructing a sewer in Milton and Hamilton Sts., Hyde Park Dist., has been awarded by the Public Works Department, to A. DADDARIO, at $12,898. Noted Sept. 10.

Northampton, Mass.—On Sept. 9 the Sewer Commissioners voted to construct a surface water sewer from Fair St. through the meadows back of Pomeroy Terrace.

East Hartford, Conn.—Bids are being received by the Commissioners of the East Hartford Fire District for laying 6800 ft. of 8- and 12-in. sewers. Plans are on file with E. H. Olmstead, Engr.

+**Hartford, Conn.**—The Board of Contract and Supply has awarded a contract to PROSPERO BORNADIES & CO. for the construction of a section of sanitary sewer at $6788.

+**Waterbury, Conn.**—The contract has been awarded by the Board of Public Works to BARBARA & D'AURIO CO., 63 Bank St., Waterbury, for building three sections each of sanitary and storm sewers.

Binghamton, N. Y.—Bids were received by the Board of Contract and Supply for the construction of a sewer along the south bank of the river, as follows: B. L. Gabriel, $14,165; George Pignatello, $18,350, and Tyne & Willey, $19,008. Noted Aug. 6.

Fairport, N. Y.—(Official)—Bids will be received by the Village Board, until Sept. 30, for constructing about 12,000 ft. of sewers. C. F. Fisher is Village Engr.

Greenwood Lake Glens (Lakeside post office), **N. J.**—Bids will be received by R. M. Ekings, 152 Market St., Paterson, until Sept. 26, for constructing a sewage system for the Ringwood Co., at Greenwood Lake Glens. Plans are on file at the office of H. J. Harder, City Engr., Paterson.

Plainfield, N. J.—Bids will be received by the Sanitary Sewerage Commission, until Oct. 7, for the construction of a sewer system and sewage-disposal plant in Piscataway Township. The work will be done jointly by Plainfield, North Plainfield and Dunellen. Noted Sept. 17.

Cresco, Penn.—(Official)—Robinson & Wagner, 37 East 28th St., New York, N. Y., are preparing plans for enlarging the sewage-disposal plant at Buckhill Falls.

Greenville, Penn.—(Official)—The Council has had plans approved for the construction of preliminary treatment tanks with disinfection apparatus for the sewer system.

Montrose, Penn.—(Official)—The Department of Health has approved plans for the construction of lateral sewers and preliminary treatment tanks and disinfection apparatus.

+**North Wales, Penn.**—(Official)—Bids were received Sept. 5, by the Borough Council, for constructing a sewage-disposal plant and sewer system, as follows: CANTRELL CONSTRUCTION CO., Real Estate Trust Bldg., Philadelphia, at $49,983 (awarded contract); Edward L. Bader, $140,292; Keeley-McFeeley Co., $71,525; Suburban Contracting Co., $64,725. Ralph Schafenacker is City Engr. Noted Aug. 27.

Troy, Penn.—(Official)—A sewer system and preliminary treatment tanks with disinfection apparatus will be installed at Troy.

West Chester, Penn.—The Sewer Committee contemplates constructing sanitary sewers in all streets north of Gay St. H. R. Guss is one of the Comm.

+**Charleston, W. Va.**—Bids were opened, Sept. 10, by the Board of City Affairs for constructing a sewer system. Contracts have been awarded to JAMES FERRY & SONS, Baltimore, Md., at $73,463 for Dist. No. 1, at $12,516 for Dist 2, and at $22,912 for Dist. 4; and to C. M. SCANLON CONTRACTING CO., Huntington, at $48,107 for Dist. 3. Noted Sept. 31.

Lafayette, Ga.—The city contemplates constructing a sewer system estimated to cost $17,000.

Miami, Fla.—Bids will be received until Oct. 15 for constructing 8- to 24-in. sanitary sewers. B. H. Klyce, Real Estate Bldg., Miami, is Engr.

New Smyrna, Fla.—An election will be held in January to vote on the proposition of issuing $16,000 in bonds the proceeds of which will be used for the construction of a sewer system. J. B. McCrary Co., Atlanta, Ga., is the Engr.

Bay Minette, Ala.—(Official)—See item under "Water Supply and Irrigation."

Okolona, Miss.—Surveys for the construction of sewers are being made. The estimated cost is $60,000. Frank L. Wilcox, Chemical Bldg., St. Louis, Mo., is Engr.

Nashville, Tenn.—The City Commissioners have appropriated $14,000 for the construction of a trunk sewer in 28th Ave. W. W. Southgate is City Engr.

+**Bowling Green, Ohio**—The contract for installing a sewer system at the State Normal College, Bowling Green, has been awarded to HUFFMAN CONKLIN CO., Columbus, at $5241.

+**Centerburg, Ohio**—The contract has been awarded by the Village Council to NATIONAL CO., South Bend, Ind., for constructing a sewer in Main St.

Cincinnati, Ohio—(Official)—Bids will be received by Philip Fosdick, Dir. of Pub. Serv., until noon, Sept. 30, for constructing a sewer in Mill Creek intercepter from Dane St. to Mitchell Ave., under Contract No. 3.

Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, until noon, Sept. 30, for constructing sewers in Rexford Ave., East 120th St. and Trowbridge Ave. Plans are on file with Robert Hoffman, City Engr.

Columbus, Ohio—Bids will be received by S. A. Kinnear, Dir. of Pub. Serv., until noon, Oct. 12, for motor-driven centrifugal pumping machinery, including pumps of 5,000,000, 10,000,000 and 15,000,000 gal. capacity.

Bids will be received by S. A. Kinnear, Dir. of Pub. Serv., until noon, Sept. 29, for constructing a storm sewer in Eldron Ave. and sewers in Steele and Shoemaker Aves., and in three alleys.

East Liverpool, Ohio—(Official)—Bids will be received by the Public Service Director, until noon, Sept. 26, for constructing a 6-in. sanitary sewer in Hubbard, Burford and Alton Sts. E. J. Smith is Dir.

+**East St. Louis, Ill.**—The contract for constructing a sewer in Eighth St. has been awarded to CHARLES RICH at $8500.

Kewaunee, Wis.—Emil E. Seldenglanz, Chmn. Bd. of Pub. Wks., will soon receive bids for the construction of 6½ blocks of vitrified pipe or concrete sewer in Milwaukee St.

+Council Bluffs, Iowa.—A contract for [illegible] ft. of sewer has been awarded to [illegible] A. WICKHAM.

Creston, Iowa.—Bids will be received by the City Clerk, until Sept. [illegible] for constructing [illegible] sanitary sewers in several streets. T. S. [illegible] is City Engr.

Oelwein, Iowa.—According to press reports, bids will be received by the City [illegible] until Sept. [illegible], for the enlargement of the [illegible] beds. The estimated cost is $7000. [illegible] E. [illegible] is City Engr.

Minneapolis, Minn.—According to press reports, the city [illegible] for sewer construction.

+Brainerd, Minn.—Contracts have been awarded for constructing sewers [illegible] to F. A. GLASS, and [illegible] to [illegible]STILL & OLSON.

Dundee, Neb.—An election will be held Oct. 3 to vote on the [illegible] of issuing [illegible] bonds for sewer construction.

+Aberdeen, S. D.—The contract for constructing storm sewers [illegible] First Ave. has been awarded to L. W. SCHMIDT[illegible], Fargo, at $11,[illegible] and $46,[illegible]1, respectively.

Grand Forks, N. D.—Bids will be received by W. H. Alexander, City Aud., until [illegible] p. m., Oct. 5, for constructing a 12-in. vitrified pipe sewer, [illegible]12 ft. long, and two manholes.

Great Falls, Mont.—According to press reports, bids will be received by W. H. Harrison, City Clk., until Oct. 1, for constructing [illegible] ft. [illegible]-in. sanitary sewer. M. L. Morris is City Engr.

+Houston, Tex.—The contract for constructing a sewer in [illegible] St. has been awarded to HORTON & HORTON, at approximately $[illegible]. Noted Sept. 10.

+Laredo, Tex.—A contract for constructing 24- and [illegible]-in. storm sewers has been awarded to A. DIETZ & BRO., at $24,[illegible]. Noted Sept. [illegible].

San Antonio, Tex.—See item under Light, Heat and Power.

Aberdeen, Wash.—Lewis D. Kelsey, City Engr., has been authorized by the City Council to prepare plans for constructing a trunk sewer to serve the district west of Division St.

Ruston, Wash.—Bids will soon be received for installing a sewer system to cost $[illegible]. L. A. Nicholson, 506 Fidelity Bldg., Tacoma, has prepared the plans.

Burns, Ore.—See item under Water Supply and Irrigation.

+Monroe, Ore.—A contract for constructing the main sewer has been awarded by the City Council to M. SWARTELY, Corvallis.

Corte Madera, Calif.—The Corte Madera Sanitary Board, 7[illegible] Pacific Bldg., San Francisco, plans an expenditure of $[illegible] for the installation of a sewer system in this city.

Huntington Beach, Calif.—Bids will be received by the City Trustees until [illegible] p. m., Sept. 28, for constructing a portion of the proposed [illegible] ft. 16-in. vitrified pipe and [illegible] ft. [illegible] pipe, average cut 14 ft. The work now ready will cost about $[illegible].

+Los Angeles, Calif.—The contract for constructing a sewer in [illegible] Ave. has been awarded to ADAM DALMATIN, at $[illegible]471.

Richmond, Calif.—H. D. Chapman, City Engr., is preparing plans for an extended sewer system in the western section of the city.

San Bernardino, Calif.—Bids will be received by S. G. [illegible], City Clk., until 7:[illegible] p. m., Oct. 5, for constructing approximately 116 ft. of [illegible]-in. vitrified pipe sewer along [illegible] St., together with two manholes, one flush tank, and twenty-six [illegible] ft. of vitrified pipe.

+San Francisco, Calif.—The contract for constructing a sewer in [illegible] has been awarded to KARL EHRHARDT at $[illegible].

Visalia, Calif.—[illegible]

London, Ont.—[illegible]

Thorold, Ont.—[illegible]

+New Westminster, B. C.—[illegible]

Vancouver, B. C.—[illegible]

GARBAGE

Columbus, Ohio.—[illegible]

Vallejo, Calif.—[illegible]

Toronto, Ont.—[illegible]

STREETS AND ROADS

Boston, Mass.—[illegible]

+[illegible]

+The contract for artificial stone sidewalks in Washington and Cambridge Sts., Brighton District, has been awarded to JOHN KELLY CO., at $[illegible]. Other bids were: Charles J. Jacobs Co., $[illegible]; John F. Beatty, $[illegible]33; Martino De Matteo, $[illegible]; Thomas W. [illegible], $[illegible]; James Doherty, $[illegible]; John L. Lane, $[illegible]; John McCourt Co., $[illegible]; Michael D. Russo, $[illegible]; William J. Rafferty Co., $[illegible]. Noted Sept. 10.

+The contract for paving Station St. with bitulithic has been awarded to JOHN F. BEATTY, at $[illegible]. Other bids were: Martino De Matteo, $[illegible]66; James Doherty, $[illegible]3; Warren Bros. Co., $[illegible]0; Charles R. Tellese, $[illegible]. Noted Sept. 1[illegible].

+Holyoke, Mass.—The contract has been awarded to P. J. KENNEDY for paving a section of [illegible] St. with asphalt blocks. Noted Sept. 3.

+Hartford, Conn.—The contract for the construction of about 6[illegible] lin. ft. gravel road on the [illegible] highway, North Canaan Township, has been awarded to LOUIS LOUGHLI & BRO., Litchfield, at about $[illegible]. Noted Aug. 6 and 2[illegible].

Hartford, Conn.—Sealed proposals for state road work were received by the State Highway Commissioner, Sept. 1[illegible], as follows:

New Milford Township, about 1[illegible],22[illegible] lin. ft. (a) native stone macadam, (b) gravel-trap rock, (c) limestone-trap rock, (d) gravel resurfacing, (e) limestone resurfacing, (f) native stone resurfacing: A. D. Pierce Jr. Co., Bridgeport, (a) $41,[illegible]3, (b) $40,786, (c) $40,786, (d) $12,11[illegible], (e) $1[illegible]12, (f) $1[illegible]; Edmund P. Wall, Torrington, [illegible]; (d) $2[illegible]3, (e) $2311, (f) $[illegible]; H. H. [illegible], Bridgeport, (a) $37,071.7[illegible], (b) $[illegible], (c) $[illegible], (d) $[illegible], (e) $4113, (f) $3431; A. Sanford Osborn, Redding, (a) $4[illegible]216, (b) $3[illegible],681, (c) $41,111, (d) $[illegible], (e) $[illegible], (f) $[illegible]; A. Brazos & Sons, Middletown, (a) $4[illegible], (b) $[illegible], (d) $[illegible], (f) $[illegible]; John de Michiel & Bro., Torrington, (a) $[illegible], (b) $[illegible], (c) $36,000.70[illegible], (d) $[illegible]179, (e) $[illegible], (f) $[illegible]; Louis Loughi & Bro., Torrington, (a) $4[illegible], (b) $[illegible], (c) $3[illegible],325, (d) $2[illegible], (e) $[illegible], (f) $[illegible]; Goodman & Trumbull Co., Litchfield, (a) $42,024, (b) $3[illegible]732, (c) $[illegible], (d) $1[illegible], (e) $2,03[illegible], (f) $1[illegible]69; A. D. Bridge's Sons, Hazardville, (a) $43,2[illegible]3, (f) $1[illegible]3; Bennett & Beard Co., Shelton, (a) $4[illegible], (b) $36,[illegible]73, (c) $3[illegible],231, (d) $2[illegible]1, (e) $[illegible], (f) $[illegible]; R. G. Miller Contracting Co., Hartford, (a) $[illegible], (b) $[illegible], (c) $34,[illegible]10, (d) $[illegible], (e) $2413, (f) $17[illegible]; Olin T. Benedict, Pittsfield, Mass., (a) $40,74[illegible], (b) $[illegible], (c) $[illegible], (d) $[illegible], (e) $202[illegible], (f) $17[illegible]. Also [illegible] lin. ft. trap rock macadam, (a) gravel-trap rock, (b) or limestone-trap rock construction on Popeau and East St.: H. Sanford Osborn, Redding, (a) $[illegible], (b) $8231, (c) $8231; A. D. Bridge's Sons, Hazardville, (a) $[illegible]; Edmund P. Wall, Torrington, (a) $[illegible], (b) $[illegible], (c) $[illegible]13; A. Brazos & Sons, Middletown, (a) $[illegible], (b) $[illegible]; Kellogg & Gregory Co., Danbury, (a) $[illegible]; John de Michiel & Bro., Torrington, (a) $7[illegible]32, (b) $[illegible], (c) $[illegible]; Goodman & Trumbull Co., Litchfield, (a) $737[illegible], (b) $72[illegible], (c) $[illegible]; Louis Loughi & Bro., Torrington, (a) $7444, (b) $[illegible], (c) $[illegible]3; D. W. Pierce Jr. Co., Bridgeport, (a) $[illegible], (b) $[illegible]166, (c) $[illegible]53[illegible]; Bennett & Beard Co., Shelton, (a) $[illegible], (b) $[illegible], (c) $[illegible]361; Olin T. Benedict, Pittsfield, Mass., (a) $6373, (b) $66[illegible], (c) $6653.

Washington Township, about 1[illegible] lin. ft. native stone macadam road and a [illegible]-ft. span reinforced concrete bridge: Edmund P. Wall, Torrington, $1[illegible]; Goodman & Trumbull Co., Litchfield, $11,97[illegible]; Caesar A. Ross, Torrington, $11,[illegible]; John de Michiel & Bro., Torrington, $11,[illegible]; Kellogg & Gregory Co., Danbury, $11,367; Louis Loughi & Bro., Torrington, $11,3[illegible]; H. H. [illegible], Bridgeport, $11,[illegible].

Berlin Township, [illegible] lin. ft. trap rock [illegible] on the Cromwell Road: Stafford & Mather, Hartford, Conn., $[illegible]; [illegible] Engineering & Construction Co., Hartford, $[illegible]; Connecticut Good Roads & Construction Co., New Britain, Conn., $[illegible]; D. Pierce Jr. Co., Bridgeport, $[illegible]; [illegible]

[illegible]

ton, Conn., $12,637; Goodman & Trumbull, Litchfield, Conn., $13,219; A. B. Cadwell, New Britain, Conn., $11,873; A. D. Bridge's Sons, Hazardville, Conn., $14,120; John de Michiel & Bro., Torrington, Conn., $11,627; Caesar A. Rossi, Torrington, Conn., $12,324.

Clinton Township, about 1663 lin.ft. concrete with washed sand, (a) unwashed sand, (b) reinforcement, (c) on the Main St.: Bristow Brothers & Knowles Corporation, Narragansett Pier, R. I., (a) $5133, (b) $4960; Piersen Engineering Construction Co., Hartford, (a) $5170, (b) $5026; Curran Corporation, Middletown, $4957, (b) $4727, (c) $295; Frank Arrigoni & Bro., Middletown, (a) $4895, (b) $4493; A. D. Bridge's Sons, Hazardville, (a) $5348, (b) $5060; B. D. Pierce, Jr. Co., Bridgeport, (a) $5588, (b) $5502.

Ridgefield Township, about 11,796 lin.ft. native stone (a) or gravel, (b) on the Danbury Road. Olin T. Benedict, Pittsfield, Mass., (a) $32,126, (b) $23,673; H. Sanford Osborn, Redding, (a) $32,749, (b) $24,008; Framingham Contracting Co., So. Framingham, Mass., (a) $30,614, (b) $23,390; Bennett N. Beard Co., Shelton, (a) $37,547, (b) $28,756; Capito & Giovaninni, 178 North St. Boston, Mass., (a) $31,795, (b) $21,591; A. Vito Construction Corporation, Thompson, (a) $30,375, (b) $22,888; Goodman & Trumbull Co., Litchfield, (a) $32,471, (b) $21,492; Charles W. Tryon, Meriden, (a) $29,672, (b) $23,296; A. D. Bridge's Sons, Hazardville, (a) $32,282; Kellogg & Gregory Co., Danbury, (a) $30,954, (b) $24,850; A. B. Cadwell, New Britain, (a) $28,808; John de Michiel & Bro., Torrington, (a) $33,137, (b) $23,955; B. D. Pierce Jr. Co., Bridgeport, (a) $32,632, (b) $23,346; Leonardo Suzio, Meriden, (a) $38,652; Lane Construction Corp. Meriden, (a) $34,211. Noted Sept. 10.

+Naugatuck, Conn.—The contract for paving Church St., from Rubber Ave. to Maple St., has been awarded to EDWARD P. TRACY, Derby, at $2.48 per sq.yd. The only other bid was that of C. W. Blakeslee & Sons, New Haven, at $2.25 per sq. yd. About 4580 sq. yd. will be required. Noted Sept. 10.

★+Amsterdam, N. Y.—The contract for paving Prospect, Grove, Schuyler and Shuler Sts., has been awarded to J. DIMANDO, Mamaronck, at $7240, $5791, $4880 and $6823. Other bidders were: S. I. Foster, Thomas R. Crane, Flood & Van Wirt, Union Paving Co. Noted Aug. 10.

+Buffalo, N. Y.—The contract for the repaving of Hudson St. has been awarded to the HENRY P. BURGARD CO.

+Granville, N. Y.—The contract for paving East Main St. with brick has been awarded to JOHN B. DOWER, Ballston Spa, at $15,853.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 11 a.m., Sept. 28, by Maurice E. Connolly, Pres., Borough of Queens, Borough Hall, for grading, curbing and laying sidewalks on Thomson Ave., from the viaduct to Diagonal St.

+Syracuse, N. Y.—The contract for paving Pond St. has been awarded to JOHN YOUNG, at $26,675.

Harrison, N. J.—The Otis Elevator Co. will pave First St., from Middlesex to Somerset St., with 3-in. asphalt paving.

Mays Landing, N. J.—The Board of Freeholders of Atlantic County has approved plans for the paving of the Meadowbrook Blvd. The approximate cost is $135,000. A. H. Nelson, Atlantic City, is Engr. in Charge.

Newton, N. J.—The Board of Chosen Freeholders of Sussex County is considering the improvement of the direct Newton-Sparta Road, at an estimated cost of about $12,000 per mile. Harvey Snook is County Engr.

+Passaic, N. J.—The contract for paving Central Ave. has been awarded to the UNION BUILDING & CONSTRUCTION CO.

+Trenton, N. J.—The contract for constructing the White Horse Road has been awarded to the NEWTON PAVING CO., at $9200.

Chester, Penn.—B. G. Ladamus, Law Bldg., Engr., is preparing plans for street improvements. The approximate cost of the work is $40,000.

Harrisburg, Penn.—(Official)—Bids will be received by the Department of State Highways, until 10 a.m., Oct. 6, for reconstructing 1050 lin.ft. of road in Tionesta Borough, Forest County.

+Philadelphia, Penn.—The contract for repaving Arch St. has been awarded to J. JOSEPH McHUGH, at $8965.

+Scranton, Penn.—A contract for paving has been awarded to the WARNER-QUINLAN CO., Coal Exchange Bldg., Wilkes-Barre.

Wilkinsburg, Penn.—(Official)—Bids will be received by Frease & Sperling, Borough Engineers, Carl Bldg., until 4 p.m., Sept. 26, for constructing concrete sidewalks on Penn Ave., Pitt and Hay Sts.

Baltimore, Md.—Bids will be received until Sept. 30, by the Board of Awards, City Hall, for paving McEldery St., Lindenwood Ave., and Loney's Lane, Contract 95. R. Keith Compton is Chmn. Paving Comm.

Quitman, Ga.—At an election held Sept. 7 the citizens voted on the proposition of issuing $35,000 in bonds for paving.

Titusville, Fla.—Bids will be received by J. P. Wilson, City Clk., until Oct. 6, for improving a portion of Tropic St.

Gadsden, Ala.—An election will be held Nov. 3 to vote on the proposition of issuing $200,000 in bonds for road construction.

Hamilton, Ala.—Bids will be received by the Board of County Commissioners, until Oct. 6, for grading and draining approximately 50 miles of road. S. E. Neill is Highway Engr.

+Chicago Junction, Ohio—(Official)—The contract for paving Spring St. has been awarded to LEE BROS., Clyde, at $24,869. Noted Aug. 13.

Chillicothe, Ohio—Bids will be received by R. B. Alexander, Audr. of Ross County, until Sept. 28, for the improvement of 1700 lin.ft. of the Clarksburg Pike.

Cincinnati, Ohio—(Official)—Bids will be received by the Board of Commissioners, until noon, Oct. 16, for repairing a part of the Ohio Pike.

(Official)—Bids will be received by Philip Fosdick, Dir. Pub. Ser., until noon, Sept. 30, for improving Bishop St. from Lakewood Ave. to St. Clair St.

Cleveland, Ohio—Bids will be received by the City Council, until Sept. 28, for the paving of Front Factory St.

+Coshocton, Ohio—Contracts have been awarded for paving North Fifth St. to T. J. NORMAN & SON, Hickory St., to J. BOCK & SON.

+Columbus, Ohio—Contracts have been awarded for paving Third and Starr Aves. to the CLEVELAND TRINIDAD PAVING CO., Reynolds Ave., to B. F. PATTERSON, Bryden Road, to W. M. GRAHAM and Buckingham St., to A. W. BURNS & CO.

Jefferson, Ohio—Bids will be received by the Commissioner of Ashtabula County until 1 p.m., Oct. 5, for grading, draining and paving East and West Road in Rome and Hargrove Townships. A. V. Hillyer is Clk.

Lorain, Ohio—(Official)—Bids will be received by L. B Johnston, Dir. Pub. Ser., until noon, Sept. 29, for improving Oberlin Ave.

Marion, Ohio—Bids will be received by C. H. Apt, City Clk., until Sept. 29, for paving Marion St.

+Napoleon, Ohio—The contract for paving Hobson St. with vitrified brick has been awarded to JOHNSON & RITZ, at $8068.

Niles, Ohio—Bids will be received by Homer Thomas, until Oct. 12, for the sale of bonds for $16,000, $3217, $12,300, $10,500, $15,558 and $4500 for street paving.

Sharonville, Ohio—(Official)—Bids will be received by Joseph Wright, Village Clk., until noon, Oct. 3, for improving Maple St., from Sycamore St. to Cornell Ave.

Swanton, Ohio—Bids will be received by William B. Elwell, Village Clk., until noon, Oct. 8, for paving North Main St. George Champe, Toledo, is Engr. in Charge.

+Toledo, Ohio—The contract for the paving of Bancroft St. has been awarded to the ASPHALT BLOCK PAVING CO., at $7426.

+Zanesville, Ohio—The contract for paving Jefferson and Madison Sts. has been awarded to ADAMS BROS. Noted Sept. 3.

Indiana—(Official)—Bids will be received as follows for road improvements in Indiana:

Rensselaer, until 2 p.m., Oct. 6, by the Commissioners of Jasper County for constructing a stone road in Kankakee Township. J. P. Hammond is Audr.

Rochester, until noon, Oct. 6, by the Commissioners of Fulton County for constructing two roads in Liberty Township.

Winamac, until noon, Oct. 6, by the Commissioners of Pulaski County for constructing roads in Van Buren, Tippecanoe and Monroe Townships. W. E. Munchenburg is Audr.

Valparaiso, until 10 a.m., Oct. 10, by the Commissioners of Porter County for constructing a gravel road in Central Township.

Greensburg, until 1 p.m., Oct. 12, by the Commissioners of Decatur County for constructing a crushed stone road in Sand Creek Township. Linton W. Sands is Audr.

Rochester, Ind.—(Official)—An election will be held, Oct. 13, to vote on the proposition of issuing $125,000 in bonds for road construction.

+Kalamazoo, Mich.—The contract for resurfacing East and West Vine St., Patterson St. and Woodland Ave. has been awarded to S. S. SAXTON CO., Richmond, Ind.

Springfield, Ill.—(Official)—Bids will be received by the State Highway Commission, until 11 a.m., Sept. 29, for the following road construction, all cement to be furnished by the state: Fayette County, Route 6, Sect. A, 7065 lin.ft. of concrete, estimated cost, $11,410; Schuyler County, Route 5, Sect. A, 5400 lin.ft. of concrete, estimated cost, $6766; Tazewell County, Route 10, Sect. D, 4000 lin. ft. of concrete, estimated cost, $7914; Whiteside County, Route 6, Sect. A, 2800 lin.ft. of concrete, estimated cost $7475; Road Island County, Route 11, Sect. A, 4969 lin. ft. of concrete, estimated cost, $7270.

+Berlin, Wis.—The contract for paving Broadway with concrete has been awarded to C. JOHNSON, Oshkosh.

Manitowoc, Wis.—Bids will be received by Arthur Reichert, City Clk., until Oct. 5, for paving portions of 25th and North 12th Sts. with macadam.

+Sheboygan, Wis.—The contract for paving Bluff Ave. with concrete has been awarded to the BIRDSALL-GRIFFITH CONSTRUCTION CO., Racine, Wis., at $19,695.

+Bettendorf, Iowa—A contract for paving 2589 sq.yd. with concrete has been awarded to A. KORNEMANN, Muscatine.

+Council Bluffs, Iowa—A contract for constructing 19,350 lin.ft. of combined curb and gutter, 10,057 sq.ft. paving, has been awarded to P. NELSON, 727 West Washington Ave., at $40,057. Noted Aug. 27.

+Davenport, Iowa—The contract for resurfacing Ripley St. has been awarded to the CENTRAL ENGINEERING CO., at $6170.

+Le Mars, Iowa—A contract for paving several blocks of Main St. has been awarded to M. L. FLYNN CO., Sioux City.

+Blue Earth, Minn.—A contract for paving five blocks of Main St. has been awarded to the NORTH STAR CONCRETE CO., Mankato.

+St. Paul, Minn.—The contract for grading Blair St., from Syndicate to Lexington Ave., has been awarded to R. D. MALONE, at $5015.

+Lincoln, Neb.—A contract for paving District 65 has been awarded to C. W. BEANS.

Omaha, Neb.—(Official)—Bids will be received by Thomas J. Flynn, City Clk., until 9 a m., Sept. 29, for improving several streets.

Missoula, Mont.—All bids for grading, curbing, laying sidewalks and paving of Stevens St. have been rejected by the City Council, and new bids will be asked. The lowest submitted was that of J. C. McGowe, for asphaltic concrete, $16,[illegible].

St. Joseph, Mo.—All bids received Sept. 4 by the Board of Public Works for paving the highway from Seventh St. and Highland Ave. to Second St. and Hamburg were rejected. Bids will be readvertised.

Caldwell, Tex.—The City Council has ordered an election to be held Oct. 18, to vote on the proposition of issuing $12,000 in bonds for street paving.

✦**Dallas, Tex.**—The contract for paving Hall, Washington, Haskins, Crowdus, Jackson, Ross, Broome, Lamar and Bryan Sts. has been awarded to the TEXAS BITULITHIC CO., Dallas.

✦**Lockhart, Tex.**—The contract for repairing 18 miles of graded roads on the San Marcos and Kyle Road has been awarded to VAN B. FLOWERS.

Lufkin, Tex.—At the election held Sept. 10, $40,000 in bonds for street paving were sold. Noted Aug. 27.

St. Johns, Ariz.—The citizens recently voted on the proposition of issuing $125,000 in bonds for the improvement of county roads.

Bellingham, Wash.—The Commissioners of Whatcom County are having estimates prepared for laying permanent surface on Guide Meridian Road, for a distance of about 2½ miles beyond the city limits.

✦**Port Townsend, Wash.**—A contract for constructing permanent highway No. 2 has been awarded to P. H. ERICKSON, Bremerton, at $7,279. Noted Aug. 27.

Seattle, Wash.—Bids will be received by the Commissioners of King County, until Sept. 29, for constructing the Issaquah-Fall City Road.

✦**Bay City, Ore.**—The City Trustees have awarded a contract for the grading and surfacing of 21 blocks in the downtown district to the TILLAMOOK BAY CONSTRUCTION CO., at $16,[illegible].

✦**Oregon City, Ore.**—The contract for paving Division St. has been awarded to J. W. SHEA.

Alameda, Calif.—The city will spend $100,000 for the improvement of Central Ave. and portions of Park and Webster Sts.

✦**Coronado, Calif.**—The contract for improving Ocean Blvd. has been awarded to the FAIRCHILD-GILMORE-WILTON CO., at $[illegible].

✦**Eagle Rock, Calif.**—The contract for improving portions of Eagle Rock Road, Eagle Rock Ave. and Wiota St. has been awarded to PETER L. FERRY, 326 West Acacia St., Tropico, at $[illegible].

✦**Los Angeles, Calif.**—The contract for improving Western Ave. from Los Feliz Road to Franklin Ave., has been awarded to R. H. McCRAY, Jr., at $4281.

✦**Richmond, Calif.**—The City Council has awarded the contract for paving Soto Ave. to FRANK AGUIAR, at $11,221.

Sacramento, Calif.—Bids will be received by the State Highway Commission until 2 p.m., Oct. 5, for constructing roads in various counties as follows: Imperial County, from Mesa Creek to Coyote Wells, about six miles; Santa Barbara County, from Zaca Station to Los Alamos, about 8.7 miles of concrete; San Luis Obispo County, from San Luis Obispo Creek to Cuesta, about 3.6 miles; Alameda County, from easterly boundary to Altamount, about 9 miles of concrete paving; Humboldt County, from Loleta to Beatrice, about 1.1 miles; Humboldt County from Shively to Jordan Creek, about 3.7 miles.

✦**Sacramento, Calif.**—The State Highway Commission has awarded contracts for highway work as follows: Kern County, from Southerly boundary to a point 2.3 miles south of [illegible], to the A. C. McCLEAN CONSTRUCTION CO., San Francisco, at $[illegible]; Kern County, to LYNN S. ATKINSON, Los Angeles, at $171,[illegible]; Santa Barbara County, to the [illegible] CONSTRUCTION CO., Los Angeles, at $[illegible]. Noted Aug. 13 and Sept. 17.

San Bernardino, Calif.—Bids will be received by [illegible], until 7:30 p.m., Oct. [illegible], for improving [illegible] from [illegible] to [illegible] [illegible]

Yuba City, Calif.—The Board of Supervisors of Sutter County is considering the construction of a highway from Yuba City to [illegible]. The estimated cost is $[illegible].

INDUSTRIAL WORKS

✦**Boston, Mass.**—[illegible]

✦**Boston, Mass.**—[illegible]

✦**Fall River, Mass.**—[illegible]

✦**Holyoke, Mass.**—[illegible]

✦**Holyoke, Mass.**—[illegible]

Peabody, Mass.—[illegible]

✦**Albany, N. Y.**—[illegible] general contract, WILLIAM CROW CONSTRUCTION CO., 103 Park Ave., New York; plumbing, JAMES WALSH SONS, Albany; electric work, MORTON HAVENS, JR., Albany.

Gloversville, N. Y.—The plant of E. S. Parkhurst & Co., manufacturer of textiles, which was recently damaged by fire will be rebuilt at once.

Peekskill, N. Y.—The Fleischmann Co. will erect a laboratory and storage building at Peekskill. M. Celendorf is Mgr., 701 Washington St., New York.

✦**Camden, N. J.**—The contract for constructing the building for the Victor Talking Machine Co. has been awarded to CRAMP & CO., Philadelphia, Penn. Estimated cost, $360,000. Noted Sept. 3.

Cape May, N. J.—Plans have been completed by Lloyd Titus, Arch., Cape May, for a cold storage building to be erected at Cape May, for the Neptune Fisheries Co. It will be one story, 153x71 ft. and 153x68 ft. Estimated to cost $100,000.

Paterson, N. J.—The East Jersey Lock Bar Pipe Co. contemplates rebuilding its plant at Paterson. The estimated cost is $100,000.

Chester, Penn.—Plans are being prepared by Peuckert & Wunder, Archs., 310 Chestnut St., Philadelphia, for the erection of a one-story brick, steel and concrete warehouse at Chester.

✦**Harrisburg, Penn.**—The Contract for the Emerson Brantingham building Co. has been awarded to ENGLISH BROS., Champaign, Ill., at $90,000.

Philadelphia, Penn.—The Barrett Mfg. Co., Philadelphia, Penn., will erect a one-story, 100x112-ft. addition to its plant at 36th St. and Grays Ferry Road.

✦The contract for the erection of the four-story warehouse at 131 North Water St. has been awarded to JAMES McCREA & BRO., 1313 Arch St., Philadelphia, Penn., at $20,000.

Pottsville, Penn.—Bids will be received until Oct. 8, by W. D. Hill, Arch., Pottsville, for a three-story, [illegible]x80-ft. shoe factory, to be erected at Pottsville.

York, Penn.—Plans are being prepared by John B. Hamme, Arch., West Bldg., for a factory to be erected for the Eisenlohr Cigar Co. Estimated cost, $15,000.

✦**Huntington, W. Va.**—The general contract for the construction of the three-story and basement warehouse, 41x[illegible] ft., on Fourth St., for the Banks Supply Co., has been awarded to JOHN R. LALANCE, 1241 Third Ave.; structural steel to RIVERSIDE BRIDGE WORKS, Martins Ferry, Ohio. Noted June 25.

Atlanta, Ga.—The Exposition Cotton Mills has had plans prepared for the construction of a 93x100-ft. warehouse.

✦**St. Augustine, Fla.**—The contract for the erection of the laundry at the Deaf, Dumb and Blind Institute has been awarded to ARTHUR E. ITTNER, Albany, Ga., at $10,889.

Carson, La.—The Central Coal & Coke Co. will rebuild the saw mill recently destroyed by fire, at Carson.

✦**Memphis, Tenn.**—The Southern R.R. Co. has awarded the contract for the erection of the roundhouse at its Forrest Yards, to the CONSOLIDATED ENGINEERING CO., Baltimore, Md. The estimated cost is $60,000.

Maysville, Ky.—Best Baldwin & Co., Archs., Cincinnati, Ohio, are preparing plans for the erection of a three-story 32x114 ft. laundry plant and a 72x41-ft. power house for Rohen & Martin, Maysville, Ky.

Bellaire, Ohio.—The American Stamping & Enameling Co. plans to construct a $200,000 addition to its plant at Bellaire.

Canal Dover, Ohio.—The Auto Products Co. will build a plant at Canal Dover for the manufacture of automobile parts and accessories. H. R. Redding, Cleveland, Ohio, is Mgr.

Cincinnati, Ohio.—The M. A. Hunt Co. plans to construct a three-story factory, [illegible]x160 ft. Estimated cost, $[illegible]. Anthony Kunz, Jr., 954 West Court St., Cincinnati, is Arch.

Cleveland, Ohio.—The Leisener Brewing Co., Cleveland, is having plans prepared for a warehouse to be constructed at Clark Ave. and West 65th St. It will be three stories, [illegible] 2[illegible] ft., of brick.

The West Steel Casting Co. is receiving bids for a [illegible] story factory addition, 91x[illegible] ft. Frederick [illegible] Bldg., Cleveland, is Arch.

The M. & M. Co., Cleveland, will erect a plant on additional property recently acquired for the purpose. J. C. M[illegible] is Gen. Mgr. of the company.

✦**Niles, Ohio.**—The [illegible] Galvanizing & Mfg. Co., Niles, Ohio, has awarded the contract to the HUNTER CONSTRUCTION CO., [illegible] Bldg., Youngstown, Ohio, for erecting a [illegible] factory [illegible] ft. [illegible] Engineering Co., [illegible] Bldg., Cleveland, is Engr.

✦**Tiffin, Ohio.**—The Great Western Pottery Co., Tiffin, has awarded the contract to A. BENTLEY & SON, Toledo, Ohio, for constructing its proposed factory at about $[illegible].

Wooster, Ohio.—The [illegible] Aluminum Co., Wooster, plans the construction of a [illegible] addition to its plant.

Detroit, Mich.—The Detroit Steel Products Co. plans to construct an addition to its spring factory. It will be [illegible] ft. [illegible] & [illegible], [illegible] Arcade, Detroit, are Archs.

The [illegible] Co., Detroit, will build a factory addition to its main plant at [illegible] Ave. and Hastings St. The new structure will be [illegible] ft., two stories. It will cost [illegible].

Chicago, Ill.—Bids are being received by [illegible] & [illegible], Archs., [illegible], Chicago, for the construction of a factory for the Albert A. Arnold Paper Co., [illegible]. It will be four stories and basement, [illegible] ft. Noted Sept. 1[illegible].

The [illegible] Machine Co., Chicago, is receiving bids for the construction of a foundry and pattern shop. The foundry will be [illegible] ft., and the pattern shop [illegible] ft.

Rockton, Ill.—The Great Northern Manufacturers [illegible] plans to construct a [illegible] ft. two story factory.

Dousman, Wis.—The Eagle Lime Products Co., Dousman, is considering the construction of a factory. Estimated cost, $10,000.

Milwaukee, Wis.—Herbst & Hufschmidt, Archs., Milwaukee, are preparing plans for a two-story laundry. Estimated cost, $20,000.

The Evinrude Motor Co., Milwaukee, plans to add a story to its factory. Estimated cost, $14,000.

Des Moines, Iowa—The Green Foundry & Furnace Works, Des Moines, has had plans prepared for a plant to be erected on a four-acre site in East Des Moines. The buildings to be erected are: Two-story, 66x200-ft. main building; one-story, 90x265-ft. foundry and machine shop; two-story, 40x120-ft. warehouse. Noted July 23.

St. Paul, Minn.—O. H. Round, Arch., Oppenheim Bldg., St. Paul, is preparing plans for the construction of a one-story and basement factory. Estimated cost, $15,000.

St. Peter, Minn.—The construction of a factory at St. Peter for the manufacture of incubators is under consideration. H. A. Nourse, St. Paul, Minn., is interested.

Ludlow, S. D.—The Equity Creamery Association plans to construct a creamery at Ludlow to cost $50,000.

Kansas City, Mo.—The R. & R. Investment Co. plans to construct a two-story and basement factory, 104x110 ft. S. E. Edwards, Sheidley Bldg., Kansas City, is Arch.

The Kansas City Terminal Ry. Co., Kansas City, has obtained a permit, and will erect a two-story brick addition to its roundhouse at 26th St. and Southwest Blvd., to cost $35,000.

Tacoma, Wash.—The Carstens Packing Co., Tacoma, plans to rebuild its factory, recently destroyed by fire at a loss of $600,000.

Portland, Ore.—George M. Harris, of Terry & Harris, Portland, Ore., is considering the construction of a cast-iron pipe foundry at Portland. The estimated cost is $250,000.

Lordsburg, Calif.—The La Verne Orange Growers' Association has decided to build a precooling plant at Lordsburg, to cost about $50,000.

San Francisco, Calif.—It is reported that the F. S. Moody Estate will construct a two-story building, 72x125 ft., on Bluxome St., San Francisco, Calif., to be occupied by the National Biscuit Co. The estimated cost is $25,000.

+Windsor, Ont.—J. T. Wing & Co., Windsor, have awarded the contract to LEO WEISS Detroit, Mich., for constructing a four-story and basement warehouse, 100x100 ft. James Pennington, La Bell Bldg., Windsor, is Arch. Noted July 23.

New Westminster, B. C.—The Brackman-Ker Milling Co. is considering rebuilding its factory at New Westminster, recently destroyed by fire at a loss of $20,000.

FEDERAL GOVERNMENT WORK

Concrete Coal Pocket—Fort Williams (Cape Cottage post office) Maine—(Official)—The following are the bids received by C. O. Zollars, Constructing Quartermaster, for constructing a concrete coal pocket at Fort Williams: Forgions & Romano, Portland, Maine, $8674; Sanders Construction Co., Portland, $8255; Mahoney Bros., Boston, Mass., $10,600; Small & Ingalls, Bar Harbor, Maine, $91,970; Marshall Bros., Portland, $8737.

Headstones—Boston, Mass.—Bids will be received until Oct. 9, by Lieut. Col. W. S. Wood, Depot Quartermaster, 263 Summer St., Boston for furnishing 12,000 white marble headstones.

Shipbuilding Cranes — Boston, Mass. — Bids will be received by H. R. Stanford, Chief, Bureau of Yards and docks, Navy Dept., Washington, D. C., until 11 a.m., Oct. 3, for constructing shipbuilding cranes at the U. S. Navy Yards, Boston, and Philadelphia, Penn.

Post Office—Danbury, Conn.,—(Official)—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 4, for constructing a two-story and basement brick post office at Danbury.

Post Office—Stamford, Conn.,—(Official)—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 4, for constructing a post office at Stamford. The building will be one-story and basement of stone brick, terra cotta and marble.

Repairs To Steamer—Fort Slocum, N. Y.—Bids will be received until Sept. 30 by the Quartermaster, U. S. Army for making repairs to the U. S. steamer, "General D. S. Stanley."

Sheet Metal Work—New York, N. Y.—(Official)—Bids will be received until 3 p.m., Oct. 2, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for replacing of old c.-i. roof trim with sheet metal on the U. S. Court House and Post Office, New York. Plans may be obtained from the Chief Engineer and Superintendent, U. S. Public Buildings, Room 727 Custom House Bldg., New York.

Piers, Ferry Rack, Bridge, Etc.—New York N. Y.—(Official)—Bids will be received by Oscar Wenderoth, Superv. Arch., Washington, D. C., until 3 p.m., Oct. 14, for constructing new dock piers, ferry rack, bridge, etc., at the U. S. barge office, New York. Plans may be obtained at the Office of the Chief Engineer and Superintendent, etc., United States Public Buildings, Room 727, Custom House Bldg., New York, N. Y., or at the office, of the Supervising Arch.

Lighting Fixtures, Etc.—New York, N. Y.—(Official)—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Sept. 29, for installing new lighting fixtures and making repairs to the old fixtures in the United States Court House and Post Office.

Acetylene Buoy Bodies—New York, N. Y.—(Borough of Richmond)—(Official)—Bids will be received by the Light House Inspector, Tompkinsville, until 2 p.m., Sept. 28, for furnishing and delivering to light house depot, Tompkinsville, the acetylene buoy bodies, type S.

Post Office—Carnegie, Penn.—(Official)—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Oct. 27, for constructing a post office at Carnegie. The building will be one-story and basement of brick.

Shipbuilding Cranes—Philadelphia, Penn.—See item under Boston, Mass.

Lock Gates, Etc.—Pittsburgh, Penn.—The date for receiving bids for steel lock gates, etc., at Lock No. 4, Monongahela River, has been extended from Oct. 3 to Oct. 15. Noted Sept. 10.

+Curbing—Washington, D. C.—The contract for furnishing curbing during the year 1915 in the District of Columbia has been awarded to the NORTH CAROLINA GRANITE CORPORATION, Mount Airy, N. C., as follows: Straight curbing, 79c. per lin.ft.; circular curbing, $1.05 per lin.ft.

+Paving Pitch—Washington, D. C.—The contract for furnishing paving pitch for use in the District of Columbia during the year 1915 has been awarded to BARRETT MFG. CO., Philadelphia, Penn., at $18 per ton.

+Fuel Oil—Washington, D. C.—The contract for furnishing fuel oil for use in the District of Columbia during the year has been awarded to the STANDARD OIL CO., Baltimore, Md., at 3.45c. per gal.

Bricks—Washington, D. C.—Bids will be received by Samuel McGowan, Paymaster Gen., Bureau of Supplies, Washington, D. C., until Oct. 6, for furnishing 132,000 dark-red hard-burned bricks f.o.b. Washington.

+Sewer Brick—Washington, D. C.—The contract for furnishing 200,000 red sewer brick for use in the District of Columbia has been awarded to the FREDERICK BRICK WORKS, Frederick, Md., at $10 per M.

+Limestone Dust—Washington, D. C.—The contract for furnishing limestone dust for use in the District of Columbia during the year 1915 has been awarded to the STANDARD LIME & STONE CO., Baltimore, Md., at $2.20 per ton.

+Paving Blocks and Sewer Bricks—Washington, D. C.—The contract for furnishing paving blocks for use in the District of Columbia during the year 1915 has been awarded to the BALTIMORE CLAY PRODUCT CO., Baltimore, Md., at $22.50 per M.; sewer bricks to the MORGANTOWN BRICK CO., Morgantown, W. Va., at $15.95 per M.

+Asphalt Cement—Washington, D. C.—The contract for furnishing asphalt cement for use in the District of Columbia during the year 1915 has been awarded to the SUN CO., Philadelphia, Penn., at $15.50 per ton.

+Cement—Washington, D. C.—The contract for furnishing portland cement for use in the District of Columbia during the year 1915 has been awarded to the SECURITY CEMENT & LIME CO., Hagerstown, Md., at $1.04 per bbl.

Sewers—Washington, D. C.—(Official)—Bids will be received by the Commissioners of the District, until 2 p.m., Sept. 28, for constructing about 6235 lin.ft. of brick and concrete trunk sewers. Oliver P. Newman, Frederick L. Siddons and Chester Harding are Comrs.

Floating Cranes—Norfolk, Va.—Bids will be received by H. R. Stanford, Chief of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Jan. 16, 1915, for a 150-ton capacity floating revolving crane for the navy yard, Norfolk.

Trestles, Etc.—Wheeling, W. Va.—Bids will be received by Maj. J. P. Jervey, Engineers Office, Wheeling, until Oct. 15, for furnishing and delivering Poiree trestles, recess and engine-pit covers for dam No. 15, Ohio River.

Boilers and Stack—Port Royal, S. C.—(Official)—The date for receiving bids for installing two 50-hp. boilers with steel stack at the pumping station, Naval Disciplinary Barracks, Port Royal, has been extended from Oct. 3 to 11 a.m. Oct. 17. H. R. Stanford is Ch., Bureau of Yards and Docks, Washington, D. C. Noted Sept. 17.

+Cement—Montgomery, Ala.—The contract for furnishing about 20,000 bbl. of American portland cement, to be delivered at Riverside, Ala., has been awarded to the CAROLINA PORTLAND CEMENT CO., Montgomery, Ala., at $29,800. Noted Sept. 10.

+Post Office—Tupelo, Miss.—The contract for constructing the post office at Tupelo has been awarded to W. H. FISSELL & CO., 1133 Broadway, New York, N. Y. Noted July 23 and Sept. 2.

+Post Office—Cookeville, Tenn.—The contract for constructing the post office at Cookeville has been awarded to W. H. FISSELL & CO., 1133 Broadway, New York, N. Y. Noted June 25 and Aug. 6.

+Post Office—Pulaski, Tenn.—The contract for constructing the post office at Pulaski has been awarded to ALGERNON BLAIR, Montgomery, Ala. Noted June 4.

+Post Office—Fulton, Ky.—The contract for constructing the post office has been awarded to J. S. ROGERS, Moorestown, N. J. Noted July 30 and Sept. 10.

★Steel Reinforcement — Ashtabula, Ohio — (Official) — The following are the bids received Sept. 10, by Roscoe House, Lighthouse Inspector, Buffalo, N. Y., for the steel reinforcement for the base of the Ashtabula West Breakwater Pierhead Light Station. August Feine & Sons Co., Buffalo, N. Y., $3175; Weatherly Iron & Steel Co., Weatherly, Penn., $2830; Buffalo Structural Steel Co., Buffalo, N. Y., $4159; Van Dorn Iron Works, Cleveland, $3849; McKinnon Iron Works, Co., Ashtabula, Ohio, $2579; Phœnix Foundry & Machine Co., Ashtabula, Ohio, $2495; Variety Iron & Steel Works, Co., Cleveland, Ohio, $2950. Noted Aug. 27.

+Elevator—Columbus, Ohio—The contract for the installation of an electric freight elevator and making miscellaneous changes, etc., in the U. S. post office and court house at Columbus, has been awarded to the OTIS ELEVATOR CO., Washington, D. C., at $8390. Noted Sept. 10.

Post Office—Collinsville, Ill.—(Official)—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 6, for constructing a two-story and basement fireproof post office at Collinsville.

Post Office—Princeton, Ill.—(Official)—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 5, for constructing a two-story and basement fireproof post office at Princeton.

Building Addition—Milwaukee, Wis.—The following are the bids received by Oscar Wenderoth, Superv. Arch., Washington, D. C., for (a) adding a third story, with reinforced

[illegible] etc., (b) adding a third story, with a [illegible] framed fourth floor supporting a wood-framed [illegible] and a [illegible] furred and plastered third story [illegible] to the [illegible] stores at Milwaukee. F. W. Tabler & Son, Milwaukee (a) $13,[illegible], (b) $11,[illegible]; General Construction Co., Milwaukee (a) $1[illegible], (b) $14,[illegible]; Northern [illegible] Co., Milwaukee (a) $17,703, (b) $1[illegible],98[illegible]; [illegible] Construction Co., Milwaukee (a) $24,[illegible]0, (b) $23,[illegible].

✦Post Office—Arkansas City, Kan.—The contract for constructing the U. S. post office at Arkansas City has been awarded to the GENERAL CONSTRUCTION CO., Milwaukee, Wis., at $[illegible].

Canal Work—[illegible], Mont.—(Official)—Bids will be received until 2 p.m., Oct. 2[illegible], by F. H. Newell, Dir. U. S. Reclamation Service, Malta, Mont., for the reconstruction of [illegible] South Canal at D[illegible] Bridge, in connection with the Milk River Irrigation Project. The work involves about [illegible] cu.yd. of excavation, 12[illegible] cu.yd. of puddled filling, [illegible] of riprap, [illegible] cu.yd. of concrete and the moving of two steel bridge spans, abutments and pier. The work is situated [illegible] side of Milk River, about 1½ miles [illegible].

✦✦Excavation, Etc.—Glendale, Ariz.—(Official)—The contract for [illegible] the Cave Creek cutoff of the Arizona Canal, Salt River Project, Ariz., and the necessary laterals, involving in all about 1[illegible] cu.yd. of excavation has been awarded to MARTIN & GILLIS, Phoenix, Ariz., at $1[illegible]. The contract for constructing about 370 cu.yd. of reinforced concrete and about 1[illegible]7 sq.yd. of grouted pavement in connection with this work has been awarded to MANLY BROS. & CO., Oklahoma City, Okla., at $2[illegible]6. The work is located near Glendale. Noted July 16.

✦Canal—Phoenix, Ariz.—(Official)—The contract for constructing the earthwork and structures in connection with the [illegible] Feeder Canal, Salt River Project, Ariz., has been awarded to S. J. HUGHES, Phoenix, at $[illegible]152.

Timber Wharf, Wharf Shed—Bremerton, Wash.—(Official)—The date for receiving bids for the construction of the timber wharf and wharf shed at the Naval Torpedo Station, Puget Sound, Wash., has been extended from 11 a.m., Sept. 2[illegible], to 11 a.m., Oct. 10. Noted Aug. 27.

✦Machinery and Valves—Seattle, Wash.—(Official)—The contract for furnishing machinery and valves for the Lake Washington Canal Locks has been awarded to HANS PEDERSON, Seattle, at $1[illegible]. Other bids were: McMyler Interstate Co., $1[illegible]6; William E. Chase Engineering Co., $122,321; J. & J. [illegible] Mulholland Co., $11[illegible]; C. C. Moore & Co., $11[illegible],620; Camden Iron Works, $163,76[illegible]; A. McLean, $130,147; Seattle Construction & Drydock Co., $117,160. Noted July 2 and July 16.

Metal Vault Equipment—San Francisco, Calif.—(Official)—Bids will be received until 3 p.m., Oct. 7, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for installing metal vault equipment at the U. S. subtreasury, San Francisco.

Miscellaneous Supplies—Panama—(Official)—Bids will be received by Maj. F. C. Boggs, Gen. Pur. Officer of the Panama Canal, Washington, D. C., until 10:30 a.m., Sept. 30, for furnishing steel wire cable, files, drill sleeves, [illegible] and [illegible] tape, twist drills, hose, metallic tapes, manila rope, rubber packing, [illegible] sheeting, cotton [illegible], coal tar, linseed oil, Japan drier, orange shellac, varnish, burnt umber and [illegible]. These supplies are to be delivered f.o.b. dock at either Colon, Atlantic Port, or Port of Ancon, Balboa, Canal Zone, [illegible] Port.

MISCELLANEOUS

Dredging and Bulkhead—Boston, Mass.—The Harbor and Land Commissioners have received the following bids for constructing a bulkhead on the east side of Saugus River, in [illegible]: George T. [illegible], $1[illegible],97[illegible]; W. S. Bendle, $16,21[illegible]; B. P. [illegible] & Co., $1[illegible]; W. H. Ellis & Sons Co., $1[illegible]; [illegible] Bros., $[illegible]; Thomas E. Ruggles, $2[illegible]. For dredging, the bids were as follows per cu.yd.: (Item 1) placing dredged material behind bulkhead, (Item 2) [illegible] dredged material and to sea, (Item 3) removing boulders: [illegible], Boston, (1) [illegible], (2) 40½c., (3) $10; John [illegible], Boston, (1) [illegible], (2) [illegible], (3) $[illegible]; [illegible] Dredging Co., Boston, (1) [illegible], (2) [illegible], (3) $1[illegible]; [illegible] & [illegible] Co., New York, (1) [illegible], (2) [illegible], (3) $10; [illegible] Dredging Co., Boston, (1) [illegible], (2) [illegible], (3) [illegible]; [illegible] Dredging Co., Boston, (1) [illegible], (2) [illegible], (3) [illegible].

✦Dredging—[illegible]

Sea Wall—[illegible]

✦Retaining Wall, Dredging, Etc.—[illegible]

✦Bridge—[illegible]

✦Subway—[illegible]

✦Creek Improvement—Syracuse, N. Y.—(Official)—Bids will be received at the office of the Syracuse Intercepting Sewer Board until 4 p.m., Oct. 7, for the improvement of Onondaga Creek in Syracuse. For details see advertisement under "Contracts to Be Let."

✦Bridge Work—Camden, N. J.—(Official)—Bids will be received by the Bridge Committee until 10 a.m., Oct. 14, for additional material in position at the new Broadway Bridge over Newton Creek, between Gloucester and Camden. Fred W. Gercke is Chn. Bridge Com. For details see advertisement under "Contracts to Be Let."

Elimination of Grade Crossing—Trenton, N. J.—The Philadelphia & Reading R.R. is making surveys preparatory to elevating the tracks of the Trenton Junction branch, for the elimination of several grade crossings.

Comfort Station—Scranton, Penn.—The contract for constructing the proposed comfort station on Court Sq. will be awarded soon by the city and county authorities. Estimated cost, $[illegible],000. J. W. Duckworth, Scranton, is Arch.

✦Wall—Charleston, W. Va.—The city has awarded the contract to BOARD & REED, Charleston, for constructing a retaining wall around the city levee from a point opposite Summers St. to the Union Bldg., at the foot of Capitol St., at $21,62[illegible]. Other bidders were: McHale & Cain, Elkins, $[illegible]1,81[illegible]; D. Minotti, Charleston, $[illegible]2,71[illegible]; Louisa Contracting Co., Louisa, Ky., $2[illegible]; Virginia Concrete Co., Richmond, Va., $24,95[illegible]; Hatfield Construction Co., $26,6[illegible]1; M. G. Watson, Huntington, W. Va., $[illegible]6,[illegible]3[illegible].

Drainage—Salisbury, N. C.—The Drainage Commissioners plan to drain Withrows and Second Creeks. The estimated cost is $75,000. C. M. Miller is the Engr. and Supt.

✦Grants Creek Drainage District has awarded the contract to MARK P. M[illegible], China Grove, N. C., for draining 1[illegible]9 acres of land and for the construction of a 14-mile canal. Estimated cost, $3[illegible],000.

Bids will be received until Oct. 3, by the Commissioners of Kerr and Sills Creeks District, Rowan County, for draining and removing 33[illegible],17[illegible] yd. material from Kerr and Sills Creeks. The estimated cost is $[illegible]. Plans and specifications, Clerk's office, Salisbury. C. M. Miller, Engr. and Supt.

Docks—Miami, Fla.—The city has commissioned Isham Randolph, Engr., Chicago, Ill., to prepare plans for municipal docks. Three sets of tentative plans have been submitted, each calling for 1000-ft. docks, including railroad trackage and accommodations for from four to eight boats. J. W. Watson is Mayor.

Docks—Mobile, Ala.—The city contemplates securing additional waterfront property and plans to build docks and warehouses at an estimated cost of $[illegible]0,000. Patrick J. Lyons is Mayor.

Drainage—Gretna, La.—The Fourth Jefferson Drainage District will vote, Sept. 2[illegible], on $2[illegible]0 bond issue for the construction of a drainage system in Subdrainage District No. 2. A. H. Ahten is the Pres.

Drainage—Gueydan, La.—The Town Council has called for bids for the construction of a drainage and navigable canal, also for clearing and deepening the drainage canal to Grand Lake. The estimated cost is $1[illegible],000.

Interlocking Plant—Chattanooga, Tenn.—The Queen & Crescent Route has authorized the expenditure of $[illegible] for extension work on the Belt Ry., Chattanooga. The work will include extension of interlocking plant at East End Ave. and the installation of automatic signals on the double-track line. H. Baker, Cincinnati, Ohio, is the Gen. Mgr.

Drainage—Jackson, Tenn.—Bids will be received until Oct. 1, by Drainage District No. 2, Madison County, A. W. Stovall, Chmn., for clearing right-of-way, [illegible] ft. wide, construction of a drainage canal 11[illegible] miles long, and construction of five laterals 100 ft. wide. A total earth removal of [illegible]12,[illegible] cu.yd.

Tunnels—Jellico, Tenn.—The Jellico Coal & R.R. Co. plans to construct two tunnels, one 3[illegible] ft. long, the other [illegible] ft. long. B. C. Barker is Ch. Engr.

Dredging—Celina, Ohio—The Commissioners of Auglaize, Mercer, Darke and Shelby Counties will let the contract Oct. 6 for the improvement of 14 miles of [illegible] Creek. The estimated cost is $[illegible].

Ditch—Princeton, Ind.—Bids will be received until Sept. [illegible] by [illegible] Meier, [illegible] of [illegible], at the office of the County Clerk, for the construction of a main ditch and two laterals.

Ditch—Albert Lea, Minn.—The date for receiving bids for the construction of Town Ditch No. 1 has been postponed until Oct. 16. Noted Aug. [illegible].

Drainage—[illegible]—The Nix Creek [illegible]

Levee—[illegible]

Recreation Pier—[illegible]

Dredging—[illegible]

Wharf—[illegible]

✦Filling—[illegible]

✦Dock—[illegible]

Cut-Off—Tacoma, Wash.—The Inter-County River Improvement Commission has rejected bids for the third time for the construction of the Murphy Cut-Off. Informal proposals will be received. The estimated cost is $200,000. W. J. Roberts is Ch. Engr. Noted Sept. 3.

Dock—Portland, Ore.—Local press reports state that the Southern Pacific Co. is planning to build a dock between the Burnside bridge and the Oregon & California dock. The estimated cost is said to be $75,000.

Automobile Plates, Chauffeurs' Badges, Etc.—Sacramento, Calif.—Low bids were received by the State Motor Vehicle Department as follows: (automobile plates), Ingram-Richardson Mfg. Co., Beaver Falls, Penn., at $50,899; (chauffeurs' badges), Greenduck Co., Chicago, Ill., at $503; (motor vehicle seals), L. A. Rubber Co., Los Angeles, at $2425.

Tunnel—San Francisco, Calif.—The Board of Public Works has extended the time for receiving bids for the construction of the Twin Peaks tunnel, to Sept. 30. Noted May 21, June 18, July 9.

Drydocks—North Vancouver, B. C.—The Amalgamated Engineering Co. has secured a subsidy from the Canadian government and will construct a 100x1150-ft. drydock, which will be divided into two compartments of 500 and 650 ft. each. The estimated cost is $6,500,000.

BUILDINGS

Manchester, N. H.—Plans are being revised for the three-story and basement hospital to be erected at Mammoth Road. Wilfred E. Provost, 581 Union St., Manchester, is the Arch. Noted July 30.

+Adams, Mass.—The contract for the erection of the armory at Adams has been awarded to JEREMIAH P. KEATING, East Main St. The estimated cost is $60,000.

Arlington, Mass.—The lowest bid received for the erection of the high school at Arlington, was submitted by the Light, Heat & Power Co., 77 Franklin St., Boston, Mass., at $156,530 Noted Sept. 10.

Brockton, Mass.—The lowest bid received for the construction of the three-story and basement high school, 188x144 ft., was submitted by C. A. Batson, 37 West Elm St. The estimated cost is $300,000.

Framingham, Mass.—Bids will be reecived until Sept. 26 by the State Board of Education, for the erection of a dormitory and refectory. David Snedden, 15 Ashburton Place, Boston, is Comr

+Lawrence, Mass.—The contract for the erection of the four-story office building for the Jos. Shattuck estate, has been awarded to the E. N. PITMAN CO., Bay State Bldg. James E. Allen, 283 Essex St., is the Arch.

+Lawrence, Mass.—Contracts for the erection of the three-story and basement school have been awarded to: (General contract) E. A. PEABODY & CO., Bay State Bldg.; (steam heating and ventilating) LAWRENCE PLUMBING & HEATING CO., 121 Newbury St.

+Springfield, Mass.—The contract for the erection of the hotel for Mrs. G. A. Rainville has been awarded to M. L. ANGERS, 327 Main St., Springfield, at $50,000.

Waltham, Mass.—Bids will be received until 10 a.m., Sept. 29, by the Public Library Commissioner, for the library to be erected at Waltham. Loring & Leland are the Archs., 7 Water St., Boston, Mass.

Pawtucket, R. I.—The lowest bidder for the 16-room school to be erected on Abbott St. was the Frank G. Rowley Co., Pawtucket, at $87,538. Noted July 23.

+Greenwich, Conn.—The general contract for constructing the school at Hamilton and Griggs Ave. has been awarded to HENRY SENFT, East Portchester, N. Y., at $44,505.

+Glens Falls, N. Y.—The general contract for the erection of the two-story and basement school has been awarded to the A. M. BARROWS CONSTRUCTION CO., 345 Fifth Ave., New York, at $44,099.

+Contracts for the erection of the bank building for the First National Bank have been awarded to: (General contract) ANDREW J. ROBINSON CO., 123 East 23d St., New York, (plastering) DAVIS BROWN, 306 East 40th St., New York.

New York, N. Y.—(Borough of Manhattan)—Plans have been completed by Severance & Van Allen, Archs., for a three-story building to be erected at 50 Broadway, for the Standard Oil Co. The estimated cost is $225,000.

Plans have been completed by Mulliken & Moeller, Archs., for two apartment houses to be erected at 310 West 86th St., for the Eighty-sixth St. and West End Ave. Co. The estimated cost is $800,000.

+The contract for the erection of the six-story clubhouse at 62d St. and Park Ave., for the Colony Club, has been awarded to NORCROSS BROS CO., 103 Park Ave., New York. Noted Sept. 3.

+The general contract f r the erection of the store and office building at Madison Ave. and 58th St., for Paul M. Herzog, has been awarded to J. T. BRADY & CO., 103 Park Ave The estimated cost is $150,000.

+Olean, N. Y.—Contracts for the erection of the seven-story, 45x100-ft. bank and office building for the First National Bank at State and Union Sts., have been awarded as follows: General contract, GEORGE A. FULLER CO., 111 Broadway, New York; electric work, ELECTRIC CONSTRUCTION & SUPPLY CO., 39 Cortland St., New York.

+Rochester, N. Y.—The contract for constructing the brick school for the Board of Education, has been awarded to the R T. FORD CO., at $111,000.

East Orange, N. J.—Plans have been completed by the Board of Trustees, of East Orange Public Library, for the additions and alterations to the library. The estimated cost is $10,000.

+Englewood, N. J.—Contracts for the erection of the two-story hospital at Englewood, have been awarded as follows: General contract, WILLIAM H. WHYTE, 382 Railroad Ave Hackensack, N. J.; brick structural steel, J. K. COOK & SONS, Athenia, N. J., reinforced concrete floors, arches, WHITE FIREPROOFING CONSTRUCTION CO., 286 Fifth Ave., New York.

Plainfield, N. J.—Bids will be received until 8 p.m., Sept. 28, by Wilder & White, Archs., 50 Church St., Manhattan, for the erection of a brick school on Evergreen Ave. The estimated cost is $125,000. Noted Sept. 17.

Trenton, N. J.—Plans are being prepared by W. A. Poland, Arch., Administration Bldg., for the erection of a two-story and basement high school. The estimated cost is $150,000.

Greensburg, Penn.—E. E. Bailey & Co., Archs., Oil City, Penn., are preparing plans for a one-story bank building, 25x100 ft., for the Westmoreland National Bank, Greensburg. Estimated cost, $50,000.

Washington, D. C.—Bids will be received until Nov. 1, by Snowden Ashford, Municipal Arch., Washington, for the high school to be erected at Washington. The estimated cost is $450,000. Noted Sept. 17.

+Huntington, W. Va.—The contract for the erection of the school at Huntington has been awarded to the KING LUMBER CO., Charlottesville, Va. Verus T. Ritter is the Arch., Huntington. Noted May 14.

+Morgantown, W. Va.—The contract for the erection of the high school at Morgantown has been awarded to R. B. KITCHEN CO., Wheeling, W. Va., at $111,085.

+Parkersburg, W. Va.—Contracts for the erection of the one-story bank building for the Parkersburg National Bank, have been awarded as follows: General contract, H. H VOUGHT & CO., 346 Madison Ave., New York; reinforced concrete, CITIZENS' CONCRETE CO., Avery St.; electric work, CITIZENS' ELECTRIC CO., 626 Julian St.

The Baltimore & Ohio R. R. Co. will construct a freight depot at Ann St. Estimated cost, $75,000.

Wheeling, W. Va.—Plans are being prepared by Edward Bates Franzheim, Arch., Schmulbach Bldg., Wheeling, Va., for remodeling the four-story bank building at Wheeling. The estimated cost is $50,000.

+Whiteville, N. C.—The contract for the erection of the county court house has been awarded to ROSE & CO., Greensboro, at $50,000.

Atlanta, Ga.—Walker & Chase, Archs., Candler Bldg., Atlanta, are preparing plans for the erection of an eight-story, 52x120-ft. office building. The estimated cost is $120,000.

+Columbus, Ga.—The contract for constructing the steel work in connection with the city hospital has been awarded to the COLUMBUS IRON WORKS CO., Columbus, Ohio.

+Savannah, Ga.—The contract for the addition to the building of the Citizens' Southern Bank has been awarded to E. MORGAN, Savannah, at $40,000. Noted Mar. 19.

Hattiesburg, Miss.—Bids for the Y. M. C. A. building, to be erected at Hattiesburg, have been rejected. New bids will be received. The estimated cost is $50,000.

Shreveport, La.—The lowest bid received for the hotel to be erected at Louisiana and Crockett St., was submitted by W. H. Werner, Shreveport, La., at $68,750. Noted Aug. 13.

+Louisville, Ky.—The contract for the erection of the 10-story office building for the Knights of Pythias, has been awarded to the FALLS CITY CONSTRUCTION CO., Realty Bldg., Louisville, Ky.

Bids will be received until 3 p.m., Oct. 1, by Samuel D. Jones, Business Dir., Bd. of Education, for a school to be erected at 42d and Herman Sts. J. Earl Henry is the Arch. and Engr.

+Louisville, Ky.—Contracts for the erection of the high school at Louisville have been awarded as follows: General contract, BAILEY & KOERNER, 511 Walker Bldg.; terrazza work, AMERICAN MOSAIC & TILE CO., 309 East Broadway; marble work, PETERS BURGHARD CO., 800 South 135th St. Noted Aug. 20.

+Contracts for the erection of the three-story and basement club house for the Y. M. H. A. have been awarded as follows: General contract, A. MARKHAM CO., 434 South Floyd St.; cut stone, PETERS BURGHARD CO., 800 South 13th St.; roofing and sheet metal work, J. F. WAGNER SONS CO., 1145 South Seventh St.

+Maysville, Ky.—Contracts for the erection of the three-story and basement, 50x88-ft. lodge building for the I. O. O. F., have been awarded as follows: General contract, McDOWELL & CASE, Maysville; structural iron, POTHOFF CONSTRUCTION CO., Front and Harriett Sts., Cincinnati, Ohio; masonry, WILLIAM D. OLIVER, 125 East Fifth St., Newport, Ky.; composition roofing and sheet metal work, RASP & SONS, Maysville, Ky.

Cleveland, Ohio—The city is considering the constructi n of a model municipal tenement house. Newton O. Baker is Mayor.

Bids are being received by Starrett & Van Vleck, Archs., New York, N. Y., for the commercial building to be constructed on Euclid Ave. for the Stock Co.

Columbus, Ohio—The Columbus Depot Co. plans to construct an interurban station. It will be three stories and basement. Estimated cost, $500,000. Frank A. Davis, Columbus, is Gen. Mgr.

East Cleveland, Ohio—R. H. Hinsdale, Arch., Osborn Bldg., Cleveland, is preparing plans for an apartment house to be constructed in East Cleveland. Estimated cost $10,000.

Hudson, Ohio—All bids have been rejected by the Board of Education for constructing the proposed three-story and basement school. Estimated cost, $50 000.

Lakewood, Ohio—W. S. Lougee, Arch., Marshall Bldg., Cleveland, Ohio, is preparing plans for a residence on Lake Ave., Lakewood, for M. F Bramley Estimated cost, $40,000.

Norwood, Ohio—The Norwood Presbyterian Church plans to erect a one-story and basement church. Estimated cost, $50 000.

Warren, Ohio.—The Western Reserve National Bank, Warren, [illegible] bank and office building, to cost $125,000. C. [illegible], Youngstown, Ohio, is receiving bids. It will be eight stories and basement, [illegible] ft.

Wellsville, Ohio.—The First M. E. Church of Wellsville is [illegible] for a church. It will be of stone, 60x110 ft. Estimated cost, $[illegible].

+Detroit, Mich.—The Board of Health has awarded the [illegible] contract to [illegible] & KELLY, Ford Bldg., [illegible] for [illegible] the hospital addition on Hamilton [illegible] at about $[illegible].

Peoria, Ill.—The city plans to construct a two-story and [illegible] addition to Whittier School. Estimated cost, $[illegible].

Quincy, Ill.—The Board of Education plans to construct a grade school to cost $[illegible]. E. G. [illegible] is Supt.

+Streator, Ill.—The general contract for the construction of the Y. M. C. A. building has been awarded to H. TAPPENDORF, Rock Island, Ill. Noted Aug. 13.

Milwaukee, Wis.—St. Joseph's Convent plans to erect a [illegible]-story temple, [illegible] ft. Estimated cost, $250,000.

Osakis, Minn.—The School Board plans to construct a school to cost $[illegible]. E. N. Hamilton, Osakis, is Supt. Bd. [illegible] Independent Joint School District No. 2 is considering the construction of a grade school to cost $50,000.

St. Paul, Minn.—The Childs Co., 200 Fifth Ave., New York, plans to remodel the building at 388 Wabash St., into a restaurant. Estimated cost, $[illegible],000.

Atchison, Kan.—St. Benedict's College, Atchison, plans to construct a building to cost $50,000. Plans are in progress. The cost will be defrayed by the alumni. Noted Sept. 17.

Atchison, Kan.—The masonic lodges building committee has rejected all bids for the construction of the proposed three-story and basement lodge and store building. Estimated cost, 50,000. Crumpacker & Wyatt, Atchison, are Archs.

Fargo, N. D.—Bids will be received, until Sept. 25, by the Board of Education for constructing a high and grade school to cost $100,000. Samuel Crabbe, City Hall, is Arch.

Kansas City, Mo.—Plans are nearing completion for the new St. Joseph's Hospital to be constructed on the block bounded by Linwood Blvd., Wabash Ave., 31st St. and Prospect St. The structure will be of reinforced concrete, six stories high and fireproof. Estimated cost, $[illegible],000.

St. Louis, Mo.—The Missouri Baptist Sanitarium will erect a four-story and basement building. Isaac S. Taylor, Arch., Mercantile Bldg., St. Louis, is receiving bids.

Barnes Hospital Association plans to construct a nurses' building to cost $100,000. It will be of brick, six stories and basement, [illegible]x103 ft. Thomas C. Link, Arch., Carlton Bldg., is completing plans.

El Paso, Tex.—St. Patricks R. C. Church will erect a two-story church to cost $75,000. Rev. Father Berry, Pastor, is receiving bids.

Denver, Colo.—Plans have been completed for a new Y. W. C. A. building to be erected near the present building. It will be of brick. Noted Sept. 17.

Bellingham, Wash.—The Skagit Construction Co. has submitted the lowest bid to the city for constructing the proposed high school. It will be of terra cotta and brick.

Olympia, Wash.—W. P. White, Arch., Hinckley Block, Seattle, Wash., has completed plans for the three-story bank and office building to be constructed at Main and Fourth Sts. Estimated cost, $[illegible].

Spokane, Wash.—H. M. Pratice, Empire Bldg., Seattle, Wash., is preparing plans for reconstructing the Pantages Theater. Estimated cost, $60,000.

Tacoma, Wash.—Heath & Gove, National Realty Bldg., Tacoma, are preparing plans for the three buildings to be constructed for the Church of the Holy Communion. Estimated cost, $135,000.

Longbeach, Calif.—The citizens will vote, Sept. 30, on the proposition to issue $100,000 in bonds for a municipal auditorium.

Los Angeles, Calif.—The Fifth Church of Christ Scientist plans to construct a church at La Brea Ave. and Hollywood Boulevard. It will be of brick. Estimated cost, $[illegible].

San Francisco, Calif.—W. H. Crim, 425 Kearny St., San Francisco, has completed plans for the five-story brick hotel to be constructed at 12th and Market Sts., for I. L. De Hall. Estimated cost, $100,000.

Reid Bros., Archs., California Pacific Bldg., San Francisco, have completed plans for the three-story reinforced concrete addition to the Lourline Baths at Bush St. Estimated cost, $100,000.

Ventura, Calif.—Ventura County plans to construct a two-story hospital, 90x175 ft. Plans are nearing completion.

+Montreal, Que.—The contract has been awarded to the C. E. DEAKIN & CO., LTD., for constructing new buildings for the Catholic Orphanage in connection with the Order of Grey Nuns, Montreal, at about $120,000.

+Berlin, Ont.—The contract has been awarded to P. H. SECORD & SONS, LTD., Brantford, Ont., for constructing the Merchants' Bank building, Berlin.

Toronto, Ont.—Bids will be received by the city, until Sept. 25, for the construction of two schools and for alterations for various schools.

+Toronto, Ont.—Contracts for constructing a cottage in connection with the buildings at the jail farm, Yonge St., have been awarded as follows: Masonry, to TEAGLE & SON, at $17,500; plumbing, heating and wiring, to the F. ARMSTRONG CO., at $14,500.

+Bassano, Alta.—The Department of Public Works, Ottawa, Ont., has awarded the contract to M. C. SACKRIDER, Medicine Hat, Alta., for constructing a public building at Bassano.

The Cement-Gun Construction Co., 311 South Michigan Ave., Chicago, announces that it has combined the business of the Gun-crete Co. and the General Cement-Gun Co., and will not only do cement gun construction work but also sell and lease complete equipments for this work. Carl Weber is President; John V. Schaefer, Secretary, and C. L. Dewey, Construction Manager.

Mr. Roger Deland, French Lecturer in Municipal Engineering, McGill University, Montreal, Canada, would like to receive catalogs and other literature from manufacturers of sewer pipe, sheet steel piling, castings, trenching machinery and other apparatus and supplies used in sewer construction. These to be used in the course in municipal engineering at the university.

BARGE CANAL WORK, ALBANY, N. Y.

Bids were received Aug. 27, by Duncan W. Peck, State Supt. Pub. Wks. for Barge Canal Contract 4-A, constructing Erie Canal from Fox Ridge to the Montezuma Aqueduct, and Contract [illegible], Erie Canal, [illegible] 2, constructing Vischers Ferry [illegible] over the Troy-Schenectady branch of the New York Central R.R. from (A) James Stewart & Co., Inc., New York; (B) [illegible] Co., Cleveland, Ohio; (C) New York State Dredging Corporation, Rochester; (D) Great Lakes Dredge & Dock Co., Buffalo; (E) Eastover Construction Co., Utica; (F) Kinser Construction Co., East St. Louis, Ill.; (G) Maryland Dredging & Contracting Co., Baltimore, Md.; (H) Merrill Ruckgaber Co., New York; (I) Frank L. Cohen, Buffalo; (J) Drake & Dean Co., Inc., Buffalo; (K) Walsh Construction Co., Davenport, Iowa; (L) Whitehead & Kales Iron Works, Detroit, Mich.; (M) Ford & Green, Schenectady; (N) State Highway Construction Co., Boston; (O) Lapfer & Renick, Buffalo; (P) Keith & Guthrie, Schenectady. The items bid were as follows:

CONTRACT 4-A

	A	B	C	D	E	F	G
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Extended totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CONTRACT 2

	H	I	J	K	L	M	N	O	P
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

RAPID TRANSIT SYSTEM, NEW YORK, N. Y.
Section 21, Route 48

Bids were received Sept. 15 by the Public Service Commission for constructing Sect. 21, Route 48, of the Park Place, William and Clark St. subway, a part of the Seventh Ave.-Lexington Ave. rapid transit system from: (A), Smith, Hauser & MasIsaacs; (B), Rapid Transit Subway Construction Co.; (C), Frederick L. Cranford, Inc.; (D), Underpinning & Foundation Co.; (E), Holbrook, Cabot & Rollins Corporation; (F), Oscar Daniels Co. The item bids were as follows:

	A	B	C	D	E	F
82,000 cu.yd. earth excavation above mean high water	$5.50	$6.00	$6.06	$6.15	$5.00	$8.50
29,500 cu.yd. earth excavation below mean high water	8.50	6.00	6 06	8 00	6.00	9.00
7000 cu.yd. earth excavation (sewers) above and below mean high water	7 00	6 00	6.06	5.00	5.06	8.50
Underpinning Building Nos. 165 to 167 William St. (lump sum)	20,000 00	25,000 00	30,000 00	50,000 00	18,000.00	100,000.00
Underpinning building Nos. 157 to 163 William St. lump sum)	10,000 00	10,000.00	7,360 00	4,000 00	6,000.00	10,000.00
Underpinning building Nos. 164 to 168 William St. (lump sum)	8,000.00	8,000 00	3,900.00	3,500.00	5,000.00	10,000.00
Underpinning Building Bo. 162 William St. (lump sum)	2,500.00	3,000 00	1,440.00	750.00	1,900 00	5,000 00
Underpinning building Nos. 156 to 160 William St. (lump sum)	8,500.00	8,000.00	6,560.00	4,000.00	6,000 00	9,000.00
Underpinning building Nos. 145 to 155 William St. (lump sum)	15,000.00	15,000.00	9,440.00	5,500.00	9,000.00	16,000.00
Underpinning building Nos. 144 to 154 William St. (lump sum)	12,000.00	15,000.00	9,600.00	8,000 00	9,000.00	12,000.00
Underpinning building Nos. 135 to 141 William St. (lump sum)	12,000.00	28,500.00	16,800.00	24,000.00	10,600.00	38,000.00
Underpinning building Nos. 123 to 133 William St. (lump sum)	26,000.C0	39,000.00	26,000.00	24,000 00	19,500.00	38,000.00
Underpinning building Nos. 111 to 121 William St. (lump sum)	24,000.00	24,000.00	16,120.00	9,000 00	10,500.00	33,000.00
Underpinning building Nos. 122 to 140 William St. (lump sum)	20,000.00	20,000.00	16,000.00	12,000 00	15,000.00	28,000.00
Underpinning building Nos. 120 William St. (lump sum)	3,000.00	4,000.00	2,400 00	4,000 00	2,500.00	8,000.00
Underpinning building Nos. 118 William St. (lump sum)	5,000.00	4,000.00	2,750 00	1,500 00	1,900.00	8,000.00
Underpinning building No. 116 William St. (lump sum)	7,500.00	5,000.00	3,080.00	1,500.00	2,300.00	9,000.00
Underpinning building Nos. 110 to 114 William St. (lump sum)	7,500 00	8,0C0.00	6,820.00	3,000.00	4,500.00	8,000.00
Underpinning building Nos. 107 to 109 William St. (lump sum)	4,000 00	3,500.00	3,025.00	2,000.00	1,900 00	2,500.00
Underpinning building Nos. 103 to 105 William St. (lump sum)	5,000.00	5,500.00	4,620.00	3,000.00	3,400 00	6,000.00
Underpinning building Nos. 99 to 101 William St. (lump sum)	5,000.00	4,000.00	3,800 00	2,500 00	2,600 00	3,000 00
Underpinning building Nos. 93 to 97 William St. (lump sum)	12,000.00	20,000.00	15,000.00	15,000.00	37,500.00	56,000.00
Underpinning building Nos. 91 William St. (lump sum)	5,000.00	4,500.00	4,500.00	12,000.00	9,400.00	23,000 00
Underpinning building Nos. 85 to 89 William St. (lump sum)	8,000.00	10,000.00	7,900.00	6,500.00	8,000.00	7,000.00
Underpinning building No. 100 William St. (lump sum)	25,000.00	36,000.00	25,200.00	30,000.00	81,000.00	40,000.00
Underpinning building No. 92 William St. (lump sum)	8,000.00	10,000.00	8,250.00	12,000.00	21,900.00	18,000.00
Underpinning building No. 90 William St. (lump sum)	6,000.00	5,500.00	4,480.00	8,000.00	18,700.00	15,000.00
Underpinning building Nos. 84 to 88 William St. (lump sum)	4,400.00	3,750.00	2,100.00	2,500 00	70.00	1,000 00
Underpinning building Nos. 81 to 83 William St. (lump sum)	8,000.00	15,500.00	15,600.00	15,000.00	30,000.00	30,000.00
Underpinning building Nos. 80 to 82 William St. (lump sum)	4,500.00	5,000.00	14,000.00	6,000.00	43,800.00	16,000 00
Underpinning building Nos. 71 to 77 William St. (lump sum)	10,000.00	12,000.00	10,000.00	8,000.00	12,000.00	10,000.00
Underpinning building Nos. 67 to 69 William St. (lump sum)	3,000.00	4,000.00	16.800.00	6,000.00	31,200.00	18,000.00
Underpinning building Nos. 74 to 78 William St. (lump sum)	3,600.00	4,500.00	9,760.00	5,000.00	37,500.00	12,000.00
Underpinning building No. 72 William St. (lump sum)	2,200.00	3,000.00	2,200.00	1,500.00	1,800.00	5,000.00
Underpinning building Nos. 68 to 70 William St. (lump sum)	11,000.00	20,000.00	16,500.00	20,000.00	37,500.00	22,000.00
Underpinning building Nos. 61 to 63 William St. (lump sum)	4,500 00	7,000.00	5,170.00	4,000.00	3,500.00	6,000.00
Underpinning building Nos. 57 to 59 William St. (lump sum)	7,000.00	6,800.00	6,930.00	6,500.00	5,200.00	23,000.00
Underpinning building No. 55 William St. (lump sum)	10,000.00	20,000.00	13,020.00	7,500.00	15,000.00	32,000.00
Underpinning building Nos. 62 to 64 William St. (lump sum).	6,000.00	10,000.00	9,600.00	8,000 00	4,400.00	85,000.00
Underpinning building No. 60 William St. (lump sum)	3,000.00	5,000.00	4,800.00	2,000.00	2,200.00	7,000.00
Underpinning building Nos. 56 to 58 William St. (lump sum)	10,000.00	16,000.00	8,580.00	7,500.00	6,000.00	29,000.00
Underpinning building Nos. 51 to 53 William St. (lump sum)	5,000.00	9,000.00	5,170.00	3,500.00	3,400.00	8,000 00
Underpinning building Nos. 45 to 49 William St. (lump sum)	12,000.00	18,000.00	17,000.00	12,000.00	43,800.00	26,000.00
Underpinning building Nos. 44 to 46 Wall St. (lump sum)	25,000.00	25,000.00	21,250.00	17,500.00	53,100.00	30,000 00
Underpinning building Nos. 52 to 54 William St. (lump sum)	32,000.00	40,000.00	70,000.00	60,000.00	187,500.00	185,000.00
Underpinning building No. 48 Wall St. (lump sum)	12,0C0.00	25,000.00	20,160.00	11,000.00	9,400.00	40,000.00
Underpinning building Nos. 37 to 39 William St. (lump sum)	5,000.00	7,000.00	9,230.00	6,500.00	145.00	2,000.00
Underpinning building Nos. 39 to 41 Exchange Pl. (lump sum)	1,000.00	1,500.00	2,000.00	750 00	50.00	500.00
Underpinning building No. 55 Wall St. (lump sum)	30,000.00	45,000.00	126,000 00	32,000.00	28,500.00	65,000.00
Underpinning building Nos. 25 to 29 William St. (lump sum)	15,000.00	10,000.00	21,300.00	20,000.00	75.00	50,000.00
Underpinning building No. 23 William St. (lump sum)	3,600.00	2,400.00	1,680.00	2,000.00	2,500.00	5,000.00
Underpinning building Nos. 17 to 21 William St. (lump sum)	6,000.00	5,000.00	4,260.00	2,500.00	70 00	1,000.00
Underpinning building Nos. 11 to 15 William St. (lump sum).	5,000.00	2,500.00	3,150.00	12,000.00	31,200 00	20,000.00
Underpinning building Nos. 26 to 28 William St. (lump sum).	20,000.00	20,000.00	28,350.00	28,000.00	53,100 00	22,000.00
Underpinning building Nos. 16 to 22 William St. (lump sum)	30,000.00	23,000.00	33,250.00	25,000.00	62,500.00	38,000.00
Underpinning Delmonico Bldg. between Beaver and South William St. (lump sum)	3,000.00	2,000.00	2,500.00	4,000.00	7,500.00	6,000.00
Underpinning Seligman Bldg. between South William and Stone Sts. (lump sum)	8,000.00	4,000.00	3,000 00	4,000.00	100 00	1,000.00
Underpinning building Nos. 60 to 62 Beaver St. (lump sum)	24,000.00	30,000.00	42,000 00	32,000.00	45,000.00	50,000.00
Underpinning Old Cotton Exchange between Stone and Pearl Sts. (lump sum)	14,700.00	18,000.00	9,855.00	15,000.00	26,300.00	28,000.00
Underpinning building No. 31 Beekman St. (lump sum)	4,500 00	2,500.00	2,400.00	4,000 00	3,000.00	8,000.00
Underpinning building No. 31 Beekman St., Nos. 34 to 38 Beekman St. (lump sum)						
18,900 cu.yd. concrete masonry	10.00	8.50	9 00	11 00	8 50	13.50
4400 cu.yd. protective concrete masonry outside water proofing.	10.00	8.50	9.00	11.00	6.50	13.50
1750 cu.yd. rubble stone masonry	8.00	8.00	8.00	10.50	6 00	8.00
50 cu.yd. dry rubble masonry	8.00	7.00	6.00	10.00	4.00	5 00
30 cu.yd. brick masonry	25.00	15.00	20.00	29.00	15.00	20 00
100 cu.yd. removal of old masonry	100.00	15.00	50.00	500.00	10.00	100 00
20 cu.yd. hollow terra-cotta brick masonry	20.00	15.00	15 00	40.00	15.00	15 00
1000 bbl. grout of portland cement	3.50	3.50	2.00	3 00	1.50	2 50
16,000 lin.ft. timber piles	1.50	0.75	0.75	2 00	0.65	0 80
2 M. ft. b.m. timber foundation	150.00	75.00	75.00	50 00	60.00	70 00
100 cu.yd. broken stone or gravel	3.00	3.00	2 50	3.50	2.00	2 00
23,400 sq.yd waterproofing, 1-ply	0.60	0.60	0.50	0.50	0.30	0.50
100 sq.yd. waterproofing, 2-ply	0.85	0.75	0 70	0.90	0.45	0.80
12,700 sq.yd. waterproofing, 3-ply	1.20	1.00	0.85	1.30	0.70	1 20
100 sq.yd. waterproofing, 4-ply	1.30	1.50	1.00	1.70	0.90	1.50
100 sq.yd. waterproofing, 5-ply	1.50	2.00	1 25	2.10	1.15	2.00
100 sq.yd. waterproofing, 6-ply	1.75	2.50	1.50	2.50	1.35	2.40
100 sq.yd. waterproofing, dry ply	0.60	0.50	0.35	0.45	0.20	0.50
3500 cu.yd. brick in asphalt mastic	30.00	27.00	25 00	25 00	24 00	35.00
100 lin.ft. vitrified drain pipe, 12-in.	1.00	0.75	1 00	1.50	0 70	1 50
100 lin.ft vitrified drain pipe, 10-in	0.80	0.60	0.80	1 30	0.65	1 25
2700 lin.ft. vitrified drain pipe, 8-in.	0.75	0.50	0 70	1 00	0 55	1 00
100 lin.ft. vitrified drain pipe, 6-in.	0.70	0 40	0.60	0.70	0.50	0 90
100 lin.ft. vitrified drain pipe, 4-in.	0.60	0 35	0.50	0.50	0 45	0.80
100 lin.ft. c.i. drain pipe, 6-in.	1.50	1.00	1.00	2.30	0.70	1 50
1000 lin.ft. c.i. drain pipe, 4-in.	1.00	0.75	0.75	1.50	0 65	1 00
100 lin.ft. c.i. drain pipe, 10-in.	2 50	2.00	1.50	3.00	1.25	3 00
50 lin.ft. c.i. pipe and fittings, 3-in extra heavy	0.80	0.80	1.00	1.15	1.00	1 00
70 lin ft. c.i. pipe and fittings, 4-in extra heavy	1 00	1.00	1.25	1.50	1 25	1 30
65 lin.ft. c.i. pipe and fittings, 6-in extra heavy	1.75	1.30	1.50	2.25	1.50	2.00
50 lin.ft. c.i. pipe and fittings, 8-in. extra heavy	2.50	1.80	1.75	3 00	2.00	2 50
42,000 duct. ft. tunnel ducts.	0 13	0.12	0.12	0.15	0.08	0.11
33,000 duct ft. railroad ducts.	0.14	0.15	0.15	0.30	0.10	0 14
1120 tons riveted steel	75 00	75.00	72 00	70 00	65 00	80 00
1980 tons steel beams and shapes	65 00	65.00	65.00	60.00	60 00	75 00
35 tons steel rods and bars	60 00	75 00	75.00	85 00	60.00	70 00
18 tons miscellaneous iron castings	90 00	65.00	75.00	85 00	60.00	70 00
2 tons miscellaneous sewer irons.	150.00	70 00	100.00	85.00	60 00	70.00
450 lb. special wire forms	0.15	0 10	0.15	0.50	0.10	0.30
100 lin ft. 1¾-in. oak or ash hand rail	0.50	0.60	0.50	1.00	0.25	0 50
3300 sq.ft. steel grating for ventilation	1 50	1.50	1 50	1.50	1.50	2 00
1600 sq.ft. vault lights	1.50	1.50	1.25	1.20	1.50	1 50
4100 sq.yd. sidewalk restored.	2.00	2.50	2.50	3.50	2.00	3 00
4200 sq.yd. repavement of roadways asphalt	2.50	3.00	2.50	3.25	2.00	4.00
1950 sq.yd. repavement of roadways granite block	2.50	3.50	2.50	3.00	2.00	3.00
1400 sq.yd. repavement of roadways, asphalt block	3.00	3.50	3.00	3.75	2.00	4 00
1100 lin.ft. new blue stone curb	2.00	1.50	1.25	1.50	1.00	2 00
100 lin.ft. new 8-in. granite curb.	2.00	1 75	2 50	2.50	1.50	2 00
11,000 lin.ft ¾-in. w i electric conduits	0.20	0 25	0 30	0 20	0 15	0.20

RAPID TRANSIT SYSTEM—(Continued)

	A	B	C	D	E	F
[illegible] 1½-in. w.i. [illegible] conduits	0 40	0 40	[illegible] 40	0 40	0 25	0 40
[illegible] 2-in. w.i. [illegible] conduits	0 50	0 50	0 50	0 50	0 20	0 50
[illegible] 1-in. w.i. [illegible] conduits	0 30	0 30	0 40	0 25	0 20	0 30
[illegible]	1 00	1 00	1 25	1 50	0 70	1 50
[illegible] pipe and fittings in [illegible]	1 75	1 50	3 00	2 50	1 50	2 00
[illegible] w.i. pipe and fittings in [illegible]	1 50	1 00	2 00	1 00	1 25	1 [illegible]
[illegible] vitrified pipe sewer, 12-in.	2 50	3 00	[illegible] 00	[illegible] 00	2 40	3 [illegible]
[illegible] vitrified pipe sewer, 15-in.	3 00	3 70	3 50	[illegible] 00	2 95	3 50
[illegible] vitrified sewer, 18-in.	[illegible] 50	4 30	4 00	6 25	3 [illegible]	4 00
[illegible] vitrified pipe sewer, 20-in.	5 00	4 50	5 00	6 [illegible]	3 65	5 00
[illegible] vitrified pipe sewer, 24-in.	6 00	5 50	6 00	7 00	4 70	6 00
[illegible] sewer pipe, [illegible]	60 00	48 00	40 00	50 00	35 00	40 00
[illegible] sewer pipe, [illegible]	100 00	70 00	75 00	100 00	75 00	70 00
[illegible] sewer, [illegible] x 2 ft. 4 in.	12 50	7 00	10 00	8 00	5 00	7 [illegible]
[illegible] sewer, [illegible] ft. [illegible] in.	15 00	1[illegible]	15 00	9 00	6 50	8 [illegible]
2-[illegible] railroad [illegible] supported directly upon the railroad structure	2000 00	1[illegible] 00	1[illegible] 00	15[illegible]	1200 00	3000 00
2-[illegible] railroad [illegible] supported [illegible] off railroad structure	2000 00	1000 00	1000 00	1[illegible] 00	1000 00	3000 00
[illegible] water pipe, [illegible]	1 50	1 25	1 50	0 60	0 75	2 00
[illegible] water pipe, 12-in.	2 00	2 00	2 [illegible]	1 20	2 25	2 [illegible]
[illegible] water pipe, 16-in.	5 00	3 00	4 00	1 [illegible]	3 00	3 [illegible]
[illegible] connections for water pipes all sizes	20 00	25 00	20 00	25 00	25 00	10 00
[illegible] gas pipe, 4-in.	1 00	0 65	1 00	0 50	0 65	0 90
[illegible] gas pipe, 6-in.	1 50	1 10	1 00	0 60	1 15	1 [illegible]
[illegible] gas pipe, 8-in.	1 50	1 50	1 50	0 80	1 25	1 [illegible]
[illegible] gas pipe, 10-in.	2 00	1 75	1 60	1 00	1 75	2 00
[illegible] gas pipe, 12-in.	2 00	2 25	1 80	1 20	2 00	3 00
[illegible] gas pipe, 20-in.	4 00	3 75	2 50	2 00	4 35	5 00
[illegible] gas pipe, 24-in.	5 00	5 00	4 00	2 40	4 70	5 [illegible]
[illegible] by-passing pipe, 8-in.	5 00	5 00	2 50	4 00	2 80	4 00
[illegible] by-passing pipe, 16-in.	10 00	8 00	5 00	7 00	8 10	9 00
[illegible] by-passing pipe on trestle, 16-in.	10 00	12 00	6 00	7 00	9 00	9 00
[illegible] by-passing pipe on trestle, 20-in.	12 00	10 00	6 00	8 50	10 20	12 00
[illegible] by-passing pipe on trestle, 8-in.	8 00	6 00	2 50	6 00	3 00	1 00
[illegible] trestle to support by-passing pipes	8 00	4 00	3 00	3 00	2 00	3 00
[illegible] for gas pipes all sizes	20 00	20 00	20 00	25 00	[illegible]	5 00
[illegible] bell and spigot pipe, straight	75 00	40 00	10 00	50 00	30 00	35 00
[illegible] bell and spigot pipe, special	100 00	75 00	80 00	100 00	60 00	70 00
[illegible] high pressure fire system water pipe	2 00	3 00	2 00	8 00	2 00	2 [illegible]
[illegible] high pressure fire system water pipe	6 00	4 00	2 00	12 00	3 50	3 00
[illegible] high pressure fire system water pipe	8 00	7 50	3 00	7 00	6 75	4 00
[illegible] and groove high pressure pipe, straight	75 00	45 00	50 00	[illegible]	30 00	35 00
[illegible] and groove high pressure pipe, special	100 00	80 00	80 00	100 00	75 00	70 00
[illegible] steam pipe, 6-in.	10 00	6 00	7 00	5 00	20 00	2 [illegible]
[illegible] steam pipe, 8-in.	12 00	8 00	9 00	6 00	22 00	3 00
[illegible] steam pipe, 10-in.	15 00	10 00	11 00	7 00	24 00	4 00
[illegible] steam pipe, 12-in.	18 00	12 00	12 00	8 00	25 00	5 00
[illegible] steam pipe, 15-in.	20 00	15 00	15 00	10 00	27 00	5 50
[illegible] steam pipe service connection	75 00	200 00	70 00	15 00	100 00	10 00
[illegible] new steam pipe, 6-in.	150 00	150 00	7 00	3 00	6 00	1 00
[illegible] new steam pipe, 8-in.	2 50	9 00	9 00	4 00	8 00	2 00
[illegible] new steam pipe, 10-in.	3 00	12 00	11 00	5 00	10 00	2 50
[illegible] new steam pipe, 12-in.	4 00	18 00	12 00	6 00	15 00	3 50
[illegible] new steam pipe, 15-in.	5 00	24 00	15 00	7 00	17 00	4 00
[illegible] air pipe, [illegible]	0 75	1 25	1 00	0 80	0 50	1 [illegible]
[illegible] new air pipe, special, 6-in.	0 75	2 50	1 50	1 00	0 75	1 [illegible]
[illegible] mail tube, [illegible]	3 00	3 00	5 00	1 50	5 00	3 00
[illegible] postal tube [illegible] 2½-in.	2 00	1 50	2 50	2 00	0 50	1 50
[illegible] postal tube [illegible] new 2½-in.	2 00	2 00	2 00	1 00	2 00	1 00
[illegible] new mail tube straight, 8-in.	4 00	3 00	5 00	3 00	10 00	3 00
[illegible] new mail tube, curved, [illegible]	6 00	7 00	6 00	18 00	25 00	[illegible]
[illegible] Western Union tube, 2½-in.	2 00	1 50	2 50	2 00	0 50	1 00
[illegible] new Western Union tube, 2½-in.	2 00	2 00	2 00	1 00	5 00	1 00
[illegible] electric ducts and conduits	0 50	0 60	0 75	1 00	0 75	0 [illegible]
[illegible] pipe, electric ducts and conduits, 2½-in.	0 50	0 60	1 00	1 00	0 50	0 [illegible]
[illegible] pipe, electric ducts and conduits, 3-in.	0 60	0 65	1 00	1 10	0 55	0 [illegible]
[illegible] pipe, electric ducts and conduits, 4½-in.	0 90	0 70	1 [illegible]	1 20	0 75	0 [illegible]
[illegible] pipe, electric ducts and conduits, [illegible]	1 25	0 75	1 50	1 50	0 80	0 [illegible]
[illegible] pipe, electric ducts and conduits, [illegible]	1 75	0 80	1 50	1 75	1 00	0 [illegible]
[illegible] fibre conduits, 3-in.	0 40	0 40	1 00	2 00	1 00	0 [illegible]
[illegible] fibre conduits, 3½-in.	0 50	0 60	1 00	2 40	1 75	0 [illegible]
[illegible] fibre conduits, 4-in.	0 60	0 70	1 25	2 75	1 50	[illegible]
[illegible] service connections all sizes	20 00	25 00	25 00	40 00	40 00	20 [illegible]
Extended totals	$2,254,[illegible]	$2,[illegible]	$[illegible]	$[illegible]	$2,106,177	$[illegible]

The R. G. Packard Co., builder of dredging machinery, [illegible] from the New York offices at 154 Pearl St., to its [illegible] at the foot of East 24th St., Bayonne, N. J.

Harry H. Wehmeyer, [illegible] West Lehigh Ave., Philadelphia, [illegible] engineer and builder, is estimating on the construction of the United States post offices at Je[illegible] and Shelbyville, Tenn., bids to be received [illegible] 11 and 12, respectively, and would like to receive catalogs and prices for structural materials.

ENLARGING POND, ATLANTIC CITY, N. J.

[illegible] were received by the city, Sept. 15, for enlarging [illegible] Pond, [illegible] (A) [illegible] & [illegible] (B) [illegible] Construction & Supply Co., (C) American Paving & Construction Co., (D) Charles L. [illegible]horn Co., (E) [illegible] L. [illegible] Co. The [illegible] bids were as follows:

	A	B	C	D	E
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0 75
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
					per M. ft.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
					per M. ft.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
					per M. ft.
					[illegible]
Extended totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The Max Ams Machine Co., Mt. Vernon, N. Y., is erecting an additional plant at Bridgeport, Conn., to take care of its increasing business, especially the export trade through its representatives in South Africa, Australia, India, China, Japan, South America, England and the continent. The area is approximately fifteen acres, on which a modern plant, equipped with every facility is being erected.

The main shop and adjacent saw tooth sections, will contain every modern tool and device that the progress of the industry requires. The main erecting shop will be provided with 25-ton electric cranes, and railroad sidings will run into the plant to facilitate the handling of large units.

In addition to these buildings, there will be a special administration building three stories high, for the general and private offices and drafting room. This building will be connected by means of bridges with the works. The power and heating plants will be in separate buildings.

The welfare of the employees of the company will be looked after by the erection of a special recreation building and the laying out of baseball grounds and tennis courts.

The output of the concern is largely machinery for the making of tin containers, applied more particularly to the food industry. It likewise builds an extensive line of power presses for the sheet metal working industry. The company expects to occupy its new home about February 1915.

WAYNE ST. VIADUCT, BUTLER, PENN.

Bids were received Aug. 25, by H. O. Carson, City Engr., for constructing the Wayne St. viaduct, from (A) Dravo Contracting Co., Pittsburgh; (B) Pittsburgh Construction Co., Pittsburgh; (C) Penn Bridge Co., Beaver Falls. The item bids were as follows:

	A	B	C
1260 cu.yd. concrete, including drains in abutments and pedestals	$8.00	$18.00	$9.00
120 cu.yd. concrete in pedestals	13.00	18.00	10.00
70 cu.yd. concrete including encased piles in pedestals	11.00	18.00	35.00
1690 cu.yd. earth fill between retaining wall	0.89	1.25	1.00
1920 lin.ft. concrete piles, premolded	3.40	1 75	2.50
3900 lb. anchor bolts and washers	0.45	0.0325	0.04
792 sq.yd. pavement on approaches	2.40	2.50	3.00
15 cu.yd. curbs on approaches	12.50	16.50	10.00
2160 sq.ft. sidewalk slab on approaches	0.19	0.25	0.12
1,760,000 lb. structural steel	0.03¾	0 0325	0.0345
66,906 lb. hand railing	0.05	0.045	0.05
256 c.i. hand railing posts	17.50	15.00	10.00
256 structural hand railing posts	6.90	6 00	5.00
24 lamp posts	31.00	30.00	30.00
192,000 lb. rails, ties, bonds and fastenings	0.034	0.03	0.23
134,000 lb. reinforcing metal	0 036	0.035	0 265
825 cu yd. concrete in sidewalk and roadway slab on viaduct proper and stairway	11.80	16.00	11.40
170 lin.ft. wainwright curb bar	0.25	0.40	0.25
Lighting system complete (lump sum)	1875.00	1000.00	1500.00
48,000 sq.ft. concrete encasement of steel work	0 17	0.16	0.25
31,000 sq.ft. waterproofing material	0 065	0.06	0.06
3450 sq.yd. lug block	2.90	2.80	2.80
3450 sq.yd. rectangular block	2 75	2.75	2.45
Extended totals with c.i. hand railing posts and lug block	$115,580	$113,263	$113,921
Extended totals with c.i. hand railing posts and rectangular block	115,062	[illegible]	112 713
Extended totals with structural hand railing and lug block	112,866	110,959	112,640
Extended totals with structural hand railing and rectangular block	112,349	110,786	111,433

American Needs—Wilbur F. Wakeman, general secretary of the American Protective Tariff League, has sent out a letter to American producers requesting them to report any article or articles (raw material or finished product) of use in agriculture, mining or manufacture in the United States, for the supply of which we are dependent upon any foreign country. From the replies received the following tabulation has been made:

Agates	Molston
Alkali	Oil, recovered
Aluminum	Oil, olive
Amber	Oil, sizing
Analine dyes	Oil, finishing
Antimony	Ozocerite
Asphaltum	Potash, crude
Barytes	Potash, carbonate of
Bearings	Potash, caustic of
Bleaching powder	Potash, hydrated carbonate of
Bronze powder	Potash, nitrate of
Carbolic acid	Potash, permanganate of
Card clothing	Pumice, lumps
Chamois skins	Pumice, powdered
China clay	Potato starch
Clay, washed	Rubber blankets
Clay marbles	Salt
Cotton, Egyptian	Saltpeter
Cyanides	Scheelite, concentrates
Duplex paper	Silex lining
Egg albumen	Skins, sheep and calf
Emery paper	Shellac
Epsom salts	Silk, artificial
Ferro-manganese	Soapstone pencils and bricks
Flint pebbles	Solder
Gallic acid	Sugar
Hemp	Talc
Jute	Tin, bars, blocks, pigs
Kieserite	Tin, grain or granulated
Leather skins	Tinfoil
Linen	Transfer paper
Lime, Vienna	Tungsten
Lithographic tusch	Vanadium
Magnesia	Walrus hide
Magnesite	Watch crystals
Manganese	Windshields
Mica	Wool
Moleskins	Zinc dust

CATALOG NOTICES

The Galion Iron Works Co., Galion, Ohio. Catalog No. 17. Cast iron and corrugated culvert pipe, road grading machines, rollers, scrapers, tractors, crushers, scarifiers, etc. Illustrated, 60 pp., 6x9 in. Catalog No. 18. Stone crushing machinery. Illustrated, 96 pp., 6x9 in.

Ransome Concrete Machinery Co., Dunellen, N. J. Catalog. Concrete machinery. Illustrated, 80 pp., 6x9 in.

Smooth-On Mfg. Co., 572-74 Communipaw Ave., Jersey City, N. J. Smooth-On Instruction Book No. 15. Iron cements, iron paints, corrugated iron gaskets. Illustrated, 104 pp., 4½x6½ in.

Essex Foundry Co., Newark, N. J. Catalog D. Drainage fittings. Illustrated, 52 pp., 6x9 in.

General Filtration Co., Rochester, N. Y. Pamphlet. Filtros. Porous filtering medium. 16 pp., 3½x6 in.

Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3024. Ingersoll-Rogler valves for air compressing cylinders. Illustrated, 28 pp., 6x9 in. Form No. 3030. Class ER-1 Ingersoll-Rogler air compressors. Illustrated, 20 pp., 6x9 in

BARGE CANAL WORK, ALBANY, N. Y.

Bids were received Aug. 11 by Duncan W. Peck, State Supt. Pub. Wks., for constructing a bridge over the Erie Canal in Yorkville, Oneida County, from (A) W. J. Burns Co., Syracuse; (B) Charles Kiehm, Utica; (C) I. M. Ludington's Sons, Inc., Rochester; (D) Harry W. Roberts & Co., Utica; (E) William F. Cogley, Utica; (F) Eastover Construction Co., Utica; (G) Scott Bros., Rome; (H) Lupfer & Remick, Buffalo; (I) Beebe & Parker, Utica; (J) John M. Holler, Albany; (K) Frank L. Cohen, Buffalo; (L) Walsh Construction Co., Davenport, Iowa. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L
Cofferdams, pumping, bailing, and draining (lump sum)	$6300	$3000	$5600	$5300	$5600	$2400	$5600	$6700	$50.00	$5600	$4000	$4500
27,400 cu.yd. excavation	0.70	0.60	0.65	0.75	0.61	0.75	0.50	0.46	0.75	0.62	0.60	0.45
25 M. ft. b.m. sheeting and bracing	50.00	50.00	40.00	50.00	50.00	50.00	45.00	50.00	50.00	50.00	50.00	50.00
1276 cu.yd. lining	1.50	1.50	1.50	1.50	1.20	1.50	1.25	1.50	1.50	1.50	1.50	1.50
8500 lin.ft. foundation piles	0.30	0 35	0.30	0.30	0.30	0.35	0.20	0.25	0.30	0.30	0.30	0.25
2066 cu.yd. second-class concrete	7.00	8.80	7.00	7.00	8.00	8.00	8.00	8.00	7.50	7.50	7.00	7.00
240 cu.yd. first-class reinforced concrete	13.00	14.00	14.00	13.00	15.00	14.00	14.00	10.00	14.00	14.00	12.00	14.00
15,260 lb. metal reinforcement	0.035	0.035	0.03	0.035	0.034	0.035	0.03	0.03	0.035	0.03	0.03	0.025
100 sq.yd. cobblestone gutter	0.75	0.75	0.75	0.75	1.00	0.75	0.75	0.75	0.75	0.75	0.75	0.70
2572 lin.ft. wooden fence	0.25	0.25	0.25	0 25	0.30	0.30	0.30	0.25	0.25	0.25	025	0.25
2872 sq.ft. concrete sidewalk	0.25	0.18	0.25	0.20	0.20	0.25	0.25	0.25	0.16	0.25	0.20	0.20
780,000 lb. structural steel	0.0415	0.038	0.04	0.04	0.042	0.0354	0.039	0.041	0.0354	0.0425	0.0425	0.042
9900 lb. c.i. pipe	0.03	0.03	0.03	0.03	0.03	0.03	0.025	0.03	0.03	0.00	0.02	0.025
452 lin ft. lattice railing	1.75	2.00	1.75	1.75	1.90	2.00	1.75	1.75	2.00	2.00	175	1 90
4270 sq.yd. bituminous macadem pavement	3.00	2.40	2.50	2.40	2.30	3.00	3.00	2.50	2.25	2.75	2.50	3.00
1620 lin.ft. concrete curb	0.80	0.65	1.00	0.75	0.75	1.00	0.75	0.70	0.80	0.80	1.00	1.00
270 lin.ft .concrete header	0.80	0.65	1.00	0.70	0.60	1.00	0.65	1.00	0.75	0.80	1.00	1.00
740 sq.yd. asphalt block pavement	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
6 oil signal lamps	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Removing existing highway bridge (lump sum)	250.00	200.00	500.00	350.00	200.00	50.00	10.00	200.00	250.00	500.00	500.00	300.00
30 cu.yd. removing existing masonry	7.00	7.00	7.00	7.00	7.00	7.00	5.00	7.00	7.00	7.00	5.00	5.00
Maintaining navigation (lump sum)	500.00	500.00	1200.00	800.00	300.00	50.00	150.00	100.00	250.00	1000.00	1000.00	600.00
Maintaining highway traffic (lump sum)	300.00	250.00	500.00	400.00	300.00	500.00	400.00	500.00	500.00	500.00	500.00	400.00
1150 lin.ft. raising or shifting railroad tracks	0.05	0.85	1.00	0.15	1.00	1.50	0.10	0.575	1.50	1.00	1.50	1.50
Extended totals	$101,161	$95,722	$99,471	$99,463	$99,599	$99,742	$94,583	$94,615	$97,302	$102,481	$98,158	$95,700

Cheney Bros., [illegible] Manchester, Conn., silk manufacturers, have had plans prepared for four buildings which will be used for the welfare of their employees. A primary school, [illegible], library and club will be erected in a quadrangle. The contract for the erection of the primary school has already been awarded to the Aberthaw Construction Co., Boston. The estimated cost of this building alone is $11[illegible]. [illegible] & Hastings, New York, are the Archs.

The New England Foundation Co., Boston, Mass., will drive [illegible] Simplex Piles for the foundation of the plant for the Standard [illegible] Co. at Long Island City, N. Y. A test of one of these piles was made for the building department of New York City. It sustained a load of 60 tons without settlement.

The same firm will use [illegible] Standard Simplex Piles for the new weave shed of the Naumkeag Steam Cotton Co., Salem, Mass.

CONCRETE STATE HIGHWAY, BRISTOL, CONN.

The following itemized bids were received by the State Highway Commissioner for the construction of a concrete state highway in Bristol, from Charles H. Terry, Bristol:

1[illegible] cu.yd. earth grading	$[illegible]
[illegible] cu.yd. borrowed embankment	0.41
Grading (sharp sand)	1.50
[illegible] sq.yd. earth grading	0.13
[illegible] cu.yd. rock excavation	2.00
[illegible] cu.yd. wet excavation	2.10
[illegible] sq.yd. telford base	0.60
[illegible] cu.yd. first class concrete	12.00
[illegible] cu.yd. second class concrete	8.00
[illegible] cu.yd. masonry	[illegible].00
[illegible] cu.yd. dry rubble masonry	[illegible].00
[illegible] cu.yd. old masonry relaid	5.00
[illegible] sq.yd. pointing old masonry	0.10
[illegible] lin.ft. corrugated iron culvert, 12-in	1.00
[illegible] lin.ft. corrugated iron culvert, 14-in	1.15
[illegible] lin.ft. corrugated iron culvert, 18-in	1.45
[illegible] lin.ft. corrugated iron culvert, 30-in	2.75
50 lin.ft. corrugated iron culvert, 36-in	3.95
470 lin.ft. relaying old pipe	0.10
11 catch basins	20.00
[illegible] sq.yd. cobble gutters	0.60
150 lin.ft. rubble drain	1.00
10 sq.yd. rip rap	1.00
[illegible] lin.ft. removing and replacing fences	0.15
[illegible] lin.ft. new stone wall fence	0.40
[illegible] lin.ft. new wire fence	0.15
[illegible] sq.yd. turf relaid	0.30
[illegible] cu.yd. sand or gravel fill	0.75
12,[illegible] sq.yd. gravel road	0.10
1[illegible] cu.yd. concrete	6.00
Extended totals	$23,3[illegible].00

SEWER, ST. LOUIS, MO.

Bids were received by the Board of Local Improvements for constructing Sections 1 and 2 of the Mill Creek sewer from (A) [illegible] A. Moreno, (B) Fruin-Colnon Construction Co. and Mason & Hanger Co., (C) CARTER CONSTRUCTION CO. (awarded both contracts), (D) Foxhall P. McCormick. The item bids are as follows:

Section 1

	B	C
[illegible] cu.yd. Class "A" excavation	$3.50	$4.25
[illegible] cu.yd. Class "C" excavation	1.65	1.10
[illegible] cu.yd. Class "A" concrete	8.00	10.70
[illegible] cu.yd. Class "B" concrete	7.00	9.00
[illegible] cu.yd. common brick masonry	10.00	14.00
[illegible] cu.yd. vitrified brick masonry	12.00	18.00
[illegible] lin.ft. sewer pipe [illegible]	5.00	8.00
[illegible] lin.ft. sewer pipe [illegible]	4.00	5.50
[illegible] lin.ft. sewer pipe [illegible]	[illegible]	4.50
[illegible] lin.ft. sewer pipe [illegible]	2.50	4.00
[illegible] lin.ft. sewer pipe [illegible]	2.00	3.00
[illegible] lin.ft. sewer pipe [illegible]	1.50	2.25
[illegible] lin.ft. sewer pipe [illegible]	1.00	1.80
[illegible] lin.ft. sewer pipe [illegible]	0.75	1.50
[illegible] lin.ft. sewer pipe [illegible]	0.50	1.00
[illegible] lin.ft. sewer pipe [illegible]	0.[illegible]	0.80
[illegible] lin.ft. reinforcing steel bars, 1¼-in	0.1[illegible]	0.24
[illegible] lin.ft. reinforcing steel bars, 1-in square	[illegible]	0.19
[illegible] lin.ft. reinforcing steel bars, [illegible] square	[illegible]	0.10
[illegible] lin.ft. reinforcing steel bars, [illegible] square	[illegible]	0.0[illegible]
[illegible]	[illegible]	1[illegible]0.00
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible] sq.ft. wakefield piling	[illegible]	[illegible]
[illegible]	[illegible]	1.[illegible]
[illegible]	[illegible]	1.[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0.[illegible]
[illegible]	[illegible]	0.[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Extended totals	[illegible]	[illegible]

Section 2

	A	B	C	D
122,[illegible] cu.yd. Class "A" excavation in tunnel	$[illegible]	$8.50	$8.35	$[illegible]
[illegible] cu.yd. Class "C" excavation in tunnel	[illegible]	[illegible]	7.00	[illegible]
[illegible] cu.yd. enlargement of section in tunnel	12.[illegible]	9.[illegible]	12.10	1[illegible]
[illegible] cu.yd. Class "A" concrete in tunnel	10.00	12.[illegible]	12.00	15.75
[illegible] cu.yd. Class "B" concrete in tunnel	10.00	10.00	10.00	14.70
[illegible] cu.yd. extra Class "A" concrete in tunnel	12.[illegible]	1[illegible]	15.00	[illegible]
[illegible] cu.yd. extra Class "B" concrete in tunnel	12.[illegible]	12.[illegible]	12.00	[illegible]
12[illegible] cu.yd. common brick masonry in tunnel	15.[illegible]	14.00	14.00	[illegible]
[illegible] cu.yd. dry packing in tunnel	[illegible]	3.00	3.50	[illegible]
[illegible] lin.ft. reinforcing steel bars in tunnel, 1¼-in	0.[illegible]	0.17	0.[illegible]5	0.15
[illegible] lin.ft. reinforcing steel bars in tunnel, 1-in square	0.15	0.13	0.20	[illegible] 12
[illegible] lin.ft. reinforcing steel bars in tunnel, [illegible] in. square	[illegible]	0.08	[illegible] 15	[illegible]
[illegible] lin.ft. reinforcing steel bars in tunnel, [illegible] in. square	0.08	0.06	0.10	[illegible]
[illegible] lin.ft. steel drain pipes, 2-in	0.[illegible]5	0.20	0.[illegible]	0.[illegible]
[illegible] lin.ft. extra drilling in tunnel	0.[illegible]	0.[illegible]	0.40	1.[illegible]
2[illegible]7 M. ft. b.m. permanent timbering	60.00	60.00	60.[illegible]	[illegible]
3,[illegible] cu.yd. Class "A" excavation in shafts	15.00	20.00	17.00	2[illegible]
2[illegible] cu.yd. Class "C" excavation in shafts	10.00	16.00	14.00	3[illegible]
[illegible] cu.yd. Class "A" concrete in shafts	12.00	12.00	14.00	2[illegible]
[illegible] cu.yd. Class "B" concrete in shafts	10.00	10.40	12.00	9.[illegible]
[illegible] cu.yd. granite concrete in shafts	20.00	13.[illegible]	1[illegible].00	1[illegible]
1[illegible] million ft. gal. pumping from shafts	0.[illegible]	0.40	[illegible]	0.50
[illegible] cu.yd. Class "A" excavation in open cut	5.00	4.00	6.00	[illegible]
[illegible] cu.yd. Class "C" excavation in open cut	2.50	4.00	5.00	2.[illegible]
300 cu.yd. Class "A" concrete in open cut	10.00	10.00	12.00	[illegible]
[illegible] cu.yd. Class "B" concrete in open cut	10.00	9.00	11.00	7.50
1[illegible] cu.yd. granite concrete in open cut	20.00	13.00	15.[illegible]	11.00
[illegible] cu.yd. common brick masonry in open cut	12.00	15.00	15.[illegible]	11.00
2[illegible] cu.yd. vitrified brick masonry in open cut	15.00	18.00	20.00	12.00
[illegible] cu.yd. granite masonry in open cut	7.00	3.50	2.50	4.[illegible]
1[illegible] lin.ft. sewer pipe, 36-in	5.00	5.00	6.00	[illegible]
1[illegible] lin.ft. sewer pipe, 33-in	5.00	4.00	5.50	4.50
1[illegible] lin.ft. sewer pipe, 30-in	4.00	3.00	5.00	4.[illegible]
1[illegible] lin.ft. sewer pipe, 27-in	3.[illegible]	[illegible].50	4.50	3.00
1[illegible] lin.ft. sewer pipe, 24-in	2.50	2.00	4.00	2.[illegible]
1[illegible] lin.ft. sewer pipe, 21-in	2.00	1.50	3.50	2.00
1[illegible] lin.ft. sewer pipe, 18-in	1.00	1.00	3.00	1.50
1[illegible] lin.ft. sewer pipe, 15-in	0.75	0.75	2.50	1.00
1[illegible] lin.ft. sewer pipe, 12-in	[illegible].50	0.[illegible]	2.00	1.00
1[illegible] lin.ft. sewer pipe, [illegible]-in	0.[illegible]5	0.[illegible]	1.00	0.50
1[illegible] lin.ft. reinforcing steel bars in open cut, 1¼-in	0.[illegible]	0.12	0.25	0.12
[illegible] lin.ft. reinforcing steel bars in open cut, 1 in. square	0.15	0.1[illegible]	0.20	0.10
[illegible] lin.ft. reinforcing steel bars in open cut, [illegible] in. square	[illegible]	0.08	0.15	0.[illegible]
[illegible] lin.ft. reinforcing steel bars in open cut, [illegible] in. square	[illegible]	0.[illegible]	0.15	0.[illegible]
[illegible] lin.ft. reinforcing steel bars in open cut, [illegible] in. square	[illegible]	0.[illegible]	0.10	[illegible]
[illegible] lin.ft. reinforcing steel bars in open cut, [illegible] in. square	[illegible]	[illegible]	0.10	[illegible]
1[illegible] 6-in. [illegible] in brick and concrete sewers	[illegible]	1.50	1.[illegible]	1.[illegible]
1[illegible] water service pipes [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] M. ft. b.m. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7,[illegible] sq.ft. wakefield piling	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] sq.ft. steel sheet piling	[illegible]	1.[illegible]	1.[illegible]	[illegible]
[illegible] sq.ft. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1[illegible] lb. steel beams	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] lb. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] lb. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Extended totals	[illegible]	[illegible]	[illegible]	[illegible]

Pan American [illegible] Trade Association—The [illegible] in New York of Latin-American republics met at the rooms of the Pan-American [illegible] Association at the Hotel [illegible], New York, Sept. [illegible] and organized the Latin-American [illegible] Association of New York, which will [illegible] to promote trade between the United States and the countries represented.

[illegible]

Prices of Engineering Materials

THE BUSINESS OUTLOOK

Overshadowing all other considerations was the flotation of the $100,000,000 New York City loan. The price paid by the city was very high. If the City of New York has to pay 6% for short-term accommodations, what can railroads and smaller municipalities expect? It may be taken for granted that the high price demanded by the bankers was to insure the success of the loan. This will have the effect of scaring off borrowers for all kinds of public improvements. The field of new construction will be linked more closely with the financial situation than ever before, and until funds can be obtained on more reasonable terms there will be a minimum of new ventures.

Railroads are doing next to nothing. Some important bridge projects on which work had already been started have been postponed. One railroad company, which has done a great deal of construction work in and around New York, has cut its engineering force in half. The reopening of the rate case is the one real hope in the railway field at present.

The iron and steel industry is less active than at any time, save the few months following the 1907 panic, and this comes after the steel industry has been operating from 65 to 75% of capacity for nearly two years.

The export field seems to have been overworked. To have something to sell is only half the problem. Merchants in the United States must arrange to buy; they must arrange to do business on a barter basis. Undoubtedly, sales to South America will increase decidedly, but the benefits for the present will be reached by those houses who established agencies in South America many years ago, who understand the people and the customs. It is an opportune time, however, to cultivate this trade, even though it be an expense to do so for a few years.

Price changes have been unimportant. The fall in tin was nearly as spectacular as the advance. Prices are now at the old level. Copper is lower, steel products are not as firmly held, and a definite cut has been made in tin plate. Quotations now are a matter of minor interest.

The situation in cotton-raising states is particularly unprecedented, for in that wide expanse of territory, cotton is the one staple on which all business hinges, and although the crop is enormous, it cannot yet be turned into money. Agricultural returns are particularly satisfactory and farmers are securing a high price for their products. The wheat belt seems to be exceedingly gratifying.

Orders for export have been received, particularly for munitions of war. These included 6,000,000 horseshoes, 50,000,000 rounds of ammunition, 10,000 saddles, and it is probable that 100,000 horses will be purchased in the United States and Canada in the next few months. In the next two months, the war in Europe should give a decided impetus to the manufacture of automobile trucks, but there will probably be more than a corresponding falling off in the number of pleasure cars sold.

The government is showing some willingness to help business, and it may be that the policy of hitting at every kind of business is past.

Idle freight cars have decreased, and about 95% of the total railway equipment is actively employed.

Efforts are being made to permanently establish, in the United States, industries which have always been carried on in Europe. It is evident that with an assured trade of two or three years, many lines of manufacture can be so firmly fixed that they will be able to resist foreign competition.

Labor is feeling the pinch. Some of the railways are paying less than earlier in the year, and good factory help is plentiful.

Labor

The supply far exceeds the demand. An increased efficiency can be expected from all classes of workers. The Brooklyn Rapid Transit, which is doing an unusually large amount of construction and repair work this year, is reported to be paying 17c. per hour for rough laborers. On subway work in New York City, $1.50 is paid for eight hours, and in Long Island the rate is $1.60. Immigration continues to fall off, but it is evident that there will be a large surplus of unemployed this winter.

A report has just been issued by the Department of Commerce which shows that there are 2,152,433 persons 10 years of age and over in New York City engaged in gainful occupations. The principal workers are distributed as follows: Manufacturing and mechanical industries, 40.6%; transportation, 7.9%; trade, 16.8%; public service, 1.9%; professional service, 5.9%; domestic and personal service, 15.5%; clerical operations, 10.9%, the remainder being distributed in miscellaneous occupations.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—The market is lifeless and the following quotations are nominal at 90c. to $1 for 1½-in. stone, and 95c. to $1.10 for ¾-in. stone. These quotations are for full cargo lots of 500 cu.yd. delivered alongside of dock New York or Brooklyn.

Sand and Gravel—Gravel is quoted at 90c. for 1½ in., while special gravel for subway specifications is quoted at $1.15.

Sand sells at 50c. per cu.yd.

The above quotations are for full cargo lots of 500 cu.yd. delivered alongside of dock, New York. In Boston gravel sells at 35c. per cu.yd. at quarry 25 miles out, the freight rate to Boston being 40c.

Cement, Lime and Brick

Cement—The cement trade is only holding its own. Numerous inquiries have been received for export to South America, but the instability of ocean freight rates is one thing that is preventing any great business to those countries. For example, with a rate of $4 per ton quoted in the morning, advancing to $5 in the afternoon, the steamship company finally refused to do anything better than $10 per ton, and that not more than 48 hours afterward. There is an insistent inquiry, and no doubt considerable business will be transacted. In this country, work is being finished up as rapidly as possible, and no new work started, so that it is evident that the cement mills will face a lean winter. Then, too, the jobbers in New York who frequently stock up their supplies are refusing to place any orders this fall. Prices are unchanged at $1.58 per bbl. for delivery within lighterage limits, New York. This is equivalent to $1.46, Jersey City, and 95c. per bbl. in bulk at the mill. The quotations given below do not include the allowance of 40c. made for bags returned:

Boston	$1.32	Chicago	$1.15
Cleveland	1.30	Detroit	1.19
Duluth	1.38	Jersey City	1.06
Minneapolis	1.35	New York	1.18
Pittsburgh	1.10	St. Paul	1.35

Lime—Business is quiet, but prices are unchanged at 97c. per bbl. for state common, 200 lb. net; $1.37 for 300 lb. "Star"; $1.55 for 300 lb. finishing; $1.10 for 200 lb. finishing and $1.72 for 350 lb.

Plaster Blocks—Prices are without change, and the market is fairly active, quotations being as follows:

	Weight, per sq.ft., lb.	Price, per sq.ft., cents
2-in.	7	6
3-in.	8½	6½
4-in.	11	7¼

These blocks are made 32 in. long by 13½ in. wide, containing 3 sq.ft. of surface. The 2-in. blocks are solid, but the others are hollow.

Brick—The market is the lowest in years, and even at that it is weak. Hudson River common brick sell at $5 to $5.50, New York. For desirable orders, even these low quotations could be shaded. Raritan River brick are $5.25 to $5.50. The number of brick sold this year is 20% less than those sold at the corresponding period last year, and 1913 was by no means a satisfactory year in the brick market.

IRON AND STEEL

Pig Iron—While the markets have barely held their own during the last eight weeks, there has been no great pressure to sell, and stocks are not large. This is the one redeeming feature of an otherwise most unsatisfactory market. Curtailment has taken place in so many lines, new construction has been nearly at a standstill, and the reduction to the irreducible minimum has been going on so long, that new buying is limited to positive needs. In the Cincinnati market, a sale of 200 tons is the only one mentioned in the report for the week. This is the market where transactions generally run from 1000 to 10,000 tons. Some of the New England foundries have tested the market for future shipment, but very few orders have been received for delivery in 1915. In fact, all blast furnaces are unwilling to make any quotations for such forward shipment. It is well to observe that the present pig-iron consumption is about 60% of normal.

Quotations for lots of 100 tons or over, ports named, are as follows: Cincinnati Southern Foundry No. 2, $13.25 to $13.75; Cincinnati Northern Foundry No. 2, $14.25 to $14.75; Cincinnati Northern Foundry No. 3, $14.00 to $14.25; New York Northern Foundry No. 1, $14.75 to $15; New York Northern Foundry No. 2X, $14.25 to $14.50; New York Northern Foundry No. 2 Plain, $14 to $14.25. Southern iron in the New York market is $14.25 to $14.50 for No. 2. Southern Foundry No. 2, Birmingham, $10.

Steel Rails—Business has been practically at a standstill. It is reported by a prominent official of the Carnegie Steel Co. that one of the railroads in Pittsburgh had not a single extra rail in stock. It is well known that many lines have drawn on their reserve stock to facilitate repairs, and have been taking up from sidings to be put into main tracks. The decision of the Interstate Commerce Commission to reopen the railway rate case will have a most important bearing on the future of the railways, for, unless there is some definite way by which the railways can be tided over the next year, there will be a list of railway receiverships which will be appalling. Prices for rails are nominal and unchanged, as follows.

These quotations are for lots of 500 tons and over: Standard sections of bessemer rails, $28; open-hearth rails, $30. These quotations are f.o.b. Pittsburgh: Girder rails, 30-ft. lengths, $36.40 per gross ton, and in 60-ft. lengths, $38.40, both f.o.b. New York. Other quotations, f.o.b. Pittsburgh, for large lots are as follows: Standard sections, $1.25; 25- to 45-lb. sections, $1.15; 16- and 20-lb., $1.20; 12- and 14-lb., $1.25; 8- and 10-lb., $1.30. Rerolled light rails are one to two dollars less per ton than previous quotations.

Structural Shapes—Bridge work, as far as new projects are concerned, is practically a thing of the past. Most all of the work projected is held up, due to lack of funds. In the building line, there is some work going on in all parts of the country, but it is very much smaller than anything in recent years. New York has more inquiries than any other

[illegible] of the [illegible], [illegible] for a [illegible] tons for a [illegible] building, [illegible] tons for an addition to the Grand Central Station, and a few small structures. Building materials have been shipped abroad, and it is doubtful if any large amount of structural shapes will go in the very near future. Prices show no change compared with last month, the base being $1.[illegible] to $1.[illegible] Pittsburgh, for I-beams, 3 to 15 in., [illegible] angles, 3 to 6 in., and Ts, 3 in. and over. For other sizes $1.[illegible] to $1.[illegible] is demanded. For Ts, $1.[illegible] to $1.[illegible]; channels and Ts under 3 in., $1.30 to $1.[illegible]; [illegible] Ts, $1.[illegible] to $1.[illegible]. Cutting to specified lengths is charged at the following rates: Under 3 ft. to 2 ft., inclusive, [illegible] per 100 lb.; 2 ft. to 1 ft., inclusive, [illegible] per 100 lb.; cutting to lengths under 1 ft., $1.[illegible]. No charges made for cutting to specified lengths over [illegible] ft.

Track Supplies—Standard railroad spikes are $1.50 to $1.[illegible]; track bolts, $1.[illegible] to $[illegible]; angle bars, $1.50. All these prices are per 100 lb. in large lots. Tie plates are $[illegible].50 to $[illegible] per net ton, f. o. b. mill.

	Cents
Railroad spikes	
3, 3½, 4 [illegible] and [illegible]	Extra 10
[illegible], 4 and [illegible]	Extra 20
3, 3½, 4 and [illegible]	Extra 10
[illegible]	Extra 10
2½, 3 and 3[illegible]	Extra 60

Plates—Business is more unsatisfactory in this line than almost any other. Scarcely any of the mills are running at more than 50 per cent. of capacity, and many of them a great deal less. The price seems to be fairly firm, $1.20 Pittsburgh, but this is nominal, for there is practically no new business. All the car orders that have been made in several months have been cancelled, and there seems to be little prospect of new orders until financial conditions materially improve. Quotations are unchanged at $1.20 Pittsburgh, or $1.[illegible] from mill in the Chicago district. For delivery from warehouse Chicago, $1.75 is demanded.

Pipe—The market is at a standstill. The Standard Oil Co. for a time refused to take more than one-third of the flow of certain wells, but recently signified its willingness to buy up two-thirds. This, of course, is no incentive to increase production nor to build new pipe lines. Until conditions improve so that there is a better demand for oil, the market for line pipe will be extremely quiet. Some of the pipe mills are not running at more than 30 or 10[illegible] of capacity. The smaller sizes of pipe are just as dull as any other, but [illegible] all discounts are firmly maintained. These discounts are as follows:

	Black	Galvanized
[illegible] to [illegible] steel butt welded	80	71½[illegible]
1½ to 6-in. steel lap welded	79[illegible]	70½[illegible]
7 to 12-in. steel lap welded	76[illegible]	65½[illegible]

At these discounts the net prices of pipe per foot at Pittsburgh are as follows:

Diameter	Cents Black	Cents Galvanized	Diameter	Cents Black	Cents Galvanized
[illegible]	[illegible]	[illegible]	[illegible]	31.00	[illegible] 61
1 [illegible]	[illegible]	[illegible]	6	12.[illegible]	[illegible]
1¼ [illegible]	[illegible]	[illegible]	7	[illegible]	[illegible].00
1½ [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible].00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$1.1[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$1.[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	$1.[illegible]	$1.[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$1.[illegible]

Cast-iron Pipe—[illegible]

Piling, Steel Sheet—[illegible]

Sheets—[illegible]

Freight Rates—[illegible]

Cleveland, 10; Columbus, 12; Cincinnati, 1[illegible]; Chicago, 2[illegible]; Denver, Colo., [illegible]½; Harrisburg, 11½; Louisville, 1[illegible]; New York, 16; Norfolk, 20; Philadelphia, 1[illegible]; Rochester, 11½; Richmond, 20; Scranton, 1[illegible]; St. Louis, 23; and Washington, 11½.

Wire Rope—Revised discounts are 17 and 2½% from list for galvanized and [illegible] and 2½% for the bright. At these discounts the net price of wire rope at the mills is as follows:

Diameter in inches	Price per foot: Cast steel	Price per foot: Crucible steel	Price per foot: Plow steel
2½	$0.7[illegible]	$0.91	$1.08
2¼	0.62	0.73	0.86
2	0.5[illegible]	0.[illegible]	0.68
1¾	0.3[illegible]	0.[illegible]	0.56
1½	0.[illegible]	0.3[illegible]	0.40
1¼	0.2[illegible]	0.24	0.28
1	0.1[illegible]	0.16	0.19
[illegible]	0.0[illegible]	0.10	0.11
[illegible]	0.0[illegible]	0.07½	0.08

Steel Shapes—Quotations from warehouse New York are unchanged from last month as follows:

	Cents Per lb
Refined iron	
1 to 1⅞ in., round and square	1.80
1½ to 4 in. x ⅜ to 1 in.	1.80
1½ to 4 in. x ¼ to [illegible] in.	2.00
Norway bars	3.20
Burdens bar iron	3.15
Soft steel	
⅜ to 3 in., round and square	1.80
1 to 6 in. x ⅜ to 1 in.	1.80
1 to 6 in. x ¼ and [illegible] in.	1.[illegible]
Rods—⅜ and [illegible] in.	1.80
Bands—1½ to 6 x [illegible] in. to No. [illegible]	2.10
Beams and channels—3 to 15 in.	1.[illegible]
Angles	
3 in. x ¼ in. and larger	1.[illegible]
3 in. x [illegible] in. and [illegible] in.	2.3[illegible]
1½ to 2¾ in. x [illegible] in. and thicker	1.9[illegible]
1½ to 2½ in. x [illegible] in.	2.[illegible]5
1 to 1¼ in. x [illegible]	2.0[illegible]
1 to 1¼ in. x [illegible] in.	2.1[illegible]
1½ to 2½ x ¼ in.	2.00
1½ to 2½ x [illegible] in.	2.10
3 in. and larger	1.80

Old Material—The market is exceedingly quiet, few of the dealers doing even a routine business, and few trades, if any, are made. The following quotations are more or less nominal in the absence of sufficient business to give a clear indication of the market. They are per gross ton in New York.

	Per Net Ton
Heavy-melting steel scrap	$[illegible] to $[illegible]
Pipes and flues	[illegible] to [illegible]
No. 1 railroad wrought	10.[illegible] to 1[illegible]
Stove plate	[illegible] to [illegible]
Malleable cast	[illegible] to [illegible]
No. 1 machinery cast	[illegible] to [illegible]
No. 1 yard wrought long	[illegible] to [illegible]
Wrought turnings	[illegible] to [illegible]

In Chicago, the situation [illegible]

Chain—[illegible]

EXTRAS TO ABOVE LIST PER 100 POUNDS

	[illegible]	[illegible]
[illegible]	$[illegible]	$[illegible]
[illegible] and larger	1.[illegible]	1.75

Switch Points—The following prices are named f.o.b., mill. for switch points in lots of ten or more pairs: for 60-lb. rail, 10-ft. points, $16.25; 15-ft. points, $17.50; for 70-lb. rail, 10-ft. points, $18; 15-ft. points, $25, for 80-lb. rail, 10-ft. points, $25.50; 15-ft. points. $27.75; for 90-lb. rail, $33.50. All of the above are furnished with three rods, except the 10-ft. points for 60- or 70-lb. rail, which have only two.

Lag Screws—The price of lag screws is lower. Cone point lag screws are sold at a base discount of 80% and 5% from list. The net prices are as follows:

Length	Diameter in inches Net per 100		
	½ in.	¾ in.	1 in.
3½ in.	$1.99	$2.02	$4.18
4 in.	1.06	2.15	4.43
4½ in.	1.05	2.28	4.68
5 in.	1.19	2.35	4.92
6 in.	1.33	2.68	5.42
7 in.	1.51	2.95	5.91
8 in.	1.60	3.21	6.35
9 in.	1.74	3.48	6.90
10 in.	1.78	3.74	7.39
11 in.	2.01	4.01	7.89
12 in.	2.15	4.36	8.38

Frogs—For mill shipments of ten or more, prices are as follows: Bolted frogs, No. 7, for 60-lb. rail, $15; for 70-lb. rail, $16.50; for 80-lb. rail, $18; No. 8 frogs for 90-lb. rail, $21; for 100-lb. rail, $23. Plate frogs, No. 7, riveted to ⅝-in. plate for 60-in. rail, $18; for 70-lb. rail, $20; for 80-lb. rail, $21.50; No. 8 frogs bolted to a ¾-in. plate for 90-lb. rail are $25.50; for 100-lb. rail, $27.50.

Spiral Riveted Pipe—Prices are without change. The following quotations are f.o.b. factory, freight equalized with New York, being figured at a discount of 50, 10 and 10% from list. These are for orders amounting to approximately $250. For large orders, prices are cheaper by 12½ to 20%.

Diameter in in.	*Thickness Birmingham wire gage	Net price per 100 ft. With bolted joints complete		
		Plain	Asphalted	Galvanized
4	18	$19.76	$21.48	$30.74
5	18	23.40	23.70	37.14
6	16	33.05	35.76	49.73
7	16	37.58	40.76	56.82
8	16	43.17	46.80	65.00
9	16	50.06	50.10	74.22
10	14	66.42	71.08	96.15
11	14	71.20	76.57	102.24
12	14	83.75	89.15	118.30
13	14	89.67	96.55	127.98
14	14	99.14	105.51	138.85
15	14	108.05	114.89	151.92
16	14	117.53	124.82	166.58
18	12	167.43	175.95	226.44
20	12	183.79	193.30	248.39
22	12	200.48	210.64	269.21
24	12	219.92	231.07	293.99
26	10	280.20	292.41	370.78
28	10	301.32	314.89	395.37
30	10	324.81	399.15	430.64

*Made in both lighter and heavier gages at corresponding differences in price.

Wire—Wire business has been cheered considerably on account of the war. There is an inquiry for 5000 tons of barbed wire for shipment to Russia, and quite a little for shipment to Canada. Most of the mills are asking $1.35 to $1.40 for plain wire, $2 for galvanized barbed wire, and $1.60 for painted barbed wire, all f.o.b. Pittsburgh.

Nails—Carload lots of wire nails are quoted at $1.60 Pittsburgh. There are very few new orders.

Coke—Prices continue to decline with the falling off in the demand. The best grades of blast-furnace coke sell at $1.60@1.65 for prompt delivery and $1.75@1.85 per net ton for contracts. For 72-hr. foundry coke, $2@2.10 can be done for spot and $2.15@2.25 on contract.

METALS

Copper—Trade has not been so dull in years. Curtailment of production is now general at all of the principal mines, and will continue to be more so unless there is a decided change. It is evident that new levels for copper quotations must be established for years to come at a lower rate. For years, it was generally agreed that copper under 15c. per lb. was cheap, and many manufacturers would have been willing to see the market on a 15c. basis. Conditions have now changed. The electrical industry, which has consumed fully 50% of the copper output, has received a serious setback, and will not be as active again for years. In the meantime, the supply of copper far exceeds the demand, and of necessity the mines which produced metal at a high cost must go out of business. Future prices of copper are likely to be around 12c. There is practically no business now and no established market, but enough is known of the situation to warrant a quotation of 11⅞c. for large lots of electrolytic. Lake copper is in relatively fair demand, particularly Calumet & Hecla brands, which have been freely bought by manufacturers of cartridges in New England who have use for that metal. It is significant to note that copper in Germany is selling at about 19c. per lb. The German importations of copper have been the mainstay of the American market for years, and now that is absolutely cut off.

Tin—Large shipments of tin are being sent to this country and the supply is now far in excess of the demand. The market is more or less irregular, but frightfully dull. Less business was transacted in the last week than similar periods for years past. Quotations are more or less nominal and it seems probable that a 30c. level, to which prices seem to be drifting, will be a maximum rather than a minimum quotation.

Lead—The market is easier, lead being obtained in New York at 2.75c. and in St. Louis at 3.60c. There is no need of exporting lead to Great Britain or France, as the supply formerly went to Germany, but is now being diverted to Great Britain.

Spelter—The market has again declined and is about at the old low quotation. In New York, 5.35c. is asked, and in St. Louis 5.20c. The foreign demand is small, but has shown some improvement due to the lower quotation.

Antimony—The market is exceedingly quiet and the quotations to jobbers are more or less fictitious, but they ask 11c. for Cookson's and 10c. for Hallett's.

Miscellaneous Metals—The following quotations are per lb. for small lots, but they may be shaded for desirable orders:

Bismuth	$4.00
Brass tubes, iron-pipe sizes:	
½-in.	.17
¾- to 3-in.	.16
3½-in.	.16
4-in.	.17
Brass rods	.14⅛
Brass sheets	.14⅜
Solder, half and half guaranteed	.26
Zinc sheets	9 to 9½
Copper sheets, base	.17½
Pig tin (five-ton lots, cash)	.33

Old Metals—The following quotations are for small lots delivered at buyer's warehouse:

	Cents
Copper, heavy and crucible	11.00
Copper, heavy and wire	10.75
Copper, light and bottoms	10.00
Brass, heavy	7.50
Brass, light	5.75
Heavy machine composition	10.00
Composition turnings	9.00
Lead, heavy	3.40
Lead, tea	3.15
Zinc scrap	3.75

REINFORCING MATERIALS

Bars, Concrete Reinforcing—Prices are steady but the volume of business continues to diminish. Quotations are as follows:

Size	Cents per pound		
	Mill shipments Pittsburgh	Warehouse Pittsburgh	Delivered from warehouse New York
¾-in. and larger	1.20	1.70	2.30
⅝-in.	1.25	1.70	2.35
½-in.	1.40	2.00	2.35
⅜-in.	1.50	2.10	2.50
¼-in.	1.80	2.35	2.80

Triangle Mesh—Quotations are without change as follows:

PRICE PER 100 SQ.FT.

Style No.	Cross sec. area per ft. width	Plain material		Galvanized	
		Carload lots	Less than car lots and over 10,000 sq.ft.	Carload lots	Less than car lots and over 10,000 sq.ft.
*4	0.102	$1.00	$1.23	$1.12	$1.34
5	0.077	0.80	0.97	0.89	1.00
6	0.058	0.63	0.77	0.71	0.84
*7	0.041	0.49	0.60	0.55	0.66
*23	0.170	1.69	2.05	1.88	2.24
24	0.142	1.46	1.77	1.62	1.93
25	0.124	1.29	1.57	1.43	1.71
*26	0.110	1.17	1.42	1.30	1.55
*27	0.085	0.96	1.17	1.07	1.28
28	0.066	0.80	0.97	0.89	1.06
29	0.049	0.66	0.80	0.73	0.87
31	0.261	2.49	3.02	2.76	3.29
32	0.225	2.16	2.62	2.10	2.86
33	0.196	1.93	2.34	2.14	2.55
34	0.146	1.48	1.80	1.64	1.96
35	0.109	1.117	1.42	1.30	1.55
36	0.075	0.87	1.05	0.97	1.15
38	0.380	3.55	4.30	3.93	4.68
*39	0.325	3.05	3.70	3.38	4.03
40	0.283	2.68	3.25	2.97	3.54
41	0.208	2.05	2.48	2.27	2.70
42	0.151	1.55	1.88	1.72	2.05
*43	0.101	1.10	1.34	1.23	1.46

*This material is made in regular widths of 18, 22, 26, 30, 34, 42, 46, 50, 54 and 58 in. Standard lengths in rolls are 150, 250, 300 and 600 ft.

CLAY PRODUCTS

Sewer Pipe—Prices are unchanged, the discounts being as follows: 24-in., 80%; 27- and 30-in., 70%; 33- and 36-in., 65%. At these discounts the net prices per ft. in New York are as follows:

Size		Size	
3-in.	$0.05	18-in.	$0.38
4-in.	0.15	20-in.	0.45
5-in.	0.08	22-in.	0.60
6-in.	0.08	24-in.	0.65
8-in.	0.11	27-in.	1.35
10-in.	0.16	30-in.	1.65
12-in.	0.20	33-in.	2.20
15-in.	0.27	36-in.	2.45

Flue Lining—Discounts are unchanged at 53% from list. At this discount the net prices per foot for New York delivery are as follows:

	Weight in lb.	Price per ft.		Weight in lb.	Price per ft.
[illegible]	11	$0 [illegible]	8½x18 in.	45	$0 152
[illegible]	[illegible]	[illegible]76	13x13-in.	45	[illegible] 115
[illegible]	[illegible]	[illegible]	13x18-in.	57	[illegible] 22
[illegible]	18	[illegible]	18x18-in.	74	0 34
[illegible]	23	0 [illegible]			

Hollow Tile—Prices are firm, with a steady market. Quotations f.o.b. Perth Amboy, N. J., are as follows:

Size	Price per block: Hollow wall tile	Size	Price per block: Interior partition block
[illegible]	$0 06	2x12x12-in.	$0 048
[illegible]	[illegible]	3x12x12-in.	0 048
[illegible]	0 1[illegible]2	4x12x12-in.	0 052
[illegible]	0 1[illegible]	6x12x12-in.	0 072
[illegible]	[illegible].1[illegible]	8x12x12-in.	0.096

MILL SUPPLIES

Belting prices are lower. Discounts on leather belting are as follows: extra heavy, 50@10 and [illegible]; heavy, 50 and 10@60%; medium, 60 and [illegible]; standard, 60 and 10@[illegible], [illegible] and 10[illegible]. The discounts applying to rubber belting are as follows: Standard, 60 and 10@60, 10 and 10[illegible]; best grades, [illegible]@50 and 10%. The net prices per foot of rubber belting given below are figured at the discount of 50 and 10%.

RUBBER BELTING, NET PRICE PER FOOT

	2-Ply	4-Ply	6-Ply	8-Ply
[illegible]	$0 1[illegible]	$0 14	$0 21	
4	13	[illegible]9	28	....
[illegible]	16	23	35	
6	1[illegible]	28	42	$0 56
[illegible]	23	33	49	66
8	26	38	[illegible]	76
9	30	43	64	85
1[illegible]	34	48	72	96
[illegible]	41	58	88	1 1[illegible]
14	4[illegible]	69	1 04	1 38
16	56	80	1 20	1 61
1[illegible]	63	91	1 36	1 82
[illegible]	71	1 02	1 52	2 03
[illegible]	78	1 13	1 70	2 2[illegible]
24	88	1 26	[illegible] 89	2 52
26	[illegible]	1 38	[illegible] 08	2 7[illegible]
[illegible]	1 [illegible]6	1 [illegible]1	[illegible] 27	3 02
[illegible]	1 1[illegible]	1 61	[illegible] 16	3 2[illegible]
30	1 [illegible]	1 89	2 83	3 78
36	1 [illegible]1	2 11	3 21	4 28
4[illegible]	1 69	2 39	3 59	4 79
46	1 87	2 65	3 97	5 29
[illegible]	2 07	2 90	4 35	5 79
[illegible]6	2 32	[illegible]	4 91	6 5[illegible]
6[illegible]	2 [illegible]0	[illegible] 13	5 24	7 06

Shafting—The mills are not operating to more than 30 or [illegible]% of capacity. The price for large lots is 66% discount from list. At this discount the net prices per foot of cold-drawn steel shafting in Pittsburgh are as follows:

Diameter in inches	Cents per foot	Diameter in inches	Cents per foot
[illegible]	[illegible]	2	[illegible] 00
[illegible]	[illegible]	2[illegible]	23 00
1[illegible]	[illegible]	2[illegible]	2[illegible]
1[illegible]	[illegible]	[illegible]	[illegible]
1[illegible]	[illegible]	3	[illegible]
1[illegible]	[illegible]	3[illegible]	[illegible]
1[illegible]	1[illegible]	4	[illegible]
1[illegible]	1[illegible]76		

Lubricating Oils—[illegible] New York [illegible] lots prices are as follows:

Neutral [illegible] filtered [illegible]

	Cents per gal
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

*Prices [illegible]

OILS AND PAINTS

Petroleum Products—[illegible]

[illegible]

Linseed Oil—[illegible]

Spirits Turpentine—[illegible]

Paints—[illegible]

Hydrex preservative paint is 75 cents per gal. in bbl lots, New York City.

Colors in oils are quoted at the following prices per lb: Lamp black, 1[illegible] to 14 cents. Chinese blue, 36 to 46 cents. Prussian blue, 32 to [illegible]6 cents. Van Dyke brown, 11 to 14 cents. Chrome green, [illegible] to 16 cents. Raw or Burnt Sienna, 1[illegible] to 15 cents. Raw or Burnt Umber, 11 to 14 cents.

LUMBER

The markets have been hard hit by the war, and prices are low. The Pacific Coast trade which has been in bad shape for years has benefited a little by the opening of the Panama Canal. Hardwoods are very dull but prices are only slightly lower. Spruce and hemlock are dull but show only slight recessions in price. There is much irregularity in quotations, for while one mill may have stock another may be obliged to buy. The same material and often variations as much as $5 per thousand are found.

MISCELLANEOUS

Lighterage Limits—The free delivery or "Lighterage Limits" in New York City are as follows: In Manhattan, from a point opposite the Fort Lee ferry, south along the Hudson River around the Battery and north along the East and Harlem Rivers to the Jerome Ave. bridge at 1[illegible]th St. In New Jersey, south from Fort Lee ferry to Bayonne City, points on the north and east shores at Staten Island, between Bridge Creek (Arlington) and Clifton, both inclusive, and including Elm Park, Erastina and Shooters Island. In Brooklyn, from 69th St., Bay Ridge, north to Pot Cove, Astoria, Long Island City.

Asbestos—Asbestos building felt and sheathing in less than ton lots is 3½c. per lb. for the light, weighing from 6 to 30 lb. per 100 sq.ft.; [illegible] per lb. is charged for the heavy, weighing from 45 to 56 lb. per sq.ft.

Millboard is made in standard sheets, 40x40 in., and 41x41 from 2 to 27 lb. per sheet. The net price in 100-lb. lots is 5c. per lb.

Asbestos wood, used for fireproofing, ventilators and smoke jacks, comes in sheets, 36x48 in., 42x48 in. and 42x96 in. The prices per sheet, f.o.b. factory, in New England, are as follows:

Thickness	Weight, pounds	Price	Thickness	Weight, pounds	Price
⅛-in.	1	$0 08	⅝-in.	5	$0 4[illegible]
3/16-in.	1½	0 12	[illegible]-in.	6	0 44
¼-in.	2	0 16	[illegible]-in.	[illegible]	[illegible]
[illegible]-in.	2½	0 2[illegible]	1-in.	8	0 [illegible]
[illegible]-in.	3	0 2[illegible]	1[illegible]-in.	1[illegible]	[illegible]
[illegible]-in.	3½	[illegible]	1½-in.	12	0 61
½-in.	4	0 32	1[illegible]-in.	16	[illegible]
[illegible]-in.	4½	0 36	2-in.	16	[illegible]

Asbestos sheathing corrugated sells at 1[illegible] per sq.ft. f.o.b. mill eastern Pennsylvania.

Telegraph Wire—The demand for telegraph wire has been fair. For lots of fair size, the wire measured in Birmingham wire gage, prices are as follows: "Extra Best," Nos. 6 to 9, 4⅜c.; Nos. 10 and 11, 4½[illegible]; No. 12, 4[illegible]c.; No. 14, 6¼c. "Best Best," Nos. 6 to 9, 3½c.; Nos. 10 and 11, 3[illegible]c.; No. 12, 3½[illegible]; No. 14, 4[illegible]. Actual freight is allowed from Trenton, N. J., where it does not exceed 25c. per 100 lb.

Explosives—Dynamite of the kind generally used by contractors is approximately 11@1[illegible] per lb., f.o.b. factory, in ton lots. Blasting powder, classified as "soda" grade, is sold at $1.20@1.40 per keg of 25 lb. in lots of 10,000 lb.

Exploders, per hundred, are sold at the following prices: 4 ft., $[illegible]60; 6 ft., $4.10; 8 ft., $4.[illegible]; 10 ft., $[illegible]; 12 ft., $[illegible]; 16 ft., $6.6[illegible]; 20 ft., $7.[illegible]; [illegible] ft., $[illegible]40; 30 ft., $[illegible]; 36 ft., $11.6[illegible].

Caps in lots of 10,000 are $[illegible] per thousand.

Blasting machines for 10 holes are $1[illegible]; [illegible] holes, $20; [illegible] holes, $40; 100 holes, $60.

Chain Belting—Prices continue unchanged. Quotations are as follows: From [illegible] hp. to [illegible] hp., [illegible] centers complete with two sprockets, $[illegible] per horsepower. From [illegible] hp. to [illegible] hp., 16-in. centers complete, $[illegible] per horsepower. For [illegible] hp. to 1[illegible] hp., [illegible]-in. centers complete, $[illegible] per horsepower. From 1[illegible] hp. to [illegible]00 hp., [illegible]-in. centers complete, $[illegible] per horsepower.

Resumption of Export Trade—The war [illegible] curtailed exports from the United States during August, but they have now been resumed on a large scale from New York. For the week ending Sept. [illegible] the exports from New York were [illegible] compared with [illegible] in the corresponding week last year. [illegible]

Old Dry Goods Firm to Move—The firm of Arnold, Constable & Co. [illegible] New York, N. Y., has [illegible] property at Fifth Ave. and [illegible]th St. [illegible]

CATALOGS WANTED

[illegible] would like to receive catalogs and other literature from manufacturers of sewer pipe, steel sheet piling, [illegible] machinery, [illegible] and supplies used in sewer construction. [illegible] to be used in the course in municipal engineering at the university.

Construction News

Items in the several departments are grouped according to states, which, in turn, are arranged geographically in the following order: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Tennessee, Kentucky, Ohio, Indiana, Michigan, Illinois, Wisconsin, Iowa, Minnesota, Kansas, Nebraska, South Dakota, North Dakota, Wyoming, Montana, Missouri, Arkansas, Texas, Oklahoma, Colorado, New Mexico, Idaho, Utah, Nevada, Arizona, Washington, Oregon, California.

★Denotes work advertised in ENGINEERING NEWS.

✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

Pan American Trade—A Warning

A special news memorandum of caution and warning regarding the Latin American commercial situation has been prepared by John Barrett, Director General of the Pan American Union, the international organization maintained in Washington by all the American republics for the development of commerce, intercourse, good understanding and peace.

The widespread and unprecedented public interest in the Latin American commercial opportunity as developed by the European war is being followed by so much misconception, in many circles, of the real trade and economic conditions obtaining in certain parts of Latin America, that Director General John Barrett of the Pan American Union in Washington has found it necessary to ascertain by cable the exact business situation in Latin America, and, as a result, to sound, in justice both to the United States and Latin America, a note of caution and warning.

On August 8, immediately after the outbreak of the European war, Director Barrett addressed a memorandum to the commercial and financial interests of the United States urging them to prepare to meet the combined responsibility and opportunity presented in Latin America by the war. This statement attracted general attention and discussion, but now a new phase of the situation, as indicated by these cable reports, has developed and is requiring careful consideration.

"These advices," he states, "emphasize that what is needed at this hour in Latin America is not so much a supply of the manufactured products of the United States, although required in considerable quantities, but money, loans and advances, credits on purchases, and markets at reasonable rates for raw products which usually go to Europe. If Latin America can sell at a fair figure her accumulating raw products and buy, in turn, through receiving financial help and coöperation in the form of advances and credits from United States exporters, importers and bankers, the situation will be speedily remedied and the commercial interests of the United States and Latin America will truly enter upon a new era of Pan American commerce and comity.

"The fact that the twenty Latin American countries last year bought imports and sold exports to the vast total of \$3,000,000,000, of which \$2,000,000,000 were transactions with Europe, proves beyond quibble or doubt that the opportunity is there but subject to the conditions herein noted. That the United States already has a good start and is making encouraging progress is shown by the fact that its exchange of trade with Latin America has grown in the last seven years, or during the present administration of the Pan American Union, nearly 100 per cent. or from \$450,000,000 to \$850,000,000.

"The European war, while greatly lessening the sources of Latin American imports and the market for exports, and opening a corresponding greater opportunity to United States exports and imports, has so unavoidably crippled Latin American financial resources and commercial machinery that it must require several months or a year before conditions can readjust themselves and permit results that many United States business men expect immediately.

"Despite the efforts, not only of the Latin-American embassies, legations and consulates, but of the Pan American Union, as an international organization, and the United States Departments of State and Commerce to state the situation exactly as it exists, countless articles have been appearing in various newspapers and magazines emphasizing an alleged 'golden opportunity' without pointing out its actual and present environments of money tightness and dislocation of international commercial methods. Numerous business men and commercial agents, in consequence, are crowding the steamers bound for Latin America with the expectation that they will find the Latin Americans awaiting them with outstretched hands filled with gold and ready to buy everything and anything they have to sell. These men will presently return to the United States and unfairly condemn and criticise the markets and peoples of the countries visited.

"A great stream of letters and telegrams from both North and South America are daily pouring into the office of the Pan American Union, as the international American bureau of information, and they prove the widespread interest in the field and opportunity, but they are invariably answered not only with the statement of the actual opportunity but with an admonition that the Latin American market, while vastly potential, is at this moment embarrassed by a serious financial stringency and dislocation of commercial conditions for which it is not in itself to blame.

"The opportunity of the hour, therefore, in a word, is not so much one for immediate large sales of United States manufactured products as one for coöperation and mutual help, together with careful investigation of commercial conditions and preparation to meet future competition successfully."

RAILWAYS

North Carolina—Plans are being prepared for the construction of a railroad from Kingston to Maple Hill, N. C., about 35 miles. J. T. Deal, Kingston, N. C., is interested.

South Carolina—Savannah Western Ry.—Surveys are being made by this company for the construction of a railroad from Estil to St. Paul, S. C., about 90 miles. C. H. Milligan, Charleston, S. C., is interested. Noted Sept. 3.

Tennessee—Alabama Great Southern Ry.—According to press reports this company plans to spend about \$85,000 for the construction of a belt line in Chattanooga, Tenn. C. Dougherty, Cincinnati, Ohio, is Ch. Engr.

✚**Wisconsin**—Chicago & Lake Superior Ry.—This company has awarded a contract to MADDEN & CONNELL, for grading its proposed extension from Cambridge, Wis. to Rockdale, Wis.

✚**Minnesota**—Minnesota Central R.R.—This company has awarded the contract for the construction of its line from St. Cloud to Kimball and Fairhaven, Minn., to F. J. GLOVER & SONS, Minneapolis, Minn.

Kansas—Newton, Kansas & Nebraska R.R.—Preliminary arrangements are being made by this company for the construction of a railroad through Harvey, McPherson, Marion and Dickinson Counties. S. V. Wardall, Newton, Kan., is Ch. Engr.

✚**South Dakota**—South Dakota Central Ry.—A contract has been awarded by this company for constructing a 16-mile extension to its line north from Watertown, S. D., to P. E. SHUGART, Nevada, Iowa.

Oklahoma—Rosston, Grand Rapids & Protection R.R.—Surveys have been started by this company for the construction of its proposed 12-mile railroad to connect a point on the Wichita Falls & Northwestern Ry., near Rosston, Okla., with Doby Springs, Okla. L. A. Walton is Pres. and Gen. Mgr. Noted Sept. 10.

✚**Washington**—Bellingham & Northern Ry.—A contract has been awarded by this company for the construction of a three-mile extension to its line from Bellingham to Lake Whatcom, to HENRY McFEE, Seattle, Wash.

Arizona—J. A. Veness, Winlock, Wash., and associates are considering plans for the construction of a railroad from Wilcox to the mining district, about 20 miles.

California—Plans are being prepared for the construction of a railroad from Crescent City, Calif., to Yreka, Calif., with several branch lines. H. S. Wooley is interested.

ELECTRIC RAILWAYS

Pittsfield, Mass.—The Berkshire St. Ry. Co. has applied to the City Council for a franchise to reconstruct its line from White Terrace to St. Joseph's Church, in Pittsfield. C. Q. Richmond, Pittsfield, is Mgr.

Winchendon Springs, Mass.—The Northern Massachusetts St. Ry. Co. contemplates the extension of its line to Winchendon Springs. J. A. Taggart, Greenfield, Mass., is Gen. Supt.

Albany, N. Y.—The City Council has granted a franchise to the United Traction Co. to construct and operate an electric railway from North Pearl St., on Sheridan Ave., to Chapel St. James F. Hamilton, Albany, is Gen. Mgr.

Bayport, N. Y.—The Suffolk Traction Co. has been granted franchises and is making preliminary arrangements for the extension of its lines from Bayport to Sayville and West Sayville. J. C. Brackenridge, 95 Liberty St., New York, N. Y., is Gen. Mgr. and Ch. Engr. Noted Sept. 3.

North Tonawanda, N. Y.—The International Ry Co. has been granted franchises to construct an electric railway in North Tonawanda and Tonawanda. J. A. McKenna, Buffalo, is Secy.

Orange, N. J.—The Public Service Ry. Co. has been granted permission to extend its lines on Central Ave. R. E. Danforth, Newark, is Gen. Mgr.

Farrell, Penn.—The Valley Street Ry. Co. has been granted a franchise to construct and operate an electric railway in Farrell. R. P. Stevens, Youngstown, Ohio, is Vice-Pres.

Watsontown, Penn.—Arrangements are being made by the Lewisburg, Milton & Watsontown Passenger Ry. Co. for the extension of its line in Watsontown to the borough line. W. W. Wilson, Milton, is Gen. Mgr. and Pur. Agt.

Washington, D. C.—The Washington Ry. & Electric Co. has been ordered by the Public Utilities Commission to extend its Anacostia line from Nichols Ave. and Fourth St. for a distance of a mile. R. W. Crowell, Washington, is Pur. Agt.

Florence, Ala.—The Florence & Huntsville Interurban Ry. Co. has been incorporated to construct an electric interurban railway from Florence to Huntsville, with a branch line from Killen to Lexington, Tenn. Thurston H. Allen, Pres.; T. W. Pratt, Vice-Pres., and N. F. Thompson, Secy.-Treas.

West Point, Miss.—The [illegible] of West Point have [illegible] to [illegible] for the extension of the line of the Mississippi [illegible] Ry Co to West Point. F. W. Crisler, [illegible] Miss., is interested.

Gallatin, Tenn.—The [illegible] Ry Co is being organized by H. H. Mayberry and associates for the purpose of constructing an electric railway from Gallatin to Springfield, Tenn.

Middletown, Ohio.—The Middletown, [illegible] & Cincinnati Interurban [illegible] is making surveys for the construction of the proposed electric railway which will connect Cincinnati and Middletown, about [illegible] miles. A branch line to Germantown and [illegible] is under consideration. Michael Kleiber, Jr., [illegible], Ohio, is interested. Noted Sept. 24.

Indianapolis, Ind.—Plans are being prepared by the Terre Haute, Indianapolis & Eastern Ry Co for the construction of an electric railway on South Eighth St., in Indianapolis. T. F. [illegible], Terre Haute, is Gen. Mgr.

Murphysboro, Ill.—(Official)—Plans have been prepared by Edward Flad & Co., Engrs., De Menil Bldg., St. Louis, Mo., for the construction of an electric railway by the Murphysboro & Southern Illinois Ry Co. from Murphysboro to Carbondale, about eight miles. Noted Sept. 17.

Corpus Christi, Tex.—The Ward Island Development Co has applied to the Commissioner's Court of Nueces County for a franchise for the construction of an interurban electric railway from Corpus Christi to Ward Island. The company will establish a pleasure resort on Ward Island. The proposed line will be six miles long.

Glen Rose, Tex.—The Glen Rose & Walnut Springs Ry Co is making preliminary arrangements to start work on the construction of its proposed electric railway to connect Glen Rose and Walnut Springs, about 11 miles.

Clovis, Calif.—The Fresno Interurban Ry Co has received a franchise from the Council to construct and operate an electric railway in Clovis. This is part of a proposed electric interurban line which will connect Fresno and Clovis. J. R. Rogers is Mgr. Noted June 18 and Sept. 3.

Los Angeles, Calif.—The City Council has granted the [illegible] Electric Ry Co a franchise to construct and operate three spur tracks in Los Angeles. J. McMillan, Los Angeles, is Gen. Mgr.

The Los Angeles Ry Co has assured a committee appointed by the Malabar Improvement Association that it will construct an electric railway on North Evergreen St., from East First to Wabash St. C. A. Henderson, Los Angeles, is Gen. Mgr. and Pur. Agt. Noted Sept. 24.

San Francisco, Calif.—M. M. O'Shaughnessy, City Engr., has prepared plans and is making surveys for the construction of the municipal electric railway through Golden Gate Park.

✦Fort Williams, Ont.—The City Council has awarded a contract to JOHN MILLEN & SONS, Toronto, for furnishing equipment for the municipal electric railway construction in Fort William.

Peterboro, Ont.—The Peterboro Radial Ry Co is considering plans for the reconstruction of its electric railway on Charlotte St. W. H. Munro, Peterboro, is Local Mgr.

Lacombe, Alta.—Surveys have been made and preliminary arrangements are being made by the Lacombe & Blindman Valley Electric Ry Co for the construction of an electric railway to connect Lacombe, [illegible] and Rimbey. J. C. Gilmour, [illegible] King St. West, Toronto, is Pres.

Vancouver, B. C.—According to press reports, the British Columbia Electric Ry Co is making preliminary arrangements for the [illegible] of a line on South [illegible] St. to connect its line with that of the Canadian Pacific Ry Co. [illegible], Vancouver, is Gen. Mgr.

LIGHT, HEAT AND POWER

Manchester, Conn.—The [illegible] Co., manufacturer of [illegible], has bought a site near its present plant [illegible] [illegible] to supply the plant [illegible].

New York, N. Y.—[illegible]

Niagara Falls, N. Y.—[illegible]

Kittanning, Penn.—[illegible]

Lewistown, Penn.—[illegible]

Mauch Chunk, Penn.—[illegible]

✦Towanda [illegible]—[illegible]

Asheville, N. C.—Preparations are being made in the western part of North Carolina for the construction of a great hydro-electric plant on the Tennessee-North Carolina line. Two dams will be built in the Hiawassee River, one at Tuckers Ferry and the other at Chambers Creek. The [illegible] will be [illegible] ft. high. It is planned to furnish power throughout the south, including Birmingham, Nashville, Montgomery, Mobile and Pensacola. When completed the development will cost from $[illegible] to $[illegible]. [illegible] Nelson, Murphy, N. C., is [illegible] of the [illegible].

Jacksonville, Fla.—It is reported that the city will install a [illegible]-kw. engine costing about $[illegible] in the municipal electric-light plant. W. H. Tucker is Supt.

Palm Beach, Fla.—At an election held on Sept. 1[illegible] the citizens voted in favor of a bond issue of $[illegible] for the installation of a municipal electric-light plant. As soon as the bonds are sold, bids for the construction of the plant will be asked. The J. B. McCrary Co., Atlanta, Ga., is preparing plans for the plant.

Florence, Ala.—The Allentown Power Co., recently incorporated with $[illegible] capital stock, will develop power on Cypress Creek by constructing two hydro-electric plants, building dams, etc.

Gibsland, La.—A franchise has been granted to H. M. Smith for the installation and operation of an electric-light and power plant. It is reported that the plant will be in operation by Nov. 1.

Melville, La.—It is reported that bids will be received until Oct. 6, by the Mayor, for the construction of an electric-light plant. Noted Sept. 24.

Princeton, Ky.—The question of a bond issue of $1[illegible], to be used for the installation of a municipal electric-light plant, will be submitted to the voters at the November election.

Sullivan, Ill.—Plans are under way for the establishment of a municipal electric-light plant. Hiram Phillips, Third National Bank Bldg., St. Louis, Mo., is Consult. Engr.

Lincoln, Neb.—Bids will be received until Oct. 1[illegible] by the City Council for improvements to the electric-light plant and waterworks system. Theodore H. Berg is City Clk.

✦Parker, S. D.—The City Council has awarded the contract for the construction of the municipal electric-light plant to the E. M. FISHER CO., Fort Dodge, Iowa, at $1[illegible]. Noted Aug. 13 and Aug. 27.

Malta, Mont.—It is reported that Shaw & Levesconte, Malta, have applied to the City Council for a franchise to install an electric-light plant in the city.

✦Edgerton, Mo.—The McComas Hydro-Electric Power Co., Edgerton, has awarded contracts (without bids) to the GENERAL ELECTRIC CO., Schenectady, N. Y., for machinery; JAMES LEFFEL CO., Springfield, Ohio, for turbines, and the J. B. EHRSAM & SONS MFG. CO., Enterprise, Kan., for the transmission system for its new plant, which will furnish electricity to 11 towns in the vicinity. The dam for the power is being built in the Platte River one mile west of Edgerton. J. M. McComas, Edgerton, is chief promoter of the company. C. O. [illegible], [illegible], Neb., is Engr.-in-Charge.

Kirkwood, Mo.—The Board of Aldermen has authorized improvements to the municipal electric-light plant, to cost about $1[illegible]. The Board of Public Improvements will have charge of the work.

Corpus Christi, Tex.—The Corpus Christi Gas Co. is building a gas manufacturing plant and will install a new distribution system. The total cost will be about $[illegible].

Marble Falls, Tex.—The proposed bond issue for the [illegible] of a [illegible] electric-light plant and water-works was [illegible] at the recent election. Noted [illegible].

Oceanside, Calif.—[illegible]

Quebec, Que.—The City Council has decided to [illegible] [illegible] J. L. [illegible], City Hall, is the [illegible].

Simcoe, Ont.—[illegible]

BRIDGES

Portland, Maine.—[illegible]

Bellingham, Mass.—[illegible]

Dedham, Mass.—[illegible]

Central Falls, R. I.—[illegible]

Elmira, N. Y.—The Board of [illegible] [illegible]

New York, N. Y.—(Borough of Bronx)—(Official)—Bids will be received until 10:30 a.m., Oct. 8, by Douglas Mathewson, Pres. Borough of the Bronx, for repairing, cleaning and painting the bridge over the tracks of the New York, New Haven & Hartford R.R. at East 153d St. The Engineer's estimates are as follows: 40,000 lb. of steel and iron in truss members, 50,000 lb. steel in floor built members, 75,000 lb. steel in rolled members in floor, 85,000 lb. steel in buckle plates, 9000 lb. iron castings, 500 sq.yd. pavement removed, cleaning and painting.

✚Syracuse, N. Y.—The Board of Contract and Supply has awarded the contract for the construction of two bridges across Onondaga Creek, one at Oxford St. and the other at West Newell St., to the HOOKWAY CONSTRUCTION CO., at $9810 and $8678 respectively.

Harrisburg, Penn.—The following bids were opened Sept. 23 by the Commissioners of Dauphin County for bridge construction: Bridge over Swatara Creek between Royalton and Middletown, (a) steel, (b) concrete: G. W. Ensign, Inc., (a) $19,958, (b) $21,103; the Ferro-Concrete Co., (a) $20,998, (b) $16,545; Pennsylvania Steel Co., (a) $19,990; Whitaker & Diehl, (a) $23,872; Central Construction & Supply Co., (b) $18,000; Bridge over Wiconsico Creek, Ferro-Concrete Co., $8847; G. W. Ensign, Inc., $6762; Whitaker & Diehl, $13,964. Noted Sept. 10.

✚New Castle, Penn.—(Official)—The Commissioners of Lawrence County have awarded the contract for the construction of a 50-ft. concrete arch over Hettenbaugh Run, Hickory Township, to C. E. KIMBROUGH, St. Cloud Bldg., New Castle, at $3130. There were nine other bids ranging from $3598 to $5063. Noted Aug. 27.

✚Philadelphia, Penn.—The Department of Public Works has awarded the following contracts for repairing and repainting bridges: AMERICAN PAVING & CONSTRUCTION CO., at $10,550 for the bridge at Broad St. and Lehigh Ave., and $3800 for the Falls of Schuylkill Bridge; C. P. GRIM, $5900 for the bridge over the Schuylkill River on the line of Girard St.; W. A. MUNDY, $7070 for the Market St. Bridge.

✚Baltimore, Md.—The State Roads Commission has awarded the contract for the construction of the draw span in the Hanover St. Bridge to the STROBEL STEEL CONSTRUCTION CO., Chicago, at $86,430. List of bidders noted Sept. 24. The Commission also awarded the contract for the excavation and fill for the city end of the Hanover St. Bridge under the arcade to H. P. CONVERSE & CO., Boston, at $4140, and the contract for the excavation and fill for the bridge to the LUCK CONSTRUCTION CO., Roanoke, Va., at $54,900.

✚Frederick, Md.—The State Roads Commission, Baltimore, has awarded the contract for the construction of a bridge across the Patapsco River, at Frederick, to the LUTEN BRIDGE CO., York, Penn., at $15,500.

Fayetteville, N. C.—(Official)—Bids will be received until noon, Oct. 12, by the Commissioners of Cumberland County for the construction of a number of concrete bridges in the county, to cost not less than $25,000 nor more than $30,000. Fulton R. Hall is Clk. of the Bd.

Dalton, Ga.—Bids will be received until Oct. 6, by H. J. Wood, Ordinary and Chn., Board of Roads and Revenue, for the construction of a bridge across Mill Creek, on the Dalton and Spring Place Road, about 3½ miles east of Dalton.

Danielsville, Ga.—Bids will be received until Oct. 21 by the Commissioners of Madison and Elbert Counties at Danielsville for the construction of a steel bridge over the Broad River at Moore's Shoals near Carlton. The bridge will be 484 ft. long, having two spans of 172 ft. each, two of 66 ft. each, and five piers containing about 530 cu.yd. rubble masonry. Searcy B. Slack, Athens, Ga., is Engr. J. W. Draper, Danielsville, is Supt. of Roads and Bridges.

Greenville, Miss.—Bids will be received until Oct. 5 by the Board of Supervisors of Washington County for the construction of three steel bridges in Bogue Pahlia Drainage District; two will be 180 ft. long each, and the other 75 ft. long. These will be the first of about 45 bridges to be built in this district. The Morgan Engineering Co., Memphis, Tenn., is Engr. in Charge.

Pittsboro, Miss.—Bids will be received until Oct. 6 by the Highway Commissioners of Supervisors' District No. 1 for building a number of bridges on the road from Pittsboro to the eastern boundary line of the district, and on the road from that line to the river crossing near Old Town. A. A. Bruner and W. R. Byars are Comrs.

★New Orleans, La.—(Official)—Bids will be received until 11 a.m., Oct. 26, by the City of New Orleans, for the construction of a Strauss trunnion bascule lift bridge over the New Basin Canal on the axis of City Park Ave. A. G. Ricks is Comr. of Public Finances. For further details, see advertisement under "Contracts to Be Let."

New Orleans, La.—Press reports state that the New Orleans Ry. & Light Co. has agreed to build a new bascule bridge at West End in place of the foot bridge now in use at the lake resort. The bridge will cost about $40,000. Hugh McCloskey is Pres. of the New Orleans Ry. & Light Co.

Plaquemine, La.—Bids will be received until Oct. 3 by the Police Jury of Iberville Parish for the c nstruction of a steel drawbridge across Bayou Grosse Tete Bay. W. A. Holloway is Pres. of the Police Jury.

✚Memphis, Tenn.—The City Council has awarded the contract for the construction of a concrete arch culvert to A. M. ALEXANDER, Memphis, at $8700.

Bellaire, Ohio—Bids will be received until Oct. 9 by the Board of Commissioners of Belmont County, St. Clairsville, for the construction of a reinforced concrete bridge over Indian Run in the city of Bellaire.

✚Duncan Falls, Ohio—The Commissioners of Muskingum County, Zanesville, have awarded the contract for the construction of a 200-ft. reinforced-concrete viaduct at the west end approach of the Duncan Falls Bridge to D. L. ELKINGTON, Toledo, Ohio, at $9650. Noted Sept. 3.

Fremont, Ohio—(Official)—All bids received Sept. 12 by the Commissioners of Sandusky County for the construction of the Tindall Bridge over the Sandusky River, Ballville Township, have been rejected. Noted Aug. 27.

West Carrollton, Ohio—Bids will be received until 10 a.m., Oct. 15, by the Commissioners of Montgomery County, Dayton, for the construction of the superstructure of a bridge over the canal at Cedar St., West Carrollton. W. H. Aszling is Secy. of the County Comrs.

Columbus, Ind.—The Board of Commissioners of Bartholemew County has appropriated $12,000 for a new bridge to replace the Marr Bridge.

✚Indianapolis, Ind.—(Official)—The Board of County Commissioners has awarded the contract for the construction of the bridge over the White River at West New York St., to the CENTRAL STATES BRIDGE CO., Indianapolis, Ind., at $125,035. Noted Aug. 6, Aug. 13, and Aug. 27.

Richmond, Ind.—The County Council of Wayne County is considering the construction of a bridge over the Whitewater River at an estimated cost of $100,000.

Wabash, Ind.—(Official)—Bids will be received until 1:30 p.m., Oct. 7, by the Board of Commissioners of Wabash County for the construction of two bridges in Chester Township, and two in Waltz Township. Daniel Showalter is County Audr.

Ecorse, Mich.—At the fall election the citizens will vote on the question of a bond issue of $35,000 to be used for building a bridge over Ecorse Creek.

★Chicago, Ill.—(Official)—Bids will be received until noon, Oct. 8, by John McGillen, Clk. of the Sanitary District of Chicago, for the construction of the superstructure of a steel highway bridge over the Calumet-Sag Channel of the Sanitary District of Chicago, on the line of Bach Road, Palos Township, Cook County. For further information, see advertisement under "Contracts to Be Let."

✚Libertyville, Ill.—(Official)—The following bids were received Sept. 5, for the construction of the Oak Spring Bridge, Libertyville Township: Cullen Friestadt, Chicago, $5445; Leo Delhaye, Waukegan, $8400; Engineering Construction Co., Chicago, $5805; Melloy Construction Co., Chicago, $7346; JOHN DARROW, Waukegan, $4790 (awarded contract); Continental Bridge Co., $4987, alternative steel plan, $4290, or for steel superstructure only, $3490. Noted Sept. 3 and Sept. 24.

Charles City, Iowa—The Board of Supervisors of Floyd County is considering a new bridge over the Cedar River to be located at Kelly St.

Leavenworth, Kan.—The Commissioners of Leavenworth County have instructed the County Clerk to advertise for bids for the construction of 19 bridges and culverts in the county to cost from $250 to $1050 each. The total cost is estimated at $15,451. Jesse Hall is County Clk.

✚Wichita, Kan.—The Commissioners of Sedgwick County have awarded the contract for the construction of six concrete bridges in Lincoln Township to the MISSOURI VALLEY BRIDGE CO.

The County Commissioners have decided to build a new bridge over Dog Creek, Rockford Township.

Hastings, Neb.—The Boards of Supervisors of Adams, Buffalo and Kearney Counties have decided to build a new concrete bridge over the South Branch of the Platte River at the point where the three counties join, northwest of Kenesaw, Adams County. The three counties will share equally in the cost of the bridge, which will be located near the new town of Denman.

Medora, N. D.—(Official)—The following bids were received Sept. 7, by the Commissioners of Billings County for the construction of a bridge over the Little Missouri River near Medora, plans (a) and (b): M. A. Adams & Co., (a) $11,960, (b) $11,570; Midland Bridge Co., (a) $11,300, (b) $10,900; Continental Bridge Co., (a) $13,400, (b) $12,700; Great Northern Bridge Co., (a) $14,300, (b) $14,600; Security Bridge Co., (a) $10,987, (b) $12,950; Hennepin Bridge Co., (b) $12,950; Canton Bridge Co., (a) $10,200. All bids were rejected. Noted Aug. 13 and Sept. 24.

✚Arrey, N. M.—The contract for the construction of a steel pony truss bridge over the Rio Grande River at Arrey has been awarded to the MIDLAND BRIDGE CO., Kansas City, Mo., at $10,475. Noted Aug. 6 under Santa Fé.

Beaumont, Tex.—The Commissioners of Jefferson County have instructed the County Engineer to prepare plans and advertise for bids as soon as possible for the construction of a drawbridge over Taylor's Bayou at the site of the old Gill Bridge.

Fredericksburg, Tex.—Bids will be received until Oct. 3 by the Commissioners of Gillespie County for the construction of a low-water bridge over the Pedernales River at Austin Crossing. Herman Usener is County Clk.

✚Mason, Tex.—The Commissioners of Mason County have awarded the contract for a reinforced concrete bridge, about 330 ft. long and 16 ft. wide, to the ALAMO CONSTRUCTION CO., at $9000.

Ellensburg, Wash.—The Improvement Committee of the City Council will soon ask for bids for replacing the bridges on Ruby and Sprague Sts. at Sixth Ave., and a bridge in West Ellensburg. .

✚Los Angeles, Calif.—The Board of Public Works has awarded the contract for the construction of a reinforced-concrete bridge over the Arroyo Seco at Ave. Forty-three, to MUNOZ & MUNOZ, at $16,479. Noted Aug. 27 and Sept. 10.

Oakland, Calif.—P. A. Haviland, County Surv. of Alameda County, is preparing plans for the repair of three bridges spanning the estuary. The estimated cost of the work is $30,000.

San Francisco, Calif.—See item under "Miscellaneous." Fool Bridges over Embarcadero.

San Jose, Calif.—Bids will be received until 11 a.m., Oct. 5, by the Board of Supervisors of Santa Clara County, for the construction of a reinforced-concrete bridge over Los Gates Creek on the Infirmary Road. J. G. McMillan is County Surv

San Luis Obispo, Calif.—The Board of Supervisors of San Luis Obispo County is preparing to build a 300-ft. bridge at Miles Station, and a steel bridge over the Salines River at San Miguel. F. J. Rodriguez, San Luis Obispo, is County Clk

✦**Santa Ana, Calif.**—The contract for the construction of the Anaheim Landing pile trestle, about 973 ft. long, has been awarded to the RUSSELL-GREENE-FOELL CO., Higgins Bldg., Los Angeles, at $7515

Santa Barbara, Calif.—(Official)—The following bids were received on Sept. 17 by the City Trustees for the construction of a bridge and wing walls at De La Guerra St., (a) bridge, (b) walls, (c) totals: W. J. [illegible], Santa Barbara, (a) $9520, (b) $1108, (c) $[illegible]; Mercereau Bridge & Construction Co., Los Angeles, (a) $6660, (b) $684, (c) $7344; Boardman Construction Co., Los Angeles, (a) $6310, (b) $810, (c) $7140; W. E. Larimer, Stockton, (c) $6758. The Engineer's estimate of the work complete was $6880. George P. Robinson is City Engr. Noted July 30

Bids will be asked within a few weeks for the construction of two other reinforced-concrete bridges with concrete retaining walls, to be located on East Blvd.

✦**Ottawa, Ont.**—The Board of Control has awarded the contract for the construction of four concrete piers and two abutments for the substructure of the Billings Bridge to THOMAS BREWSTER, Lyons St., Ottawa. The contract for the superstructure of the Billings Bridge has been awarded to the DOMINION BRIDGE CO., LTD., Montreal, Que., at $32,7[illegible] for the steel, and $9990 for its erection. Noted July 23

WATER SUPPLY—IRRIGATION

Amsterdam, N. Y.—The contract has been readvertised and bids will be received until Oct. 6 by the Commissioner of Public Works for making 50 or more wash borings at Glen Wild. James P. Wilson is City Clk. Noted Sept. 10

Brownsville, N. Y.—The citizens voted $30,000 in bonds, the proceeds to be used for the installation of a water system. Noted Sept. 17

Greece (Gates post office), **N. Y.**—The creation of a new water district is contemplated by the citizens, requiring about five miles of water mains. Clifford E. Clark is Comr.

✦**Liberty, N. Y.**—The contract for constructing a 500,000-gal. reservoir has been awarded by the Board of Water Commissioners to GEORGE MESLER, Liberty, at $5000. Bids opened Sept. 10. Noted Sept. 3

Newark, N. J.—Runyon & Carey, Engrs., have been retained by the Board of Chosen Freeholders to prepare plans and specifications for the installation of a complete water system at the Overbrook Hospital. Noted May 21

Perth Amboy, N. J.—The Board of Water Commissioners has voted to install new 6-in. water pipe lines in Bertrand Ave., Cornell St., Hoffmann Ave., Neville St., Donald Ave., [illegible] Ave. and Menzer St. The work is estimated to cost [illegible].

Philadelphia, Penn.—Bids will be received by the Director of Public Works until Oct. 6 for repairing the Fairhill reservoir, pumps for Torresdale, Wents Farm and Belmont pumping stations, feed water regulators for Shawmont and Queen Lane, flanged heads for Torresdale pumping station, structural steel for Belmont pumping station and steel doors for [illegible] filters.

✦**Pittsburgh, Penn.**—(Official)—Bids will be received by the City Controller, until 10 a.m., Oct. 15, for laying two [illegible] steel pipe lines across the Bloomfield Bridge and for laying [illegible]-in. and 16-in. c.-i. pipe lines from Herron Hill [illegible] to Garfield Tanks. Robert Swan is Dir. of Pub. Wks.

Reading, Penn.—An election will be held in November to vote on the proposition of issuing $150,000, the proceeds of which to be used for the construction of a new reservoir.

✦**Baltimore, Md.**—The contract for [illegible] 15-ft. relief [illegible] of the New Loch Raven dam has been awarded, according to press reports, to KING BROS., at $11[illegible].

Scottsville, Va.—Bids will be received by P. L. Fox, Chn. of the Water and Light [illegible], until [illegible] p.m., Oct. [illegible], for installing a water system and electric-light plant. R. T. Sun[illegible] [illegible] is Engr.

Barboursville, W. Va.—About [illegible] ft. of additional water mains will be laid by the city to connect with the municipal plant.

Huntington, W. Va.—Bonds for [illegible] were voted at [illegible] election, the proceeds of which will be used for [illegible] of a water system. [illegible] Chapman is Mayor. [illegible]

Louisville, Ga.—Bids will be received by [illegible] Pothall, City Clk., until [illegible] for making extensions to the water system. [illegible] is Consult. Engr. [illegible]

Jacksonville, Fla.—Bids will be received by the Board of [illegible]

Plant City, Fla.—[illegible]

Georgiana, Ala.—[illegible]

New Orleans, La.—[illegible]

Plaquemine, La.—(Official)—Bids will soon be received for [illegible] C. A. [illegible] is City Engr. [illegible]

Cleveland, Ohio.—[illegible]

Middletown, Ohio—Bids will be received until Oct. 15, by the City Commissioners for repairing the Holly quadruplex water power driven pump and for installing a water power operated pump having a capacity of 1050 gal. per minute. Pollard & Ellms, Union Central Bldg., Cincinnati, are the Engrs.

Russell, Ohio—Bonds were voted by the citizens at a recent election, the proceeds to be used for the construction of a municipal water system.

✦**Sandusky, Ohio**—Press reports state the contract for the construction of the new water-works intake pipe and crib has been awarded to SHIRLEY-SHELDON CO., Toledo, at $40,813. Noted Sept. 9

Steubenville, Ohio—The ordinance authorizing a bond issue of $60,000 for the completion of the filtration plant and for covering the reservoirs has been repealed and a new bond issue of $65,000 passed. Charles R. Wells is City Engr. Noted Aug. 27.

Gary, Ind.—Bids will be received until Oct. 12 by H. C. Francis, City Clk., for the sale of $76,000 in bonds the proceeds of which will be used for the construction of a water system. Noted Sept. 3.

Chicago, Ill.—(Official)—Bids will be received until 11 a.m., Oct. 5, by the Harbor and Subway Commission for furnishing and installing water supply, sewage plumbing, gas and drainage systems on Pier No. 2 in Harbor District No. 1. E. C. Shankland is Chn. Harbor and Subway Comn.

Joliet, Ill.—The Common Council contemplates constructing another reservoir with a capacity of 4,000,000 gal. C. D. O'Callaghan is City Engr.

Red Bud, Ill.—Bids will be received by the City Clerk until Oct. 9 for installing a water system. E. A. Thompson, East St. Louis, is Engr. Noted Sept. 21

✦**Appleton, Wis.**—Press reports state that the contract has been awarded to ALLIS-CHALMERS MFG. CO. for furnishing a motor-driven centrifugal pump for the municipal water-works. Noted Sept. 3

Bloomington, Wis.—At a recent election the citizens voted to issue bonds for the installation of a water system. Noted June 25.

Wauwatosa, Wis.—(Official)—Bids will be received by the Board of Public Works, until 10 a.m., Oct. 3, for laying water mains and sewers in portions of various streets. F. A. Torkelson is City Engr. Noted June 25.

Ankeny, Iowa—Bids will be received until 8 a.m., Oct. 12, for the construction of a municipal water system. The estimated cost is $12,000

Chariton, Iowa—The construction of a reservoir and the extension of the water mains are under consideration.

✦**Columbia Heights, Minn.**—(Official)—The contract for extending the water system has been awarded to W. D. LOVELL, 1415 Eighth St. S. E., Minneapolis, at $[illegible]3.5. Bids were opened Sept. 19. Noted Sept. 10

Ely, Minn.—Bids will be received by L. Wisted Jr., City Clk., until 8 p.m., Oct. 5 for furnishing one cross compound Meyer gear crank and fly wheel pumping engine, with a capacity of 1,500,000 gal., one 100-kw. alternating current engine type generator, one steam engine and [illegible],000-gal. steel tank on steel tower. W. C. Huck, Minneapolis, is Consult. Engr.

Hibbing, Minn.—Bids are being received for the construction of a 1,000,000-gal. concrete reservoir. The estimated cost is $14,000

✦**Wellington, Kan.**—(Official)—The contract for furnishing and laying [illegible] ft. of 16-in. Matheson Joint steel pipe and 10,000 ft. of 18-in. pipe has been awarded to N. S. SHERMAN MACHINE & IRON WORKS, Oklahoma City, Oklahoma, at $[illegible]. The contract for a [illegible]-gal. tank was awarded to CHICAGO BRIDGE & IRON WORKS, at $[illegible]. The Benham Engineering Co. is the Consult. Engr. Noted Aug. 27

Alliance, Neb.—Plans have been prepared for the construction of a new storage reservoir for the city. The reservoir will be built of reinforced concrete, [illegible] ft. and will have a capacity of [illegible] gal. The estimated cost is $[illegible]

✦**Aberdeen, S. D.**—The contract for constructing a water system has been awarded by the city to STANLEY [illegible] [illegible], Yankton, at $[illegible]

Summit, S. D.—The city will construct a municipal water system at an estimated cost of $[illegible]

✦**New Rockford, N. D.**—The contract for constructing a water system has been awarded to JAMES KENNEDY, Fargo, at $[illegible]

Chinook, Mont.—At an election held recently the citizens voted to issue $[illegible] in bonds, the proceeds of which to be used for the [illegible] of the water works. [illegible] Great Falls, is the Engr. Noted Aug. 6

✦**Hardin, Mont.**—The contract for constructing a water system for the city has been awarded to SECURITY BRIDGE CO., Billings, Mont., at $[illegible]

✦**Melstone, Mont.**—The contract for installing a municipal water system has been awarded to NOWELL-ATHERLEY CO., [illegible], Mont. Noted Sept. 17

Arkadelphia, Ark.—The Arkansas Power Co. has been granted a new franchise and will install pumps and a filtration plant.

Electra, Tex.—The City Commission contemplates developing a water supply [illegible] miles from Electra and to construct a water works at Electra.

El Paso, Tex.—Bids for installing a new pump and boilers at the [illegible] water works plant were received by the City Council as follows: Fulton Iron Works, St. Louis, Mo., [illegible]; [illegible], Fred M. Prescott Steam Pump Co., El Paso, [illegible]; International Harvester [illegible] & Machinery Co., El Paso, $[illegible]; De La Vergne Engine Co., [illegible]. The different bidders [illegible] was for different [illegible] of work. Noted Sept. 24

Nampa, Idaho—An election will be held Oct. 10, to vote on the proposition of bonding the Nampa Meridian Irrigation District to the extent of $3,304,500 for improvements. F. C. Horn, Boise, is Consult. Engr.

St. Maries, Idaho—At a recent meeting, the City Council voted to retain a hydraulic engineer, to investigate the present water supply in Cedar, Thorn and Cañon Creeks, and make a report on it, with estimate of cost of installing a water system to supply St. Maries.

Seattle, Wash.—The City Council has authorized the laying of water mains in 38th, 39th, 40th, 41st and 42d Aves., S. W. from West Alaska to West Charleston St., West Oregon. West Gennessee, West Dakota and Belvidere Ave. A. H. Dimock is City Engr.

✚**Seattle, Wash.**—The contract for laying water mains in 47th Ave. N. W. has been awarded to L. COLUCCIO, Seattle, at $8248. Noted Sept. 24.

Garden Grove, Calif.—The Garden Grove Water Co. will build a storage tank and a new distributing system and install a pumping plant. J. A. Knapp is Pres. of Bd. of Dir.

Glendora, Calif.—Bonds to the amount of $57,500 have been voted for the construction of a water system.

Orange, Calif.—The El Modena Domestic Water Co. has been organized with $10,000 capital by John King, H. M. Gray and George Wood and others. The company will distribute water at El Modena.

Red Bluff, Calif.—The citizens contemplate installing a municipal water system at a cost of $85,000.

Montcalmville, Que.—The Council contemplates constructing water mains, and sewers, W. D. Baillarge, 50 St. Louis St., is Engr.

Saanichton, B. C.—The citizens contemplate spending $375,000 for the construction of a water system.

Vancouver, B. C.—Plans are being prepared by the municipal engineer for a water system for West Vancouver. A pipe line will be built up Sister Creek about three miles from the water front which will require 20 miles of steel pipe. A dam will also be constructed with a capacity of 2,000,000 gal.

SEWERS

Boston, Mass.—Bids will be received until Oct. 2, by the Public Works Department for constructing sewers in St. Andrews Road, East Boston, Cummings Road and Commonwealth Ave., Brighton District. L. K. Rourke is Comr.

✚The contract for constructing sewers and drains in Blue Hill Ave. and Deering Road, Dorchester District, has been awarded to WILLIAM L. DOLAN, at $6066. Other bidders were: L. Balboni, $6161; F. Drinkwater, $6170; Antony Gefalo, $6189; John Guarino, $6209; M. De Sisto, $6229; West Roxbury Trap Rock Co., $6890; A. Baruffaldi, $6905; M. H. Kelley, $6949; James J. Conway, $7088; James F. Murphy, $7294; J. H. Ferguson, $7471; William Barrett, $7533; George J. Regan, $8470. L. K. Rourke is Comn. of Pub. Wks. Noted Sept. 24.

Chicopee, Mass.—The Board of Aldermen has passed an order appropriating $14,000 for sewers in the Fairview District.

✚**Binghamton, N. Y.**—The contract for constructing a sewer in the Sixth ward has beeen awarded by the Board of Contract and Supply to B. L. GABRIEL, at $14,165. Noted Sept. 24.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by L. H. Pounds, Pres., Borough of Brooklyn, until 11 a.m., Oct. 7, for constructing sanitary sewers in West 27th St. from Surf Ave. to Neptune Ave.

★**Patchogue, N. Y.**—The low bidder for constructing a storm water sewer was George Marshall & Son, Jamaica, at $5764. Edward B. Woodruff is Village Clk. Noted Aug. 20.

Syracuse, N. Y.—The Common Council contemplates constructing a sewer in Warner Ave., from Cannon St. to Hope Ave. The estimated cost is $6000.

Syracuse, N. Y.—Bids will be received until 4 p.m., Oct. 7, by the Intercepting Sewer Board for completing the Onondaga Creek sewer.

East Orange, N. J.—Bids were received, Sept. 14, for constructing a sewer drain in Fourth Ave. and North 19th St. George Olcott & Son, East Orange, was low bidder at $4426. Noted Sept. 3.

Orange, N. J.—(Official)—Bids will be received by John J. Byrne, City Clk., until 4 p.m., Oct. 6, for constructing sewers in various streets.

Woodbridge, N. J.—(Official)—Bids will be received until 8:30 p.m., Oct. 7, at the Town Hall, for constructing vitrified pipe sewers in First, Third and Tappan St. at Port Reading.

✚**Altoona, Penn.**—The contract for constructing a sanitary sewer system in the 11th Ward has been awarded to LOOMIS & KING, Altoona, at $16,343. Noted June 18.

✚**Archbald, Penn.**—The contract for constructing a sewer in Hill St. has been awarded to BOLAND BROS., at $10,450. Noted Sept. 17.

Hazleton, Penn.—An election will soon be held to vote on the proposition of issuing bonds for $200,000 for the construction of sewers. Barton Youngman is City Engr.

Muncy, Penn.—Plans will be filed with the State Board of Health by the Borough Council for a sewage-disposal plant.

Norristown, Penn.—An election will be held in November to vote on the proposition of issuing $100,000 in bonds, the proceeds of which are to be used for the construction of a sewage-disposal system.

Parkesburg, Penn.—Plans are being prepared by F. H. Shaw, Engr., Brenaman Bldg., Lancaster, for the construction of a sewer system and sewage disposal plant. Noted Sept. 3.

Philadelphia, Penn.—A sewer will be constructed in Indiana Ave., from Fourth to 12th St., at an estimated cost of $200,000.

Reading, Penn.—The City Council has authorized a bond issue of $50,000 for the construction of a sewage filter. Edmund Ulrich is City Engr. Noted Sept. 17.

Wilmington, Del.—The city contemplates extending the Rising Sun sewer. The sum of $10,000 will be contributed by private parties.

Rockville, Md.—Bids will be received until Oct. 7 by John J. Higgins, Clk., to Council and Mayor, for constructing a sewer system and sewage disposal plant. Ezra B. Whitman, Fidelity Bldg., Baltimore, is Consult. Engr.

Augusta, Ga.—Bids will be received about Oct. 2 for constructing sewers from Wrightsboro Road extension to empty into Mollie's Branch near Buckeye Oil Mill. The estimated cost is $12,000. Nisbet Wingfield is Comr. Pub. Wks.

Lafayette, Ga.—Bonds for $17,000 have been voted by the citizens, the proceeds of which will be used for the laying of sewers. Noted Sept. 24.

Louisville, Ga.—Bids will be received by J. H. Polhall, City Clk., until noon, Oct. 6, for laying sanitary sewers. W. Hopson Goodlie, Macon, is Consult. Engr. Noted Sept. 10.

✚**Daytona, Fla.**—(Official)—The contract for installing a Riensch-Wurl screen in the sewage-treatment plant has been awarded by the Board of Public Works to SANITATION CORPORATION, 50 Church St., New York, N. Y. George W. Fuller, New York, N. Y., is Consult. Engr. Noted June 18.

Pablo Beach, Fla.—Bonds for $35,000 have been voted by the citizens, the proceeds of which will be used for the construction of sewers. Charles H. Mann is Bond Trustee. Noted Sept. 10.

New Orleans, La.—(Official)—Bids will be received by the Sewage and Water Board, City Hall, until Nov. 4, for extending the sewer system. Specifications are on file at the office of "Engineering News." Noted Sept. 10.

✚**Nashville, Tenn.**—The contract for constructing a sewer in 28th Ave. has been awarded to THOMAS MILLER & CO., at $10,770.

Cincinnati, Ohio—(Official)—Bids will be received by Philip Fosdick Dir. Pub. Ser. until noon, Oct. 8, for constructing a sewer in Montana Ave.

Cincinnati, Ohio—(Official)—Bids will be received by Philip Fosdick, Dir. of Pub. Ser., until noon, Oct. 8, for constructing a sewer in the ravine east of Concordia St., from Melish to Lincoln Ave.

✚The contract for constructing part of Duck Creek intercepting sewer from Evanston to Dana Ave. has been awarded by the Director of Public Service to D. P. FOLEY, Cincinnati, at $25,335. Bids opened Sept. 18. Noted Sept. 17.

New Philadelphia, Ohio—Bids will be received by J. E. Scott, Dir. of Pub. Serv., until Oct. 5, for installing a sanitary sewage lift on West High St.

✚**Wooster, Ohio**—The contract for constructing sewers in several streets has been awarded to BARRET & VITARO, Wooster, at $4926.

✚**Youngstown, Ohio**—The contract for laying the Mahoning Ave. sewer has been awarded to ANDREW TRUPPO, at $33,000; the Steelton District sewer to CHARLES HARRIS, at $47,000, and another section of the Steelton sewer to A. O'HARA, at $11,500, and district sewer No. 3 to EDWARD CONRICOTTE, at $11,000.

Geneva, Ill.—The Embankment Co., Geneva, Ill., will sublet contracts for constructing about five miles of 6- to 10-in. tile sewers. Bids are now being received.

✚**Beloit, Wis.**—The contract for constructing sewers has been awarded to CLAYTON E. TOLE CO., Rockford, Ill., at $5036. Other bids were: G. W. Mulholland, Kaukauna, $5121; Johnson & Thompson, Racine, $5126; Sweeny Bros., Reedsburg, $6034; Thill-Manning-Whalen Co., La Crosse, $6377; George Welch, Beloit, $5645. Noted Sept. 10.

Oshkosh, Wis.—Bids will be received by the Board of Public Works until 2 p.m., Oct. 2, for constructing a sewer in Lincoln St.

Wauwatosa, Wis.—(Official)—See item under "Water Supply and Irrigation."

Clinton, Iowa—Bids will be received by F. W. Leedham, City Clk., until 8 p.m., Oct. 13, for constructing a sewer in Fourth St. The work involves 830 cu.yd. of rock excavation, and 1600 ft. 18- and 10-in. vitrified pipe.

Grinnell, Iowa—(Official)—Bids will be received by the City Council, until 7:30 p.m., Oct. 12, for constructing 12¾ miles of 8- to 22-in. sewers with sedimentation tank and sand filters. A. C. Harriman is City Clk. Iowa Engineering Co., Clinton, is Engr. in Charge.

Waukon, Iowa—An election will be held Oct. 12 to vote on the proposition to issue $25,000 in bonds for a sewer system.

New Ulm, Minn.—Bids will be received by William Backer, City Clk., until 5 p.m., Oct. 8, for constructing a sanitary and storm sewer on First St.

Proctor, Minn.—Bids will be received by R. G. Wombacher until noon, Oct. 12, for constructing sewers and a sewage disposal plant.

Fort Scott, Kan.—Bids will soon be received by Miss C. Lueffel, City Clk., for a sewage-disposal system. The approximate cost is $25,000.

Hutchinson, Kan.—Plans are being prepared for the construction of an intercepting sewer which will connect all the submains and laterals. Bids will soon be received for the work.

✚**Havelock, Neb.**—The contract for constructing sewers has been awarded to the WILSON REINFORCED CONCRETE CO., Wahoo, at approximately $6000.

Bismarck, N. D.—Bids will be received by R. H. Thistlethwaite, City Audr., until 8 p.m., Oct. 9, for a lateral sewer in First St.

Billings, Mont.—Bids will be received by L. E. Torrence, City Clk., until 8 p.m., Oct. 6, for constructing sewers in District Nos. 120 and 118.

✦Tulsa, Okla.—A contract for constructing a sanitary sewer [illegible] has been awarded to C. D. [illegible]

✦Pocatello, Idaho.—A contract for constructing a sewer in [illegible] has been awarded to E. M. HARRISON, Lewiston, [illegible]

✦Astoria, Ore.—The contract for constructing a sewer system in [illegible] District has been awarded to K. SAVSET [illegible]

Mount Angel, Ore.—The City Council is [illegible] for the construction of a system of septic tanks.

✦Los Angeles, Calif.—T. J. SHEA has been awarded the contract at $[illegible] for constructing a storm sewer in Santa Monica Blvd., known as the [illegible] storm sewer.

✦San Francisco, Calif.—The Board of Public Works has awarded a contract for the construction of a sewer in Fulton St. to [illegible], at $[illegible]

Santa Barbara, Calif.—An entirely new sewer system is being planned for Santa Barbara. George P. Robinson is City Engr.

Hamilton, Ont.—Bids will soon be received by the City Council for constructing one mile of concrete sewers. The estimated cost is $[illegible]. A. F. Macallum is Engr.

Montcalm, Que.—See item under "Water Supply and Irrigation."

✦Moose Jaw, Sask.—Contracts for constructing sewers under Contracts Nos. [illegible] and [illegible] have been awarded to F. F. [illegible], Kerrobert, Sask., at $[illegible] and $[illegible], respectively.

GARBAGE.

Boston, Mass.—Bids will be received until Oct. 14 by the Public Works Dept., for the construction of refuse receiving stations at Ward St., Roxbury District. L. K. Rourke is Comr.

Nutley, N. J.—The Board of Health is considering the installation of a garbage incinerator. Dr. Royal Langdon is the Chmn.

STREETS AND ROADS.

Augusta, Maine.—The following bids were received by the State Highway Commissioner for constructing two sections of highways in Carmel, (a) 2.11 miles, Sect. No. 1, and (b) [illegible] miles in Sect. No. 2: Mitchell & Johnson, Oakland, (a) $[illegible], (b) $[illegible]; Thompson & Shannon, East Newport, (a) $[illegible]; Mullen & Hughes, Bangor, (a) $12,[illegible], (b) $12,[illegible]; [illegible] Baker, Woolwich, (a) $11,[illegible]; Small & Ingalls, Bar Harbor, (b) $1[illegible]

Nashua, N. H.—All bids received Sept. 14 by the Board of Public Works for improving Bridge St. have been rejected. The City will do the work. Noted Sept. 10.

✦Boston, Mass.—The contract for constructing bitulithic pavement on Washington St., in Dorchester District, has been awarded to JAMES DOHERTY at $[illegible]. Other bids were: Warren Bros. Co., $[illegible]; John F. Beatty, $[illegible]; William J. Rafferty Co., $[illegible]. Noted Sept. 17.

✦The contract for constructing [illegible] bituminous macadam [illegible] St., West Roxbury District, has been awarded to WEST ROXBURY TRAP ROCK CO., at $[illegible]. Other bids were: Marino De Matteo, $[illegible]; John Kelly Co., $[illegible]; James Doherty, $[illegible]; William J. Barry, $[illegible]; John Beatty, $[illegible]; William J. Rafferty Co., $[illegible]; Thomas F. [illegible], $[illegible]. Noted Sept. 17.

✦The contract for building [illegible] ft. of bituminous macadam state road in Wrentham was awarded by the Highway Commission to the FRAMINGHAM CONSTRUCTION CO. [illegible]

[illegible]

✦Hartford, Conn.—[illegible]

[illegible]

✦Hartford, Conn.—[illegible]

New York, N. Y.—(Borough of Bronx)—(Official)—Bids will be received until 11 a. m., Oct. [illegible] by Douglas Mathewson, Borough Pres., for paving with sheet asphalt on a concrete foundation, the roadway of Kelly St. from Intervale Ave. to East 163d St. and setting curb along same route.

(Borough of Bronx)—[illegible]—See item under "Bridges."

(Borough of Queens)—(Official)—Bids were received Sept. [illegible] by Maurice E. Connolly, Pres. of the Borough of Queens, for improving Metropolitan Ave. from Dry Dock Harper [illegible] to Fulton St., as follows: Aztec Asphalt Co., Inc., $[illegible]; Borough Asphalt Co., $[illegible]; Uvalde Contracting Co., $[illegible]; Barber Asphalt Paving Co., $[illegible]; Sicilian Asphalt Paving Co., $[illegible]; Cleveland Trinidad Paving Co., $[illegible],667; Henry I. Mullen Contracting Co., $[illegible]. Noted Sept. 1[illegible]

✦Audubon, N. J.—The Borough officials have awarded a contract for concrete paving, including gutters, curbs and walks, on all local thoroughfares still unimproved, to the LoCATO CONSTRUCTION CO., at approximately $[illegible],000.

✦Cranford, N. J.—The Borough Council has awarded the contract for macadamizing Center St. and Spruce Ave., to CHARLES LENTZ, Rahway, at $[illegible]

Jersey City, N. J.—The Board of Chosen Freeholders of Hudson County has had plans and specifications prepared for the improvement of the Paterson Plank Road, from Homestead Station to Secaucus, with granite blocks on concrete foundation.

New Brunswick, N. J.—(Official)—Bids were received by the Board of Chosen Freeholders of Middlesex County, Sept. 21, for resurfacing a section of the Middlesex-Essex Road with bituminous concrete, as follows: T. H. Riddle, New Brunswick, $[illegible]; Conrad Scholt, New Brunswick, $[illegible]; Northern Construction Co., Newark, $[illegible]. Noted Sept. 17.

Paterson, N. J.—Bids will be received by the Board of Public Works, until Oct. 6, for paving parts of Fulton Place, Mercer, Sussex and other streets with macadam.

West New York (Weehawken post office), N. J.—Bids will be received by the Town Council, until Oct. 13, for opening Palisade Ave. from 12th St. south.

✦Carbondale, Penn.—The contract for paving South Church St. and Gordon Ave. with brick has been awarded to JOHN BOOTH, 191[illegible] Forbes St., Pittsburgh.

✦Connellsville, Penn.—The contract for paving Baldwin and Ashland Aves. has been awarded to SAMUEL HOLMES & CO., Scottdale, at $11,192. The only other bid was that of Duggan & Miller, $12,[illegible]. Noted Sept. [illegible]

✦Kingston, Penn.—The contract for paving Penn and Grove Sts. has been awarded to D. M. ROSSER, at $21,610.

Petersburg, Va.—According to press reports bids will soon be received by the City Council for the improvement of River, Rock, Old and Second Sts.

✦Philadelphia, Penn.—The contract for resurfacing Welsh Road from Bustleton Ave. to Frankford Ave. with macadam has been awarded to the UNION PAVING CO. at $[illegible]

✦Pittsburgh, Penn.—The contract for improving the [illegible] and Perrysville Road has been awarded to D. W. CHALLIS & SONS, Sewickley, at $[illegible]

✦Baltimore, Md.—Contracts have been awarded by the State Road Commissioners, 601 Garrett Bldg., Baltimore, to P. FLANIGAN & SON, 120 East Lexington St., at $[illegible], to pave Liberty and Cathedral Sts., from Baltimore to Peabody Alley, with asphalt or granite block, with bituminous filler, at the option of O. E. Weller, [illegible]

Bids will be received at the [illegible] City Hall, at the City Register's Office, until Oct. [illegible], for grading, curbing and paving Flower, May, Morton and other streets, under Contract No. [illegible] [illegible]

Moundsville, W. Va.—Bids will be received by the City Council until Oct. [illegible] for constructing concrete sidewalks [illegible]

Asheville, N. C.—Bids will be received by County Commissioners [illegible]

Macon, Ga.—An election will be held Nov. [illegible] [illegible]

Plant City, Fla.—[illegible]

✦Lafayette, Ala.—[illegible]

Ozark, Ala.—[illegible]

Port Allen, La.—[illegible]

✦Jackson, Tenn.—[illegible]

✦Louisville, Ky.—[illegible]

Taylorsville, Ky.—[illegible]

Cleveland, Ohio.—[illegible]

+Crooksville, Ohio—The contract for paving North Buckeye and China St. with brick has been awarded to BOCK & SON.

+Lima, Ohio—Bids have been received for paving South Metcalf St. as follows: H. C. Enck, Lima, $22,894; E. C. Freshwald, Chester, W. Va., $21,705; A. L. Metheany, Lima, $23,920; Summers & Hardin, Lima, $24,963; Blodget & Mullin, Lima, $22,830; Hedges & Dye, Covington, Ky., $25,976; Jameson & Blosser, Lima, $24,284; TOY & MULLIGAN, Lima, $20,308 (awarded contract). Noted Aug. 27.

Marysville, Ohio—Charles A. Morelock, Audr. of Union County, will receive bids until Oct. 3, for constructing the Samuel Road in Darby and Union Townships.

+Massillon, Ohio—PHILIP DIEFENBACHER & SONS have been awarded the contract for improving Front St. at $23,000.

Norwalk, Ohio—H. J. Pierson, Dir. of Pub. Ser., will receive bids Oct. 5 for the improvement of Carter St., by grading and paving the roadway with bithulithic or wood block.

Piqua, Ohio—The County Commissioners have decided to straighten the Troy Pike at an estimated cost of $17,000.

Steubenville, Ohio—Bids will be received by the Auditor of Jefferson County until Oct. 23 for the sale of $18,000 and $65,000 in bonds for road improvements.

Indiana—(Official)—Bids will be received as follows for road improvements in Indiana:

Muncie, until 10 a.m., Oct. 14, by the Commissioners of Delaware County for constructing a crushed stone road in Union Township. F. M. Williams is Audr.

Mt. Vernon, until 2 p.m., Oct. 15, by the Commissioners of Posey County for constructing 9475 ft. of road in Black Township. J. R. Haines is Audr.

Spencer, until 2 p.m., Oct. 17 by the Commissioners of Owen County for constructing macadamized roads in Clay and Lafayette Townships. G. W. Stwalley is Audr.

Auburn, until 10 a.m., Dec. 9, by the Commissioners of De Kalb County for constructing a road on the Butler-Jackson Township line. A. W. Madden Audr.

Winchester, Ind.—(Official)—Bids will be received by the Common Council until 8 a.m., Oct. 15 for constructing 4250 sq.yd. of concrete pavement. S. D. Fox is City Clk.

+Detroit, Mich.—(Official)—Contracts have been awarded for paving Romeyn St. to the DETROIT ASPHALT PAVING CO. at $8739; Fort St. from Wilkie to Elsmere St. to E. PORATH & SON at $13,518; Holcomb Ave. from Kerscheval to Mack St. to E. MEREDITH CO. at $22,086.

Oskaloosa, Iowa—(Official)—Bids will be received by the City Council until 8 p.m., Oct. 2, for grading, paving, curbing and guttering a number of streets. T. H. Cartin is City Clk.

Hastings, Minn.—Bids will be received by A. P. Hoffman, County Audr. until 1:30 p.m., Oct. 6, for constructing a section of state road, No. 8.

Leavenworth, Kan.—The City Commissioners have accepted plans and specifications of John B. Franks, City Engr., for paving and curbing Sixth St. from Choctaw to Oak St.

Pierre, S. D.—Bids will be received by James A. Quigg, County Audr., until 2 p.m., Oct. 6, for grading approximately 1057 cu.yd. on the Black and Yellow Trail.

Grand Forks, N. D.—Bids will be received by W. H. Alexander, City Audr. until 4 p.m., Oct. 5, for grading University Ave.

+Kansas City, Mo.—Contracts have been awarded for paving Montgall St. from 15th to 18th to A. JAICKS & CO., 20th St. from Baltimore to Grand St. to J. C. LYLE at $7896; 31st St. from McGee to Troost St. to E. D. TYNER & CO., at $7391.

+Springfield, Mo.—The City Council has awarded the contract to JARRETT-RICHARDSON PAVING CO. for paving Kimbrough St. from St. Louis to Elm St. The approximate cost of the work is $20,000.

+Pine Bluff, Ark.—The contract for graveling Olive St. from 20th to 26th Ave. has been awarded to C. E. PHILPOT.

+Goldendale, Wash.—A contract for changing and grading permanent highway No. 4, Maryhill Mountain Division, has been awarded to J. H. SELLERS, at $12,280.

+Seattle, Wash.—The Board of Public works has awarded contracts for paving 47th Ave. Northwest to J. J. MANEY, at $20,445; sandstone paving on West Less St. to JOHN G. PIERCE, at $3582 and for planking 26th Ave. Southwest to SWAN & BJORK, at $8356.

Walla Walla, Wash.—All bids received for paving Clifton, Alvarado and Estrala St., have been rejected. H. L. Wilson Co., at $8855 for crushed rock base, asphalt or concrete top, was low. The work covers a distance of 3600 ft. New bids will be asked.

Astoria, Ore.—All bids submitted for improvement of Alameda Ave., from Columbia to Ilwaco Ave., and for improvement of Date St. have been rejected and new bids, under revised specifications, will be asked.

Brawley, Calif. The city contemplates spending about $10 000 for street improvement work.

Sacramento, Calif.—The citizens of Sacramento County will vote Oct. 16 on the proposition to issue $2,245,000 in bonds for the construction of the Sacramento River Road.

Los Angeles, Calif.—Bids will be received by the Board of County Supervisors, until 2 p.m., Oct. 13, for macadamizing one mile of county road, known as Section Center Ave.

Sacramento, Calif. (Official)—Bids were received, Sept. 21, by the State Highway Commission, for constructing roads in various counties, as follows: (a) Santa Barbara County, Sect. 3, Route 2; (b) Santa Clara County, Sect. B, Route 5; (c) Contra Costa County, Sect. B, Route 14; (d) Glenn County, Sect. A, Route 7; (e) Siskiyou County, Sect. A, Route 3—R. H. McCray Co., Los Angeles, (a) $72,294; J. N. Calback, San Diego, (a) $58,923; Lyman S. Atkinson, Los Angeles, (a) $86,633; Occidental Construction Co., Los Angeles, (b) $95,513; Palmer & McBryde, San Francisco, (b) $100,668, (c) $60,879, (e) $81,794; Paterson & Grier, San Francisco, (b) $81,110; Mahoney Bros., San Francisco, (b) $89,583, (c) $59,430; W. J Schmidt, Berkeley, (b) $87,223; John A. Marshall, Berkeley, (b) $72,626; P. L. Burr, San Francisco, (b) $88,130, (c) $48,821; F. F. Prendergast, Los Angeles, (b) $95,160; Bates, Barland & Ayer, Oakland, (b) $99,415, (c) $42,097; Berry, Mackie & Co., San Francisco, (b) $85,490, (c) $55,311; James H. Smith, San Francisco, (c) $52,024; O'Brien Bros., Sansalito, (c) $50,346; F. Rolandi, San Francisco, (c) $68,925, (e) $72,672; A. W. Gorrill, San Francisco, (d) $47,964; E. T. Johnson, Portland, Ore., (e) $71,613; Moffett & Mead, San Francisco, (e) $124,026; Toohey & Johnson, Phœnix, Ariz., (e) $67,123. Noted Sept. 10.

+San Francisco, Calif.—The Board of Public Works has awarded a contract for the paving of Fulton St., from 25th Ave. westerly, to the FAY IMPROVEMENT CO., Phelan Bldg., at $13,355.

San Jose, Calif.—J. G. McMillan County Surveyor of Santa Clara County, is preparing preliminary plans for a highway through Pacheco Pass. The total cost of the road through the pass is estimated at $170,000.

Santa Barbara, Calif.—The City Council has rejected all bids for the paving of Valerio St.

Santa Rosa, Calif.—An election will be held, Nov. 3, to vote on the proposition of issuing $1,600,000 in bonds for permanent road improvements.

Whittier, Calif.—Bids will be received by the City Trustees, until 7:30 p m., Oct. 5, for paving approximately 100,000 sq.ft. on Philadelphia St. with asphalt.

+Galt, Ont.—The contract for improving Ainslie St. North has been awarded to the WARREN BITULITHIC PAVING CO.

+Kingston, Ont.—The City Council has awarded the contract to the KINGSTON CONSTRUCTION CO. for paving Princess St.

+Ottawa, Ont.—A contract for constructing 23,800 sq.yd. of asphalt, 12,900 lin.ft. of gutter and 2900 sq.yd. of stone blocks has been awarded to the UNION CONSTRUCTION CO. at $71,110.

The City Council contemplates constructing an asphalt pavement on Gloucester St.

Owen Sound, Ont.—The Town Council has authorized the construction of a concrete roadway on Tenth St. The estimated cost of the work is $500,000.

+Niagara Falls, Ont.—A contract for constructing 1700 sq.yd. of concrete sidewalks has been awarded to FERRIS & MANLEY.

Niagara Falls, Ont.—(Official)—Bids will be received by the Queen Victoria Niagara Falls Park Commissioners, until noon, Oct. 5, for constructing about 8500 ft. of concrete roadway through the villages of Bridgeburg and Fort Lee. John H. Jackson is Supt.

+Windsor, Ont.—The contract for resurfacing a section of Chatam and Park Sts. has been awarded to the CANADIAN DOLARWAY PAVING CO., LTD., Royal Bank Bldg.

INDUSTRIAL WORKS

+Milford, Mass.—The contract for the erection of the reinforced concrete storehouse and coal shed for the Milford Water Works, has been awarded to the J. W. BISHOP CO., 109 Foster St., Worcester, Mass. William Wheeler, 14 Beacon St., Boston, is the Engr.

Worcester, Mass.—Bids will be received until Oct. 1, for the construction of the leather plant for the Graton & Knight Mfg. Co., 344 Franklin St.

+Bridgeport, Conn.—The contract for the construction of the addition to the Frisbie Pie Co. has been awarded to the T. J. PARDY CONSTRUCTION CO. Noted Sept. 17.

Hartford, Conn.—Bids will be received until Oct. 5, by Ford, Buck & Sheldon, Inc., 60 Prospect St., Hartford, for the construction of buildings at the plant of the Capitol City Lumber Co.

Norwalk, Conn.—The Neptune Hardware Mfg. Co. contemplates erecting a factory in Keyser Place. The estimated cost is $11,600.

Cortland, N. Y.—The Cortland Carriage Goods Co. will erect a one-story addition to its plant, 162x300 ft.

Mount Vernon, N. Y.—Plans are being prepared by S. A. Guttenburg, Proctor Bldg., for a factory, 40x110 ft., for the Benford Mfg. Co., manufacturer of spark plugs.

Newburgh, N. Y.—The Stroock Plush Works will erect a three-story addition to its plant. A. B. Hagar, 50 Church St., New York, is Pres.

New York, N. Y.—(Borough of Brooklyn)—Plans have been completed for the construction of a garage at Albany Ave. and Herkimer St., for John W. Sullivan.

+New York, N. Y.—(Borough of Queens)—The contract for the construction of the five-story factory at Williams St and Harris Ave., Long Island City, has been awarded to J. ODELL WHITENECK, 231 West 18th St., New York.

+Rochester, N. Y.—Contracts for alterations and the one-story addition to the factory of the Ritter Dental Mfg. Co. have been awarded as follows: Structural steel, F. L. HEUGHES CO.; masonry, EDWARD STANCHEN; carpentry, W. F. MASS CO., Rochester.

Union, N. J.—Plans have been prepared by C. F. Long, Arch., 1 Montgomery St., Jersey City, for the construction of a three-story factory at Union for the Premier Briar Pipe Co. The estimated cost is $30,000.

Lewiston, Penn.—Plans are being prepared by C. Howard Lloyd, Harrisburg, Penn., for the construction of a three-story brick warehouse, 40x100 ft., for Whitman, Swartz & Co. The estimated cost is $15,000.

Philadelphia, Penn.—Plans are being prepared by M Haupt for alterations and additions to the six-story factory at 13th and Cherry Sts. for Abraham Steinfeld. The estimated cost is $20,000.

Philadelphia, Penn.—Watson & Huckle, Archs., 1211 Walnut St., Philadelphia, are preparing plans for the construction of a two-story, 30x200-ft. brick factory for the Hess Bright Mfg Co. The estimated cost is $20,000.

✦The contract for the construction of the one-story addition, [illegible] ft. on [illegible] Ave., for the [illegible] Paper Co., has been awarded to the BARCLAY WHITE & CO., Philadelphia, Penn., at $[illegible].

Baltimore, Md.—The Oriental Rug Co. will erect a three-story [illegible] and warehouse. The estimated cost is $10,0[illegible]. [illegible] Russell, [illegible] Clifton Ave., Baltimore, is the Arch.

✦**Norfolk, Va.**—The contract for the construction of the warehouse for the Security & Safe Deposit Co. has been awarded to the RICHARDSON CONSTRUCTION CO., Norfolk, at $[illegible].

✦**Tallahassee, Fla.**—The contract for the construction of the warehouse, for the Mutual Warehouse Co., has been awarded to O. H. PARKER, Tallahassee.

Avondale (Birmingham Post office), **Ala.**—The International Export Co. contemplates erecting an oil plant at Avondale. The estimated cost is $1,000,000. J. A. Landry, 620 Audubon Bldg., is interested.

✦**Jackson, Miss.**—The contract for constructing the roundhouse and buildings for the Illinois Central R.R. has been awarded to GEORGE B. SWIFT & CO., Chicago, Ill.

✦**Memphis, Tenn.**—The contract for constructing a roundhouse at Forrest Yards, for the Southern Ry., has been awarded to the CONSOLIDATED ENGINEERING CO., Baltimore, at $6[illegible],000.

✦The Southern Ry. has awarded the contract for the construction of shop buildings to the RAGLAND, BAXTER MORFORD CO., Nashville, Tenn.

Canton, Ohio—The Stark Broom Co., Canton, Ohio, recently incorporated with a capital of $30,000, will construct a broom factory in Canton. L. A. Maust and A. O. Hard are interested.

✦**Cleveland, Ohio**—The Enamel Products Co. has awarded the contract to WILLIAM DUNBAR & CO., Cedar Ave., Cleveland, for constructing a factory. It will be 7[illegible]x250 ft.

Galion, Ohio—The American Metallic Grave Vault Co., Galion, will make extensions and improvements to its present plant.

✦**Toledo, Ohio**—The Turner Realty Co. has awarded the contract to S. J. PICKETT, Toledo, for constructing a five-story concrete warehouse, at about $75,000.

Hartford City, Ind.—The South Bend Pickle Works, South Bend, Ind., plans to construct a factory at Hartford City. Estimated cost, $10,000.

Indianapolis, Ind.—The National Automobile Co., Indianapolis, will construct a factory addition.

✦**Laporte, Ind.**—The contract for constructing a factory at Laporte has been awarded to the LARSON-DANIELSON CO., Laporte. Estimated cost, $125,000.

Chicago, Ill.—The Chicago & Alton R.R. Co., Chicago, will construct a roundhouse to cost $[illegible].

Dallas, Ill.—Fred and A. S. Dusenberg, Dallas, plan to construct a factory at Dallas for the manufacture of "Dusenberg" engines and cars.

East St. Louis, Ill.—The Central [illegible] & Machinery Co., East St. Louis, plans to construct a factory to cost $35,-[illegible].

Milwaukee, Wis.—[illegible] & Son, Archs., Germania Bldg., Milwaukee, are receiving bids for the construction of a freight warehouse for the Chicago, [illegible] & Milwaukee [illegible] at the foot of [illegible] St. Estimated cost, $[illegible].

New London, Wis.—The [illegible] Mfg. Co., West Bend, Wis., plans to construct a factory at New London. [illegible] Civil Advancement Association, is interested.

Sheboygan, Wis.—The Sheboygan [illegible] Furniture Co. will construct a [illegible] factory. Estimated cost, $[illegible].

Denison, Iowa—The [illegible] Bottling Works plan to construct [illegible].

Duluth, Minn.—The Minnesota Glove & Fur Mfg. Co., Duluth, [illegible] plans to construct a glove factory in Duluth. Estimated cost $[illegible]. Percival M. Young is [illegible].

Duluth, Minn.—[illegible], Milwaukee, Wis., plans to construct a [illegible] factory at Duluth. Estimated cost, $[illegible].

St. Louis, Mo.—[illegible]

Dallas, Tex.—The Commissioners of [illegible] County have [illegible]

Portland, Ore.—[illegible]

Bakersfield, Calif.—[illegible]

Crockett, Calif.—[illegible]

Heber, Calif.—[illegible]

Los Angeles, Calif.—[illegible]

Los Angeles, Calif.—[illegible] Ave. and [illegible]

St. for the Dixon Art Glass Co., 1356 Wall St. The building will be [illegible]x140 ft., and will have reinforced concrete frame, roof slab and floors, brick filler walls, ruffled brick exterior facing with artificial stone trim. The cost is estimated at $6[illegible],0[illegible]0.

Oakland, Calif.—The California Fireproofing Co., Bankers' Investment Bldg., San Francisco, Calif., plans to construct a factory at Oakland. S. W. [illegible] is Secy.-Treas.

Palermo, Calif.—Grinnel Burt and associates, of Palermo, will construct an olive pickling and canning plant. Estimated cost, $10,000.

Santa Clara, Calif.—P. A. Brangier and others of Santa Clara, plan to construct a potash plant at Lick's Mill, two miles north of Santa Clara. Estimated cost, $1[illegible],0[illegible]0.

Brampton, Ont.—Bids are being received by Audrey Butler, Arch., 104 Main St., Niagara Falls, Ont., for a jam factory for Landners, Ltd., to be constructed at Brampton.

Goderich, Ont.—J. E. Baechler, Goderich, plans to construct an addition to his furniture factory. Estimated cost, $50,000.

Hamilton, Ont.—Proctor & Gamble, Cincinnati, Ohio, will construct a factory at Hamilton. Plans have been prepared.

St. Catharines, Ont.—The Marathon Rubber Co., Akron, Ohio, is having plans prepared for a plant to be constructed at St. Catharines. Estimated cost, $[illegible]0,000.

Medicine Hat, Alta.—The Saskatchewan Bridge & Iron Co., Medicine Hat, plans to construct a plant to cost $2[illegible]0,000.

Lulu Island, B. C.—The British Columbia Steel Works, Lulu Island, plan to construct additional buildings. A site of five acres has been purchased.

FEDERAL GOVERNMENT WORK

Repairing Vessel—Portland, Maine—Bids will be received by the Lighthouse Inspector, Portland, until 2 p.m., Oct. 2[illegible], for docking and repairing Portland light vessel.

Appraisers Stores—Boston, Mass.—The government will construct appraisers stores at Otis Wharf, Atlantic Ave., Boston, to cost about $1,2[illegible]0,000. W. N. Collier, Post Office Bldg., is in charge.

★**Coal**—New York, N. Y.—(Official)—Bids will be received until noon, Oct. 8, by Col. S. W. Roessler, Army Bldg., for furnishing and trimming into U. S. dredges during the period ending Sept. 30, 1915, 90[illegible]0 to 25,000 tons (more or less) of bituminous coal.

Lighting Fixtures, Etc.—New York, N. Y.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Oct. 22, for installing a conduit and wiring system, and lighting fixtures at the U. S. appraiser's warehouse, New York, N. Y.

Repairs To Building—Trenton, N. J.—Bids will be received at the office of the Custodian, U. S. Post Office, Trenton, until 2 p.m., Oct. 13, for making repairs to the building.

✦**Storehouses**—Philadelphia, Penn.—The contract for constructing the artillery and metal storehouses at the Frankford Arsenal, has been awarded to P. J. HURLEY, 1[illegible]3 Cherry St., Philadelphia, at $17,977 and $11,9[illegible] respectively. Noted Sept. 10.

Porches—Philadelphia, Penn.—(Official)—Bids will be received by H. R. Stanford, Ch. Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Oct. 1[illegible], for constructing porches on marine officers quarters, Nos. 4 and [illegible], Navy Yard, Philadelphia.

✦**Cement Sidewalks**—Washington, D. C.—The contract for constructing about 7[illegible] sq. yd. of cement sidewalks has been awarded to EDWARD [illegible], Washington, D. C., at [illegible]6c. per sq. yd.

Road Work—Washington, D. C.—The following bids were received by the [illegible] Quartermaster, Washington, for [illegible] the road from Highway bridge to Arlington, Va.: [illegible], Washington, D. C., $[illegible]; [illegible] Bros., Washington, D. C., $[illegible]; Harper & [illegible], Washington, D. C., $[illegible]; L. M. [illegible], Washington, D. C., $[illegible].

Lintels—Washington, D. C.—Bids will be received by the Commissioners [illegible]

Refrigerating Apparatus—Washington, D. C.—[illegible]

Skylights—Washington, D. C.—The following are the bids [illegible]

★**Laundry Machinery**—Washington, D. C.—(Official)—Bids [illegible]

✦**Post Office**—[illegible], Va.—The contract for constructing the post office at [illegible] has been awarded to W. H. [illegible], New York, N. Y., at $[illegible]. The building will be of [illegible].

Turbines and Compressors—Wheeling, W. Va.—Bids will be received by [illegible], Engineers Office, Wheeling, until 11 a.m., Oct. 1[illegible], for furnishing and delivering two [illegible]-hp. water turbines and two [illegible] air compressors at dam No. [illegible], Ohio River.

+Post Office—Rocky Mount, N. C.—The contract for constructing the post office at Rocky Mount has been awarded to the J. S. ROGERS & CO., Moorestown, N. J., at $62,633. The building will be of limestone.

Roofing Material—Atlanta, Ga.—Bids will be received by F. H. Duehay, Supt. of Prisons, Dept. of Justice, Washington, D. C., until 10 a.m., Oct. 12, for furnishing and delivering at the United States penitentiary, Atlanta, reinforcing material for roof of west main cell wing, U. S. penitentiary, Atlanta.

+Post Office—Bardstown, Ky.—The contract for constructing the post office at Bardstown has been awarded to ROGERS & KAISER, Webster Bldg., Chicago, Ill., at $56,428.

Steel Hull—Cincinnati, Ohio—Bids will be received by Lieut. Col. H. Jervey, Custom House, Cincinnati, until 10 a.m., Oct. 28, for constructing a steel hull for Big Sandy River, W. Va., and Ky.

Steel Deck Barges—Cincinnati, Ohio—(Official)—Bids will be received until 10 a.m., Oct. 23, by Lieut. Col. H. Jervey, Custom House, Cincinnati, for constructing two steel deck barges.

+Post Office—Winfield, Kan.—(Official)—The contract for constructing the post office at Winfield has been awarded to the DIETER & WENZEL CONSTRUCTION CO., Wichita, Kan., at $51,200. The building will be of limestone. Noted Aug. 20, and Sept. 10.

Post Office—Mandan, N. D.—The following are the bids received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for constructing a post office at Mandan: (a) limestone; (b) sandstone: George W. Stiles Construction Co., Chicago, Ill. (a) $45,000; Watt Construction Co., Mott, N. D. (a) $46,000; (b) $46,300; J. W. Miller, St. Paul, Minn., (a) $47,439. Noted Aug. 20.

+Post Office—Brigham City, Utah—The contract for constructing the post office at Brigham City has been awarded to GEORGE A. WHITMETER & SONS, Ogden, Utah, at $50,234. Noted May 7 and June 11.

Steel Pipes—Okanogan, Wash.—Bids will be received until 2 p.m., Oct. 13, at the office of the U. S. Reclamation Service, Los Angeles, Calif., until 2 p.m., Oct. 13, for erecting riveted steel pressure pipes for the Okanogan project.

★Lantern—Portland, Ore.—(Official)—Bids will be received by the Lighthouse Inspector, Portland, until 2 p.m., Oct. 10, for furnishing one standard fourth order lantern.

Quay Wall—Mare Island (Vallejo post office), Calif.—Bids were received by the Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. G., on Sept. 19, for pile and lumber work for reconstructing the quay wall at the navy yard, Mare Island, Calif., from the Thompson Bridge Co., 103 Main St., San Francisco, at $20,534, and the Healy-Tibbitt Construction Co., San Francisco, at $30,000.

Tower and Tank—Honolulu, Hawaii—Bids will be received until 3 p.m., Oct. 27, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a concrete water tower, concrete tank, etc., at the quarantine station, Honolulu.

+Cold-Storage Plant — Pearl Harbor, Hawaii — The contract for the construction and equipment of an ammonia ice-making and refrigerating plant, has been awarded to the VILTER MFG. CO., Milwaukee, Wis., at $18,600. Noted July 30 and Sept. 3.

Steel—Philippine Islands—(Official)—The following are the bids received by Col. S. W. Roessler, Corps Engrs., U. S. A., Room 707, Army Bldg., New York, N. Y., for furnishing structural steel for the Philippine Islands: Theodore Smith & Sons, $6681; United States Steel Export Co., $5991; Riter-Connelly Mfg. Co., $7740; Independent Bridge Co., $7700; Pennsylvania Bridge Co., $6340. Noted Sept. 17.

MISCELLANEOUS

+Fire Cable—Boston, Mass.—The contract for furnishing the fire department with rubber insulated lead covered cable has been awarded to the STANDARD UNDERGROUND CABLE CO., at $7201. Other bids were: National India Rubber Co., $8114; F. M. Ferrin, $8285; Safety Insulated Wire & Cable Co., $8377.

Wharf—Boston, Mass.—Bids will be received until Oct. 8, by the Public Works Dept., for the construction of a wharf and fender pier at Broadway Bridge. L. K. Rourke is Comr.

Seawall—Boston, Mass.—Bids will be received until Oct. 7, by the Public Works Dept., for the construction of a seawall along East First St., South Boston. L. K. Rourke is Comr.

Pavilion and Tunnel—Boston, Mass.—Bids will be received until Oct. 5, by the City Hospital Trustees for the erection of a ward pavilion and tunnel at Harrison Ave. and Northampton St., A. Schuman is the Chn. Edward P. Dana, 20 Central St., is the Arch.

+Zoological Building—Boston, Mass.—The contract for the construction of the elephant house at Franklin Park has been awarded to JOHN F. GRIFFIN CO., at $27,916.

Barge Canal Work—Albany, N. Y.—Duncan W. Peck, State Supt. of Pub. Wks., will receive bids until noon, Oct. 27, for the following work: (Contract 14-B, Erie Canal, Sections 1 and 2.) For closing the openings in the Crescent Dam, removing the Erie Canal aqueduct and Halfmoon Bridge at Crescent, and making repairs to the lock and dam at Vischers Ferry. Estimated cost, $79,965; (Terminal Contract No. 35), constructing a dockwall on the north bank of the Mohawk River, near the Erie Canal aqueduct, at Crescent. Estimated cost, $11,976.

Barge Canal Work—Albany, N. Y.—Bids will be received on Oct. 20, at noon, by Duncan W. Peck, State Supt., Pub. Wks., Albany, for the construction of five additional pieces of barge canal work, as follows: Contract K, for constructing the superstructure of three highway bridges at Ovid St., Bridge St. and Seneca Falls and Washington St.; Contract M, furnishing power plants, electrical equipment and machinery, for operating and lighting locks, 1, 2, 3, and 4 of the Cayuga and Seneca canal; Contract 115, building the superstructure of movable dam 4 over the Mohawk River at Scotia; Contract 55-B, replacement of gate hoists and the furnishing and installation of chain hoists and additional guides for gate stems at the Delta dam; Contract C-1, clearing the site for construction work at Seneca Falls, including the removal of 181 buildings.

+Barge Canal Work—Albany, N. Y.—Duncan W. Peck, State Supt., Pub. Wks., has awarded contracts as follows: Raising and improving portion of highway on west side of Oswego River, Granby, I. M. LUDINGTONS SONS, INC., at $2505; completing construction of canal from Crockers Reef to Ft. Edward, HOLLER & SHEPPARD, Rochester, at $120,459; construction of bridge over Erie Canal, Yorkville, SCOTT BROS., Rome, at $94,583; Terminal Contract 324, construction of a dock wall on the east bank of Hudson River at Thompson, CHAMPLAIN ENGINEERING AND CONTRACTING CO., Saratoga Springs, at $16,843; construction of lock and removal of tide gates in Shinnecock and Peconic canal, RIVERSIDE CONTRACTING CO., New York, N. Y., at $38,368; constructing certain highways adjacent to Hinckley Reservoir, JACKSON L. RICHMOND, Little Falls, at $93,981; Contract 126, raising bridges at Mechanicsville, HORSEHEADS CONSTRUCTION CO., Horseheads, N. Y., at $6904; Contract 125, constructing substructure, superstructure and approaches of Vischers Ferry Road Viaduct, over Troy-Schenectady branch of N. Y. C. & H. R. R.R., KEITH O. GUTHRIE, Schenectady, at $41,267; improvement of Fulmer Creek, Mohawk, S. R. ROSOFF, Herkimer, N. Y., at $5875. Noted Aug. 20 and Sept. 3.

★Boiler, Stack, Etc.—Binghamton, N. Y.—(Official)—Bids will be received by the State Hospital Commission, Capitol, Albany, until 3 p.m., Oct. -9, for installing a new boiler, stack, etc., at the Binghamton State Hospital, Binghamton, N. Y. Lewis F. Pilcher, Capitol, Albany, is State Arch.

★Building Improvements—Buffalo, N. Y.—Bids will be received until noon, Oct. 19, by Dr. Thomas Finnegan, Asst. Comr. of Elementary Education, Education Bldg., Albany, N. Y., for construction of a rear porch on the principal's residence, interior telephones, clocks, program, bells and fire-alarm system for the State Normal School, Buffalo, N. Y. For further information, see advertisement under "Contracts to Be Let."

+Subway—New York, N. Y.—(Borough of Manhattan)—(Official)—The Public Service Commission has awarded the contract for the construction of Section 2I, Route 48 of the Park Place, William and Clark St. subway route to SMITH, HAUSER & McISAAC, INC., at $2,254,670. Noted Sept. 17.

+Dredging—New York, N. Y.—(Official)—(Borough of Brooklyn)—The contract for dredging 15,000 yd. in Newtown Creek was awarded Sept. 22 to WILLIAM BEAR, at 40c. per cu.yd., scow measurement.

+The contract for dredging 5000 yd. in Gowanus Canal was awarded to R. G. PACKARD CO., at 42½c. per cu.yd. Noted Sept. 17.

Removing Foundations, Etc.—New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by Cabot Ward, Pres., Park Bd., Municipal Bldg., Borough Manhattan, until 3 p.m., Oct. 8, for the removal of old foundations, piles, bulkheads, walks, floors, columns, etc., also excavating and grading at Seaside Park. This contract has been abandoned by Charles O'Hara.

Roof Repairs—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by John A. Kingsbury, Comr., Dept. Public Charities, Municipal Bldg., until Oct. 8, for laying new tin roof and repairing slate and metal work on the Metropolitan Hospital, Blackwells Island. Bids will be received on the same date also for laying new tin roof and repairing slate and sheet metal work on the T. & S. Bldg., Blackwells Island.

+Elevated Railroad Work—New York, N. Y.—(Borough of Brooklyn)—The New York Municipal Railway Corporation, with the approval of the Public Service Commission, has awarded the contract to the EMPIRE CONSTRUCTION CO., for the installation of tracks and line equipment on the Liberty Ave. extension, at $115,987.

+Channel Work and Dams—Rochester, N. Y.—The contract for deepening the channel from Upper Falls to the Central Ave. dam and for the construction of the movable dams has been awarded to the T. A. GILLESPIE CO., at $59,600. Noted July 9.

Wharf—Jersey City, N. J.—The Board of City Commissioners plans the construction of a city wharf at the foot of Howell St. Property for the improvement is now under negotiation.

+Pier—Trenton, N. J.—The city has awarded the contract for the construction of a reinforced concrete and frame pier to the AMERICAN PAVING & CONSTRUCTION CO., South Ninth St., Philadelphia, Penn., at $41,490.

Fire Station and Apparatus—Westville, N. J.—The Union Fire Co. plans the erection of a fire station and the purchase of improved fire apparatus.

Motor Fire Apparatus—Williamsport, Penn.—The city is contemplating the purchase of an automobile fire truck.

Harbor Improvements—Baltimore, Md.—The Board of Estimates has approved proposed harbor loan for improvements estimated to cost approximately $1,500,000, itemized as follows: $250,000 for dredging channel to 35 ft.; $1,000,000 to complete third section of Key Highway; $350,000 to widen St. Paul St., from Center to Lexington St. O. F. L. Lackey is Harbor Engr. Noted Sept. 3.

Undergrade Crossing—Graham, Va.—The Norfolk & Western Ry. plans to construct an undergrade crosing estimated to cost $20,000. J. E. Crawford, Roanoke, is Ch. Engr.

Marine Railway and Floating Drydock—Norfolk, Va.—W. E. Thomas & Co., Norfolk, have purchased property with river frontage of 375 ft. where a 1500-ton marine railway and a floating drydock of 3500 tons capacity will be constructed. The estimated cost is $150,000.

Tunnels—Parkersburg, W. Va.—It is reported that the Charleston, Parkersburg & Northern Ry. contemplates the construction of five tunnels along the railway Parkersburg and Charleston, a distance of 75 miles. Robert Cutler is the Ch. Engr.

♦**Dock**—[illegible], S. C.—The Southern Ry. has awarded the contract for the construction of coal dock facilities at this point to the WELLMAN-SEAVER-MORGAN CO., Cleveland, Ohio. The estimated cost is $[illegible].

Terminal Docks and Building—Savannah, Ga.—See item under "Buildings."

Drainage—[illegible], Fla.—The [illegible] Creek Drainage District, [illegible], Secy., will probably receive bids about Nov. 1 for the construction of a drainage system in central Polk County. Reclamation plan includes system of open ditches with [illegible] and [illegible] laterals. Total yardage about [illegible] cu. yd. Estimated cost $[illegible]. McIlush & Broyhill, [illegible]ington, Ill., are the Engrs.

♦**Swimming Pool**—Gulfport, Fla.—The Bay View Development Co. has awarded the contract for the construction of a [illegible]-ft. reinforced concrete swimming pool at Boca Ciega Bay to Z. FRANKLIN POTTER, Petersburg, Fla.

♦**Dredging and Terminal Docks**—Jacksonville, Fla.—The [illegible] Co. has awarded the contract for the construction of terminal docks and a bulkhead at Talleyrand Ave., to W. P. RICHARDSON & CO., Jacksonville. The contract for dredging slips on either side of the docks was awarded to G. W. PARKHILL.

♦**Water and Sewer System**—Camp Hill, Ala.—(Official)—Bids will be received by the town until noon, Oct. 15, for constructing water and sewer systems. W. C. Newell is Mayor and Edgar B. Kay, Tuscaloosa, is Engr. For details, see advertisement under "Contracts to Be Let."

Terminal Improvement—New Orleans, La.—The New Orleans Ry. & Light Co., according to press reports, plans to spend $[illegible] in improvements to its terminal property.

♦**Levee**—New Orleans, La.—The Orleans Levee Board has awarded the contract for levee work to J. H. LEWIS, as follows: [illegible]-ft. levee from Naval Station to Orleans St., and new levee and enlargement from Orleans to Camus. Noted Sept. 17.

Tracings—Cincinnati, Ohio—Bids will be received by Philip [illegible], Dir. Pub. Ser., City Hall, until noon, Oct. [illegible], for furnishing six reproductions on cloth from the tracings of the [illegible] survey of the city of Cincinnati. The estimated number of tracings to be reproduced is [illegible]. Specifications, from office of Division of Sewerage, 306 Odd Fellows Temple.

Metal Fence and Repairing—Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, room [illegible], City Hall, until Oct. 7, for furnishing metal fence for the [illegible] Reservoir, and until Oct. 9 for repairing, straightening and extending present iron fence. Plans and specifications are at the office of C. F. Schultz, Water Dept.

Tower House and Tunnel—Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, Room [illegible], City Hall, until noon, Oct. 9, for the construction of a tower house and tunnel for the Cleveland City Hospital group. Plans and specifications may be had from the City Architect, [illegible] City Hall.

Boat House—Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, Room [illegible], City Hall, until noon, Oct. 9, for the construction of a boat house at [illegible] Lake Park. For plans and specifications address, City Architect, [illegible] City Hall.

Parks and Playgrounds—Dayton, Ohio—The citizens will vote at the November election on $[illegible] bond issue for the construction of parks and playgrounds.

♦**Ditch**—[illegible], Ind.—The contracts for the construction of a ditch for draining [illegible] acres in [illegible] and [illegible] Counties have been awarded as follows: (Metal portion), [illegible] CONSTRUCTION CO., [illegible], Ind., at $[illegible]; (earth portion), [illegible] & [illegible] CO., [illegible] at $[illegible]. Noted [illegible].

♦**Drainage**—[illegible], Wis.—The general contract for the [illegible] has been awarded to JOHN [illegible]ETT, [illegible].

♦**Drainage**—[illegible], Iowa—The contract for the [illegible] ft. [illegible] has been awarded to [illegible] at $[illegible].

Drainage—[illegible] Improvement District No. [illegible]. The estimated cost is [illegible].

Levee—[illegible] is the Engr.

♦**Drainage**—[illegible]

Natatorium—[illegible]

Drainage—[illegible]

♦**Grain Elevator**—[illegible]

♦**Dock**—[illegible]

♦**Dredge**—[illegible]

Dams and Levees—Los Angeles, Calif.—Los Angeles County is having the preliminary surveys made and plans to build a series of dams and levees for protection from high waters. The estimated cost of the project is $[illegible],000,000. H. Hawgood is Chmn. of the Bd. of Engrs.

Bulkhead—San Diego, Calif.—The San Diego Reclamation & [illegible] Co. has entered into negotiations with the city, and if satisfactory to both parties, plans to construct a bulkhead from [illegible] to Hawthorne St. The estimated cost is $[illegible].

Car Loops and Foot Bridges—San Francisco, Calif.—Plans have been prepared by M. M. O'Shaughnessy, City Engr., for new car loops at the Ferry Bldg. and foot bridges over the Embarcadero. The estimated cost is $[illegible].

Piers—San Francisco, Calif.—The State Board of Harbor Commissioners has authorized the calling for bids for the construction of Piers No. 16 and 18, to be located between Mission and Howard Sts. Each pier will be [illegible] ft. built on creosoted piles.

Elevators—Montreal, Que.—Bids will be received until Oct. 7 by the Department of Public Works for the installation of two standard passenger and six standard freight elevators in the Examining Warehouse, Montreal. R. C. Desrochers is the Secy.

BUILDINGS

Boston, Mass.—Bids will be received, until Oct. 6, by the Schoolhouse Commissioners, for constructing a school on Blossom St.

Framingham, Mass.—Bids were received for the construction of the dormitory and refectory in connection with the State Normal School, as follows: Kennedy & Peterson Construction Co., Boston, at $67,800; J. J. [illegible] Co., South Framingham, $71,[illegible]; Charles E. Currier Co., Boston, $72,[illegible]; Whiton & Haynes Co., Boston, $73,968; Thomas P. Hurley, Marlboro, $7[illegible]; Edward F. Miner Building Co., Worcester, $74,730; Norcross Bros. Co., Boston, $74,[illegible]; Buckley Co., $7[illegible]; Michael J. Rousseau, $7[illegible]; Holt, Fairchild Co., Boston, $77,326; J. W. Bishop, Worcester, $77,[illegible]; F. W. Pittman Co., Lawrence, $81,[illegible]; John W. Duff Co., $82,064; Bigelow & Harriman, Boston, $83,28[illegible]; Woodbury & Leighton Co., $85,976; John J. Powers, Worcester, $89,[illegible]; Harry L. Egan, South Framingham, $[illegible]; Merrill & Taber, Framingham, $[illegible]; William Crane, $88,165. Noted Sept. 24.

Somerville, Mass.—Augustus [illegible], Dorchester, will erect a three-story, 130x200-ft. brick apartment house on [illegible] St. The estimated cost is $75,000.

♦**Springfield, Mass.**—The general contract for the construction of the mercantile building for the Liberty Realty Trust has been awarded to FRED T. LEY & CO., Springfield.

Worcester, Mass.—The lowest bid received for the construction of the [illegible] Square schoolhouse was submitted by the Central Building Co., at $6[illegible]. Noted Sept. 17.

Pawtucket, R. I.—Bids will be received until noon, Oct. [illegible], by [illegible], Engr., New Haven, Conn., for the union station at Pawtucket for the N. Y., N. H. & H. R.R. The estimated cost is $[illegible].

♦The contracts for the construction of the Newport Ave. school and the [illegible] St. school have been awarded to F. G. [illegible]OWLEY CO., Pawtucket, R. I. Noted Sept. [illegible].

Milford, Conn.—Bids will be received until [illegible] p.m., Oct. [illegible], by the Town School Committee, for a brick school at Walnut Beach. Joseph A. Jackson, [illegible] Broadway, New York, N. Y., is the Arch.

New Britain, Conn.—Plans have been completed for a high school on [illegible] St. It will be [illegible] ft. of brick and reinforced concrete construction. Walter P. [illegible], [illegible] Main St., is the Arch. Noted June [illegible].

Norwalk, Conn.—Plans have been completed for a two-story [illegible] school on Prospect Ave. It will be [illegible] ft. Joseph A. Jackson, [illegible] Broadway, New York, N. Y., is the Arch.

South Norwalk, Conn.—The Norwalk Hospital Association contemplates the erection of a hospital on [illegible] Ave., South Norwalk. The estimated cost is $[illegible].

Harriman, N. Y.—W. I. [illegible], Arch., [illegible], is preparing plans for a [illegible] high school at Harriman. The estimated cost is $[illegible].

♦**Hicksville, N. Y.**—The general contract for the construction of the [illegible], Hicksville, has been awarded to [illegible], [illegible], L. I. The estimated cost is $[illegible].

Ithaca, N. Y.—[illegible], Archs., [illegible], are preparing plans for the construction of [illegible] at Cornell University. The estimated cost is $[illegible].

New York, N. Y.—[illegible] Co. will erect [illegible] apartment house at [illegible]. The estimated cost is $[illegible]. [illegible] is the Arch.

Plans have been completed by Robert [illegible], Arch., [illegible] Fifth Ave., for a [illegible] hospital at [illegible]. The estimated cost is $[illegible].

New York, N. Y.—(Borough of Manhattan)—Plans have been completed for a [illegible]-story [illegible] building to be erected at [illegible]. The estimated cost is $[illegible].

New York, N. Y.—(Borough of Manhattan)—Plans have been completed by [illegible], Archs., [illegible], for a [illegible]-story apartment house to be erected at [illegible]. The estimated cost is $[illegible].

Plans have been completed by Robert T. Lyons, Arch., [illegible], for a [illegible]-story apartment house to be erected at [illegible] Ave. and [illegible] St. The estimated cost is $[illegible].

The [illegible] Co., [illegible] and McDougall Sts., [illegible] building at [illegible]. The estimated cost is $[illegible].

Plans have been completed for the construction of a 12-story apartment house at Park Ave. and 54th St. The estimated cost is $500,000.

The New York Order of the Knights of Columbus contemplate erecting a clubhouse. The estimated cost is $125,000. William P. Myhan, 120 Franklin St., is Chn. of Com.

+The general contract for the construction of the six-story brick and limestone parochial school at 147 St. Nicholes Ave., has been awarded to M. REID & CO., INC., 114 West 59th St., New York.

+The general contract for the construction of a three-story store and loft building at 451 Fourth Ave., for the Ogden Goelet Estate has been awarded to R. H. CASEY, 246 West 16th St., New York.

Poughkeepsie, N. Y.—Edward C. Smith, 39 Market St., is preparing plans for the school to be erected at Poughkeepsie. The estimated cost is $75,000.

Belleville, N. J.—Charles Granville Jones, Arch., Belleville, is preparing plans for the erection of a high school at Belleville. The estimated cost is $106,000. Noted Sept. 3.

+Bradley Beach, N. J.—The contract for constructing the addition to the Bradley Park school has been awarded to GEORGE W. HENDERSON, Avon, N. J., at $52,000. Other bidders were as follows: Herbert Gardner, Asbury Park, N. J., $54,807; Charles E. Preston, Monticello, N. Y., $54,150; Berry Goodwin Co., Philadelphia, Penn., $55,257.

+Elizabeth, N. J.—The contract for construction of the school at Grove and Murray Sts. has been awarded to EDWARD M. WALDRON, INC., Newark, at $72,412.

Jersey City, N. J.—The lowest bid received for the erection of School No. 5, Merseles and Third St., has been submitted by W. H. and F. W. Cain, at $228,916. Noted Sept. 3.

Montclair, N. J.—Bids will be received, until Oct. 5, by Guilbert & Betelle, Archs., 665 Broad St., Newark, N. J., for the construction of the dormitory for the Russ Memorial Hall. The estimated cost is $90,000.

New Brunswick, N. J.—The Board of Education is having plans prepared for the construction of a high school. The estimated cost is $150,000.

Paterson, N. J.—The Board of Education is planning the erection of additions to Schools Nos. 6, 10 and 21. John R. Wilson is Supt.

Allentown, Penn.—The Board of Trustees of the Rittersville State Homeopathic Hospital, have adopted plans for the construction of buildings. An appropriation of $105,000 has been made.

Elizabethtown, Penn.—The Pennsylvania R.R. Co. contemplates constructing a station at Elizabethtown. The estimated cost is $40,000.

New Kensington, Penn.—S. F. Heckert, Arch., Bessemer Bldg., Pittsburgh, is preparing plans for the construction of a hospital for the Citizens General Hospital. The estimated cost is $50,000.

Pittsburgh, Penn.—Plans have been completed by Janssen & Abbott, Archs., Pittsburgh, for the construction of a three-story brick building for the Tuberculosis League, Bedford Ave. and Wandless Sts. The estimated cost is $50,000.

Wilkes-Barre, Penn.—Plans are being prepared by Sturtevant & Poggi, Archs., Coal Exchange Bldg., for a four-story brick and steel Masonic Temple at Wilkes-Barre. The estimated cost is $75,000.

+Wilkes-Barre, Penn.—The contract for the erection of a two-story high school on Casey Ave. has beeen awarded to HERMAN MAILANDER, 169 Barney St., Wilkes-Barre. Owen McGlynn, Simon Long Bldg., is the Arch.

+Hagerstown, Md.—The contract for the construction of the Maryland Theater has been awarded to G. B. McWOLF, Hagerstown, at $90,000. Noted June 4.

Alexandria, Va.—Bids will be received until Oct. 9, by Committee on Public Property and Commission on Schools, for constructing a high school on Cameron St. Noted Sept. 17.

Lexington, Va.—Bids wil be received, until Oct. 7, by Flournoy & Flournoy, Archs., Wilkins Bldg., Washington, D. C., for the construction of a three-story and basement, 220x80-ft. gymnasium. The estimated cost is $80,000.

Charleston, W. Va.—Bids will be received, about Oct. 25, by F. L. Packard, Arch., Hayden Bldg., Columbus, Ohio, for constructing a school. The estimated cost is $150,000.

+Spartanburg, S. C.—The general contract for constructing the two-story city hall and jail has been awarded to L. E. PALMER, Augusta, Ga.

+Savannah, Ga.—The contract for the erection of terminals at Savannah, for the Ocean Steampship Co., has been awarded to the PHOENIX CONSTRUCTION CO., New York, at $700,000.

Dunedin, Fla.—Bids will be received, until Oct. 6, by Dixie M. Hollis, Secy. Bd. of Pub. Instruction, for constructing a brick school at Dunedin.

Jacksonville, Fla.—The lowest bids for the erection of the jailer's residence, courthouse and jail, were submitted by W. P. Richardson & Co., Jacksonville, at $214,160, and $207,163, respectively. Noted Sept. 3.

+Miami, Fla.—The contract for the construction of a high school has been awarded to ST. JOHN CONSTRUCTION CO., Miami, at $46,570. Noted May 21.

Panama City, Fla.—Bids will be received, until Oct. 5, by R. L. McKenzie, Chn., Bay County Comrs., for constructing the courthouse and jail. The estimated cost is $60,000.

+Tampa, Fla.—The contract for the construction of the public library at Tampa has been awarded to AULICK, BATES & HADNELL, Tampa, at $47,565. Noted Sept. 3.

+Meridian, Miss.—The contract for the construction of the city hall has been awarded to HANCOCK & MCARTHUR, at $88,000.

+Walthall, Miss.—The general contract for the construction of the courthouse for the Webster County Commission has been awarded to the LITTLE CLECKLER CONSTRUCTION CO., Anniston, Ala., at $35,000. Noted Aug. 20.

+Paris, Ky.—The contract for the construction of the Y. M. C. A. building has been awarded to CULLEN & VAUGHN, Hamilton, Ohio, at $45,000.

Ashtabula, Ohio—Bids were received, Sept. 24, by the Board of Education for constructing the new high school. The lowest bid was submitted by the Mayben-Frenchtel Co., Gadsen, Ala., at $147,278.

+Canal Dover, Ohio—The contract for the construction of the proposed high school has been awarded by the city to the WENTZ CONSTRUCTION CO., Canal Dover, at $126,619. Howard & Merriam, Columbus, Ohio, are Archs. Noted July 16.

Cincinnati, Ohio—The Krug Realty Co., Cincinnati, plans to construct a nine-story office building on Walnut St. Estimated cost, $150,000.

Cincinnati, Ohio—Bids will be received until noon, Oct. 22, by William Leimann, City Audr., for the purchase of $100,000 of bonds for the purpose of enlarging, improving, equipping and furnishing the new general hospital.

+Cleveland, Ohio—The contract has been awarded to the ROWLAND E. CURRY CO., 1900 Euclid Ave., Cleveland, for constructing the proposed three-story, fire-proof school, at $151,810. Walker & Weeks, Cleveland, are Archs.

+Cleveland, Ohio—The contract for the construction of a new building at 7911 Detroit Ave., Cleveland, for the St. John's Hospital, has been awarded to the W. B. McALLISTER CO., 2163 East 31st St., Cleveland. Estimated cost, $125,000. W. S. Lougee, Marshall Bldg., is the Arch.

+Hamilton, Ohio—The contract for constructing the temple for the B. P. O. E. of Hamilton has been awarded to W. C. HANDSKY & SON, Zanesville, Ohio, at $62,743.

+Medina, Ohio—The Pythian Sisters have awarded the contract to RODERICK GRANT, Cleveland, Ohio, for constructing a new building at Medina. Estimated cost, $75,000. Kregelius & Robinson, Leader News Bldg., Cleveland, Ohio, are Archs. Noted July 23.

Oak Harbor, Ohio—Bids will be received until noon, Oct. 10, by the Adjutant-General, Columbus, Ohio, for the construction of an armory at Oak Harbor. B. L. Barger, Columbus, is Secy. State Armory Bd.

+Steubenville, Ohio—Bids have been opened as follows for constructing a market house: Fitzsimmons & Co., $38,000; McFeeley Bros., $39,975; James Coyne, $37,415; GUY JOHNSON CO., $34,886 (awarded contract).

Terre Haute, Ind.—Contracts for the proposed vocational school here will be awarded about Oct. 15. Estimated cost, $150,000. MacLucas & Filton, Lemcke Annex, Indianapolis, Ind., are Archs. Noted Sept. 3.

DAM, CLINTON, MASS.

+Bids were received Sept. 10, by the Water Commissioners, for the construction of a concrete dam at the Heywood Basin, from (A) Thomas A. Cassidy, Fitchburg; (B) R. H. NEWELL & N. S. BROCK, Uxbridge (awarded contract); (C) Walter L. Mellen, Worcester; (D) Murphy & Hennessy, Clinton; (E) Light, Heat & Power Corporation, Boston; (F) King Construction Co., Boston; (G) Ryan & Keon, Boston; (H) Hancock Engineering Co., Boston; (I) G. Rossi & Son, Leominster; (J) Clinton Concrete Co., Clinton. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
600 cu.yd. clearing site for dam and sloping ground	$0.45	$0.45	$0.60	$0.50	$0.72	$2.00	$0.50	$0.90	$0.37	$0.40
380 cu.yd. earth excavation, in trench...	0.45	1.00	0.80	1.00	0.79	3.00	0.50	1.00	0.90	1.00
100 cu.yd. rock excavation, in trench	1.00	1.00	3.25	1.00	1.50	7.00	3.00	1.85	3.00	3.80
2275 cu.yd. earth excavation for waste and discharge channel	0.45	0.50	0.65	0.325	0.66	0.60	0.50	0.85	0.60	0.35
115 cu.yd. rock excavation for waste and discharge channel	1.00	1.50	3.15	1.90	1.50	1.50	3.00	5.00	2.60	2.80
310 cu.yd. concrete masonry, Class A	9.00	8.00	13.27	7.75	10.80	10.35	12.50	11.76	8.00	8.10
360 cu.yd. concrete masonry, Class B.	7.50	7.00	13.27	6.50	7.20	8.95	7.50	6.85	7.75	7.30
300 cu.yd. rubble masonry.	5.25	5.00	5.04	1.75	6.60	5.25	5.50	1.38	5.00	4.50
8700 lb. reinforcing steel..	0.045	0.05	0.04	0.035	0.048	0.025	0.05	0.05	0.05	0.037
310 lin.ft. 36-in. c.i. pipe	9.25	6.55	7.46	8.00	8.60	10.18	8.75	7.95	7.00	8.00
235 lin.ft. 18-in. c.i. pipe	5.00	2.70	2.83	2.50	2.87	1.87	3.25	5.10	6.00	2.55
1 36-in. sluice gate, 36-in. gate valve, 2 18-in. gate valves	1075.00	1025.00	1206.93	1550.00	1123.00	1030.21	2000.00	1200.00	990.00	1213.00
5750 cu.yd. earth fill	0.50	0.39	0.65	0.55	0.48	1.22	0.60	0.90	0.47	0.50
707 sq.yd. paving slope of dam	0.95	1.00	0.70	1.80	1.20	1.65	1.25	1.85	0.95	1.35
350 sq.yd. paving spillway and discharge channels	0.85	1.00	0.65	0.90	1.80	1.50	1.00	1.85	0.75	1.20
350 cu.yd. loaming top and lower slope of dam.	1.75	1.00	0.60	0.50	0.60	1.00	1.75	1.25	0.45	0.40
Flour, door, windows and roof of gate house. .	250.00	350.00	385.00	225.00	300.00	227.00	350.00	600.00	400.00	205.00
Copper screens for gate house.	105.00	100.00	91.86	275.00	58.00	121.00	150.00	100.00	100.00	96.00
Screen for inlet of discharge pipe	90.00	35.00	119.77	45.00	30.00	25.00	50.00	20.00	75.00	34.00
Extended totals.	$19,803	$17,122	$23,034	$18,509	$20,842	$28,207	$21,258	$24,928	$18,675	$17,978

Detroit, Mich.—Revised plans have been completed by W. B. [illegible], Arch., Detroit, for the detention house to be [illegible] by Wayne County. Estimated cost, $[illegible],000. All [illegible] original plans were rejected. Noted Aug. [illegible].

✦Detroit, Mich.—The [illegible] Court Realty Co. has awarded the contract to [illegible] & [illegible]GHTON, Detroit, for constructing [illegible] apartment house. It will be a [illegible] structure of brick and stone.

Detroit, Mich.—Plans are being prepared by E. R. Dunlap, Arch., [illegible], for the [illegible]-story concrete apartment house to be constructed at St. [illegible] and Jefferson Aves., for [illegible] & [illegible], Detroit.

Detroit, Mich.—The congregation of Our Father, Detroit, will erect a new church at Cass and Prentiss Aves. Estimated cost, $[illegible].

✦Detroit, Mich.—The general contract has been awarded to FRANK [illegible], Detroit, for constructing the [illegible] Theater at $[illegible].

Munising, Mich.—[illegible] & Kuetzli, Camp Bldg., Milwaukee, Wis., are preparing plans for a grade school to be [illegible] at Munising. Bids will be received soon. Estimated cost, $[illegible].

Chicago, Ill.—Bids will be received until Oct. 5, by J. B. [illegible], State Arch., 29 South La Salle St., Chicago, for constructing an armory to cost $[illegible]0,000.

✦Joliet, Ill.—The contract has been awarded to VICTOR AHLV[illegible], Joliet, for constructing the St. Cyril Methodist [illegible] at Elwood St. and Henderson Ave., at about $15,000.

✦Peoria, Ill.—The Board of School Inspectors has awarded the contract to R. IBEN, Peoria, for constructing the "Loucks" school, at $42,[illegible]0.

Fond du Lac, Wis.—Plans are being completed by Allen D. [illegible], Arch., Madison, Wis., for the building for the Woman's Industrial Home to be erected near Fond du Lac. Estimated cost, $2[illegible].

✦Menominee, Wis.—The contract has been awarded to JUL[illegible]S [illegible]TKE, Marinette, Wis., for constructing the proposed vocational education building at Menominee. Estimated cost, $50,000.

✦Watertown, Wis.—The Bank of Watertown has awarded the contract to FERDINAND BEHLKE, Watertown, for constructing its proposed new building. It will be two-story and basement, 83x45 ft. A. C. Clas, Milwaukee, Wis., is Arch.

Burlington, Iowa.—Bids will be received until noon, Oct. 1[illegible], by the School Board for constructing two schools. Eckland & De Arment, Moline, Ill., are Archs.

Duluth, Minn.—Plans have been completed by F. W. Perkins, Arch., Chicago, Ill., and Duluth, Minn., for the residence to be constructed by Marcus L. Faye in the East End district.

St. Paul, Minn.—D. H. Bradley and L. T. Lefebre, St. Paul, will construct a seven-story store and office building. Estimated cost, $[illegible].

✦St. Paul, Minn.—The contract has been awarded to GILB[illegible]T[illegible]N & TAN[illegible], Missoula, Mont., for the stone work on the 1[illegible]-story railway exchange.

Independence, Kan.—The City Commissioners will call for an election soon to vote on the question of issuing bonds for a new city hall.

Dodson, Mont.—D[illegible] & J[illegible] Dodson have engaged [illegible] & [illegible], Archs., Helena, Mont., to prepare plans for a $[illegible] hotel to be constructed at Dodson.

Belleville, Mo.—The plans of the Public Library Board for the proposed library have been approved by the Carnegie Commission. Estimated cost, $1[illegible].

Carthage, Mo.—L. M. Th[illegible], County Clk., Carthage, will receive bids until [illegible], Oct. 1[illegible], for the construction of Jasper County almshouse as per plans and specifications of A. C. [illegible], Arch., [illegible] Miners Bank Bldg., Joplin, Mo. Plans are also on file with the County Clerk.

Jefferson City, Mo.—The Central Missouri Trust Co., Jefferson City, has had plans prepared for a [illegible]-story bank building.

Denison, Tex.—[illegible], Arch., Denison, is preparing plans for the hotel to be constructed by the T[illegible] Hotel Co. on West Main St. It will be eight stories, [illegible] ft. Estimated cost, $[illegible].

✦San Antonio, Tex.—The [illegible] Board has awarded the contract to [illegible] & [illegible] Co., San Antonio, for constructing a [illegible] school, at $[illegible]. Noted Sept. [illegible].

✦Seattle, Wash.—The contract has been awarded to [illegible] & [illegible], Missoula, Mont., for the stone work on the [illegible]-story [illegible] building.

Spokane, Wash.—[illegible] cost, $[illegible].

✦Eugene, Ore.—The contract for the construction of the [illegible] building for the University of Oregon [illegible] has been awarded to [illegible], Portland, Ore., at $[illegible]. [illegible]

✦Alhambra, Calif.—The contract has been awarded to [illegible] for constructing [illegible]. [illegible]

[illegible]

✦Lindsay, Calif.—The [illegible] has awarded the contract for the construction of a [illegible] school building [illegible], at $[illegible].

Longbeach, Calif.—[illegible] from four to eight stories. The cost is estimated at $3[illegible].

San Bernardino, Calif.—Bids will be received until 2 p.m., Oct. [illegible], by F. W. Conrad, Secy., High School District, for constructing a group of high school buildings. Anthony [illegible], 14[illegible] Third St., Los Angeles, Calif., is Supt. of Construction.

San Bernardino, Calif.—Bids will be received by the Board of Education until 2 p.m., Oct. 1[illegible], for the construction of the [illegible] high school. Estimated cost, $[illegible].

San Bernardino, Calif.—The Supervisors of San Bernardino County have called an election for Oct. [illegible]. The citizens will vote on the proposition to issue $1[illegible] in bonds for the construction of county hospital buildings.

San Francisco, Calif.—The city plans to construct a three-story and basement detention home to cost $[illegible], on West Mission St. between Brady and 1[illegible]th Sts.

San Francisco, Calif.—The Library Trustees have approved the plans for a new library to cost $1,0[illegible],000. The plans were prepared by George W. Kelham, Arch., Sharon Bldg., San Francisco.

San Francisco, Calif.—Carl Gellfuss, Arch., San Francisco, is preparing plans for a six-story and basement apartment house to be constructed on Powell St.

✦San Francisco, Calif.—The Board of Public Works has awarded a contract for the carpentry and mill work in the new city hall to MONSON BROS., San Francisco, at $1[illegible].

Venice, Calif.—B. Felix and associates, Venice, plan to construct a three-story brick building at Marine and Navy Sts. Estimated cost, $115,000.

Ventura, Calif.—Albert C. Martin, Arch., 1[illegible]0 Higgins Bldg., has completed plans for the new county hospital to be erected at Ventura. The plans have been approved by the State Board of Charities and bids will be asked at once by the Board of Supervisors. The building will be a two-story brick structure, 175x90 ft. Noted Sept. [illegible].

Lachine, Que.—J. E. Vian, Arch., Lachine, is preparing plans for the proposed city hall for Lachine. Estimated cost, $100,000.

Montreal, Que.—F. T. Jackalin, Jacobs Bldg., Montreal, is preparing plans for a theater to cost $60,000.

Toronto, Ont.—Bids will be asked soon by the Provincial Hydro-Electric Commission, Toronto, for the construction of the office building at 1[illegible]2 University Ave. W. W. Pope, Continental Life Bldg., Toronto, is Arch.

Regina, Sask.—Storey & Van Egmond, Archs., Regina, have prepared plans for a three-story store building to be constructed at Albert St. and 1[illegible]th St. Estimated cost, $[illegible],000.

✦Vancouver, B. C.—British Columbia University has awarded the contract to McLEAN & CO., 1[illegible] Pacific Block, Vancouver, for constructing the science building, at about $100,000.

Financiers Loyal to the Country's Welfare—John Skelton Williams, Comptroller of Currency, was recently the principal speaker before the Indiana Bankers Association. An interesting point emphasized by Mr. Williams was the fact that at the present time the United States is a Mount Ararat of a universe overwhelmed by a deluge of blood, of confusion and raging strife, and that the country stood upon the threshold of opportunity for that reason. In part, his speech was as follows:

"The Federal reserve act is not a measure which serves only banks and their customers, but it is destined, I firmly believe, to exert a powerful influence for good on the lives and fortunes of all classes of our population. It is the instrumentality through which the American people will be freed from the domination of a financial oligarchy. It restores to the channels of commerce and industry hundreds of millions of dollars of money which was drawn from the sections where it was most needed to lie idle in the vaults of the big banks in two or three cities or used by [illegible] these banks [illegible] to the stock market.

"It provides for a system to meet completely and effectively the requirements of expanding or contracting business according to the seasons and the varying conditions [illegible]

[illegible]

If we allowed the currency supply to become inadequate for our requirements, we might inflict the penalties of confiscation and ruin on the innocent many to the enrichment of the designing and remorseless few.

"If we should allow inflation of the currency away from safe and solid bases of actual and irreproachable value, we would be like a man drinking himself to frenzy and torpor while his honor and the safety of his home depended on his steadiness and strength. Therefore, we have felt and tested and studied and have striven to work and build swiftly but carefully; to act promptly, but with thoughtful provision for the situation as it is, while keeping alert eyes on the possibilities of the days and months to come.

"In this work all of us have united. It is deeply gratifying to me to be able to certify how much the country owes of its growing prospects and increasing stability to the genius, skill and generous, patient, broad patriotism of its bankers in all sections. Those of New York, Chicago and other large cities have been not only willing but zealous in coöperation and with valuable and timely service. Most of them have tendered their resources and their services to help the public interest. But the people of all grades and sections have, as a general rule, done what they could to forward a difficult and complicated labor.

"The administration has been given full cause to feel gratefully and exultingly that, when the common defense and the general welfare are involved, the free citizens of the United States have no lines of differences in politics, in sections, in social grades or the distribution of the favors of Fortune. The people, regardless of party, have given cordial and cheerful sanction to every movement and act approved by their reason as being for the good of the republic.

"The work of adjustment and of getting the machinery of business on perfect foundations and oiled and leveled is not completed; but it is well started with safe and efficient methods. We and our business machinery will be required to work not only for ourselves, but for the world. The task is enormous, but it is in conjunction necessarily. In protecting our own stability, we protect the world's finance and commerce. In conserving the interests of the other nations, we conserve our own and improve the opportunities that practically are forced upon us. Along with illimitable responsibilities, the prospect of illimitable expansion confronts us."

Trade with Brazil—In a recent issue of the "Daily Consular and Trade Reports," the following article on the present trade situation in Brazil, written by the consuls, appeared:

"As this is the dull season, about the only merchandise to be shipped consists of rubber, although it is possible that some green and sun-dried hides, which ordinarily go to Germany, will go forward, especially if arrangements can be made to fumigate the green hides, sacking them being out of the question on account of cost.

"Aside from this, the situation nere is very complicated because of the lack of sufficient money with which to handle business, the uncertainties of the exchange market, which is largely in the hands of European bankers, and the increase in freight and insurance rates. Until these matters adjust themselves, it will be very difficult for merchants to do business, and especially with the United States, as there are no American banks or shipping companies. The steamship 'Purus,' which carries this dispatch, will leave here in a few days with a fair amount of rubber, most of which is billed to order and is in a measure an experimental shipment. The continuance of shipping in this way will depend upon the result of the sales in this instance.

"Notwithstanding the complicated banking situation, local collections for foreign account continue remarkably good, but orders for new goods will be limited in amount until it can be estimated where the exchange rate will establish itself. For this same reason, no doubt, American exporters are insisting upon cash with orders or guaranties.

"Anxiety as to future coal supplies is becoming more and more apparent as efforts to charter steamers continue to fail. One firm has offered as a special inducement to prepay freight, but to date has failed to arrange for a steamer. The prices of coal, \$3.15 per ton, f.o.b. shipping port, is considered reasonable in view of the circumstances, and it is to be hoped that some means will be found to solve transportation difficulties.

"The daily papers have been most active in advising the local public of the action of American trade and commercial associations and their intentions as regards this market, and as much of our success in retaining this market depends upon the initial action of the American exporter, it is hoped that he will be able to fulfill the promises implied in the action taken by the associations.

"There is an excellent demand here at present, on account of the European war, for all staples, such as corn, flour, canned goods, smoked meats, beans, oil, prints, shoes, hats, hardware, coal, machinery, electrical supplies and drugs.

"Foodstuffs and almost everything else have already trebled in price since the beginning of the month. Coal is now selling at \$40 per ton, but it is understood that the English Government has requisitioned all of the remaining supply that the two leading dealers at Pernambuco (both of whom are English) have on hand. The tramways and gas companies have enough coal to last six weeks only.

"Consul P. Merrill Griffith, Pernambuco, is at a loss to know just what arrangements can be made at present for the payment of merchandise ordered and shipped there, as the banks are all closed by order of the Brazilian Government, and have been for the last two weeks. It is reported that they will reopen soon, but indications are that there will be such a run that they may be forced to close within a short time. With New York houses having known and established representatives here, the situation is different, inasmuch as payments for goods ordered may be deferred indefinitely.

"The best way to send supplies to Pernambuco at present is by steamers flying neutral flags. The Lloyd Brazileiro intends to reëstablish its passenger service between New York and Brazil, which for some time has been discontinued.

"Sugar and cotton are the chief exports, and as this is one of the richest and most fertile sections of Brazil, sugar and cotton are chiefly raised. Nothing is being exported now, and the natives are beginning to realize how much they are dependent upon the outside world for supplies. Thousands are unemployed and many families are already suffering. There is little money and prices are very high. The Government of Argentina will not export any more flour, and the only source of such supplies for Brazil is the United States.

"Competent representatives thoroughly conversant with the customs and language of the people of this country should be sent out immediately if at all possible. Brazilians are not prejudiced against American goods at any time, and business connections can now be formed which may endure indefinitely."

Training Dye Makers—Under the direction of Dr. Allen Rodgers of Pratt Institute Brooklyn, a miniature factory has been set up to make American dyes from American raw materials. It is also proposed to train young men to become foremen of American dye factories.

In "American Industries" the official organ of the "National Association of Manufacturers," Harold Lambert Allen has printed a lengthy article from which the following extracts have been taken.

"Prior to the beginning of the European war it was not generally realized to what extent many industries of the United States are dependent on foreign supplies. We had grown accustomed to think of this country as the source of raw materials for European factories, rather than the consumer dependent on foreign products in a large measure for the maintenance of some of our largest industries—dyes for the textile, leather and paper trades. Although during the last five years the imports of dyestuffs into the United States have remained practically stationary, owing to the enlargement of the chemical works in the United States, we are dependent on Germany for such large quantities of dyestuffs that the stoppage of imports since the beginning of the war presents a serious problem to the consumers of those commodities.

"Figures obtained from official sources show that the total average purchases from abroad of alizarin and other coal tar colors have been about \$10,000,000 annually during the past six years. In 1913 the total value of imported dye stuffs from all foreign countries was \$10,395,744, including indigo and aniline salts. Of this amount Germany furnished \$8,876,020, while during the unfinished year 1914, we have imported from that country artificial dye stuffs valued at \$7,940,061, indicating that had the war not occurred the imports for both years would have been about equal. It is reasonable to assume that, had there been any great discrepancy between the imports of 1913 and 1914, they would have been larger this year, since we have already imported \$5,965,537 worth of finished coal tar colors (not including alizarin, aniline salts or indigo) this year, in comparison with the somewhat smaller value of \$5,766,600 of the same products during 1913. At all events it is obvious that the hiatus left in the American market by the war is not an inconsiderable one, and is large enough to present a serious problem to the textile and leather trades. Figures for 1913, the last complete year, as previously given, show the imports of foreign artificial dye stuffs to have been \$10,395,744, and it is this amount that American manufacturers must now supply.

"The United States must have dyes. These must be either imported or manufactured in this country, and since the war has paralyzed the trade of Germany, from whom we obtain by far the largest supply of imported dyes, only one cargo having reached this country since the beginning of hostilities, Yankee ingenuity must come to the rescue. The solution is all American dyes for American manufactured goods. We must establish a dye manufacturing industry in the United States which will supply not only the demands of the home market, but which may compete successfully with other nations for the dye trade of the world. * * *

"In order to build up an American dye manufacturing industry that will supply all of the demands of the home market and compete succesfully with foreign manufacturers for the dye trade of the world, proper support must be given the industry by both the Government and the consumers. * * *

"The part the Government must play in upbuilding the dye industry is an important one. A sufficiently high tariff must be placed on dyes to insure American manufacturers against the destructive competition for foreign combinations when the war is over. The coal-tar color industry in the United States makes no plea for protection in the ground of fostering an infant industry, but sfiicient protection should be given to prevent this county from being made the dumping ground for the overproduction of Germany. Unless this is done German manufacturers will be in a position to destroy the American coal-tar industry when the war is over, exactly as was done in the case of the hydrochinon industry.

"It must be remembered that even with chemists able to properly compound dyes great skill is necessary to their proper manufacture. The technical processes involved are exceedingly nice and considerable experience is necessary before the proper technique is acquired. In Grmany for many years the industrial schools have been training young men to assume responsible positions in dye factories, and in this country for a time some difficulty will likely be experienced in obtaining skilled labor. Foremost among American industrial schools to perceive the trend of the times is Pratt Institute in Brooklyn, N. Y. Under the direction of Dr. Allen Rodgers that institution has taken steps to install a miniature factory to manufacture all American dyes from all American raw products and train young men to become foremen in dye factories. It must be remembered that the dye industry, if greatly enlarged at all, will be placed on a permanent basis, and the importance of this experiment cannot be overestimated."

CATALOG NOTICES

Tate, Jones & Co., Inc., Pittsburgh, Penn. Catalog. Appliances for burning fuel oil. Illustrated, 32 pp., 8½x11 in.

Easton Car & Construction Co., Easton, Penn. Catalog Industrial railway material and cars. Illustrated, 52 pp., 8x10½ in.

Weller Mfg. Co., Chicago, Ill. Catalog No. 25. Unit-system storage bins. Illustrated, 6x9 in.

Toch Bros., 320 Fifth Ave., New York. Catalog. Railroad and marine paints. Illustrated, 32 pp., 5x7 in.

Contracts to Be Let

Bids received until Oct. 7, 1914.

Trunk Sewer and Sewage Disposal Works

Plainfield, N. J.

Sealed proposals for constructing a trunk sewer and sewage disposal works will be received by the Joint Meeting of the Inhabitants of the City of Plainfield, the Borough of North Plainfield and the Borough of Dunellen, N. J., until eight o'clock P. M., October 7, 1914. Proposals should be delivered to C. M. Dolliver, Secretary of the Joint Meeting, 119 North Avenue, Plainfield, N. J., and may be either for the trunk sewer (Contract A) or the sewage disposal works (Contract B) or both [illegible].

Contract A comprises some 17,000 feet of 42-inch reinforced concrete sewer, [illegible] feet of inverted siphons, consisting of [illegible] cast-iron pipe lines, and about [illegible] feet of [illegible]-inch force main.

Contract B is for the construction of a sewage disposal works, comprising the following structures: preliminary settling tanks of the Imhoff type, a sludge drying bed and [illegible], 2 sprinkling filter units with a [illegible] area of stone bed of about 1½ acres with a depth of [illegible] feet of stone, and double final settling tanks similar in construction to the preliminary tanks. There are also a small laboratory and sludge pumping station. The tanks, filter walls, etc., are to be built of reinforced concrete.

Proposals must be accompanied by a certified check on a National Bank or Trust Company for Twenty-five Hundred ($2,500) Dollars for each contract bid upon.

The bidder to whom a contract is awarded will be required to execute same and furnish a surety company bond in the sum of Fifty (50%) Per Cent. of the amount of the contract within ten days (Sundays excepted) after receiving [illegible] notice of the award. The Joint Meeting reserves the right to reject any or all bids.

Plans and specifications may be obtained from George W. Fuller, Engineer, 170 Broadway, New York City, upon deposit of Twenty-five ($25) Dollars, which will be refunded if said plans and specifications are returned in good condition within [illegible] days after bids have been received and acted upon by the said Joint Meeting.

Bids should be made on the blank Form of Proposals bound with the specifications and in case it is desired to bid on both contracts each bid should be made in a separate pamphlet.

C. M. DOLLIVER,
Secretary.

Bids received until Oct. 8, 1914.

Steel Highway Bridge

THE SANITARY DISTRICT OF CHICAGO

Sealed proposals endorsed "PROPOSALS FOR ERECTION OF BACH ROAD BRIDGE" will be received by the Clerk of The Sanitary District of Chicago at the office of said District, Room 700, No. 910 South Michigan Avenue, Chicago, Illinois, until 12 M., standard time, on Thursday, October 8, 1914, and will be publicly opened by the Board of Trustees of said Sanitary District at a meeting to be held on that day or at the first meeting thereafter.

The work for which said tenders are invited consists of the ERECTION AND COMPLETION of the superstructure of the STEEL HIGHWAY BRIDGE across the Calumet-Sag Channel of The Sanitary District of Chicago on the line of BACH ROAD, situated in the Township of [illegible], County of Cook, State of Illinois. The superstructure steel for said bridge will be furnished by the said Sanitary District and weighs one hundred and ten (110) tons, more or less.

A deposit of THREE HUNDRED DOLLARS ($300.00) is required with each proposal.

All proposals must be made upon blank forms of proposal furnished by said Sanitary District and shall be made in accordance with and to conform to all the terms and conditions set forth in "Requirements for Bidding and Instructions to Bidders" attached thereto.

Form of proposal, contract, specifications and plans may be obtained upon application at the office of said Sanitary District. A deposit of Five Dollars ($5.00) will be required for each set of plans and specifications taken out. Said sum of Five Dollars ($5.00) so deposited will be refunded to said [illegible] upon the return of said plans and specifications to said Sanitary District in good condition, provided same are returned within fifteen (15) days after the date on which said proposals are opened.

The Board of Trustees of said Sanitary District reserves the right to reject any or all proposals.

THE SANITARY DISTRICT OF CHICAGO,
By THOMAS A. SMYTH,
President of its Board of Trustees.

Attest:
JOHN McGILLEN, Clerk.
Chicago, September [illegible], 1914.

Bids received until Oct. 6, 1914.

Vault Equipment

NOTICE TO CONTRACTORS

Trenton, N. J.

Sealed proposals will be received at the office of the [illegible], New Jersey, at [illegible] [illegible]

[illegible]

Bids received until Oct. 13, 1914.

Building Improvements

NOTICE TO CONTRACTORS. Sealed proposals for [illegible] [illegible] Albany, N. Y. [illegible] Capitol, Albany, N. Y.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

SHARP CURTAILMENT IN BUILDING OPERATION

In 20 cities in the 1 tern States, there was a falling off of 39%; expressed in dollars, this was from $27,000,000 last year to $16,000,000 this year. A $4,500,000 loss in Albany, N. Y., was accounted for by the change in the building laws; otherwise, losses were more or less proportionate. In New York City, building was surprising; Manhattan Borough nearly equalled last year; in Bronx, fully 100% larger than in September last year, and in Brooklyn, fully 50%. In the Bronx, building for the first nine months of the year was ahead of the corresponding period last year, and Brooklyn $10,000,000 ahead. This is partially accounted for by developments in the opening of new subways, but it is remarkable, nevertheless. In Philadelphia, there is a loss of more than 50%, which is the first important loss recorded in that city this year. For the first nine months of the year, the loss was approximately $27,000,000, most of which is accounted for in the month of September. This makes a loss of approximately 11.5% compared with the corresponding month last year.

In 16 cities in the Middle West, the loss was not as pronounced, amounting to about $5,000,000, or 23%. The most startling loss was in the City of Chicago, $2,500,000; Detroit, $500,000; Grand Rapids, $1,000,000, but September, 1913, was above the average, and Minneapolis, $600,000. It is interesting to note that in these cities for the first nine months of the year, there was a gain of approximately 4%.

In seven Southern cities, the tightness of money is most evident, decreases being general in each case and amounting to 41% for September and 15% for the first nine months of the year.

Returns from Pacific Coast States have been meager, and the five cities heard from were perhaps not enough to form any adequate basis for comparison, but the loss in September amounted to 64%, comparing with 19% for the first nine months.

EASTERN STATES

	Month of September 1914	Month of September 1913	First Nine Months of Year 1914	First Nine Months of Year 1913
Albany, N. Y.......	$267,325	$4,995,375	$5,423,475	$7,757,590
Boston..........	516,179	823,875	14,815,623	14,055,255
Bridgeport, Conn...	314,890	224,323	2,116,999	2,288,429
Buffalo, N. Y.......	761,000	821,000	9,260,006	8,897,243
Elizabeth, N. J.....	72,309	182,000	1,051,622	2,047,005
Hartford, Conn..	129,010	369,421	3,600,356	4,040,446
Hoboken, N. J....	10,000	20,000	740,727	386,142
Jersey City, N. J.	154,467	244,872	2,974,116	4,442,261
Newark, N. J.....	231,660	561,526	8,671,940	11,907,244
New Haven, Conn.	431,610	243,880	3,337,802	2,963,671
New York, N. Y.				
Manhattan....	5,109,050	5,699,400	39,600,090	52,329,435
Bronx....	1,156,300	485,790	18,139,268	18,022,906
Brooklyn.....	3,206,660	2,102,825	33,099,510	23,487,511
*Queens......	1,172,540	1,783,240	15,216,085	13,382,396
Paterson, N J..	72,783	54,215	1,373,198	1,115,154
Philadelphia, Penn	1,811,250	4,402,090	30,221,630	33,907,075
Pittsburgh, Penn....	880,649	1,434,790	12,858,866	12,492,596
Reading, Penn...	47,150	69,025	1,090,350	683,725
Rochester, N. Y....	666,554	834,226	7,570,636	7,523,961
Scranton, Penn....	313,218	71,420	1,251,070	1,020,367
Springfield, Mass. ..	255,016	232,025	4,281,205	3,529,178
Syracuse, N. Y... ..	219,085	1,441,613	2,199,540	4,065,858
Worcester, Mass....	181,115	404,619	3,979,259	3,761,226
Totals..........	$16,837,280	$27,501,550	$207,357,288	$234,106,684
	Loss............39%		Loss...........11.5%	

MIDDLE WEST

Akron, Ohio..	$267,325	$393,645	$3,177,530	$4,285,950
Chicago, Ill......	4,925,900	7,358,920	63,760,710	67,429,877
Cincinnati, Ohio..	665,608	869,376	7,837,668	6,916,542
Cleveland, Ohio....	2,132,970	1,949,545	21,672,855	18,558,665
Columbus, Ohio..	491,725	473,195	4,863,256	4,087,083
Dallas, Tex.....	140,269	469,925	....	....
Denver, Colo...	1,007,130	295,490	2,844,553	3,341,145
Detroit, Mich.......	1,547,235	2,056,855	23,497,065	23,647,008
Duluth, Minn.......	187,829	473,897	2,372,693	3,585,414
Grand Rapids, Mich.	427,624	1,573,350	3,172,664	3,484,148
Indianapolis, Ind...	411,628	675,504	6,980,469	7,607,745
Kansas City, Mo..	565,035	676,695	16,106,360	7,630,121
Milwaukee, Wis.	1,162,004	874,509	8,187,351	10,054,581
Minneapolis, Minn.	881,275	1,449,650	12,924,940	9,647,350
Salt Lake City, Utah.	481,850	142,937	2,596,959	1,572,390
Toledo, Ohio.......	360,358	672,489	5,263,622	4,535,251
Totals ..	$15,655,765	$20,405,982	$185,168,695	$178,793,079
	Loss.. ..... 23%		Gain... ....4%	

PACIFIC COAST STATES

Los Angeles, Calif...	$1,106,061	$1,748,665	$11,280,932	$25,583,262
Portland, Ore.......	309,140	1,621,005	5,770,185	11,040,950
Spokane, Wash......	42,265	679,115	849,017	3,116,633
San Francisco, Calif.	830,018	2,273,723	21,991,561	16,818,659
Tacoma, Wash......	86,826	157,785	1,709,033	2,158,321
Totals..........	$2,374,376	$6,480,293	$47,690,731	$58,747,825
	Loss........ 64%		Loss.. .... 19%	

*Not included in totals.

SOUTHERN STATES

Atlanta, Ga.........	$170,804	$384,723	$4,038,536	$4,277,079
Birmingham, Ala....	162,315	242,099	2,827,860	5,250,136
Chattanooga, Tenn..	77,387	50,120	957,007	860,120
Memphis, Tenn.....	132,160	288,355	2,655,709	3,470,761
New Orleans, La....	159,277	186,769	2,329,569	3,542,229
Richmond, Va.......	72,305	85,883	2,817,585	2,533,623
Washington, D. C...	390,511	740,886	7,702,789	7,568,591
Totals.........	$1,164,759	$1,978,835	$23,329,055	$27,502,539
	Loss...........41%		Loss............15%	

RAILWAYS

Maine—Eastern Maine R.R.—Preliminary surveys are being made by this company for the construction of a railway from Houlton to Bangor, Maine. D. W. Burpee is Ch. Engr.

New York—Lehigh Valley R.R.—The Traffic Bureau of Syracuse, N. Y., has petitioned this company to extend its line from either Weedsport or Auburn to Syracuse. E. B. Ashby, New York, is Ch. Engr.

✚**North Carolina**—Southern Ry.—A contract has been awarded by this company for the second track work on its line from Alexander to Craggy, N. C., about 10 miles, to the MORROW CONSTRUCTION CO., Greensboro, N. C. Noted Sept. 3.

Georgia—According to press reports the Louisville & Nashville R.R. is interested in the construction of a railway from Atlanta to Cartersville, Ga. Preliminary surveys are being made. A company is being incorporated, to be known as the North Georgia Mineral Co., for the purpose.

✚**Alabama**—Alabama Great Southern R.R.—This company has awarded a contract to H. C. ELKINS, Baltimore, Md., for 11 miles of double-track work from Birmingham to Mobile Junction, Ala. C. Dougherty, Cincinnati, Ohio, is Ch. Engr.

Mississippi—Mobile & Ohio R.R.—At a recent meeting this company voted to issue bonds for double tracking its line from Corinth, Miss., to Jackson, Tenn., about 57 miles. B. A. Wood, Mobile, Ala., is Ch. Engr.

Louisiana—Orange & Northwestern R.R.—Preliminary arrangements are being made by this company for laying tracks on its proposed line through Vinton, La. J. S. Pyeatt, Orange, Tex., is Mgr.

Kentucky—Louisville & Nashville R.R. — This company plans to award a contract soon for the construction of a three-mile line from Raymond to Jenkins, Ky. W. H. Courtenay, Louisville, Ky., is Ch. Engr.

Texas—Kansas City, Mexico & Orient R.R.—This company has voted to issue $1,488,000 in bonds for the construction of its line from Girvin to Alpine, Tex. R. P. Parker, San Angelo, Tex., is Ch. Engr.

New Mexico—Atchison, Topeka & Santa Fé R.R.—Final surveys are being made by this company for the construction of a railway from Santa Fé to Taos, N. M. F. M. Bisbee, Amarillo, Tex., is Ch. Engr., of Western lines.

Idaho—Oregon Short Line R.R.—Plans are being prepared by this company for the construction of a second track on its main line from Pocatello, Idaho to Blackfoot, Idaho. Carl Stradley, Salt Lake City, Utah, is Ch. Engr.

Arizona—Southern Pacific Co.—This company will improve and lay new rails on its Tucson division in Arizona.

California—California Terminal Ry.—Plans are being considered by this company for the construction of a railway from San Francisco to Sacramento, with branch lines to Petaluma and Napa. The total length of the road and branches will be 118 miles.

ELECTRIC RAILWAYS

Buffalo, N. Y.—The City Council has granted a franchise to the International Ry. Co. to construct and operate an electric railway from Elmwood Ave. to Main St. in Buffalo. J. C. Sheldon, Buffalo, is Pur. Agt.

Opelika, Ala.—Preliminary arrangements are being made by the Carmack Ry. & Power Co. for the construction of an electric railway from Opelika to Auburn, about eight miles. H. A. Bedell, Opelika, is Pres.

Covington, Ky.—The South Covington & Cincinnati St. Ry. Co. is considering plans for the extension of its line from Covington to Erlanger.

Akron, Ohio—The Northern Ohio Traction & Light Co. will be compelled to construct new lines in Maple St., Wooster Ave. and Grant St. Charles Currie, Akron, is Gen. Mgr.

Cleveland, Ohio—The City Engineer has been commissioned by the City Council to prepare an estimate of the cost of constructing a municipal elevated railway system.

Columbus, Ohio—According to press reports the City Council is considering plans for the construction of an elevated railway on High St. to connect Hilltop and Coumbus. Henry Maetzel is City Engr.

Indianapolis, Ind.—The Board of Public Works has ordered the Indianapolis Traction & Terminal Co. to construct a railway on West Tenth St.

Richmond, Ind.—The Richmond-Hammond Traction Co. has completed surveys for the construction of an electric railway from Richmond to Hammond with a spur track to Connersville. Eugene Purtelle is interested.

Freeport, Ill.—Plans are being prepared by the Freeport Ry. & Light Co. for the construction of a new line in Freeport. [illegible] Alexander, [illegible], Ill., is Vice-Pres.

Galesburg, Ill.—The [illegible] Ry., Light & Power Co. contemplates the extension of its line on West Losey St. in Galesburg. H. [illegible], Peoria, is Gen. Mgr.

Junction City, Kan.—According to press reports the Manhattan [illegible] contemplates the construction of an electric railway to Fort [illegible].

St. Louis, Mo.—The United Rys. Co. has been petitioned to [illegible] plans for the construction of a two-mile railway to connect the [illegible] and Manchester lines. Robert McCulloch, St. Louis, is Pres., Gen. Mgr. and Pur. Agt.

San Antonio, Tex.—The San Antonio Belt & Terminal Ry. Co. has been granted a [illegible]-year franchise by the City Council for the construction of its tracks over West Fells Ave. and other streets. The company will construct extensive track terminals and station buildings. It is a subsidiary of the Missouri, Kansas & Texas Ry. Co.

Cushing, Okla.—The Cushing Construction Co. has been [illegible] to construct an electric railway from Cushing to the oil fields in the vicinity. Frank Brown, R. D. Long and [illegible] are interested.

Ogden, Utah.—Plans are being considered by the Ogden [illegible] Transit Co. for the construction of an electric railway on [illegible] Ave. P. D. Kline, Ogden, is Gen. Mgr. and Pur. Agt.

Phoenix, Ariz.—The City Council has granted a franchise to the Phoenix Ry. Co. to extend its [illegible] line to the city line, about [illegible] miles. Samuel H. Mitchell, Phoenix, is Gen. Mgr. and Pur. Agt.

Malaga, Wash.—Preliminary arrangements are being made by H[illegible] Hayes for the construction of an electric railway from Malaga to Leavenworth.

Corona, Calif.—The Pacific Electric Ry. Co. has applied to the City Council for a franchise to construct and operate an electric railway from Ontario and Lincoln Sts. to Taylor St. and South on Taylor St. to Lemon St. J. McMillan, Los Angeles, is Gen. Mgr.

Los Angeles, Calif.—The Los Angeles Silica Corporation will construct a [illegible]-ft. aerial tramway from its quarries to the railroad at San Fernando. J. A. Fairchild is Mgr.

San Francisco, Calif.—The city will rearrange the street car tracks at the foot of Market St. and pave a street to be opened up there at a cost of $[illegible],000. M. M. O'Shaughnessy is City Engr.

The Board of Supervisors has decided in favor of a combined cable and electric line over Church St. Hill, as a part of the municipal system. The hill section will cost about $[illegible].

Brantford, Ont.—The Brantford St. Ry. Co. has applied to the City Council for a franchise to extend its lines and construct a loop in Brantford. E. B. Stockdale, Toronto, is Gen. Mgr.

Stratford, Ont.—The City Council is preparing to construct an electric railway on Arthur, Brock, Nelson and St. Paul Aves. T. H. Jones is Consult. Engr. and C. H. Hartman is [illegible] Ry. Comm.

Edmonton, Alta.—The Edmonton Tramways Co., Ltd., has completed preliminary arrangements and plans to start work soon on the construction of its proposed line through Edmonton. This is part of a line which will eventually connect Edmonton and Fort Saskatchewan.

LIGHT, HEAT AND POWER

★**Bath, N. Y.**—Official bids will be received until 11 a.m. [illegible] by Joseph H. Coulllen, Pres., New York State Soldiers and Sailors Home, Bath, N. Y., for alterations to the electric plant, underground piping, steam, etc. For particulars see advertisement under "Contracts To Be Let."

★**Ithaca, N. Y.**—The following bids were received Sept. 28 by [illegible] Trustees of Cornell University, for the heating, plumbing and electrical work for the New York State [illegible] Hall at Cornell University:

Heating Work—Proposal No. 1: Danforth Co., Buffalo, [illegible]; [illegible], Syracuse, $[illegible]; L. W. [illegible], [illegible]; [illegible] Engineering Co., $[illegible].

Heating Work—Proposal No. 2: Edward Joy Co., Syracuse, $[illegible]; [illegible] Co., Buffalo, $[illegible]; L. W. [illegible], [illegible].

Plumbing and Drainage: E. T. [illegible] Co., Rochester, $[illegible]; Edward Joy Co., Syracuse, $[illegible]; A. [illegible] Co., [illegible], $[illegible]; [illegible] Co., Ithaca, $[illegible]; [illegible] Plumbing Co., Ithaca, $[illegible].

Electric Work: [illegible], New York, $[illegible]; Buffalo [illegible] Co., Buffalo, $[illegible]; [illegible] Co., $[illegible]; [illegible] Co., New York, $[illegible]; T. F. [illegible], New York, $[illegible]; [illegible] Co., $[illegible]; New York Construction Co., New York, $[illegible]; Edward Joy Co., Syracuse, $[illegible]. Noted Sept. [illegible].

New York, N. Y.—[illegible] of Manhattan—Officials [illegible]. The following bids were opened [illegible] for installing electrical equipment in [illegible] [illegible] T. Frederick Jackson, Inc., $[illegible]; [illegible] & [illegible], $[illegible]; [illegible] & [illegible], $[illegible]; [illegible], $[illegible]; [illegible] Construction Co., $[illegible]; [illegible] Electric Equipment Co., Inc., $[illegible].

[illegible] of [illegible]—[illegible] bids for electrical equipment [illegible] Public Schools [illegible] were received from: New York Construction Co., $[illegible]; Jamaica [illegible] Equipment Co., $[illegible]; T. Frederick Jackson, Inc., $[illegible]; [illegible], $[illegible].

[illegible]—[illegible] bids for installing electrical equipment in [illegible] [illegible]. New York Construction Co., $[illegible]; [illegible] Equipment Co., $[illegible]; T. Frederick Jackson, Inc., $[illegible]. Noted Oct. 1.

Lynchburg, Va.—Plans have been prepared and submitted to the City Council by [illegible], Consult. Engr., for a municipal electric-light plant. The estimated cost is $[illegible].

Branchville, S. C.—The citizens have voted in favor of a bond issue of $10,000 to be used for the equipment of a municipal electric-light plant.

Westminster, S. C.—At a recent election, a bond issue of $16,000 was voted for the construction of a municipal electric-light plant.

Mount Vernon, Ga.—At the November election, the citizens will vote on the question of a $[illegible] bond issue, the proceeds to be used for the construction of a municipal electric-light plant.

✚**Mobile, Ala.**—The School Commission has awarded the contract for the installation of a fan blast system of combined heating and ventilating in Barton Academy, Russell School, Semmes School and Old Shell Road School, to the MONCRIEF FURNACE CO., Atlanta, Ga., at $17,[illegible].

Jackson, Miss.—The city is considering the installation of an electric-light and power plant to cost about $2[illegible],000. M. L. Culley is City Engr.

✚**Meridian, Miss.**—The Tuberculosis Hospital Commission has awarded the contract for the construction of an electric-light and power plant for the hospital to the DALTON ELECTRIC CO.

Bristol, Ind.—It is reported that a franchise has been granted to A. H. Timm, Constantine, Mich., for the installation of an electric-light plant in Bristol.

Portage, Wis.—It is reported that plans have been prepared for a municipal electric-light plant estimated to cost $60,000. A. T. Maltby, 20 West Jackson Blvd., Chicago, Ill., is Engr.-in-Charge.

Audubon, Iowa.—Press reports state that the Audubon Electric Light Plant, owned by N. L. Freeman, was recently destroyed by a cyclone.

Carroll, Iowa.—The Carroll Light & Heat Co. contemplates improvements to its power plant, distributing system and heating mains to cost about $3[illegible],000. Fred C. Ross is Mgr.

Duluth, Minn.—The City Council has passed an ordinance appropriating $85,800 for the construction of the first unit of a municipal electric-lighting plant, which will supply electricity to the territory between 3[illegible]th and 74th Aves. West. Noted Sept. 3.

Greensburg, Kan.—The municipal electric-light plant expects to purchase within the next three months a [illegible]0-hp. engine, a 17[illegible]-kva. alternating current generator, three-phase, 2300 volts, 50 cycles, and material for an 11-mile transmission line. J. W. Pennington is City Clk.

Kearney, Neb.—The Kearney Water & Electric Power Co. has applied to the State Railway Commission for permission to issue $35,000 in bonds, the proceeds of which will be used to enlarge and improve the present plant.

Sidney, Mont.—The Sidney Light & Power Co. has been incorporated with Sidney as its headquarters. The company will soon begin the construction of an electric power plant to supply this city and neighboring towns.

Wibaux, Mont.—A special election will soon be held to vote on the question of granting a franchise to Henry Zolphl for the installation of an electric-light and heating plant. It is reported that Mr. Zolphl, if the franchise is granted, will build a plant costing from $20,000 to $2[illegible],000.

Brownsville, Tex.—James A. Browne, owner of the local street railway system, has announced that he will build a power plant, and convert the transit system from gasoline motor to electricity.

Malad City, Idaho.—The Evans Light & Power Co., Malad City, is considering the construction of a new lighting plant, to be located near the city. J. H. Campbell is Mgr. and Supt. of the company.

Spencer, Idaho.—The Wood Livestock Co. has been granted a franchise for the construction of a power plant and distributing system to supply the city with light and power. F. J. Hagenbarth is Pres. of the company.

Mesa, Ariz.—The South Side Gas & Electric Co. plans to build a substation costing about $[illegible] for the purpose of distributing the electricity which is generated at the power plant at the Roosevelt Dam. H. L. Chandler is Mgr. of the South Side Co.

Seattle, Wash.—The City Council in connection with the proposed extension of the municipal power plant, has received an offer from J. T. Mitchell to sell power rights on the South Fork of the Skokomish River for $[illegible]. Mr. Mitchell claims that the site, which is located in Mason County, is capable of developing 7[illegible] hp., and that the cost of development would approximate $[illegible], or about $[illegible] less than the site at Lake Cushman, which is under consideration. Noted Sept. 24.

Summerville, Ore.—The Kless [illegible] Co., Summerville, is [illegible] to extend its transmission lines into the [illegible] Valley, and will furnish light and power to the farmers and small towns along the line.

Warrenton, Ore.—The city has granted a [illegible]-year franchise to the Pacific Power & Light Co., Astoria, Ore., to furnish light and power to Warrenton. Construction work will be begun at once, as the franchise stipulates that service shall be furnished within about [illegible] months. The estimated cost of the work is $[illegible]. William H. [illegible], of the Pacific Power & Light Co., will have charge of the work.

Yoncalla, Ore.—A special election will be held in December to vote on the question of a bond issue, the proceeds of which are to be used for the construction of an electric-light system.

✚**Bakersfield, Calif.**—The Board of Education of Kern County has awarded the contract for heating and ventilating systems in the new [illegible] school at Bakersfield to the AMERICAN HEATING & CONSTRUCTION CO., Los Angeles, at $[illegible].

Pasadena, Calif.—The Pasadena Hospital Association will soon begin the construction of a new boiler house and the installation of new boiler equipment at the present hospital at [illegible] and [illegible] Sts., Pasadena. The cost of the work will be about $[illegible].

Fraserville, Que.—It is reported that bids will be asked in December or January for additions to the power house of the municipal lighting system, including penstock, waterwheel, dynamo and motors. The estimated cost is $25,000. E. Talls is Clk.

+Joliette, Que.—The contract for the construction of a hydraulic plant at Joliette has been awarded to ARSENE-AULT & PLAMONDON, Montreal, Que., at $32,516. The work includes building a concrete dam, reinforced concrete retaining walls for the headrace, concrete headwall, a stave pipe and a reinforced concrete power house.

BRIDGES

Holyoke, Mass.—Press reports state that the Board of Selectmen has voted to spend $5000 in repairing the Sunderland Bridge over the Connecticut River. T. J. McCarthy is City Engr.

Bridgeport, Conn.—It is reported that the Board of Selectmen is considering the construction of a bridge over the Pequonnock River at Grand St., and one at East Washington Ave. Alfred H. Terry is City Engr.

+South Norwalk, Conn.—(Official)—The Board of Selectmen has awarded the contract for the erection of the steel work for the draw span of the Washington St. Bridge, South Norwalk, to TOOLE & SUNDERLIN, Bridgeport, Conn.

Charlotte, N. Y.—Owing to the present condition of the money market, the Monroe County Building Commission, Rochester, has deferred the awarding of the contract for the construction of the bridge over the Genesee River at Stutson St., Charlotte. List of bidders noted Aug. 13.

New York, N. Y.—(Official)—Bids will be received until 2 p.m., Oct. 15, by F. J. H. Kracke, Comr. of Bridges, Municipal Bldg., Borough of Manhattan, for additions and repairs to the south approach of the Fresh Kills Bridge over Richmond Creek.

Syracuse, N. Y.—Plans have been prepared by J. A. Bensel, State Engr., for the construction of a bridge over the Erie Canal at West Genesee St., estimated to cost $60,00. Bids will be asked as soon as the plans are approved by the City Engineer, J. A. Wooley.

+Troy, N. Y.—(Official)—The Troy & West Troy Bridge Co. has awarded the contract for the construction of the Congress St. Bridge to the FORT PITT BRIDGE WORKS, Pittsburgh, Penn. Noted Sept. 24.

Camden, N. J.—Bids will be received until Oct. 14 by the Board of Chosen Freeholders of Camden County for material for the Broadway Bridge over Newton Creek as follows: 80,000 lb. of structural steel, 400 lb. trunnions and pins, 4000 lb. trunnion bearings, sleeves, etc., 5000 lb. reinforcing steel, 2500 lb. wire mesh, etc. J. J. Albertson is County Engr.

+Jersey City, N. J.—(Official)—The Boulevard Commissioners of Hudson County have awarded the contract for the construction of a bridge over the railroad cut on the Hudson Blvd. to C. S. EDWARDS, First National Bank Bldg., Exchange Place, Jersey City, at $9447. Other bidders were: R. J. Emmer, $9600; C. S. Callery, $9450; Curtis & Cavanagh, $10,390. Noted Sept. 3 and Sept. 24.

Jersey City, N. J.—Bids will be asked in a short time by the Board of Chosen Freeholders of Hudson County for repairs to the Jackson Ave. Bridge over the Passaic River, plans for which are now being prepared.

+The Public Service Co., of Jersey City has awarded the contract for the construction of an electrically operated and magnetically controlled gantry bridge to the ROBINS CONVEYING BELT CO., 13 Park Row, New York, N. Y., at about $50,000. The bridge will be 200 ft. long.

South Amboy, N. J.—The Raritan River R.R. Co. has been granted permission to build a new bridge over its tracks on Washington Ave.

Pittsburgh, Penn.—(Official)—Bids will be received until noon, Oct. 20, by R. J. Cunningham, Controller of Allegheny County, for the construction of Bridge No. 21 over Pine Creek, near Alison Park Station, Hampton Township. J. C. Chalfant is County Engr.

+Pittsburgh, Penn.—The Department of Public Works has awarded the contract for building the substructure of the new Sylvan Ave. Bridge to the DRAVO CONTRACTING CO., Pittsburgh, at $29,907. Noted Sept. 24.

Suffolk, Va.—The City Council and the Board of Supervisors of Nansemond County are considering the construction of a bridge over the Nansemond River. The estimated cost is $9700 for a double-track or $9100 for a single-track bridge.

+Moorefield, W. Va.—(Official)—The County Court of Hardy County has awarded the contract for the construction of a steel bridge with concrete abutments over the Lost River above Millers Ford to the FARRIS BRIDGE CO., Pittsburgh, Penn., and Charleston, W. Va., at $4000. Noted Sept. 17.

+Winston-Salem, N. C.—The Commissioners of Forsyth and Yadkin Counties have awarded the contract for the construction of a bridge across the Yadkin River at Conrads Ferry to the VINCENNES BRIDGE CO., Vincennes, Ind., at $23,349. The bridge will be about 860 ft. long. Noted July 23 and Aug. 6.

+Americus, Ga.—The Commissioners of Sumter County have awarded the contract for the construction of two reinforced-concrete bridges on the Americus-Smithville Road, one over Muckalee Creek and a smaller one over Bear Creek, to J. H. SCRUGGS, Birmingham, Ala.

Rome, Ga.—Bids will be received until Oct. 19 by the County Board of Floyd County for the construction of a concrete bridge over Armuchee Creek on the Summerville Road. Kieffer Lindsey is County Engr.

Knoxville, Tenn.—J. Boyd McCalla, City Engr., has recommended to the City Commission the construction of a concrete viaduct across First Creek and East Clinch Ave. The estimated cost is $6000.

Birmingham, Ohio—(Official)—Bids will be received until 1:30 p.m., Oct. 12, by the Board of Commissioners of Erie County, Sandusky, for placing a creosote wood floor on Bridge F-202 near Birmingham. The estimated cost of the work is $6925, and includes 65,131 ft. of planking, 862 sq.yd. of wood block, bolts, washers, lag screws, spikes, etc. Hayes M. Adams is County Audr. and Clk. of Comrs.

Cincinnati, Ohio—(Official)—Bids will be received until noon, Oct. 23, by the Board of Commissioners of Hamilton County for the construction of a concrete arch, and widening Drake Ave. about half a mile north of Indian Hill Ave., Columbia Township, Spec. 709; and for repairing a bridge on Muddy Creek Road, Green Township, Spec. 704. Albert Reinhardt is Clk. of Comrs.

+Cleveland, Ohio—The Commissioner of Purchases and Supplies has awarded the contract for the construction of the substructure of the Clark Ave. Viaduct to the GREAT LAKES DREDGE & DOCK CO., Chicago, Ill., at $124,938. Noted Sept. 10.

Cleveland, Ohio—Press reports state that a movement is on foot to rebuild the old Superior Viaduct at a cost of about $750,000. The proposed plan is to rebuild the easterly half of the viaduct, placing the approach at St. Clair Ave. N. W., instead of Superior Ave., N. W., to relieve the traffic congestion at the latter point. This viaduct was built during the middle 70's, and it is stated that the masonry will require practically no changes.

Dayton, Ohio—O(fficial)—Bids will be received until 10 a.m., Oct. 20, by the Board of Commissioners of Montgomery County for the construction of Bridge No. 16, Van Buren Township. Walter H. Aszling is Secy. of Comrs.

+New Lexington, Ohio—(Official)—The Board of Commissioners of Perry County has awarded the contract for the superstructure of a bridge over Jonathan Creek, Madison Township, to the CAPITOL CONSTRUCTION CO., Columbus, at $4795. Noted Sept. 17.

+Anderson, Ind.—(Official)—The Commissioners of Madison County have awarded the contract for the construction of an additional span to the 12th St. Bridge to the BURK CONSTRUCTION CO., Newcastle, Ind., at $6149. Noted Sept. 24.

Indianapolis, Ind.—Bids will be received until 10 a.m., Oct. 19, by W. T. Patten, Audr. of Marion County, for repairs to the Speedway Bridge, Wayne Township.

Danville, Ill.—(Official)—The question of a bond issue of $80,000 to be used for the construction of a bridge over the North Fork River at Bridge St. will be submitted to the voters at the November election. W. H. Martin is City Engr. Noted Sept. 24.

Rochester, Minn.—(Official)—Bids will be received until 10 a.m., Oct. 20, by the Commissioners of Olmstead County for furnishing steel for State Bridge No. 1501. L. D. Bailey is Dist. Engr.

+Concordia, Kan.—The Board of Commissioners of Cloud County has awarded the contract for the construction of three county bridges to the WESTERN BRIDGE CO., Harrisonville, Mo., at $6430 ;a contract for four bridges was awarded to FRED LANDRETH, Republic, Kan., at $5650. Bids were opened Sept. 24. Noted Sept. 3.

Nebraska City, Neb.—(Official)—Bids will be received until noon, Oct. 16, by the Commissioners of Otoe County for filling of wings and bridges and grading on the North Eighth and North 16th St. Bridges. Louis Stutt is County Clk.

+Amity, Ark.—The Commissioners of Clark County, Arkadelphia, have awarded the contract for the construction of a steel bridge across the Caddo River near Amity to the VINCENNES BRIDGE CO., Vincennes, Ind., at $11,970. It will have three 130-ft. spans.

+Beeville, Tex.—The Commissioners of Bee County have awarded a contract for the construction of a reinforced concrete bridge over Aransas Creek on the Beeville-Skidmore Road to AUSTIN BROS., Dallas, at $6348; the contract for a bridge over Aransas Creek on the Skidmore-Corrigan Ranch Road was awarded to the EL PASO BRIDGE CO., El Paso, at $5600.

+Cameron, Tex.—The Commissioners of Road District No. 2 have awarded the contract for the construction of a number of bridges in the district to AUSTIN BROS. at $11,366. Bids were opened Sept. 24.

Denison, Tex.—The City Commissioners have rejected all bids received for the construction of a six-ft. walkway bridge over the shops of the Missouri, Kansas & Texas Ry. Co., estimated to cost $12,500 and are considering the construction of a viaduct for vehicles to cost about $45,000. A. B. Clenny is City Engr. Noted Sept. 3.

+Enid, Okla. The Commissioners of Garfield County have awarded a contract for building three new bridges and repairing several others to the MONARCH BRIDGE CO. at $8709.

Ogden, Utah—The City Commission and the Ogden Rapid Transit Co. plan to build a new bridge over the Ogden River at Lincoln Ave. Washington Jenkins is City Engr.

+Flagstaff, Ariz.—The Board of Supervisors of Coconino County has awarded the contract for the construction of a concrete arch over Cañon Diablo to THOMAS MADDOCK, Williams, Ariz., at $9000. Noted Aug. 6, 19 and 20.

Seattle, Wash.—The City Council has passed an ordinance appropriating $10,000 to pay the expense of preparing preliminary plans for the construction of four bridges across Lake Washington Canal. The estimated cost of these bridges is $1,350,000. Noted July 23 and Aug. 27.

Fairfield, Calif. — The Board of Supervisors of Solano County has approved of plans for a bridge across Putah Creek on the State Highway, to be built jointly by Solano and Yolo Counties. The estimated cost of the bridge is $110,000.

Fresno, Calif.—It is reported that the Atchison, Topeka & Santa Fé Ry. Co. will build a steel bridge over the tracks of the Fresno Traction Co. G. W. Harris, Los Angeles, Calif., is Ch. Engr.

Los Angeles, Calif.—The lowest bids repairing the Fourth St. Bridge over the Los Angeles River was that of the Russell-Green-Foell Co. at $14,600.

Red Bluff, Calif.—Press reports state that bids will be received until [illegible] by the Board of Supervisors of Tehama County for the construction of a number of bridges on the State Highway from the Glenn County line, running north to [illegible]. The estimated cost is $[illegible] for the concrete bridges and $[illegible] for those of steel.

+Santa Ana, Calif.—The contract for the construction of a reinforced concrete bridge over San Juan Creek has been awarded to the [illegible] BRIDGE & CONSTRUCTION CO. at $[illegible].

Visalia, Calif.—It is reported that bids will soon be asked for the construction of three bridges over Deer Creek. A. M. [illegible] is Clk. of the Bd. of Supervisors of Tulare County.

Chatham, Ont.—See item under "Miscellaneous."

Dundas, Ont.—The Town Council is having plans prepared for the construction of a steel viaduct over Court St. John S. Fry is Town [illegible].

Hamilton, Ont.—The City Council contemplates the construction of a [illegible]-ft. bridge at Burlington Heights in conjunction with the Toronto-Hamilton concrete road. A. F. Macallum is Engr. in Charge.

St. Catharines, Ont.—(Official) Bids will be received until [illegible] p.m., Oct. [illegible], by the City Council for the construction of the substructure of the St. Paul St. High Level Bridge. The principal items are: [illegible] cu.yd. of excavation, [illegible] cu.yd. concrete masonry in abutments, [illegible] cu.yd. concrete masonry in [illegible], [illegible] lin.ft. timber piles, 72[illegible] lb. of anchor bolts and [illegible] lb. of steel reinforcement. W. P. Near is City Engr.

Fort George, B. C.—Plans are being prepared, and bids will be asked at once for a new bridge over the Upper Mud River to replace one recently washed away. It is also reported that two bridges will be built further up the river at an approximate cost of $17,[illegible].

WATER SUPPLY—IRRIGATION

Boston, Mass.—The following bids were received by the Metropolitan Water and Sewerage Board for the construction of a screen house at East Boston: Apted & McDuffee, Malden, $[illegible]; W[illegible] & Leighton, $10,3[illegible]; J. F. Locatelli Co., Inc., $[illegible]; Patrick Rush, East Boston, $[illegible]; C. A. Dodge Co., Cambridge, $[illegible]; Michael I. Pisano, $[illegible]; J. Calligan Co., $[illegible]. Charles D. Smith, 1 Ashburton Pl., is Chief Engr. Noted Sept. [illegible].

Lenox, Mass.—The Lenox Water Co. contemplates constructing a new reservoir on Richmond Mountain. George F. [illegible] is Supt.

+Lowell, Mass.—According to press reports, the contract for [illegible] a filtration plant has been awarded to CHARLES R. [illegible], Boston, at $[illegible]. Other bidders were: [illegible], $[illegible]; [illegible] Co., $120,000; William [illegible], $1[illegible]; and Daniel H. Walker, $162,222. Noted July 9.

Waterbury, Conn.—The city contemplates building another reservoir. Robert A. Cairns, City Engr., has selected a site, according to press reports, near Litchfield.

+Leicestershire, N. Y.—The contract for furnishing a pumping engine for the water department has been awarded to FORD M[illegible] STEAM PUMP CO., Milwaukee, Wis., at $10,[illegible]. Noted Sept. 3.

Lyons, N. Y.—Bids will be received by the Village Clerk until Oct. 1[illegible] for furnishing c.-i. water pipe and specials. J. F. W[illegible] Co., [illegible] Bldg., Buffalo, is the Engr.

New York, N. Y.—(Borough of Brooklyn)—(Official)—No bids were received Sept. [illegible] for dismantling and transporting two water tube boilers from pumping station No. 1, Borough of Queens, and one steel stack from [illegible] Brook pumping station to the [illegible] pumping station and re-erecting them. The contract has been readvertised and bids will be received until Oct. 1[illegible] by William Williams, Commr. of Water Supply, Gas and Electricity, Municipal Bldg., Manhattan. Noted Sept. 24.

+Atlantic City, N. J.—(Official)—Bids were received Oct. 1 for increasing the [illegible] of the Lower [illegible] [illegible]: EDWARD [illegible] CO., at $[illegible] (awarded contract); William H. [illegible], $[illegible]; Charles T. [illegible] Co., $[illegible]; Merrill [illegible] Co., $[illegible]; [illegible] Co., $[illegible]; [illegible] & [illegible], $[illegible]; Kelley, [illegible] Co., $[illegible]; [illegible], $[illegible]; [illegible] & [illegible], $[illegible]; [illegible] & [illegible] Co., $[illegible]; and [illegible] Co., $[illegible]. Noted Sept. [illegible].

Hancock, Md.—Plans are being prepared by Alfred M. [illegible], [illegible] Bldg., Baltimore, for the construction of a water system and sewer system, estimated to cost $[illegible]. Noted Aug. [illegible].

+Washington, D. C.—(Official)—The contract for furnishing [illegible] water [illegible] has been awarded to STANDARD [illegible] & [illegible] CO., [illegible], at $[illegible]. [illegible]

New Smyrna, Fla.—The city contemplates issuing bonds for the construction of a water system and sewer system. [illegible] is City Clk.

Birmingham, Ala.—[illegible] bonds for [illegible] the proceeds will be used for the construction of a water system. [illegible] is City Engr. Noted Aug. [illegible].

Ozark, Ala.—Bonds for $[illegible], the proceeds of which will be used for the construction of a water system, have been voted. [illegible]

Nashville, Tenn.—An appropriation of $[illegible] has been [illegible] for [illegible] pipe and fittings for the water department.

+Cleveland, Ohio.—The contract for the construction of the [illegible] has been awarded to the [illegible] Co., Cleveland, Ohio.

Cleveland, Ohio.—(Official)—Bids will be received by the Commissioner of Purchases and Supplies, until noon, Oct. 21, for furnishing three low lift steam turbine reduction gear centrifugal pumps for the Water Department.

Cleveland, Ohio.—(Official)—Bids will be received by A. R. Callow, Comr. of Purchases and Supplies, until noon, Oct. 11, for constructing superstructures for filters.

+Dayton, Ohio.—The contract for constructing water mains across the Miami River above Dayton View has been awarded to SHAFOR & DILL at $18,500.

Delta, Ohio.—(Official)—The village was unable to sell its bonds for water works improvements but has arranged with the contractor to receive bonds in payment for his work. The W. J. Sherman Co., 613 Nasby Bldg., Toledo, Ohio, is the Engr.

Fostoria, Ohio.—The City Council has adopted an ordinance providing for a bond issue of $7[illegible],000, the proceeds to be used for extensions and improvements to the water system. Noted Sept. 17.

Mt. Blanchard, Ohio.—The citizens plan to construct a water system, to cost $10,000.

Steubenville, Ohio.—(Official)—Bids will be received until noon, Oct. 23, by Charles R. Wells, City Audr., for the purchase of $65,000 of bonds, the proceeds to be used for the completion of the filtration plant. Noted Oct. 1.

Wooster, Ohio.—A steel storage tank with a capacity of 1[illegible],000,000 gal. will be constructed by the City Council.

Orion, Mich.—On Sept. 29 the citizens voted $[illegible] in bonds the proceeds of which to be used for the installation of a water system. Smith & [illegible] Co., Nasby Bldg., Toledo, Ohio, is the Engr. Noted Sept. 17.

Grand Ridge, Ill.—Bids are being received by the Village Clerk for laying 14,000 ft. of c.-i. water mains.

+Joy, Ill.—The contract for constructing a 30,000-gal. steel tank has been awarded to ROCK ISLAND BRIDGE & IRON WORKS, Rock Island, Ill.

Kansas, Ill.—(Official)—Bids will be received by the President of the Board of Trustees until 1:30 p.m., Oct. 12, for erecting a steel tower and tank and for furnishing a deep well pump. L. S. Phipps is Pres. Noted June 11.

Viola, Ill.—The city contemplates installing a municipal water system. Philip Horton, Peoria, is Engr.

+Cascade, Wis.—The contract for furnishing 800 ft. of 3[illegible]-in. steel water pipe has been awarded by Schlenter Bros. to the OPTENBERG IRON WORKS, Sheboygan.

Milwaukee, Wis.—Bids will soon be received for the construction of the Lake Shore intake tunnel to connect the new Linwood Ave. water works intake with the North Point pumping station. The estimated cost is $17[illegible],000. Fred G. Simmons is Commr. of Pub. Wks.

Sheboygan Falls, Wis.—The Common Council contemplates issuing bonds for the construction of a municipal water system and sewage system.

Winterset, Iowa.—The town contemplates making extensive improvements to the water system. Harper & Stiles, Grand Ave. Temple, Kansas City, Mo., are the Engrs.

Fordyce, Neb.—Bonds for $6[illegible] were voted by the citizens, the proceeds of which will be used for the construction of a municipal water system. J. D. Smith, Hartington, is Engr.

Lincoln, Neb.—Bids will be received until 2 p.m., Oct. 1[illegible], by T. H. Berg, City Clk., for one 7[illegible]-kw. turbine and generator, [illegible]-volt, one condenser for [illegible] hp. [illegible] engine. The estimated cost is $[illegible]. Adna Dobson is City Engr.

Kremlin, Mont.—The installation of a water system is under consideration.

Joplin, Mo.—Extensions to the system of the Joplin Water Works Co. are contemplated. The estimated cost is about $12,000.

+El Paso, Tex.—The City Council has awarded the contract for [illegible] for the water works plant to FULTON IRON WORKS, St. Louis, Mo., at $1[illegible]. Noted Oct. 1.

Hagerman, N. M.—The Town Trustees are developing a water supply for the proposed water works system that is to be put in here. Bonds in the sum of $16,[illegible] have been voted for the purpose.

+Shelley, Idaho.—The contract for constructing a steel water tank and tower has been awarded by the city to [illegible], Salt Lake City, Utah.

Ogden, Utah.—Bids will be received, according to press reports, until Oct. 1[illegible], by F. [illegible] Stamford, [illegible], for sinking artesian wells for the water department.

Seattle, Wash.—The City Council has authorized the laying of a water main in 13th Ave. South from Duwamish Ave. to [illegible] St.

Eugene, Ore.—The contract awarded to [illegible] & Johnson for constructing a reservoir has been rescinded. The contract will soon be readvertised for this work. Noted Sept. [illegible].

Oregon City, Ore.—Bids will soon be received for the construction of a pipe line from Clackamas to Oregon City and for the construction of a reservoir with a capacity of [illegible] gal. The estimated cost is $[illegible]. [illegible] & [illegible], [illegible] Bldg., Portland, are the Engrs. Noted Apr. [illegible].

Arcadia, Calif.—According to press reports the city will construct a water system costing $[illegible]. Bonds for this purpose have been voted. Mark Kahl, City Hall, is City Engr.

Imperial, Calif.—W. H. [illegible], receiver for the [illegible] Improvement Co., has been granted permission by the [illegible] Court to expend the sum of $[illegible] for [illegible] improvements to the irrigation system in the Imperial Valley. The work required will be located on the Mexican side of the boundary line. About $[illegible] will be expended upon a [illegible] by the [illegible] and $[illegible] for a dredge.

Redding, Calif.—(Official)—A. T. Brown, Anderson, Calif., is not Chief Engineer of the Anderson-Cottonwood Irrigation District as stated in the issue of Sept. 17.

San Francisco, Calif.—Bids will be received about Dec. 1 for constructing a reservoir in Lincoln having a capacity of 3,000,000 gal.

+★Winnipeg, Man.—(Official)—Contracts for constructing 85 miles, consisting of five sections all of which are about the same length, of concrete aqueduct have been awarded by the Greater Winnipeg Water District to: Contract 30, J. H. TREMBLAY CO. LTD., Winnipeg, at $549,549; 31, THOMAS KELLY & SONS, Winnipeg, at $1,301,485; 32, 33 and 34 to NORTHERN CONSTRUCTION CO. and CARTER HALLS ALDINGER LTD., Winnipeg, at $1,268,680, for Contract 32, $1,137,010 for Contract 33 and $1,489,520 for Contract 34. Bids opened Sept. 19. S. H. Reynolds is Chmn. of Comrs. Noted July 30.

SEWERS

Boston, Mass.—Bids will be received until Oct. 10, by the Public Works Department for constructing sewers in Ashley and Boardman Sts., West Rozbury District. L. K. Rourke is Comr.

Providence, R. I.—The City Council has recommended the construction of sewers in Barrows, Irene St., Mount Hope Ave., Ivy and 12th St. Walter F. Slade is Ch. Engr.

New Britain, Conn.—The Board of Public Works has authorized the expenditure of $10,000 for the completion and repair of the sewer system. William A. Hall is City Engr.

Lewiston, N. Y.—The Village Board contemplates building a sewer system in the northern section of the village.

+Rochester, N. Y.—The contract for building the Linden St. sewer has been awarded to SCHROEDER HICKS CONSTRUCTION CO., at $9334 by the Board of Contract and Supply.

Hoboken, N. J.—Plans have been approved by the State Board of Health for the construction of a sewer system for the southern section of North Bergen.

+Newark, N. J.—The Board of Works has awarded the following contracts for sewer construction: To MICHAEL STEFANELLI, north westerly section of Vailsburgh sewer at $18,166,, and Abinger Pl. and Boylan St. sewers at $1059; to THOMAS MERCADANTE, Stuyvesant Ave. sewer at $855. Noted Sept. 30.

Easton, Penn.—At an election held recently bonds for $300,000 for the construction of sewer system and disposal plant were defeated.

+Montoursville, Penn.—Contract awarded to JOHN C. SCHRADE, INC., 2132 Beverly Road, Brooklyn, N. Y., for constructing a storm sewer, in Broad St. About one mile of 30-in. segmental blocks, and 24 in., 18 in., 15 in. and 12 in. vitrified pipe, manholes and catch basins were required. S. D. Neyhard is Engr.

Pittsburgh, Penn.—(Official)—See item under "Streets and Roads."

+Richmond, Va.—Contracts for the construction of sewers have been awarded by the Administration Board to NICHOLAS & HENLY and SCOTT-NUEKOLS CO., at $7470 and $23,411 respectively. Noted Sept. 10.

+Thomasville, N. C.—The contract for extending the sewer system has been awarded to the J. B. McCRARY CO., Atlanta, Ga., at $12,000.

Winston Salem, N. C.—Plans have been prepared by J. L. Ludlow, Engr., Winston-Salem for the construction of a sewage disposal plant. Noted July 16.

Macon, Ga.—The citizens contemplate constructing a sewer system in the Vineville section. J. J. Gaillard is City Engr.

Ocala, Fla.—An election will be held to vote on the proposition of issuing bond for $100,000, the proceeds of which will be used for the construction of a sewer system.

Tampa, Fla.—The low bidders for constructing sewers in the De Soto Park section were Kennedy & Bond at $0.17 a lin.ft. Noted Sept. 10.

West Palm Beach, Fla.—At an election held Sept. 21, bonds were voted; the proceeds of which to be used for the construction of a sewer system.

+Bessemer, Ala.—(Official)—The contract for constructing a sanitary sewerage disposal plant has been awarded to the SOUTHERN ASPHALT & CONSTRUCTION CO., Birmingham, at approximately $85,000.

Louisville, Ky.—The Sewer system at the State Fair Grounds will probably be extended by the State Fair Board.

+Cincinnati, Ohio—(Official)—The contract for constructing a sewer in Mill Creek intercepter from Dane St. to Mitchell Ave., under Contract No. 3 has been awarded to THURBER & CO. at $163,590. Noted Sept. 24.

Cleveland, Ohio—The City Council contemplates issuing bonds for $200,000 the proceeds of which to be used for the building of a sewer in Dugway Brook.

Coshocton, Ohio—The State Board of Health has approved the plans of Chester & Fleming, Pittsburgh, Engrs., for the sewerage disposal plant and water reservoir of this city. Noted Aug. 27 and Sept. 3.

Franklin, Ohio—The citizens contemplate constructing sewers in the north side district.

+Port Clinton, Ohio—(Official)—The contract for constructing sewers in Perry and Canal St. has been awarded to F. J. RICHARDSON, Port Clinton, at $5902. Bids opened Sept. 23. Noted Sept. 3.

Xenia, Ohio—Plans have been prepared by the W. J. Sherman Co., Toledo, for the construction of a new sewage disposal plant. Noted July 23.

+Terre Haute, Ind.—The contract for constructing a sewer in 18th St., from Liberty Ave. to Hulman St., has been awarded to the J. PAUL WELCH CO., at $12,500.

+Fairfield, Ill.—A contract for constructing a sanitary sewer system has been awarded to the RILEY CONSTRUCTION CO., St. Louis, Mo., at $29,348.

Beaver Dam, Wis.—Bids will be received by the City Clerk until Oct. 12, for constructing storm sewers in various streets.

+Kewaunee, Wis.—The contract for constructing a storm sewer in Milwaukee St. has been awarded to G. W. MULHOLLAND, Two Rivers, Wis., at $5000. Noted Sept. 24.

Kiel, Wis.—Bids will be received by Fred Duecker, Village Clk., for constructing and laying 2950 ft. of 10-in. vitrified pipe sewer; 318 ft. of 8-in. vitrified pipe sewer; 1000 ft. of 6-in. and 3000 ft. of 4-in. c.-i. water mains.

+La Crosse, Wis.—The contract for constructing a 12-in. vitrified sewer on 13th St., from Madison to Cass St., and on Fourth and Berlin Sts., has been awarded to OLAF SWEIMES, at $6953.

Oelwein, Iowa—(Official)—Bids were received Sept. 28 by the City Council for the enlargement of the filter beds as follows: Wilson & Dobson, New Hampton, $7783; Tschirgi & Son, Cedar Rapids, $7731; De La Hunt, Cedar Rapids, $10,060. All bids were rejected. The work will probably be done by day labor. Noted Sept. 24.

Postville, Iowa—An election will be held, Oct. 12, to vote on the proposition to issue $25,000 in bonds, the proceeds of which will be used for constructing a sewer system.

Brainerd, Minn.—Bids will be received by V. N. Roderick, City Clk., until 8 p.m., Oct. 19, for constructing a sewer in District No. 6.

St. Paul, Minn.—Bids will be received by A. Hohenstein, City Pur. Agt., until 10 a.m., Aug. 12, for constructing a sewer in Fulton St., from Palace St. to Jefferson Ave., and in Wentworth Ave., from Doane St. to St. Anthony Ave.

+St. Joseph, Mo.—Contracts have been awarded for constructing sewers in Districts Nos. 55 and 17 to the SKILLBRED CONSTRUCTION CO.; District No. 138, to J. F. BUIS; in District 127, to W. B. KELLY.

St. Joseph, Mo.—Bids will soon be received by the Board of Public Works for constructing sewers in Districts, Nos. 37, 98, 101, 111, 139 and 144.

+Argenta, Ark.—A contract for constructing a storm and sanitary sewer system in Sewer Improvement District No. 1 has been awarded to GASS & HORTON, Houston, Tex., at $275,245.

Cleburne, Tex.—The citizens contemplate holding an election to vote on $180,000 in bonds, the proceeds of which will be used for constructing a sewer system.

El Paso, Tex.—The City Council has purchased a site for the construction of the proposed sewage disposal plant. The filtration system will be used. The cost of the improvement will be about $25,000.

Fort Worth, Tex.—The City Commission has under consideration the construction of a sewage disposal plant to cost several hundred thousand dollars. Bonds will be issued for the purpose.

+Granger, Tex.—A contract for constructing a sewer system has been awarded to the DALLAS LIME & GRAVEL CO. at $12,236.

+Salt Lake City, Utah—The contract for the construction of a seven-mile sewer has been awarded by the City Commissioners to HENRY C. ULEN at $671,000.

Spokane, Wash.—Bids will be received by G. W. Duffy, City Clk., until Oct. 15, to construct a sewer. The approximate cost of the work is $18,500.

Portland, Ore.—Bids have been received by the City Council for sewer work as follows: In Base Line Road and East 78th St., Edward Sandeberg, for vitrified pipe, $7686; Keating & O'Neill, for vitrified pipe, $7584; Azar & Co., concrete pipe, $6334. Sewer in East Seventh and East Yamhill St., Edward Sandeberg, vitrified pipe, $10,336; George Gordon, vitrified pipe, $9468; Keating & O'Neill (pipe not specified), $10,436; Azar & Co., concrete pipe, $8591.

+Sacramento, Calif.—A contract for constructing a sewage pumping plant has been awarded to J. W. TERREL, at $21,950.

+San Francisco, Calif.—The Board of Public Works has awarded the contract for constructing a sewer in Fifth St. between Brannan and Channel Sts. to the HEALY-TIBBITTS CONSTRUCTION CO., San Francisco, at $66,000.

Willows, Calif.—Plans are being prepared by the City Engineer for the construction of a sewer. The estimated cost is $25,000.

Leamington, Ont.—Bids will soon be received by the Town Council for constructing a sewer. The estimated cost is $35,000. John A. Baird is Engr.

Peterboro, Ont.—Bids will soon be received by the City Council for the construction of a concrete sewer outlet.

+Toronto, Ont.—The contract for constructing a sewer in Windermere Ave. has been awarded to the CONNOLLY-AGNEW CONSTRUCTION CO., at $5365.

Regina, Sask.—The City Council will build an extension to the pump house at the sewage disposal work. The estimated cost of the work is $5000. M. F. McArthur is Engr.

GARBAGE

+Amsterdam, N. Y.—The MORSE BOULGER DESTRUCTOR CO., New York, N. Y., has been awarded the contract for the installation of a garbage incinerator, at $7900.

+Pensacola, Fla.—The city has awarded the contract to the NYE ODORLESS CREMATORY CO., Macon, Ga., for the construction of a 10-ton capacity crematory.

Iron Mountain, Mich.—The city plans to install a garbage incinerator.

Chicago, Ill.—The Board of Health has had plans prepared and will build a one-story brick garbage incinerator at 28th St. and Sacramento Ave. The estimated cost is $5000. E. W. Kallar is the Arch.

San Antonio, Tex.—The City Council has under consideration the construction of a garbage incinerator estimated to cost about $50,000.

STREETS AND ROADS

✦**Boston, Mass.**—The contract for a bituminous macadam roadway in Frankford St., East Boston, has been awarded to MARTINO DI MATTEO, at $[illegible]. Other bids were, James Doherty, $[illegible]; Hugh J. McGuire, $6[illegible]. Noted Sept 24.

Bids will be received, until Oct 13, by Public Works Department, for macadam roadways and [illegible] block pavement in [illegible] and Houston Sts., West Roxbury, and in Langdon St., Roxbury District. J. K. Rourke is Comr.

✦**New York, N. Y.**—(Borough of Queens)—(Official) Bids were received by Maurice E. Connolly, Pres., Borough of Queens, for regulating, grading, curbing and laying sidewalks [illegible] with all work incidental thereto, in Thompson Ave. from [illegible] to [illegible] St., as follows: DEGNON CONTRACTING CO., $[illegible] (awarded contract); [illegible] & [illegible] Contracting Co., $[illegible]; Astoria Contracting Co., $11,-6[illegible]; Charles A. Meyers Contracting Co., $11,6[illegible]; Welsh Bros. Contracting Co., $11,[illegible]; Evergreen Construction Co., $12,861; Thomas [illegible] Contracting Co., $13,9[illegible]; Peace Bros., $13,-[illegible]; L. S. Fulton, $1[illegible]; Henry J. Mullen Contracting Co., $1[illegible]; Leo E. Keily, Inc., $17,[illegible]. Noted Sept 24.

Oneonta, N. Y.—Plans are being prepared by F. M. Gurney, City Engr., for 13,[illegible] sq.yd. of paving.

✦**Rochester, N. Y.**—The contract for paving Wren, Dove and [illegible] Sts. with asphalt has been awarded to RAUBER & VI[illegible], 179 South Ave., at $23,6[illegible].

Newton, N. J.—The Board of Chosen Freeholders, Essex County, has approved plans for the construction of an improved road from Newton to Sparta, about five miles, at an estimated cost of $12[illegible], and the immediate advertising for bids. Harvey [illegible] is County Engr. Noted Sept 21.

South Orange, N. J.—The Board of Trustees has passed an ordinance providing for the paving of Third St. between [illegible] and Church Sts. with 8-in. telford pavement.

✦**Trenton, N. J.**—The Board of City Commissioners has awarded a contract to the NEWTON PAVING CO. for macadamizing Cleveland Ave. from Greenwood to Hamilton Ave.

The State Road Commission is considering the improvement of the road from Keyport to Lakewood by way of Freehold, and the highway from Berlin (Camden County) to Atlantic City.

Erie, Penn.—The City Council has passed an ordinance providing for the repaving of Sixth St., from State to German St. The approximate cost is $10,[illegible].

Pittsburgh, Penn.—(Official)—Bids will be received by the City Controller, Municipal Hall, until 10 a.m., Oct 1[illegible], for improving several streets by grading, curbing, paving and constructing sewers.

Baltimore, Md.—Bids will be received until Oct 14, by the Board of Awards, City Hall at the City Register's Office, for the grading, curbing and paving with sheet asphalt and vitrified block on concrete base, Center St., from Howard St. to Washington [illegible]; Saratoga St. from Green to Howard St. and Greene St., from Lexington to Franklin St., to be done under Contract No. [illegible]. The work includes [illegible]00 sq.yd. of vitrified block, [illegible] sq.yd. of sheet asphalt. R. Keith Compton is Consulting Engr.

Petersburg, Va.—(Official)—Bids will be received by J. B. [illegible], City Clk. of [illegible], until [illegible], Oct 1[illegible], for constructing [illegible] sq.yd. of creosoted wood-block pavement on [illegible] Bank and Halifax St. P. G. Hastings is Clk. of the Coun.

✦**Richmond, Va.**—(Official)—Bids were received, Sept 17, by the City [illegible] for 11,[illegible] sq.yd. of paving, as follows: CENTRAL CONSTRUCTION & SUPPLY CO., $[illegible] (awarded [illegible]); [illegible]

Ocala, Fla.—[illegible]

✦**West Palm Beach, Fla.**—[illegible]

Gadsden, Ala.—[illegible]

Starkville, Miss.—[illegible]

New Orleans, La.—[illegible]

Louisville, Ky.—[illegible]

✦**Columbus, Ohio.**—[illegible]

Hocking County—Chillicothe-Logan Road, waterbound macadam, J. A. JONES, Ironton, $1[illegible].

Holmes County—Sect [illegible], Millersburg-Canal Road, waterbound macadam, F. M. DEETZ, Millersburg, $9792.

Jackson County—Columbus-Ironton Road. No bids. [illegible] waterbound macadam, WOLFE & SEEPLE, Toledo, $[illegible]1,000.

Jefferson County—Ohio River Road, brick, ANDREW W. McDONALD, Steubenville, $29,[illegible]00.

Madison County—Washington-London Road, waterbound macadam, J. M. SNOUFFER, Columbus, $[illegible],000.

Madison County—Sect [illegible], Marysville-London Road, waterbound macadam, J. M. SNOUFFER, Columbus, $17,400.

Vinton County—McArthur-Logan Road, waterbound macadam, J. R. FREINER, Hamden, $[illegible],711.

Mahoning County—Sect H, Akron-Youngstown Road, brick, W. E. [illegible], Ravenna, $[illegible],6[illegible].

Summit County—Sect A, Akron-Medina Road, wood block, WILDS & DAVIDSON, Akron, $[illegible].

✦**Columbus, Ohio.**—The contract for repaving High St. from Livingston Ave. to Town St. has been awarded to the CLEVELAND TRINIDAD PAVING CO.

Lima, Ohio.—The resurfacing of West High St. has been authorized by the City Council.

✦**Norwalk, Ohio.**—(Official)—The contract for improving the Newman Road has been awarded to RILEY PARDO, Norwalk, at $8710. Other bids were: Modern Construction Co., $10,100; F. L. Rice & Sons, $9140. Noted Sept 1[illegible].

✦**Oak Hill, Ohio.**—The contract for paving Main St. has been awarded to KAPPE BROS., Portsmouth, at $[illegible]2[illegible].

Painesville, Ohio.—The contract for paving the Ridge and Arnold Road in Willoughby Township with brick has not been awarded by the County Commissioners as the bonds were not sold. Noted Aug 2[illegible].

Sandusky, Ohio.—Bids will be received by the City Aud. until Oct 31 for the sale of $11[illegible] in bonds. The proceeds of which will be used to improve sections of Scott, Fifth, Meigs, Monroe, Adams, Wayne and Van Buren Sts.

✦**Crown Point, Ind.**—A contract has been awarded by the County Commissioners to M. R. HEINY, Gary, at $[illegible], for improving Cline and Fifth Aves. in Gary and 1[illegible]1st St. in Indiana Harbor.

✦**Fort Wayne, Ind.**—The contract for constructing the stone road on the line between Allen and DeKalb Counties has been awarded to CHARLES W. EHLING, at $1[illegible],98[illegible].

Hillsboro, Ill.—Bids were received by the Board of Local Improvements for paving Fairmount Place from Wolfe & Co., Alton, and Self & Koller, Pana.

✦**Springfield, Ill.**—The Illinois State Highway Commission awarded contracts, Sept [illegible], for highway work as follows:

Fayette County, Route 6, Sect A, 7[illegible]6 lin.ft. concrete, P. M. JOHNSTON & CO., St. Elmo, Ill., $[illegible].

Schuyler County, Route [illegible], Sect A, 6766 lin.ft. concrete, J. F. BALL & CO., [illegible], $6[illegible]66.

Tazewell County, Route 10, Sect B, [illegible] lin.ft. concrete, W. D. ALEXANDER CO., Normal, Ill., $[illegible].

Whiteside County, Route 6, Sect A, [illegible] lin.ft. concrete, SHUGART & MUNSON, Nevada, M[illegible], $[illegible].

Rock Island County, Route 1[illegible], Sect A, [illegible] lin.ft. concrete, McCARTHY IMPROVEMENT CO., Davenport, Iowa, $[illegible]. Noted Sept [illegible].

Sullivan, Ill.—(Official)—Bids will be received until 2 p.m., Oct 1[illegible], for constructing approximately [illegible] sq.yd. of brick pavement, [illegible]00 lin.ft. of combined concrete curb and gutter. Claude L. James, Mattoon, Ill., is Engr.-in-Charge.

✦**Ashland, Wis.**—The contract for grading White River [illegible] has been awarded to M. [illegible] YARD, at [illegible]

✦**Fond du Lac, Wis.**—[illegible] has been awarded to [illegible] FIELD. Noted Sept [illegible].

✦**Madison, Wis.**—Contracts for paving West Main and Francis St. and West Washington Ave. [illegible] have been awarded to the JOHNSON CONTRACTING CO., Milwaukee, [illegible]

Anamosa, Iowa.—Bids will be received by C. V. [illegible], City Clk., until 6 p.m., Oct 1[illegible], for paving about [illegible] sq.yd. with vitrified paving blocks.

✦**Carroll, Iowa.**—The contract for [illegible] of the [illegible] Highway has been awarded to LITTLE [illegible]

Des Moines, Iowa.—Bids will be received by [illegible], City Clk., until [illegible], Oct 1[illegible], for paving [illegible] Ave.

Morris, Minn.—[illegible]

✦**Sanborn, Minn.**—[illegible] to SCHMIT[illegible]

Atchison, Kan.—(Official)—Bids will be received by the Board of County Commissioners [illegible], Oct 19, for [illegible] the Leavenworth [illegible]. C. M. Volker is County Engr.

✦**Leavenworth, Kan.**—The contract for paving [illegible] has been awarded to the E. W. [illegible] CONSTRUCTION CO.

Pittsburgh, Kan.—[illegible]

✦The contract for [illegible] Ave. [illegible] has been awarded to the WILLIAMS CONSTRUCTION CO., Joplin, Mo.

✦**Omaha, Neb.**—The contract for paving Military Ave. has been awarded to the [illegible] CONSTRUCTION CO., South Omaha.

Independence, Mo.—The County Court will rebuild [illegible] [illegible]

+Nevada, Mo.—A contract for paving 12,000 sq.yd. with asphalt macadam has been awarded to V. G. KOCH, Joplin, Mo.

Osceola, Mo.—An election will be held Nov. 3 to vote on the proposition of issuing $14,000 in bonds for constructing roads.

+Pine Bluff, Ark.—A contract for constructing 28 miles of macadam road from Star City to Jefferson County Line via Grady has been awarded to E. A. HENSLEY and John PERDUE at approximately $108,000.

Rockwall, Tex.—Rockwall County will issue $20,000 in bonds for road improvements.

San Antonio, Tex.—Preliminary steps have been taken by D. E. Colp of San Antonio, Secy. of the Texas Good Roads League and Asst. Secy. of the Texas division of the National Highway Association, to obtain a 100-ft. right of way for a proposed asphalt highway to be constructed through the state from north to south. The route of the proposed highway is from Wichita Falls, situated near the Texas-Oklahoma border, to Laredo on the Mexico border, passing through Fort Worth, Waco, Austin, San Antonio and a number of smaller towns.

Sherman, Tex.—The City Council will soon receive bids for paving East Lamar St.

McAllister, Okla.—Bids will be received by the City Council until Oct. 14, to pave Third St. from Delaware to Miami Ave. J. M. Gannaway is City Clk.

+Pocatello, Idaho—A contract for paving District No. 6, 7 and 8 has been awarded to STRANGE & McGUIRE, Lewistown, Mont., at $36,000. Noted Aug. 27.

+Seattle, Wash.—The contract for paving Queen Anne Blvd. with asphalt has been awarded to D. H. TRAPHAGEN at $8780.

(Official)—Bids will be received by the Board of County Commissioners of King County until 10 a.m., Oct. 20, for constructing the Medina-Bellvue Road.

Seattle, Wash.—Bids will be received by the Board of County Commissioners, until Oct. 12, for paving 14th Ave. south to Des Moines Road. Byron Phelps is Clk. of the Bd.

+Portland, Ore.—The contract for concrete walks, curbs, etc. on 61st St., S. E., has been awarded to MILLER & BAUER, at $16,326.

Arcadia, Calif.—The city contemplates spending about $150,000 for constructing oil macadam roads within the city limits. Mark Ehle is City Eng.

Eureka, Calif.—(Official)—Bids will be received by the Board of Supervisors of Humboldt County until 2 p.m., Oct. 13, for the purchase of $150,000 in bonds for highways.

+Los Angeles, Calif.—The FAIRCHILD-GILMORE-WILTON CO. has been awarded the contract at $97,120, for improving Lyon St. from Macy to Aliso St.

+Los Angeles, Calif.—The FAIRCHILD-GILMORE-WILTON CO. has been awarded a contract at $114,025, for improving Sixth St., from Palso Verdes St. to Cabrillo Ave.

Red Bluff, Calif.—Bids will be received by the Board of Supervisors, until Oct. 14, for the construction of a section of the Red Bluff and Susanville Road. H. C. Kauffman is Chmn. of the Bd. of Supervisors.

+Sacramento, Calif.—The State Highway Commission has awarded contracts for road construction as follows: Santa Clara County, from southerly boundary to Los Gatos, to JOHN A. MARSHALL, of Berkeley, at $72,626; Contra Costa County, from Eckley to Martinez, to BATES, BORLAND & AYER, Oakland, at $42,097; Siskiyou County, from Weed to Dunsmuir, to TOOHEY & JOHNSON, Phoenix, Ariz., at $67,123; Los Angeles County, from Section 17 to the Castiac School, to MAHONEY BROS., San Francisco, at $123,158. Bids for work in Napa and Glenn Counties have been rejected and the work will be done by day labor. Noted Sept. 10 and Oct. 1.

San Francisco, Calif.—The city will pave the Civic Center with vitrified brick and improve the streets leading to the exposition, and Tenth and Eleventh Sts. The cost will be about $180,000.

Sloat Boulevard is to be paved by the city, the United R.R. and the Spring Valley Water Co., at a cost of $96,000.

+Santa Barbara, Calif.—(Official)—A contract for street and sewer work in Moreno-Grand-Valerio Improvement District has been awarded to F. R. RITCHIE & CO., San Francisco, at $47,872. N. F. Hewitt Co., Los Angeles, submitted a bid of $52,286.

Santa Monica, Calif.—Bids will be received by the City Clerk, until Oct. 12, for improving portions of Ashland Ave. from Eighth to 14th St.

+Upland, Calif.—The contract for improving 12th St. has been awarded to the GEORGE SNYDER CONTRACTING CO., Ocean Park.

Chatam, Ont.—The City Council has had plans prepared for constructing 9150 sq.yd. of concrete pavement. The estimated cost is $12,500. W. G. Merr is City Clk.

Ford City, Ont.—The City Council has awarded the contract to the CANADIAN DOLARWAY PAVING CO., LTD., Royal Bank Bldg., Windsor, for resurfacing a section of Sandwich St.

South Vancouver, B. C.—The City Council proposes to pave 63d Ave. with gravel bitulithic. The approximate cost of the work is $15,000. S. B. Bennett is Municipal Engr.

+South Vancouver, B. C.—The contract for paving Victoria Road has been awarded to the BITULITHIC PAVING CO. at $71,000.

INDUSTRIAL WORKS

+Auburn, Maine—The contract for the erection of a factory for the Manufacturers' Box Co. has been awarded to FRED W. KEENE, 45 Fourth Ave. Lancaster & Libby, General Theatre Bldg., Lewiston, Maine, are the Archs.

Manchester, N. H.—Plans are being prepared for a two-story factory for the Amoskeag Mfg. Co . The estimated cost is $50,000.

+Boston, Mass.—The contract for the construction of the two-story building for the U. S. Fastener Co. has been awarded to C. A. DODGE & CO., Erie and Albany Sts., Cambridge.

+Holyoke, Mass.—The contract for the construction of the factory on Winter St. for the Eureka Ruling & Binding Co. has beeen awarded to JOHN J. O'NEIL CO., Holyoke, Mass., at $20,800. Ellsworth & Howes are the Archs.

+New York, N. Y.—(Borough of Queens)—The contract for the construction of the superstructure of the warehouse and assembly plant, at Long Island City, for the Ford Motor Co., has been awarded to the W. L. CROW CONSTRUCTION CO., 103 Park Ave. Noted July 30.

+The general contract for the construction of a can factory at the Devoe works of the Standard Oil Co., at Long Island City, has been awarded to H. D. BEST & CO., 320 Fifth Ave., New York. The estimated cost is $200,000.

+Baltimore, Md.—The contract for the construction of the storage building for the Crown Cork & Seal Co. has been awarded to the WEST CONSTRUCTION CO., Knickerbocker Bldg., Baltimore.

+The contract for the construction of the factory and warehouse for the Dix Mfg. Co. has been awarded to JAMES J. O'CONNER, 427 East Lexington St. Noted Aug. 13.

+Charlotte, N. C.—The general contract for the construction of the warehouse for Alexander Sprunt & Sons has been awarded to the FISKE CARTER CONSTRUCTION CO., Greenville, S. C.

Louisville, Ky.—R. L. Kaufman, Mgr. Grocers' Biscuit Co., announces that plans are being prepared for rebuilding the plant, recently destroyed by fire.

Carrollton, Ohio—M. F. Albright and Richard Albright, Carrollton, plan to construct a seven-kiln pottery.

Cleveland, Ohio—G. T. Bauder, 2869 Coleridge Ave., Cleveland, will erect a $25,000 manufacturing plant at 2125 Superior Ave., to be used for a cloak and suit factory.

+The contract has been awarded to MORROW BROS., Baltimore, for constructing the four-story reinforced-concrete, brick and terra cotta assembly plant for the Ford Motor Co., Cleveland.

+Cleveland, Ohio—The Osborn Engineerinf Co., Arch., has awarded the contract to the MASTERS & MULLEN CO., Cleveland, for constructing four factory buildings for the Atlantic Refining Co., at East 79th St. and Kinsman Rd. Estimated cost, $12,000.

+Cleveland, Ohio—The contract for the construction of the 10-story commercial warehouse at Mandrake and West Ninth Sts., for the William Bingham Co., Superior Ave., Cleveland, has been awarded the CROWELL-LUNDOFF-LITTLE CO., 1951 East 57th St., Cleveland. Estimated cost, $1,000,000. Christian, Schwarzenberg & Gade, 1900 Euclid Ave., Cleveland, are the Archs.

The Hildebrand Provision Co. plans to construct a factory at its plant on Clark Ave. It will be two stories, 76x66 ft., of reinforced concrete. Estimated cost, $16,000.

The West Steel Castings Co. will ask for bids soon for constructing a factory. It will be one story, 51x95 ft. Estimated cost, $50,000.

The Cleveland & Youngstown Ry. Co. plans to construct a six-story freight terminal and warehouse at Broadway and Orange Ave. Estimated cost, $750,000.

Napoleon, Ohio—The Detroit, Toledo & Ironton R.R. plans to construct a 13-stall roundhouse at Napoleon.

Youngstown, Ohio—The Willys-Overland Co. plans to construct extensions at its plant to cost $200,000.

Connersville, Ind.—The city will establish a municipal abattoir, requiring refrigerating apparatus and other equipment.

Kenosha, Wis.—The Bain Wagon Co. plans to construct a warehouse and paint shop of brick, concrete and mill construction, two-story and basement, 54x192 ft. and 50x175 ft. The superstructure plans are in preparation. Estimated cost, $80,000; D. J. Harif is Supt.

Port Edwards, Wis.—The Nekoosa-Edwards Paper Co., Port Edwards, plans improvements at its plant, to cost $25,000.

+Davenport, Iowa—The Henry Kohrs Packing Co. has awarded the contract to A. A. ARNAULD, McManus Bldg., Davenport, for constructing an addition to its packing plant, at $10,000.

Keokuk, Iowa—The Johnson Smelting Co., Keokuk, plans to construct a building at Keokuk to cost $75,000.

Duluth, Minn.—The Northwestern Textile Co. plans to construct a factory at Duluth. Estimated cost, $50,000.

Duluth, Minn.—The Zenith Furnace Co., Duluth, plans to construct improvements at its furnace here. Estimated cost, $35,000.

Idaho Falls, Idaho—A site has been secured in this city for the construction of a factory by the C. O. Farm Implement Co. Work will begin soon. The company is represented locally by S. Keller, of the F. C. Bowman Co.

Pasco, Wash.—W. F. Chute, Pasco, plans to construct a large grape-juice factory here. Financial arrangements for the plant have been made.

Spokane, Wash.—P. C. Patterson, local representative of W. P. Fuller & Co., has secured a site on Desmet Ave., on which the company will erect a warehouse. Estimated cost, $50,000.

Sumas, Wash.—The Standard Powders Co., Grand Hotel, Sumas, plans to construct a new factory.

Tacoma, Wash.—The Monogram Shingle Co. plans to rebuild its plant recently destroyed by fire.

Hillsboro, Ore.—The Pacific Coast Condensed Milk Co., Hillsboro, will enlarge its milk-condensing plant at an estimated cost of $25,000.

♦Los Angeles, Calif.—The [illegible] has been awarded to the [illegible] CONSTRUCTION CO., 10th and Tennessee Sts., Los Angeles, for the construction of a one-story brick laundry at [illegible] St., for the Los Angeles Laundry Co., [illegible] St. Estimated cost, $35,[illegible]. The building will be [illegible] ft., with a concrete foundation, cement floors, reinforced-concrete [illegible] and floor slabs and ruffled brick [illegible]. Plans were prepared by Fred A. Hale, Arch., 614 San Fernando St.

♦Montreal, Que.—The contract has been awarded to [illegible], 6 [illegible] St., Montreal, for the construction of [illegible] addition to the plant of the Toilet Laundry Co., Ltd. Estimated cost, $[illegible].

St. Jerome, Que.—[illegible] & Girard, Archs., Southam Bldg., Montreal, Que., are receiving bids for constructing two factories at St. Jerome, Que., one story, each 5[illegible]x1[illegible] ft., of brick.

Edmonton, Alta.—Hardie & Maitland, Archs., Edmonton, have completed plans for a warehouse to be constructed in Third St., for M. A. Miller. Estimated cost, $28,000.

FEDERAL GOVERNMENT WORK

♦Test Piles—Boston, Mass.—The contract for driving, testing and pulling piles at the building on Atlantic Ave. for the U. S. [illegible] has been awarded to W. A. NORTEN, [illegible] Boston. The building will be of brick, eight-stories, [illegible] ft. W. N. [illegible], Post Office Bldg., is in charge. Noted [illegible].

Shipbuilding Ways, Etc.—Boston, Mass.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a.m., Oct. 21, for shipbuilding ways and [illegible] at the Navy Yard, Boston, Mass. Plans will be obtained on application to the Bureau or to the Commandant of the navy yard. H. R. Stanford is Chief of the Bureau.

♦Paving—Springfield, Mass.—The contract for paving with [illegible] brick that portion of Pearl St. belonging to the United States and for resurfacing a portion of the same street, has been awarded to ADAMS & BENTON, Springfield, at $9000. Noted Sept. 3.

♦For Purchasing Steamer—Newport, R. I.—(Official)—Bids will be received at the U. S. Engineers office, Newport, until 11 a.m., Nov. 2, for purchasing the steamer "Cora." For further information see item under "Contracts To Be Let."

Repairs To Roof—Buffalo, N. Y.—Bids will be received by the Custodian, U. S. Public Bldg., until 2 p.m., Oct. 13, for making repairs to the roof of the building.

Cement—New York, N. Y.—Bids will be received until [illegible] Oct. 19, by Col. A. L. Smith, Depot Quartermaster, Army Bldg., for delivering 14,[illegible] barrels of Portland cement.

Sheet Metal Work—New York, N. Y.—(Official)—The following are the bids received for replacing of the old [illegible] roof with sheet metal on the U. S. Court House and Post Office, New York: Howard H. Peterson, New York, $37,100; [illegible] Construction Co., New York, $[illegible],317; North East [illegible] Co., New York, $29,67[illegible]; Keppen Construction Co., New York, $[illegible]; Neptune H. Smyth, New York, $24,893. Noted [illegible] 21.

♦Lock Gates—Troy, N. Y.—The following are the bids received by Col. W[illegible], Corps Engrs., U. S. A., Army Bldg., for [illegible] lock gates at Troy Locks, Hudson River: [illegible] Rail & Construction Co., New York, N. Y., $[illegible]; [illegible] Bridge Co., Pittsburgh, Penn., $[illegible]; [illegible] & [illegible] Iron Works, Detroit, Mich., $27,081; [illegible] Falls, Penn., $[illegible]; KING BRIDGE Co., Cleveland, Ohio, $21,[illegible] (awarded contract).

Post Office—Jersey City, N. J.—The government will soon [illegible] for constructing a post office in the Hudson City section.

♦Steel Hull—Pittsburgh, Penn.—(Official)—Bids will be received by [illegible], U. S. Engineers office, Pittsburgh, Penn., until [illegible], Nov. 6, for constructing the steel hull for the [illegible] boat "Kittanning."

♦Wye Levels—Washington, D. C.—(Official)—Bids will be received at the office of the Coast and Geodetic Survey, [illegible] New Jersey Ave., S. E., Washington, D. C., until 2 p.m., Oct. 12, for furnishing eight [illegible] wye levels [illegible] with tripods. Specifications may be obtained on application to the Superintendent, Coast and Geodetic Survey.

Life Saving Station—Wilmington, N. C.—Bids will be received until 2 p.m., Oct. [illegible], by S. I. Kimball, Gen. Supt., Life Saving Service, Washington, D. C., for the construction of a life saving station at Cape Fear, N. C.

Motor Boat—Wilmington, N. C.—(Official)—The following are the bids received by [illegible] H. W. [illegible], Corps Engrs., U. S. A., for [illegible] motor boat: [illegible]; [illegible] Kyle & [illegible]; [illegible]; Gas Engine & Power Co. and Charles L. Seabury & Co., $[illegible]; [illegible] Marine Equipment Co., [illegible]; [illegible] Boat Co., $[illegible]; [illegible]; [illegible] Co., $11,[illegible].

Mill Work—Atlanta, Ga.—Bids were received by F. H. [illegible], Supt. of [illegible], Washington, D. C., for mill work for the [illegible] building at the U. S. Penitentiary, Atlanta, [illegible] & [illegible] Co., St. Louis, Mo., [illegible]; and the [illegible] Co., Louisville, Ky., at [illegible]. Noted Sept. [illegible].

Repairs To Building—[illegible], Ga.—Bids will be received until [illegible], by the Custodian, U. S. post office, for making repairs to the building.

Post Office—[illegible], Tenn.—(Official)—Bids will be received until 3 p.m., [illegible], by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for constructing a [illegible] and basement stone and brick post office at [illegible].

Post Office—[illegible], Ind.—Bids received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for constructing the post office at [illegible] have [illegible] Aug. [illegible].

Breakwater—Indiana Harbor, Ind.—The following are the bids received by Lieut. Col. W. V. Judson, Corps Engrs., U. S. A., for constructing a rubble mound breakwater at Indiana Harbor: Edward Gillen Dock, Dredge & Construction Co., Racine, Wis., $1.86½ (per ton of 2000 lb.); Burk, Smith & Nelson, Muskegon, Mich., $2; Great Lakes Dredge & Dock Co., Chicago, Ill., $1.4[illegible]; Fitz-Simmons & Connell Dredge & Dock Co., Chicago, Ill., $2.2[illegible]; Greiling Bros. Co., Green Bay, Wis., $1.[illegible]; Byrne Bros. Dredging & Engineering Co., Chicago, $2.7[illegible]. Noted Sept. 3.

Post Office—Cadillac, Mich.—The following are the bids received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, for constructing the post office at Cadillac: Northern Construction Co., Milwaukee, Wis., $6[illegible],849; Cadillac Cabinet & Construction Co., Cadillac, $78,000; C. Hoertz & Son, Grand Rapids, Mich., $6[illegible],37[illegible].

Breakwater—Marquette, Mich.—Bids will be received until 10 a.m., Oct. 23, at the U. S. Engineer's Office, Canal Park, Duluth, Minn., for constructing a rubble mound breakwater at Marquette.

Post Office—Canton, Ill.—(Official)—Bids will be received until 3 p.m., Nov. 10, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for constructing a two-story and basement stone, terra cotta and brick post office at Canton.

♦Elevators—Wichita, Kan.—The contract for the installation of hoistway, electric passenger elevator, hydraulic lift, etc., in the U. S. post office at Wichita, has been awarded to KAESTNER & HECHT, Chicago, Ill., at $[illegible].

♦Steel Flumes—North Platte, Neb.—(Official)—The contract for furnishing steel flumes for the North Platte Irrigation Project has been awarded by the U. S. Reclamation Service to the HINMAN HYDRAULIC MFG. CO., Denver, Colo., at $6773 f.o.b. Denver.

Post Office—Amarillo, Tex.—The following are the bids received by Oscar Wenderoth, Superv. Arch., Washington, D. C., for constructing the post office at Amarillo: (a) limestone, (b) limestone and sandstone, (c) sandstone. M. Yeager & Son, Danville, Ill., (a) $167,359, (b) $1[illegible],3[illegible]9, (c) $174,3[illegible]9; J. L. Crouse & Son, Greensburo, N. C., (a) $168,604, (b) $174,601, (c) $175,601; George W. Stiles Construction Co., Chicago, Ill., (a) $176,6[illegible], (b) $186,6[illegible], (c) $18[illegible]6[illegible]; [illegible] S. Moore, La Fayette, Ind., (a) $179,072, (c) $193,1[illegible]5; W. M. Rice, Amarillo, (a) $1[illegible],[illegible]11; J. H. Weise, [illegible], Neb., (a) $188,720; J. E. & A. L. Pennock, Philadelphia, Penn., (a) $188,747; (c) $196,630; Dieter & Wenzel Construction Co., Wichita, Kan., (a) $192,[illegible]0; C. G. R[illegible]ganamore, Amarillo, (a) $191,989. Noted Aug. 27.

♦Post Office—Clarksville, Tex.—The contract for the construction of the post office at Clarksville has been awarded to G. A. SHAUL, Seneca, Kan., at $41,9[illegible]6.

♦Elevator—Guthrie, Okla.—The contract for installing the passenger elevator in the U. S. post office and court house at Guthrie has been awarded to KAESTNER & HECHT, Chicago, Ill., at $[illegible]. Noted June 2[illegible] and July 3[illegible].

♦Canal Work—Provo, Utah—Bids will be received at the office of the United States Reclamation Service, Provo, Utah, until Nov. 1[illegible], for the construction of divisions 1, [illegible] and [illegible] of the High Line Canal and structures, Strawberry Valley project, Utah, involving about 3[illegible] cu. yd. of canal excavation, 2300 cu. yd. of excavation for structures, 33[illegible] cu. yd. of reinforced concrete, 16[illegible] sq. ft. of canal lining, 2[illegible] lin. ft. of tunnel, complete with concrete lining, laying about 17[illegible] ft. of vitrified pipe of various sizes, also 14[illegible] cu. yd. of backfilling and small quantities of rock filling and stone paving and the placing of sluice gates and structural steel. The canal will extend in a southwesterly direction from the power plant of the U. S. Reclamation Service near the mouth of Spanish Fork Cañon to a station near Payson City.

Canal Work—Benton City, Wash.—Bids will be received at the office of the U. S. Reclamation Service, Sunnyside, Wash., until 2 p.m., Oct. 26, for the construction of about 1[illegible] miles of main canal extension of the Sunnyside Canal, near Benton City. The work requires the excavation of about 6[illegible] cu. yd. of earth and 1[illegible] cu. yd. of rock, the construction of six pipe lines, the total length of which is about 4,[illegible]10 ft.

Dredging and Jetty Work—Port Townsend, Wash.—Bids will be received until [illegible] Oct. 16, by Maj. J. B. Cavanaugh, [illegible] Bldg., Seattle, Wash., for dredging and jetty construction in Port Townsend Bay and Oak Bay, Wash.

♦Post Office—The Dalles, Ore.—(Official)—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until [illegible] p.m., Nov. 1[illegible], for constructing the U. S. post office. For further information see advertisement under "Contracts To Be Let."

Ward Pavilions—Mare Island (Vallejo post office), Calif.—(Official)—Bids will be received until 11 a.m., Oct. [illegible], by H. R. Stanford, Chief Bureau of Yards and Docks, Washington, D. C., for the construction of five temporary one-story wooden ward pavilions at the Naval Hospital Reservation.

Pipe Construction—Honolulu, Hawaii—The government will soon call for bids for constructing water pipes from Fort Shafter to [illegible], about six miles. Lieut. Col. [illegible] is Chief Quartermaster.

Miscellaneous Supplies—Panama—Bids will be received until [illegible] a.m., Oct. 2[illegible], by Maj. F. C. Boggs, Gen. Purchasing Officer of the Panama Canal, Washington, D. C., for furnishing structural steel, galvanized steel, steel [illegible], chain, [illegible], bronze [illegible], brass and copper tubing, buckets, garbage cans, water coolers, [illegible], cotton waste, [illegible], pipe covering, [illegible], oilcloth, mattress ticking, leather, [illegible], soap, [illegible], paints, varnish, wallboard and [illegible].

Miscellaneous Supplies—Panama—Bids will be received by Maj. F. C. Boggs, Gen. Pur. Officer, Panama Canal, Washington, D. C., until Oct. [illegible], for furnishing electrical apparatus, [illegible], pipe, iron and brass pipe fittings, [illegible] water fittings, angle and globe valves, brass [illegible], flush [illegible], tips and ferrules.

Underground Cable—Panama—Bids will be received until 10:30 a.m., Oct. 16, by Maj. F. C. Boggs, Gen. Pur. Officer, Panama Canal Comn., Washington, D. C., for underground cable work at Ancon, Balboa, and Gatun. The work requires bracing rods, angle and sheet steel, soft steel, checkered steel plates, natural black slate, paint mills and paint mixers.

Substructures—San Juan, Porto Rico—The following bids were received by the Light-House Inspector, San Juan, for erecting three iron substructures on concrete piles at Anedago Shoal front and rear range lights and Catano front range light, in San Juan Harbor: P. J. Carlin Construction Co., New York, N. Y., $5450; Joseph J. Blandford, $5572; Thomas Sampson, $5960. Noted Aug. 6.

MISCELLANEOUS

+**Sea Wall**—Boston, Mass.—The contract for building the sea wall at Winthrop Shore Reservation, Winthrop, has been awarded to CAPUTO & GIOVANNINI, Boston, at $21,651. Other bids were as follows: J. H. Ferguson, Dorchester, $22,301; Rowe Contracting Co., Boston, $23,660; Leighton Mitchell Co., Boston, $24,253; Lawler Bros., Charlestown, $24,895; W. H. Elis & Son Co., East Boston, $26,450; Boston Contracting Co., Charlestown, $27,280; John Cashman & Sons Co., Boston, $27,922; T. Stuart & Son Co., Newton, $28,014; Thomas Fitzgibbon, Beverly, $28,800; Hugh Nawn Contracting Co., Roxbury, $30,240; Michael D. Russo, Boston, $31,439; Coleman Bros., Boston, $33,385; Hancock Engineering Co., Boston, $35,568; McCarthy & Walsh, East Boston, $37,427; George T. Rendle Co., East Boston, $40,197. John R. Rablin, 114 Bergen St., is Ch. Engr., Metropolitan Park Comn.

+**Filling**—Providence, R. I.—The contract for filling at the seawall, Fields Point, has been awarded to the WILSON & ENGLISH CONSTRUCTION CO., New York, N. Y., at $59,434.

Subway—New York, N. Y.—(Borough of Brooklyn)—Bids were received Oct. 6, by the Public Service Commission, 154 Nassau St., for constructing subway to connect the Lexington Ave. line with the present Fourth Ave. line as follows: Holbrook, Cabot & Rollins Corporation, 331 Madison Ave., New York, $4,353,000; Smith Hauser & McIsaac, Inc., 18 East 41st St., New York; $4,241,000; Rapid Transit Subway Construction Co., 165 Broadway, New York, $3,079,000; T. A. Gillespie & Co., 50 Church St., New York, $3,390,00; Degnon Contracting Co., 30 East 42d St., New York, $3,124,000. These are unofficial totals. Noted Sept. 17.

Motor Fire Apparatus—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until 10:30 a.m., Oct. 16, by Robert Adamson, Fire Commissioner, Municipal Bldg., for furnishing and delivering two gasoline propelled tractors, one for steam fire engine and one for hook and ladder truck.

Bids will also be received on the same date for furnishing and delivering 10 gasoline propelled tractors, seven for steam fire engines and three for hook and ladder trucks.

Loading Platform—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until noon, Oct. 15, by J. T. Fetherston, Commissioner of Street Cleaning, Municipal Bldg., for furnishing all the labor and material required for the construction of a covered dumping board and ramp on a concrete and pile platform, between 77th and 78th St., North River, Borough of Manhattan.

+**Vesel**—New York, N. Y.—The Gulf Oil Co. has placed an order with the NEW YORK SHIPBUILDING CO. for an oil tanker of 2,205,000-gal. capacity. The estimated cost is $250,000.

+**Playground**—New York, N. Y.—(Borough of Brooklyn)—The contract for the construction of the Betsy Head Memorial Playground and Recreation Center in the Brownsville section of Brooklyn has been awarded to the T. J. BUCKLEY CONSTRUCTION CO., 303 Fifth Ave., New York. The estimated cost is about $100,000. Noted Aug. 20.

Elevated Railroad Work—New York, N. Y.—(Borough of Manhattan)—The Interborough Rapid Transit Co. has notified the Public Service Commission that it has agreed to the widening of the 23d St. station platforms.

+**Dredging**—Rochester, N. Y.—The State Engineers office has awarded the contract to the EASTOVER CONSTRUCTION CO. for dredging a channel through Billinghurst Island, located in the Chemung River. The estimated cost is $25,000.

Fire Station—Hoboken, N. J.—Plans have been completed and bids will be received shortly by the City Council for the erection of a fire station to replace that of Engine Co. 3, recently torn down.

Repairing Public Ground—Hoboken, N. J.—Bids will be received by the Hoboken City Council until Oct. 14, for repairs to the public ground. Address City Hall, Hoboken.

Retaining Wall — Bradentown, Fla. — (Official) — Philip Lacey, Comr. of Pub. Wks., will receive bids until Oct. 12 for the construction of a 700-ft. reinforced concrete retaining wall, including filling, piles and handrail. About 326 cu.yd. concrete will be required.

+**Retaining Wall and Dredging**—Jacksonville, Fla.—The Port Commissioners, F. W. Bruce, Ch. Engr., have awarded the contract to WADE, CLOWER & WADE, Jacksonville, for the construction of retaining wall for municipal docks. The contract for the steel piling was awarded to the LACKAWANNA STEEL CO., Lackawanna, N. Y., and for dredging and filling about 100,000 cu.yd. to the HOME DREDGING CO., Mobile. Estimated cost $80,000.

Drainage—Titusville, Fla.—Upper St. Johns Drainage District has been established by decree of the court. The district embraces 265,000 acres in the valley of the St. Johns River in Brevard, Orange and Osceola Counties, including basins of Lakes Poinsett, Winder and Washington. Isham Randolph & Co., Chicago and Jacksonville, are the Engrs.

Seawall—West Palm Beach, Fla.—The city has voted $100,000 bonds for the construction of a seawall along Lake Worth.

Playgrounds—Birmingham, Ala.—A budget calling for an expenditure of $15,375 for the maintenance of playgrounds for the coming year has been presented to the City Commission by the playground associations.

+**Drainage**—Ripley, Miss.—Telahatchie Drainage District No. 1, of Tippah County has awarded the contract to N. C. McGINNIS CO., Memphis, Tenn., for the construction of a drainage canal; channel 14 ft. wide, dredge boat construction. About 539 acres of land will be drained for agricultural purposes. Noted Sept. 10.

Fire Station—Akron, Ohio—Bids on the revised plans for the fire station for engine company No. 1, have been received. The Akron Storage & Contracting Co., at $47,000 was the lowest bidder. Noted Sept. 17.

Elimination of Grade Crossing, Parks and Playgrounds—Dayton, Ohio—The resolution has been passed providing for a bond issue of $1,000,000 for the citys share of the expense for the elimination of grade crossings. Also an issue of $250,000 in bonds for purchasing and improving property for parks and playgrounds.

Drains—Muncie, Ind.—Bids will be received until 2 p.m., Oct. 12, by Gideon Warren, Supt. of Const. for open drain and tile drain.

Ditch—Gridley, Ill.—Bids will be received until Oct. 15 by Township Drainage District No. 1 for the excavation of 63,000 cu.yd. of ditch. Harman Engineering Co., Peoria, are the Engrs.

Retaining Walls—Delevan, Wis.—Harley J. Doane, City Clk., will receive bids until Oct. 16, for the construction of retaining walls on both sides of the ditch from Phœnix St. North.

Breakwater—Milwaukee, Wis.—The Park Board has voted to construct an addition 800 ft. of breakwater to preserve the dirt which will be dumped for the construction of the proposed lake shore drive.

+**Grain Sheds**—Milwaukee, Wis. — The contract for the construction of grain storage sheds for the Milwaukee Malting Co., South Bay, has been awarded to F. LUENZMANN at $10,000.

+**Dock Reconstruction**—Racine, Wis.—The Goodrich Transportation Co. has awarded the contract to PETER W. GALLOWAY, for rebuilding its docks. The estimated cost is $15,000.

+**Drainage**—Forest City, Iowa—The contract for open work in Drainage District No. 5 has been awarded to R. S. MORROW, Council Bluffs, at $10.40 per cu.yd.; tile work, to D. L. DAVIDSON, Forest City, at $33,000; NATIONAL CLAY WORKS, Mason City, for furnishing tile. Noted Aug. 6.

+**Drainage**—Storm Lake, Iowa—The following contracts have been awarded: (Contract 60) SAC CITY CEMENT PRODUCTS CO.; (Contract 61) NEWELL CEMENT TILE CO.; (Contract 63) SAC CITY CEMENT PRODUCTS CO.; (Contract 65) McHOSE TILE CO., Boone.

+**Ditch**—Williams, Iowa—The contract for the construction of the Lohman tile ditch has been awarded to the NATIONAL SEWER PIPE CO., at $14,244; labor, to T. J. BLACKMORE, at $8261.

Ditch—Red Lake Falls, Minn.—Bids will be received until 2 p.m., Oct. 17, by George Bupond, County Audr., for the construction of Judicial Ditch No. 60. Work will include 424,000 cu.yd. earth excavation, 75 corrugated metal culverts and 1298 cu.yd. reinforced concrete. George A. Ralph, 410 Shubert Bldg., St. Paul, is Engr. in Charge.

Elimination of Grade Crossing—Jefferson City, Mo.—The Public Service Commission has ordered the Chicago & Alton Railroad to eliminate its grade crossing at Blue Ave. between Kansas City and Independence. Plans prepared by the Commission Engineer call for a 487-ft. reinforced overhead crossing to cost $32,492. The railroad is to pay 60% and Jackson County 40% of the cost.

Market—St. Louis, Mo.—The Merchants & Consumers Market-House Association, organized with $125,000 capital, has acquired a site and plans to erect a two-story, 180x210-ft. market. The estimated cost including the site is $190,000. C. B. Yoder & Co., Archs., prepared the plans.

Drainage—Wynne, Ark.—Drainage District No. 3, W. H. Newsom, Engr., will receive bids until Oct. 12, for the construction of drainage canals as follows: No. 1, 22.4 miles of 14-ft. bottom and 2.5 miles of 20-ft. bottom, total yardage, 615,000 yd.; No. 2, 15.7 miles of 14-ft. bottom, total yardage, 590,000 yd.; No. 3, 5.2 miles of 16-ft. bottom, 3 miles 24-ft. bottom, 8 miles 30-ft. bottom and 4 miles of 60-ft. bottom, total yardage, 840,000 yd., No. 4, 12 miles of 14-ft. bottom, total yardage, 280,000 yd.

Wharf and Park Improvements—Austin, Tex.—The city has had plans prepared and will construct a 600-ft. wharf and make park improvements. The estimated cost is $10,000. A. C. Scott is Consult Engr.

+**Drainage**—Beaumont, Tex.—The contract for the construction of four drainage ditches in Drainage District No. 4, Jefferson County, has been awarded to the LAKE ARTHUR DREDGING CO. at 10c. per cu.yd. The estimated cost of the system is $62,800. Noted Sept. 10.

Wharf and Warehouse—Houston, Tex.—Bids will be received until 2 p.m., Oct. 26, by E. E. Sands, City Engr., for the construction of a wharf and reinforced concrete warehouse on the Houston Ship Channel. The estimated cost is $250,000. Noted Sept. 17.

Tunnel—Seattle, Wash.—An ordinance has been introduced in the City Council by the International Terminals Co. for constructing three miles of tunnel under the city. Estimated cost about $2,000,000.

+**Bulkhead**—Seattle, Wash.—The Inter-Counties River Improvement Association has awarded the contract for bulkhead work, to BEARANCE & CLEAVER, American Bank Bldg., Seattle, at $13,460.

Crane—Seattle, Wash.—The following bids were received by the Port of Seattle Commission for furnishing a gantry crane for the Smiths Cove project: Shaw Electric Crane Co., Muskegon, Mich., $40,921, alternate bid, $38,590; Brown Hoisting Co., $48,200; Toledo Bridge & Crane Co., $52,500. Noted June 11, July 30, Aug. 27.

Dikes—Tacoma, Wash.—Preliminary work will soon be started for the construction of dikes to protect 2350 acres of land from water encroachment in the tide flats section of

[illegible] Creek. The estimated cost is about $1[illegible]. H. C. [illegible], [illegible] and [illegible] are the County [illegible]. Noted [illegible].

Dock—[illegible] The Southern Pacific Co. is having plans prepared and will soon receive bids for the construction of a [illegible] on the West side of Willamette River. The estimated cost is $[illegible]. H. A. Hampton, Wells-Fargo Bldg., is the [illegible].

Telephone Cables—[illegible]—The [illegible] Telephone & Telegraph Co. [illegible] to make extensions which will call for [illegible] ft. of underground cable and 6[illegible] ft. of relief [illegible]. The estimated cost is $[illegible].

Subway—Fresno, Calif.—The Fresno Traction Co. plans to construct a subway under the Santa Fe tracks. The estimated cost is $[illegible]. F. W. Webster is Gen. Mgr.

Dance Floor—[illegible], Calif.—The citizens will make a [illegible] in the form of a petition to the City Council for the [illegible] of a dancing floor at the municipal pleasure pier, [illegible] at a cost of $[illegible].

✦Train Sheds—Los Angeles, Calif.—The Southern Pacific [illegible] has awarded the contract for the construction of reinforced concrete train sheds at the Arcade Depot to the VAN SANT-HOUGHTON CO., San Francisco, at $[illegible].

Dredging—[illegible], Calif.—Plans are being prepared for the [illegible] of Estuary Channel from [illegible] to [illegible] ft. for a distance of [illegible] ft.

Wharves—Oakland, Calif.—The De Fremery Wharf & Land Co. has been granted permission by the Railroad Commission to make a bond issue of $10[illegible] for additions to its wharf [illegible].

Pumping Plants—San Francisco, Calif.—Plans have been completed by [illegible] & Porter, Engrs., Nevada Bank Bldg., for [illegible] pumping plants to be erected by the American Pipe Line Co., [illegible] St., San Francisco, on its line between [illegible] and [illegible].

Steel Doors—San Francisco, Calif.—Bids will be received by the State Board of Harbor Commissioners until Oct. 2[illegible], for the installation of steel rolling doors on sheds of Piers Nos. 1[illegible], 1[illegible] and 1[illegible]. [illegible] V. [illegible] is Secy. of the Bd.

Dredging and Bridges—Chatham, Ont.—Plans are being prepared for the City Council for 16 reinforced concrete bridges and dredging work estimated to cost $[illegible]. George A. [illegible], [illegible] King St., is the Engr.

✦Grandstand Addition—Fort Erie, Ont.—The contract for the construction of an addition to the grandstand at the Fort Erie racetrack has been awarded to O. C. TEAL. The estimated cost is $[illegible].

BUILDINGS

✦Boston, Mass.—The contract for the construction of the addition to the Massachusetts Homeopathic Hospital has been awarded to H. P. CUMMINGS CONSTRUCTION CO., [illegible]. Kendall, Taylor & Co., [illegible] Federal St., are the Archs.

G. Henri [illegible], Arch., 1[illegible] Beacon St., has prepared plans for a hotel to be erected on the site of the Boston Theatre. It will be of gray brick and [illegible] terra cotta. The estimated cost is $1,[illegible],000.

Cambridge, Mass.—Low bids received for the [illegible] were as follows: General construction, [illegible], at $[illegible]; electrical work, [illegible], $[illegible]; heating, [illegible], $[illegible].

✦Fall River, Mass.—The contract for the addition to St. [illegible] has been awarded to CHARLES H. [illegible]. [illegible] J. [illegible], [illegible], is the Arch.

Waltham, Mass.—The lowest bid received for the [illegible] was submitted by [illegible] & [illegible], at $[illegible].

✦Worcester, Mass.—The contract for the construction of [illegible] has been awarded to [illegible], Worcester, Mass., at $[illegible]. Noted Oct. [illegible].

Slocum, R. I.—[illegible]

✦Buffalo, N. Y.—[illegible]

✦Hudson, N. Y.—[illegible]

✦Ithaca, N. Y.—[illegible]

New York, N. Y. (Borough of Manhattan)—Plans have been completed by York & Sawyer, Archs., [illegible] East 41st St., for the construction of a building for the New York Orthopedic Dispensary and Hospital, at [illegible]th St. and Ave. A. The estimated cost is $6[illegible],000.

Plans are being prepared by Parish & Schroeder, Archs., 12 West 3[illegible]th St., for an eight-story, [illegible]-ft. clubhouse for nurses, to be erected at 1[illegible] East [illegible]th St. The estimated cost is $[illegible],000.

Plans are being prepared by George Fred Pelham, Arch., 30 East [illegible] St., for a 1[illegible]-story apartment house at 16[illegible] East [illegible] St., for the Rexton Realty Co., [illegible] Liberty St. The estimated cost is $1[illegible],000.

✦Rensselaer, N. Y.—Contracts for the construction of a three-story [illegible] at Lawrence and [illegible] Sts. have been awarded to LEAHY & SHUFELL, Rensselaer, [illegible]; ZEPF BROS., Rensselaer, carpentry. The estimated cost is $[illegible].

✦Utica, N. Y.—The contract for constructing the three-story brick clubhouse for the B. P. O. E. has been awarded to R. G. LLOYD CO., 3[illegible] South St. The estimated cost is $[illegible],000.

Yonkers, N. Y.—George H. Chamberlain, Arch., 1[illegible] South Broadway, has completed revised plans for the Y. M. C. A. building to be erected at Riverdale Ave. and Hudson St. The estimated cost is $1[illegible]. [illegible] & [illegible], 1[illegible] South La Salle St., are the Engrs.

Bids will be received about [illegible] 1, by Lewis F. [illegible], State Arch., Albany, N. Y., for the two-story, 111x16[illegible]-ft. brick and steel armory, at North Broadway and [illegible] Place, for the N. Y. State Armory Commission. The estimated cost is $[illegible],000.

Plans have been completed by William E. Lehman, [illegible] Broad St., Newark, N. J., for the five-story brick theatre and office building for [illegible] & Epstein, 11[illegible] Broadway. The estimated cost is $[illegible],000.

West New York (Weehawken post office), **N. J.**—Bids will be received until Oct. 1[illegible], by James L. Wolfe, Town Clk., for the municipal building for the Town Council. The estimated cost is $[illegible],000.

✦Allentown, Penn.—The contract for the construction of buildings at the Homeopathic State Hospital for the Insane has been awarded as follows: Reception building, HOWARD E. STOUDT, Bethlehem, Penn.; [illegible], [illegible] TZ & CALDER, Allentown, Penn. Noted Oct. 1.

✦Lansdowne, Penn.—The contract for the construction of the school at Lansdowne has been awarded to WILBER BEAUMONT, Philadelphia, Penn. The estimated cost is $[illegible]0,000.

✦Philadelphia, Penn.—The contract for the construction of the four-story hospital for the Children's Hospital has been awarded to ROYDHOUSE ARTY CO., Fidelity Bldg. The estimated cost is $1[illegible].

Pittsburgh, Penn.—Plans have been prepared by J. [illegible] [illegible], 11[illegible] Sixth St., for the construction of a [illegible]-story apartment house on Federal St., Northside. The estimated cost is $[illegible]00,000.

Plans have been completed by F. J. [illegible], [illegible] Fourth Ave., for the construction of a [illegible]-story clubhouse for the [illegible] Republican Club. The estimated cost is $[illegible].

✦York, Penn.—The contracts for the construction of the [illegible] and [illegible] schools have been awarded to [illegible] OERMAN, at $[illegible].

Wilmington, Del.—[illegible]—Bids will be received by the New Castle County [illegible] Commission, [illegible] Bldg., Wilmington, for the [illegible] steel [illegible], carpentry and [illegible] work, plastering and [illegible] stone work, metal [illegible] and [illegible], glass and glazing, electric elevators, [illegible] vault doors, [illegible] etc., for the [illegible] for New Castle County [illegible] Wilmington. [illegible]

Belair, Md.—Bids will be received until Oct. [illegible], by M. A. [illegible], for the [illegible]. The estimated cost is $[illegible]. [illegible], is the Arch.

✦Lexington, Va.—[illegible]

✦Staunton, Va.—The contract for the construction of the Y. M. C. A. building has been awarded to the [illegible] CO., [illegible].

Berkeley Springs, W. Va.—Plans have been prepared by [illegible] & [illegible], Archs., [illegible], N. W., Washington, D. C., for a [illegible] hotel for the [illegible]. The estimated cost is $[illegible].

✦Parkersburg, W. Va.—The contract for the construction of the [illegible] has been awarded to the [illegible] CONSTRUCTION CO., [illegible], Ohio.

✦Anderson, S. C.—The general contract for the construction of the [illegible] building for the Anderson [illegible] Co. has been awarded to [illegible]; [illegible] work, to ANDERSON MACHINE & FOUNDRY CO. The estimated cost is $[illegible].

✦Ft. Myers, Fla.—The contract for the construction of the [illegible] has been awarded to [illegible], Tampa, Fla., at $[illegible]. Noted Aug. [illegible].

✦Jacksonville, Fla.—The contract for the construction of the [illegible] has been awarded to [illegible], at $[illegible].

✦McComb, Miss.—The contract for the construction of the [illegible] has been awarded to the [illegible] CONSTRUCTION CO., [illegible].

✦Louisville, Ky.—Contracts for the construction of the [illegible] have been awarded as follows: General contract, [illegible] & [illegible], [illegible] AMERICAN MOSAIC & TILE CO., [illegible] Broadway; [illegible] & [illegible] CO.; [illegible], steel, the [illegible] CO., Louisville. The estimated cost is $[illegible]. Noted June [illegible].

Cincinnati, Ohio—Plans are nearing completion for the proposed chemistry building to be constructed for the University of Cincinnati. Estimated cost, $200,000. Tietig & Lee, Lyric Bldg., Cincinnati, are Archs.

+Cleveland, Ohio—The Tyroler Realty Co. has awarded the contract to ROY BLACK, Cleveland, for constructing a six-story store building, 71x149 ft., at about $200,000.

Cleveland, Ohio—A. F. Wasrelewski, 1401 Sixth St., Minneapolis, Minn., is preparing plans for a one-story and basement school, 60x125 ft., for St. Joseph's R. C. Church, Rev. J. P. Kocinski, Pastor, 1411 East 33rd St., Cleveland. Estimated cost, $50,000.

+The Board of Control has awarded the contract to the GEORGE A. FULLER CO., New York, for interior work on the city hall, at $1,217,112.

+The East Ohio Gas Co. has awarded the contract to JAMES L. STUART, Illumination Bldg., Cleveland, for constructing a six-story and basement office building, 116x166 ft., at about $500,000.

The Fireproof Building Co., Cleveland, plans to construct a 10-story and basement commercial building, 80x198 ft. Estimated cost, $250,000.

Elyria, Ohio—The St. Agnes R. C. Church is having plans prepared for the construction of a church. It will be one-story and basement, 60x200 ft. Estimated cost, $50,000.

+Hamilton, Ohio—The contract has been awarded to W. H. HANSCHE, Hamilton, for constructing the temple for the B. P. O. E., at $72,478.

Hudson, Ohio—Bids will be asked soon by J. W. C. Carbusier, Arch., Lenox Bldg., Hudson, for constructing a three-story and basement grade school, at about $50,000.

Toledo, Ohio—The Board of Education is considering plans for three new schools to cost $500,000. F. G. Crane is Pres.

Wickliffe, Ohio—Plans are being prepared by F. C. Warner, Arch., Cleveland, for a grade school, to cost $40,000.

Willoughby, Ohio—Plans are being prepared by F. C. Warner, Arch., Cleveland, for a high school. Estimated cost, $90,000.

Greencastle, Ind.—Hugh Doherty, Indianapolis, Ind., President of Board of Trustees of Depauw University, Greencastle, will appoint a building committee to arrange for the proposed construction of a gymnasium. Estimated cost, $100,000.

Logansport, Ind.—Plans have been completed for the construction of the Dieckmann Hospital, provided for in the will of D. D. Dieckmann. A. G. Jenkins, Logansport, is interested.

+Flint, Mich.—Van Leyen & Schilling, Archs., 1117 Union Trust Bldg., Detroit, Mich., have awarded the general contract for the two-story and basement school, 55x89 ft. for All Saints Parish, Rev. John Hewelt, pastor, Flint, to H. V. SNYDER, Battle Creek, Mich. Estimated cost, $75,000.

Chicago, Ill.—The South Side Hebrew Synagogue has secured a site at Michigan Ave. and 59th St., on which to construct a new synagogue, to cost $150,000. M. F. Woldenberg is Secy.

Chicago, Ill.—Marshall & Fox, Archs., First National Bank Bldg., Chicago, have prepared plans for a fireproof club-house to be erected by the South Shore Country Club. Estimated cost, $375,000.

East St. Louis, Ill.—The Building Committee of the Board of Education plans to construct an auditorium for the new high school. Estimated cost, $100,000.

+Freeport, Ill.—The contract for constructing the Y. M. C. A. building has been awarded to WINCHESTER & STEWART, Rockford, Ill., at $61,902.

+Eau Claire, Wis.—Van Ryn & De Gelleke, Archs., Milwaukee, Wis., have awarded the iron and steel work on the new $250,000 state normal school here to the WORDEN-ALLEN CO., Milwaukee.

Marinette, Wis.—The initial contract for the construction of the proposed new $120,000 high-school building has been awarded to J. E. UTKE, Marinette. The contract was for the foundation.

Marshfield, Wis.—H. T. Liebert, Arch., Wausau, Wis., is receiving bids for the construction of a mercantile building for C. C. Blodgett. It will be of brick, three-story and basement, 50x150 ft.

Prairie du Chien, Wis.—Plans are being completed for the construction of a building for Campion College here. Brielmaier & Sons, Milwaukee, Wis., are Archs. It will be of brick, concrete and stone.

Racine, Wis.—Preliminary plans for the new $175,000 Y. M. C. A. building to be erected at Fourth and Wisconsin St., are being prepared by C. D. McLane, Arch., Rock Island, Ill. It will be of brick, concrete and steel, four- to six-stories and basement, about 120x175 ft.

+Wausau, Wis.—The general contract for the construction of the church for the Episcopal congregation has been awarded to the HERMAN CONSTRUCTION CO., Antigo, Wis. Estimated cost, $50,000. Chromaster, Spier & Swarthout are Archs.

+The general contract for the construction of the First Universalist church has been awarded to JOHN ANDRES & SON. Estimated cost, $50,000.

Burlington, Iowa—Bids will be received until noon, Oct. 15, by D. S. Cooper, Secy. Bd. of Education, for constructing two schools.

Glen Lake (Hopkins post office) **Minn.**—Plans have been prepared by Sund & Dunham, Archs., Andrus Bldg., Minneapolis, Minn., for the construction of the Hennepin County sanatorium at Glen Lake. A separate power plant and laundry will be erected in the rear of the sanatorium. Estimated cost, $100,000. E. G. Gale is Chn., Hennipin County Sanatorium Comn.

Medicine Lake, Minn.—The Sisters of St. Joseph of the Holy Angels Academy, Sixth Ave. North and Fourth St., Minneapolis, have had plans prepared for the construction of a school at Medicine Lake, Minn., to cost about $200,000.

+Minneapolis, Minn.—The contract for the construction of a two-story brick and steel passenger station for the Great Northern R.R Co., on Hennepin Ave., Minneapolis, has been awarded to the C. W. GINDELE CO., Chicago, Ill. Estimated cost, $278,000. Charles S. Frost is Arch.

Great Falls, Mont.—The Building Committee of the Y. M. C. A. has approved plans prepared by G. H. Shanley, Arch., for the building to be constructed at First Ave. and Park Drive. Estimated cost, $100,000.

Carthage, Mo.—The County Court has approved plans for the proposed almshouse to be constructed on the Grand Ave. Rd. south of Carthage.

San Antonio, Tex.—The National Masonic Sanitarium Association recently organized, contemplates the erection of a sanitarium and hospital. Estimated cost, $50,000.

Selden (Dona Ana Post Office), **N. M.**—Thomas Taggart, of Indianapolis, Ind., contemplates the construction of a hotel at Selden.

Silver City, N. M.—Plans have been prepared by Trost & Trost, Arch., El Paso, Tex., for the four-story reinforced-concrete hotel to be erected at Silver City, at a cost of $100,000. J. F. Cleveland and associates are interested. Noted July 30.

Portland, Ore.—James S. Winters, Couch Bldg., Portland, at $40,987, submitted the lowest bid for construction of the Emmanuel Hospital. The building will be of reinforced concrete and brick construction.

+Bakersfield, Calif.—The Board of Education of Kern County has awarded a contract for the general construction of a high school to the THEWHITT-SHIELDS CO., Fresno, at $53,290.

+The Board of Supervisors of Kern County has awarded a contract for the construction of an auditorium to the THEWHITT-SHIELDS CO., Fresno, at $52,000. Noted Aug. 6.

Lindsay, Calif.—F. W. Griffin, Arch., has completed plans for a grammar school. Estimated cost, $45,000.

Longbeach, Calif.—Krempel & Erkes, Archs., Henne Bldg., Los Angeles, have completed plans and specifications for the construction of a five-story and basement Class B bank building at Pine Ave. and Broadway, Long Beach, for Mrs. Lucy Hauerwaas. The building will be 50x150 ft., and will have concrete foundation and basement, structural steel, brick walls, pressed brick facing.

Los Angeles, Calif.—W. J. Pearson, plans to construct an 18-story fire-proof hotel at 10th and Hope Sts. Estimated cost, about $1,000,000.

+Los Angeles, Calif.—The contract for the construction of a seven-story hotel on East Fifth St., for Charles Wellington Howard, has been awarded to HUNZIKER & BERGER, Los Angeles at about $70,000. L. L. Jones is Arch.

+J. V. McNEIL, 530 Citizens National Bank Bldg., Los Angeles, has been awarded the general contract at $54,793 for the construction of the eight-story and basement Class A store and office building at Broadway and Eighth St. for the Spring St. Co., Hulett C. Merritt, Pres. 702 South Spring St., Reid Bros., San Francisco, are Archs.

H. O. Thompson will construct an 11-story and basement store and hotel building on East Fifth St., near Los Angeles St. John J. Frauenfelder is the Arch.

Oakland, Calif.—Plans are being prepared for a seven-story brick and steel hotel to be constructed for O. J. Meade. Estimated cost, $150,000. George W. Patton, 2126 Emerson St., Berkeley, Calif., is Arch.

Oroville, Calif.—The county will construct a Hall of Records at Oroville to cost $40,000. C. L. Kaiser is Arch.

Sacramento, Calif.—Plans are being prepared for a new hospital to be erected by Sacramento County at an estimated cost of $500,000. R. A. Herold, Forum Bldg., is the Arch.

San Diego, Calif.—The Board of Education has rejected all bids submitted for the construction of Stockton School. Plans will be revised, providing for a building to cost $40,000 instead of $60,000.

San Francisco, Calif.—Houghton Sawyer, Arch., Shreve Bldg., San Francisco, has completed plans for a seven-story apartment house to be constructed at Mason and California St. to cost, $250,000.

San Francisco, Calif.—The Charles C. Judson Co. will construct a seven-story hotel at Taylor and Post Sts. William H. Weeks is Arch.

C. O. Claussen, Arch., Hearst Bldg., San Francisco, is preparing plans for a six-story apartment house at Eddy and Leavenworth St. for George Bennett. Estimated cost, $10,000.

Sydney, N. S.—A. M. Crofton, 291 Charlotte St., has purchased a site for the erection of a four-story Y. M. C. A. building, to cost $55,000.

Montreal, Que.—Plans are being prepared and bids will be received soon by P. A. Westover, Arch., Keith Theater Bldg., Philadelphia, Penn., for the general contract to construct the $300,000 theater at Montreal for the Imperial Theater Co. The associate architects are Barott, Blackader & Webster, New Birks Bldg., Montreal.

★Santo Domingo, R. D.—(Official)—Juan Alejandro, Ibarra, Separacion No. 43 Santo Domingo, Republica Dominicana, desires to contract with some company willing to construct houses on time payments. He will properly guarantee capital and interest, and the right to erect all buildings contemplated. He has 300,000 sq.m. at Villa Francisca, suburb of the capital. All kinds of propositions considered. Correspondence in English, French and Spanish. In the town of Villa Francisca there are no taxes, fiscal nor municipal. The city board furnishes cement for side walks and the law guarantees 6% annually on capital invested in construction of houses purchasable on time. There are guarantees against all risks. Further information furnished on application.

Contracts to Be Let

Bids received until Oct. 20, 1914.

Notice to Contractors

NEW COUNTY BUILDING FOR NEW CASTLE COUNTY AND NEW MUNICIPAL BUILDING FOR THE CITY OF WILMINGTON

Sealed proposals will be received by the New Castle County Building Commission and the Wilmington Building Commission at the office of the Commissions in the Church Building at the corner of Market and Tenth Sts., in the City of Wilmington, Delaware, up to 11 o'clock A.M. (Eastern time) on the 20th day of October, 1914 for the Rolled Steel Windows for the Carpentry and Cabinet Work for the Plastering and Imitation Stone Work for the Metal Furring and Lathing, for the Glass and Glazing for the Electric Elevators, for the Magnesite Floors, for the Cork Floors, for the Vault Doors, and for the Tile Work entering into the construction and completion of the New County Building for New Castle County and of the New Municipal Building for the City of Wilmington situated between King Street and French Street and between Tenth Street and Eleventh Street, in the City of Wilmington, Delaware, and will be opened publicly and declared by the Commissions in their office. A separate proposal is required for each of the buildings for each department or class of work above listed.

Each proposal for Rolled Steel Windows shall be accompanied by a certified check or cash deposit in the amount of Four Hundred Dollars ($400).

Each proposal for Carpentry and Cabinet Work shall be accompanied by a certified check or cash deposit in the amount of One Thousand Five Hundred Dollars ($1,500).

Each proposal for Plastering and Imitation Stone Work shall be accompanied by a certified check or cash deposit in the amount of One Thousand Dollars ($1,000).

Each proposal for Metal Furring and Lathing shall be accompanied by a certified check or cash deposit in the amount of Five Hundred Dollars ($500).

Each proposal for Glass and Glazing shall be accompanied by a certified check or cash deposit in the amount of Two Hundred Dollars ($200).

Each proposal for Electric Elevators shall be accompanied by a certified check or cash deposit in the amount of Five Hundred Dollars ($500).

Each proposal for Magnesite Floors shall be accompanied by a certified check or cash deposit in the amount of One Hundred Dollars ($100).

Each proposal for Cork Floors shall be accompanied by a certified check or cash deposit in the amount of One Hundred Dollars ($100).

Each proposal for Vault Doors shall be accompanied by a certified check or cash deposit in the amount of Fifty Dollars ($50).

Each proposal for Tile Work shall be accompanied by a certified check or cash deposit in the amount of Two Hundred Dollars ($200).

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Bids received until Oct. 27, 1914.

Alteration to Electric Plant

Bath, N. Y.

NOTICE TO CONTRACTORS.—Sealed proposals for Alterations to Electric Plant, Underground Piping, Steam, etc., at the New York State Soldiers and Sailors Home, Bath, New York, will be received by the Honorable Joseph H. Goulden, President Board of Trustees, New York Soldiers and Sailors Home, Bath, New York, until October 27, 1914, at eleven o'clock A. M., when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect and shall be accompanied by a certified check in the sum of 5% of the amount of bid. Contractors to whom awards are made will be required to furnish surety company bond in the sum of 50% of the amount of contract within thirty days (30) after official notice of award of contract and in accordance with the terms of Specifications Nos. 2763 and 2751. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the New York office of the Department of Architecture, 1224 Woolworth Building, at the New York State Soldiers & Sailors Home, Bath, New York, and at the office of the Department of Architecture, Albany, New York. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon the deposit of certified check in the sum of ten dollars (10) made payable to the State of New York for each branch of the work, which check will be returned if plans and specifications are sent back in good order to the State Architect. LEWIS F. PILCHER, Capitol, Albany, N. Y.

Dated October 2, 1914.

WILLIAM H. NICHOLS, Secretary.

Bids received until Oct. 26, 1914.

Bridge

DEPARTMENT OF PUBLIC FINANCES, ACCOUNTING DIVISION, CITY OF NEW ORLEANS

New Orleans, La., Sept. 23, 1914.

Pursuant to Ordinance Nos. [illegible] C. C. S. Sealed proposals will be received at this office until the hour of 11 o'clock A.M. Monday, October 26, 1914, for [illegible] Trunnion Bascule Lift Bridge over the New Basin Canal on the axis of City Park Avenue, in accordance with plans and specifications on file in the office of the City Engineer. Deposit of [illegible] with the City Treasurer, and his receipt or certified check enclosed with bid. [illegible] of the contract price. The City Engineer will furnish bidders with a blank form of proposal. [illegible] will be considered unless submitted on such form. [illegible]

The City reserves the right to reject any and all bids.

A. G. RICKS,
Commissioner.

Bids received until Oct. 13, 1914.

Street Paving

Petersburg, Va.

Sealed proposals addressed to J. P. Jones, Chairman of Street Committee, and plainly marked "PAVING BIDS" will be received until October 13th, 1914, at noon, for the construction of [illegible] square yards, more or less, of [illegible] block paving on East [illegible] Streets, Petersburg, Virginia.

Specifications upon application to [illegible] City Engineer. Each bid must be accompanied by a certified check in the sum of [illegible] payable to F. G. [illegible] City Treasurer as evidence of good faith. The Street Committee and the City Council reserve the right to reject any or all bids.

[illegible], Clerk.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

SEPTEMBER BUILDING RETURNS

Building returns received too late for publication in last week's issue are given below. There is little change in these figures, the loss being about the same.

	Month of September 1914	Month of September 1913	First nine months of year 1914	First nine months of year 1913
Eastern States				
Baltimore, Md.	$577,692	$808,237	$10,702,179	$7,258,617
For returns from 20 cities published Oct. 8, see p. 227.	16,837,280	27,501,550	207,357,288	234,106,684
Totals	$17,414,972	$28,309,787	$218,059,467	$241,365,301
	Loss 39%		Loss 9%	
Middle West				
Kansas City, Kan.	$62,163	$67,140	$922,151	$942,411
St. Louis, Mo.	519,639	1,180,809	10,422,715	12,676,063
San Antonio, Tex	188,123	176,128		
For returns from 16 cities published Oct. 8, see p. 227.	15,655,765	20,405,982	185,168,695	178,793,079
Totals	$16,425,690	$21,830,059	$196,513,561	$192,411,553
	Loss 24%		Gain 2%	
Southern States				
Louisville, Ky.	$267,370	$297,170	$3,734,475	$3,378,870
Tampa, Fla.	61,210	53,055	1,178,300	1,156,471
For returns from 7 cities published Oct 8, see p. 227	1,164,759	1,978,835	23,329,055	27,502,539
Totals	$1,493,339	$2,329,060	$28,241,830	$32,037,880
	Loss 35%		Loss 11%	
Pacific Coast				
Seattle, Wash.	$547,190	$692,885	$10,517,160	$7,909,400
For returns from 5 cities published Oct. 8, see p. 227	1,374,376	6,480,293	47,690,731	58,747,825
Totals	$1,921,566	$7,173,178	$58,207,891	$66,657,225
	Loss 73%		Loss 12%	

RAILWAYS

✚**Connecticut**—New York, New Haven & Hartford R.R.—This company has awarded a contract to HOLBROOK, CABOT & ROLLINS CORPORATION, Boston, Mass., for constructing a new main line in New London, Conn., from Hallam St. to the terminal of the new bridge over the Thames River.

North Carolina—Cliffside R.R.—Surveys have been made by this company for the extension of its line from Cliffside to the Brand River. R. R. Haynes, Cliffside, N. C., is Pres. and W. H. Terrell is Ch. Engr.

Georgia—Swift Lumber Co.—The construction of a nine mile extension from Meigs, Ga., to Coolidge and Pavo, Ga., is contemplated by this company.

Iowa—Charles City Western Ry.—Plans are being made by this company to electrify and extend its 16-mile railway in Iowa. E. R. Erusberger, Charles City, Iowa, is Gen. Mgr.

Arkansas—Joneshoro, Lake City & Eastern R.R.—Plans are being prepared by this company for the construction of two extensions into the timber lands from Jonesboro, Ark.

Texas—Altus, Roswell & El Paso R.R.—This company has been organized for the purpose of constructing a railway from Memphis, Tex., to Roswell, N. M., about 291 miles. E. C. Noble, Lubbock, Tex., is Pres. and Gen. Mgr.

Oklahoma—The Oil Belt Terminal Co., Jennings, Okla., has been purchased by C. N. Haskell, Tulsa, Okla., and associates. The new owners plan the extension of the line from Jennings to Drumright and Cushing, Okla., about 21 miles.

New Mexico—Altus Roswell & El Paso R.R.—See item under Texas.

Oregon—The citizens of Douglas County, at an election to be held soon, will vote on the proposition to issue $500,000 in bonds, the proceeds of which will be used for the construction of a railway from Roseburg, Ore., to Coos Bay tidewater.

California—Atchison, Topeka & Santa Fe R.R.—Preliminary arrangements are being made by this company for improving its tracks and roadbed from Richmond, Calif., to Stockton, Calif. F. M. Bisbee, Amarillo, Tex., is Ch. Engr. Western lines.

✚**Ontario**—Lake Huron & Northern Ontario—This company has awarded the contract for the extension of the railway, formerly the Bruce Mines & Algoma line, from Bruce Mines, Ont., north, to the ONTARIO NORTHERN CONSTRUCTION CO. H. Appleton, Bruce Mines, Ont., is Vice-Pres. and Gen. Mgr.

ELECTRIC RAILWAYS

Washburn, Maine—Plans have been completed and surveys are being made by the Quebec Extension Ry. to begin construction in 1915 of its 100-mile line between Washburn and Quebec. It will extend across the northern part of Maine to connect the existing lines at Quebec and New Brunswick, and across New Brunswick to the Quebec border.

Franklin, Mass.—The Milford, Attleboro & Woonsocket St. Ry. has applied to the City Council for a franchise to relocate its tracks in Central St.

Swampscott, Mass.—The City Council has granted permission to the Bay State St. Ry. to double track its line on Humphrey St., from the Lynn line to Commonwealth Ave.

Danbury, Conn.—Plans of the Danbury & Bethel St. Ry. for the reconstruction of its track on White St., Danbury, and the construction of a turnout at that place have been approved by the Public Utilities Commission.

Burgettstown, Penn.—Plans are being considered by the West Penn Traction Co. for the extension of its Oakdale and McDonald branch to Burgettstown. W. E. Moore, First National Bank Bldg., Pittsburgh, is Vice-Pres. and Gen. Mgr.

Marietta, Penn.—The Conestoga Traction Co. plans to extend its lines from Marietta to Maytown, a distance of three miles.

Philadelphia, Penn.—The Philadelphia Rapid Transit Co. has been requested to consider plans for extending its line on 56th St.

Washington, D. C.—The House of Representatives has passed a Senate bill authorizing the Washington Ry. & Electric Ry. to extend its tracks from the point where its present tracks intersect Portland St., S. E., thence along Portland St. in a westerly direction to Fourth St., S. W.

Owensport, W. Va.—A company is being organized under the name of the West Virginia Electric Co. for the purpose of building a 50-mile electric railway from Owensport to Weston.

Durham, N. C.—Plans are being made to organize a company for the purpose of building a 12-mile electric line between Durham and Chapel Hill. C. G. Creighton, Durham, is interested.

Lula, Ga.—The Lula-Homer Ry. Co. has been recently organized for the purpose of building a 15-mile railway from Lula to Homer. The incorporators are: S. A. Carter, W. A. Boling, B. E. Chapman, Joel Coffee and E. F. Whitworth, Lula; C. H. Chambers and E. A. Mize, Homer.

Gadsden, Ala.—Plans have been prepared and a preliminary survey has been made for the proposed electric railway from Gadsden to Centre through a section of Cherokee County. It is also planned to extend the line to East Gadsden which will require the construction of a bridge across the Coosa River.

Alexandria, La.—S. A. Guy and W. A. Sullivan, Shreveport, La., are interested in the construction of an electric railway in Alexandria.

Cleveland, Ohio—The Cleveland Ry. has been requested to consider plans for extending its Madison Ave. line from the present terminus at West 117th St. to the Rocky River in Cleveland.

Ypsilanti, Mich.—The Ypsilanti St. Ry. has requested the City Council to grant it a franchise to construct an electric belt line in Ypsilanti and to arrange to use the tracks of the Detroit, Jackson & Chicago Ry. on Michigan Ave., Washington, and West Cross Sts. Frederick H. Zeigen, Detroit, Mich., is Pres.

East Dubuque, Ill.—It is planned to organize a company for the purpose of building an electric railway to connect Platteville with Lancaster, the county seat of Grant County, the inland villages west and north, and also to connect with the Chicago, Milwaukee & St. Paul R.R. and the Chicago, Northwestern R.R. at Shullsburg, the Illinois Central R.R. at Apple River, Ill., the Chicago, Great Western R.R. at Stackton and the several lines at Freeport, where connections will be made with the Illinois Traction System, thus giving Grant County a direct route to Chicago.

Los Angeles, Calif.—The City Council has granted a franchise for a period of 21 years to the Pacific Electric Ry. Co. to construct and operate an electric railway in sections of Sixth St. and Central Ave. J. McMillan, Los Angeles, is Gen. Mgr.

Redlands, Calif.—Plans are under consideration for building an electric railway from Redlands Junction to Yucaipa via Redlands. G. S. Biggin and E. A. Warner are interested.

San Francisco, Calif.—The North Beach Promotion Association has requested the Board of Supervisors to authorize the San Francisco Ry. to extend its line down Stockton St. to the Embarcadero.

Stockton, Calif.—The City Council has been requested by the Tidewater Southern Ry. to grant it a franchise for the purpose of extending its tracks in Stockton to connect its warehouses, manufactories and other industries and enterprises within its line of railway and for the purpose of connecting its line with the tracks of other railroad companies in Stockton.

St. John, N. B.—The St. John Ry. has been requested to consider plans for extending its lines through Simonds, St. John County.

LIGHT, HEAT AND POWER

+Peabody, Mass.—The [illegible] Leather Co. has awarded the contract for the construction of a [illegible]-ft. concrete power house in the rear of its plant at Wallis and Hardy Sts. to the E. H. [illegible] Co. at about $[illegible].

Binghamton, N. Y.—Bids will be received until Oct. 19, by J. H. [illegible], Secy. State Hospital Comn., Albany, N. Y., for a new boiler, stack, etc., at the Binghamton State Hospital.

+Contracts for the installation of electrical equipment in the new high schools at [illegible] and Lestershire, Broome County, have been awarded to the [illegible]ANDING ELECTRIC SUPPLY CO., State St., Binghamton.

Pittsburgh, Penn.—As the Allegheny County Light Co. has refused to reduce the price of electric current furnished to the city schools the Board of Education is having plans and estimates prepared for installing power plants in at least five of the largest school buildings. C. L. Woolbridge is Supt. of Bldgs. for the Bd. of Education.

Frostburg, Md.—The Hagerstown & Frederick Electric Ry. Co. has recently purchased the plant of the Frostburg Illuminating Co., and plans to enlarge and improve the plant.

+Princess Anne, Md.—[illegible] has awarded the contract for the construction of a [illegible]x42-ft. brick power house to [illegible] & M[illegible], Princess Anne. The cost of the plant, including equipment, will be about $[illegible].

Westminster, S. C.—At a recent election the citizens voted in favor of a bond issue of $[illegible] to be used for the construction of a municipal electric-light plant. Plans have been prepared by the J. B. McCrary Co., Atlanta, Ga. Noted Aug. [illegible].

Leesburg, Ga.—The J. B. McCrary Co., Atlanta, Ga., has prepared plans for a municipal electric plant to cost, it is reported, about $[illegible]. Noted Jan. [illegible], 1914.

Pulaski, Tenn.—The city will build a brick power house, and will remove the electric-light plant from the City Hall. James T. W[illegible] is Mgr. and Engr. of the power station.

Butler, Ohio.—The citizens have voted $[illegible] in bonds to be used in purchasing a gas engine for the municipal electric-light plant. Other improvements to the plant are also under consideration.

Camden, Ohio.—The citizens will vote Nov. [illegible], on the question of a bond issue, the proceeds of which will be used for the construction of a light plant and water system, estimated to cost $[illegible].

+Marysville, Ohio.—The State Board, Columbus, has awarded the contract for power house equipment, wells and the installation of pumps at the State Reformatory for Women to SHELDON ENGINEERING CO., Toledo, Ohio, at $[illegible].

Spencerville, Ohio.—It is reported that bids will be asked for [illegible] the municipal electric-light plant as soon as [illegible] which was voted for the purpose [illegible]. Noted July 16.

Toledo, Ohio.—Bids will be received until Nov. 6 by the Board of Commissioners of Lucas County for the construction of a power house and equipment for the new heating, lighting and power plant at the Lucas County Children's Home. [illegible] is County Audr. [illegible]

Lansing, Mich.—The Electric Light Commissioners and the [illegible] a site for South [illegible] [illegible] pumping station [illegible] Board of Water Works.

Saginaw, Mich.—The City Council has been petitioned to [illegible] for the construction of a [illegible] plant [illegible] H. Fowle is City Engr. Noted [illegible].

Vanderbilt, Mich.—[illegible] to supply electricity to the [illegible]

Wyandotte, Mich.—It is reported that the improvements to the [illegible]

Carbondale, Ill.—[illegible]

Lockwood, Iowa.—[illegible]

Monona, Iowa.—[illegible]

Oelwein, Iowa.—[illegible]

Sergeant Bluff, Iowa.—[illegible]

Kansas City, Kan.—[illegible]

[illegible], Neb.—[illegible]

Summit, S. D.—[illegible]

Crane, Mo.—The Crane Ice & Cold Storage Co., owned by C. F. Woodson and W. E. Montgomery, contemplates the establishment of an electric-light station in connection with the 10-ton ice plant about to be built.

Smithville, Mo.—At a recent special election, the citizens voted in favor of establishing a municipal electric-light plant.

Sand Springs, Okla.—The Sand Springs Power, Light & Water Co., P. O. Box 128, Tulsa, Okla., plans to install an electric-light plant in Sand Springs.

+Moab, Utah.—J. W. Christensen, Fairview, and C. A. Hammond, Moab, who were recently granted a franchise for the establishment and operation of an electric-light plant, have awarded the contracts for equipment for the plant and distributing system to the INTER-MOUNTAIN ELECTRIC CO., East First South St., Salt Lake City.

San Francisco, Calif.—It is reported that the Board of Public Works has directed the Board of Consulting Architects to prepare plans for the construction of a power plant for the Civic Center. It will cost about $75,000. M. M. O'Shaughnessy is City Engr.

Sydney, N. S.—Bids will be received until Oct. 3 by the City Council for furnishing one 22[illegible]-volt, three-phase 60-cycle turbine pump, and an all-air priming pump. Norman [illegible] is Engr.

St. John, N. B.—Bids are being received by Francis S. Walker, Sanitary Engr., 18 Germain St., for boiler fittings for the heating plant for the new hospital.

BRIDGES

+Bellingham, Mass.—(Official)—The Board of Selectmen has awarded the contract for the construction of a bridge over the Charles River at Caryville, to JAMES A. MONROE, North Attleboro, Mass. Noted Oct. 1.

Boston, Mass.—Bids were opened Oct. 6 by the Metropolitan Park Commission for the construction of the reinforced concrete substructure of the Wellington Bridge at Somerville and Medford, to replace the one destroyed by fire last June. The three lowest bids were: Coleman Bros., Boston, $44,013; T. Stuart's Son Co., Newton, Mass., $49,9[illegible]; W. M. Bailey, Malden, Mass., $57,515. Noted June 11, July 9 and Sept. 3.

+New London, Conn.—It is reported that the New York, New Haven & Hartford R.R. has awarded the contract for constructing the westerly approaches of its proposed bridge over the Thames River to RYAN & KEON, 176 Federal St., Boston. The contract includes two concrete bridges over Winthrop Cove in addition to the embankment.

+Schuylerville, N. Y.—(Official)—Bids will be received until 1 p.m., Nov. 6, by the Town Clerk of the Town of Saratoga, in the village of Schuylerville, for the construction of the substructure and superstructure of a bridge over the west channel of the Hudson River near Schuylerville. For further information, see advertisement under "Contracts to Be Let."

New Brunswick, N. J.—(Official)—Bids will be received until [illegible] p.m., Oct. 26, by the Board of Chosen Freeholders of Middlesex County for the construction of a reinforced concrete bridge over [illegible] Creek at [illegible] St., Borough of Roosevelt. Alvin B. Fox, Perth Amboy, is County Engr. A. J. Gebhardt is Dir. Bd. of Chosen Freeholders.

South Amboy, N. J.—(Official)—The Raritan River R.R. is constructing a bridge over its tracks at Washington Ave. The work is being done by the railroad's own forces under the direction of Thomas [illegible], Engr. of M. W. and Structures. The bridge will be of reinforced concrete and will cost about $[illegible]. Noted Oct. [illegible].

Trenton, N. J.—The city contemplates the construction of [illegible] bridge over Assunpink Creek [illegible] with the river property. J. [illegible] is City [illegible].

+Allentown, Penn.—The Commissioners of Lehigh County have awarded contracts for the construction of [illegible] and the repair of two others to the ALLENTOWN CONSTRUCTION CO. at $[illegible]. [illegible] CONTRACTING CO. at $[illegible]. Noted [illegible].

+Ellwood City, Penn.—[illegible]

+Harrisburg, Penn.—[illegible]

Philadelphia, Penn.—[illegible]

Leipsic, Del.—[illegible]

Wilmington, Del.—The City Council is considering the construction of a bridge over the Brandywine at Washington St. [illegible] is City Engr.

Gadsden, Ala.—See item under "Electric Railways."

+Greenville, Miss.—(Official)—The Board of Supervisors of [illegible]

+Newton, Miss.—(Official)—The Board of Supervisors of Newton County has awarded the contract for the construction of 18 small bridges, of creosoted timber, in District No. 4, to R. E. KEITH, Decatur, Miss., at $8840. Noted Sept. 24.

Lake Charles, La.—The Police Jury of Calcasieu Parish has appointed a special committee to take charge of preliminary plans for a reinforced concrete bridge over the Calcasieu River, at Lake Charles. The estimated cost of the bridge is $175,000.

Plaquemine, La.—(Official)—The Police Jury of Iberville Parish has rejected all bids received Oct. 3 for the construction of a steel drawbridge over Bayou Grosse Tete Bay, and the work will be readvertised. W. A. Holloway is Pres. of the Police Jury. Noted Oct. 1.

Memphis, Tenn.—Bids for the construction of a reinforced-concrete culvert over the Bayou Gayoso at Mill Ave. were received as follows: F. D. Harvey, $13,675; T. A. Gavin, $14,065; Koehler Bros. & Fowler Construction Co., $13,400; William O. White, $11,277; A. M. Alexander, $11,100; B. C. Pouncy, $15,800; Larkin & Co., $13,387. J. H. Weatherford is City Engr.

+Louisa, Ky.—The Chesapeake & Ohio Ry. has awarded the contract for the construction of a bridge over the Levisa Fork of the Big Sandy River, about three miles from Louisa, to the VIRGINIA CONCRETE CO., Roanoke, Va.

Ludlow, Ky.—Plans have been prepared for a new concrete viaduct at Elm St. over the tracks of the Queen & Crescent Route. The estimated cost is $34,615, or about $16,000 more than the original estimates, owing to the difficulty in securing a solid foundation on account of the beds of quicksand. The plans have been referred to the Committee on Streets and Railroads. Noted Sept. 17.

+Cincinnati, Ohio—(Official)—The Commissioners of Hamilton County have awarded contracts for the construction of a concrete bridge over Mill Creek on Wayne Ave., Springfield Township, and for the repair of a bridge over Syracuse Creek near Perin's Place, Symmes Township, to CHARLES STAAB, Reading, Ohio, at $32,160 and $1125 respectively. Noted Sept. 17.

Delaware, Ohio—(Official)—Plans have not yet been completed for the construction of a concrete bridge over the Olentangy River, at Winter St., of which the estimated cost is $36,000. A special committee of the Commercial Club has coöperated with the Commissioners of Delaware County to promote the construction of this bridge. Bids will be received by the County Commissioners. Noted Sept. 24.

Lima, Ohio—Bids will be received until noon, Oct. 21, by the Board of Commissioners of Allen County for the construction of the superstructure of a bridge in Bath Township. H. J. Lawlor is Clk. of Comrs.

Warren, Ohio—Bids will be received until 1 p.m., Oct. 19, by W. R. Harrington, Audr. of Trumbull County, for the construction of a bridge in Idylwild Park, Brookfield Township.

+Rensselaer, Ind.—(Official)—The Commissioners of Jasper County awarded the following contracts on Oct. 6, for the construction of nine bridges in the county: B. D. McCOLTY, Rensselaer, $2191 for three bridges; F. M. WILLIAMS, Winamac, $1583 for two bridges; ELKHART BRIDGE CO., Elkhart, $695 for one bridge; ROCHESTER BRIDGE CO., Rochester, Ind., $3289 for one bridge; EAST ST. LOUIS BRIDGE CO., East St. Louis, Ill., $1380 for two bridges.

+Harmon, Ill.—(Official)—Harmon Township has awarded the contract for the construction of the Clatworthy Bridge to the CLINTON BRIDGE WORKS, Clinton, Iowa, at $2985; the contract for the Kimball Bridge was awarded to the JOLIET BRIDGE & IRON CO., Joliet, Ill., at $3047. The Decatur Bridge Co., Decatur, Ill., bid $3500 and $3600 respectively for these bridges. Noted Sept. 24.

LaSalle, Ill.—It is reported that the Shippingsport Bridge at LaSalle has been condemned as unsafe, and that the State and County Engineers will recommend the construction of a new bridge over the Illinois River at this point. The approximate cost will be $125,000. George Farnsworth, Ottawa, Ill., is County Engr. of LaSalle County.

Kansas City, Kan.—The Commissioners of Wyandotte County have instructed the County Engineer to prepare plans for the reconstruction of the Central Ave. Bridge over the Kaw River. The estimated cost of an entire new bridge is $250,000, or if one or two spans of the old bridge are used, about $60,000 may be saved. The Metropolitan Street Ry. Co. will pay a part of the cost. Frank Holcomb is County Clk. Noted Sept. 24.

+Leavenworth, Kan.—(Official)—Contracts for the construction of 19 small bridges and culverts, total cost about $15,450, have been awarded by the Commissioners of Leavenworth County to: The MISSOURI VALLEY BRIDGE CO.; FRED. TERRY & SON; TIERNEY & HAND and JEFFRIES & MARTIN. Noted Oct. 1.

Wichita, Kan.—The Commissioners of Sedgwick County have passed a resolution for the construction of a pile bridge over the Arkansas River in Riverside Township. It will be about 400 ft. long. Plans will be prepared at once by E. V. Moone, County Engr., and bids will soon be asked.

Medora, N. D.—(Official)—We are advised that bids for a bridge over the Little Missouri River will not be readvertised at present, as there is no sale for the boads to pay for its construction. List of bids received Sept. 7. Noted Oct. 1.

Billings, Mont.—Press reports state that the Commissioners of Yellowstone County have selected a site over the Yellowstone River near Duck Creek for the construction of a bridge to cost about $30,000.

Independence, Mo.—The Missouri State Utilities Commission has ordered the construction of a viaduct over the 15th St. Road crossing of the Chicago & Alton R.R., the railroad company to pay 60%, and Jackson County 40% of the cost, which is estimated at $32,490. The viaduct is to be of concrete, 478 ft. long, 30 ft. wide, with approaches of 375 ft. Plans are to be prepared by the Engineer of Jackson County, and approved by the Utilities Commission and the railroad. They must be submitted to the Commission by Nov. 20.

Jefferson City, Mo.—The Highway Engineer of Cole County has prepared plans for the construction of a bridge, about 1300 ft. long, over the Osage River at Lisletown. The estimated cost is $65,000, the expense to be divided between Cole and Osage Counties. It is reported that bonds will be voted to pay for this bridge.

Monticello, Ark.—Bids will be received until noon, Oct. 24, by W. A. Coker, County Judge of Drew County, for the construction of a steel bridge over Bayou Bartholemew, three miles west of Tillar. Noted Sept. 17.

Wynne, Ark.—It is reported that bids will soon be asked for the construction of 15 highway bridges over the canals in Drainage District No. 3, of Cross County. W. S. Newsom, Wynne, is Engr.

Dallas, Tex.—The Board of City Commissioners has rejected all bids for the construction of a concrete arch over Turtle Creek at Bowen St. as being too high. New bids will be asked. There were four bids, ranging from $14,750 to $29,349. S. B. Scott is Street Comr.

+Fort Worth, Tex.—(Official)—The Commissioners of Tarrant County have awarded the contract for the construction of a bridge on the Fort Worth and Azle Road to the TRINITY BRIDGE CO., at $4389. Other bidders were: Mahuren & Chester, $4845; Montgomery, Watt & Echols, $4888; Tarrant Construction Co., $5262; El Paso Bridge Co., $5309; E. C. Woodward, $5750. Noted Sept. 24.

Fredericksburg, Tex.—(Official)—The Commissioners of Gillespie County rejected all bids received Oct. 3 for the construction of a low-water bridge over the Pedernales River, at Austin Crossing. Herman Usener is County Clk. Noted Oct. 1.

Memphis, Tex.—The Altus, Roswell & El Paso R.R. will, it is reported, build two steel bridges and several wooden trestles on its proposed line from Memphis, Tex., to Roswell, N. M.

San Antonio, Tex.—The City Council plans the construction of two bridges over San Pedro Creek, one at North Flores St. and the other at West Laurel St. A. C. Paneoast is City Engr.

Twin Falls, Idaho—The Board of Commissioners of Twin Falls County has appropriated $10,000 for the Shoshone Falls Bridge, $9000 for the Hansen Bridge, and $4000 for the Murtaugh Bridge. The money will be available when the state, Lincoln and Minidoka Counties have appropriated similar amounts.

+Provo, Utah—(Official)—The Commissioners of Utah County have awarded the contract for the construction of a bridge over the Provo River at Pleasant View to the PROVO FOUNDRY & MACHINE CO., Provo, at $4050; the contract for a bridge over the Jordan River near Lehi was awarded to the MIDLAND BRIDGE CO., Kansas City, Mo., at $4380. List of bidders noted Sept. 24.

Buckley, Wash.—The following bids were received by the Commissioners of King County for furnishing steel for the King-Pierce County bridge over the White River at Buckley: United States Steel Co., $11,472; Minnesota Steel & Machine Co., $12,000; Illinois Steel & Bridge Co., $12,697; Omaha Structural Steel Co., $12,831; Massillon Co., $13,059; C. W. Raynor, $11,625; Milwaukee Bridge & Iron Co., $11,998; C. W. Kinnan & Co., $13,000; Central States Bridge Co., $11,620. Noted July 30, Aug. 6 and Sept. 3.

Seattle, Wash.—The City Council failed to pass the ordinance appropriating $8000 from the general fund for the completion of the piers of the Montlake Blvd. Bridge. Noted July 16 and Sept. 10.

+Seattle, Wash.—The Board of Park Commissioners has awarded the contract for the construction of a bridge across the McGaw St. Gulch to ELMER JOHNSON, 6742 Third Ave. N. W., Seattle, at about $5000.

Bonsall, Calif.—(Official)—Bids will be received until 11 a.m., Oct. 19, by the Board of Supervisors of San Diego County, San Diego, for the construction of a reinforced concrete bridge at the mouth of Gopher Cañon near Bonsall, Route 4, Div. 2, County Highway Commission Survey. B. Allen, San Diego, is Deputy Clk. of the Bd. of Supvrs.

San Jose, Calif.—(Official)—Bids will be received until 11 a.m., Oct. 19, by the Board of Supervisors of Santa Clara County, for the construction of a steel pony truss bridge over Uvas Creek on the Bodfish Mill Road. Henry M. Ayer is Chn. of the Bd. Henry A. Pfister is Clk.

WATER SUPPLY—IRRIGATION

★Kings Park, N. Y.—(Official)—Bids will be received by the State Hospital Commission, Capitol, Albany, until 3 p.m., Oct. 19, for driving two artesian wells at the Kings Park State Hospital. For details see advertisement under "Contract To Be Let."

Manchester, N. Y.—The proposition to issue bonds for construction of a water system has been defeated. Noted Sept. 17.

Nyack, N. Y.—The water system will be extended in the southwestern portion of the city at an estimated cost of $7000.

Asbury Park, N. J.—The Common Council has disposed of $50,000 water bonds, recently voted, for the improvement of the water system.

Clinton, N. J.—Bids will be received, until Oct. 22, by the Board of Managers, State Reformatory for Women, for installing a water system in accordance with plans on file at the office of the Commissioner of Charities, Trenton.

Hackensack, N. J.—The Hackensack Water Co. will install a water supply system in the Sunnyside Ave. section, North Bergen. Noted May 28.

New Brunswick, N. J.—The Tide Water Pipe Co. has applied to the Board of Freeholders for permission to install new pipe lines in Woodbridge Road, St. George's Ave., Woodbridge Ave., and Rahway Ave.

Sewell, N. J.—The Board of Public Utility Commissioners has granted the Sewell Water Co. permission to issue $22,500 of its capital stock to provide for improvements.

Wildwood, N. J.—The Board of Commissioners plans to erect a new water plant with a capacity of 3,000,000 gal. daily. The plant is estimated to cost $[illegible],000.

Harrisburg, Penn.—The State Water Supply Commission contemplates constructing a storage reservoir in Crawford County. The estimated cost of the project is $1,600,000.

✦Philadelphia, Penn.—(Official)—The contract for two [illegible]-gal. per day steam turbine driven gear centrifugal pumps has been awarded to DeLAVAL STEAM TURBINE CO., Trenton, N. J. Noted Oct. 1.

Brunswick, Md.—The Board of Aldermen and the Mayor contemplate issuing bonds for $30,000, the proceeds to be used for the improvement of the water system.

Princess Anne, Md.—A franchise has been granted to E. C. Lannon, New York, N. Y., to construct a water system.

Oenia, Fla.—An ordinance has been passed by the Council authorizing the sale of $[illegible] in bonds, the proceeds of which will be used for the improvement of the water system.

Camp Hill, Ala.—Bids will be received by W. C. Newell, Mayor, until noon, Oct. 1[illegible], for constructing a water and a sewer system. Edgar B. Kay, Tuscaloosa, Ala., is Engr. Noted June 4.

✦McComb, Miss.—The contract for constructing a concrete reservoir has been awarded by the city to SLADER & WINNERLAND, McComb, Miss. Bids opened Sept. 29. Noted Sept. 1[illegible].

Vicksburg, Miss.—All bids received Sept. 21 for the installation of a municipal water system have been rejected. The work will be readvertised. A. L. Dabeny, Portland Bldg., Memphis, Tenn., is Engr. Noted Aug. 20.

New Orleans, La.—Bids will be received by the Sewerage and Water Board, until Dec. 1, for furnishing riveted steel pipe, five and 12 ft. in diameter, approximate weight 150,000 lb. George G. Earl is Gen. Supt.

Providence, Ky.—Bids are being received by W. E. Hunter, 1[illegible] W. Vine Ave., Knoxville, Tenn., for laying two miles each of 4, 6, 8, 10-in. c-i. pipe and equipment for the Providence Water & Utilities Co. Noted Sept. 10.

Belleville, Ohio.—The city contemplates spending $25,000 for the installation of a water system.

Camden, Ohio.—The proposition to issue $35,000 in bonds for the construction of a water system and electric light plant will be voted on at the November election. The Bellaire Engineering Co. is preparing plans.

Lakewood, Ohio.—An election will be held in November to vote on the proposition of issuing $150,000 in bonds, the proceeds of which will be used for the construction of a municipal water system.

Zanesville, Ohio.—The Council contemplates issuing $25,000 in bonds, the proceeds to be used for the improvement of the water system.

Ferdinand, Ind.—(Official)—A water works company has been organized with a capital of $21,000. E. D. Pickhardt, Huntingburg, Ind., Construction Engr., is in the market for material for the construction of the system.

Ashton, Ill.—At an election held Oct. 6, bonds for $18,000 for the construction of a water system were voted. Noted Aug. 1[illegible].

✦Casey, Ill.—The contract for constructing a pumping plant and pipe line has been awarded, according to press reports, to HALL CONSTRUCTION CO., at $60,000.

✦Decatur, Ill.—(Official)—Bids will be received until 10 a.m., Oct. 26, for the sale of the second-hand filter plant machinery. Jerome J. Heger is City Clk.

✦Grandmound, Iowa.—The contract for erecting a 90-ft. steel tower, [illegible] tank, pumping station, etc., has been awarded to DES MOINES BRIDGE & IRON WORKS, Des Moines, at $[illegible]. Bids opened Sept. 29. Noted Sept. 24.

Hameston, Iowa.—An election will soon be held to vote on the proposition of issuing $10,0[illegible] in bonds, the proceeds to be used for the completion of the water system. Noted Aug. [illegible].

✦Stanton, Iowa.—(Official)—Bids were received Oct. 1 for constructing a water system as follows: E. J. HICKLE, Kansas City, Mo., at $10,469 (awarded contract); [illegible] $10,600; [illegible] & Taylor, $11,[illegible]; [illegible] Engine & Supply Co., $10,[illegible]; [illegible], $11,[illegible]; [illegible]; Public Service Construction Co., $[illegible]; and [illegible] W. [illegible] Co., $10,9[illegible]. Noted Sept. 1[illegible].

Virginia, Minn.—Bids will be received by the Water and Light Commission until 7 p.m., Oct. 1[illegible], for furnishing and installing two [illegible] horizontal tubular boilers at the water works. [illegible] T. [illegible] is Engr.

Clatonia, Neb.—[illegible] The Marts Engineering Co. [illegible] Noted Aug. 6.

Sioux Falls, S. D.—[illegible]

Summit, S. D.—[illegible]

Billings, Mont.—[illegible]

Rolla, Mo.—[illegible]

✦Denison, Tex.—[illegible] AMERICAN WATER [illegible]

Livingston, Tex.—Bonds for $25,000, the proceeds to be used for the construction of a water system, have been voted by the citizens.

Pecos, Tex.—An election will be held to vote on the proposition of issuing bonds for the construction of an irrigation district in Reeves County. Noted July 9.

Port Lavaca, Tex.—The Citizens Light & Water Co. has been organized and will construct a water works and electric light plant. R. H. Hamilton is interested.

Denver, Colo.—A preliminary survey of water conduit routes from Platte Cañon to Denver is being made. L. Reynolds is in charge. Noted July 9.

Kanosh, Utah.—Bonds for the installation of a water system have been voted by the citizens.

Everett, Wash.—According to press reports, W. R. Thompson, Seattle, has been retained by the City Commission to prepare plans for the municipal water system, estimated to cost $100,000.

Quincy, Wash.—An election will be held on Nov. 3, to vote on the proposition of issuing bonds, the proceeds of which to be used for the construction of the Quincy Valley Irrigation project. Noted Jan. 29.

Seattle, Wash.—An ordinance authorizing the installation of water mains in Graham St. has been passed by the City Council.

Cucamonga, Calif.—The Old Settlers Water Co. has been purchased by the Cucamonga Water Co. for $2[illegible],000. Improvements will be made.

Orland, Calif.—Plans will be prepared by the City Engineer for the extension of the water and sewer systems. Bonds for this purchase have been voted. Noted May 28.

Richmond, Calif.—The bond issue for $2,500,000 for the construction of a municipal water system was defeated at a recent election. Noted June 11.

Riverbank, Calif.—Bonds for $400,000 were voted by the residents of the Oakdale Irrigation District on Oct. [illegible]. The proceeds will be used for the extensions of the laterals and for making improvements.

✦Montreal, Que.—(Official)—The contract for installing a 24,000,000-gal. pump at the water works has been awarded to E. LAURIE & CO., 245 Bleury St., Montreal, agent for DeLaval Turbine Co., at $17,775. Noted July 23.

Saanichton, B. C.—Bonds for $375,000 for the construction of a water system have been voted by the ratepayers. Noted Oct. 1.

SEWERS

Boston, Mass.—Bids will be received until Oct. 19, by the Public Works Department for constructing a sewer in Tip Top St., Brighton, Herman St., West Roxbury and Lovell and Porter Sts., East Boston. L. E. Rourke is Comr.

Bids will be received until Oct. 2[illegible] by the Public Works Department, for constructing sewers in Regent Road, Lenoxdale Ave. and Manley St., Dorchester District. L. K. Rourke is Comr.

New Bedford, Mass.—Bids will be received until Oct. 21, by Charles S. Ashley, Mayor, and the Board of Aldermen, for furnishing a centrifugal pump and motor for the intercepting sewer system. William F. Williams, New Bedford, is Consult. Engr.

Worcester, Mass.—The Sewer Committee has asked the Finance Committee of the Council to appropriate $[illegible] for the construction of the outfall sewer.

Elmira, N. Y.—F. H. Shaw, Lancaster, Penn., is preparing plans for the construction of a sewage disposal plant.

✦Fairport, N. Y.—(Official)—Bids were received Sept. 2[illegible] for constructing about [illegible] ft. of sewers as follows: JAMES F. LEARY CONSTRUCTION CO. INC., Rochester, at $[illegible] (awarded contract); A. J. Shaw, Jr., $1[illegible]; Bishop Construction Co., $[illegible]; Goggin & Schultz, $2[illegible]; and Samuel [illegible], $[illegible]. Noted Sept. 24.

Greece, N. Y.—Bonds will be issued for the construction of a sewer system in the [illegible] District. The estimated cost is $[illegible].

Lestershire, N. Y.—[illegible] was low bidder for constructing sewers in [illegible] and Ave. A.

Greenwood Lake Glen (Lakeside post office), **N. J.**—(Official)—Bids will be received by [illegible] M. [illegible], [illegible] Market St., Paterson, until [illegible] p.m., Oct. 16, for constructing a sewage disposal plant for the [illegible] Co. at Greenwood Lake Glen. Noted Sept. [illegible].

Phillipsburg, N. J.—The State Board of Health has directed the city to construct a sewage disposal plant within one year.

Breckenridge, Penn.—Plans have been prepared by [illegible] Hudson, Engr., for the installation of a sewage disposal plant for Breckenridge and Tarentum.

Connellsville, Penn.—A sewage disposal plant to cost $[illegible] has been ordered constructed by the State Board of Health not later than Jan. 1, 1916. Charles F. [illegible] is City Engr.

✦East Orange, N. J.—The contract for constructing a [illegible] [illegible] Fourth Ave. and [illegible] St. has been awarded to [illegible] [illegible] Metropolitan Bldg., [illegible]. Noted [illegible].

Tampa, Fla.—Ralph Ma[illegible], City Engr., has been authorized to prepare plans for the [illegible] part of the [illegible].

Camp Hill, Ala.—See [illegible] under "Water Supply" and [illegible].

✦New Orleans, La.—(Official)—Bids were received Oct. [illegible] by the Sewerage and Water Board for constructing the [illegible] Ave. [illegible] as follows: [illegible]; VICTOR LAM[illegible] (awarded contract); F. A. Nicolet & Son, $[illegible]; John Reiss, $[illegible]; Kane Kelly Construction Co., $[illegible]; and Jefferson Construction Co., $[illegible]. Bids were also received for the [illegible] as follows: Kane Kelly Con-

struction Co., $315,077; VICTOR LAMBOU, $266,544 (awarded contract); A. L. Patterson, $286,737; Hampton Reynolds, $280,652; F. A. Noullet & Son, $289,039; and Jefferson Construction Co., $298,354.

✚New Orleans, La.—The contract for constructing a pumping station on Protection Levee has been awarded by the Sewage and Water Board to JOHN REISS, at $50,942.

✚Farmer City, Ill.—A contract for constructing 11,000 ft. of sewers has been awarded to S. A. TUTTLE, Decatur, at $19,701.

✚Carlyle, Ill.—A contract for constructing a sewer has been awarded to D. E. NIPP, Flora, Ill., at $21,325.

Appleton, Wis.—Bids will be received by F. L. Williams, City Clk., until 9 a.m., Nov. 3, for constructing a sewer in Front St.

✚Creston, Iowa—(Official)—Bids were received, Sept. 30, by the City Clerk, for constructing 8- and 10-in. sanitary sewers in several streets as follows: W. F. Power, Guthrie, Okla., $13,051; A. C. Comstock, Cedar Rapids, Iowa, $12,947; John S. Harrington, Topeka, Kan., $11,702; H. D. Hallett, Aurora, Ill., $15,489; J. S. McLaughlin & Sons, Red Oak, Iowa, $12,445; Akin Flutter Co., Corning, Iowa, $13,407; ALAMO ENGINE & SUPPLY CO., Omaha, Neb., $11,036 (awarded contract); Public Service Construction Co., Omaha, Neb., $11,827; Arthur A. Dobson Co., Lincoln, Neb., $11,736; McCoy & Taylor, Kansas City, Mo., $12,526; Briggs & Corey, Shenandoah, Iowa, $13,265; Blackhawk Construction Co., Waterloo, Iowa, $12,723. Noted Sept. 24.

✚Pocahontas, Iowa—A contract for installing a sewer system has been awarded to HUGHES & CLUBB, Rockford, Ill., at $62,950.

Albion, Neb.—Bids will be received by George Brower, City Clk., until noon, Oct. 30, for constructing a sewer in District No. 4.

Mitchell, Neb.—Bids will be received by G. E. Mark, Village Clk., until 6 p.m., Nov. 17, for constructing lateral sewers in District No. 1.

Aurora, Mo.—Bids will soon be received for a sewage and purification system to be installed by the city. Worley & Black, Engrs., Kansas City, are preparing plans.

✚Granger, Tex.—A contract for constructing a sanitary sewer system has been awarded to DALLAS LIME & GRAVEL CO., Dallas, at $15,000. The work consists of four miles of 6-, 8- and 10-in. sewer and filters. Noted Sept. 17.

Lawton, Okla.—Bids will be received by the City Commissioners, until Oct. 22, for constructing a sewer system in Gore Blvd.

Cathlamet, Wash.—Bids will be received by the City Council, until Oct. 19, for constructing a sewer system. Noted Sept. 17.

✚Hood River, Ore.—A contract for constructing sewers in Division 1, of General Sewer District No. 2 has been awarded to the TRANSFER & LIVERTY CLAY PIPE CO., at $5322.

Portland, Ore.—Bids will soon be received by the City Council for constructing a sewer in East 74th St., from Thorburn Ave. to East 72d St. The estimated cost is $7300.

✚Los Angeles, Calif.—The contract for constructing a sewer in Moneta Ave. has been awarded to B. ZAICH at $11,925.

✚Winnipeg, Man.—The contract for constructing a sewer on Main St. has been awarded to THOMAS JACKSON & SONS, at $15,478.

GARBAGE

Jersey City, N. J.—Bids will be received until 2 p.m. Oct. 22, by M. I. Fagen, City Clk., for the collection and removal of ashes, garbage, kitchen refuse and paper for a period of one year.

Madison, Wis.—J. P. Donovan, Dir. Pub. Health, has asked for an appropriation for the installation of two garbage incinerators for the disposal of the city's refuse. The estimated cost is about $23,000.

✚Chisholm, Minn.—The contract for the installation of a six-ton capacity McGuire incinerator has been awarded to the C. E. HUNTER CO., Chicago, Ill., at $4650.

Corpus Christi, Tex.—Bids will be received until Nov. 3 by the City Clerk for furnishing material and constructing garbage crematory. Estimated cost about $20,000.

STREETS AND ROADS

★Hartford, Conn.—(Official)—Bids will be received by the State Highway Commissioner, Room 27, State Capitol, until 2 p.m., Oct. 21, as follows:

Preston Township—about 4990 lin.ft. native stone macadam or gravel on the Norwich-Westerly Turnpike. Estimated quantities, 4800 cu.yd. earth grading, 5760 sq.yd. 7-in. native stone or gravel road, 2000 sq.yd. 4-in. macadam or gravel road, 2000 sq.yd. telford base, 635 lb. steel reinforcement, 155 lin.ft. corrugated iron pipe culverts, 1000 lin.ft. rubble drain, 50 cu.yd. crushed stone fill.

Sterling Township, about 5480 lin.ft. native stone macadam or gravel on the Plainfield Road. Estimated quantities, 2980 cu.yd. earth grading, 620 cu.yd. rock excavation, 8026 sq.yd. 7-in. native stone or gravel road, 500 sq.yd. 4-in. native stone or gravel road, 500 sq.yd. telford, 1300 lb. steel reinforcement, 260 lin.ft. corrugated iron pipe culverts, 400 lin.ft. rubble drain. Specifications at Town Clerk's office, Sterling.

Southbury Township, a section of reinforced concrete retaining wall on the Newton Turnpike. Estimated quantities, 300 cu.yd. earth excavation, 500 cu.yd. borrowed embankment, 100 cu.yd. rock excavation, 530 cu.yd. second class concrete, 5000 lb. reinforcement. Specifications at office of George E. Smith, Div. Engr., New Milford.

Coventry Township, about 4700 lin.ft. native stone macadam on the Hartford-Willimantic Turnpike. Estimated quantities, 3180 cu.yd. borrowed embankment, 5655 sq.yd. 7-in. macadam, 2500 sq.yd. 4-in. macadam, 2500 sq.yd. telford base, 20 cu.yd. concrete, 220 lin.ft. corrugated iron pipe culverts, 1000 lin.ft. rubble drain, 50 cu.yd crushed stone fill. Specifications at Selectmen's office, South Coventry.

East Haven Township: Stone macadam, bituminous macadam or plain concrete on the Short Beach Road. Estimated quantities, 1370 cu.yd. earth grading, 25 cu.yd. borrowed embankment, 3220 cu.yd. rock excavation, 4715 sq.yd. 7-in. macadam and 1500 sq.yd. 4-in. macadam construction, 1500 sq.yd. 4-in. macadam construction, 1500 sq.yd. telford, 1187 cu.yd. concrete, 5215 sq.yd. bituminous macadam, 210 lin.ft. corrugated iron pipe culvert.

Morris Township: About 6700 lin.ft. native stone macadam or gravel on the Watertown Road. Estimated quantities, 1869 cu.yd. earth grading, 3210 cu.yd. borrowed embankment, 100 cu.yd. rock excavation, 150 cu.yd. wet excavation, 1000 lin.ft. rubble drain, 8420 sq.yd. 7-in. and 2000 sq.yd. 4-in. macadam or 10,400 sq.yd. gravel, 2000 lin.ft. telford, 270 lin.ft. corrugated iron pipe culverts.

Danbury Township: About 11,777 lin.ft. trap rock macadam, rocmac, gravel or concrete on Lake Ave. Estimated quantities, 7660 cu.yd. earth grading, 50 cu.yd. borrowed embankment, 800 cu.yd. rock excavation, 1400 lin.ft. rubble drain, 730 lin.ft. corrugated iron pipe culverts, 61 cu.yd. concrete; 20,940 sq.yd. gravel surfacing or 4070 cu.yd. concrete road or 20,940 sq.yd. rocmac surfacing; 3500 sq.yd. telford base. Specifications at Selectmen's office, Danbury.

Old Lyme Township: The construction of the abutments for an 80-ft. span bridge. Specifications at State Highway Commissioner's office, Hartford.

✚Hartford, Conn.—The contract for the construction of a section of trap rock macadam road on the Cromwell-Berlin Road has been awarded to STAFFORD & MATHER, Hartford, at about $6592.

★Albany, N. Y.—(Official)—Bids will be received by John N. Carlisle, State Highway Comr., until 1 p.m., Oct. 30, for improving highways in various counties. For particulars, see advertisement under "Contracts to Be Let."

Syracuse, N. Y.—The Common Council has voted to pave East Raynor Ave. The approximate cost is $40,000.

★Bayonne, N. J.—(Official)—Bids will be received by William P. Lee, City Clk., until 8 p.m., Oct. 20, for improving Sixth St., from Broadway to Ave. A with sheet asphalt; for improving Fifth St. from Ave. A to Broadway; Eighth St. from Ave. A to Broadway, and Humphreys Ave. from Fifth to Seventh St., with bituminous concrete; for improving 16th St., between Broadway and Hudson Boulevard; 32d St., between Ave. A and Ave. E, with sheet asphalt. For further information see advertisement under "Contracts to Be Let."

Jersey City, N. J.—Bids will be received by the City Commissioners until Oct. 22 for improving Jackson Ave. from McAdoo to Fulton Ave. C. Van Keuren is City Engr.

The Boulevard Commissioners will receive bids until Oct. 19 for repaving Hudson Blvd., from Newark Ave., to the Paterson Plank Road, about five miles, with bituminous concrete pavement, laid on macadam. J. C. Sweeney is Clk. of the Comrs.

Kearney, N. J.—Bids will soon be received by the Town Council for paving Grove St. from Kearney to Highland Ave.

New Brunswick, N. J.—The Board of Freeholders has approved plans for the improvement of the second section of Woodbridge Ave., from Bonhamtown to Bloomfield's Corner.

✚Rahway, N. J.—The contract for paving Irving St. from Poplar St. to Milton Ave. and Milton Ave. from Pennsylvania R.R. arch to Main St. has been awarded to HASTINGS PAVING CO.

✚Mt. Union, Penn.—The contract for paving Shirley and Jefferson Sts. with brick has been awarded to the GREGORY PAVING CO., Lewistown, at $13,000.

Baltimore, Md.—Bids will be received by the Board of Awards, City Hall, at the City Register's Office, until Oct. 21, for grading, curbing and paving, with concrete blocks, on concrete base, Caroline St., from Thames to Pratt St., 16,500 sq.yd., under Contract No. 90; work under Contract 100 Exeter St., from Low to Gay St., Wolfe St., from Fell to Aliceanna St., Fell St., from Ann St. to waterfront, and Thames St., from Philpot St., to Broadway, 13,700 sq.yd. R. Keith Compton is Chn

✚Baltimore, Md.—The contract for improving Eastern Ave. by curbing and paving with asphalt has been awarded to P. FLANIGAN & SON, Baltimore, at $20,553.

Denton, Md.—The Caroline County Commissioners will receive bids, until Oct. 30, for the construction of State-aid highway, upon or along a section of Denton-Hillsboro Road; Hillsboro-New Bridge Road between Hillsboro and Stoney Road; also Bridgeton and Goldsboro; 1¼ miles including a 75-ft. steel concrete bridge. Owen G. Garey is Pres. of the Comrs.

✚Gate City, Va.—A contract for grading 14 miles of pike roads has been awarded to OLIVER & HILL, Maryville, Tenn., at approximately $50,000.

✚New Cumberland, W. Va.—A contract for constructing three miles of brick pavement has been awarded to FREDERICK ROBINSON.

Welch, W. Va.—The citizens of Big Creek Magisterial District, McDowell County, will vote, Nov. 3, on the proposition to issue $165,000 in bonds for road construction.

Dade City, Fla.—The citizens of Zephyrhills Township, Pasco County, have voted on the proposition to issue $30,000 in bonds for constructing approximately 15 miles of road.

Bay Minette, Ala.—The citizens of Baldwin County contemplate voting on the proposition to issue $250,000 in bonds to construct roads.

Birmingham, Ala.—The City Council contemplates paving Tenth Ave. from 26th to 28th St., with asphaltic concrete having 4-in. concrete base and 1½-in. wearing surface. The estimated cost is $8245. Julian Kendrick is City Engr.

Camden, Ala.—Bids will be received by the County Court until Nov. 2 for grading, draining and surfacing a section of the Camden and Millers Ferry Road. W. S. Keller is State Highway Engr.

Wedowee, Ala.—Bids will be received by Commissioners of Randolph County until Oct. 28, for improving the Wedowee and Roanoke Road. The estimated cost is $8000. W. S. Keeler, Montgomery, is State Highway Engr.

+Alexandria, La.—The City Council has awarded the contract to pave Lee St., from Slaughter House Bayou to the city limits to FRANK T. CONSTANT.

Whitesburg, Ky.—At an election to be held in November, the citizens of Letcher County will vote on the proposition to issue bonds for road construction.

Carrollton, Ohio—(Official)—Bids will be received by E. F. Lawler, Village Clk., until noon, Oct. 1[illegible], for improving a section of Mill St.

Cleveland, Ohio—The Board of Control has authorized the paving of [illegible] Road at a cost of $2[illegible].

Greenspring, Ohio—Bids will be received by the Town Clerk until Oct. [illegible], for [illegible] sq.yd. of paving. George Champe, 61[illegible] The Nasby, Toledo, Ohio, is Engr. in Charge.

+Mt. Gilead, Ohio—The contract for paving East Union St. and a section of West High St. has been awarded to WIELAND & MILLER at $1[illegible].

Toledo, Ohio—Bids will be received by the County Commissioners, until Oct. 2[illegible], for grading and macadamizing Lockwood Ave., in Washington Township. Charles J. Sanzenbacher is County Engr.

Indiana—(Official)—Bids will be received as follows for road improvements in Indiana:

Lawrenceburg, until noon, Nov. 2, by the Commissioners of Dearborn County, for constructing roads in Lawrenceburg and [illegible] Townships. W. S. Fagaly is Audr.

Salem, until Nov. [illegible], by the Commissioners of Washington County, for constructing the [illegible] Ferry Road in Gibson Township. F. [illegible] M[illegible] is Audr.

Greencastle, until 2 p.m., Nov. [illegible], by the Commissioners of Putnam County, for constructing a stone road in Russell Township. C. L. [illegible] is Audr.

Corydon, until 2 p.m., Nov. [illegible], by the Commissioners of Harrison County, for constructing a road in Harrison Township. J. L. [illegible] is Audr.

Shelbyville, until 11 a.m., Nov. [illegible], by the Commissioners of Shelby County, for constructing gravel roads in Sugar Creek Township and Washington Townships and one on line between [illegible] and Shelby Townships. F. W. Fa[illegible] is Audr.

+Brownstown, Ind.—(Official)—A contract for constructing two roads in [illegible] Township has been awarded to JOHN SPIKER, [illegible], Ind. Noted Sept. 17.

+Lawrenceburg, Ind.—(Official)—A contract for constructing a gravel road in Lawrenceburg Township has been awarded to NUGENT & HINES, Harrison, Ohio, at $[illegible]. The only other bid was that of Van Camp Bros., Newtonsville, Ohio, at $[illegible]. Noted Sept. 17.

+Rochester, Ind.—(Official)—A contract for constructing a gravel road in [illegible] Township has been awarded by the Commissioners of Fulton County to H. F. MACKEY, Marion, Ind., at $[illegible].

+Detroit, Mich.—(Official)—Contracts have been awarded for paving [illegible] Ave. to the DETROIT ASPHALT PAVING CO., at $[illegible]; [illegible] Ave. to J. W. HANLEY at $[illegible].

+Cairo, Ill.—(Official)—Bids will be received by the Board of Local Improvements until 11 a.m., Oct. 19 for street improvements in Paving District No. 1. For particulars see advertisement under "Contracts To Be Let."

+Decatur, Ill.—The contract for paving Jasper St. has been awarded by the Board of Local Improvements to McCALMAN CONSTRUCTION CO., Decatur, at $16,[illegible].

Springfield, Ill.—(Official)—Bids will be received by the State Highway Commission until 11 a.m., Oct. 22 for constructing three roads in Fulton County. The estimated cost is $[illegible]. All cement to be furnished by the state.

+Muscatine, Iowa—The contract for paving [illegible] St. N. of the [illegible] has been awarded to C. L. GOCHANOUR, [illegible], Iowa, at $[illegible].

+Oskaloosa, Iowa—(Official)—A contract for grading, paving, curbing and guttering a number of streets has been awarded to the BURLINGTON CONSTRUCTION CO., Burlington, Iowa, at approximately $[illegible]. Noted Oct. 1.

+Winfield, Kan.—A contract for paving 10 blocks with [illegible] has been awarded to ELLETT & VANCE, [illegible], at $[illegible]. Other bids were: [illegible] Wilson & Co., Kansas City, Kan., $[illegible]; T. R. [illegible] Co., Winfield, $[illegible]. [illegible] to be paved.

Grand Island, Neb.—Bids will be received by H. F. Clifford, City Clk., until 8 p.m., Oct. [illegible], for paving in District No. 1[illegible].

+Conway, Ark.—A contract for street improvements in [illegible] has been awarded to P. J. CONNELLY, Little Rock, at $[illegible].

+Houston, Tex.—The contract for paving Crawford St. has been awarded to the [illegible] PAVING CO., Houston, at $[illegible].

Orange, Tex.—[illegible]

Eugene, Ore.—[illegible]

+Hoquiam, Wash.—[illegible]

Olympia, Wash.—[illegible]

South Bend, Wash.—[illegible]

+Corona, Calif.—[illegible]

Huntington Beach, Calif.—Bids were received, Sept. 28, by the City Trustees for improving sections of 17th St. and Delaware Ave., as follows: M. L. Hubermann, Santa Ana, $24,110; Pierson & Anderson, Venice, $24,742; M. M. McCombs, Los Angeles, $27,[illegible].

+Los Angeles, Calif.—A contract for grading and concrete work in Road District No. 66 has been awarded to J. E. HADDOCKS, 357 North Chester Ave., Pasadena, at $48,962.

+Stockton, Calif.—The contract for improving Weber Ave. has been awarded to CLARK & HENRY, Stockton, at $37,500.

Ottawa, Ont.—Bids will soon be received by the City Council for paving 1373 sq.yd. with wood block and constructing [illegible] lin.ft. of gutter. The estimated cost is $7000. F. C. Askwith is Engr.-in-Charge.

INDUSTRIAL WORKS

Franklin, Mass.—The Massachusetts Waste Co. will erect a factory at Franklin. The estimated cost is $[illegible].

+Salem, Mass.—The contract for the construction of the factory for the Thermos Bottle Co. has been awarded to PATRICK CREEDON.

+Worcester, Mass.—The contract for constructing two buildings to the plant of the Graton & Knight Mfg. Co., [illegible] Franklin St., has been awarded to GEORGE A. FULLER CO., Boston, Mass., and New York, at $1[illegible].

+Bridgeport, Conn.—The contract for constructing the addition to the plant of the Union Metallic Cartridge Co. has been awarded to T. J. PARDY CONSTRUCTION CO.

New York, N. Y.—(Borough of Brooklyn)—The Peter Cooper Glue Co. will rebuild its factory at Maspeth and Gardner Aves., Williamsburg.

New York, N. Y.—(Borough of Brooklyn)—T. H. Engelhardt, Arch., [illegible] Broadway, will receive bids for alterations to the brewery at [illegible] and Georgia Aves., for [illegible]. The estimated cost is $[illegible].

+Seneca Falls, N. Y.—The contract for the construction of the buildings for [illegible] & Co., pump manufacturers, has been awarded to ALEXANDER, SHUMWAY & UTZ CO., Rochester, N. Y. Noted Sept. 3.

+Syracuse, N. Y.—The contract for the construction of a factory building for the New Process Gear Corporation has been awarded to R. W. HOWSE CONSTRUCTION CO., [illegible] West 40th St., New York. Noted Aug. 27.

Philadelphia, Penn.—Bids will be received until Oct. 19 by Watson & Huckel, Archts., 1211 Walnut St., for the construction of a two-story brick [illegible]-ft. factory for the [illegible] Bright Mfg. Co. Noted Oct. 1.

+Pittsburgh, Penn.—The contract for constructing the garage at 114[illegible] Shady Ave. for Frank [illegible] has been awarded to J. G. FULLMAN, Eastend Trust Bldg., at $[illegible].

Newport News, Va.—Bids will be received by Frank [illegible], Arch., Norfolk, Va., for the construction of the plant for the Newport News Fish & Ice Co. The estimated cost is $[illegible].

+Waycross, Ga.—The contract for constructing the warehouse for the Waycross Warehouse Co. has been awarded to V. C. PARKER.

+Jacksonville, Fla.—The contract for the construction of a storage building for the Atlantic Coast Line Ry. has been awarded to F. W. PARKER, Curry Bldg. The estimated cost is $[illegible].

Birmingham, Ala.—The North State Engineering & Construction Co. will erect an ice plant on Ave. A. The estimated cost is $[illegible].

North Birmingham, Ala.—The North Birmingham Packing Co. will remodel its ice plant. The estimated cost is $[illegible].

New Orleans, La.—The Export Oil Corporation will build a plant, including tanks, refiner and pipe line. The estimated cost is $1,[illegible].

Cincinnati, Ohio—The [illegible] Valve Co. plans the construction of an addition to its plant on Spring Grove Ave., Cincinnati. [illegible] is Arch.

+Cleveland, Ohio—The contract for the construction of a warehouse for the White Automobile Co., St. Clair Ave., Cleveland, has been awarded to the [illegible] CONSTRUCTION CO., [illegible] East [illegible] St., Cleveland. Estimated cost $[illegible].

+The contract for the construction of a three-story factory [illegible] ft., has been awarded to FRANK [illegible], for [illegible]. Estimated cost, $[illegible].

+The contract for the construction of a three-story factory has been awarded to CROWELL-LUNDOFF-LITTLE CO., [illegible] East [illegible] St., Cleveland, for K. W. [illegible] Co., [illegible]. Estimated cost, $[illegible].

+The contract for the construction of a three-story factory [illegible], has been awarded to FAITH CONSTRUCTION CO., [illegible] Ave., Cleveland, for the [illegible] Co. [illegible]. Estimated cost, $[illegible].

+Geneva, Ohio—The contract for the construction of a warehouse [illegible] ft. has been awarded to C. J. SWEENEY [illegible], for the Geneva Metal Wheel Co.

+Carrol, Ohio—The contract for the construction of a factory for the [illegible] Co. has been awarded to McCLINTIC-MARSHALL CO., [illegible] Bldg., Pittsburgh, Penn. Estimated cost $[illegible].

+St. Charles [illegible] **Ohio**—The BELLEFONTAINE [illegible] CO., Bellefontaine, has received the contract for the construction of two factories for the St. Marys [illegible] Co., St. Marys, Ohio.

Denmark, Wis.—Plans are being prepared by Foeller [illegible], Archts., [illegible], for the construction of a two-story [illegible] ft. for the Denmark [illegible]. Estimated cost $[illegible].

Racine, Wis.—Plans for the construction of a three-story warehouse, 34x60 ft., are being prepared by C. H. Tharinger, Arch., 2324 State St., Milwaukee. Estimated cost, $25,000.

Chinook, Mont.—Plans have been completed for the construction of a packing plant to be erected by the Chinook Packing Co.

Houston, Tex.—Bids will be received until 2 p.m., Oct. 26, at the office of the City Secretary, for the construction of a one-story reinforced-concrete warehouse, 100x1200 ft., on the Houston Ship Channel. Estimated cost, $300,000.

Edmonds, Wash.—Plans are being prepared by H. Bundy and F. H. Watson, Edmonds, for the construction of a box factory.

Seattle, Wash.—The following bids were submitted to the Port of Seattle Commission for the construction of a cold storage warehouse: Pearson Construction Co., $165,895; Butler Construction Co., $188,800; $189,600 (alternate bid); Hans Pederson, $165,475.

Sumas, Wash.—M. Leavly, Supt. of the South Sumas, B. C. Creamery, contemplates the construction of a cheese factory at Sumas. Estimated cost, $10,000.

Vancouver, B. C.—The Dominion Shipbuilding & Dry Dock Co., Ltd., 14 Canada Life Bldg., Vancouver, is having plans prepared for another unit of the shipbuilding plant at Lynn Creek. The estimated cost is $5,000,000.

FEDERAL GOVERNMENT WORK

Post Office—Narragansett Pier, R. I.—The following bids were received on Oct. 7 by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, for the construction of the U. S. public building at Narragansett Pier; (a) limestone, (b) sandstone; Charles McCall Co., Philadelphia, Penn., (a) $48,980; (b) $49,500. James A. Monroe, North Attleboro, Mass., (a) $51,834; (b) $52,300. Thomas W. Cissell, Wooster, Ohio, (a) $54,950; (b) $57,900. W. H. Fissell & Co., New York, N. Y., (a) $51,734; (b) $54,734. E. T. Abbott Construction Co., New York, N. Y., (a) $49,675; (b) $50,800. William H. Egan, New York, N. Y., (a) $52,101; (b) $52,637. Harry Wehmeyer, Philadelphia, Penn., (a) $58,182; (b) $58,832. Hope Building Co., Providence, R. I., (a) $57,500; (b) $58,100. William Werner, New York, N. Y. (a) $57,450; (b) $58,450. Westchester Engineering Co., White Plains, N. Y., (a) $48,975; (b) $51,000. Noted Sept. 3.

+Paving—New York, N. Y.—(Borough of Brooklyn)—The contract for wood block and granite paving in the New York navy yard, has been awarded to MACK BROS., 512 Broadway, New York, N. Y., at about $16,000. Noted Aug. 20, and Sept. 10.

Ventilating Apparatus—Rochester, N. Y.—Bids will be received until 3 p.m., Oct. 22, by the Custodian, Public Bldg., for installing ventilating apparatus.

+Locomotive Cranes—Philadelphia, Penn.—(Official)—The contract for furnishing four steam operated revolving locomotive cranes for the government has been awarded to the LINK-BELT CO., Chicago, Ill. Three of these cranes will be used at the Philadelphia navy yard and the fourth at Charleston, S. C. Noted Sept. 2 and Sept. 17.

★Lock Gates—Pittsburgh, Penn.—(Official)—The following are the bids received by Lieut.-Col. Francis R. Shunk, Corps Engrs., U. S. A., for furnishing and erecting steel lock gates, valves and lock-operating machinery at Lock 4, Monongahela River, (a) Section A, (b) Section B, (c) total: Union Foundry & Machine Co., Pittsburgh, Penn., (a) $9814; (b) $13,808; (c) $23,623. Poole Engineering & Machine Co., Pittsburgh, Penn., (a) $8500; (c) $8500. Whitehead & Kales Iron Works, Detroit, Mich., (a) $14,177; (b) $16,367; (c) $30,544. Lawrence D. Weaning, c o Variety Iron Works Co., Cleveland, Ohio, (a) $11,815; (b) $15,169; (c) $26,984. Summerfeld Machine & Mfg. Co., Pittsburgh, Penn., (a) $10,375; H. P. Gazzam Machine Co., Pittsburgh, Penn., (a) $7289; Simonds Mfg. Co., Pittsburgh, Penn., (a) $12,203; Braddock Machine & Mfg. Co., Braddock, Penn., (a) $9390; Pittsburgh Valve Foundry & Construction Co., Pittsburgh, Penn., (a) $10,500; Thomas Carlin's Sons Co., Pittsburgh, Penn., (a) $7900; Taylor-Wilson Mfg. Co., McKees Rocks, Penn., (a) $10,700; Rosedale Foundry & Machine Co., Pittsburgh, Penn., (a) $11,345; Penn Bridge Co., Beaver Falls, Penn., (a) $9940; (b) $14,900; J. & J. B. Milholland Co., Pittsburgh, Penn., (a) $7495; Independent Bridge Co., Pittsburgh, Penn., (b) $14,750. Noted Sept. 10.

Repairing Vessel—Baltimore, Md.—Bids will be received by the Light House Inspector, Baltimore, until 2 p.m., Oct. 20, for repairing the tender "Jessamine.'

Repairs to Appraisers Stores—Baltimore, Md.—The following bids were received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for making repairs to mechanical equipment and construction changes at the U. S. Appraisers Stores, Baltimore: Newport Contracting & Engineering Co., Newport News, Va., $6589; Bloomenthal-Kahn Electric Co., Baltimore, Md., $7400; Grohne Contracting Co., Joliet, Ill., $6644; Electromechanical Co., Baltimore, Md., $10,154; George W. Walther & Co., Baltimore, Md., $7800; Riggs, Distalar & Springer, Inc., Baltimore, Md., $8456.

+Road Work—Washington, D. C.—The contract for constructing the road from Highway Bridge to Arlington, Va., has been awarded to L. M. JOHNSON, at $8197. Noted Oct. 1.

Skylights—Washington, D. C.—The Secretary of the Interior, Washington, D. C., has rejected all bids received for installing skylights on the Patent Office Bldg., Washington. Noted Oct. 1.

Hospitals—Washington, D. C.—Bids will be received by Cato Sells, Comr., Dept., of the Interior, office of Indian Affairs, Washington, until 2 p.m., Nov. 3, for the construction of frame hospitals at the Indian agencies at Pima and San Xavier, Ariz.; Carson, Nev.; Mescalero, N. M.; Turtle Mountain, N. D., and Blackfoot, Mont. Additional information may be obtained from the superintendents of Indian schools as follows: Pima school, Sacaton, Ariz.; San Xavier school, Tucson, Ariz.; Carson school, Stewart, Nev.; Mescalero school, Mescalero, N. M.; Turtle Mountain school, Belcourt, N. D., and Blackfeet school, Browning, Mont.

Sewers—Washington, D. C.—(Official)—The following are the bids received by the Commissioners of the District for sewer construction as follows: For constructing 930 lin.ft. of 3 ft. diameter, brick and concrete sewer, in Varnum St., N. W., as follows: (a) ordinary excavation; (b) concrete masonry; (c) vitrified brick masonry; (d) sewer brick masonry; prices per cu.yd. William F. Cush, Washington, D. C., (a) $1.10; (b) $7.25; (c) $21; (d) 14. Warren F. Brennizer Construction Co., Washington, D. C., (a) $0.60; (b) $6.50; (c) $20; (d) $12. M. O'Herron & Son, Baltimore, Md., (a) $1.25; (b) $8; (c) $20; (d) $15. Whiting-Turner Construction Co., Baltimore, Md., (a) $1; (b) $10.60; (c) $22.50; (d) $14. George Hyman, Washington, D. C., (a) $0.80; (b) $8; (c) $20; (d) $14.

For constructing, in 14th St., N. W., 1360 lin.ft. brick and concrete sewer, 2¼x3 ft., as follows: (a) ordinary excavation; (b) concrete masonry; (c) vitrified brick; (d) sewer brick, prices per cu.yd. William F. Cush, Washington, D. C., (a) $0.46; (b) $7; (c) $20.50; (d) $13.50. James W. Bean, Washington, D. C., (a) $0.60; (b) $6.50; (c) $21; (d) $14. W. F. Brennizer Construction Co., Washington, D. C., (a) $0.55; (b) $6.75; (c) $21; (d) $12. Whiting-Turner Construction Co., (a) $1.49; (b) $6.50; (c) $21.50; (d) $13. M. O'Herron & Son, Baltimore, Md., (a) $1.20; (b) $8; (c) $20; (d) $15. George Hyman, Washington, D. C., (a) $0.50; (b) $6.75; (c) $19; (d) $14.

For constructing in T St., N. W., 980 lin.ft. of 3 ft. diameter brick and concrete sewer and 1465 lin.ft. of brick and concrete sewer, 2½x3 ft., as follows: (a) ordinary excavation; (b) concrete masonry; (c) vitrified brick masonry; (d) sewer brick masonry. William F. Cush, Washington, D. C., (a) $0.56; (b) $6.65; (c) $21; (d) $13. Jas. W. Bean, Washington, D. C., (a) $0.50; (b) $5.98; (c) $20; (d) $13. W. F. Brennizer Construction Co., Washington, D. C., (a) $0.60; (b) $5.70; (c) $20; (d) $13. M. O'Herron & Son, Baltimore, Md., (a) $1.15; (b) $7.50; (c) $20; (d) $15. Whiting-Turner Construction Co., Baltimore, Md., (a) $1.22; (b) $7.49; (c) $22.50; (d) $13. George Hyman, Washington, D. C., (a) $0.50; (b) $6.50; (c) $19; (d) $14.

For constructing in 16th St. and in Upshur St., N. W., 1500 lin.ft. of 3 ft. diameter, brick and concrete sewer, as follows: (a) ordinary excavation; (b) concrete masonry; (c) vitrified brick masonry; (d) sewer brick masonry; prices per cu.yd. William F. Cush, Washington, D. C., (a) $0.44; (b) $7; (c) $21; (d) $13.50. M. O'Herron & Son, Baltimore, Md., (a) $1.20; (b) $8; (c) $20; (d) $15. W. F. Brennizer Construction Co., Washington, D. C., (a) $0.55; (b) $6.75; (c) $20; (d) $12. James W. Bean, Washington, D. C., (a) $0.65; (b) $6.50; (c) $21; (d) $14. Whiting-Turner Construction Co., Baltimore, Md., (a) $1.18; (b) $8.30; (c) $22.50; (d) $14. George Hyman, Washington, D. C., (a) $0.45; (b) $6.75; (c) $19; (d) $14.

★Track-Scale Testing Equipment—Washington, D. C.—Bids will be received at the office of the Bureau of Standards, Department of Commerce, Washington, D. C., until 2 p.m., Nov. 19, for furnishing a railroad track-scale testing equipment built along the same general lines as the one now in use by the Bureau.

+School—Washington, D. C.—(Official)—The contract for constructing the Central High School has been awarded to WILLIAM DALL & CO., Cleveland, Ohio. A stadium will also be constructed.

Repairs To Roof—National Soldiers' Home, Va.—Bids will be received until 1:30 p.m., Oct. 23, by F. E. Skinner, Treas., Southern Branch, N. H. D. V. S., for making repairs to the roof.

+Dredging—Wilmington, N. C.—The contract for dredging in the waterway from Core Sound to Beaufort Harbor, N. C. has been awarded to the SAM DREDGING & CONSTRUCTION CO., Philadelphia, Penn., at $24,000. Noted Aug. 27.

+Locomotive Cranes—Charleston, S. C. — See item under Philadelphia, Penn.

+Breakwater—Indiana Harbor, Ind.—The contract for the construction of a rubble mound breakwater at Indiana Harbor has been awarded to the GREAT LAKES DREDGE & DOCK CO., Chicago, Ill., at $180,000. Noted Sept. 3 and Oct. 8.

+Post Office—Holland, Mich.—The contract for the construction of the U. S. post office at Holland, has been awarded to GEORGE W. STILES CONSTRUCTION CO., Rookery Bldg., Chicago, Ill., at $65,138. Noted July 30 and Sept. 17.

+Post Office—McPherson, Kan.—The contract for constructing the U. S. post office at McPherson, has been awarded to HIRAM LLOYD BUILDING & CONSTRUCTION CO., St. Louis, Mo., at $43,366.

+Post Office—Excelsior Springs, Mo. — The contract for constructing the post office at Excelsior Springs, has been awarded to J. H. WIESE CO., Omaha, Neb., at $46,370.

★Canal Work—Provo, Utah—(Official)—Bids for constructing sections of the High Line Canal will be opened at 2 p.m., Nov. 16, and not on Nov. 15, as noted in issue of Oct. 8.

Cement—Seattle, Wash.—Bids will be received until 3 p.m., Oct. 19, by Col. George B. Davis, Depot Quartermaster, for furnishing and delivering at Seattle, Wash., and at Honolulu, 14,000 bbl. of American portland cement

+Lumber—Seattle, Wash.—(Official)—The contract for furnishing about 506,333 ft. b.m., of lumber has been awarded to the ROBERT DOLLAR CO., San Francisco, Calif., at $10,633, c.i.f. ship's tackle, Manila, P. I. Other bids were f.o.b. Seattle. Bolcom Mills Inc., Seattle, $5822; St. Paul & Tacoma Lumber Co., Seattle, $5012; Swayne & Hoyt Inc., Seattle, $4886; A. B. Field & Co., Seattle, $4936; Charles Nelson Co., Seattle, $5012. Noted Sept. 17.

+Quay Wall—Mare Island, Calif. (Vallejo post office)—The contract for pile and lumber work for reconstructing the quay at the navy yard, Mare Island, has been awarded to THOMPSON BRIDGE VO., San Francisco, at $20,534. Noted Oct. 1.

Vault Equipment—San Francisco, Calif.—Bids were received by Oscar Wenderoth, Superv. Arch., Washington, D. C., for installing metal vault equipment in the U. S. subtreasury at San Francisco, from the York Safe & Lock Co., York, Penn., at $5135 and the Hermann Safe Co., San Francisco, at $3591. Noted Sept. 27.

Cement—San Francisco, Calif.—Bids will be received by W. H. [illegible], Depot Quartermaster, 1086 North Point St., San Francisco, until 3 p.m., Oct. 19, for furnishing 14,000 bbl. of cement.

✦Coal-Hoisting Tower—San Diego, Calif.—The contract for completing the coal hoisting tower at the naval coast [illegible], San Diego, has been awarded to the McMYLER INTERSTATE CO., Bedford, Ohio, $[illegible]. Noted July 30 and Sept. [illegible]

Miscellaneous—Panama—Bids will be received by Maj. F. C. Boggs, Gen. Pur. Officer of the Panama Canal Comn., Washington, D. C., until Oct. 31, for furnishing electrical material, files, sheet copper, steam suction and water hose, wire nails, aluminum paint, lampblack in oil, white lead in oil, chloride of lime, lard oil, linseed oil, burnt sienna, liquid coal tar, turpentine, imitation damar varnish, rubbing varnish, white dry zinc, white zinc in oil, copper tacks, sheet zinc, round steel and steel angles.

Fuel Oil—Panama—Bids will soon be received by the Purchasing Officer for furnishing about 6,000,000 bbl. of fuel oil. This amount is the estimated quantity needed for the year ending Dec. 31, 1915.

Steel Rails, Etc.—Panama—Bids will be received by Maj. F. C. Boggs, Gen. Pur. Officer of the Panama Canal Comn., Washington, D. C., until 10:30 a.m., Oct. 19, for furnishing steel rails, etc.

✦Steel—Philippine Islands—(Official) The contract for furnishing structural steel for the Philippine Islands has been awarded to U. S. STEEL EXPORT CO., at $5991. Noted Sept. 17 and Oct. 1.

MISCELLANEOUS

Breakwater—Boston, Mass.—Bids will be asked soon by the Directors of the Port for the construction of 1100 ft. of breakwater at South Boston for the protection of the fish pier. The estimated cost is $2[illegible],000. Frank W. Hodgdon, 40 Cathedral St., is Ch. Engr.

Pavilion and Tunnel—Boston, Mass.—The following bids were received by the City Hospital Trustees for the construction of a pavilion and tunnel at Harrison Ave. and Northampton St. for the City Hospital: Horton & Hemenway, $222,4[illegible]; Whiton & Haynes Co., $233,000; William Crane, $248,-[illegible]; Marr Bros. & Stewart Co., $259,192; Michael Meehan, $277,[illegible]0. Noted Oct. 1.

✦Elevators—Worcester, Mass.—The contract for the installation of two passenger and three freight elevators in the Osgood Bradley Bldg., Grafton and Franklin Sts., has been awarded to the OTIS ELEVATOR CO., Worcester, at $20,000.

✦Barge Canal Work—Albany, N. Y.—(Official)—Bids will be received until Nov. 10, by Duncan W. Peck, State Supt. of Pub. Wks., for Contract G, Cayuga and Seneca Canal, furnishing and erecting the lock gates, lock valves and buffer beams for Locks 2, 3 and 4, needle beam for the spillway in Dam 3, superstructure for the Taintor gates at Waterloo, guard gates at Locks 3 and 4 and over the old canal at Waterloo. Engineer's estimate, $119,5[illegible].

Barge Canal Work—Albany, N. Y.—Bids will be received by Duncan W. Peck, State Supt. of Pub. Wks., until noon, Nov. 3, for Contract No. 10-C, Oswego Canal, Section 1, calling for filling portions of the abandoned Oswego Canal and the removal of a bridge over the abandoned canal at Oneida St., Fulton, N. Y. Engineer's estimate, $[illegible]6,737.

Bids will also be received, until noon, Oct. 20, for Contract [illegible], for completing the approaches to the South Ave. bridge at Station [illegible] on site of Contract No. [illegible]3, Town of Brighton, Monroe County, N. Y. Engineer's estimate, $[illegible]500.

Subway—New York, N. Y.—(Borough of Manhattan)—Bids were received by the Public Service Commission, Oct. 9, for the construction of Section 1, Route 48, a part of the Seventh Ave.-Lexington Ave. rapid transit system. The following are the [illegible] totals: F. L. Cranford Inc., $1,57[illegible]; [illegible] Contracting Co., $1,711,000; Smith, Hauser & McIsaac, Inc., $[illegible]; Holbrook, Cabot & Rollins Corporation, $1,96[illegible]; [illegible] Daniels Co., $1,97[illegible]; Underpinning & Foundation Co., $[illegible]; Rapid Transit Subway Construction Co., $[illegible]. Noted Sept. 24.

✦Subway—New York, N. Y.—(Borough of Manhattan)—[illegible] The Public Service Commission has awarded the contract to the RAPID TRANSIT CONSTRUCTION CO. at $[illegible], for the construction of the subway section connecting the Lexington Ave. line with the present Fourth Ave. line. Noted Sept. 17. List of bidders, Oct. 8.

✦Subway Work—New York, N. Y.—(Borough of Brooklyn)—[illegible] The Public Service Commission has approved the [illegible] to the [illegible] CONTRACTING CO. at $1,[illegible], for the [illegible] of the [illegible] in the Fourth Ave. subway [illegible] between Manhattan Bridge and [illegible]th St.

✦Elevated Railway Work—New York, N. Y.—(Borough of [illegible])—[illegible] The Public Service Commission has [illegible] the award of the contract to the TERRY & TENCH CO., INC., at $[illegible], for the construction of additional tracks on the Broadway elevated railroad between [illegible] St. and Myrtle Ave.

Roof Repairs—New York, N. Y.—(Borough of Manhattan)—[illegible]

✦Coal Pocket and Dock—New York, N. Y.—(Borough of [illegible])—[illegible]

Filling and Grading—Trenton, N. J.—The [illegible] at $18,490, for the filling of the Lamberton St. Parkway between the Trenton Yacht Club and the city line. The same company was also low bidder at $34,000 for filling and grading at the site of the sewage and disposal plant below Riverview Cemetery.

✦Pumping Station—Charlotte, N. C.—(Official)—Bids will be received, until Oct. 26, for excavating, piling, furnishing of material and building foundations and pumping station for the Lake Mattamuskeet Drainage District, Hyde County, N. C. For details see advertisement under "Contracts To Be Let."

Dredging—Savannah, Ga.—The city contemplates deepening the Ogeechee Canal. Estimated cost, $50,000 to $60,000. E. R. Conant is Ch. Engr. R. J. Davant is Mayor.

Drainage—Gretna, La.—Jefferson County Fourth Drainage District has voted $24,000 in bonds to provide for the construction of a drainage system in Sub-Drainage District No. 2. A. H. Ahten is Pres. of Comrs. Noted Sept. 28.

Drainage—Lottie, La.—Bids will be received, until Nov. 1, by the Slidell Drainage District Supervisors for draining 17,000 acres in Point Coupee parish, 25 miles east of Baton Rouge; constructing main canal, 5 miles long and three laterals 3 miles long. The estimated cost is $20,000, dredge-boat construction.

Levees—New Orleans, La.—The Board of State Engineers is preparing plans and specifications for 271,000 cu.yd. of levee protection in various parts of the state. Contracts will be let the latter part of Oct.

✦Levee Work—New Orleans, La.—The State Board of Engineers has awarded the following contracts for levee construction: Waterproof front levee, Tensas parish, 15,000 cu.yd., and Ferriday front levee, Concordia parish, 40,000 cu.yd., to JUNKEN BROS.; St. Joseph front levee, Tensas parish, 35,000 cu.yd., to ROBERT NICHOLSON. Junior levee, Plaquemines parish, new levee and wooden revetment 1070 ft., to W. E. GIVEN, lowest bid submitted for Caernarvon levee, Plaquemines parish, by Lyon & Adams.

✦Concrete Tunnel Work—Pulaski, Tenn.—The Louisville & Nashville R.R. has awarded the contract for lining a double track tunnel near this city, to MEACHAM CONSTRUCTION CO., Hopkinsville, Ky. 10,000 cu.yd. of concrete will be used.

✦Drainage—Jackson, Tenn.—Madison County Drainage District No. 2 has awarded the contract to D. W. ROBINS, Tupelo, Miss., for the construction of an 18-mile drainage canal, 35 ft. wide and 8 ft. deep. Noted June 11, July 9, Sept. 24.

Coal Handling Plant and Dock—Toledo, Ohio—It is reported that the Cincinnati, Hamilton & Dayton R.R. Co. plans to install a coal hoisting plant and the enlarging of its docks.

Fire Alarm and Police Signal System—Youngstown, Ohio—The City Council has passed an ordinance to issue $18,000 in bonds for purchasing and installing a new fire and police signal system.

Dredging—Kokomo, Ind.—(Official)—The Board of County Commissioners, E. R. Swift, Audr., will receive bids, until Oct. 19, for dredging a channel in Wild Cat Creek, near the McCann St. Bridge.

Deep Waterway—Chicago, Ill.—The Board of Supervising Engineers which has been investigating the proposed construction of a Lakes-to-Gulf deep waterway, has made its report. The plan recommended calls for the construction of a water course from Chicago to the Illinois River at La Salle. The estimated cost of the project is $3,075,000.

Drain—Manson, Iowa—The final survey for the Cedar Joint drain is being completed by engineers, J. J. Moore and Simon Moeler. The main branch will be 20 miles long. The estimated cost is $20[illegible].

✦Ditch—Webster City, Iowa—Contracts for the construction of the Peterson ditch were awarded as follows: (Tile) NATIONAL SEWER PIPE CO., Webster City, at $[illegible]; (Excavation) EVANS & HOWARD, St. Louis, at $16,[illegible]; (Labor) OLKEN & SWEAZY, Webster City, at $[illegible].

Drainage—Wichita, Kan.—The City Council has adopted an ordinance for the extension of the Wichita Drainage Canal from the city limits to the Arkansas River.

Subway—Glendive, Mont.—The Northern Pacific Ry. Co. has had plans prepared for the construction of a 16-ft. pedestrian subway under its tracks at Power St. The estimated cost is $1[illegible].

Drainage—Mexico, Mo.—The Riverlands Levee District plans to drain 9[illegible]0 acres north of Louisiana. The estimated cost is $1[illegible].

Stadium—Little Rock, Ark.—The Board of Trade School and College Athletic Committee plan to construct a stadium in West End Park. The estimated cost is $[illegible],000.

Levee—Scanlon, Ark.—R. H. and G. A. McWilliams, 112[illegible] Exchange Bldg., Memphis, Tenn., will receive bids for 12,000 cu.yd. of levee enlargement near Scanlon.

Bulkhead, Warehouse and Wharf—Houston, Tex.—Bids will be received, until Oct. 26, at the office of the City Secretary, for the construction of a creosoted timber bulkhead [illegible] ft. long, one-story [illegible] ft. reinforced-concrete warehouse and a [illegible] ft. timber wharf on creosoted piles. The estimated cost is $[illegible]. Specifications are on file at the office of E. E. Sands, City Engr. Noted Oct. 8.

Fire Alarm System—[illegible], Calif.—The Board of Trustees plans to install a fire alarm system.

Drainage and Reclamation—Lemoore, Calif.—The [illegible] [illegible] M. Kearns Bldg., Fresno, Calif., [illegible] to [illegible] reclamation and [illegible] on the [illegible] lands near Lemoore. The estimated cost is $[illegible]. [illegible] of the [illegible] Dept. will be in charge of the [illegible].

✦Elevators—Los Angeles, Calif.—The J. W. [illegible] Co. has awarded the contract to the OTIS ELEVATOR CO. at $[illegible] for furnishing and installing 8 passenger elevators, one [illegible] elevator and [illegible] in its new [illegible] building at [illegible] St. and [illegible] Ave.

Drainage and Levees—Marysville, Calif.—Property owners in Drainage District No. [illegible] have voted $[illegible] in bonds for raising levees and improving the drainage system.

+**Cement**—San Diego, Calif.—The Superintendent of the Department of Finance has awarded the contract to the UNION LIME CO., Los Angeles, at $2.19 per bbl. less 10c. for return of sacks, for furnishing 5000 bbl. of cement for conduit work on the water system.

Seawall—San Francisco, Calif.—The city contemplates building a seawall from Jones to Larkin St. M. M. O'Shaughnessy is City Engr.

Tunnel—San Francisco, Calif.—(Official)—The one bid submitted Sept. 30 for the construction of the Twin Peaks Tunnel was that of Erickson & Petterson, San Francisco, at $3,475,300. The contract will be awarded to this firm. Noted May 21, June 18, July 9 and Sept. 24.

Drydock and Shipbuilding Plant—Prince Rupert, B. C.—The President of the Grand Trunk Ry. has announced that the company has had plans prepared for the construction of a drydock, large enough to accommodate a 20,000-ton battleship, also a complete shipbuilding plant.

BUILDINGS

Boston, Mass.—F. A. Norcross, Arch., 46 Cornhill St., has prepared plans for a five-story 70x80-ft. studio building at 491 Huntington Ave. The estimated cost is $80,000.

+The contract for the construction of the Christian Science Church at Elm Hill Ave. and Waumbeck St., has been awarded to NORCROSS BROS. CO., Worcester, Mass.

Worcester, Mass.—Edwin T. Chapin, Arch., State Mutual Bldg., is preparing plans for the construction of a four-story brick mercantile building at Harding and Cherry Sts. for Jacob H. Asher.

Greenwich, Conn.—Carrere & Hastings, Archs., 225 Fifth Ave., New York, N. Y., are preparing plans for the three-story brick and steel hospital for the Greenwich Hospital Association. The estimated cost is $250,000.

Norwalk, Conn.—Plans have been completed by Philip N. Sunderland, Arch., 81 West St., Danbury, Conn., for the construction of a two-story, 63x105-ft. school, on Cedar St.

Binghamton, N. Y. — Lewis F. Pilcher, Arch., Capitol, Albany, N. Y., has completed plans for the three-story brick and stone parent's building at the Binghamton State Hospital. The estimated cost is $225,000. J. H. B. Hanify is Secy.

★**Farmingdale, N. Y.**—Bids will be received until 10 a.m., Oct. 22, by A. A. Johnson, Acting Secy., Board of Trustees, State School of Agriculture on Long Island, 30 Lafayette Ave., Brooklyn, for constructing, heating, plumbing and electric work for dormitory at the New York State School of Agriculture on Long Island, near Farmingdale, New York. Lewis F. Pilcher is State Arch., Capitol, Albany, N. Y. For further information see advertisement under "Contracts To Be Let."

New York, N. Y.—(Borough of Bronx)—Bids will be received until 3 p.m., Oct. 19, by C. B. J. Snyder, Supt. School Buildings, Park Ave. and 59th St., for an addition to school No. 12, Frisby and Benson Aves.

New York, N. Y.—(Borough of Bronx)—Lewis Allen Abramson, Arch., 220 Fifth Ave., has prepared plans for the hospital to be erected at Charlotte St. and Crotona Park East. The estimated cost is $200,000.

(Borough of Manhattan)—Plans are being prepared by Gronenburg & Leuchlag, Archs., 303 Fifth Ave., for a six-story apartment house at 114th St. and Seventh Ave., for the 114th St. and Seventh Ave. Construction Co. The estimated cost is $150,000.

The Murray Hill Investing Co. will erect an 11-story commercial building at Fifth Ave. and 37th St. The estimated cost is $1,500,000. Warren & Wetmore, 16 East 47th St., are the Archs.

+The general contract for constructing the Women's Hospital at 109th St. and Amsterdam Ave., has been awarded to ISAAC S. ROSSELL, 1 Madison Ave., New York. The estimated cost is $100,000.

Plans have been filed by George P. Pelham, Arch., 30 East 42d St., for the 11-story apartment house to be erected at Riverside Drive and 149th St., for the West Side Construction Co. The estimated cost is $425,000.

The Grand Rapids Furniture Co. will erect a ten-story commercial building at 18 East 50th St.

Rochester, N. Y.—J. H. Oberlies, Arch., 838 Granite Bldg., has completed plans for the construction of a three-story and basement high school on Lake Ave. The estimated cost is $150,000.

Syracuse, N. Y.—Plans are being prepared by Taber & Baxter, Archs., Gurney Bldg., Syracuse, N. Y., for the construction of an eight-story hotel at South Salina and West Adams Sts. for the Syracuse Co. The estimated cost is $300,000.

Yonkers, N. Y.—Plans have been prepared by Beersman & Vollmer, 244 Fifth Ave., New York, for the construction of a four-story masonic temple at Guion St. and South Broadway. The estimated cost is $70,000.

+**Jersey City, N. J.**—The contract for the construction of the school for St. John's Church, on Hudson County Blvd., has been awarded to MICHAEL T. CONNELLY CONTRACTING CO., 238-17th St., Jersey City, N. J., at $145,000.

+**Newark, N. J.**—Contracts for the construction of an addition to the 13th Ave., school have been awarded as follows: Masonry, REYNOLDS CONSTRUCTION CO., $52,850; steel and iron, HEDDEN IRON CONSTRUCTION CO., $11,605; heating and ventilating, E. G. WOOLFOLK & CO., Inc., $14,777.

West Hoboken, N. J.—Hensel & Ware, Archs., 246 Summit Ave., West Hoboken, are preparing plans for the construction of a school for St. Joseph's Catholic Church. The estimated cost is $70,000.

Bellefonte, Penn.—John T. Windrim, Arch., Commonwealth Bldg., Philadelphia, Penn., has prepared plans for the construction of a two-story brick, stone and concrete penitentiary at Bellefonte.

Martinsburg, W. Va.—Bids will be received until Mar. 1, by O. M. Ramsey & Co., for constructing a five-story, 31x150 ft. apartment building. The estimated cost is $40,000.

Spartanburg, S. C.—Bids will be received until Oct. 27, by the Steedly Hospital Directors, for constructing a four-story and basement hospital. The estimated cost is $45,000.

+**Hattiesburg, Miss.**—The contract for the construction of the Y. M. C. A. building has been awarded to C. O. EURE. Noted Sept. 24.

+**Alexandria, La.**—The contract for the construction of the high school at Alexandria, has been awarded to CALDWELL BROS., Abbeville, La., at $107,222. Noted Sept. 17.

+**Louisville, Ky.**—The general contract for th school to be erected at 42d and Herman Sts., has been awarded to the GENERAL CONSTRUCTION CO., at $62,500; heating and ventilating, $11,475. Noted Sept. 24.

+**Ashtabula, Ohio**—The contract for the construction of a high school has been awarded to the NATIONAL FIREPROOFING CO., 1315 Citizens Bldg., Cleveland, by the city. Estimated cost $166,185.

Canton, Ohio—Plans have been prepared for the construction of a two-story freight house for the Wheeling & Lake Erie R.R. W. L. Rohbock, 509 Electric Bldg., Cleveland, Ohio, is the Arch. Estimated cost $100,000.

+**Cincinnati, Ohio**—The contract for the construction of a four-story and basement service building, 160x200 ft., for the Ford Motor Co., 911 Race St., Cincinnati, has been awarded to IRWIN & LEIGHTON, 126 North 12th St., Philadelphia, Penn. Estimated cost, $250,000.

Cleveland, Ohio—Plans are being prepared by Charles W. Hopkinson, Arch., 900 Rose Bldg., Cleveland, for the construction of a two-story and basement gymnasium for the Western Reserve University, Euclid Ave. Estimated cost, $125,000.

+**Cleveland, Ohio**—The contracts for the construction of four apartment houses on Stearns Road, have been awarded to MORRIS & CORNSWEET, 716 Society for Savings Bldg., Cleveland. Estimated cost, one $50,000, one $40,000 and two $35,000.

Plans have been prepared for the construction of an addition to the Charity Hospital at Central and East 22d St., Cleveland, by Walker & Weeks, Arch., 1900 Euclid Vav., Cleveland. Estimated cost, $200,000.

Plans are being prepared for the construction of a large building for the Western Reserve University, Euclid Ave. Cleveland to be erected at Adelbert and Cummington Roads, East Cleveland. Estimated cost, $100,000.

+The contract for the construction of a building at 2035 West 65th St., for the St. Colman's Church, Cleveland, has been awarded to the ANDREWS BROS., 130 Engineers Bldg., Cleveland. Estimated cost, $135,000.

Munising, Mich.—Charlton & Kuenzli, Arch., Camp Bldg., Milwaukee, Wis., have prepared plans for the construction of a two-story school. Estimated cost, $75,000.

+**Marshfield, Wis.**—The contracts for the erection of two buildings, three-story, 50x100 ft. and three-story, 50x50 ft., have been awarded to the WEINBERG CONSTRUCTION CO., for the Blodgett Wholesale Grocery Co. Noted Oct. 8.

Milwaukee, Wis.—Marshall & Fox, Arch., Chicago, have prepared plans for the erection of the Plankinton Block on Grand Ave. between West Water and Second St., for Charles W. Somers, Cleveland, Ohio.

Martin Tullgren & Sons, Archs., 133 Second St., have prepared plans for the erection of a three-story apartment building at 21st St. and Grand Ave. Estimated cost, $100,000.

Omaha, Neb.—John McDonald, Arch., is preparing plans for the construction of the Creighton Home for Working Girls on Dodge St., between 20th and 24th St. Estimated cost, $100,000.

Portland, Ore.—Bids will be received by the School Board until Oct. 20, for the construction of the Couch School. Estimated cost, $160,000.

+**Los Angeles, Calif.**—The contract for constructing a ten-story and basement brick building, at Eighth St. and Broadway for the Spring Street Co., Los Angeles, Calif., has been awarded to J. V. McNEIL at $54,593.

+The contract for the construction of a four-story apartment building at Grand Ave. and Court St. has been awarded to the CALIFORNIA ARCHITECTURAL & CONSTRUCTION CO., Los Angeles, for George J. Ley, Los Angeles. Estimated cost, $60,000.

Palo Alto, Calif.—Bakewell & Brown, Arch., San Francisco, have prepared plans for the construction of two gymnasiums for the Stanford University. Estimated cost, $200,000.

Sacramento, Calif.—The Sacramento Athletic Club contemplates the erection of a building at 11th and J Sts. Estimated cost $100,000. H. E. Yardley, J. M. Inman and Dr. F. E. Shaw are interested.

San Francisco, Calif.—Plans are being prepared for the construction of a building at 65th St. and University Ave. to replace the Wadsworth School recently damaged by fire. Estimated cost, $285,000.

The E. Keeler Co., of Williamsport, Penn., manufacturer of boilers, completed on Saturday, Oct. 10, fifty years of corporate existence. On that day their shops were closed and employees given a holiday. In the evening the company gave a banquet to its employees at which more than 300 were present. The President of the company, Mr. C. La Rue Munson, acted as toastmaster, and addresses were made by the Vice-President, Isaac Barton, Mr. Riley Allen, a director, Shop Superintendent Allison, Mr. J. W. Parker, manager of the Philadelphia office, and Mr. Ambrose B. Dean, manager of the New York office. The company has never closed its doors, never reduced the wages of its workmen, and never had a strike nor a lockout. The President read the names of a dozen employees who had served the company continuously from 18 to 39 years. Two of the founders of the company are still living and were present, Isaac Barton, Vice-President, and William H. Maitland.

Contracts to Be Let

Bids received until Oct. 21, 1914.

Proposal for State Road Work

Hartford, Conn.

SEALED PROPOSALS will be received by the State Highway Commissioner, Room 27, Capitol, Hartford, Conn., until 2 P. M. Wednesday, October 21, 1914, for the following sections of State Road Work in accordance with plans and specifications on file in the office of the State Highway Commissioner and at the following places: TOWN OF PRESTON—about [illegible] linear feet of Native Stone Macadam or Gravel Construction. Plans and specifications at home of Walter M. [illegible], third selectman, Preston. TOWN OF STERLING—about [illegible] linear feet of Native Stone Macadam or Gravel Construction. Plans and specifications at Town Clerk's office, [illegible]. TOWN OF COVENTRY—about [illegible] linear feet of Native Stone Macadam Construction. Plans and specifications at Town Clerk's Office, South Coventry. TOWN OF OLD LYME—Construction of Abutments and Approaches together with the erection of an [illegible]-foot Span [illegible] Steel Girder Arch Bridge. Plans and specifications at State Capitol, Hartford. TOWN OF DANBURY—about 11,777 linear feet of Concrete Pavement (Plain or Reinforced), Trap Rock Macadam, Bituminous or Gravel Construction. Plans and specifications at Selectmen's office, Danbury. TOWN OF EAST HAVEN—about 3[illegible] linear feet of Concrete [illegible], Bituminous Native Stone Macadam, or Native Stone Macadam Construction. Plans and specifications at Town Clerk's Office, East Haven. TOWN OF MORRIS—about [illegible] linear feet of Native Stone Macadam or Gravel Construction. Plans and specifications at Town Clerk's office, East Morris. TOWN OF SOUTHBURY—Construction of a section of Reinforced Concrete Retaining Wall. Plans and specifications at office of George E. Smith, Division Engineer, New Haven. All bids must be accompanied by a surety company bond or a certified check not less than one-third of the cost of the work. The State Highway Commissioner reserves the right to reject any and all bids.

Dated at Hartford, Conn., October 7th, 1914.

CHARLES J. BENNETT, State Highway Commissioner,
Room 27, Capitol, Hartford, Conn.

Bids received until Oct. 22, 1914.

Dormitory at State School

Farmingdale, N. Y.

NOTICE TO CONTRACTORS. Sealed proposals for [illegible] plumbing and electric work for Dormitory at the New York State School of Agriculture on Long Island, Farmingdale, New York, will be received by [illegible] [illegible] of Trustees [illegible] State School of Agriculture on Long Island [illegible] Lafayette Avenue, Brooklyn, New York, until [illegible] A. M. on Thursday, October 22nd, 1914, when they will be publicly opened and read. [illegible]

Bids received until Oct. 20, 1914.

Street Improvements

Bayonne, N. J.

Sealed proposals will be received by the Council of the City of Bayonne, N. J., at a meeting to be held in the City Hall, on Tuesday, October 20th, 1914, at 8 o'clock P. M. For all labor and material required for the improvement of the following streets, viz.:—(1) Fourteenth Street, from Hudson Boulevard to Avenue A. (2) [illegible] Street, from Fifth Street to Evergreen Street. (3) Twentieth Street, from Hudson Boulevard to Avenue A. (4) Thirty-eighth Street, from Hudson Boulevard to Avenue C. (5) Hobart Avenue, from Third Street to Oak Street. (6) Forty-Seventh Street, from Broadway to Avenue E. (7) Fifty-first Street, from Avenue E to Hudson Boulevard. (8) Fifteenth Street, from Avenue A to Hudson Boulevard. (9) Fifty-third Street, from Hudson Boulevard to Broadway. (10) Twelfth Street, from Avenue A to Dummy Road. (11) [illegible] Street, from [illegible] Street to [illegible] Avenue. (12) Fiftieth Street, from Hudson Boulevard to Avenue C. (13) [illegible] Avenue, from Fifth Street to Third Street. (14) Avenue C, from Fifty-fourth Street to Morris Canal. (15) Forty-first Street, from Avenue B to Avenue C. (16) George Street, from Lexington Avenue to Hobart Avenue. (17) Avenue A, from North Street to Twenty-first Street, with sheet asphalt, all under one contract. There will be required about 33,9[illegible]0 squ. yards asphalt paving on concrete, 3[illegible]0 lin. feet new blue stone curb, 6[illegible] lin. feet old curb re-set, 9560 squ. feet new concrete flag, 6[illegible] squ. feet flag re-set, 1[illegible]0 squ. yards belgian block pavement re-laid, 63[illegible] squ. feet new blue stone flag, [illegible] lin. feet new concrete curb, 1030 lin. feet new concrete curb and gutter, together with other appurtenances.

All bids must be on the regular forms provided for the purpose and submitted in sealed envelopes plainly endorsed with the name of the bidder and the title of the improvement.

Checks submitted in lieu of bond must be certified, or the bid will be rejected.

Plans and specifications for the work are on file in the office of the City Surveyor, where blank forms of proposals or any other information may be obtained.

The amount of bond required is $100,000.00.

The time allowed for the completion of the work is one hundred sixty (160) days.

The Council reserves the right to reject any or all bids.

By order of the Council.

W. M. [illegible], City Clerk.

Bids received until Oct. 19, 1914.

Building Improvements

[illegible], N. Y.

NOTICE TO CONTRACTORS. Sealed proposals for [illegible] Normal School, [illegible], N. Y., will be received by [illegible] Thomas E. [illegible], Assistant Commissioner for Elementary Education, Education Building, Albany, N. Y., until [illegible], when they will be publicly opened and read. Proposals shall be [illegible] by the State Architect and shall be accompanied by certified check [illegible] of the amount of [illegible]. Contractors to whom the awards are made will be required to furnish surety company bonds in the amount of [illegible] of the amount of contract within thirty (30) days after official notice of award of contract and in accordance with the terms of Specifications [illegible]. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the New York office of the Department of Architecture, Room 1[illegible], [illegible] Building, at the office of the Department of Architecture, Capitol, Albany, N. Y., and at the [illegible] State Normal School, [illegible], N. Y. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany, N. Y., on reasonable notice to and at the discretion of the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS

West Virginia—Horse Creek Land & Mining Co.—The construction of a railway in the Duvall District, Lincoln County, W. Va., is contemplated by this company. L. E. Poteet, Charleston, W. Va., is Gen. Mgr. and Romine & Snyder are Engrs.

✚**Michigan**—Battle Creek-Coldwater R.R.—This company has awarded a contract to JOHN T. ADAMS, Columbus, Ohio, for constructing its line from Battle Creek, Mich., to Coldwater, Mich.

Montana—The construction of a railway from Bozeman, Mont., to Yellowstone, Mont., is contemplated. E. W. Dawes, Bozeman, is interested.

Great Northern Ry.—It is reported that this company plans the extension for a distance of several miles of its line from Gilman to Augusta, Mont. It is stated work will start within 30 days.

✚**Arkansas**—The A. L. Clark Lumber Co., Arkadelphia, Ark., has awarded the contract for the construction of a logging road in Pike County, Ark., to J. N. GEORGE & SONS.

Texas—Gulf, Freeport & Northern R.R.—This company is making preliminary arrangements for the extension of its railway from Freeport to Rosenburg, Tex. C. L. Sharp, Freeport, Tex., is Gen. Mgr. Noted Sept. 3.

Quanah, Acme & Pacific R.R.—This company has completed surveys for the construction of a railway from Roaring Springs, Tex., to Roswell, N. M., about 200 miles. Robert Gray, Quanah, Tex., is Gen. Mgr. Noted Sept. 24.

Arizona—The Gunn-Thompson Co. will construct a railway from its mine at Superior, Ariz., to a connection with the Phœnix & Eastern R.R. at Webster, Ariz., about 20 miles.

Oregon—Devereaux & Tripp, Eugene, Ore., have charge of the construction of a logging railway to be constructed up Lost Creek from Natron extension, through Dexter, into timber land. The road has been surveyed and construction will begin soon.

The County Court of Lane County, Eugene, Ore., has granted permission to the Jowler Lumber Co. to construct a logging railway across the county road, to connect with its timber properties.

California—California Terminal Ry.—Plans are being prepared by this company for the construction of a railway from San Rafael, Calif., to Sacramento, Calif. The line will pass through Marin, Sonoma, Napa, Solano, Yolo and Sacramento Counties.

ELECTRIC RAILWAYS

Haverhill, Mass.—Arrangements are being made by the Bay State St. Ry. Co. for the reconstruction of its line on River St. in Haverhill. A. P. Emmons, Boston, is Pur. Agt.

New Bedford, Mass.—The Union St. Ry. Co. has applied to the City Council for a franchise to extend several of its lines in New Bedford. Elton S. Wilde, New Bedford, is Vice-Pres., Gen. Supt. and Pur. Agt.

Westfield, Mass.—The Springfield St. Ry Co. has been granted a franchise to double track its line along the state highway in Westfield. R. W. Reynolds, Springfield, is Mgr.

Niagara Falls, N. Y.—The Niagara River & Eastern R.R. Co. has been incorporated to construct an electric railway from the terminal of the Buffalo, Lockport & Rochester Ry. in Buffalo to Niagara Falls. The incorporators are E. G. Connette, Frank A. Dudley, A. J. Porter and A. W. Gray, all of Niagara Falls.

Washington, D. C.—The Washington Ry. & Electric Co. is considering plans for the extension of its line from 14th and B St., southwest, to the Bureau of Printing and Engraving. R. W. Crowell, 213 14th St., N. W., Washington, is Pur. Agt.

Athens, W. Va.—The Mercer Electric Ry. Co. is making preliminary arrangements for the construction of an electric railway from Athens to Princeton, about seven miles. R. G. Meador, Athens, is Pres.

Weston, W. Va.—Preliminary plans are being considered by the Weston & Glenville Electric Ry. Co. for the construction of an electric railway from Weston to Glenville, about 25 miles. Lloyd Rinehart, Weston, is interested.

Spartanburg, S. C.—The Piedmont & Northern Ry. Co. is preparing to extend its electric interurban line from Spartanburg to Gastonia, about 32 miles.

Jacksonville, Fla.—The Jacksonville Traction Co. is preparing plans for the extension of several of its lines in Jacksonville. Hardy Croom, Jacksonville, is Local Mgr. and Pur. Agt.

Marion, Ill.—The Board of Supervisors of Williamson County has granted a franchise to the Southern Illinois Ry. & Power Co. to construct and operate an electric railway from Marion to Carrier Mills. W. H. Scott, Chicago, is Vice-Pres., Gen. Mgr. and Pur. Agt.

Peoria, Ill.—According to press reports surveys are being made by W. H. Schott Co., Engrs., 111 Monroe St., Chicago, Ill., for the construction of an electric interurban line from Peoria to Washington.

Hutchinson, Kan.—The Arkansas Valley Interurban Ry. Co. and the Hutchinson St. Ry. Co. have entered into an agreement under which the lines of both companies will be connected. This will require the extension of the Arkansas Valley line for a distance of about two miles.

St. Louis, Mo.—The United Rys. Co. is considering plans for the extension of its line on Union Ave. to the city limits. Richard McCulloch, St. Louis, is Vice-Pres. and Gen. Mgr.

Hot Springs, Ark.—Preliminary arrangements are being made by the Hot Springs St. Ry Co. for the extension of its line on Malvern Ave. to the Country Club. S. E. Dillon, Hot Springs, is Gen. Mgr.

✚**Dallas, Tex.**—The contract for the construction of a street railway from the downtown section of Dallas to the campus of the Southern Methodist University has been awarded by the Board of Trustees of the institution to the STONE & WEBSTER ENGINEERING CORPORATION, Boston, Mass. Noted June 18 and July 2.

Mexia, Tex.—The Commercial Club is interested in the construction of an electric railway in Mexia.

Ardmore, Okla.—Preliminary arrangements are being made by the Ardmore & Western Interurban Ry. Co. for the construction of an electric railway from Ardmore to Oil City.

Lewiston, Idaho—An electric railway will be constructed from Lewiston to Clarkston by R. C. Dahlhjelm, St. Paul, Minn., who has taken over the Lewiston Terminal Co.

Fresno, Calif.—The City Council has granted a franchise to the Fresno Traction Co. for the construction of an electric railway on South J St. and Fresno Ave. Frank W. Webster, Fresno, is Gen. Mgr.

Long Beach, Calif.—The Pacific Electric Ry. Co. has applied to the City Council for a franchise to construct and operate an electric railway in Long Beach. J. McMillan, Los Angeles, is Gen. Mgr.

Sausalito, Calif.—The Sausalito Incline Ry. Co. has been granted permission to construct an incline railway in Sausalito. Allen H. Vance, Sausalito, is interested.

Turlock, Calif.—F. P. Will, Burlingame, Calif., plans to build a trackless trolley system from Turlock to Denair, about four miles. The system will cost approximately $20,000.

Cornwall, Ont.—The Cornwall St. Ry. Co. has been granted a franchise to extend its lines and build loop lines on Cumberland and Water St. William Hodge, Cornwall, is Gen. Mgr. and Pur. Agt.

Sarnia, Ont.—The Sarnia St. Ry. Co. has been granted permission to reconstruct its line on Christina St. George E. Wadland, Sarnia, is Gen. Mgr. and Pur. Agt.

LIGHT, HEAT AND POWER

West Springfield, Mass.—Bids will soon be asked by the Ramapogue Ice Co. for the construction of a dam in the Westfield River. Bliss & Lavalle, Springfield, Mass., have charge of engineering. Noted July 23 and Aug. 6.

New Britain, Conn.—The Board of Education contemplates the installation of a heating plant for the central group of school buildings. Walter P. Crabtree, 272 Main St., will have charge of the work.

✚**Waterbury, Conn.**—The George A. Fuller Co., New York, N. Y., general contractors for the new municipal building at Grand and Field St., has awarded a sub-contract for the heating, ventilating and plumbing equipment to the BARLOW BROS. CO., 63 Grand St., Waterbury, at about $75,000.

★**Hudson, N. Y.**—Bids will be received, until 2 p.m., Oct. 23, by (Miss) Mary Hinckley, Pres., Bd. of Mgr., New York Training School for Girls, for heating, plumbing, electric work and electric elevator in the hospital building, refrigerating plant and equipment, heating, plumbing and electric work in the contagious hospital of the New York State School. Lewis F. Pilcher, Capitol, Albany, is State Arch.

★**Ithaca, N. Y.**—(Official)—Bids will be received, until 2 p.m., Oct. 31, by E. L. Williams, Treas., Cornell University, for underground steam piping, conduits, pumps, etc., in connection with the central heating plant for the New York State College of Agriculture, Cornell University, Ithaca, N. Y. Green & Wicks, 110 Franklin St., Buffalo, N. Y., are Archs.

Newburgh, N. Y.—The Central Hudson Gas & Electric Co. has applied to the City Council for permission to lay a conduit system from its power station in Montgomery St. to its substation in Balmville. The estimated cost of the work is $50,000.

★**Butler, N. J.**—All bids received by the Borough Council for the construction of a municipal electric light plant were rejected as being above the appropriation of $30,000. The plans will be revised and new bids will be asked. George J. Fritz is Borough Clk. Noted Aug. 27.

Irvington, N. J.—The Town Council has retained Runyon & Carey, Consult. Engrs., Newark, N. J., to prepare plans and estimates for the installation of a municipal electric light plant. Isaac J. Casey is City Engr.

Paterson, N. J.—The Board of Public Works is considering plans for the installation of a municipal distributing system for city lighting and other purposes. The power will be secured from the Public Service Electric Co. H. J. Harder is City Engr.

+Philadelphia, Penn.—The A. Schoenhut Co., manufacturer of toys, has awarded the contract for the construction of a one-story brick and reinforced-concrete power house and garage at Boston Ave. and York St., to FRED A. HAVENS & CO., 517 North 19th St., Philadelphia. Noted Sept. 24.

Orangeburg, S. C.—The City Council contemplates improvements to the municipal electric light plant at an estimated cost of $10,000. Additional boilers will be installed. L. H. W[illegible]amaker is Mgr. of the plant.

Lakeland, Fla.—At a special election held Oct. 6, the citizens voted in favor of a bond issue of $138,000, the proceeds of which will be used to enlarge the electric light plant and water works system, and extend the distribution lines.

Jackson, Miss.—The City Engineer has prepared two sets of plans for a municipal light and power plant. The first plan, calling for the location of the plant in the city, will cost about $16[illegible]. The other plan, locating the power house at the pumping station of the water-works system, will cost $1[illegible]. Both plans include an estimate of $29,000 for underground wiring in the business section of the city. A special election will be called to vote on the question of a bond issue for the construction of the plant. M. L. Culley is City Engr. Noted Oct. 8.

Bunkie, La.—The Bunkie Ice Co. has been granted a franchise to light the city, and will at once install a power plant for that purpose. W. L. Thompson, Boyce, La., is Superv. Engr.

Gretna, La.—The City Council is considering the establishment of a municipal electric light plant at a cost of about $3[illegible].

Pebble, Ky.—At a recent election, the citizens voted in favor of establishing a municipal electric light plant.

Cleveland, Ohio—The lowest bid received by the city for the construction of a new power house for the Cleveland City Hospital was that of Metzger & Wells, Reed Bldg., Philadelphia, Penn., at about $90,000. Noted July 16.

Wellsville, Ohio—The Supreme Court of Ohio has authorized the City to proceed with the construction of a municipal electric light plant. This settles the suit to enjoin Wellsville from bonding the city for $60,000 for the construction of the plant.

Atwood, Ill.—At a special election held Oct. 3, the question of issuing bonds for constructing a municipal electric lighting system was carried.

Ceylon, Minn.—The Village Council is receiving bids for the construction of a municipal electric-light plant, estimated to cost $8000. The building will be of concrete block, one story, 2[illegible] ft. Earle D. Jackson, Capital Bank Bldg., St. Paul, Minn., is Engr.-in-Charge. Noted Aug. 13.

St. Paul, Minn.—A permit has been issued by the city building department for the construction of a power house for the new Catholic Cathedral at Selby and Farrington Ave. The building will be of brick and concrete, and will cost about $1[illegible].

Maxwell, Neb.—The Village Board has retained the Alamo Engine & Supply Co., Omaha, Neb., to prepare plans for a municipal electric light plant, to cost approximately $16,500. The question of a bond issue for its construction will be submitted to the voters.

Cuero, Tex.—The Cuero Commercial Club, G. H. Harris, Secy., and other citizens, are promoting the installation of a gas generating plant and distribution system for Cuero.

Port Lavaca, Tex.—The Citizens' Light & Water Co., recently [illegible], is considering the establishment of an electric power plant.

+San Antonio, Tex.—The Commissioners Court of Bexar County has awarded the contract for a new heating plant in the County Court House to WILLIAM G. SCHWIETH, at $[illegible], and a contract for electric wiring in the building to MARTIN WRIGHT, at $[illegible].

Tishomingo, Okla.—It is reported that F. A. Gillespie, T[illegible], Okla., has bought a power site of 90 acres on the [illegible] River, and will develop about 1[illegible]00 hp.

Victor, Idaho—A special election will be held, Oct. 31, to vote on the question of a bond issue for the purpose of installing a municipal electric light and power plant. The estimated cost is $[illegible]. M. H. Brinton is City Clk.

Tonopah, Nev.—The Nevada-California Power Co. will extend its transmission line from Tonopah to Manhattan, a distance of [illegible] miles. D. M. Wells, Goldfield, Nev., is Dist. Mgr.

Winnemucca, Nev.—W. J. [illegible] and Frank L. Peter [illegible] a gas plant and installing a distributing system.

Olympia, Wash.—The [illegible] Co. will install a gas distributing system in Olympia.

Winlock, Wash.—The [illegible] Co., a subsidiary of the Washington-Oregon Corporation, Vancouver, Wash., will build a transmission line from Winlock to Toledo. [illegible] is Supt. of the Washington-Oregon Corp.

Venso, Calif.—It is reported that a special election will [illegible]

+Bakersfield, Calif.—The Board of Supervisors of Kern [illegible]

Santa Maria, Calif.—[illegible] A. G. Watson, [illegible]

Woodland, Calif.—[illegible]

Juneau, Alaska—E. P. Kennedy and J. W. Beckman are interested in the construction of a hydro-electric power plant on the Speel River, about 35 miles south of Juneau. Noted Sept. 24.

Chatham, Ont.—The City Council has passed a by-law authorizing the equipment of a new hydro-electric plant, estimated to cost $150,000. An engineer will be engaged, and the plans prepared as soon as possible.

Stettler, Alta.—See item under "Water Supply and Irrigation."

BRIDGES

+Boston, Mass.—(Official)—The Metropolitan Park Commission has awarded the contract for the superstructure of the Wellington Bridge at Somerville and Medford to COLEMAN BROS., Boston, at $44,013. Other bidders were: Michael D. Russo, Boston, $76,287; W. H. Ellis & Son Co., East Boston, $63,936; H. P. Converse, Boston, $61,000; Charles Essena & Co., Boston, $60,346; W. A. Murtfeldt Co., Boston, $57,930; Rendle & Stoddard, East Boston, $57,884; Hugh Nawn Contracting Co., Roxbury, $53,371; W. A. & H. A. Root, Inc., Boston, $52,745; William M. Bailey, Boston, $51,515; T. Stuart Son Co., Boston, $49,960. Noted Oct. 15.

+Dedham, Mass.—(Official)—The Commissioners of Norfolk County have awarded the contract for the construction of a concrete beam bridge between Norwood and Canton, to R. L. WHIPPLE & CO., 306 Main St., Worcester, Mass., at $8837. Other bidders were: Hyde Park Construction Co., $9168; Moore & Co., $9750; Hancock Engineering Co., $11,884; Walter Smith & Son, $15,036; Thomas E. Ruggles Co., $17,000. Noted Oct. 1.

Bristol, Conn.—The Common Council has authorized Carleton W. Buell, City Engr., to prepare plans for a concrete bridge on Pond St.

Old Lyme, Conn.—Bids are being received by Charles J. Bennett, State Highway Comr., Capitol, Hartford, for the construction of an 80-ft. bridge, including abutments and approaches, at Old Lyme. It will be of the steel arch girder type.

Glens Falls, N. Y.—The Town Board, according to press reports, has engaged the Concrete-Steel Engineering Co., New York, N. Y., to prepare plans for a bridge over the east channel of the Hudson River at Glens Falls. Bids for its construction will probably not be asked before the late winter or early spring.

New York, N. Y.—(Borough of Bronx)—(Official)—The following bids were received Oct. 8 for repairing, cleaning and painting the bridge over the tracks of the New York, New Haven & Hartford R.R., at East 153d St.: Jopson Gifford Co., $33,275; the Marble Arch Co., Kingsbridge Road and Jerome Ave., New York, $33,300; the Snare & Triest Co., Woolworth Bldg., New York, $31,630; Neptune H. Smythe, Inc., 413 East 34th St., New York, $33,630. Noted Oct. 1.

+Camden, N. J.—(Official)—The Board of Chosen Freeholders of Camden County has awarded the contract for furnishing the material for the Broadway Bridge over Newton Creek to the KELLY-McFEELY CO., Camden, at $14,150. The bid of the Owego Bridge Co., Owego, N. Y., was $16,074. J. J. Albertson is County Engr. Noted Oct. 8.

Dover, N. J.—(Official)—Bids will be received until 3 p.m., Oct. 31, by the Bridge Committee of Morris County at the Mansion House, Dover, for masonry and placing steel beams and concrete arches for the bridge known as the Bryant Bridge, on the road from Succasunna to Ironia, Randolph Township, Morris County. William A. Kinney, John A. Bermingham and Leonard Elliott form the Bridge Com.

Kingston, N. J.—It is reported that the Boards of Chosen Freeholders of Somerset, Mercer and Middlesex Counties and the Pennsylvania R.R. contemplate the construction of a new bridge over the Raritan Canal at Kingston.

+New Brunswick, N. J.—The Board of Chosen Freeholders of Middlesex County has awarded the contract for the construction of a bridge on the Perth Amboy-Metuchen Road to JOSEPH McEWEN, JR.

+Marcus Hook, Penn.—The Commissioners of Delaware County, Media, have awarded the contract for a bridge at Marcus Hook to ERNEST PALMER, Wallingford, Penn., at about $10[illegible]0.

Louisa, Va.—(Official)—Bids will be received until noon, Oct. [illegible], by the Clerk of the Circuit Court of Louisa County, for the construction of a [illegible]-ft. bridge, with a 1[illegible]-ft. roadway, over the Little River. The superstructure will be of steel with a concrete substructure.

Princeton, W. Va.—See item under "Streets and Roads."

Fayetteville, N. C.—(Official)—The Commissioners of Cumberland County awarded no contracts from bids received Oct. 1[illegible] for the construction of a number of concrete bridges in the county, estimated to cost from $[illegible] to $10,0[illegible], and the matter has been deferred for a time. Fulton R. Hall is Clk. of Comrs. Noted Oct. 1.

Fort Lauderdale, Fla.—Bids will be received until Nov. 3, by the Commissioners of [illegible] County, Miami, for a steel [illegible] bridge [illegible] and abutments over the New River at Fort Lauderdale. The successful contractor is also to provide a temporary bridge for use while the new structure is being built. F. T. Merrill is Clk. of the County Comrs. Noted Feb. [illegible] and Aug. [illegible].

Jackson, Miss.—The Board of Supervisors of Hinds County, [illegible], and the Board of Supervisors of Warren County, Vicksburg, will [illegible] bids for the construction of a reinforced-concrete bridge over the Big Black River. The estimated cost of the structure is $14,000, of which each county will pay half. W. W. Dowling is Chancery Clk. of Hinds County.

Pittsboro, Miss.—Bids will be received until Nov. 2, by the [illegible] of Supervisors District No. 1, of Calhoun County, for the construction of culverts on the road from Pittsboro to the western boundary of the district, the road from Big Creek to the western boundary, and the

extension of the road from Pittsboro to the northern boundary of the district. A. A. Bruner is a Comr.

Nashville, Tenn.—The City Council plans to build a reinforced-concrete viaduct over the tracks of the Nashville, Chattanooga & St. Louis Ry. at Cedar St. The estimated cost of the viaduct is $45,000, and it is proposed that the city, the railway and the Nashville Ry. & Light Co. share equally in the cost. W. W. Southgate is City Engr.

Rogersville, Tenn.—The Commissioners of Hawkins County have appropriated $18,000 for the construction of a bridge at Durem.

Elizabethtown, Ky.—The Fiscal Courts of Hardin and Grayson Counties plan to build a reinforced-concrete bridge at Hughes Mill. W. C. Montgomery, Elizabethtown, is Judge of Hardin County.

Cincinnati, Ohio—The Board of Park Commissioners and the City Engineer are preparing plans for a new concrete bridge to replace the present one at the Park Ave. entrance to Eden Park. Philip Fosdick is Dir. of Pub. Ser.

Marietta, Ohio—Bids will be received until noon, Oct. 23, by the Board of Commissioners of Washington County for the construction of the superstructure of the Big Run Bridge, Adams Township. W. B. Alexander is County Audr.

Painesville, Ohio—Bids will be received until noon, Nov. 2, by the Commissioners of Washington County, for the construction of a steel bridge over the east branch of the Chagrin River, Kentland Township. W. A. Davis is County Audr.

Toledo, Ohio—(Official)—Bids will be received until 10 a.m., Nov. 13, by the Board of Supervisors of Lucas County, for the construction of the substructure and superstructure of a bridge on Detroit Ave. over the Miami and Erie Canal, Washington Township; new abutment and floor for a bridge on Road No. 455 over Shantee Creek, Washington Township; new abutments and floor for the bridge on Road No. 455 over Silver Creek, Washington Township, and the south abutment to bridge on Key St., over the Miami and Erie Canal, Maumee. Charles J. Sanzenbacher is County Audr.

+West Carrollton, Ohio—(Official)—The Board of Commissioners of Montgomery County has awarded the contract for the superstructure of a bridge over the canal at Cedar St., West Carrollton, to the BROOKVILLE BRIDGE CO., Brookville, Ohio. Noted Oct. 1.

Ecorse, Mich.—At a special election held Oct. 13, the voters defeated a bond issue of $35,000 for the purpose of building a lift bridge over Ecorse Creek at West Jefferson Ave. The present bridge has been condemned, however, so the Township Board has been petitioned to present the question to the voters again. Noted Oct. 1.

+Cambridge, Ill.—(Official)—The following bids were received, Oct. 12, by the Highway Commission of Henry County, for the construction of the Baxter Bridge, Atkinson Township: Modern Steel Structural Co. (superstructure only), $1742; PORTER-McCULLY CONSTRUCTION CO., Mackinaw, Ill., $4400 (awarded contract); Joliet Bridge & Iron Co., $4647; C. H. Hamann, $4400; Continental Bridge Co. (superstructure only), $1875; Decatur Bridge Co., $4460.

De Pere, Wis.—The 475-ft. bridge over the Fox River at this point must either be repaired at once, at a cost of about $15,000, or a new structure, estimated to cost $75,000, will be necessary. M. W. Torkelson, State Bridge Engr., Madison, Wis., is in favor of the new bridge. Noted Aug. 13.

Madison, Wis.—The State Highway Commission, M. W. Torkelson, Bridge Engr., is having plans prepared for the construction of a four-span bridge in the Town of Dewey, Rusk County. W. O. Hotchkiss, Capitol Bldg., Madison, is Secy. of the Highway Comn.

+Larned, Kan.—The Commissioners of Pawnee County, Larned, and of Edwards County, Kinsley, have awarded the contract for the construction of a 510-ft. bridge over the Arkansas River at Nettleton to the MIDLAND VALLEY BRIDGE CO., at $6300. Pawnee County also plans the construction of two other bridges, one at Garfield, and the other five miles east of Larned.

+Fairmont, Minn.—The City Council has awarded the contract for the construction of a reinforced-concrete bridge to O. C. GOULD & SON, Fairmont, at $6600.

+Contact, Mont.—The Commissioners of Park County, Livingston, have awarded the contract for a bridge over the Salmon River at Contact, to the JOHN BURKE CO., Salt Lake City, Utah. The bridge will be 60 ft. long, of steel with concrete abutments.

Lewistown, Mont.—The Commissioners of Fergus County have awarded the contract for a bridge over Ross Fork to the SECURITY BRIDGE CO., Lewistown, at $5600.

St. Louis, Mo.—At the regular election, on Nov. 3, the citizens will vote on the question of a bond issue of $2,750,000 to be used for constructing the approaches of the Free Bridge over the Mississippi River. James A. Hooke is Dir. of Pub. Utilities. Noted May 14.

+Warren, Ark.—The Bridge Commissioners of Bradley County have awarded the contract for the construction of a steel bridge across the Saline River, on the Warren-Pine Bluff Road, to the MEMPHIS BRIDGE CO., Memphis, Tenn., at $16,500. Noted Sept. 17.

+Beaumont, Tex.—(Official)—The Commissioners of Jefferson County have awarded the contract for the construction of a 96-ft. timber bridge, with a 20-ft. lift span, over Taylor's Bayou, to SPENCE & HOWE, Port Arthur, Tex. Fred R. Blanchette is County Road Engr. Noted Oct. 1.

Dallas, Tex.—It is reported that the City Engineer will soon prepare plans for the construction of a viaduct at Merlin St. The Gulf, Colorado & Santa Fe Ry. will pay a part of the cost of the structure. J. M. Preston is City Engr.

+Houston, Tex.—The International & Great Northern Ry. has awarded the contract for the construction of a steel bascule bridge over the Buffalo Bayou to the AMERICAN BRIDGE CO., at $35,000.

Idabel, Okla.—The question of a bond issue of $122,000, to be used for the construction of 37 bridges, will be submitted to the voters of McCurtain County at the regular election of Nov. 3.

Caldwell, Idaho—Bids will soon be asked by the Commissioners of Canyon County for the construction of a steel bridge to replace the bridge over Indian Creek on the county line between Canyon and Ada Counties, and for a steel bridge over Willow Creek in the northern part of the county. Fred H. McConnell is County Engr.

Portland, Ore.—The Southern Pacific Co. and the Oregon-Washington R.R. & Navigation Co. jointly are having plans prepared by H. W. Holmes, Portland, for a number of bridges and approaches to be placed over crossings. The largest bridge will be located at East 37th St. It will be of reinforced concrete, and is estimated to cost $40,000.

Vale, Ore.—Press reports state that the taxpayers of Malheur County will shortly hold an election to vote on the question of a bond issue of $30,000 for the purpose of building a bridge across the Snake River, near Nyssa.

Bakersfield, Calif.—Bids will be received, until 2 p.m., Oct. 28, by the Board of Supervisors of Kern County, for constructing bridges and culverts on about 5.6 miles of the Bakersfield-Glennville Road, Div. 9, Sect. 2. All corrugated iron pipe to be furnished by the county. P. H. Everett is Ch. Engr.

+Red Bluff, Calif.—The Board of Supervisors of Tehama County has awarded contracts for the construction of four bridges in the county to McCARTNEY & HASKELL, at $11,613. Noted Oct. 8.

Santa Barbara, Calif.—The Board of Supervisors of Santa Barbara County will soon advertise for bids for the construction of a 400-ft. bridge at El Guamada, estimated cost, $40,000, and for a 625-ft. bridge over the Arroyo Honda, cost, $75,000. Both will be of reinforced concrete. F. F. Flourney is County Surv.

+Santa Cruz, Calif.—The contract for the construction of four bridges on the State Highway near Santa Cruz has been awarded to OTTO PARLIER, Tulare, Calif., at about $13,000.

Ottawa, Ont.—The City Council has authorized Archibald Currie, City Engr., to advertise for bids at once for the construction of a steel bascule bridge at Pretoria Ave. The estimated cost is $120,000.

Victoria, B. C.—Plans have been prepared, and it is reported that a by-law will be submitted to the ratepayers this year, for the construction of a bridge on Johnson St., to cost about $750,000. Wellington J. Dowler is City Clk.

WATER SUPPLY—IRRIGATION

Auburn, Maine—The construction of a reservoir at East Auburn is contemplated by the city to furnish water and fire protection. Forrest Bisbee is Supt. of Water Wks.

+Gardiner, Maine—(Correction)—In the issue of Sept. 17 it was stated that Young & Hyde, New York, N. Y., were awarded the contract for constructing a slow sand filtration plant at Gardiner. The bids have been rejected and the contract readvertised, bids being received Oct. 1. The contract has now been awarded to J. H. FERGUSON, Dorchester, Mass., at $47,128. Noted Sept. 17.

Newburyport, Mass.—Bonds for $55,000, recently voted by the citizens for the improvement of the water-works, have been sold. Noted Sept. 24.

Bellmore, N. Y.—Plans have been filed with the State Conservation Commission by the Bellmore Citizens Water Co. for the installation of a new water system for Bellmore. The estimated cost is $40,000. Townsend G. Smith is Engr.

★New York, N. Y.—(Official)—Bids will be received by the Board of Water Supply, Municipal Bldg., until 11 a.m., Nov. 10, for Contract 160, for the construction of the Moodna Siphon supplementary shaft and tunnel of the Catskill aqueduct. Charles Strauss is Pres. of the Bd. For details, see advertisement under "Contracts to Be Let."

New Brunswick, N. J.—The City Water Commission plans to increase the water-storage capacity. Plans are being prepared.

Buckhannon, W. Va.—The Buckhannon Light & Water Co. plans to construct a 2,000,000-gal. reservoir. J. G. Mayfield is Gen. Mgr

Allendale, S. C.—Bids will be received, until Nov. 18, by W. F. Googe, Chn. Comrs., Pub. Wks., for constructing water and sewer systems and electric-light plant. H. S. Jaudon Engineering Co., Savannah, Ga., is the Engr. Noted June 4.

+Batesburg, S. C.—(Official)—The contract for furnishing 6-in. c.-i. class C water pipe, two-way hydrants, valves and specials has been awarded to R. L. FARMER, Springfield, S. C., at $0.62 per lin.ft., $28 each, $15 each and $0.03 each, respectively. J. B. Holman is Pres. Bd. of Pub. Wks. Noted June 11.

★Mullins, S. C.—(Official)—Bids will be received by the Board of Public Works until 4 p.m., Oct. 29, for constructing a water system. Plans are on file at the office of F. A. Smith, Chn. Bd. of Pub. Wks.

Covington, Ga.—The Council contemplates constructing a reservoir for the water system. J. H. Overholt is Clk.

Louisville, Ga.—See item under "Sewers."

Lakeland, Fla.—At an election held Oct. 6, bonds for $130,000 were voted by the citizens, the proceeds of which will be used for the improvement of the water system and electric-light plant Noted June 4.

Palmetto, Fla.—Bids will be received until 2 p.m., Oct. 26, by A. M. Lamb, Pres. of Council, for furnishing two 40- to 50-hp. kerosene oil Diesel or semi-Diesel engines and two 500-gal. triplex pumps. J. B. McCrary Co., Atlanta, Ga., is the Engr.

+Bessemer, Ala.—The contract for constructing a sanitary sewage disposal plant has been awarded to the SOUTHERN ASPHALT CO., at $76,494.

Gulfport, Miss.—[illegible] will soon be received for the [illegible] of a water system estimated to cost [illegible]. Hubert [illegible] is [illegible].

Houma, La.—[illegible] will be received by the Mayor until Nov. [illegible] for [illegible] a [illegible] pump with a capacity of [illegible] gal. per minute [illegible] to a [illegible] motor.

Mansfield, La.—Bids will be received until Nov. [illegible], by L. F. [illegible], City Clk., for furnishing and installing pumping machinery in [illegible] plant now under construction.

Bluffton, Ohio.—The village [illegible] spending $70[illegible] for the [illegible] of the water system.

Canton, Ohio.—The Water Committee of the City Council [illegible] to make an investigation and survey of the water situation at Canton.

✦Cleveland, Ohio.—The contract for furnishing pumping [illegible] the city water-works has been awarded to ALLIS-CHALMERS MFG. CO., Milwaukee, Wis., at $2[illegible]. Noted Oct. 1.

Kenmore, Ohio.—Bonds for $[illegible] were voted by the citizens [illegible]. The proceeds will be used for the installation of a water system. [illegible] Engineering Co., Akron, is the Engr.

Toledo, Ohio.—The Director of Public Service has been asked by the Council to purchase two [illegible]-hp. boilers with mechanical stokers for the water works and a tar extractor for the gas engines of the filtration plant.

✦Grand Ridge, Ill.—The contract for laying 11,000 ft. of c.-i. water [illegible] has been awarded by the Village Trustees to H. C. WOOLCOX, Oglesby, at $10,000. Noted Oct. 8.

Grays Lake, Ill.—Bids will be received, until Nov. 2, by the Village Clerk, for furnishing deep well pump and motor. D. G. White is Clk.

★Oglesby, Ill.—(Official.) Bids will be received until 8 p.m., Nov. [illegible], for driving a 16[illegible]-ft. artesian well. John Corgiat is City Clk. For details, see advertisement under "Contracts to Be Let."

✦Red Bud, Ill.—The contract for constructing a water system has been awarded to KATZ CONSTRUCTION CO., Omaha, Neb., at $[illegible]. Bids opened Oct. [illegible]. Noted Oct. 1.

Elkhorn, Wis.—The driving of a new well 1500 to 1600 ft. deep is being considered by the Water and Light Commission.

Hayward, Wis.—A special election will be held Nov. 7, to vote on the question of issuing bonds for $12,[illegible] for the erection of a water-works.

Manitowoc, Wis.—Bids are being received by Arthur [illegible], City Clk., for furnishing and erecting one 3,000,000-[illegible] pumping engine, complete with condenser, air pumps, piping, valves and auxiliary apparatus and two tubular boilers at the city pumping station.

✦Wabeno, Wis.—The contract for installing a water system has been awarded to LOWENK & CHAFEE, Rhinelander, Wis. Bids opened Oct. 1. Noted Sept. 24.

✦Wauwatosa, Wis.—Contracts have been awarded by the [illegible] of Milwaukee for improvements and extensions to the water systems at several of the county institutions as follows: To [illegible] SERVICE CONSTRUCTION CO., [illegible], for general contract, including water [illegible]; KEEHN [illegible] CO., [illegible], for boiler; GENERAL CONCRETE CONSTRUCTION CO., Chicago, Ill., for stack; WISCONSIN CEMENT CONSTRUCTION CO., Milwaukee, for reservoir; and RELIANCE BOILER WORKS, for [illegible]. Noted Oct. 1.

Des Moines, Iowa.—An election will be held Nov. 3 to vote on the question of issuing bonds for $[illegible], the proceeds of which to be used for the purchase and improvement of the water-works. [illegible] is Mayor.

✦Redwood Falls, Minn.—The contract for constructing water mains and sewers has been awarded to WILLIAM C. FRAZER, [illegible], at $[illegible].

✦Riverton, Minn.—The contract for installing water and sewer systems has been awarded to [illegible] BROS., at $[illegible].

✦Casper, Wyo.—[illegible]

Clydepark, Mont.—[illegible]

Miles City, Mont.—[illegible]

Winnett, Mont.—[illegible]

Barstow, Tex.—[illegible]

✦El Paso, Tex.—[illegible]

✦Livingston, Tex.—[illegible]

Rusk, Tex.—[illegible]

Vale, Ohio.—[illegible]

McCammon, Idaho.—[illegible]

Roberts, Idaho.—The North Lake Canal Co. is now being incorporated and will construct an irrigation system to water [illegible] acres from waters of Crystal Lake.

Wendell, Idaho.—The citizens contemplate issuing bonds for $[illegible], the proceeds of which to be used for the purchase and improvement of the water system.

Salt Lake City, Utah.—All bids received by the city, Oct. 1, for constructing a rubble concrete dam at Twin Lakes, Big Cottonwood Canyon, have been rejected and contract has been readvertised. Sylvester Q. Cannon is City Engr.

✦The contract for constructing a reinforced-concrete reservoir at Fifth and South St. has been awarded to R. E. WILSON, [illegible] Harmony Pl., Salt Lake City, at $[illegible],411. Noted July 9.

Ellensburg, Wash.—The Cascade Irrigation District is preparing to replace all wooden flumes with steel. The estimated cost is $12[illegible],000.

The Ellensburg Gas & Water Co. will build a three-mile extension to its system to supply the village of Kittitas.

Alturas, Calif.—According to press reports the Modoc County Irrigation Co. plans to construct an irrigation system, to cost $1,000,000. A. T. Currier is Pres. of the company.

Azusa, Calif.—An election will soon be held to vote on the question of issuing $[illegible] in bonds for the construction of a new water works and $[illegible],000 in bonds for the construction of a lighting plant.

San Diego, Calif.—Plans have been prepared and bids will soon be received for the construction of a filtration house and tanks on the lower Otay dam. The estimated cost is $60,000. Noted Aug. 27.

Santa Ana, Calif.—The Allis-Chalmers Co., at $18,983 and $20,682, was low bidder for furnishing a pumping engine and boiler for the water works. Bids opened Oct. 5. Noted Sept. 24.

Leamington, Ont.—The Town Council has authorized the construction of water mains from the lake and the installation of additional equipment. R. M. Selkirk is Clk.

Stettler, Alta.—The Town Council will extend the water system at an estimated cost of $[illegible] and the electric light system at a cost of $10,000. J. Jameson is Engr.

SEWERS

✦Augusta, Maine.—The contract for constructing sewers in Chestnut and Willow St. has been awarded to FRED E. WENTWORTH.

Old Orchard, Maine.—Bonds for $[illegible] for the extension of the sewer system in [illegible] Grand Ave. have been voted.

✦Boston, Mass.—Bids were received Oct. [illegible], for constructing sewers in East First St. The contract has been awarded to ANTONY CEFALO, at $[illegible]. Other bids were: Anthony Baruffaldi, $[illegible]; M. H. Kelley, $[illegible]; J. J. Conway, $[illegible]; and T. J. O'Connell, $[illegible]. L. K. Rourke is Comr.

✦Bids were received, Oct. 9, as follows, for constructing sewers in Dempster St.: ANTONY CEFALO, at $[illegible] (awarded contract); Anthony Baruffaldi, $[illegible]; J. J. Conway, $[illegible]; M. DeSisto, $7581; M. H. Kelley, $[illegible]; M. DeMattee, $[illegible]; Louis B[illegible], $8921, and Charles J. Jacobs Co., $[illegible]. L. K. Rourke is Comr.

Bids will be received, until Oct. [illegible], by the Public Works Department for constructing sewers in Greenleaf and Howland St., Roxbury District, and in Morse St., Dorchester. L. K. Rourke is Comr.

Worcester, Mass.—The Sewer Committee contemplates spending $1[illegible] for sewer connections in Chandler St.

★Woonsocket, R. I.—(Official.) Bids will be received until [illegible] by the Board of Sewer Commissioners, for constructing a sewer in the [illegible] District. Frank H. Mills is City Engr.

✦New York, N. Y.—(Borough of Brooklyn)—(Official)—The contract for constructing a sanitary sewer in West [illegible]th St. from [illegible] Ave. to Neptune Ave. has been awarded to D. LONERGAN CO., [illegible] Ave., Brooklyn, at $11,[illegible]. Bids opened Oct. 7. Noted Oct. 1.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by [illegible] Williams, Comr. Water Supply, Gas and Electricity, Municipal Bldg., Manhattan, until [illegible] for [illegible] boiler in the [illegible] pumping station and one boiler in the [illegible] pumping station [illegible] and re-erecting them.

[illegible]

Syracuse, N. Y.—The low bidder for completing the [illegible] sewer was the [illegible] Co. [illegible] New York, at $[illegible]. Bids opened Oct. [illegible]. Noted Oct. [illegible].

Syracuse, N. Y.—The Common Council has authorized the construction of a [illegible] sewer in [illegible] Ave., a [illegible] sewer in [illegible] Ave. and a [illegible] sewer in Crescent Ave.

Belvidere, N. J.—The Board of Freeholders has instructed the Directors of the County Almshouse to build a sewage disposal plant in accordance with recent orders received from the State Board of Health.

Elizabeth, N. J.—(Official)—Bids will be received by the City Council until 8 p.m., Nov. [illegible], for constructing a sewer in [illegible] St. from [illegible] Ave. to near [illegible] Ave. William [illegible] is Comr.

Jersey City, N. J.—Bids will be received by the City Commissioners, until 2 p.m., Oct. 29, for constructing a 48-in. c.-i. pipe sewer in Secaucus Road from Tonnelle Ave., east. Michael I. Fagen, City Hall, is City Clk.

+Plainfield, N. J.—(Official)—Bids were received by the Sanitary Sewerage Commission, Oct. 7, for constructing a sewer system (A), and sewage disposal plant (B), in Piscataway Township as follows: CAULDWELL-WINGATE CO. & ATLANTIC CONSTRUCTION & SUPPLY CO. ASSOCIATION, New York, N. Y., (A) $100,909 (awarded contract), (B) $156,465; EDWARD L. BADER, Atlantic City, (B) $133,102 (awarded contract), (A) $184,406; John C. Serade, Inc., (A) $103,910; Fusco Construction Co., $109,779, (B) $143,634; Schneider Stelle Co., (A) $110,296, (B) $205,020; George P. Olcott & Son, (A) $110,462, (B) $170,002; Kelley-McFeeley Co., $114,151, (B) $181,406; H. C. Brooks Co., Inc., (A) $117,550; T. Foster Callahan, (A) $119,755; Merrill-Ruckgaber Co., (A) $122,585; Ryan & Reilly Co., (A) $122,950; William McCarthy, (A) $127,169; H. K. Corbin Co., Inc., (A) $128,650; John W. Heller, (A) $133,075, (B) $161,342; Joseph L. Sigretto & Co., (A) $131,901, (B) $156,434; Whiting-Turner Construction Co., (A) $146,751; New York & New Jersey Construction Co., (A) $150,723, (B) $187,783; Charles Ippolito, (A) $171,573, (B) $216,995; Michael Garafano & Di Napoli & Toriello Construction Co., (A) $194,574; Stobaugh Contracting Co., (A) $198,633; J. B. Pennell & Co., (A) $217,241; Herbert O. Gardner & Andrew T. Van Cleve, (B) $149,032; Suburban Engineering Co., (B) $149,849; Pitt Construction Co., Inc., (B) $154,077; Arthur E. Smith, (B) $159,285; Mason Hilton & Co., (B) $171,500; Eon Engineering & Construction Co., (B) $180,523; L. B. Cleveland, (B) $196,341; and Pratt, Reed, Phillips & Co., (B) $231,474. George W. Fuller, 170 Broadway, New York, N. Y., is Engr. Noted Sept. 24.

Downingtown, Penn.—The Council contemplates installing a sewer system, estimated to cost $75,000.

Portvue (McKeesport post office), **Penn.**—The borough plans to install a sewer system. H. D. Reed is Clk.

Baltimore, Md.—An election will be held in November to vote on the proposition of issuing $3,000,000; the proceeds will be used for the extension of the sewer system.

Rockville, Md.—Bids were received, Oct. 7, by John J. Higgins, Clk., for constructing a sewer system and sewage disposal plant. The Warren F. Brenizer Co., Washington, D. C., was low bidder at $21,820 for constructing sewers, and the Cantrell Construction Co., Philadelphia, Penn., was low bidder at $10,000 for constructing the sewage disposal plant. Noted Oct. 1.

Southport, N. C.—The Board of Aldermen will have plans prepared for the installation of sewer and water systems.

Allendale, S. C.—See item under "Water Supply and Irrigation."

★Mullins, S. C.—(Official)—Bids will be received by the Board of Public Works, until 4 p.m., Oct. 29, for constructing about six miles of sewer mains. F. A. Smith is Chn., Bd. Pub. Wks.

Louisville, Ga.—The low bidders for installing a sewer system and extending the water system were Mischler & Flynn, Chattanooga, Tenn., at $12,535. Bids opened Oct. 6. Noted Oct. 1.

+Savannah, Ga.—The contract for constructing sewers has been awarded by the Mayor to GADSDEN CONTRACTING CO., Savannah, and GUILD & CO., Chattanooga, Tenn., at $510,000, and to A. J. TWIGGS & SONS, at $136,994. Noted Aug. 27.

Tampa, Fla.—J. C. McNeill, Tampa, was low bidder, at $101,378, for completing the Hyde Park sanitary sewer system. Noted Oct. 15.

★Tampa, Fla.—(Official)—Bids will be received by the Board of Commissioners of Public Works, until 2 p.m., Oct. 28, for constructing sewers in Section 8, Hyde Park. D. B. McKay is Chn. Noted Oct. 15.

Georgetown, Ky.—An election will be held, Nov. 3, to vote on the proposition of issuing $20,000 in bonds, the proceeds to be used for the construction of sewers.

+Louisville, Ky.—The contract for building a sewer in Locust St. has been awarded to K. A. BARKER, Louisville, at $15,900.

Cleveland, Ohio—No bids were received by the city for the purchase of $100,000 in sewer bonds for the construction of a sewage disposal plant.

Fostoria, Ohio—All bids received Oct. 9, by E. K. Cunningham, Dir. of Pub. Ser., for installing a sewage disposal plant have been rejected. Noted Sept. 3.

Lindenwald (Hamilton post office), **Ohio**—A sanitary sewer system will be constructed in Lindenwald, according to press reports.

Minerva, Ohio—(Official)—Bids will be received by Austin Freed, Clk., until noon, Nov. 4, for constructing a storm water sewer.

Zanesville, Ohio—Bids will be received, until 11 a.m., Nov. 9, by the County Commissioner, for building 1200 ft. of 24-in. vitrified pipe storm sewer in Springfield Township.

Peoria, Ill.—Bids will be received by the Board of Local Improvements until Oct. 26, for constructing one sanitary and one storm sewer. Sherman W. Eckley is Pres. of the Bd.

+Antigo, Wis.—The contract for constructing a sewer extension in Sixth Ave. has been awarded to CONAHEN & GARDINSKY.

West Allis, Wis.—Bids will be received by the Acting Board of Public Works until Oct. 24, for constructing 10-, 12-, 15- and 24-in. sewers in various streets. A. L. Kenny, J. W. Schumacher and William Eggert are members.

★Clinton, Iowa—(Official)—Bids will be received by Frank W. Leedham, City Clk., until 8 p.m., Nov. 10, for constructing a sanitary and storm sewer in District No. 4.

+Park Rapids, Minn.—A contract for constructing a sewer system has been awarded to the GRAND FORKS CEMENT CO., at $5495. Other bids were: Hugh T. Bosworth, $5750; Black Hawk Cement Co., $5703; Wm. C. Fraser, St. Paul, $5650.

Pine City, Minn.—(Official)—Bids will be received by H. J. Buirge, Village Clk. until 7:30 p.m., Oct. 28, for constructing a sanitary sewer system. J. F. Druar, 312-316 Commercial Bldg., St. Paul, Minn. is Engr.-in-Charge.

+Riverton, Minn.—See item under "Water Supply and Irrigation."

Fort Scott, Kan.—Bids will be received by Worley & Black, Reliance Bldg., Kansas City, Mo., Engrs.-in-Charge until Oct. 27 for constructing a sewage and purification plant. The plant including outlet sewers will cost approximately $25,000. Noted Oct. 1.

+Columbus, Neb.—According to press reports a contract for constructing a sewer system has been awarded to the OFFERMAN CONSTRUCTION CO., South Omaha at $21,500.

+Casper, Wyo.—See item under "Water Supply and Irrigation."

Portland, Ore.—According to press reports bids will be received by the City Auditor about Dec. 1, for constructing a trunk sewer in Willow and East 82d St. The work consists of 3500 lin.ft. 8- to 24-in. pipe sewer, 15 ft. deep and 1780 lin.ft. 30- to 60-in. concrete sewer, 20 ft. deep. The estimated cost is $187,600.

+Huntington Beach, Calif.—A contract for constructing a section of the municipal sewer system has been awarded to JOSEPH CHUTUK, Los Angeles, at $11,723.

+Los Angeles, Calif.—The contract for constructing a sewer in Brent St. from East Fourth to East Eighth St. has been awarded to LEO MILETICH, at $50,000.

Esquimalt, B. C.—Bids will soon be received by the City Council for constructing a sewer in Constance Ave. District. The estimated cost is $300,000. C. H. Topp, 211 Pemberton Ave., Victoria, B. C., is Engr.

GARBAGE

+Boston, Mass.—The following bids were received by L. K. Rourke, Comr. Pub. Wks., for the construction of a refuse receiving station at Ward St., Roxbury District: MERRIMAC CONSTRUCTION CO., $15,973 (awarded contract); John Bowen, $17,784; W. H. Ellis & Son Co., $18,328; Hapgood, Frost & Co., $18,360; M. J. Fish & Son, $18,894; C. J. Jacobs Co., $18,986; Michael Meehan, $19,410; H. P. Converse & Co., $22,684. Noted Oct. 1.

Yonkers, N. Y.—The City Council has authorized the City Engineer to prepare plans for a garbage crematory.

Allentown, Penn.—The city plans to install a garbage disposal plant and collection system similar to the one at Easton, Penn.

Dayton, Ohio—The City Commission has authorized the issue of $10,000 in bonds for the construction of five buildings to house the garbage incinerator equipment which will be installed later at an additional cost of $40,000.

Maryville, Ill.—Plans reported completed for the installation of a garbage incinerator.

Okmulgee, Okla.—Bids will be received until Nov. 9 by the Commissioner of Finance for the construction and equipment of an incinerator and garbage disposal plant, having a capacity of five tons per 24 hours. Noted Sept. 3.

Toronto, Ont.—Street Commissioner Wilson is having plans prepared which will be completed about Nov. 15, for new incinerator plants to cost about $150,000.

STREETS AND ROADS

+Boston, Mass.—A contract for constructing 10,500 lin.ft. of macadam road in Becket has been awarded to the LANE CONSTRUCTION CO. at $16,096. Other bids were: Amos D. Bridge's Sons, Inc., Hazardville, Conn., $16,325; Lynn, Holman & Cobb, $16,498; B. Preini, $16,651; Olin T. Benedict, Pittsfield, Mass., $16,720; M. Bianco, $16,806; M. L. Camarco, $17,238; H. I. Pier, $17,343; Horne Lowe Construction Co., $17,721; Way & Cellilli, $17,859; R. F. Hudson, Melrose, $17,963; F. E. Ellis, Melrose, $18,198; R. W. Emerson, $18,329; R. Pollato, $18,995; J. M. McCormick, $20,246; Hugh J. Maguire, $20,996. Noted Sept. 17.

+Boston, Mass.—The contract for paving Langden St., Roxbury District, has been awarded to the SIMPSON BROS. CORPORATION, at $6069. The only other bid was that of Charles B. Telless, at $6610. Noted Oct. 8.

+The contract for the construction of 10,000 lin.ft. of gravel roadway in Lanesboro has been awarded by the State Highway Commission to R. W. EMERSON, Pittsfield, at $10,313. Other bids were: Way & Cellilli, Springfield, $11,058; Framingham Contracting Co., $11,483; P. Perini, Rutland, $11,589; A. D. Bridge's Sons, Inc., $11,931; Lindberg & Cobb, Pittsfield, $12,046; Colonial Construction Co., Boston, $12,288; M. L. Camarco, Lee, $13,192; Horne Lowe Construction Co., Millbury, $13,233; S. W. Menaque, Stockbridge, $13,823; W. R. Pratt, Dalton, $13,918; Hyde, Crowe & Walsh, Pittsfield, $14,126; New England Contracting Co., Worcester, $14,523; Lane Construction Co., Meriden, Conn., $15,591; Cordner & Montague, Springfield, $16,463; Ross & Son, Woburn, $16,520.

+Albany, N. Y.—Bids were received by the State Highway Commission, 55 Lancaster St., Oct. 15, for the construction of public highways by state aid, as follows:

Road No. 5518, Allegany County, 4.75 miles—William J. Fox, Oramel, $56,998; Frank L. Cohen, Buffalo, $58,877; Drake & Deane, Buffalo, $56,123; Greenfield Construction Co., Hornell, $57,720; Sullivan Construction Co., Syracuse, $56,596; Frank L. Malone, Syracuse, $57,544; Kennedy Construction Co., Albany, $53,587; Edward T. Beck & Co., Warren, Penn., $59,973; Wood & Tompkins, Hilton, $58,872; Thomas F. Shaughnessy, Albany, $54,189; McLaughlin & Burchill, Syracuse, $56,519. Award withheld.

Road No. 1161, Broome County, 0.38 mile—John Kelley, Elmira, $28,791; Tyne & Willey, Binghamton, $27,958; C. D. DEAN, Albany, $24,789 (awarded contract); Joseph Walker Construction Co., Albany, $27,092; Arthur D. Osborne, Binghamton, $28,021.

Road No. 5243-B, Broome County, 4.29 miles—LANE CONSTRUCTION CORPORATION, Meriden, Conn., $22,879.

Road No 5213-A, Broome County, 4 67 miles—Lane Construction Corporation, Meriden, Conn., $66,760 JOSEPH WALKER CONSTRUCTION CO., Albany, N Y, $61,[illegible] (awarded contract)

Road No [illegible]6, Chenango County, 5 63 miles—Schunnemunk Construction Co, Highland Mills, $97,41[illegible], Paddleford & King, Sherburne, $97,6[illegible] James Anderson, Albany, $101,99[illegible] Joseph Walker Construction Co, Albany, $[illegible] NEWPORT CONSTRUCTION CO, Herkimer, $91,629 (awarded contract)

Road No 1[illegible], Cortland County, [illegible]25 miles—RICHARD HOPKINS, Troy, $45,419 (awarded contract) Joseph Walker Construction Co, Albany, $47,9[illegible] S P Hull, Cortland, $48,-[illegible] Hovey Benedict Williamsport, Penn, $47,49[illegible] Amos D Bridge's Sons, Hazardville, Conn, $45,64[illegible] Paddleford & King, Sherburne $47,[illegible], and nine others

Road No [illegible], Cortland County, 2 11 miles—John P Dugan & Co, Amsterdam, $26,3[illegible] Paddleford & King, Sherburne $[illegible] CROWE & WALSH, Pittsfield, Mass, $26,173 (awarded contract), Hovey Benedict, Williamsport, Penn, $26,9[illegible] Phelan & Sullivan, Utica, $29,32[illegible], S T Hull, Cortland, $[illegible], and two others

Road No [illegible], Clinton County, 6 72 miles—Lynden Construction Co, Albany, $74,1[illegible] Bluff Point Stone Co, Plattsburgh, $64,7[illegible] Flood & Van Virt, Hudson Falls, $73,170, Spellman-Oliver Co, Chateaugay, $66,7[illegible] RICHARD HOPKINS, Troy, $64,19[illegible] (awarded contract) Keeseville Roads Co, Keeseville, $67,62[illegible] J D Moynehan, Port Henry, $70,[illegible]

Road No 1[illegible]-A, Erie County, 0 39 mile—Austin W Simmons, Buffalo, $2[illegible],716 Fugate & Hutchinson, Olean, $20,370 Award withheld

Road No [illegible]-A Franklin Co, 0 92 mile—Tupper Lake Construction Co, Tupper Lake, $16,3[illegible] James L Kehoe, Newburgh, $1[illegible] JOHN F LEWIS, Albany, $14,426 (awarded contract) S R Russoff, Herkimer, $16,565

Road No 61[illegible], Fulton County, 9 26 miles—C W Tryon, Boyntonville, $9[illegible] Bridgeport Construction Co, Poughkeepsie $97,6[illegible] Amos D Bridge's Sons, Hazardville Conn, $[illegible] Hines Bros & Welch, Gloversville, $99,621, LANE CONSTRUCTION CORPORATION, Meriden, Conn, $91,70[illegible] (awarded contract), James Martin, Utica, $102,131, and four others

Road No 5[illegible]11, Hamilton County, 6 98 miles—Creeden & Fitch, New York, $103,7[illegible], Murray Construction Co, Troy, $[illegible] PARKER HASSAM PAVING CO, Worcester, Mass, $101,310 (awarded contract) Brown & Lowe Co, Schenectady, $1[illegible],849 C W Tryon, Boyntonville, $106,342 William G Fox, Saratoga Springs, $10[illegible], and five others

Road No [illegible]13, Herkimer County, 0 90 mile—Thurman W Dix, Burlington, Vt, $16,099 Phelan & Sullivan, Utica, $15,-[illegible] W J Kennedy, Utica, $16,191 Daniel L Mott, Utica, $16,[illegible] HARRY W ROBERTS & CO., Utica, $15,3[illegible]2 (awarded contract), and one other

Road No [illegible]11, Herkimer County, 0 09 mile—CROWE & WALSH, Pittsfield Mass $5542 (awarded contract), James Dempsey Frankford $6126

Road No [illegible]72, Herkimer County, 6 15 miles—Lane Construction Corporation, Meriden, Conn, $66,400, Joseph Walker Construction Co, Albany, $66,2[illegible] STATE HIGHWAY CONSTRUCTION CO, Beacon, $63,838 (awarded contract), James Anderson, Albany, $66,017, Newport Construction Co, Herkimer, $73,[illegible]

Road No [illegible]1[illegible], Madison County, 0 61 mile—John H Gordon, Albany $10,374 S P Hull, Cortland, $10,391, C O McComb, Syracuse, $10,372 Paddleford & King, Sherburne, $10,-[illegible] John P Dugan & Co Amsterdam, $[illegible] CROWE & WALSH Pittsfield, Mass, $9[illegible] (awarded contract), W K Kennedy, Utica, $10,[illegible]

Road No 12[illegible]1 Nassau County 0 61 mile—Fairfield Landscape & Nurseries Co New York $7815 Helling Bros, [illegible]lenhurst, $[illegible] Murray & Gardner, Inc, Center Moriches, $7[illegible] Delta Contracting Co, Jamaica, $[illegible] John H Eldert, Richmond Hill, $[illegible] James Garafano & Sons, Mt Vernon, $[illegible] DAVID FALCONER CONTRACTING CO, Long Island City $[illegible] (awarded contract)

Road No [illegible], Otsego County, 7 75 miles—Langen Construction Corporation Albany, $96,616 Parker-Hassam Paving Co, Worcester, Mass, $[illegible] Joseph Walker Construction Co, Albany $[illegible] Brown & Lowe Co, Schenectady, $[illegible] Newport Construction Co Herkimer, $[illegible] Paddleford & King, Sherburne $[illegible] CARANFA CONSTRUCTION CO, Troy, $91,[illegible] (awarded contract), and two others

Road No 11[illegible] Oneida County, 11 73 miles—Dale Engineering Co, Utica, $119,[illegible] James Anderson, Albany, $131,6[illegible] [illegible] Construction Co, Utica $1[illegible] P H Murray, [illegible] $11[illegible] Conroy & Nivlorf, Oneida, $11[illegible] Newport Construction Co, Herkimer $11[illegible] JOSEPH WALKER CONSTRUCTION CO Albany $1[illegible],181 (awarded contract), State Highway Construction Co, Beacon, $1[illegible]

Road No [illegible], Onondaga County, [illegible] miles—J W Brennan Construction Co, Geneva, $1[illegible] Joseph Walker Construction Co, Albany, $[illegible] James Anderson, Albany, $[illegible] Sullivan Construction Co, Syracuse $[illegible] John [illegible] Monroe Roads Co, Pittsford $[illegible] DALE ENGINEERING CO, Utica, $[illegible] (awarded contract), and nine others

[illegible]

Road No 1[illegible] [illegible] County, [illegible] miles—KENNEDY CONSTRUCTION CO, Albany, $[illegible] (awarded contract) [illegible]

[illegible]

[illegible]

[illegible]

$69,393 Bradley & Nolan, Corning, $70,083, JOSEPH WALKER CONSTRUCTION CO, Albany, $63,2[illegible] (awarded contract) Thomas Fitzgerald Co, Fredonia, $68,982, Greenfield Construction Co, Hornell, $69,396, and 11 others

Road No 1211, Seneca County, 1 19 miles—Sullivan Construction Co, Syracuse, $71,139, Thomas F Shaughnessy, Albany, $69,[illegible]23, Drake & Deane Co, Buffalo, $70,2[illegible], PATRICK D CONLEY, Ithaca, $69,511 (awarded contract), J W Brennan Construction Co, Inc, Geneva, $70,230 Stanley Construction Co, Buffalo, $71,5[illegible], and nine others

Road No 1169, Tompkins County, 6 31 miles—Peter F Connolly Co, Horseheads, $6[illegible],001 Patrick D Conley, Ithaca, $63,997 WILLIAM HAZZARD, Trumansburg, $60,941 (awarded contract); Richard Hopkins, Troy, $62,715, Lane Construction Corporation, Meriden, Conn, $6[illegible],962, McGreevey, McGuigan & Baum, Elmira, $6[illegible],616

Road No [illegible]361-A, Westchester County, 1 68 miles—State Highway Construction Co, Beacon, $21,992, James Garafano & Son, Inc, Mt Vernon, $20,762 Frank E Gore, New York, $21,242 Eggleston & Garthwaite, Yonkers, $21,463 Joseph Johnson Sons, West New Brighton, $21,102, ALEX ROHAN Haverstraw, $20,269 (awarded contract)

Road No 1219, Yates County, 6 miles—Atlanta Construction Co, Atlanta, $77,564, J W Brennan Construction Co, Geneva, $80,361 Ontario Roads Co, Inc, Manchester, Conn, $78,795 Charles M Kelley, Penn Yan, $7[illegible],706 Greenfield Construction Co, Hornell, $81,999, Parker-Hassam Paving Co, Worcester, Mass, $82,397, McLaughlin & Burchill, Syracuse, $79,76[illegible] Award withheld

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by L H Pounds, Pres of the Borough of Brooklyn, until 11 a m, Oct 27, for improving East Seventh St from Ditmas to 18th Ave East Ninth St from Ave N to Ave O, East 18th St from Ave M to Ave N East 22d St from Ditmas to Newkirk Ave East 23d St from Ave M to Ave N, East 24th St from Ave M to Ave N Hinsdale Ave from Riverdale Ave to New Lots Ave, and for 100 tons of refined asphalt

(Borough of Manhattan)—(Official)—Bids will be received by R A C Smith, Comr of Docks, Pier "A," foot of Battery Place, North River, until noon, Oct 27, for cement, sand and 1½-in broken stone

✦**Rome, N. Y.**—The contract for paving Rouck St from Dominick to Whitesboro St has been awarded to the WARREN BROS Co, at $7781

Hoboken, N. J.—(Official)—Bids will be received, until [illegible] p m, Oct 28, by James H Loudrigan, City Clk, for repaving and improving portions of Jefferson St, Madison St and the adjoining streets to the extent necessary for a proper connection with the new improvements

Jersey City, N. J.—(Official)—Bids will be received, until 2 p m, Oct 29, by Michael I Fagan, City Clk, for asphalt paving on Enos Place from Sip Ave to Newkirk St also for asphalt pavement on Stegman St, from Ocean Ave to Garfield Ave

Jersey City, N. J.—Bids will be received by the Board of Chosen Freeholders of Hudson County until 3 p m Oct 2[illegible] for the sale of $150,000 in bonds, the proceeds of which will be used for repairing the Hudson County Boulevard.

Newton, N. J.—Bids will be received by the Board of Chosen Freeholders of Sussex County, until Nov 9, for constructing the Newton-Sparta Rd William Iliff is Dir Noted Sept 24 and Oct 8

Paterson, N. J.—The Board of Chosen Freeholders of Passaic County plans for the construction of a road from the Charcoal Road to Greenwood Lake Glens, and for the improvement of Charcoal Road, at a cost of about $30,000 County Engineer Garwood Ferguson will prepare plans

Perth Amboy, N. J.—The City Council is negotiating with the Board of Freeholders for the improvement of New Brunswick Ave Approximate cost is $15,000

Harrisburg, Penn.—(Official)—Bids will be received by W H Lynch, Supt of St and Pub Improvements until noon Oct 24, for constructing approximately 31,000 sq yd of sheet asphalt

Harrisburg, Penn.—Bids will be received until 10 a m, Nov 1[illegible], at the office of the State Highway Department, Capitol Bldg, for the following road construction Washington County, Cecil Township—11,3[illegible] lin ft asphaltic concrete and 1500 lin ft brick block pavement 16 ft wide Chester County, Penn Township—666[illegible] lin ft asphaltic bituminous macadam (penetration method) 16 ft wide Jefferson County, Brookville Borough—[illegible]100 lin ft brick block pavement 16 ft wide Beaver County Moon and Hopewell Townships—13,19[illegible] lin ft brick block pavement 16 ft wide Edward M Bigelow is Comr

✦**Baltimore, Md**—The contract has been awarded by the city for the grading, curbing and paving with sheet asphalt on concrete base, McElderry St from Linwood Ave to [illegible] Lane about 31[illegible] sq yd, to the BALTIMORE ASPHALT BLOCK & TILE CO, [illegible]31 Courtland St

✦**Bel Air, Md**—The contract for paving Hughes Hill Road through [illegible] to the Pennsylvania State Line has been awarded to the JUNIATA PAVING CO, Philadelphia, Penn, at $[illegible]

Princeton, W Va—Bids will be received by the Commissioners of Mercer County until Oct [illegible] for improving several roads and for constructing three steel bridges across the Bluestone River W I [illegible] is Co Engr

✦**Hamilton, Ala**—A contract for constructing approximately [illegible] miles of graded road has been awarded to BOYD & BRADSHAW at $[illegible] Noted Sept [illegible]

Montgomery, Ala—Bids will be received by Robert [illegible] City Treas, until Oct [illegible] for paving Dunbar St

✦**Ozark, Ala**—(Official)—The contract for improving a section of the Ozark and Ariton Road has been awarded to J O BROWN, Montgomery, at $[illegible] As only $[illegible] has been appropriated only part of the work will be done Other bids were J J Dupuntvant $[illegible] Whatley Bros $[illegible] D H [illegible] & Co $[illegible] [illegible] Construction Co $[illegible] Noted [illegible]

Memphis, Tenn.—J. H. Weatherford, City Engr., has prepared plans for surfacing Summit St. from Union to Vinton Ave. with gravel.

Athens, Ohio—Bart Davidson, Dir. of Pub. Ser., will receive bids, until Oct. 24, for grading, draining, curbing and paving Stewart St.

Cincinnati, Ohio—Bids will be received by the County Commissioners, until noon, Nov. 6, for improving the Miles Road in Springfield Township and the North Bend Road in Green Township.

Cleveland, Ohio—(Official)—Bids will be received by the Board of County Commissioners, until 10 a.m., Oct. 31, for the improvement of the Pettibone Road from Broadway Road to Som Center in Solon Township. E. G. Krause is Clk. of the Comrs.

Girard, Ohio—(Official)—Bids will be received by the Village Council, until noon, Oct. 26, for improving sections of State and Prospect St.

+Lorain, Ohio—The contract for paving Oberlin Ave. has been awarded to the OHIO ENGINEERING CO., at $37,000. Noted Sept. 24.

Mansfield, Ohio—An election will be held in November to vote on the question of issuing $30,000 in bonds, the proceeds of which will be used for the improvement of the road from Mansfield to Ashland and from Mansfield to Wooster.

+Swanton, Ohio—The contract for paving North Main St. has been awarded to the MINNICK CONSTRUCTION CO., New Castle, Ind., at $15,657. Other bids were: McKinney Bros., Toledo, Ohio, $18,617; G. H. Heffner & Son, Celina, $17,160; R. C. Roach, Waterville, $16,548; Lininger & Burnett, Conneaut, at $16,432.

Wapakoneta, Ohio—Henry Moser, Dir. of Pub. Ser., will receive bids, until Nov. 6, for paving Perry and Main Sts.

+Indianapolis, Ind.—The contract for paving East New York St., from Dorman St. to Arsenal Ave., has been awarded to the REPUBLIC CONSTRUCTION CO., at $10,522.

Vevay, Ind.—(Official)—Bids will be received by the Treasurer of Whitley County, until 1:30 p.m., Nov. 7, for the sale of $18,560 in bonds for highway improvements.

Vincennes, Ind.—Bids will be received by H. J. Watts, until 4 p.m., Oct. 26, for paving 29,000 sq.yd. with asphalt, wood block, concrete or brick.

+Wyandotte, Mich.—The contract for paving Oak St., from 12th to 13th, has been awarded to R. D. BAKER & CO., at $13,067.

Champaign, Ill.—All bids received by the Board of Local Improvements for paving Healy St. have been rejected. The work will be readvertised.

+Moline, Ill.—The contract for paving 13th St. with asphalt has been awarded to the McCARTHY IMPROVEMENT CO.

+Monroe, Wis.—The contract for paving Emerson St. has been awarded to THOMAS QUINN, Madison.

+St. Paul, Minn.—The contract for paving a section of Robert St. has been awarded to the GENERAL CONTRACTING CO.

+Sioux Falls, S. D.—A contract for paving sections of Summit Ave. and Ninth St. has been awarded to C. H. ATKINSON CO., Watertown. Noted Sept. 3.

+Bozeman, Mont.—THE WARREN CONSTRUCTION CO. has been awarded the contract for paving College St. from Central to Tracy Ave.

+Kansas City, Mo.—THE CLEVELAND-TRINIDAD PAVING CO., Cleveland, Ohio, has been awarded the contract for paving Cypress St., from 24th to 27th St., 6097 sq.yd., with concrete. The approximate cost is $5426.

+Little Rock, Ark.—The contract for paving West 17th St. with asphalt has been awarded to M. D. L. COOK, at $5885.

Marion, Ark.—Bids will be received by F. K. Lashbrook, Secy. of the Crittenden County Road Improvement District, until noon, Nov. 3, for the sale of $325,000 in bonds, the proceeds of which will be used for the improvement of roads.

+Houston, Tex.—The contract for paving Webster St. from Crawford to St. Emanuel St. has been awarded to HORTON & HORTON.

(Official)—Bids will be received by Ben Campbell, Mayor, until 2 p.m., Oct. 24, for improving sections of Louisiana St.

Tulsa, Okla.—(Official)—Bids will be received by the Board of Commissioners, until 5 p.m., Oct. 26, for improving several streets. E. B. Cline is City Audr.

Albion, Idaho—At an election to be held in November, the citizens of Cassia County will vote on the question of issuing $50,000 in bonds, the proceeds of which will be used for constructing roads.

Everett, Wash.—An election will be held, Nov. 3, to vote on the question of issuing $1,500,000 in bonds for improving roads.

Vancouver, Wash.—(Official)—Bids will be received by the State Highway Board, until 2 p.m., Oct. 26, for improving the Pacific Highway between Woodland and La Center. W. R. Roy is Secy. of the Bd.

+El Monte, Calif.—A contract for improving approximately 23,000 lin.ft. of road has been awarded to J. O. STANFORD, Long Beach, at $15,000.

+Huntington Beach, Calif.—PEARSON & ANDERSON, Venice, have been awarded the contract at $24,742 for concrete paving on 17th St. and Delaware Ave. Noted Oct. 15.

+Inglewood, Calif.—The contract for improving Allen Ave. has been awarded to J. HEIN, 511 Stimson Bldg.

+Los Angeles, Calif.—GEO. H. OSWALD, O. T. Johnson Bldg., has been awarded the contract at $118,122, for improving Moneta Ave., between Slauson and Manchester Ave. The work consists of 525,200 sq.ft. asphalt paving, 17,900 ft. curb, 203,000 sq.ft. sidewalk, 17,963 sq.ft. concrete gutter, also a reinforced concrete culvert.

Martinez, Calif.—Bids will soon be received by the Board of Supervisors of Contra County for constructing the Bay Point-Martinez Highway. The estimated cost is $167,000.

Monterey, Calif.—The City Engineer is preparing plans for the improvement of Tyler, Pacific, El Dorago and Carmelito St. H. J. Schaufele is the Comr. of Pub. Wks.

Pasadena, Calif.—Bids will be received by H. Dyer, City Clk., until 9 a.m., Oct. 27, for improving Stevenson Ave. from East Orange Grove Ave. to Washington St. Approximately ¾ of a mile will be improved.

+Riverside, Calif.—The contract for improving a section of Magnolia Ave. has been awarded to JOHNSON & SHEA CO., Riverside, at $31,859.

Sacramento, Calif.—(Official)—Bids were received by the State Highway Commission, Oct. 5, for constructing roads in various counties as follows: (a) Humboldt County, Route 1, Sect. D; (b) Alameda County, Route 5, Sect. A.; (c) Santa Barbara County, Route 2, Sect. A; (d) Santa Barbara County, Route 2, Sect. C; (e) Santa Barbara County, Route 2, Sect. G and I; (f) San Luis Obispo County, Route 2, Sect. B; (g) San Luis Obispo County, Route 2, Sect. D; (h) Solano County, Route 2, Sect. D; (i) Imperial County, Route 12, Sect. A; (j) Sacramento County, Route 11, Sect. A; (k) Humboldt County, Route 1, Sect. G; George W. Conners, Eureka, (a) $30,937, (g) $49,750, (k) $28,524; William Crowley & T. E. Clarey, Eureka, (a) $28,625, (k) $25,993; Rush R. Smith, Fortuna, (a) $31,286, (k) $32,153; F. H. Green, Eureka, (a) $29,292, (k) $28,497; Elsemore & Jacobs, Eureka, (a) $33,906, (k) $18,778; Petersen & Grier, San Francisco, (b) $46,749; Palmer & McBryde, San Francisco, (b) $38,032; P. L. Burr, San Francisco, (b) $46,891, (e) $103,010, (g) $44,679; F. Rolandi, San Francisco, (c) $18,751, (d) $74,127, (f) $75,761; Rogers Bros. Co., Los Angeles, (c) $18,856, (d) $62,680, (f) $73,775, (i) $99,724; Rice & Dutcher, Imperial, (c) $21,264, (d) $67,953, (f) $78,902, (i) $86,052; Tieslau Bros., San Francisco, (d) $72,978, (f) $86,332; W. E. Calahan Construction Co., Arlington, (e) $97,432; R. H. McCray Co., Los Angeles, (e) $82,284; J. H. McMillen, Wasco, (b) $92,897, (g) $63,329; Brashear Burns Co., Los Angeles, (e) $82,411, (g) $61,191; C. H. Hudson, Los Angeles, (e) $79,191, (f) $76,920, (g) $47,111; Bates, Borland & Ayer, Stockton, (f) $78,825, (h) $46,153; J. W. Calback, San Diego, (f) $71,989, (i) $68,145; Berry Mackee & Co., San Francisco, (a) $50,787, (k) $27,213; Joseph Mulligan, Los Angeles, (g) $47,837; Richard Rothwell, Los Angeles, (g) $65,577; Marsh Bros. & Gardenier, Inc., San Francisco, (g) $53,009; Sandercock Transfer Co., San Luis Obispo, (g) $66,395; Enoch S. Hunt, Alameda, (g) $46,605; Mahoney Bros., San Francisco, (g) $53,837; A. M. Gorrill, San Francisco, (h) $47,054, (j) $39,141; Commary Petersen Co., San Francisco, (h) $63,943; Callahan & Hedrick, El Centro, (i) $72,132; Rochelt & Stevens, Los Angeles, (i) $69,921. Noted Sept. 24.

Sacramento, Calif.—Bids will be called in about two weeks for 23.7 miles of state highway construction, including 8.4 miles between Williams and Colusa County, 11.7 miles in Imperial County between Wells and Dixieland, and 3.6 miles in Orange County, on the easterly boundary. The estimated cost is $250,000.

+San Bernardino, Calif.—The contract for improving Sixth St. from B to I St. has been awarded to W. D. BOHAN, at $23,335. Noted Sept. 24.

Santa Monica, Calif.—Bids will be received by G. A. Murray, City Clk., until 2 p.m., Oct. 26, for improving 26th St. between the right-of-way of the Pacific Electric Ry. Co. and the northwest city limits.

+Santa Monica, Calif.—A contract for improving a number of streets has been awarded to the JOY CONSTRUCTION CO., at $36,114.

+Upland, Calif.—The contract for improving San Antonio Ave. has been awarded to the SOUTHERN CALIFORNIA CONSTRUCTION CO., Ocean Park, at $53,262.

+Whittier, Calif.—The contract for constructing about 100,000 sq.ft. of asphalt paving on Philadelphia St. has been awarded to the FAIRCHILD-GILMORE-WILTON CO., at $14,800. Noted Oct. 1.

East View, Ont.—The contract for constructing concrete sidewalks on Montreal Road has been awarded by the City Council to A. NEWLANDS, Belmont Ave., Ottawa, South, at approximately $8000.

+Ottawa, Ont.—A contract for constructing 32,976 sq.yd. of asphalt, 9808 sq.ft. water table, 13,598 lin.ft. of gutter and 4676 lin.ft. of curb and gutter has been awarded to the OTTAWA CONSTRUCTION CO., at $85,892.

INDUSTRIAL WORKS

Bridgeport, Conn.—Bids are being received by Briggs & Caldwell, Archs., 309 Security Bldg., for the construction of a cold storage building on Congress St., for the Terry Estate.

Hartford, Conn.—Bids are being received by the Capitol City Lumber Co., 115 Front St., for the construction of three buildings on Park St. Ford, Buck & Sheldon, 60 Prospect St., Hartford, are the Engrs.

+Stamford, Conn.—The contract for the construction of two buildings for Richards & Co. has been awarded to J. W. FERGUSON, Stamford.

Dunkirk, N. Y.—The Dunkirk Industrial Co. contemplates erecting a three-story silk glove mill, 57x57 ft., for the American Glove Co.

+Edwards, N. Y.—The contract for three reduction mills for the Northern Ore Co. has been awarded to DUNN & SHERIDAN, 1123 Broadway, New York.

Geneseo, N. Y.—The foundry of the Geneseo Foundry Co., recently destroyed by fire, will be rebuilt.

+Jamestown, N. Y.—The general contract for the construction of a three-story factory for the Seabury Co. has been awarded to ALBIN JOHNSON, Connecticut Ave.

+New York, N. Y.—(Borough of Bronx)—The general contract for the construction of the three-story reinforced-concrete bakery at Wales Ave. and 142d St. has been awarded to WILLIAM HENDERSON, INC., 516 Fifth Ave., New York.

New York, N. Y.—(Borough of Manhattan)—Plans have been completed by Maynicke & Francke, Archs., 25 East 26th St., for the construction of an 11-story stock house at 210 East 92d St. The estimated cost is $150,000.

New York, N. Y.—(Borough of Queens)—The Sterling Gum Co., Long Island City, will erect a [illegible]-story and basement factory on Harris Ave., Long Island City.

New York, N. Y.—(Borough of [illegible])—The Sullivan Bottle Works Co. is planning the erection of a factory on [illegible] St. [illegible].

✦**New York, N. Y.**—(Borough of [illegible])—The American [illegible] Co. has awarded the contract for the construction of [illegible] buildings at Tompkinsville, S. I., to the R. & W. CONSTRUCTION Co., Newark, N. J., at $[illegible].

Syracuse, N. Y.—[illegible] & [illegible], Archs., are receiving bids for the [illegible]-story [illegible] ft. factory for the O. K. Mfg. Co. The estimated cost is $[illegible].

Syracuse, N. Y.—The Syracuse Motor Car Co., 235 West [illegible] St., [illegible] erecting a garage on West Willow St. The estimated cost is $[illegible].

✦**Bordentown, N. J.**—The contract for the construction of the [illegible]-story [illegible] factory for [illegible] & Son has been awarded to H. B. MILLER, Edgewater, N. J. Noted Sept. 17.

✦**Newark, N. J.**—The Spring St. Realty Co. has awarded the contract to JAMES CONNELLY for additions and improvements to its factory at 16 Spring St.

Passaic, N. J.—The Passaic Glass Co., Passaic, has had plans prepared for an addition, one story, 40x60 ft.

Paterson, N. J.—T. A. Gillespie & Co., 50 Church St., New York, are having plans prepared for a pipe factory to cost $[illegible].

✦**Townley** ([illegible] P. O.), **N. J.**—(Official)—The contract for the construction of the grain elevator at Townley for Charles [illegible] & Son, [illegible] Meserole St., Brooklyn, N. Y., has been awarded to the TURNER CONSTRUCTION CO., 11 [illegible], New York. Hosmer & Co., 118 Market St., Newark, N. J., are the Archs.

Philadelphia, Penn.—The Linde Air Products Co. plans to erect a plant on [illegible] and [illegible] Sts.

✦The contract for the construction of the two-story brick factory for the [illegible] Mfg. Co. has been awarded to HALLOWELL [illegible] CO., Philadelphia, Penn. Noted Oct. 15.

✦The contract for the construction of the eight-story brick and concrete factory at [illegible] and Market Sts., for E. M. [illegible], has been awarded to WILLIAM STEELE & SONS CO., Philadelphia. The estimated cost is $[illegible].

Reading, Penn.—[illegible], Arch., 119 South Fifth St., has prepared plans for the three-story, 37x[illegible] ft. factory for [illegible]. The estimated cost is $[illegible].

Wilkes-Barre, Penn.—[illegible] & Poggi, Archs., Wilkes-Barre, have prepared plans for the construction of colliery [illegible] for the [illegible] & Wilkes-Barre Coal Co. The estimated cost is $[illegible].

Cumberland, Md.—The Builders' Supply Co. will erect a three-story brick and reinforced-concrete warehouse. The estimated cost is $[illegible].

✦**Winston-Salem, N. C.**—The contract for the construction of the building for the [illegible] Knitting Co. has been awarded to the FOGLE BROS. CO., Winston-Salem.

✦**Whitney, S. C.**—The Whitney Mfg. Co., Whitney, S. C., has awarded the contract for the construction of a three-story mill at Whitney to the JORDAN MUNN CONSTRUCTION CO., Greenville, S. C. The estimated cost is $[illegible].

Cleveland, Ohio—Willard Hirsh, Arch., 1302 Swetland Bldg., is preparing plans for the construction of a two-story factory for the [illegible] Ice Cream Co., [illegible] Bldg. Estimated cost, $[illegible].

[illegible] & [illegible], Archs., Penobscot Bldg., Detroit, Mich., have completed the plans for the construction of a [illegible] ft. four-story and basement factory, for the Otis Elevator Co., [illegible] News Bldg. Estimated cost, $6[illegible].

✦**Springfield, Ohio**—The contract for the construction of a [illegible]-story [illegible] has been awarded to the CONCRETE STEEL CONSTRUCTION CO. by [illegible]. Estimated cost, $[illegible]. Noted [illegible] 27.

Gary, Ind.—The [illegible] Brick & Tile Co. contemplates erecting a plant, the first unit of which will cost $[illegible]. [illegible]

✦The contract for the construction of a three-story factory [illegible] for the Detroit Creamery Co., [illegible] and [illegible] Ave., has been awarded to MAX BARTHOLOMAEI, [illegible] Warren Ave., West Detroit. Estimated cost, $[illegible].

✦**Pontiac, Mich.**—The general contract for the construction of the [illegible]-story [illegible] plant at Pontiac for [illegible] has been awarded to [illegible] BROS.

✦**Blue Island, Ill.**—The contract for the construction of the [illegible] for [illegible], [illegible] Vermont St., has been awarded to the [illegible] ENGINEERING & CONSTRUCTION CO., [illegible].

Chicago, Ill.—[illegible], Archs., [illegible] South [illegible] Ave., are receiving bids for the construction of a [illegible]-story garage [illegible] for the [illegible] Garage Co., [illegible]. The estimated cost is $[illegible].

Elgin, Ill.—[illegible] Archs. [illegible] for the construction of a [illegible] factory for the [illegible] Mfg. Co. The estimated cost is $[illegible].

Milwaukee, Wis.—The [illegible] Co. [illegible] the construction of a [illegible] building on [illegible]. Estimated cost, $[illegible].

St. Louis, Mo.—Plans are being prepared by [illegible] for the construction of a [illegible]-story factory and [illegible] building for the [illegible] Transfer Co. The estimated cost is $[illegible].

[illegible] have been prepared by [illegible] Co., Archs., [illegible] for the construction of a [illegible]-story [illegible] factory, for the J. L. [illegible]. Estimated cost, $[illegible].

✦**Portland, Ore.**—The contract for the construction of a [illegible]-story [illegible] for the [illegible] has been awarded to [illegible]. Estimated cost, $[illegible].

Agnew, Calif.—The Pacific Chemical Co., Berkeley, Calif., is having plans prepared by William Binder, Arch., San José, Calif., for a group of factory buildings at Agnew, estimated to cost $60,000.

✦**Pomona, Calif.**—The contract for the construction of an ice plant has been awarded to F. L. SOMERS, for the La Verne Orange Growers Association. Estimated cost, $[illegible].

FEDERAL GOVERNMENT WORK

The following allotments have been made from the River and Harbor Act of Oct. 2, 1914, appropriating $[illegible] for preservation and maintenance of existing river and harbor works and for the prosecution of projects heretofore authorized:

Portland Harbor, Maine, $[illegible]; Isles of Shoals Harbor, Maine, $[illegible]; Salem Harbor, Mass., $[illegible]; Boston Harbor, Mass., $[illegible]; Stonington Harbor, Conn., $[illegible]; New Haven Harbor, Conn., $[illegible]; Housatonic River, Conn., $[illegible]; Thames River, Conn., $[illegible].

Port Chester Harbor, N. Y., $1[illegible]; Mamaroneck Harbor, N. Y., $3[illegible]; Gowanus Bay, N. Y., [illegible]; Bay Ridge and Red Hook Channels, $1[illegible]; Harlem River Channel, New York Harbor, $1[illegible]; Charlotte Harbor, N. Y., $[illegible]; East Chester Creek, N. Y., $2[illegible]; Westchester Creek, N. Y., $[illegible]; Harlem River, N. Y., $[illegible]; Hudson River, N. Y., $[illegible]; Staten Island Sound, N. Y. and N. J., $[illegible]; Raritan Bay, N. J., $[illegible]; Newark Bay and Passaic River, N. J., $[illegible]; Woodbridge Creek, N. J., $[illegible]; Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth Rivers, Shoal Harbor and Compton Creek and Cheesequake Creek, N. J., $[illegible]; Shrewsbury River, N. J., $[illegible]; Absecon Inlet, N. J., $[illegible].

Delaware River below Philadelphia, Penn., $[illegible]; Wilmington Harbor, Del., $[illegible]; Pittsburgh Harbor, Penn., $[illegible]; Waterway from Chincoteague Bay, Va., to Delaware Bay, Del., $[illegible].

Potomac River at Washington, D. C., $[illegible]; Mattaponi and Pamunkey Rivers, Va., $[illegible]; Rappahannock River, Va., $5000; Beaufort Harbor, N. C., $[illegible]; Beaufort Inlet, N. C., $10,000; Fishing Creek, N. C., $[illegible]; Pamlico and Tar Rivers, N. C., $18,[illegible]; Bay River, N. C., $[illegible]; Contentnea Creek, N. C., $2[illegible]; Neuse River, N. C., $[illegible]; Swift Creek, N. C., $[illegible]; Waterway from Pamlico Sound to Beaufort Inlet, N. C., $[illegible]; New River, N. C., [illegible] waterways between Beaufort Harbor and New River and between New River and Swansboro, $16,[illegible]; Northeast [illegible] and Cape Fear [illegible] Wilmington Rivers, N. C., $[illegible]; Cape Fear River above Wilmington, N. C., [illegible] $[illegible]; Cape Fear River at and below Wilmington, N. C., $11[illegible]; Charleston Harbor, S. C., [illegible] $[illegible]; Winyah Bay, S. C., $15,[illegible]; Great Pee Dee River, S. C., [illegible], Wateree and Congaree Rivers, S. C., $[illegible].

Savannah Harbor, Ga., $[illegible]; Brunswick Harbor, Ga., $[illegible]; Savannah River below Augusta, Ga., $1[illegible]; Altamaha, Oconee and Ocmulgee Rivers, Ga., $[illegible]; Flint River, Ga., $[illegible]; Chattahoochee River, below Columbus, Ga., $[illegible]; Coosa River, Ga., and Ala., Lock and Dam No. [illegible] and Dam No. 5, $3[illegible]; Lock and Dam at [illegible], Ga., $[illegible]; Tampa Bay, Fla., $[illegible]; St. Petersburg Harbor, Fla., $[illegible]; Apalachicola Bay, Fla., $[illegible]; St. Andrews Bay, Fla., $[illegible]; Narrows in Santa Rosa Sound, Fla., $[illegible]; St. Johns River, Fla., Jacksonville to the ocean, $[illegible]; Jacksonville to Palatka, $[illegible]; Palatka to Lake Harney, $[illegible]; Indian River, Fla., $[illegible]; Caloosahatchee River, Fla., $[illegible]; [illegible] River, Fla., $10,[illegible]; Apalachicola River, Fla., [illegible]; [illegible] Slough, lower Chipola River and upper Chipola River from Marianna to its mouth, $[illegible]; Channel from Clearwater Harbor to Tampa Bay, Fla., $[illegible]; Channel from Apalachicola River to St. Andrews Bay, Fla., $[illegible]; Choctawhatchee River, Fla., and Ala., $[illegible]; [illegible] and [illegible] the water hyacinth in Fla., Miss., La., and Tex., $[illegible].

Mobile Harbor, Ala., $[illegible]; Mobile Bar, Ala., $[illegible]; Alabama River, Ala., including Coosa River up to Wetumpka, $[illegible]; Black Warrior and Tombigbee Rivers, [illegible]; [illegible]; Gulfport Harbor and Ship Island Pass, Miss., $[illegible]; [illegible] Rivers, Miss., $[illegible]; [illegible] and [illegible] Rivers, [illegible]; Tallahatchie, Big Sunflower and Coldwater Rivers, Tchula Lake, [illegible] and Washington Bayous, Lake Washington and Deer Creek, $[illegible]; Big Sunflower River, Miss., lock and dam, $[illegible]; [illegible] River, [illegible], Bayou Teche, La., $[illegible]; Bayou Vermilion and Mermentau River, La., and tributaries, including [illegible] Bayous, $[illegible]; Bayou Terrebonne, La., $[illegible]; Atchafalaya River below Morgan City, La., $[illegible]; [illegible], La., $[illegible].

Galveston Harbor, Tex., $[illegible]; Channel from Galveston Harbor to Texas City, Tex., $[illegible]; Port Bolivar Channel, Tex., $[illegible]; Port Aransas, Tex., $[illegible]; Sabine Pass, Tex., $[illegible]; [illegible] Channel, Tex., $[illegible]; [illegible] Channel, [illegible] Trinity River, [illegible] [illegible]

[illegible]

Red River, [illegible] Fulton, Ark., $[illegible]; Red River below Fulton, Ark., [illegible] [illegible] Arkansas River, Ark., [illegible]; White River, Ark., $[illegible]; [illegible] Ouachita and [illegible] Rivers, Ark. and La., [illegible]; [illegible] St. Francis and L'Anguille Rivers and Blackfish Bayou, Ark., $[illegible].

Tennessee River between Florence and Riverton, Ala., $[illegible] below Riverton, Ala., $[illegible]; Cumberland River [illegible] [illegible] Harbor, Ohio, $[illegible]; Port Clinton Harbor, Ohio, $[illegible]; Huron Harbor, Ohio, [illegible]; Vermilion Harbor, Ohio, $[illegible]; Cleveland Harbor, Ohio, $[illegible]; Conneaut Harbor, Ohio, $[illegible].

Ohio River: Open-channel work, $19,000; locks and dams, $1,750,000; Ontonagon Harbor, Mich., $10,000; St. Joseph Harbor, Mich., $3000; South Haven Harbor, Mich., $4500; Muskegon Harbor, Mich., $4500; Ludington Harbor, Mich., $6000; Frankfort Harbor, Mich., $4000; Charlevoix Harbor, Mich., $2000; waterway across Keweenaw Point, Mich., harbor of refuge, $75,000; Ashland Harbor, Wis., $10,000; Racine Harbor, Wis., $3000; Fox River, Wis., $10,000; Warroad Harbor, Minn., $2000; Zipple Bay, Lake of the Woods, Minn., $1000; Agate Bay, Minn., $5000; Chicago River, Ill., $10,000; Calumet River, Ill., $10,000; Michigan City Harbor, Ind., $50,000.

Mississippi River: Head of passes to Ohio River (work of Mississippi River Commission), $3,750,000; Ohio River to Missouri River, $250,000; Missouri River to Minneapolis, Minn., $800,000; St. Paul to Minneapolis, Minn., $150,000; Brainerd to Grand Rapids, Minn., $4000; Missouri River: Kansas City to the mouth, $850,000; Kansas City to Sioux City, $50,000; Sioux City to Fort Benton, $50,000; Gasconade River, Mo., $15,000.

Los Angeles Harbor, Calif., $42,000; Oakland Harbor, Calif., $98,000; Humboldt Harbor and Bay, Calif., $200,000; Sacramento and Feather Rivers, Calif. (work of the California Débris Commission), $60,000; Coos Bay, Ore., $70,000; Coquille River, Ore., $26,000; Siuslaw River, Ore., $5000; Snake River, Ore., Wash., and Idaho, $5000; Columbia River and tributaries above Celilo Falls to the mouth of Snake River, Ore., and Wash., $10,000; Columbia River, between the foot of the Dalles Rapids and the head of Celilo Falls, Ore., and Wash., $525,000; Willamette and Yamhill Rivers above Portland, Ore., $25,500; Columbia and lower Willamette Rivers below Portland, Ore., $200,000; Columbia River at the mouth, Ore. and Wash., $1,000,000; Grays Harbor and Chehalis River, Wash., $15,000; Grays Harbor and Bar, Wash., $110,000; Columbia River, between Bridgeport and Kettle Falls, Wash., $35,000; Cowlitz and Lewis Rivers, Wash., $6000.

Reserved for contingencies, $995,220.

Elevators—Bangor, Maine—Bids will be received by Oscar T. Wenderoth, Superv. Arch., Washington, D. C., until 3 p.m., Nov. 9, for installing an electric passenger elevator and a hydraulic freight lift in the U. S. post office at Bangor.

+Concrete Coal Pocket—Fort Williams (Cape Cottage post office), Maine—The contract for the construction of a concrete coal pocket at Fort Williams has been awarded to the SAUNDERS CONTRACTING CO., Portland, Maine, at $8253. Noted Sept. 24.

Storehouse—Portsmouth, N. H.—The Quartermaster-General has directed the Constructing Quartermaster at Fort Constitution, N. H., to prepare plans and call for bids for the construction of a storehouse at Portsmouth.

Headstones—Boston, Mass.—Bids were received by Lieut.-Col. W. S. Wood, Depot Quartermaster, for furnishing 12,000 white marble headstones from W. H. Gross & W. H. Deely, Lee, Mass., at $2.48 per stone, and the Vermont Marble Co., Proctor, Vt., at $2.56 per stone. Noted Sept. 24.

★Dredging Plant for Hire—Boston, Mass.—(Official)—Bids will be received by Lieut.-Col. W. E. Craighill, U. S. Engineers' Office, Boston, until noon, Oct. 30, for hire of dredging plant in Boston Harbor.

Shipbuilding Cranes—Boston, Mass.—The following are the bids received by H. R. Stanford, Chief, Bureau of Yards and Docks, for constructing shipbuilding cranes at the U. S. Navy Yards, Boston, and Philadelphia, Penn.: (a) For four cranes delivered f.o.b. cars, U. S. Navy Yard, Boston, Mass., (b) for four cranes delivered f.o.b. cars, U. S. Navy Yard, Philadelphia: Cleveland Crane & Engineering Co., Wickliff, Ohio, (a) $37,860, (b) $37,860; Wellman-Seaver-Morgan Co., 7000 Central Ave., Cleveland, (a) $41,916, (b) $41,584; Niles-Bement-Pond Co., New York, N. Y., (a) $29,860, (b) $29,440; Orton & Steinbrenner Co., Chicago, Ill., (a) $19,784 and $16,430, (b) $19,776 and $16,331; American Hoist & Derrick Co., 63 South Roberts St., St. Paul, Minn., (a) $19,916, $19,316, $20,824 and $20,824, (b) $19,756, $19,156, $20,664 and $20,664; Morgan Engineering Co., Alliance, O., (a) $29,750, (b) $29,575; Whiting Foundry Equipment Co., Harvey, Ill., (a) $24,618, (b) $24,430; Terry & Tench Co., Grand Central Terminal, New York, Boston cranes, $38,350, erected, $52,168; Philadelphia, $37,950, erected, $50,268; McMyler Interstate Co., Bedford, Ohio, (a) $24,920 and $23,040, (b) $24,740 and $22,860. Noted Sept. 24.

Mezzanine Floor—Worcester, Mass.—The following bids were received by the Custodian, U. S. post office, Worcester, for constructing a mezzanine floor in the post office: E. J. Cross Co., 82 Foster St., Worcester, $10,742; James Mills & Sons Co., 4 Walnut St., Worcester, $8287; C. W. Humphreville Construction Co., Westfield, Mass., $8742; J. W. Bishop Co., 109 Foster St., Worcester, $9543; Norcross Bros. Co., Worcester, $9761; Ernest Whitehead, 8 Norwich St., Worcester, $10,040; Central Building Co., Worcester, Mass., $10,300.

Lighting System—Newport, R. I.—Bids will be received by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Oct. 31, for installing a street-lighting system at the naval hospital, Newport.

+Switchboard, Wiring, Etc.—New York, N. Y.—(Borough of Manhattan) The contract for installing a new main switchboard, basement floor, new conduit, wiring, electric fixtures and panel board in the U. S. subtreasury, New York, has been awarded to THOMPSON-BONNY CO., 45 York St. (Borough of Brooklyn), New York, N. Y., at $5125.

Iron—New York, N. Y.—(Borough of Richmond)—Bids will be received by the Light House Inspector, Tompkinsville, until 2 p.m., Oct. 26, for furnishing and delivering at Tompkinsville, about 40,000 lb. of round, square and flat iron.

Piers, Ferry Rack, Bridge, Etc.—New York, N. Y.—The following bids were received by Oscar Wenderoth, Superv. Arch., Washington, D. C., for constructing new dock piers and ferry rack bridge: (a) for the construction of ferry rack bridge, gallows frame, lifting mechanism and all appurtenances for piers A and C, (b) for construction of pier B—Snare & Triest Co., New York, N. Y., (a) $86,400, (b) $26,700; Howard H. Peterson & Co., New York, N. Y., (a) $91,747, (b) $27,600; Stillman, Dehanty & Ferris Co., Jersey City, N. J., (a) $83,621, (b) $29,100; Northeastern Construction Co., New York, N. Y., (a) $77,369, (b) $25,030; Bonacel Contracting Co., New York, N. Y., (a) $85,740, (b) $29,500; the Phœnix Construction Co., New York, N. Y., (a) $76,397, (b) $23,500. Noted Sept. 24.

+Sheet Metal Work—New York, N. Y.—The contract for replacing the old c.-i. roof with sheet metal on the U. S. Court House and Post Office, New York, has been awarded to NEPTUNE B. SMYTH, 43 East 34th St., New York, N. Y., at $24,893. Noted Sept. 24 and Oct. 1.

+Post Office—Port Jervis, N. Y.—The contract for constructing the post office at Port Jervis has been awarded to JOSEPH DI BENEDETTO, 423 East 115th St., New York, N. Y., at $47,329. Noted Aug. 6 and Sept. 17.

Post Office—Morristown, N. J.—Bids will be received until 3 p.m., Dec. 5, by Oscar T. Wenderoth, Superv. Arch., Washington, D. C., for constructing a post office at Morristown. The building will be two stories and basement, of brick and marble.

Dredging—Tuckerton, N. J.—Bids received by Maj. E. N. Johnson, Corps Engrs., U. S. A., Wilmington, Del., for dredging in Tuckerton Creek have been rejected. New bids for the work will soon be called.

Shipbuilding Cranes—Philadelphia, Penn.—See item under Boston, Mass. Noted Sept. 24.

+Lock Gates—Pittsburgh, Penn.—The contract for furnishing and erecting steel lock gates, valves and lock-operating machinery at Lock 4, Monongahela River, has been awarded as follows: Sect. A, H. P. GAZZAM, Pittsburgh, $7289; Sect. B, UNION FOUNDRY & MACHINE CO., Pittsburgh, $13,809. Noted Sept. 10 and Oct. 15.

Pipe, Sand, Gravel and Cement—Washington, D. C.—Bids will be received by the Depot Quartermaster, U. S. Army, Washington, D. C., for furnishing 125 tons of gravel, 75 tons of sand, 80 bbl. portland cement and 750 ft. terra cotta pipe.

Motor Trucks—Washington, D. C.—Bids will be received by the Depot Quartermaster, U. S. Army, Washington, D. C., until 11 a.m., Oct. 24, for furnishing two four-wheel drive motor trucks. J. B. Houston is Lieut.-Col. Quartermaster Corps.

★Rewiring—Washington, D. C.—(Official)—Bids will be received, until 2 p.m., Nov. 21, by the Secretary of the Interior, Washington, D. C., for rewiring the first floor and basement of the Patent Office Bldg. B. Sweeney is Asst. Secy.

★Bridge—Washington, D. C.—(Official)—Bids will be received by the Secretary, Board of Commissioners, District Bldg., Washington, until 2 p.m., Nov. 17, for the construction of a reinforced-concrete arch bridge across Rock Creek Valley. For further information see advertisement under "Contracts to Be Let."

Life Saving Station—Lillington, N. C.—Bids were received by S. I. Kimball, Gen. Supt., Life Saving Service, Washington, D. C., for constructing the life saving station at Cape Fear, N. C., from E. Hart, Norfolk, Va., $9680, and A. J. Robbins, Southport, N. C., $8671. Noted Oct. 8.

Plastering Material—Atlanta, Ga.—Bids will be received by F. H. Duehay, Supt. of Prisons, Dept. of Justice, Washington, D. C., until 10 a.m., Oct. 23, for furnishing and delivering at the U. S. penitentiary, Atlanta, plastering material to be used in the construction of hospital building.

Rock—Greenville, Miss.—See item under "New Orleans, La."

Rock—New Orleans, La.—Bids will be received until 11 a.m., Oct. 26, by Maj. W. G. Caples, Q. & C. Bldg., New Orleans, for furnishing and delivering 40,000 tons of rock on the Mississippi River, between Greenville, Miss., and New Orleans, La.

+★Stone—New Orleans, La.—The contract for furnishing about 65,000 tons of stone, to be placed on the jetties at Southwest Pass, Mississippi River, has been awarded to L. ALEXANDER, at $381,550. Noted Sept. 17.

Post Office—Jellico, Tenn.—Bids were received as follows by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office building at Jellico, (a) limestone, (b) sandstone, (c) Tennessee marble, (d) other marble, (e) Kentucky limestone: Volney E. Taylor, Huntington, W. Va., (a) $58,385, (d) $69,295; Westchester Engineering Co., White Plains, N. Y., (a) $59,126, (b) $63,000, (c) $73,000, (d) $72,000, (e) $64,000; William H. Fissell & Co., New York, N. Y., (a) $59,700, (b) $62,700, (d) $72,540, (e) $61,468; J. L. Crouse, Greensboro, N. C., (a) $61,998, (b) $63,400, (c) $78,552, (d) $73,302; George W. Stiles Construction Co., Chicago, Ill., (a) $63,861, (d) $75,661, (e) $65,361; William O'Neill & Co., Faribault, Minn., (a) $64,319, (c) $77,781, (d) $75,136; James De Vault, Canton, Ohio, (a) $64,579, (b) $66,000, (d) $75,337; M. Yeager & Son, Danville, Ill., (a) $67,475, (b) $69,975, (c) $76,975, (d) $76,975; Longest & Tessier Co., Greensboro, N. C., (a) $68,800, (b) $68,800, (c) $78,800, (d) $79,500; George A. Clayton, Atlanta, Ga., (a) $74,244, (d) $80,481; Paradis Construction Co., Louisville, Ky., (a) $78,000, (b) $79,000, (c) $84,300, (d) $88,100. Noted Sept. 10.

Post Office—Shelbyville, Tenn.—The following bids were received by Oscar Wenderoth, Superv. Arch., Washington, D. C., for constructing the post office at Shelbyville: Longest & Tessier Co., Greensboro, N. C., $53,900; Voeney E. Taylor, Huntington, W. Va., $45,480; J. L. Crouse, Greensboro, N. C., $53,195; William O'Neil & Son Co., Faribault, Minn., $56,758. Noted Sept. 10.

Improving Post Office and Court House—Detroit, Mich.—Bids will be received by Oscar T. Wenderoth, Washington, D. C., until 3 p.m., Nov. 25, for extending and remodelling the U. S. post office and court house.

★Dredging—Chicago, Ill.—(Official)—Bids will be received by Lieut.-Col. W. V. Judson, 508 Federal Bldg., Chicago, until 10 a.m., Nov. 13, for dredging in the Chicago River, Ill.

Conduit and Cable System—Minneapolis, Minn.—Bids will be received by Oscar Wenderoth, Superv. Arch., Washington, D. C., until 3 p.m., Nov. 3, for the construction of an underground conduit and cable system for lighting, power and telephone service between the present U. S. court house and post office and the new post office building.

+Post Office—Amarillo, Tex.—The contract for the construction of the post office at Amarillo has been awarded to M. YEAGER & SON, Danville, Ill. Noted Aug 27 and Oct. 8.

Water System—El Paso, Tex.—The Constructing Quartermaster, El Paso, has been directed to advertise for bids for the extension of the water system.

Buildings—Fort Bliss, Tex.—The Constructing Quartermaster, El Paso, has been directed to advertise for bids for constructing new buildings at Fort Bliss.

Post Office—Uvalde, Tex.—Bids were received by Oscar Wenderoth, Superv. Arch., Washington, D. C., for constructing the post office at Uvalde from the Dieter & Wenzel Construction Co., Wichita, Kan., at $64,113, and George [illegible] Co., Security Bldg., Chicago, Ill., at $56,400. Noted Aug. 27.

Post Office—El Reno, Okla.—Bids will be received by Oscar Wenderoth, Superv. Arch., Washington, D. C., until 3 p.m., Nov. 24, for constructing a post office at El Reno. The building will be two stories and basement, of fireproof construction.

Sewer System—Lawton, Okla.—Bids will be received by the Secretary, Department of the Interior, until 2 p.m., Nov. 7, for constructing a storm water sewer for the north addition of the city. R. Sweeney is Ass't Secy.

✦Steel Rolling Crest—Grand Valley, Colo.—Bids will be received at the office of the U. S. Reclamation Service, Washington, D. C., until 2 p.m., Nov. 19, for furnishing one steel rolling crest for the Grand River Diversion Dam, Grand Valley Project, Colorado, consisting of six 70x10-ft. 3-in. rollers and one 6x12-ft. 1-in. roller and accessories, involving a total weight of about [illegible] lb.

Water Heater—Las Animas, Colo.—All bids received Oct. 3, by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., for installing a feed water heater at the naval hospital, Las Animas, have been rejected. The specifications will be revised and the work readvertised. Noted Sept. 17.

Drainage—Roswell, N. M.—Press reports state that R. A. Hart, Drainage Engr., Salt Lake City, Utah, has reported in favor of draining 40,000 acres of land in Pecos Valley.

Timber Wharf, Wharf Shed—Bremerton, Wash.—The following bids were received by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing the timber wharf and wharf shed at the naval torpedo station, Puget Sound: Erickson & Larson, Seattle, Wash., $8493; J. L. Murphy & Son, Tacoma, Wash., $9198; Fleiner & Eahl, Seattle, $6989; Charles H. Schaar, Seattle, $[illegible]; J. A. McEachern, Seattle, $10,048; P. Manson, Dockton, Wash., $[illegible]. Noted Sept. 24.

Coal Platform and Flume—San Diego, Calif.—Bids were received by H. R. Stanford, Chief, Bureau of Yards and Docks, Washington, D. C., for making an extension to the coal platform and flume at the naval coal depot, San Diego, from Frederick Steffgen, San Diego, $8215, and Holland Construction Co., San Diego, $9760. Noted Sept. 17.

✦Lumber—Honolulu, H. T.—CHARLES NELSON & CO., San Francisco, Calif., have been awarded the contract for furnishing 260,136 ft. of lumber at Honolulu, at $9.80 per M., plus $[illegible] for transportation.

Miscellaneous Supplies—Panama—Bids will be received until 10:30 a.m., Oct. 31, by Maj. F. C. Boggs, Gen. Pur. Officer of the Panama Canal, for furnishing, by steamer, free of all charges, on dock at either Colon, Atlantic port, or Port of Ancon, Balboa, Canal Zone, Pacific port, Isthmus of Panama: Steel angles, cold-rolled steel, nails, tacks, sheet copper, sheet zinc, files, hose, electric fuses and cable connections, lamp cord, copper wire, fuse wire, coal tar, chloride of lime, white zinc, white lead, lampblack, aluminum paint, burnt sienna, lard oil, linseed oil, turpentine and varnish.

Structural Steel—Panama—Bids will be received until Oct. 29, by Maj. F. C. Boggs, Gen. Pur. Officer of the Panama Canal, for furnishing 113,947 lb. of structural steel for the freight house at Panama.

Building—San Juan, Porto Rico—The following are the bids received by H. R. Stanford, Chief, Bureau of Yards and Docks, for constructing the radio building and chief operators' quarters at the naval radio station, San Juan: Henry Muck, Pensacola, Fla., $16,100; P. J. Carlin Construction Co., 1117 Broadway, New York, N. Y., $213[illegible]; Thomas Sampson, San Juan, P. R., $19,29[illegible]; A. Guerini, San Juan, $6150; Francisco Pons, San Juan, $[illegible]. Noted Sept. 3.

MISCELLANEOUS

✦Seawall and Filling—Boston, Mass.—The following bids were received for the construction of the seawall across the water passageway on the southerly line of East First St., also for furnishing [illegible] of filling: JOHN CASHMAN & [illegible] Co., $[illegible] (awarded contract); H. P. Converse & Co., $[illegible]; George [illegible] Co., $[illegible]; Hugh Nawn Contracting Co., $[illegible]; [illegible] Bros., $[illegible]; McCarthy & Walsh, $[illegible]; J. J. [illegible], $[illegible]; W. H. Ellis & Son Co., $[illegible]; [illegible], $[illegible]; William L. Miller Co., $[illegible]; John [illegible], $[illegible]. [illegible] is the Comr. of Public Wks.

✦Fire Station—[illegible], Mass.—The contract for the construction of the two-story fire station [illegible] has been awarded to FRANKLIN D. WILLIAMS, [illegible] Wier St., [illegible]. [illegible] is the Arch.

Sewer Wall—[illegible], R. I.—The Board of Harbor Commissioners has granted permission to the Harbor Improvement Commission to [illegible] and call for bids for the construction of a [illegible]-ft. sea wall at [illegible].

✦Hardware—[illegible], N. Y.—(Official)—Bids will be received until [illegible] for furnishing [illegible] hardware [illegible] at the New York State [illegible]. [illegible] For details, see advertisement under "Contracts to Be Let."

✦[illegible] Plant Extension—[illegible] [illegible] For details, see advertisement under "Contracts to Be Let."

✦Loading Platform—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for the construction of a covered dumping board and ramp between 77th and 78th St., North River, has been awarded to the RIVERSIDE CONTRACTING CO., 39 Cortlandt St., New York, at about $38,000. Noted Oct. 8.

✦Roof Repairs—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for laying new tin roof and repairing slate and metal work on the Metropolitan Hospital, Blackwell's Island, has been awarded to the QUALITY SHEET METAL WORKS. The contract for the same work on the T & S Bldg. has been awarded to the ANCHOR CORRUGATING CONSTRUCTION CO. Noted Oct. 1.

✦Subway—New York, N. Y.—(Borough of Manhattan)—(Official)—The Public Service Commission has awarded the contract for the construction of Route 1, Section 4A of the subway system to F. L. CRANFORD INC., at $1,571,363. List of bidders noted Oct. 15.

✦Jetties—Asbury Park, N. J.—The Public Grounds Commission will receive bids until Nov. 4, for the construction of jetties on the beach at Asbury Park, N. J. W. P. Sherman is Secy. For details, see advertisement under "Contracts to Be Let."

✦Road Work—Camden, N. J.—(Official)—Bids will be received by the Road Committee, until 10 a.m., Nov. 11, for constructing a number of roads. For details, see advertisement under "Contracts to Be Let." J. J. Albertson is County Engr.

Barn—Paterson, N. J.—The city will receive bids soon for the construction of a two-story, 32x102-ft. barn. The estimated cost is $10,000.

✦Sewage Ejector—Red Bank, N. J.—(Official)—Bids will be received by the Borough Clerk, until 8 p.m., Nov. 2, for constructing a sewage ejector. Geo. D. Cooper, 60 Broad St., Red Bank, is Engr.

Market—Bristol, Penn.—M. J. Hill, Gen. Mgr., Trenton Market, has acquired a site at Mill and Bath St. Plans are being prepared for the construction of a market for local farmers.

Overhead Crossing—Philadelphia, Penn.—The application of the city for an overhead crossing for the tracks of the Philadelphia & Reading R.R. at Tulip and Emerald St., has been approved by the Public Service Commission at Harrisburg.

✦Air Compressors and Water Turbine—Pittsburgh, Penn.—(Official)—Bids will be received by the U. S. Engineer Office, until noon, Nov. 21, for installing two air compressors and one water turbine complete, at Lock No. 2, Monongahela River. Francis R. Shunk is Lt.-Col.

Comfort Station—Scranton, Penn.—The following bids were received by Mayor Jermyn for the construction of a comfort station: F. E. Sykes & Co., $19,[illegible]; E. S. Williams, $20,188; Peter Stipp & Sons, $20,643; Ludwig T. Stipp, $20,[illegible]; Williams & Richardson, $20,917; Matthias Stipp, $2[illegible]. Noted Sept. 24.

✦Sewers—Washington, D. C.—(Official)—Bids will be received by the Commissioners, until 2 p.m., Oct. 30, for constructing sewers in the District of Columbia. For details, see advertisement under "Contracts to Be Let."

✦Sewer—Norfolk, Va.—(Official)—Bids will be received by the Board of Control, until 1 p.m., Oct. 29, for laying sewer and water pipes on Armistead Bridge Road, West Ghent Blvd., Harrington, Gates, Brandon, Spottswood and Shirley Ave. W. H. Taylor, Jr., is Asst. City Engr.

Foundation and Pumping Station—Charlotte, N. C.—Bids will be received until Oct. 26 by the Morris Machine Works, Charlotte, for excavation, piling, and constructing foundation and pumping station for the Lake Matamuskeet Drainage District, Hyde County, N. C.

✦Drainage—Jackson, Tenn.—The contract for the construction of 15 mi. of drainage canal and laterals in Drainage District No. 2 has been awarded to D. W. ROBBINS, Tupelo, at about $60,000. A. W. Stovall is the Chmn. Noted July 16, Sept. 24.

✦Levee Work—Memphis, Tenn.—(Official)—Bids will be received by the Mississippi River Commission, First and Second Districts, Rm. 20, Custom House, Memphis, until 11 a.m., Nov. 9, for constructing 3,311,000 cu. yd. of levee work. E. M. Markham is Maj.

Steel Dump Cars—Chicago, Ill.—Bids will be received until Oct. 26 by the Commissioner of Public Works, for 200 steel dump cars for use in the construction of the Wilson Ave. water tunnel.

Drainage—Watseka, Ill.—Bids will be received until Oct. 31 by Martinton Drainage District No. 4 for excavating 11,[illegible] ft. of main open ditch and two laterals, also for 2113 ft. of 1[illegible] and 1120 ft. of 2-in. tile. C. F. Helman, Paxton, Ill., is the Engr.

Harbor Improvements—Milwaukee, Wis.—The Harbor Commission, in conjunction with the Chicago, Milwaukee & St. Paul Ry. Co., has made arrangements for the widening of the Menominee River. The plans will soon be submitted to the Common Council for ratification.

✦Drainage—[illegible], Iowa—The Board of Supervisors has awarded the following contracts for the construction of drainage ditches: [illegible] west of [illegible], ARTHUR Mc[illegible], [illegible] at $[illegible]; [illegible], JOHN N[illegible] at $[illegible]; [illegible], LOVELLY & [illegible], at $[illegible]. Noted Sept. 1.

Drainage—[illegible], Iowa—Bids will be received until Oct. [illegible] by the county Auditor for constructing Drain No. [illegible]. [illegible] ft. of [illegible] tile will be required.

✦Dredging—[illegible], Iowa—The contract for dredging [illegible] has been awarded to the LANA[illegible] [illegible], Council Bluffs, Iowa, at [illegible] per cu. yd. [illegible] to be removed. W. O. [illegible] is the Engr.

Metal Furniture, Fixtures and Equipment—Flandreau, S. D.—(Official)—Bids will be received until Nov. 17, by George A. [illegible], [illegible] Supt., Flandreau, S. D., for furnish-

ing and installing metal and wooden furniture, fixtures and equipment in the Moody County Court House. Plans are on file at the office of the County Auditor and Joseph Schwarz, Arch., Sioux Falls.

Diverting Channel—Kalispell, Mont.—The County Commissioners, Flathead County, have engaged W. W. Pennington, Butte, to prepare estimate of the cost of changing the channel of Flathead River above the steel bridge. If cost is satisfactory, a special election will be called to vote a bond issue.

Ditch and Flume—Missoula, Mont.—Bids will be received by S. H. Ketcham, Engr., 220 Higgins Ave., Missoula, for constructing 1200 ft. of flume and three miles of 3-ft. ditch near Iron Mountain.

✚Drainage—Wynne, Ark.—The entire contract for the construction of a drainage system in Drainage District No. 3 has been awarded by the Commissioners to S. COLEMAN & SONS, Paragould, at $192,000. The contract calls for 2,325,000 cu.yd. of excavation and ditching over a territory of 75 miles; 900 ft. of corrugated iron culvert pipe; 15 iron bridges with concrete abutments. Noted Oct. 8.

Park Improvement—Beaumont, Tex.—Competitive plans, specifications and estimates, are reported to be desired by the Board of Park Commissioners until Nov. 2, for raising grade and improving Island Park, including bridge across Brakes' Bayou.

★Carts, Cans and Street Sweepers—San Antonio, Tex.—The city of San Antonio will receive bids, until Nov. 9, for furnishing carts for carrying demountable cans, cans and modern street sweepers. Ray Mackey is City Pur. Agt. For details, see advertisement under "Contracts to Be Let."

Drainage—Tempe, Ariz.—A drainage district has been organized by the owners of about 3000 acres of land near here. Bonds will be issued soon for the construction of a drainage system.

Motor Fire Apparatus—Seattle, Wash.—The following bids were received by the Board of Public Works for furnishing the fire department with three combination chemical and hose motor trucks: White Co., $16,905; Gorham Fire Apparatus Co., $17,490; Robinson Fire Apparatus Co., $18,000; A. G. Long, $18,000; Nott, Joslyn & Co., $19,000.

Cement—Seattle, Wash.—The Port of Seattle Commission will receive bids, until Oct. 29, for furnishing 20,000 bbl. of cement.

✚Copper Wire—Seattle, Wash.—The contract for furnishing the city with 165,000 ft. of copper wire has been awarded to W. A. CLARK WIRE CO., at $21,067.

Dredge—Tacoma, Wash.—The two lowest bids received by the Inter County River Improvement Association for furnishing an 18-in. hydraulic dredge for use in the Stuck River, were as follows: Seattle Machine Works, $57,500; Washington Iron Works, $64,000.

Jetty—Vancouver, Wash.—A jetty, 2000 ft. in length, extending from the Oregon shore into the Columbia River, will be constructed at the port of Vancouver. The cost will be paid out of a fund raised by taxing property owners in the port for the past two years. The amount available at the present date is $30,000.

Drainage—Walla Walla, Wash.—J. W. Sweazy, County Audr., will receive bids, until Nov. 2, for the construction of a drainage system in Drainage District No. 2, Walla Walla County. Work will include 10.2 miles of open ditches, construction of several wooden structures and pumping plant.

✚Dock—Portland, Ore.—The Southern Pacific Co. has awarded the contract to the INTERNATIONAL CONSTRUCTION CO., for building an open dock on the west side of Willamette River. The estimated cost is $15,000. H. A. Hampton is the Engr. Noted Oct. 8.

Dredging Bonds—Longbeach, Calif.—At a special election held Oct. 2, $30,000 in bonds were voted to pay for the dredging of the entrance to Longbeach harbor.

Fire Alarm System—Merced, Calif.—The City Trustees have ordered the City Engineer to prepare plans and specifications for a 25-box fire alarm system.

Oil Supply Station—Oakdale, Calif.—The Standard Oil Co. is having plans prepared for the construction of an oil supply station. The estimated cost is $10,000.

Retaining Wall—Sacramento, Calif.—The City Commission has ordered new plans to be prepared for the sheet pile retaining wall to be built in the levee near the swimming baths. The estimated cost is $10,500.

Tunnel—San Francisco, Calif.—(Official)—The Board of Public Works has rejected the bid of Erickson & Petterson for the construction of the Twin Peaks Tunnel because of interlineation. New bids will be received until Oct. 28. The period for completion has been extended from 600 to 1000 days. Noted May 21, June 18, July 9, Sept. 24 and Oct. 15.

✚Piers—San Francisco, Calif.—The Board of State Harbor Commissioners has awarded the following contracts for the construction of piers: (Pier 16) HEALY-TIBBITTS CONSTRUCTION CO., at $108,720; (Pier 18) SAN FRANCISCO BRIDGE CO., at $11,800. Noted Oct. 1.

Breakwater—Kingston, Ont.—The city contemplates the construction of a breakwater estimated to cost about $30,000.

Traveling Crane—Toronto, Ont.—Bids will be received until Oct. 27, by the Mayor, Chmn. of the Bd. of Control, for furnishing an overhead hand-operated traveling crane.

Subway—Weston, Ont.—The Town Council plans to construct a subway estimated to cost $18,000. E. A. James, 57 Adelaide St., is tho Engr.

BUILDINGS

✚Portsmouth, N. H.—The contract for the construction of the state armory at Portsmouth has been awarded to SACCO & WOOD. C. R. Whitcher, Manchester, is the Arch.

Brattleboro, Vt.—Bids will soon be received for the construction of a two-story station for the Boston & Maine and Central Vermont railroads. J. M. Morrison, St. Albans, is the Engr.

✚Amherst, Mass.—The contract for the construction of the chapter house for the Delta Kappa Epsilon fraternity has been awarded to the H. WALES LINES CO., at $65,000.

✚Boston, Mass.—The contract for the addition to the City Contagious Hospital has been awarded to JOSEPH M. DOLAN, 197 Sidney St., Cambridge, at $50,000.

✚Boston, Mass.—The contract for the construction of the 11-story hotel at Washington and Avery Sts., for the Commonwealth Association, Inc., has been awarded to the HAYNES CONSTRUCTION CO. The estimated cost is $1,250,000.

✚The contract for the construction of the Home for Little Wanderers has been awarded to the WOODBURY & LEIGHTON CO., 185 Summer St.

✚Everett, Mass.—The contract for the construction of the school on Floyd St. has been awarded to WHITON & HAYNES, 200 Devonshire St., Boston.

✚Framingham, Mass.—The contract for the construction of the dormitory and refectory at the State Normal School has been awarded to J. J. PRINDIVILLE CO., South Framingham, Mass., at $71,500. Noted Oct. 1.

Long Island (Boston post office), **Mass.**—Bids will be received by the Infirmary Trustees for the erection of three buildings at Long Island. Thomas A. McQuade, 28 Court St., Boston, is Chn.

✚Lynn, Mass.—The contract for the construction of the school in the Blossom St. district has been awarded to KENNEDY & PETERSON, 7 Water St., Boston, at $130,540.

✚Mount Auburn, Mass.—The contract for the construction of the three-story school at Mount Auburn has been awarded to JOHN D. BYRNE & Co., Inc., 182 Sidney St. E. T. P. Graham, 20 Beacon St., is the Arch.

✚Pittsfield, Mass.—The contract for the construction of the school in the Dawes District has been awarded to FOOTE & JONES, 80 Bradford St. The estimated cost is $50,000. Arthur Vance is Chn. of the Com.

✚Worcester, Mass.—The contract for the construction of the building for the Worcester Boy's Club has been awarded to J. J. POWER, Worcester, at $80,000.

✚Worcester, Mass.—The contract for the construction of the four-story brick home for the Sisters of Mercy has been awarded to McDERMOTT BROS., at $50,000. E. P. Fitzgerald is the Arch.

Bridgeport, Conn.—Plans are being prepared by Skinner & Walker, Archs., 1188 Main St., for the city almshouse buildings to be erected near Palisade Ave. The estimated cost is $175,000.

Winstead, Conn.—Plans have been completed by Louis E. Jallade, Arch., 37 Liberty St., New York, for the construction of a three-story, 87x150-ft. Y. M. C. A. building on Main St.

✚Albany, N. Y.—Contracts for the additions to schools Nos. 16 and 18 have been awarded as follows: School No. 16, general contract, J. D. WALDBILLIG, at $44,564; school No. 18, PETER KEELER BUILDING CO., at $64,833. Noted Sept. 17.

★Buffalo, N. Y.—Bids will be received, until Oct. 30 (change of date from Oct. 23), by Col. Franklin W. Ward, Secy., State Bd. of Armory Commissioners, 14 State St., Albany, N. Y., for construction, heating, plumbing and electric work for armory and stable ,at Buffalo, for Troop "I," First Cavalry, N. G. N. Y. Noted Oct. 8.

Manhasset, N. Y.—The Board of Education contemplates erecting a two-story brick school at Manhasset, L. I. The estimated cost is $70,000. Frederick Briggs, Plandome, L. I., is the Arch.

New York, N. Y.—(Borough of Manhattan)—Plans have been completed by Gronenberg & Leuchtag, Archs., 303 Fifth Ave., for the six-story apartment to be erected at 111th St. and Seventh Ave. The estimated cost is $130,000.

✚The general contract for the construction of the 12-story apartment house at Seventh Ave. and 59th St., for Sol Bloom, has been awarded to the HEDDEN CONSTRUCTION CO., 1 Madison Ave., New York.

✚The masonry contract for the 12-story store and loft building at 35 West 35th St., for Raymond & Reisman, 507 West 113th St., has been awarded to the WILLIAM M. MOORE CONSTRUCTION CO., 516 West 139th St., New York. The estimated cost is $180,000.

Lorenz F. J. Weiher, Arch., 271 West 125th St., is preparing plans for the construction of an eight-story store and loft building, at 12 East 46th St., for the Ritz Realty Co.

✚Ossining, N. Y.—The general contract for alterations and an addition to the four-story theater and office building at Main St. and Croton Ave. has been awarded to the GRANNIS & WARLEY CONTRACTING CO., Depot Square. The estimated cost is $45,000.

Syracuse, N. Y.—The University Club will erect a clubhouse at Fayette Park. The estimated cost is $55,000.

Troy, N. Y.—Bids will be received, about Nov. 1, by William E. Clark, Arch., 506 Frear Bldg., for additions to the hospital at 14th St. and Fifth Ave. The estimated cost is $150,000.

Bloomfield, N. J.—Bids will be received, until Nov. 2, by the Board of Education, for constructing a high school at Bloomfield. William Whitney Rasmussen, 1133 Broadway, New York, is the Arch.

✚East Orange, N. J.—The general contract for alterations and additions to the one-story brick library at Main St. and Munn Ave. has been awarded to the ESSEX CONSTRUCTION CO., 85 Academy St. Noted Sept. 24.

Jersey City, N. J.—Preliminary plans are being prepared for the Lincoln High School to be constructed at Harrison and Crescent Ave. Estimated cost, $100,000. John T. Rowland, Jersey City, is the Arch.

✚Jersey City, N. J.—The contract for an addition to the Tuberculosis Hospital has been awarded to DENNIS MULLINS, INC., Montclair, N. J., at $114,900. Noted Sept. 3.

Newark, N. J.—Preliminary plans have been prepared by [illegible] Archs., City Hall, for the [illegible] McKinley School. The estimated cost is $1[illegible]. R. D. [illegible] & Co. [illegible] The estimated cost is $1[illegible].

Ridgefield Park, N. J.—[illegible] J. [illegible], Arch., [illegible] St., [illegible] N. J., is preparing plans for a church and parochial school for St. Francis R. C. Church, Ridgefield Park. The estimated cost is $1[illegible].

Spring Lake, N. J.—Bids will be received until Oct. 21, by [illegible] & [illegible], Archs., 1211 Walnut St., Philadelphia, Penn., for alterations and additions to Hotel Monmouth. The estimated cost is $7[illegible].

West New York (Weehawken post office), N. J.—The lowest bidder for the construction of the [illegible] building at [illegible] Tweed [illegible] was George T. Martin, 588 Fifth Ave., New York, at $[illegible]. Noted Oct. 8.

+Allentown, Penn.—The general contract for the construction of the [illegible] has been awarded to [illegible] CONSTRUCTION CO., at $[illegible].

McKeesport, Penn.—Bids will be received until Jan. 1, by W. T. [illegible], Secy., Bd. of Education, for the construction of the high school. The estimated cost is $200,000.

+Philadelphia, Penn.—The contract for the construction of the [illegible]-story building for the Carmelite Convent at Oak Lane has been awarded to M[illegible] & KEATING, Bailey Bldg.

+The contract for the construction of the four-story brick building at Eighth St. and [illegible] Ave., for Philip Rh[illegible], has been awarded to STACEY REEVES & SON, 2011 [illegible] St., Philadelphia, Penn., at $[illegible].

Pittsburgh, Penn.—Bids will be received until 3 p.m., Nov. 5, by George W. Gerwig, Secy., Bd. of Education, Fulton Bldg., for the construction of the [illegible] High School.

Bids will be received until Nov. 3 by George W. Gerwig, Secy., Bd. of Education, Fulton Bldg., for general repairs and alterations to the [illegible] School.

+Pittston, Penn.—The contract for the construction of the two-story school at Pittston has been awarded to MILES J. FREY, at $[illegible].

+Radford, Va.—The contract for the construction of the Normal School of Virginia has been awarded to LONGEST & TESSIER, at $[illegible].

+Roanoke, Va.—The contract for the construction of the [illegible] court house at Roanoke has been awarded to the KING LUMBER CO., Charlottesville, Va., at $218,0[illegible]. Noted Aug. 27.

+Charlotte, N. C.—The contract for the construction of the library at Charlotte has been awarded to J. A. JONES, Charlotte, at $[illegible].

+Hickory, N. C.—The general contract for the construction of the building for the First National Bank has been awarded to J. A. [illegible]; architectural terra cotta, ATLANTIC TERRA COTTA CO.; concrete reinforcement, SOUTHERN ENGINEERING CO.; ornamental iron and structural steel, [illegible] IRON WORKS, all of Charlotte, N. C.

Citra, Fla.—Bids will be received until Nov. [illegible] by J. H. [illegible], Secy., Marion County Bd. of Pub. Instruction, Ocala, Fla., for the construction of the school at Citra. [illegible]

+West Palm Beach, Fla.—The lowest bid received for the construction of the three-story and basement court house was that of the King Lumber Co., Charlottesville, Va., at $171,[illegible]. Noted [illegible].

Iberville, La.—Bids will be received until Nov. [illegible] [illegible]

+New Orleans, La.—The contract for the construction of the [illegible] Park has been awarded to [illegible] at $[illegible].

Louisville, Ky.—[illegible] Archs., [illegible], are preparing plans for the construction of a theater and [illegible] at Louisville. The estimated cost is $[illegible].

+Canton, Ohio.—The general contract for the Y. M. C. A. building has been awarded to [illegible], Canton, Ohio. The estimated cost is $[illegible]. Noted Aug. [illegible].

+Cleveland, Ohio.—[illegible]

Columbus, Ohio.—[illegible]

Hudson, Ohio.—Bids will be received until noon, Nov. [illegible], by [illegible] S. Walker, Clk. Bd. of Education, for constructing a school at Hudson. J. W. C. Corbusier, 309 Lennox Bldg., Cleveland, Ohio, is the Arch. Noted Oct. [illegible].

Delaware, Ohio.—Plans are being prepared by O. N. Chamberlain, [illegible] Schofield Bldg., Cleveland, for the construction of a four-story, 1[illegible]x165-ft. building for the Hotel [illegible]. Estimated cost $[illegible].

Painesville, Ohio.—Albert [illegible]field, Arch., 915 Garfield Bldg., Cleveland, is preparing plans for the construction of a one-story and basement gymnasium for Lake Erie College, Painesville. Estimated cost $[illegible].

Sandusky, Ohio.—The Cedar Point Co. is having plans prepared for [illegible] buildings to the White House Hotel. Estimated cost $1[illegible].

+South Newburg, Ohio.—The contract for the construction of the [illegible] for the village of South Newburg has been awarded to H. WOODLEY, [illegible] Ave., Cleveland.

Danville, Ind.—Plans are being prepared by Layton Allen, Arch., Indianapolis, for the construction of a two-story and basement, 6[illegible]x[illegible]-ft. Science hall for the Central Normal College.

Terre Haute, Ind.—Bids will be received until 10 p.m., Nov. 5, for the construction of a three-story reinforced concrete normal school by the Board of Trustees, State Normal School. Noted Aug. 6, Sept. [illegible] and Oct. 1.

Grand Rapids, Mich.—John F. Smith, Arch., [illegible] Houseman Bldg., is preparing plans for the construction of a [illegible]-story and basement [illegible]x11[illegible]-ft. building, for the St. Anthony's R. C. Church. Estimated cost $7[illegible].

+Port Huron, Mich.—The contract for the construction of a two-story and basement, [illegible]-ft. infirmary, has been awarded to AUGUST SCHULTZ, 9[illegible]3 Bancroft St., for the County of St. Clair. Estimated cost, $6[illegible].

Chicago, Ill.—Plans are being prepared for the construction of an eight-story, 12[illegible]x12[illegible]-ft. office building, for the Methodist Book Co., at Rush and Superior Sts. Estimated cost, $[illegible].

Peoria, Ill.—Bids will be received until 2 p.m., Oct. 25, by Anna Lyngersen, Secy., School Dist., for the construction of a high school.

Appleton, Wis.—Plans will be prepared by the Lawrence College Trustees for the construction of a girls' dormitory. Estimated cost $70,000.

Milwaukee, Wis.—Plans have been prepared by A. C. Clas, Arch., Milwaukee, for the construction of building on the Mariner Site, West Water and Sycamore St. The building will be 12[illegible] ft. and will cost $1[illegible].

Oshkosh, Wis.—William Waters and Henry Auler, Archs., are preparing plans for the addition and alterations to the Oshkosh High School. Estimated cost, $16[illegible].

+Iowa City, Iowa.—The contract for the construction of the women's gymnasium at the University of Iowa has been awarded to T. N. STARK CO., Cedar Rapids. Estimated cost $61,[illegible].

Muscatine, Iowa.—Plans are being prepared by J. E. Mills & Son, Archs., Detroit, Mich., for the construction of a three-story armory and garage for the city. Estimated cost, $[illegible]. Contracts to be awarded about Nov. [illegible].

Sioux City, Iowa.—Plans are completed for the construction of a freight depot for the Northwestern Ry. Co. Estimated cost, $11[illegible].

Minneapolis, Minn.—The plans for the erection of the [illegible] building for the University of Minnesota, have been prepared by C. H. Johnston, Arch., and the contracts will be awarded about Nov. 1. Estimated cost, $[illegible].

+Concordia, Kan.—The contract for the construction of an eight-story [illegible] at Market and [illegible] St., has been awarded to WILLIAM STEELE & SONS CO., for Edward M. Harris. Estimated cost $[illegible].

+Salina, Kan.—F. M. SPENCER & SON, Topeka, has been awarded the contract for the construction of a Union Station for the following railways: Union Pacific; Chicago, Rock Island & Pacific; Atchison, Topeka & Santa Fe; Missouri Pacific Ry. Estimated cost, $[illegible].

+St. Louis, Mo.—The contract for the construction of the [illegible] school at [illegible] has been awarded to the [illegible] CONSTRUCTION CO. Estimated cost, $[illegible].

+The contract for the construction of the [illegible] [illegible]

Bartlesville, Okla.—[illegible]

+Seattle, Wash.—The contract for the construction of a [illegible] hotel has been awarded to [illegible]

Spokane, Wash.—[illegible]

Colton, Calif.—[illegible]

Sacramento, Calif.—The Chamber of Commerce [illegible]

Quebec, Que.—[illegible]

+Victoria, B. C.—The contract for the construction of [illegible] CHARLES W. [illegible]

STATE HIGHWAYS, SACRAMENTO, CALIF.

Bids were received Sept. 21 by the State Highway Commission, for highway construction in various counties from (A) Occidental Construction Co., Los Angeles; (B) Palmer & McBryde, San Francisco; (C) Petersen & Grier, San Francisco; (D) Mahoney Bros., San Francisco; (E) W. J. Schmidt, Berkeley; (F) John A. Marshall, Berkeley; (G) P. L. Burr, San Francisco; (H) F. F. Prendergast, Los Angeles; (I) Bates, Borland & Ayer, Oakland; (J) Berry, Mackie & Co., San Francisco; (K) James H. Smith, San Francisco; (L) O'Brien Bros., Sausalito; (M) F. Rolandi, San Francisco; (N) R. H. McCray Co., Los Angeles; (O) J. W. Calback, San Diego; (P) Lynn S. Atkinson, Los Angeles; (Q) A. W. Gorrill, San Francisco; (R) P. H. Hoare, Oakland; (S) E. T. Johnson, Portland, Ore.; (T) Moffett & Mead, San Francisco; (U) Toohey & Johnson, Phoenix, Ariz. The item bids were as follows:

SISKIYOU COUNTY

	B	M	S	T	U
97,000 cu.yd. excavation..	$0.65	$0.61	$0.61	$1.10	$0.47
2508 lin.ft. 12-in. corrugated iron pipe........	0.75	0.60	0.50	0.75	0.50
436 lin.ft. 18-in. corrugated iron pipe........	1.00	0.80	0.75	1.00	0.60
248 lin.ft. 24-in. corrugated iron pipe........	1.25	1.10	1.00	1.50	0.80
702 cu.yd. Class B concrete for culverts and monuments	20.00	12.00	12.00	17.00	23.60
275 cu.yd. dry rubble concrete wall	3.00	4.00	2.00	3.00	4.00
3000 lin.ft. guard rail....	0.30	0.50	0.40	0.45	0.60
352 monuments	1.00	1.00	1.25	1.50	1.00
Extended totals	$81,794	$72,672	$71,613	$124,026	$67,123

SANTA BARBARA COUNTY

	N	O	P
40,000 cu.yd. ordinary excavation.....	$0.40	$0.38	$0.75
13,700 cu.yd. loose rock excavation...	0.78	0.62	0.75
4400 cu.yd. solid rock excavation.....	1.00	1.10	0.75
858 lin.ft. 12-in. corrugated iron pipe.	0.75	0.60	1.25
267 lin.ft. 18-in. corrugated iron pipe.	1.00	0.70	1.25
490 lin.ft. 24-in. corrugated iron pipe.	1.00	0.80	1.25
34 lin.ft. 36-in. corrugated iron pipe..	1.25	1.00	1.25
515 cu.yd. Class B concrete for culverts and monuments..............	11.50	8.00	12.00
4800 cu.yd. Class B concrete for pavements	4.50	3.65	4.50
275 cu.yd. dry rubble retaining wall..	3.50	2.80	7.00
400 cu.yd. rubble masonry retaining wall	4.00	3.50	7.00
11,880 lin.ft. guard rail..............	0.80	0.45	0.70
176 monuments	1.00	0.60	1.00
Extended totals	$72,294	$58,923	$86,633

SANTA CLARA COUNTY

	A	B	C	D	E	F	G	H	I	J
98,000 cu.yd. excavation............	$0.75	$0.78	$0.60	$0.68	$0.69	$0.52	$0.68	$0.75	$0.83	$0.70
1270 lin.ft. 12-in. corrugated iron pipe	0.40	0.40	0.50	0.75	0.50	0.30	0.60	0.50	0.50	0.50
700 lin.ft. 18-in. corrugated iron pipe	0.60	0.50	0.75	1.00	0.70	0.50	0.75	0.60	0.75	0.70
250 lin.ft. 24-in. corrugated iron pipe	0.80	0.60	1.00	1.50	1.00	0.60	0.90	0.80	1.00	1.00
60 lin.ft. 30-in. corrugated iron pipe.	1.00	0.75	1.25	1.50	1.50	1.00	1.20	1.00	1.50	1.50
850 cu.yd. Class B concrete.........	15.00	20.00	15.00	15.00	11.00	16.00	13.50	16.00	10.00	12.00
19,000 lin.ft. guard rail............	0.40	0.30	0.40	0.40	0.40	0.35	0.40	0.33	0.35	0.25
475 monuments	1.00	1.00	1.00	1.00	2.50	1.00	1.75	1.00	3.00	1.00
Extended totals	$95,513	$100,668	$81,110	$89,582	$87,222	$72,626	$88,130	$95,160	$99,150	$85,490

CONTRA COSTA COUNTY

	B	D	G	I	J	K	L	M
70,000 cu.yd. excavation..........................	$0.60	$0.60	$0.46	$0.40	$0.60	$0.52	$0.495	$0.75
440 lin.ft. 12-in. corrugated iron pipe...............	0.40	0.75	0.50	0.50	0.50	0.55	0.62	0.60
70 lin.ft. 15-in. corrugated iron pipe................	0.50	1.00	0.60	0.60	0.70	0.70	0.62	0.65
260 lin.ft. 18-in. corrugated iron pipe...............	0.60	1.00	0.75	0.75	0.70	0.80	0.80	0.75
200 lin.ft. 24-in. corugated iron pipe..............	0.70	1.50	0.90	1.00	1.00	1.10	1.00	1.00
640 lin.ft. 30-in. corrugated iron pipe..............	0.80	1.50	1.10	1.50	1.00	1.25	1.20	1.50
630 cu.yd. Class B concrete......................	20.00	15.00	13.00	10.00	12.00	11.50	13.00	10.00
16,000 lin.ft. guard rail.........................	0.30	0.35	0.40	0.30	0.25	0.40	0.35	0.50
466 monuments	1.00	1.00	1.50	3.00	1.00	1.00	0.90	1.00
Extended totals	$60,879	$59,430	$48,821	$42,079	$55,311	$52,024	$50,346	$68,924

ENLARGING POND, ATLANTIC CITY, N. J.

✚Bids were received Oct. 1 by the Board of Commissioners for enlarging lower Doughty Pond from (A) EDWARD L. EADER CO., (awarded contract); (B) William H. Arthur Co.; (C) Charles T. Eastburn Co.; (D) Merrill-Ruckgaber Co.; (E) Fillebrown Taylor Co.; (F) Norton & Gorman; (G) Kelley McFeeley Co.; (H) F. J. Boas Co.; (I) Sutton & Corson; (J) Atlantic Construction & Supply Co. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
30,000 cu.yd. embankment..........	$0.40	$0.52	$0.40	$0.55	$0.53	$0.60	$0.60	$0.58	$0.58	$0.71
24,100 sq.ft. steel sheet piling.......	0.80	0.85	0.90	0.90	0.875	1.00	0.83	0.90	0.90	0.89
20 cu.yd. cement grout.............	20.00	10.00	10.45	25.00	25.00	25.00	21.35	10.00	60.00	25.00
24,100 lin.ft. wood stripping........	0.01	0.02	0.02	0.02	0.01	0.04	0.04	0.02	0.02	0.04
1577 cu.yd. concrete in spillway.....	9.00	7.63	8.79	7.50	9.40	6.00	8.76	10.00	9.99	13.00
1000 lb. reinforcing steel...........	0.05	0.05	0.18	0.05	0.07	0.05	0.06	0.05	0.135	0.04
59 expansion bolts.................	4.00	2.50	1.98	3.00	5.00	2.50	3.00	2.00	1.12	5.00
15 cu.yd. concrete in wood stave collar	30.00	11.00	12.00	15.00	12.00	15.00	11.37	10.00	26.77	15.00
2575 cu.yd. concrete in core wall...	6.35	6.80	7.82	7.50	8.00	8.00	7.90	8.80	8.00	8.00
13 M. ft. b.m. lumber..............	0.05	0.045	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.035
Bridge from bank to intake (lump sum)	175.00	195.17	148.80	200.00	130.00	200.00	376.00	160.00	210.65	264.00
3800 lin.ft. piling spillway foundation	0.25	0.25	0.25	0.25	0.30	0.30	0.28	0.25	0.34	0.35
9 M ft. b.m. spillway foundation....	0.04	0.05	0.04	0.05	0.055	0.04	0.04	0.04	0.05	0.045
36,000 sq.ft. concrete lining........	0.13	0.12	0.14	0.13	0.15	0.15	0.15	0.14	0.20	0.14
New intake screen chamber (lump sum)	1000.00	1250.00	1219.92	1500.00	1500.00	2000.00	2552.00	2515.00	2683.64	1600.00
100 cu.yd. concrete not in plans.....	6.00	7.63	7.00	8.00	8.00	8.00	9.76	10.00	8.19	10.00
100 cu.yd. excavation not in plans...	0.50	1.50	1.00	1.00	1.00	1.00	1.00	2.00	1.00	1.50
500 lb. steel rods not in plans......	0.05	0.05	0.04	0.05	0.07	0.05	0.06	0.10	0.135	0.04
5 M. ft b.m. not in plans...........	0.04	0.045	0.04	0.05	0.05	0.04	0.04	0.06	0.054	0.03
Extended totals................	$71,891	$75,585	$78,518	$80,369	$84,067	$84,793	$85,537	$89,615	$91,342	$96,288

SEAWALL, WINTHROP, MASS.

✚Bids were received Sept. 23 for the construction of a seawall at the north end of the Winthrop Shore Reservation, from (A) George T. Rendle Co., East Boston; (B) McCarthy & Walsh, East Boston; (C) Hancock Engineering Co., Boston; (D) Coleman Bros., Boston; (E) Michael D. Russo, Boston; (F) Hugh Nawn Contracting Co., Roxbury; (G) Thomas Fitzgibbon, Beverley; (H) T. Stuart & Son Co., Newton; (I) John Cashman & Sons Co., Boston; (J) Boston Contracting Co., Charlestown; (K) W. H. Ellis & Son Co., East Boston; (L) Lawler Bros., Charlestown; (M) Leighton-Mitchell Co., Boston; (N) Rowe Contracting Co., Boston; (O) J. H. Ferguson, Dorchester; (P) CAPUTO & GIOVANNINI, Boston (awarded contract). The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
2000 cu.yd. earth excavation	$2 80	$2 25	$1 56	$2 00	$0 75	$0 75	$0 75	$1 10	$0 40	$0 50	$0 70	$0 75	$0 76	$0 50	$0 58	$0.60
9000 cu.yd. filling material	1 10	1.00	1.20	0 80	0 45	0 75	1 00	0 75	0 60	0 55	0 50	0 65	0 56	0 70	0.55	0.45
25 M. ft. b.m. lumber .	100 00	75 00	87 60	45 00	65 00	60 00	58 00	50 00	65 00	50 00	55 00	80 00	60 00	55 00	60.00	40.00
1650 cu.yd. concrete masonry in walls...	9 25	8 50	6 61	8 00	9 60	7 00	6.60	6 00	8 00	7 00	6.00	5 00	5 00	5 50	4 95	5.85
360 cu yd. stone masonry	7 50	10 00	12 14	9 00	8 00	10 00	8 00	13 75	8 25	13 00	14 00	8 50	10.30	10 00	7 00	7.20
770 lin.ft. stone coping.	5 50	5 75	5 43	6 00	7 20	7 00	4 00	3 85	5 10	5 00	5 50	5 50	5 50	3 00	5 20	4 10
Extended totals	$40,197	$37,427	$35,568	$33,385	$31,439	$30,240	$28,800	$28,014	$27,922	$27,280	$26,450	$24,895	$24,253	$23 660	$22,301	$21,651

RAPID TRANSIT SYSTEM, NEW YORK, N. Y.

Bids were received, Oct. 6, by the Public Service Commission for constructing Section 1, Route 43, and Section 1, Route 26 of the Lexington Ave.-Fourth Ave. rapid transit system from (A) Rapid Transit Subway Construction Co., 165 Broadway, New York, (B) Degnon Contracting Co., 30 East 42d St., New York, (C) T. A. Gillespie Co., 50 Church St., New York, (D) Smith, Hauser & MacIsaac, Inc., 18 East 41st St., New York, (E) Holbrook, Cabot & Rollins Corporation, 331 Madison Ave., New York. The item bids were as follows:

SECTION 1, ROUTE 43

	A	B	C	D	E
61,[illegible] cu. yd. earth excavation above mean high water	$5.10	$6.00	$[illegible]	$[illegible]	$10.[illegible]
11,[illegible] cu. yd. earth excavation for sewers	[illegible]	6.00	9.[illegible]	[illegible]	10.00
4,6[illegible] cu. yd. rock excavation	7.[illegible]	7.50	[illegible]	15.[illegible]	15.[illegible]
[illegible] cu. yd. rock excavation for sewers, etc.	[illegible]	7.50	1[illegible]	15.00	10.[illegible]
Underpinning of					
1-story terminal building, S.E. cor. Park Ave. and 41st St. (lump sum)	10,000.00	25,000.00	30,000.00	10,000.00	
[illegible]-story building, Nos. 118-120 E. 42d St. (lump sum)	5,000.00	3,500.00	10,000.00	5,000.00	[illegible]
For [illegible] protecting, etc., Park Ave. (lump sum)	10,000.00	1,500.00	5,000.00	15,000.00	[illegible]
[illegible] cu. yd. tunnel excavation S.B. local, Sta. 202+08 to sta. 204+[illegible]	20.00	15.00	2[illegible].00	25.00	15.00
Tunnel excavation S.B. local, Sta. 2[illegible]+25 to [illegible] 50 ft.					
[illegible] cu. yd. north of E. 41st St.	11.00	12.00	12.00	15.00	2[illegible]
Express tracks in Park Ave., from sta. 204+60 to sta. 207+16 including					
[illegible] cu. yd. cross passage and signal tower	20.00	15.00	22.00	[illegible]	20.[illegible]
[illegible] cu. yd. express tracks in Park Ave., Sta. 207+16 to 210+15	13.00	12.00	15.00	15.[illegible]	25.0[illegible]
[illegible] cu. yd. N.B. local. From sta. 2[illegible]+47 to sta. 209+53	30.00	15.00	20.00	35.00	20.0[illegible]
[illegible] cu. yd. excavation for working shafts	1[illegible].00	15.00	10.00	[illegible].00	30.0[illegible]
[illegible] cu. yd. concrete masonry	11.00	12.00	12.00	12.0[illegible]	12.00
[illegible] cu. yd. protective concrete outside waterproofing	11.00	12.00	10.0[illegible]	12.00	12.0[illegible]
[illegible] cu. yd. rubble stone masonry	8.00	7.50	8.00	1[illegible].00	8.00
[illegible] cu. yd. dry rubble masonry	6.00	5.00	6.00	10.00	6.00
[illegible] cu. yd. brick masonry	20.00	15.[illegible]	15.00	[illegible].00	2[illegible]
[illegible] cu. yd. hollow terra cotta masonry	15.00	15.[illegible]	15.00	[illegible]	20.[illegible]
3[illegible] bbl. portland cement grout	3.50	4.50	3.50	4.50	4.[illegible]
[illegible] sq. yd. resurfacing concrete masonry	5.00	2.50	4.00	2.50	2.[illegible]
[illegible] lin. ft. timber piles	0.75	0.50	0.75	1.00	0.50
2 M ft. [illegible] timber foundations	100.00	50.00	75.00	50.00	50.00
[illegible] cu. yd. broken stone and gravel	2.50	2.50	2.00	3.[illegible]	1.5[illegible]
[illegible] sq. yd. 1-ply waterproofing	0.75	0.55	0.60	1.0[illegible]	0.30
[illegible] sq. yd. 2-ply waterproofing	1.00	1.00	0.75	1.25	0.45
7[illegible]20 sq. yd. 3-ply waterproofing	1.25	1.25	1.00	2.[illegible]	0.75
1[illegible] sq. yd. 4-ply waterproofing	1.50	1.50	1.50	3.[illegible]	0.90
1[illegible] sq. yd. 5-ply waterproofing	2.00	1.75	2.00	3.50	1.15
[illegible]50 sq. yd. 6-ply waterproofing	2.25	2.00	2.50	4.00	1.35
1[illegible] sq. yd. dry-ply waterproofing	0.60	0.40	0.5[illegible]	1.00	0.2[illegible]
6[illegible] cu. yd. brick in asphalt mastic	35.00	25.00	3[illegible].0[illegible]	[illegible].00	25.[illegible]
1[illegible] lin. ft. 1[illegible]-in. vitrified pipe	0.80	0.80	1.00	1.50	0.7[illegible]
1[illegible] lin. ft. 1[illegible]-in. vitrified pipe	0.70	0.60	0.80	1.25	0.65
[illegible] lin. ft. 8-in. vitrified pipe	0.60	0.40	0.75	1.[illegible]	0.55
1[illegible] lin. ft. 6-in. vitrified pipe	0.50	0.30	0.70	1.[illegible]0	0.5[illegible]
1[illegible] lin. ft. 4-in. vitrified pipe	0.40	0.20	0.60	[illegible]	0.[illegible]5
1[illegible] lin. ft. 8-in. c.i. pipe	1.50	1.25	1.50	2.[illegible]0	1.[illegible]
1[illegible] lin. ft. 6-in. c.i. pipe	1.10	1.00	1.[illegible]0	1.75	0.7[illegible]
1[illegible] lin. ft. 4-in. c.i. pipe	0.80	1.00	[illegible].75	1.50	0.65
[illegible] lin. ft. 1[illegible]-in. c.i. pipe	2.00	1.50	2.[illegible]0	3.00	1.25
[illegible] lin. ft. 3-in. extra heavy c.i. pipe specials and fittings	1.00	1.00	[illegible]	1.25	1.[illegible]
[illegible] lin. ft. 4-in. extra heavy c.i. pipe specials and fittings	1.25	1.0[illegible]	1.[illegible]0	1.50	1.25
[illegible] lin. ft. 6-in. extra heavy c.i. pipe specials and fittings	1.75	1.25	1.75	1.75	1.5[illegible]
[illegible] lin. ft. 8-in. extra heavy c.i. pipe specials and fittings	2.00	1.50	2.5[illegible]	2.25	2.[illegible]
[illegible] duct-ft. tunnel ducts	0.15	0.15	0.13	0.2[illegible]	0.12
[illegible] duct-ft. railroad ducts	0.17	0.15	0.15	[illegible]	0.1[illegible]
[illegible] tons riveted steel	95.00	90.[illegible]	[illegible]	[illegible]	75.[illegible]
[illegible] tons removal of old steel	50.00	4[illegible]	3[illegible]	125.[illegible]	2[illegible]
[illegible] lin. ft. [illegible] columns	20.00	2[illegible]	[illegible]	12[illegible]	[illegible]
[illegible] tons steel beams and shapes	72.00	[illegible]	6[illegible]	[illegible]	7[illegible]
[illegible] [illegible]-in. holes in steel	[illegible]	0.[illegible]0	1.[illegible]0	[illegible]	2.[illegible]
[illegible] [illegible] and bars	1[illegible]	6[illegible]	6[illegible]	1[illegible]	[illegible]
[illegible] tons [illegible] iron castings	75.[illegible]	6[illegible]	75.[illegible]	1[illegible]	6[illegible]
[illegible] tons [illegible] iron sewer fittings	[illegible]	6[illegible]	[illegible]	1[illegible]	6[illegible]
[illegible] special wire forms	0.10	0.15	[illegible]	[illegible]	0.1[illegible]
[illegible] lin. ft. [illegible] rail	0.60	[illegible]	[illegible]	1.[illegible]	0.4[illegible]
[illegible] steel [illegible]	1.[illegible]	1.[illegible]	1.[illegible]	2.[illegible]	[illegible]
[illegible]	1.60	1.[illegible]	1.[illegible]	[illegible]	2.[illegible]
[illegible] sq. yd. [illegible] restored [illegible]	2.75	2.[illegible]0	2.[illegible]	[illegible]	2.[illegible]
[illegible] sq. yd. asphalt pavement restored	3.[illegible]	[illegible]	3.[illegible]	[illegible]	2.[illegible]
[illegible] sq. yd. [illegible] block pavement restored	[illegible]	3.[illegible]	3.[illegible]0	[illegible]	2.1[illegible]
[illegible] sq. yd. asphalt block pavement restored	3.10	3.[illegible]	2.[illegible]	[illegible]	2.[illegible]
[illegible] lin. ft. [illegible] curb in place	1.[illegible]0	1.[illegible]	1.[illegible]	[illegible]	1.[illegible]
[illegible] lin. ft. [illegible] granite curb in place	2.00	2.[illegible]0	2.[illegible]	3.[illegible]	1.[illegible]
[illegible] lin. ft. [illegible]-in. [illegible] electric conduit in place	[illegible]	0.[illegible]	0.1[illegible]	[illegible]	0.1[illegible]
[illegible] lin. ft. [illegible]-in. [illegible] electric conduit in place	0.1[illegible]	0.40	[illegible]	[illegible]	[illegible]
[illegible] lin. ft. [illegible]-in. [illegible] electric conduit in place	[illegible]	0.[illegible]0	0.[illegible]0	0.[illegible]	[illegible]
[illegible] lin. ft. [illegible]-in. [illegible] electric conduit in place	[illegible]	0.[illegible]5	0.30	0.[illegible]	0.[illegible]
[illegible] boxes in place	[illegible]	1.[illegible]0	1.[illegible]0	2.[illegible]	0.[illegible]
[illegible] boxes in place	[illegible]	[illegible]	1.[illegible]0	[illegible]	1.[illegible]
[illegible] pipe specials and fittings	2.[illegible]	1.[illegible]	1.[illegible]	[illegible]	1.[illegible]
[illegible] pipe specials and fittings	1.[illegible]	1.[illegible]	[illegible]	2.[illegible]	1.[illegible]
[illegible] lin. ft. [illegible]-in. vitrified sewer pipe	5.[illegible]	[illegible]	[illegible]	3.[illegible]	1.[illegible]
[illegible] lin. ft. [illegible]-in. vitrified sewer pipe	6.[illegible]0	[illegible]	[illegible]	4.[illegible]	1.[illegible]
[illegible] lin. ft. [illegible]-in. vitrified sewer pipe	7.[illegible]	[illegible]	[illegible]	4.[illegible]	2.[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	7[illegible]	1[illegible]	7[illegible]	[illegible]	[illegible]
[illegible]	1[illegible]	1[illegible]	1[illegible]	[illegible]	[illegible]
[illegible]	1[illegible]	1[illegible]	1[illegible]	[illegible]	[illegible]
[illegible]	1[illegible]	1[illegible]	1[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible].00	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible].00	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1,[illegible]	1,[illegible]	1,[illegible]	1,[illegible]
[illegible]	[illegible]	1,[illegible]	1,[illegible]	[illegible]	1,[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.[illegible]	1.[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1[illegible]	1[illegible]	[illegible]
[illegible]	[illegible]	2[illegible]	[illegible]	1[illegible]	[illegible]
[illegible]	[illegible]	1.[illegible]	0.[illegible]	1.[illegible]	1.[illegible]
[illegible]	[illegible]	1.[illegible]	0.[illegible]	1.[illegible]	1.[illegible]
[illegible]	[illegible]	1.[illegible]	1.[illegible]	1.[illegible]	2.[illegible]
[illegible]	[illegible]	[illegible]	2.[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2.[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2.[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2.0[illegible]	[illegible]	[illegible]
[illegible]	1[illegible]	[illegible]	1[illegible]	1[illegible]	[illegible]

1600 lin.ft. bypassing 20-in. w.i. pipe on trestle	12.00	7.50	12.00	15.00	15.00
1600 lin.ft. trestle to support bypassing pipes	4.00	2.00	5.00	5.00	5.00
200 lin.ft. 6-in. w.i. gas pipe in place	1.50	1.00	3.00	2.00	3.00
1000 lin.ft. 8-in. w.i. gas pipe in place	1.75	1.25	4.00	2.50	4.00
100 lin.ft. 12-in. w.i. gas pipe in place	3.00	1.50	5.00	3.00	6.00
20 gas service restored	20.00	25.00	20.00	25.00	25.00
100 ton new c i. hub and spigot water and gas pipe, straight	40.00	40.00	60.00	50.00	30.00
100 lin.ft. new standard weight w.i. gas pipe, 6-in	1.50	1.00	1.00	1.00	1.00
100 lin.ft. new standard weight w.i. gas pipe, 8-in	2.00	1.25	1.50	1.25	1.25
100 lin.ft. new standard weight w.i. gas pipe, 12-in	3.00	2.00	2.00	1.50	2.00
50 ton special c.i. hub and spigot castings	75.00	60.00	75.00	100.00	60.00
1000 lb. new malleable fittings for w.i. gas pipe	0.12	0.05	0.10	0.15	0.15
200 lin.ft. 8-in. high pressure fire system water pipe	3.00	2.00	1.00	5.00	1.95
100 lin.ft. 12-in. high pressure fire system water pipe	4.00	3.00	1.50	6.00	3.50
200 lin.ft. 16-in. high pressure fire system water pipe	5.00	4.00	2.00	8.00	6.35
10 ton new c.i. spigot and groove straight pipe	45.00	40.00	60.00	50.00	30.00
5 ton special c.i. spigot and groove castings	80.00	60.00	75.00	100.00	75.00
500 lin.ft. 6-in. air pipe in place	1.25	1.00	1.25	1.00	0.30
100 lin ft. new 6-in. air pipe in place	2.50	1.00	2.50	1.25	0.50
900 lin.ft. 8-in. mail tubes in place	3.00	5.00	3.00	3.00	10.00
100 lin.ft. new 8-in. mail tubes in place, straight	3.00	3.00	4.00	4.00	10.00
50 lin.ft. new 8-in. mail tubes in place, curved	5.00	8.00	6.00	10.00	25.00
5000 duct-ft. electric ducts and conduits in place	0.60	0.80	0.50	1.00	0.75
5000 lin.ft. 2½-in. w.i. duct pipes	0.60	0.80	0.50	0.75	0.60
15,000 lin.ft. 3-in w.i. duct pipes	0.65	0.80	0.60	0.80	0.70
200 lin.ft. 3½-in. w.i. duct pipes	0.70	0.80	0.90	0.90	0.75
400 lin.ft. 4-in. w.i. duct pipes	0.75	0.80	1.25	1.00	0.80
500 lin.ft. 2-in. Edison conduits	0.50	1.50	0.50	0.75	1.00
500 lin ft. 2½-in. Edison conduits	0.60	1.50	0.60	0.80	1.25
800 lin.ft. 3-in. Edison conduits	0.70	1.50	0.70	0.90	1.50
20 electric service restored	20.00	25.00	20.00	25.00	25.00
Extended totals	$2,368,867	$2,476,350	$2,720,276	$3,394,340	$3,606,330

Section 1—Route 26

	A	B	C	D	E
750 cu.yd. earth excavatinn	$5.00	$6.00	$10.00	$10.00	$10.00
125 cu.yd. rock excavation	10.00	7.50	10.00	20.00	15.00
34,050 cu.yd. tunnel excavation	12.00	10.00	11.00	12.00	13.00
15,100 cu.yd. concrete masonry	13.00	12.00	11.00	12.50	12.00
3810 cu.yd. protective concrete outside waterproofing	11.00	12.00	11.00	12.50	12.00
50 cu.yd. brick masonry	20.00	15.00	15.00	30.00	20.00
50 cu.yd. hollow terra cotta masonry	15.00	15.00	15.00	30.00	20.00
4400 bbl. portland cement grout	3.50	4.50	3.50	4.50	4.00
50 cu.yd. broken stone and gravel	2.50	2.50	3.00	3.00	1.50
720 sq.yd. 1-ply waterproofing	0.60	0.75	0.60	1.00	0.30
100 sq.yd. 2-ply waterproofing	0.75	1.00	0.75	1.25	0.45
300 sq.yd. 3-ply waterproofing	1.00	1.25	1.00	2.50	0.75
100 sq.yd. 4-ply waterproofing	1.25	1.50	1.50	3.00	0.90
100 sq.yd. 5-ply waterproofing	1.50	1.75	2.00	3.50	1.15
100 sq.yd. 6-ply waterproofing	1.75	2.00	2.50	4.00	1.35
100 sq.yd. dry ply waterproofing	0.50	0.40	0.50	1.00	0.20
100 sq.yd. 1-ply waterproofing (tunnel)	1.00	0.75	1.20	5.00	0.60
100 sq.yd. 2-ply waterproofing (tunnel)	1.50	1.00	1.50	5.00	0.90
100 sq.yd. 3-ply waterproofing (tunnel)	2.00	1.25	2.00	5.00	1.50
100 sq.yd. 4-ply waterproofing (tunnel)	2.50	1.50	3.00	5.00	1.75
100 sq.yd. 5-ply waterproofing (tunnel)	3.00	1.75	4.00	5.00	2.30
5000 sq.yd. 6-ply waterproofing (tunnel)	3.50	2.50	5.00	6.00	2.70
160 cu.yd. brick in asphalt mastic	40.00	30.00	30.00	35.00	25.00
50 lin.ft. 12-in. vitrified pipe	0.75	0.80	1.00	1.50	0.70
50 lin.ft. 10-in. vitrified pipe	0.65	0.60	0.80	1.25	0.65
50 lin.ft. 8-in. vitrified pipe	0.50	0.40	0.75	1.00	0.55
50 lin.ft. 6-in. vitrified pipe	0.40	0.30	0.70	1.00	0.50
50 lin.ft. 4-in. vitrified pipe	0.35	0.20	0.60	0.80	0.45
50 lin.ft. 6-in. c.i. pipe	1.50	1.00	1.00	1.75	0.70
200 lin.ft. 4-in. c.i. pipe	1.00	1.00	0.75	1.50	0.65
50 lin.ft. 3-in. extra heavy c.i. pipe specials and fittings	1.00	1.00	0.80	1.25	1.00
50 lin.ft. 4-in. extra heavy c.i. pipe specials and fittings	1.25	1.00	1.00	1.50	1.25
50 lin.ft. 6-in. extra heavy c.i. pipe specials and fittings	1.75	1.25	1.75	1.75	1.50
50 lin.ft. 8-in. extra heavy c.i. pipe specials and fittings	2.00	1.50	2.50	2.25	2.00
11,000 duct ft. tunnel ducts	0.25	0.15	0.13	0.20	0.12
190 ton riveted steel	80.00	90.00	80.00	100.00	75.00
120 ton steel beams and shapes	72.00	80.00	60.00	90.00	70.00
18 ton steel rods and bars	80.00	60.00	60.00	90.00	80.00
4 ton miscellaneous iron castings	75.00	60.00	75.00	100.00	60.00
800 lb. special wire forms	0.10	0.15	0.15	0.20	0.15
2080 lin.ft. 1¾-in. oak hand rail	0.60	0.50	0.50	1.00	0.40
330 sq.ft. steel grating	1.50	1.50	1.50	2.00	2.00
90 sq.yd. street surface restored, sidewalk	2.75	2.00	2.50	5.00	2.00
100 lin.ft. new bluestone curb in place	1.50	1.50	1.50	2.50	1.00
100 lin.ft. new 8-in. granite curb in place	2.00	2.00	2.00	3.50	1.50
1500 lin.ft. ¾-in. w.i. electric conduits in place	0.25	0.30	0.25	0.25	0.15
275 lin.ft. 1½-in. w.i. electric conduits in place	0.40	0.40	0.40	0.50	0.20
200 lin.ft. 2-in. w.i. electric conduits in place	0.50	0.50	0.50	0.60	0.25
2500 lin.ft. 1-in. w.i. electric conduits in place	0.30	0.35	0.30	0.40	0.20
110 c.i. outlet boxes in place	1.00	1.00	1.00	2.00	0.70
20 c.i. pull boxes in place	5.00	5.00	1.50	5.00	1.00
50 lin.ft. 6-in. extra heavy c.i. pipe specials and fittings	2.00	1.50	1.50	2.50	1.50
50 lin.ft. 3-in. extra heavy c.i. pipe specials and fittings	1.00	1.00	0.80	2.00	1.25
Extended totals	$728,445	$648,115	$670,512	$759,920	$747,022
Extended grand totals routes 43 and 26	$3,097,312	$3,124,465	$3,390,787	$1,154,260	$1,353,352

BRIDGE SUPERSTRUCTURE, MASSILLON, OHIO

+Bids were received by the Commissioners of Stark County, Canton, Sept. 9, for the construction of the superstructure of the bridge across the Ohio Canal, Tuscarawas River, from (A) Fred Heisler, Massillon; (B) Hanneman Bros., Detroit, Mich.; (C) T. B. Husband, Cleveland; (D) Connolly-Cannon Co., Phillipsburg, N. J.; (E) Luke & O'Brien, Canton; (F) Cullen-Friestedt Co., Chicago, Ill.; (G) S. C. KISTNER & SON, Delaware, Ohio (awarded contract); (H) Thomas Sheahan, Hagerstown, Md.; (I) L. A. Mullins & Co., Cleveland; (J) E. J. Lander, Canton. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
600 cu.yd. excavation	$3.00	$3.00	$1.00	$3.50	$2.00	$.372	$5.00	$3.25	$2.00	$7.50
155 cu.yd. concrete footers	6.00	8.00	7.00	7.00	7.50	7.20	9.00	9.00	6.50	9.25
64 cu.yd. concrete wall	6.00	7.00	8.00	10.00	6.00	9.85	7.00	8.00	7.50	12.50
1100 cu.yd. concrete trestle	13.00	11.35	12.00	18.00	12.00	16.10	9.75	14.90	11.50	13.00
210 cu.yd. concrete floors	10.00	12.00	14.00	25.00	11.00	17.35	11.25	12.00	13.00	15.00
2200 cu.yd. concrete finish	.75	.85	.60	2.25	.80	.67	.75	1.00	.50	.45
182,000 lb. reinforcing steel	.02625	.025	.03	.05	.0275	.045	.025	.03	0.35	.025
1020 lin.ft. setting pipe	.15	.25	.10	.50	.25	.25	.25	.25	30	.15
Extended totals	$26,094	$25,168	$25,219	$43,435	$25,276	$35,251	$24,385	$30,682	$25,843	$29,877

Decrease in Immigration—Figures of the Department of Labor show that since July 1, 1914, there has been a decided decrease in the influx of foreigners to this country. There were 34,637 entering in July, compared with 87,658 of the same month in 1913. In August there has been a further reduction of about 20,000, and September arrivals will probably be even less.

The New Haven Reduces Its Board—It is the intention of the New Haven R.R. to reduce the number of its board of directors from 27 to 17. Four men, William Rockefeller, George F. Baker, Charles F. Brooker and J. S. Elton, have already resigned from the board of directors. The reason for their resignations has not been disclosed.

RAPID TRANSIT SYSTEM, NEW YORK, N. Y.

Section 1, Route 18

+Bids were received by the [illegible] Commission [illegible] Section 1, Route 18 of the [illegible] rapid transit [illegible] from (A) FREDERICK L. CRANFORD (N.) 17 [illegible] St., Brooklyn, (awarded contract); (B) [illegible] Contracting Co., [illegible] East [illegible] St., New York; (C) [illegible] & [illegible], Inc., 18 East [illegible] St., New York; (D) Holbrook, Cabot & Rollins Corporation, [illegible] Ave., New York; (E) [illegible] Co., Woolworth Bldg., New York; (F) Underpinning & Foundation Co., 290 Broadway, New York; (G) Rapid Transit Subway Construction Co., 16[illegible] Broadway, New York. The item bids were as follows:

	A	B	C	D	E	F	G
[illegible] cu yd earth excavation above mean high water	$6 [illegible]	$5 [illegible]	$6 [illegible]	$6 [illegible]	$6 [illegible]	$6 [illegible]	$6 [illegible]
[illegible] cu yd earth excavation below mean high water	6 [illegible]	[illegible]	7 [illegible]	7 [illegible]	[illegible]	1[illegible]	13 [illegible]
[illegible] cu yd rock excavation [illegible] above and below mean high water	6 [illegible]	[illegible]	[illegible]	6 [illegible]	6 [illegible]	1[illegible]	6 00
[illegible] front ft underpinning buildings on Park Place less than 7 stories	7[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12[illegible]	120 0[illegible]
724 front ft underpinning buildings on Park Place 7 to 12 stories	[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	12[illegible]	2[illegible]0 00
[illegible] front ft [illegible] buildings on Park Place including labor and material	1[illegible]	[illegible]	[illegible]	7[illegible]	[illegible]	12[illegible]	[illegible]
Protecting U. S. Post Office building during construction (lump sum)	2[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]	[illegible]
Underpinning buildings No. [illegible] Park Row and No. 1 Beekman St. (lump sum)	[illegible]	[illegible]	[illegible]	[illegible]	6[illegible]	17,[illegible]	14,[illegible]0 00
Underpinning buildings No. 145 Nassau St. and 38 Park Row (lump sum)	21,75[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]0.00
Underpinning buildings Nos. 3 to 5 Beekman St. (lump sum)	12,8[illegible] 00	[illegible]	20,[illegible]	[illegible]	[illegible]	[illegible]	25,[illegible]
Underpinning buildings No. 1[illegible] Nassau St. and 14 Beekman St. (lump sum)	[illegible]	[illegible]	12,[illegible]	[illegible]	14,[illegible]	[illegible]	[illegible]0 00
Underpinning buildings No. 1[illegible] Nassau St. and 13 Beekman St. (lump sum)	[illegible],340 [illegible]	12,[illegible]	1[illegible]	[illegible]	12,[illegible]	15,[illegible]	15,[illegible]
Underpinning buildings Nos. 16 to 22 Beekman St. (lump sum)	13,585 [illegible]	18,000 00	11,[illegible]	13,750 [illegible]	21,[illegible]	[illegible]	25,0[illegible]0 00
Underpinning buildings Nos. [illegible] and 17 Beekman St. (lump sum)	7,50[illegible]	15,000 00	2,[illegible]	15,62[illegible]	1[illegible]	1[illegible]	15,[illegible]0
Underpinning buildings Nos. 19 to 29 Beekman St. (lump sum)	8,1[illegible]	12,500 00	[illegible] 00	10,1[illegible]	1[illegible]	1[illegible]	17,[illegible] 00
[illegible] cu yd tunnel excavation including timbering and disposal of material	[illegible] 20	12	16 00	11 [illegible]	9 [illegible]	18 75	15 [illegible]
[illegible] cu yd concrete masonry	8 80	10 [illegible]	16 2[illegible]	9,[illegible]	11 [illegible]	12 [illegible]	12 [illegible]
[illegible] cu yd [illegible] concrete masonry outside waterproofing	8 80	16 [illegible]	16 25	7 [illegible]	12 00	11 5[illegible]	10 [illegible]
[illegible] cu yd rubble stone masonry	6 50	[illegible]	10 25	8 [illegible]	[illegible]	11 [illegible]	[illegible]
5[illegible] cu yd dry rubble masonry	6 00	[illegible]	10 25	5 00	5 [illegible]	[illegible]	[illegible]
15 cu yd brick masonry	2[illegible] 0[illegible]	15 00	25 00	15 00	2[illegible] 00	3[illegible]	20 [illegible]
[illegible] cu yd removal of concrete as required by Sect. No. 416	7[illegible] 00	20 00	100 00	15 [illegible]	[illegible]	6[illegible]	2[illegible]
[illegible] cu yd [illegible]	15 00	15 00	25 00	15 00	1[illegible]	3[illegible]	15 [illegible]
[illegible] bbl. portland cement	3 00	4 00	3 [illegible]	2 [illegible]	3 [illegible]	4 [illegible]	3 [illegible]
[illegible] lin ft timber piles	[illegible]	0 [illegible]	1 [illegible]	0 75	0 6[illegible]	[illegible]	1 [illegible]
[illegible] M ft b.m. timber foundations	75 00	100 00	1[illegible] 00	7[illegible]	7[illegible]	5[illegible]	75 [illegible]
[illegible] cu yd broken stone or gravel	2 5[illegible]	2 [illegible]	3 [illegible]	2 [illegible]	2 [illegible]	4 [illegible]	3 [illegible]
[illegible] sq yd waterproofing, 1-ply	0 50	75 00	0 6[illegible]	0 3[illegible]	0 [illegible]	0 5[illegible]	0 60
[illegible] sq yd waterproofing, 2-ply	0 70	1 00	[illegible] 85	0 1[illegible]	[illegible]	0 [illegible]	0 [illegible]
[illegible] sq yd waterproofing, 3-ply	0 8[illegible]	1 25	1 20	0 70	0 9[illegible]	1 [illegible]	1 [illegible]
[illegible] sq yd waterproofing, 4-ply	1 0[illegible]	1 [illegible]	1 30	0 9[illegible]	1 [illegible]	1 [illegible]	1 [illegible]
[illegible] sq yd waterproofing, 5-ply	1 [illegible]	1 [illegible]	1 50	1 1[illegible]	1 [illegible]	2 1[illegible]	2 [illegible]
[illegible] sq yd waterproofing, 6-ply	1 5[illegible]	[illegible]	1 7[illegible]	1 [illegible]	1 [illegible]	[illegible]	2 [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SECTION 1, ROUTE 48—(Continued)

25 service connections for water pipes, all sizes	20.00	25.00	20.00	25.00	20.00	25.00	20.00
600 lin.ft. c.i. gas pipe, 4-in	1.00	1.00	1.00	0.65	1.00	0.80	0.75
1000 lin.ft. c.i. gas pipe, 6-in	1.00	1.00	1.50	1.15	1.50	1.00	1.00
200 lin.ft. c.i. gas pipe, 8-in	1.50	1.25	1.75	1.25	2.00	1.20	1.25
100 lin.ft. c.i. gas pipe, 16-in	3.00	1.75	4.00	3.50	3.00	2.00	3.00
2800 lin.ft. w.i. bypassing pipe, 6-in	2.50	5.00	4.50	1.70	2.50	4.00	4.00
100 lin.ft. w.i. bypassing pipe, 8-in	2.50	5.50	5.00	3.00	3.50	5.00	5.00
50 lin.ft. w.i. bypassing pipe, 12-in	3.50	6.00	8.00	4.00	5.00	6.00	9.00
100 lin.ft. w.i. bypassing pipe on trestle, 12-in	3.50	6.00	8.00	4.50	5.00	6.00	10.00
100 lin.ft. w.i. bypassing pipe on trestle, 8 in	2.50	5.50	5.00	3.50	3.00	5.00	6.00
100 lin.ft. trestle to support bypassing pipes	3.00	2.00	8.00	3.00	3.00	3.00	4.00
25 service connection, for gas pipes all sizes	20.00	25.00	20.00	15.00	20.00	25.00	20.00
10 ton c.i. hub and spigot pipe (straight)	40.00	40.00	65.00	35.00	40.00	60.00	45.00
5 ton c.i. hub and spigot pipe (special)	80.00	60.00	100.00	70.00	80.00	100.00	75.00
100 lin.ft. 8-in. high-pressure fire system water pipe	2.00	2.00	3.00	2.00	2.00	8.00	3.00
100 lin.ft. 12-in. high-pressure fire system water pipe	3.00	3.00	6.00	3.50	3.00	10.00	5.00
450 lin.ft. 16-in. high-pressure fire system water pipe	3.00	4.00	8.00	6.35	4.50	12.00	6.00
8 ton c.i. spigot and groove high-pressure pipe (straight)	50.00	40.00	65.00	35.00	50.00	60.00	45.00
6 ton c.i. spigot and groove high-pressure pipe (special)	80.00	60.00	100.00	75.00	80.00	100.00	80.00
100 lin.ft. steam pipe, 6-in	8.00	7.50	15.00	10.00	4.00	30.00	6.00
100 lin.ft. steam pipe, 4-in	7.00	5.00	15.00	7.00	3.00	30.00	5.00
100 lin.ft. steam pipe, 8-in	15.00	10.00	20.00	12.00	5.00	32.00	8.00
15 service connections for steam pipes	70.00	50.00	75.00	100.00	25.00	60.00	200.00
100 lin.ft. new steam pipe, 6-in	7.00	2.50	1.50	6.00	4.00	2.00	7.00
100 lin.ft. new steam pipe, 8-in	9.00	3.00	2.00	8.00	5.00	3.00	8.50
100 lin.ft. new steam pipe, 4 in	6.00	2.00	2.00	4.00	4.00	1.50	4.50
200 lin.ft. air pipe in connection with mail tube, 2 in	1.75	1.00	1.00	1.00	2.00	0.50	1.00
100 lin.ft. new air pipe connection with mail tube, 2-in	1.75	1.00	1.00	0.50	2.00	1.00	1.50
1000 lin.ft. mail tube, 8 in	5.00	2.50	3.00	5.00	4.00	5.00	3.00
200 lin.ft. new mail tube (straight) 8 in	5.00	3.00	4.00	5.00	4.00	5.00	3.00
100 lin.ft. new mail tube (curved), 8-in	6.00	5.00	6.00	8.90	8.00	10.00	6.00
100 lin.ft. Western Union tube, 1¾ in	2.50	1.00	2.00	1.50	0.50	1.00	1.00
100 lin.ft. new Western Union tube, 1¾ in	2.00	1.00	2.00	1.50	0.50	1.00	1.50
100 duct ft. electric ducts and conduits (Sec. 62)	1.50	0.60	1.00	1.00	0.50	1.00	0.60
5000 lin.ft. w.i. pipe electric ducts and conduits, 2½ in. (Sec. 62)	0.50	0.60	0.50	0.75	0.50	0.60	0.60
7000 lin.ft. w.i. pipe electric ducts and conduit, 3 in. (Sec. 62)	0.50	0.60	0.60	1.00	0.50	0.70	0.65
700 lin.ft. Edison conduit, 2-in. (Sec. 62)	1.00	0.75	0.50	1.00	0.50	2.00	0.50
600 lin.ft. Edison conduit, 3 in. (Sec. 62)	1.25	0.75	0.60	1.50	0.50	2.50	0.70
600 lin.ft. w.i. pipe, 2 in. (Sec. 62)	1.00	0.75	0.50	0.40	0.50	2.00	0.50
50 electric ducts service connection, all sizes	25.00	50.00	20.00	25.00	30.00	25.00	20.00
Extended totals	$1,571,363	$1,714,200	$1,886,467	$1,967,471	$1,975,732	$2,049,398	$2,250,175

SEWERS, FAIRPORT, N. Y.

+Bids were received Sept. 30 by the city for sewer construction from (A) JAMES F. LEARY CONSTRUCTION CO., INC., Rochester (awarded contract); (B) A. J. Shaw, Jr., Batavia; (C) Bishop Construction Co., Rochester; (D) Goggin & Schultz, Fredonia; (E) Samuel Bonn, Syracuse. The item bids were as follows:

Section 1, Storm Sewers

	A	B	C	D	E
60 lin.ft. 33-in. concrete sewer 6 ft. deep	$2.08	$2.45	$2.48	$3.00	$2.50
428 lin.ft. 33-in. concrete sewer 6 to 8 ft. deep	2.14	2.65	2.67	3.50	2.70
210 lin.ft. 33-in. concrete sewer, 8 to 10 ft. deep	2.28	2.90	2.95	3.75	3.90
305 lin.ft. 30-in. concrete sewer, 6 ft. deep	2.00	2.20	2.23	3.75	2.40
356 lin.ft. 22-in. vitrified pipe sewer, 6 ft. deep	1.70	1.35	1.35	1.75	1.65
326 lin.ft. 22-in. vitrified pipe sewer, 6 ft. deep	1.42	1.10	1.13	1.55	1.60
77 lin.ft. 12-in. vitrified pipe sewer, 6 ft. deep	0.92	0.75	0.75	0.85	1.35
170 lin.ft. 10-in. vitrified pipe sewer, 6 ft. deep	0.70	0.65	0.70	0.75	1.20
23 lin.ft. standard brick manholes	6.00	5.25	5.25	3.50	7.50
26 lin.ft. standard concrete manholes	7.00	5.75	5.50	5.00	6.50
13 catch basins	0.00	25.00	27.00	15.00	30.00
15 cu.yd. concrete, Class A	7.00	11.00	11.00	8.00	15.00
50 cu.yd. concrete, Class B	6.00	5.50	5.50	7.00	8.00
700 lb. reinforcing steel	0.03	0.05	0.05	0.04	0.05
Branches and slants	4.25	1.00	1.00	0.50	1.50
10 cu.yd. rock excavation	3.00	3.00	2.00	4.00	6.00

Section 2, Sanitary Sewers

	A	B	C	D	E
30 lin.ft. 10-in. vitrified pipe sewer, 10 to 12 ft. deep	$1.08	$1.25	$1.39	$1.75	$1.50
291 lin.ft. 10-in. vitrified pipe sewer, 12 to 14 ft. deep	1.18	1.45	1.66	2.00	1.80
215 lin.ft. 10-in. vitrified pipe sewer, 14 to 16 ft. deep	1.38	1.75	1.83	2.25	1.90
215 lin.ft. 10-in. vitrified pipe sewer, 16 to 18 ft. deep	1.50	2.20	2.25	2.50	2.10
225 lin.ft. 10-in. vitrified pipe sewer, 18 to 20 ft. deep	1.62	2.40	2.55	2.95	2.35
295 lin.ft. 10-in. vitrified pipe sewer, 20 to 22 ft. deep	1.85	2.75	3.25	3.35	2.50
540 lin.ft. 8-in. vitrified pipe sewer, 6 ft. deep	0.58	0.55	0.59	0.50	0.80
4453 lin.ft. 8-in. vitrified pipe sewer, 6 to 8 ft. deep	0.66	0.65	0.69	0.75	0.90
1204 lin.ft. 8-in. vitrified pipe sewer, 8 to 10 ft. deep	0.70	0.80	0.90	1.00	1.15
470 lin.ft. 8-in. vitrified pipe sewer, 10 to 12 ft. deep	0.86	1.10	1.19	1.25	1.25
162 lin.ft. 8-in. vitrified pipe sewer, 12 to 14 ft. deep	0.94	1.36	1.52	1.55	1.10
2550 lin.ft. 6-in. vitrified pipe sewer, 6 ft. deep	0.30	0.38	0.51	0.35	0.52
50 lin.ft. 6-in. vitrified pipe sewer, 6 to 8 ft. deep	0.63	0.60	0.75	0.35	0.75
85 lin.ft. 6-in. vitrified pipe sewer, 8 to 10 ft. deep	0.68	0.70	0.95	0.75	1.10
140 lin.ft. standard brick manholes	6.00	5.25	5.25	3.50	9.00
140 lin.ft. standard concrete manholes	7.00	5.25	5.50	5.00	8.50
37 cu.yd. concrete, Class A	7.00	11.00	11.00	10.00	20.00
70 cu.yd. concrete, Class B	6.00	5.50	5.50	9.00	8.00
12 branches on 6-in. sewer	0.27	0.50	0.75	0.25	0.15
180 branches on 8-in. sewer	0.40	0.55	0.80	0.50	0.60
14 branches on 10-in. sewer	0.54	0.70	1.00	0.60	0.75
50 cu.yd. rock excavation	3.00	3.00	2.00	4.00	6.00
2 M ft. b.m. lumber left in place	40.00	40.00	30.00	40.00	32.00
5 extra manholes heads	10.00	3.50	8.50	8.00	15.00

Section 3, Intercepting Sewers

	A	B	C	D	E
42 lin.ft. 10-in. vitrified pipe sewer, 6 ft. deep	$0.70	$.65	$0.70	$0.65	$0.75
57 lin.ft. 10-in. vitrified pipe sewer, 6 to 8 ft. deep	0.82	0.80	0.91	0.75	0.80
282 lin.ft. 10-in. vitrified pipe sewer, 8 to 10 ft. deep	0.85	1.05	1.09	0.85	1.00
420 lin.ft. 10-in. vitrified pipe sewer, 10 to 12 ft. deep	1.08	1.20	1.30	1.00	1.50
40 lin.ft. 10-in. vitrified pipe sewer, 12 to 14 ft. deep	1.18	1.55	1.55	1.20	1.80
580 lin.ft. 8-in. vitrified pipe sewer, 6 ft. deep	0.58	0.50	0.55	0.50	0.50
179 lin.ft. 8-in. vitrified pipe sewer, 6 to 8 ft. deep	0.66	0.70	0.77	0.75	0.60
11 lin.ft. 8-in. vitrified pipe sewer, 8 to 10 ft. deep	0.70	0.85	1.03	1.00	1.00
24 lin.ft. 8-in. vitrified pipe sewer, 10 to 12 ft. deep	0.86	1.10	1 1 19	25	1.15
70 lin.ft. 8-in. vitrified pipe sewer, 12 to 14 ft. deep	0.94	1.40	1.52	1.50	1.25
36 lin.ft. 6-in. vitrified pipe sewer, 6 ft. deep	0.63	0.40	0.51	0.35	0.55
48 lin.ft. 10-in. c.i. pipe sewer, 8 ft. deep	2.50	1.20	1.25	1.50	1.75
24 lin.ft. 8-in. c.i. pipe sewer, 8 to 10 ft zdeep	2.57	1.60	1.66	2.00	2.50
24 lin.ft. 8-in. c.i. pipe sewer, 6 ft. deep	2.00	0.95	1.10	1.35	1.60
24 lin.ft. 8-in. c.i. pipe sewer, 6 to 8 ft. deep	2.08	1.15	1.18	1.50	2.00
65 lin.ft. 8-in. c.i. pipe sewer, 8 to 10 ft. deep	2.17	1.35	1.39	2.00	2.40
65 lin.ft. standard brick manholes	6.00	5.25	5.25	3.50	8.50
65 lin.ft. standard concrete manholes	7.00	5.25	5.50	5.00	7.50
39.4 cu.yd. concrete, Class A	7.00	11.00	11.00	10.00	20.00
20 cu.yd. concrete, Class B	6.00	5.00	5.50	9.00	8.00
11 branches on 8-in. sewer	0.40	0.55	0.80	0.50	0.60
3 branches on 10-in. sewer	0.50	0.70	1.00	0.60	0.75
150 cu.yd. rock excavation	3.00	3.00	2.00	4.00	6.00
2 M ft. b.m. lumber left in place	40.00	40.00	30.00	40.00	32.00
20 cu.yd. quicksand excavation	5.00	3.00	2.00	4.00	6.00
2 extra manhole heads	10.00	3.50	8.50	8.00	15.00
365 lin.ft. 6-in. c.i. pipe in siphons	1.80	1.00	1.43	0.75	1.30
1000 lb. reinforcing steel	0.03	0.05	0.05	0.04	0.05
1240 lb. c.i. specials	0.04	0.05	0.06	0.03	0.08
Extended totals	$18,228	$19,236	$20,593	$21,827	$25,347

Whiting Foundry Equipment Co., Harvey, Ill. Catalog No. 111. Overhead tramrail equipment. Illustrated, 12 pp., 6x9 in.

B. K. Elliott Co., Pittsburgh, Penn. Catalog. Drawing materials and surveying instruments. Illustrated, 440 pages, 6x9 in.

Wern Stone Paving Co., Inc., 55 Liberty St., New York Durax paving blocks. Illustrated, 40 pp., 7½x10 in.

Edward R. Bacon Co., 51-53 Minna St., San Francisco, Calif. Bulletin No. 10. Wallace concrete and lumber hoists. Illustrated, 8 pp., 6x9 in.

General Filtration Co., Inc., Cutler Building, Rochester, N. Y. Catalog Filtros. Porous mineral ware. Illustrated, 28 pp., 5x7 in.

Sewage Treatment Plant, Akron, Ohio

Bids were received by the Director of Public Service, Aug 11, for the construction of a sewage-treatment plant, according to plans prepared by R. Winthrop Pratt, Cleveland, from (A) F. McSHAFFREY & SON, Akron (awarded contract), (B) J. [illegible] & Son, Cleveland, (C) J. C. Devine, Alliance.

	A	B	C
56[illegible] cu yd earth excavation	$1 75	$1 00	$1 00
[illegible] cu yd gravel embankment	10	10	25
[illegible] cu yd top soil grading	40	80	1 00
[illegible] sq ft gravel walks	[illegible]	10	10
[illegible] sq yd sodding	20	40	30
[illegible] acres seeding	1[illegible] 00	60 00	76 00
Trimming lawns (lump sum)	1[illegible] 00	[illegible]0 00	400 00
[illegible] sq yd macadam roadways	1 2[illegible]	1 75	75
Plain concrete work (lump sum)	61,6[illegible] 00	71,[illegible]0 00	60,000 00
Reinforced concrete work (lump sum)	[illegible],000 00	92,000 00	11,000 00
Steel reinforcing (lump sum)	[illegible]4,000 00	20,000 00	25,000 00
Brick work (lump sum)	2,[illegible]50 00	1,200 00	1,500 00
Cut stone work (lump sum)	100 00	200 00	200 00
Structural steel and light iron work (lump sum)	1,450 00	1,500 00	1,200 00
Carpenter and mill work (lump sum)	1,050 00	1,300 00	1,000 00
Sheet metal work (lump sum)	450 00	300 00	200 00
Electrical work (lump sum)	1,050 00	1,000 00	800 00
Plumbing (lump sum)	[illegible]0 00	5,000 00	4,000 00
C-I pipe work (lump sum)	34,000 00	26,000 00	30,000 00
Valves (lump sum)	10,[illegible]00 00	11,000 00	10,000 00
Sluice gates (lump sum)	[illegible]50 00	[illegible]00 00	600 00
Special castings (lump sum)	2,000 00	3,[illegible]00 00	5,000 00
Vitrified pipe work (lump sum)	43,000 00	44,000 00	42,000 00
Steel tanks and appurtenances (lump sum)	800 00	1,100 00	1,200 00
Sludge press and appurtenances (lump sum)	4,800 00	5,000 00	5,000 00
Air compressor and appurtenances (lump sum)	1,700 00	1,600 00	1,800 00
Pumps and appurtenances (lump sum)	1,200 00	1,200 00	1,[illegible]00 00
Miscellaneous steel, iron and wood work (lump sum)	2,500 00	3,000 00	3,000 00
Elevator and appurtenances (lump sum)	1,100 00	1,000 00	1,000 00
Industrial equipment (lump sum)	3,350 00	3,500 00	3,000 00
Filtering material (lump sum)	91,000 00	91,000 00	95,[illegible]00 00
Sprinkling filter nozzles (lump sum)	3,100 00	3,200 00	3,000 00
Controlling apparatus (lump sum)	3,750 00	4,000 00	3,500 00
Outfall pipe (lump sum)	3,000 00	3,800 00	2,500 00
Main sewer extension (lump sum)	14,000 00	14,000 00	1[illegible],000 00
Removal of present buildings (lump sum)	200 00	300 00	500 00
Fence (lump sum)	2[illegible]0 00	200 00	200 00
Additional plain concrete work (per cu yd)	10 00	10 00	9 00
Additional reinforced concrete work (per cu yd)	15 00	50 00	[illegible]
Additional steel reinforcement (per lb)	03	05	04
Additional brick work (per M)	30 00	[illegible]5 00	25 00
Additional C I pipe (per lb)	02	04	03
Additional W I pipe (per lb)	06	05	
Additional filtering material (sand) (per cu yd)	1 50	1 50	1 75
Additional filtering material (gravel) (per cu yd)	1 65	2 00	1 75
Additional filtering material (slag) (per cu yd)	1 40	1 25	1 50
Sheeting and shoring in place	[illegible]0 00	50 00	30 00
Additional fencing (per lin ft)	1 00	50	50
Extended totals	$413,[illegible]14	$42[illegible],125	$447,100

BARGE CANAL WORK, BRIDGE, SYRACUSE, N. Y.

Bids were received by Duncan W. Peck, State Supt. Pub. Wks., Capitol, Albany, Oct. 1, for constructing a bascule bridge over the Erie Canal at West Genesee St., Syracuse, N. Y., from (A) Walsh Construction Co., Davenport, Iowa; (B) Frank L. Cohen, Buffalo, (C) Lupfer & Remick, Buffalo; (D) Engineer's Estimate. The item bids were as follows:

	A	B	C	D
Coffer dams pumping, bailing and draining (lump sum)	$2000 00	$2400 00	$1 00	$2000 00
210 cu yd excavation	1 75	2 00	75	2 00
100 cu yd second class concrete	7 00	7 50	8 50	7 50
700 cu yd reinforced concrete Class A	10 50	12 00	14 00	12 00
53 cu yd reinforced concrete, Class B	20 00	20 00	23 00	20 00
630 sq yd approach pavements	1 00	3 00	3 00	3 00
2100 sq ft concrete sidewalks	25	12	25	25
10 sq ft vault lights	2 00	3 00	3 00	1 00
38,000 lb metal reinforcement	03	02	025	03
270,000 lb structural steel	0434	04	039	045
35,000 lb machinery	15	14	12	14
14.5 M ft b m lumber	60 00	50 00	52 00	45 00
140 lin ft lattice railing	1 75	2 00	2 00	2 00
2400 lb metal duct	12	12	10	12
Track work on bridge approaches (lump sum)	200 00	100 00	220 00	200 00
Electrical equipment (lump sum)	3100 00	[illegible]	4000 00	[illegible]
Plumbing (lump sum)	500 00	500 00	200 00	500 00
Hardware, roofing and painting (lump sum)	500 00	500 00	500 00	500 00
Maintenance accessories (lump sum)	150 00	200 00	210 00	150 00
Maintaining navigation (lump sum)	500 00	50 00	25 00	500 00
Maintaining traffic for vehicles (lump sum)	500 00	100 00	[illegible]	500 00
Extended totals	$44,[illegible]	$43,[illegible]	$43,472	$4[illegible],485

MUNICIPAL BOND SALES FALL OFF

Sales of municipal bonds in September aggregated $4,880,000 according to the "Financial Chronicle." This does not include resales nor short-term financiering. It compares, however, most unfavorably with bond sales in recent years, as for example, with $24,974,000 in the same month last year. The issues for the first nine months of this year aggregate $381,000,000. This is the largest ever reported for the first nine months of the year, comparing, as it does, with $2[illegible],000 the first nine months of 1913. The following table, compiled by the "Financial Chronicle" shows the output of permanent municipal bonds issued for the month of September and for the nine months in this and previous years:

	Month of September	First Nine Months of the year
1914	$4,880,400	$381,[illegible]960
1913	24,974,251	2[illegible]0,781,633
1912	25,469,643	317,91[illegible],921
1911	26,487,290	314,[illegible]3,570
1910	18,264,071	211,[illegible]1,042
1909	23,001,771	27[illegible],389,451
1908	34,531,814	243,241,117
1907	47,917,077	199,7[illegible]2,964
1906	8,950,418	153,1[illegible]2,345
1905	9,835,200	141,[illegible]1,727
1904	10,694,671	1[illegible]7,[illegible]21,657
1903	8,763,079	111,745,993
1902	9,179,654	117,6[illegible]8,455
1901	14,405,056	9[illegible],[illegible]24,[illegible]01
1900	4,033,899	97,194,441
1899	7,261,593	9[illegible],[illegible]6,427
1898	6,173,665	[illegible]1,1[illegible],569
1897	9,172,691	106,1[illegible]2,463
1896	3,693,457	6[illegible],2[illegible],416
1895	11,123,212	92,[illegible],916
1894	8,749,347	90,[illegible]1,836
1893	[illegible]5,137	[illegible],566
1892	6,242,9[illegible]2	6[illegible],[illegible]1,934

CANALS, NEW ORLEANS, LA.

[illegible] Oct. [illegible] by the Sewerage and Water Board for Contract 63-D constructing Broad St. Canal and for Contract 63-[illegible] constructing St. Bernard Ave. Canal from (A) [illegible] Kelly Construction Co., (B) Victor Lambert, (C) A. L. Patterson, (D) [illegible] Reynolds, (E) F. A. [illegible] & Son, (F) Jefferson Construction Co., (G) John Reiss. The item bids were as follows:

CONTRACT 63-D

	A	B	C	D	E	F
[illegible] excavation	[illegible]	11 10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10 [illegible]	11 [illegible]
[illegible] concrete 1:2:4 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] concrete 1:3:[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2 20	2 00	2 [illegible]	2 [illegible]
Estimated totals	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$289,030	$29[illegible],254

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS

Pennsylvania—The City Council of Philadelphia has authorized this company to elevate its tracks on East Lehigh Ave., from Trenton Ave. to Richmond St., and on Richmond St. to Cumberland St. Estimated cost, $500,000. A. C. Shand, Philadelphia, is Ch. Engr. See item under Miscellaneous.

District of Columbia—Norfolk & Washington R.R.—See item under Virginia.

Virginia—Norfolk, Yorktown & Washington R.R.—Surveys are being made by this company for the construction of its proposed railway to connect Norfolk, Newport News, Hampton, Yorktown and Alexandria, Va., and Washington, D. C. W. H. Edwards, Newport News, is interested.

West Virginia—Cherry River Southern R.R.—Arrangements are being made by this company to award contracts soon for the construction of its proposed railway to connect Curtin and Bays, W. Va.

North Carolina—Kinston-Carolina R.R. & Lumber Co.—Plans are being prepared by this company for the extension of its line from Kinston to Pink Hill, N. C., about 20 miles.

South Carolina—Savannah Western R.R.—The citizens of Manning, S. C., have voted to issue bonds for $10,000 to aid this company in constructing its proposed railway through Manning. C. H. Milligan, Charleston, S. C., is interested. Noted Oct. 1.

North Dakota—Northern Pacific Ry.—Plans are being prepared for this company for the extension of its Cannonball branch to Fort Yates, N. D. W. L. Darling, St. Paul, Minn., is Ch. Engr.

✚Texas—Van Horn Valley Land & Ry. Co.—This company has awarded a contract to KING & RUNQUIST, Duluth, Minn., for the construction of a railway from Van Horn, Tex., to the New Mexico boundary.

Texas—Galveston, Harrisburg & San Antonio R.R.—This company plans to reconstruct its lines from San Antonio, Tex., to El Paso, Tex., about 600 miles. I. A. Cottingham, Houston, Tex., is Asst. Gen. Mgr.

✚Washington—Northern Pacific Ry.—This company has awarded a contract to W. J. HOY & CO., St. Paul, for grade separation work in Spokane, Wash.

ELECTRIC RAILWAYS

Boston, Mass.—The Boston Elevated Ry. Co. plans to extend its line from Summer St. to the Commonwealth fish piers and Atlantic Ave. Edward Mahler, Boston, is Pur. Agt.

Fitchburg, Mass.—The Fitchburg & Leominster St. Ry. Co. plans the extension of its line in Fitchburg to the Fair Grounds. W. W. Sargent, Fitchburg, is Pres. and Gen. Mgr.

Tuckahoe, N. Y.—According to press reports, plans are being prepared by the Westchester Electric R.R. Co. for the extension of its Mount Vernon-North Pelham line from North Pelham to the New York Central & Hudson River R.R. station in Tuckahoe. William B. Wheeler, Mount Vernon, is Supt.

New Castle, Penn.—The New Castle Electric St. Ry. Co. will extend its lines in New Castle for a distance of about five miles. G. F. Ravenel is Secy.

Phœnixville, Penn.—Arrangements are being made by the Perkiomen Electric Transit Co. for the construction of a trackless trolley system from Phœnixville to Emaus, about 40 miles. James L. Wolcott, Dover, Del., is interested.

✚Princeton, W. Va.—The Princeton Power Co. has awarded the contract for the construction of an electric railway from Princeton to Bluefield, about 12 miles, to WALTON & CO., Falls Mills, Va.

Decatur, Ala.—Humphrey Read, Florence, Ala., is interested in the construction of an electric railway to connect Decatur, Huntsville, Athens and Florence.

New Orleans, La.—Plans are being considered by the New Orleans Ry. & Light Co. for the construction of an electric railway in the Seventh Ward in New Orleans. M. S. Sloan, New Orleans, is Gen. Mgr.

Nashville, Tenn.—Plans are being considered by the Nashville St. Ry. Co. for the extension of its Fifth Ave. line in Nashville. A. E. Beazley, Nashville, is Pur. Agt.

Detroit, Mich.—Plans are being prepared by the Detroit United Ry. Co. for the extension of its Kercheval line to Connor's Creek Ave., in Detroit. F. W. Brooks, Detroit, is Gen. Mgr.

Holland, Mich.—It is reported that the Chicago-Michigan Ry. Co. will construct an electric railway from Holland to Allegan.

Bloomington, Ill.—The Bloomington & Normal St. Ry. Co. contemplates the reconstruction of its line on Clinton St., in Bloomington. M. G. Linn, Blomington, is Gen. Supt.

Waukegan, Ill.—The Waukegan, Fox Lake & Western Ry. Co. is preparing to double track its line on Washington St., in Waukegan. Edward J. Block, Highwood, Ill., is Gen Supt.

Eau Claire, Wis.—The Wisconsin-Minnesota Light & Power Co. will soon award contracts for the extension of its line to Mount Tom.

Des Moines, Iowa—Extensive improvements are planned by the Des Moines City Ry. Co. on its Center St. line. F. M. Harris, Des Moines, is Treas. and Pur. Agt.

Aurora, Minn.—The Mesaba Ry. Co. is preparing plans for the extension of its line to Aurora. Work will not be started before the spring. H. S. Newton, Virginia, Minn., is Gen. Mgr.

St. Peter, Minn.—Plans are being considered by the Electric Short Line Ry. Co. for the construction of an electric railway in St. Peter. DeKoven Hunter, Minneapolis, is Gen. Mgr.

St. Louis, Mo.—The United Rys. Co. plans the construction of an electric railway from Wellston to Lindenwood. Robert McCulloch, St. Louis, is Pres., Gen. Mgr. and Pur. Agt.

Brenham, Tex.—W. W. Umbenhause & Co., Philadelphia, Penn., is interested in the construction of a system of interurban electric railways from Brenham to towns in the vicinity.

Houston, Tex.—The Houston Electric Ry. Co. contemplates double tracking its line on Fannin and Travis St., in Houston. David Daly, Houston, is Local Mgr.

Lewiston, Idaho—Plans are being prepared by R. C. Dahlheim and associates for the construction of an electric railway in Lewiston. Noted Oct. 22.

Pocatello, Idaho—Preliminary arrangements are being made by the Pocatello Traction Co. for the construction of an electric railway in Pocatello. J. D. Browning is interested. Noted May 7.

Snohomish, Wash.—The City Council has granted a franchise to the Puget Sound Electric Ry. Co. to extend its line on Main St. in Snohomish. L. H. Bean, Tacoma, is Local Mgr.

Los Angeles, Calif.—The Los Angeles Ry. Corporation has applied to the City Council for a franchise to construct a double-track extension of its line on East First St. C. A. Henderson, Los Angeles, is Asst. Gen. Mgr. and Pur. Agt.

San Lorenz, Calif.—The City Council has granted a franchise to the San Francisco-Oakland Terminal Ry. Co. to extend its line in San Lorenz. A. W. McLimont, Oakland, is Gen. Mgr.

LIGHT, HEAT AND POWER

Greensboro, Vt.—The Greensboro Electric Co. will shortly call for bids for the construction of a hydro-electric plant. M. L. Saunders, White River Junction, Vt., is Engr.-in-Charge.

Rutland, Vt.—F. L. Austin, 240 College St., Burlington, Vt., is preparing plans for an addition to the power house of the House of Correction, Rutland. The building will be of brick, one story, 28x32 ft. J. E. Weeks, Rutland, is Chn. of the Com. in Charge.

Southbridge, Mass.—The Webster & Southbridge Gas & Electric Co. will install a new switchboard, to cost about $4000, in its Southbridge plant. H. S. Shaw, Webster, Mass., is Treas. and Mgr.

New Haven, Conn.—The United Illuminating Co., New Haven and Bridgeport, Conn., has increased its capital stock by $500,000 for the purpose of making improvements in the New Haven plant. R. A. Manwaring, New Haven, is Mgr.

✚Auburn, N. Y.—The Empire Gas & Electric Co., of Geneva, has awarded the contract for the foundation of its new 500,000-ft. gas holder at Auburn to the MacARTHUR CONCRETE PILE FOUNDATION CO., New York, N. Y. The contract for the tank has been awarded to the BARTLETT-HAYWARD CO., Baltimore, Md.

★Bath, N. Y.—(Official)—Bids will be received until 11 a.m., Nov. 17, by Joseph A. Goulden, Pres. Bd. of Trustees, New York State Soldiers' & Sailors' Home, Bath, for installing electric elevators in the Convalescent Barracks. For further details, see advertisement under "Contracts To Be Let."

Irvington, N. J.—(Official)—We are advised by I. J. Casey, City Engr., that a municipal electric-light plant will not be built in Irvington at the present time. Noted, Oct. 22.

Lansford, Penn.—The Panther Valley Electric Light, Heat & Power Co. has had plans prepared by the Schofield Engineering Co., Commercial Trust Bldg., Philadelphia, for a new one-story brick substation at Lansford.

Walterboro, S. C.—At a recent special election, the citizens voted in favor of a bond issue of $15,000 to be used for the construction of a municipal electric-light plant. Noted Sept. 17.

Melville, La.—All bids received, Oct. 6, for the construction of a municipal electric-light plant were rejected, and new bids will be received until Nov. 3, by the Mayor and City Council. H. S. Joseph, M. D., is Mayor. W. L. Thompson, Boyce, La., is Engr.-in-Charge. Noted Sept. 24 and Oct. 1.

New Orleans, La.—Bids will be received until Nov. 10, by the Board of Control, Louisiana Lepers' Home, for the construction of an electric-light plant for the Home. A 25-kw. generator will be installed. J. J. Powell, 128 New Courthouse Bldg., New Orleans, is Pres. Bd. of Control. Samuel Stone, Jr., 602 Liverpool & London Globe Bldg., is Arch.

West Monroe, La.—The City Council is considering plans for the installation of a municipal light and power plant.

Maysville, Ky.—It is reported that B. L. Baldwin & Co., Perin Bldg., Cincinnati, Ohio, is preparing plans for the construction of a power house for Rohen & Martin, Maysville.

Cleveland, Ohio—The Willard Storage Battery Co. has taken out a permit for the construction of a power house at 280 East 131st St., to cost about $5000. It will be of reinforced concrete, 49x57 ft.

Cleveland, Ohio.—[illegible] F. H. [illegible] for the [illegible] plant for the [illegible] [illegible]

Bids will be received until [illegible] Nov. [illegible] by the [illegible] City Hall [illegible] for the Department of Public [illegible]

[illegible] the Commissioner [illegible] City Hall [illegible] substation [illegible] electric light department [illegible] of the Holt & [illegible]

Pemberville, Ohio.—The Town Council has engaged F. H. [illegible] Toledo, Ohio, to prepare plans [illegible] electric light plant. [illegible]

Weyauwega, Wis.—It is reported that Frank H. Joslyn [illegible] purchased the property of the Weyauwega Electric Light Co. [illegible]

Chariton, Iowa.—[illegible] White [illegible] First National [illegible]

Virginia, Minn.—C. K. [illegible] has prepared plans [illegible] of [illegible] ft. [illegible] The lighting will be [illegible]

Billings, Mont.—The [illegible] will begin construction [illegible] to have a capacity of [illegible] W. B. [illegible] Mgr. of the [illegible]

Billings, Okla.—[illegible] Water Supply and Irrigation.

Victor, Idaho.—It is reported that the City Council is considering the installation of a municipal electric distributing system.

Prescott, Ariz.—The Arizona Hydraulic Power Co. has had plans prepared for its hydro-electric plant on the Upper Verde River. [illegible] for three units with a development of [illegible] hp. The estimated cost is $1,7[illegible],000. The main transmission line will [illegible] Energy from the plant will be furnished to [illegible] The flood waters, after passing through the plants, will be used for irrigation purposes. E. B. [illegible] is Pres. of the company.

Cathlamet, Wash.—A bond issue of $[illegible] has been voted, to be used for [illegible] of the first unit of a municipal electric light plant. Noted Sept. [illegible] and Sept. [illegible]

Sequim, Wash.—The City Council has granted a franchise to J. L. Keeler, [illegible] for the installation and operation of a light and power plant. Financial arrangements have been completed and the construction of the plant will soon be [illegible]

Alameda, Calif.—The City Trustees have decided to extend [illegible] lines of the municipal electric light plant to [illegible] Joseph B. [illegible] is City [illegible]

Fresno, Calif.—The Board of City Trustees and Mayor [illegible] are considering plans for placing all electric wires in the business section of the city in underground conduits.

Los Angeles, Calif.—The Los Angeles Gas & Electric [illegible] [illegible]

Riverside, Calif.—[illegible]

Dawson, Yukon Ter., Alaska.—[illegible]

Flesherton, Ont.—[illegible]

✦**Toronto, Ont.**—[illegible]

BRIDGES

✦**Van Buren, Maine.**—[illegible]

Brattleboro, Vt.—[illegible]

Rockland, Maine.—[illegible]

Albany, N. Y.—[illegible]

[illegible] The estimated cost [illegible] John F. [illegible] Rensselaer, prepared the plans.

New York, N. Y.—Borough of Bronx—(Official.) All bids received [illegible] for [illegible] and painting the bridge over the tracks of the New York New Haven & Hartford R.R. at East [illegible] St. have been rejected, and new bids for the work will be received about Nov. [illegible] Noted Oct. 1 and Oct. [illegible]

✦Borough of Richmond—(Official.) The contract for [illegible] and repairs to the [illegible] Bridge over Richmond Creek has been awarded to OTTO METZ, [illegible] Palmetto St., Brooklyn. Noted Oct. [illegible]

New Castle, Penn.—(Official.) Bids will be received until [illegible] Nov. [illegible] by [illegible] Supt. of Public Grounds and Buildings, Harrisburg, Penn., for the removal of the old substructure and [illegible] a new bridge over the Shenango River at [illegible] St., New Castle, Lawrence County. [illegible] Pittsburgh, is Engr.-in-Charge.

✦**Philadelphia, Penn.**—(Official.) The contract for the construction of a [illegible] concrete bridge on the line of [illegible] Ave., over tracks of the Philadelphia & Reading Ry., has been awarded to RICHARD WALSH, [illegible] St., Philadelphia, at $16,[illegible] Other bidders were: [illegible] $31,[illegible]; American Paving & Construction Co., $[illegible]; W. [illegible] Ware Co., $[illegible]; [illegible] $[illegible]; Smart & Trites Co., $[illegible]; M. & J. B. McHugh, $[illegible]; James McGraw & Co., $[illegible]; Thomas R. [illegible], $[illegible]; James K. [illegible], $[illegible]; Francis J. [illegible], $[illegible]; John M. [illegible], $[illegible]; Carl R. [illegible], $[illegible] Noted [illegible] Oct. 15 as [illegible] Ave. Bridge.

✦**Pittsburgh, Penn.**—(Official.) The Commissioners of Allegheny County have awarded the contract for the construction of a bridge over [illegible] Creek, near [illegible] Park Station, to the FORT PITT BRIDGE WORKS, [illegible] Bldg., Pittsburgh, at $[illegible] Noted [illegible]

Biltmore, N. C.—The Commissioners of [illegible] County, Asheville, have authorized the construction of a bridge over the Swannanoa River at Biltmore to cost about $[illegible] Biltmore Estate will pay $[illegible] and will [illegible] $[illegible] to the county, and the Asheville Light & Power Co. will give $[illegible] toward the cost of its construction. Noted July 3[illegible]

✦**Rome, Ga.**—(Official.) The County Board of Floyd County has awarded the contract for the construction of a concrete bridge over [illegible] Creek, on the Summerville Road, to W. A. HIX, Albertville, Ga., at $[illegible] Other bids ranged from $6,[illegible] to $11,[illegible] Noted Oct. [illegible]

Olga, Fla.—The War Department has authorized the Board of Commissioners of Lee County, Fort Myers, to construct a bridge across the Caloosahatchee River, at Olga, and bids for the work will soon be received. Noted Mar. 26.

Vicksburg, Miss.—(Official.) Bids will be received until noon, Nov. 2, by J. D. Laughlin, Chancery Clk. of Warren County, for the construction of a [illegible]-ft. steel bridge over the Big Black River, near the Alabama & Vicksburg Ry., at [illegible] Ferry. W. F. King is Asst. Engr. Noted Oct. 15 under Jackson, Miss.

Yazoo City, Miss.—Bids will be received until Nov. [illegible] by the Board of Supervisors of Yazoo County, for the construction of a bridge over Piney Creek. S. S. [illegible] is Chancery Clk.

New Orleans, La.—The Public Belt R.R. of New Orleans plans to build a bridge over the canal at [illegible] Ave. The estimated cost is $[illegible] W. J. Hardee is Ch. Engr.

✦The city has awarded the contract for the construction of a reinforced-concrete bridge over the [illegible] Ave. [illegible] to W. J. NEVILLE, at $[illegible]

✦**New Orleans, La.**—The Department of Public [illegible] bridges to the MIDLAND BRIDGE CO., Kansas City, Mo. [illegible]

Chattanooga, Tenn.—(Official.) Bids were received [illegible]

Knoxville, Tenn.—[illegible]

Cleveland, Ohio.—(Official.) [illegible]

Miamisburg, Ohio.—(Official.) [illegible]

✦**West Carrollton, Ohio.**—The Commissioners of Montgomery County [illegible]

Columbus, Ind.—The Commissioners of Bartholemew County have rejected all bids received for the construction of the Clifty Bridge, on the Hartsville Pike, east of the city, and will receive new bids until Nov. 13. It is reported that the Board has decided to build a single span of 200 ft.

Fort Wayne, Ind.—(Official)—Bids will be received, until 10 a.m., Nov. 19, by the Board of Commissioners of Allen County for the construction of a bridge over the St. Mary's River, at Harrison St., Fort Wayne. Calvin H. Brown is County Audr.

+Danville, Ill.—The Commissioners of Vermilion County have awarded the contract for the construction of the Wallace Chapel Bridge over Blue Grass Creek to the EAST ST. LOUIS BRIDGE CO., East St. Louis, Ill., at $4198.

+Madison, Wis.—(Official) — The State Highway Commission has awarded the contract for the construction of a bridge in the Town of Dewey, Rusk County, to the WORDEN-ALLEN CO., Milwaukee, at $10,492. Noted Oct. 22.

St. Paul, Minn.—Plans have been completed for the bridge across the Mississippi River, to replace the one now used by the Omaha and St. Paul railways. The preliminary estimate of the cost of the work is from $200,000 to $300,000. The War Department has granted permission for the construction of the bridge, and as soon as methods of financing can be arranged, the work will be begun.

Junction City, Kan.—(Official)—Bids will be received until noon, Nov. 5, by the County Clerk of Geary County, for the construction of a reinforced-concrete bridge over a branch of McDowell Creek, at Briggs Crossing, Winfield Township. J. G. Furrow is Chn. of the County Comrs.

Lincoln, Kan.—(Official)—Bids will be received until noon, Nov. 7, by the Board of Commissioners of Lincoln County, for the construction of four bridges from 20 to 32 ft. long. W. W. Dehler is Chn. of Bd. of Comrs C. E. Booze is County Clk.

Wichita, Kan.—(Official)—Bids will be received until noon, Nov. 9, by W. J. McLean, City Clk., for the construction of a reinforced-concrete bridge over the Little Arkansas River, between Central and South Riverside Parks. It will consist of six 35-ft. spans, with a 20-ft. roadway and two 5½-ft. walks. The estimated cost is $15,000. Bert C. Wells is City Engr. Noted July 23 and Aug. 13.

+Nebraska City, Neb.—The Commissioners of Otoe County have awarded the contract for filling of wings and bridges and grading on the North Eighth and North 16th St. Bridges to FRANK THOMAS, Nebraska City, at 18c. and 22c. per cu.yd. Noted Oct. 8.

Billings, Mont.—(Official)—The question of a bond issue of $77,000 for the construction of two bridges will be submitted to the voters of Yellowstone County at the regular general election on Nov. 3. H. E. Howell is Deputy County Clk.

Wynne, Ark.—(Official)—Drainage District No. 3, of Cross County, will build about 30 bridges in connection with other improvements in the district. No definite time has been set for receiving bids on account of uncertain financial conditions. Each bidder will furnish his own plans for bridges, which will be of steel. W. S. Newsom is Asst. Engr. Noted Oct. 15.

+Coleman, Tex.—The Commissioners Court of Coleman County has awarded the contract for the construction of three county bridges to the A. L. GREENBURG IRON CO., Terre Haute, Ind., at $6300.

+San Antonio, Tex.—The Commissioners Court of Bexar County has awarded the contract for the construction of a concrete bridge over Zarzamora Creek to the TOPEKA BRIDGE & IRON CO., at $17.10 per cu.yd.

Uvalde, Tex.—The Commissioners Court of Uvalde County will soon ask bids for the construction of a concrete bridge over the Nueces River, on the Eagle Pass Rd., about eight miles from Uvalde.

+Durant, Okla.—The Commissioners of Bryan County have awarded the contract for the construction of two steel bridges over the Blue River to the MISSOURI VALLEY BRIDGE & IRON CO., Leavenworth, Kan. Each will be 100 ft. long Varner Stinson is County Engr.

Anthony, N. M.—The Board of Commissioners of Dona Ana County, Las Cruces, contemplates building a new bridge over the Rio Grande River at this point.

San Marcial, N. M.—Plans are being prepared by James A. French, Santa Fé, N. M., State Engr., for a steel bridge to be built across the Rio Grande River, at San Marcial The estimated cost is $15,000.

+Colfax, Wash.—The Commissioners of Whitman County have awarded the contract for the construction of a bridge at Colfax to the A. G. BEAGLE CO., Spokane, at $7550; the contract for a bridge at Elberton was awarded to CHARLES G. HUBER, Seattle, at $6450. Both will be of reinforced concrete. Noted Sept 17.

Chico, Calif.—The Board of Supervisors of Butte County, Oroville, has authorized the construction of a bridge over Mud Creek, on Reading Ave., near Chico. M. C. Polk, Chico, is County Engr.

+Santa Barbara, Calif.—The City Trustees have awarded contracts for the construction of two reinforced concrete bridges on the East Blvd to. MUNOZ & MUNOZ, 800 Central Bldg. Los Angeles, at $11,321 for the bridge over Salinas Creek; BOARDMAN CONSTRUCTION CO., 1107 Story Bldg., Los Angeles, at $11,890 for the bridge over Aliso Creek. Noted Oct. 1.

+Visalia, Calif.—The Board of Supervisors of Tulare County has awarded the contract for the construction of two bridges over Deer Creek, near Porterville, to the PARLIER CONSTRUCTION CO., Tulare, at $1276. Noted Oct. 8.

+London, Ont.—The contract for the construction of a reinforced-concrete bridge across Second St. has been awarded by the City Council and the County of Middlesex to McKAY & WEBSTER, Toronto, at about $14,300. William N. Ashplant, City Engr., has charge of the work.

WATER SUPPLY—IRRIGATION

Pittsfield, Mass.—The Aldermen have voted an appropriation of $10,000 for extending water mains from Pontoosuc Lake station to Lanesboro line. J. P. Barnes is Chn. Bd. of Pub. Wks.

Warwick, R. I.—The citizens contemplate installing a water system.

Lindenhurst, N. Y.—Plans have been prepared by for the installation of a water system, including a filtration plant. W. E. Sexton, Mineola, is Engr. The estimated cost is abou $70,000.

Mayville, N. Y.—The citizens voted in favor of issuing $9700 in bonds for the improvement of the water system and electric-light plant. W. H. Scofield is Clk.

Tamaqua, Penn.—Plans have been prepared by John H Lance, Wilkes-Barre, for the construction of a reservoir at Owl Creek. The estimated cost is $69,000.

Oswego, N. Y.—The Department of Water has authorize the laying of water mains in Lyon and Ohio St. F. W. Ormsby is Supt.

Perrysburg, N. Y.—(Official)—Bids will be received by th Commissioner of Public Works, Municipal Bldg., Buffalo, until 11 a.m., Nov. 2, for laying a c.-i. water pipe line connectin the new reservoir with the main building of the J. N. Adam Memorial Hospital, Perrysburg. Francis G. Ward is Comr.

+★Riverhead, N. Y.—The contract for constructing a water system has been awarded to WILLIAM G. FRITZ CO., Newark, N. J., at $79,000. Bids opened Aug. 25. Noted Aug. 13.

Morristown, N. J.—The Whippany Water Co., Morristown, has been incorporated by B. Dickson and will furnish wate to Hanover Township.

Barnesboro, Penn.—Plans for the construction of a water system and reservoir for Barnesboro are being prepared.

Pittsburgh, Penn.—The Department of Public Works contemplates installing centrifugal pumps, estimated to cost $50,000.

Frederick, Md.—William H. Boardman, Consult. Engr., Philadelphia, Penn., has been retained by the city to make recommendations about the water supply. A storage reservoir to cost $100,000 is included.

Norfolk, Va.—The city is taking steps to either buy or condemn water sites for the proposed improvement to its water system. Thomas B. Dornin is Engr. in charge of the Water Dept.

+Tryon, N. C.—The contract for constructing a water system has been awarded to A. H. GUION & CO., Gastonia. G. H. Holmes is Engr. Noted Aug. 6.

★Columbus, Ga.—(Official)—Bids will be received by the Board of Water Commissioners until 3 p.m., Nov. 17, for constructing a water system. J. L. Ludlow, Winston-Salem, N. C., is Engr. For details see advertisement under "Contracts to Be Let." Noted Sept. 3.

Manchester, Ga.—J. N. Hazelhurst & Sons, Engrs., Atlanta have made surveys for the construction of water and sewer systems, estimated to cost $40,000. The citizens will vote on the question of issuing bonds for this purpose. Noted Aug. 27.

Gulfport, Miss.—Bids will be received until Nov. 3 by E. W. Wells, Clk., for installing a water system. Noted Oct. 22.

New Orleans, La.—Bids will be received, until noon, Nov. 10, by the Board of Control, Louisiana Leper Home, Roo 128, New Court House Bldg., for boilers, engines, pumps, water supply and sewer system for the Louisiana Lep Home, Iberville Parish. S. Stone, Jr., 602 Liverpool, Londo & Globe Bldg., New Orleans, is Arch.

West Monroe, La.—Bids will be received until Nov. 14 fo enlarging the water system and constructing an electric-ligh plant. N. G. Tippit is Mayor.

Charleston, Tenn.—The Charleston Water Co. has been organized by J. N. Moore and E. A. Edwards. The company will construct a water system.

Covington, Ky.—An election will soon be held to vote on the question of issuing $200,000 in bonds, the proceeds of which to be used for the improvement of the water system. Noted May 21.

Cincinnati, Ohio—J. A. Hiller, Supt. of the Water Works has been directed by the Board of Control to prepare plan for the relining of the Eden Park reservoir. The estimated cost is $57,000.

Cleveland, Ohio—Plans are being prepared by R. Winthro Pratt, 708 Hippodrome Bldg., Cleveland, for a pumping statio for the city The estimated cost is $100,000.

Greenville, Ohio—The citizens voted against the question of issuing $80,000 in bonds for the installation of a filtration plant Noted Sept. 17.

Springfield, Ohio—(Official)—Bids will be received, until 4 p.m., Nov 16, by J. M. Pierce, County Audr., for installing a water system at the new county infirmary in Bethel Township.

Trotwood, Ohio—Bids will be received by John E. Fox, Clk., Bd. of Pub. Affairs, until 2 p.m., Oct. 30 for extendin the water system

Bloomington, Ind.—The preparation of plans has been authorized by the Mayor and Council, according to press reports, for the construction of a pipe line from White Rive to Bloomington.

Manistique, Mich.—All bids received Oct. 8 for constructin a gravity pipe line have been rejected. Alvord & Burdi Hartford Bldg., Chicago, Ill., are the Engrs.

Hinsdale, Ill.—[illegible] will be received until Nov. [illegible] for installing a water softening plant [illegible] W. [illegible] West Randolph St., Chicago, is Engr.

Joliet, Ill.—[illegible] the Council for the construction of the new reservoir [illegible] The Council [illegible] whether to [illegible] or to build a less expensive reservoir. Noted Oct. [illegible]

Paris, Ill.—The Council contemplates spending $[illegible] to [illegible]

Strongharst, Ill.—The citizens voted to issue bonds for $[illegible], the proceeds of which will be used for the construction of a municipal water system.

Sullivan, Ill.—Plans are being prepared for the construction of a water system. [illegible] is Consult. Engr. Noted Aug. [illegible]

Viola, Ill.—Plans are being prepared by [illegible] & [illegible], [illegible] Central National Bank Bldg., Peoria, for the installation of a water system. Noted Oct. [illegible]

South Stillwater, Minn.—Bids will be received until [illegible] p.m., Oct. [illegible] by [illegible] for drilling an artesian well.

Fort Scott, Kan.—An election will be held in January, to vote on the question of issuing bonds for $[illegible],000, the proceeds of which will be used for the construction of a reservoir. Noted Aug. [illegible]

Sioux Falls, S. D.—The citizens voted in favor of issuing bonds for $[illegible] for the extension of the water system. Noted Oct. [illegible]

✦Baker, Mont.—The contract for installing a water system has been awarded by the city to SECURITY BRIDGE CO., at $[illegible]

Caruthersville, Mo.—The citizens will vote on the question of issuing bonds for the installation of a water system. Frank L. [illegible], Syndicate Bldg., St. Louis, is Engr.

Kansas City, Mo.—The city is having plans and specifications prepared for the installation of a new pumping engine for the low-service pumping station of the water-works. [illegible] Lowther is Ch. Engr. of the Water Bd.

Galveston, Tex.—The Anahuac Canal Co. has been organized by [illegible] S. [illegible], L. R. Miller and John Wooten, with a capital of $[illegible]. The company will construct an irrigation system in the Anahuac district.

The city contemplates extending the salt water mains. Estimates are now being prepared. A. T. Dickey is City Engr.

Billings, Okla.—Bids will be received by the City Clerk, until Oct. [illegible], for the construction of a water system and electric-light plant. The estimated cost is $30,000. E. T. Archer & Co., Kansas City, Mo., is the Engr. Noted Oct. 2, 1913.

Mangum, Okla.—The citizens voted in favor of issuing $[illegible] in bonds for the construction of a water pumping plant, electric-light system and ice plant.

Shoshone, Idaho.—No bids were received by Harry W. [illegible], Clk., for the purchase of $[illegible] in bonds, the proceeds of which would have been used for the improvement of the municipal water system. Noted Sept. 17.

Weiser, Idaho.—The landowners in the East Weiser Irrigation District have voted $16,[illegible] in bonds, the proceeds of which will be used for irrigation in the "Old Town" section.

Yuma, Ariz.—The landowners of the Cibola Valley, north of Yuma, have organized an irrigation district and voted bonds for $[illegible]. The proceeds will be used for the construction of an irrigation system to water about 18,000 acres.

Chehalis, Wash.—The City Commission plans to spend $19,[illegible] for the extension of the water system.

Hood River, Ore.—[illegible] & [illegible] Co., Portland, was low bidder at $[illegible] for constructing the headworks at the [illegible] of the East Fork of the Hood River for the East Fork Irrigation District. [illegible] is Secy.

Salem, Ore.—The application of the Goose Lake Valley Irrigation Co. for the construction of an irrigation project to water [illegible] acres has been approved by John H. Lewis, State Engr.

Oakdale, Calif.—At a recent election, bonds for the completion of the Oakdale Irrigation District were voted. Noted Aug. [illegible]

Oceanside, Calif.—The [illegible] Mutual Water Co. has recently been incorporated with a capital of $[illegible]. W. G. [illegible] is interested.

Sunnyvale, Calif.—According to press reports bids will be received [illegible] until Nov. [illegible] for the installation of a water system.

Venice, Calif.—The city contemplates spending about $[illegible] for the [illegible] of the salt water mains and for the improvement of the water system.

St. John, N. B.—The City Council has authorized the laying of [illegible] of water mains at an estimated cost of $[illegible]. [illegible] is Water and Sewerage Engr.

SEWERAGE

Boston, Mass.—Bids will be received until Oct. [illegible] by the Public Works Department, for constructing sewers in West [illegible] St. [illegible] and in Washington St., West Roxbury District. [illegible] is [illegible]

Milford, Mass.—The question of appropriating $[illegible] for the construction of a new system for the sewer outlet will be voted on at the November election. [illegible] is Engr.

New Rochelle, N. Y.—The City Council has had plans prepared and will submit them to the State Board of Health for the construction of a sewage disposal plant. John [illegible] is Comr. of Pub. Wks.

New York, N. Y.—(Borough of Brooklyn.)—(Official.)—Bids will be received by [illegible], Pres. of the Borough of Brooklyn, until 11 a.m., Nov. [illegible], for constructing a sewer in East [illegible] St. and in [illegible] Ave.

(Borough of Brooklyn.)—(Official.)—The lowest bid received Oct. [illegible], for dismantling the boilers in the Ridgewood North [illegible] pumping station and [illegible] in the Jamaica pumping station No. [illegible] and transporting them to the Jamaica pumping station No. 1, was that of Dover Boiler Works, at $[illegible]. Noted Oct. 22.

Rome, N. Y.—Plans are being prepared by Charles W. Knight & [illegible], for the construction of a sewage disposal plant. The work is under the supervision of [illegible] & Gregory, New York.

Schenectady, N. Y.—The Board of Contract and Supply has authorized the construction of sewers in Foster Ave., [illegible] St. and [illegible] Ave. John H. [illegible] is City Clk.

✦The contract for constructing sewers in 11 streets has been awarded to THOMAS R. CRANE, at $[illegible]

Syracuse, N. Y.—The Council has authorized the construction of a sewer in [illegible] Ave. The estimated cost is about $[illegible]. W. T. Wooley is City Engr.

Hackensack, N. J.—Bids will be received by the City Commission, until Dec. [illegible], for constructing a sanitary sewer system and disposal plant. Fred J. Thomson is City Clk.

Montclair, N. J.—The Council has authorized the construction of a trunk sewer on the east side of Upper Montclair. The estimated cost is $[illegible],000. E. S. Closson is Engr.

Pitman, N. J.—The Council contemplates constructing a municipal sewer system.

✦Red Bank, N. J.—(Official.)—Bids will be received by the Mayor and Council until [illegible] p.m., Nov. [illegible], for installing a sewage ejector or lift at the Armory, Red Bank. A. C. Harrison is Borough Clk.

Verona, N. J.—The Council contemplates constructing a sewer system.

Beaver, Penn.—The Council has been advised by James C. Leaf, Engr., Rochester, N. Y., to construct a storm water sewer at an estimated cost of $[illegible]

Chester, Penn.—Bids are being received for the construction of a sewer in Fourth St. and two sewers in Seventh and New Market Sts. John H. [illegible] is City Clk.

✦Philadelphia, Penn.—Contracts have been awarded to DAVID PEOPLES, [illegible] Parkway Bldg., Philadelphia, for constructing sewers in Haverford Ave., at $[illegible], in 34th St. at $36,136, and in Venango St., at $[illegible]

Pittsburgh, Penn.—(Official.)—Bids will be received, until 10 a.m., Nov. 2, by the City Controller for constructing sewers in Brashear St., Southern Ave., [illegible] St., [illegible] St. and Cranby Alley, Kennedy Ave., Northumberland St. and Whitney St. Robert Swan is Dir. Pub. Wks.

Portvue (McKeesport post office), **Penn.**—(Official.)—Bids will be received by the Borough until [illegible] p.m., Nov. [illegible], for constructing a sewer system. [illegible] H. Reed is Secy. Noted Oct. 22.

Royersford, Penn.—Plans will be prepared by Herbert G. Hatton, Engr., for the construction of a sewer system for Royersford.

Kinston, N. C.—Bonds for $10,[illegible] for making extensions to the sewer system and other improvements have been sold. F. I. Sutton is Mayor. Noted Mar. [illegible], 1914, and July 9, 1914.

Manchester, Ga.—See item under "Water Supply and Irrigation."

Canton, Ohio.—Bids will be received by the City Council, until Nov. 9, for constructing a storm sewer in [illegible] St.

Cleveland, Ohio.—Bids will be received by the Commissioner of Purchases and Supplies, Room [illegible], City Hall, until Nov. [illegible], for constructing sewers in East [illegible] St. and West [illegible] St., Elizabeth and [illegible] Ave. Robert Hoffman is City Engr.

Conneaut, Ohio.—(Official.)—Bids will be received by S. W. Mahaffey, Dir. Pub. Ser., until noon, Nov. 10, for constructing a sewerage system and sewage treatment plant for the Grand-view Ave. Allotment.

Springfield, Ohio.—(Official.)—Bids will be received by Charles E. Ashburner, City Mgr., until [illegible], Nov. [illegible], for constructing a sewer in North St. from [illegible] to Foster St. and in Spring St. from North St. to Buck Creek.

Michigan City, Ind.—(Official.)—Bids will be received by the Board of Public Works until 10 a.m., Nov. [illegible], for constructing a sewer in Michigan St.

Ames, Iowa.—(Official.)—Bids will be received by A. H. Maxwell, City Clk., until [illegible] p.m., Nov. 2, for constructing a storm sewer in District No. 1.

✦Atlantic, Iowa.—A contract for constructing sanitary sewers has been awarded to [illegible], Council Bluffs, at $[illegible]. Noted Sept. 17.

Waukon, Iowa.—At a recent election the citizens voted in favor of issuing $[illegible] in bonds for the installation of a sewerage system. Noted Oct. 1.

✦Proctor, Minn.—Bids were received, Oct. 12, by the Village Council, for (a) sewer system, (b) disposal plant: WHITNEY BROS. & STACK CO., Duluth, (a) $20,981, (b) $13,-021 (awarded contract); King & Benquist, Duluth, (a) $[illegible], (b) $[illegible]; [illegible] Dahl Co., Duluth, (a) $[illegible], (b) $[illegible]; [illegible] Donnell, Duluth, (a) $[illegible], (b) $[illegible]

Hutchinson, Kan.—(Official.)—Bids will be received by the Board of Commissioners until [illegible] p.m., Nov. [illegible], for constructing [illegible] outlet sewer. [illegible] is City Clk. Noted Oct. [illegible]

Olathe, Kan.—Bids will be received by the City Clerk until Nov. [illegible], for constructing main sewer No. [illegible], lateral sewer [illegible] in District No. [illegible] and lateral sewer No. [illegible] in Sewer District No. 1. [illegible] is City Engr.

Grand Forks, N. D.—(Official.)—Bids will be received, until [illegible] p.m., Nov. [illegible], for constructing a lateral sewer in District No. [illegible] and for extending lateral sewer No. [illegible] in District No. [illegible]. [illegible] is City Aud.

Wahpeton, N. D.—Bids will be received by [illegible], City Aud., until [illegible] p.m., Nov. [illegible], for constructing a sewer extension in [illegible] St.

Roundup, Mont.—Bids will be received by Claude A. Renshaw, City Engr., until Dec. 7, for the sale of $20,000 in bonds, the proceeds of which will be used for constructing a main sewer and disposal plant. Noted Sept. 1.

Argenta, Ark.—Bids will be received, until Nov. 5, for constructing sewers in Sewer District No. 1. The estimated cost is $300,000. Lund & Hill, Little Rock, Ark., are Engrs.-in-Charge.

Georgetown, Tex.—An expenditure of $20,000 is contemplated by the city for constructing sewers.

+Uvalde, Tex.—A contract for constructing sewers has been awarded to the O'NEIL ENGINEERING CO., Dallas, Tex.

+Bartlesville, Okla.—A contract for constructing a number of sewers has been awarded to W. F. POWERS, Guthrie, at approximately $10,000.

+Haskell, Okla.—A contract for constructing a sewer system, including disposal plant, has been awarded to J. K. ROSCH & SON, Tulsa.

+Boise, Idaho—The contract for constructing the South Boise sewer system has been awarded to the IDAHO HARDWARE & PLUMBING CO., Boise, at $64,336.

Cathlamet, Wash.—(Official)—Bids were received, Oct. 19, by the City Council, for constructing a sewer system, as follows: Keating & O'Neil, $8096; R. D. Crow, $11,378; C. G. Randler, $10,444; James Kennedy Contracting Co., $9341. No award will be made until the validity of the bonds is passed on. Noted Sept. 17 and Oct. 15.

+Spokane, Wash.—A contract for constructing sewers has been awarded to JAMES BROAD at $19,465. Other bids were: J. W. Hosford, $21,597 and P. L. Langan, $20,949. Noted Oct. 8.

Portland, Ore.—George Gordon submitted the lowest bid, at $6187, for constructing a sewer in East 74th St. from Thornburn Ave. to East 72d St.

John R. Hansan, City Engr., has prepared plans for rebuilding 400 ft. of sewer on East Alder St. from East Second St. to the river, at an estimated cost of $10,000.

+Bakersfield, Calif.—A contract for constructing sewers in Districts Nos. 20 and 21 has becen awarded to E. C. HAMLIN, San José.

Holtville, Calif.—An expenditure of $30,000 is contemplated by the city for constructing a sewerage system.

+Los Angeles, Calif.—The contract for constructing a sewer in Brent and other streets has been awarded to LEO MILETICH, at $50,000.

Sacramento, Calif.—The City Commission has rescinded its decision to award the contract for the construction of units A and B of the trunk line sewers to the Matthews Construction Co., and will shortly call for new bids. The work will cost about $40,000.

+Santa Barbara, Calif.—A contract for improving the Valerio and Hollister St. section of the main sewer has been awarded to F. R. RITCHIE CO., San Francisco, at approximately $90,000.

Santa Rosa, Calif.—Bids will soon be received by the City Council for constructing 14,400 ft. of sewers.

GARBAGE

Buffalo, N. Y.—The city is having plans prepared for a garbage and refuse disposal plant to be erected at the foot of Massachusetts Ave. The estimated cost is $100,000. Howard L. Beck is the Arch. Francis G. Ward is Comr. Pub. Wks.

Philadelphia, Penn.—The only bid received for the 1915 contract for garbage removal was that of the Penn Reduction Co., at $323,588. Bids will be received until Nov. 6 by the Director, Department of Public Works, for (Schedule A) cleaning of streets, roads, alleys, inlets and markets for the year 1915 and all work incidental thereto; (Schedule B)—collection and disposal of ashes and rubbish for the year 1915 and all work incidental thereto.

STREETS AND ROADS

Boston, Mass.—Bids will be received by the Public Works Department, until Oct. 30, for pavements and roadways on Castlegate Rd., Dorchester, and Lockwood St., Hyde Park District. L. K. Rourke is Comr.

Bids will be received until Nov. 3, by the State Highway Commission, for the construction of 14,000 lin.ft. of road in Williamsburg and 9000 lin.ft. in Montague. Arthur W. Dean, 15 Ashburton Pl., is Ch. Engr.

+The contract for building 8600 lin.ft. of state road in Sheffield has been awarded by the State Highway Commission to B. PERINI & CO., Ashland, at $7580. Other bids were: O. W. Benedict, Pittsfield, $7753; H I. Geer, $7777; Lindholm & Cobb, $8652; S. W. Menaquale & Co., $8656; Columbus Contracting Co., $9196; M. L. Camarco, $9280; C. D. Cunningham, Cheshire, $9756; E. J. Rourke, $9878; Way & Cellilli, $10,002; Horne-Lowe Contracting Co., Millbury, $10,411; Robinson & Co., Westfield, $10,529; New England Construction Co., Worcester, $10,667; W. J. Racco, Southbridge, $10,725; R. J. Hudson, $11,259; Lane Construction Co., Meriden, Conn., $11,437; Hyde, Crowe & Walsh, $11,677; John de Michiel, Torrington, Conn., $11,835.

Hartford, Conn.—Bids were received by the State Highway Commissioner, Oct. 21, for the following road work:

Preston Township—About 4990 lin.ft. (a) native stone macadam, (b) gravel, on the Norwich-Westerly Turnpike. Estimated quantities: 4800 cu.yd. earth grading, 150 cu.yd. borrowed embankment, 325 cu.yd. rock excavation, 40 cu.yd. wet excavation, 5760 sq.yd. 7-in. macadam and 2000 sq.yd. 4-in. macadam, or 7760 sq.yd. 8-in. gravel surface, 580 tons trap rock screenings, 140 cu.yd. native stones in piles, 2000 sq.yd. telford base, 7 cu.yd. first-class concrete, 10 cu.yd. second-class concrete, 635 lb. steel beams and reinforcement, 100 cu.yd. new masonry, 70 cu.yd. new dry rubble masonry, 30 cu.yd. old masonry torn down and relaid, 50 sq.yd. pointing old masonry, 15 lin.ft. gas pipe railing, 155 lin ft. corrugated iron pipe culverts, one standard catch basin, 100 sq.yd. cobble gutter, 1000 lin.ft. rubble drain, 1930 lin.ft. removing and replacing stone walls and fences, 100 lin.ft. new stone wall, 100 lin.ft. new wire fence, 10 sq.yd. turf relaid, 50 cu.yd. sand fill, 50 cu.yd. crushed stone fill, 3880 gal. of liquid asphalt or asphaltic flush coat in place and covered—Ahern Construction Co. Willimantic, Conn., (a) $15,017, (b) $13,406; Olin T. Benedict, Pittsfield, Mass., (a) $14,691, (b) $12,779; Bristow Bros. & Knowles Corporation, Narragansett Pier, R. I., (a) $13,344; Frank A. Wilcox, Norwich, Conn., (a) $13,675, (b) $10,851; A. Brazos & Sons, Middletown, Conn., (a) $14,448, (b) $10,987; A. Vito Construction Corporation, Thompson, Conn., (a) $13,279; Goodman & Trumbull Co., Litchfield, Conn., (a) $14,873; A. D. Bridge's Sons, Inc., Hazardville, Conn., (a) $12,311.

Sterling Township—About 5480 lin.ft. (a) native stone macadam, (b) gravel, on the Plainfield Road. Estimated quantities: 2980 cu.yd. earth grading, 50 cu.yd. borrowed embankment, 620 cu.yd. rock excavation, 70 cu.yd. wet excavation, 8025 sq.yd. 7-in. macadam and 500 sq.yd. 4-in. macadam, or 8525 sq.yd. gravel surfacing, 635 tons trap rock screenings, 155 cu.yd. native stone in piles, 500 sq.yd. telford base, 4562 gal. liquid asphalt or asphaltic flush coat in place and covered, 15 cu.yd. first-class concrete, 10 cu.yd. second-class concrete, 1300 lb. steel beams and reinforcement, 50 cu.yd. new masonry, 10 cu.yd. new dry rubble masonry, 50 cu.yd. old masonry torn down and relaid, 50 sq.yd. pointing old masonry, 25 lin.ft. gas pipe railing, 260 lin.ft. corrugated iron pipe culvert, 1000 lin.ft. relaying old pipe, 4 standard catch basins, 100 sq.yd. cobble gutters, 400 lin.ft. rubble drain, 150 lin.ft. removing and replacing stone walls or fences, 100 lin.ft. new stone wall, 100 lin.ft. new wire fence, 10 sq.yd. turf relaid, 100 cu.yd. sand or gravel fill, 100 cu.yd. crushed stone fill—A. D. Bridge's Sons. Inc., Hazardville, Conn., (a) $9981, (b) $8619; Goodman & Trumbull Co., Litchfield, Conn., (a) $11,786; A. Vito Construction Corporation, Thompson, Conn., (a) $12,833; Joseph McCormack, East Providence, R. I., (a) $13,242, (b) $11,322; Ahern Construction Corporation, Willimantic, Conn., (a) $13,588, (b) $12,011; Olin T. Benedict, Pittsfield, Mass., (a) $12,716, (b) $9987; John de Michiel & Bro., Torrington, Conn., (a) $13,164, (b) $9510; Bristow Bros. & Knowles Corporation, Narragansett Pier, R. I., (a) $12,719.

Coventry Township—About 4700 lin.ft. native stone macadam on the South Coventry Road. Estimated quantities: 590 cu.yd. earth grading, 3180 cu.yd. borrowed embankment, 25 cu.yd. rock excavation, 5855 sq.yd. 7-in. macadam and 2500 sq.yd. 4-in. macadam, 630 tons trap rock screenings, 135 cu.yd. native stone in piles, 2500 sq.yd. telford base, 4177 gal. liquid asphalt or asphaltic flush coat in place and covered, 10 cu.yd. second-class concrete, 10 cu.yd. new masonry, 10 cu.yd. new dry rubble masonry, 10 cu.yd. old masonry torn down and relaid, 50 sq.yd. pointing old masonry, 220 lin.ft. corrugated iron pipe culvert, one standard catch basin, 100 sq.yd. cobble gutter, 1000 lin.ft. rubble drain, 100 lin.ft. removing and replacing stone walls or fences, 100 lin.ft. new stone walls, 100 lin.ft. new wire fence, 50 cu.yd. sand or gravel fill, 50 cu.yd. crushed stone fill—A. D. Bridge's Sons, Inc., Hazardville, Conn., $11,566; Goodman & Trumbull Co., Litchfield, Conn., $12,340; Ahern Construction Co., Willimantic, Conn., $13,086; A. B. Cadwell, New Britain, Conn., $12,790; Olin T. Benedict, Pittsfield, Mass., $12,627; Bristow Bros. & Knowles Corporation, Narragansett Pier, R. I., $12,204; A. Brazos & Sons, Middletown, Conn., $13,155.

Danbury Township—11,777 lin.ft. (a) trap rock macadam, (b) gravel, (c) plain concrete washed sand, (d) plain concrete unwashed sand, (e) rocmac or (f) hassam pavement, on Lake Ave.; 7660 cu.yd. earth grading, 50 cu.yd. borrowed embankment, 800 cu.yd. rock excavation, 17,440 sq.yd. 7-in. macadam and 3500 sq.yd. 4-in. macadam, or 20,940 sq.yd. gravel, or 4070 cu.yd. concrete, or 20,940 sq.yd. rocmac pavement, 170 cu.yd. trap rock in piles, 2500 sq.yd. telford base, 10,470 gal. liquid asphalt or asphaltic flush coat in place and covered, 20,940 sq.yd. steel reinforcement, 51 cu.yd. first-class concrete, 10 cu.yd. second-class concrete, 13,470 lb. steel beams and reinforcement, 210 cu.yd. new masonry, 10 cu.yd. dry rubble masonry, 200 cu.yd. old masonry torn down and relaid, 50 sq.yd. pointing old masonry, 80 lin.ft. gas pipe railing, 730 lin.ft. corrugated iron culverts, four standard catch basins, 1200 sq.yd. cobble gutters, 1400 lin.ft. rubble drain, 5500 lin.ft. removing and replacing stone walls, 100 lin.ft. new stone wall, 100 lin.ft. new wire fence, 10 sq.yd. turf relaid, 100 cu.yd. sand or gravel fill, 100 cu.yd. crushed stone fill—B. D. Pierce, Jr., Co., Bridgeport, Conn., (a) $33,387, (b) $26,619, (c) $47,768, (d) $46,792; John de Michiel & Bro., Torrington, Conn., (a) $27,783, (b) $21,737, (c) $35,984, (d) $34,886, (e) $37,651; Leonardo Suzio, Meriden, Conn., (a) $33,600, (b) $26,763, (c) $41,493, (d) $40,679; H. Sanford Osborn, Redding Ridge, Conn., (a) $29,506, (b) $24,631, (c) $41,082, (d) $39,861; C. W. Blakeslee & Sons, New Haven, Conn., (a) $36,484, (b) $31,483, (c) $45,548, (d) $44,408; Alex Burgess, Croton Falls, N. Y., (a) $36,361, (c) $46,287, (d) $45,880; Daly & Merritt, Portchester, N. Y., (a) $42,905, (b) $38,757, (c) $52,530, (d) $50,495; A. D. Bridge's Sons, Inc., Hazardville, Conn., (a) $33,500, (c) $42,845, (d) $41,217, (e) $38,603; Louis Longhi & Bro., Torrington, Conn., (a) $29,775, (b) $24,150, (c) $41,624, (d) $40,403; Edward Tracy, Derby, Conn., (a) $48,173, (b) $34,280; William J. Mertz, Portchester, N. Y., (c) $44,582, (d) $43,564; Connecticut Hassam Paving Co., New Haven, Conn., (f) $47,234; Bennett N. Beard Co., Shelton, Conn., (a) $33,178, (b) $26,467, (c) $48,557, (d) $46,522; Goodman & Trumbull Co., Litchfield, Conn., (a) $31,193, (b) $23,546, (c) $43,277, (d) $42,259; A. Vito Construction Corporation, Thompson, Conn., (a) $32,812, (b) $24,536, (c) $42,824, (d) $41,807; Bristow Bros. & Knowles Corporation, Narragansett Pier, R. I., (a) $36,377, (b) $28,276, (c) $45,744, (d) $44,727; Framingham Construction Co., South Framingham, Mass., (a) $28,769, (b) $21,590; Connecticut Good Roads & Improvement Co., New Britain, Conn., (a) $31,295, (b) $24,974, (c) $40,529, (d) $39,023; Olin T. Benedict, Pittsfield, Mass., (a) $27,787, (b) $22,024; A. Brazos & Sons, Middletown, Conn., (a) $34,650, (b) $26,304; A. C. Sternberg, Jr., Construction Corporation, West Hartford, Conn., (a) $34,831, (b) $25,788, (c) $43,634, (d) $42,942; Kellogg & Gregory Co., Danbury, Conn., (a) $35,847, (b) $27,530.

East Haven Township—About 3995 lin.ft. (a) native stone macadam, (b) concrete washed sand, (c) concrete unwashed sand, or (d) bituminous macadam, on the Short Beach Road. Estimated quantities: 1370 cu yd. earth grading, 25 cu.yd. borrowed embankment, 3220 cu.yd. rock excavation, 4715 sq.yd. 7-in. and 1500 sq.yd. 4-in. macadam, or 1187 cu.yd. concrete, or 6215 sq.yd. bituminous macadam, 465 tons trap rock screenings, 115 cu yd. native stone in piles, 1500 sq.yd. telford base, 3107 sq.yd. liquid asphalt or asphaltic flush coat in place and covered, 10 cu yd. second-class concrete, 10 cu.yd. new masonry, 10 cu yd. new dry rubble masonry, 10 cu yd. old masonry torn down and relaid, 50 sq.yd. pointing old masonry, 210 lin.ft. corrugated iron pipe culvert, three standard catch basins, 100 sq.yd. cobble gutters, 300 lin.ft. rubble drain, 500

[illegible]

Hartford, Conn. [illegible]

New York, N. Y. [illegible]

Camden, N. J. [illegible]

East Orange, N. J. [illegible]

Hackensack, N. J. [illegible]

Jersey City, N. J. [illegible]

Jersey City, N. J. [illegible]

Harrisburg, Penn. [illegible]

Philadelphia, Penn. [illegible]

[illegible]

+New Cumberland, W. Va.—A [illegible] for constructing [illegible] pavement [illegible] awarded to FRED ROBINSON, at approximately $2[illegible]

Lake City, Fla.—[illegible] will be received by the Board of [illegible] Works, until Nov. 16, for paving approximately [illegible] with vitrified brick on sand base.

Vernon, Fla.—Bids will be received by the County [illegible], until Nov. [illegible], for building a [illegible]-mile road from [illegible] Ferry and Vernon [illegible], and a six-mile road from [illegible] of Chipley Township toward Orange Hill. W. H. Gainer is County Clk.

Huntsville, Ala.—At the general election the [illegible] of Madison County will vote on the question of issuing [illegible] in bonds for constructing roads.

Vicksburg, Miss.—Bids will be received by J. [illegible], until [illegible] Nov. 3, for constructing a road from [illegible] Ferry to [illegible] Ferry.

Hindman, Ky.—An election will be held Nov. 4, to vote on the question of issuing $[illegible] in bonds, the proceeds of which will be used for road construction.

Cincinnati, Ohio.—[illegible]—Bids will be received by [illegible] Sec. until [illegible] Nov. [illegible], for improving [illegible] St. [illegible] to [illegible] St.

[illegible]—[illegible] will be received by the Board of County Commissioners until [illegible] Nov. 6 for improving a section of the North Bend Rd. [illegible] is Pres. and Albert [illegible] is Clk. of the Bd.

+Cincinnati, Ohio.—[illegible]—The contract for [illegible] of [illegible] Av. has been awarded to the [illegible] CONSTRUCTION CO., at $31,67[illegible]. Noted Oct. [illegible]

+Napoleon, Ohio.—The contract for paving West Main St. with [illegible] has been awarded to JOHNSON & HITZ, Napoleon, at $[illegible]

Indiana.—[illegible]—Bids will be received as follows for road improvements in Indiana:

Monticello, until 10 a.m., Nov. [illegible], by the Commissioners of White County, for constructing a road in [illegible] Township. [illegible] Fisher is Audr.

Winamac, until noon, Nov. [illegible], by the Commissioners of Pulaski County, for constructing a road in [illegible] Township. W. E. [illegible] is Audr.

Crown Point, until 1 p.m., Nov. [illegible], by the Commissioners of Lake County, for constructing roads in North and [illegible] Townships. Edward Simon is Audr.

Brownstown, until 1 p.m., Nov. 12, by the Commissioners of Jackson and Bartholomew Counties, for constructing a county line road. Albert Leudtke is Audr. of Jackson County.

Fort Wayne, until 10 a.m., Nov. 12, by the Commissioners of Allen County, for constructing a stone road in Lafayette Township. [illegible] Brown is Audr.

Richmond, until 11 a.m., Nov. 21, by the Commissioners of Wayne County, for constructing a highway in Wayne Township. [illegible] is Audr.

Indianapolis, until 10 a.m., Nov. 22, by the Commissioners of Marion County, for constructing a gravel road in Franklin Township. W. T. [illegible] is Audr.

+Fort Wayne, Ind.—The contract for constructing [illegible] No. [illegible] has been awarded to DEAN ELLISON, at $[illegible]

+Greensburg, Ind.—A contract for constructing a crushed stone road in Sand Creek Township has been awarded to MOORE & CRISL, [illegible] at $[illegible]. Noted [illegible]

+Mt. Vernon, Ind.—A contract for constructing [illegible] ft. of gravel road has been awarded to the MT. VERNON CONSTRUCTION CO., at $[illegible]. Noted Oct. [illegible]

+Muncie, Ind.—The contract for constructing a crushed stone road in [illegible] Township has been awarded to [illegible], at $[illegible]. Noted Oct. [illegible]

+Sullivan, Ill.—A contract for [illegible] has been awarded to L. R. HAUSHMANN, [illegible]

St. Paul, Minn.—Bids will be received [illegible]

Hutchinson, Kan.—[illegible]

+Great Falls, Mont.—[illegible]

+Kansas City, Mo.—The contract for [illegible]

Dallas, Tex.—[illegible]

+El Paso, Tex.—The contract for [illegible]

San Antonio, Tex.—[illegible]

+Temple, Tex.—A contract for [illegible]

Idabel, Okla.—[illegible]

Port Orchard, Wash.—[illegible]

+Prosser, Wash.—The contract for [illegible]

+Portland, Ore.—Contracts have been awarded for paving Webster St. from Denver to Delaware Ave. and Fremont St. from East 33d St. to County Rd. No. 316 to OSCAR HUBER, at $24,529; East Grand St. from Grand Ave. to East 11th St. to the OREGON HASSAM PAVING CO., at $12,016.

+St. Helens, Ore.—The contract for constructing the Pittsburgh-St. Helens Road has been awarded to the MILLS-ERMSTROM CO., Veronia, at $21,816.

Berkeley, Calif.—The San Francisco-Oakland Terminal Rys. Co. is preparing to pave a section of Grove St., at an estimated cost of $37,000. W. R. Alberger, Oakland, Calif., is Gen. Mgr.

Fresno, Calif.—Bids will be received by the Board of Supervisors until Nov. 6, for constructing the Dunlap cutoff Road, a 2.9 mile roadway which will extend from the old Millwood Rd. one mile east of Dunlap to the Sand Creek Rd. near the Woodey place. The estimated cost is about $14,000.

Los Angeles, Calif.—Bids will be received by the Board of Supervisors until 2 p.m., Nov. 2, for grading and constructing oil macadam pavement and reinforced concrete culverts in Road District No. 71. The work lies on Lark Ellen and Cypress Aves. about one mile west of Covina, and consists of 3260 cu.yd. excavation, 10,670 ft. shaping roadbed, 6985 ton rock, 53.2 cu.yd. concrete, 3421 lb. steel. Estimated cost $9333.

+Manhattan Beach, Calif.—A contract for improving a number of streets has been awarded to the BARBER ASPHALT CO., at approximately $200,000.

Petaluma, Calif.—An expenditure of $20,000 is contemplated by the city for paving Washington St.

Porterville, Calif.—Bids will soon be received by the City Council for paving Main, Cleveland and Morton St.

+Richmond, Calif.—The City Council has awarded a contract for street paving to L. L. PAGE, Richmond, at $11,346.

+Sacramento, Calif.—The City Commission has awarded the contract for paving Front St. from N to O St. to ADOLPH TEICHERT, at $6000.

+Sacramento, Calif.—The State Highway Commission has awarded contracts for highway work as follows: Santa Barbara County, between Stony Creek and El Capital, 10.2 miles, to C. H. HUDSON, Los Angeles, Calif., at $79,191; Kern County, from southerly boundary to Rose Station, to A. C. McCLEAN CONSTRUCTION CO., San Francisco, Calif., at $68,004; Humboldt County, between Loleta and Beatrice, 4.3 miles, to ELSMORE & JACOBS, Eureka, Calif., at $18,777; Humboldt County, from Shively to Jordan Creek, 3.7 miles, to WILLIAM CROWLEY and T. E. CLONEY, at $28,624; Imperial County, between Meyers Creek and Coyote Wells, about 6 miles, to J. W. CALBOCK, San Diego, Calif., at $68,145; Alameda County, from easterly boundary to Altamont, about 5.9, to PALMER & McBRIDE, San Francisco, Calif., at $38,032. The section in Santa Barbara County over Serana Gap will be built by day labor under the direction of the State Engineer. Noted Sept. 24 and Oct. 22.

(Official)—Bids will be received by the State Highway Commission, 515 Forum Bldg., until 2 p.m., Nov. 9, for the following road construction: Colusa County, from Williams to Colusa, about 8.4 miles in length, to be built of portland cement concrete. Glenn County, from the southerly boundary to Willows, about 8.5 miles in length, to be built of portland cement concrete. Solano County, from a point 2½ miles south of Cordelia to Fairfield, about 8.1 miles in length, to be built of portland cement concrete. Imperial County, from Coyote Wells to Dixieland, about 11.7 miles in length, to be built of portland cement concrete.

+San Mateo, Calif.—The City Trustees have awarded a contract for paving work in the downtown district to A. G. RAISCH, San Francisco, at $12,800.

Santa Ana, Calif.—Bids will be received by the Board of Supervisors until 10 a.m., Nov. 4 for grading and paving certain streets in Road Improvement District No. 1 and for surfacing Sievers Cañon Rd.

The Commissioners of Orange County contemplate constructing a boulevard from Newport to Huntington Beach.

+Sawtelle, Calif.—GEORGE R. CURTISS, 552 North St. Louis St., Los Angeles, has been awarded the contract at $19,835 for improving Tenth and Ohio St.

+Suisun, Calif.—The contract for paving Union Ave. with macadam has been awarded to W. R. CONNELLY, at $5941.

INDUSTRIAL WORKS

+Atlantic, Mass. The contract for the construction of the factory buildings for the Atlantic Rubber Co., has been awarded to MACKENZIE & TEMPLE, 50 Central St., Quincy, Mass.

+Boston, Mass.—The contract for the construction of the six-story brick and stone warehouse on Sleeper St., for the Boston Wharf Co., has been awarded to J. M. & C. J. BUCKLEY, 184 Federal St. M. D. Safford, 259 Summer St., is the Arch.

+Brookline, Mass.—The contract for the garage to be erected at 11 Pearl St., for Harry E. Chase, has been awarded to WILSON & TOMLINSON.

+Cambridge, Mass.—The second unit of the plant of Lever Bros. has been awarded to WALSH BROS., Cambridge, Mass. Thomas M. James, Cambridge, is the Arch.

+Worcester, Mass.—The contract for the construction of two buildings at the plant of the Spencer Wire Co. has been awarded to E. J. CROSS CO., Foster St., Worcester, Mass.

New Haven, Conn.—The Standard Wash Tray Works, will erect an addition, 75x150 ft. J. Weinstein, 6 Church Sq., New Haven, is the Arch.

+Jamestown, N. Y. The general contract for the construction of the three-story factory for the Seabury Mfg. Co. has been awarded to ALBIN JOHNSON.

+New York, N. Y.—(Borough of Brooklyn)—The general contract for the one-story brick foundry at Rapelyea and Van Brunt St., for the Atlantic Basin Iron Works, has been awarded to A. E. KLEINERT, 316 Flatbush Ave. The estimated cost is $15,000.

Bids are being received by Frederick Putnam Platt, Arch., 1123 Broadway New York, for the two-story brick warehouse at 99 Lexington Ave., for Alfred E. McAdam, 97 Lexington Ave. The estimated cost is $25,000.

+New York, N. Y.—(Borough of Richmond)—(Official)—The foundation contract for the warehouses at Tompkinsville, for the American Dock Co., has been awarded to the McARTHUR CONCRETE PILE & FOUNDATION CO., 11 Pine St., New York. Noted Oct. 22.

Niagara Falls, N. Y.—Plans are being prepared by D. A. Crone, Arch., Oliver Bldg., for the construction of a two-story and basement, 82x250 ft. factory for the Santo Rubber Co. The estimated cost is $100,000. Noted June 25.

Springville, N. Y.—The plant of the James H. Gray Milling Co., recently destroyed by fire will be rebuilt.

+Utica, N. Y.—The general contract for the construction of the paper factory for the E. P. Bailey Co. has been awarded to HARRY LANCASTER; steel work, UTICA STEAM ENGINE & BOILER WORKS. The estimated cost is $26,000.

+Jersey City, N. J.—The foundation contract for the one-story, 250x350-ft. warehouse, on Westside Ave., for Joseph T. Ryerson & Son, 30 Church St., New York, has been awarded to the DAVID HENRY BUILDING CO., 207 Market St. The estimated cost is $20,000.

Newark, N. J.—The Newark Plaster Co. contemplates erecting manufacturing buildings at Newark Plank Rd. and Passaic Ave. The estimated cost is $75,000.

Pittston, Penn.—Plans are being prepared by C. F. Hettinger & Co., Archs., Roxbury, Mass., for an addition to the brewery at Pittston. The estimated cost is $50,000.

Vista, Penn.—The Williams Tire Co. has purchased ten acres of land upon which it will erect a plant. A. D. Williams, Glassport, Penn., is the Pres.

+Suffolk, Va.—The contract for rebuilding the plant of the John King Peanut Co. has been awarded to JESSE JOHNSON, Norfolk, Va., at $15,927.

+Greensboro, N. C.—The contract for the erection of 10 warehouses for the Revolution Cotton Mills has been awarded to G. T. STONE.

Cincinnati, Ohio—Early & Daniels, grain dealers, 35 Carew Bldg., have plans completed for the warehouse to be erected at Sixth and Harriet St. The estimated cost is $75,000.

East St. Louis, Ill.—The Champion Feed Milling Co., Lyons, Iowa, contemplates constructing a feed mill at 21st St. and McCasland Ave., East St. Louis. Estimated cost, $50,000.

+Green Bay, Wis.—The contract for the construction of the three-story 40x170 ft. factory on East River at Van Buren St. has been awarded to the FABRY CONSTRUCTION CO.

+Madison, Wis.—Contracts for the construction of a two-story and basement, 25x100-ft. bottling plant for the Heibel Bottling Co. have been awarded to L. B. GILBERT, masonry; FREDERICKSON BROS., carpentry. Estimated cost, $20,000. Noted Aug. 20.

Milwaukee, Wis.—F. W. Andree, Arch., Cawker Bldg., is preparing plans for the construction of a three-story and basement, 20x120-ft. warehouse, at East Water and Buffalo St.

Milwaukee, Wis.—Lockwood, Greene & Co., Archs., 38 S. Dearborn St., Chicago, Ill., is preparing plans for the construction of a six-story and basement, 115x135-ft. warehouse, at Fourth and Fowler St., for the B. J. Johnson Soap Co. Estimated cost, $100,000.

Sauk City, Wis.—Plans are being prepared by Joseph Dresen, Arch., for the construction of a gasoline engine factory for the Shaw Motor Co., Chicago, Ill. Estimated cost, $25,000.

Sheboygan, Wis.—Plans have been prepared for the plant to be erected for the Sheboygan Cigar Box Lumber & Mfg. Co. C. F. Ringer & Son, Hathaway Bldg., Milwaukee, Wis., are the Archs. Noted Aug. 27.

+Waukesha, Wis.—The contract for the addition to the plant of the Spring City Foundry Co., has been awarded to GEORGE WARD, 112 West Ave., Waukesha, Wis.

San Antonio, Tex.—Leo M. J. Deilman, Arch., has prepared plans for the construction of a warehouse for the Mission Ice & Fuel Co.

Peck, Idaho—P. S. Lantzy, Spokane, Wash., plans the construction of a flour mill and an electric light plant. Estimated cost, $20,000.

+Seattle, Wash.—The contract for the construction of the first unit of the cold storage warehouse, at the East Waterway Turning Basin, for the Seattle Port Commission, has been awarded to the BUTLER CONSTRUCTION CO. Estimated cost, $129,300. Noted Oct. 15.

Ashland, Ore.—Plans are being prepared for the construction of an evaporation plant for M. C. Bressler, Ashland.

+Portland, Ore.—The contract for the construction of a factory for the Portland Oxygen & Hydrogen Co., at Seventeenth Ave., between Center and Borse St., has been awarded to W. C. MOORE.

Claremont, Calif.—Plans are being prepared for the construction of a pre-cooling plant at Oberlin and Cornell St for the Union Ice Co. Estimated cost, $100,000.

Los Angeles, Calif.—The Givan Paper Mills Co., Union Oil Bldg., recently incorporated, contemplates constructing a plant to cost $175,000 Pockney French, B. H. Smith and Frank G. Hickox are interested.

Oakland, Calif.—Bids will be received about Nov. 15. by Cheney & Hobart, Archs., San Francisco, Calif., for construction of a plant to be erected at 12th and Union St., for the Shredded Wheat Biscuit Co., Niagara Falls, N. Y. The estimated cost is $100,000. Noted Sept. 10.

Visalia, Calif.—The Mineral King Fruit Co. contemplates constructing a reinforced-concrete warehouse, 100x200 ft. [illegible]

◆Bedford, Que.—The contract for the construction of the factory for the [illegible] Mfg. Co. has been awarded to GRAY & [illegible].

Fort Erie, Ont.—The Crystal Cut Glass Co., Ltd., will erect a [illegible] at [illegible] and [illegible] St. W. [illegible] L. [illegible] is the Pres.

Kingston, Ont.—The [illegible] Fertilizer Co., Paterson, N. J., will erect a plant at Kingston. The estimated cost is [illegible].

New Westminster, B. C.—[illegible] & Mercer, Archts., are preparing plans for the construction of the elevator and warehouse for the [illegible] Milling Co. Estimated cost [illegible]. Noted Sept. [illegible].

Vancouver, B. C.—Salmon River Lumber & Shingle Co., Ltd., [illegible] Hastings St., contemplates the construction of a lumber mill to cost approximately $10,000.

FEDERAL GOVERNMENT WORK

◆Dredging—Portland, Me.—Bids will be received by Lieut.-Col. W. E. Craighill, [illegible] Congress St., Portland, until noon, Nov. 28, for dredging in Portland Harbor.

Repairing Vessel—Portland, Me.—The date for receiving bids for docking and repairing the Portland light vessel has been extended from Oct. [illegible] to Nov. 2. C. E. Sherman is Inspector. Noted Oct. [illegible].

Shipbuilding Ways, Etc.—Boston, Mass.—The following are the bids received for shipbuilding ways and appurtenances at the Navy Yard, Boston: H. P. Converse & Co., Boston, $77,321, alternate bids, [illegible], [illegible]; William P. Miller Co., 171 Alford St., Boston, [illegible]; W. H. Ellis & Son Co., 479 Meridian St., East Boston, $117,[illegible]; George T. Rendle Co., [illegible] Condor St., East Boston, [illegible]; Crandall Engineering Co., 102 Border St., East Boston, [illegible]; C. M. Leach, Boston, $113,000. Noted Oct. [illegible].

◆Mezzanine Floor, Worcester, Mass.—The contract for constructing a mezzanine floor in the post office has been awarded to James Miles & Son Co., Worcester, at $8287. Noted Oct. 22.

Dredging, Etc.—Newport, R. I.—Bids will be received by Col. John Millis, U. S. Engineer's office, Newport, until noon, Nov. [illegible], for dredging and rock removal in Newport Harbor.

Repairs to Mailing Platform—Buffalo, N. Y.—The only bid received for making repairs to the mailing platform, etc., at the U. S. post office, Buffalo, was from the Gentner-Savage Co., Buffalo, N. Y., at $[illegible].

Mechanical Equipment—Syracuse, N. Y.—Bids will be received, until 3 p.m., Nov. 16, by Oscar T. Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for installing a conduit and wiring system, lighting fixtures, and making heating repairs and extensions, at the U. S. post office and court house.

Bulkhead, Storehouse and Oilhouse—Atlantic City, N. J.—Bids will be received by Maj. E. N. Johnston, Corps Engrs., U. S. A., Wilmington, Del., until Nov. 7, for building bulkhead, storehouse and oilhouse at Atlantic City.

◆Air Compressors—Pittsburgh, Penn.—Bids will be received until noon, Nov. 21, by Lieut.-Col. Francis R. Shunk, Corps Engrs., U. S. A., for furnishing and installing two air compressors and one water turbine at Lock No. [illegible], Monongahela River.

◆Repairs to Post Office—Baltimore, Md.—The contract for making repairs to mechanical equipment and certain construction changes in the U. S. post office at Baltimore has been awarded to the NEWPORT CONTRACTING & ENGINEERING CO., Newport News, Va., at $[illegible].

Buildings—Washington, D. C.—Bids will be received at the office of the Superintendent, Coast and Geodetic Survey, [illegible] New Jersey Ave. S. E., Washington, D. C., until 2 p.m., Oct. [illegible], for the construction of two buildings for the Coast and Geodetic Survey.

◆Memorial—Washington, D. C.—The contract for the construction of the memorial to the women of the Civil War has been awarded to the BOYLE-ROBERTSON CONSTRUCTION CO., Washington, D. C., at $[illegible], using Danby marble. Bids were opened Aug. [illegible]. Noted July [illegible].

◆Concrete Footbridge—Fortress Monroe, Va.—Bids will be received by the quartermaster until noon, Nov. 11, for the construction of a concrete footbridge across the moat at Fortress Monroe. The work necessitates changing the location of the electrical conduit.

Trestles—Wheeling, W. Va.—The lowest bid submitted for furnishing and delivering [illegible] trestles, [illegible] and [illegible] for Dam No. [illegible], Ohio River, was from the Toledo Bridge & Crane Co., Toledo, at $[illegible]. [illegible] is Capt., Corps of Engrs. Noted Sept. [illegible].

◆Post Office—[illegible]—The contract for the construction of the post office at [illegible] has been awarded to the [illegible] Construction Co., Norfolk, Va., at $[illegible].

Dock Piers—Jacksonville, Fla.—Press reports state that the Government will construct dock piers at Jacksonville. Maj. [illegible], Corps Engrs., is in charge.

◆Roof Repairs—New Orleans, La.—The contract for making repairs to the roofs of the buildings at the naval station, New Orleans, has been awarded to HENRY [illegible], [illegible], at $[illegible].

Levee Work—Memphis, Tenn.—Bids will be received until 11 a.m., Nov. [illegible], by the Mississippi River Commission, Custom House, Memphis, for constructing about [illegible] cu. yd. of levee work in the Upper and Lower St. Francis and White River levee districts. [illegible] is Major.

◆Post Office—[illegible]—The contract for the construction of the post office at [illegible] has been awarded to [illegible], Chattanooga, Tenn., at $[illegible]. Noted Aug. [illegible].

Steel Hull—[illegible]—Bids will be received until [illegible] a.m., Nov. [illegible], by [illegible], Custom House, [illegible], for constructing a steel hull for dipper dredge. For [illegible], see Proposals Pages.

Steel Deck Barges—Cincinnati, Ohio—The following are the bids received by Lieut.-Col. H. Jervey, Custom House, for constructing two steel deck barges: Jones & Laughlin Steel Co., Pittsburgh, Penn., (a) delivery at Carrollton, Ky., $[illegible], (b) delivery at shipyard, $[illegible]; Pittsburgh-Des Moines Steel Co., Pittsburgh, Penn., (a) $11,[illegible], (b) $[illegible]; Hartmann-Greiling Co., Green Bay, Wis., (a) $11,[illegible], (b) $11,[illegible]; Dubuque Boat & Boiler Works, Dubuque, Iowa, (a) $11,[illegible]; Charles Hegewald Co., New Albany, Ind., (a) $11,[illegible], (b) $11,[illegible]; Edward J. Howard, Jeffersonville, Ind., (a) $11,[illegible], (b) $11,[illegible]; J. K. Petty & Co., Inc., Philadelphia, Penn., (a) $[illegible]; American Bridge Co., Cincinnati, Ohio, (a) $[illegible], (b) $[illegible]. Noted Oct. 1.

◆Breakwater—Marquette, Mich.—The contract for constructing a rubble mound breakwater at Marquette has been awarded to T. L. DUROCHER, Sault Ste. Marie, Mich., at $176,[illegible]. Other bids were: Great Lakes Dredge & Dock Co., Duluth, Minn., at $[illegible]; Zenith Dredge Co., at $[illegible]; and Greiling Bros. Co., Green Bay, Wis., at $213,[illegible]. E. D. Peek is Maj., Corps of Engrs. Noted Oct. [illegible].

Steel and Lathing—Chicago, Ill.—Bids will be received by Capt. Roy B. Harper, Acting Depot Quartermaster, 11[illegible] East Ontario St., Chicago, until Nov. 9, for furnishing and delivering f.o.b. place of manufacture, Kahn bars, floor tiles, deformed square bars and about 16,800 ft. of expanded metal lath.

Post Office—Sparta, Wis.—Bids will be received by Oscar T. Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Nov. 30, for constructing the post office at Sparta. The building will be one story and basement, of brick and stone.

Gate Hoisting Equipment—Moran, Wyo.—Bids will be received by the U. S. Reclamation Service, Boise, Idaho, until 2 p.m., Nov. 22, for furnishing certain gate hoisting equipment for sluice gates in connection with the Jackson enlargement project, Moran. For particulars write U. S. Reclamation Service, Boise, Idaho, or Washington, D. C. F. H. Newell is Dir.

◆Canals and Dikes—Malta, Mont.—The following are the bids received by the U. S. Reclamation Service, Malta, for the earthwork and structures in connection with the Nelson Reservoir outlet canals, dikes and controlling works: Security Bridge Co., Minneapolis, Minn., (a) Schedule 1, $10,[illegible], (b) Schedule 2, $18,160; Dooling Bros., (a) $1[illegible]; Charles Wilhite & Co., Malta, (a) $13,610; James O'Connor, 2[illegible] Park Ave., Council Bluffs, Iowa, (a) $13,630; W. J. Hoy Co., St. Paul, Minn., (a) $14,702, (b) $20,680; Heuser & Son, Malta, Mont., (b) $27,620. Noted Sept. 10.

Post Office—Uvalde, Tex.—Bids received, Oct. 6, by the Supervising Arch., for constructing the post office at Uvalde have been rejected. Noted Aug. [illegible] and Oct. 22.

Drainage—Nampa, Idaho—According to press reports, the U. S. Reclamation Service has appropriated $[illegible] for the purpose of draining lands in the Nampa-Meridian Irrigation District.

Hull—Portland, Ore.—Bids will be received by Lieut.-Col. C. H. McKinstrey, Custom House, Portland, until Nov. [illegible], for the construction of a wooden hull to be used as a combination dredge and snagboat.

◆Coal Platform and Flume—San Diego, Calif.—The contract for making an extension to the coal platform and flume at the naval coal depot, San Diego, has been awarded to FREDERICK STEFFGEN, San Diego, at $[illegible]. Noted Sept. 17 and Oct. [illegible].

Miscellaneous—San Francisco, Calif.—Bids will be received by Lieut.-Col. W. H. Hart, Depot Quartermaster, San Francisco, until 10 a.m., Nov. [illegible], for furnishing hardware, lighting fixtures, etc.

Locomotive—Pearl Harbor, H. T.—Bids will be received by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Nov. 14, for one narrow-gage, saddle-tank switching locomotive, delivered at the naval station, Pearl Harbor, Hawaii.

MISCELLANEOUS

◆Wharf and Fender Pier—Boston, Mass.—The Public Works Department has awarded the contract for the construction of a draw fender pier and wharf at South Boston to W. H. ELLIS, East Boston. Noted Oct. [illegible].

Shore Improvement, Breakwater, Etc.—Boston, Mass.—Plans for the improvement of the Dorchester Bay Strandway were filed with Mayor Curley, Oct. [illegible], by Commissioners Rourke, Dillon and Mahoney. The plans call for the reclamation of [illegible] acres of land, creation of a white sand beach [illegible] ft. wide, diverting the sewerage discharge and the construction of a breakwater. Estimated cost about $[illegible].

Monument—Worcester, Mass.—Competitive sketches will be received by the Spanish American Monument Association for a monument to be erected in Armory Court. The estimated cost is $[illegible]. A. A. Brigham, [illegible] Main St., is the Chmn.

◆Barge Canal Work—Albany, N. Y.—[illegible]—The following bids were received Oct. [illegible], by [illegible] W. [illegible], State Supt. Pub. Wks., for Barge Canal Work: (a) Contract K, for constructing the superstructures of three highway bridges; (b) Contract No. [illegible], construction of the superstructure of movable dam No. [illegible] over the Mohawk River at [illegible]; (c) Contract M, power plants, electrical equipment and machinery for operation locks [illegible], [illegible] and [illegible] Cayuga and Seneca Canal: PHOENIX BRIDGE Co., [illegible] Williams St., New York, (a) $[illegible] (awarded contract), (b) $[illegible]; Pennsylvania Bridge Co., Beaver Falls, Penn., (a) $[illegible], (b) $10[illegible]; Fort Pitt Bridge Co., Pittsburgh, Penn., (a) $[illegible], (b) $[illegible]; Larkin & Sangster, Seneca Falls, N. Y., (a) $[illegible]; Toledo Bridge & Crane Co., Toledo, Ohio, (a) $[illegible]; Lupfer & Remick, Buffalo, N. Y., (a) $[illegible], (b) $[illegible], (c) $[illegible]; [illegible], Buffalo, N. Y., (a) $[illegible]; Whitehead & Kales Iron Works, Detroit, Mich., (a) $[illegible], (b) $[illegible]; [illegible] & MacArthur Bros. Co., Albany, N. Y., (a) $[illegible]; Wright Mfg. Co., Lisbon, Ohio, (c) informal.

The following bids were also received for Contract No. 23-B—completing the approaches to the South Ave. Bridge on site of contract No. 23, Brighton, Monroe County: MICHAEL E. SWEENEY, Rochester, N. Y., $5262 (awarded contract); S. R. Rosoff, Herkimer, N. Y., $5495; E. R. Weed & Son, Holley, N. Y., $5997; M. J. Sullivan, Deerfield, N. Y., $6046; L. G. Snyder, Rochester, N. Y., $6366; Genesee Contracting Co., Rochester, N. Y., $6280. Noted Oct. 1.

Barge Canal Work—Albany, N. Y.—(Official)—Bids will be received by Duncan W. Peck, State Supt. Pub. Wks., until noon, Nov. 20, for the following contracts: (Contract J), for constructing the substructure, superstructure and approaches of a highway bridge over the Cayuga and Seneca Canal at Fourth St., Watkins, and for constructing a section of dockwall between the west abutment and the end of the terminal dockwall. Engineer's estimate, $52,939.75; (Terminal Contract No. 29), for constructing a harbor, dockwall and two breakwaters in Oneida Lake at Constantia, N. Y. Engineer's estimate, $43,573.50.

Dredging—Albany, N. Y.—An ordinance will be introduced at a meeting of the Common Council to be held soon authorizing a bond issue of $35,000 to provide funds for dredging the Albany basin.

Motor Fire Apparatus—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until Nov. 4 by Robert Adamson, Fire Comr., Municipal Bldg., Borough of Manhattan, for furnishing and applying eight gasoline propelled tractors, five for steam fire engines and three for hook and ladder trucks. Bids will also be received for furnishing and applying ten gasoline propelled tractors, seven for steam fire engines, and three for hook and ladder trucks.

+Motor Fire Apparatus—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for furnishing the Fire Department with two gasoline propelled tractors has been awarded to the C. J. CROSS FRONT DRIVE TRACTOR CO., at $6780. The contract for furnishing ten gasoline propelled tractors, seven for steam fire engines, and three for hook and ladder trucks, has been awarded to the FRONT DRIVE MOTOR CO., Hoboken, N. J., at $36,000. Noted Oct. 8.

Creek Improvement—Syracuse, N. Y.—The following bids were received by the Syracuse Intercepting Sewer Board for the improvement of Onondaga Creek: Merrill-Ruckgaber Co., New York, $153,105; John Young, Syracuse, $167,770; Walsh Construction Co., Davenport, Iowa, $168,755; E. W. Foley Construction Co., New York, $180,103; F. J. Cogan Co., New York, $181,460; State Highway Construction Co., $194,496; Larkin & Sangster, Seneca Falls, $202,503. Noted Sept. 24.

+Fire Station—Union, N. J.—The contract for the erection of a two-story fire station on Third St., has been awarded to ROBERT G. & WILLIAM E. LIMOUZE at $14,989. Noted Aug. 13.

Elimination of Grade Crossing—Philadelphia, Penn.—Mayor Blankenburg has signed an ordinance authorizing the elevation of the tracks of the Pennsylvania R.R. on Lehigh Ave., between Richmond St. and Trenton Ave. The estimated cost is $5,000,000. The expense will be shared equally by the city and the Pennsylvania R.R.

Subway—Cumberland, Md.—James P. Gaffney, City Engr., is preparing plans for a subway to be constructed at Green St. crossing of the Baltimore & Ohio R.R.

+Dock—Jones (Hollywood post office), Md.—The Maryland, Delaware & Virginia Ry. Co. has awarded the contract for the construction of a 300-ft. dock to GEORGE D. TURNER, Prince Frederick, Md.

+Filling—Bay St. Louis, Miss.—The Sea Wall Commission has awarded the contract for filling behind the proposed seawall to JOHN ANDERSON, Abbeville, La., at 14c. per cu.yd.

+Drainage—Clarksdale, Miss.—The Coahoma Drainage District Commissioners have awarded the contract to the MEMPHIS CANAL CONSTRUCTION CO., for the construction of a drainage system for the reclamation of 18,000 acres in northern Coahoma County. The estimated cost is $65,000. E. L. Fontaine is County Engr.

Memorial—Vicksburg, Miss.—The Michigan-Vicksburg National Park Commission will select a site in the park for a memorial from the State of Michigan, estimated to cost $20,000. W. T. Rigsby is Chmn.

+Levee Work—New Orleans, La.—Contracts for levee work aggregating 271,000 cu.yd., have been awarded by the State Board of Engineers, as follows: Wilson Levee—65,000 cu.yd., G. C. HOWELL, 12.4c. per cu.yd.; Saucier Levee—50,000 cu.yd., W. M. RUSHING, 11.4c. per cu.yd.; Sarto Levee—100,000 cu.yd., RUSHING & HOWELL, 11.7c. per cu.yd.; Rapp Levee—40,000 cu.yd., LOWER COAST CONSTRUCTION CO., 15.4c. per cu.yd.; Norbert Buras Levee—16,000 cu.yd., SMITH BROS., 23.5c. per cu.yd.

Riveted Steel Pipe—New Orleans, La.—(Official)—Bids will be received until Dec. 1 by F. S. Shields, Secy., Sewerage and Water Bd., for furnishing 5-ft. and 12-ft. riveted steel pipe; approximate weight, 150,000 lb. Specifications are on file at the offices of the Board, Room 508, City Hall Annex, New Orleans.

+Levee—New Orleans, La.—The State Board of Engineers has awarded the contract for the construction of the Cærnavon levee to W. E. GEREN, at 42c. per cu.yd. The work calls for 30,000 cu.yd. of earth work.

Stadium—Lexington, Ky.—Walter E. Rowe, Dean of the College of Engineering, Kentucky University, is preparing plans for a reinforced-concrete stadium having a seating capacity of 5000.

Motor Trucks—Cleveland, Ohio—Bids will be received until Nov. 6, by the Commissioner of Purchases and Supplies, Room 513, City Hall, for furnishing motor trucks for use by the municipal electric-light department. Specifications may be obtained of F. W. Ballard, Comr., Heat and Light Dept.

Fire Escapes—Cleveland, Ohio—(Official)—Bids will be received at the office of the Clerk of the Board of Education, East Sixth St., until noon Nov. 23, for furnishing the necessary materials and labor for the construction of fire escapes for South School. Frank G. Hogen is Dir. of Schools.

Dredging—Millersburg, Ohio—The County Commissioners have plans under consideration for dredging and straightening the west branch of Sugar Creek.

Coal Docks, Hoisting and Dumping Equipment—Toledo, Ohio—The Cincinnati, Hamilton & Dayton R.R. Co. is having plans prepared for coal docks, additional yard facilities, coal hoisting and dumping equipment. The estimated cost is $500,000.

Memorial Chapel—Willoughby, Ohio—(Official)—The Andrews Institute for Girls, Sidney S. Wilson, Gen. Mgr., will receive sketches, plans and estimates until Nov. 15, of a memorial chapel to be erected in the cemetery of the Village of Willoughby. Cost not to exceed $30,000.

Mausoleum—Wooster, Ohio—Plans have been completed by Knox & Elliott, Archs., Rockefeller Bldg., Cleveland, Ohio, for a one-story, 30x113-ft. granite mausoleum, to be erected in Oak Hill Cemetery.

Fire and Police Signal System—Youngstown, Ohio—The city contemplates the installation of a fire and police signal system, estimated to cost about $18,000.

Stadium—Evansville, Ind.—The City School Board plans to erect a steel stadium on the Garvin Park Athletic Field.

Creek Improvement—Fort Wayne, Ind.—The city contemplates straightening Spy Run Creek south of the Lawton Park bridge.

Subway—Danville, Ill.—The following were the three lowest bids received by the Board of Local Improvements for the construction of the Fairchild St. subway: Carson-Payson Co., Danville, $94,008; E. R. Harding Co., Racine, Wis., $113,720; Pronger & Fletcher, Blue Island, Ill., $124,850.

Drainage—Lincoln, Ill.—(Official)—Bids will be received, until Nov. 3, by William Bates, County Surv., for furnishing 550 ft. 24-in. standard sewer pipe, 3450 ft. 20-in., 3200 ft. 12-in. and 790 ft. 10-in. shale field tile for Union Drainage District No. 1.

Fire Station and Motor Apparatus—Milwaukee, Wis.—Plans are being prepared by the Department of Public Buildings, J. C. Pinney, Supt., for a two-story, 30x85-ft. fire station, to be erected at 39th and Vliet St. The estimated cost is $30,000. Motor fire apparatus will be purchased.

Breakwater—Racine, Wis.—P. H. Donnolly, City Engr., will receive bids for the construction of a breakwater in Lake Michigan, between 10th and 12th St.

Drainage—Sheboygan, Wis.—J. Donahue, Consult. Engr., Sheboygan, is preparing specifications for the construction of 13,000 ft. of drainage canals on the Pinehurst farm of Peter Reiss, Sheboygan Falls.

+Drain—Fort Dodge, Iowa—The Webster County Commissioners have awarded the contract to JENSEN, KJAR & JACOBSON, Humboldt, Iowa, at $24,741 for furnishing the labor and material for the construction of Drain No. 195.

+Drainage—Hampton, Iowa—Drainage District No. 34 has awarded contracts for drainage work to LINNAN & CLANCY, Fonda, Iowa, at $22,474, for labor; WHAT CHEER CLAY PRODUCT CO., What Cheer, Iowa, at $32,187, for tile.

Drainage District No. 32 has awarded the following contracts for drainage work: (Tile), HAWKEYE CONSTRUCTION CO., Webster City, at $24,127, including 66,100 ft. 6-in. to 36-in. hard burned clay shale tile; (Labor), JAMES SLATTEY, Algona, at $10,814.

Drainage—St. Joseph Mo.—W. B. Hazen, Engr., has been retained by the Nishrabotna Drainage District to make surveys for improvements in the drainage system.

Subways—St. Louis, Mo.—According to reports the Missouri Pacific Ry. System, J. R. Stephens, Ch. Engr., contemplates the construction of subways for the elimination of grade crossings at Eager Rd., Shaw Ave., McRee Ave., King's Highway and Wilson Ave., Oak Hill and Carondelet branch. The estimated cost is $278,467.

Amusement Pier—Galveston, Tex.—Edward Avory and C. H. Gordon contemplate building an amusement pier at the foot of 14th St. The estimated cost is $15,000.

Carts, Cans and Sweepers—San Antonio, Tex.—(Official)—Bids will be received, until 4 p.m., Nov. 9, by Ray M Mackey, City Purch. Agt., for carts carrying demountable cans, cans and modern sweepers.

Drainage District—Victoria, Tex.—Preliminary steps have been taken by land owners in Victoria County for the formation of Drainage District No. 3. The proposed district will comprise 70,000 acres of land.

Fire Protection System—Seattle, Wash.—The lowest bid submitted to the Seattle Port Commission for the installation of a fire protection system in the Smith's Cove warehouse, was that of the Rautman Plumbing & Heating Co., at $15,379, with an alternate bid of $14,739.

+Dredge—Tacoma, Wash.—The contract for building a 20-in. electric dredge to be used by King and Pierce Counties in the Stuck River Flood Improvement has been awarded to TWEEDEN & MARSH, Tacoma, at $72,000.

+Dock—Portland, Ore.—The Southern Pacific Co. has awarded the contract for the construction of a timber, level dock, at East Burnside and Gilsan St., to the GUTHRIE-McDOUGAL CO., Portland, at $50,000. Noted Sept. 24.

Dock Work—Portland, Ore.—The city has disposed of the $100,000 bond issue to be used for the construction of docks. Plans for the additional work will be prepared at once.

Dock and Shed—Portland, Ore.—The Oregon-Washington R.R. & Navigation Co. has received a permit for the construction of a dock and shed at the foot of East Fremont St The estimated cost is $85,000.

Subway—Bakersfield, Calif.—The city of Bakersfield and the Southern Pacific Co. plan to construct a subway for the elimination of the grade crossing at Baker St and the Southern Pacific Ry. The estimated cost is $100,000.

Fire Alarm Systems—Fresno, Calif—The Fire Commissioners have under consideration the installation of a 300-box fire alarm system

+Pipe Line—Martinez, Calif.—The [illegible] Shell Oil Co. has [illegible] the contract for excavation for [illegible] pipe line from [illegible] to Martinez, [illegible] miles, to F. S. LANE, Los Angeles, at [illegible]

Dredge—[illegible], Calif.—[illegible] W. H. [illegible] for the [illegible] Development Co., has been authorized by [illegible] to [illegible] a dredge for use in the Alamo [illegible] cost not to exceed $[illegible]

+Pile Work—San Francisco, Calif.—The State Board of Harbor Commissioners has awarded the contract for driving [illegible] for the [illegible] to the HEALEY TIBBITTS CONSTRUCTION CO., at $[illegible]

Motor Fire Apparatus—San Francisco, Calif.—The Fire Commissioners will receive bids soon for furnishing the department with motor tractors, automobile pumping engines and [illegible] trucks. The estimated cost is $[illegible]

Drydock—Long Point, Que.—The Canadian Vickers Co. plans to construct a [illegible] drydock at Long Point. The estimated cost is $[illegible]

Creek Improvement—New [illegible]—Bids reported desired [illegible] Nov. [illegible] for removing rock and earth from the bed of [illegible] Creek. S. B. [illegible], Smith's Falls, is Mun. Engr. For further information address Township Clerk, New Dublin.

Dike and Ditch—P[illegible], B. C.—An [illegible]-ft. dike and a 20-ft. [illegible] will be constructed at Richmond. The estimated cost is [illegible]. [illegible] & [illegible], Vancouver, B. C., are Consult. Engrs.

BUILDINGS

+Auburn, Maine—The contract for the construction of the Home for Aged Women has been awarded to T. F. MOREAU, 164 [illegible] St., Lewiston. It will be three stories, of brick. Gibbs & [illegible], Lewiston, are the Archs.

+North Haverhill, N. H.—The contract for the construction of the [illegible] at North Haverhill has been awarded to the H. P. CUMMINGS CONSTRUCTION CO., Woodsville. F. Lyman Clark, 1[illegible] Dartmouth St., Boston, is the Arch.

Brattleboro, Vt.—See [illegible] under Bridges.

St. Johnsbury, Vt.—C. R. Crandall, Arch., Burlington, is preparing plans for the additions to the St. Johnsbury Hotel.

+Arlington, Mass.—The contract for the construction of a high school on Massachusetts Ave. has been awarded to the LIGHT, HEAT & POWER CO., [illegible] Franklin St., Boston. E. S. Prescott, 12 Pearl St., Boston, is the Arch.

Long Island (Boston post office), **Mass.**—Bids will be received until Nov. 12, by the Infirmary Trustees, for the erection of [illegible] buildings at Long Island. Noted Oct. 22.

Milton, Mass.—Plans are being prepared by Parker, Thomas & Rice, Archs., 110 State St., Boston, for the construction of a town [illegible]. The estimated cost is $200,000.

+Plymouth, Mass.—The contract for the construction of the [illegible]-story brick and reinforced concrete building at Plymouth has been awarded to the HANCOCK ENGINEERING CO., 79 Chestnut St., Boston. R. T. C. Jackson, Boston, is the Arch. The estimated cost is $35,000.

+Salem, Mass.—The contract for the construction of the four-story building at Lafayette and Harbor St., for Dr. Emil Poirer, has been awarded to JOHN J. FLYNN & SON, 59 Summer St. George H. Fanning, 221 Essex St., is the Arch.

Salem, Mass.—Bids will soon be received by Little & Brown, Archs., for the Masonic Temple to be erected at Salem. The estimated cost is $150,000.

Southbridge, Mass.—Peabody & Stearns, Archs., 53 State St., Boston, are preparing plans for the high school at Main and Marcy St.

Continued on Page 2[illegible]

SEWERS, PLAINFIELD, N. J.

+Bids were received Oct. 7, by the Sanitary Sewerage Commission for constructing sewers. For Contract A (trunk sewer), bids were submitted by (A) CAULDWELL-WINGATE CO. & ATLANTIC CONSTRUCTION & SUPPLY CO., New York, N. Y. (awarded contract); (B) John C. [illegible], Inc., Brooklyn, N. Y.; (C) Fusco Construction Co., Newark, N. J.; (D) [illegible] Co., New Brunswick; (E) George P. [illegible] & Son, Orange; (F) Keley McKeever Co., Camden; (G) H. C. [illegible] Co., Inc., Martinsburg, W. Va.; (H) T. [illegible], Elizabeth; (I) Merrill [illegible] Co., New York, N. Y.; (J) Ryan & [illegible] Co., Baltimore, Md.; (K) [illegible] McCarthy, Baltimore, Md.; (L) H. K. [illegible] Co., Inc., New York, N. Y.; (M) [illegible] W. Heller, Newark; (N) Joseph [illegible] & Co., [illegible], N. Y.; (O) Whiting Turner Construction Co., Baltimore, Md.; (P) New York & New Jersey Construction Co., Newark; (Q) Charles [illegible]; (R) Edward [illegible], Atlantic City; (S) [illegible] & [illegible] Construction Co., [illegible]; (T) [illegible] Construction Co., New York, N. Y.; (U) J. H. [illegible] & Co., [illegible], N. Y. For Contract B (sewage disposal works) bids were submitted by (A) EDWARD L. [illegible], Atlantic City (awarded contract); (B) [illegible] Construction [illegible]; (C) Herbert [illegible] & Andrew T. Van [illegible]; [illegible] Park; (D) [illegible] Engineering Co., New York; [illegible] Co., Inc., Pittsburgh, Penn.; (F) [illegible], N. Y.; (G) [illegible] & Atlantic Construction & Supply Co., New York, N. Y.; (H) [illegible]; (I) John W. [illegible]; (J) George [illegible] & Son, Orange; (K) [illegible] & Co., New York, N. Y.; (L) [illegible] Engineering & Construction Co., Long Island City, N. Y.; (M) Keley-McKeever Co., Camden; (N) New York & New Jersey Construction Co., Newark; (O) Louis [illegible]; (P) [illegible] Co., New Brunswick; (Q) Charles [illegible]; (R) [illegible] & Co., [illegible]; (S) [illegible]. The [illegible] bids were as follows:

Contract B

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
[illegible] cu yd earth excavation	$0.75	$0.[illegible]	$0.7[illegible]	$0.40	$0.60	$1.00	$0.70	$0.35	$0.64	$0.55	$0.90	$0.90	$0.40	$1.25	$0.95	$0.60	$0.80	$1.25	$0.80
[illegible] cu yd [illegible] embankment	0.40	0.[illegible]	0.50	0.25	0.30	0.25	0.45	0.27	0.25	0.40	0.20	0.40	0.50	0.75	0.50	[illegible]	[illegible]	0.30	0.40
[illegible] seeding	100.00	250.00	[illegible]	50.00	100.00	50.00	25.00	50.00	150.00	50.00	20.00	20.00	25.00	150.00	100.00	75.00	50.00	200.00	100.00
[illegible] sodding	[illegible]	[illegible]	0.50	0.25	0.15	0.50	0.10	0.36	0.30	0.35	0.20	0.20	0.13	0.25	0.30	0.10	0.30	[illegible]	0.20
[illegible] macadam roads and walks [illegible]	1.50	[illegible]	0.75	0.90	1.20	0.75	0.75	0.63	0.75	0.80	0.60	0.50	0.90	1.50	1.25	1.10	1.00	1.25	0.50
Preliminary settling tanks (lump sum)	34,[illegible]	[illegible]	[illegible]	36,[illegible]	30,[illegible]	30,000.00	33,[illegible]	38,435.00	30,400.00	47,085.00	40,000.00	41,000.00	46,376.00	48,000.00	47,000.00	58,035.00	64,000.00	56,110.00	59,300.00
Dosing tank and apparatus (lump sum)	[illegible]	[illegible]	[illegible]	[illegible]	1,200.00	3,000.00	3,084.00	4,877.00	5,000.00	3,021.00	5,000.00	3,000.00	4,016.00	[illegible]	[illegible]	4,202.00	[illegible]	[illegible]	10,000.00
Sprinkling filter (lump sum)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	78,000.00	78,541.00	71,825.00	77,731.00	82,208.00	82,500.00	94,000.00	86,173.00	[illegible]	[illegible]	91,300.00	87,000.00	97,950.00	[illegible]
Sludge-drying bed (lump sum)	[illegible]	[illegible]	[illegible]	[illegible]	3,200.00	4,200.00	[illegible]	1,791.00	3,000.00	3,400.00	5,000.00	[illegible]	[illegible]	7,000.00	[illegible]	4,477.00	[illegible]	7,095.00	[illegible]
Final settling tank (lump sum)	[illegible]	[illegible]	11,[illegible].97	[illegible]	9,000.00	12,250.00	10,796.00	[illegible]	13,700.00	9,468.00	11,[illegible]	[illegible]	17,167.00	14,[illegible]	15,[illegible]	[illegible]	24,[illegible]	[illegible]	14,000.00
Laboratory building (lump sum)	[illegible]	[illegible]	2,750.00	2,750.00	2,000.00	1,800.00	4,104.00	1,207.00	2,500.00	5,000.00	[illegible]	[illegible]	2,700.00	1,500.00	3,000.00	2,800.00	4,000.00	4,000.00	[illegible]
[illegible] cu yd additional concrete	[illegible]	[illegible]	7.00	10.[illegible]	10.[illegible]	6.00	12.00	10.00	8.00	15.00	12.00	8.00	10.00	10.00	15.00	14.00	20.00	13.00	10.00
[illegible] lb additional steel reinforcement	[illegible]	[illegible]	[illegible]	[illegible]	0.03	0.03	0.04	0.02½	0.04	0.02½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.04	0.04
30 lin ft additional concrete channels, 30-in	[illegible]	1.[illegible]	2.[illegible]	[illegible]	3.00	5.00	3.00	3.00	5.00	5.50	1.00	3.00	10.00	2.50	10.00	[illegible]	6.00	8.00	3.50
30 lin ft additional concrete pipe, 36-in	6.00	3.00	2.50	3.75	3.00	4.00	3.00	3.50	4.00	5.50	5.00	4.00	10.00	2.50	10.00	6.00	4.00	5.00	3.50
30 lin ft additional concrete pipe, [illegible]	[illegible]	2.50	2.00	3.00	2.50	4.00	3.00	3.00	3.50	4.50	1.00	3.00	9.00	2.00	9.00	[illegible]	1.50	4.00	3.00
30 lin ft additional c. i. [illegible] pipe	[illegible]	3.25	5.25	5.50	5.00	4.00	4.00	4.00	7.00	3.80	9.00	7.00	5.06	6.00	5.00	5.50	6.00	7.50	5.00
40 lin ft additional c. i. line, 8-in	0.40	1.00	1.29	0.90	0.80	0.70	0.70	0.94	1.00	0.66	1.30	0.85	1.58	0.70	1.50	1.10	2.00	1.10	0.80
20 lin ft additional c. i. line, 6-in	0.60	0.75	1.04	0.60	0.60	0.60	0.60	0.72	0.75	0.50	1.00	0.75	1.27	0.50	1.00	1.00	1.75	0.80	0.70
20 lin ft additional vitrified pipe line, 8-in	[illegible]	0.30	0.7[illegible]	0.85	0.25	0.35	0.18	0.20	0.30	0.1[illegible]	0.25	0.30	0.81	0.16	0.30	0.90	0.75	0.28	0.40
[illegible] lin ft c. i. pipe line, 4-in	0.60	0.37	0.58	0.50	0.40	0.60	0.57	0.55	0.50	[illegible]	1.00	0.60	0.35	0.35	0.70	0.58	1.34	1.08	0.40
400 lin ft galvanized pipe line, 2-in	0.20	0.15	0.30	0.26	0.25	0.20	0.20	0.25	0.30	0.19	0.25	0.25	0.24	0.15	0.35	0.35	0.25	0.2[illegible]	0.13
400 lin ft galvanized pipe line, 1½-in	[illegible]	0.18	0.34	0.30	0.20	0.20	0.25	0.22½	0.20	0.15	0.20	0.20	0.21	0.10	0.2[illegible]	0.2[illegible]	0.20	0.20	0.11
4 fire hydrants and gates	50.00	35.00	44.00	50.00	40.00	60.00	40.00	45.00	50.00	55.00	75.00	50.00	34.95	[illegible]	40.00	40.00	50.00	75.00	60.00
Extended totals	$141,102	$143,[illegible]	$149,[illegible]	$149,849	$151,077	$156,131	$156,465	$150,285	$161,142	$170,[illegible]	$171,[illegible]	$180,[illegible]	$181,[illegible]	$187,781	$196,111	$[illegible]	$216,007	$231,175	$153,588

Contract A

Item	A	B	C	D	E	F	G	H	I	J
150 lin.ft. 42-in reinforced concrete sewer without excavation	$2.30	$2.50	$3.27	$3.08	$2.90	$2.92	$3.50	$3.50	$3.10	$2.56
4000 lin.ft. 42-in. reinforced concrete sewer 6 ft. deep	2.54	3.00	3.90	3.30	3.82	3.34	3.50	3.80	3.40	3.47
8500 lin.ft. 42-in. reinforced concrete sewer 6 to 8 ft. deep	2.93	3.15	4.17	3.40	4.03	3.55	4.00	4.00	3.85	3.76
1400 lin.ft. 42-in. reinforced concrete sewer 8 to 10 ft. deep	3.50	3.35	4.35	3.77	4.88	4.21	5.45	4.25	4.60	4.67
1400 lin.ft. 42-in. reinforced concrete sewer, 10 to 12 ft. deep	3.80	3.70	4.67	3.95	5.32	4.55	6.20	4.60	5.10	4.99
600 lin.ft. 42-in. reinforced concrete sewer, 12 to 14 ft. deep	4.21	4.15	5.00	4.25	5.88	5.22	7.40	5.25	5.80	5.67
100 lin.ft. 42-in. reinforced concrete sewer, 14 to 16 ft. deep	4.85	4.65	5.50	4.75	6.60	5.89	9.00	6.75	7.00	6.34
5000 lin.ft. laying 20-in. c.i. siphon, 6 ft. deep	1.20	0.80	0.77	0.80	0.80	0.96	0.00	1.00	1.25	1.41
1500 lin.ft laying 20-in. c.i. siphon, 6 to 8 ft. deep	1.35	0.90	0.85	1.26	1.06	1.18	0.90	1.20	1.65	1.58
800 lin.ft. laying 20-in. c.i. siphon, 8 to 10 ft. deep	1.53	1.05	1.00	2.06	1.35	1.84	1.20	1.50	2.10	1.78
100 lin.ft. laying 20-in. c.i. siphon, 10 to 12 ft. deep	2.00	1.25	1.25	3.95	1.72	2.37	1.80	2.00	2.50	2.08
100 lin.ft. laying 20-in. c.i. siphon, 12 to 14 ft. deep	2.50	1.50	1.75	5.90	2.00	2.59	2.40	2.35	3.10	2.58
50 lin.ft. laying 20-in. c.i. siphon, 14 to 16 ft deep	2.45	1.80	2.50	8.20	2.30	3.51	3.45	2.65	4.10	3.05
Laying c.i. force main										
4000 lin.ft 8-in. 6 ft. deep	0.40	0.35	0.42	0.36	0.32	0.55	0.43	0.50	0.80	0.68
300 lin.ft. 8-in. 6 to 8 ft. deep	0.46	0.40	0.47	0.56	0.53	0.63	0.58	0.85	1.00	0.75
200 lin.ft. 8-in. 8 to 10 ft. deep	0.55	0.50	0.52	1.16	0.79	1.13	0.75	1.10	1.40	0.94
100 lin.ft. 8-in. 10 to 12 ft. deep	0.73	0.70	0.65	2.96	1.17	1.52	1.00	1.50	1.85	1.26
50 lin.ft. 8-in. 12 to 14 ft. deep	0.93	0.95	0.80	4.75	1.60	2.46	1.25	1.80	2.40	1.33
50 lin.ft. 8-in. 14 to 16 ft. deep	1.08	1.25	1.00	7.10	1.90	3.45	1.75	2.15	3.25	1.86
680 tons c.i. pipe	21.42	23.00	22.50	21.60	21.00	21.15	24.53	24.50	27.00	23.28
5 tons c.i. specials	61.00	95.00	65.00	55.00	82.00	58.88	60.00	80.00	70.00	66.00
30 standard manholes, all depths	30.00	45.00	55.00	59.25	65.00	47.00	60.00	60.00	70.00	50.00
2 spec'l cl'n'g manholes, Pl'nfld and main trunk siphons, Type A	707.00	850.00	250.00	542.00	322.00	910.42	300.00	300.00	680.00	660.00
2 spec'l cl'n'g manholes, Rock Av. and Gr'n Br'k, Type B	809.00	1250.00	300.00	778.00	660.00	1181.00	1150.00	900.00	1200.00	990.00
2 spec'l cl'n'g manholes, Darling Farm and Gr'n Br'k, Type C	957.00	1100.00	400.00	639.00	611.00	1078.00	700.00	1000.00	1200.00	1080.00
1 siphon chambers, Rock Av. at Pl'nfld outfall sewer	646.00	425.00	200.00	594.00	344.00	055.00	450.00	300.00	420.00	675.00
1 siphon chambers, Rock Av. at Green Brook Road	681.00	500.00	350.00	345.00	328.00	943.00	525.00	500.00	420.00	750.00
1 siphon chambers Cramer Farm-main trunk siphon	675.00	500.00	250.00	403.00	380.00	795.00	485.00	400.00	420.00	650.00
1 siphon chambers, Darling Farm-main trunk siphon	588.00	500.00	250.00	320.00	280.00	795.00	325.00	300.00	280.00	585.00
4 siphon chambers effluent outfall	512.00	750.00	250.00	372.00	254.00	742.00	335.00	400.00	315.00	535.00
1 str'm cross'g, Rock Av. and Green Brook	170.00	500.00	250.00	2130.00	350.00	539.00	500.00	1000.00	650.00	1000.00
1 str'm cross'g, Dunellen force main and Green Brook	500.00	500.00	100.00	480.00	150.00	489.00	200.00	500.00	210.00	950.00
1 str'm cross'g, main trunk siphon and Green Brook	700.00	500.00	100.00	1200.00	250.00	489.00	300.00	600.00	530.00	950.00
1 str'm cross'g, effluent outfall and Green Brook, upper	700.00	500.00	100.00	1200.00	250.00	489.00	300.00	600.00	500.00	1200.00
1 str'm cross'g, effluent outfall and Green Brook, lower	700.00	500.00	100.00	575.00	300.00	489.00	300.00	600.00	500.00	1200.00
1 measuring chamb. and appurtens, Rock Av. and Green Brook Road	1750.00	2375.00	1000.00	1375.00	1340.00	907.00	2150.00	1100.00	980.00	1300.00
1 Venturi meter and register, Plainfield	1224.00	1250.00	1000.00	1043.00	925.00	1547.00	1027.00	1150.00	350.00	1350.00
1 Venturi meter and register, N. Plainfield	950.00	950.00	750.00	750.00	675.00	1247.00	779.00	800.00	980.00	1050.00
1 Venturi meter and register, Dunellen	856.00	750.00	600.00	554.00	525.00	694.00	628.00	650.00	750.00	860.00
100 cu.yd. rock excavation	4.00	4.75	4.00	3.00	3.00	5.00	3.00	5.00	2.80	3.00
30 cu.yd. extra earth excavation	0.75	2.00	0.69	2.00	0.50	1.50	2.00	2.00	1.40	3.00
200 cu.yd. additional concrete	10.00	10.00	9.00	12.00	9.00	10.00	8.50	10.00	10.00	9.00
5000 lb. additional reinforcement	0.03½	0.03	0.04	0.03	0.02	0.05	0.03½	0.04	0.04	0.06
4500 cu.yd. earth embankment and filling	0.55	0.30	0.75	0.90	0.30	0.40	0.60	0.60	0.30	0.40
50 cu.yd. broken stone and gravel filling	3.00	2.00	2.50	1.75	2.00	3.65	2.50	2.50	2.80	3.50
10 M. ft. b.m. lumber for foundations	40.00	45.00	50.00	48.00	40.00	45.00	50.00	50.00	50.00	40.00
10 M. ft. b.m. sheathing left in place	30.00	35.00	45.00	38.00	32.00	45.00	15.00	40.00	40.00	30.00
20 cu.yd. stone paving	5.00	4.00	3.00	6.00	2.00	3.95	7.50	3.00	2.80	4.50
4 air valves	15.00	25.00	15.00	15.00	16.00	10.00	20.00	25.00	35.00	5.00
7000 lin.ft. ¾-in. galv. wire rope in siphons	0.04	0.05	0.06	0.02	0.05	0.05	0.05	0.06	0.07	0.04
2000 lin.ft. piling	0.10	0.75	0.50	0.45	0.60	0.40	0.25	1.00	0.40	0.50
Extended totals	$100,909	$103,910	$109,779	$110,296	$110,462	$114,152	$117,551	$119,755	$122,585	$122,950

Item	K	L	M	N	O	P	Q	R	S	T	U
150 lin.ft. 42-in reinforced concrete sewer without excavation	$3.80	$3.50	$3.50	$5.50	$4.00	$3.50	$1.83	$5.43	$6.32	$5.35	$6.00
4000 lin.ft. 42-in. reinforced concrete sewer 6 ft. deep	3.95	4.80	4.50	5.50	4.73	4.00	5.11	6.50	7.10	5.90	7.68
8500 lin.ft. 42-in. reinforced concrete sewer 6 to 8 ft. deep	4.45	5.00	5.25	5.50	5.37	4.50	5.94	6.64	7.40	6.50	8.15
1400 lin.ft. 42-in. reinforced concrete sewer 8 to 10 ft. deep	4.80	5.25	6.10	5.50	6.32	5.00	6.83	8.19	8.12	7.50	9.45
1400 lin.ft. 42-in. reinforced concrete sewer, 10 to 12 ft. deep	5.33	6.25	6.80	5.50	6.93	5.50	8.17	9.65	8.57	8.10	10.67
600 lin.ft. 42-in. reinforced concrete sewer, 12 to 14 ft. deep	6.45	7.50	7.80	5.50	7.67	6.00	10.52	11.00	9.32	8.50	12.60
100 lin.ft. 42-in. reinforced concrete sewer, 14 to 16 ft. deep	7.00	8.50	9.00	5.50	8.39	6.50	14.35	12.00	10.82	9.00	13.50
5000 lin.ft. laying 20-in. c.i. siphon, 6 ft. deep	0.85	0.80	1.10	2.00	1.88	2.70	2.00	3.00	3.10	3.00	2.50
1500 lin.ft laying 20-in. c.i. siphon, 6 to 8 ft. deep	1.00	0.85	1.40	2.00	2.15	2.90	2.90	3.71	3.37	3.30	3.16
800 lin.ft. laying 20-in. c.i. siphon, 8 to 10 ft. deep	1.50	1.00	2.25	2.00	2.40	3.10	3.59	7.20	3.65	3.50	4.34
100 lin.ft. laying 20-in. c.i. siphon, 10 to 12 ft. deep	2.00	1.25	2.85	2.00	2.67	3.40	4.38	8.70	4.00	3.70	5.87
100 lin.ft. laying 20-in. c.i. siphon, 12 to 14 ft. deep	2.35	1.50	3.25	2.00	2.92	3.70	5.58	9.70	4.60	4.20	7.79
50 lin.ft. laying 20-in. c.i. siphon, 14 to 16 ft deep	2.50	2.00	4.15	2.00	3.18	4.00	7.26	12.00	5.15	4.50	11.27
Laying c.i. force main											
4000 lin.ft 8-in. 6 ft. deep	0.55	0.30	0.50	0.75	0.68	0.50	1.11	0.73	1.15	0.95	1.62
300 lin.ft. 8-in. 6 to 8 ft. deep	0.70	0.35	0.60	0.75	0.93	1.00	1.51	1.13	1.28	1.10	1.82
200 lin.ft. 8-in. 8 to 10 ft. deep	0.90	0.50	0.75	0.75	1.10	1.25	2.05	1.60	1.55	1.20	2.68
100 lin.ft. 8-in. 10 to 12 ft. deep	1.15	0.70	0.90	0.75	2.22	1.60	2.70	4.00	1.75	1.35	3.27
50 lin.ft. 8-in. 12 to 14 ft. deep	1.25	1.00	1.20	0.75	2.60	2.00	3.76	4.50	2.10	1.75	4.32
50 lin.ft. 8-in. 14 to 16 ft. deep	1.50	1.50	1.50	0.75	3.07	2.40	5.06	5.00	2.50	2.00	5.06
680 tons c.i. pipe	21.50	20.50	24.50	22.00	19.85	30.00	25.00	21.40	28.00	27.60	25.00
5 tons c.i. specials	100.00	55.00	75.00	36.00	75.00	55.00	70.00	87.00	60.00	70.00	60.00
30 standard manholes, all depths	60.00	55.00	35.00	40.00	60.00	70.00	45.00	55.00	40.00	80.00	100.00
2 spec'l cl'n'g manholes, Pl'nfld and main trunk siphons, Type A	500.00	360.00	150.00	40.00	400.00	450.00	574.60	220.00	225.00	700.00	412.00
2 spec'l cl'n'g manholes, Rock Av. and Gr'n Br'k, Type B	625.00	520.00	200.00	40.00	785.00	700.00	930.00	380.00	375.00	1300.00	906.25
2 spec'l cl'n'g manholes, Darling Farm and Gr'n Br'k, Type C	625.00	550.00	200.00	40.00	750.00	700.00	886.00	380.00	375.00	1250.00	713.75
1 siphon chambers, Rock Av. at Pl'nfld outfall sewer	700.00	290.00	200.00	40.00	310.00	400.00	450.00	600.00	425.00	350.00	500.00
1 siphon chambers, Rock Av. at Green Brook Road	700.00	430.00	200.00	40.00	415.00	560.00	479.00	430.00	425.00	475.00	500.00
1 siphon chambers Cramer Farm-main trunk siphon	700.00	335.00	200.00	40.00	275.00	600.00	408.00	250.00	600.00	400.00	383.00
1 siphon chambers, Darling Farm-main trunk siphon	700.00	240.00	200.00	40.00	250.00	350.00	239.00	450.00	600.00	300.00	375.00
4 siphon chambers effluent outfall	500.00	250.00	300.00	40.00	275.00	450.00	389.00	150.00	325.00	450.00	490.00
1 str'm cross'g, Rock Av. and Green Brook	1600.00	750.00	1500.00	1100.00	1600.00	3000.00	500.00	2700.00	1500.00	4000.00	900.00
1 str'm cross'g, Dunellen force main and Green Brook	2000.00	250.00	200.00	1100.00	900.00	2000.00	500.00	100.00	800.00	3000.00	800.00
1 str'm cross'g, main trunk siphon and Green Brook	1200.00	900.00	500.00	1100.00	900.00	2000.00	700.00	500.00	1350.00	3000.00	800.00
1 str'm cross'g, effluent outfall and Green Brook, upper	2000.00	1000.00	500.00	1100.00	1500.00	1500.00	900.00	500.00	1200.00	3000.00	1250.00
1 str'm cross'g, effluent outfall and Green Brook, lower	[illegible]	1000.00	500.00	1100.00	1500.00	1500.00	900.00	1500.00	1200.00	3000.00	1875.00
1 measuring chamb. and appurtens, Rock Av. and Green Brook Road	1800.00	1020.00	500.00	600.00	1550.00	1500.00	1470.00	1100.00	250.00	1000.00	2500.00
1 Venturi meter and register, Plainfield	1000.00	950.00	1000.00	100.00	1175.00	1500.00	1000.00	1150.00	1325.00	1100.00	900.000
1 Venturi meter and register, N. Plainfield	800.00	700.00	750.00	750.00	900.00	900.00	700.00	800.00	1030.00	750.00	654.00
1 Venturi meter and register, Dunellen	550.00	550.00	625.00	600.00	750.00	600.00	600.00	600.00	750.00	675.00	503.00
100 cu.yd. rock excavation	3.00	3.00	2.50	0.01	4.00	5.00	3.00	2.50	3.00	4.00	3.00
30 cu.yd. extra earth excavation	2.00	1.50	0.60	1.00	2.00	0.60	3.00	1.50	0.50	1.50	2.00
200 cu.yd. additional concrete	7.00	7.50	8.00	6.00	10.00	9.00	15.00	8.00	6.50	15.00	15.00
5000 lb. additional reinforcement	0.04	0.03	0.04	0.03	0.06	0.05	0.05	0.05	0.04	0.05	0.05
4500 cu.yd. earth embankment and filling	0.30	0.75	0.45	0.01	0.30	0.50	0.75	0.40	0.40	0.50	0.75
50 cu.yd. broken stone and gravel filling	2.00	2.30	2.00	2.50	3.00	2.50	3.00	2.90	2.50	3.00	3.00
10 M. ft. b.m. lumber for foundations	45.00	40.00	40.00	40.00	40.00	50.00	60.00	50.00	40.00	50.00	50.00
10 M. ft. b.m. sheathing left in place	30.00	50.00	35.00	40.00	40.00	30.00	55.00	30.00	38.00	50.00	50.00
20 cu.yd. stone paving	5.00	5.00	3.00	3.00	10.00	5.00	5.00	10.00	2.50	6.00	5.00
4 air valves	10.00	25.00	25.00	50.00	15.00	25.00	20.00	10.00	15.00	50.00	5.00
7000 lin.ft. ¾-in. galv. wire rope in siphons	0.30	0.10	0.05	0.07	0.06	0.10	0.10	0.05	0.05	0.20	0.10
2000 lin.ft. piling	0.40	0.75	0.40	0.50	0.10	0.75	1.75	0.60	0.90	1.00	0.50
Extended totals	$127,169	$128,650	$133,075	$136,901	$146,759	$150,723	$171,573	$184,406	$194,574	$198,633	$217,241

+Worcester, Mass.—The contract for the addition to the [illegible] has been awarded to [illegible] [illegible]. The estimated cost is [illegible]. [illegible] Kim-[illegible] [illegible], are the Archs.

[illegible] have been prepared by [illegible], Arch., [illegible] for alterations to the [illegible] High School. [illegible] is Mayor.

Dansville, N. Y.—Plans are being prepared by J. T. Co[illegible] [illegible] for a school at [illegible], for St. [illegible] R. C. Church. The estimated cost is [illegible].

+New York, N. Y.—(Borough of [illegible])—The contract for the [illegible] to be erected at [illegible] Park, has been awarded to [illegible] KUHS BROS. [illegible] [illegible] St. and [illegible] Ave. Noted Sept. [illegible].

New York, N. Y.—(Borough of [illegible])—Bids were received for the addition to school [illegible] [illegible] and [illegible] Ave. as follows: William J. [illegible] [illegible]; Fal[illegible] & M[illegible] [illegible]; [illegible] Kirk [illegible]; Thomas [illegible] [illegible]; [illegible] N. Y., [illegible]; Joseph [illegible] [illegible]; Wells N[illegible] [illegible], New York, [illegible]; [illegible] Kl[illegible] $73[illegible]. Noted Oct. [illegible].

+New York, N. Y.—(Borough of Manhattan)—The [illegible] contract for the five-story store and loft building at [illegible] West [illegible] St. has been awarded to CLARK & CO., [illegible] Fifth Ave., New York. Noted Sept. [illegible].

+Syracuse, N. Y.—The contract for the construction of the [illegible] has been awarded to FRED A. CA[illegible]WELL, [illegible], at $[illegible].

+Utica, N. Y.—The American Motion Picture Co. has awarded the general contract for the construction of a theater to GRIFFITH & [illegible], Utica, at $125,000. Green & W[illegible], [illegible] F[illegible] St., Buffalo, N. Y., are Archs.

Yonkers, N. Y.—H. [illegible] Quick, Arch., 18 South Broadway, Yonkers, is preparing plans for the construction of a three-story building on [illegible] Broadway, for the Philipse Manor [illegible].

Plans are being prepared by William E. Lehman, Arch., [illegible] Broad St., Newark, N. J., for the construction of a five-story theater and [illegible] building, 100x150 ft., for Allen & F[illegible], 110 Broadway, New York. The estimated cost is $[illegible].

Flemington, N. J.—Bids will be received, until Oct. 24, by [illegible], Board of Education, for the construction of a [illegible] school at Flemington. The estimated cost is $[illegible]. J. N. Pierson & Son, 15 Smith St., Perth Amboy, N. J., is the Arch.

+Jersey City, N. J.—The general contract for the school to be [illegible] St. has been awarded to W. H. & F. W. CANE, Woolworth Bldg., New York. The estimated cost is $[illegible]. Noted Oct. 1.

+West New York, N. J.—The contract for the construction of the [illegible] has been awarded to GEORGE P. MARTIN, 3[illegible] Ave., New York, at $7[illegible]. Henry Andes submitted a bid at $7[illegible]. Noted Oct. 22.

+Allentown, Penn.—The contract for the construction of the [illegible] armory at Allentown has been awarded to J. L. M[illegible] & SON, Allentown, at $17,[illegible].

+Philadelphia, Penn.—The contract for the construction of the [illegible] apartment building at [illegible] and Walnut St. for the [illegible] Apartment Co. has been awarded to the [illegible] CONSTRUCTION CO., Philadelphia, Penn. The estimated cost is $[illegible].

Philadelphia, Penn.—The County Medical Society is planning the erection of a building at [illegible] and Locust St. The estimated cost is $[illegible].

Philadelphia, Penn.—Plans are being prepared by M. H. [illegible], [illegible] Bldg., Philadelphia, for the construction of a two-story reinforced concrete addition at [illegible] and Chestnut St., to the [illegible] Sales & Service Bldg.

+Pittsburgh, Penn.—The contract for the construction of the [illegible] school for St. [illegible] congregation has been awarded to the DUQUESNE CONSTRUCTION CO., Pittsburgh, at $[illegible].

Scranton, Penn.—Albert J. [illegible], Arch., Scranton, is preparing plans for the [illegible] to be erected for the Y. M. H. A.

Waynesboro, Penn.—Bids will be received about Nov. 1, by J. W. [illegible], Arch., [illegible], for the construction of a three-story [illegible] theater and apartment building for the Waynesboro [illegible] Co. The estimated cost is $[illegible].

+Wilmington, Del.—The contract for the granite work to be used on the exterior of the [illegible] building at Tenth and French St., has been awarded to the [illegible] PINK GRANITE CO., [illegible], Mass., at $[illegible].

Baltimore, Md.—Plans are being prepared by F. F. Fa[illegible], Arch., [illegible] Bldg., Washington, for a two-story convent, to be constructed for the [illegible] Sisters at Caroline and [illegible] St.

+Elkton, Md.—The contract for constructing the armory at Elkton, has been awarded to LEVI E. PATTERSON, Perryville, Md.

+Lexington, Va.—(Official)—The contract for the construction of the gymnasium for the Washington and Lee University has been awarded to M. B. STODDARD, Staunton, Va. Noted Oct. 8.

+Richmond, Va.—The contract for the construction of the school at [illegible] and [illegible] St., Richmond, has been awarded to J. T. NECKOLS, at $3[illegible].

+Richmond, Va.—Contracts for the construction of the B[illegible]ford school have been awarded as follows: Reinforcing steel, TRUSSED CONCRETE STEEL CO., Youngstown, Ohio; granite, RICHMOND GRANITE CO.; sheet metal, N. W. MARTIN & BRO.; limestone, HOADLEY STONE CO., Bloomington, Ind.; structural steel and architectural iron, [illegible] BROS., Pleasant and Davis St., Baltimore. Noted June 4.

+The contract for the construction of the school at 3[illegible]th and N St. has been awarded to J. T. NECKOLS, Richmond. The estimated cost is $10,000.

+Roanoke, Va.—Contracts for the construction of the Y. M. C. A. building have been awarded as follows: Limestone, BOWMAN & KING STONE CO., Bloomington, Ind.; granite, [illegible] & HOFFMAN GRANITE CO., Mt. Airey, N. C.; lumber, CENTRAL MFG. CO.; mill work, VIRGINIA LUMBER MFG. CO.; structural steel and iron work, VIRGINIA BRIDGE & IRON CO., all of Roanoke.

Charleston, S. C.—Plans have been completed for the erection of a hotel for C. H. [illegible]. The estimated cost is $[illegible].

Tampa, Fla.—Plans are being prepared by Fred J. James, Arch., Tampa, for the four-story, [illegible]-ft. [illegible] building for the Gray Bell Realty Co. The estimated cost is $[illegible],000.

+West Palm Beach, Fla.—The contract for the construction of the court house at West Palm Beach has been awarded to EWERT P. MAULE, at $[illegible].

Birmingham, Ala.—Plans are being prepared by W. [illegible] Welton, Arch., Birmingham, for the construction of a three-story manual training school. The estimated cost is $[illegible].

+New Orleans, La.—The general contract for the school on [illegible] St. has been awarded to MICHAEL [illegible] & CO., [illegible]116 Magazine St. E. A. Christy, New Orleans, is the Arch.

New Orleans, La.—Bids will be received until Nov. 19, by P. Stalger, Secy., Bd. of Control, for the construction of [illegible] electric system and a sewer system at the Lepers Colony, Iberville parish.

Continued on Page [illegible]

Contracts for Dual System of Rapid Transit

FOR OPERATION BY NEW YORK MUNICIPAL RAILWAY CORPORATION

([illegible]) Route No. [illegible]

			Contract	Amount of	Date Work Estimated to Finish
[illegible]	[illegible]	F. L. Cranford, [illegible]	[illegible] 1913	$[illegible]	Sept. 15, 1914
[illegible]	[illegible]	F. L. Cranford, [illegible]	[illegible] 1913	[illegible]	Sept. 15, 1914
[illegible]	[illegible]	[illegible] Contracting Co., [illegible], N. Y.	Feb. [illegible] 1913	[illegible]	Feb. 1, 1915
[illegible]	[illegible]	[illegible] Co., [illegible] Ave., N. Y.	[illegible] 1913	[illegible]	[illegible]
[illegible]	[illegible]	[illegible], N. Y.	[illegible] 1913	[illegible]	[illegible]
[illegible]	[illegible]	[illegible], N. Y.	[illegible] 1913	[illegible]	[illegible]
[illegible]	[illegible]	[illegible] Park Ave., N. Y.	[illegible] 1 1913	$[illegible]	[illegible]
[illegible]	[illegible]	[illegible], N. Y.		[illegible]	[illegible]
[illegible]	[illegible]	[illegible] Contracting Co., [illegible], N. Y.		[illegible]	[illegible]
[illegible]	[illegible]	[illegible], N. Y.		$[illegible]	[illegible]

[illegible]

[illegible]	[illegible]	[illegible] Contracting Co., [illegible], N. Y.	[illegible]	$[illegible]	[illegible]
[illegible]	[illegible]	[illegible] Contracting Co., [illegible], N. Y.	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]	[illegible]	[illegible], N. Y.	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible], N. Y.		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]

Contracts for Dual System of Rapid Transit—Continued

FOR OPERATION BY INTERBOROUGH RAPID TRANSIT CO.

		Seventh Ave.-Lexington Ave. Subway—Routes Nos. 5, 19 and 22, 43, 16, 4 and 38, 9 and 48			
*6	26th St. to 40th St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	$3,634,213.50	Nov. 3, 1910
	* Work stopped on April 26, 1912, on account of change in routing of this branch.				
		Lexington Avenue Branch—Route No. 5			
7	43d St. to 53d St.	Rapid Transit Subway Construction Co., 165 Broadway, New York		$1,915,164.00	June 25, 1914
8	53rd St. to 67th St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	$3,369,484.20	Nov. 3, 1910
9	67th St. to 79th St.	P. McGovern & Co., 1 Madison Ave., N. Y.	Feb. 13, 1912	1,961,997.00	Dec. 14, 1911
10	79th St. to 93rd St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	3,253,072.80	Nov. 3, 1910
11	93rd St. to 106th St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	3,132,195.05	Nov. 3, 1910
12	106th St. to 118th St.	Oscar Daniels Co., Woolworth Bldg., N. Y.	Sept. 3, 1911	2,825,740.74	Nov. 3, 1910
13	118th St. to 129th St.	Bradley Contracting Co., 1 Madison Ave., N. Y. (Assigned to McMullen, Snare & Triest, Inc.)	Nov. 17, 1911	4,071,416.50	Nov. 3, 1911
14	129th St. to 135th St.	Arthur McMullen & Olaf Hoff, 149 Broadway, N. Y.	July 23, 1912	3,889,775.05	June 16, 1912
15	135th St. to 157th St.	Hagerty-Drummond Co., 48 Park Row, N. Y. (Assigned to Rogers & Hagerty)	Nov. 17, 1911	3,820,129.75	Nov. 3, 1910
Total				$26,323,811.09	
		Southern Boulevard Branch—Routes Nos. 19 and 22 (In the Bronx)			
1	138th St. to 147th St.	John F. Stevens Construction Co., 55 Wall St., N. Y. (Assigned Oct. 23, 1913 to Richard Carvel Co., Inc., 401 West 59th St., N. Y.)	Oct. 22, 1912	$2,253,281.75	Sept. 26, 1912
1-A	147th St. to Bancroft St.	Rodgers & Hagerty, E. 152nd St. and Harlem River, N. Y.		2,253,159.25	Dec. 11, 1913
Total				$4,506,441.00	
		Jerome Avenue Branch—Route No. 16—(In the Bronx)			
1	157th St. to 182nd St.	Oscar Daniels Co., Woolworth Bldg., N. Y.	Dec. 31, 1913	$1,077,978.00	Dec. 11, 1913
2	182nd St. to Woodlawn Road	Cooper & Evans, 220 Broadway, N. Y.		1,075,831.00	Feb. 19, 1914
		Seventh Avenue-Lexington Ave.—Routes Nos. 4 and 38			
1	Battery Park to Greenwich and Vesey St.	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.		$2,120,000.00	April 30, 1914
1-A	Connection from 7th Ave. Subway to present subway	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.		$474,244.00	June 18, 1914
2	Vesey to Beach St.	Degnon Contracting Co., 30 East 42nd St., N. Y.	Mar. 1914	3,059,522.00	Dec. 11, 1913
3	Beach St. to Commerce St.	Degnon Contracting Co., 30 East 42nd St., N. Y.	Dec. 31, 1913	2,185,063.50	Nov. 20, 1913
4	Commerce St. to 16th St.	United States Realty & Improvement Co., 111 Broadway, N. Y.	Mar. 6, 1913	1,837,726.00	Mar. 12, 1914
5	16th St. to 30th St.	Canavan Bros., N. Y.	Dec. 31, 1913	2,401,306.75	Nov. 20, 1913
6	30th St. to 43rd St.	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.	Dec. 31, 1913	2,292,000.00	Jan. 8, 1914
6-A	43rd to 45th St. Times Sq.	Holbrook Cabot & Rollins Corp., 331 Madison Ave. N. Y.		421,566.00	May 28, 1914
Total				$14,790,428.25	
		White Plains Road Line—Route No. 18—(In the Bronx)			
1	180th St. to Burke Ave.	Oscar Daniels Co., Woolworth Bldg., N. Y.	Mar. 16, 1914	914,400.00	Feb. 19, 1914
2	Burke Ave. to 241st St.	Alfred P. Roth, Broad St., N. Y.	Dec. 31, 1913	958,484.00	Dec. 4, 1913
		†Woodside, Astoria and Corona Line—Routes Nos. 36 and 37—(In Queens)			
1	Queensboro Bridge Plaza	Snare & Triest, 143 Liberty St., N. Y.	Oct. 7, 1913	$884,859.00	Aug. 28, 1913
2	Astoria Line	Cooper & Evans, 220 Broadway, N. Y.	Mar. 11, 1913	860,743.50	Feb. 13, 1913
3	Corona Line	E. E. Smith Contracting Co., 101 Park Ave., N. Y.	Mar. 11, 1913	2,063,588.00	Feb. 13, 1913
Total				$3,809,190.50	
		Steinway Tunnel Extension—Route No. 50—(In Queens)			
	Davis St. and Ely Ave., Van Alst Ave. to Queensboro Bridge	Degnon Contracting Co., 30 East 42nd St., N. Y.	Dec. 1, 1913	$557,857.50	
		Route 48			
3	Clark Tunnel	*Booth & Finn Ltd., and O'Rourke Engineering & Contracting Co.		$6,469,916.00	June 4, 1919
		Lutheran Cemetery and Myrtle Ave. Connection			
2		Phoenix Bridge Co., 49 William St., N. Y.		$707,661.00	
2		F. W. Burnham, 30 East 42nd St., N. Y.	Mar. 1914	143,225.00	
		Reconstruction Steinway Tunnel-Route 26			
	42nd and Lexington Ave., under East River to Jackson and Alst Ave., L. I. City	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.	Feb. 17, 1914	$383,911.00	Feb. 26, 1914
		Connection with Brighton Beach Line—Route 12			
1	St. Felix St and Ashland Pl. to Hanson Pl.	Cranford Co., 190 Montague St., Brooklyn		$2,195,296.00	June 25, 1914
1-A	In Flatbush Ave., between St. Marks Ave., Prospect Park Plaza	Cranford Co., 190 Montague St., Brooklyn		$2,225,519.25	April 9, 1914
1		Frederick L. Cranford, Inc., 177 Montague St., Brooklyn		1,571,363.00	Oct. 22, 1914
2		Smith, Hauser & MacIsaacs		2,254,670.00	Sept. 24, 1914

* Awarded two contracts jointly.
† Trackage rights also to New York Municipal Railway Corporation.

+Alliance, Ohio—The contract for the construction of a two-story and basement City Hall building, 90x120 ft., has been awarded to GEORGE B. McMULLAN CO., 1749 East 55th St., Cleveland. Estimated cost, $75,000.

Cincinnati, Ohio—Harry Hake, Arch., Provident Bank Bldg., is preparing plans for the construction of a convention hall, to cost $250,000.

Lakewood, Ohio—John Warner, Arch., Marion Bldg., Cleveland, has prepared plans for the construction of a building on West 114th St., for the Highland Congregational Church. Estimated cost, $40,000.

Lakewood, Ohio—Charles W. Hopkinson, Arch., Rose Bldg., Cleveland, has prepared plans for the construction of a library to cost $50,000.

Lorain, Ohio—H. G. Ford, Arch., has prepared plans for the construction of a three-story fireproof high school. Estimated cost, $150,000.

Toledo, Ohio—Mills, Rhines, Bellman & Nordhoff, Archs., are preparing plans for the construction of a hotel at Jefferson Ave. and St. Clair St., for W. D. Stroud, Los Angeles, Calif. Estimated cost, $400,000.

Battle Creek, Mich.—Plans are being prepared by M. J. Morehouse, Arch., 343 S. Dearborn St., Chicago, Ill., for a five-story and basement hall building, 60x100 ft., for the Kellogg Toasted Corn Flake Co., Battle Creek. Estimated cost, $150,000.

Detroit, Mich.—Stahl, Kinsey & Chapman, Archs., 117 Fort St. West, are preparing plans for the construction of a two-story and basement, 75x75-ft. church for the Bethany Presbyterian congregation. Estimated cost, $75,000.

Antigo, Wis.—P. J. Hansen & Co. are contemplating the construction of a theater, 44x185 ft., at Antigo.

Horison, Wis.—Plans are being prepared by H. W. Buemming, Arch., 521 Jackson St., Milwaukee, for the construction of a three-story and basement, 52x160-ft. building for the Travelers Hotel Co.

Milwaukee, Wis.—Brust & Philipp, Archs., Free Press Bldg., are preparing plans for the construction of a three-story and basement, 82x150-ft. building, for St. Catherine's Home for Working Girls, at 1131 Sycamore St. Estimated cost, $100,000.

Racine, Wis.—Guilbert & Funston, Archs. Robinson Block, are preparing plans for the construction of a two-story, 140x240-ft. grade school, gymnasium and auditorium at West Racine. The estimated cost is $100,000.

Superior, Wis.—F. E. Johnson, Arch., is preparing plans for the construction of a two-story and basement, 59x100-ft. theater for C. D. Armstrong, Ashland.

Union Grove, Wis.—Bids will be received, about Nov. 1, by M. J. Toppins, Secy. of the Home for Feeble-Minded and Epileptics, Capitol Bldg., Madison, for the construction of buildings for the institution at Union Grove. Estimated cost, $1,000,000.

+Glen Lake [illegible] **Minn.**—The contract for [illegible] Hennepin County [illegible] has been [illegible] JAMES [illegible] Minneapolis. Estimated cost, $[illegible]. Noted Oct [illegible].

St. Paul, Minn.—[illegible], Arch., Endicott Bldg., is preparing plans for the construction of a [illegible], estimated to cost $[illegible]. Dr [illegible], [illegible] Lowry Bldg., is Chm of the Bldg Com.

Anaconda, Mont.—R [illegible] contemplates constructing a [illegible]-story reinforced-concrete hotel. Estimated cost, $[illegible].

+Carthage, Mo.—The contract for the construction of the [illegible] was awarded to [illegible] J McNERNEY. The estimated cost is $[illegible]. Noted Oct [illegible].

Jefferson City, Mo.—Bids will be received about Apr 1, 1915, for the construction of a seven-story bank building for the Jefferson Investment Co. Estimated cost, $[illegible]. Miller & Miller are the Archts. Noted Oct 1.

+Kansas City, Mo.—The contract for the construction of a three-story reinforced-concrete office building at Eighth and Wyandotte St has been awarded to HARVEY STIVER for John L Glover. Estimated cost $50,000.

+Springfield, Mo.—The Heer Andres Investment Co has awarded the contract for [illegible] tons of steel for the six-story building for the Heer Dry Goods Co to the CHRISTOPHER-SIMPSON STEEL & IRON CO, St Louis. Noted Sept 10.

Dallas, Texas.—Plans are being prepared for the construction of an office building for the Texas & Pacific R.R. Co. Estimated cost, $[illegible],000.

Tucson, Ariz.—The Federal Bldg Co., recently incorporated, contemplates the construction of an office building, to cost $[illegible]. Epes Randolph, L H Manning and Charles F Solomon are interested.

Seattle, Wash.—Bids for the Columbia Branch library will be received soon by W Marbury, Arch., 71[illegible] White Bldg. The structure will be of terra cotta, with slate roof and concrete foundations. Estimated cost, $50,000.

Portland, Ore.—N N Carpenter contemplates constructing a fireproof office building at Grand Ave and East Alder St. Estimated cost, $[illegible],000.

Berkeley, Calif.—The city contemplates the construction of five [illegible] which will cost $[illegible]0,000.

+Fresno, Calif.—The School Board has awarded the contract for the construction of a two-story school, to D A EVANS. The estimated cost is $[illegible].

Longbeach, Calif.—Homer Laughlin Jr, Los Angeles, contemplates constructing a fireproof theater to cost about $12[illegible].

+Los Angeles, Calif.—The contract for the construction of a [illegible], at 61st and Figueroa St, has been awarded to [illegible] GRANT, [illegible] West 37th St. The estimated cost is $66,7[illegible]0.

Oakland, Calif.—The Second Church of Christ, Scientist, is contemplating the construction of a building at 34th and Elm St. Estimated cost, $[illegible].

Oakland, Calif.—[illegible], Arch., [illegible] Bldg., San Francisco, is preparing plans for an addition to the California [illegible] at [illegible] and [illegible] St. Estimated cost, $[illegible].

Oakland, Calif.—Plans are being prepared by George W [illegible], Arch., [illegible], for the construction of a [illegible]-story [illegible] at [illegible] for [illegible] Meade.

San Fernando, Calif.—John C Austin, Arch., [illegible] Wright & Callender Bldg., Los Angeles, is preparing plans for the construction of a [illegible]-story reinforced-concrete administration building, and [illegible] reinforced-concrete [illegible]. Estimated cost, $[illegible].

+Santa Cruz, Calif.—[illegible]

Montreal, Que.—[illegible]

Quebec, Que.—[illegible]

+Hamilton, Ont.—[illegible]

North Bay, Ont.—[illegible]

+Toronto, Ont.—[illegible]

Toronto, Ont.—[illegible]

Toronto, Ont.—[illegible]

Windsor, Ont.—[illegible]

Edmonton, Alta.—[illegible]

+Vancouver, B. C.—[illegible]

Victoria, B. C.—[illegible]

for the entire building and $[illegible] for the work less the top story.

The Standard Scale & Supply Co., Pittsburgh, Penn., has recently completed a contract for furnishing and installing weighing equipment for the Government of Uruguay at the Port of Montevideo.

On this contract the company earned $17,000 in bonuses for finishing the work ahead of the contract time. This bonus, it is claimed, was earned through the efficiency and simplicity of the Standard Low Charging Concrete Mixers. These, it is stated, were so well attended and packed as to be practically ready for work as soon as landed.

Subway Anniversary.—The first section of New York City's subway has been in operation for ten years, having been first opened on Oct 27, 1904. Within three years after its opening the subway was carrying [illegible] passengers daily. At the present time it carries upward of 1,[illegible] passengers for each week day, and has carried over 1,[illegible] in one day.

Walter E. Buckingham, formerly manager of sales for the National Bridge Works, has organized the Buckingham Steel Co., Inc., with offices at 50 Church St., New York. In the past has also been connected with Post & McCord, Milliken Bros and the Lackawanna Steel Co. The company will carry a line of structural steel and merchant shapes and will be prepared to fabricate material for early shipment.

The National Tube Co., Frick Bldg., Pittsburgh, Penn., has recently shown a series of industrial motion pictures at the Raleigh Hotel, Washington, D. C., and the Monticello Hotel, Norfolk, Va., illustrating the manufacture of "National" pipe. The pictures showed clearly the treatment of the ore from the time it was taken from the mine until it became the finished product.

Manufacturers receive War Orders.—Orders for army supplies of every description continue to occupy the center of the stage in many lines of domestic trade. Wire manufacturers report a good demand for their products, especially barbed wire. It is learned that an independent company in the last week was offered an order for 5[illegible] tons of this commodity for export to Russia, shipments to begin immediately, but the concern could only promise 2[illegible] tons in November, and 75[illegible] tons during December, which was unsatisfactory, the order ultimately going to the American Steel & Wire Co., a subsidiary of the United States Steel Corporation, which, it is understood, took the whole of the order, calling for approximately 15,000 tons.

The Chilean R.R. contract calling for 300,000 tons of coal a year for a period of three years, which has been offered to producers in this country, is being carefully studied. Representatives of 12 different coal companies in the Pennsylvania district, advices say, have visited the offices of the Pittsburgh Foreign Trade Commission to examine the specifications. It is admitted that there are difficulties in the way of acceptance, such as the chemical difference between Pittsburgh coal and the variety to which the Chilean railroads have been accustomed, the matter of tariffs, facilities of shipment, etc., but it is believed all these will be overcome.

The placing of the contract calling for 300,000 tons of coal in the Pittsburgh district each year would mean employment for large numbers of [illegible] during what is ordinarily a dull season. [illegible]

[illegible]

South America Hard Hit.—[illegible]

The Allegheny Foundry & Machine Co.—[illegible]

CATALOG NOTICES

[illegible]

Prices of Engineering Materials

PRICE CHANGES AND THE BUSINESS OUTLOOK

Distinct improvement in the financial situation has marked the course of the month's events. Several weak stocks, which might have led to considerable trouble, have been cleared up. This does not, by any manner of means, indicate that money or capital is cheap, but a part of the task has been accomplished successfully. The ability of London to draw gold from the United States is evidently diminishing, and it is probable that by the first of November the balance of exchange will turn in favor of the United States. This does not mean that gold will flow back to us, but it will mean an end to the heavy outflow which has been so marked.

While it is difficult to secure capital, and the price is practically prohibitive in some instances, it is well to note that New England municipalities have been able to float long-term bond issues and the short-term notes of railways and industrial companies coming due are taken care of as they mature. Capital is undoubtedly accumulating, but it is not available for new construction. Numerous instances are found where contractors have taken bonds in payment for their work in lieu of the possibility of the work's being postponed.

Railroad construction is at the lowest point since the depression of the '70's, less money being put into permanent improvements by railways at this time, in proportion to the value of their property, than ever before. This is particularly noticeable in the purchases of new equipment and new motive power. The railway rate case has been reopened, but apparently, from newspaper accounts, there is little hope of any relief being granted.

The iron and steel industry is at a lower ebb than at any time in recent history. Export orders are few; the small amount of new construction in the United States has practically stopped the buying of steel. In fact, the output of the mills now is insufficient to take care of the replacements which should be made. As an indication of the hard position of the steel companies, it is noted that the United States Steel Corporation cut the dividend rate on its common stock to one-half of one per cent. The former rate was one and one-quarter per cent. quarterly.

The export situation is much improved. The buying of machine tools by the belligerent powers has been large; likewise, ammunition, horses, and automobiles. The purchasing agents of various foreign governments have been busily engaged during the last few days in buying automobiles and it is probable that this country will have an opportunity to furnish as much war material as it can produce.

Foreign trade is rapidly assuming normal proportions. Large shipments of foodstuffs and military supplies, as well as the belated shipments of cotton now beginning, are rapidly clearing the situation, and it is probable that foreign exchange will shortly turn in favor of the United States, particularly if European holders of American securities do not sell them in this market. This is of course impossible as long as the New York Stock Exchange remains closed.

Advertisements of contracts in which it is definitely stated that the contractor will be paid in bonds of the municipality or county, are common. This is simply another way of getting around the law prohibiting the sale of stocks or bonds at less than par.

Financial relief will probably be found for the more hard-pressed cotton planters, but the cotton states have suffered a severe setback which cannot be minimized. Their ability to go into diversified farming another year may mean much continued prosperity, but it does not buy food and clothes for this winter.

Added to the long list of dividends which have been passed since the announcement of the war, comes the reduction in the quarterly disbursement of the United States Steel Corporation. This conservative policy may not be to the liking of investors, but it is thoroughly sound, and will make for better business in the future.

The inability of railways to secure funds, as well as municipalities and industrials, during the past two or three years, is now generally recognized as being due more to the preparation of European nations for a general war, than any other one thing. While it is not much consolation to ascertain this, it is some satisfaction to find out that after all, the ills to which we have been subject were not all of our own making.

Labor is anxious to work, and at comparatively any wage. Factory help is very plentiful. Rough labor is in larger supply than at any other time in the last half dozen years.

An indication of better business in mill construction is the recent award made by the Naumkeag Steam Cotton Co., Salem, Mass., to the Turner Construction Co., 11 Broadway, New York, N. Y., for the construction of a mill and storehouse. The mill will be four stories and basement, 135x722 ft., and the storehouse five stories and basement, 82x500 ft., both of reinforced concrete.

LABOR

Conditions for the worker are more unsatisfactory than they have been since the panic of 1907, and in fact, at that time there was more hope for a better employment of labor in the near future than there is at present. It is evident that even should the railways secure higher rates, and consequently have more funds, they would apply these funds to liquidating past indebtedness before making new improvements. With the cities and municipalities restricted in their borrowing power as they are, there will be less construction than in several years. The building industry during the winter, at least, will be cut down to small proportions.

CEMENT, LIME AND BRICK

Cement—Manufacturers of cement have not had as much business as they expected; that is, strictly new business. Deliveries on old contracts, however, have kept up surprisingly well, particularly in and around New York, and one of the peculiar features of the situation is the report that the sellers of Rosendale cement have disposed of more cement this year than in several years past. Moreover, the towing business on the Hudson River has been more satisfactory than ever before. There is no cutting the price of cement, and while it is likely that a good deal of the production of the Lehigh Valley District will have to be cut down, it is significant to note likewise that the towing businesss on the Hudson River has been more active than in several years. An export demand has made itself felt, but due to the inability of bankers to provide a medium of exchange and to extend credit, there has been practically no business closed. Moreover, steamship accommodations are most unsatisfactory, particularly for this kind of material, which must go at a low rate or not at all.

In the West prices are 5c. per bbl. lower:

The quotations given below do not include the allowance of 40c. made for bags returned:

Boston	$1.32	Chicago	$1.10
Cleveland	1.25	Detroit	1.14
Duluth	1.33	Jersey City	1.06
Minneapolis	1.30	New York	1.18
Pittsburgh	1.05	St. Paul	1.30

Lime—Business is quiet, but prices are unchanged at 97c. per bbl. for state common, 200 lb. net; $1.37 for 300 lb. "Star"; $1.55 for 300 lb. finishing; $1.10 for 200 lb. finishing and $1.72 for 350 lb.

Brick—Prices are even lower than a month ago. For Hudson River common brick, delivered New York, the market is $5 to $5.25, being weak at that. Raritan River bricks are $5.25 to $5.50. Stocks appear to be accumulating in all markets.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—The market continues without change. The quotations are absolutely nominal, 1½-in. stone selling at 90c., while ¾-in. stone sells at 95c. to $1.05. These quotations are for full cargo lots of 500 cu.yd., delivered alongside of dock, New York.

Sand and Gravel—Gravel is quoted at 90c. for 1½-in., but special gravel, which will pass subway specifications, is held at $1.15. Sand sells for 50c. per cu.yd. The above quotations are for full cargo lots of 500 cu.yd., delivered alongside of dock, New York.

In Boston, gravel sells for 35c. per cu.yd. at quarry 35 miles out, the freight rate to Boston being 40c.

IRON AND STEEL

Pig Iron—The market has never been quite as dull since the depression of 1893 as it is at present. Even the financial panic of 1907, which resulted in a cutting down of production, was more drastic, perhaps, than at present, but there was some business. Now the trade seems to be at a standstill. A few foundries in New England have bought sparingly, and some cast-iron pipemakers have been in the market. But as a general rule, prices are slowly crumbling, and even at that, no buyers come into the market. It is significant that producers in the Alabama field maintain a price of $10, but stocks are accumulating in the yards in large amounts.

Quotations for lots of 100 tons or over, ports named, are as follows: Cincinnati Southern Foundry No. 2, $13 to $13.50; Cincinnati Northern Foundry No. 2, $14.25 to $14.75; Cincinnati Northern Foundry No. 3, $14 to $14.25; New York Northern Foundry No. 1, $14.50 to $14.75; New York Northern Foundry No. 2X, $14.25 to $14.50; New York Northern Foundry No. 2 Plain, $13.75 to $14. Southern iron in the New York market is $14.25 to $14.50 for No. 2. Southern Foundry No. 2, Birmingham, $10.

Steel Rails—There is practically no new business. Some of the Western lines are buying rails, but prices are nominal.

These quotations are for lots of 500 tons and over: Standard sections of bessemer rails, $28; open-hearth rails, $30. These quotations are f.o.b. Pittsburgh; Girder rails, 30-ft. lengths, $36.40 per gross ton, and in 60-ft. lengths, $38.40, both f.o.b. New York. Other quotations, f.o.b. Pittsburgh, for large lots, are as follows: Standard sections, $1.25; 25- to 45-lb. sections, $1.15; 16- and 20-lb., $1.20; 12- and 14-lb., $1.25; 8- and 10-lb., $1.30.

Structural Shapes—Business is no worse than a month ago, except some of the shops have finished the work booked earlier and there are few new jobs coming in. Railroads work is at a standstill, but new building has not fallen off as much as many feared. Prices are more or less nominal at a reduction of $1 per ton compared with last month. The base quotation is $1.15 to $1.20, Pittsburgh, for I-beams, 2 to 15 in.; channels, 2 to 1 in., angles, 2 to 6 in., and Y's, 3 in. and over. For other sizes, $1.25 to $1.30 is demanded. For T's, $1.20 to $1.25; channels and T's under 3 in., $1.25 to $1.30; handrail T's, $1.95 to $2.10. Cutting to specified lengths is charged at the following rates: Under 3 ft. to 2 ft., inclusive, 25c. per 100 lb.; 2 ft. to 1 ft., inclusive, 50c. per 100 lb. Cutting to lengths under 1 ft., $1.55. No charges made for cutting to specified lengths over 3 ft.

Track Supplies—There is little business, but some extreme-[illegible] quotations have been made for tie-plates, one order for [illegible] tons going at around $[illegible] per ton at the mill. Railroad spikes are $1.[illegible] to $1.6[illegible]; track bolts, with square nuts, $1.[illegible] to $2, and angle bars $[illegible].

The extras on railroad spikes [illegible] as follows:

Railroad spikes	Cents
[illegible] 3½, 4 4½ and [illegible]	Extra 10
[illegible], 4 and [illegible]	Extra 20
[illegible] 3½, 4 and [illegible]	Extra 30
[illegible]	Extra 40
[illegible], 3 and 3[illegible]	Extra 60

Plates—There are very few new orders, and the outlook for [illegible] betterment in that line of trade. [illegible] plates in Pittsburgh selling at $1.[illegible]. In Chicago the price is $1.[illegible] at mill and $1.75 from store.

Pipe—An inquiry is in the market for considerable line [illegible], but the slowing down of foreign demand for oil would [illegible] that very little of this kind of construction will be undertaken in the near future. The demand for smaller sizes of pipe has fallen off in about the same proportion.

Discounts applying to the standard list are as follows:

	Black	Galvanized
[illegible]- to 3-in. steel butt welded	[illegible]	71½%
1½- to 6-in. steel lap welded	79%	70½%
7- to 12-in. steel lap welded	76%	65½%

At these discounts, the net prices of pipe per foot at Pittsburgh are as follows:

Diameter	Cents Black	Cents Galvanized	Diameter	Cents Black	Cents Galvanized
[illegible]	2.3[illegible]	[illegible]	[illegible]-in.	31.00	13.60
[illegible]	3.[illegible]	[illegible]	6-in.	42.00	[illegible]6.80
[illegible]	4.6[illegible]	6.[illegible]	7-in.	57.00	[illegible]8.00
[illegible]	[illegible]	7.[illegible]	8-in.	60.00	[illegible]6.00
[illegible]	[illegible]	1[illegible]	9-in.	[illegible].50	$1.19
[illegible]	[illegible]	1[illegible]	10-in.	[illegible]9.00	$1.42
[illegible]	16.[illegible]	[illegible]	11-in.	$1.12	$1.60
[illegible]	[illegible]	[illegible]	12-in.	$1.22	$1.74

Sheets—Prices are from $1 to $2 per ton lower. The mills are operating to about [illegible] of capacity. Prices are as follows:

The following quotations are for large lots of sheets in Pittsburgh, and small lots from store New York:

	Cents per Pound, Large lots Pittsburgh, Black	Galv.	Warehouse delivery New York, Black	Galv.
No. 1[illegible]	1.6[illegible]	1.[illegible]0	2.20	
No. 12	1.6[illegible]	[illegible]0	2.[illegible]	2.[illegible]
No. [illegible]	1.6[illegible]	2.00	2.3[illegible]	2.[illegible]
No. [illegible]	1.7[illegible]	2.15	2.[illegible]	2.[illegible]
Nos. [illegible] and [illegible]	1.7[illegible]	2.30	2.[illegible]	3.00
Nos. 2[illegible] and [illegible]	1.[illegible]	2.[illegible]	2.50	3.1[illegible]
No. [illegible]	1.[illegible]	2.60	[illegible]	3.[illegible]0
No. 27	1.[illegible]	[illegible]	2.60	3.[illegible]
No. 28	1.[illegible]	2.[illegible]0	[illegible]	3.60

Wire Rope—Revised discounts are 47 and 2½% from list for galvanized [illegible] 2½% for the bright. At these discounts the net price of wire rope at the mills is as follows:

Diameter in inches	Price per foot, [illegible] steel	Crucible steel	Plow steel
[illegible]	$[illegible]	$[illegible]	$1.[illegible]
[illegible]	[illegible]	0.[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0.[illegible]	0.[illegible]
[illegible]	[illegible]	0.[illegible]	0.[illegible]
[illegible]	[illegible]	0.[illegible]	[illegible]
[illegible]	[illegible]	0.16	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Steel Shapes—[illegible] from warehouse New York are [illegible] from last month as follows:

	Cents Per lb.
[illegible]	
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
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[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Old Material—The market has seldom been in as unsatisfactory a state as at present. Prices are lower than before in years, considering the quotations for new material, and reductions of 50c. and 75c. a ton have been made below the extremely low prices ruling about the first of August. In New York, there is practically no business, and the quotations given below are largely nominal. They are as follows, per gross ton, delivered in New York:

	Per Net Ton
Heavy-melting steel scrap	$7.25 to $7.50
Pipes and flues	7.25 to 7.50
No. 1 railroad wrought	9.50 to 10.00
Stove plate	7.00 to 7.50
Malleable cast	7.25 to 7.75
No. 1 machinery cast	9.50 to 10.00
No. 1 yard wrought long	8.00 to 8.50
Wrought turnings	5.25 to 5.75

In Chicago, the market is not quite as unsatisfactory. Some sales have been made by the railways, but prices in general are so low that no effort is being made to ship scrap except where storage yards are too congested to permit of any further accumulation. It is notable that the consumers and buyers of scrap are purchasing some on a speculative basis. Quotations are as follows:

	Per Gross Ton
Heavy-melting steel scrap	$8.50 to $8.75
	Per net ton
No. 1 railroad wrought	$7.75 to $8.00
No. 2 railroad wrought	7.25 to 7.[illegible]0
No. 1 cast scrap	9.[illegible] to 9.2[illegible]
Pipes and flues	5.5[illegible] to [illegible]
Agricultural malleable	7.50 to 7.75
Railroad malleable	8.00 to 8.25

In Pittsburgh, heavy-smelting steel scrap has sold as low as $10.50. The Pennsylvania R.R. and the Baltimore & Ohio R.R. both are putting out lists indicating that they have more scrap for sale than usual at this time of year. Reductions in Pittsburgh are not as drastic as in other parts of the country. Quotations per gross ton are as follows:

Heavy-melting steel scrap	$10.50 to $10.75
Re-rolling rails	12.00 to 12.25
No. 1 foundry cast	11.50 to 11.75
Old car wheels	11.25 to 11.50
Machine shop turnings	6.75 to 7.25
Railroad malleable	10.50 to 10.75

Chain—Prices are steady and without change, as follows: These prices are per 100 lb., f.o.b., Pittsburgh:

$\frac{3}{16}$ in.	$7.50	½ and [illegible] in.	$3.[illegible]
¼ in.	4.95	⅝ and [illegible] in.	2.[illegible]
[illegible] in.	3.95	¾ and [illegible] in.	2.90
⅜ in.	3.40	⅞ and [illegible] in.	2.70
$\frac{7}{16}$ in.	3.20	1 to 1¼ in.	2.60

EXTRAS TO ABOVE LIST PER 100 POUNDS

	For BB	For BBB
$\frac{3}{16}$-in. and ¼-in.	$1.50	$2.00
$\frac{5}{16}$-in. and larger	1.25	1.75

REINFORCING MATERIALS

Bars, Concrete Reinforcing—The demand is very light and no extreme quotations have been named in New York. It is probable that some concessions would be made from the following prices which are repeated from last month:

Size	Cents per pound, Mill shipments Pittsburgh	Warehouse Pittsburgh	Delivered from warehouse New York
[illegible]-in. and larger	1.[illegible]	1.[illegible]	2.3[illegible]
⅝-in.	1.2[illegible]	1.70	2.3[illegible]
½-in.	1.[illegible]	2.[illegible]	2.35
[illegible]-in.	1.[illegible]	2.1[illegible]	2.[illegible]
¼-in.	1.[illegible]	2.3[illegible]	2.[illegible]

Triangle Mesh—Quotations are without change as follows:

PRICE PER 100 SQ. FT.

Style No.	Cross sec. area per ft. width	Plain material, Carload lots	Plain material, Less than car lots and over 1[illegible] sq.ft.	Galvanized, Carload lots	Galvanized, Less than car lots and over 1[illegible] sq.ft.
*4	[illegible]	$1.[illegible]	$1.[illegible]	$1.12	$1.34
[illegible]	[illegible]	[illegible]	[illegible]	0.[illegible]	1.[illegible]
6	[illegible]	[illegible]	[illegible]	0.71	0.[illegible]
*[illegible]	[illegible]	[illegible]	[illegible]	0.[illegible]	[illegible]
*[illegible]	[illegible]	1.[illegible]	2.[illegible]	1.[illegible]	2.[illegible]
[illegible]	[illegible]	1.[illegible]	1.[illegible]	1.62	1.92
[illegible]	[illegible]	1.[illegible]	1.[illegible]	1.[illegible]	1.71
*[illegible]	[illegible]	1.1[illegible]	1.[illegible]	1.[illegible]	1.[illegible]
*[illegible]	[illegible]	[illegible]	1.1[illegible]	1.[illegible]	1.[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.[illegible]
11	[illegible]	[illegible]	1.[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.[illegible]
[illegible]	[illegible]	1.[illegible]	2.[illegible]	2.11	2.6[illegible]
[illegible]	[illegible]	1.[illegible]	1.[illegible]	1.[illegible]	1.[illegible]
[illegible]	[illegible]	1.[illegible]	1.[illegible]	1.[illegible]	1.[illegible]
[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	1.15
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
*[illegible]	[illegible]	1.[illegible]	[illegible]	2.[illegible]	[illegible]
[illegible]	[illegible]	1.[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2.[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1.[illegible]	1.[illegible]	1.[illegible]	2.05
*[illegible]	[illegible]	1.1[illegible]	1.[illegible]	1.[illegible]	1.[illegible]

*This material is made in regular widths of 18, 22, 26, 30 [illegible] Standard lengths in rolls are [illegible] and [illegible] ft.

METALS

Copper—It is becoming more and more evident day by day that the price of copper and of products made of this metal must go to new levels. With the market almost as dull as possible, with scarcely any business of quantity, comes the announcement that the British Government has put copper on the contraband list, with a view to shutting off supplies which go to Germany by way of Holland and Denmark. This is a serious blow to the copper industry in the United States, for Germany would continue to take much metal. The dullness has had little effect on prices. Sales have been at 11¼ to 11½c., delivered in New York. The unevenness in the market is seen by quotations of 12 to 12½c. for copper wire in carload lots at the mill, 16½c. for copper sheet. In Germany, electrolytic copper sells at about 20c.

Tin—The price of tin dropped below the 30c. level early in the month, but later advanced to 31¾c., when announcement was made that a ship carrying 1000 tons of tin had been sunk. When it is realized that 1000 tons of tin is about 8% of the visible supply all over the world, the importance of such a loss can be seen. But even this had little effect in keeping the price up, for by the end of October it had again dropped below 30c. Quotations range from 29½ to 30½c. for large lots, depending on the nature of the transaction.

Lead—The market is again easier, sales in New York being made at 3.50c., and the St. Louis market quoted at 3.35 to 3.40c.

Spelter—The market has declined again, and 5.05 to 5.15c. is demanded in New York, while in St. Louis, prime Western brands of spelter can be had at 4.95c.

Aluminum—The metal is quiet and prices are easier, 18 to 19c. per lb. for No. 1 ingot in large lots.

Antimony—All the antimony used in the United States is imported. At the outbreak of the war, there were large stocks on hand in this country. At that time, prices shot up rapidly, but later declined. Antimony is now being shipped abroad. Quotations are much unsettled, ordinary brands selling at 14 to 15c., and Cookson's at 17½ to 18c.

Miscellaneous Metals—The following quotations are per lb. for small lots, but they may be shaded for desirable orders:

Bismuth	$3.75 to $4.00
Brass tubes, iron-pipe sizes:	
½-in.	.16
¾- to 3-in.	.15
3½-in.	.15
4-in.	.16
Brass rods	.13¾
Brass sheets	.14
Solder, half and half guaranteed	.21
Zinc sheets	9 to 9½
Copper sheets, base	.16½
Pig tin (five-ton lots, cash)	.30

Old Metals—The following quotations are for small lots delivered at buyer's warehouse:

	Cents
Copper, heavy and crucible	10.00
Copper, heavy and wire	9.50
Copper, light and bottoms	8.50
Brass, heavy	7.25
Brass, light	5.25
Heavy machine composition	8.75
Composition turnings	8.00
Lead, heavy	3.00
Lead, tea	2.75
Zinc scrap	3.25

MILL SUPPLIES

Belting—The market is without change. Discounts on leather belting are as follows: Extra heavy, 50@50 and 5%; heavy, 50 and 10@60%; medium, 60 and 5@65%; standard, 60 and 10@60, 10 and 10%. The discounts applying to rubber belting are as follows: Standard, 60 and 10@60, 10 and 10%; best grades, 50@50 and 10%. The net prices per foot of rubber belting given below are figured at the discount of 50 and 10%.

RUBBER BELTING, NET PRICE PER FOOT

	2-Ply	4-Ply	6-Ply	8-Ply
3	$0.10	$0.14	$0.21	....
4	.13	.19	.28	....
5	.16	.23	.35	....
6	.19	.28	.42	$0.56
7	.23	.33	.49	.66
8	.26	.38	.57	.76
9	.30	.43	.64	.85
10	.34	.48	.72	.96
12	.41	.58	.88	1.17
14	.49	.69	1.04	1.38
16	.56	.80	1.20	1.61
18	.63	.91	1.36	1.82
20	.71	1.02	1.52	2.03
22	.78	1.13	1.70	2.27
24	.88	1.26	1.89	2.52
26	.97	1.38	2.08	2.77
28	1.06	1.51	2.27	3.02
30	1.15	1.64	2.46	3.27
34	1.33	1.89	2.83	3.78
38	1.51	2.14	3.21	4.28
42	1.69	2.39	3.59	4.79
46	1.87	2.65	3.97	5.29
50	2.05	2.90	4.35	5.79
56	2.32	3.28	4.91	6.55
60	2.50	3.53	5.29	7.06

Lubricating Oils—For delivery in New York in 5-bbl. lots, prices are as follows:

	Cents per gal.
*Cylinder, dark	19@23
*Cylinder, steam refined	13@19
Neutral oils, filtered:	
Stainless, white, 32 to 34 gravity	26@28
Lemon, 33 to 34 gravity	16@16
Dark, 32 gravity	14@16
Crank case oil	14@16

*Prices are according to test.

Shafting—The only consumers of importance are the automobile makers. The discount for large lots is 66% from list. At this discount, the net prices per foot of cold-drawn steel shafting in Pittsburgh are as follows:

Diameter in inches	Cents per foot	Diameter in inches	Cents per foot
¾	2.80	2	23.00
1	4.97	2¼	23.00
1¼	7.72	2½	28.36
1⅜	9.44	2¾	34.31
1½	10.20	3	41.90
1⅝	11.97	3½	61.04
1¾	13.87	4	86.70
1⅞	15.96		

CLAY PRODUCTS

Flue Lining—Discounts are unchanged at 83% from list. At this discount, the net prices per foot for New York delivery are as follows:

	Weight in lb.	Price per ft.		Weight in lb.	Price per ft.
4½x8½-in.	14	$0.06	8½x18-in.	45	$0.152
4½x13-in.	20	0.076	13x13-in.	45	0.145
7½x7½-in.	15	0.068	13x18-in.	57	0.22
8½x8½-in.	18	0.076	18x18-in.	75	0.34
8½x13-in.	28	0.11			

Sewer Pipe—In the smaller sizes, there has been a slight drop in price, 3- to 24-in. being quoted at a discount of 82%. In the larger sizes, discounts remain unchanged, as follows: 27- and 30-in., 70%; 33- and 36-in., 65%. At these discounts, the net prices per foot in New York are as follows:

Size		Size	
3-in.	$0.045	18-in.	$0.342
4-in.	0.045	20-in.	0.405
5-in.	0.072	22-in.	0.54
6-in.	0.072	24-in.	0.585
8-in.	0.099	27-in.	1.35
10-in.	0.144	30-in.	1.65
12-in.	0.18	33-in.	2.20
15-in.	0.243	36-in.	2.45

Railway Ties—Business during the month has been exceedingly dull. Standard sizes of yellow-pine cross ties are quoted as follows: 7x9 in. by 8 ft. 6 in., 76c.; 6x8 in. by 8 ft., 64c.

MISCELLANEOUS

Wood Preservatives—Special preservatives for lumber are sold at the following prices per gallon delivered to points in this country: Pentin, a flame proof preservative, 80c. per gal.: Creolin, a creosote, flame proof, 45c. per gal.; Maretin, a preservative for marine use, 60c. per gal.

Lighterage Limits—The free delivery or "Lighterage Limits" in New York City are as follows: In Manhattan, from a point opposite the Fort Lee ferry, south along the Hudson River around the Battery and north along the East and Harlem Rivers to the Jerome Ave. Bridge at 155th St. In New Jersey, south from Fort Lee ferry to Bayonne City, points on the north and east shores at Staten Island, between Bridge Creek (Arlington) and Clifton, both inclusive, and including Elm Park, Erastina and Shooters Island. In Brooklyn, from 69th St., Bay Ridge, north to Pot Cove, Astoria, Long Island City.

Asbestos—Asbestos building felt and sheathing in less than ton lots is 3½c. per lb. for the light, weighing from 6 to 30 lb. per 100 sq.ft.; 4c. per lb. is charged for the heavy, weighing from 45 to 56 lb. per sq.ft.

Millboard is made in standard sheets, 40x40 in., and 41x40 from 2 to 27 lb. per sheet. The net price in 100-lb. lots is 5c. per lb.

Asbestos wood, used for fireproofing, ventilators and smoke jacks, comes in sheets, 36x48 in., 42x48 in. and 42x96 in. The prices per sheet, f.o.b. factory, in New England, aro as follows:

Thickness	Weight, pounds	Price	Thickness	Weight, pounds	Price
⅛-in.	1	$0.08	⅝-in.	5	$0.40
3/16-in.	1½	0.12	¾-in.	6	0.44
¼-in.	2	0.16	⅞-in.	7	0.48
5/16-in.	2½	0.20	1-in.	8	0.52
⅜-in.	3	0.28	1¼-in.	10	0.56
7/16-in.	3½	0.28	1½-in.	12	0.64
½-in.	4	0.32	1¾-in.	16	0.72
9/16-in.	4½	0.36	2-in.	16	0.80

Asbestos sheathing, corrugated, sells at 15c., per sq.ft. f.o.b. mill eastern Pennsylvania.

Telegraph Wire—The demand for telegraph wire has been fair. For lots of fair size, the wire measured in Birmingham wire gage, prices are as follows: "Extra Best," Nos. 6 to 9, 4⅜c.; Nos. 10 and 11, 4½c.; No. 12, 4⅝c.; No. 14, 5⅛c.; "Best Best" Nos. 6 to 9, 3½c.; Nos. 10 and 11, 3⅜c.; No. 12, 3½c.; No. 14, 4c. Actual freight is allowed from Trenton, N. J., where it does not exceed 25c. per 100 lb.

Explosives—Dynamite of the kind generally used by contractors is approximately 11@13c. per lb., f.o.b. factory, in ton lots. Blasting powder, classified as "soda" grade, is sold at $1.20@1.40 per keg of 25 lb. in lots of 10,000 lb.

Exploders, per hundred, are sold at the following prices: 4 ft., $3.60; 6 ft., $4 10; 8 ft., $1 60; 10 ft., $5.10; 12 ft., $5.60; 16 ft., $6.60; 20 ft., $7.50; 25 ft., $9.40; 30 ft., $12; 36 ft., $14.60.

Caps in lots of 10,000 are $7@8 per thousand.

Blasting machines for 10 holes are $12; 25 holes, $20; 50 holes, $40; 100 holes, $60.

Chain Belting—Prices continue unchanged. Quotations are as follows: From 3 hp. to 10 hp., 30-in. centers complete with two sprockets, $7@8 per horsepower. From 10 hp. to 25 hp., 36-in. centers complete, $5@6 per horsepower. For 25 hp. to 100 hp., 56-in. centers complete, $1@5 per horsepower. From 100 hp. to 500 hp., 72-in. centers complete, $3@4 per horsepower.

Construction News

★ [illegible] work advertised in ENGINEERING NEWS
✦ [illegible] contract awarded. The names of bidders awarded contracts are set in CAPITALS

RAILWAYS

✦Kentucky—Louisville & Nashville R R—This company is [illegible] 2½ miles of track at Hatfield, Ky

Illinois—Quincy & Hamilton Ry—This company has been incorporated to construct a railway from Quincy, Ill., to Hamilton, Ill., about [illegible] miles. The incorporators are C S. Carsallen, C D Warren, Toronto, Ont, C H Petsche, St Paul, Minn., F D [illegible], Chicago, Ill., E W Wood and R. W [illegible], Hamilton, Ill

✦Wisconsin—Chicago & Northwestern R R—This company has awarded a contract to the CLEARY, WHITE & DUFFY CO., for the construction of the Kingston-Crandon line in Wisconsin.

Texas—Uvalde & Northern R R—This company is making arrangements to resume work on the construction of its line from Uvalde to Leahy, Tex., about 30 miles. F H Dillon, [illegible], Tex., is Ch Engr

Kansas City, Mexico & Orient Ry—According to press reports plans are being prepared by this company for the extension of its line from Fort Stockton to Del Rio, Tex. R. [illegible], San Angelo, Tex., is Ch Engr

John D Kinney, Austin, Tex., is interested in the construction of a railway from Austin to Big Springs, Tex., about 2[illegible] miles

Idaho—Oregon Short Line R R—This company contemplates the purchase of the Gilmore & Pittsburg Ry., and extending the line from Salmon, Idaho, to Grangeville, Idaho. Carl Stradley, Salt Lake City, Utah, is Ch Engr.

Idaho—Nez Perce & Idaho Ry—The Farmers Union, Nez Perce, Idaho, and the Nez Perce Commercial Club are interested in a movement to secure stock subscriptions for the extension of this company's line from Nez Perce to Waha

Oregon—Northern Pacific Ry—A cash bonus and right-of-way will be offered to induce this company to construct a [illegible]-mile spur from Myrick to Holdman, Ore. R. O Earnhart, Pendleton, Ore., is interested

California—Atchison, Topeka & Santa Fé Ry—An expenditure of $[illegible] will be made by this company for the construction of [illegible] washing tracks and narrow gage push car tracks in connection with its line through Los Angeles, Calif. F M Bisbee, Amarillo, Tex., is Ch Engr Western lines.

ELECTRIC RAILWAYS

Brockton, Mass.—The Bay State St Ry has requested the [illegible] to grant a franchise for the relocation of its tracks on [illegible] St and Pleasant St. A P Emmons, Boston, is Pur Agt

Franklin, Mass.—The Milford, Attleboro & Woonsocket St Ry will relocate its tracks on West Central St, Franklin. H C Page, Worcester, is Gen Mgr

New Haven, Conn.—The Connecticut Co plans to extend its [illegible] Ave line two miles beyond the city limits to Center [illegible]. F P Harlan, New Haven, is Mgr

Long Branch, N J.—The city will cooperate with the Freehold [illegible] Association to construct an electric railway from Trenton to the seashore.

Cumberland, Md.—The Cumberland & Westernport Electric Ry Co has applied to the Public Service Commission for permission to extend its railway from Cumberland to connect with the [illegible] line about two miles.

Jacksonville, Fla.—The Jacksonville Traction Co is preparing to extend its lines on [illegible] St, Jacksonville. [illegible] is Mgr

Algiers [illegible], **La.**—Mayor [illegible] is interested in the construction of an electric railway in Algiers

Cincinnati, Ohio—Plans are being prepared by the [illegible] for the construction of a belt line in Cincinnati. [illegible] is Gen Mgr

East St Louis, Ill.—The East St Louis & Suburban Ry Co is [illegible] plans for the extension of its line to [illegible], about [illegible] miles. [illegible] is [illegible]

St Paul, Minn.—[illegible]

Ogden, Utah—[illegible]

✦Fallon, Nev.—[illegible]

Bisbee, Ariz.—[illegible]

Spokane, Wash.—[illegible]

Sacramento, Calif.—The California Terminal Ry is making arrangements to construct an interurban railway from San Rafael to Sacramento. C W Conlisk, San Francisco, is interested

Snohomish, Wash.—The Council has granted a [illegible]-year franchise to the Everett Ry, Light & Water Co to extend its line from a connection with the Northern Pacific R R to Union Ave and First St, Snohomish. D C Barnes, Everett, is Mgr

Fresno, Calif.—The Council has granted the Fresno Traction Co permission to double track its lines over certain streets. Frank W Webster, Fresno, is Gen Mgr

Los Angeles, Calif.—The City Council has been advised by the Board of Public Utilities to grant a franchise to Louis Ginger for the construction of an incline railway in Griffith Park, Los Angeles

The City Council has been recommended by the Public Utilities Committee to grant a franchise for the extension of the East First St line in the Malibar improvement district to the East city limits of Los Angeles

Brantford, Ont.—The Brantford St Ry Co plans to extend its lines and to construct a loop in Brantford. The company has applied to the Council for a franchise for this extension. E B Stockdale, 45 King St., West Toronto, is Gen Mgr

LIGHT, HEAT AND POWER

★Buffalo, N. Y.—(Official)—Bids will be received until noon, Nov. 9, by Dr Thomas E. Finegan, Asst Comr of Elementary Education, Educational Bldg, Albany, N. Y., for electric fixtures at the Buffalo State Normal School. Lewis F Pilcher, Capitol, Albany, is State Arch

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by C B J Snyder, Supt. School Bldgs, Park Ave and 59th St, Borough of Manhattan, until 3 p m., Nov. 9, for installing electric equipment in Public School No 1[illegible] on Dean St.

Weedsport, N. Y.—At a recent election, the citizens voted in favor of issuing $18,000 in bonds, to be used for the construction of a municipal electric light plant

Baltimore, Md.—(Official)—See item under "Water Supply and Irrigation"

Frostburg, Md.—It is reported that the Hagerstown & Frederick Electric Ry Co, Hagerstown, Md., plans to enlarge its power plant at Frostburg for the purpose of supplying light and power to the towns of Western Port and Midland. M A Pooler is local Mgr

Durham, N. C.—The Southern Power Co., Charlotte, N C., has purchased a site of several acres between Durham and University station, on which to build an auxiliary power plant. It will have a capacity of 10,000 hp and the estimated cost is $500,000. B N Duke, Durham, is Vice Pres. of the company

Homestead, Fla.—The Homestead Light Heat, Ice & Power Co., recently organized, is preparing to equip an electric light plant and ice factory, at a cost of from $1[illegible] to $16,[illegible]. J P Free is Mgr

Marianna, Fla.—See item under "Water Supply and Irrigation"

Chattanooga, Tenn.—The Chattanooga Gas Co contemplates laying an [illegible] gas main, about 1½ miles long, along Hooker Rd, to connect the plants of the Chattanooga Gas Co and the Chattanooga Gas & Coal Products Co. The estimated cost is $[illegible]

Dresden, Tenn.—The Board of Aldermen has ordered a special election to be held Nov. [illegible] for the purpose of voting a bond issue of $[illegible] to be used for the construction of a municipal electric light plant and waterworks system.

Louisville, Ky.—The [illegible] Clothing & [illegible] Co plans to [illegible] power plant, for which a boiler, engine and [illegible] will be required

Hamden, Ohio—The Hocking Valley Ry Co has given notice that it will no longer furnish energy to the village after Jan 1, 1915, and a [illegible] has been started to organize a company, to be known as the Hamden Light & Garage Co, to furnish electricity to the village. The capital stock will be from $[illegible] to $[illegible]

Huntington, Ind.—[illegible]—Bids will be received until Nov. [illegible] by the Board of Public Works for steam, exhaust and power plant piping in the municipal electric-light and water plant. [illegible]

Battle Creek, Mich.—The Kellogg Toasted Corn Flakes Co [illegible]

Edwardsville, Ill.—Bids will be received until Nov. [illegible] by [illegible] of Madison County, for installing two electric passenger elevators and [illegible] equipment in the Madison County court house. [illegible] Kirsch, Magnolia Ave and [illegible] St, St Louis, Mo., is Arch

Nokomis, Ill.—At a recent special election, the citizens voted in favor of issuing $[illegible] in bonds, the proceeds of

which will be used for the construction of a municipal electric light plant.

Rankin, Ill.—The Village Board has granted a franchise to Charles Crump, Marine, Ill., for the installation and operation of an electric light plant for Rankin.

Beloit, Wis.—It is reported that the Fairbanks-Morse Mfg. Co. will remodel its power house and install new boilers in the early spring.

Union Grove, Wis.—The first unit of the State Home for Feebleminded and Epileptics at Union Grove will include the power plant required for the entire group of buildings, estimated to cost $1,000,000. The first unit will cost about $250,000, and work will start about Dec. 1. Vaughn, Myer & Sweet, Majestic Bldg., Milwaukee, are Consult. Engrs. M. J. Tappin, Madison, Wis., is Secy., State Bd. of Control.

Pocahontas, Iowa—It is reported that the Electric Light Commissioners will shortly begin the construction of a substation and three-quarters of a mile of transmission line to connect the municipal electric light plant with the line of the Northern Iowa Power Co.; or the Commissioners will purchase a 100-hp. oil engine and generators, transformers, switches, etc. O. B. Cade is Mgr. of the municipal plant.

Alpha, Minn.—The Town Council has granted a franchise to L. T. Sterling to build and operate an electric light plant in Alpha. It is reported that construction work will be begun at once.

Aurora, Minn.—The City Council has decided to build a municipal electric light plant to cost about $27,000.

Oakes, N. D.—Press reports state that the Oakes Light & Power Co. is considering the extension of its power and lighting system.

Cabool, Mo.—It is reported that the Bauch Mill & Elevator Co. is considering the establishment of an electric light plant and ice factory to be operated in connection with its flour mill. A. R. Beckett is interested.

Blanchard, Wash.—The Stone & Webster Engineering Corporation, Boston, Mass., will organize a subsidiary company to supply electricity to Blanchard and Edison, Wash., and the surrounding farming country. The substation will be located at Edison. W. E. Herring, Puget Sound Traction, Light & Power Co., Seattle, Wash., is interested.

Baker, Ore.—The City Commissioners have ordered estimates prepared of the probable cost of a municipal light and waterworks system to supply the dwellings and business houses of the town.

Bakersfield, Calif.—The County Highway Commission of Kern County has received bids for constructing 9.5 miles of transmission line in the county from: The Power Equipment Co., Rialto Bldg., San Francisco, at $11,000, and from John R. Cahill at $16,000.

Pittsburg, Calif.—The Contra Costa Gas Co. will shortly begin the construction of a gas generating plant at Pittsburg, and will lay pipe lines to Antioch, Concord and Martinez. S. W. Coleman is Pres. of the company.

✚Redwood City, Calif.—The Pacific Gas & Electric Co. has awarded the contract for the foundation of its new gasholder at Redwood City to the DUNCAN-HARRISON CO., at $10,960. Noted Sept. 24.

Bedford, Que.—The Bedford Mfg. Co. is having plans prepared for the construction and equipment of a power plant on the Pike River, to supply energy to its factories.

Fort William, Ont.—The Consolidated Elevator Co. will build a new office and transformer station at an estimated cost of $25,000. The building will be of brick, one story. Electrical equipment will be required.

BRIDGES

✚Sunderland, Mass.—The Board of Selectmen has awarded the contract for the construction of concrete abutments for a town bridge to the CASPER RANGER CONSTRUCTION CO., Holyoke, Mass.

New Britain, Conn.—The Board of Public Works has been petitioned to make an appropriation for the construction of a bridge at Rhodes St. Alfred L. Thompson is City Clk.

✚Audubon, N. J.—The Pennsylvania R.R. has awarded the contract for repairing five bridges over the Cape May cutoff in this borough and Haddon Township to the Le CATO CONSTRUCTION CO., Audubon.

✚New Brunswick, N. J.—(Official)—The Board of Chosen Freeholders of Middlesex County has awarded the contract for the construction of a reinforced concrete bridge at Bryant St., Borough of Roosevelt, to HERMAN BROS., Roosevelt. Noted Oct. 15.

Trenton, N. J.—The Board of Chosen Freeholders of Mercer County has authorized the construction of a new bridge over Pond Run. Theodore Tobish, County Engr., will have charge of the work.

Woodbury, N. J.—The Board of Chosen Freeholders of Gloucester County has appointed a special committee to investigate conditions for building a new bridge over Woodbury Creek on the Crown Point Road.

Duquesne, Penn.—Press reports state that the Carnegie Steel Co., Pittsburgh, plans to build a steel viaduct over the railway tracks near the South Duquesne station, for the use of pedestrians.

Erie, Penn.—It is reported that the State Highway Department and the Commissioners of Erie County will spend about $250,000 for the construction of reinforced concrete arches and bridges to eliminate grade crossings along the Lake Shore & Michigan Southern Ry. in Erie County. Plans are almost completed for the work. E. M. Bigelow, Harrisburg, is State Highway Comr.

✚Shamokin, Penn.—The Commissioners of Northumberland County, Sunbury, have awarded the contract for the construction of a bridge over Shamokin Creek at Walnut St., Shamokin, to PETER BARR, Shamokin, at $7587.

✚Atlanta, Ga.—Press reports state that a contract for the construction of a viaduct connecting the Broad St. Viaduct and the Forsyth St. Viaduct, to be built along the north side of the railway tracks, has been awarded to the GRIFFIN CONSTRUCTION CO. R. M. Clayton is City Engr.

✚Danielsville, Ga.—The Commissioners of Elbert and Madison Counties have awarded the contract for the construction of a steel bridge over the Broad River at Moore's Shoals near Carlton to the EAST ST. LOUIS BRIDGE CO., East St. Louis, Ill., at $10,195. Noted Oct. 1.

St. Augustine, Fla.—Bids will be received until Nov. 16 by the Commissioners of St. John County for the construction of a concrete bridge. The J. B. McCrary Co., Atlanta, Ga., is Engr.-in-Charge. W. Wallace Snow, St. Augustine, is Clk. of Comrs.

★Crawley, La.—(Official)—Bids will be received until noon, Nov. 28, by the Police Jury of Acadia Parish, for the construction of two steel bridges with concrete abutments, and necessary timber and earth approaches. J. K. Toler is Clk. of the Police Jury.

★New Orleans, La.—The following bids were opened Oct. 26 by the city for the construction of a Strauss trunnion bascule bridge over the New Basin Canal at City Park Ave.: Sterling Engineering Co., $40,985; Penn Bridge Co., $34,800; Midland Bridge Co., $38,787; Missouri Bridge & Iron Co., $40,233. A. G. Ricks is Comr. of Pub. Finances. Noted Oct. 1.

✚Chattanooga, Tenn. — (Official) — The Tennessee River Bridge Committee has awarded the contract for the concrete substructure of the Market St. Bridge to the VANG CONSTRUCTION CO., Cumberland, Md., at $342,491. The contract for the Scherzer rolling bascule has been awarded to the TOLEDO BRIDGE & CRANE CO., Toledo, Ohio, at $119,096. Partial list of bidders noted Oct. 29.

Georgetown, Ky.—The Queen & Crescent Route contemplates building a viaduct at Georgetown over Clayton Ave. extended. C. Dougherty, Cincinnati, Ohio, is Ch. Engr.

✚Birmingham, Ohio—The Board of Commissioners of Erie County, Sandusky, has awarded the contract for placing a creosoted wood block floor on Bridge F-202, near Birmingham, to the STANDARD ENGINEERING CO., Toledo, at $4990. Noted Oct. 8.

Bloomington, Ill.—The Board of Commissioners of McLean County is considering the construction of a bridge over the North Fork of Salt Creek on the county line.

✚Madison, Wis.—(Official)—The State Highway Commission has awarded the contract for constructing a six-span plate girder bridge to the WORDEN ALLEN CO., Milwaukee, at $9500. M. W. Torkelson is State Bridge Engr.

✚New Ulm, Minn.—A contract for tiling, culverts and bridges on State Highway No. 54, Brown County, has been awarded to OTTO NEITGE at $11,577.

Armour, S. D.—Bids will be received, until Nov. 10, by C. F. Meyer, Audr. of Douglas County, for the construction of corrugated iron or steel culverts and for bridge work during 1915.

Bellefourche, S. D.—Bids will be received, until 2 p.m., Nov. 17, by F. E. Bennett, Audr. of Butte County, for the construction of wood and steel bridges in the county during the coming year.

Castlewood, S. D.—Bids will be received, until Nov. 18, by Guy Osborn, Audr. of Meade County, for county bridge construction during 1915.

Elk Point, S. D.—Bids will be received, until Dec. 24, by Edward Holden, Audr. of Union County, for bridge construction during 1915.

Volga, S. D.—Bids will be received, until Nov. 17, by F. H. Ripley, Audr. of Brookings County, for the construction of all county bridges during 1915.

Harrisburg, Tex.—The Commissioners Court of Harris County, Houston, has instructed the County Engineer to prepare two sets of plans for a bridge, one for a steel structure and the other of reinforced concrete, across Brays Bayou at Harrisburg on the Houston- La Porte Road. H. L. Washburn, Houston, is County Audr.

✚Watonga, Okla.—The Board of Commissioners of Blaine County has awarded the contract for the construction of two bridges over the North Canadian River to the BOARDMAN BRIDGE CO., Oklahoma City, at $4425.

✚Buckley, Wash.—The Commissioners of King and Pierce Counties have awarded the contract for furnishing the steel for the bridge over the White River at Buckley to C. W. RAYNOR, 804 Spalding Bldg., Portland, Ore., at $11,625. List of bidders noted Oct. 15. The bridge will be built by day labor.

✚Portland, Ore.—The City Commission has awarded the contract for repairs to the Grand Ave. Bridge over Sullivan's Gulch to JEFFREY & BUFTON at $7990. Noted Aug. 27.

✚The Dalles, Ore.—The Board of Commissioners of Wasco County has awarded the contract for the construction of two reinforced-concrete bridges over Eight-Mile Creek, east of The Dalles, at Hewitt Place and Waterman Place, to ALBERT FREDERICK, The Dalles, at $12.90 per cu.yd. for concrete and $3.30 per 100 lb. for iron.

Westport, Ore.—The Columbia & Nehalem R.R. has had plans prepared for a trestle near Westport. It will be about 1950 ft. long.

Fairfax, Calif.—Bids will be received, until Nov. 10, by the Board of Supervisors of Marin County, San Rafael, for the construction of a reinforced-concrete bridge on the Bolinas Road, near Fairfax.

✚Fairfield, Calif.—(Official)—The Supervisors of Solano and Yolo Counties have awarded the contract for the construction of a bridge over Putah Creeek, on the State Highway, to the CLINTON FIREPROOFING CO., San Francisco, at $30,500. Noted Oct. 8.

✚San Jose, Calif.—(Official)—The Board of Supervisors of Santa Clara County has awarded the contract for the construction of a pony truss bridge over Uvas Creeek, on the Bodfish Mill Road, to W. L. GILLHAM & SON, San Jose, at $4157. Other bidders were: Security Construction Co., $4368; John Doyle, $4887; R. H. Jamison, $4915; Peterson & Grier, $4870. Noted Oct. 15.

Ottawa, Ont.—(Official)—We are advised that plans for the [illegible] are being revised and no date for [illegible] has been set. Archibald Currie is City Engr. Noted Oct. [illegible].

WATER SUPPLY—IRRIGATION

Troy, N. H.—[illegible] & Sawyer, Engrs., Manchester, have been retained by the city to prepare plans for the construction of a gravity water system.

Boston, Mass.—Bids will be received by the Public Works Department until Nov. 18 for laying two miles of 16-in. high-service pipe in South Boston. L. K. Rourke is Comr.

Warren, Mass.—The town contemplates installing a water system. The question will be voted on at the annual town meeting in March.

New York, N. Y.—The State Conservation Commission has granted permission to New York to impound the water from [illegible] Creek. The city will build a reservoir at Plattsville capable of supplying [illegible] gal. a day.

Watervliet, N. Y.—The city will install a filtration plant estimated to cost $[illegible]. Frank Koss is City Engr. Noted May 2[illegible].

Burlington, N. J.—The Common Council plans to make improvements to the water works. New pumping machinery will be installed and the plant will be converted from steam to electricity.

Hopewell, N. J.—The Borough Council has authorized the issuance of $[illegible] in bonds, the proceeds of which to be used for the improvement of the water system.

Trenton, N. J.—The Water Department is considering the enlargement of its [illegible] reservoir so as to increase the capacity by [illegible] gal. Alvin Hughes is Supt.

Woodstown, N. J.—(Official)—Bids will be received by the Water Committee of the Council until Nov. 16 for drilling one [illegible]-in. well. J. H. [illegible] is Borough Clk. For details see advertisement under "Contracts To Be Let."

Bristol, Penn.—Plans are being prepared by W. H. Boardman, Engr., [illegible] Walnut St., Philadelphia, for the construction of a reservoir and a pumping plant for Bristol.

New Castle, Penn.—The Council contemplates issuing bonds for $[illegible], the proceeds of which will be used for the acquisition of a water system.

Philadelphia, Penn.—Contracts have been awarded by the Department of Public Works for turbo-centrifugal pumps for Torresdale and Wentz Farm to SOUTHWARK FOUNDRY & MACHINE CO. at $[illegible] for item one and at $2280 for item two and to [illegible] CENTRIFUGAL PUMP & MACHINE CO. at $16,2[illegible] for item three. Bids opened Oct. 6. Noted Oct. 1.

Baltimore, Md.—(Official)—Bids will be received until 11 a.m., Nov. 1[illegible], by the Board of Awards for heating systems for the filtration plant and high service pumping station.

Benwood, W. Va.—The citizens contemplate issuing bonds, the proceeds of which to be used for the construction of a water system.

North View (Clarksburg post office), **W. Va.**—Bids will be received by the Recorder until Nov. 1[illegible], for the purchase of $[illegible] in bonds, the proceeds of which to be used for the installation of a water system.

Mullins, S. C.—(Official)—Bids were received, Oct. 2[illegible], for the construction of a water and sewer systems. The following are the low bidders: Pumping station, complete, Municipal Improvement Co., Augusta, Ga., $1767; centrifugal pump and motor, [illegible] Harleston, Jr., $1110; triplex pump and gasoline engine, J. R. [illegible], $16[illegible]; laying pipe, Municipal Improvement Co., $[illegible]; furnishing valves and hydrants, Columbus Iron Works, $[illegible]; furnishing c. i. pipe, Glamorgan Pipe & Foundry Co., $12,416; tower and tank, J. S. Schofield's Sons Co., $[illegible]; sewer construction, Municipal Improvement Co., $[illegible]; furnishing terra cotta pipe, Georgia Vitrified Brick & Clay Co., $[illegible]. Gilbert C. White is Engr. Noted Oct. [illegible].

Marianna, Fla.—Bonds for $[illegible] for the construction of a water system and electric-light plant have been voted by the citizens. [illegible] is Mayor.

Camp Hill, Ala.—The contract for constructing a water system has been awarded by the city to [illegible] & [illegible] at $[illegible]. Bids opened Oct. 1[illegible]. Noted Oct. [illegible].

Georgiana, Ala.—The contract for constructing a water system has been awarded by the city to J. B. McCRARY CO., Atlanta, Ga., at $[illegible]. Noted Oct. [illegible].

Dresden, Tenn.—At an election to be held Nov. [illegible], the citizens will vote on the question of issuing bonds for $[illegible], the proceeds of which to be used for the construction of a water system and electric-light plant.

Newport, Tenn.—Bonds for $[illegible] for the extension of the water system have been voted.

Madisonville, Ky.—The contract for constructing a reservoir [illegible] has been awarded by the Board of [illegible] to [illegible] at about $[illegible].

Archbold, Ohio.—Contracts for the installation of the water system have been awarded to H. D. HALLETT, [illegible], at $[illegible].

Cleveland, Ohio.—[illegible] will be received until [illegible] for the [illegible] and [illegible] for [illegible] plant.

Medina, Ohio.—[illegible]

Pataskala, Ohio.—Plans are being prepared by [illegible] for the construction of a water system. The estimated cost is $[illegible].

West Salem, Ohio.—[illegible]

Wyoming, Ohio.—Bids will be received until [illegible] Nov. 1[illegible] [illegible] for making improvements to the water system.

Earlville, Ill.—The citizens contemplate spending $14,000 for the improvement of the water system.

Kansas, Ill.—The contract for erecting a steel tower and tank has been awarded by the Board of Trustees to CHICAGO BRIDGE & IRON WORKS, Chicago. Bids opened Oct. 12. Noted Oct. 8.

Sparta, Ill.—The Sparta Water Supply Co., recently incorporated with $2[illegible] capital, will construct a complete water system. E. H. McGuire is interested.

Milwaukee, Wis.—Contracts for the construction of the Lake Shore intake tunnel will not be awarded until 1915. Noted Oct. 8.

Iowa Falls, Iowa.—Bids will soon be received by E. L. Marriage, City Mgr., for [illegible] ft. of 6- to 4-in. c. i. water pipe. The estimated cost is $6[illegible].

Rockwell City, Iowa.—The contract for making extensions to the water system has been awarded by the city to BLACK HAWK CONSTRUCTION CO., Waterloo. Noted Aug. 27.

Ely, Minn.—Contracts for installing a 3[illegible]-gal. steel tank and for a pumping engine have been awarded by the city to DES MOINES BRIDGE & IRON CO., Des Moines, at $15,[illegible]2 and to PLATT IRON WORKS CO., Dayton, Ohio, at $[illegible] respectively. Bids opened Oct. 5. Noted Oct. 1.

Hibbing, Minn.—The contract for laying two miles of water mains and constructing a reservoir has been awarded to BUTLER-COONS CONTRACTING CO., Hibbing. Noted Oct. 1.

Holton, Kan.—Plans have been prepared by Worley & Black, Kansas City, Mo., for the installation of a water system, estimated to cost $[illegible]. C. E. Mitchell is City Clk.

Medicine Bow, Wyo.—Bids will be received until Nov. 7, by the Town Council for the construction of a water system. C. C. Carlisle, First National Bank Bldg., Cheyenne, is Engr. Noted Sept. 10.

Powell, Wyo.—C. H. Green & Co., Spokane, Wash., is preparing plans for the construction of a gravity water system. W. A. Daming is Town Clk.

Joliet, Mont.—The Joliet Water Co. will make extensions to its water system. Pipes will be laid to the main channel of Rock Creek and a concrete reservoir will be built.

Harrison, Ark.—An election will be held Dec. 2[illegible] to vote on the question of issuing bonds for $[illegible], the proceeds of which to be used for the purchase and enlargement of the water and sewer systems. Noted Jan. 1[illegible].

Texarkana, Ark.—The city contemplates installing a municipal water system.

Tillar, Ark.—A water system will be constructed in Water Improvement District No. 1.

Central Park (Houston post office), **Tex.**—The Council will soon call an election to vote on the question of issuing bonds, the proceeds of which will be used for the construction of a water system.

Cleburne, Tex.—Press reports state that the Gulf, Colorado & Santa Fe Ry. has appropriated $16,446 for the drilling of a deep well and equipping with pumping machinery. F. Merritt, Galveston, is Ch. Engr.

Electra, Tex.—(Official)—The contract for erecting a 60,000-gal. water tank and tower has been awarded by the city to CHICAGO BRIDGE & IRON CO., Chicago, Ill. Joseph F. Overbey is Engr. Noted Oct. 1.

Magnolia Park (Houston post office), **Tex.**—An election will be held Nov. 1[illegible], to vote on the question of issuing bonds for $150,000, the proceeds of which will be used for the construction of a water system. Noted Aug. 27.

McKinney, Tex.—The contract for constructing a water works and electric-light plant has been awarded by the city to J. E. COOPER, McKinney, at $[illegible].

Morris, Okla.—Bids will be received, until 6 p.m., Nov. 16, by the Board of Trustees for constructing a water system. The estimated cost is $[illegible]. The contractor will be paid in bonds. The Benham Engineering Co., Oklahoma City, is Engr. Noted Apr. 2[illegible].

Oklahoma City, Okla.—The City Commission will call an election to vote on the question of issuing $[illegible] in bonds, the proceeds to be used for the construction of water reservoirs. [illegible] McCl[illegible]re is City Engr.

Boise, Idaho.—Plans for the extension of the water system to cover the entire South Side section are being prepared for the Boise Artesian Hot & Cold Water Co., Boise.

Camas, Wash.—The Camas Water Co. has been incorporated by [illegible], Camas, [illegible], Portland, Ore., and H. L. [illegible], Vancouver, B. C., with $[illegible] capital. The company will construct a water system to supply Camas.

Morton, Wash.—The Council contemplates spending $[illegible] for the installation of a municipal water system.

Baker, Ore.—See item under Light, Heat and Power.

Arcadia, Calif.—[illegible], City Engr., is preparing plans for construction of a water system to cost $[illegible].

Glendora, Calif.—Plans are being prepared by Floyd G. [illegible], City Engr., Central Bldg., Los Angeles, for the construction of a water system, estimated to cost $[illegible]. Noted Oct. 1.

San Diego, Calif.—Bids will be received until 10 [illegible] a.m., Nov. [illegible], by [illegible], Supt. Dept. of Finance, for material for the installation of a filtration plant on the lower Otay [illegible]. Noted Oct. [illegible].

San Diego, Calif.—The contract for steel riveted pipe for the [illegible] line has been awarded by the Council to WESTERN PIPE & STEEL CO. at $[illegible].

Susanville, Calif.—An election will soon be held to vote on the question of issuing bonds for the construction of a municipal water system.

Bartonville, Ont.—See item under "Sewers."

Regina, Sask.—The Council has authorized the preparation of plans for the construction of a [illegible]-gal. reservoir.

SEWERS

Boston, Mass.—Bids will be received by the Public Works Department until Nov. 6 for constructing sewers and drains in Powellton St. and Columbia Rd. L. K. Rourke is Comr.

Bids will be received until Nov. 10, by the Public Works Department for constructing sewers and drains in Westmoreland St. and Wellington Way, Dorchester District, and for constructing sewers in East Boston. L. K. Rourke is Comr.

Bronxville, N. Y.—A sewer will be constructed in Kraft Ave. Plans have been approved by the State Conservation Commission for this work.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by L. H. Pounds, Borough Pres., until 11 a.m., Nov. 6, for constructing sewers in various streets.

+(Borough of Brooklyn)—(Official) — Bids were received Oct. 27, by L. H. Pounds, Pres. of the Borough and contracts have been awarded as follows: To MURPHY BROS., for constructing sewers in 17th St., at $2844, in 13th St., at $2180, in 11th Ave., at $1017, in East 13th St., at $916, in Williams Ave., at $707, and for house connections at $633; and to PAINO BROS., for a sewer in 71st St. at $1881. Noted Oct. 22.

(Borough of Richmond)—(Official)—Bids will be received by Charles J. McCormack, Borough Pres., until noon, Nov. 10 for constructing temporary and permanent combined sewers in various streets and for grading and repairing the walks on Charles Ave. between Lafayette and Nicholas Ave.

New York, N. Y.—The city will rebuild the sewers in Wall and Liberty St., according to press reports. The estimated cost is $18,000.

Ogdensburg, N. Y. — The State Conservation Commission has approved plans for the construction of a trunk sewer in Monroe Ave. George A. Tate is City Engr.

Syracuse, N. Y.—See item under "Miscellaneous."

Wappingers Falls, N. Y.—Plans have been approved by the State Conservation Commission for the construction of sewer and water systems at Wappingers Falls.

Westfield, N. Y.—Plans have been approved by the State Conservation Commission for the extension of sewers in Jackson, Davis and Billsborow St.

Camden, N. J.—Bids will be received by the City Council until Nov. 20 for constructing sewers in the Rosedale district.

Jersey City, N. J.—(Official)—Bids were received Oct. 29, for constructing a 48-in. c.-i. pipe sewer in Secaucus Rd. and Tonnelle Ave. as follows: Clinton Contracting Co., 97% of standard; Edward P. O'Neill, 97% of standard; James McAvoy, 124% of standard; Robert Maddington & Sons, 112% of standard; and Charles T. Kavanaugh, Inc., 99½% of standard. Noted Oct. 22.

Madison, N. J.—(Official)—Bids will be received until 8 p.m., Nov. 6 by the Sewer Committee for constructing a sewer in Howell St. from Brittin to Locust St. Robert H. Holmes is Chn.

Cairnbrook, Penn.—(Official)—A sewer system and sewage treatment plant will be constructed at Cairnbrook. Plans have been approved by the State Department of Health.

Downingtown, Penn.—(Official)—Plans are being prepared by Herbert W. Hutton, Engr., Equitable Bldg., Wilmington, Del., for the installation of a sewage disposal plant and sewer system. Noted Oct. 22.

Gallitzin, Penn.—The Borough Council has been advised by the State Health Commission to construct a sewage disposal plant to be in operation by July, 1917.

Kutpmont, Penn.—(Official)—The village will install a sewer system. Plans have been approved by the State Department of Health.

Philadelphia, Penn.—(Official)—The State Department of Health has approved plans for the construction of lateral sewers in Philadelphia.

Reading, Penn.—(Official)—Plans for the construction of a sewage treatment plant in Lower Heidleburg Township have been approved by the State Department of Health.

Sharon Hill, Penn.—An election will soon be held to vote on the question of issuing bonds for $10,000 for the extension of the sewer system.

Stroudsburg, Penn.—(Official)—Barrett Township will construct an addition to its sewage treatment plant. Plans for this work have been approved by the State Department of Health.

Upper Darby, Penn.—The city contemplates spending $150,000 for the construction of sewers and making other improvements.

★**Mullins, S. C.**—See item under "Water Supply and Irrigation."

Marianna, Fla.—The citizens voted against the question of issuing bonds for the construction of sewers.

+**Miami, Fla.**—The contract for constructing sanitary sewers has been awarded to J. J. QUINN & CO., Bedford, Ind., at $122,077. Bids opened Oct. 15. Noted Sept. 24.

+★**Tampa, Fla.**—(Official)—The contract for constructing sewers in Section 8, Hyde Park, has been awarded by the Board of Commissioners to BENJAMIN THOMPSON, Tampa, at $90,984. Other bids were Bryan & Co., Jacksonville, $98,180; Michler & Flynn, Nashville, Tenn., $96,612; and J. C. McNeill, Tamps, $98,700. D. B. McKay is Mayor. Noted Oct. 22.

+**Camp Hill, Ala.**—The contract for constructing a complete sewer system has been awarded to SULLIVAN, LONG & HAGERTY, Bessemer, Ala., at $7996. Bids opened Oct. 15. Noted Oct. 15.

★**Canton, Ohio**—(Official)—Bids will be received by Z. W. Kent, Dir. of Pub. Ser., until noon, Nov. 11, for constructing the main sewer to the new sewage disposal plant. For particulars, see advertisement under "Contracts to Be Let."

Chillicothe, Ohio—Bids will be received by the City Auditor, until Nov. 16, for the sale of $31,000 in bonds for constructing Honey Creek Sewer No. 4.

+**Cincinnati, Ohio**—A contract for constructing sewers in Dewey, Gilsey and Sargent Ave. has been awarded to the KIRCHNER CONSTRUCTION CO., 221 West Ninth St., at $14,337.

East Youngstown, Ohio—(Official)—Bids will be received by G. R. Anderson, Village Clk., until noon, Nov. 13, for constructing a sewer in Wilson Ave.

Painesville, Ohio—Bids will be received by the Board of Public Service, until Nov. 15, for constructing a santiary sewer.

Atlanta, Ill.—Plans have been prepared by Melluish & Broyhill, Bloomington, Ill., Consult. Engrs., for constructing a sewer system. About two miles of pipe will be required.

+**Peoria, Ill.**—(Official)—A contract for constructing one sanitary and one storm sewer has been awarded to GREEN & SONS CO., Ottawa, Ill., at $26,918. Other bids were: Bainewalt Construction Co., Peoria, Ill., $26,986; Yale & Reagan, Chicago, Ill., $26,989; E. R. Harding Co., Racine, Wis., $27,673; A. C. Comstock & Co., Cedar Rapids, Iowa, $27,987; A. D. Thompson Co., Peoria, Ill., $28,157. Noted Oct. 22.

+**Kewaunee, Wis.**—The contract for constructing a sewer in Harrison St. has been awarded to MULHOLLAND & SON.

Madison, Wis.—Bids will be received by O. S. Norsman, City Clk., until Nov. 13, for constructing a storm sewer in Bassett St. E. E. Parker is City Engr.

+**Racine, Wis.**—A contract for constructing two large trunk sewers has been awarded to E. R. HARDING CO.

+**Pine City, Minn.**—(Official)—A contract for constructing a sanitary sewer system has been awarded to ROGERS & McLEAN, Duluth, Minn., at $5788. Noted Oct. 22.

+**Glendive, Mont.**—The contract for installing sewers in district between Minnesota and Fifth St. South, and South 23d and 27th St. to FRANK SAVARSEY, at $8886.

+**Lewistown, Mont.**—A contract for constructing sewers in Districts Nos. 36, 37, 38 and 39 has been awarded to L. W. SCHRUTH, at $12,843.

+**Aurora, Mo.**—(Official)—A contract for constructing a sewage and purification system has been awarded to McCOY & TAYLOR, Avilon Hotel, Kansas City, Mo., at $19,907. Other bids were: W. McElroy, Fort Scott, $23,585; Horton Concrete Construction Co., Kansas City, $22,001; Launder & Gessner, Kansas City, $25,629; Clements & Lourey, Coffeyville, $21,265; Middleton & Ludlow, Kansas City, $23,147; O'Neil Construction Co., Leavenworth, $22,984; Everett & Burt, Hutchinson, Kan., $27,234; Inter-Mountain Bridge & Construction Co., Tecumseh, Neb., $27, 669. Noted Oct. 15.

Harrison, Ark.—An election will be held, Dec. 22, to vote on the question of issuing $90,000 in bonds, the proceeds of which will be used for constructing a sewer system, purchasing and enlarging water-works.

+**Pocatello, Idaho**—The City Trustees have awarded a contract for sewer work to R. M. BARSDEN, Butte, Mont., at $84,297.

Montavilla, Ore.—Bids will soon be received for the construction of a new sewer known as the Willow and East 82d St. branch. The estimated cost is $183,000.

Chino, Calif.—Plans for the proposed sewer system have beeen prepared by Olmstead & Gillelen, Hollingsworth Bldg., Los Angeles. The estimated cost is $50,000.

+**Los Angeles, Calif.**—According to press reports, the contract for constructing a sewer in Vermont Ave., between Florence Ave. and 65th St., has beeen awarded to MLAGENOVICH & GILLESPIE, at $20,000.

+**Sacramento, Calif.**—(Official)—The contract for constructing trunk line sewer, Sects. A and B, Unit No. 1, has been awarded to the ROSS CONSTRUCTION CO., at $52,8777.

Sacramento, Calif.—Bids will soon be received by the City Commission for constructing the second unit of the suburban sewer along Riverside Rd. to Maple Park.

Ventura, Calif.—The Board of Trustees has instructed the City Engineer to prepare plans for the construction of a storm sewer in Oak St. The cost is estimated at $24,000.

Visalia, Calif.—An election will soon be held to vote on the question of issuing $108,000 in bonds for extending the sewer system.

Bartonville, Ont.—Plans are being prepared by A. F. McCallum, City Engr. of Hamilton, Ont., for a $20,000 sewage system and a $50,000 waterworks system.

Cobalt, Ont.—The Town Council contemplates constructing one mile of 15-in. sewer. Code & Code, Cobalt, Ont., is the Engr.

+**Hamilton, Ont.**—A contract for sewer pipe has beeen awarded to McALLISTER & CO., Toronto, at approximately $16,000.

+**Toronto, Ont.**—The contract for constructing the sewer in Argyle St. has been awarded to the GAWNE CONTRACTING CO., at $36,800.

Toronto, Ont.—(Official)—Bids will be received by H. C. Hocken, Chmn., Bd. of Control, until noon, Nov. 10, for constructing a number of sewers in various streets.

Vancouver, B. C.—Bi is will soon be received by the City Council for constructing sewers on six streets. The estimated cost is $25,000. F. L. Fellows is Engr. In-Charge.

GARBAGE

Miami, Fla.—(Official)—Bids will be received, until Nov. 19, by the city for machinery for a garbage disposal plant; two tons per hour capacity. John R. Baylis, 704 Farley Bldg., Birmingham, Ala., is the Engr.

Norwood, Ohio—The Public Service Commission has submitted a report recommending and directing the purchase of a garbage disposal plant. The Director of Public Service has been authorized to call for bids. The estimated cost is $30,000.

Steubenville, Ohio—Bids will be received by Henry H. Henderson, Dir., Pub. Serv., until Nov. 16, for re-building the incinerating furnaces of the city garbage plant.

+**San Francisco, Calif.**—The Panama-Pacific International Exposition Co. has awarded a contract to C. D. CHOLWELL, at [illegible], for the construction of a garbage disposal plant.

STREETS AND ROADS

Boston, Mass.—Bids will be received until Nov. 6 for [illegible] on [illegible] and [illegible] St. and [illegible] Paisley Park [illegible] District. [illegible]

+**Boston, Mass.**—The contract for excavating and grading [illegible] St., [illegible] District, has been awarded to JOHN KELLY CO., [illegible]. Other bids were: James Doherty, $10,-[illegible]; Hugh Nawn Contracting Co., $11,[illegible]; J. C. Coleman & Sons Co., $[illegible]; W. J. Berry, $1[illegible]; Coleman Bros., $12,-[illegible]; John F. [illegible], $12,[illegible]; D. M. [illegible] & Co., $14,[illegible]; John McCourt Co., $[illegible]; M. De Sesto, $1[illegible].

+The contract for a bituminous macadam roadway in [illegible] St., West Roxbury District, has been awarded to MARTINO DE MATTEO, at $14[illegible]. Other bids were: John Kelly Co., $1[illegible]; James Doherty, $1700; West Roxbury Trap Rock Co., $1[illegible]; W. J. Rafferty Co., $[illegible]121; Hugh J. Masters, $[illegible]; John F. Lynch, $[illegible].

Hartford, Conn.—Contracts for state road work, bids for which were received by the State Highway Commissioner, Oct. [illegible], have been awarded as follows:

[illegible] Township—A section of native stone macadam construction on the Norwich-Westerly Turnpike, to AMOS D. BRIDGE'S SONS, INC., Hazardville, Conn., at $8000.

[illegible] Township—About [illegible] lin. ft. native stone macadam construction on the Plainfield Road, to AMOS D. BRIDGE'S SONS, INC., Hazardville, Conn., at $77[illegible].

Morris Township—A section of gravel construction on the East Morris Road, to JOHN DE MICHIEL & BRO., Torrington, Conn., at $[illegible].

[illegible] Township—A section of gravel construction on [illegible] Ave., to the FRAMINGHAM CONSTRUCTION CO., South Framingham, Mass., at $[illegible].

Coventry Township—A section of native stone macadam construction on the Willimantic Road, to AMOS D. BRIDGE'S SONS, INC., Hazardville, Conn., at $6649. Noted Sept. 1[illegible] and 24.

Albany, N. Y.—Bids were received by the State Highway Commission, [illegible] St., Oct. 3[illegible], for the construction of [illegible] highways by state aid, as follows:

Road No. [illegible]17-A, Chautauqua County, 6.82 miles—Thurman W. [illegible], [illegible], Vt., $106,804; Ontario Roads Co., Manchester, N. Y., $1[illegible]178; K. A. Culkin & Co., Oswego, N. Y., $1[illegible]; Lawrence Schultze, Fredonia, N. Y., $100,198; Harry B. Harrison, East Rochester, N. Y., $10[illegible]16.

Road No. [illegible]-A, Chautauqua County, [illegible]96 miles—Ontario Roads Co., Manchester, N. Y., $92,887; Edward T. Beck & Co., Warren, [illegible], $92,1[illegible]; Harry B. Harrison, East Rochester, N. Y., $9[illegible]16; J. A. Culkin & Co., Oswego, N. Y., $93,619.

Road No. [illegible]63-A, Chautauqua County, [illegible] miles—Harry B. Harrison, East Rochester, N. Y., $95,167; Thomas Mahoney, Jamestown, N. Y., $95,[illegible]; Edward T. Beck & Co., Warren, [illegible], $[illegible]; Ontario Roads Co., Inc., Manchester, N. Y., $[illegible].

Road No. [illegible], Clinton County, 11.85 miles—Beede Bros., Keene Valley, N. Y., $114,1[illegible]; Gruner & Hallenbeck, Harriman, N. Y., $124,431; Amos D. Bridge's Sons, Inc., Hazardville, Conn., $112,127; Samuel Reskin, Beacon, N. Y., $108,6[illegible]; [illegible] Co., Chateaugay, N. Y., $10[illegible],387; John H. Gordon, Albany, N. Y., $111,[illegible], and 13 others.

Road No. 11[illegible], Erie County, [illegible] miles—Flower City Contracting Co., Rochester, N. Y., $1[illegible],566; Thomas F. Shaughnessy, Albany, N. Y., $132,710; Henry P. Burgard Co., Buffalo, N. Y., $1[illegible]; [illegible] Dugan Son, Olean, N. Y., $135,[illegible]; Alfred L. [illegible], Binghamton, N. Y., $1[illegible]; Brooks & Julian, Rochester, N. Y., $1[illegible], and 1[illegible] others.

Road No. [illegible], Erie County, 6.7[illegible] miles—Rich Construction Co., [illegible], N. Y., $[illegible]; Cheektowaga Construction Corporation, Buffalo, N. Y., $[illegible]; Frank L. Cohen, Buffalo, N. Y., $[illegible]; [illegible] & [illegible], Rochester, N. Y., $[illegible]; [illegible] Construction Co., Buffalo, $[illegible]; Bridgeport Construction Co., Poughkeepsie, N. Y., $1[illegible]; Harry B. Harrison, East Rochester, N. Y., $[illegible], and 10 others.

[illegible]

Construction Co., Hornell, N. Y., $39,937; Brooks & Julian, Rochester, N. Y., $39,[illegible]; C. O. McComb, Syracuse, N. Y., $39,-6[illegible], and nine others.

Road No. [illegible]1, Oneida County, [illegible].70 miles—J. G. Hayes, Hornell, N. Y., $[illegible],221; Frank L. Cohen, Buffalo, N. Y., $59,[illegible]; James Anderson, Albany, N. Y., $[illegible],614; Newport Construction Co., Herkimer, N. Y., $[illegible],977; John P. Dugan Co., Amsterdam, N. Y., $[illegible],932; Gruner & Hallenbeck, Harriman, N. Y., $[illegible]; Paddleford & King, Sherburne, N. Y., $[illegible], and seven others.

Road No. [illegible]78-A, Rensselaer County, 3.66 miles—J. P. [illegible], Albany, N. Y., $[illegible]; Gifford Construction Co., Jamaica, N. Y., $42,[illegible]; Langan Construction Corporation, Albany, N. Y., $[illegible]; Murray Construction Corporation, Troy, N. Y., $[illegible]; Thomas F. Shaughnessy, Albany, N. Y., $[illegible]; Bellotte & Marchese, Troy, N. Y., $[illegible], and six others.

Road No. 121[illegible], Schoharie County, [illegible].16 miles—George H. McAvoy, Creek Locks, N. Y., $3[illegible],666; L. B. Harrison, New York, $3[illegible],128; Frank E. Gore, New York, $[illegible]; S. V. Van Wagonen, Rondout, N. Y., $[illegible],160; State Highway Construction Co., Beacon, N. Y., $[illegible]3,172; St. Lawrence Construction Co., Albany, N. Y., $31,066; Bridgeport Construction Co., Poughkeepsie, N. Y., $31,524; James Garafano & Sons, Inc., Mt. Vernon, N. Y., $31,847; Lane Construction Corporation, Meriden, Conn., $33,[illegible]39, and two others.

Road No. [illegible]286-A, Schoharie County, 0.62 mile—Frank E. Gore, New York, $11,0[illegible]2; Were & Gaspary, N. Y., $[illegible].

Road No. 986, Sullivan County, 10.[illegible]7 miles—Ruddy Saunders Construction Co., Troy, N. Y., $119,[illegible]; M. R. Aldrich, Poughkeepsie, N. Y., $107,986; Bridgeport Construction Co., Poughkeepsie, N. Y., $101,314; Stanley Construction Co., Buffalo, N. Y., $113,328; Frank P. Gore, New York, $113,[illegible]; Hembdt & Washington, Monticello, N. Y., $112,[illegible]; C. W. Tyrone, Boyntonville, N. Y., $109,821; Schunnemunk Construction Co., Highland Mills, N. Y., $116,256; A. Vito Construction Corporation, Thompson, Conn., $1[illegible],847; L. B. Harrison, New York City, $122,847; Haves Benedict, Williamsport, Penn., $124,1[illegible]; A. Brazos & Son, Inc., Middletown, Conn., $112,661; Samuel Reskin, Beacon, N. Y., $114,386.

Road No. [illegible]06, Broome County, 1.[illegible]7 miles—Tyne & Willey, Binghamton, N. Y., $62,[illegible]38; Frank E. Gore, New York, $63,[illegible]02; Greenfield Construction Co., Hornell, N. Y., $6[illegible]; L. B. Harrison, New York, $66,[illegible]94; Stanley Construction Co., Buffalo, N. Y., $60,799; John Johnson Construction Co., Buffalo, N. Y., $62,507; McGreevey, McGuigan & [illegible], Elmira, N. Y., $61,476; Paddleford & King, Sherburne, N. Y., $[illegible]; Arthur D. Osborne, Binghamton, N. Y., $61,1[illegible]1; C. D. [illegible], Albany, N. Y., $61,029; John Kelly, Elmira, N. Y., $61,0[illegible].

Road No. 1145, Onondaga County, 0.76 mile—C. T. H[illegible]way Construction Co., Syracuse, N. Y., $[illegible]6,9[illegible]; Samuel Rosen, Syracuse, N. Y., $26,733.

Road No. [illegible]21, Herkimer County, [illegible].27 miles—S. V. Van Wagonen, Rondout, N. Y., $50,2[illegible]; Stanley Construction Co., Buffalo, N. Y., $47,[illegible]31; James Garafano & Son, Mt. Vernon, N. Y., $18,434; Newport Construction Co., Herkimer, N. Y., $19,663; James Anderson, Albany, N. Y., $[illegible]; Paddleford & King, Sherburne, N. Y., $19,196; Ruddy Saunders Construction Co., Troy, N. Y., $19,910, and 12 others.

+**New York, N. Y.**—(Borough of Brooklyn)—(Official)—Contracts have been awarded for improving East Seventh St. from Ditmas to 18th Ave., [illegible]dale Ave. from Riverdale to New Lots Ave., to H. KLEPPER, at $2127 and $[illegible]62[illegible], respectively. East Ninth St. from Ave. N to O, East 22d St. from Ditmas to Newkirk, East 23d St. from Ave. M to N, and East 24th St. from Ave. M to N, to the BROOKLYN ALCATRAZ ASPHALT CO., at $[illegible], $3[illegible]07, $4190 and $4190, respectively. East 22d St. from Ditmas to Newkirk Ave., to H. M. MENDATTO, at $27[illegible]. Noted Oct. 2[illegible].

(Borough of Bronx)—(Official)—Bids will be received by Douglas Mathewson, Borough Pres., until [illegible] a.m., Nov. 10, for paving with bituminous concrete certain streets in the borough.

(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., until [illegible] p.m., Nov. 11, for repaving various streets in the borough. Sheet asphalt, wood block and granite block pavement will be used.

(Borough of Richmond)—(Official)—See item under "Sewers."

(Borough of Richmond)—(Official)—Bids will be received by Charles J. McCormack, Pres. Borough of Richmond, until noon, Nov. 10, for repaving with bituminous concrete Innis St. from John St. to Nicholas Ave.

Bids will also be received on that date for laying granite block pavement on Richmond Turnpike from [illegible] Ave. to [illegible] St., and for regrading Innis St. between Nicholas Ave. and John St., and resetting curbs and relaying cement sidewalks along the same.

(Borough of Brooklyn)—(Official)—Bids will be received by L. H. Pounds, Borough Pres., until 11 a.m., Nov. 11, for repaving with granite pavement certain streets. Bids will also be received for furnishing and delivering [illegible] bbl. portland cement.

+**West New York, N. J.**—The Town Council, Oct. [illegible], awarded the contract to PATRICK CURTIN and THOMAS CAVANAGH, West New York, for paving Palisade Ave. with asphalt, from 1[illegible]th St. to the Union Hill Township line. Noted Oct. [illegible].

+**Birmingham, Ala.**—The contract for [illegible] of the Jasper Rd. has been awarded to C. H. [illegible] at [illegible] per [illegible].

+**New Orleans, La.**—(Official)—A contract for constructing a [illegible] public highway from [illegible] to Washington Parish line, St. Tammany Parish, has been awarded to JOHN F. KENNEDY, [illegible], at $[illegible]. Other bids were: [illegible]

New Orleans, La.—The Commission Council has decided to pave [illegible] from [illegible] to [illegible] with pitch lake asphalt.

Jackson, Ky.—The City Council contemplates holding an election to vote on issuing $1[illegible] in bonds for macadamizing streets.

Louisville, Ky.—Bids will soon be received by the Board of Public Works for paving [illegible] St. from Fourth to Sixth St. with bituminous macadam.

+Louisville, Ky.—The contract for reconstructing Ninth St. from Magazine to Madison St. has been awarded to HENRY BICKEL CO., Louisville, at $10,500.

+Vanceburg, Ky.—A contract for constructing 1½ miles of water-bound macadam road has been awarded to JAMES I. HILL.

+Cincinnati, Ohio—(Official)—The contract for improving Humphrey's Hill, in Symes Township, and Hoover Road, in Whitewater Township, has been awarded to JAMES L. RADABAUGH, Montgomery, Ohio, at $5880. Noted Oct. 1.

+Columbus, Ohio—The State Highway Commission awarded contracts as follows:

Columbiana County, Unity-Salem Road, brick, MORGAN BROS., Ravenna, Ohio, at $7269.

Williams County, Sect. 1, Edon-Cooney Road, waterbound macadam R. M. MYERS, Attica, Ohio, at $12,999.

Stark County, Sect. F, Canton-Massillon Road, brick, F. L. COHEN, Buffalo, Ohio, at $56,200.

Lawrence County, Sect., Jackson-Ironton Road, J. C. GANNON, Ironton, Ohio, at $10,100.

Wayne County, Sect. M, Wooster-Massillon Road, brick, ENTERPRISING PAVING & CONTRACTING CO., Cleveland, Ohio, at $54,984.

Harrison County, Sect. 2, Cadiz-Carrollton Road, waterbound macadam. JOHN M. WHEELER, Cadiz, Ohio, at $11,343.

Hardin County, Sect. G, Roundhead-Ada Road, waterbound macadam. SOUSLEY & BOLSLIN, Ada, Ohio, at $6640.

Scioto County, Sects. G and H, Portsmouth-Columbus Road, brick and concrete. A. W. BURNS & CO., Columbus, Ohio, at $81,820.

Monroe County, Sect. F, Ohio River Road, concrete. FOSTER CONSTRUCTION CO., Richmond, Ind., at $18,888.

Butler County, Columbia Bridge Road, macadam. GARVER & WERTZ, Hamilton, Ohio, at $10,703.

Summit County, Cleveland-East Liverpool Road, brick. L. H. YOUNG CONTRACTING CO., Youngstown, Ohio, at $42,520.

+Girard, Ohio—The contract for paving a section of Prospect St. has been awarded to TURNER & OLSEN, Youngstown, at $6355. Noted Oct. 22.

+Greenspring, Ohio—The contract for paving West Adams St. has been awarded to LEE BROS., Clyde, Ohio, at $15,339.

+Hubbard, Ohio—The contract for paving South Main and East Liberty St. has been awarded to TURNER & OLSON, Youngstown, at $32,500.

+Indianapolis, Ind.—The contract for constructing a road on the line between White and Tippecanoe Counties has been awarded to BEN OILER, Battle Ground at $12,300.

+Paoli, Ind.—A contract for constructing a gravel road has been awarded to A. L. WAYRICK, French Lick, Ind.

+Spencer, Ind.—The contract for constructing the Lafayette Township Road has been awarded by the County Commissioners to WOOD & CARPENTER Spencer, Ind., at $7447. Noted Oct. 1.

+Detroit, Mich.—(Official)—Contracts have been awarded for paving Sterling Ave. from Holden Ave. to West Grand Blvd. to J. PORATH, at $5708. Other bids were: Otis Cement Construction Co., $5876; F. Porath & Son, $6291; E. Meredith Co.; $6994; T. E. Currie, $6266; Central Ave. from Lodge to Ferndale Ave. to OTIS CEMENT CONSTRUCTION CO., at $13,598: Other bids were: J. Porath, $14,606; F. Porath & Son, $14,841; E. Meredith & Co., $14,779; J. A. Mercier, $14,270; T. E. Currie, $15,030.

Chicago, Ill.—According to press reports the City Council contemplates constructing a boulevard to connect the north and south side boulevard systems. Estimated cost is $8,000,000.

+Galesburg, Ill.—The contract for repaving North Cedar St. has been awarded to J. B. McAULEY, at $29,178. The only other bid was that of P. H. Tiernan, at $29,389.

St. Louis, Mo.—(Official)—Bids will be received by the Board of Public Works, until noon, Nov. 10, for reconstructing Miami St. from Broadway to Oregon Ave. The estimated cost is $28,647. E. R. Kinsey is Pres. and W. T. Findly is Secy.

McKinney, Tex.—(Official)—Bids will be received by the County Commissioners until noon, Nov. 18 for constructing the McKinney-Celina Rd. Paul Creager is Engr.-in-Charge.

Temple, Tex.—(Official)—Bids will be received by the Commissioners Count of Bell County, Belton until 10 a.m., Nov. 13 for constructing a number of streets. W. E. Hall is County Audr.

+Tulsa, Okla.—(Official)—A contract for improving several streets has been awarded to F. P. McCORMICK, Tulsa, Okla. Noted Oct. 22.

+Denver, Colo.—A contract for constructing 8½ miles of road from Pagosa Springs to the top of the Wolf Creek Divide has been awarded by the State Highway Commission to LOWELL & LOGAN, Pagosa Springs, at $19,691.

+Salt Lake City, Utah—The contract for resurfacing Sixth East St. has been awarded to J. W. MELLEN, at $15,325. Other bids were: Strange & Maguire, $17,505; P. J. Moran, $16,761.

Kennewick, Wash.—The County Commissioners of Benton County plan to construct a road between Kennewick and Finley.

Seattle, Wash.—The City Council has authorized the paving with concrete Ewing St., Shoreland Drive, from Lake Park Drive to connect with existing pavement and for laying concrete sidewalks on Day St.

+Seattle, Wash.—The contract for paving West Morgan St. has been awarded to H. BRICE at $5015.

+Spokane, Wash.—The contract for curbing and paving. Gordon Ave. from Perry to Division St. has been awarded to C. M. PAYNE at approximately $5090.

Tacoma, Wash.—Plans are being prepared by M. Roy Thompson, County Engr., for the laying of six miles of pavement on Pioneer Way between Alderton and Orting.

+Walla Walla, Wash.—The contract for constructing one mile of Inland Empire road between Walla Walla and Waitsburg has been awarded to L. L. LANNING, Walla Walla, at $6000.

Prairie City, Ore.—According to press reports a road will be constructed between Long Creek and Prairie City, a distance of 30 miles.

Glendora, Calif.—Bids will be received by the Board of Trustees until Nov. 9 for improving Media Ave. F. G. Dessery, 514 Central Bldg., Los Angeles, is Engr.-in-Charge.

+Los Angeles, Calif.—Contracts have been awarded for street improvement as follows: Sapphire St.; GEORGE R. CURTIS at $7319; Alvarado St., S. McCRAY at $9022; Casanova St., WALTER OVERELL at $11,511.

Martinez, Calif.—The Mount Diablo Scenic Boulevard Co. is preparing to construct a toll road to the top of Mount Diablo, at an estimated cost of $60,000. R. N. Burgess, 734 Market St., San Francisco, Calif., is interested.

+Riverside, Calif.—A contract for constructing nine miles of concrete paving on Route No. 4 has been awarded by the Commissioners of Riverside County to the CONNERS CONTRACTING CO., 709 Higgins Bldg., Los Angeles, at $28,462.

San Bernardino, Calif.—At a recent election, the citizens voted in favor of issuing $1,750,000 in bonds for highway construction.

San Francisco, Calif.—The Board of Public Works has authorized the paving of Sloat Blvd. at an estimated cost of $56,400. Noted Oct. 8.

Visalia, Calif.—An election will be held Dec. 3, to vote on the question of issuing $1,488,555 in bonds for permanent road improvements.

Ottawa, Ont.—The City Council contemplates paving Lisgar St. from Elgin to Bank St., Bronson St. and Roemac St. from Laurier to Slater St.

+Toronto, Ont.—The Board of Control contemplates extending Wilton Ave. from Bolton to Logan Ave. The estimated cost is $622,000. R. C. Harris is Comr. Pub. Wks.

INDUSTRIAL WORKS

Worcester, Mass.—The Pan American Match Co., Burnett St., is having plans prepared for a two-story, 78x230-ft. reinforced concrete factory.

The Hovey Laundry Co. will erect a four-story building on Austin St. The estimated cost is $35,000.

New York, N. Y.—(Borough of Bronx)—Plans have been completed for the three-story brick bakery at Wales Ave. and 142d St., for the Ward Baking Co. The estimated cost is $75,000.

+(Borough of Manhattan)—The contract for the construction of the factory at 612 East 15th St., for Thomas Crump, Greenwich, Conn., has been awarded to the HELLMAN CONSTRUCTION CO., 160 East 66th St.

(Borough of Queens)—Plans have been completed by Henry J. Horwitz, Arch., New York, for the five-story carpet factory at Webster and Sixth Ave., for Anna S. Anabel, Morristown, N. J. The estimated cost is $80,000.

Olean, N. Y.—The Vacuum Oil Co. will erect an addition to its refining plant at Olean. The estimated cost is $125,000.

+Newark, N. J.—The Public Service Electric Co. has awarded a contract to the LACKAWANNA BRIDGE CO. for structural and ornamental steel work for its new electric power station at Point-No-Point.

Philadelphia, Penn.—Ferdinand B. Fleming has purchased a site at Front and Florist St., upon which will be erected a two-story factory. The estimated cost is $40,000.

+Pittsburgh, Penn.—The contract for the six-story reinforced concrete warehouse on Forbes St., has been awarded to the FETZER WINGER CO. The estimated cost is $40,000.

Baltimore, Md.—The Hubbard Fertilizer Co., 802 Keyser Bldg., will rebuild the factory and warehouse recently destroyed by fire.

New Orleans, La.—The Board of Commissioners of the Port of New Orleans will erect cotton warehouses and a terminal consisting of one-story reinforced concrete warehouses, cotton compress shed and building, and reinforced concrete wharf. The estimated cost is $2,500,000.

+Louisville, Ky.—The general contract for the construction of the warehouse for the Fireproof Storage Co., has been awarded to the NATIONAL CONCRETE CONSTRUCTION CO., Louisville, Ky.; stone work PETER BURGHARD STONE CO., sheet metal, J. F. WAGNER & SONS, iron work, JOSEPH HALSTEAD & CO., Chicago, Ill. Noted June 25.

+Cleveland, Ohio—The contract for the construction of a 75x156-ft. factory, on West 117th St., for the Cleveland Welding & Mfg. Co., has been awarded to the HUNKIN-CONKEY CONSTRUCTION CO., 321 Cuyahoga Bldg.

Cleveland, Ohio—Bids will be received about Jan. 1, 1915, by the Belt Line Terminal Warehouse Co. for the construction of a four-story and basement, 150x340 ft. warehouse. Estimated cost, $150,000. W. S. Ferguson Co., 1900 Euclid Bldg., Cleveland, is the Arch.

Springfield, Ohio—Robert C. Gowalt, Arch., has prepared plans for the construction of a two-story, 20x90-ft. addition to the plant of the Nolte Brass Co.

Bay City, Mich.—The United States Pipe Co. contemplates constructing two buildings, 40x60 ft. and 25x100 ft.

Chicago, Ill.—The Justrite Mfg. Co. contemplates constructing a plant at Hawthorne and Southport Ave., estimated to cost $100,000.

+Rockton, Ill.—The general contract for the construction of the factory for the Great Northern Mfg. Co., has been awarded to W. D. REICHENBACH, 603 Mulberry St. The estimated cost is $10,000.

+South Germantown, Wis.—Contracts have been awarded for the construction of a milk condensing plant for the Badger Condensed Milk Co., for general contract, DAHLMAN CONSTRUCTION CO., Milwaukee, Wis.; steel work, WORDEN ALLEN CO., Milwaukee, Wis.

+Bovey, Minn.—The general contract for the construction of the one-story 40x48-ft. creamery for the Farmers' Co-Operative Creamery Co., has been awarded to CHARLES CHALBERG, Bovey, Minn.

+Sioux Falls, S. D.—The contract for the construction of a five-story and basement, 91x119-ft factory for the Manchester Biscuit Co, has been awarded to O H PAULSON CO., Stillwater, Minn Estimated cost, $80,000 Noted Aug. 20

Taylor, Tex.—The Taylor Bonded Warehouse Co contemplates constructing a [illegible]x[illegible]0-ft warehouse

Denver, Colo.—The M J O'Fallon Supply Co contemplates erecting a four-story fireproof warehouse on Blake St., between [illegible] and [illegible] St. Estimated cost $25,000

Lehi, Utah—The Hastings Industrial Co Chicago Ill, contemplates the construction of a canning factory, to cost [illegible]

Port Angeles, Wash.—Plans are being prepared for the Puget Sound Mills & Timber Co, for the construction of a box factory Estimated cost, $10,000

Seattle, Wash.—The contract awarded to the Butler Construction Co, for the construction of the first unit of the [illegible] storage warehouse, at the East Waterway Turning Basin, has been rescinded by the Seattle Port Commission Bids will be received about Dec 1 Noted Oct 15 and Oct 29

Seattle, Wash.—A Hanregan, 2309 Madison St, is contemplating the construction of a plant to cost $60,000.

Wenatchee, Wash.—W J Patterson, Salem, Ore, contemplates constructing an evaporating plant at Wenatchee

Hood River, Ore.—The Stanley Smith Lumber Co, recently destroyed by fire, will be rebuilt, at an estimated cost of $6[illegible],

+Portland, Ore.—The contract for alterations and additions to the plant of the Portland Electric Ice Co 20th and Marshall St has been awarded to the EISELGUHR CO, Los Angeles

Stanfield, Ore.—The Peerless Air Motor Co. will erect a windmill factory at Stanfield Frank R Roles is local representative

Richmond, Calif.—Plans are being prepared for a one-story, [illegible]x[illegible]-ft building for the Giant Valve & Mfg Co

Sacramento, Calif.—The Golden West Motors Co contemplates constructing a one-story 150x300-ft addition M L. Burns, Ochsner Bldg., is Pres.

San Francisco, Calif.—The California Canneries Co contemplates constructing a 200x300-ft addition at Eighteenth and Minnesota St Isidor Jacobs is Pres

Vancouver, B. C.—Bids will be received soon by the Department of Public Works, for the construction of a 1,500,000-bu grain elevator on the Government Dock

Vancouver, B. C.—Bids will be received until Nov 13, by Dept of Trade & Commerce, Ottawa, for the construction of a reinforced concrete grain elevator

FEDERAL GOVERNMENT WORK

Shipbuilding Cranes—Boston, Mass—Bids will be received by H R Stanford, Chief, Bureau of Yards and Docks, Washington D C until Nov 9, for constructing shipbuilding cranes for the Boston and Philadelphia Navy Yards

+Post Office—Narragansett Pier, R I—The contract for the construction of the U S post office at Narragansett Pier, R I, has been awarded to the CHARLES McCALL CO, 1715 [illegible] St Philadelphia, Penn, at $[illegible] Noted Sept 3 and Oct 1

+Dredging—New Haven Conn—Bids will be received by Maj [illegible] U S Engineer Office, New London, until 2 [illegible] Dec 16 for dredging in New Haven Harbor

Lighting Fixtures, Etc.—New York N Y—The following bids were received by Oscar Wenderoth, Superv Arch Treas Dept, Washington D C, for installing conduit and wiring system and lighting fixtures in the U S appraisers warehouse, New York: W G Cornell Co, Washington, D C, $27,[illegible] [illegible]

+Mail Handling Apparatus—New York N Y—Bids will be received by Oscar Wenderoth, Superv Arch Treasury Dept, Washington, D C, until 3 p m Dec 1[illegible], for installing [illegible] apparatus in the [illegible]

Repairs To Building—[illegible]

Post Office—[illegible]

Porches—[illegible]

Shipbuilding Cranes—Philadelphia Penn—See item under Boston, Mass

Gasoline Cutter—Philadelphia, Penn—Bids will be received by Col George A Zinn Witherspoon Bldg, Philadelphia, until noon Nov 3[illegible], for constructing and delivering a gasoline cutter, including wooden hull and house

+Wicket Irons, Horses and Props—Pittsburgh, Penn—Bids will be received by Lieut-Col Francis R. Shunk U S Engineer office Pittsburgh until noon, Dec 2 for furnishing and delivering wicket irons, horses and props for Dam No. 10, Ohio River

+Excavating—Wilmington, Del—Bids will be received by Maj E N Johnston U S Engineer office Wilmington, until 11 a m, Nov 23, for excavating Inland Waterway between Rehoboth Bay and Delaware Bay Lewes Canal Del

Building—Washington, D C—Bids will be received by the Secretary Board of Commissioners District Bldg, until 2 p.m., Nov 9, for the repair and reconstruction of the Western High School Chester Harding is one of the Comrs

Motor Trucks—Washington, D C—The following bids were received by the depot quartermaster, U S Army, Washington, D. C, for furnishing two four-wheel drive motor trucks Briggs-Seabury Ordnance Co, Sharon Penn, $[illegible] each, Four-Wheel Drive Auto Co, Clintonville, Wis, $[illegible]360 each, Duplex Motor Co, Charlotte, Mich $[illegible] each Thomas B. Jeffrey Co., Kenosha, Wis, $[illegible] each Noted Oct 22

+Trestles—Wheeling W Va—The contract for furnishing and delivering Poiree trestles, recess and engine pit covers for Dam No. 15, Ohio River, has been awarded to the TOLEDO BRIDGE & CRANE CO., Toledo, Ohio, at $[illegible] Noted Sept 24, and Oct. 29

+Piling—Wilmington N C—Bids will be received by Maj H W Stickle U S Engineer Office, until Dec 1 for furnishing and delivering 2716 pieces short leaf pine piling

+Repairs—Mobile Ala—The contract for repairs to screenwork and lighting, at the U S customhouse Mobile has been awarded to JETT BROS CONTRACTING CO, Mobile, at $8688.

Earthwork—Vicksburg, Miss—Bids will be received by Maj. F R. Slattery, War Dept Mississippi River Comn., Third Dist., until 11 a.m., Nov. 10 for constructing about 267,[illegible] cu.yd. of earthwork in this district

Earthwork—New Orleans, La—Bids will be received by Maj W. G. Caples, Queen & Crescent Bldg New Orleans, until 11 a.m., Nov 9, for constructing about 2,1[illegible] cu yd of earthwork, in the Lower Tensas, Atchafalaya, Lafourche Barataria and Lake Borgue levee districts

Rock—New Orleans, La—The following bids were received for furnishing and delivering rock on the Mississippi River Lester F Alexander, New Orleans, La, 6[illegible] tons for delivery at New Orleans on U S barges $2[illegible] per ton Big Rock Stone & Construction Co, Little Rock, Ark, [illegible] tons for delivery at Vidalia, La, on U S barges, at $1.95 per ton. Noted Oct. 22

Brush and Poles—Memphis Tenn—Bids will be received by Maj. E M Markham, Custom House Memphis, until 11 a m, Nov 6, for furnishing 21,[illegible] cords of brush and poles for revetment work in the first and second districts Mississippi River

+Post Office—Shelbyville Tenn—The contract for the construction of the U S post office at Shelbyville has been awarded to VOLNEY E TAYLOR, Huntington, W Va, at $15,160 Noted Sept 10 and Oct 22

Post Office—Robinson Ill—Bids will be received by Oscar Wenderoth, Superv Arch, Treasury Dept Washington D C until 3 p m, Dec [illegible], for constructing the U S post office at Robinson The building will be one story and basement, of brick and stone

Buildings—Saratoga Wyo—Bids will be received by the Commissioner of Fisheries Washington D C until [illegible] p m Nov 2[illegible] for constructing a hatchery building a superintendent's residence and a fish culturist's cottage at the [illegible]

+Canal Construction—Great Falls Mont—Bids will be received at the office of the United States Reclamation Service, Great Falls until [illegible] [illegible]

+Canals and Dikes—Malta Mont—[illegible]

+Canal Work—[illegible]

Post Office—[illegible]

Dredging and Jetty Work—[illegible]

Bridges—[illegible]

Fuel Oil—Panama—Bids will be received by Maj. F. C. Boggs, Gen. Pur. Officer of the Panama Canal, Washington, D. C., until 10:30 a.m., Nov. 23, for furnishing f.o.b. at either Cristobal Atlantic port or Port of Ancon Balboa, Canal Zone, Pacific port, Isthmus of Panama, fuel oil for the period beginning Jan. 1, 1915 and ending Dec. 31, 1915. Noted Oct. 15.

Post Office—Glens Falls, N. Y.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Dec. 17, for constructing a U. S. post office at Glens Falls. The building will be two-stories and basement, of brick and stone.

MISCELLANEOUS

+Breakwater—Boston, Mass.—The Port Directors have awarded the contract for the construction of a timber breakwater on the easterly side of the Fish Pier, South Boston, to W. H. ELLIS & SON CO., at $17,879. Other bids were as follows: George T. Rendle Co., $18,640; H. P. Converse & Co., $21,977; W. T. Rendle, $22,360. Noted Oct. 15.

+Dredging and Bulkheads—Lynn, Mass.—The State Board of Harbor and Land Commissioners has awarded the contract for dredging and building bulkheads in the Saugus River to the EASTERN DREDGING CO., at about $95,000. Noted Sept. 10.

+Comfort Station—Springfield, Mass.—The contract for the construction of a public comfort station has been awarded to the A. E. STEPHENS CO., Springfield. An appropriation of $24,000 has been made for the building.

Barge Canal Work—Albany, N. Y.—(Official)—The following bids were received, Oct. 27, by Duncan W. Peck, State Supt., Pub. Wks., for (a) Contract 14-B, closing the openings in the Barge Canal dam in the Mohawk River below Crescent, removing the old Erie Canal aqueduct and the toll bridge at Crescent and making repairs to the lock and dam at Vischer's Ferry; (b) Terminal Contract No. 35, for constructing a dockwall on the north side of the Mohawk River near the site of the canal aqueduct at Crescent: Brown & Lowe, Schenectady, (a) $71,410, (b) $11,199; F. W. Foley Contracting Corporation, New York, (a) $71,960, (b) $9918; John W. Davitt, Albany, (a) $72,650; Drilling Contracting Co., Inc., Amsterdam, (a) $73,280; State Highway Construction Co., Beacon, (a) $73,360; Larkin & Sangster, Seneca Falls, (a) $74,030, (b) $10,959; Louis B. Cleveland, Watertown, (a) $79,168, (b) $11,721; Mason, Hilton & Co., New York, (a) $82,069, (b) $12,479; Flood & Van Wirt, Hudson Falls, (a) $86,759, (b) $10,209; Eastover Construction Co., Inc., Utica, (a) $101,000; Young & Hyde, Schenectady, (b) $11,905; S. R. Rosoff, Herkimer, (b) $10,382; McHarg & Barton, New York, (b) $12,260; Edwin B. Salisbury, Mechanicsville, (b) $10,396; Robert I. Gleason, Albany, (b) $10,716; George Holler, Albany, (b) $10,435; Norton & Gorman Contracting Co., Brooklyn, (b) $10,746. Noted Oct. 1.

★Tile Floors, Metal Work—Albany, N. Y.—(Official)—Bids will be received, until 2 p.m., Nov. 12, by the Trustees of Public Buildings, Albany, N. Y., for new tile floors, hollow metal doors, steel lockers and filing cases, and general construction work, also electric wiring for Document Room in the New York State Capitol, Albany, N. Y. Drawings and specifications may be consulted at the New York office of the Department of Architecture, Room 1224 Woolworth Bldg., New York, and at the Department of Architecture, Albany. Lewis F. Pilcher is State Arch.

Dock—Dunkirk, N. Y.—The plans and specifications prepared by W. H. Shelton, City Engr., for the municipal dock, have been approved by the City Council. The estimated cost is $100,000. The U. S. government has made an appropriation of $90,000 for harbor and breakwater improvements contingent upon its construction. Noted Sept. 10.

Steam Asphalt Rollers—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Borough Pres., until 2 p.m., Nov. 11, for furnishing and delivering five steam asphalt rollers.

★+Creek Improvement—Syracuse, N. Y.—(Official)—The Syracuse Intercepting Sewer Board has awarded the contract for the improvement of Onondaga Creek to JOHN YOUNG, Syracuse, at $167,770. Other bids received were as follows: Walsh Construction Co., $168,775; E. W. Foley Construction Co., $180,103; State Highway Construction Co., $194,490; Larkin & Sangster, $202,503. Glenn D. Holmes is Ch. Engr. Noted Sept. 24, Oct. 29.

Pier Extensions—Jersey City, N. J.—The Central R.R. of New Jersey has applied to the New Jersey Riparian Commissioners for permission to extend its piers at Communipaw to a point 800 ft. back of Bedloe's Island.

Grandstand—Newark, N. J.—The Board of Freeholders has authorized the erection of a grandstand at the Weequahic Park Race Course, estimated to cost $30,000; construction will be under the jurisdiction of the Essex County Park Commission.

+Stables—Newark, N. J.—The Board of Works has awarded the contract for the erection of the city stables on Elizabeth Ave., to E. M. WALDRON, INC., at $180,000. Noted July 30.

Harbor Improvement Bonds—Trenton, N. J.—The Board of City Commissioners has authorized an issue of $50,000 in bonds to be used for harbor improvements. Frank Thompson is City Clk.

+Monument—Baltimore, Md.—The Maryland division of the Daughters of the Confederacy has awarded the contract to MAXWELL MILLER, Baltimore, at $16,000, for the construction of the monument to the Maryland Women of the Confederacy.

Arch and Retaining Wall—Richmond, Va.—Bids will be received, until Nov. 6, by the city for the construction of retaining walls and an arch under Broad St. Charles E. Bolling is City Engr.

Drainage Bonds—Salisbury, N. C.—The Board of Drainage Commissioner for Sill's Creek Drainage District proposes to issue bonds for $19,000, representing the cost of drainage improvements contemplated by the district. J. F. Turner is Chmn. C. M. Miller is Engr. and Supt.

+Retaining Wall—Atlanta, Ga.—The Georgia School of Technology has awarded the contract to H. J. CARR & CO., at $12,000, for the construction of a retaining wall on West North Ave.

Amusement Park—Macon, Ga.—The Coney Island Amusement & Realty Co., Coney Island, N. Y., has leased Crump's Park which it will remodel, making extensive additions and improvements, including roller coaster, toboggan slide, circle swing, roller skating rink, dancing pavilion and natatorium. R. F. Jeffereys, Landscape Arch., will be in charge.

Elimination of Grade Crossing—Macon, Ga.—The Central of Georgia Ry., it is reported, plans to construct a reinforced-concrete underpass from Plum and Sixth St. to Plum and Fifth. The estimated cost is $74,000. C. K. Lawrence is Ch. Engr.

Sea Wall and Filling—Lake Worth, Fla.—The city contemplates extensive improvements in the lake frontage, including 600 ft. of seawall, three-acre fill for a park, two yacht harbors, lake shore drive and baseball park. G. Sherman Childs is City Engr.

Levee Work—Vicksburg, Miss.—The lowest bid received for the construction of 2,000,000 yd. of levee enlargement along the Arkansas River in the Third District, was that of John R. Scott, St. Louis, Mo., at $280,000.

Dredging—Portland, Ind.—The City Council contemplates dredging the Salamonia River through the city of Portland.

+Drain—St. John's, Mich.—The Clinton County Board has awarded the contract for the construction of the Remey-Chandler Drain to JAMES W. SANDERSON, at $25,000.

+River Improvement—Kankakee, Ill.—The contract for constructing 28 miles of ditch, 15 ft. deep and 100 ft. wide, to divert the Kankakee River for the elimination of curves, has been awarded to the McWILLIAMS CO., Chicago, at $300,000.

Drain—Clarion, Iowa—(Official)—Bids will be received, until 2 p.m., Nov. 12, by F. E. Osier, County Audr., for the construction of Drain No. 90, requiring 5362 ft. of open ditch and 27,500 ft. of tile drain.

+Drain—Clarion, Iowa—The contract for the construction of Drain 108 has been awarded to HANS J. DIXON, Coulter, at $13,449. F. E. Osier is County Audr. Noted Oct. 22.

Ditch—Blue Earth, Minn.—Bids will be received by Jesse L. Herring, County Audr., until Nov. 11, for the construction of Ditch No. 20. The work includes 153,664 cu.yd. open ditch and about 459,000 ft. of 6-in. to 30-in. No. 1 hard burned clay or cement tile.

Ditch—Marshall, Minn.—Bids will be received, until 9 a.m., Nov. 9, by E. S. Shepard, County Audr., for the construction of Ditch No. 13. Tile work estimated to cost about $14,659; and $5384 for open work.

+Ditch—Red Lake Falls, Minn.—The contract for the construction of Judicial Ditch No. 60 has been awarded to D. A. FOLEY & CO., Aitkin, Minn., at $41,087. The contract calls for 424,000 cu.yd. of excavation, 75 corrugated metal culverts and 1300 cu.yd. of reinforced concrete. Noted Oct. 8.

+Ditch—Windom, Minn.—The contract for the construction of Judicial Ditch No. 6 has been awarded to REDDING & SMAAGE, at $20,757.

Drainage Bonds—Jefferson City, Mo.—Fabius Drainage District will issue bonds to cover the cost of reclaiming 22,000 acres of swamp and overflow land in Lewis and Marion counties. The estimated cost is $300,000. John H. Nolan is Land Reclamation Comr.

Drainage and Levee Work—New Madrid, Mo.—St. John Levee and Drainage District, comprising 315,000 acres in New Madrid and Mississippi counties, plans to construct several hundred miles of canals and 6,200,000 cu.yd. of levees; entire project calls for 970,000 cu.yd. floating dredge work, 12,000,000 cu.yd. of drag line excavation, and 200,000 cu.yd. of suction dredge work. Total estimated cost is $3,750,000. The Miller Engineering Co., Little Rock, Ark., is in charge of the construction.

Dredging—South St. Joseph, Mo.—The city, county and stockyards companies have made arrangements for financing the plan to dredge Brown's branch. The city engineer's estimate is $12,000.

Drainage District—Horatio, Ark.—A petition has been filed in the county court for the creation of a levee and drainage district of 43,000 acres in the Cossatot and Little Rivers section. The estimated cost of the levee and 15 miles of channel changes is about $97,800.

Drainage—Houston, Tex.—Bids will be received, until Nov. 21, by Harris County Drainage District No. 7, C. L. Anderson, Chmn., for the construction of drainage canals in the district. Successful bidder to purchase entire bond issue of $140,000. J. S. Burk, 1818 Walker Ave., Houston, is the Engr.

+Drainage—Downey, Idaho—The Woodland Drainage Corporation has awarded the contract for draining 3000 acres of land in the district to the H. N. THORNTON CO., Salt Lake City, at $15,000.

Vessel—Bellingham, Wash.—Captain E. R. Gawley, of the Bellingham-Alaska Trade & Transportation Co., announces that plans are being prepared and bids will soon be received for the construction of a 1000-ton capacity vessel of light draft.

Fire Hose—Portland, Ore.—Bids will be received by the City Purchasing Agent for fire hose to cost $12,000.

Motor Fire Apparatus—Portland, Ore.—Bids will be received, until 2 p.m., Nov. 16, by J. R. Wood, City Pur. Agt., for furnishing one six-cylinder motor hook and ladder truck, with one chemical engine, and one four-cylinder motor chemical engine.

+Vessel—St. Helena, Ore.—The International Portland Cement Co., Spokane, has awarded the contract for building a tugboat to the ST. HELENS SHIPBUILDING CO.

Pier—Longbeach, Calif.—Trounce & Stoecker, Owl Bldg., San Diego, at $46,600, submitted the lowest bid for the construction of the reinforced-concrete pier to be built at Longbeach in accordance with plans and specifications prepared by John Schulz, Engr., Wright & Callender Bldg., Los Angeles. Noted June 18.

Tunnel, San Francisco, Calif.—(Official)—Bids for the construction of the Twin Peaks Tunnel were received by the [illegible] Public Works on October [illegible]. The lowest bid was that of [illegible] & Co., at $[illegible]. Three other contractors submitted bids as follows: [illegible], $[illegible]; [illegible] P. Welsh, $[illegible]. This is the third time that bids have been received for this work. [illegible] there were no bidders due to [illegible]. On the second one Hans Pederson submitted a bid for $[illegible] but it was rejected due to [illegible]. The City Engineer has the various proposals under [illegible] it is expected that the contract will be awarded within a few days. The Engineer's estimate was $3,433,-[illegible]. M. M. O'Shaughnessy is City Engr.

BUILDINGS

Brockton, Mass.—Waldo V. Howard and Ralph P. [illegible], Archs., have prepared plans for the construction of a school [illegible] Crescent St. The estimated cost is $[illegible].

Holyoke, Mass.—The Board of Public Works has retained G. P. B. Alderman, Arch., to prepare plans for the Central [illegible] School.

Pittsfield, Mass.—Bids will be received by J. McArthur [illegible], Pittsfield, for an addition to the school at Pittsfield.

•Buffalo, N. Y.—The lowest bids received by Col. Franklin W. Ward, Secy. State Armory Comn., 174 State St., Albany, for [illegible] at [illegible] Buffalo for Troop I, were as follows: General construction, F. H. Everett, Buffalo, at $111,[illegible]; heating, [illegible], N. Y., $[illegible]; plumbing, George H. [illegible], Buffalo, N. Y. Noted Oct. 22.

Florida, N. Y.—Alfred Peters, Arch., Metropolitan Bldg., Newark, N. J., is preparing plans for a parochial school at Florida, for the parish of St. Joseph. The estimated cost is $[illegible].

Keeseville, N. Y.—Frank J. Dwyer, Arch., 12 Academy St., Amsterdam, N. Y., has completed revised plans for the two-story [illegible] school on Front St., for the Board of Education. The estimated cost is $[illegible].

•Lockport, N. Y.—Bids will be received, until 8 p.m., Nov. 17, by [illegible], Clk., Bd. of Education, Lockport, for the enlargement and improvement of the Union School. W. Neil Smith, [illegible] Park Ave., New York, is the Arch.

New York, N. Y.—(Borough of Manhattan)—Plans have been filed by the Interborough Rapid Transit Co., for the construction of a five-story building at 156 East 42d St. The estimated cost is $[illegible].

Plans have been prepared for the construction of a 12-story apartment house at Park Ave. and 61st St., for the Edgar A. [illegible] Co. The estimated cost is $[illegible].

+The general contract for the construction of the Y. M. C. A. building at [illegible] East Third St. has been awarded to the GEORGE A. FULLER CO., 111 Broadway, New York. The estimated cost is $[illegible].

Plans have been completed by Schwartz & Gross, Archs., 347 Fifth Ave., for the [illegible]-story apartment house to be erected at [illegible] Parkway and 16[illegible]th St., for Albert J. Schwarzler. The estimated cost is $[illegible].

+The structural steel contract for the six-story brick hospital at [illegible] and Amsterdam Ave. for the Women's Hospital has been awarded to BIGELOW & NICHOLS, 3[illegible] East 4[illegible] St. Noted Oct. [illegible].

Plattsburg, N. Y.—The city contemplates the erection of a [illegible]. W. H. [illegible], is Mayor. The estimated cost is $[illegible].

Bayonne, N. J.—Plans have been completed by John H. and Wilson C. [illegible], Archs., [illegible] Bldg., Newark, for the construction of a two-story city hall on Ave. C. The estimated cost is $[illegible]. Noted Sept. 17.

Jersey City, N. J.—St. John's Church on Summit Ave., recently destroyed by fire, will be rebuilt. Bids will be asked about Nov. [illegible].

Morristown, N. J.—The city is considering the construction of a high school to cost $[illegible]. John T. [illegible], Essex Bldg., Newark, N. J., is the Arch.

+Secaucus, N. J.—The Board of Chosen Freeholders awarded the contract to DENNIS MULLINS, INC., for completing the [illegible] extension to the administration building, [illegible] to the [illegible] and [illegible] at the Tuberculosis Hospital at Snake Hill. [illegible] at $[illegible].

Lancaster, Penn.—[illegible], Arch., [illegible], has completed plans for the three-story [illegible] Y. W. C. A. building at Lancaster.

Nesquehoning, Penn.—[illegible] & Adams, Archs., [illegible], has completed plans for the [illegible] high school at Nesquehoning.

+Pittsburgh, Penn.—The contract for the construction of the [illegible] has been awarded to [illegible]. [illegible] are the Archs.

+Wilkinsburg, Penn.—The contract for the construction of the church for the [illegible] has been awarded to HOFFMAN & CO., Wilkinsburg. The estimated cost is $[illegible].

+Baltimore, Md.—Contracts for the construction of the [illegible] building have been awarded as follows: [illegible] work, [illegible]; [illegible] steel, [illegible]; [illegible], Washington, D. C.; [illegible] Trinity Ave., New York, N. Y.

Alexandria, Va.—The lowest bid received for the construction of the high school was submitted by [illegible] Bldg., Washington, D. C., at $[illegible].

+Charleston, W. Va.—The contract for the church to be erected for the St. Paul Evangelical Lutheran congregation, has been awarded to A. T. HAZEN, Charleston, W. Va. The estimated cost is $15,000.

Huntington, W. Va.—Plans have been prepared by Verus T. Ritter, Arch., Huntington, for the three-story high school at Huntington. The estimated cost is $[illegible].

+Staunton, W. Va.—The contract for the construction of the Y. M. C. A. building at Staunton has been awarded to CULLEN & VAUGHN, Hamilton, Ohio, at $[illegible].

Savannah, Ga.—Plans have been approved by the Georgia Hotel Co. for the construction of a hotel at Savannah. The estimated cost is $[illegible],000.

Bids will be received, until Nov. 1[illegible], by H. W. Witcover, Arch., National Bank Bldg., for the construction of a three-story brick building for the Jewish Educational Alliance. The estimated cost is $[illegible].

Clearwater, Fla.—Bids will be received until Nov. 1[illegible], by C. W. [illegible], Clk., Pinellas County, for alterations to the courthouse. Willis R. Biggers, Tampa, Fla., is the Arch.

+Panama City, Fla.—The commissioners of Bay County have awarded the contract for the construction of a courthouse and jail to F. M. DOBSON & CO., Montgomery, Ala. Noted Oct. 1.

+Tampa, Fla.—Contracts for the construction of the city hall have been awarded as follows: General contract, McGUCKIN & HYER, Consumers' Ice Co. Bldg., Tampa; cement, LEHIGH PORTLAND CEMENT CO., Savannah; brick, HAY WALKER BRICK CO., Pittsburgh; steel and cast iron, CHATTANOOGA ROOFING & FOUNDRY CO.; reinforcing steel, ATLANTA STONE CO.; granite, CALITH STONE CO.; terra cotta, ATLANTA TERRA COTTA CO., all of Atlanta, Ga.

+Chattanooga, Tenn.—The general contract for the gymnasium, to be erected for the University of Chattanooga, has been awarded to T. S. MOODY & CO., Chattanooga. The estimated cost is $40,000.

Memphis, Tenn.—Bids will be received, until Nov. 11, by Jones & Furbringer, Archs., Porter Bldg., for the construction of a temple for the Congregation Children of Israel. The estimated cost is $100,000.

Boston, Ohio—The Toledo Christian Endeavor Association contemplates constructing a building, to cost $100,000.

Cedar Point, Ohio—W. W. Hodges, Arch., 1119 Schofield Bldg., Cleveland, is preparing plans for the construction of a two-story hotel, for the Cedar Point Amusement Co. The estimated cost is $100,000.

Cincinnati, Ohio—Harry Hake, Arch., Provident Bank Bldg., is preparing plans for the construction of an eight-story department store at Fourth and Race St., for H. & S. Pogue. The estimated cost is $1,000,000.

Cleveland, Ohio—Bids will be received, until Nov. 21, by Walker & Weeks, Arch., 1900 Euclid Ave., for the construction of a six-story, 52x17[illegible]-ft. hospital, to cost about $[illegible]. Noted Oct. 1[illegible].

Cleveland, Ohio—Jacob Babin, [illegible] Euclid Ave., contemplates constructing a three-story building at Euclid and Lake Front Ave., at a cost of $[illegible].

A. F. Janowitz, Arch., 3[illegible] Permanent Bldg., has prepared plans for the construction of an apartment house at East [illegible] St. and Ashbury Ave., for A. M. Gordon. Estimated cost, $[illegible].

+Toledo, Ohio—The contract for constructing the foundation for the First Congregational Church has been awarded to the MacARTHUR CONCRETE PILE & FOUNDATION CO., 11 Pine St., New York, N. Y. Mills, Rhines, Bellman & Nordhoff, Ohio Bldg., Toledo, are the Archs.

Willoughby, Ohio—Bids will be received, until Nov. 1[illegible], by the Andrews Institute for Girls, for the construction of a memorial chapel, to cost about $30,000.

+Ann Arbor, Mich.—The contract for the construction of a four-story and basement, [illegible]-ft. science building for the University of Michigan has been awarded to IRWIN & LEIGHTON, [illegible] Bank Bldg., Detroit. The estimated cost is $[illegible].

+Bay City, Mich.—The contract for the construction of a three-story, [illegible]-ft. Y. M. C. A. building, has been awarded to [illegible] BROS., East Jordan. Estimated cost, $[illegible]. Noted Aug. [illegible].

Detroit, Mich.—Plans are being prepared by Smith, Hinchman & Grylls, [illegible] Washington Arcade Bldg., for the construction of a six-story and basement, [illegible]-ft. court house, estimated to cost $[illegible]. George H. Fenkel, City Hall, [illegible].

Chicago, Ill.—The Chicago Nursery and Half Orphan Asylum contemplates constructing an addition at [illegible] and North Francisco Ave., to be known as the Charles A. Chapin Memorial. Estimated cost, $[illegible].

Chicago, Ill.—The directors of the John Crerar Library, recently incorporated, are contemplating the construction of a public library at East Randolph St. and Michigan Ave. Estimated cost, $1,[illegible].

Hamtramck, Mich.—Van Leyen & Schilling, Archs., 111[illegible] Union Trust Bldg., Detroit, are preparing plans for the construction of a one-story, [illegible]-ft. church, for the St. Florian Parish. Estimated cost, $[illegible].

+Chicago, Ill.—Contracts for the construction of an armory on West Washington Blvd. have been awarded as follows: [illegible], construction of the armory, $[illegible]; WHITE CITY ELECTRIC CO., electrical work, $[illegible]; HANLEY [illegible] CO., heating and ventilation, $[illegible]. Noted Oct. 1.

Springfield, Ill.—[illegible], Arch., is preparing plans for the construction of a [illegible]-story, [illegible]-ft. apartment [illegible] at [illegible] St., for Mrs. S. [illegible]. Estimated cost, $[illegible].

Milwaukee, Wis.—A. D. Koch, Arch., is preparing plans for the construction of a 10-story building on West Water St., for the [illegible] Investment Co. Estimated cost, $[illegible].

Superior, Wis.—Shurick and Solheim, Archs., Duluth, Minn., are preparing plans for the construction of a three-story brick building, to cost $40,000.

✚**Burlington, Iowa**—The contract for the construction of two schools for the Board of Education has been awarded to J. H. HUNZINGER, Iowa City. The estimated cost is $79,238.

Minneapolis, Minn.—The First M. E. Church contemplates constructing a six-story dormitory for the University of Minnesota. Estimated cost, $90,000.

Minneapolis, Minn.—W. B. Ittner, Arch., St. Louis, Mo., and Stebbins & Haxly, Archs. for the Board of Education, have prepared plans for the construction of three grade schools. Estimated cost, $200,000. Noted Dec. 25, 1913.

Eureka Lake (Ogden post office), **Kan.**—The I. O. O. F. contemplates constructing a building estimated to cost $50,000. J. E. Brooks, Sedan, is Grand Master.

Salt Lake City, Utah—The Board of Education contemplates constructing a school on Tenth St., South, at an estimated cost of $75,000.

La Grande, Wash.—Houghtaling & Dougan, Archs., Henry Bldg., Portland, Ore., are preparing plans for the construction of a parochial school. The estimated cost is $75,000.

Seattle, Wash.—P. Davis contemplates constructing a four-story department house, at Terry Ave. and Jefferson St., to cost $60,000.

West Seattle (Seattle post office), **Wash.**—The School Board of District No. 1 contemplates constructing a high school, to cost about $200,000.

Portland, Ore.—Bids will be received soon by the School Board, for the construction of the Shattuck School, on Broadway and College St. Estimated cost, $160,000.

✚**Alhambra, Calif.**—The contract for the construction of three high schools has been awarded to JOHN SIMPSON CO., Baker-Detwiler Bldg., Los Angeles. The estimated cost is $66,435. Noted Oct. 1.

Los Angeles, Calif.—Bids will be received about Nov. 15 for the construction of a church, 100x225 ft., at Adams and Figueroa St., for the St. Vincent's Parish. Estimated cost, $200,000.

Sacramento, Calif.—The city authorities propose to build a jail and police court at Sixth and H St., to cost about $225,000.

✚**San Francisco, Calif.**—The contract for the construction of the foundation of the Firemen's Fund Insurance Co. at Lansome and California St. has been awarded to the McARTHUR CONCRETE PILE & FOUNDATION CO, 11 Pine St., New York, N. Y. Lewis P. Hobart is the Arch.

Santa Monica, Calif.—The Pacific Telephone & Telegraph Co. have prepared plans for the construction of a three-story and basement central station at Fourth St. and Central Ave. The estimated cost is $50,000. Bids will be received soon by the engineering department at San Francisco.

Ventura, Calif.—Bids for the construction of the county hospital were rejected by the County Commissioners and new bids will be received about Jan. 1, 1915. Noted Sept. 24 and Oct. 1.

St. Thomas, Ont.—The Roman Catholics of St. Thomas contemplate constructing a hospital near Kettle Creek. Estimated cost, $100,000.

✚**Toronto, Ont.**—The contract for the construction of the six-story and basement, 63x83-ft. office building, on University Ave., for the Providencial Hydro-electric Commission, has been awarded to WITCHALL & SON. Noted Oct 1.

✚**New Westminister, B. C.**—The contract for the construction of the three-story addition to the court house has been awarded to the DOMINION CONSTRUCTION CO., Vancouver, B. C., at an estimated cost of $56,000. Noted July 30.

Point Grey, B. C.—Bids will be received soon by the School Board for the construction of a school, to cost about $50,000. R. W. Twizell is the Arch.

BARGE CANAL WORK, ALBANY, N. Y.

Contract No. 14-B

Bids were received, Oct. 27, by Duncan W. Peck, State Supt., Pub. Wks., for Contract No. 14-B, closing openings in dam in the Mohawk River, removing bridge and aqueduct at Crescent and repairing dam at Vischers Ferry, from (A) Drilling Contracting Co., Amsterdam, N. Y.; (B) Eastover Construction Co., Utica, N. Y.; (C) Brown & Lowe, Schenectady, N. Y.; (D) Mason Hilton Co., 17 Battery Pl., New York, N. Y.; (E) E. W. Foley Contracting Corporation, New York, N. Y.; (F) Flood & Van Wirt Co., Hudson Falls, N. Y.; (G) State Highway Construction Co., Beacon, N. Y.; (H) Larkin & Sangster; Seneca Falls, N. Y.; (I) John W. Davitt, Albany, N. Y.; (J) L. B. Cleveland, Watertown, N. Y. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
Coffer-dams, pumping, bailing and draining (lump sum)	$10,000 00	$12,000 00	$10,000.00	$10,000.00	$8,000 00	$12,000.00	$9,000.00	$7,000.00	$10,000.00	$9,540 00
6700 cu.yd. excavation	0 65	0.95	0 74	0.80	0.75	0.96	0 80	0.65	0.70	0.80
6000 cu.yd. forming embankment	0 15	0 18	0 15	0.15	0.15	0 15	0 15	0.15	0 15	0.15
120 cu.yd. lining	2 00	2 40	2.00	2 40	2.00	2.00	2.00	2.00	2 00	2.00
1.1 M.ft.b.m. sawed lumber, white oak	100 00	100.00	95.00	100.00	100.00	100.00	100.00	100.00	100 00	100.00
4 mooring piles 8 ft. long	5 00	5.00	15.00	5.00	5 00	5.00	5 00	5.00	5.00	5.00
720 cu.yd. first-class concrete	10 00	12.00	9 60	10.00	9.00	12.00	9.00	9 50	10.00	9.75
3540 cu.yd. second-class concrete	9 00	10.00	8 10	8 50	8.50	9 35	8.25	8.00	9.00	8.47
280 cu.yd. wash wall	2 00	2 40	2.00	2 20	2.00	2.00	2.00	2.00	2 00	2 00
500 cu.yd. second-class rip-rap	1 50	1.80	2 50	1.50	1.50	1.50	1.50	1.50	1 75	1 50
340 lin.ft. wooden fence	0 20	0 20	0 25	0.20	0 20	0.24	0.20	0.20	0.20	0.20
340 lb. miscellaneous metal	0 05	0.06	0 05	0.05	0 05	0.05	0.05	0.05	0.05	0.05
Removing crescent aqueduct (lump sum)	17,000 00	35,000.00	17,900.00	27,000.00	20,000.00	24,000.00	21,000.00	25,000.00	16,460 00	24,950 00
Removing guide piers at Vischer's Ferry Lock (lump sum)	600 00	720 00	600 00	600.00	400 00	660.00	600 00	600.00	600.00	600.00
Deduct for removing Halfmoon Bridge (lump sum)	450 00	343.40	900 00	1,000.00	850 00	800.00	1,000.00	800.00	1,000.00	1,000.00
Extended totals	$73,280	$101,000	$71,410	$82,069	$71,960	$86,760	$73,360	$74,034	$72,650	$79,169

BARGE CANAL WORK, ALBANY, N. Y.

Bids were received, Oct. 20, by Duncan W. Peck, State Supt., Pub. Wks., for Contract K, constructing superstructure of three highway bridges in Seneca Falls and Waterloo and for Contract 115, constructing the superstructure of movable dam No. 4 over the Mohawk River at Scotla, from (A) Phoenix Bridge Co., 49 William St., New York, N. Y.; (B) Penn Bridge Co., Beaver Falls, Penn.; (C) Fort Pitt Bridge Co., 45 Broadway, New York, N. Y.; (D) Larkin & Sangster, Seneca Falls, N. Y.; (E) Toledo Bridge & Crane Co., Toledo, Ohio; (F) Lupfer & Remick, Buffalo, N. Y.; (G) Chesley, Earl & Heimbach, Inc., Buffalo, N. Y.; (H) Whitehead & Kales Iron Works, Detroit, Mich. The item bids were as follows:

CONTRACT K

	A	B	C	D	E	F	G	H
565 cu.yd. first-class reinforced concrete	$11 50	$10.40	$11 00	$12.00	$12 00	$10 00	$14 00	$12 00
1,391,000 lb. structural steel	0 0348	0.0355	0.0373	0 037	0 0372	0 0405	0 039	0.041
98,000 lb. metal reinforcement	0 0275	0 027	0.0275	0 0275	0 025	0.02	0 03	0 029
1300 sq.yd. asphalt block pavement	2 00	2 00	2 00	2 00	2 00	1 75	1.90	2 00
160 sq.yd. medina stone block pavement	3 00	3 00	2 60	3.00	3 50	2 50	2 75	3 00
970 lin.ft. lattice railing	1 50	1 70	1 75	2.10	2 00	1 75	1.70	2 00
12 oil signal lamps	15.00	15 00	15.00	15.00	15 00	15 00	12 00	15 00
Maintaining highway traffic (lump sum)	500 00	500 00	100 00	......	500 00	500 00	400 00	500.00
Maintaining navigation (lump sum)	500 00	500 00	100.00	500.00	500 00	500 00	400 00	500 00
Total	$63,314 30	$63,811 50	$65,887 80	$66,739 00	$67,255 20	$69,498 00	$70,602 00	$72,853 00
Deduct for bridge superstructure at Ovid St.	100.00	100.00	100 00	100 00	100 00	280 00	102 00	10 00
Extended totals	$63,214 00	$63,711 00	$65,787 00	$66,639.00	$67,155 00	$69,218.00	$70,500.00	$72,843 00

CONTRACT 115

	A	B	C	F	H
2,430,000 lb. structural steel	$0 0398	$0.0373	$0 0411	$0.0406	$0 0444
81,000 lb w i. chains	0 06½	0 06	0 07	0 06	0 07½
30 M ft B.m. yellow pine sawed lumber	65 00	55 00	63 00	45 00	65 00
1 1 M ft. B.m. white oak sawed lumber	100 00	100 00	90 00	100 00	100 00
240 lin ft. w. i. pipe railing	1 50	1 25	1 50	1 50	1 50
112,600 lb. furnishing f.o.b. cars Scotia, buckle plates and miscellaneous metal	0 04	0 04	0 05	0 03½	0 03
112,600 lb. hauling from cars Scotia and erecting buckle plates and miscellaneous metal	0 015	0 0125	0 015	0.15	0 15
1567 lin.ft furnishing f.o.b. cars Scotia, w.i. pipe railing	1 30	0 75	1 00	0 80	1 00
1567 lin.ft hauling from cars Scotia and erecting w. i. pipe railing	0 20	0 25	0 15	0 20	0 20
20 installing trolley brackets	3 00	3 00	3 00	3 00	3 00
Extended totals	$118,072 00	$123,694 00	$113,302 00	$112,895 00	$105,883 00

Safeguarding United States Investments—The precipitous decline in the price of securities listed on the New York Stock Exchange during the last days of July was due to the sales by foreign holders. It is estimated that our securities held abroad have an aggregate value of $3,000,000,000 to $5,000,000,000. To pay for these in gold would be impossible, to pay for them in foodstuffs and merchandise would entail great sacrifices, to pay for them in extended credits would entail the least disturbance to business here, and would, moreover, be most satisfactory to foreign holders. In a recent article in the "Journal of Commerce," which is reprinted in part, the opinion is expressed that the latter course may be worked out.

"The attitude of the administration toward the placing of the so called credit loans is practically a reply to the representations as to the situation that have been made to it. At the outbreak of the war, the view was taken that no foreign loans ought to be placed in the United States because such action would be a violation of neutrality. This position led to the practical vetoing of a large French loan that was then being negotiated. The answer of foreigners was in substance that in that event they would simply call for the liquidation of American securities which their citizens were holding, and would use the cash proceeds in buying supplies. This proposition has practically led to a reconsideration of the problem. If foreign governments are allowed to place a sort of loan in the United States in the shape of a credit with American bankers, probably to be funded at a more convenient season into longer term securities, the consequence of such action is to obviate the necessity of placing such loans in their own territory. Citizens who would otherwise be disposed to take up the issues are not called upon to do so, and consequently the selling of American securities in order to realize funds for war operations is checked. The foreigners get American capital, but they get it on new terms as to interest and without the necessity of marking down their American issues.

"The United States uses its exports as a means of liquidating its current trade balance and of meeting such demands for the return of actually invested capital as may be made. The outcome is an adjustment of international relationships which obviates the further draining away of gold from the United States if the plan works smoothly. Assuming that it is put into effect with full success, the consequence of its operation would naturally be the readjustment of conditions and the probable early opening of the exchanges. This does not mean of course that such opening is necessarily to occur in the immediate future, although it is believed that healthier conditions would result if such opening were to occur. Even Southern cotton interests now seem to desire the reopening of the Cotton Exchange. But it does mean that the foundation of an accommodation looking in that direction will have been laid.

"The possibility of settling matters in this way was not opened until the question what should be actually regarded as contraband was tentatively settled, and such a settlement has been one of the objects most earnestly sought by the administration for a good while past. The adjustment on cotton is one of the features of the working out of the problem, and similar action in the way of determining exactly what export embargoes shall be enforced is in process of being planned. It is believed that complete revival of the export trade will be due to three conditions, as follows: (1) growing dependence of foreign nations upon the supplies of food and goods in the United States, (2) settlement of outstanding questions regarding the treatment to be accorded to cargoes shipped in neutral vessels and to vessels in general under the American flag, (3) working out of a system of loans under which all nations will be able to make their bargains for American goods and pay for them in credits, such credits of course, being charged off against obligations of the United States which would otherwise be likely to be liquidated by the sale of securities and the demand for cash in payment therefor.

"Students of international trade believe that while the present active export movement will go on and will tend to keep our domestic establishments busy manufacturing and shipping goods abroad for a good while in order to make up for the lowered productivity of the nations that are at war, and while this will result in corresponding profits, inasmuch as the prices for the goods will necessarily be high and the return to producers in proportion, there will be a perceptible check to the further extension of enterprise in this country. This will result from the fact that the profits of the business we shall be doing will be simply used in liquidating obligations due abroad or in taking up foreign obligations which call merely for payment in the future.

"There will be no foreign capital seeking investment on favorable terms in the United States. Indeed, [illegible]

[illegible]

New Haven Indictments—In the United States District Court, on Nov. 1, indictments were handed down charging 21 of the directorate with conspiracy of the Sherman anti-trust law.

At the request of the government attorney, the court ordered the issuance of bench warrants for William Rockefeller, George Macculloch Miller, Charles F. Brooker, William Skinner, D. Newton Barney, Robert W. Taft, James S. Elton, James S. Hemmingway, Lewis Cass Ledyard, Charles M. Pratt, A. Heaton Robertson, Frederick F. Brewster, Henry K. McHarg, Edward D. Robbins, formerly general counsel of the railroad, Alexander Cochrane, John L. Billard, George F. Baker, Thomas de Witt Cuyler, Theodore N. Vail, Edward Milligan and Francis T. Maxwell.

MUNICIPAL BOND SALES INCREASE

While Still below normal, municipal bond sales made a far better showing in October than in September. The sales for October aggregated $15,755,700 according to the "Financial Chronicle."

The following table, compiled by that journal shows the output of permanent municipal bond issues for the month of October and the ten months in previous years.

	Month of October	For the ten months
1914	$15,755,700	$396,794,664
1913	23,321,444	317,431,159
1912	27,659,990	343,571,920
1911	26,169,621	341,093,191
1910	27,437,207	254,975,246
1909	14,377,636	266,767,267
1908	14,575,529	257,219,946
1907	9,793,378	209,516,322
1906	14,519,277	167,971,622
1905	7,915,406	148,937,223
1904	17,299,985	208,221,642
1903	12,186,885	123,942,674
1902	8,488,424	122,167,279
1901	9,779,197	108,103,196
1900	16,421,185	112,615,626
1899	9,314,986	104,341,291
1898	4,966,667	88,877,166
1897	6,672,393	113,279,776
1896	4,699,463	65,917,679
1895	6,697,812	95,958,928
1894	6,665,617	99,147,371
1893	11,919,373	52,613,939
1892	11,766,428	73,377,284

Gain in Automobiles—Statistics compiled by "Automobile" as of Oct. 1, covering the official registration of automobiles in the several states, indicate that there were on that date not less than 1,788,253 cars of all types registered, as against 1,584,282 on July 1, a gain of 203,703 in three months. These figures, however, include a considerable proportion of duplication of registration, and, applying certain deductions, the probable total number of cars actually in use is placed at 1,735,369. These were divided by states as follows:

New York	169,475	Virginia	13,938
Illinois	126,681	Maine	13,294
Pennsylvania	123,773	South Carolina	[illegible]
Ohio	119,950	North Carolina	13,460
California	116,661	Rhode Island	12,2[illegible]
Iowa	100,183	Florida	10,661
Texas	[illegible]	New Hampshire	9,079
Michigan	74,777	Montana	8,961
Massachusetts	71,996	Alabama	7,950
Minnesota	66,974	West Virginia	[illegible]
Indiana	66,700	Vermont	[illegible]
Nebraska	62,129	Utah	[illegible]
New Jersey	[illegible]	Oklahoma	[illegible]
Wisconsin	[illegible]	Arkansas	5,415
Missouri	[illegible]	Kentucky	[illegible]
Kansas	[illegible]	Arizona	[illegible]
Washington	[illegible]	Idaho	[illegible]
Connecticut	[illegible]	New Mexico	[illegible]
Georgia	[illegible]	Delaware	[illegible]
South Dakota	[illegible]	Louisiana	[illegible]
Maryland	[illegible]	Wyoming	[illegible]
Tennessee	[illegible]	Mississippi	[illegible]
District of Columbia	[illegible]	Nevada	[illegible]
Colorado	[illegible]		
North Dakota	[illegible]	Total	1,735,369
Oregon	13,984		

Division as to gas and electric power and commercial and passenger cars is not uniformly stated by the several states, but as far as the returns show the division was as follows:

State	Total registrations	—Gasoline— Passenger	Commercial	—Electric— Passenger	Commercial
Alabama	[illegible]	[illegible]	[illegible]	150	[illegible]
Arizona	4,463	[illegible]	114	16	[illegible]
Connecticut	[illegible]	[illegible]	2,619	120	[illegible]
Georgia	16,116	[illegible]	16	100	[illegible]
Indiana	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Maine	14,119	[illegible]	616	6	[illegible]
Maryland	[illegible]	[illegible]	1,691	[illegible]	[illegible]
Massachusetts	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nevada	[illegible]	[illegible]	40	[illegible]	[illegible]
New Hampshire	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
New York	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
North Carolina	[illegible]	11,610	[illegible]	[illegible]	[illegible]
North Dakota	[illegible]	[illegible]	17	[illegible]	[illegible]
Ohio	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oklahoma	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oregon	[illegible]	[illegible]	1,717	80	[illegible]
Pennsylvania	[illegible]	[illegible]	[illegible]	10,371	[illegible]
Rhode Island	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Utah	[illegible]	[illegible]	119	119	[illegible]
Vermont	[illegible]	[illegible]	[illegible]	4	[illegible]

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

IMPROVEMENT IN BUILDING OPERATIONS

There has been more activity in the building trade than in several months, notably the gain of October over September. While there is a loss for the month of October over the corresponding month of last year, it is not as great as the one in September over last year. In 20 cities in the Eastern States there was a total cost of new buildings from plans filed in October of $15,780,695, compared with $17,676,641 for the month of October, 1913, or a loss of 10%, whereas the loss in the same cities for September was 39%. The estimated cost of new buildings for the first ten months of 1914 was $234,240,624, compared with $244,916,477 of last year, or a loss of 5%.

In 22 cities in the Middle West, the loss was 24% for October, or $16,820,300, compared with $22,293,612 for October of last year. This is about the same percentage of loss as in September. There is a gain of 2% for the first ten months of this year over last, expressed in dollars it is $215,503,529 for 1914 and $210,754,757 for 1913.

In nine Southern cities there is a loss of only 25% for October. This is a gain of 16% over last month, for the loss for September was 41%. The total for October is $1,776,372, compared with $2,342,976 for last year.

Only five cities in the Pacific Coast States have been heard from, but the loss is small, both in the figures for October and for the first ten months of the year; however, there is a gain over last month. On the whole, the building figures for October from the entire country show an improvement.

EASTERN STATES

	Month of October 1914	Month of October 1913	First Ten Months of Year 1914	First Ten Months of Year 1913
Albany, N. Y.	$239,225	$781,965	$5,662,700	$8,539,555
Baltimore, Md.	289,567	697,606	10,991,746	7,956,223
Bridgeport, Conn.	174,437	169,060	2,291,436	2,457,489
Buffalo, N. Y.	604,000	1,347,000	9,864,006	10,244,243
Elizabeth, N. J.	163,405	180,105	1,215,027	2,227,410
Hartford, Conn.	360,135	422,865	3,360,491	4,463,311
Hoboken, N. J.	24,950	7,800	765,677	393,942
Jersey City, N. J.	156,850	401,589	3,130,966	4,843,850
Newark, N. J.	120,410	675,530	8,792,350	12,582,774
New Haven, Conn.	231,315	214,785	3,569,117	3,178,456
New York, N. Y.				
Manhattan	3,551,075	2,442,100	43,151,165	54,771,535
Bronx	1,202,675	705,485	19,641,943	18,728,391
Brooklyn	2,453,340	2,222,630	35,552,850	25,710,141
Queens	967,840	1,206,538	16,183,925	14,588,934
Paterson, N. J.	55,247	172,605	1,428,445	1,287,759
Philadelphia, Penn.	2,467,310	2,754,785	32,688,940	36,661,860
Pittsburgh, Penn.	1,085,348	1,362,387	13,944,214	13,854,983
Reading, Penn.	28,475	103,125	1,118,825	786,850
Rochester, N. Y.	401,192	735,403	7,971,828	8,259,364
Scranton, Penn.	300,835	102,251	1,551,905	1,122,618
Springfield, Mass.	228,825	327,498	4,510,030	3,856,676
Syracuse, N. Y.	258,665	78,985	2,458,205	4,144,843
Worcester, Mass.	415,574	494,044	4,394,833	4,255,270
Totals	$15,780,695	$17,676,641	$234,240,624	$244,916,477
	Loss 10%		Loss 5%	

MIDDLE WEST

	Month of October 1914	Month of October 1913	First Ten Months of Year 1914	First Ten Months of Year 1913
Akron, Ohio	$248,465	$463,425	$3,425,995	$4,749,375
Chicago, Ill.	6,774,200	9,314,000	70,534,910	76,743,877
Cincinnati, Ohio	402,235	581,345	8,239,903	7,497,887
Cleveland, Ohio	2,265,685	1,979,075	23,938,540	20,537,740
Columbus, Ohio	649,220	590,005	5,512,476	4,677,088
Dallas, Tex.	204,150	519,435	4,989,737	7,361,015
Denver, Colo.	157,985	241,703	3,002,538	3,582,848
Des Moines, Iowa	145,084	122,360	1,795,248	1,532,169
Detroit, Mich.*	1,233,130	3,079,540	24,640,195	26,726,548
Duluth, Minn.	236,625	212,452	2,609,318	3,797,866
Evansville, Ind.	99,850	137,286	1,212,304	1,612,238
Grand Rapids, Mich.	152,080	257,763	3,324,744	3,742,011
Indianapolis, Ind.	337,689	573,048	7,318,158	8,180,793
Kansas City, Kan.	66,552	69,030	988,703	1,011,441
Kansas City, Mo.	533,790	1,540,705	16,640,150	9,170,826
Milwaukee, Wis.	611,577	1,209,215	8,798,928	11,263,796
Minneapolis, Minn.	1,064,570	1,240,950	13,989,510	10,888,300
Omaha, Neb.	157,675	294,025	4,260,398	3,692,668
St Louis, Mo.	1,115,874	820,073	11,538,589	13,496,136
St Paul, Minn.	1,001,300	804,252	12,430,645	8,088,355
Salt Lake City, Utah.	107,605	171,795	2,701,564	1,741,185
San Antonio, Tex.	83,150	275,405	2,579,610	1,980,727
Toledo, Ohio.	404,939	868,165	5,668,561	5,403,416
Totals	$16,820,300	$22,293,612	$215,503,529	$210,754,757
	Loss 24%		Gain 2%	

SOUTHERN STATES

	Month of October 1914	Month of October 1913	First Ten Months of Year 1914	First Ten Months of Year 1913
Atlanta, Ga.	$215,988	$338,340	$4,251,524	$4,615,419
Birmingham, Ala	138,373	254,741	2,966,233	5,501,877
Chattanooga, Tenn.	61,872	89,420	1,018,879	959,540
Louisville, Ky	327,040	332,580	4,061,515	3,711,150
Memphis, Tenn.	105,580	196,990	2,761,289	3,667,751
New Orleans, La.	286,378	208,750	2,615,947	3,750,979
Richmond, Va.	122,620	147,060	2,940,205	2,680,683
Tampa, Fla.	111,110	114,163	1,289,110	1,270,634
Washington, D. C.	407,411	660,932	8,110,200	8,229,523
Totals	$1,776,372	$2,342,976	$30,018,202	$34,390,856
	Loss 25%		Loss 12%	

PACIFIC COAST STATES

	Month of October 1914	Month of October 1913	First Ten Months of Year 1914	First Ten Months of Year 1913
Los Angeles, Calif	$1,565,000	$1,701,550	$15,845,932	$27,284,812
Portland, Ore.	508,705	681,710	6,278,890	11,722,660
San Francisco, Calif.	1,479,518	1,118,280	26,471,082	17,936,939
Seattle, Wash.*	610,660	474,190	11,127,820	8,383,590
Spokane, Wash.	60,450	140,340	909,467	3,286,973
Tacoma, Wash.	46,563	138,223	1,845,596	2,296,544
Totals	$3,660,236	$3,780,103	$61,350,967	$62,527,928
	Loss 6%		Loss 2%	

*Not included in totals.

RAILWAYS

✚**West Virginia**—The Big Bend Coal Co. has awarded a contract to RYAN & CO., Lexington, Ky., for constructing a 2½ railway around Hatfield Curve, near Matewan, W. Va.

✚Norfolk & Western Ry.—J. J. BOXLEY & SON, Roanoke, Va., has been awarded the contract by this company for the construction of a five-mile line from the Dry Fork branch near Berwind, W. Va.

✚**Illinois**—Illinois Central R.R.—This company has awarded the contract for the construction of a 2.5 mile spur line from Oak Ridge, Ill., to Mine No. 3 of the Peabody Coal Co. in Williamson County, Ill., to W. H. WINDHAM, Centralia, Ill.

Wisconsin—Superior & Southeastern Ry.—Plans are being considered by this company for the extension of its line from New Richmond, Wis., into Bayfield County. J. E. Glover, New Richmond, is Pres.

South Dakota—Sioux Falls & Western Ry.—Preliminary arrangements are being made by this company for the construction of a line from Sioux Falls to Wheeler, S. D. George Schlosser, Sioux Falls, is interested.

✚**Arkansas**—The A. L. Clark Lumber Co. has awarded a contract to J. N. GEORGE & SON for constructing a six mile railway at Glenwood, Ark.

✚McCrory & Beedeville Southern Ry.—This company has awarded a contract to W. A. COLE, McCrory, Ark., for taking up eight miles of its railway in Arkansas.

Texas—Kansas City, Mexico & Orient R.R.—It is announced that construction will be resumed soon on the branch line of this company between San Antonio and Del Rio, Tex. The road will be about 200 miles long. R. P. Parker, San Angelo, Tex., is Ch. Engr. Noted Nov. 5.

New Mexico—Atchison, Topeka & Santa Fe Ry.—This company plans to purchase the line of the New Mexico Central R.R. and extending it from Torrance to Roswell, N. M., about 100 miles. F. M. Bisbee, Amarillo, Tex., is Ch. Engr., Western lines.

Arizona—San Diego & Arizona Ry.—See item under California.

California—San Diego & Arizona Ry.—This company will issue $25,000,000 bonds for further construction work. About $15,000,000 will be spent in finishing the line to El Centro, Calif., and $10,000,000 for constructing the line to Yuma, Ariz. George Holmes, San Diego, Calif., is Pur. Agt.

ELECTRIC RAILWAYS

Boston, Mass.—The Boston Elevated Ry. Co. is preparing plans for the extension of its line from its present terminus on Playstead Rd. to Madison St. Edward Mahler, Boston, is Pur. Agt.

New Britain, Conn.—The Connecticut Co. is preparing plans for double tracking several of its lines in New Britain. F. L. Beardsley, New Britain, is Supt.

Camden, N. J.—The Public Service Ry. Co. plans the improvement of its Haddon Heights and Clementon branch lines, to cost about $50,000. R. E. Danforth, Newark, is Gen. Mgr.

Paterson, N. J.—The Public Service Ry. Co. has submitted a detailed statement to the Board of Public Utility Commissioners estimating the cost of the proposed track elevation for its local lines over the Erie R.R. right of way, at $62,278. R. E. Danforth, Newark, is Gen. Mgr.

Point Marion, Penn.—See item under Morgantown, W. Va.

West Newton, Penn.—The West Penn Traction Co. plans to start work soon on the construction of its proposed electric railway from West Newton and Hunker Station. W. E. Moore, First National Bank Bldg., Pittsburgh, is Vice-Pres. and Gen. Mgr.

Charlottesville, Va.—Plans are being prepared by the Charlottesville Interurban Ry. Co. for the construction of an electric railway from Charlottesville to Alberne, about 15 miles. Walter Washabaugh, Charlottesville, is Ch. Engr.

✚**Morgantown, W. Va.**—The Morgantown Interurban Ry. Co. has awarded the contract for constructing its line from Morgantown, W. Va., to Point Marion, Penn., about nine miles, to JOSEPH VANDERGRIFT. Noted May 29.

Gadsden, Ala.—According to press reports preliminary surveys are being made by C. L. March, Gadsden, for the construction of an interurban electric railway from Gadsden to Center Noted Oct 15.

Huntsville, Ala.—The Huntsville & Florence [illegible] Ry. Co. is making preliminary arrangements for the construction of an electric railway from Huntsville to Florence. [illegible] W. [illegible], Huntsville, is interested. Noted Oct. 1.

Rochelle, Ill.—The Lee County Central Electric Ry. Co. has been granted permission to extend its electric railway from [illegible] to Rochelle. F. R. [illegible], [illegible], Ill., is Gen. Supt.

Bryan, Tex.—L. M. Hewett and associates are preparing to construct an interurban electric line to connect Bryan, [illegible], [illegible] and [illegible]. From [illegible] the proposed road will run north to Bryan, forming a loop of about [illegible] miles. [illegible] of the project are being [illegible] along the route.

Castroville, Tex.—The citizens of Castroville, La Coste, Rio Medina and [illegible] have raised a bonus of $[illegible],000 to aid the San Antonio, [illegible] & [illegible] Interurban Ry. Co. in constructing its line from San Antonio to the Medina dam. [illegible] Miller, [illegible] Bldg., San Antonio, is Gen. Mgr. Noted Sept. [illegible].

Dayton, Tex.—Plans are being prepared for the construction of an electric railway to connect Dayton, Houston, Beaumont and Liberty.

Mexia, Tex.—Preliminary arrangements are being made for the construction of an electric railway in Mexia. The Commercial Club is interested. Noted Oct. [illegible].

Easton, Calif.—The Easton Electric Ry. Co. will extend its line from Easton to [illegible] Hills.

Los Angeles, Calif.—The City Council will soon call for bids for a franchise to extend the electric railway on Evergreen Ave., Wabash Ave., [illegible] St. and Marengo Ave. in [illegible] Heights.

The Pacific Electric Ry. Co. has announced that construction will be started soon on the extension of the electric railway from Riverside to Corona. The cost will be about $[illegible]. J. M. Miller, Los Angeles, is Gen. Mgr.

Montreal, Que.—The Montreal & Southern Counties Ry. Co. has been granted permission by the City Council to connect its lines with the tracks of the Grand Trunk Ry. Co. and the Montreal Tramways Co. in Montreal. W. R. Powell, Montreal, is Vice-Pres. and Gen. Mgr.

Sudbury, Ont.—The Sudbury-Copper Cliff Suburban Electric Ry. Co. has completed surveys for the construction of an electric railway from Sudbury to Copper Cliff, about five miles. J. H. [illegible], Sudbury, is Pres. Noted Feb. 12.

Toronto, Ont.—The city is making arrangements with the Toronto Ry. Co. for the reconstruction of the line on College St. from [illegible] Ave. to Lansdowne Ave.

Winnipeg, Man.—Plans are being prepared by the Winnipeg Electric Ry. Co. for the construction of an electric railway in the northwestern section of Winnipeg. Wilford Phillips, Winnipeg, is Gen. Mgr. and Ch. Engr.

LIGHT, HEAT AND POWER

Framingham, Mass.—(Official)—Bids will be received until noon, Nov. [illegible], by the Massachusetts Board of Education, [illegible] Ashburton Pl., Boston, for heating and ventilation and plumbing equipment for the new dormitory and refectory building of the State Normal School, Framingham. The [illegible] Kimball Co., 6 [illegible] St., Boston, is Engr.-in-Charge. [illegible] is Commr. of Education.

Pascoag, R. I.—(Official)—Bids will be received until noon, Nov. [illegible], by the Pascoag Fire District Electric Light Board, A. [illegible], for the construction of electric lines, and [illegible] and installing substation equipment throughout the districts of Pascoag and Harrisville, R. I.

New Britain, Conn.—Plans are being prepared by Walter [illegible], [illegible] Main St., for a central heating and lighting plant for the [illegible] schools. The building will be [illegible] ft. and will contain [illegible] boilers.

Bedford Hills, N. Y.—(Official)—Bids will be received [illegible] Nov. 2[illegible] by [illegible] Wood, Pres. [illegible] of [illegible] Reformatory for Women, Bedford Hills, for boiler house equipment, [illegible] lights at the Reformatory. [illegible] on file at the office of the Department of [illegible], New York, N. Y., or with [illegible], Capitol, Albany, N. Y.

Orangeburg, N. Y.—The [illegible] Co., Orangeburg, has awarded the contract for the [illegible] of a [illegible] brick and steel power house to the FLINT BUILDING & CONSTRUCTION CO. [illegible] will be [illegible] ft.

Burlington, N. J.—[illegible]

Trenton, N. J.—It is reported that the [illegible] [illegible] Wright [illegible] Trenton.

Hastings, Penn.—[illegible]

Washington, D. C.—[illegible]

[illegible], W. Va.—[illegible]

[illegible], N. C.—[illegible] with [illegible] will be installed. Gilbert C. White, Charlotte, N. C., is Engr.-in-Charge.

Cleveland, Tenn.—The Tennessee Power Co. has secured a site along the [illegible] River in Georgia and will build the fourth and fifth of its power [illegible] on that stream. J. A. Cunningham, Cleveland, is Gen. Supt. of the Tennessee Power Co.

Louisville, Ky.—The Louisville Chemical Co., 11[illegible] South Seventh St., contemplates equipping its proposed new plant with electrically driven machinery.

Conneaut, Ohio.—The City Council is considering plans for rebuilding the municipal electric-light plant at a cost of about $[illegible],000. The matter will be held in abeyance until next spring. S. W. [illegible] is Dir. Pub. Serv.

Pemberville, Ohio.—The village has sold $[illegible] in bonds, the proceeds of which will be used for the installation of a municipal electric-light plant. Fred H. Froelich, Toledo, Ohio, is Engr.-in-Charge.

St. Henry, Ohio.—It is reported that bids will be received until Nov. 2[illegible] for the construction of a municipal electric lighting system to be operated in conjunction with the water works plant. The Council has recently authorized a bond issue to pay for the work.

Sandusky, Ohio.—(Official)—Bids will be received until noon, Nov. 30, by John J. Molter, Dir. of Pub. Ser., for furnishing and operating a complete electric lighting system for the streets, lanes, parks and public places of the city.

Mount Morris, Mich.—The Village Council is considering the question of establishing a municipal electric-light plant if bonds to pay for its construction can be sold.

Sturgis, Mich.—Robinson & Campau, [illegible] Houseman Bldg., Grand Rapids, Mich., are preparing plans for a central heating plant to be located in Sturgis. The estimated cost is $1[illegible],000.

Atwood, Ill.—The Village Board has engaged Ralph Blackwell to supervise the installation of a municipal electric-light plant for which bonds were recently authorized.

Greeley, Iowa.—Fire on Oct. 3[illegible] destroyed the municipal electric-light plant at a loss of about $[illegible]. It is reported that plans are being made for rebuilding the plant, which had been in operation a few months only.

Larchwood, Iowa.—The City Council has engaged Earle D. Jackson, Capitol Bank Bldg., St. Paul, Minn., to supervise the engineering work in connection with the construction of the proposed municipal electric light plant. The estimated cost is $10,000.

Marengo, Iowa.—The Iowa Ry. & Light Co., Cedar Rapids, has been granted permission to rebuild the electric light plant and system in Marengo. Robert S. Cook, Cedar Rapids, is Pur. Agt.

Talmage, Neb.—At a recent election, the citizens voted in favor of a bond issue of $[illegible], the proceeds of which will be used for the establishment of a municipal electric light plant.

New Haven, Mo.—See item under "Water Supply and Irrigation."

Cuero, Tex.—It is reported that the Columbus Gas Co., Milwaukee, Wis., will apply to the City Council for a franchise to build a gas manufacturing plant and lay a distributing system. The entire plant will cost about $[illegible].

Waco, Tex.—The Texas Power & Light Co. has applied to the City Council for a franchise to install and operate a natural gas distributing system in Waco.

Pryor, Okla.—The City Light & Ice Co., recently incorporated with a capital stock of $[illegible], plans to equip and operate an electric-light plant in Pryor.

Alamogordo, N. M.—W. [illegible] and associates contemplate establishing an electric-power plant at Alamogordo and will build transmission lines to [illegible] in the Alamogordo Valley to operate pumping plants for irrigation purposes.

Lahontan, Nev.—The Nevada Valleys Power Co. has awarded the contract for the construction of an [illegible]-mile transmission line from Lahontan to [illegible], Nev., to J. W. FINCH.

Phoenix, Ariz.—The City Commission is considering the establishment of a municipal electric-light and power plant. Bonds will be issued to pay the cost of construction. Fred N. [illegible] is City Engr.

El Centro, Calif.—The [illegible] Power Co. will build a substation at this place to cost about $[illegible] and will construct a [illegible] line from El Centro to [illegible] and [illegible] at a cost of about $[illegible].

Fowler, Calif.—The Fowler Gas Co. plans to extend its mains and otherwise improve its system at a cost of about $1[illegible].

St. Malo, Que.—Bids will be received until Dec. 1, by W. [illegible], Secy. of the National Transcontinental Ry., Ottawa, Ont., for [illegible] heater, steam [illegible] and wiring for the [illegible] of the National Transcontinental Ry. at St. Malo.

[illegible], Ont.—The Town Council has passed a by-law authorizing the extension of the hydro-electric system in [illegible] at a cost of about $[illegible]. W. H. [illegible] is Town Clk.

Toronto, Ont.—The Board of Education will purchase [illegible] for the new [illegible] school building at a total cost of about $[illegible]. W. C. Wilkinson is [illegible].

Walkerville, Ont.—The Town Council plans to install a new distributing system for the hydro-electric plant to cost about $[illegible].

Williamsburg, Ont.—The Town Council will build a new [illegible] to cost about $[illegible]. George Lake is Town Clk.

New Denver, B. C.—It is reported that the New Denver [illegible] Co. is [illegible] plans prepared for rebuilding its power plant which was burned last summer. The company will also extend its transmission lines [illegible].

BRIDGES

★**Portland, Maine**—The following bids were opened Nov. 2, by the Commissioners of Cumberland County for the construction of a bridge between Portland and South Portland, (Div. A) foundation work; (Div. B) steel superstructure of the middle portion, including the draw; (Div. C) concrete superstructure of the rest of the bridge. Noted Sept. 24 and Oct. 1.

	Div. A	Div. B	Div. C
Lackawanna Bridge Co., New York	......	$168,742	......
Foley Contracting Co., New York	$403,600	171,800	$207,000
McClintic-Marshall Co., Boston	......	171,800	......
P. J. Carlin Construction Co., New York	394,500	161,000	358,000
T. L. Eyre, Philadelphia	281,000	......	281,000
The Foundation Co., New York	495,888	......	......
McArthur Bros. and the Foundation Co., N. Y.	490,385	155,000	290,000
Phœnix Bridge Co., Boston	......	139,650	......
Pennsylvania Steel Co., Boston	......	147,400	......
American Bridge Co., Boston	......	156,500	......
H. P. Converse & Co., Boston	345,181	160,273	279,599
Walsh Construction Co., Albany, N. Y.	380,000	170,000	270,000
T. Stuart & Son Co., Newton, Mass.	337,000	......	250,000
John Cashman & Sons, Boston, and Roy H. Beedy	325,000	......	......
Frawley-Kaufman Contracting Co., New York	......	......	328,000
McHarg-Barton Co., New York	324,700	......	307,886
Boston Bridge Works, Boston	......	149,485	......
Fraser, Brace & Co., New York	484,349	......	353,420
John Monks & Sons, New York	559,800	......	......
Fred T. Ley & Co., Springfield, Mass.	......	......	331,687
O'Brien Construction Co., New York	......	......	300,000
Fort Pitt Bridge Works, Pittsburg.	......	215,677	......
A. W. Kurz, New York	......	172,500	......
Strobel Steel Construction Co., Chicago	......	159,800	......
Holbrook, Cabot & Rollins, Boston.	324,000	......	315,000

✚**Buckland, Mass.**—(Official)—The State Highway Commission has awarded the contract for the construction of a reinforced concrete bridge at Buckland to the HYNES CONSTRUCTION CO., Springfield, Mass. There were 13 other bidders. Noted Oct. 29.

Bristol, Conn.—(Official)—Bids will be received until 7 p.m., Nov. 17, by Thomas B. Steele, City Clk., for the construction of two small bridges, one on Pond St. and the other on Terryville Rd. Carleton W. Buell is City Engr. Noted Oct. 22.

New Britain, Conn.—(Official)—Bids will be asked about the first of the year for the construction of a bridge on Rhodes St., for which the Board of Public Works was recently asked to make an appropriation. W. H. Hall is City Engr. Noted Nov. 5.

Hopewell, N. J.—It is reported that the Philadelphia & Reading Ry. plans to build a new steel bridge over its tracks at Greenwood Ave. William Hunter, Philadelphia, Penn., is Ch. Engr.

Perth Amboy, N. J.—The Board of Chosen Freeholders of Middlesex County will shortly authorize repairs to the county bridge at Perth Amboy at an approximate cost of $15,000. Alvin B. Fox, Perth Amboy, is County Engr.

Pine Brook, N. J.—The Boards of Chosen Freeholders of Essex and Morris Counties have approved the plans prepared by Frederick A. Reimer, County Engr. of Essex County, for a bridge over the Passaic River at the Essex and Morris County boundary line. It will have three 50-ft. spans, and is estimated to cost $17,500. Noted May 14 and May 21.

Philadelphia, Penn.—Included in the bond issue of $11,300,000 which was voted by the citizens at the recent general election, is the sum of $300,000 to be used for the construction of new bridges. M. L. Cooke is Dir. Dept. of Pub. Wks.

Christiansburg, Va.—(Official)—Bids will be received until noon, Nov. 18, by the Clerk of the Circuit Court of Montgomery County for the construction of a bridge over Thomas Creek near Whitethorne. It will be about 80 ft. long with a 12-ft. roadway.

Covington, Va.—(Official)—Bids will be received until noon, Nov. 18, by the Clerk of the Circuit Court of Alleghany County for the construction of a 102-ft. bridge over Dunlap Creek at Sampson Damron Ford. The Childrey Co., Richmond, Va., is Engr.-in-Charge.

Roanoke, Va.—The Norfolk & Western Ry. plans the construction of concrete culverts and three iron bridges with concrete piers in connection with the building of a branch line, about five miles long, along Wolf Creek from Narrows, Giles County. J. E. Crawford, Roanoke, is Ch. Engr.

Jacksonville, Fla.—The Ponce de Leon Bridge Co. has been incorporated with a capital stock of $30,000 and will build a bridge over the North River from Kruth's Island to the Gardiner property.

Cleveland, Ohio—At the recent general election, the citizens voted in favor of a bond issue of $5,000,000 to be used for the construction of a high-level bridge across the Cuyahoga River from Lorain Ave. to Ontario St. Frank T. Andrews is Chn., Bd. of County Comrs. Noted Oct. 29.

Columbus, Ohio—(Official) — Bids will be received until noon, Nov. 30, by the Board of Commissioners of Franklin County for building approaches to the Hellbranch Bridge at Pisgah Hill on the London and Lancaster Road, Pleasant Township; Engineer's Estimate No. 146. John Scott is Clk. of County Comrs.

Fremont, Ohio—The Board of Commissioners of Sandusky County has directed the County Engineer to prepare plans for a bridge across Sugar Creek and another one over the Snyder Ditch.

✚**Hamilton, Ohio**—The Board of Commissioners of Butler County has awarded the contract for the construction of Kings Bridge over Indian Creek, Reily Township, to C. C. UMEL & SON, Hamilton, at $4400.

Marietta, Ohio—(Official)—Bids will be received until 1 p.m., Dec. 1, by the Board of Commissioners of Washington County, for the construction of the Cow Run Bridge, Lawrence Township, and the Chuffy Bridge, Waterford Township. W. B. Alexander is County Audr.

Lansing, Mich.—(Official)—Bids will be received until noon, Dec. 1, by Frank F. Rogers, State Highway Comr., for the construction of a 130-ft. riveted pratt truss over the Tittabawassee River, Jerome Township, Midland County.

Danville, Ill.—(Official)—At the recent election, the question of a bond issue of $80,000 for the construction of a bridge over the North Fork River at Bridge St. was carried. It is uncertain when plans will be completed and ready for bids. W. H. Martin is City Engr. Noted Sept. 24 and Oct. 8.

Ottawa, Kan.—The Commissioners of Franklin County are asking bids for the construction of a bridge over the Marais des Cygnes River at Richter. An appropriation of $8000 has been made for this structure.

Salina, Kan.—The citizens of Salina Township have voted $25,000 in bonds for the construction of a bridge over the Grand River at Salina.

Salina, Kan.—(Official)—Bids will be advertised about Dec. 1 for the construction of a concrete bridge over the Smoky Hill River at Iron Ave., Salina. Bids will be received by the Board of Commissioners of Saline County. Wilmarth & Zerbe, Consult. Engrs., prepared the plans. A. W. Godfrey is County Clk. Noted Aug. 27.

Mitchell, S. D.—(Official)—Bids will be received until 2 p.m., Dec. 1, by R. A. Zangle, Audr. of Davison County, for the construction of all county bridges during the ensuing year.

Sioux Falls, S. D.—(Official)—Bids will be received until Nov. 21, by the Board of Commissioners of Minnehaha County for building all bridges, abutments and approaches in the county during 1915. Harry H. Howe is County Audr.

St. Louis, Mo.—At a special election held Nov. 6, the citizens voted in favor of issuing $2,750,000 in bonds for the purpose of completing the Free Bridge over the Mississippi River. It is understood that the work will be begun as soon as arrangements can be made. This bond issue has been defeated at three previous elections. James A. Hooke is Dir. of Pub. Utilities. Noted May 14 and Oct. 22.

Little Rock, Ark.—The County Levy Court of Pulaski County has appropriated $5000 for the construction of a bridge over the Arkansas River between Little Rock and Argenta.

Pine Bluff, Ark.—The Board of Public Affairs has rejected as too high all bids received, Oct. 23, for the construction of a reinforced-concrete bridge over Brump's Bayou at Fifth Ave. F. R. Allen is City Engr.

✚**Cleburne, Tex.**—The City Council has awarded the contract for the construction of a concrete bridge over East Buffalo Creek to R. L. DAVIDSON.

Houston, Tex.—(Official)—Bids will be received until 10 a.m., Nov. 16, by H. L. Washburn, Audr. of Harris County, for the construction of six concrete culverts and one combination timber and concrete bridge on the Alascoceta Road.

✚**Lampasas, Tex.**—The Commissioners Court of Lampasas County has awarded the contract for the construction of four bridges in the county to HESS & SKINNER, Dallas. A bond issue of $14,000 was voted last summer to pay for this work. Noted Aug. 6.

✚**Sherman, Tex.**—The Commissioners Court of Grayson County has awarded the contracts for the construction of a bridge over Shannon Creek and one over Choctaw Creek, nine and ten miles respectively northeast of Sherman, to the WESTERN BRIDGE CO., Sherman.

Colorado Springs, Colo.—The two lowest bids received Oct. 21, by the City Council for rebuilding the Bijou Viaduct were: Fox & Smith, Florence, Colo., $14,500 for the two west arches, or $32,000 for viaduct complete; the Martin Carroll Co., Kansas City, Mo., $21,000 for two west arches, or $39,686 for viaduct complete. Noted Aug. 27.

Seattle, Wash.—It is reported that bids will soon be asked by A. L. Valentine, Chn. Bd. of Pub. Wks., for the construction of a drawbridge over the Duwamish Waterway at Eighth Ave., Southeast. It will cost about $40,000. A. H. Dimock is City Engr.

The following bids were opened recently for the construction of the Fairview Bridge: C. Geske & Co., $20,824; Elmer Johnson, $21,279; A. Rydstrom, $26,651; J. R. Wood, $22,574; Weymouth Construction Co., $24,423; Sound Construction Co., $29,337; Hanson & Co., $22,549; P. J. McHugh, $25,181; P. Manson, $22,700.

✚**Redwood City, Calif.**—The Board of Supervisors of San Mateo County has awarded a contract for the construction of a timber and concrete bridge in the Third Township to BARRETT & HILP, San Francisco, Calif., at $5308, and a contract for the construction of a bridge in the Fourth Township to SAVAGE BROS., San Francisco, at $6759.

✚**Santa Barbara, Calif.**—(Official)—The following bids were received, Oct. 15, by the City Council, for the construction of two bridges on the East Blvd., (a) bridge over Alisos Creek, (b) bridge over Salinas Creek: BOARDMAN CONSTRUCTION CO., Los Angeles, (a) $11,890 (awarded contract), (b) $13,303; Mercereau Bridge & Construction Co., Los Angeles, (a) $15,244, (b) $12,224; Russell-Green-Foell Co., Los Angeles, (a) $13,682, (b) $12,827; Mesmer & Rice, (a) $14,100, (b) $12,542; MUNOZ & MUNOZ, Los Angeles, (a) $14,610, (b) $11,324 (awarded contract); E. F. Edwards, Santa Barbara, (a) $14,780, (b) $11,850; Magnus Johnson, (a) $14,188, (b) $12,282. Noted Oct. 1 and Oct. 29.

Halifax, N. S.—Bids will be received until Nov. 25 by the Road Commissioner, Halifax, for the construction of 80 culverts and small bridges on the Windsor-Walton Rd.

St. Hilaire, Que.—Bids will be received until Dec. 7, by J. E. N. Desrochers for the Municipal Council for the construction of three bridges, reinforced concrete abutments and steel superstructures.

✚**St. Catharines, Ont.**—The Civic Works Committee has awarded the contract for the concrete substructure of the St. Paul St. High Level Bridge to CAMPBELL & LATTIMER, Toronto, Ont., at $21,744. This sum is about $10,000 less than the engineer's estimate. Noted Oct. 8.

Winnipeg, Man.—[illegible]

WATER SUPPLY—IRRIGATION

Auburn, Maine.—[illegible]

Boston, Mass.—[illegible]

Hartford, Conn.—[illegible]

Churchill, N. Y.—[illegible]

+Lyons, N. Y.—[illegible]

Troy, N. Y.—[illegible]

+Wappingers Falls, N. Y.—[illegible]

Jersey City, N. J.—[illegible]

Altoona, Penn.—[illegible]

Dayton, Penn.—[illegible]

Glasgow, Penn.—[illegible]

Jamestown, Penn.—[illegible]

Philadelphia, Penn.—[illegible]

Red Lion, Penn.—[illegible]

Stroudsburg, Penn.—[illegible]

Baltimore, Md.—[illegible]

+Fort Mill, S. C.—[illegible]

+Palmetto, Fla.—[illegible]

Gulfport, Miss.—[illegible]

+Vicksburg, Miss.—[illegible]

+Cleveland, Ohio.—[illegible]

Springfield, Ohio.—[illegible]

+Joliet, Ill.—[illegible]

Paris, Ill.—[illegible]

Mendota, Ill.—[illegible]

[illegible]

[illegible]

+Lincoln, Neb.—The contract for machinery for the water [illegible] MERKLE-HINES MACHINERY CO., [illegible] City, Mo. [illegible] Noted Oct. [illegible]

Billings, Mont.—Bids will be received until Dec. 1, by the City Council for the purchase of $[illegible] in bonds. The proceeds will be used for the construction of a water system. [illegible]

New Haven, Mo.—Bonds for $[illegible] have been voted by the [illegible], the proceeds of which will be used for the [illegible] of the [illegible] water system and for the establishment of an electric light system.

Electra, Tex.—Bids will soon be received by the city for the construction of a reservoir and for laying water mains. Noted [illegible]

Franklin, Tex.—The City Council contemplates [illegible] for the construction of a water system and electric light system.

Marshall, Tex.—The City Commission has authorized the drilling of a well [illegible] ft. deep for the water system.

Texas City, Tex.—An election will be held, Dec. 2, to vote on the [illegible] of [illegible] bonds for $[illegible], the proceeds of which will be used for the purchase and improvement of the present water system and for the construction of an independent source of water supply. John W. Maxcy, Houston, is [illegible]

Kellogg, Idaho.—The Bunker Hill & Sullivan Co. will petition the Council for a franchise for the construction and operation of water and electric light systems. Walter C. Clark is [illegible]

Payette, Idaho.—An election will be held, Nov. 14, to vote on the [illegible] of [illegible] bonds for $6[illegible], the proceeds to be used for the installation of a filtration plant at the water works.

Seattle, Wash.—[illegible] at $7011, was low bidder for [illegible] Graham St. Noted Oct. 1[illegible]

The City Council has authorized the laying of water mains [illegible] Ave. S. and [illegible] Ave. S. W.

+Hood River, Ore.—The contract for constructing the [illegible] for the [illegible] Fork Irrigation district has been awarded to [illegible] & [illegible] CO., Portland, at $1[illegible],16[illegible] Noted Oct. 2[illegible]

Oregon City, Ore.—(Official) Bids will be received by the South Fork Water Commission, until 2 p.m., Nov. 21, for constructing subdivisions Nos. 1 and [illegible] of the South Fork Water Supply System. About [illegible] miles of pipe will be required. [illegible] is [illegible] Noted Oct. [illegible]

+Calexico, Calif.—The contract for constructing a [illegible] filter and washer has been awarded by the city to [illegible] FILTRATION CO., Pacific Electric Bldg., Los Angeles, at $11,[illegible] Noted Aug. 20.

Menlo Park, Calif.—The Bear Gulch Water Co. will make improvements to its plant, estimated to cost $[illegible]

Orange, Calif.—The [illegible] Water Co. has been organized by W. [illegible], M. O. Ainsworth and G. [illegible]. A well will be [illegible] and a pumping plant constructed for the irrigation of [illegible] groves.

Reedley, Calif.—The City Trustees have decided to install an [illegible] plant with a capacity of [illegible] gal. daily.

Riverside, Calif.—The Red Mountain Water Co., recently incorporated with $1[illegible] capital, will construct an irrigation system in [illegible] County. F. A. Little is interested.

+San Diego, Calif.—The contract for [illegible] has been awarded by the city to LLEWELLYN IRON WORKS, Los Angeles, at $[illegible]

Susanville, Calif.—Surveys are being made by the [illegible] of the irrigation system.

Fort Rouge, Ont.—Bids will be received by F. [illegible], until Nov. 16, for [illegible] to the water system.

Galt, Ont.—The Town Council will improve and extend the water [illegible] at an estimated cost of $[illegible]

Ottawa, Ont.—Bids will be received until Nov. [illegible] by the City [illegible] for [illegible] level pumping station. F. C. [illegible]

Port Hope, Ont.—Bids will be received [illegible] Water Commissioners for laying steel pipe [illegible] Toronto [illegible]

+Toronto, Ont.—[illegible]

Moose Jaw, Sask.—Plans are being prepared by [illegible] to the water system. The estimated cost is $[illegible]

SEWERS

Boston, Mass.—[illegible]

Boston, Mass.—Bids will be received by the Board of [illegible]

+Waterbury, Conn.—[illegible]

New York, N. Y.—[illegible]

✚**Schenectady, N. Y.**—The contract for constructing two miles of sanitary sewer has been awarded to THOMAS F. MacGREGOR, Jay St., Schenectady, at $7939. Noted Oct. 28.

★**Wappingers Falls, N. Y.**—(Official)—Bids will be received by the Board of Trustees, until 8 p.m., Nov. 18, for constructing a sewer system for Wappingers Falls. Edward M. Drake is Pres. and H. L. Sterling, 56 Second St., Newburgh, is Engr. For details see advertisement under "Contracts To Be Let."

Camden, N. J.—Bids will be received, until Nov. 16, by the Committee on Streets and Highways, for constructing sewers in Boyd, Berwick, Berkley, Garden and 20th St. and Marlton Ave. J. C. Haines is Chn.

✚**Clinton, N. J.**—Contracts have been awarded for constructing a sewer system and sewage disposal plant at the State Reformatory for Women to SUBURBAN ENGINEERING CO., New York, N. Y.; GIBBS & BUCHICCHIO, Trenton, and NEW YORK SEWAGE DISPOSAL CO., New York, N. Y.

★**Dunellen, N. J.**—(Official)—Bids will be received by the Borough Council until 8 p.m., Dec. 7, for constructing a sewage collecting system. For particulars see advertisement under "Contracts to Be Let."

✚**Greenwood Lake Glens** (Lakeside post office), **N. J.**—The contract for constructing a sewage disposal plant and sewer system has been awarded by R. M. Ekins, 152 Market St., Paterson, to FRANK PUGLIA, 34 Cross St., Paterson, at $7900 for the sewage disposal plant and for pipe at 95c. and $1.40 per ft. Noted Oct. 15.

Manasquan, N. J.—Bids will be received, until Nov. 17, by the Mayor and Council for laying about 4000 ft. of sewer pipe, 4200 ft. of water pipe and constructing a sewage clarification tank. Pugh & Hubbard, Witherspoon Bldg., Philadelphia, Penn., are the Engrs.

North Bergen (Weehawken post office), **N. J.**—The North Bergen Township Committee has adopted an ordinance for the construction of sewers and for a sewage disposal plant for the southern section of North Bergen.

Rahway, N. J.—The Common Council has authorized the purchase of property in Haydock St., to be used as a site for a sewage disposal plant.

Trenton, N. J.—Press reports state that bonds for $32,400 have been sold, the proceeds of which will be used for the construction of sewers and drains.

Norristown, Penn.—(Official)—At a recent election the citizens voted against the question of issuing bonds for $100,000 for the construction of a sewage disposal system. S. C. Corson is Borough Engr. Noted Oct. 1.

Oak Lane (Philadelphia post office), **Penn.**—The citizens contemplate the installation of a sewer system.

Philadelphia, Penn.—The citizens voted in favor of issuing bonds for $1,150,000 for the extension of the sewer system.

Tarentum, Penn.—A plan has been agreed upon by Tarentum and Brackenridge for the construction of a sewage disposal plant. W. A. Gibson is Town Secy. of Tarentum and George H. Dickey is Town Secy. of Brackenridge. Noted Oct. 15.

★**West Chester, Penn.**—The contract for constructing 12,500 ft. of sanitary sewer extension has been awarded to M. & T. E. FARRELL, West Chester at $6320. Oher bids were: W. P. Davis, West Chester, $11,979, Dunleavy Bros., Coatesville, $7902; Bruno Puzzimento, Seneca Falls, N. Y., $11,218.

Baltimore, Md.—At an election held Nov. 3, bonds for $3,000,000, the proceeds of which to be used for the completion of the sewer system, were voted. H. K. McCay is City Engr.

Eustis, Fla.—The citizens will vote on the question of issuing bonds, the proceeds to be used for the construction of a sewer system. J. H. Kennedy is Mayor.

Ocala, Fla.—At an election held Oct. 27, the citizens voted in favor of issuing bonds for $100,000 for the construction of sewers. Noted Oct. 8.

Lookout Mountain, Tenn.—Press reports state that a septic tank for sewage disposal will be installed at Lookout Mountain.

Memphis, Tenn.—Bids were received for constructing a lateral sewer in Fourth St. between Market and Monroe Ave. as follows: B. C. Pouncy, $14,908; V. F. Garvin, $19,404; G. O. White & Co., $19,064; Noll Construction Co., $24,730; T. A. Garvin, $19,021; F. D. Harvey & Co., $13,926.

✚**Canton, Ohio**—The contract for constructing the Tuscarawas St. sewer has been awarded to GLEN HEADLEY at $14,500.

Dodgeville, Wis.—Bids will be received by E. L. Williams, City Clk., until 9 a.m., Nov. 20, for constructing sewers in Eldorado St. and De Forest Ave.

Oconomowoc, Wis.—See item under "Water Supply-Irrigation."

✚**Burlington, Iowa**—The contract for constructing the Louisa St. sewer and its branches has been awarded to HOLMES & WALTER CONSTRUCTION CO.

Keota, Iowa—According to press reports the City Council contemplates the installation of a sewerage system.

Postville, Iowa—At a recent election the citizens voted in favor of issuing $25,000 in bonds for the installation of a sewerage system. Noted Oct. 8.

Barnesville, Minn. The City Council rejected all bids received Oct. 23, for extending the sewer system. The work will be done by day labor.

✚**Blooming Prairie, Minn.**—A contract for constructing a sewer system has been awarded to W. DANFORTH, St. Paul, Minn., at approximately $15,000.

✚**Owatonna, Minn.**—A contract for constructing a sanitary sewer system has been awarded to W. DANFORTH at $15,914. Other bids were: Green Constructing Co., $16,378; William C. Frazer, $17,582, Kirchu Bros., $18,180, William Bosworth, $18,318; Sykes Co., $18,418, Beogan-Adams $18,440; Ilstrup & Olson, $16,612.

Red Lake Falls, Minn.—Bids will be received by I. Lemieux, Secy. Bd. of Education, until 1 p.m., Nov. 13, for constructing a sewer. The work includes 11,040 ft. 8- and 12-in. pipe.

✚**Fort Scott, Kan.**—A contract for constructing a sewage and purification plant has been awarded to McCOY & TAYLOR, Kansas City, Mo., at $19,907. Other bids were: Clements & Louery, Coffeyville, Kan., $21,265; Horton Concrete Construction Co., Kansas City Mo., $22,001. O'Neil Construction Co., Leavenworth, Kan., $23,147. Noted Oct. 1 and 22.

✚**Olathe, Kan.**—(Official)—The contract for constructing main sewer No. 3, lateral sewers Nos. 1 and 2 in Sewer District No. 3 and lateral sewer No. 11 in Sewer District No. 1 has been awarded to EVERETT & BURT, Hutchinson, Kan., at $11,586. Other bids were: James Stanton, $15,971; Stock & Curry, $15,733; J. H. Cosgrove, $13,973; McCoy & Taylor, $12,959; Middleton & Ludlow, $12,501. Noted Oct. 29.

Springfield, Mo.—The City Council contemplates an expenditure of $30,000 for sewer construction.

✚**Argenta, Ark.**—(Official)—A contract for constructing sewers in Sewer District No. 1 has been awarded to MARINO, BROOKS & BURKHAM, St. Louis, Mo., at $228,477. Other bids were: R. Mobley, Argenta, Ark., $251,165; F. D. Horton & H. C. Gass, Houston, Tex., $281,008; Southern Asphalt Construction Co., $256,947; Jacob Althaus & Co., St. Louis, Mo., $289,587; William S. Riley, St. Louis, Mo., $281,197. Noted Oct. 29.

Cleburne, Tex.—The City Council contemplates constructing a sewer system.

Houston, Tex.—(Official)—At an election held Oct. 28 the citizens voted in favor of issuing $2,000,000 in bonds for sanitary and storm sewage disposal.

Texas City, Tex.—An election will be held Dec. 2, to vote on the question of issuing $25,000 in bonds, the proceeds of which will be used to purchase and extend sewer system and develop and construct independent separate system of sanitary sewers and sewage-disposal plant. John W. Maxey is Engr.-in-Charge.

Portland, Ore.—According to press reports the City Commission contemplates constructing a concrete storm sewer in Fulton Park and Carson Heights. The work includes 3040 ft., 51- to 43-in. and 1024 ft., 51- to 52-in. pipe. The estimated cost is $34,604. A. L. Barbur is City Audr.

Bids were received Oct. 21 by the City Commission for constructing vitrified pipe sewers on Long and 45th Ave. as follows: Edward Sandeberg, $15,064; Abraham Son & Co., $15,646; John Keating, $15,739; C. G. Randles, $16,558.

Etna, Calif.—The Town Trustees will receive bids soon for the construction of a sewer system for which $21,000 in bonds have been voted.

Los Angeles, Calif.—Bids will be received by the Board of Public Works until 10 a.m., Nov. 30, for constructing a reinforced concrete Imhoff sewage disposal tank at Wilmington. The estimated cost is $5800. H. B. Ferris is Secy. of the Bd.

✚The contract for constructing a sewer in Fifth St. between Van Ness and Westminster Ave. has been awarded to ANDREW JAYICH at $5200.

Hamilton, Ont.—The City Council contemplates an expenditure of $130,000 for constructing sewers in the eastern section of the city. M. A. F. McCallum is Engr.-in-Charge.

GARBAGE

Boston, Mass.—Bids will be received, until Nov. 16, by the Board of Public Works, for the removal of snow and ice for the winter season, 1914-1915. L. K. Rourke is Comr.

Jersey City, N. J.—The following were low bidders for the removal of ashes and garbage for a period of one year: Montgomery & Conlin, $81,000 (separated); Thomas Harrington Sons Co., $85,000 (unseparated). Noted Oct. 15.

Louisville, Ky.—The Board of Public Safety contemplates the installation of a garbage incinerator.

Akron, Ohio—The city contemplates the construction of a waste reduction plant for the disposal of old bottles, rubbish and garbage.

Superior, Wis.—The city plans to build a garbage incinerator. The amount available is $18,000. C. M. Gould is Health Comr.

Hot Springs, Ark.—The City Council has authorized the Board of City Affairs to receive bids for the construction of a garbage incinerator.

San Francisco, Calif.—(Official)—Neil H. McKay, Consult. Engr., 247 Tenth Ave., San Francisco, is preparing plans and specifications for a refuse and garbage incinerating plant and wishes to get into communication with leading incinerator companies.

STREETS AND ROADS

Boston, Mass.—Bids will be received, until Nov. 17, for the construction of 6600 lin.ft. of state highway in Dudley. Arthur W. Dean, of Ashburton, Penn., is Ch. Engr. of Highway Comm.

✚The contract for paving Fabyan St., Dorchester District, has been awarded to MARTINO DE MATTEO, at $5998. Other bids were: Central Construction Co., Hugh J. McGuire, John F. Beatty, J. J. McCarthy, James Doherty, W. J. Rafferty Co., Warren Bros Co., and John F. Lynch.

Boston, Mass.—Bids will be received until Nov. 13, for roadway construction on St. Andrew Rd. East Boston, and on St. Albans St., West Roxbury. L. K. Rourke is Comr. of Pub. Wks.

Bids will be received until Nov. 16, for paving Dempster and Greenleaf St. in Roxbury District. L. K. Rourke is Comr. of Pub. Wks.

✚The contract for the construction of 9000 lin.ft. of road in Montague, has been awarded to the LANE CONSTRUCTION CORPORATION at $4825. Other bids were, Fred E. Ellis, $5215; New England Contracting Co., $5245; Horne-Lowe Constructing Co., $5274; O. T. Benedict, $5485; D. O'Connell & Sons, $6105; Flynt Granite Co., $6350.

✚The contract for 14,000 lin.ft. of road in Williamstown, has been awarded to the COLUMBUS CONSTRUCTION CO., at $13,641. Other bids were: R. F Hudson, $15,514; Horne-Lowe Con-

[illegible] Co., [illegible]; Frank [illegible], [illegible]; Wm. A. Cahill, [illegible]; [illegible]; [illegible]; Floyd Granite Co., [illegible]. Noted [illegible].

◆**Dorchester, Mass.**—A contract for road [illegible] on [illegible] Ave. has been awarded to HUGH J. McGUIRE, [illegible] St., [illegible], Mass., at [illegible].

◆**Holyoke, Mass.**—The contract for renewing the asphalt wearing surface of [illegible] from [illegible] to Hampden St. has been awarded to DANIEL O'CONNELL'S SONS CO.

◆**Hartford, Conn.**—The State Highway Commission has awarded the contract for road construction in Torrington Township, [illegible] resurfacing on the [illegible] Rd., to JOHN DE MICHIEL & BRO., Torrington, at [illegible]. Other bids were: [illegible] & Bro., Torrington, [illegible]; [illegible] Good Roads & Construction Co., New Britain, [illegible]; [illegible] T. Benedict, Pittsfield, Mass., [illegible]; J. F. [illegible], Torrington, [illegible]; Goodman & Trumbull Co., [illegible]; [illegible], [illegible] Congress Ave., New Haven, [illegible]; R. H. [illegible], Jr., Co., Bridgeport, [illegible]; A. C. [illegible], Jr., Construction Co., West Hartford, [illegible]. Noted Oct. 29.

◆**Penn Yan, N. Y.**—A contract for constructing a road from [illegible] St., Penn Yan, to Esperanza, has been awarded to C. N. KELLY, Penn Yan.

Bordentown, N. J.—The Burlington County Good Roads Association is negotiating with the Board of Commissioners for the improvement of the highway between Bordentown and Burlington.

Jersey City, N. J.—Plans are being prepared by C. A. Van Keuren, City Engr., for the improvement of Summit and [illegible] Ave. M. I. Fagen is City Clk.

◆**Newark, N. J.**—The contract for paving 14th Ave. has been awarded to the NEWARK PAVING CO., at $1766.

◆The contract for paving Grafton, Lanark, and Marion Ave. with asphalt block has been awarded to JOHN GEIGER'S SONS, INC., Newark, at [illegible].

Perth Amboy, N. J.—S. J. Mason, City Engr., has completed plans for the improvement of Amboy Ave., at an estimated cost of [illegible].

Harrisburg, Penn.—Bids will be received by the State Highway Department, until Nov. 24, for reconstructing 20,1[illegible] lin. ft. of brick [illegible] pavement in Butler, Summit and Jefferson Townships in Butler County. E. M. Bigelow is Highway Commr.

◆**Philadelphia, Penn.**—The contract for paving Wayne Ave. from [illegible] Ave. to Hortter St. and between Hortter and [illegible] St. has been awarded to the McNICHOL PAVING & CONSTRUCTION CO., at [illegible].

At the recent election the citizens voted in favor of issuing [illegible] in bonds for improving streets and roads.

◆**Williamsport, Penn.**—The contract for paving West Third St. from [illegible] to William St. has been awarded to R. H. [illegible].

Baltimore, Md.—Bids will be received until Nov. 24, by the State Roads Commission, [illegible] Bldg., Baltimore, for the construction of four sections of State Highway in Washington County.

◆**Charleston, W. Va.**—A contract for paving a number of streets with asphalt has been awarded to R. M. HUDSON, Atlanta, Ga., at approximately [illegible].

Moundsville, W. Va.—(Official)—Bids will be received by J. [illegible], County Clk., until noon, Nov. 19, for improving a portion of the [illegible] in Washington District.

Asheville, N. C.—Bids will be received by C. H. Neal, Rd. Engr., until Dec. 6, for constructing seven miles of bituminous [illegible].

Centreville, Ala.—According to press reports bids will be received by the Commissioners of [illegible] County, until Nov. [illegible], for improving the Centreville and [illegible] Rd. W. S. Keller is State Highway Engr.

Wartburg, Tenn.—At a recent election the citizens of [illegible] County voted in favor of issuing [illegible] in bonds for road improvements.

Covington, Ky.—(Official)—Bids will be received by the Fiscal Court of Kenton County until [illegible] Nov. 1[illegible], for [illegible] a section of the [illegible].

Grayson, Ky.—The citizens of Carter County have voted in favor of issuing [illegible] in bonds for building roads.

Shelbyville, Ky.—The Fiscal Court of Shelby County plans [illegible].

◆**Cincinnati, Ohio.**—[illegible]

Fremont, Ohio.—At a recent election the citizens of [illegible] Township voted in favor of issuing [illegible] in bonds for road improvements.

◆**Middletown, Ohio.**—The contract for [illegible] has been awarded to [illegible].

Youngstown, Ohio.—Bids will be received [illegible].

◆**Shelbyville, Ind.**—(Official)—The contract for [illegible] has been awarded to [illegible].

◆**Waukesha, Wis.**—A contract for constructing [illegible] has been awarded to [illegible].

Burlington, Iowa.—[illegible]

Muscatine, Iowa.—[illegible]

◆**Eveleth, Minn.**—The contract for paving [illegible] has been awarded to [illegible].

Farmington, Minn.—Bids have been received for improving the [illegible] Hill Rd. as follows: H. M. Kingston and John [illegible], [illegible]; John E. Blomstrand, [illegible]; Leroy H. Howe, [illegible]; [illegible], $8770; Beecher Improvement Co., $6200.

◆**St. Paul, Minn.**—The contract for repairing Robert St. has been awarded to the CENTRAL CONSTRUCTION CO., 500 Capital Bank Bldg., at $17,748.

Kansas City, Kan.—The Commissioners of Wyandotte County voted Oct. 26, in favor of macadamizing a section of Leavenworth Rd. The estimated cost is $8270.

◆**Wichita, Kan.**—The contract for improving South Volutsia Ave. has been awarded to H. L. MILES.

Great Falls, Mont.—The County Commissioners of Cascade and Meagher Counties, with the coöperation of the Government, will reconstruct a road between Neihart and White Sulphur Springs, uniting the two national parks, Glacier and Yellowstone. The road will be about eight miles long and will cost approximately $10,000.

◆**Livingston, Mont.**—A contract for constructing concrete sidewalks in District No. 60 has been awarded to RIFLER & SWORDER.

Roundup, Mont.—At the general election the citizens of Musselshell County voted in favor of issuing $200,000 in bonds for road improvements.

Caldwell, Tex.—At a recent election the citizens voted in favor of issuing $12,000 in bonds for improving streets.

◆**Lewiston, Idaho.**—A contract for paving seven miles of highway in the Lewiston Orchards Highway District has been awarded to the WARREN CONSTRUCTION CO., Spokane, Wash., at $32,000.

◆**Olympia, Wash.**—The contract for surfacing about three miles of the Pacific Highway between Woodland and La Center has been awarded to HAYDEN BROS. & BIDWELL, Portland, Ore., at $6960. Noted Oct. 15.

◆**Seattle, Wash.**—The contract for constructing three miles of the Medina-Bellevue Rd. has been awarded to W. MARTELL, Seattle, at $13,825. Noted Oct. 8.

Portland, Ore.—Plans have been prepared for the improvement of East Grant St. from Grand Ave. to East 11th St. The approximate cost is $14,258.

Los Angeles, Calif.—(Official)—Bids will be received by H. J. Lelande, Clk. Bd. of Supervisors, until 2 p.m., Nov. 16, for improving several streets in Road Improvement District No. 31.

Monrovia, Calif.—The City Council plans an expenditure of $1[illegible] for street improvements.

◆**Pasadena, Calif.**—The contract for improving Stevenson Ave. from East Orange Grove Ave. to Washington St. has been awarded to T. C. BREITENSTEIN, [illegible] Douglas St., Pasadena, at $9060. Other bids were: H. E. Cox, $10,17[illegible]; Charles A. Baldwin, $9171. Noted Oct. 22.

Porterville, Calif.—According to press reports bids will be received until Dec. 7, for grading and paving about 5[illegible] sq. yd. with 1½-in. asphalt concrete pavement on a 5-in. concrete base. L. H. Alhouse is City Engr.

◆**Sacramento, Calif.**—(Official)—The State Highway Commission has awarded a contract for constructing [illegible] miles of the Bakersfield-Glenville Rd., Kern County, to F. H. JAMESON, at [illegible]. Other bids were: Shattuck & Nimmo, $1[illegible]; West & Cochran, $11,796; M. T. Kean, $12,26[illegible]; Castro & Blaisdell, $1[illegible],168; J. H. McMillan, $12,9[illegible]; T. L. [illegible], $11,[illegible]; Wernigger, Stevens & Hitchcock, $13,781; Geo. S. Benson & Sons, $11,0[illegible]; J. H. Falconer, $18,286; Berry, Mackie & Co., $[illegible],292.

◆**Santa Rosa, Calif.**—The City Trustees have awarded a contract for street paving to the CITY STREET IMPROVEMENT CO., San Francisco, Calif., at 1[illegible]¾c. per sq.ft.

◆**Sausalito, Calif.**—The City Council has awarded a contract for grading several streets to EATON & SMITH, San Francisco, Calif., at $21,10[illegible].

INDUSTRIAL WORKS

Auburn, Maine.—The Androscoggin Co., Washington St., will erect a foundry to cost $[illegible]. George W. McFallen is Pres.

◆**Lawrence, Mass.**—The contract for the construction of the factory for the Lawrence Mattress Co. has been awarded to ANTONIO CHAMEY, [illegible] Fitz St. It will be two stories, [illegible] ft., estimated to cost $1[illegible].

◆**Salem, Mass.**—(Official)—The general contract for the construction of the plant for the Naumkeag Steam Cotton Co. has been awarded to the TURNER CONSTRUCTION CO., [illegible] Broadway, New York. Noted June [illegible].

Bridgeport, Conn.—The Remington Arms Union Metallic Cartridge Co. is having plans prepared for a [illegible]-story factory at Bridgeport.

Buffalo, N. Y.—The Ford Motor Co., Detroit, Mich., has purchased a site adjoining the New York Central Belt Line [illegible], at Buffalo, upon which will be erected a four-story factory and warehouse. The estimated cost is $[illegible].

Buffalo, N. Y.—The [illegible] Concrete [illegible] Co., recently incorporated, will erect a plant for the manufacture of [illegible]. The estimated cost is $[illegible]. W. F. [illegible] is the Pres.

The [illegible] Co. is having plans prepared for an addition to its plant at [illegible] St. and the Erie R.R.

The [illegible] & Malleable Casting Co. is preparing plans for a [illegible] building [illegible] ft. in connection with its plant at [illegible] Ave.

The [illegible] Motor Co. will erect a four-story and basement factory at [illegible] St. and the Erie R.R. George K. [illegible] is Pres.

Hudson, N. Y.—The [illegible] Bag & Paper Co. is having plans prepared for the construction of a [illegible] paper mill.

Lockport, N. Y.—The Harrison Mfg. Co., manufacturer of [illegible], will enlarge its plant.

New York, N. Y.—(Borough of [illegible])—The Fletcher [illegible], [illegible] St., New York, has prepared plans for a plant at Morris Heights for the New York Yacht, Launch & Engine Co.

New York, N. Y.—(Borough of Brooklyn)—L. S. Beardsley, Arch., 38 West 32d St., is preparing plans for a two-story reinforced-concrete bakery at Rutledge St., for Dugan Bros., 287 Broadway, Brooklyn.

+New York, N. Y.—(Borough of Brooklyn)—The general contract for the three-story brick factory at 330 Melrose St., for Samuel Graber, has been awarded to ANDREW ADAMS & CO., 254 Melrose St. The estimated cost is $15,000.

+The general contract for the construction of the two-story brick and steel factory at 222 44th St., for the Fred H. Levey Co., has been awarded to F. J. ASHFIELD, 350 Fulton St.

+(Borough of Manhattan)—The general contract for the construction of the 11-story brewery and stock house at 210 East 92d St., for Jacob Ruppert Brewing Co., has beeen awarded to MURPHY BROS., Madison Ave. and 42d St. Noted Oct. 22.

+(Borough of Richmond)—The general contract for the construction of the warehouse for the American Dock Co. has been awarded to the R. & W. CONCRETE CO., 207 Market St., Newark, N. J. The estimated cost is $161,000. Noted Oct. 29.

Oneonta, N. Y.—The Sheffield Farms Slawson Decker Co. will erect a creamery at Oneonta. W. H. Sheffield, Hobart, N. Y., is Pres.

Rochester, N. Y.—Anthony J. Weetzer is having plans prepared by H. B. Nurse, Arch., Cutler Bldg., for a two-story, 70x90-ft. wagon factory and garage.

Eddystone, Penn.—The Tindel Morris Co. will expend about $100,000 for enlargements and improvements to its plant.

New Castle, Del.—The Bethlehem Steel Co., South Bethlehem, Penn., will erect a plant at New Castle for the pressing of papier mache cases.

+Americus, Ga.—The contract for the construction of the warehouse on Spring St. has been awarded to F. W. GRIFFEN, Americus, Ga.

+Cleveland, Ohio—The contract for the construction of a two-story and basement 30x80-ft. factory for the Tabor Ice Cream Co., Quimby Bldg., has been awarded to METTLER-GLOYD CO., 713 Prospect Ave., Cleveland. Estimated cost, $40,000. Noted Oct. 22.

Fort Wayne, Ind.—Plans have been prepared for the construction of a 40x141-ft. factory, on Lewis and Calhoun St. for the Cooney Bayer Cigar Co. Estimated cost, $40,000.

Chicago, Ill.—The Chicago Compressed Gas Co., recently organized, have purchased a site at 58th Ave. and 66th St. on which will be constructed a brick and concrete 100x200-ft., factory. Harry G. Austin is Pres. and Herbert P. Harding is Secy. of the company.

+Peoria, Ill.—The contract for the construction of a factory at Washington and Vons St. for the W. H. Carr Medicine Co., has been awarded to V. JOBST & SONS. Estimated cost, $40,000.

Grand Rapids, Mich.—The Inter-State Oil Co., La Crosse, contemplates constructing a warehouse, estimated to cost, $10,000.

Milwaukee, Wis.—Contracts for the construction of the warehouse at Fourth and Fowler St., for B. J. Johnson Soap Co. have been awarded to the NORTHERN CONSTRUCTION CO. general contract; WORDEN-ALLEN CO., steel. Estimated cost, $100,000.

Waukesha, Wis.—Plans are being prepared for the Waukesha Spring Water Ice Co. for the construction of an ice plant, at Waukesha.

Denton, Mont.—Plans have been prepared and a site secured for the construction of a large flour mill, for Albert Johnson.

Ekalaka, Mont.—Wennigan & Fisher have purchased a site for the construction of a flour mill, elevator and feed grinding mill, at Ekalaka.

Geraldine, Mont.—Plans are being prepared by W. H. Waidman for the construction of a flour and feed mill to cost $25,000.

Seattle, Wash.—The Cross-Bodine Lumber Co. recently incorporated with a capital of $50,000, contemplates constructing a lumber mill. R. M. Cross and A. L. Hill are interested.

Seattle, Wash.—Bids will soon be received for the construction of a plant at Occidental and First St. for the Cumberland Coal Co. Estimated cost $18,000. Reitze, Storey & Duffy, Engrs., Northern Bank Bldg., are preparing the plans.

Spokane, Wash.—Bids will soon be received for the construction of a packing plant for Mitchem Bros., to cost, $25,000. Noted July 23.

Carlton, Ore.—The Carlton Fir Lumber Co., contemplates constructing a mill to replace the one recently destroyed by fire. Estimated cost, $100,000. Charles E. Lodd is Pres.

Klamath Falls, Ore.—The Lamm Lumber Co., recently incorporated, contemplates constructing sawmill on Upper Klamath Lake. W. F. Lamow, F. N. De Neffe and J. L. Conley, Portland, are interested.

The Pelican Bay Lumber Co. contemplates constructing a sawmill, estimated to cost, $95,000. F. Hill Hunter, Spokane, Wash., is the Engr.

Fresno, Calif.—The People's Ice Co., contemplates constructing an ice-plant to cost $40,000. J. H. Wooden and F. W. Gregory are interested.

+Oakland, Calif.—The contract for the construction of a one-story packing plant on Second St. for On & Breedlove, has been awarded to B. PEARSON, 2403 Grant St., Berkeley. Estimated cost, $10,000.

Santa Rosa, Calif.—The Sebastopol Berry Growers contemplates constructing a factory and a pre-cooling plant. Estimated cost, $50,000.

Listowel, Ont.—Libbey, McNeil & Libbey, Chicago, Ill., contemplate constructing a factory, to cost $100,000.

Regina, Sask.—Plans have been prepared for the construction of a two-story, 75x125-ft. warehouse at Dewdney and McIntyre St., for Cushing Bros. Estimated cost, $10,000.

Regine, Sask.—Tudhope, Anderson & Co., contemplate constructing a two-story, 50x135-ft., warehouse, to cost $20,000.

FEDERAL GOVERNMENT WORK

Shipbuilding Cranes—Boston, Mass.—Bids were received as follows, Nov. 9, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing and installing four shipbuilding cranes at the Boston Navy Yard under item (1), and five at the Philadelphia Navy Yard, under item (2): McMyler-Interstate Co., Bedford, Ohio, item (1), design A, $38,600; B, $38,720; C, $38,400; D, $38,520; item (2), design A, $47,700; B, $47,850; C, $47,450; D, $47,600; Maine Electric Co., Portland, Ore., (1) $51,336, (2) $64,170; Cleveland Crane & Engineering Co., Wickliffe, Ohio, (1) $57,260, (2) $71,425; Terry & Tench Co., New York, N. Y., (1) $43,297, (2) $52,530; Orton & Steinbrenner Co., Chicago, Ill., (1), design A, $41,820; AA, $39,886; B, $40,326; BA, $38,011; C, $30,879; CA, $31,119; (2), design A, $51,836; AA, $49,281; B, $49,939; BA, $47,045; C, $38,252; CA, $38,569; American Hoist & Derrick Co., St. Paul, Minn., (1) $38,304; alt. A, $38,104; B, $38,504; C, $41,844; D, add $100 to each crane; (2) $47,241; alt. A, $46,991; B, $47,491; C, $51,666; D, add $100 to each crane; Wellman-Seaver-Morgan Co., Cleveland, Ohio, (1) $56,500; (2) $70,000; Whiting Foundry & Equipment Co., Harvey, Ill., (1) $57,185, (2) $70,635; Niles-Bement-Pond Co., 111 Broadway, New York, N. Y., (1) $79,600, (2) $97,900; Morgan Engineering Co., Alliance, Ohio, (1) $48,750, (2) $60,750. Noted Nov. 5.

Post Office—Danbury, Conn.—Bids were received as follows, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Danbury, (a) limestone; (b) sandstone: George T. Kelly, Yonkers, N. Y., (a) $67,888; William Werner, New York, N. Y. (Borough of Brooklyn), $67,377; Kelly & Kelly, Inc., Long Island City, N. Y., $65,700; M. Yeager & Co., Danville, Ill., $71,425; William H. Fissell & Co., New York, $67,900; Walter L. Mellen, Worcester, Mass., $74,420; J. E. & A. L. Pennock, Philadelphia, Penn., $71,600; Conners Bros. Co., Lowell, Mass., $84,755; George R. Wells & Co., New York, $64,820; Westchester Engineering Co., White Plains, N. Y., $63,350; William H. Egan, New York, $71,200; A. W. King, New York, $69,866; Charles McCaul Co., Philadelphia, Penn., $58,495; Joseph Christiano, Greenwich, Conn., $115,000. Noted Sept. 24.

Post Office—Stamford, Conn.—Bids were received as follows, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Stamford, (a) limestone; (b) sandstone: George T. Kelly, Yonkers, N. Y., (a) $109,900. William Werner, New York, N. Y. (Borough of Brooklyn), (a) $110,750; (b) $110,750. M. Yeager & Sons, Danville, Ill., (a) $113,827; (b) $116,127. Kelly & Kelly, Inc., Long Island City, N. Y., (a) $115,000; (b) $115,000. J. E. & A. L. Pennock, Philadelphia, Penn., (a) $109,800; (b) $112,400. William H. Fissell & Co., New York, N. Y., (a) $111,300; (b) $112,400 John Lowry, Jr., New York, N. Y., (a) $110,300; (b) $112,400. George R. Wells & Co., New York, N. Y., (a) $102,186; (b) $102,686. Lewis P. Fluhrer Co., New York, N. Y., (a) $120,000; (b) $121,400. Conners Bros. Co., Lowell, Mass., (a) $111,730; (b) $112,400. King Lumber Co., Charlottesville, Va., (a) $139,900; (b) $142,000. Westchester Engineering Co., White Plains, N. Y., (a) $111,870; (b) $113,800. Astoria Realty & Construction Co., New York, N. Y., (a) $96,897; (b) $96,897. William H. Egan, New York, N. Y., $111,967; (b) $112,900. John G. Unkefer & Co., Minerva, Ohio, (a) $111,524; (b) $112,524. Oscawanna Building Co., New York, N. Y., (a) $99,700; (b) $101,200. Joseph Christiano, Greenwich, Conn., (a) $140,000; (b) $140,000. John H. Parker Co., New York, N. Y., (a) $105,916; (b) $109,916. Charles McCaul Co., Philadelphia, Penn., (a) $91,265; (b) $93,465. Noted Sept. 24.

+Lighting Fixtures, Etc.—New York, N. Y.—The contract for installing a conduit and wiring system and lighting fixtures in the U. S. Appraiser's Warehouse, New York, has been awarded to the LORD ELECTRIC CO., 105 West 40th St., New York, N. Y., at $24,458.

+Piers, Ferry Rack, Bridge, Etc.—New York, N. Y.—The contract for the construction of the dock piers, ferry rack, bridge, etc., at the U. S. barge office, New York, has been awarded to the PHOENIX CONSTRUCTION CO., 41 Park Row, New York. Noted Sept. 24 and Oct. 22.

Lumber—Philadelphia, Penn.—Bids will be received by Lieut. Col. Cyrus S. Radford, Assist. Quartermaster, 1100 South Broad St., until 11 a.m., Nov. 17, for furnishing 100,000 ft. No. 3 barn grade white pine or white cedar and 20,000 ft. No. 3 barn grade white pine.

Shipbuilding Cranes—Philadelphia, Penn.—See item under Boston, Mass. Noted Nov. 5.

Building—Washington, D. C.—Bids were received as follows, by the Commissioners of the District of Columbia, for the repair and reconstruction of Western High School Building No. 117, at 35th and R St., Washington: Andrew Murray, Washington, $60,990; Wells Bros. Co., New York, $67,000; James L. Parsons, Washington, $59,277; George A. Fuller Construction Co., New York, $52,750; Melton Construction Co., Inc., Washington, $50,995; Irwin & Leighton, Philadelphia, Penn., $59,800; Skinker & Garrett, $56,928; Conners Bros. Co., Lowell, Mass., $63,700; Boyle-Robertson Construction Co., Washington, $55,335; P. F. Gormley Co., $57,577; George E. Wyne, $54,500; Singer Fence Co., $57,021; Arthur Cowsill, $51,000; W. E. Mooney, $63,920; Richardson & Burgess, Inc., $48,877; Harry H. Wehmeyer, Philadelphia, Penn., $66,840.

+Laundry Machinery—Washington, D. C.—The contract for furnishing and installing laundry machinery in the Government Hospital for the Insane, Washington, D. C., has been awarded to the AMERICAN LAUNDRY MACHINERY CO., Washington, D. C., at $5370. Noted Oct. 1.

Hospitals—Washington, D. C.—The following bids were received by the Commissioner of Indian Affairs, Interior Dept., Washington, D. C., for constructing frame hospitals at the Indian agencies at Pima and San Xavier, Ariz., Carson, Nev.; Mescalero, N. M.; Turtle Mountain, N. D., and Blackfoot, Mont.: F. S. Berger, St. Paul, Minn., $17,600; Turtle Mountain,

[illegible] Reno Nev [illegible] Carson, Nev [illegible] Los Angeles, Calif [illegible] Xavier, Ariz [illegible] Phoenix, Ariz [illegible] Ariz [illegible] Carson, Nev [illegible] for all six [illegible] San Francisco, Calif [illegible] Nev [illegible] El Paso, Tex [illegible] N M [illegible] Mont [illegible] Noted [illegible]

Building—Washington, D C—Bids will be received by H [illegible] Bureau of Yards and Docks, Navy Dept, Washington, D C, until [illegible] Nov [illegible] for constructing a [illegible] warehouse [illegible] ft, with an annex [illegible]

Hotels—Washington, D C—The Commissioners of the District have rejected all bids received [illegible] for furnishing [illegible] for the [illegible] School Bldg, Washington. Noted [illegible]

Excavating and Building—Washington, D C—Bids will be received at the office of the Secretary of the Board of Commissioners, District Bldg, until 2 p m, Nov [illegible], for excavation, [illegible] for High School No 174, First St, N W, between [illegible] St. Oliver [illegible] Newman is one of the Comrs

✦Life Saving Station—[illegible] N C—The contract for the construction of a life saving station at Cape Fear, N C, has been awarded to [illegible] ROBBINS, Southport, N C, at [illegible] Noted [illegible]

✦Post Office—[illegible] (Official)—Bids will be received by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, until [illegible] p m, Dec 17, for constructing a post office at [illegible] The building will be of brick, stone and terra cotta, two stories and basement

Post Office—[illegible] Mass—Bids will be received until 3 p m, Dec 21, by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, for constructing a post office at [illegible] The building will be two stories and basement, of stone

✦Post Office—[illegible] Ky—The contract for constructing the U S post office at [illegible] has been awarded to the J S [illegible] Co, [illegible] N J

Post Office—[illegible] Ky—Bids will be received by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, until 3 p m, Dec [illegible] for constructing a post office at [illegible] The building will be two stories and basement, of stone

✦Mail Handling Apparatus—Detroit, Mich—Bids will be received by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, until [illegible] p m, Dec 12, for installing a mail handling apparatus in the post office at Detroit

Post Office—Ishpeming, Mich—Bids will be received by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, until 3 p m, Dec 1[illegible], for constructing a post office at Ishpeming. The building will be two stories and basement

Life Saving Station—[illegible] Island, Mich—Bids will be received by S I Kimball, Gen Superv, U S Life Saving Service, Treasury Dept, Washington, D C, until 2 p m, Dec [illegible], for constructing a life saving station and launchway at [illegible] Island

Building—[illegible] Mich—Bids will be received, until [illegible] p m, Dec [illegible], by the Lighthouse Inspector, Milwaukee, Wis, for constructing Keepers Quarters (duplex apartments) at the [illegible] Light station

Post Office—[illegible] Ill—Bids were received as follows by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, for the construction of a post office at [illegible] [illegible]

Post Office—[illegible] Ill—Bids were received as follows by Oscar Wenderoth, Superv Arch, Treasury Dept, Washington, D C, for the construction of a post office at [illegible] [illegible]

Conduit and Cable System—[illegible]

Building—Fort [illegible]—Bids will be received by the Constructing Quartermaster, Fort [illegible] for the construction of a [illegible]

Canal Work—[illegible] [illegible]

Bldg, Great Falls, Mont, (b) $3770; Charles Wilhite & Co, [illegible] Mont, (c) $[illegible],370. Noted Sept 24

Earthwork—Elsberry, Mo—Bids will be received, until 11 a m, Nov 13, by Maj Clarke S. Smith, Mississippi River Comn, International Life Bldg, St Louis, Mo, for constructing about [illegible] cu yd of earthwork in the Elsberry District

✦Earthwork—Grand Valley, Colo—The contract for the earthwork in connection with the Grand Valley project has been awarded to THORN & WHITING, Springville, Utah, at $[illegible]

Ward Pavilions—Mare Island (Vallejo post office), Calif—The following bids were received for constructing five one-story ward pavilions at the naval hospital reservation: R S K McMiller, San Francisco, Calif, $24,615; Gutleben Bros, San Francisco, Calif, $23,300; Hansborough-Johnston Co, San Francisco, $[illegible],253; Thompson & Walker, San Francisco, Calif, $[illegible],594; W N Concannon Co, San Francisco, Calif, using Johns-Manville board, $25,619, using Compo board, $26,-[illegible]; Burnham Plumbing Co, San Francisco, Calif, $2[illegible],797; Henry C Warwick, San Francisco, Calif, $23,405; D L Bruce, San Francisco, Calif, $25,135; M Sheehey & Bros, San Francisco, Calif, $2[illegible],232. Noted Oct 8

MISCELLANEOUS

Fender Pier—Boston, Mass—Bids will be received by the Public Works Department, until Nov 13, for the construction of a fender pier at Chelsea Bridge, north. L K Rourke is Comr

Quay Wall—Pawtucket, R I—The State Harbor Commission has rejected all bids for the construction of a quay wall at Pawtucket. New bids will be received shortly under a changed form of contract and specifications. S M Conant is Chmn of the Comn. Noted Oct 22

✦Barge Canal Work—Albany, N Y—Duncan W Peck, State Supt Pub Wks, has awarded Terminal Contract No. 2[illegible] to JOSEPH P CASEY, Bascom, N Y, at $9671. Contract No 11 R has been awarded to BROWN & LOWE, Schenectady, at $71,[illegible]21. List of bidders noted Nov 5

✦Barge Canal Work—Albany, N Y—Duncan W Peck, State Supt Pub Wks, has awarded the contract to LUPFER & REMICK, at $188,031, for the erection and equipment of power plants, electrical equipment and machinery for operating locks 1, 2, 3 and 4, Cayuga and Seneca Canal. Noted Oct [illegible]

✦Finishing Hardware—Farmingdale, N Y—(Official)—Bids will be received by A. A. Johnson, Acting Secy Bd Trustees, Room 43, 16 Court St, Brooklyn, N Y, until 10 a m, Nov 12, for furnishing the finishing hardware for the director's residence, horticultural building and agronomy building at the new State School of Agriculture, near Farmingdale, Long Island, N Y. Specifications are on file at the Department of Architecture, Albany, and at the New York office, Room 1224 Woolworth Bldg

✦Mausoleum—New York, N Y—(Borough of Queens)—(Official)—The contract for the construction of the Raegener Mausoleum in Lutheran Cemetery has been awarded to McDERMOTT & HANIGAN, INC, 103 Park Ave, New York, at $1[illegible],000. Nortman & Braun are the Archs

Motor Fire Apparatus—New York, N Y—(Borough of Manhattan)—(Official)—The only bid received on Nov 4 by Commissioner Robert Adamson, for furnishing the fire department with 18 gasoline propelled tractors, was that of the Front Drive Motor Co, Willow Ave, Hoboken, N J, at $61,[illegible]0. Noted Oct 29

Materials For Park Improvement—Jersey City, N J—Bids will be received by the Hudson County Park Commission, No 1 Exchange Pl, until 2 p m, Nov 17, for furnishing materials as follows: 936 lin ft chain link woven steel fencing, one double gate, 11 ft opening; 164 lin ft chain link woven steel tennis fencing; five single gates; 16 galvanized steel tubing tennis net posts; five chain link woven baseball backstops; 100 cu yd coarse cinders; 1100 cu yd ¾ in limestone screenings; [illegible] cu yd [illegible] Cow Bay grit; [illegible] cu yd [illegible] limestone screenings

Motor Fire Apparatus—Orange, N J—The City Commission will receive bids, until Nov 17, for furnishing motor fire apparatus. All bids formerly received have been rejected. William F Kearney is Dir Pub Safety

✦Creek Improvement—Lebanon, Penn—The contract for the lowering of the bed of Quittapa Creek is reported awarded to JAMES H [illegible], Lebanon, at $10,[illegible]. T P Crowell is City Engr

Piers, Bulkheads, Fire Apparatus and Stations—Philadelphia, Penn—The citizens voted a loan of $11,2[illegible] at the [illegible] election for municipal improvements. Of this amount [illegible] will be expended as follows: For completing [illegible] [illegible]

✦Creek Straightening—[illegible]—(Official)—Bids will be received [illegible] for excavating a channel [illegible]

✦Dredging—Baltimore, Md—The State [illegible] MARYLAND [illegible]

Canal—[illegible]

Steel and Wood Furnishings—[illegible] Fla—Bids will be received by the Board of [illegible] Works until Dec 1 for steel and wood furnishings for the new city hall. [illegible]

Motor Fire Apparatus—[illegible] Mass—The city will receive bids [illegible] for furnishing the fire department [illegible]

Stadium—Akron, Ohio—Plans are being prepared for a stadium to be erected on Buchtel Field for Akron University. Estimated cost about $50,000.

Subway, Ore Docks and Freight Terminal—Barberton, Ohio—O. C. Barber, Barberton, Ohio, match manufacturer, has had plans prepared for the development of 40 acres of land on the lake front, between East 55th and East 67th St. The plans include the construction of iron ore docks, a four-track subway under East 55th St. and freight terminals. The estimated cost of the project is $9,000,000. The Osborn Engineering Co., 740 Engineers Bldg., Cleveland, has prepared the plans.

Comfort Station—Lorain, Ohio—The city plans to construct a public comfort station in Washington Park. C. M. Osbourne is City Engr.

Docks and Yard Improvements—Toledo, Ohio—The Cincinnati, Hamilton & Dayton R.R. is having plans prepared for coal docks, modern car dumping facilities, coal-hoisting machinery and additional yards at Toledo. The estimated cost is $500,000. Noted Oct. 15.

Motor Fire Apparatus—Indianapolis, Ind.—The City Council has authorized a bond issue of $80,000, of which $52,000 will be used for the purchase of motor fire apparatus.

Drainage—Urbana, Ill.—Bids will be received by the County Clerk until 11 a.m., Nov. 14, for drainage work in the Little Vermilion special drainage district. The work includes furnishing and laying 7410 ft. of 8- to 20-in. tile. Plans on file at the office of the County Clerk, Urbana.

+Breakwater—Racine, Wis.—The contract for the construction of a lake shore breakwater, including 831 lin.ft. of double pile protection and 100 lin.ft. of single pile protection, has been awarded to P. W. GALLOWAY, Racine, at $21,750. P. H. Connoly is City Engr. Noted Oct. 29.

Park Extension—Des Moines, Iowa—It is reported that the state plans an expenditure of $2,000,000 for the extension of Capitol Park.

Ditch—Logan, Iowa—The County Board has rejected all bids received for the construction of the Timber Creek lateral of the Boyer River Ditch. The lowest bid was 21c. per cu.yd.

Ditches—Bemidji, Minn.—Bids will be received until Nov. 27, by J. L. George, County Audr., Beltrami County, for constructing the following ditches: Judicial ditch 22, estimated cost $20,510; judicial ditch 23, estimated cost $59,949; judicial ditch 24, estimated cost $41,683. E. J. Bourgeois is the Engr.

+Dike—Kansas City, Kan.—The Kaw Valley Drainage Board has awarded a contract to the G. F. MUNDAL CONSTRUCTION CO., at $81,700 for raising the Kaw River dike 3½ ft. and widening it 20 ft. for a distance of 2000 ft.

Pier—Austin, Tex.—The lowest bid received for the construction of a reinforced concrete pier and floating wharf at the dam, was that of A. A. Mundt, at $13,745. S. S. Posey is City Engr. Noted Oct. 8.

Levee—Fort Worth, Tex.—F. J. Von Zuben, City Engineer, has prepared plans for the construction of a levee to protect the water-works plant from the overflow of the Clear Fork River. The plans and specifications were recently submitted to the City Council for approval.

Park and Harbor Improvement Bonds—Houston, Tex.—(Official)—The bond issue of $3,000,000 to provide adequate harbor facilities was voted by a large majority on Oct. 28. An issue of $250,000 for park improvements was also voted. E. E. Sands, City Engineer, will be in charge of the park work, while J. F. Coleman, New Orleans, has been retained by the Harbor Board as Consult. Engr.

Wharf and Warehouse—Houston, Tex.—The following bids were received, Oct. 28, by the City Council, for the construction of the first wharf and warehouse on the Turning Basin: Horton & Horton, $218,840; James Stewart & Co., $242,242; American Construction Co., $247,000; H. C. Gass, $274,900; Perry & Bonner, $284,500; Central Contracting Co., $314,700. E. E. Sands is City Engr. Noted Sept. 17, Oct. 8.

Breakwater and Filling — Albuquerque, N. M. — (Official)—Pitt Ross, County Surv., will receive bids until Nov. 14 for the construction of a breakwater, 192 ft. long, on the west bank of the river above the Alameda Bridge.

+Fire Protection System—Seattle, Wash.—(Official)—The Port of Seattle Commission has awarded the contract for the installation of a fire protective system in the Smith's Cove warehouses to the RAUTMAN PLUMBING & HEATING CO., at $15,379. Other bids were: Ward & Sherer, $17,027; Norton & Smith, $17,621; Rockwood Sprinkler Co., $17,294; P. R. Ellis, $18,140; Automatic Sprinkler Co. of America, $18,354; Eckhart Plumbing & Heating Co., $19,984; P. J. Lavan, $21,300; J. R. West is Act. Ch. Engr. Noted Oct. 29.

Tunnel—Seattle, Wash.—The City Council has passed a resolution providing for the construction of a 560-ft. tunnel under Dearborn St., from 11th Ave. S. to 12th Ave. S. A. H. Dimock, City Engr., will prepare the plans.

Vessel—Seattle, Wash.—The following bids were received by the Eagle Harbor Transportation Co. for the construction of a 130-ft. passenger steamer, having a speed of 15 knots per hour: Martinolich Co., $14,500, delivery in six months; Joseph Supple, $16,300, delivery in four months; J. F. Duthie & Co., $18,900, delivery in four months; Hall Bros., $21,500, delivery in five months. L. H. Coolidge, Naval Arch., prepared the plans.

+Steel Doors—San Francisco, Calif.—The State Board of Harbor Commissioners has awarded the contract for furnishing and installing steel rolling doors on piers 16, 18 and 37 to the KINNEAR MFG. CO., Columbus, Ohio, at $28,509. Noted Oct. 8.

+Tunnel—San Francisco, Calif.—The Board of Public Works has awarded the contract for the construction of the Twin Peaks Tunnel to R. C. STORRIE & CO., San Francisco, at $3,372,000. M. M. O'Shaughnessy is City Engr. List of bidders noted Nov. 5.

+Pier—Long Beach, Calif.—The contract for the construction of the Belmont Heights, Devil's Gate, pier has been awarded to TROUNCE & STOECHER, Los Angeles, at $46,000. Noted June 18, Nov. 5.

Conservation-Protection Works—San Bernardino, Calif.—(Official)—F. C. Finkle, C. E., Hellman Bldg., Los Angeles, reports that he has completed plans and specifications for the conservation-protection works along Lytle Creek, San Bernardino.

Dock—San Pedro, Calif.—The Crescent Wharf & Warehouse Co., 410 Security Bldg., Los Angeles, plans to rebuild at once its wharf and warehouse, recently destroyed by fire.

Drain—Alvinston, Ont.—Bids will be received until Nov. 21, by Commissioner W. J. Bourne, for constructing the Smith-Patterson Drain. Plans and specifications on file with the Commissioner.

Fire Alarm System—Newmarket, Ont.—Bids will soon be received by P. K. Anderson, City Clerk, for the installation of a fire-alarm system for which plans are now being prepared.

BUILDINGS

+Slocum, R. I.—Contracts for the construction of the buildings at the Rhode Island School for Feebleminded at Exeter, have been awarded as follows: General contract, H. WALES LINES CO., Meriden, Conn., at $78,851; wiring, WHITALL ELECTRIC CO., Westerly, $2170; heating, J. J. HURLEY & CO., Boston, Mass.; $10,244. Noted Oct. 8.

+Boston, Mass.—The contract for the construction of a school at the West End has been awarded to the JOHN F. GRIFFEN CO., at $173,496. Other bids were: Whiton & Haynes, $174,900; Patrick Rich, $176,400; William Crane, $177,456; J. E. Locatelli Co., $181,889; Norcross Bros. Co., $183,500; Joseph Slotnick, $184,000; McGahey & O'Conner, $186,000; McDonald & Kivell, $186,573; Manus J. Fish & Son, $201,425. Joseph Lomasney, 120 Boylston St., is Chn. of the School House Comn.

Harold F. Kellogg, Arch., 141 Milk St., is preparing plans for the two-story brick building at Dudley and Kenilworth St., for the Roxbury Boys' Institute. The estimated cost is $130,000.

+The contract for the construction of the seven-story brick building at 1126 Boylston St., for T. J. Rearson, has been awarded to the BOYLSTON CONSTRUCTION CO. The estimated cost is $125,000.

Mattapan (Boston post office), **Mass.**—Plans are being prepared by Harrison H. Atwood, Arch., 61 Allen St., for the construction of a police station at Mattapan. Richard A. Lynch, City Hall Annex, is Supt. of Pub. Bldgs.

+Providence, R. I.—The contract for the construction of a three-story office building on Westminster St., for Julius Palmer, has been awarded to CHARLES B. McGUIRE CO.

Plans are being prepared by Frank Miles Day & Son, Archs., Philadelphia, Penn., for an addition to the Rhode Island School of Design.

New London, Conn.—Plans have been prepared by Dudley St. Clair Donnelly, for the Y. M. C. A. building to be erected at New London.

+Norwalk, Conn.—The general contract for the construction of the theater on Wall St., for Samuel J. Kantor, has been awarded to M. J. RIORDAN, Norwalk.

Baldwin, N. Y.—Tooker & Marsh, Archs., 101 Park Ave., New York, are preparing plans for the two-story brick school for the Board of Education. The estimated cost is $40,000. J. Steel is Pres. of the Bd.

Delhi, N. Y.—Pierce & Bickford, Archs., 118 Lake St., Elmira, have prepared plans for the construction of a two-story, brick and concrete 65x100-ft. school. The estimated cost is $65,000.

★Hudson, N. Y.—The following bids were received by Miss Mary Hinckley, Pres. Bd. of Mgrs., New York State Training School for Girls, Hudson, for hospital buildings at the school: Carlin Co., Inc., New York, $61,800; Emerson Building Co. New York, $59,380; W. L. Mellen, Worcester, Mass., $60,978; Weaver Building & Supply Co., Hudson, $70,385; Feeney & Sheehan Building Co., Albany, $64,993; McCann Building Co., Albany, N. Y., $61,300; D. W. Dean, $65,857. Noted Oct. 8.

New York, N. Y.—(Borough of Broooklyn)—Plans have been filed by William E. Austin, Arch., 46 West 24th St., New York, for the construction of a three-story hospital to be erected at Winthrop St. and Albany Ave. The estimated cost is $100,000.

Syracuse, N. Y.—Plans have been completed by James A. Randall, Arch., for the construction of [illegible]-story parochial school at Montgomery and Madison S[illegible]. The estimated cost is $60,000.

Yonkers, N. Y.—Bids are being received by George H. Chamberlain, 18 South Broadway, for the construction of a six-story Y. M. C. A. building at Riverdale Ave. and Hudson St. The estimated cost is $100,000.

★Yorktown Heights, N. Y.—(Official)—Bids will be received until noon, Nov. 19 by William B. Osgood, Pres., Bd. of Mgrs., New York State Training School for Boys, 2 West 45th St., New York, for construction, heating, plumbing, and electric work for seven cottages, at the New York State Training School for Boys. Lewis F. Pilcher, Capitol, Albany, N. Y., is State Arch. For further information see advertisement under "Contracts To Be Let."

+Flemington, N. J.—The Board of Education has awarded the contract for a high school at Flemington to C. E. PRESTON, Monticello, N. Y., at $44,170. Noted Oct. 29.

+Johnsonburg, N. J.—The contract for the construction of a school in the Franklin district has been awarded to ALFRED DENEE by the Frelinghuysen Township Board of Education.

Trenton, N. J.—The Board of Education is planning the erection of a high school in the North Trenton section, to cost about $40,000.

Easton, Penn.—Bids are being received by Carrere & Hastings, Archs., 225 Fifth Ave., New York, N. Y., for constructing a one-story, 96x112-ft. stone chapel for Lafayette College. The estimated cost is $100,000.

+New Brighton, Penn.—The contract for the construction of the Y. M. C. A. building at Third Ave. and Eighth St. has been awarded to the R. D. McDANEL CO., New Brighton, Penn.

Waynesboro, Penn.—Bids will be received [illegible] by [illegible] & [illegible], Archs., [illegible] La Salle St., Chicago, for the construction of the Y. M. C. A. building at Waynesboro. The estimated cost is $[illegible]. Noted [illegible] 17.

✦**Wilmington, Del.**—[illegible]—Bids will be received until [illegible] by the New Castle County Building Commission and the W[illegible] Building Commission, [illegible], Wilmington, for the [illegible] marble, interior cut stone, [illegible] work, [illegible] and ornamental iron, hollow metal doors, [illegible] and [illegible] hardware, [illegible] to be used in the construction of the County Building for New Castle County and of the Municipal Building for Wilmington. Thomas F. [illegible], Secy. of the New Castle County Bldg. Comm. and of the Wilmington Bldg. Comm. For details see advertisement under "Contracts To Be Let." Noted [illegible].

✦**Hagerstown, Md.**—The contract for [illegible] the [illegible] Hotel has been awarded to [illegible] McW[illegible], Frederick, Md. The estimated cost is $[illegible].

Charleston, W. Va.—Bids will be received until Nov. 24, by A. [illegible], [illegible] Bldg. Co., for the construction of a school at Charleston. The estimated cost is $1[illegible],000.

Beaufort, N. C.—Bids will be received until Nov. [illegible], by [illegible] E. [illegible], Arch., Wilmington, N. C., for the construction of a school at Beaufort.

Atlanta, Ga.—Plans have been completed by Hentz[illegible] [illegible] Third National Bank Bldg., for the construction of [illegible] for the Georgia Baptist Hospital. The estimated cost is $[illegible].

Jacksonville, Fla.—Plans are being prepared by W. B. Tal[illegible], Arch., [illegible] Bldg., for the construction of an armory at Jacksonville. The estimated cost is $[illegible].

St. Petersburg, Fla.—Bids will be received until Nov. 14, by the [illegible] County Commissioners for the construction of an addition to the courthouse. The estimated cost is $[illegible]. W. [illegible], Tampa, Fla., is Arch.

✦**New Orleans, La.**—[illegible]—Bids will be received by the Board of Commissioners of the Port of New Orleans, until [illegible], for the construction of a group of buildings. [illegible] is [illegible]. For details see advertisement under "Contracts To Be Let."

New Orleans, La.—[illegible] Weil, Arch., is preparing plans for a building to be erected for Jerusalem Temple of New Orleans. The estimated cost is $[illegible]. Charles Weinberg, of the [illegible] Co., is Chm. of the Bldg. Comm.

✦**Nashville, Tenn.**—Contracts for the construction of the [illegible] have been awarded as follows: [illegible] BRICK CO., cut stone, FOSTER, [illegible] & [illegible], [illegible] work, NASHVILLE [illegible], concrete work, ADAMANT STONE & CONCRETE CO., all of Nashville, Tenn.

Louisville, Ky.—Plans have been completed by J. Earl Henry, Arch., [illegible], for the construction of a school for the [illegible] District. The estimated cost is $[illegible].

The [illegible] Masonic Lodge will erect a three-story building at Fourth St. and Central Ave. The estimated cost is $[illegible].

Mount Sterling, Ky.—[illegible] & [illegible], Archs., [illegible], are preparing plans for the construction of a [illegible] for the [illegible]. The estimated cost is $[illegible].

✦**Cleveland, Ohio.**—The contract for the construction of an apartment house [illegible] for C. H. [illegible], has been awarded to [illegible] WEAVER. Estimated cost $[illegible].

[illegible]

Norwood, Ohio.—[illegible]

Greensburg, Ind.—Bids will be received until 10 a.m. Nov. [illegible], by [illegible] Secy. of the Y. M. C. A., Greensburg, for the construction of a two-story and basement, 80x160-ft. building, to cost $[illegible].

Grand Rapids, Mich.—Robinson & Campau, Archs., [illegible], are revising plans for the construction of a [illegible] ft. building for the First M. E. Church. Estimated cost, $17[illegible].

Chicago, Ill.—Plans have been prepared by William L. Klewer & Son, Archs., 64 West Randolph St., for the construction of a five-story, 7[illegible]x[illegible]-ft. fireproof department store at 4,[illegible], for Albert E. Cook. Estimated cost, $13[illegible],000.

Chicago, Ill.—Bids are being received by Beifield & Hirch, [illegible] West Monroe St., for the construction of the three-story and basement [illegible]-ft. apartment house, at [illegible] Christiana Ave. The estimated cost is $[illegible].

Evanston, Ill.—Shepley, Putnam & Coolidge, Archs., 134 South La Salle St., Chicago, have prepared plans for the construction of a three-story and basement political science building for the Northwestern University. Estimated cost, $[illegible].

Quincy, Ill.—The B'Nai Israel congregation contemplates constructing a four-story building at Quincy, to cost about $[illegible].

Milwaukee, Wis.—Plans are being prepared for the Badger State Investment Co., for a three-story and basement, [illegible] ft. reinforced concrete addition to the Merrill Bldg. on [illegible] St. and Grand Ave. Estimated cost, $1[illegible].

✦The contract for the construction of the County House of Correction has been awarded to the CODDINGTON ENGINEERING CO. Estimated cost, $600,[illegible]. Noted July 23 and Aug. 27.

Fort Dodge, Iowa.—J. O. Damon, Jr., Arch., is preparing plans for the construction of a two-story and basement city hall. Estimated cost, $[illegible],000.

BRIDGE, CHATTANOOGA, TENN.

✦Bids were received, Oct. 22, by the Tennessee Bridge Committee, for the construction of the superstructure of the Market St. Bridge across the Tennessee River. For the masonry bids were submitted by (A), T. Stuart & Son Co.; (B), Thomas Sheehan; (C), Bates & Rogers; (D), Hannon Hickey & Co.; (E), Hackerdorn Construction Co.; (F), Mason & Hilton; (G), Cleary White Co.; (H), National Engineering & Foundation Co.; (I), George A. Fuller Co.; (J), VANG CONSTRUCTION CO., Cumberland, Md. (awarded contract); (K), T. L. Eyre; (L), Hardaway Construction Co.; (M), M. C. Mosley; (N), Missouri Valley Bridge & Iron Co. For the steel work, fixed and bascule spans, bids were submitted by (A), Strobel Steel Construction Co.; (B), Pennsylvania Steel Co.; (C), Penn Bridge Co.; (D), Milwaukee Bridge Co.; (E), TOLEDO BRIDGE & CRANE CO., Toledo, Ohio (awarded contract). The item bids were as follows:

FIXED SPAN

	A	B	C	D	E
[illegible] structural steel	$0.0325	$0.0375	$0.048	$0.0445	$0.041
[illegible]	0.12	1.[illegible]	0.07	0.07	[illegible]
[illegible]	60.00	[illegible]	55.00	65.00	57.[illegible]
[illegible]	4.00	2.50	3.00	2.00	3.00
[illegible]	4.00	2.20	1.75	2.50	1.50
Estimated totals	$88,054	$76,649	$7[illegible]	$73,021	$65,12[illegible]

BASCULE SPAN

	A	B	C	D	E
[illegible] structural steel	$0.0539	$0.0425	$0.0[illegible]	$0.044[illegible]	$0.04[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0.11	[illegible]	0.[illegible]	[illegible]	[illegible]
[illegible]	0.1[illegible]	0.1	[illegible] 16	[illegible]	0.11
[illegible]	[illegible]	0.[illegible]	0.[illegible]	0.7[illegible]	[illegible]
[illegible]	1[illegible]	11.00	[illegible]	1[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4.00	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1.00	2.[illegible]	1.[illegible]	[illegible]	1.50
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Estimated totals	$1[illegible]	$1[illegible]	$[illegible]	$1[illegible]	$11[illegible]

MASONRY

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$11.75	[illegible]	[illegible]	[illegible]	[illegible]	$1.00	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Estimated totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Hampton, Iowa—Plans have been prepared by Wetherell & Gage, Arch., Youngerman Bldg., Des Moines, for the construction of a three-story, 88x122-ft. hospital, for Leefers Co. Estimated cost, $60,000.

+St. Paul, Minn.—The contract for the construction of a four-story and basement, 46x108-ft., building for the St. Johns Hospital Association, has been awarded to LAUER BROS., Chestnut St. Estimated cost, $60,000.

Wichita, Kan.—The Board of Education contemplates constructing a $100,000 grade school for the Webster and Emerson School Districts.

Sioux Falls, S. D.—E. L. Masqueray, Arch., Endicott Bldg., St. Paul, Minn., is preparing plans for the construction of a cathedral at Sioux Falls. The estimated cost is $200,000.

Helena, Mont.—Link & Haire, Archs. have prepared plans for the construction of the Masonic Temple. The estimated cost is $75,000.

St. Joseph, Mo.—Bids for constructing the foundation of the Methodist Episcopal Hospital will be received by Eckel & Aldrich, Archs., 1104 Corby Forsee Bldg. Estimated cost, $100,000.

St. Louis, Mo.—C. J. and F. E. Briner, Elec. Engrs., 207 Franklin Ave., contemplate constructing a three-story, fireproof building on Morgan St., between Tenth and Eleventh St. The estimated cost is $50,000.

+Carlsbad, Tex.—The contract for the construction of the dormitory for the Texas Tuberculosis Sanitarium has been awarded to J. C. JOPLIN & BROS., Beatty Bldg.

+Albany, Ore.—The contract for the construction of the brick and concrete Central School has been awarded to N. E. HOOVER. Estimated cost, $39,150.

Portland, Ore.—T. T. Jones, Arch., 334 East Third St., has prepared plans for the construction of a two-story school for the Richmond School District. Estimated cost, $55,000.

San Francisco, Calif.—Bakewell & Brown, Archs., 251 Kearny St., have prepared plans for the construction of a five-story hospital on Webster St. for the Cooper Medical College. The estimated cost is $150,000.

+San Francisco, Calif.—Contracts for the interior work of the city hall have been awarded as follows: UNITED STATES METAL PRODUCTS CO., sheet metal work, $66.780; P. E. DENIVELLE, ornamental composition plaster, $9325; PARAFFINE PAINT CO., painting, $6582. Noted Oct. 1.

San Mateo, Calif.—W. D. Shea, Arch., San Francisco, is preparing plans for the construction of a building for the Knights of Columbus Hall Association. Estimated cost, $50,000.

+Hamilton, Ont.—The contract for constructing the foundation of the Royal Connaught Hotel, has been awarded to the RAYMOND CONCRETE PILE CO., LTD., New Birks Bldg., Montreal, Que. Stone & Webster Construction Co. is the general contractor.

+Hamilton, Ont.—Contracts for the construction of the Dundurn St. School have been awarded as follows: Masonry, MITCHELL & RIDDELL, $45,900; heating and plumbing, ADAM CLARK, $19,167; carpentry, JAMES CALVERT, $17,000. Estimated cost, $95,550.

Toronto, Ont.—Bids will soon be received by G. W. Gouinlock, Arch., Temple Bldg., for constructing the Machinery Hall, at the Exhibition Grounds. The structure will be reinforced concrete and brick and will cost about $145,000.

Moncton, N. B.—Plans are being prepared for the construction of a hotel near the Union Depot, Moncton.

The Stephens-Adamson Manufacturing Co., Aurora, Ill., is changing the electrical equipment throughout its shops, using individual motors and group drives. Tests have been made on all machines, and the results assure a considerable saving in power cost. Plans are also being prepared for another structural steel shop; construction of the same to be begun immediately after the first of the year. This will be the eighth building of the company's plant. This company reports a very satisfactory increase in its business during the present year and a most encouraging outlook.

SEWER, CINCINNATI, OHIO

+Bids were received by the Director of Public Service, for constructing a sewer in Duck Creek Rd. from, (A) Engineer's estimate; (B) D. P. FOLEY, Cincinnati (awarded Contract No. 1); (C) John Dempsey, Cincinnati; (D) Connelly Construction Co., Cincinnati; (E) Thurber & Co., Cincinnati; (F) R. E. Cash, Cincinnati; (G) Welling & Franz, Cincinnati; (H) James Duff Construction Co.; (I) Thomas Maloney, Cincinnati; (J) John B. McLane & Co., Newport, Ky.; (K) Thomas P. Strack, Cincinnati; (L) M. J. McCarthy, Cincinnati; (M) Henkel & Sullivan, Cincinnati; (N) CANNELL-AMES CONSTRUCTION CO., Columbus (awarded Contract No. 2); (O) Evan Evans, Cincinnati. The item bids were as follows:

CONTRACT NO. 1

Brick Sewer

	A	B	C	D	E	F	G	H	I	J	K	L	M	O
636 lin.ft. 36-in. brick sewer, complete	$7 50	$4 55	$4.60	$5.50	$6.90	$4.50	$5.60	$7.00	$3.50	$6.70	$7.50	$3.50	$6.00	$6.50
598 lin.ft. 42-in. brick sewer, complete	8.00	4 75	5 80	6.00	7 75	5.00	5.90	7.25	4 00	7.50	8.00	4 50	7 00	7.25
880 lin.ft. 78-in. brick sewer, complete	16.00	14.10	14 80	14.00	18 50	13 50	13 75	16 25	14 80	13.40	16.00	15.00	15 00	15.50
356 lin.ft. 6½x9-ft. concrete sewer, complete	30.00	18.00	19 50	23 00	21.00	25 00	24 50	22 00	28.00	28.60	25.00	28 00	30 00	35 00
3 manholes (standard) on brick sewers 4 ft. diameter or less	80 00	100.00	50 00	80.00	50.00	70 00	75 00	65.00	80 00	100 00	80 00	60 00	70.00	75 00
4 manholes (standard) on brick sewers of over 4 ft. diameter	120 00	100 00	80.00	80 00	50.00	100.00	75.00	90.00	120.00	100.00	120.00	70.00	100 00	100 00
1 drop manhole	100.00	85 00	80.00	80 00	50.00	90 00	100.00	100 00	100.00	100.00	100.00	100.00	100.00	100 00
Extended totals	$35,134	$25,335	$26,910	$28,234	$33,179	$27,332	$28,537	$31,574	$28,430	$31,520	$33,354	$28,645	$32,592	$35,294

CONTRACT NO. 2

Reinforced Concrete Sewer

	A	G	H	J	K	L	N
2225 lin.ft. 39-in. reinforced concrete	$9 00	$9 00	$8 50	$8 34	$8 00	$9 00	$5 00
3218 lin.ft. 42-in. reinforced concrete	14 00	15 00	11 00	12 10	13 00	15 00	10 50
1147 lin.ft. 45-in. reinforced concrete	5 00	6 00	7 72	6 41	8 00	11 00	9 10
24 manholes (standard) on concrete sewer, 4 ft in diameter or less	100 00	90 00	80 00	60 00	100 00	100 00	80 00
1 drop manhole on trunk sewer	120 00	100 00	100 00	100 00	120 00	100 00	125.00
140 cu.yd. concrete masonry, Class 2, foundations	10 00	12 00	8 00	8 00	10 00	10 00	6 00
Extended totals	$71,732	$79,117	$66,305	$67,541	$72,730	$84,812	$58,237

The General Railway Signal Co., Rochester, N. Y., in a notice issued by W. W. Salmon, Pres. and Gen. Mgr., announces the following changes in organization: M. Wuerpel has been appointed Assistant to the President. S. G. Johnson, Vice-Pres., will be in full charge of the Sales Department, which includes all branch and foreign offices, commercial engineering, commercial inspection and contract installation, reporting to the President and General Manager, and with headquarters at Rochester. A Department of Publicity and Education has been created and H. M. Sperry will assume duties as manager of this department, reporting to the President and General Manager, and coöperating closely with all departments. This department will take over the advertising and catalog work and will undertake an educational campaign in regard to the signaling of steam and electric railways.

The Lidgerwood Manufacturing Co., 96 Liberty St., New York, N. Y., has built during the years it has been in business over 37,000 steam and electric hoists. This is probably the greatest record of hoisting engine production made by any one concern.

Vitrified Pipe Sewer

	A	B	G	H	J	K	L	N
60 lin.ft. 8-in. vitrified pipe sewer	$2 00	$1 00	$1 50	$1 50	$0 80	$1 00	$2 00	$1.50
230 lin.ft. 18-in. vitrified pipe sewer	2 00	2 00	1 50	1 65	2 00	1 90	2 00	1.50
1030 lin.ft. 32-in. vitrified pipe sewer	5 00	4 50	4 30	2 85	3.50	2 00	3 00	1.50
152 lin.ft. 32-in. vitrified pipe sewer "B" line	3 00	4 50	2 70	2 65	2 00	2 50	2 00	1 00
20 lin.ft. 24-in. vitrified pipe sewer	3 00	5 00	2 00	3 25	2 00	3 00	3 00	2 00
6 manholes (standard) on pipe sewer	70 00	80 00	70 00	60 00	70 00	70 00	70 00	60 00
3 manholes (standard) on pipe sewer "B" line	60 00	80 00	60 00	50 00	70 00	60 00	60 00	60 00
6 6-in. stubs in trunk sewer	0 30	0 50	0 30	0 35	0 30	0 30	0 30	0 40
3 12-in. slants in trunk sewer	1 00	1 00	1 00	1 50	1 00	1 00	1 00	0 50
1 22-in. slant in trunk sewer	5 00	2 50	2 50	3 00	5 00	5 00	1 00	3 00
1 24-in. slant in trunk sewer	5 00	2 50	2 75	3 25	5 00	5 00	4.00	3 50
200 cu.yd. concrete masonry, Class 2	7 50	6 50	10 00	8 00	7 00	7 50	1 00	6 00
5 cu.yd. concrete masonry, Class 3	7 00	7 50	8 00	10.00	10 00	7 00	6 00	12 00
10 cu.yd. brick masonry	13 00	10 00	12 00	15 00	12 00	13 00	12 00	15 00
2800 lin.ft. 8 in. underdrain, complete	0 60	0 02	0 50	0 15	0 50	0 40	0 10	0 10
100 cu.yd. gravel refill	2 00	2 00	2.00	3 50	2 00	2 00	1 00	2 50
10 sq.yd. rip-rap	2 00	5.00	1 50	4 00	2 00	2 00	0 02	2 00
100 cu.yd. special excavation	0.60	1 00	0 50	1 50	1 00	0 60	0 02	0 40
35 M. ft. b.m. sheeting left in place	20 00	30 00	20 00	25.00	20 00	20 00	20.00	20 00
2000 lin.ft. 10 in. underdrain, complete	0 70	0 02	0 60	0 20	0 60	0 50	0 20	0 10
1000 lin.ft. 12 in. underdrain, complete	0 80	0 02	0 70	0 25	0 70	0 60	0 25	0 10
Extended totals	$14,286	$10,973	$13,159	$9,476	$11,592	$10,757	$7,329	$6,022

Contracts to Be Let

Bids received until Dec. 1, 1914.

New County Building

FOR NEW CASTLE COUNTY AND NEW MUNICIPAL BUILDING FOR THE CITY OF WILMINGTON

Sealed proposals will be received by the New Castle County Building Commission and the Wilmington Building Commission at the office of the Commission in the Church Building, at the corner of Market and Tenth Sts., in the City of Wilmington, Delaware, up to 11 o'clock A.M. (Eastern time) on the first day of December, 1914, for the Interior Marble, for the Interior Cut Stone, for the Bronze Work, for the Miscellaneous and Ornamental Iron, for the Painting and Finishing, for the Hollow Metal Doors, for the Finished Hardware, for the Brick Paving, for the Sidewalks, and for the Revolving Doors, entering into the construction and completion of the new County Building for New Castle County and of the new Municipal Building for the City of Wilmington, situated between King Street and French Street and between Tenth Street and Eleventh Street, in the City of Wilmington, Delaware, and will be opened publicly and declared by the Commissions in their offices. A separate proposal is required for each of the buildings for each department or class of work above listed.

Each proposal for Interior Marble shall be accompanied by a certified check or cash deposit in the amount of Four Hundred Dollars ($[illegible]).

Each proposal for Interior Cut Stone shall be accompanied by a certified check or cash deposit in the amount of Three Hundred Dollars ($[illegible]).

Each proposal for Bronze Work shall be accompanied by a certified check or cash deposit in the amount of Six Hundred Dollars ($[illegible]).

Each proposal for Misc. and Ornamental Iron shall be accompanied by a certified check or cash deposit in the amount of Five Hundred Dollars ($500).

Each proposal for Painting and Finishing shall be accompanied by a certified check or cash deposit in the amount of Three Hundred Dollars ($[illegible]).

Each proposal for Hollow Metal Doors shall be accompanied by a certified check or cash deposit in the amount of Eight Hundred Dollars ($[illegible]).

Each proposal for Finished Hardware shall be accompanied by a certified check or cash deposit in the amount of Two Hundred Dollars ($[illegible]).

[illegible] of Two Hundred Dollars ($[illegible]).

[illegible] of Two Hundred Dollars ($[illegible]).

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Bids received until Nov. 17, 1914.

Union School Building

Lockport, N. Y.

SEALED PROPOSALS will be received by the Board of Education, City of Lockport, New York, at its office in the Union School Building, up to eight o'clock p.m., November 17th, for the material and labor as shown on plans and included in specifications prepared by Wm. Nell Smith, Architect, 101 Park Avenue, New York City, and the heating and ventilation plans and specifications prepared by Douglas Sprague, Engineering Architect, 39 Cortlandt Street, New York City, for the enlargement and improvement of the Union School Building, which plans and specifications have been approved by the State Education Department.

Said plans and specifications may be seen at the office of said Board of Education, or at the offices of said architects. Copies thereof may be obtained by prospective proposers upon request to said Board and payment of five dollars per set of plans and specifications—said amount to be returned to the proposer upon return of plans and specifications to the Board, in good condition.

Separate proposals may be made by contractors for the labor and material included in the separate Masonry, Carpentry, Plumbing, Electrical, and Heating and Ventilation specifications, and proposals for the entire work, separately itemized, may be submitted. All proposals must be accompanied by a certified check or a proposal bond for two per cent. of the amount of the proposal, as guarantee that proposer will enter into contract for the full performance of the work upon which proposal is submitted, if the proposal is accepted.

The Board of Education hereby reserves the right to accept or reject any or all of the proposals that may be received. By order of the Board of Education, Lockport, N. Y., October 19th, 1914.

EMMET BELKNAP,
Clerk of the Board.

Bids received until Dec. 7, 1914.

Sewage Collecting System

Dunellen, New Jersey.

Sealed proposals for constructing a sewage collecting system will be received by the Council of the Borough of Dunellen until 8 P.M., December 7th, 1914. Proposals should be delivered to William P. Deering, Clerk of the Borough, at the Borough Hall, North Avenue, Dunellen, New Jersey.

The work comprises a system of vitrified pipe sewers with [illegible] joints. There are about 14 miles of street sewer, ranging from [illegible] to [illegible] inches in diameter, two small sewage pumping stations and about [illegible] feet of 6-inch cast iron force main.

Proposals must be accompanied by a certified check on a national bank or trust company for Two Thousand ($[illegible]) Dollars. The bidder to whom the contract is awarded will be required to execute a contract and furnish a surety bond [illegible] of the amount of the contract within ten days [illegible] after receiving [illegible] notice of the award. The bond shall be satisfactory to the Borough both [illegible]

[illegible]

The plans and specifications may be obtained from [illegible], New York City, upon [illegible] Dollars ($[illegible]), which will be refunded [illegible] plans and specifications are returned in good condition [illegible]

[illegible]

[illegible]

BY ORDER OF THE MAYOR AND BOROUGH COUNCIL OF THE BOROUGH OF DUNELLEN.
WILLIAM P. DEERING,
Borough Clerk.

Construction News

Demand that Aliens Quit New York Subway

Stoppage of work on New York's entire rapid transit system, thereby throwing 18,000 men out of work, is threatened by the action of the Bricklayers' Union in resurrecting a long forgotten clause of the labor law, which states that only citizens of the United States may be employed on municipal work.

The following is a letter which John Gill, business agent of the Bricklayers and Masons Union, has sent to all subway contractors:

"I beg to notify you that your company and all subcontractors doing work are openly and wantonly violating the labor law of this state with regard to employing men on your work who are not citizens of the United States, and with regard to paying laborers and tradesmen wages less than the prevailing rate; also, with regard to complying with the labor law, which requires that the contractor shall keep the name of each workman, and if a naturalized citizen, the date of citizenship and the court out of which his papers were issued.

"I hereby demand that you make a thorough investigation among your employees, with the advantages at your disposal, to ascertain the above facts. I desire to further notify you that these violations are open and notorious and conducted by you to such an extent as to be a matter of common knowledge.

"In the event that you fail to comply with the law forthwith, I shall take whatever steps, as a citizen and as a representative of organized labor, to prosecute you for such violations, as I deem necessary."

The Public Service Commission has made a statement which says, in part:

"The penalties prescribed for violations of the law include not merely the forfeiture of the contract, but also the punishment of offenders for misdemeanor. It is also said that if the Public Service Commission should countenance such violation its members would be liable to prosecution for malfeasance."

In an interview, Chairman McCall, of the Public Service Commission, said: "The commission is obliged to enforce the law. As to whether or not it is unconstitutional, I can only say that we have no authority to interpret the law ourselves. We would not be justified in paying vouchers if we were aware of violations, and I doubt if the comptroller would recognize them if we did issue them. We are considering steps to test the law as quickly as possible."

That 90% of the pick and shovel men are aliens is admitted by the contractors. They say they can't get native Americans to do this work. Even among skilled laborers the percentage of aliens is large. Some contractors have laid off a part of their forces pending legal advice.

Opening the Federal Reserve Bank—Important at any time, but doubly so now, since the financial centers of Europe have been shaken to their foundations and foreign credit severely dislodged, was the opening of the Federal Reserve Bank on Nov. 16. The credit and financial interchange of the country for more than a generation has been carried on through a loose organization of more than 7500 national banks, many state banks, and trust companies. The national banking system, which was purely a measure put forward at the time of the Civil War, to facilitate the sale of government bonds, has been antiquated for more than a score of years. Great hopes are held that the new system of credit interchange, with proper Federal control and supervision of business men, will free the country from the yearly financial stringency during the period, August to December, incident to the gathering of the crops. The United States having the largest store of gold in the world, has made little scientific use of this vast hoard for the promotion of credit. The new system, which began last Monday, comprises twelve reserve banks located in Boston, New York, Philadelphia, Cleveland, Richmond, Atlanta, Chicago, St. Louis, Minneapolis, Kansas City, Dallas and San Francisco. The bank in New York, which like all other Federal Reserve Banks, does business only with other banks, received over $100,000,000 the first day. The first receipt given out was for $21,000,000.

The Government to Aid Manufacturers—On July 15, Congress appropriated $100,000 for commercial attaches, to be appointed by the Secretary of Commerce, to investigate and determine whereby the sale of manufactured goods and raw materials from the United States, might be extended in foreign lands, such commercial attaches to report directly to the Secretary of Commerce. This plan was promoted prior to the beginning of hostilities in Europe, and also before there was any knowledge that foreign markets would be open to the United States as the result of war. While the war has of necessity changed the time for sending these attaches to the various countries, they will be more valuable as trade scouts now than was before thought possible. According to the bill in Congress, the number was limited to ten, and of these nine have already been appointed and assigned as follows:

A. H. Baldwin, to London, England; Erwin W. Thompson, to Berlin, Germany; Dr. Albert Hale, Buenos Ayres, Argentina; C. W. A. Veditz, to Paris, France; Julean H. Arnold, to Pekin, China; Prof. Lincoln Hutchinson, to Rio de Janeiro, Brazil; A. L. Harrington, to Lima, Peru; Verne L. R. Havens, to Santiago, Chile; and Henry D. Baker, to Petrograd, Russia.

The Platinum Output of the United States in 1913 was about 1034 oz., according to the U. S. Geological Survey. About 650 oz. was recovered from gold and copper bullion was made. The production of the country from imported sands was 39,154 ounces.

Orders for War Materials Placed in the United States

Manufacturers in the United States have secured much business from the belligerent nations for war materials. A large steel company has orders enough to tax its facilities for a year, and there are many smaller orders, as follows:

The Baldwin Locomotive Works, Philadelphia, Penn., has begun work on the recent order from the Russian Government for 30 locomotives.

An order for 25,000 steel barrels for export has beeen placed in Cleveland, while an export house in New York states that it has been figuring on an inquiry for 50,000 steel barrels for Russia. High freights have been a stumbling block, deterring the quick closing of orders.

The Firth-Sterling Steel Co., Demmler, Penn., has received an order for 20,000 three-inch, 10,000 six-inch and 5000 eight-inch shells, while the Economy Cartridge & Fuse Co., of Pittsburgh, has an order for 5,000,000 rounds of Mauser rifle ammunition. A New England manufacturer of ammunition early in the war received an order for 50,000,000 rounds of ammunition.

The Pittsburgh Gage & Supply Co. has received an order for $50,000 worth of wire rope, chains and fittings, while the Maccomber & White Rope Co., Chicago, has received a similar order amounting to $47,000. These materials will be used by the Studebaker Wagon Co., South Bend, Ind., in connection with a $6,500,000 order from the English and French governments for wagons and harness.

Important Electrification Contract

Announcement has been made that the Chicago, Milwaukee & St. Paul R.R. will start active work on the electrification of 450 miles of main line in the spring. A contract involving $2,000,000 has already been entered into with the General Electric Co. While the work involves a substitution of motive power on 450 miles of line (see "Engineering News," Jan. 16, 1913), only 117 miles are involved in this contract. The work will include the mountain district between Avery, Idaho, and Harlowton, Mont. This work is under the supervision of C. A. Gooodnow, Asst. to A. J. Earling, Pres.

Rapid Transit Line Held Up—The Public Service Commission for the First District announced during the week that it had failed to legalize the Flushing route, known as Route No. 52, by the filing of the necessary number of property owners' consents. This route is an extension of the Corona, Queens Borough, route from Albertis Ave. through Flushing to Bayside. The Long Island R.R. Co. owns sufficient property along a portion of the route to control the majority of consents, which must represent a majority in value, in this particular vicinity. The railroad company refuses to sign the necessary consent. The Commission now has under consideration the adoption of one of the following ways of getting around the difficulty: It may go to the Appellate Division, which may give its consent to the building of the line in lieu of the property owners' consents; or it may adopt two new routes, which, taken together, would be identical with the present route, and the first route, which is for immediate construction, would extend from Alburtis Ave. to Main St., Flushing, and the other the rest of the distance. The Commission considers it probable that it will secure sufficient consents for the building of the Flushing line.

The National City Bank of New York has been granted permission by the Government of Argentina to establish a branch at Buenos Aires. This will be the first branch of an American bank to be opened on foreign soil. The bank will be managed by John H. Allen, former manager of the Bank of Hayti. A. V. Edwards, of the credit department of the National City Bank, is expected to arrive in Buenos Ayres within the next week, to have charge of the formation of a credit bureau to be organized in connection with the branch for the purpose of furnishing credit information to exporters and importers.

Iron Ore in the Philippines—The Philippine "Journal of Science" reports that H. F. Cameron, department engineer for Mindanao and Sulu, has discovered a deposit of iron ore in Surigao province on the island of Mindanao, which appears to be of large extent, probably covering an area of 40 square miles. The ore is a clayey red limonite, carrying 55 to 60% metallic iron; no sulphur or phosphorus, but traces of chromium. The area over which the deposit extends has been reserved from mineral location, by order of the government, until further information can be obtained as to the extent and value of the deposit, through surveys to be made by the Bureau of Science.

READERS' WANTS

The Department of Public Works, Detroit, Mich., George H. Fenkell, Commissioner, would like to receive information from firms manufacturing receptacles suitable for the storage of garbage, refuse and ashes. The department contemplates the enforcement of ordinances relative to the storage of such materials, preparatory to their being removed by the Department. The Commissioner would also like to receive cuts, specifications and prices.

CATALOG NOTICES

The Marion Malleable Iron Works, Marion, Ind. Catalog. Shoes for wood stave pipe. Illustrated, 136 pp., 4½x7 in.

David Lupton's Sons Co., Philadelphia, Penn. Catalog No. 8. Steel sash, partitions, doors, sash operating device, etc. Illustrated, 84 pp., 8½x11 in.

Eureka Machine Co., Lansing, Mich. Catalog. Concrete and mortar mixers. Illustrated, 32 pp., 7x10 in.

RAILWAYS

New York—[illegible]

North Carolina—[illegible]

Louisiana—[illegible]

Michigan—[illegible]

Wisconsin—[illegible]

Minnesota—[illegible]

Kansas—[illegible]

Texas—[illegible]

California—[illegible]

Alberta—[illegible]

ELECTRIC RAILWAYS

Mattawamkeag, Maine—The Mattawamkeag & Northern [illegible] Bangor, Maine, is interested.

New Bedford, Mass.—[illegible]

Corry, Penn.—[illegible]

Philadelphia, Penn.—[illegible]

Rochester, Penn.—[illegible]

Richmond, Va.—[illegible]

Nashville, Tenn.—[illegible]

Nashville, Tenn.—[illegible]

Louisville, Ky.—[illegible]

Paris, Ky.—[illegible]

Carbondale, Ill.—[illegible]

East St. Louis, Ill.—[illegible]

Peoria, Ill.—[illegible]

Wheaton, Ill.—[illegible]

Missoula, Mont.—[illegible]

Corpus Christi, Tex.—[illegible]

El Paso, Tex.—[illegible] Kansas City, Kan., [illegible] for the construction of [illegible] from the business section of El Paso to [illegible]

Los Angeles, Calif.—The City Council has recommended [illegible] electric railway [illegible] Orchard St. through [illegible] districts to the boundary limits of [illegible]

San Francisco, Calif.—The Fifteenth St. and Park Hill [illegible] has petitioned the City Council to [illegible] of the municipal electric railway from [illegible] Market St. to [illegible] 14th and [illegible] St.

Toronto, Ont.—The City Council is [illegible] plans for the extension of the municipal electric railway lines to North Toronto, [illegible] H. C. Hocken is [illegible] Bd. of Control.

Edmonton, Alta.—The Edmonton Northwestern Radial Ry. Co., Edmonton, Alta., has applied for a charter to build an [illegible] railway from Edmonton northwest to the [illegible] Woods, Bigger & Collins, Edmonton, Alta., are interested.

LIGHT, HEAT AND POWER

✦Turners Falls, Mass.—Contracts for a power house [illegible] awarded to FRED T. LEY & CO., INC., [illegible] Springfield, Mass., for the steel and concrete work [illegible] THOMAS BROS., Turners Falls, for the [illegible] The [illegible] will be [illegible] ft., 16 ft. high of brick on a steel frame with reinforced concrete floors and roof.

Bridgeport, Conn.—The National Lock Washer Co., manufacturer of washers and allied products, will [illegible] a [illegible] power plant in connection with its factory. W. C. [illegible]

Perth Amboy, N. J.—At the general election held Nov. [illegible] voted in favor of installing and operating a municipal electric-light plant estimated to cost about [illegible] J. [illegible] is City Engr.

Kutztown, Penn.—At the recent election the citizens voted in favor of an issue of [illegible] in bonds of which [illegible] will be used for enlarging the municipal electric-light plant. F. [illegible] is Mgr. and Supt. of the plant.

Pittsburgh, Penn.—The [illegible] Committee of the Board of [illegible] has recommended the award of the contract for [illegible] equipment in the Schenley High School to the [illegible] Engineering Co., Pittsburgh at [illegible], and the award of the contract for heating and ventilating apparatus to the [illegible] Co., Chicago, Ill., at [illegible]

✦Logan, W. Va.—[illegible]—The Logan County Power & Light Co. will shortly award the contract for the [illegible] of a [illegible] concrete brick-lined chimney to the [illegible] CONCRETE CONSTRUCTION CO., [illegible] Church St., New York, N. Y. Noted [illegible] Sept. 17 and Nov. 12.

Spray, N. C.—The [illegible] Mills Co., Spray, manufacturers of [illegible] goods, is having plans prepared for a power plant to cost about [illegible]

Ocala, Fla.—The citizens have voted in favor of issuing [illegible] to be used for the construction of a municipal [illegible] plant.

Mobile, Ala.—The Board of [illegible] has rejected all bids [illegible] heating equipment for the [illegible] New [illegible] will [illegible] be [illegible] and the contract [illegible]

Gretna, La.—It is reported that the contract for the [illegible] of a municipal electric-light plant for Gretna will [illegible] New Orleans, La. [illegible]

✦Melville, La.—The Board of Aldermen has awarded the contract for the construction of a municipal electric-light plant [illegible] Noted Sept. [illegible]

Johnson City, Tenn.—It is reported that the [illegible]

Corbin, Ky.—[illegible]

New Haven, Ky.—[illegible]

✦Cleveland, Ohio.—[illegible]

Crestline, Ohio.—[illegible]

Lorain, Ohio.—[illegible]

Bellevue, Ohio.—[illegible]

✦Peoria, Ill.—[illegible]

Marshfield, Wis.—It is reported that the Empire Gas Improvement Construction Co., Minneapolis, Minn., is considering the installation of a gas system in Marshfield. A. M. Sutherland is Pres. of the company.

Crystal City, Tex.—The City Council has granted a franchise to A. D. Riddle, Cotulla, Tex., to construct and operate an electric-light plant.

Orange, Tex.—It is reported that W. H. Stark, formerly Vice-Pres. and Secy. of the Orange Ice, Light & Water Co. has purchased the plants of the company and will enlarge and improve the light and power plant.

Seguin, Tex.—See item under "Water Supply and Irrigation."

+Billings, Okla.—See item under "Water Supply and Irrigation."

Yale, Okla.—The City Council is having plans prepared by H. Askin, Consult. Engr., Cushing, Okla., for the installation of a municipal electric-light plant and extensions to the waterworks system at a total cost of about $15,000.

Ellensburg, Wash.—The Northern Pacific Ry. will equip its new coal bunkers at Ellensburg throughout with electrically operated machinery.

Fowler, Calif.—The Fowler Gas Co. will issue $15,000 in bonds to make additions to the plant and extensions to the system.

San Francisco, Calif.—The Board of Public Works has had tentative plans prepared by James F. Whittlesey, Elec. Engr., for a plant for lighting and heating the Civic Center at a cost of about $225,000. Noted Oct. 15.

Edmonton, Alta.—The Edmonton, Dunvegan & British Columbia Ry., Edmonton, has had plans prepared for the construction of a new power house at St. Albert's Trail, Alta.

BRIDGES

Portland, Maine—In addition to the list of bids published in the issue of Nov. 12 for the several divisions of the bridge between Portland and South Portland, the following bids were received for piling for foundation work: P. J. Carlin Construction Co., $27,545; John Cashman & Sons Co., $24,190; H. P. Converse & Co., $21,527; T. L. Eyre, $21,820; E. W. Foley Co., $32,570; Foundation Co., $26,982; Fraser, Brace & Co., $24,961; Holbrook, Cabot, Rollins Co., $28,135; MacArthur Bros. Co., $27,832; McHarg-Barton Co., $22,792; John Monks & Son, $51,356; T. Stuart & Sons Co., $33,663; Walsh Construction Co., $27,332.

Concord, N. H.—The Board of Public Works has engaged bridge engineers to prepare plans for a new steel bridge with concrete roadway to replace the present wooden structure over the Merrimack River at the South End. William B. Howe is City Engr.

Holyoke, Mass.—It is reported that plans are being prepared by W. H. Howes, Holyoke, for a new bridge at the upper end of Elmwood Park at Pine St. It will be of concrete, 65 ft. long and 40 ft. wide. T. J. McCarthy is City Engr.

Hartford, Conn.—Bids will be received until 2 p.m., Nov. 30, by the State Highway Commissioner for the construction of a 60-ft. bridge on the Clayton Road, North Canaan Township, and for removing an old bridge in Old Lyme Township to a new location, and constructing abutments, wing walls and approaches, and painting the bridge.

New York, N. Y.—(Borough of Queens) — Press reports state that the Corporate Stock Committee of the Board of Estimate of the city of New York will recommend an immediate appropriation of about $400,000 for reconstructing the Queensboro Bridge to adapt it to the operation of rapid transit trains. F. J. H. Kracke is Comr. Dept. of Bridges.

Olean, N. Y.—At the recent general election, the citizens voted in favor of building a new bridge, estimated to cost $20,000, over the Allegheny River at some point between Seventh and 19th St. H. E. Bunce is City Engr.

+★Schuylerville, N. Y.—(Official)—The following bids were received Nov. 6 for the construction of a bridge over the west channel of the Hudson River near Schuylerville: Lupfer, Remick & Shea, $23,650; E. W. Foley, $26,790; Parker & Beebe, $22,828; Lou B. Cleveland, $23,373; Holler & Shepard, $22,637; Callahan & Prescott, $21,958; Flood & Van Wirt, $21,505; E. N. & R. E. SPALDING, Suffield, Conn., $18,051 (awarded contract); Seiling & Crocker, $23,815; Groton Bridge Co., $21,570; Harrison Burton Co., $21,658. Noted Oct. 15.

Nutley, N. J.—It is reported that the Board of Chosen Freeholders of Essex County, Newark, plans to build a new bridge over the Third River at Essex St. and Vreeland Ave., Nutley.

+Lewistown, Penn.—The Borough Council has awarded the contract for the construction of a bridge on Dorcas St., to WAGAMAN BROS., Dallastown, Peon., at about $20,000.

+New Castle, Penn.—(Official)—The Committee on Grounds and Public Buildings, Harrisburg, has awarded the contract for removing the old bridge and building a new one over the Shenango River at Grant St., New Castle, to GEORGE W. ENSIGN, INC., Harrisburg, at $43,247. Other bidders were: Canton Bridge Co., Canton, Ohio, $54,114; Penn Bridge Co., Beaver Falls, Penn., $49,170; McClintic-Marshall Co., Pittsburgh, $50,895; Fort Pitt Bridge Works, Pittsburgh, $44,900. Noted Oct. 29.

+Sparrows Point, Md.—(Official)—The Maryland Steel Co. has awarded the contract for the construction of a reinforced concrete ore trestle at its Sparrows Point plant to the RAYMOND CONCRETE PILE CO., 140 Cedar St., New York, N. Y.

Appomattox, Va.—(Official)—Bids will be received until noon, Nov. 27, by the Clerk of the Circuit Court of Appomattox County for the construction of a 72-ft. bridge over the Falling River about four miles from Appomattox, and for a 37-ft. bridge over Cub Creek about seven miles from Appomattox. The Childrey Co., Richmond, Va., is Engr.-in-Charge.

Lynchburg, Va.—The Chesapeake & Ohio Ry., the Norfolk & Western Ry., the Southern Ry., the city of Lynchburg and Amherst County have entered into an agreement for the construction of a 1700-ft. reinforced concrete viaduct over the James River at the foot of Seventh St., Lynchburg. The estimated cost is $300,000, of which the city will pay $50,000 and Amherst County $10,000. H. L. Shaner is City Engr. Noted July 16 and July 30.

Princeton, W. Va.—The Princeton Power Co., Princeton, plans to construct five steel bridges on its railway line between Princeton and Bluefield, a distance of 12 miles. G. H. Hill is Ch. Engr.

Bids will be received, until Nov. 19, by the Board of Commissioners of Mercer County, for the construction of three reinforced-concrete bridges over the Bluestone River. W. I. Lee is Ch. Engr. of Const.

Fort Lauderdale, Fla.—Bids were opened, Nov. 3, by the Commissioners of Dade County for the construction of a double-track steel bridge over the New River at Fort Lauderdale, but all were rejected as too high. This is the second time that bids for this work have been rejected. The bids for various designs follow: Edwards Construction Co., Tampa, $26,300 and $35,500; Champion Bridge Co., Wilmington, Ohio, $24,495; Standish & Allen Co., Chicago, Ill., $18,800, $19,030, $27,800 and $28,300. Noted July 23, Aug. 20 and Oct. 22.

Vicksburg, Miss.—Owing to the alleged deficiencies of the plans prepared for the steel bridge over the Big Black River at Holt's Ferry, the Boards of Supervisors of Warren and Hinds Counties have postponed opening bids for the construction of the bridge from Nov. 3, until early in December. J. D. Laughlin, Vicksburg, is Chancery Clk. of Warren County. Noted Oct. 15 and Oc. 29.

+★New Orleans, La.—The city has awarded the contract for the construction of the Strauss trunnion bascule bridge over the New Basin Canal at City Park Ave. to the PENN BRIDGE CO., Beaver Falls, Penn., at $34,800. Noted Oct. 1 and Nov. 5.

+Miamisburg, Ohio—(Official)—The following bids were received, Nov. 6, by the Board of Commissioners of Montgomery County, Dayton, for the construction of the steel superstructure of Bridge No. 241, over the Great Miami River at Linden Ave., Miamisburg: BROOKVILLE BRIDGE CO., Brookville, Ohio, $44,800 (awarded contract); King Bridge Co., Cleveland, $47,450; Riverside Bridge Co., Martin's Ferry, Ohio, $50,560; Toledo Bridge Co., Toledo, $52,990; E. M. Scully, Columbus, $52,475; Childers Construction Co., Columbus, $50,818. Victor C. Smith is County Engr. Noted Oct. 29.

+Sciotoville, Ohio—The Chesapeake & Ohio Ry. has awarded the contract for the substructure of a bridge across the Ohio River, to the DRAVO CONTRACTING CO., Pittsburgh, Penn. It will consist of 27 concrete piers for bridge and approaches. The estimated cost of the entire bridge is $2,000,000. F. I. Cabell, Richmond, Va., is Ch. Engr. Chesapeake & Ohio Ry. Noted Jan. 29 and July 23.

Alton, Ill.—(Official)—A special election will be held Nov. 28, in the city of Alton to vote on the qestion of a bond issue of $55,000 for the purpose of building a viaduct across Seventh St. between State and Alby St., and $15,000 for building and equipping a fire station in Upper Alton. B. R. Kennedy is City Clk.

+Taylorville, Ill.—The Commissioners of Christian County have awarded the contract for the construction of a 126-ft. bridge over the South Fork of the Sangamon River to MILLER & HUSBAND, Springfield, Ill. It will be of steel, four spans of 24 ft. each and one of 30 ft., with a 15-ft. concrete roadway.

Keokuk, Iowa—Recent press reports state the bids will be asked soon by the Keokuk & Hamilton Bridge Co. for the reconstruction of the bridge over the Mississippi River between Keokuk and Hamilton, Ill. The estimated cost of the work is $400,000. Plans were prepared by Ralph Modjeski, Orchestra Hall, Chicago, Ill., and have been approved by the War Department. Theodore Gilman is Secy. of the Keokuk & Hamilton Bridge Co. Noted Aug. 6 and Sept. 3.

+Shenandoah, Iowa—The Commissioners of Page County, Clarinda, have awarded a contract for the construction of a bridge over Four-Mile Creek at Shenandoah to BRIGGS & COREY at $4200. Half the cost will be borne by the city of Shenandoah.

Independence, Kan.—Bids will be received until Nov. 23, by the Commissioners of Montgomery County, Gerald A. Otwell, Clk., for the repair of the McTaggart Bridge over the Verdigris River.

+Wichita, Kan.—(Official)—The City Council has awarded the contract for the construction of a reinforced concrete bridge over the Little Arkansas River between Central and South Riverside Parks to the MARSH ENGINEERING CO., Des Moines, Iowa, at $13,950. There were eight other bidders. Noted Oct. 29.

+Armour, S. D.—(Official)—The Board of Commissioners of Douglas County has awarded the contract for all bridge work in the county during 1915 to the FEDERAL BRIDGE CO., Des Moines, Iowa. C. F. Meyer is County Audr. Noted Nov. 5.

Billings, Mont.—It is reported that bids will soon be asked for the construction of two reinforced concrete bridges over the Yellowstone River, one at Pompey's Pillar and the other west of Billings. The two bridges will cost $75,000. Noted Oct. 15 and Oct. 29.

Chouteau, Mont.—The Commissioners of Teton County are having plans prepared for four new steel bridges to be built in this district, and bids for their construction will soon be asked.

★Marion, Ark.—(Official)—Bids will be received until noon, Dec. 1, for the construction of a reinforced concrete viaduct approximately 2½ miles long. H. W. Hesterly is Engr.-in-Charge.

El Paso, Tex.—It is reported that Morris & Co., Chicago, Ill., meat packers, will build a reinforced concrete viaduct over the Rio Grande River in connection with the stockyards to be established by the company in El Paso.

Chandler, Okla.—(Official)—Bids will be received [illegible] Nov. [illegible] by the [illegible] of Lincoln County [illegible] Drainage [illegible] No. 1 for the construction of a steel bridge over the [illegible] of the [illegible] is County [illegible].

✦**El Reno, Okla.**—The [illegible] Commissioners of [illegible] County has awarded the contract for the construction of three [illegible] bridges to the [illegible] Co., [illegible].

Idabel, Okla.—(Official)—At the recent general election the citizens of McCurtain County [illegible] of a bond issue of $[illegible] for the construction of [illegible] bridges in the county. J. W. [illegible] is County Clk. Noted Oct. [illegible].

Pima, Ariz.—A special election will be held Nov. [illegible] for the purpose of voting on the question of issuing $[illegible] in bonds to be used for building a bridge over the Gila River near Pima.

✦**Glendale, Calif.**—Contracts for the construction of a [illegible] concrete bridge over the [illegible] at [illegible] Way crossing, and for [illegible] and protecting the [illegible] have been awarded to [illegible] & [illegible], [illegible] Bldg., Los Angeles, at $[illegible] and $[illegible] respectively.

✦**Red Bluff, Calif.**—The following bids were received by the Board of Supervisors of Tehama County for the construction of eight bridges on the State Highway from the [illegible] County line to Corning: (a) concrete; (b) steel. [illegible] (a) $[illegible], (b) $[illegible]; [illegible] Construction Co. [illegible] (a) $[illegible]; [illegible] Bridge Co., (b) $[illegible]; Fritz & [illegible] $[illegible]; [illegible] San Francisco, Calif., (a) $[illegible] [illegible]; F. W. Miller, (a) $[illegible], (b) $[illegible]. Noted [illegible].

San Jose, Calif.—The Board of Supervisors of Santa Clara County has rejected all bids received for the construction of a reinforced concrete bridge over Los Gatos Creek on the [illegible] Road. [illegible] is County Supv. Noted Oct. 1.

✦The [illegible] has awarded the contract for construction of a bridge over [illegible] Creek at [illegible] Road to [illegible] & [illegible] [illegible].

Cairo, Ont.—The Township Council of Euphemia Township has passed a by-law authorizing the reconstruction of a bridge over the [illegible] and [illegible] Townships [illegible]. D. M. [illegible] is Township Clk.

●**Toronto, Ont.**—(Official)—Bids will be received until [illegible] by H. C. Hocken, Chn. Bd. of Control, for building across the Rosedale Valley a bridge 86 ft. wide, consisting of [illegible] steel [illegible] with piers and approaches, about [illegible] ft. long, and a concrete retaining wall about 17[illegible] ft. long.

St. Catharines, Ont.—(Official)—Bids will be received until [illegible] by [illegible], City Engr., for the construction of the [illegible] Street Lift Bridge, 12[illegible] ft. long, [illegible] ft. wide and [illegible] ft. above the water level of the Old Welland Canal. About [illegible] lb. of steel will be required. Noted Oct. [illegible].

WATER SUPPLY—IRRIGATION

●**Boston, Mass.**—(Official)—Bids will be received by the Metropolitan Water and Sewerage Board until [illegible] p.m., Nov. [illegible] for [illegible] tons of [illegible] pipe and [illegible] tons of specials. [illegible] is Ch. Engr. Water Wks.

Bids will be received until Nov. [illegible] by the Public Works Department for laying [illegible] ft. of [illegible] water pipe in [illegible] streets. [illegible] is Comr.

✦●**New York, N. Y.**—(Official)—Bids were received Nov. [illegible] by the Board of Water Supply, Municipal Bldg., for the [illegible] of the [illegible] shafts and tunnel of the [illegible] Contract [illegible] as follows: [illegible]. Noted Oct. [illegible].

Port Washington, N. Y.—The citizens [illegible] a municipal water system [illegible].

Hamburg, N. J.—The town officials are considering the [illegible] of a water system.

Newark, N. J.—Bids will be received by the Commissioners of [illegible] for a steel tower and water tank [illegible]. [illegible].

Juniata, Penn.—The [illegible] water [illegible].

Pine Grove, Penn.—Bids will soon be received for the [illegible].

Tamaqua, Penn.—The citizens [illegible] voted [illegible] bonds [illegible] for the construction of a reservoir. [illegible].

Tipton, Penn.—Bonds for $[illegible] were [illegible] the proceeds of which will be used for the [illegible] of [illegible] to the water system.

●**Baltimore, Md.**—(Official)—Bids will be received until [illegible] by the Board of Awards for [illegible]. [illegible].

Shadyside, W. Va.—The [illegible] are considering [illegible] the construction of a municipal water system.

Clearwater, Fla.—[illegible].

●**Manatee, Fla.**—(Official)—Bids will be received until [illegible] 1[illegible] by the city for constructing a water system and for laying three miles of pavement. Frank J. Fagan is [illegible] of [illegible] Wks. and City Engr. For details see advertisement under "Contracts To Be Let."

✦●**New Orleans, La.**—The contract has been awarded by the Sewerage and Water Board to ETTA CONTRACTING CO. at $[illegible] for making extensions to the water and sewer systems. [illegible] Nov. 4. Noted Oct. 1.

Covington, Ky.—The bond issue for $200,000, the proceeds to be used for the improvement of the water system, has been [illegible] by the voters. Noted Oct. 29.

Sebree, Ky.—At an election held Nov. 3, the citizens voted in favor of issuing bonds for $[illegible], the proceeds to be used for the installation of a water system. Noted Sept. 24.

Attica, Ohio—(Official)—W. J. Sherman Co., Toledo, has been retained by the village to prepare preliminary plans for the improvement of the municipal water system.

Bluffton, Ohio—(Official)—The village has retained the W. J. Sherman Co., Toledo, to prepare preliminary plans for the improvement of the municipal water system. Noted Oct. 22.

Canton, Ohio—(Official)—R. Winthrop Pratt, Hippodrome Bldg., Cleveland, will make an investigation and estimate the cost for making improvements and enlarging the water system. Noted Oct. 22.

East Liverpool, Ohio—(Official)—R. Winthrop Pratt, Hippodrome Bldg., Cleveland, has been retained by the city to prepare plans for making improvements to the water system.

Lakewood, Ohio—At an election held Nov. 3, the citizens voted against the question of issuing bonds for $[illegible] for the construction of a municipal water system. Noted Sept. 24.

Marion, Ohio—The citizens voted in favor of issuing bonds, the proceeds of which to be used for the enlargement of the water system. H. H. Noyes is City Engr. Noted Sept. 24.

Mt. Blanchard, Ohio—The citizens voted in favor of issuing bonds for $[illegible], the proceeds to be used for the construction of a water system. Noted Oct. [illegible].

Upper Sandusky, Ohio—(Official)—R. Winthrop Pratt, Hippodrome Bldg., Cleveland, has been retained by the city to prepare plans and supervise the construction work in connection with the remodelling of the filtration plant.

Woodsville, Ohio—Bonds for $2[illegible],000, the proceeds of which will be used for the installation of a water system, were voted by the citizens.

✦**Ashton, Ill.**—The contract for constructing a water system has been awarded to W. F. HOY, Woodstock, Ill., at about $16,[illegible].

●**Chicago, Ill.**—(Official)—Bids will be received by the City of Chicago, until 11 a.m., Dec. 2, for constructing Sec. 1, of the Wilson Ave. water tunnel, including an intake crib and shaft. L. E. McGann is Comr. of Pub. Wks. For details see advertisement under "Contracts To Be Let."

✦**Malta, Ill.**—The contract for installing a water system has been awarded to NATIONAL CONSTRUCTION CO., South Bend, Ind., at about $17,000.

✦**Rock Island, Ill.**—The contract for the installation of a 6,000,000-gal. two stage pump for the water system has been awarded to HENRY R. WORTHINGTON CO., Harrison, N. J., at $[illegible]. Noted July 30.

Villa Grove, Ill.—J. Rollin Gray, Old Colony Bldg., Chicago, has been retained to prepare plans for the construction of a water system. Noted Aug. 13.

Hayward, Wis.—The Common Council has voted in favor of issuing bonds for $12,000, the proceeds to be used for the construction of a water system. Noted Oct. 22.

Duluth, Minn.—The Council has authorized the expenditure of $[illegible] for the purchase of pipe for the water system and electric light system.

Coffeyville, Kan.—The citizens voted in favor of issuing bonds for $[illegible], the proceeds of which will be used for the construction of a filtration plant. A. C. [illegible] is City Engr.

Douglass, Kan.—The citizens voted in favor of issuing $[illegible] in bonds, the proceeds of which will be used for the extension of the water system.

Mott, N. D.—The citizens contemplate spending $[illegible] for the installation of a water system. [illegible], Engr.

✦**Medicine Bow, Wyo.**—Bids were received Nov. [illegible] by the Town Council for the construction of a water system. The contract has been awarded to J. S. SCHWARTZ, [illegible], Colorado Springs, Colo., at $[illegible]. Noted Nov. [illegible].

Corpus Christi, Tex.—[illegible] for the improvement of the water system. [illegible] is City Engr. Noted Sept. 1[illegible].

Del Rio, Tex.—The Val Verde Irrigation Co. plans to construct a system of irrigation at Del Rio to water [illegible] acres.

✦**Polytechnic, Tex.**—The contract has been awarded to J. [illegible], Fort Worth, for laying water mains and settling [illegible].

Seguin, Tex.—Bonds have been voted by the citizens, the proceeds to be used for the improvement of the municipal water system and electric light plant. The estimated cost is $[illegible].

✦**Ardmore, Okla.**—The contract has been awarded to [illegible], Ardmore, Okla., at $[illegible] for the laying of water mains, sewer pipe and gas mains to connect the [illegible] with the Ardmore systems.

✦**Billings, Okla.**—The contract for the construction of a water system and electric light plant has been awarded to [illegible] CONSTRUCTION CO., [illegible], Okla., at $2[illegible]. Noted Oct. [illegible].

Tularosa, N. M.—[illegible] W. Mitchell plans to construct an irrigation system near Tularosa.

Tremonton, Utah—The citizens voted in favor of issuing $[illegible] in bonds, the proceeds of which will be used for the [illegible] of a [illegible] water supply.

Seattle, Wash.—Oliver T. Erickson, Councilman, has introduced a bill into the Council appropriating $5000 from Cedar River water extension fund, No. 2, to cover the cost of plans and estimates for an extension of the Cedar River water system to West Seattle, the Duwamish Valley, and a portion of Rainier Valley. The work will cost approximately $3,000,000. A reservoir in West Seattle, and a third penstock connecting the water system with the Cedar River intake at Landsburg, are included in the improvement.

✚The contract for laying water mains in the southern section of the city has been awarded to GUILIO ARGENTIETI, at $7011. Noted Nov. 12.

✚**Seattle, Wash.**—The contract for installing a sprinkler system on Hanford St. wharf has been awarded to AUTOMATIC SPRINKLER CO. OF AMERICA, at $15,584.

Azusa, Calif.—Bonds for $35,000 have been voted by the citizens, the proceeds of which will be used for the installation of a water system. Noted Oct. 22.

Brawley, Calif.—The citizens voted in favor of issuing bonds for $35,000, the proceeds to be used for the improvement of the municipal water system. C. J. Park is City Engr.

El Centro, Calif.—The citizens of Imperial Valley voted in favor of issuing bonds for $3,500,000 for the purchase of the irrigation system of the California Development Co.

Marysville, Calif.—The capital stock of the Hallwood Irrigation Co. has been increased from $25,000 to $50,000 for the extension of its system.

Oakdale, Calif.—The Sierra & San Francisco Power Co., San Francisco, contemplates constructing reservoirs above Oakdale for irrigation and power purposes. The estimated cost is $4,000,000. H. F. Jackson, Berkeley, is Gen. Mgr.

✚**Orland, Calif.**—See item under "Sewers."

San Diego, Calif.—The Paumo Valley Water Co., recently organized by J. Moore, Jr., J. C. Adams and G. M. Henderson with a capital stock of $300,000, will construct an irrigation system to water about 12,000 acres.

Ottawa, Ont.—Bids will be received until 4 p.m., Nov. 26, by the Secretary of the Board of Control for a 15,000,000-gal., elecrically driven, direct connected, low-lift turbine pump and motor. F. C. Askwith is City Engr.

The City Council has passed a by-law authorizing the expenditure of $250,000 for the construction of an intake pipe for the water system.

Thorold, Ont.—Bids will be received by the Chairman of the Board of Water Commissioners until 8 p.m., Nov. 25, for a filtration plant. Plans are on file with Chipman & Power, Engrs., Mail Bldg., Toronto, Ont.

SEWERS

Boston, Mass.—Bids will be received, until Nov. 19, by the Public Works Department, for constructing sewers and drains in Intervale St., Dorchester District and until Nov. 23 for sewers and drains in Spring St., West Roxbury District. L. K. Rourke is Comr.

✚★**Woonsocket, R. I.**—The contract for constructing sewers in the Fairmont District has been awarded by the Board of Sewer Commissioners to THOMAS BRUNO, Boston, Mass. Bids opened Nov. 2. Noted Oct. 22.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received, until 11 a.m., Nov. 25, by L. H. Pounds, Pres., Borough of Brooklyn, for constructing an outlet sewer in Shore Rd., from 83d to 79th St.

✚(Borough of Brooklyn) — (Official) — The contract for dismantling one boiler in the Ridgewood North Side pumping station and one boiler in the Jameco pumping station No. 2 and transporting them to the Jameco pumping station No. 1, has been awarded to DOVER BOILER WORKS, at $4778. Noted Oct. 22 and Oct. 29.

Lyndhurst, N. J.—The Union Township Board of Commissioners has authorized the preparation of plans for the construction of a sewer system.

Montclair, N. J.—The construction of a trunk sewer in the east side of Upper Montclair has been deferred until spring. Noted Oct. 29.

★**North Plainfield, N. J.**—(Official)—Bids will be received, until 8 p.m., Dec. 8, by the Borough of North Plainfield, for constructing a sewage collecting system and outfall sewer. C. M. Dolliver is Borough Clk. For details see advertisement under "Contracts To Be Let."

Bradford, Penn.—Plans have been prepared by B. A. Wise, City Engr., for the construction of a sewage settling system and a sewage disinfecting system.

Miner's Mills, Penn.—On Nov. 3 the citizens voted in favor of issuing bonds for $40,000 for the construction of sewers and for paving.

Parkesburg, Penn.—At a recent election the citizens voted in favor of issuing bonds for the construction of a sewer system and sewage disposal plant. Noted Oct. 1.

★**Baltimore, Md.**—(Official)—Bids will be received until 11 a.m., Dec. 2, by the Sewerage Commission for building Section 10 of the High Level interceptor, Contract 126; Ostend St. trunk sewer, Contract 138; lateral sewers and house connections in District 44-B, Contract 139; for Contract 140 and for building storm water drains under Contract 41. Calvin W. Hendrick is Ch. Engr. of the Sewerage Comm.

✚**Richmond, Va.**—According to press reports, contracts have been awarded to BURTON MARYE, at $20,718 for Section 1-A of the Bacon Quarter branch sewer and to SAVILLE & CLAIBORNE at $20,693 for Section 1-B.

Lancaster, S. C.—Bids will be received until 3 p.m., Dec. 1, by John Crawford, City Clk., for installing two sewage disposal plants. The H. S. Jaudon Engineering Co., Savannah, Ga., is the Engr.

Manchester, Ga.—The citizens have decided to postpone the construction of the sewer system. J. N. Hazlehurst & Sons, Atlanta, are the Engrs.

Clearwater, Fla.—Bids will be received about Jan. 1, by R. T. Daniel, City Clk., for the construction of a sewer system and septic tank. The estimated cost is $18,000. Noted July 9.

★**Manatee, Fla.**—(Official)—Bids will be received, until noon, Dec. 15, by the city, for constructing a system of storm and sanitary sewers. Frank J. Fagan is Comr. of Pub. Wks. and City Engr. For details see advertisement under "Contracts To Be Let."

Cleveland, Ohio—The City Council has sold $117,000 in bonds for constructing sewers in East Cleveland.

Lancaster, Ohio—Bids will be received by John A. Mayer, Dir., Pub. Ser., until Nov. 25, for constructing and completing a sewer and laterals in Pierce Ave. in District No. 5.

Newburg Heights (Newburg post office) **Ohio**—(Official)—Bids will be received by J. A. Fitzgerald, Village Clk., until noon, Nov. 27, for constructing a sewer in East 53rd St.

Rocky River, Ohio—At the general election the citizens voted in favor of issuing $50,000 in bonds for sewers and a sewage disposal plant.

Toledo, Ohio—The city, acting jointly with the County Commissioners, will install a storm water sewer in the Norwood District in the near future. The estimated cost is $7000.

✚**Evansville, Ind.**—A contract for constructing three lateral sewers has been awarded to J. L. NEWMAN.

Grosse Point, Mich.—At the general election the citizens voted in favor of issuing $100,000 in bonds for trunk sewer construction.

Harbor Beach, Mich.—At the general election the citizens voted in favor of issuing $30,000 in bonds for installing a complete sewer system.

Joliet, Ill.—(Official)—Bids will be received by the Board of Local Improvements until 10 a.m., Nov. 23, for constructing a sewer in Wilson St. and Grant Ave.

Algona, Iowa—The City Council has authorized the City Engineer to prepare plans for the construction of two sewers in the Second and Third Districts.

★✚**Clinton, Iowa**—(Official)—A contract for constructing a sanitary and storm sewer in District No. 4, has been awarded to A. R. COFFEEN, Decorah, Iowa, at $5168. Other bids were: John F. Bredow, Davenport, Iowa, $6412; James J. McGuigan & Co., Albany, N. Y., $5504; D. E. Keeler & Co., Davenport, Iowa, $6166; Dearborn Construction Co., Waterloo, Iowa, $6535; Thomas Carey & Sons, Clinton, Iowa, $5465. Noted Oct. 22.

Brainerd, Minn.—Bids will be received by U. N. Roderick, City Clk., until 8 p.m., Dec. 7, for constructing a lateral sewer in District No. 3.

✚**Hutchinson, Kan.**—(Official)—The contract for constructing an intercepting sewer outlet has been awarded to EVERETT & BURT, Hutchinson, at $15,883. Noted Oct. 1 and 29.

✚**Kansas City, Mo.**—A contract for constructing joint district sewers in Districts No. 360, 361, 362, 364 and 365, Division No. 5, has been awarded to LEO E. KOEHLER, at $39,872.

Uvalde, Tex.—The City Council has approved the bond issue of $35,000 to construct a sewer system.

Colorado Springs, Colo.—(Official) — Plans are being prepared by R. Winthrop Pratt, Hippodrome Bldg., Cleveland, Ohio, for the construction of a sewage treatment plant at the Cragmore Sanitorium at Colorado Springs.

✚**Los Angeles, Calif.**—The contract for constructing the Alameda St. storm drain and sanitary sewer and for paving Alameda and other streets, has been awarded to T. J. SHEA, 1800 Oxford St., at $195,147.

✚**Orland, Calif.**—A contract has been awarded by the Board of Trustees to C. D. VINCENT, Oakland, Calif., at $12,015 for extending the sewer and water systems.

Venice, Calif.—The City Council contemplates an expenditure of $30,000 for an outfall sewer and septic tank.

Toronto, Ont.—Bids will be received until Nov. 25 for constructing sewers in various streets. Chipman & Power, Mail Blg., Toronto, are Engrs.-in-Charge.

✚**Halifax, N. S.**—A contract for constructing a number of sewers has been awarded to Robert & Co. at $14,000.

STREETS AND ROADS

Boston, Mass.—Plans are being prepared for the proposed South Shore Boulevard to be built by the Metropolitan Park Commission. Estimated cost $450,000. John R. Rablin, 14 Beacon St., is Ch. Engr.

Hartford, Conn.—Bids will be received at the office of the State Highway Commissioner, Capitol, Hartford, until 2 p.m., Nov. 30, for the following state road work:

Lebanon Township, about 7300 lin.ft. native stone macadam on the Creamery Hill Rd. Estimated quantities, 1020 cu.yd. earth grading, 3825 cu.yd. borrowed embankment, 1010 sq.yd. earth grading, 100 cu.yd. rock excavation, 90 cu.yd. wet excavation 8865 sq.yd. 7-in. and 2500 sq.yd. 4-in. macadam, 2500 sq.yd. telford base, 850 tons trap rock screenings, 210 tons three-quarter inch native stone in piles, 5683 gal. asphaltic oil or asphaltic flush coat applied, 35 cu.yd. first class concrete, 10 cu.yd. second class concrete, 11,530 lb. steel beams and reinforcement, 10 cu.yd. dry rubble wall, 145 cu.yd. new masonry, 50 sq.yd. repointing old masonry, 49 lin.ft. gas pipe railing, 414 lin.ft. corrugated iron pipe culverts, one catch basin and strainer, 100 sq.yd. cobble gutters, 300 lin.ft. rubble drain, 1500 lin.ft. replacing stone walls, 100 lin.ft. new stone fence, 100 lin.ft. new wire fence, 100 cu.yd. sand or gravel fill, 2300 cu.yd. stone fill. Specifications on file at the Town Clerk's office, Lebanon.

Sherman Township, about 3898 lin.ft. native stone macadam on the Gaylordsville Rd. Esimated quantities, 1575 cu.yd. earth grading, 1000 cu.yd. borrowed embankment, 2040 cu.yd. rock excavation, 5970 sq.yd. 7-in. and 100 sq.yd. 4-in. macadam, 100 sq.yd. telford base, 450 tons trap rock screenings, 110 tons ¾-in. trap rock in piles, 3035 gal. asphaltic oil or asphalt flush coat applied, 10 cu.yd. second class cement, 10 cu.yd. new masonry, 10 cu.yd. old masonry relaid, 50 sq.yd. repointing old masonry, 226 lin.ft. corrugated iron pipe culverts, one catch basin and strainer, 226 lin.ft. corrugated iron pipe culverts, one catch basin and strainer, 100 sq.yd. cobble gutters, 100 lin.ft. rubble drain, 1400 lin.ft. stone walls re-

[illegible]

[illegible] Erie County, 4.04 miles. COLD SPRING CONSTRUCTION CO., Buffalo, N. Y., [illegible]

[illegible] Erie County, 4.[illegible] miles. All bids were rejected.

[illegible] Erie County, 6.[illegible] miles. RICH CONSTRUCTION CO., INC., [illegible] N. Y., [illegible]

Road No. [illegible] Madison County, [illegible] miles. PADDLEFORD & KING, [illegible], N. Y., [illegible]

Road No. [illegible] Madison County, 1.[illegible] miles. PADDLEFORD & KING, [illegible], N. Y., $1[illegible],614.

Road No. [illegible] Monroe County, [illegible] miles. C. G. McCOMB, [illegible] N. Y., [illegible]

Road [illegible], [illegible] County, 5.7 miles. J. G. HAYES, [illegible] N. Y., [illegible]

Road No. [illegible] A, Rensselaer County, 3.66 miles. GIFFORD CONSTRUCTION CO., [illegible], N. Y., [illegible]

Road No. [illegible], Schoharie County, 4.16 miles. GEORGE H. MacAVOY, Creek Locks, N. Y., $[illegible]0,66[illegible].

Road No. [illegible]6 A, Schoharie County, 0.6[illegible] mile. WERA & GASTALDY, [illegible]66 [illegible] Ave., Albany, N. Y., [illegible]

Road No. [illegible]86, Sullivan County, 1[illegible] miles. BRIDGEPORT CONSTRUCTION CO., Poughkeepsie, N. Y., [illegible]

Road No. [illegible]6, Broome County, 1.[illegible] miles. PADDLEFORD & KING, Sherburne, N. Y., [illegible]

Road No. 111[illegible], Onondaga County, 0.76 miles. All bids were rejected.

Road No. [illegible] Herkimer County, [illegible] miles. STANLEY CONSTRUCTION CO., Buffalo, N. Y., $17,[illegible]3.

Noted Oct. 1[illegible] and Nov. [illegible]

Little Falls, N. Y.—At the general election the citizens voted in favor of issuing $[illegible]0,000 in bonds for paving.

New York, N. Y. (Borough of Manhattan)—(Official)—The following bids were received, Nov. 11, by Marcus M. Marks, Borough Pres., for repaving Ave. D from Fifth to [illegible]th St. with sheet asphalt and granite block pavement on concrete foundations: Uvalde Asphalt Co., $21,764; Barber Asphalt Paving Co., $22,719; Sicilian Asphalt Paving Co., $[illegible]; Aztec Asphalt Co., $20,611. For repaving Washington Place from Broadway to Washington Sq. with wood block on concrete foundation: Mack Bros. Contracting Co., $[illegible]; Barber Asphalt Paving Co., $9332; J. Leopold & Co., Inc., $[illegible]; M. J. Fitzgerald, $8036. For paving 191st St. from Audubon to Wadsworth Ave. with sheet asphalt on concrete foundation: Barber Asphalt Paving Co., $6[illegible]3; Asphalt Paving Co., $[illegible]3; Uvalde Asphalt Co., $[illegible]. Noted Nov. [illegible]

(Borough of Bronx)—(Official)—Bids will be received by Douglas Mathewson, Pres. of the Bronx, until [illegible] a. m., Nov. 30, for improving Park St. from East 149th St. to Westchester Ave. and Park Ave. from 1[illegible]th St. to Morris Ave.

(Borough of Richmond)—Bids were received, Nov. 10, by the Borough President, for repaving Richmond Turnpike between Cebra Ave. and Louis St. and a portion of Innes St. with granite block. Joseph Johnson's Sons, West New Brighton, N. Y., submitted the lowest bids at $[illegible] and $[illegible], respectively.

Whitehall, N. Y.—At the general election the citizens voted to pave Broad, South Canal and Canal St. with brick. The estimated cost is $[illegible].

Camden, N. J.—The City Council has passed an ordinance providing for the paving of Division and Sixth St. with belgian block on a [illegible] concrete foundation. W. D. Brown is City Clk.

+Millburn, N. J.—The contract for constructing a [illegible] road on [illegible] Ave. has been awarded to the FRANKLIN CONSTRUCTION CO., [illegible] St., New York, N. Y.

Newark, N. J.—The Board of Works plans to pave South [illegible] from South Orange Ave. to the East Orange line, with bitulithic pavement.

Newton, N. J.—The State Road Department has had surveys made by [illegible], County [illegible], for the construction of a [illegible] road from [illegible] to [illegible].

Princeton, N. J.—The Street Committee of the City Council plans to improve [illegible] St. from [illegible] Lane to [illegible] St., with bitulithic or other asphalt pavement on concrete foundation.

+Trenton, N. J.—The State Road Department has awarded contracts to JOHN [illegible] LA COMPTE, [illegible] City, and [illegible] HAFFMAN, [illegible], for [illegible] [illegible] The [illegible] the following districts: [illegible] River, West Creek, [illegible] Chestnut Neck, [illegible]

+Harrisburg, Penn.—The following bids were received Nov. [illegible] by the State Highway Department for road [illegible] [illegible] Township, [illegible] [illegible] SAMUEL [illegible] CO., [illegible] Pittsburgh, [illegible] [illegible] Altoona, [illegible] [illegible] THOMPSON & MATSON, [illegible] Franklin, $[illegible]

[illegible] Township, [illegible] ft. [illegible] Pittsburgh, $[illegible] [illegible] Ellwood City, $[illegible] [illegible] New Brighton, $[illegible]; H. H. Taylor, [illegible] [illegible] Construction Co., [illegible], $[illegible]; [illegible] McCrady Bros., Braddock, $[illegible]; [illegible] Pittsburgh, $[illegible]; Bell [illegible] Altoona, $[illegible]; John L. [illegible], Ebensburg, $[illegible]; [illegible], $42,204; Duquesne Contracting Co., Pittsburgh, $[illegible]; W. C. [illegible] Ambler, $[illegible]; [illegible] SOMERSET

CONTRACTING CO., INC., Somerset, $79,597 (awarded contract); Matthew Ott & Co., Pittsburgh, $80,531.

Chester County, Penn Township, 6662 ft. asphaltic bituminous macadam. Penetration method. D. E. O'Connell & Son, Avondale, $21,153; Corcoran Construction Co., West Chester, $18,283; Hollingsworth & McDowell, Marshallton, Del., $22,372; Dwyer & Co., Philadelphia, $21,607; Ambler-Davis Co., Philadelphia, $18,791; Ernest Palmer, Wallingford, $21,651; O. W. Rackle, Providence, R. I., $23,852; George C. Souder, Lancaster, $19,697; M. BENNETT & SONS, Indiana, $17,994 (awarded contract); B. F. Wickersham, Kennett Square, $25,182; Charles H. Dunleavy, Coatesville, $20,272; Paul J. Snyder & Co., Philadelphia, $21,662; D. Webster Anders, Philadelphia, $19,440; M. & T. E. Farrell, West Chester, $20,069; W. C. Evans, Ambler, $21,978; Ryan Bros., Coudersport, $26,361; Morris Construction Co., Philadelphia, $20,413. Noted Oct. 22.

Miner's Mills, Penn.—See item under "Water Supply and Irrigation."

Pittsburgh, Penn.—The City Council has voted to pave Kennedy Ave., Crombie, Herschel, Reed and Landwehr St.

★**Petersburg, Va.**—(Official)—Bids will be received until noon, Nov. 30, for 13,000 yd. of paving on East Bank and Halifax St. with creosoted block and 500 yd. on Old and Short Market St. with granite block. J. R. Jones is Ch. of St. Comn. and P. G. Bunting is Clk. of St. Comn. For particulars, see advertisement under "Contracts to Be Let."

Asheville, N. C.—Bids will be received by Charles H. Neal, Rd. Engr., until Dec. 6, for constructing seven miles of 16-ft. bituminous macadam road.

Warrentown, N. C.—Bids will be received by the County Commissioners until Dec. 7, for the sale of $20,000 in bonds for constructing roads.

Apalachicola, Fla.—Bids will be received by the County Clerk until Nov. 23, for the sale of $20,000 in bonds for constructing roads.

Jacksonville, Fla.—(Official)—Bids will be received by the Board of Trustees until 8 p.m., Nov. 23, for improving a section of the Boulevard.

★**Manatee, Fla.**—(Official)—See item under "Water Supply and Irrigation."

✚**Camden, Ala.**—The contract for grading, draining and surfacing a section of the Camden and Millers Ferry Rd. has been awarded to D. R. COOK & CO., Selma, Ala., at $11,867. Noted Oct. 15.

✚**Gadsden, Ala.**—The contract for improving Walnut St. has been awarded to C. O. DUNCAN, at $5130.

Manchester, Tenn.—An election will be held, Dec. 5, to vote on the question of issuing $12,000 in bonds for road construction.

Grayson, Ky.—At a recent election the citizens of Carter County have voted in favor of issuing $150,000 in bonds for road construction.

Cheviot (Cincinnati post office), **Ohio**—(Official)—Bids will be received by Albert J. Reusing, Village Clk., until noon, Dec. 2, for improving Glenmore Ave. from Woodbine Ave. to the North Corporation line.

✚**Cincinnati, Ohio**—A contract for improving Miles Rd. has been awarded to O. E. ROBINSON, Cincinnati, at $8007.

Fostoria, Ohio—At the general election, the citizens of Jackson Township voted in favor of issuing $50,000 in bonds for improving roads.

McArthur, Ohio—The City Council has sold $9000 in bonds for constructing a number of macadam streets.

Martins Ferry, Ohio—(Official)—Bids will be received by Brock Brown, Dir. Pub. Ser., until noon, Nov. 23, for paving Center St. from Clark to First St. G. H. Harris is Clk. of the Dept.

Wapakoneta, Ohio—The low bidders for paving Perry and Main St. with asphaltic concrete were Toy & Mulligan, Lima, at $22,000. Noted Oct. 22.

Washington, Ohio—(Official)—Bids will be received by the Director of Public Service, until noon, Nov. 28, for improving North St. from East St. to Gibbs Ave. Ray Maddox is Clk.

Indiana—(Official)—Bids will be received as follows for road improvements in Indiana:

Brownstown, until 1:30 p.m., Dec. 7, by the Commissioners of Jackson County, for constructing a gravel road in Grassy Fork Township. Albert Leudtke is Audr.

Williamsport, until 9 a.m., Dec. 7, by the Commissioners of Warren County, for constructing a road in Pine Township. D. H. Moffit is Audr.

Rochester, until 2 p.m., Dec. 8, by the Commissioners of Fulton County, for constructing two roads in Union Township an done in Rochester Township. W. C. Miller is Audr.

Kokomo, until 10 a.m., Dec. 8, by the Commissioners of Howard County, for constructing a road in Center Township. E. B. Swift is Audr.

✚**Corydon, Ind.**—A contract for constructing a road in Harrison Township has been awarded to JOHN DE CHAMP at $7310.

✚**Monticello, Ind.**—A contract for constructing a road in Union Township has been awarded to O. E. SHAFER, Royal Center, Ind. Noted Oct. 29.

Danville, Ill.—At the general election the citizens of Vermillion County voted in favor of issuing $1,500,000 in bonds for constructing 175 miles of brick or concrete roads.

✚**Peru, Ill.**—A contract for paving a section of Grant St. has been awarded to TROMPETER & SONS, at $8500.

✚**Mankato, Minn.**—A contract for constructing state highway No. 2 has been awarded to J. SAMPSON & CO., Sioux Falls, S. D., at $46,538. Other bids were: Stevens Bros., St. Paul, $48,405; Frederick & Barnard, Minneapolis, $48,623.

Atchison, Kan.—(Official)—Bids will be received by C. M. Volker, County Clk., until noon, Nov. 21, for improving a section of the Leavenworth Branch Rd.

Houston, Tex.—Plans are being prepared by E. E. Sands, City Engr., for paving West Alabama St. from Main to San Jacinto St.

Bids will be received by H. L. Washburn, County Audr., until 10 a.m., Nov. 28, for grading approaches to the San Jacinto Bridge. Approximately 4000 yd. are to be paved.

Tulsa, Okla.—Plans are being prepared by E. C. Hughes, City Engr., for macadamizing 10 blocks in West Tulsa. The estimated cost is $12,000.

✚**Phoenix, Ariz.**—(Official)—A contract for extending one mile of highway from Kingman, Mohave County, has been awarded to F. O. B. KINGMAN at $8281.

✚**Fresno, Calif.**—(Official)—A contract for constructing a section of the Dunlap Cutoff Rd. has been awarded to C. M. BAKER, Reedley, Calif., at $4700. The only other bid was that of W. F. Jones, $6200. Noted Oct. 29.

✚**Los Angeles, Calif.**—See item under "Sewers."

✚GEORGE R. CURTIS, 552 South St. Louis St., has been awarded the contract at $56,879 for improving Santa Barbara Ave. from Budlong Ave. to the west city boundary.

Pasadena, Calif.—Bids will be received by Herman Dyer, City Clk., until 9 a.m., Nov. 24, for constructing 35,000 sq.ft. of 5-in. oil macadam pavement on Glenarm Ave. from Raymond to Maringo Ave.

Pomona, Calif.—The City Council contemplates paving nine miles of streets.

✚**Santa Ana, Calif.**—MAX HUBERMAN has been awarded the contract, at $20,584, for constructing Sect. 3 of Talbert Rd.

Susanville, Calif.—An election will be held Nov. 23, to vote on the question of issuing $10,000 in bonds for street and bridge improvements.

Yuba City, Calif.—Bids will be received some time in December by the Board of Supervisors of Sutter County for constructing a concrete macadam road from Yuba City to the northern end of the county.

INDUSTRIAL WORKS

Boston, Mass.—Plans have been completed by F. A. Norcross, for a four-story brick building for manufacturing purpose, at 889 Washington St., for Esther Lewis. The estimated cost is $80,000.

The Sears Roebuck Co., Chicago, Ill., contemplates constructing a factory on Walpole St.

✚**Holyoke, Mass.**—The Farr Alpaca Co. has awarded a contract to DANIEL O'CONNELL'S SONS, for an addition to its plant on Jackson St. The estimated cost is $15,000.

✚**Worcester, Mass.**—The contract for the construction of the one-story warehouse, 40x120 ft., for the Worcester Woolen Mills, has been awarded to the E. J. CROSS CO., Foster St., Worcester, Mass.

Bids are being received by Henry N. Tyler, New York, for a garage at 185 Commercial St., for the H. H. Bigelow Estate. It will be three stories, 50x125 ft. of brick and reinforced concrete.

✚(Official)—The contract for the construction of the warehouse for the Robertson Electric Construction Co. has been awarded to the TURNER CONSTRUCTION CO., 11 Broadway, New York. It will be three stories and basement, 340x115 ft.

Baldwinsville, N. Y.—Plans are being completed for rebuilding the paper mill of R. S. Hoffman, recently destroyed by fire.

✚**Buffalo, N. Y.**—The contract for the construction of the boiler house and dryer building for the Superior Elevator Co., on the Buffalo River, has been awarded to the MONARCH ENGINEERING CO., Buffalo.

✚**Elmira, N. Y.**—The contract for the addition to the plant of the Thatcher Mfg. Co., Grand Central Ave., has been awarded to the W. R. COMPTON REALTY & BUILDING CO. The estimated cost is $125,000.

New York, N. Y.—(Borough of Bronx)—The Liberty Glace & Netting Works, East 228th St. and Bronxwood Ave., will construct a two-story factory and a 50x110-ft. addition.

L. C. Holden, Arch., 103 Park Ave., is preparing plans for a nine-story, 79x159-ft. warehouse, to be constructed at 1922 Webster Ave., for the Dochtermann Van & Express Co.

✚**Peekskill, N. Y.**—The general contract for the construction of the laboratory building at the plant of the Fleischmann Mfg. Co., has been awarded to the DRUMM CONSTRUCTION CO. Noted Sept. 24.

Penn Yan, N. Y.—The Barden & Robinson Basket Co. will build a factory, 72x100 ft. The estimated cost is $50,000.

✚**Syracuse, N. Y.**—The general contract for the construction of a two-story machine shop for the Le Fevre Arms Co., has been awarded to DAWSON BROS.

✚**Camden, N. J.**—(Official)—The foundation contract for the building for the Victor Talking Machine Co. has been awarded to the RAYMOND CONCRETE PILE CO. Noted Sept. 24.

Cranford, N. J.—George Damon & Sons, 44 Beekman St., New York, plan to construct two brick and concrete factories at Cranford. S. K. Townley, Bridge St., Newark, is the Arch.

Harrison, N. J.—Bids are being received by C. P. Baldwin, Arch., 45 Clinton St., Newark, for constructing a factory for the Calculagraph Co. It will be two stories, of reinforced concrete, 50x100 ft. Estimated cost, $20,000.

Milton, Penn.—The Milton Brick Co. will construct an addition to its plant. The estimated cost is $35,000.

Philadelphia, Penn.—M. Patterson, 2203 Pearl St., will build a two-story and basement factory, 26x100 ft.

Pittsburgh, Penn.—The H. E. Goss Co., Pittsburgh, will construct a five-story factory to cost $20,000.

York, Penn.—H. L. Newman, York, Penn., will construct a two-story brick factory, 65x100 ft.

Wilmington, Del.—[illegible] will build a two-story [illegible]. The estimated cost is [illegible].

Baltimore, Md.—[illegible] at Curtis Bay. The estimated cost is [illegible].

Plans are being prepared [illegible] Arch., for a [illegible] St., for the [illegible] Co.

♦Richmond, Va.—The contract for the construction of the [illegible] Locomotive [illegible] New York, has been awarded to the LACKAWANNA [illegible] N. Y. The estimated cost is [illegible].

Buckhannon, W. Va.—T. M. [illegible] and C. B. [illegible] will [illegible] factory. The estimated cost is [illegible].

Clarksburg, W. Va.—The Pittsburgh Plate Glass Co. will [illegible] at Clarksburg, W. Va. The estimated cost is [illegible].

Kannapolis, N. C.—Plans have been [illegible] for an addition to the [illegible] plant of the [illegible] Mfg. Co.

Cheraw, S. C.—The [illegible] Lumber Co. will rebuild its plant, recently destroyed by fire. The estimated cost is [illegible].

Logtown, Miss.—The H. Weston Lumber Co. will rebuild its plant, recently destroyed by fire.

Canton, Ohio—The [illegible] Co., recently incorporated, [illegible] plant to cost $10,000. J. E. McClain, [illegible] are interested.

Cleveland, Ohio—The [illegible] Co., 1140 West Sixth St., contemplates construction a brick and reinforced-concrete factory at [illegible] and East [illegible] St. Estimated cost, [illegible]. Construction will start in the spring.

Zanesville, Ohio—The [illegible] Sanitary Packing Co., recently incorporated with a capital of [illegible], contemplates constructing a packing plant. J. T. [illegible] is interested.

Detroit, Mich.—Plans are being prepared for the construction of a six-story brick and steel store and factory on Larned St., for the [illegible] Co.

Chicago, Ill.—The Standard Oil Co. has purchased a site on the [illegible] River, between Hawthorne St. and the right-of-way of the Chicago, Milwaukee & St. Paul R.R., for the construction of a [illegible] plant.

Chicago, Ill.—[illegible] has purchased a site, [illegible] ft., on [illegible] St., for the construction of a seven-story and basement [illegible] manufacturing plant and warehouse.

Denverside (East St. Louis post office), **Ill.**—Plans are being prepared for the Southern Ry. Co. for the construction of terminal facilities estimated to cost [illegible]. The plans include an [illegible]-stall roundhouse, [illegible]-ft. turntable, coal and water-handling plant, machine shop and additional machinery.

Milwaukee, Wis.—Bids soon will be received by Henry [illegible], Arch., [illegible] West Water St., for the construction of a two-story and basement [illegible] reinforced-concrete storage building for [illegible] Packing Co., at [illegible] and Bremen St. Estimated cost, [illegible].

Racine, Wis.—Plans are being revised for the construction of a warehouse on Main St., for Andrew [illegible]. Estimated cost, [illegible]. C. H. [illegible], 2424 State St., Milwaukee, is the Arch. Noted [illegible].

Opheim, Mont.—The [illegible] Lumber Co., recently incorporated with a capital of [illegible], plans to construct a sawmill near Opheim.

Beaumont, Tex.—[illegible], has purchased a site for the construction of an oil refinery.

Grants Pass, Ore.—The [illegible] Lumber Co. contemplates constructing a sawmill at Grants Pass.

Portland, Ore.—Plans are being prepared by [illegible], Arch., [illegible] Bldg., for the construction of a [illegible] and [illegible] factory for the [illegible] Co. Estimated cost, [illegible].

Salem, Ore.—[illegible] factory at Salem.

East San Pedro, Calif.—The [illegible] Wharf & Warehouse Co., recently destroyed by fire [illegible] contemplates reconstructing its plant.

El Centro, Calif.—[illegible] Co. contemplates constructing a [illegible] plant. The [illegible] will cost [illegible].

Oakland, Calif.—[illegible] Estimated cost, [illegible].

Trenton, Ont.—[illegible] Estimated cost, [illegible].

FEDERAL GOVERNMENT WORK

Elevators—[illegible]

♦Ship Building Ways—[illegible]

Dredging—[illegible]

♦Roof Repairs—Buffalo, N. Y.—The contract for repairs to roof of the U. S. post office has been awarded to the [illegible] FAIRCHILD CO., Buffalo, N. Y., at [illegible].

♦Dredging—New York, N. Y.—Bids will be received by Col. Frederick V. Abbott, Army Bldg., 39 Whitehall St., New York, until noon Dec. [illegible], for dredging in Staten Island Sound, N. Y. and N. J.

Roads—West Point, N. Y.—Bids will be received until noon Dec. [illegible], by the Quartermaster, for resurfacing the main road from [illegible] to the south end of the military reservation.

Jacks, Lock Gates, Etc.—Pittsburgh, Penn.—Bids will be received until noon, Dec. 17, by Lieut. Col. Francis R. Shunk, U. S. Engineer Office, Pittsburgh, for furnishing and delivering [illegible] valve jacks, lock gate engines and gate operating machinery for Lock No. 14, Ohio River.

Grading—Washington, D. C.—The following bids were received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for grading grounds and roads at the [illegible] Laboratory, Washington, D. C.: (a) for grading grounds [illegible] in accordance with plans No. 1-A, (b) No. 1-B: Whiting-Turner Construction Co., Baltimore, Md., (a) [illegible], (b) [illegible]; [illegible] Co., Washington, (a) [illegible], (b) [illegible]; Charles H. Tompkins, Washington, D. C., (a) [illegible], (b) [illegible]; John H. Nolan Construction Co., Washington, D. C., (a) [illegible], (b) [illegible]; R. J. [illegible] Construction Co., Washington, D. C., (a) [illegible], (b) [illegible]; L. M. Johnston, Arlington, Va., (a) [illegible], (b) [illegible].

Buildings—Washington, D. C.—The following bids were received by the Superintendent, U. S. Coast and Geodetic Survey, Washington, for the construction of two buildings: (a) one-story building, (b) two-story building: Arthur M. Poynton, Washington, D. C., (a) $4860, (b) [illegible]; [illegible] & Son, Washington, D. C., (a) [illegible], (b) [illegible]; Charles A. Langley, Washington, D. C., (a) [illegible], (b) [illegible]; William E. [illegible], Washington, D. C., (a) [illegible], (b) [illegible]; James L. [illegible], Washington, D. C., (a) [illegible], (b) [illegible]; Walter P. Avery, Washington, D. C., (a) [illegible], (b) [illegible]; R. P. Whitty Co., Washington, D. C., (a) [illegible], (b) [illegible]; H. J. Montgomery, Washington, D. C., (a) $4693, (b) [illegible]; Skinker & Garrett Co., Washington, D. C., (a) [illegible], (b) [illegible]. Noted Nov. [illegible].

Building—Arlington, Va.—Bids will be received until 11 a.m., Dec. 7, at the Executive Office, Arlington Memorial Amphitheater Commission, for the erection of a memorial amphitheater and chapel in the Arlington National Cemetery.

♦Earthwork—Vicksburg, Miss.—The contract for constructing about 267,000 cu.yd. of earthwork in this district has been awarded to R. T. CLARK & CO., Natchez, Miss. Noted Nov. [illegible].

Levee Work—Memphis, Tenn.—The following bids were received by the Mississippi River Commission for constructing about 3,311,000 cu.yd. of levee work in the Upper and Lower St. Francis and White River levee districts: Lacy Bros., Arkansas City, Ark., (d) White River levee district, [illegible], (e) grand (total), [illegible]; R. T. Clark & Co., Natchez, Miss., (d) [illegible], (e) [illegible]; Jackson & Harber, Natchez, Miss., (f) Lower St. Francis levee district, [illegible], (e) [illegible]; R. L. Leonard, Memphis, Tenn., (a) Upper St. Francis levee district, [illegible], (b) Lake on Slough Landing Neck, [illegible], (c) [illegible], (d) [illegible], (e) [illegible]; M. C. Connors & Co., Chicago, Ill., (a) [illegible], (c) [illegible], (e) [illegible]; J. M. Sullivan, New Orleans, La., (d) [illegible], (e) [illegible]; Sessions & [illegible], Grace, Miss., (a) [illegible], (b) [illegible], (c) [illegible], (d) [illegible], (e) [illegible]; Robert Nicholson & Co., Lake Providence, La., (a) [illegible], (e) [illegible]; Martin Jennings, Memphis, Tenn., (d) [illegible], (e) [illegible]; J. A. Hurt, [illegible], Miss., (d) [illegible], (e) [illegible]; S. B. Hughes Construction Co., Greenville, Miss., (c) [illegible], (d) [illegible], (e) [illegible]; C. C. Alderholt, Rosedale, Miss., (e) [illegible], (f) [illegible], (e) [illegible]; Boudreaux & Callahan, Hickman, Ky., (a) [illegible], (b) [illegible], (e) [illegible]; Aderholt Bros., Rosedale, Miss., (d) [illegible], (e) [illegible]; W. T. & E. M. Lowrance & Co., Memphis, Tenn., (a) [illegible], (b) [illegible], (c) [illegible], (d) [illegible], (e) [illegible]; Holloway, Lee & Brown, Charleston, Mo., (a) [illegible], (e) [illegible]; [illegible] Jackson & [illegible], Ky., (d) [illegible], (e) [illegible]; [illegible] & [illegible], Hickman, Ky., (c) [illegible], (e) [illegible]; [illegible] & Rodgers Bros., Memphis, Tenn., (a) [illegible], (b) [illegible], (c) [illegible], (e) [illegible]; [illegible] Bros. Contracting Co., Memphis, Tenn., (d) [illegible], (e) [illegible]; [illegible], Greenville, Miss., (b) [illegible], (e) [illegible]; [illegible] Lowrance Bros. Co., Memphis, Tenn., (a) [illegible], (b) [illegible], (c) [illegible], (e) [illegible]; [illegible] Sweeney, St. Thomas, Ark., (e) [illegible]; [illegible] Bros. & R. T. [illegible], [illegible], (d) [illegible], (e) [illegible]; M. [illegible], Arkansas City, Ark., (d) [illegible], (e) [illegible]; H. H. [illegible] Levee Co., Vicksburg, Miss., (d) [illegible], (e) [illegible]; J. M. Johnston & [illegible], (d) [illegible], (e) [illegible]; Turner & McCarter, Memphis, Tenn., (a) [illegible], (e) [illegible]; [illegible], Memphis, Tenn., (c) [illegible], (e) [illegible]; [illegible], (b) [illegible], (e) [illegible]. Noted Oct. [illegible].

♦Levee Work—Memphis, Tenn.—Contracts have been awarded as follows by [illegible] Mississippi River Commission: [illegible] ROBERT NICHOLSON & CO., Lake Providence, La. [illegible] HAMILTON AND [illegible] LINNAN [illegible] AND [illegible] & CO., Memphis, Tenn. [illegible] LEONARD, Memphis, Tenn. [illegible] BOUDREAUX, CALLAHAN & [illegible] Noted Oct. [illegible].

Post Office—Canton, Ill.—Bids were received as follows, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at Canton, (a) limestone; (b) sandstone: Thomas W. Cissel, Wooster, Ohio, (a) $59,600; (b) $61,000. James Devault, Canton, Ohio, (a) $62,-780; (b) $63,200. George W. Stiles Construction Co., Chicago, Ill., (a) $63,286. Westchester Engineering Co., White Plains, N. Y., (a) $64,315; (b) $66,840. William O'Neill & Son Co., Faribault, Minn., (a) $64,650. J. H. Wisse, Omaha, Neb., (a) $65,650. Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $66,567. Noted Oct. 8.

★**Dredging**—Chicago, Ill.—The following bids were received for dredging in the Chicago River, Ill.: Greiling Bros. Co., Green Bay, Wis., $36,540; FitzSimons & Connell Dredge & Dock Co., Chicago, Ill., $31,363; Great Lakes Dredge & Dock Co., Chicago, Ill., $29,942; Byrne Bros. Dredging & Engineering Co., Chicago, Ill., $35,525. Noted Oct. 22.

✚**Building**—Milwaukee, Wis.—The contract for the construction complete, of the U. S. appraiser's stores at Milwaukee, has been awarded to the NORTHERN CONSTRUCTION CO., Milwaukee, Wis., using limestone for all stonework, except where granite is required at $89,822.

★**Elevator**—Minot, N. D.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Dec. 14, for the installation complete of an electric passenger elevator in the U. S. post office and courthouse at Minot.

★**Jetty Work**—Sabine Pass, Tex.—Bids will be received at the U. S. Engineer Office, Dallas, Tex., until noon, Dec. 12, for jetty work at Sabine Pass. J. H. Jackson is Mayor.

Sewer Systems—Lawton, Okla.—The following bids were received at the Interior Department, Washington, D. C., for sewer construction in the north addition of Lawton: L. J. Roach, Tulsa, Okla., $33,280; Intermountain Bridge & Construction Co., Tecumseh, Neb., $43,760; Mayfield & Shaw, Fort Bliss, Tex., $27,308; Charles H. Shaw, Lawton, Okla., $31,931; O'Neil Construction Co., Leavenworth, Kan., $30,150; F. W. Keeney & Co., Oklahoma City, Okla., $64,453; Standard Construction Co., St. Joseph, Mo., $38,968; Spencer J. Wick, El Reno, Okla., $32,868; E. R. Kerby, Lawton, Okla., $29,857; W. D. Lovell, Minneapolis, Minn., $36,997. Noted Oct. 22.

Canal Work—Benton City, Wash.—The following are the bids received for the construction of about 13¼ miles of main canal extension of the Sunnyside Canal, near Benton City. Valley Construction So., North Yakima, $91,625; Oregon Bridge & Construction Co., Portland, Ore., $87,653; Nettleton Bruce & Eschbach, Seattle, $99,720; Consolidated Contract Co., Portland, $96,239; George P. Wright, Tacoma, $91,093; McDonald & McGuire, $197,973; Grant, Smith & Co., Seattle, $96,128. Noted Oct. 8.

Hull—Portland, Ore.—The following bids were received for the construction of a wooden hull to be used as a combination dredge and snagboat: Willamette Iron & Steel Works, Portland, Ore., $29,825; Joseph Suple, Portland, Ore., $35,044; Portland Iron Works, Ore., $39,715; Wilson Bros., Astoria, Ore., $36,440; Hall Bros., Winslow, Wash., $42,483. Noted Oct. 29.

Repairing and Docking Light Vessel—Portland, Ore.—The following bids were received by the Light House Inspector, for repairing and docking light-vessel No. 67: (a) necessary items; (b) optional items. Hall Bros., Marine Ry. & Shipbuilding Co., Winslow, Wash., (a) $25,849; (b) $2310. Seattle Construction & Dry Dock Co., Seattle, Wash., $19,920; (b) $1465.62. Willamette Iron & Steel Works, Portland, Ore., (a) $15,014; (b) $1721. Puget Sound Navy Yard, Bremerton, Wash., (a) $20,384; (b) $2461.

Post Office—The Dalles, Ore.—Bids were received as follows, by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at The Dalles, (a) limestone; (b) sandstone; (c) any local stone: H. E. Doering, Portland, Ore., (a) $81,394; (b) $80,974; (c) $81,218. A. W. Kutsche, Portland, Ore., (a) $80,160; (b) $79,-960; (c) $80,960. George W. Stiles Construction Co., Chicago, Ill., (a) $82,613; (b) $81,613. J. L. Murphey & Sons, Tacoma, Wash., (a) $82,989; (b) $81,837; (c) $82,809. John Almeter, Portland, Ore., (a) $78,415; (b) $76,915. R. E. Campbell, Salt Lake City, Utah, (a) $79,468; (b) same; (c) $80,500. Palmberg & Mattson, Astoria, Ore., (a) $87,990; (b) $86,990; (c) $87,990. George Isaakson, Portland, Ore., (a) $76,000; (b) $73,-978. Shanan-Blair Co., Portland, Ore., (a) $80,380; (b) $77,680. Pearson Construction Co., Seattle, Wash., (a) $85,500; (b) $85,320; (c) $82,930. Welch Bros & Hannaman, Grass Valley, Calif., (a) $80,698; (b) $79,539; (c) $80,200. Frederick A. Erixon, Salem, Ore., (a) $85,321; (b) $76,300 (c) $95,399. Sound Construction & Engineering Co., Seattle, Wash., (a) $82,034; (b) $82,660; (c) $82,784. Noted Oct. 8.

✚**Ward Pavilions**—Mare Island (Vallejo post office), Calif. —The contract has been awarded by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of ward pavilion at the Naval Hospital, Mare Island, to GUTLEBEN BROS., San Francisco, Calif., at $23,020. Noted Oct. 8 and Nov. 12.

✚**Building**—San Juan, Porto Rico—The contract for the construction of a radio building and operators' quarters at San Juan, has been awarded to A. GUERINI, San Juan, at $6151. Noted Sept. 3 and Octl 22.

MISCELLANEOUS

Motor Ambulances—Boston, Mass.—Bids will be received, until Nov. 27, by the City Hospital Department, for furnishing two gasoline propelled ambulances. Frank H. Holt, M. D., is Act. Supt.

✚**Motor Fire Apparatus**—Boston, Mass.—The city has awarded a contract to the AMERICAN & BRITISH MFG. CO., at $16,610, for furnishing the fire department with three water tower tractors. John Grady is Fire Comr.

Quay Wall—Pawtucket, R. I.—(Official)—The State Harbor Improvement Commission will receive bids, until Nov. 24, for the construction of a 700-ft. granite quay wall on the easterly side of the Pawtucket River. William D. Bullock is the Engr. Noted Oct. 22 and Nov. 12.

Guard Railing—Hartford, Conn.—Bids will be received by the Highway Commissioner, until 2 p.m., Nov. 30, for constructing 29,000 lin. ft. of wood guard railing in the following towns: Avon, Canton, Ellington, Somers, Stafford, Willington, Columbia, Groton, North Branford, East Haven, Hamden, Orange, Naugatuck, Bethlehem and Southbury. Specifications on file at the office of the Highway Commission.

★**Exhibit Cases and Electric Wiring**—Albany, N. Y.—(Official)—Bids will be received by John H. Finley, Comr. Education, Education Bldg., Albany, until 3 p.m., Dec. 15, for furnishing cases for Iroquois Indian Exhibit; construction and electric wiring in the New York State Education Bldg., Albany. Drawings and specifications may be consulted at the New York office of the Department of Architecture, Room 1224 Woolworth Bldg., and at the Department of Architecture, Capitol, Albany, N. Y.

Creek Improvement—Albany, N. Y.—Duncan W. Peck, State Supt., Pub. Wks., will receive bids until noon, Nov. 24, for the improvement of Ellicott Creek at Tonawanda, Erie County. Estimated cost about $69,000.

✚**Dredging**—Albany, N. Y.—The Board of Contracts and Supply has awarded the contract for 65,500 cu.yd. of dredging in Albany basin, to the GREAT LAKES DOCK & DREDGE CO., Chicago, Ill., at 40c. per cu.yd. Frank R. Lanagan is City Engr. Noted Oct. 29.

Barge Canal Work—Albany, N. Y.—The following bids have been received by Duncan W. Peck, State Supt., Pub. Wks., for Contract G, furnishing and erecting the lock gates, valves and buffer beams for locks 2, 3 and 4 and needle beams for the spillway in Dam 2, also for the superstructure of the gates at Waterloo: Lupfer & Remick, Buffalo, $110,115; Sherman & Stalter, Cleveland, $112,012; Whitehead & Kales, Detroit, $112,290; J. J. & J. B. Mulholland Co., Pittsburgh, $119,587; Penn Bridge Co., Beaver Falls, Penn., $123,920, Larkin & Sangster, Seneca Falls, N. Y., $128,981.

✚The following bids were also received for Contract No. 10-C, filling portions of the abandoned Oswego Canal and the removal of a bridge over the abandoned canal at Oneida St., Fulton, N. Y.: S. R. ROSOFF, Herkimer, N. Y., $38,490 (awarded contract); Eastover Construction Co., Inc., Utica, $53,537; A. L. Anderson & Bro., Inc., Altoona, Penn., $47,608; Cleveland & Sons Co., Brockport, $51,137; State Highway Construction Co., Beacon, $43,459; I. M. Ludington's Sons, Inc., Rochester, $44,672; C. T. Hookway Construction Co., Syracuse, $52,909; Owen McNally, Oswego, $52,017; Lathrop, Shea & Henwood Co., Buffalo, $83,337; Chesley, Earl & Heimbach, Inc., Buffalo, $37,170; J. H. Gallup, T. C. Howry & Fred Pierce, Syracuse, $43,947; Flood & Van Wirt Co., Hudson Falls, $46,460; Carver Construction Co., Fulton, $48,009; E. W. Foley Contracting Corporation, New York, $39,501; Lupfer & Remick, Buffalo, $49,078; Roger B. Kennedy, Utica, $47,669; J. A. Culkins Co., Oswego, $43,667; Oswego Construction Co., Fulton, $44,058; Parker & Beebe, Waterford, $41,887; Richards & Gaston, New York, $43,652; Frederick D. Dutcher, Fulton, $52,152; Norton & Gorman Contracting Co., Brooklyn, N. Y., $46,377; Drilling Contracting Co., Albany, $53,371. Noted Oct. 15.

✚**Comfort Station**—Buffalo, N. Y.—The contract for the construction of a comfort station, in Lafayette Sq., has been awarded by the Park Commissioners, to the BISON CONSTRUCTION CO., at $15,638.

Bridge Alterations—New York, N. Y.—(Borough of Manhattan)—The Board of Aldermen has voted an appropriation of $45,000 for moving the cables on the Williamsburg Bridge. These changes are necessary to permit operation of the subway cars under the dual rapid transit contracts.

★**Subway Reconstruction**—New York, N. Y.—(Borough of Brooklyn)—(Official)—The Public Service Commission for the First District, 154 Nassau St., New York, will receive bids, until Dec. 1, for the reconstruction of part of Section No. 9-C-1 of Route No. 9, a part of the Fourth Ave. Subway in Brooklyn. The work will include the installation of cross-overs and the partial reconstruction of the DeKalb Ave. station in Flatbush Ave. Extension.

★**Subway**—New York, N. Y.—(Borough of Manhattan)—(Official)—The Public Service Commission for the First District, 154 Nassau St., will receive bids until Dec. 11, for the construction of Section No. 4 of Routes 4 and 36, a part of the Broadway-Fourth Ave. Rapid Transit railroad in the Borough of Manhattan.

Pier Extension—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by R. A. C. Smith, Comr., Docks, Dept. Docks and Ferries, Battery Place, until noon, Nov. 25, for furnishing the labor and materials necessary for extending Pier 43, North River, and depositing rip rap thereat.

Dumping Board—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received by the Commissioner of Street Cleaning, Room 1224, Municipal Bldg., until noon, Nov. 27, for constructing portions of a dumping board and covering the entire dumping board at the foot of East 72d St., Borough of Manhattan.

Steam Asphalt Rollers—New York, N. Y.—(Borough of Manhattan)—(Official)—The following bids were received Nov. 11, by Marcus M. Marks, Borough Pres., for furnishing and delivering five steam asphalt rollers: Kelly, Springfield Co., $6225; Good Roads Machinery Co., $6235; Barber Asphalt Co., $6490; Erie Machine Shops, $6630; Buffalo Steam Roller Co., $10,175. Noted Nov. 5.

✚**Motor Fire Apparatus**—New York, N. Y.—(Borough of Manhattan)—(Official)—Robert Adamson, Fire Comr., has awarded the contract for furnishing the fire department with 18 gasoline propelled tractors to the FRONT DRIVE MOTOR CO., Willow Ave., Hoboken, N. J., at $64,800. Noted Oct. 29 and Nov. 12.

✚★**Jetties**—Asbury Park, N. J.—(Official)—The following bids were received by the Public Grounds Commission for constructing three jetties, 180 ft. each, on the beach at Asbury Park: (a) creosoted pile per lin.ft., (b) reinforced concrete per lin.ft.: H. O. GARDNER, (b) $19 (awarded contract); J. J. Schultheiser, Harrington, N. J., (a) $13.23, (b) $19.50; George Wooley, North Long Branch, N. J., (a) $14; Conger-Duncan Construction Co., 17 Battery Pl., New York, (a) $14.30, (b) $29.70; C. A. Brown, 62 William St., New York, (a) $14.98,

(d) $17, Hecht [illegible] Construction Co., [illegible] Broadway, New York, (e) [illegible] New York (g) [illegible] Co., [illegible] New York (a) [illegible] Noted Oct [illegible]

Pig Lead and Lead Pipe—[illegible]—The Board of [illegible] will receive bids until [illegible] Nov. [illegible] for furnishing pig lead and lead pipe. Specifications are on file at the office of [illegible]

Fire Station—[illegible] N. J.—The Council will receive bids until [illegible] for the construction of a fire station at [illegible] J. H. Lendrigan is City Clk. Noted [illegible]

Motor Fire Apparatus—[illegible] N. J.—The City Council will receive bids for furnishing the fire department with [illegible]

Bathhouse—Newark, N. J.—The Common Council has approved plans and specifications for a bathhouse to be erected on [illegible] It will be [illegible] stories, having a swimming pool [illegible] ft. The estimated cost is [illegible] James S. [illegible] is Arch.

Comfort Station—[illegible]ton, Penn.—The following bids were received, Nov. 5, for the construction of a public comfort station, [illegible] were rejected [illegible] Conn Stapp & Sons, [illegible] F. S. Sykes & Co., [illegible] Williamson & Richardson, [illegible] Construction Co., [illegible] Mathews Stapp, [illegible] Co., [illegible] James Nevins, [illegible] T. Stapp, [illegible] Noted Sept. [illegible] and Oct. [illegible]

✦Monument—West Chester, Penn.—The County Commissioners have awarded the contract to HARRY [illegible] at [illegible] for the erection of a monument to commemorate the services of those from that county who served in the Civil War.

✦Rip Rap—Wilkes-Barre, Penn.—The City Commissioners have awarded the contract for the rip rapping of the river bank between [illegible] and Shelton St., to the HERRICK CONSTRUCTION CO., at [illegible] per sq. yd. for new material and 20c. [illegible]

Natatorium—[illegible] Md.—The city plans to construct a natatorium [illegible] The estimated cost is about [illegible] of which [illegible] is to be furnished by the Bath Commission [illegible] Park Board.

Harbor Improvement Bonds—Baltimore, Md.—On Nov. 3 the citizens voted in favor of issuing $1,000,000 in bonds for harbor improvements. Noted Sept. [illegible] and Oct. 1.

Canal—[illegible] Md.—(Official)—The proposed canal [illegible] by the legislature [illegible] subject to ratification by the citizens of [illegible] was defeated at a recent election. [illegible] is Clerk to the County Com. Noted Nov. 12.

Drainage—[illegible] N. C.—(Official)—Bids will be received until [illegible] by the Board of Drainage Commissioners, [illegible] District, for the removal of [illegible] and other work necessary [illegible] Estimated cost $17,166. Bids will also be received at the same time and place by the Commissioners of Kerr Creek Drainage District for the removal of [illegible] of Kerr Creek. C. M. Miller, [illegible]

✦✦Dredging—[illegible] Fla.—According to press reports the Port Commission has awarded the contract for dredging in connection with the new municipal docks, to the [illegible] Co., Mobile, Ala. Noted Aug. [illegible]

Fire Boat and Motor Apparatus—Cleveland, Ohio.—[illegible] in his report to the Council recommends an appropriation of [illegible] for building a fire boat [illegible] $10,000 for new cells [illegible] for motor [illegible]

✦Freight Terminal—Cleveland, Ohio.—The Cleveland & Buffalo and the Detroit & Cleveland Navigation Co. [illegible] awarded the contract for the construction of freight [illegible] at the foot of [illegible] St. to [illegible] Detroit, Mich. The estimated cost is about [illegible]

River Straightening—[illegible]

Motor Fire Apparatus—[illegible]

✦Dock—Toledo, Ohio.—The [illegible] Hamilton & Chicago Co. [illegible] has awarded the contract for the construction of a [illegible] dock to the [illegible] Co., [illegible] at about [illegible] Noted [illegible]

✦Mausoleum—[illegible]

Park Work—[illegible]

Motor Fire Apparatus—[illegible]

Drain—[illegible]

Ditch—[illegible]

Dredge—[illegible]

Drainage—[illegible]sberry, Mo.—The Mississippi River Commission, [illegible] Life bldg., will receive bids until Nov. 23, for [illegible] about [illegible] cu. yd. earthwork in [illegible]sberry Drainage District.

Amusement Park—Corpus Christi, Tex.—The Ward Island [illegible] Co., recently organized with a capital stock of [illegible] plans to build an amusement park on Ward Island eight miles from Corpus Christi.

Park and Boulevard—Dallas, Tex.—(Official)—The Dallas Park Board has appointed Myers & Noyes, Consult. Engrs., Dallas, to carry out the plans of George Kessler, Landscape Arch., for the development of a park and boulevard system.

Head Gates and Canal Extension—Roberts, Idaho—Bids for the construction of [illegible] lateral reinforced-concrete head gates and for the extension of the canal, are being received by the [illegible] & Market Lake Canal Co. William [illegible] is Secy.

Dock—Everett, Wash.—The Great Northern Co. has approved the plans for the construction of a dock north of the [illegible] Dock on the bay front. The estimated cost is [illegible]

Motor Fire Apparatus—Seattle, Wash.—(Official)—A communication from the Seattle Port Commission states that all bids received, for furnishing the fire department with three [illegible] chemical and hose motor trucks, were rejected. Noted Oct. 22.

✦Canal—Seattle, Wash.—The contract for the construction of a canal between Oak Bay and Port Townsend has been awarded to the PUGET SOUND BRIDGE & DREDGING CO., Seattle, at $41,[illegible]

Waterway—Tacoma, Wash.—The County Commissioners have received a petition from owners of property along the tide flats, asking that a waterway improvement district be formed to dredge a channel, [illegible] miles long, on the tide flats, to be known as the Hylebos Creek Waterway. L. A. Nicholson, Engr., has prepared plans for a channel [illegible] ft. deep at low water, and varying from [illegible] to [illegible] ft. in width. The estimated cost is $[illegible],000. Noted July 9 and Oct. [illegible]

Bathhouse and Natatorium—Alameda, Calif.—The Neptune Surf Beach Co. plans to build a [illegible]-room bathhouse and enclosed natatorium at Alameda. M. H. Owens and W. Edwards are interested.

Jetties, Pile Driving and Ditches—Blythe, Calif.—Bids will be received, until [illegible] p.m., Nov. 23, by the trustees of the Palo Verde Levee District, Riverside and Imperial Counties, for constructing jetties, pile driving, ditches and other work. Alfred Solano, James Rennie and David Darling are the Trustees.

✦Sheet Metal Work—San Francisco, Calif.—The Board of Public Works has awarded the contract for sheet metal work on the new City Hall to the UNITED STATES SHEET METAL CO., at $66,[illegible]

Fire Station and Apparatus—Venice, Calif.—The City Council contemplates an expenditure of $3[illegible],000 for building a fire station and the purchase of apparatus.

Boilers, Stokers and Heaters—St. Malo, Que.—The National Transcontinental Ry., Ottawa, Ont., will receive bids until Dec. 1, for supplying and installing boilers, stokers, feed water heaters, steam engines or turbines and generators, switchboard and wiring for [illegible] Locomotive and Car Shops at St. Malo. W. J. Press, Ottawa, is Mech. Engr.

Fire Station—Oakville, Ont.—The Town Council plans to build a fire station estimated to cost about [illegible] W. [illegible] is the Town Clk.

Parks and Playgrounds—Toronto, Ont.—The City Council has passed a bylaw authorizing the raising and expenditure of [illegible] for purchasing parks and playgrounds.

✦Oil Tanks—Prince Rupert, B. C.—The Imperial Oil Co. has awarded a contract for the construction of five oil tanks to [illegible] LTD., Vancouver.

✦Terminals—Winnipeg, B. C.—The Grand Trunk Pacific Ry. Co. has awarded a contract to CARTER, HALL & ALDINGER, Winnipeg, at about [illegible],000, for the construction of terminals at the four divisional points in British Columbia [illegible] Smithers and [illegible]

BUILDINGS

Boston, Mass.—Bids will be received until Nov. 24, by the City Hospital Department, for additions to the [illegible] buildings [illegible] Ave. A. [illegible] is Chn. of the Trustees.

[illegible] & [illegible], Archs., [illegible] Tremont St., are preparing plans for a [illegible] apartment building at 116 Hanover St., for [illegible]

Mattapan (Boston p. o.), Mass.—Bids will be received until [illegible] by the Public Buildings Department, for constructing a police station at Mattapan. Richard A. Lynch, was City Hall Annex [illegible]

✦Wellesley, Mass.—The contract for the construction of the group of buildings at Wellesley College, has been awarded to the [illegible] CO., New York and Boston. The estimated cost is [illegible] Coolidge & Carlson, Boston, Mass., are the Archs.

Worcester, Mass.—Bids are being received by [illegible] for constructing a building at the Worcester Academy. The estimated cost is [illegible]

Buffalo, N. Y.—[illegible] Main St., will [illegible] a [illegible] building [illegible] The estimated cost is [illegible] is the Arch.

✦✦Farmingdale, N. Y.—The general contract for the [illegible] of the [illegible] dormitory at the New York State School of Agriculture has been awarded to FRANK A. [illegible] New Rochelle, N. Y. Noted [illegible]

Long Beach, N. Y.—[illegible], Arch., is preparing plans for a [illegible] ft. sanitarium, at Long Beach, for a [illegible] headed by F. D. Drake. The estimated cost is [illegible]

New York, N. Y.—(Borough of Manhattan)—Bids will be received about Dec. 10, by Maynicke & Franke, Archs., 25 East 26th St., for the 20-story store and loft building to be constructed at Broadway and 26th St., for the estate of Frederick Ayer, 141 Milk St., Boston, Mass. The estimated cost is $800,000.

+Yonkers, N. Y.—The contract for the construction of the Grand Theater on South Broadway has been awarded to GEORGE T. KELLEY, Yonkers. The estimated cost is $300,000. Noted Oct. 29.

+Bloomfield, N. J.—The general contract for the construction of the two-story brick school on Grove St., for the Board of Education, has been awarded to A. P. CLARK CO., 264 Claremont Ave., Montclair, N. J. Noted Oct. 22.

Newark, N. J.—The T. B. Peddie Estate plans to construct a mercantile building at 128 Market St. It will be four stories and basement, 125x40 ft. Estimated cost about $58,000. Bruce B. Kitchell, 207 Market St., Newark, is Arch.

Swedesboro, N. J.—The First National Bank of Swedesboro plans to construct a building to cost $10,000.

+Upper Montclair, N. J.—The general contract for the construction of the three-story Edward Russ Memorial Hall, at the State Normal School, has been awarded to FRED KILGUS, 13 South Sixth St., Newark, N. J. Noted Oct. 1.

+Pittsburgh, Penn.—(Official)—The contract for constructing the Schenley High School has been awarded to L. L. STUART, Pittsburgh, at $741,100. Bids were received Nov. 3, and other bidders were: Thomas Reilly Co., Pittsburgh, $681,226; John H. Parker Co., New York, $701,505; George A. Fuller Co., $704,390; Henry Shenk Co., Pittsburgh, Penn., $706,183; James G. Doak, Philadelphia, Penn., $716,313; W. F. Trimble & Sons Co., Pittsburgh, $721,797; George Hogg Co., Pittsburgh, $722,125; Thompson Starrett Co., Pittsburgh, $733,325; Golden & Crick, Pittsburgh, Penn., $779,540; William Dall, Cleveland, Ohio, $805,300; Marble Arch Co., New York, $857,757. Noted Oct. 22.

Wilkes-Barre, Penn.—Sturdevant & Poggi, Archs., Coal Exchange Bldg., have prepared plans for the five-story Masonic Temple to be erected at Wilkes-Barre. The estimated cost is $75,000.

Newport News, Va.—The lowest bid received for the construction of the General and Nonsectarian Hospital was submitted by J. W. Davis, Newport News, at $30,402. Donald McKee, Newport News, is Arch.

Norfolk, Va.—Plans have been completed by C. M. Major, Arch., Norfolk, for the building to be built for the Fraternal Order of Eagles.

Charleston, W. Va.—H. Rus Warne & David Dick, Archs., are preparing plans for remodeling and additions to the Masonic Temple. The estimated cost is $50,000.

+Wheeling, W. Va.—The contract for the construction of the hotel on the Orpheum Theatre site has been awarded to the GATES BUILDING CO., Wheeling. The estimated cost is $65,000.

Clearwater, Fla.—Bids will be received, until Nov. 23, by the Pinellas County Commissioners, for additions and alterations to the county jail. Willis R. Biggers, Tampa, Fla., is Arch. Noted Nov. 5.

+Jacksonville, Fla.—The Southern Investment & Amusement Co. has awarded the contract for the construction of a theater on Adams St. to the JACKSONVILLE CONTRACTING CO., Jacksonville. The estimated cost is $60,000.

+West Palm Beach, Fla.—The contract awarded to E. P. MAULE, for the construction of the courthouse at West Palm Beach, has been rescinded by the Pinellas County Commissioners. Noted Oct. 29.

Lexington, Ky.—The Board of Trustees of the Transylvania University contemplates constructing a dormitory. The estimated cost is $50,000.

Cincinnati, Ohio—Plans are being prepared by Elzner & Anderson, Archs., for the construction of a Y. M. C. A. building on West Ninth St. Estimated cost, $100,000.

Cleveland, Ohio—The Euclid Logan Co. is planning the construction of a seven-story fireproof apartment at East 97th St. and Euclid Ave. Estimated cost, $90,000. W. B. Davis is Pres.

Cleveland, Ohio—R. M. Hulett Co., Archs., 474 Lennox Bldg., have prepared plans for the construction of a three-story, 70x120-ft., clubhouse, at 3143-51 West 25th St., for the German Club. Estimated cost $35,000. Noted Aug. 27.

Cleveland, Ohio—Bids will be received until 1 p.m., Dec. 7, by the Clerk of the Board of Education, East Sixth St., Cleveland, for the alterations and additions to the Central High School on East 55th St., near Cedar Ave. Frank G. Hogen is the Dir. of Schools.

+Hudson, Ohio—The contract for the construction of a school has been awarded to RODERICK D. GRANT. Estimated cost, $43,535. Noted Oct. 8 and 22.

Lakewood, Ohio—Charles W. Hopkinson, Arch., Rose Bldg., Cleveland, is preparing plans for the construction of four public schools, estimated to cost, $160,000.

+Warren, Ohio—The contract for the construction of the six-story building, for the Western Reserve National Bank, has been awarded to GEORGE A. FULLER CO., 40 Taylor Arcade, Cleveland. Noted Sept. 24.

Fair Oaks, Ind.—F. L. Kronenberg, Arch., Madison, Wis., is preparing plans for the construction of the two-story and basement, 80x166 ft., Elmside grade school.

+Terre Haute, Ind.—The contract for the construction of a normal school has been awarded to the BEDFORD STONE & CONSTRUCTION CO., Indianapolis. Noted Aug. 6, Sept. 3, Oct. 1 and 22.

+Michigamme, Mich.—The contract for the construction of a school and boiler house has been awarded to J. S. WALHMAN by the Board of Education. Estimated cost, $40,000.

Ypsilanti, Mich.—Bids will soon be received by the Board of Education, Ypsilanti, for the construction of the $110,000 high school. Noted Sept. 3.

Chicago, Ill.—Murray Wolbach, 105 South Dearborn St., plans the construction of a number of apartment buildings, estimated to cost $1,100,000.

Fall River, Wis.—Bids are being received by Viola Hains, Clk. School Bd., for the construction of a school building. Chandler & Park, 400 Main St., Racine, are the Archs.

La Crosse, Wis.—The State Board of Normal Regents, Madison, contemplates constructing a $75,000, physical training building at the State Normal School. Estimated cost, $75,000.

Ladysmith, Wis.—Plans have been prepared for the construction of a three-story and basement, 60x110-ft. hospital, for the Mantellate Sisters, O. S. M.

Madison, Wis.—Plans are being prepared by Claude & Starck, Archs., Badger Annex, for the construction of the Lincoln grade school. Estimated cost, $100,000.

Milwaukee, Wis.—The lowest bids submitted for the construction of the school at 49th and Elm St. were as follows: Walter Buchholz, masonry, $20,575; Wierdsma & Laatsch, carpentry, $15,341; Paul Riesen & Co., excavating and concrete, $12,381; Erdman & Meyer, stone, $5373; Grant Marble Co., marble, $2492; Milwaukee Structural Steel Co., steel, $1888; Mueller Co., heating, $9470; National Heat Regulator Co., heat regulation, $1043; R. Jeske, sheet metal.

+Minneapolis, Minn.—The contract for the construction of the two-story and basement 126x173-ft. grade school has been awarded to J. E. PILGRAM, Minneapolis. Noted Dec. 25, 1913, and Nov. 5.

+Kansas City, Mo.—The contract for the construction of a 100x133-ft. building at Troost Ave. and 38th St., for the First English Lutheran Church, has been awarded to CHARLES W. LOVETT. Estimated cost, $40,000.

Fort Worth, Tex.—The Commissioner's Court of Tarrant County, contemplates constructing a jail at Fort Worth, to cost about, $150,000.

Nezperce, Idaho—Hyslop & Westcott, Spokane, Wash., have prepared plans for the construction of a four-story fireproof hotel to cost $100,000.

Pocatello, Idaho—G. S. Allen and H. E. Bartlett are contemplating the construction of a hotel to cost $120,000.

Grand Canyon, Ariz.—The Atchison, Topeka & Santa Fé Ry. is preparing plans for the construction of a hotel at Grand Canyon, to cost about $65,000.

Seattle, Wash.—Plans are being prepared by Howells & Stokes, Archs., Henry Bldg., for the construction of a four-story, reinforced-concrete office and store building for P. S Foust. The estimated cost is $200,000.

+Portland, Ore.—BOYAJOHN-ARNOLD Co. has been awarded the contract for the construction of the Couch School, at an estimated cost of $119,584. The heating contract was awarded to W. W. COX, at $26,038. Noted Oct. 15.

+Decoto, Calif.—The contract for the construction of dormitories for the California Masonic Home has been awarded to THOMAS H. DAY'S SONS, San Francisco. Estimated cost, $34,787.

Dixon, Calif.—The Board of Education plans the construction of a $53,000 high school at Dixon. D. H. White, Fairfield, Calif., is the Supt. of Schools of Solano County.

Eagle Rock (Glendale post office), **Calif.**—H. A. Reeves, Arch., Chamber of Commerce Bldg., Los Angeles, is preparing plans for the construction of a fireproof school at Eagle Rock. Estimated cost, $60,000.

Los Angeles, Calif.—The Trustees of the Cienaga School District are contemplating the construction of a $60,000 school. H. G. Marxmiller, 411 Grant Bldg., is interested.

Oakland, Calif.—A. F. White, Portland, Ore., contemplates constructing an office building on Franklin St., to cost $125,000.

Petaluma, Calif.—Brainerd Jones, Arch., is preparing plans for the construction of a school at Fair and Douglass St. for the Petaluma School District. Estimated cost, $100,000.

San Francisco, Calif.—Plans are being prepared by William Beasley, Arch., for the construction of a three-story and basement theater and store building on Fourth and Market St. Estimated cost, $200,000.

San Francisco, Calif.—Henry C. Smith, Arch., is preparing plans for the construction of a reinforced-concrete apartment house at Taylor and Greene St. Estimated cost, $60,000.

San Francisco, Calif.—J. R. Hanify contemplates constructing a theater and store building at Eddy and Fillmore St., at an estimated cost of $70,000. Reid Bros., Sutter and Montgomery St., are the Archs.

+San Francisco, Calif.—The contract for the construction of a one-story brick and steel building for the Third Church of Christ Scientist, has been awarded to ARTHUR ARLETT, Sheldon Bldg. The estimated cost is $80,00.

Woodland, Calif.—Plans are being prepared by W. H. Weeks, Arch., 75 Post St., San Francisco, for the construction of a grammar school. Estimated cost, $100,000.

Montreal, Que.—Bids will be received until Jan. 15, 1915, by Gauthier & Daoust, Archs., 180 St. James St., Montreal for the construction of a building for the Deaf and Dumb Institution at St. Laurent, Montreal, Que.

Ottawa, Ont.—Plans are being prepared by C. Bordeur, Arch., Quebec, Que., for the construction of a $156,000 church on Wellington and Fairmont St., for the Capuchin Fathers.

Toronto, Ont.—The Board of Education contemplates constructing a three-story, brick school on Euclid Ave., near Fallis St. Estimated cost, $55,800.

+British Columbia, Can.—The contract for the construction of four terminals for the Grand Trunk Pacific Ry. Co., Winnipeg, Man., at Prince George, Endako, Smithers and Pacific, has been awarded to CARTER, HALL AND ALDINGER, Winnipeg, Man. Estimated cost, $300,000.

Contracts to Be Let

Bids received until Dec. 1, 1914.

New County Building

FOR NEW CASTLE COUNTY AND NEW MUNICIPAL BUILDING FOR THE CITY OF WILMINGTON

Sealed proposals will be received by the New Castle County Building Commission and the Wilmington Building Commission [illegible] Building, at the corner of [illegible] and Tenth Sts., in the City of Wilmington, Delaware, up to 11 o'clock A.M. (Eastern time) on the first day of December, 1914, for the Interior Marble, for the Interior Cut Stone, for the Bronze Work, for the Miscellaneous and Ornamental Iron, for the Painting and Finishing, for the Hollow Metal Doors, for the Finished Hardware, for the Brick Paving for the sidewalks, and for the Revolving Doors, entering into the construction and completion of the new County Building for New Castle County and of the new Municipal Building for the City of Wilmington, situated between King Street and French Street and between Tenth Street and [illegible] Street in the City of Wilmington, Delaware, and will be opened publicly and declared by the Commission in their office. A separate proposal is required for each of the buildings, for each department or class of work above listed.

Each proposal for Interior Marble shall be accompanied by a certified check or cash deposit in the amount of Four Hundred Dollars ($400).

Each proposal for Interior Cut Stone shall be accompanied by a certified check or cash deposit in the amount of Three Hundred Dollars ($300).

Each proposal for Bronze Work shall be accompanied by a certified check or cash deposit in the amount of Six Hundred Dollars ($600).

Each proposal for Misc. and Ornamental Iron shall be accompanied by a certified check or cash deposit in the amount of Five Hundred Dollars ($500).

Each proposal for Painting and Finishing shall be accompanied by a certified check or cash deposit in the amount of Three Hundred Dollars ($300).

Each proposal for Hollow Metal Doors shall be accompanied by a certified check or cash deposit in the amount of Eight Hundred Dollars ($800).

Each proposal for Finished Hardware shall be accompanied by a certified check or cash deposit in the amount of Two Hundred Dollars ($200).

Each proposal for Brick Paving shall be accompanied by a certified check or cash deposit in the amount of Two Hundred Dollars ($200).

Each proposal for Sidewalks shall be accompanied by a certified check or cash deposit in the amount of Two Hundred Dollars ($200).

Each proposal for Revolving Doors shall be accompanied by a certified check or cash deposit in the amount of [illegible] Hundred Dollars ($[illegible]).

The Commission [illegible] the right to reject any or all proposals [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Secretary of The New Castle County Building Commission and of the Wilmington Building Commission.

Bids received until Dec. 2, 1914.

Reinforced Concrete Tunnel Lining

Baltimore, Md.

Sealed bids or proposals endorsed "Bid for the construction of a reinforced concrete lining in Gunpowder Tunnel, Improvement of Gunpowder Supply, Contract No. 37," addressed to the Board of Awards of Baltimore City, will be received at the office of the City Register, City Hall, Baltimore, Md., until 11 A.M. Wednesday, December 2nd, 1914, for lining with eight (8) inches of reinforced concrete about [illegible] lin. ft. of aqueduct tunnel, 12 feet in present diameter, with appurtenant valves, fittings, etc., between Loch Raven and Lake Montebello, Baltimore, Md.

Plans and specifications may be obtained at the office of the Water Engineer, City Hall, Baltimore, Md., on and after Wednesday, November 16th, 1914. A charge of Five Dollars ($5.00) will be made for each set of plans and specifications. This amount will be refunded on their return on or before December 1[illegible]th, 1914, in good condition. Specifications used in making a bid will be considered as returned.

A certified check on a Clearing House Bank made payable to the Mayor and City Council of Baltimore for the sum of Three thousand dollars ($3000.00) will be required with each bid.

Approximate quantities are as follows:

Excavation for vault and steel sections	255 cu yds
Furnishing & Placing steel bends, straight & tapered pipe	$22\frac{1}{2}$ tons
Placing 60-inch gate valve and cast iron pipe	
1:2:4 Concrete in vault walls and around pipe	325 cu yds
Furnishing & Placing 3" dia. vault drain	24 lin ft
Furnishing & Placing reinforcing steel channel ladders	3387 lbs
Gunite lining in bends straight and tapered pipe	1703 sq ft
(Alternate) Bitumastic Enamel Lining	17[illegible]3 sq ft
Furnishing & Placing 1" pipe for sub-drain	1[illegible]0 lin ft
Furnishing & Placing $1\frac{1}{2}$" pipe for sub-drain	30 lin ft
Furnishing & Placing 3" pipe for sub-drain	100 lin ft
Furnishing & Placing 4" pipe for sub-drain	[illegible]0 lin ft
Furnishing & Placing 6" pipe for sub-drain	50 lin ft
Excavating for furnishing & placing [illegible]" sub-drain	3[illegible]0 lin ft
Excavating for furnishing & placing [illegible]" sub-drain	[illegible]20 lin ft
Excavating for furnishing & placing 10" sub-drain	1[illegible]0 lin ft
Excavating for furnishing & placing 12" sub-drain	390 lin ft
Excavating for furnishing & placing 16" sub-drain	[illegible]20 lin ft
Furnishing & Placing [illegible] to 4" C.I. Tees for sub-drains	
Furnishing & Placing 1[illegible]"x1[illegible]"x4" to 6" C.I. Tees for sub-drains	
Furnishing & Placing 1[illegible]"x12"x4" to 6" C.I. Tees for sub-drains	
Furnishing & Placing 16"x16"x4" to 6" C.I. Tees for sub-drains	
Furnishing & Placing [illegible] Gate Valve	
Alternate—Furnishing & [illegible] System	17[illegible]0 lin ft
[illegible]	[illegible]
[illegible]	[illegible]
Alternate—Reinforced Concrete [illegible]	[illegible]
[illegible]	[illegible]

The successful bidder will be required to give bond [illegible] with the City Charter [illegible].

The Board of Awards reserves the right to reject any or all bids.

Approved November 11, 1914.

[illegible]

Acting [illegible], Board of Awards.

[illegible] CHAMBITT,

Acting Water Engineer.

[illegible] R. WHITMAN,

[illegible] Engineer.

[illegible] OFFICE, ARLINGTON MEMORIAL AMPHITHEATER COMMISSION, [illegible] New York Avenue, Washington, D. C., November [illegible], 1914—Sealed proposals for the erection of a memorial amphitheatre and chapel in the Arlington National Cemetery, Va., will be received here until 11 o'clock [illegible], [illegible], 1914, and then publicly opened. [illegible] upon application. WM. W. HARTS, Colonel [illegible], Executive Officer.

Construction News

Testing the Alien Labor Law in Court.

Numerous conferences have been held by those interested in building New York's new Rapid Transit system with the view to finding a way out. The law is simple, clear and mandatory in its provision that "Citizens of the United States shall be employed." The only discretionary power is that "Citizens of the State of New York shall be given preference."

The unions are by no means a unit as to the advisability of pressing the matter, for it is evident if the excavating is delayed, and most of the aliens are employed at that work, that it will throw out of work a great number of skilled citizens during the winter. Three contractors, the Cranford Co., the Dock Contracting Co. and Oscar Daniels, have discharged their alien laborers and thus far are meeting with little or no success in obtaining citizen pick and shovel workers.

The contention that American workmen can be obtained at $2.50 to $3 per day is probably as correct as it is economically unsound. There is no likelihood of any great amount of excavating being done at such wages. That wages are the crux of the matter is seen in the following statement of Antonio Sangimbene, organizer of the Excavators' Union.

"The objections of the other unions to our alien members are largely based on the fact that the alien laborers have worked for small wages. But we are making preparations to demand higher wages for them, and in this we are being assisted by the 1400 members of the Rockmen's Union, 600 of whom are citizens. As there are aliens in nearly all of the unions whose members are engaged in subway work, it seems as if there was too much jealousy on the part of the other unions."

Contractors, although troubled, are pleased that the matter should have been brought up at this time, for there is a chance of repealing the law, and there is more likelihood of securing citizen laborers than at any time in the last four years.

An attempt will be made to test the constitutionality of the law. Such a case will be given preference in the Court of Appeals.

Viewed from another angle it might be advantageous to postpone further work, since progress has been far more rapid than was anticipated, until legislative relief is obtained.

Improved Demand for Bonds—Sales of municipal bonds in October amounted to $13,141,429, according to the "Financial Chronicle;" this is the largest output since the war began, but is still far below previous years. In the three months of August, September and October, the sales have amounted to $33,041,024, compared with $85,546,251 in the corresponding month last year. In fact, the sales for the three months mentioned have not fallen below $60,000,000 in any year since 1911. In spite of the relatively poor showing in the last three months the sales of municipal bonds for the first ten months of the year surpass those of any previous full calendar year.

National and State Debts

Coming as they do at a time when there is widespread inquiry whether state and city governments can continue increasing their indebtedness for public improvements, recent figures published by the Census Bureau throw a new light on the subject.

As is always the case, figures furnished by the government are not brought down to date, still the comparison with former years gives the trend of events. The sums involved are so enormous that for many purposes it is far more convenient and satisfactory to give figures indicating the per capita debt. It is sufficient to show that the national debt amounted to $1,028,000,000 in 1913 and the aggregate debt of the 48 states was $345,000,000. These figures do not include the indebtedness of smaller geographical units such as counties, cities and townships.

Comparison of Debts

The accompanying table shows the debts of the nation and states year by year from 1901 to 1913, inclusive. Under the headings "Amount" six figures are omitted in each case.

	*Indebtedness					
	Total		National		48 States	
Fiscal Year	Amount	Per Capita	Amount	Per Capita	Amount	Per Capita
1913.....	$1,374	$14.15	$1,028	$10.59	$345	$3.57
1912.....	1,327	13.89	1,027	10.75	299	3.15
1911.....	1,291	13.75	1,015	10.81	275	2.95
1910.....	1,302	14.11	1,046	11.34	256	2.78
1909.....	1,265	13.95	1,023	11.29	241	2.67
1908.....	1,177	13.22	938	10.53	239	2.70
1907.....	1,113	12.74	878	10.05	235	2.70
1906.....	1,202	14.01	964	11.24	238	2.79
1905.....	1,228	14.59	989	11.75	238	2.85
1904.....	1,202	14.56	967	11.71	235	2.86
1903.....	1,157	14.29	925	11.42	232	2.88
1902.....	1,208	15.23	969	12.22	239	3.03
1901.....	1,273	16.38	1,044	13.44	228	2.95

*Less sinking fund assets or fund available for payment of debt.

From this it is clear that the national indebtedness, as far as the burden of each individual is concerned, is being reduced in spite of the Panama Canal expenditures, while the States are increasing their indebtedness; especially during the last two years.

Nearly half the indebtedness of all the states is incurred by New York and Massachusetts while the credit of these two states stands perhaps higher than any other in the Union.

While deductions drawn from few figures are apt to be misleading it is worthy of notice that the states of Massachusetts and New York make up more than half the total debt, yet it is well known that these two states can market their bonds at as low a rate of interest, if not lower, than any other states. This might indicate that the market for state bonds is wider than may be indicated.

The accompanying compilation shows the total and per capita debt of the several states.

	Debt, Less Sinking Fund Assets	
State	Amount	Per Capita
Alabama	$13,132,375	$5.95
Arizona	3,064,818	13.28
Arkansas	1,236,066	0.76
California	10,222,744	3.83
Colorado	3,173,949	3.70
Connecticut	7,110,451	6.12
Delaware	763,122	3.70
District of Columbia	....	....
Florida	619,199	0.77
Georgia	6,934,202	2.57
Idaho	2,143,314	5.92
Illinois	2,272,620	0.39
Indiana	1,350,305	0.49
Iowa	356,670	0.16
Kansas	243,121	0.14
Kentucky	4,441,867	1.90
Louisiana	13,546,150	7.89
Maine	1,254,998	1.67
Maryland	7,333,913	5.56
Massachusetts	79,551,090	22.78
Michigan	7,089,092	2.41
Minnesota	1,345,290	0.63
Mississippi	4,460,519	2.41
Missouri	4,671,218	1.40
Montana	1,512,874	3.73
Nebraska	374,394	0.31
Nevada	607,695	6.70
New Hampshire	1,955,611	4.50
New Jersey	642,069	0.24
New Mexico	1,218,209	3.41
New York	86,205,247	9.05
North Carolina	8,058,430	3.54
North Dakota	820,424	1.29
Ohio	5,142,042	1.05
Oklahoma	6,930,243	3.74
Oregon	30,852	0.04
Pennsylvania	....	....
Rhode Island	5,126,815	9.02
South Carolina	6,190,036	3.98
South Dakota	370,000	0.58
Tennessee	11,811,640	5.32
Texas	4,656,499	1.14
Utah	1,429,694	3.62
Vermont	569,906	1.58
Virginia	22,043,145	10.46
Washington	1,556,012	1.21
West Virginia	....	....
Wisconsin	2,251,000	0.93
Wyoming	122,375	0.77
Total	$345,942,305	$3.57

RAILWAYS

New York.—Erie R.R.—[illegible] New Jersey.

New Jersey.—[illegible]

New Jersey.—Erie R.R.—[illegible] freight line from Jersey [illegible] New York, N. Y., is [illegible]

North Carolina.—[illegible] & Hertford Ry.—This company [illegible] railway from [illegible] about [illegible] miles. J. F. [illegible]

S. S. [illegible] contemplate the construction of a railway from [illegible] N. C., about [illegible] miles.

Iowa.—Chicago, Milwaukee & St. Paul Ry.—[illegible] are being [illegible] by this company for the [illegible] of its yards [illegible] C. W. [illegible], Chicago, Ill., [illegible] Engr.

✦Minnesota.—Minneapolis, St. Paul, Rochester & Dubuque [illegible] Co.—A contract has been awarded by this company [illegible] St. Paul, Minn., for constructing a [illegible] from the Minnesota River to the new terminal in [illegible], Minn.

Utah.—[illegible] Pacific R.R.—Contracts will soon be awarded by this company for double-tracking its line from Ogden to [illegible], Utah. [illegible] Salt Lake City, Utah, is Ch. Engr.

Arizona.—[illegible] & Western Ry.—Surveys have been completed and work will be started next spring by this company [illegible] its proposed railway from Kelton to [illegible], Ariz., about [illegible] miles. [illegible] Street, 1611 Harris Trust Bldg., Chicago, Ill., is interested. Noted July 23.

Oregon.—Great Southern R.R.—Surveys have been made by this company for the extension of its railway from Friend, [illegible] miles. J. L. Meier, Portland, [illegible] is Vice-Pres. and Gen. Mgr.

California.—Atchison, Topeka & Santa Fé Ry.—This company [illegible] the construction of a five-mile spur from [illegible] in the vicinity. F. M. [illegible] Western lines.

Ontario.—[illegible] & [illegible] Ry.—This company has been [illegible] a railway from tidewater to the valley of the [illegible] River, about 112 miles.

ELECTRIC RAILWAYS

Bangor, Maine.—[illegible] are being prepared by the Bangor [illegible] through Post Office Sq. [illegible], Bangor, is Pres. and Gen. Mgr.

Saybrook, Conn.—The Shore Line Electric Ry. Co. has plans [illegible] its line from Chester to Middletown [illegible] General Assembly [illegible] Norwich, is [illegible]

Newark, N. J.—The Board of Public Works has granted [illegible] Newark [illegible] Newark, is [illegible]

Middletown, Penn.—[illegible]

Swissvale, Penn.—[illegible]

Washington, D. C.—[illegible] Light Co. [illegible] Alexandria to [illegible]

Corinth, Miss.—[illegible]

New Orleans, La.—The New Orleans Ry. & Light Co. [illegible] M. B. [illegible], New Orleans, is Gen. Mgr.

Sandwich, Ill.—[illegible]

Davenport, Iowa.—The Tri-City Ry. Co. [illegible]

Fleetwood, Mont.—[illegible]

Cleburne, Tex.—[illegible]

Dallas, Tex.—The Texas Traction Co. [illegible]

Houston, Tex.—[illegible]

Robert Lee, Tex.—The construction of an interurban electric railway from Robert Lee to Bronte is being promoted by the property owners of the two towns and along the route of the proposed line. The road will be about 10 miles long.

Lewiston, Idaho.—The State Highway Commission has granted a franchise to A. G. Nortz, Lewiston, to construct and operate a street car line across the Lewiston-Clarkston bridge.

Tucson, Ariz.—The Tucson Rapid Transit Co. has under consideration plans for the construction of several miles of extensions of its lines. It has applied to the City Council for a new [illegible]-year franchise.

Prineville, Ore.—The Metolius, Prineville & Eastern Ry. Co., recently incorporated, has completed surveys for the construction of an electric railway from Prineville to Metolius, about [illegible] miles. H. B. Scheel, Prineville, is Pres.

San Rafael, Calif.—The California Terminal Ry. Co. is securing the right-of-way for its proposed electric interurban railway from San Rafael to Sacramento, about 90 miles. C. W. [illegible], San Francisco, is interested.

Stockton, Calif.—The Stockton Electric Ry. Co. has been requested to consider plans for extending its tracks on Fourth St. Frank W. Webster, Stockton, is Gen. Mgr.

Ottawa, Ont.—The Morrisburg & Ottawa Electric Ry. Co., recently organized, plans to construct an electric railway in Ottawa. J. G. Kilt, Citizens Bldg., Ottawa, is interested.

LIGHT, HEAT AND POWER

New Britain, Conn.—Walter P. Crabtree, Arch., has prepared plans for a boiler house for the new vocational high school. The building will be [illegible] ft., with a 12[illegible]-ft. chimney, and will be equipped with six tubular boilers and possibly a lighting plant. Bids will be received at the same time for the high school building.

Trenton, N. J.—Mayor Frederick W. Donnelly has recommended to the City Commission an investigation of the city's property at Sanhican Creek, with a view to establishing a municipal hydro-electric light and power system.

Hastings, Penn.—At the recent general election the citizens voted in favor of a bond issue of $3[illegible],000, to be used for the establishment of a municipal electric lighting system.

✦Pittsburgh, Penn.—It is reported that the contract for electrical work in the Schenley High School has been awarded to the CRAIG ELECTRIC CO., Pittsburgh, at $35,900. Noted Nov. 19.

Staunton, Va.—The City Council has authorized the issue of $[illegible] in bonds for the purpose of reconstructing the municipal electric light plant. It is understood that entire new equipment will be purchased. J. S. Gabbert is Supt. of the plant. Norton Argenbright is City Clk.

Princeton, Ky.—At the recent general election, the question of a bond issue for the installation of a municipal electric light plant was defeated. Noted Oct. [illegible]

Mason, Ohio.—Bids will be received until Nov. 30, by R. W. [illegible], Village Clk., for the construction of a power plant and equipment for the same, including boiler, engine, pump, generator, exciter, switchboard, transformer, etc.

Tiffin, Ohio.—It is reported that the Ohio Light & Power Co., Tiffin, is preparing to move its plant from the present location in the center of the city to a point in the suburbs along the route of the Cleveland, Cincinnati, Chicago & St. Louis Ry. Frank [illegible], Tiffin, is Mgr. and Cont. Agt.

Roann, Ind.—The Roann Light & Power Co., recently incorporated, will equip an electric light and power plant to furnish energy to Roann and adjacent territory. The work will include the construction of about 11 miles of transmission line. [illegible] is Secy. of the company.

Detroit, Mich.—The Public Lighting Commission has [illegible] Smith, Hinchman & Grylls, [illegible] Washington [illegible], for the construction of an addition to the [illegible] The new building will be used as a [illegible] and transformer room and will cost about [illegible]

Melrose, Wis.—A special election has been [illegible] for the [illegible]

✦Lake Park, Iowa.—The Town Council has awarded the contract for the construction of an electric light system [illegible] ELECTRIC CO. [illegible] The Rock Island [illegible] Rock Island, Ill. [illegible]

Kearney, Neb.—The State Railway Commission has permitted the Kearney Water & Electric Power Co. to issue [illegible] of which the proceeds of [illegible] will be used [illegible] the power plant of the company. [illegible] Noted Oct. [illegible]

North Bend, Neb.—It is reported that the contract for the construction of the proposed municipal electric light plant will be awarded [illegible] C. A. Sjogren [illegible] Omaha, Neb., is Engr. in Charge. [illegible]

Eureka, Mont.—The Eureka Lumber Co. will [illegible] power house in the rebuilding of its plant, which was recently destroyed by fire. The power plant will be equipped with [illegible] boilers. [illegible] in charge of all construction work. [illegible] is Pres. of the Eureka Lumber Co.

Waco, Tex.—The Texas Power & Light Co. has entered into an agreement with [illegible], Pittsburgh, Penn., [illegible] The work will cost approximately [illegible]

Ogden, Utah—The Grand Canyon Canal & Power Co. has been incorporated with a capital stock of $200,000 and will oevelop power on the John Days River in eastern Idaho and western Wyoming, for general hydro-electric work. H. J. Craven, Ogden, Utah; Sidney W. Badcon and C. H. Gosling, both of Pocatello, Idaho, are the incorporators.

+Ashton, Idaho—The Ashton-St. Anthony Power Co. has awarded the contra for the construction of a concrete dam to MALCOLM & LARSON, Ashton, at $54,000.

+Pocatello, Idaho—The Oregon Short Line R.R. has awarded the contract for the installation of a hot-water heating system in the new shops and roundhouse at this point to the JESSE COOGAN ENGINEERING CO., 404 State St., Salt Lake City, Utah. The same company has been awarded contracts for heating, plumbing and power plant equipment in the new Union station at Pocatello.

Ashland, Ore.—The City Council is considering the establishment of an auxiliary electric light plant, estimated to cost $32,000.

Nome, Alaska—The Seward Peninsula Power Co. plans to make extensive improvements to its power house and extend its distribution lines. This company furnishes light, heat, power and fire protection to the city. A. J. McConnell is Gen. Mgr.

Dresden, Ont.—The City Council has engaged J. T. Bridgewater, Dresden, to prepare plans and receive bids for the construction of a new hydro-electric lighting system for the town. Noted July 30.

Fort William, Ont.—S. J. McQueen, 23 Murray Block, Fort William, will receive bids soon for about $25,000 worth of electrical equipment for the new transformer station of the Consolidated Elevator Co. Noted Nov. 5.

Waterford, Ont.—The Hydro-Electric Power Commission of Ontario will shortly ask bids for the construction of a brick substation at Waterford. W. W. Pope, Continental Life Bldg., Toronto, is Secy. of the Comn.

BRIDGES

+Bristol, Conn.—(Official)—The Common Council has awarded the contract for the construction of two small bridges on Pond St. and Terryville Rd., to DEAN & CO., Plainville, Conn., and J. E. GOODRICH, Glastonbury, Conn., respectively. Noted Oct. 22 and Nov. 12.

+New York, N. Y.—(Borough of Bronx)—(Official)—The contract for repairing, cleaning and painting the bridge over the tracks of the New York, New Haven & Hartford R.R., at East 153d St., has been awarded to CONNERS BROS. CO., Kingsbridge Rd., at $25,920. Other bids were: Jobson-Gifford Co., $31,812; Snare & Triest, $32,130; Marble Arch Co., $31,660; N. B. Smythe, $29,430. Noted Oct. 1, 22 and 29.

★Northfield, N. J.—(Official)—Bids will be received, until noon, Dec. 9, by the Board of Chosen Freeholders of Atlantic County, Memorial Hall, Atlantic City, N. J., for the construction of a highway bridge with approaches over English Creek on the road from Northfield to Mays Landing. A. H. Nelson is County Engr. George B. Jeffers is Chn., Rd. Com. See advertisement under "Contracts To Be Let" in issue of Nov. 19.

★Somers Point, N. J.—(Official)—Bids will be received, until noon, Dec. 9, by the Board of Chosen Freeholders of Atlantic County, Memorial Hall, Atlantic City, N. J., for the construction of a highway bridge over Patcong Creek near Somers Point, Atlantic County. A. H. Nelson, 638 Bartlett Bldg., Atlantic City, is County Engr. James Clark is Chn., Bridge Com. See advertisement under "Contracts To Be Let" in issue of Nov. 19.

Pittsburgh, Penn.—(Official)—Bids will be received until noon, Dec. 4, by R. J. Cunningham, Controller of Allegheny County, for the construction of Bridge, No. 19 over Pine Creek, Shaler Township. It will be of reinforced concrete, faced with stone. J. G. Chalfant is County Engr.

+Wilkes-Barre, Penn.—The city has awarded the contract for the construction of a 1200-ft. reinforced concrete railway viaduct to the C. M. NEELD CO., Henry W. Oliver Bldg., Pittsburgh, at about $90,000. The expense will be borne by the three railways who will use the bridge, the Public Service Commission to determine the share each road will pay.

Charleston, W. Va.—It is reported that the Charleston, Parkersburg & Western R.R. Co., C. P. Peyton, Ch. Engr., will receive bids, until Jan. 1, for the construction of a number of bridges on a 56-mile railway to be built from Charleston to Palestine, W. Va.

Milton, Fla.—Bids will be received until Dec. 7, by the Board of Commissioners of Santa Rosa County, H. W. Thompson, Clk., for the construction of two steel drawbridges, one over the Blackwater River at Milton, and the other over the Escambia River near Chumuckla Mineral Springs, Fla. Henry H. Mentz, Milton, is Consult. Engr.

Laurel, Miss.—Bids will be received until Dec. 7, by the Board of Highway Commissioners of the Second District, Jones County, for the construction of a 110-ft. steel bridge over Horse Creek. W. H. Bufkin is Clk. F. T. Myers is Engr.

Vicksburg, Miss.—(Official)—Bids will be received until noon, Dec. 9, by the Chancery Clerk of Warren County, Vicksburg, and the Chancery Clerk of Hinds County, Jackson, for the construction of a 520-ft. steel bridge over the Big Black River near the Alabama & Vicksburg Ry. at Holt's Ferry. Moore & Thomas, Vicksburg, are Highway Engrs. Noted Oct 29 and Nov. 19.

Cincinnati, Ohio—The Department of Public Service is considering the construction of a concrete viaduct over Kemper Lane, at an estimated cost of $165,000. Philip Fosdick is Dir. of Pub. Ser.

Dayton, Ohio—Bids will be received soon by the Commissioners of Montgomery County for the construction of the Stewart St. canal bridge. Bonds for $15,000 to pay for the bridge and $7600 for the approaches have been issued. Victor C. Smith is County Engr.

+Toledo, Ohio—(Official)—The Board of Commissioners of Lucas County has awarded contracts for bridge work from bids received Nov. 13 to the following: M. RABBITT & SON CO., Toledo; EMIL WOLFF, East Toledo; E. N. OBERLE, Grand Rapids, Ohio; W. J. DEMUTH, Whitehouse, Ohio; STANDARD ENGINEERING CO., Toledo. Charles J. Sanzenbacher is County Audr. Noted Oct. 22.

Zanesville, Ohio—It is reported that the citizens are promoting a plan to build a new bridge at Third St. next spring. John S. Dennis is City Engr.

+Columbus, Ind.—(Official)—The Commissioners of Bartholemew County have awarded the contract for the construction of the Clifty Bridge on the Hartsville Pike to the CRAIG CONSTRUCTION CO., Greensburg, Ind., at $11,100. Other bidders were: Vincennes Bridge Co., $11,480; Central States Bridge Co., $11,822; Brookville Bridge Co., $11,990; Caldwell & Drake Iron Works, $11,567. The last named firm will furnish and erect the 200-ft. steel superstructure. Noted Oct. 29.

+Fort Wayne, Ind.—(Official)—The Board of Commissioners of Allen County has awarded the contract for the construction of the bridge over the St. Mary's River at Harrison St. to the CARMICHAEL & CRYDER CO., St. Louis, Mo., at $70,474. Other bidders were: H. J. Collins & Co., Cleveland, Ohio, $72,874; Turner Improvement Co., Des Moines, Iowa, $73,200; Hickey Construction Co., St. Louis, $74,947; Indiana Engineering Co., Fort Wayne, $74,989; Cleary-White Construction Co., Chicago, $79,341; A. Y. Yawger & Co., Indianapolis, Ind., $79,440; O'Lake & Hagan Co., Chicago, $84,766; Dravo Construction Co., Pittsburgh, Penn., $89,950. Noted Oct. 29.

Mosinee, Wis.—It is reported that the Village Board and the Town of Kronenwetter plan to build a reinforced-concrete bridge, estimated to cost $25,000, over the Wisconsin River at Mosinee. The State Highway Department will pay a part of the cost. M. W. Torkelson, Madison, Wis., is State Bridge Engr.

+Porterfield, Wis.—The Commissioners of Marinette County, Marinette, have awarded the contract for the construction of a steel bridge at Porterfield to the VULCAN MFG. CO., Fond du Lac, Wis.

Spencer, Iowa—At the recent election, the citizens of Clay County voted a bond issue of $42,000 for the construction of a concrete bridge over the Little Sioux River at the south end of Main St., Spencer. The bridge will be about 350 ft. long and 36 ft. wide. Plans will be prepared by the State Highway Commission, Des Moines.

Breckenridge, Minn.—Bids will be received until Dec. 5, by P. E. Truax, Audr. of Wilkin County, for the construction of ten bridges, one 26x20 ft., two 24x16 ft., one 24x20 ft., four 20x16 ft., and two 20x20 ft.

Salina, Kan.—Bids will be received until Dec. 15, by A. W. Godfrey, Clk. of Saline County, for constructing a bridge over the Smoky Hill River at Iron Ave., Salina. Wilmarth & Zerbe, Salina, are Engrs. in Charge. Noted Aug. 27 and Nov. 12.

Miller, S. D.—Bids will be received until Jan 8. 1915. by the Auditor of Hand County, for the construction and repair of all county bridges for the year 1915.

St. Louis, Mo.—(Official)—Plans are being prepared for the completion of the Municipal Free Bridge over the Mississippi River, for which $2,750,000 in bonds was voted at an election on Nov. 6. The approaches will consist of steel trestles, including a combined railway and highway approach, 2363 ft. long, a railway approach of 10,975 ft. and a highway approach 2943 ft. long. The actual construction work will probably not be begun before February, 1915. Clinton H. Fisk is Ch. Engr. of Const. Noted May 14, Oct. 22 and Nov. 12.

Little Rock, Ark.—(Official)—We are advised that the Commissioners of Pulaski County have made no appropriation for the construction of a bridge between Little Rock and Argenta, but have left the matter to the judgment of County Judge Joseph Asher with power to decide the matter. H. S. Turner is County Clk. Noted Nov. 12.

Dallas, Tex.—It is reported that the Union Terminal Co., together with the street railway and interurban companies, is considering the construction of a viaduct over the railway tracks on Jefferson Ave.

+San Antonio, Tex.—(Official)—The City Council has awarded the contract for the construction of the new St. Mary Bridge to the TEXAS CONSTRUCTION CO., at $14,442. Hans Helland is City Engr.

Victoria, Tex.—The Commissioners Court of Victoria County will soon award the contract for the construction of a bridge across Coleto Creek. The estimated cost is $9000.

+Enid, Okla.—(Official)—The Commissioners of Garfield County have awarded the contract for the construction of a concrete bridge on the line between Garfield and Grant Counties to the OREGONIA BRIDGE CO., Lebanon, Ohio.

Oklahoma City, Okla.—It is reported that bids will be received until Dec. 9, by the Board of Commissioners of Oklahoma County, for the construction of 20 bridges, at a total cost of about $30,000; the largest structure will be over the North Canadian River near Harrah, to cost about $4500. H. C. Adams, County Engr., has charge of the work.

Tulsa, Okla.—Bids will be received until 6 p.m., Dec. 7, by R. E. Curran, County Clk. of Tulsa County, for the construction of four bridges.

+Colorado Springs, Colo.—(Official)—The City Council received the following bids, Oct. 21, for the reconstruction of the Bijou Viaduct, (a) two west arches, (b) entire viaduct: Robert Clough & Co., Colorado Springs, (a) $21,347, (b) no bid; CENTRAL CONSTRUCTION CO., Colorado Springs, (a) $21,385 (awarded contract), (b) $39,406; Fox & Smith, Florence, Colo., (a) $22,500, (b) $42,000; Martin Carroll Co., Kansas City, Mo., (a) $21,594, (b) $39,468; Shelly-Hare, Colorado Springs, $22,500, (b) $47,500; Midland Bridge Co., Kansas City, Mo., (a) $24,500, (b) $48,000; Missouri Valley Bridge Co., (a) $25,000, (b) $45,700; Pueblo Bridge Co., Pueblo, Colo., (a) $21,392, (b) $39,000. F. F. Mallon is City Engr. Noted Aug. 27 and Nov. 12.

Grangeville, Idaho—The [illegible] Commercial Club has [illegible] a committee [illegible] the construction of a bridge over the Salmon River [illegible] western portion of Idaho County [illegible] of the county. A F [illegible] and W W [illegible] form the committee.

Provo, Utah—It is reported that the Commissioners of Utah County will build a new bridge over the Jordan River at [illegible].

Reno, Nev—The City Council and the Board of Commissioners of Washoe County are [illegible] the construction of a steel or concrete bridge over the Truckee River, estimated to cost $[illegible]. [illegible] is City Engr.

Tucson, Ariz—A special election will be held Dec 14 to vote for [illegible] bonds [illegible] which a [illegible] for the construction of a reinforced-concrete bridge over the Santa Cruz River. [illegible] is City Clk.

Spokane, Wash—The Commissioner of Public Works has recommended to the City Council the construction of a concrete [illegible] at the [illegible] of the Monroe St Bridge. The estimated cost is from $[illegible] to $[illegible]. Morton Macartney is City Engr.

Portland, Ore—Bonds to the amount of $[illegible] have been [illegible] and the preliminary [illegible] work will be begun [illegible] the Interstate Bridge across the Columbia River, connecting Portland with Vancouver, Wash. The bridge is estimated to cost, when completed, $1,200,000. Noted [illegible] and Jan 1, 1914.

♦**Merced, Calif.**—The Board of Supervisors of Merced County has awarded a contract for the construction of concrete [illegible] on the State Highway to THOMPSON BROS., Fresno, Calif., at $[illegible].

♦**Woodland, Calif.**—A contract for the construction of a bridge over the cut now being made in the Knights Landing [illegible] drainage district, has been awarded to JENKINS & [illegible], Sacramento, at $[illegible].

London, Ont.—(Official.) Bids will be received until Dec [illegible] Engr of Middlesex County, London, and [illegible] Engr of Elgin County, St Thomas, Ont., for the construction of the [illegible] Bridge over the River Thames between the two counties.

♦**Toronto, Ont.**—(Official.) Plans and specifications for the [illegible] of the Bloor St Viaduct, bids for the construction of which will be received until Dec 21, are on file at the office of "Engineering News," 10th Ave and 36th St, New York, N Y. Noted Nov 19.

Victoria, B. C.—The City Council has instructed the City Engineer to prepare plans for rebuilding the Rock Bay Bridge. Wellington J. Dowler is City Clk.

The [illegible] Great Eastern Ry., R D Thomas, Secy and Treas, [illegible] Belmont House, Victoria, has filed plans for a bridge to be built over the [illegible] River, at Station 1011.

WATER SUPPLY—IRRIGATION

Dalton, Mass.—The city contemplates constructing a new reservoir. [illegible] is Supt.

Fall River, Mass.—Water mains will be laid in Chicago St from Jefferson to [illegible] St. Patrick Killan is Supt Water Dept.

●**Buffalo, N. Y.**—(Official.) Bids will be received by the State Hospital Commission, Capitol, Albany, until 3 p.m. Dec [illegible] for [illegible] a water softening plant at the Buffalo State Hospital, Buffalo. Plans are on file with Lewis F. Pilcher, State Arch. For details see advertisement under "Contracts To Be Let."

♦**Buffalo, N. Y.**—The contract for additional work at the new pumping station has been awarded by the city to [illegible] CONSTRUCTION CO., at $[illegible].

Saratoga Springs, N. Y.—The city contemplates installing a [illegible] plant [illegible] estimated to cost $[illegible]. John [illegible] is Comr. Sewers, Water and Streets.

Yonkers, N. Y.—Plans are being prepared by Daniel Fulton, City Engr, for a new water system, including a reservoir, [illegible] reservoir at East View and a pumping station on Saw Mill River Rd. The estimated cost is $[illegible]. Noted Aug 13, 1914.

Trenton, N. J.—No bids were received Nov 6 by the city for laying water mains in [illegible].

Aspers, Penn.—(Official.) Plans have been prepared for making extensions to the water system.

Bellwood, Penn.—The citizens have voted in favor of issuing bonds, the proceeds of which will be used for installation of water and sewer systems.

Juniata, Penn.—Bonds for $[illegible] have been voted by the citizens, the proceeds will be used to construct a new water main from the reservoir to the city. Noted [illegible] 19.

Lansdowne, Penn.—(Official.) The State Department of Health has approved plans for the installation of a water system.

Mahanoy City, Penn.—According to press reports the Mahanoy City Water Co. will lay a [illegible] and construct a reservoir. Noted July [illegible].

♦●**Pittsburgh, Penn.**—The contract for laying two [illegible] pipe lines across the [illegible] Bridge and [illegible] from the [illegible] Hill reservoir to the [illegible] has been awarded to [illegible] CONSTRUCTION CO., Pittsburgh, at $[illegible]. Bids opened Nov [illegible]. Noted Oct [illegible].

♦**Pittsburgh, Penn.**—The contract for [illegible] plans and specifications for the [illegible] pumping station has been awarded to [illegible], Pittsburgh at $[illegible]. Bids opened [illegible]. Noted Sept [illegible].

Sheridan, Penn.—(Official.) Plans have been approved by the State Department of Health for making extensions to the water system.

Sykesville, Penn.—At a recent election, the citizens voted in favor of installing a municipal water system. Noted Sept 24.

Stuart, Va.—Bids will be received, until Nov 30, by S A Thomas, for constructing a water and sewer system. J N Ambler, Winston-Salem, N C, is Engr.

Selma, N. C.—The city, according to press reports, will install water meters. K. L. Shipwash is Supt.

Columbia, S. C.—The city contemplates making the following improvements at the municipal water system: Six 1,000,000-gal filters, one 3,000,000-gal steam pump, one 5,000,000-gal water-power pump and 20 miles of water mains. F. C. Wyse is Supt.

Manning, S. C.—Bids will be received until Dec 4, by the City Clerk, for the purchase of $30,000 in bonds, the proceeds of which will be used for the construction of a water system.

Largo, Fla.—The citizens contemplate issuing bonds, the proceeds of which will be used for the installation of a water system.

Live Oak, Fla.—The citizens contemplate installing new equipment at the water-works and constructing a reservoir. L. T. Morgan is City Engr.

New Smyrna, Fla.—An election will be held Jan 12 to vote on the question of issuing $17,000 in bonds, the proceeds of which to be used for the installation of a water system. J B McCrary Co., Atlanta, Ga., is the Engr. Noted Oct 8.

Montgomery, Ala.—The city contemplates constructing a 3,000,000-gal reservoir. W. T. Perry is Supt. of Const.

Alexandria, La.—Bids will be received until Dec 7 for two two-stage fire pumps, a single stage service pump, a vertical submerged-type pump for condenser, a surface condenser and a vertical sewage pump. Sol Weil is City Clk.

Plaquemine, La.—Bids will be received until Dec 1, for the sale of $12,000 in bonds, the proceeds of which will be used for the construction of a water system. L. H. Le Blanc is City Clk. Noted Oct 1.

Jackson, Ky.—The construction of a water system is contemplated by the city. The estimated cost is $25,000.

Lawrenceburg, Ky.—At an election held Nov 3, the citizens voted in favor of issuing bonds, the proceeds of which will be used for the improvement of the water system. Noted July 9.

Princeton, Ind.—The installation of a purification plant at the water-works of the Princeton Water & Lighting Co is contemplated. H. E. Taylor is Supt.

Benton Harbor, Mich.—At a recent election the citizens voted against the question of issuing bonds for $60,000, the proceeds of which would have been used for the improvement of the municipal water system.

Detroit, Mich.—Burt E. Taylor and others have incorporated the Schoolcraft Water Co. with a capital of $10,000.

Greenville, Mich.—The Board of Public Works contemplates installing a 2,000,000-gal pump at the water-works. T. J. Potter is Chn.

Beald, Ill.—The citizens, at a recent election, voted to issue bonds, the proceeds of which will be used for the installation of a water system.

Herrin, Ill.—The city contemplates installing a filtration plant at the water-works in 191[illegible].

Neoga, Ill.—Bids will be received until Dec 4, by the Board of Village Trustees for constructing a water system. Claude L. James, Mattoon, is Engr.

Stronghurst, Ill.—Bids will be received until Dec 4, by A H Kershaw, Secy, Bd Local Impvt, for the purchase of $[illegible] in bonds, the proceeds of which will be used for the construction of a water system. W. S. Shields, Chicago, is Engr. Noted Oct 29.

Wilmington, Ill.—Bids will be received until Nov 27 by the City Council, for constructing a 60,000-gal tank on a [illegible]-ft elevation. T. Monsen is City Clk.

Des Moines, Iowa—Bonds for $2,150,000 have been voted by the citizens, the proceeds of which will be used for the purchase and improvement of the water system. Noted Oct [illegible].

Eldon, Iowa—The Council contemplates making extensions to the municipal water system. C. A. [illegible] is Supt.

Iowa Falls, Iowa—Bids will be received until Dec [illegible] by E. L. Marriage, City Mgr, for making extensions to the water and sewer systems. J. H. Farrington is City Engr. Noted Nov [illegible].

Mason City, Iowa—The city plans to lay three miles of water mains. W. A. Jull is Supt.

Wayzata, Minn.—On Nov 3 the citizens voted in favor of issuing bonds for $[illegible], the proceeds to be used for the construction of a water system. B. Bickford is City Clk.

Fredonia, Kan.—The town contemplates installing a rapid sand filtration plant, new [illegible] pumps and moving the pumping station. C. H. De Fal is Supt.

Hardepark, Mont.—C H [illegible] Co, Spokane, Wash, was [illegible] for a water system. Bonds for $[illegible] have been voted for the construction. Noted Oct 22.

♦**Forsyth, Mont.**—The contract for constructing a concrete settling basin in connection with the water system has been awarded to L. W. Wills, Forsyth, at $[illegible]. Noted Aug [illegible].

Cape Girardeau, Mo.—The Missouri Public Utilities Co contemplates constructing a settling basin and installing a 2,000,000-gal pump. H. W. [illegible] is Secy.

Glenwood, Ark.—Plans are being prepared by the United Engineering & Construction Co., Muskogee, Okla., for the construction of a water system. Noted Aug 20.

Pilot Point, Tex.—A water system will be installed by the city in the spring. The estimated cost is $[illegible]. J. [illegible] is Engr.

San Benito, Tex.—An offer of $300,000 has been made by the land owners of the district watered by the San Benito Land & Irrigation Co. for the latter's irrigation system. If the pending transaction is consummated the irrigation system will be extended.

✚**Morris, Okla.**—The contract for constructing a water system has been awarded by the Board of Trustees to N. S. SHERMAN MACHINE & IRON WORKS, Oklahoma City, Okla., at $37,500. Other bids were J. R. Sutherlin Construction Co., Kansas City, Mo., $37,777; F. W. Keeney & Co., Oklahoma City, $37,800; J. E. Davis, Caddo, $38,935; Connelly Construction Co., El Reno, $39,496; J. J. Rooney, Muskogee, $39,698 and the United Engineering & Construction Co., Muskogee, $40,435. The Benham Engineering Co., Oklahoma City, is the Engr. Bids opened Nov. 16. Noted Nov. 5.

Phœnix, Ariz.—The city plans to install pumping machinery of from 3,000,000 to 5,000,000 gal. capacity. V. A. Thompson is Supt.

Tacoma, Wash.—The City Council has passed ordinances providing for the construction of a 12-in. c.-i. pipe, with hydrants and appurtenances. The estimated cost is $10,000. W. D. Nickeus is City Clk.

Oregon City, Ore.—The date for receiving bids for constructing the subdivisions of the South Fork has been extended from Nov. 21 to Nov. 28, by the South Fork Water Commission. Noted Nov. 12.

Portland, Ore.—Bids will be received until, Nov. 27, by A. L. Barbour, City Audr., for the purchase of $135,000 in bonds, all or in part, the proceeds of which will be used for the improvement of the water system.

Corning, Calif.—An election will soon he held to vote on the question of issuing bonds for $30,000, the proceeds of which are to be used for making extensions to the water and sewer systems.

San Diego, Calif.—Bids were received Nov. 9, for installing a filtration plant as follows: W. A. Pope & C. Widdikamp, Chicago, Ill., $59,750; California Jewell Filter Co., $52,954; and C. F. Braum & Co., $67,680 and $59,650. Noted Nov. 5.

Sierra Madre, Calif.—William Mulholland, Consult. Engr., Los Angeles, has been retained by the city to investigate the establishment of an intake for the municipal water system.

Oakville, Ont.—The Town Council plans to extend the water mains into Pine District suburb. William E. Crawley is Clk.

Empress, Alta.—The Town Council has authorized the coning of 3000 ft. of 6-in. c.-i. water mains with specials. W. J. Moore is Mgr.

Empress, Alta.—The Town Council has authorized the construction of a water system, estimated to cost $60,000. E. L. Miles, 233 Judge Travis Bldg., Calgary, Alta., is Mgr.

Victoria, B. C.—The City Council has appointed Du Cane & Dutcher, Rogers Bldg., Vancouver to prepare plans for the Sooke Lake water project.

SEWERS

Warren, Mass.—Plans are being prepared for the installation of a sewer system in the spring.

Jamestown, N. Y.—The citizens contemplate issuing $25,000 in bonds, the proceeds of which will be used for the construction of sewers. Christ Neilsen is Chn. of the Sewer Com.

Syracuse, N. Y.—Plans have been prepared by W. T. Wooley, City Engr., for the construction of sanitary and storm water sewers in the Huntley Tract and in the Fourth Ward.

✚**Camden, N. J.**—Contracts for constructing sewers have been awarded to AARON WARD, at $1.39 per lin.ft., and to W. PENN CORSON, at $5.27 per lin.ft. Bids opened Nov. 12. Noted Nov. 12.

Trenton, N. J.—Bids will be received by the City Commission, until 2:30 p.m., Dec. 2, for constructing a sewer in Lawton Alley, No. 607. Frank Thompson is City Clk.

Bellwood, Penn.—At a recent election, the citizens voted in favor of issuing bonds, the proceeds to be used for the construction of sewer and water systems.

Coraopolis, Penn.—(Official)—The State Department of Health has approved plans for the construction of lateral sewers.

Hyndman, Penn.—(Official)—Lateral sewers will be constructed in Hyndman, the plans for which have been approved by the State Department of Health.

Langeloth, Penn.—(Official)—A sewer system and sewage treatment plant will be installed. Plans have been approved by the State Department of Health.

Lansdowne, Penn.—(Official)—The city will construct a sewage-treatment plant and lateral sewers. Plans for this work have been approved by the State Department of Health.

Lebanon, Penn.—The city contemplates constructing a second sewage disposal plant. T. R. Crowell is City Engr.

Modena, Penn.—(Official)—The State Department of Health has approved plans for the construction of a sewer system and sewage-treatment plant.

Monongahela, Penn.—(Official)—Plans have been prepared and approved by the State Department of Health for the construction of lateral sewers.

Renovo, Penn.—(Official)—A temporary sewage-treatment plant will be constructed at South Renovo. Plans have been approved by the State Department of Health.

✚**Rockville, Md.**—The contract for constructing a sewer system and sewage-disposal plant has been awarded to WARREN F. BRENZIER CO., Washington, D. C., at $21,820. Noted Oct. 22.

✚**Norfolk, Va.**—The contract for laying sewer pipe has been awarded to F. G. McGUIRE, Norfolk, at $11,000. Noted Sept. 17.

Stuart, Va.—See item under Water Supply and Irrigation.

Manning, S. C.—Bids will be received until Dec. 1, by the Town Clerk, for the purchase of $10,000 in bonds, the proceeds of which will be used for the installation of a sewer system. Noted Sept. 3.

✚**Augusta, Ga.**—The contract for constructing a sewer in Camille St., has been awarded to T. O. BROWN & SON, Augusta, at $13,238.

West Palm Beach, Fla.—Bids will be received until Dec. 12, by the City Clerk, for the purchase of $100,000 in bonds, the proceeds of which will be used for the improvement of the sewer system, street improvement and riparian improvement.

Letonia, Ohio—Plans have been submitted to the City Council by C. O. Bossert, Salem, Ohio, Engr., for the proposed sanitary sewer system.

Marion, Ohio—The City Council contemplates constructing an enlarged sewage disposal plant and a trunk line sewer west from Center and Davids St.

Fort Wayne, Ind.—(Official)—Bids will be received by the Board of Public Works, until 7:30 p.m., Dec. 3, for constructing a main sewer. H. W. Becker is Clk. of the Bd.

Waterloo, Ind.—(Official)—Bids will be received until 7 p.m., Dec. 3, for constructing a combined storm and sanitary sewer and sewage disposal plant. W. R. Newcomer is Town Clk. Lige Heating & Ventilating Co., Auburn, is Engr.-in-Charge.

Staunton, Ill.—The City Council voted in favor of issuing $70,000 in bonds for the construction of a sewer system. Work will be done in the spring.

Appleton, Wis.—Plans are being prepared by Thomas W. Orbison, Consult. Engr., for the proposed trunk sewer.

✚**Madison, Wis.**—(Official)—The contract for constructing a storm sewer in Bassett St. has been awarded to J. W. MITCHELL, Madison, Wis., at $17,480. Noted Nov. 5.

Keota, Iowa—(Official)—Bids will be received by Town Council, until Dec. 9, for constructing five miles of sanitary sewers and a sewage disposal plant. W. F. Stoutner is Town Clk.

Brainerd, Minn.—Bids will be received by V. N. Roderick, City Clk., until 8 p.m., Dec. 7, for constructing a lateral sewer in District No. 3.

✚**Tracy, Minn.**—A contract for constructing 6000 ft. of sewer has been awarded to H. J. CATHROE, Omaha, Neb., at $5780.

San Antonio, Tex.—Plans are being prepared by Samuel M. Gray, Providence, R. I., expert Sewer Engr., for a complete system of sanitary and storm sewers.

Lawton, Okla.—Bids have been received for constructing a sewer along Gore Blvd., as follows: Mayfield & Shaw, Fort Bliss, Tex., $27,308; F. W. Cooney & Co., $64,453; E. R. Kirby, Lawton, $29,858; Charles H. Shaw, $31,931. Noted Oct. 15.

Tucson, Ariz.—An election will be held, Dec. 14, to vote on the question of issuing $50,000 in bonds for constructing outfall sewers.

Portland, Ore—The City Council is considering the recommendations of the City Engineering Department that the Tanner Creek trunk sewer be rebuilt at once. The work will cost between $175,000 and $240,000.

East San Diego, Calif.—(Official)—The Board of Trustees has authorized H. A. Kuehmsted, City Engr., to prepare plans for the construction of 30 miles of sanitary sewers.

Etna Mills, Calif.—Bids will be received by the City Trustees, until Nov. 28, for constructing a sewer system and disposal works. M. F. Smith is City Clk. Noted Nov. 12.

✚**Los Angeles, Calif.**—The contract for constructing a sewer in Fifth St., from Van Ness Ave. to Westminster Ave., has been awarded to ANDREW JAYICH.

Visalia, Calif.—An election will soon be held to vote on the question of issuing $120,000 in bonds for a municipal sewer system.

Ottawa, Ont.—The construction of the $60,000 sewerage system, including the laying of tile and brick sewers, will be done by day labor. R. L. Haycock, Sewerage Engr., will supervise the work.

✚**Toronto, Ont.**—The contract for constructing main sewer No. 5 has been awarded to FUSSEL-McREYNOLDS CO., at $41,644.

✚Contracts for sewer pipe in connection with the North Toronto sewerage system have been awarded by the Board of Control to the NATIONAL IRON WORKS, Toronto, 24-in. pipe, $5280, 36-in. pipe, $9445; CANADIAN ALLIS CHALMERS, LTD., Toronto, 30-in. pipe, $7280, 30-in. B. pipe, $9595.

GARBAGE

✚**Utica, N. Y.**—The city has awarded the contract for the disposal of garbage from the period, Nov. 23, 1914, to Dec. 31, 1918, to H. STAPPENBECKS & SONS, Utica, at $16,821.

✚**Jersey City, N. J.**—(Official)—The city has awarded the contract for the removal of ashes and garbage for a period of one year, to MONTGOMERY & CONLIN, at $81,000. Noted Oct. 15. List of bidders Nov. 12.

✚**Philadelphia, Penn.**—The Director of the Department of Public Works has awarded the contract for garbage removal and disposal for the year 1915, to the PENN REDUCTION CO., at $323,583. Following are reported to be lowest bids opened Nov 6 by Director Department of Public Works for (a) cleaning of streets, roads, alleys, inlets and markets for the year 1915 and all work incidental thereto; (b) collection and disposal of ashes and rubbish for the year 1915 and all work incidental thereto: Dist. 1A, Jas. A. Mullen, (a) $91,700, (b) $43,770; Dist. 1B, Jas. Irwin, (a) $104,038; Dist. 1B, Peoples Bros., (b) $48,900; Dist. 2, Edwin H. Vare, (a) $290,000, (b) $70,000; Dist. 3, Edwin H. Vare, (a) $290,000, (b) $82,000; Dist. 4A, Jas. D. Dorney, (a) $131,000, (b) $66,000; Dist. 4B, Thos. E. Flanagan, (a) $103,309, (b) $83,391; Dist. 5, Jas. D. Dorney, (a) $162,000, Dist. 5, Frank Curran, (b) $64,720; Dist. 6, Estate of David McMahon, (a) $146,900, (b) $84,900. Noted Oct. 29

Dayton, Ohio—An ordinance authorizing $45,000 in bonds for the erection of a garbage disposal plant was introduced at a recent meeting of the City Commission. The same body recently authorized a bond issue of $10,000 for the construction of five buildings to house the incinerating equipment Noted Oct. 22

Norwood, Ohio—[illegible] Dr [illegible] will [illegible] of a garbage [illegible]

Detroit, Mich.—[illegible]

Ishpeming, Mich.—[illegible] the matter thoroughly.

Pontiac, Mich.—[illegible] garbage [illegible]

Des Moines, Iowa—[illegible] with the view of [illegible] for garbage disposal.

+Corpus Christi, Tex.—[illegible] garbage incinerator to the SAN ANTONIO MACHINE & SUPPLY CO. at [illegible] Noted Oct. [illegible]

Billings, Mont.—According to press reports the question of [illegible] is under consideration. [illegible]

Ottawa, Ont.—[illegible] to the City Council [illegible] the construction of an incinerator to [illegible] The estimated cost is [illegible]

Toronto, Ont.—The Works Committee has approved plans for the construction of an incinerator on Toronto Island. The estimated cost is [illegible]

STREETS AND ROADS

+Boston, Mass.—The contract for the construction of [illegible] was awarded by the Highway Commission to the FRAMINGHAM CONSTRUCTION CO. at [illegible] Other bids were: W. D. Smith, Weathers [illegible]; [illegible] Construction Co., Thompson, Conn., $7128; [illegible] & Son, Medford, [illegible] Southbridge, [illegible]; T. Ross & [illegible], Worcester, [illegible] Contracting Co., Millbury, [illegible] New England Contracting Co., Worcester, [illegible]; Flint [illegible]; J. H. Downey, Dudley, [illegible]; [illegible] Springfield, [illegible] Marinello Construction Co., [illegible] N. H., [illegible] Andrew M. Cusack, Boston, $11,[illegible] Arthur W. [illegible] Pl., is Chief Engr. Noted Nov. [illegible]

Bids will be received until Nov. 27, for the construction of [illegible] West Roxbury District. L. K. [illegible]

The contract for [illegible] block pavement in Dempster St., [illegible] District, has been awarded by the Public Works Department to [illegible] CORPORATION at [illegible]. Other bids were: [illegible] Contracting Co., [illegible]; C. J. Jacobs Co., [illegible]; [illegible] & Sons Co., [illegible]; C. [illegible] Telless, $11,[illegible] L. K. [illegible] Noted Nov. 12.

+Ansonia, Conn.—A contract for paving on Liberty and [illegible] St. has been awarded to O'NEIL & BEARD, Shelton, Conn., at [illegible]

+Albany, N. Y.—[illegible] Bids will be received by John [illegible] State Highway Commr., [illegible] Lancaster St., until [illegible] for improving highways in various counties. [illegible] "Contracts to Be Let."

New York, N. Y.—[illegible]

New York, N. Y.—[illegible]

New York, N. Y.—[illegible]

New York, N. Y.—[illegible]

+Bayonne, N. J.—[illegible]

Camden, N. J.—[illegible]

+Hammonton, N. J.—[illegible]

+Irvington, N. J.—[illegible]

Jersey City, N. J.—[illegible]

Nutley, N. J.—[illegible]

Orange, N. J.—[illegible]

[illegible] Point, N. J.—(Official)—Bids will be received by the [illegible] Freeholders, of Atlantic County, [illegible] City, N. J., until noon, Dec. [illegible], for [illegible] Point-Longport Blvd. A. H. Nelson, [illegible] is in Charge. For particulars, see advertisement [illegible] Contracts To Be Let.

+Trenton, N. J.—The contract for surfacing Greenwood Ave. [illegible] to the NEWTON PAVING CO.

Charleroi, Penn.—At a recent election, the citizens voted in favor of [illegible] bonds for municipal improvements [illegible] streets.

+Pittsburgh, Penn.—A contract for constructing the [illegible] has been awarded to the MONO CONSTRUCTION CO. at [illegible]

+[illegible] for repaving Fourth Ave. with creosoted wood [illegible] has been awarded to M. O. HERRON CO. at [illegible]

(Official)—Bids will be received by the City Controller until [illegible] Nov. 30, for improving Sassafras St. from Liberty Ave. to 28th St.

+Uniontown, Penn.—(Official)—Contracts have been awarded for constructing roads in Luzerne and Washington Townships to HEAGAN & LYNCH, Uniontown, at $24,00[illegible], and V. De [illegible], Fayette City, at $6[illegible] respectively. Noted Oct. [illegible]

+Sarasota, Fla.—A contract for paving has been awarded to the SOUTHERN ASPHALT & CONSTRUCTION CO., Birmingham, Ala., at $12,[illegible]

Gulfport, Miss.—At the meeting of the County Board of Supervisors, Dec. 7, the project to build a boulevard along the Mississippi Sound, as a link in the New Orleans-Mobile [illegible] will be considered.

Holly Springs, Miss.—An election will be held Dec. 8, to vote on the question of issuing $15,000 in bonds to pave or [illegible] streets and the public square.

Louisville, Ky.—The contract for constructing approximately eight blocks of Market St. will soon be awarded by the Board of Public Works.

Mt. Vernon, Ky.—The Rockcastle Fiscal Court has appropriated funds for the construction of ten miles of road which will be a part of the Boone Way, a proposed highway from Crab Orchard, Ky., to Cumberland Gap, Tenn.

Cheviot (Cincinnati post office), **Ohio**—(Official)—Bids will be received by Albert L. Reusing, Village Clk., until noon, Dec. 2 for the improvement of a section of Harding Ave.

Kenton, Ohio—Bids will be received by the Auditor of Hardin County until Nov. 30, for the sale of $2[illegible] in bonds for road improvements.

Newark, Ohio—Bids will be received by the Commissioners of Licking County until Dec. 5, for the sale of $[illegible], $27,[illegible] and $1[illegible] in bonds for road improvements throughout the county. F. I. Mercer is Clk. of Commrs.

+Wapakoneta, Ohio—(Official)—The contract for paving Perry and Main St. has been awarded to H. P. STREICHER CO., Toledo, at $[illegible]. Noted Oct. 22 and Nov. 19.

+Warren, Ohio—The contract for paving W. South St. has been awarded to TURNER & OLSON, Youngstown, at $[illegible]

+Brownstown, Ind.—A contract for constructing a gravel road has been awarded to MEREDITH & HARLWAY, [illegible], Ind., at $[illegible]

Fort Wayne, Ind.—(Official)—Bids will be received by the Commissioners of Allen County until [illegible] Dec. 16 for the construction of a stone road on line between [illegible] Townships. Calvin N. Brown is Audr.

Indianapolis, Ind.—(Official)—Bids will be received by the Commissioners of Marion County until [illegible] Dec. [illegible] for constructing a road in Lawrence Township.

Rochester, Ind.—(Official)—Bids will be received [illegible] Fulton County [illegible] for the sale of [illegible] in bonds for highway improvements.

Vincennes, Ind.—(Official)—All bids received [illegible] have been rejected. New bids will be received until [illegible] Noted Oct. [illegible]

Port Huron, Mich.—(Official)—Bids will be received by the [illegible]

St. Joseph, Mich.—[illegible]

Wyandotte, Mich.—At the [illegible]

+Appleton, Wis.—A contract for [illegible]

Madison, Wis.—The State Highway Commission [illegible]

Hutchinson, Kan.—[illegible]

Deer Lodge, Mont.—The citizens of Powell County voted in favor of [illegible] bonds for road work.

Townsend, Mont.—The citizens of [illegible] County have voted in favor of issuing [illegible] in bonds for road work.

+St. Louis, Mo.—The contract for improving [illegible] has been awarded to JOHN [illegible]

+Little Rock, Ark.—A contract for [illegible] has been awarded to [illegible] at about [illegible]

Laredo, Tex.—An election will be held Dec. 15 to vote on the question of issuing [illegible] in bonds for constructing roads in Laredo and [illegible] Districts.

+Pocatello, Idaho—A contract for 45,329 sq.yd. gravel surfacing, 26,416 cu.yd. excavation and 88,000 lin.ft. curbing has been awarded to J. J. CARROLL, Boise, at $34,530.

Cathlamet, Wash.—The citizens of Wahkiakum County recently voted $75,000 in bonds for building a main trunk road to complete the road from Kelso westward down Columbia River through Wahkiakum and Pacific Counties. Plans are being prepared and bids will soon be received.

Seattle, Wash.—The following bids were recently received by the Board of Public Works for paving East Mercer St. with (a) No. 1 brick, (b) No. 2 brick: L. Coluccio, 1624 Lane St. (a) $33,281 (b) $34,321; Elliott Construction Co., (a) $35,267, (b) $36,267; P. J. McHugh, (a) $35,460, (b) $35,860; D. H. Traphagen, (a) $36,674, (b) $38,274.

+Eugene, Ore.—The contract for paving Sixth Ave. with gravel bitulithic has been awarded to CLARK & HENRY, Portland at $28,235.

Sacramento, Calif.—(Official)—Bids were received, Nov. 9, by the State Highway Commissioners for constructing roads in the following counties: (a) Imperial County, (b) Solano County, (c) Glenn County, (d) Colusa County; W. F. Callahan & P. L. Hedrick, El Centro, (a) $63,233; Rice & Dutcher, Imperial, (a) $72,174; Brashear, Burns Co., Los Angeles, (a) $79,035; J. W. Calback, San Diego, (a) $76,779; F. Leffler, San Francisco, (b) $47,256, (c) $47,530; Tieslau Bros., San Francisco, (b) $48,363, (c) $50,640, (d) $66,408; Commary, Peterson Co., Inc., San Francisco, (b) $49,473, (d) $66,582; P. L. Burr, San Francisco, (b) $42,832, (c) $46,311, (d) $60,358, P. H. Hoare, Oakland (b) $40,357, (c) $50,462 Bates, Boreland & Ayer, Oakland, (b) $45,717, (c) $52,294, (d) $58,884; A. W. Garrill, San Francisco, (b) $47,431, (c) $49,216, (d) $61,754; C. W. Cross, Oakland, (c) $40,814; (d) $55,062, Chico Construction Co., Chico, (c) $41,276; Rochett Kearney & Co., Los Angeles, (c) $40,917, (d) $55,438; E. T. Johnson, Portland, Ore., (c) $43,412, (d) $57,091. Noted Oct. 29.

+San Francisco, Calif.—The Westgate Park Co. has awarded a contract for the paving of Junipero Serra Blvd., between Monterey and St. Francis Blvds. to the CITY STREET IMPROVEMENT CO

Santa Ana, Calif.—All bids received by W. B. Williams, County Clk., for grading and surfacing Siever's Cañon County Rd. have been rejected. Noted Oct. 21.

+Bridgeburg, Ont.—The contract for completing a section of the Canadian-Niagara Blvd. has been awarded to J. M. McNAMARA, St. Catharines, at $32,000.

Hillsburgh, Ont.—An election will be held, Dec. 15, to vote on the question of issuing $20,000 in bonds for road work.

INDUSTRIAL WORKS

+Providence, R. I.—(Official)—The general contract for the construction of the warehouse for the R. L. Green Paper Co. has been awarded to the TURNER CONSTRUCTION CO. It will be five stories and basement.

+Bridgeport, Conn.—The contract for the addition to the plant of the Connecticut Breweries Co. has been awarded to HAUG & ROEHRICH.

Jamestown, N. Y.—Freeburg & Fidler, Archs., 505 Chadakoin Bldg., are preparing plans for the three-story addition to the plant of the Crescent Tool Co. The estimated cost is $50,000.

Lyons, N. Y.—The Joppa Cigar Mfg. Co., Warren Bldg., will erect a two-story factory on Geneva St

+New York, N. Y.—(Borough of Manhattan)—Plans have been filed by C. P. H. Gilbert for a 10-story addition to the warehouse at 11 Beach St. for Deering, Milliken & Co., 30 Varick St. The foundation contract has been awarded to CHARLES T. WILLS, INC.

(Borough of Bronx)—L. C. Holden, Arch., is preparing plans for a nine-story warehouse at 1922 Webster Ave., for the Dochterman Realty Co. The estimated cost is $125,000.

Morristown, N. J.—Walter B. Pierson, Arch., 72 Trinity Place, New York, is preparing plans for rebuilding the factory of V. R. Wulff, 33 South St. The estimated cost is $50,000.

Newark, N. J.—J. W. Beardsley's Sons, 474 Greenwich St., New York, contemplates erecting an addition to the four-story plant on Brighton Ave. The estimated cost is $20,000.

Harrisburg, Penn.—Plans are being prepared by Day & Zimmerman, Archs., Philadelphia, for the buildings to the constructed for the W. O. Hickok Mfg. Co. The estimated cost is $150,000.

New Kensington, Penn.—The Pittsburg Dry Goods Co. will construct a two-story brick factory on Stanton Ave. The estimated cost is $15,000. W. L. Laughlin, New Kensington, is Arch.

Scranton, Penn.—The Directors of the Scranton Industrial Development Co. will erect a plant on Green Ridge St. for the Motorkart Co., of Peekskill, N. Y. The estimated cost is $60,000.

Baltimore, Md.—The Western Maryland Ry. Co. is planning the erection of an elevator at Port Covington. The estimated cost is $650,000.

+Chattanooga, Tenn—The contract for the construction of the plant for the Chattanooga Coal & Biproduct Co., has been awarded to the WESTERN GAS CONSTRUCTION CO.

Canton, Ohio—The Little Grip Co., recently incorporated with a capital of $35,000, plans the construction of a plant at Canton. M. A. Little, W. E. Sherlock and Charles S. MacDowell are interested.

Saint Maries, Idaho—The Saint Maries Lumber Co. plans the construction of a box factory, to cost $60,000. M. P. Bogle is Pres.

+Sheboygan, Wis.—Contracts have been awarded by the Sheboygan Cigar Co. for the construction of a factory as follows: Concrete, PETER SINNER; masonry, WILLIAM GUENTEHR & SON; carpentry, ALBERT NACH & CO. Noted Aug. 27 and Oct. 29.

Armstead, Mont.—H. P. Protenger contemplates constructing a flour mill and grain elevator with a capacity of 150 bbl. a day.

Eureka, Mont.—Dion & Horstkette, Archs., Minneapolis, Minn., are preparing plans for rebuilding a sawmill recently destroyed by fire, for the Eureka Lumber Co. The estimated cost is $150,000. C. A. Weil is Pres.

Great Falls, Mont.—The Hazlewood Co., Ltd., Spokane, Wash., plans the construction, about Jan. 1, of the first unit of a series of plants to be constructed in Montana. F. N. Martin is Secy. and Treas.

Fort Worth, Tex.—The Southwestern Cooperage Co., recently incorporated, plans the construction of a one-story, 60x150-ft. corrugated iron factory.

The Texas Anchor Fence, Iron & Wire Works plans the construction of a one-story, 100x120-ft. building, estimated to cost $15,000.

Anacortes, Wash.—The Fidalgo Island Packing Co. contemplates an expenditure of $45,000 for improving and constructing additions to the canning plant.

Clarkston, Wash.—Bids will soon be received by the American Asbestos Mfg. & Milling Co., recently incorporated, for the construction of a plant at Clarkston.

Conway, Wash.—The Government Standard Powders Co., of Washington, recently incorporated, plans the construction of a plant to manufacture the Government Standard Grade Powders.

Everett, Wash.—Frank Estes contemplates reconstructing the shingle mill recently destroyed by fire.

North Yakima, Wash.—The North Yakima Brewing & Malting Co. contemplates improving and altering its plant. Estimated cost, $45,000.

The Union Oil Co., of California, contemplates constructing a plant to cost about $15,000. C. M. Covell, Seattle, is interested.

Pendleton, Ore.—The Empire Mfg. Co. contemplates the construction of a plant to cost about $50,000.

+Los Angeles, Calif.—The contract for the construction of a Class C, 100x272-ft. warehouse, at Alameda and Palmetto St., for Rudgear-Merle Co., has been awarded to F. O. ENGSTRUM CO. Estimated cost, $65,000. William Curlett & Son are Archs.

Oakland, Calif.—The Bekins Van & Storage Co. plans the construction of an eight-story fireproof warehouse at 22d St. and San Pablo Ave. Estimated cost, $150,000.

Port Elgin, Ont.—Simon Buschlen contemplates constructing a basket-making factory at Port Elgin.

Sarnia, Ont.—R. W. Soper, Arch., has prepared plans for the construction of a factory for the Sarnia Sheet Metal Products Co. Estimated cost, $40,000.

Stratford, Ont.—Plans are being prepared for the Colonial Player Piano Co. for the construction of a factory at South Stratford.

FEDERAL GOVERNMENT WORK

Bridge—Washington, D. C.—Bids were received, as follows, by the Commissioners of the District, for the construction of reinforced-concrete bridge, consisting of a single multiple rib arch of 200 ft. actual span, the abutments of which will be founded in solid rock, over Rock Creek, within the lines of Pennsylvania Ave. It will have a width of 70 ft. between balustrades, consisting of a 50-ft. roadway and two 10-ft. sidewalks. It will consist of a deck system carried by columns and walls on one 12-ft. arch rib and four 6-ft. arch ribs. In Design A, the bridge will be faced with facing mortar, will have a showing span of 155 ft., and a total overall length of 271 ft. In Design B, the bridge will be faced with stone, will have a showing span of 164 ft. and a total overall length of 276 ft. Bid a provides for construction of bridge according to Design A. Bids b-1, b-2 and b-3 provide for the construction of the bridge according to Design B. Bid b-1 provides for facing stone to be buff Indiana limestone; b-2, facing stone to be sandstone similar to "Kingwood"; b-3, facing stone to be granite. Item 1 calls for excavation of 160 cu.yd. of earth; item 2, excavation of 200 cu.yd. of rock; item 3, 400 cu.yd. of masonry excavation.

Bidders are as follows:

(A) Hardaway Contracting Co., Columbus, Ga.; (B) A. L. Guidone & Co., New York, N. Y.; (C) Barzaghi-Vought Co., New York, N. Y.; (D) L. B. Cleveland, Watertown, N. Y.; (E) McArthur Bros. Co., New York, N. Y.; (F) Conners Bros. Co., New York, N. Y.; (G) Interstate Construction Co., New York, N. Y.; (H) Thomas Sheahan, Hagerstown, Md.; (I) O. P. Allen Construction Co., Washington, D. C.; (J) Snare & Triest, New York, N. Y.; (K) Ward & Tully, Inc., New York, N. Y.; (L) Merrill-Ruckgaber Co., New York, N. Y.; (M) Cranford Construction Co., Washington, D. C.; (N) O'Brien Construction Co., New York, N. Y.; (O) L. Hankins, Richmond, Va.; (P) Whiting-Turner Construction Co., Baltimore, Md.; (Q) C. Faith & Co., Philadelphia, Penn.; (R) Willard Boggs & Co., Spartansburg, S. C.; (S) Penn Bridge Co., Washington, D. C.; (T) Davis Construction Co., Washington, D. C.; (U) W. H. H. Allen Construction Co., Washington, D. C.; (V) M. F. Comer & Co., Washington, D. C.; (W) C. B. Clark & Co., Baltimore, Md..

	Item 1	2	3	Bid a	Bid b-1	Bid b-2	Bid b-3
A	$0 75	$3 00	$3 00	$60,500	$69,500	$70,500	$87,500
B	2 00	3 50	5.00	82,300	91,500	101,500	109,500
C	1 00	5.00	2 00	63,215	73,953	73,953	92,556
D	1 00	4 00	4 00	58,750	74,321	83,081	93,541
E	2 00	5.00	6.00	70,500	85,033	92,200	102,400
F	12 00	25 00	20.00	83,216	90,350	98,671	109,800
G	1 00	4 00	4.00	71,750	85,700	93,650	103,100
H	1.50	0 00	15.00	87,521	108,735	120,537	130,357
I	0 41	5 50	6.60	66,600			
J	1 50	4 00	9.00	81,000	95,300	105,000	116,030
K	1 00	4 00	5 00	103,300	118,500	127,000	137,000
L	1 00	10 00	10 00	73,000	83,000	91,000	101,000
M	2 00	2 00	3 00	102,000	114,200	124,100	135,000
N	1 00	5 00	4 00	75,000	85,000	95,000	106,000
O	1 20	5 80	5 80	86,000	99,000	104,000	114,000
P	1 500	4 00	10.00	67,000	79,000	88,400	95,030
Q	0 50	9 00	15 00	75,000	89,000	97,000	106,000
R	0 60	5 00	5.00	92 300	110,000	116,500	125,600
S	1 00	2 50	3 00	53,700	68,300	77,300	88,400
T	0 60	4 00	5 00	65,297	73,671	81,284	90,384
U	2 50	5 00	12 00	77,527	92,185	96,735	100,285
V	1 25	7 00	5 00	73,170	83,000	92,700	103,300
W	1 25	4 00	4 50	57,820	72,840	81,000	92,520

Building—Washington, D. C.—[illegible] for the Commissioners of the District of Columbia, [illegible] N. W., between [illegible] Washington [illegible] George A. [illegible] New York, N. Y., [illegible] George [illegible] Construction Co. [illegible] Arthur [illegible] Philadelphia, Penn., [illegible] Arthur Cowsill, [illegible] Construction Co., [illegible] New York, N. Y., $77,[illegible] Above [illegible] of Washington unless otherwise stated. Noted Nov. [illegible]

Dump Scows—[illegible] W. Va.—Bids will be received [illegible] U. S. Engineer Office, until 11 a.m. Dec. [illegible] for furnishing and delivering [illegible] dump scows [illegible] U. S. E. D. [illegible] No. [illegible]

♦**Breakwater**—Cape Lookout, N. C.—Bids will be received by Maj. H. W. Stickle, U. S. Engineer Office, Wilmington, N. C., until [illegible] for the construction of a breakwater [illegible] rubble stone [illegible] at Cape Lookout.

Earthwork—New Orleans, La.—The following are the bids received for the construction of approximately [illegible] cu. yd. of levee work in the Lower Tensas, Atchafalaya, Lafourche, Barataria, Pontchartrain and Lake Borgne Levee Districts:

LOWER TENSAS LEVEE DISTRICT

Levee	Cu. Yd.	Contractor	Price (c. yd.)
[illegible]	[illegible]	[illegible], Lake Providence, La.	[illegible]
[illegible]	[illegible]	W. C. [illegible], Vicksburg, Miss.	[illegible]
White Oak Lake, Lot No. 1	[illegible]	[illegible], Natchez, Miss.	[illegible]
White Oak Lake, Lot No. 3	[illegible]	[illegible], Vidalia, La.	[illegible]
White Oak Lake, Lot No. 3	[illegible]	[illegible], Natchez, Miss.	[illegible]
[illegible], Lots 1 and 2	[illegible]	[illegible] Co., Ltd., New Orleans, La.	[illegible]

ATCHAFALAYA LEVEE DISTRICT

[illegible]	[illegible]	[illegible]-White Co., Ltd., New Orleans	16
[illegible]	[illegible]	[illegible]-White Co., Ltd., New Orleans	16
Upper [illegible]	[illegible]	[illegible]-White Co., Ltd., New Orleans	16
Lower [illegible]	[illegible]	[illegible]-White Co., Ltd., New Orleans	16
[illegible]	[illegible]	[illegible]-White Co., Ltd., New Orleans	16

LAFOURCHE LEVEE DISTRICT

[illegible]	150,000	R. T. Clark & Co., Natchez, Miss.	[illegible]
[illegible]	[illegible]	W. F. [illegible], Baton Rouge [illegible]	[illegible]

BARATARIA LEVEE DISTRICT

[illegible]	[illegible]	[illegible] & [illegible]	21

PONTCHARTRAIN LEVEE DISTRICT

[illegible]	[illegible]	[illegible], Vicksburg, Miss.	[illegible]
[illegible]	[illegible]	[illegible]-White Co., Ltd., New Orleans	[illegible]

LAKE BORGNE LEVEE DISTRICT

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

♦**Rock**—New Orleans, La.—[illegible]

Post Office—[illegible]

Levee Work—[illegible]

♦**Brush and Poles**—Memphis, Tenn.—The contract for furnishing [illegible] of brush and poles for revetment work in the [illegible] districts, Mississippi River, has been [illegible] to the TENNESSEE CONTRACTING CO., Memphis, Tenn., at [illegible]. Noted Nov. 5.

♦**Steel Deck Barges**—Cincinnati, Ohio—The contract for [illegible] steel deck barges has been awarded to the AMERICAN BRIDGE CO., Cincinnati, at $1[illegible],400. Noted Oct. 1.

Steel Hull—Cincinnati, Ohio—The following are the bids received for [illegible] and delivering steel hull for dipper dredge [illegible]: Hartmann Greiling Co., Green Bay, Wis., (a) [illegible] steel hull delivered at Carrollton, Ky., $13,2[illegible]; (b) [illegible] delivered at shipyard, $11,2[illegible]; Jones & Laughlin Steel Co., (a) $[illegible], (b) $11,6[illegible]; Dubuque Boat & Boiler Works, Dubuque, Iowa, (a) $[illegible]16; Charles Hegewald Co., New Albany, Ind., (a) $[illegible], (b) $[illegible]; Milwaukee Bridge Co., Milwaukee, Wis., (a) $1[illegible]; Edward J. Howard, Jeffersonville, Ind., (a) $1[illegible], (b) $10,3[illegible]; Pittsburgh-Des Moines Steel Co., Pittsburgh, Penn., (a) $10,13[illegible], (b) $[illegible]; American Bridge Co., Cincinnati, (a) $[illegible], (b) $[illegible]; Rock Island Bridge & Iron Works, Rock Island, Ill., (a) $9[illegible]. Noted Oct. 2[illegible].

Repairs To Post Office—Springfield, Ohio—Bids were received by the Custodian, U. S. post office, for repairs to the U. S. post office, Springfield, from Sieverling & Fairbairn, Springfield, at $11,03[illegible], and the Grohue Contracting Co., Joliet, Ill., at $[illegible].

♦**Post Office**—Portland, Ind.—The contract has been awarded for the construction of a post office at Portland, to DUNLAP & CO., Columbus, Ind., at $44,926. Noted Sept. 17.

♦**Post Office**—Cadillac, Mich.—The contract for constructing the U. S. post office at Cadillac has been awarded to C. HOERTZ & SON, Grand Rapids, Mich., at $65,37[illegible]. Noted Oct. 8.

♦**Post Office**—Princeton, Ill.—The contract has been awarded for the construction of a post office at Princeton to W. C. CARTER CO., Chicago, Ill., at $55,645. Noted Sept. 24 and Nov. 12.

♦**Canal Work**—Dodson, Mont.—The contract for the reconstruction of the Dodson South Canal at Dodson Bridge, has been awarded to JAMES O'CONNOR, Council Bluffs, Iowa, at $[illegible] for Schedule 1 and the SECURITY BRIDGE CO., Minneapolis, Minn., at $3060 for Schedule 2. Noted Sept. 24 and Nov. 12.

♦**Earthwork**—Great Falls, Mont.—Bids will be received by the U. S. Reclamation Service, Great Falls, until 3 p.m. Dec. [illegible] for earthwork on Greenfields Distribution System, Greenfields, South and Mill Coulee Canals, involving about 3[illegible]00 cu. yd. of excavation. The work is situated on the north side of Sun River, about 25 miles northwest of Great Falls, Mont., about six miles north of Fort Shaw, Mont., on the Sun River Branch of the Great Northern Railway, and about six miles south of the towns of Bole, Sloan and Cordova, Mont., on the Choteau Branch of the Great Northern Ry.

♦**Excavation Construction**—St. Ignatius, Mont.—Bids will be received by the U. S. Reclamation Service, St. Ignatius, until 2 p.m. Dec. [illegible], for the construction of structures on Pablo laterals "A" and "31 A" and sub-laterals, involving about 9[illegible] cu. yd. of excavation, 1,[illegible]0 cu. yd. of concrete, [illegible] sq. yd. of paving, the placing of about 73,[illegible]0 lb. of reinforcing steel, and the manufacturing and laying of about 2[illegible] lin. ft. of concrete pipe. The work is situated on the east side of the Flathead River, from six to 12 miles southwest of Polson, Mont.

Post Office—La Junta, Colo.—Bids will be received by [illegible] Wenderoth, Supervising Arch., Treasury Dept., Washington, D. C., until [illegible] p.m. Jan. 4 for constructing a post office at La Junta. The building will be two stories and basement of stone and terra cotta.

Canal Work—Provo, Utah—The lowest bids submitted for [illegible] sections of the High Line Canal were from the [illegible] Construction Co., Springville, Utah, for [illegible] 1 and [illegible] at $1[illegible] and $1[illegible], respectively, and [illegible] for Division 2 at $2[illegible].

♦**Buildings, Etc.**—Fort Huachuca, Ariz.—Bids will be received until 1 p.m. Dec. [illegible] by the Constructing Quartermaster, for [illegible] double quarters, one [illegible], [illegible] stables, one hay shed and [illegible] buildings [illegible] and 6[illegible].

♦**Wood Stave Pipe**—[illegible] City, Wash.—The contract has been awarded to the PACIFIC TANK & PIPE CO., Portland, [illegible] at $[illegible] for the construction of about [illegible] lin. ft. of wood [illegible] pipe in connection with the Sunnyside Irrigation [illegible].

♦**Timber Wharf, Wharf Shed**—Bremerton, Wash.—The contract for constructing the timber wharf and wharf shed of the Naval [illegible] Station, Puget Sound, Wash., has been awarded to [illegible] & [illegible], [illegible] 17th Ave. S. W., Seattle, at $[illegible]. Noted Sept. 24 and Oct. 22.

♦**Dredging and Jetty Work**—Port Townsend, Wash.—The [illegible] for dredging and jetty construction in Port Townsend [illegible] Bay, Wash., has been awarded to [illegible] Co., Seattle, Wash., at $[illegible]. Noted [illegible]

MISCELLANEOUS

♦**Tunnel**—[illegible], Mass.—[illegible]—Bids for building [illegible] Tunnel will be received by the Boston [illegible] Commission [illegible] The [illegible] the Fort Point Channel [illegible] about [illegible] ft. [illegible] ft. [illegible] of the [illegible] Ave. to South [illegible] The tunnel will be of [illegible] and [illegible] ft. It will consist of two [illegible] about 14 ft. [illegible] The part [illegible] be constructed [illegible] to be let.

Foot and Wagon Tunnel—[illegible], Mass.—A [illegible] and [illegible] tunnel in East Boston, which would [illegible] the [illegible] has been [illegible] by the [illegible] to the Transit Commission. The

estimated cost of the project, which is still in the embryo stage, is $3,000,000.

Barge Canal Work—Albany, N. Y.—The following bids were received Nov. 20, by Duncan W. Peck, State Supt., Pub. Wks., for Contract J, for constructing the substructure, superstructure and approaches of a highway bridge over the Cayuga and Seneca Canal at Fourth St., Watkins, and for constructing a section of dockwall: Oswego Construction Co., $47,646; Chesley, Earl & Heimbach, $48,065; Walsh Construction Co., Davenport, Iowa, $48,204; Brooks & Julian, $48,883; Barrally & Ingersoll, $48,970; Frank L. Cohen, $49,020; Seneca Engineering Co., $49,226; John Kelly, $50,722; D. L. Taylor & Co., $51,413; L. B. Cleveland, $51,590; Drake & Dean Co., Inc., $52,125; Scott Bros., $53,412; Lathrop Shea & Henwood Co., $53,746; Flood & Van Wirt, $55,720.

Bids were also received as follows for Terminal Contract No. 29; constructing a harbor, dockwall and two breakwaters in Oneida Lake, Constantia, N. Y.: Barraly & Ingersoll, $38,733; Eastover Construction Co., $42,727; James Stewart & Co., Inc., $47,376. Noted Oct. 29.

+Barge Canal Work—Albany, N. Y.—Duncan W. Peck, State Supt., Pub. Wks., has awarded Contract G, Cayuga and Seneca Canal, to LUPFER & REMICK, Buffalo, at $110,115. Noted Oct. 15, Nov. 19.

★Subway—New York, N. Y.—(Borough of Manhattan)—(Official)—The Public Service Commission for the First District, 154 Nassau St., will receive bids until Dec. 11, for the construction of Section No. 4 of Routes No. 4 and 36, a part of the Broadway-Fourth Ave. Rapid Transit railway in the Borough of Manhattan. For details see advertisement under "Contracts to Be Let."

★Sanitary Work—Rochester, N. Y.—(Official)—Bids will be received by the State Hospital Commission, Capitol, Albany, until 3 p.m., Dec. 4, for new sanitary work at the Rochester State Hospital, Rochester, N. Y. For details see advertisement under "Contracts To Be Let."

Stadium—Rochester, N. Y.—The Trustees of Rochester University are having plans prepared for the construction of a stadium. A 15-acre tract of land will be purchased and a new athletic field laid out. The estimated cost of the improvements is $50,000.

+Tug Boat—Tonawanda, N. Y.—The Tonawanda & Green Island Ferry Co. has awarded the contract for building a steel tug boat, to the COWLES SHIPYARDS CO., Buffalo.

Fire Station—Arlington, N. J.—The North Arlington Borough Council contemplates the construction of a fire station on Kearny Ave.

Fire Station—Hoboken N. J.—Bids will be received until, Dec. 9, by the City Clerk, City Hall, Hoboken, for the construction of a fire station.

Waiting Stations—Hoboken, N. J.—The Board of Public Utility Commissioners has directed the Public Service Ry. Co. to build inclosed waiting stations on its elevated line at Washington, Willow and Henderson St.

Fire Station—Rahway, N. J.—The City Council plans to construct a fire station on lower Main St. for Lincoln Hook & Ladder Co. No. 2.

★+Bulkhead & Terminal Basin—Trenton, N. J.—(Official)—The city has awarded the contract for the construction of a bulkhead and terminal basin near Ferry St. in the Delaware River, to the AMERICAN PAVING & CONSTRUCTION CO., Philadelphia, Penn., at $40,461. Frank Thompson is City Clk. Noted Aug. 27.

Fire Apparatus—Union, N. J.—Bids will be received until 8 p.m., Nov. 30, by the Board of Council for fire apparatus. E. Bautz, Jr., is Town Clk. (J. W. H.)

Stock Yard Improvements—Pittsburgh, Penn.—(Official)—R. B. Burgess, Consult. Engr., Pittsburgh, has been commissioned by the Pittsburgh Union Stock Yards Co. to make a complete physical valuation of its property on Herrs Island; also to prepare plans for a new pump house, mule pens, and foundations and basement for the fertilizer building. Catalogs are desired from manufacturers who are interested.

+Comfort Station—Scranton, Penn.—(Official)—The general contract for the construction of the public comfort station has been awarded to PETER STIPP & SONS, Scranton, at $14,744. William A. Schunk is City Engr. Noted Sept. 24, Oct. 2, Nov. 9.

+Pier—New Castle, Del.—According to press reports, the BETHLEHEM STEEL WORKS has been awarded a contract for the construction of a 400-ft. steel pier which will be used in connection with a $300,000 plant being built for the manufacture of loaded projectiles.

Breakwater—Baltimore, Md.—According to press reports the Park Board has decided to build a breakwater at Fort McHenry to protect the proposed bathing beach, piers and boat clubs. The estimated cost is $37,000, which will be paid for out of the $1,500,000 harbor loan passed at the last election.

+Tunnel and Grading—Berwind, W. Va.—The Norfolk & Western Ry., Roanoke, Va., J. E. Crawford, Ch. Engr., has awarded the contract for the construction of a tunnel on Jacob's Fork and five miles of grading, to J. J. BOXLEY SON & CO., Bedford City, Va. The estimated cost is about $250,000.

Seawall and Filling—Fort Pierce, Fla.—City has had surveys made and plans will be prepared for the construction of a seawall with back fill, along the river front. It will extend from the mouth of the canal to the Court House grounds, about 300 ft. from shore line. The J. B. McCrary Co., Engrs., Atlanta, Ga., will prepare the plans.

+Memorial Terrace—Put-In-Bay, Ohio—(Official)—The Interstate Board of the Perry's Victory Centennial Commission has awarded the contract for completing the Perry Memorial Terrace to the STEWART ENGINEERING CORPORATION, 17 Battery Pl., New York. The work covered by the contract extends over 14 acres and includes a reinforced-concrete terrace, resting on piles; granite and sandstone masonry; brick paving; dredging, excavating and filling; and all the landscape gardening. J. H. Freedlander and C. D Seymour, 224 Fifth Ave., New York, are the Associate Archs.

+Motor Fire Apparatus—Toledo, Ohio—The Board of Control has awarded the following contracts for motor driven combination and chemical wagons: GAMBLE MOTOR CAR CO., at $60,600, for furnishing 12 cars; SEAGRAVE CO., at $15,809, for three cars; ROBINSON FIRE APPARATUS MFG. CO., St. Louis, at $10,450, for two cars.

Retaining Wall—Fort Wayne, Ind.—(Official)—Bids will be received until 7 p.m., Dec. 3, by the Board of Public Works, for the construction of a concrete wall along the West side of St. Joseph Blvd., from Columbia Ave. to McDougal Ave. H. W. Becker is Clk.

Drain—Portland, Ind.—Bids will be received until, Dec. 23, by W. H. Badders, Supt., for excavating 240,000 cu.yd. earth and constructing five miles of open and tile drain.

+Ditches—Blue Earth, Minn.—The following contracts for constructing ditches have been awarded: Ditch No. 20, 153,664 yd. open work and 459,000 ft. tile, MULGREN BOYCE CO., Dubuque, Iowa, at 10c. per cu.yd. (open work), SCHULTZ & BUCK, Clarion, Iowa, at $70,000 (tile work); ditch No. 24, about 19,000 ft. tile, D. C. ARMSTRONG, at $6400; ditch No. 23, 42,000 ft. tile, CARL C. KUNDSEN at $14,137. Noted Nov. 5.

Ditch—Duluth, Minn.—The County Board has commissioned A. E. Dyer, retiring County Surv., to prepare plans for the construction of County Ditch, No. 4. It will be 18 miles long, passing through townships 19, 20, 52, 53 and 54.

Park Bonds—Duluth, Minn.—The City Commission has authorized an issue of $50,000 in bonds for buying parks and parkways. About $26,000 will be used for the purchase of Fairmont Park extension in West Duluth.

+Canal Reconstruction—Malta, Mont.—The contract for reconstructing certain sections of the Dodson South Canal has been awarded to the JAMES O'CONNOR CO., Council Bluffs, Iowa, at $33,895. The contract for reinforced concrete work has been awarded to the SECURITY BRIDGE CO., Minneapolis, Minn.

+Grading—Kansas City, Mo.—The contract for grading the plot in front of the Union Station, which will be used as a park, has been awarded to W. C. MULLINS, at $40,000. Curtis Hill is City Engr.

+Drainage—Bloomer, Wis.—The contract for draining 500 acres of land in the Lafayette Drainage District has been awarded to the WISCONSIN DRAINAGE CO.

Drainage—Marion, Ark.—(Official)—Bids will be received until noon, Dec. 7, by W. H. Newsom, Engr., Drainage District No. 2, Crittenden County, for the excavation of 5,164,000 cu.yd. of earth, floating dredge work; about a mile and a half designed as team work.

Stockyard—El Paso, Tex.—The Cattlemen's Stockyards Association has been organized here and plans to construct stockyards for the handling of Mexican cattle. The company has a capital stock of $500,000.

Dock—Orange, Tex.—The city plans to construct a dock, 400 ft. long, extending from Second to Third St.

Drainage Districts—Roswell, N. M.—Four drainage districts have been organized in Chaves County, for draining 54,000 acres of land. They are as follows: Dexter-Greenfield, 19,800 acres; Roswell District, 15,000 acres; Hagerman District, 7000 acres; East Grand Plains District, 12,000 acres. About 370 miles of tile drain will be laid, estimated to cost $700,00. H. W. Vauchelet is the Engr. for the first three districts. W. A. Wilson for the fourth.

Fire Department and Park Improvement Bonds—Tucson, Ariz.—An election will be held, on Dec. 14, to vote $225,000 in bonds for municipal improvements. Of this sum $25,000 will be used for park improvements and $50,000 for the fire department.

Drainage—Grandview, Wash.—The Commissioners of Yakima County announce that a second bond issue of $100,000 will be necessary to construct the pumping plant in connection with the drainage of 5000 acres of land, by Yakima County and the government. Bids for machinery will be asked for shortly.

Ferry Slip Extension—Seattle, Wash.—The Port of Seattle, J. R. West, Ch. Engr., is having plans prepared for a 100-ft. extension of the West Seattle ferry slip, at the foot of Marion Street. Preliminary plans have been completed. The estimated cost is $20,000.

+Vessel—Seattle, Wash.—The contract for converting the steamer "Dirigo" into an oil burner for the Alaska line has been awarded to the COMMERCIAL BOILER WORKS, at $30,000.

+Fire Protection System—Seattle, Wash.—The contract for fire protection in the Hanford St. storage shed has been awarded to the AUTOMATIC SPRINKLER CO., at $15,583.

Vessel—Seattle, Wash.—The Puget Sound Navigation Co. is having plans prepared for a geared turbine, 24-knot passenger boat.

Dock Reconstruction—Seattle, Wash.—The Grand Trunk Pacific Steamship Co., whose dock was recently destroyed by fire, is having plans prepared for its reconstruction. It will be two stories, slow burning, with corrugated iron exterior. The estimated cost is $75,000.

Escalators—Seattle, Wash.—The City Council plans to install escalators on Seneca St., between Second and Fourth Ave. Estimated cost, $20,000.

+Dredging—Tacoma, Wash.—Pierce and King Counties have awarded the contract for dredging the Puyallup River, to CROSS, ROLLINS & CO., Seattle, at $250,000. Noted Sept. 17.

+Drainage—Walla Walla, Wash.—The Commissioners of Walla Walla County have awarded the contract for the construction of a drainage system in District No. 2, to HANS PEDERSON, Seattle, at about $39,375. J. W. Sweazy is County Clk. Noted Oct. 22.

Railway Terminal—The Dalles, Ore.—The Oregon-Washington Ry. & Navigation Co. plans to install freight terminal facilities and a 30-engine roundhouse, at an estimated cost of $140,000. J. D. Farrell, Portland, Ore., is Pres.

+Wharves and Bulkhead—Richmond, Calif.—The contract for the construction of wharves and a bulkhead in the Ellis Landing Ship Canal has been awarded to the PACIFIC CONSTRUCTION CO., at $60,000 Haviland & Tibbetts, San Francisco, are Engrs.

Drydock—[illegible] It will be [illegible] ft. long and [illegible] ft. wide.

♦Pier—[illegible] exhibition grounds, [illegible]

♦Creek Improvement—[illegible] Noted [illegible]

Pavilion Repairs—[illegible] The estimated cost is $[illegible]

♦Coal Handling Plant—[illegible] The contract for [illegible] & CO., Chicago, Ill., at $[illegible]

Fire Stations—[illegible] Plans are being prepared and bids will be received in the near future for the construction of two fire stations. The estimated cost is $75,000. [illegible] Archs.

BUILDINGS

♦Fall River, Mass.—The contract for the construction of a [illegible] has been awarded to [illegible] New York, N. Y. The estimated cost is $[illegible]

♦Pittsfield, Mass.—The contract for the construction of the [illegible] school has been awarded to [illegible] Noted Nov. [illegible]

♦Pawtucket, R. I.—The contract for the construction of the [illegible] for the New York, New Haven & Hartford R.R. has been awarded to [illegible] CO., [illegible] The estimated cost is $[illegible] Noted Nov. [illegible]

Bridgeport, Conn.—[illegible] Archs., [illegible] The estimated cost is $[illegible] Noted [illegible]

♦Derby, Conn.—The contract for the construction of the [illegible] has been awarded to MAX M. [illegible] at $[illegible] Noted Sept. [illegible]

Geneva, N. Y.—[illegible] Archs., [illegible] are preparing plans for the construction of a moving-picture theater on [illegible] St., for T. H. Sweeney & Son [illegible] The estimated cost is $[illegible]

Hornell, N. Y.—[illegible] Arch., [illegible] Lafayette Ave., Buffalo, N. Y., is preparing plans for the construction of a three-story [illegible] on Main St. The estimated cost is $[illegible]

♦Hudson, N. Y.—[illegible] Bids will be received until [illegible] by the Board of Managers, New York State [illegible] Hudson, for the [illegible] work and electric [illegible] at the New York State Training School for Girls, Hudson, N. Y. For details see advertisement under "Proposals Invited." Noted Nov. 12.

Jamestown, N. Y.—[illegible] The estimated cost is $[illegible]

Lake George, N. Y.—[illegible] New York, are preparing plans for [illegible] The estimated cost is $[illegible]

New York, N. Y.—[illegible] The estimated cost is $[illegible]

New York, N. Y.—[illegible] Bids will be received [illegible] by the Board of Trustees, Bellevue [illegible]

New York, N. Y.—[illegible]

BARGE CANAL WORK, ALBANY, N. Y.

[illegible]

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Yonkers, N. Y.—The lowest bidder received for the construction of the Y. M. C. A. building at Riverdale Ave. and Hudson St., was that of George T. Kelly, 20 John St., Yonkers, at $122,268 Noted Nov. 12.

George Howard Chamberlain, Arch., 18 South Broadway, is preparing plans for the four-story brick high school, for the Board of Education.

Atlantic City, N. J.—The City Commissioners are considering the construction of a convention hall on Albany Ave. The estimated cost is $100,000.

Belleville, N. J.—Charles Granville Jones, Arch., 280 Broadway, New York, has completed plans for the high school on Washington Ave. and Holmes St., for the Board of Education. The estimated cost is $105,000.

✚**Englewood, N. J.**—The metal work contract for two brick and terra cotta additions to the Englewood Hospital, has been awarded to DANIEL McGRATH, 185 Moore St., Hackensack, N. J.

Jersey City, N. J.—Bids are being received by E. C. Horn, Sons, Archs., 1476 Broadway, New York, for alterations to the theater and dance hall at 57 Newark Ave., for the Hill Arcade Realty Co., 75 Montgomery St. The estimated cost is $80,000.

Secaucus, N. J.—Joseph Lugosch, Arch., Kossuth St., Union Hill, is preparing plans for the county penitentiary to be erected at Snake Hill, Hudson County, N. J.

✚**Spring Lake Beach, N. J.**—The contract for the addition to the Monmouth Hotel, has been awarded to HORACE H. MOORE, Spring Lake Beach, at $100,000.

Johnstown, Penn.—Kenneth M. Murchison, Arch., 101 Park Ave., New York, is preparing plans for the construction of a station at Johnstown, for the Pennsylvania R.R. The estimated cost is $100,000.

★**Swatara Station, Penn.**—(Official)—Bids will be received by the Board of School Directors of Swatara Township, Dauphin County, Penn., for a duly authorized school bond issue of $17,000. John M. Erb is Secy., Harrisburg, Penn.

Monroe, La.—Bids will be received until 8 p.m., Dec. 15, by the Young Men's Hebrew Association, for constructing the temple for the Congregation of Bnai Israel.

Cincinnati, Ohio—Bids will be received until noon, Dec. 1, by Daniel Lawrence, University of Cincinnati, for the construction of the chemistry building. Estimated cost, $175,000. Tietig & Lee, Lyric Bldg., Cincinnati, are Archs. Noted Oct. 8.

✚**Cleveland, Ohio**—The contract for the construction of a six-story and basement, 71x149-ft. store building for the Tyroller Realty Co., has been awarded to ROY BLACK, 605 Sincere Bldg. Estimated cost, $200,000. Noted Sept. 10.

✚The contract for the construction of a six-story and basement, 100x185-ft. building on Euclid Ave. near East 14th St., for the Lindner Co., has been awarded to the CROWELL, LUNDOFF & LITTLE CO., 1957 East 55th St., Cleveland. Estimated cost, $400,000.

The Euclid Leasehold Assessment Co. plans the construction of a $75,000 building at 2018-2020 Euclid Ave. The construction will start in the spring.

✚**Columbus, Ohio**—The contract for the construction of a building on East Broad St., for the First Church of Christ, has been awarded to J. W. HECKART. The estimated cost is $80,000.

East Cleveland, Ohio—S. Deckelbaum, 2350 East 30th St., Cleveland, plans the construction of two apartment buildings at Superior Ave. and Forest Hill Rd. Estimated cost, $50,000.

Rocky River, Ohio—Steffens & Steffens, Archs., 1028 Williams Bldg., Cleveland, are preparing plans for the construction of a ten-story and basement, 50x125-ft. store building for Mathews & Gilbert Co., 911 Williams Bldg., Cleveland. Estimated cost, $100,000. Construction will begin in the spring.

✚**Detroit, Mich.**—The contract for the construction of a ten-story and basement store building for David Stott, of the David Stott Milling Co., Detroit, has been awarded to JAMES BLACK CONSTRUCTION CO., 212 West Washington St., Chicago, Ill. Estimated cost, $150,000. Marshall & Fox, 38 South Dearborn St., Chicago, Ill., are the Archs.

Chicago, Ill.—Regelin, Jenson & Co. has purchased a site for a syndicate which plans the construction of a 140x150-ft. apartment house on North Clark St. and Rogers Ave. Estimated cost, $175,000.

East St. Louis, Ill.—The Board of Education contemplates constructing a high school with a gymnasium on Ninth St. and Ohio Ave. Estimated cost, $200,000. D. Walton Potts is Supt. of the East St. Louis public schools.

Milwaukee, Wis.—Oscar Brachman plans to construct an apartment house on La Fayette Pl. and Summit Ave. Estimated cost, $50,000.

STATE HIGHWAYS, CALIFORNIA

Bids were received, Nov. 9, by the State Highway Commission, Sacramento, Calif., for constructing state highways in Glenn, Colusa, Imperial and Solano Counties, from (A) Fred Leffler, San Francisco; (B) Petersen & Grier, San Francisco; (C) Tieslau Bros., San Francisco; (D) P. L. Burr, San Francisco; (E) C. W. Cross, Oakland; (F) Chico Construction Co., Chico; (G) P. H. Hoare, Oakland; (H) Rochelt, Kearney & Co., Los Angeles; (I) Bates, Borland & Ayer, Oakland; (J) E. T. Johnson, Portland, Ore.; (K) A. W. Gorrill, San Francisco; (L) W. F. Callahan & P. L. Hendrick, El Centro; (M) Rice & Dutcher, Imperial; (N) Brashear-Burns Co., Los Angeles; (O) J. W. Calback, San Diego; (P) Conmary-Peterson Co., Inc., San Francisco. The item bids were as follows:

Imperial County	L	M	N	O
19,300 cu.yd. excavation, without classification	$0 30	$0 72	$0 45	$0 50
104 lin.ft., 18-in. corrugated iron pipe	0 45	0 70	0 80	0 60
52 lin.ft., 24-in. corrugated iron pipe	0 70	1 00	0.90	0 70
38 lin.ft., 30-in. corrugated iron pipe	1 00	1.50	0.95	0.80
25 cu.yd. concrete, class B, for culverts and monuments	9 50	13 00	11 00	8.00
11,500 cu.yd. concrete, class B, for pavement	4.90	4 95	5 99	5.75
1200 lin.ft. guard rail	0.55	0.55	0.75	0 50
124 monuments	0.60	1 50	1 00	0 60
Extended totals	$63,233	$72,174	$79,035	$76,779

Solano County	A	C	D	G	I	K	P
20,000 cu.yd. excavation, without classification	$0 75	$0 80	$0 60	$0.65	$0.69	$0 95	$0 75
200 lin.ft., 12-in. corrugated iron pipe	0 50	0 60	0 55	0 30	0.50	0 55	0.50
72 lin.ft., 18-in. corrugated iron pipe	0 75	0.75	0 70	0 40	0 60	0 65	0.75
120 lin.ft., 24-in. corrugated iron pipe	1 00	1 00	0.85	0 60	0 75	0 80	1.00
24 lin.ft., 36-in. corrugated iron pipe	1 50	1 50	1 00	0 80	0.75	1 00	1.50
100 cu.yd. concrete, class B, for culverts and monuments	10 00	11 00	9 50	11 50	10.00	10 00	11 00
8100 cu.yd. concrete, class B, for pavement	3 75	3 75	3 60	3.15	3 70	3 29	4 00
1050 lin.ft. guard rail	0 50	0 40	0 35	0.40	0 40	0 35	0 50
92 monuments	0 50	1 50	1 00	1 00	3 00	1.50	1 50
Extended totals	$47,256	$48,363	$42,832	$40,357	$45,717	$47,431	$49,473

Glenn County	A	B	C	D	E	F	G	H	I	J
22,000 cu.yd. excavation without classification	$0 75	$0.71	$0.75	$0 65	$0 60	$0.55	$0.75	$0 60	$0.73	$0.60
240 lin.ft., 18-in. corrugated iron pipe	0.75	0.60	0.75	0 60	0.35	0 90	0 45	0.50	0.60	0 50
264 lin.ft., 24-in. corrugated iron pipe	1.50	0.80	1 00	0.75	0.40	1.10	0.60	0.55	0.75	0.50
360 cu.yd. concrete, class B, for culverts and monuments	10.00	11 00	10.00	9 00	9 00	9 00	10.00	8 00	10.00	9 00
8400 cu.yd. concrete, class B, for pavement	3.10	3.50	3 50	3 31⅓	2 80	3.00	3 50	2 85	3.75	3 10
1500 lin.ft. guard rail	0.50	0 40	0.40	0.35	0.40	0.40	0.40	0.40	0.40	0.40
64 monuments	1.00	1 00	1.50	0.90	1.00	1.25	1.50	0.50	3.00	1 25
Extended totals	$47,530	$49,999	$50,640	$40,311	$40,814	$41,726	$50,462	$40,917	$52,294	$43,412

Colusa County	B	C	D	E	H	I	J	K
37,500 cu yd. excavation without classification	$0 65	$0 70	$0 55	$0.68	$0 60	$0 59	$0 60	$0 67
120 lin.ft., 12-in. corrugated iron pipe	0 40	0 60	0 50	0 30	0 40	0 50	0 40	0 60
216 lin.ft., 18-in. corrugated iron pipe	0 60	0 75	0 65	0 35	0 50	0 60	0 50	0.60
48 lin.ft., 24-in. corrugated iron pipe	0 80	1 00	0 80	0 40	0 55	0 75	0.75	0.80
150 cu.yd. concrete, class B, for culverts and monuments	12 00	12 00	10 50	9 00	8 00	10 00	10 00	11.00
8600 cu.yd. concrete, class B, for pavement	4 20	3 95	4 05	2 85	3 20	3 70	3.35	3.62
10,000 lin ft. guard rail	0 40	0.40	0 30	0.35	0.40	0.30	0.40	0.35
71 monuments	1 00	1 50	1 25	1 00	0 50	3 00	1.25	1 50
Extended totals	$66,582	$66,409	$60,358	$55,061	$55,438	$58,884	$57,091	$61,754

BARGE CANAL WORK, ALBANY, N. Y.

Contract G

Bids were received by Duncan W. Peck, State Supt. Pub. Wks., Nov. 10, for Contract G, Cayuga and Seneca Canal, for lock gates, lock valves and buffer beams for Locks 2, 3 and 4; needle beam for the spillway in Dam 2; superstructure for gates at Waterloo and guard gates at Locks 3 and 4, from (A) Penn Bridge Co, Beaver Falls, Penn.; (B) J. J. & J. B. Millholland Co., Pittsburgh, Penn.; (C) Larkin & Sangster, Seneca Falls; (D) Lupfer & Remick, Buffalo; (E) Whitehead & Kales Iron Works, Detroit, Mich.; (F) Sherman Stalter Co., Cleveland, Ohio. The item bids were as follows:

CONTRACT G

	A	B	C	D	E	F
221 M ft. b.m. dimension lumber in lock gates	$115.00	$108.00	$130.00	$120.00	$100.00	$110.00
22.4 M ft. b.m. yellow pine sawed lumber	65 00	71.00	65.00	65.00	65.00	60.59
127 cu.yd. second-class concrete	10.80	12.50	8.00	9.00	9 00	9.00
836,000 lb. structural steel	0.054	0.0438	0.054	0.04½	0.049	0.046
14,000 lb. metal reinforcement	0.03	0.0256	0.03	0.03	0.03	0.03
382,000 lb. machinery	0.107	0.1140	0.11¼	0.10½	0.09¾	0.10
278,000 lb. c.-i. counter-weights and keys	0.03	0.0346	0.03	0.007	0.029	0.026
Installing electrical equipment and testing	300.00	800.00	300.00	300.00	300.00	300.00
Extended totals	$123,921	$119,588	$128,981	$110,115	$112,290	$112,012

St. Paul, Minn.—[illegible] for the construction of [illegible] St., between [illegible].

The [illegible] contemplates the construction of a [illegible] building on the [illegible] of [illegible] Ave. and [illegible] St.

[illegible], Arch., is preparing plans for the construction of a [illegible] on [illegible] Ave., between [illegible] and [illegible] Ave., for D. C. McKenna, Lake City, [illegible]. Estimated cost, [illegible].

Bozeman, Mont.—The following bids were received for the construction of the Y. M. C. A. building: H. O. Kennedy [illegible]; [illegible], Great Falls, Mont., [illegible]; [illegible], Missoula, Mont., [illegible]; [illegible], Billings, Mont., [illegible]; F. L. [illegible], Bozeman, Mont., [illegible]. Noted [illegible].

St. Joseph, Mo.—[illegible] The contract for the construction of [illegible] will be awarded [illegible] 1, 1915. [illegible], St. Joseph, are Archs. Noted Nov. 12.

St. Louis, Mo.—[illegible] plans the construction of a [illegible] building at [illegible] and Locust St., estimated to cost [illegible]. The building will be used as the ticket offices for the Wabash, Missouri Pacific, Missouri, Kansas & Texas and the Chicago, Burlington & Quincy railways.

St. Louis, Mo.—The St. Louis Art League contemplates constructing a [illegible] at an estimated cost of [illegible].

Austin, Tex.—[illegible] plans the construction of a [illegible] on [illegible] Ave. [illegible] Chicago, Ill., is Arch. Noted [illegible].

✦**San Antonio, Tex.**—The contract for the construction of the [illegible] hospital has been awarded to J. R. DAVIS. The estimated cost is [illegible]. Noted [illegible].

Oklahoma City, Okla.—Bids will be received, until Dec. 17, by the State Capitol Commission, for the construction of the [illegible] of the state capitol. Estimated cost, $1,[illegible],000. Noted [illegible].

Fresno, Calif.—[illegible], Arch., is preparing plans for the construction of a four-story brick and steel hotel for [illegible], San Francisco. The estimated cost is [illegible].

Owensmouth, Calif.—The Owensmouth Union High School [illegible] of a [illegible] school. M. A. [illegible] is President of the District Trustees. J. C. [illegible] Bldg., Los Angeles, is Arch.

Rio Vista, Calif.—Henry C. Smith, Arch., is preparing plans for the [illegible] of a [illegible] school at Rio Vista.

San Francisco, Calif.—Plans are being prepared by [illegible] & [illegible], Archs., for the construction of a four-story and [illegible]-ft. apartment house on Mason St., for [illegible]. Estimated cost, [illegible].

TWIN PEAKS TUNNEL, SAN FRANCISCO, CALIF.

✦Bids for the construction of Twin Peaks Tunnel were received by the Board of Public Works, San Francisco, Oct. [illegible]. This was the third time that proposals were invited. On the first occasion, due to the size of the bond required by the city, there were no bidders. The contract was readvertised, Sept. [illegible] being the date set for receiving proposals. The only one submitted was that of Hans Pederson, who offered to do the work for $3,[illegible]. In his bid, however, Mr. Pederson did not comply with the terms of the city charter, which provides that there can be no alterations or interlineations in the "Form of Proposal" furnished to bidders with the specifications. The proposal was therefore rejected and Oct. 28 set as the date for opening new bids. Bids were received from (A) ROBERT C. STORRIE & CO. (awarded contract), (B) McArthur Bros., (C) Hans Pederson, (D) Twohy Bros. Co. The item bids were as follows:

	A	B	C	D
[illegible] ft. earth ([illegible] ft. wide x [illegible] ft. [illegible] high in the clear)	[illegible]	$[illegible]	$[illegible]	$[illegible]
[illegible] ft. soft rock (25 ft. wide x 22 ft. [illegible] high in the clear)	[illegible]	215.00	[illegible]	[illegible]
[illegible] ft. hard rock (25 ft. wide x 21 ft. [illegible] high in the clear)	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] ft. [illegible] ft. 6 [illegible] section	[illegible]	[illegible]	[illegible]	[illegible]
1 [illegible] ft. flat top section	[illegible]	320.00	[illegible]	[illegible]
1 [illegible] ([illegible] ft.)	[illegible]	61,[illegible]	[illegible]	[illegible]
1 [illegible] approach	[illegible]	[illegible]	21,000.00	26,000.00
1 retaining wall [illegible] 17th St.	[illegible]	[illegible]	37,[illegible]	[illegible]
1 [illegible] Valley station	120,000.00	1[illegible]2,700.00	1[illegible]2,[illegible]	1[illegible],000.00
1 [illegible] intake station (18th St.)	[illegible]	[illegible]	7,[illegible]	7,000.00
1 [illegible] intake station (relief house)	15,[illegible]	30,000.00	[illegible]	[illegible]
1 Laguna Honda station	225,[illegible]	[illegible]2,000.00	[illegible]	[illegible]
1 westerly portal	11,[illegible]	16,[illegible]	7,[illegible]	[illegible]
1 drain for tunnel (18th St. to Douglass St.)	2,[illegible]	3,[illegible]	[illegible]	[illegible]
1 [illegible] Corbett grand St.	2,[illegible]	2,7[illegible]	2,[illegible]	2,1[illegible]
Extended totals	$3,[illegible]72,[illegible]	$3,[illegible]	$3,[illegible]	$3,[illegible]

CATSKILL AQUEDUCT, NEW YORK, N. Y.

Moodna Siphon

✦Bids were received by the Board of Water Supply, Nov. 18, for [illegible] constructing the Moodna Siphon [illegible] shafts and tunnel of the Catskill Aqueduct in Cornwall, N. Y. [illegible]: (A) [illegible] DANIELS CO., Woolworth Bldg., New York (awarded contract); (B) T. A. Gillespie Co., [illegible], New York; (C) Mason & Hanger Co., Van Cortlandt Park, New York; (D) Pittsburgh Contracting Co., [illegible], New York; (E) J. F. [illegible] Co., Woolworth Bldg., New York; (F) Holbrook, Cabot & Rollins Corporation and George B. Fry, 331 Madison Ave., New York; (G) Snare & Triest Co., Woolworth Bldg., New York; (H) Degnon Contracting Co., [illegible] East [illegible] St., New York; (I) Dravo Contracting Co., Diamond Bank Bldg., Pittsburgh, Penn.; (J) Smith, Hauser & Maclsaac, [illegible] East [illegible] St., New York. The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Unfilled Tonnage—From the monthly unfilled tonnage report of the United States Steel Corporation it shows a total of unfilled orders on the company's books as of Oct. 31, aggregating 3,461,097 tons. This represents a decrease of 326,570 tons for the month.

The following tables gives the unfilled tonnage of the United States Steel Corporation by the months since June 30, 1910, together with tonnage at close of each quarter from June 30, 1902:

Oct. 31, '14	3,461,097	Mar. 31, '11	3,447,301
Sept. 30, '14	3,787,667	Feb. 28, '11	3,400,543
Aug. 31, '14	4,213,331	Jan. 31, '11	3,110,919
July 31, '14	4.159,589	Dec. 31, '10	2,674,757
June 30, '14	4,032,857	Nov. 30, '10	2,760,413
May 31, '14	3,998,160	Oct. 31, '10	2,871,949
Apr. 30, '14	4,277,068	Sep. 30, '10	3,156,106
Mar. 31, '14	4,653,825	Aug. 31, '10	3,537,128
Feb. 28, '14	5,026,440	July 31, '10	3,970,931
Jan. 31, '14	4,613,680	June 30, '10	4,257,794
Dec. 31, '13	4,282,108	Mar. 31, '10	5,402,514
Nov. 30, '13	4,396,347	Dec. 31, '09	5,927,031
Oct. 31, '13	4,513,767	Sep. 30, '09	4,796,833
Sep. 30, '13	5,003,785	June 30, '09	4,057,939
Aug. 31, '13	5,223,468	Mar. 31, '09	3,542,595
July 31, '13	5,399,316	Dec. 31, '08	3,603,527
June 30, '13	5,807,317	Sep. 30, '08	3,421,977
May 31, '13	6,324,432	June 30, '08	3,313,876
Apr. 30, '13	6,978,762	Mar. 31, '08	3,765,343
Mar. 31, '13	7,468,956	Dec. 31, '07	4,624,552
Feb. 28, '13	7.656,714	Sep. 30, '07	6,425,008
Jan. 31, '13	7,827,368	June 10, '07	7,603,878
Dec. 31, '12	7,932,164	Mar. 31, '07	8,043,858
Nov. 30, '12	7,852,883	Dec. 31, '06	8,489,719
Oct. 31, '12	7,594,381	Sep. 30, '06	7,936,884
Sep. 30, '12	6,551,507	June 30, '06	6,809,859
Aug. 31, '12	6,163,375	Mar. 31, '06	7,018,712
July 31, '12	5,957,079	Dec. 31, '05	7,605,086
June 30, '12	5,807,346	Sep. 30, '05	5,865,377
May 31, '12	5,750,983	June 30, '05	4,820,655
Apr. 30, '12	5,664,885	Mar. 31, '05	5,579,560
Mar. 31, '12	5,304,841	Dec. 31, '04	4,696,203
Feb. 29, '12	5,454,200	Sep. 30, '04	3,027,436
Jan. 31, '12	5,379,721	June 30, '04	3,192,277
Dec. 31, '11	5,084,761	Mar. 31, '04	4,136,961
Nov. 30, '11	4,141,955	Dec. 31, '03	3,215,123
Oct. 31, '11	3,694,328	Sep. 30, '03	3,278,742
Sep. 30, '11	3,611,317	June 30, '03	4,666,578
Aug. 31, '11	3,695,985	Mar. 31, '03	5,410,719
July 31, '11	3,584,085	Dec. 31, '02	5,347,523
June 30, '11	3,361,093	Sep. 30, '02	4,843,007
May 30, '11	3,113,187	June 30, '02	4,791,993
Apr. 30, '11	3,218,704		

Idle Equipment—From the most recent report of the American Railway Association it shows that there was a net surplus of 170,096 freight cars on the railroads of the United States and Canada on Nov. 1, 1914, compared with 151,982 Oct. 1, 1914.

The following table shows the comparative conditions of freight traffic on the railroads at various periods within the past year:

1914—	Surplus	Shortage	Net Surp.
Nov. 1	172,325	2,229	170,096
Oct. 15	154,342	2,360	151,982
Oct. 1	133,382	2,355	131,027
Sept. 15	138,108	2,059	136,049
Sept. 1	165,244	1,918	163,326
Aug. 15	174,260	2,115	172,145
Aug. 1	198,998	2,333	196,665
July 15	228,384	1,843	226,541
July 1	220,875	1,333	219,545
June 15	232,994	660	232,334
May 31	242,572	770	241,802
May 15	239,406	764	238,642
May 1	230,533	1,654	228,879
Apr. 15	213,324	455	212,869
Apr. 1	141,525	2,013	139,512
Mar. 15	132,010	7,145	124,865
Mar. 1	159,480	5,573	153,907
Feb. 14	199,385	2,333	197,052
Feb. 1	211,960	2,282	209,678
Jan. 15	217,274	2,385	214,889
Jan 1	190,521	1,671	188,850
1913—			
Dec. 15	107,513	5,698	101,545
Dec. 1	67,446	10,212	57,234
Nov. 15	46,059	23,407	22,652
Nov. 1	38,276	40,118	*1,842
Oct. 15	37,198	41,994	*6,048
Oct. 1	41,994	31,620	10,374

*Net shortage.

The fact that there is a comparative shrinkage in the demand for freight capacity on Nov. 1 this year of over 170,000 cars compared with the net shortage of 1842 cars at the same part of last year speaks for itself in viewing relative conditions of business in domestic lines.

Steel Company to Expand—The Wickwire Steel Co., Tonawanda, N. Y., proposes to extend its manufacturing by building a new billet mill and mills for rolling rods and wire. The company will also join with the Cement-Solvay Co., Syracuse, N. Y., in the construction of by-product coke ovens. The Wickwire Steel Co. has just filed a mortgage for $2,500,000 to provide funds for this work. It is expected that construction work will start next spring on the steel plant and coking ovens. An expenditure of $1,500,000 is being made at this time.

The Firth-Sterling Steel Co., Pittsburgh, Penn., has recently received an order from the allied forces of Europe for 20,000 three-inch, 10,000 six-inch and 5000 eight-inch shells. This is one of the largest orders booked since the beginning of the war. It is reported that some larger projectiles have been ordered from the same company.

The MacArthur Concrete Pile & Foundation Co. has appointed Douglas-Milligan Co. as its Sales Agents for Eastern Canada, with main office in the New Birks Bldg., Montreal and branch office at 95 King St., East, Toronto. The company is also equipped to construct foundations for all sorts of structures where unfavorable soil conditions are encountered. It has already done a large amount of this work both in Canada and the United States.

The MacArthur Concrete Pile & Foundation Co. has sold the patent rights to drive the Pedestal Pile in Japan to the Oriental Compressol Co., Tokio, Japan. The reputation of this important form of concrete piling is recognized by progressive Japanese engineers and contractors and this purchase emphasizes anew the spirit of enterprise and advancement of the Japanese people.

Packing Goods for Export—Probably no subject has been reiterated more by government officials and the press than that of proper packing for export. It would seem as though American manufacturers had grasped the situation by this time but evidently they have not. The following letter from Mr. Hood, the representative of "Engineering News" in South America, written from Callao, Peru, again brings this subject to the attention of manufacturers:

"I previously called attention to the carelessness of American shippers in the matter of packing. I want to reiterate that American shippers send their goods here in **crates** while foreign shippers enclose them in **boxes**.

"Americans use 1-in. and 1¼-in. material while foreigners use 2-in. and 2½-in. lumber and their boxes are reënforced by heavy cross-braces, screwed in, and the whole protected by bands of sheet iron on exposed edges.

"It will be useless for us to create a market here if shippers do not pack their goods as described. The reason for this is that there are few harbors here and unloading is effected by transferring to lighters in heavy seas.

"The fault lies with the big shipper as well as small, and it is a wonder we have any trade here at all. Here are two instances in Quito, vouched for by Mr. Chas. S. Hartman, the American Minister to Ecuador.

"1st. The Quito Electric Light & Power Co. bought seven motors from one of the largest, if not the largest, manufacturers in the United States. These motors arrived in Quito absolutely bare of any crate or other protecting material.

2d. Senor Monje ordered laundry machines from the United States and they arrived in Quito, in flimsy crates, broken in 9 places. As the broken parts cannot be made in this country, the machines are absolutely useless. Senor Monje emphatically declared that under no circumstances will he buy anything further from the United States."

CATALOG NOTICES

The Wyoming Shovel Works, Wyoming, Penn. Catalog. Wyoming-Mayari steel shovels. Illustrated, 32 pp. 3½x6½ in.

Ingersoll-Rand Co., 11 Broadway, New York. Form No. 4033. "Little Tugger" air hoist. Illustrated, 8 pp., 6x9 in. Form No. 8013. "Little David" pneumatic chipping, calking and scaling hammers. Illustrated, 12 pp., 6x9 in. Form No. 8207. "Little David" pneumatic drills. Illustrated, 36 pp., 6x9 in.

Sprague Electric Works, 527-531 W. 34th St., New York. Bulletin No. 48,700. Monorail cranes. Illustrated, 48 pp., 8x10½ in. Bulletin No. 48,701. Electric dynamometers. Illustrated, 24 pp., 8x10½ in.

Link-Belt Co., Philadelphia, Penn. Book No. 158. Locomotive cranes. Illustrated, 38 pp., 8½x11 in.

W. E. Caldwell Co., Inc., Louisville, Ky. Catalog. Tanks and towers. Illustrated, 40 pp., 6x8½ in.

Goldschmidt Thermit Co., 90 West St., New York. Pamphlet No. 16. "The Thermit Process of Pipe Welding." Illustrated, 24 pp., 6x9 in. Pamphlet No. 39. Thermit insert fully welded rail joint. Illustrated, 4x9 in.

American Vanadium Co., Vanadium Building, Pittsburgh, Penn. Catalog. Vanadium rails. Illustrated, 24 pp., 6x9 in.

National India Rubber Co., Bristol, R. I., Catalog. Aërial and underground railroad signal wires and cables. Illustrated, 30 pp., 6x9 in.

Milwaukee Locomotive Mfg. Co., Milwaukee, Wis. Publication No. 104. Gasoline locomotives. Illustrated, 40 pp., 7x10 in.

United Iron Works Co., Springfield, Mo. Catalog. Turner combination drag line ditcher and shovel. Illustrated, 22 pp., 7x10 in.

American Blower Co., Detroit, Mich. Bulletin No. 27. Sirocco heating, ventilating and cooling system at the Ford Motor Company's plant. Illustrated, 16 pp., 8½x11 in.

General Electric Co., Schenectady, N. Y. Bulletin No. 44,003. Modern electric railway apparatus. Illustrated, 30 pp., 8x10½ in. Bulletin No. 44,300. Gas-electric motor cars and locomotives. Illustrated, 8 pp., 8x10½ in. Bulletins Nos. 44,403 and 44,405. Railway motors. Illustrated. 8x10½ in. Bulletin No. 46,018. Portable voltmeter, type P-8. Illustrated, 8x10½ in.

Atlas Engineering Co., Milwaukee, Wis. Catalog. Concrete mixers. Illustrated, 30 pp., 7x10 in.

Contracts to Be Let

Bids received until Dec. 21, 1914

Construction of a Bridge on the Rosedale Section of the Bloor Street Viaduct

Toronto, Ontario.

Tenders will be received by registered post only, addressed to the [illegible] of the Board of Control, City Hall, Toronto, Canada, up to noon on Monday, December 21st, 1914, for constructing across the Rosedale Valley a Bridge 86 feet wide, consisting of [illegible] steel [illegible] spans with piers and [illegible], the length being approximately five hundred and eighty feet, and a retaining wall approximately one hundred and seventy feet long extending [illegible] from the bridge. Bidders [illegible] specifications including [illegible] and form of tender, [illegible] to the Commissioner of Works, Toronto, after paying to the Commissioner of Works twenty-five dollars for each set, this sum to be refunded upon return of plans. The Engineer's [illegible] will also be sent on request. [illegible] may be seen at the offices of the Commissioner of Works, Toronto, the Commercial Intelligence Department of the Board of Trade, London, England; The Engineering News, New York; Engineering and Contracting, Chicago; and [illegible], London, England.

Those desiring to submit tenders on reinforced concrete construction [illegible] without any expense whatsoever to the city, their own plans and specifications based on the loading given in the specifications for steel construction, and [illegible] on the steel. These tenders will be received up to noon on Monday, December 21st, 1914.

[illegible]

A deposit [illegible] of a certified cheque [illegible] of the amount of the tender [illegible] the City Treasurer [illegible]

[illegible]

The lowest or any tender not necessarily accepted.

[illegible]
Chairman Board of Control.
City Hall, Toronto, Nov. [illegible], 1914.

Bids received until Dec. 8, 1914.

Sewage Collecting System and Outfall Sewer

North Plainfield, N. J.

Sealed proposals for constructing a sewage collecting system and outfall sewer will be received by The Borough of North Plainfield, N. J., until 8 o'clock P. M., December the 8th, 1914. Proposals should be delivered to C. M. Dolliver, Borough Clerk, at the Borough Hall, Somerset St., North Plainfield, N. J., and may be either for Sewage Collecting System and Outfall Sewer, Contract No. 1, or Sewage Collecting System, Contract No. 2, or both separately.

Contract No. 1 comprises:

(a) About 11 miles of vitrified pipe sewers with bituminous joints, ranging from 8 to 24 inches in diameter.

(b) A small sewage pumping station.

(c) A 6-inch cast-iron force main about 1,600 feet long.

(d) A 24-inch outfall sewer approximately 1.1 miles in length, consisting partly of vitrified pipe and partly of concrete pipe.

Contract No. 2 comprises about 10.1 miles of vitrified pipe sewers with bituminous joints, ranging from 8 to 18 inches in diameter.

Proposals must be accompanied by a certified check on a National Bank or trust company for Twenty-five Hundred ($2,500.00) Dollars, for each contract bid upon.

The bidder to whom the contract is awarded will be required to execute same and furnish a surety bond in the sum of [illegible] per cent of the amount of the contract within ten days (Sundays excepted) after receiving official notice of the award. The bond shall be satisfactory to the Borough both as to form and surety. The Borough reserves the right to reject any or all bids.

Plans and specifications may be obtained from George W. Fuller, Engineer, 170 Broadway, New York, N. Y., upon depositing $[illegible], which will be refunded if said plans and specifications are returned in good condition within thirty days after bids have been received and acted upon by the said Borough.

Bids should be made on the Blank Form of Proposal bound with the specifications, and in case it is desired to bid on both contracts each bid should be made in a separate proposal.

C. M. DOLLIVER, Borough Clerk.

Bids received until Dec. 10, 1914.

Highway Work

[illegible] of the State Commission of Highways

Albany, New York, Nov. [illegible], 1914.

[illegible]

JOHN N. CARLISLE, Commissioner.
[illegible], Secretary.

Bids received until Dec. 9, 1914.

Somers Point - Longport Boulevard

Atlantic City, N. J.

[illegible]

The [illegible] is reserved to reject any or all bids.

[illegible] JEFFRIES
[illegible] Longport Road Committee.
[illegible]

Construction News

THE ALIEN LABOR CASE IN COURT

The Bricklayers & Masons Union has withdrawn its complaint filed with the Public Service Commission for the First District against the Dock Contractor Co., for alleged violation of the Labor Law.

John Gill, Business Agent of the union, had complained that this company, which has the contract for the new subway in Broadway between Bleecker St. and Union Sq., had been employing workmen who were not citizens of the United States, this being a violation of the Labor Law which states that only citizens may be employed on municipal work.

Upon the affidavit of W. V. McMenimen, Vice-Pres. and Gen. Mgr., of the Dock Contractor Co., that the company has not employed anyone but citizens since Nov. 7, Gill withdrew his complaint; but immediately filed another against the Underpinning & Foundation Co., a sub-contractor on the section of the Dock Contractor Co. The allegation against this company is the same as that previously made against the Dock Contractor Co.

William E. Heim, 1 Madison Ave., a taxpayer and employee of one of the subway contractors was granted an injunction by Judge Davis, restraining the Public Service Commission from holding up the vouchers of subway contractors pending a ruling by the courts.

THE NEW UNION STATION AT KANSAS CITY, MO.

The new union station at Kansas City, Mo., which was opened to traffic on Nov. 1, is shown in the accompanying cut.* The building is of Bedford stone, with trimming of gray granite and cast concrete blocks. The large central portion contains the main hall, 240x103 ft., 92 ft. high, with a semicircular ticket office having 24 windows. Around this hall are the various station facilities, and approaches to the restaurant and dining rooms in the right wing and to the baggage room in the left wing. Railway offices occupy the upper floors.

New Union Station, Kansas City

The waiting room, 350x78 ft., occupies a building behind the headhouse and extending across the tracks. Along each side of this is a broad corridor with stairways to the train platforms below, and the waiting room has a door at each stairway. Outgoing passengers pass through these doors, while incoming passengers pass along the corridors to the main hall. The top of the trainshed is about level with the street, as shown. A brief description of the new station and terminal was given in our issue of Oct. 29.

The building cost about $6,000,000, and the land, tracks, etc., about $6,000,000 more, while the total cost of the station, approaches, new belt line, etc., which are included in the new terminal works, represent over $40,000,000. The George H. Fuller Co. had the contract for the station. Jarvis Hunt was the Architect, and John V. Hanna is Chief Engineer of the Kansas City Terminal Ry.

Pointers on South American Trade—People who sell in South America should post themselves on the commercial law of the country with which they are dealing.

At a recent conference of manufacturers in Boston, the story was told of a representative of one of the leading makers of typewriters, who opened an office in the Argentine with a view to selling machines on long credit by means of the installment-lease system so much used in this country. He sold one machine on which he received several payments, but then got nothing for some months, despite his urgent correspondence. One day the machine in question was sent in for repairs. Very naturally it was held and the purchaser notified that it would not be returned until some arrangement was made respecting the balance due.

The next day the agent of the typewriter company found himself in jail. There he stayed until the efforts of the American consul and a promise never to do it again secured his release. It seems that in that country a sale is a sale; the property changes hands "for keeps," and no string can be tied to it.

Another fact of importance was brought out, that is, European transportation lines have a system of rebates calculated to make it difficult for Americans to break in. A contract is entered into by a merchant in South America by which he agrees to have all his imports come by a certain line, in consideration for which he is to have a 10% ocean-freight rebate, payable six months later. This is enough to make it advantageous for him to have goods from this country sent to Europe and reshipped by the transportation company with which he has the contract, instead of shipping direct from here.

Business Results of the War—Evidences are multiplying that the cutting off of supplies from Europe is stimulating the creation of new industries in this country. As a result of the stoppage of potash shipments from Germany, the Pittsburgh Industrial Development Commission has organized and incorporated a company, to be known as the Farmers' Fertilizer Co., having $1,000,000 capital. Seven acres of land have been purchased and the company will employ 100 men in manufacturing commercial potash under a patented process. It will make use of the slag from the Pittsburgh mills, which heretofore has been a waste material, by mixing it with Tennessee phosphate. Orders have come from the nations at war for supplies, such as clothing, ammunition and guns.

A Vermont manufacturer of ammunition has recently received an order for $2,500,000 worth of rifle cartridges for one of the belligerent powers. In order to handle this contract, rush orders for $250,000 worth of machinery have been placed.

Robert Pluym, representing Pluym-Ochs, Ltd., Petrograd, in an interview at the offices of the American Express Co., 65 Broadway, New York, said that his firm was in the market for agricultural machinery, machine tools, and miscellaneous supplies. Russia, he said, had been spending yearly $500,000,000 for German goods, and that now the United States inevitably must get the bulk of this trade.

Municipal Bond Sales—A sharp falling off in municipal bond sales in November was reported by the "Financial Chronicle." They amounted to $12,779,800, compared with $30,708,700 in the corresponding month last year. The total sales this year aggregate $427,803,300, which is far larger than any previous year.

*Reproduced from a print made by the Teachenor-Bartberger Engraving Co., of Kansas City, Mo.

SCHENLEY HIGH SCHOOL, PITTSBURGH, PENN.

[illegible] Electric Co., Pittsburgh; [illegible] Lougheridge Engineering Co., Pittsburgh; [illegible] Commercial Construction Co., New York, N. Y.; [illegible] L. H. Nelson Co., Pittsburgh; [illegible] W. H. Ochiltree Co., Pittsburgh; [illegible] Morganstern Electric Co., Pittsburgh; [illegible] Electric Co., Pittsburgh; [illegible] Bids for the general construction were submitted by (A) Thomas Reilly Co., Pittsburgh; (B) [illegible] New York, N. Y.; (C) [illegible] Pittsburgh; (D) Henry Shenk Co., Pittsburgh; (E) [illegible], Philadelphia; (F) W. F. Trimble & Sons Co., Pittsburgh; (G) [illegible] Hogg Co., Pittsburgh; (H) Thompson-Starrett Co., Pittsburgh; (I) J. L. Stuart, Pittsburgh; (J) [illegible], Pittsburgh; (K) William [illegible], Cleveland, Ohio; (L) [illegible] Arch Co., New York, N. Y. The item bids were as follows:

Front Elevation of the Schenley High School, Pittsburgh

GENERAL CONSTRUCTION

	A	B	C	D	E	F	G	H	I	J	K	L
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$712,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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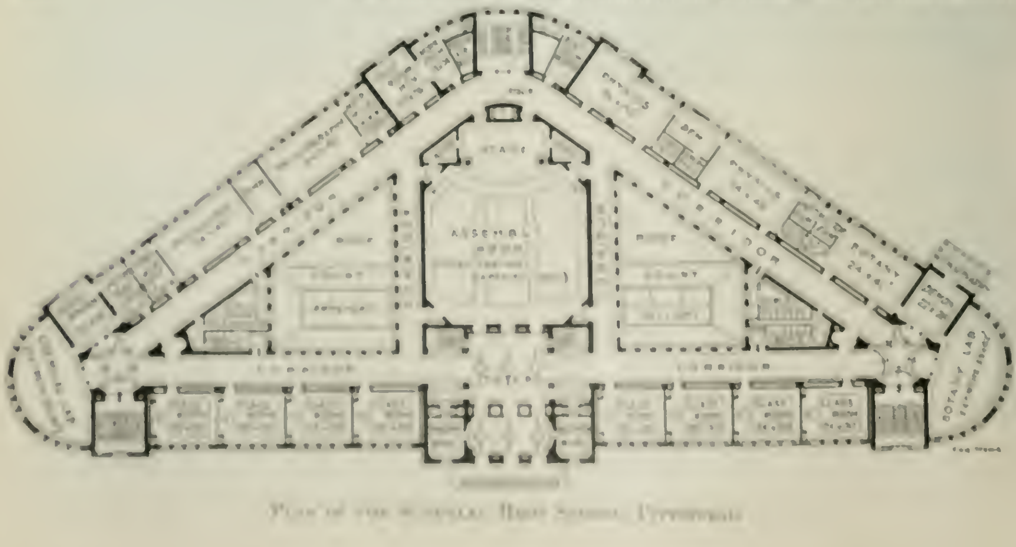
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



Plan of the Schenley High School, Pittsburgh

Prices of Engineering Materials

PRICE CHANGES AND THE BUSINESS OUTLOOK

Sentiment, the incentive which starts the mainspring of business, has decidedly improved. From all parts of the country come reports of a better feeling among manufacturers, distributors, and men conversant with the business situation. In many localities, improvement in business has already been seen, but this is by no means general, and in some cases the reverse is true. But there is a feeling that businss conditions will improve from now on, and in spite of the terrible happenings in Europe, this country can and must go on. Many new avenues of business have been looked into, but as yet only a little work has been done toward their development.

Of primary importance, so far as construction work is concerned, is the announcement that the Chicago, Milwaukee & St. Paul will immediately start on the electrification of 107 miles of its Mountain Division. This is the first important railway contract that has been let since the war, and emphasizes the advantage of working when material and labor are low.

Orders for munitions of war and supplies for the armies in Europe have been exceedingly large. Various estimates are given as to the total amount of these orders, but because of duplication and the impossibility of securing any real information until shipments are being made, it is out of the question to form any exact estimate as to their value. They undoubtedly will run into the hundreds of millions of dollars, and it would seem as though the stream of goods to Europe had only started.

Numerous factories have been built as a result of the war, chiefly by makers of munitions of war, but other manufacturers are making preparations to do an increased business. More attention is being paid to the manufacture of alloy steel and electrical steels than ever before, and laboratory experiments have been started on the manufacture of dye stuffs. There is no doubt that these materials can be made in the United States just as satisfactorily as abroad, if we only have to do it.

An announcement by the President of the United States that hereafter there will be more coöperation between the Government at Washington and the railroads, was received with delight. That the people are getting tired of a lot of regulations aimed at the railroads, is perhaps seen in the referendum vote repealing the Missouri Full Crew Law. During the last week in November, the Interstate Commerce Commission handed down a decision allowing rate increases in the West and in the South.

The iron and steel industry of the country is working at perhaps 30% of capacity. New orders are being received at about that rate. Stocks are not accumulating, and it is evident that prices are near bottom. Some exceedingly low quotations have been made for the delivery of fabricated material for use by the Isthmian Canal Commission, and cast-iron pipe is lower, perhaps, than before in a great many years. It is reported that the Pennsylvania R.R. bought cast-iron pipe for $17, delivered to lines of railway. The city of Boston recently purchased pipe at $19.70. Similar low quotations have been current in other branches of the trade.

It would seem as though this were a good time for municipalities to make improvements. Recently a small water works job was let, a job which would ordinarily cost $60,000 to $65,000, and there were 42 contractors who put in bids for the work. On a government job, more than one hundred sets of plans were requested. Contractors all over the country are anxious to do some kind of work, and perhaps too anxious for their own advantage. It would be better for some of them to stop work for a year or so rather than take contracts at figures where there can be no hope of a profit.

Contractors on the New York subway have been greatly disturbed by contemplated action under a 17-year-old law which had never been enforced. This alien labor clause, reference to which is made in another column, will not tie up the building of subways in the city, but may delay them somewhat for the next two or three months. It will be possible to secure enough laborers who have naturalization papers, even if the law is not declared unconstitutional. It must be pointed out that this is an especially good time to test such a law.

Building operations continue to fall off. In October they were about 70 per cent. of the corresponding month last year. In November they will be somewhat less. New building is restricted more by title companies' and the banks' refusals to lend, than anything else. At least two corporations have been organized in New York to buy up any real bargains in real estate.

Interest in shipbuilding is reviving. An announcement has been made that a $2,500,000 drydock will be built on the Pacific Coast, the Fore River shipbuilding plant at Quincy, Mass., will be enlarged, and there are inquiries in the steel market for about 20,000 tons of plates and shapes which will be required for coastwise vessels and vessels using the Panama Canal. More than three-quarters of a million tons' register of foreign vessels has been transferred to the American flag as a result of recent legislation.

Trading was resumed on the New York Stock Exchange on November 28 This applies to trading in bonds only, and these above a prescribed minimum limit. The Stock Exchange had been closed since July 30. It is interesting to note that about 78 stocks are now selling through the New York Stock Exchange Clearing House at prices above those recorded on July 30.

LABOR

Probably more men are unemployed in the City of New York than ever before in the history of the city, and those conversant with the situation fear there will be more unemployed this winter than ever before. This seems rather improbable. It is evident that business conditions are improving and will shortly take up in a large measure the great horde of unemployed. But this has no effect on labor unions, who continue to make demands for shorter hours and higher wages. A long forgotten law in New York prohibits the employment of any but citizens of the United States on public works. This, unless it is found unconstitutional, will throw out of employment a great number of excavators and other rough laborers, but the unions constantly say that there are 25,000 men in this city, who can do this work, but will be unwilling to work with a pick and shovel, or anything else for that matter, for less than $3 per day. Immigration is at about one-third of the normal rate. In September the number of aliens who entered this country was less than 30,000. During the first nine months of the year only 610,000 came to the United States, while in the fiscal year ending June 30, 1909, only 751,000 aliens came to the country. It is evident that there will be a thorough revamping of the immigration law aimed to keep out of this country Europeans who might come as a result of the great war. Wages are practically unchanged at $1.60 per day.

CEMENT, LIME AND BRICK

Cement—More than the usual cutting has been going on by the small manufacturers of cement, who are endeavoring to dispose of surplus stocks in the markets of New York and vicinity. These cuts range from 5 to 7½ cents, but no trustworthy evidence is forthcoming that the larger manufacturers have departed from their regular quotation of $1.58 New York. Production is being curtailed, and manufacturers are seeking to avoid the accumulation of any more stocks, during the winter months, than are necessary. There is a general note of optimism, however, and many feel that with the advent of spring conditions will show a material improvement. Prices in the West are unchanged from last month.

The quotations given below do not include the charge of 40 cents made for bags, but are for barrels of cement delivered at the points named, in cloth sacks less their charge:

Boston	$1.32	Chicago	$1.10
Cleveland	1.25	Detroit	1.14
Duluth	1.33	Jersey City	1.06
Minneapolis	1.30	New York	1.18
Pittsburgh	1.05	St. Paul	1.30

Lime—Business continues quiet and prices are unchanged; 97c. per barrel for state common, 200 lb. net; $1.37 for 300 lb. barrel; $1.55 for 300 lb. finishing; $1.10 for 200 lb. finishing; and $1.72 for 350 lb.

Brick—Prices are about the same as last month, shipments on the river much restricted. Prices are not so low as would be expected under the circumstances, as $5.25 is quoted for Hudson River Common.

IRON AND STEEL

Little change is shown in the iron market, compared with last month. While sentiment is more cheerful, actual business booked has not been much larger, and from the coke production, pig-iron output, and the operation at the mills, it can be seen that the steel industry is working at about 30% of its maximum capacity. The orders received by manufacturers in the last month include approximately that figure. It is well to point out at this time, while the orders from foreign nations for munitions of war have been large in point of dollars, they have not affected the steel industry greatly in point of tonnage. Interest is still centered in the outcome of the railway rate case, and it is believed on practically all sides that a new era is dawning, and one in which the blind antagonism to railways and big business will be at an end. Should the railways be in a position to release orders for immediate improvements, the iron trade would be greatly stimulated.

Pig-Iron—Toward the end of the month the pig-iron market brightened considerably, and sales of foundry grades from Buffalo furnaces aggregated fully 200,000 tons. Most of this business was taken by small foundries in New England and on the Atlantic Seaboard, but one concern, the American Radiator Co., purchased well over 100,000 tons. The price was attractive, and buying resulted in quotations of 25c. more per ton. Most of the furnaces in that district are now well sold up for the first quarter of 1915, and some of them have considerable business in the second quarter. In the Southern field prices are maintained at $10 per ton for No. 2 in Birmingham. The Steel Corporation has recently sold some foundry iron for delivery in Cincinnati, which includes several attractive lots. Southern foundry interests are somewhat busier. Some machine tool builders have been exceedingly active. The attractive prices at which pig-iron has been offered have stimulated activity in more than one line.

Quotations for pig-iron in lots of 100 tons or over at the points named are as follows: Cincinnati: Southern Foundry No. 2, $13.00 to $13.50; Northern Foundry No. 2, $14.25 to $14.75; Northern Foundry No. 3, $14.00 to $14.25.

In New York, iron is quoted as follows: No. 2-X Northern Foundry, $13.75 to $14.25; No. 2 plain Northern Foundry, $13.75; No. 2 Southern Foundry, delivered tidewater, N. Y., $14.25 to $14.50.

In Birmingham, Southern Foundry No. 2 is $10 to $10.25. Several sales have been made at the latter figure. In Chicago, Northern Foundry No. 2 is $12.50 to $13. In Pittsburgh, bessemer iron is $14.70 and basic $13.35 to $13.45. This includes the 95-cent freight rate from the Valley to the Pittsburgh District.

Steel Rails—Some business has developed, and the New York Central has put in an order for 25,000 tons, which went to the Lackawanna Steel Co. This is only about 20% of the normal requirement of the road mentioned, but so far no other roads have placed any orders of importance. An inquiry is in the market for 30,000 tons of rails for Norway, but the hopes of getting this order are not great. Quotations for lots of 500 tons or over are unchanged. Standard sections of bessemer are $28, and basic $30. These quotations are per net ton f.o.b. Pittsburgh. Girder rails in 30-ft. lengths are $36.40 per gross ton, and in 60-ft. lengths $38.40, both f.o.b. New York. Other quotations f.o.b. Pittsburgh for large lots are as follows: Standard sections, $1.25; 25- to 45-lb. sections, $1.15; 16- to 20-lb., $1.20; 12- to 14-lb., $1.25; 8- to 12-lb., $1.30. All of these quotations are per 100 lb. Relaying rails in New York are cheaper at $19 to $19.50 per ton.

Structural Shapes—Reports of the Bridge Builders' Society indicate that fabricating shops of the country are operating to about 35% of normal. Railroads are doing practically nothing and there is less building in prospect than a month ago. The mills are operating to about 30% of maximum capacity. Prices are $1 to $2 per ton lower than last month, and for large lots at the mill Pittsburgh are as follows:

I-beams 3 to 15 in., channels 3 to 15 in., angles 3 to 6 in., and tees 3 in. and over, 1.10c. Other quotations are as follows: I-beams over 18 in., H-beams over 18 in., channels over 16 in., and angles over 6 in., 1.20c.; tees, 1.15c.; deck beams and bulb angles, 1.40c.; hand-rail tees, 1.85c. Cutting to specified lengths is charged for at the following rates: Under 3 ft. to 2 ft., inclusive, 25c. per 100 lb.; 2 ft. to 1 ft., inclusive, 50c.; less than 1 ft., $1.55. No charge is made for cutting to specified lengths over 3 ft.

In Chicago the base price is 1.25@1.34c. In New York, 1.26@1.31c. In San Francisco, 2@2.05c.

Plates—Improvement is evident in the demand for plates. It is probable that several boats will shortly be laid down. These will be used in the coastwise trade and also through the Panama Canal. The base price is 1.05c., Pittsburgh. This is for gages ¼ in. and over; for gages under ¼ in., to and including 3/16 in., 1.15c. is demanded. In Chicago mill deliveries are 1.25@1.30c., and plates from store are 1.65@1.75c. In New York mill shipments are 1.31c.

Pipe—Inquiries for line pipe have been postponed and the mills are operating to only a small ratio of their capacity.

Discounts have been revised, making net prices lower. Revised discounts applying to standard lists are as follows:

	Black	Galvanized
¾- to 2-in. steel, butt welded	81%	72½%
2½- to 6-in. steel, lap welded	80%	72½%
7- to 12-in. steel, lap welded	77%	66½%

At these discounts, the net prices of pipe per foot, in large lots, at Pittsburgh are as follows:

Diameter	Cents: Black	Cents: Galvanized	Diameter	Cents: Black	Cents: Galvanized
¾-in.	2.20	3.15	5-in.	29.60	42.20
1-in	3.24	4.67	6-in.	38.40	54.60
1¼-in	4.38	6.30	7-in.	55.00	80.00
1½-in	5.25	7.55	8-in.	57.50	84.00
2-in.	7.05	10.15	9-in.	79.50	$1.16
2½-in.	11.70	16.70	10-in.	95.00	$1.38
3-in.	15.25	21.80	11-in.	$1.06	$1.55
4-in.	21.80	31.00	12-in.	$1.17	$1.70

Sheets—Some inquiries have been received for export, the chief one being from Italy. Prices are from $1 to $2 per ton less than last month, as follows:

The following quotations are for large lots of sheets in Pittsburgh, and small lots from store, New York.

	Cents per Pound: Large lots Pittsburgh		Ware house delivery New York	
	Black	Galv.	Black	Galv
No. 10	1.55	1.90	....	....
No. 12	1.55	2.00	....	....
No. 14	1.60	2.00	....	....
No. 16	1.65	2.15	2.35	2.75
Nos. 18 and 20	1.70	2.30	2.40	2.90
Nos. 22 and 24	1.75	2.45	2.45	3.05
No. 26	1.80	2.60	2.50	3.20
No. 27	1.85	2.75	2.55	3.35
No. 28	1.90	2.90	2.60	3.50

Cast Iron Pipe—Prices of cast-iron pipe are practically the lowest they have been in a generation, and the great competition among manufacturers of pipe has resulted in considerable buying, particularly by those water departments which are well fixed financially. A recent sale of about 4000 tons in the City of Boston brought out the price of $19.70 delivered, while a reported sale to the Pennsylvania R.R. was made on a basis of $17 delivered on the property of the company. The following quotations are per net ton at the points named:

Birmingham, Ala., 4- and 6-in., $19.50.
New York 4-in. and larger $20 to $20.50.
Chicago, 4 in., $26, 6- to 12 in., $24; Over 12-in., $23.
Cleveland, 3- to 20-in., $21.50, 24- to 28-in., $21.
Gas pipe is a dollar per ton higher in all markets.

Steel Sheet Piling—The market is quiet, but the base price in Pittsburgh is practically unchanged at $1.55 to $1.60.

Wire Rope—Revised discounts are 47 and 2½% from list for galvanized and 55 and 2½% for the bright. At these discounts the net price of wire rope at the mills is as follows:

Diameter in inches	Price per foot: Cast steel	Crucible steel	Plow steel
2½	$0.76	$0.91	$1.08
2¼	0.62	0.73	0.86
2	0.50	0.58	0.68
1¾	0.39	0.48	0.56
1½	0.29	0.35	0.40
1¼	0.20	0.24	0.28
1	0.14	0.16	0.19
¾	0.09	0.10	0.11
⅝	0.06	0.07½	0.08

Steel Shapes—Quotations from warehouse, New York, are unchanged from last month as follows:

Refined iron.	Cents Per lb.
1 to 1⅞ in., round and square	1.80
1½ to 4 in. x ⅜ to 1 in.	1.80
1½ to 4 in. x ¼ to 5/16 in.	2.00
Norway bars	3.20
Burdens bar iron	3.15
Soft steel:	
¾ to 3 in., round and square	1.80
1 to 6 in. x ⅜ to 1 in.	1.80
1 to 6 in. x ¼ and 5/16 in.	1.95
Rods—⅝ and 11/16 in.	1.90
Bands—1½ to 6x3/16 in. to No. 8	2.10
Beams and channels—3 to 15 in.	1.85
Angles:	
3 in. x ¼ in. and larger	1.85
3 in. x 3/16 in. and ⅛ in.	2.30
1½ to 2¾ in. x 3/16 in. and thicker	1.95
1½ to 2½ in. x ⅛ in.	2.05
1 to 1¼ in. x 3/16 in.	2.05
1 to 1¼ in. x ⅛ in.	2.10
1½ to 2½ x ¼ in.	2.00
1½ to 2½ x 3/16 in.	2.10
3 in. and larger	1.90

Old Material—Prices must be near bottom, for it scarcely pays to collect, sort and ship some kinds of scrap. In New York prices have declined 25 to 50c. a ton from last month. Dealers' selling prices are as follows:

	Per Net Ton
Heavy-melting steel scrap	$7.00@ 7.25
Pipes and flues	7.00@ 7.25
No. 1 railroad wrought	8.50@ 9.00
Stove plate	7.25@ 7.50
Malleable cast	6.50@ 7.00
No. 1 machinery cast	9.50@10.00
No. 1 yard wrought, long	8.00@ 8.50
Wrought turnings	5.00@ 5.50

In Chicago a better feeling is evident, and, although quotations are lower than last month, there has been a slight advance from the prices quoted early in November. Prices are as follows:

	Per Gross Ton
Heavy-melting steel scrap	$8.00@8.25
	Per Net Ton
No. 1 railroad wrought	7.50@7.75
No. 2 railroad wrought	7.00@7.25
No. 1 cast scrap	8.50@8.75
Pipes and flues	5.50@5.75
Agricultural malleable	7.25@7.50
Railroad malleable	7.75@8.00

Pittsburgh markets are exceedingly dull, but there is a better feeling among dealers than a month ago. Quotations per gross ton are as follows:

Heavy-melting steel scrap	$9.25@ 9.50
Re-rolling rails	11.50@12.00
No. 1 foundry cast	11.00@12.00
Old car wheels	9.50@10.00
Machine shop turnings	7.50@ 8.00
Railroad malleable	9.00@ 9.50

Chain—Prices are steady and without change, as follows: These prices are per 100 lb., f.o.b., Pittsburgh:

3/16 in.	$7.50	½ and 9/16 in.	$3.00
¼ in.	4.95	⅝ and 11/16 in.	2.90
5/16 in.	3.95	¾ and 13/16 in.	2.80
⅜ in.	3.40	⅞ and 15/16 in.	2.70
7/16 in.	3.20	1 to 1¼ in.	2.60

EXTRAS TO ABOVE LIST PER 100 POUNDS

	For BB	For BBB
3/16-in. and ¼-in.	$1.50	$2.00
5/16-in. and larger	1.25	1.75

Freight Rates—The freight rates on finished steel products from the Pittsburgh district, including plates, structural shapes, merchant steel and iron bar, pipe fittings, plain and galvanized wire, nails, rivets spikes, and bolts, black sheets (except planished) chains, etc., are as follows in cents per hundred pounds: Albany, 16; Buffalo, 11; Boston, 18; Baltimore, 14½; Canandaigua, 13½; Cleveland, 10; Columbus, 12; Cincinnati, 15; Chicago, 18; Denver, Colo., 85½; Harrisburg, 14½; Louisville, 18; New York, 16; Norfolk, 20; Philadelphia, 15; Rochester, 11½; Richmond, 20; Scranton, 15; St. Louis, 23; Washington, 14½.

Freight Rates via Panama—Rates of freight per 100 lb. in carload lots from the points named to Pacific coast ports are current for shapes, reinforcing bars, plates, wire and similar products:

New York, 25c.; Pittsburgh, 41c.; Youngstown, 43c.; Niles, 43c.; Wheeling, 41c.; Steubenville, 41c.; Johnstown, 39.5c.; Coatesville, 34c.; Steelton, 35c.; Bethlehem, 32.5c.; Cleveland, 44c.; Chicago, 55c.

Wire—The demand for wire has shown a distinct improvement, due to large orders coming from the nations at war. Prices are as follows: Plain wire, Pittsburgh, is $1.40 to $1.45; galvanized wire, Pittsurgh, $1.80 to $1.85; painted barbed wire, Pittsburgh, $1.60 to $1.65; galvanized barbed wire, Pittsburgh, $2 to $2.05; galvanized staples, $2, and polished staples, $1.60. All these prices are per hundred pounds for large lots in the Pittsburgh market.

Coke—Prices show a slight improvement. For prompt shipments of furnace coke $1.50 to $1.60 per net ton at oven is demanded and for forward shipments, $1.75. For 72-hr. foundry coke the price is $1.75 for delivery during the first half of 1915. The output of coke is about 40% of maximum being figured at 206,000 tons weekly in the upper and lower Connellsville Region the middle of November.

REINFORCING MATERIALS

Bars, Concrete Reinforcing—Prices of bars are fairly steady, but it is probable that an attractive quotation could be obtained for a large lot. Prices are as follows:

	Cents per pound		
Size	Mill Shipments Pittsburgh	Warehouse Pittsburgh	Delivered from Warehouse New York
¾-in. and larger......	1.15	1.60	2.20
⅝ in.	1.20	1.75	2.25
½-in.	1.35	1.90	2.30
⅜-in.	1.45	2.00	2.40
¼-in.	1.75	2.25	2.70

Triangle Mesh—Business is quiet, but prices are without change as follows:

PRICE PER 100 SQ.FT.

		Plain material		Galvanized	
Style No.	Cross sec. area per ft. width	Carload lots	Less than car lots and over 10,000 sq.ft.	Carload lots	Less than car lots and over 10,000 sq.ft.
*4	$0.102	$1.00	$1.23	$1.12	$1.34
5	0.077	0.80	0.97	0.89	1.00
6	0.058	0.63	0.77	0.71	0.84
*7	0.041	0.49	0.60	0.55	0.66
*23	0.170	1.69	2.05	1.88	2.24
24	0.142	1.46	1.77	1.62	1.93
25	0.124	1.29	1.57	1.43	1.71
*26	0.110	1.17	1.42	1.30	1.55
*27	0.085	0.96	1.17	1.07	1.28
28	0.066	0.80	0.97	0.89	1.06
29	0.049	0.66	0.80	0.73	0.87
31	0.261	2.49	3.02	2.76	3.29
32	0.225	2.16	2.62	2.40	2.86
33	0.196	1.93	2.34	2.14	2.55
34	0.146	1.48	1.80	1.64	1.96
35	0.109	1.117	1.42	1.30	1.55
36	0.075	0.87	1.05	0.97	1.15
38	0.380	3.55	4.30	3.93	4.68
*39	0.325	3.05	3.70	3 38	4.03
40	0.283	2.68	3.25	2.97	3.54
41	0.208	2.05	2.48	2.27	2.70
42	0.151	1.55	1.88	1.72	2.05
*43	0.101	1.10	1.34	1.23	1.46

*This material is made in regular widths of 18, 22, 26, 30, 34, 42, 46, 50, 54 and 58 in. Standard lengths in rolls are 150, 250, 300 and 600 ft.

METALS

Copper—Extensive buying by domestic consumers took place early in November, and for ten days or thereabouts, very brisk business resulted. Initial transactions were made at a quotation of approximately 11.20c., the lowest price reached for copper since 1908, and the market quickly advanced to 12.50c. cash New York for electrolytic. Practically all of this buying was by domestic consumers, but it cannot be said that the ultimate consumption of the metal purchased will be in the United States. It is known that a great deal was bought to fill orders for munitions of war and much of it for shipment to Europe in a partially manufactured state. Large buying has taken place of copper which will be used for locomotive fireboxes, and a great quantity of metal has been purchased for boiler tubes. There has also been considerable copper sheathing purchased. Except for export to Great Britain and neutral countries, there is little foreign business. Vessels sailing for Italian ports refuse to take copper since recent seizures, and the same is true of vessels sailing to Scandinavian and Holland ports. For metals consigned directly to neutral governments, there is practically no danger of seizure. Consumption of Lake copper is exceedingly large, and stocks are low. The price of electrolytic at the close of the month was 12.50c., and of Lake, 12.62½.

Tin—Speculative factors in the tin market are present in great numbers. The possibility of the closing of the Suez Canal by the Turks is just dangerous enough so that one dealer takes a chance on the metal getting through and another fears the canal will be closed. Shipments across the Pacific in English vessels are also attended with some risk. For this reason prices have advanced in spite of a very poor demand, and the quotation is around 34c. The arrivals during November, including the "Marquette," were figured at 2260 tons—considerably below normal consumption demand.

Lead—The market has shown fair strength, an advance of $4 per ton being announced Nov. 18. This brings the price to 3.90c. New York and 3.77½c. St. Louis. There have been heavy purchases of lead by manufacturers of ammunition. Then, too, the old prices were below the cost of production.

Spelter—Business is exceedingly quiet, but prices have advanced slightly, and in New York 5.30c. is quoted while in St. Louis 5.15c. is the price.

Antimony—The market is exceedingly irregular, and there is little buying. American manufacturers making shrapnel have use for antimony. Quotations are most irregular, at 17 to 18c. for Cookson's, 15 to 16c. for Halletts', and 13½ to 14½c. for other brands.

Aluminum—Prices have advanced slightly, and No. 1 ingots are now quoted at 19 to 19.50c. New York.

Miscellaneous Metals—Prices are higher, due to a better demand for copper and the scarcity of tin. For small lots in New York, prices are as follows:

Bismuth	$3.75 to $4.00
Brass tubes, iron-pipe sizes:	
½-in.	.16
¾- to 3-in.	.15
3½-in.	.15
4-in.	.16
Brass rods	.13¾
Brass sheets	.14
Solder, half and half guaranteed...............	.22
Zinc sheets	9 to 9½
Copper sheets, base	.17½
Pig tin (five-ton lots, cash)....................	.34

Old Metals—Somewhat better prices have been made, due to the advance in virgin metals. The following quotations represent those paid by dealers for old metals in New York:

	Cents
Copper, heavy and crucible..............................	10.50
Copper, heavy and wire..............................	10.00
Copper, light and bottoms..............................	9.00
Brass, heavy	7.75
Brass, light..............................	5.75
Heavy machine composition..............................	9.25
Composition turnings	8.25
Lead, heavy..............................	3.40
Lead, tea..............................	3.15
Zinc scrap	3.50

CLAY PRODUCTS

Flue Lining—Discounts are unchanged at 83% from list At this discount, the net prices per foot for New York delivery are as follows:

	Weight in lb.	Price per ft.		Weight in lb.	Price per ft.
4½x8½-in....	14	$0.06	8½x18-in....	45	$0.152
4½x13-in.....	20	0.076	13x13-in.....	45	0.145
7½x7½-in....	15	0.068	13x18-in.....	57	0.22
8½x8½-in....	18	0.076	18x18-in.....	75	0.34
8½x13-in.....	28	0.11			

Sewer Pipe—In the smaller sizes, there has been a slight drop in price, 3- to 24-in. being quoted at a discount of 82%. In the larger sizes, discounts remain unchanged, as follows: 27- and 30-in., 70%; 33- and 36-in., 65%. At these discounts, the net prices per foot in New York are as follows:

Size		Size	
3-in..................	$0.045	18-in..................	$0.342
4-in..................	0.045	20-in..................	0.405
5-in..................	0.072	22-in..................	0.54
6-in..................	0.072	24-in..................	0.585
8-in..................	0.099	27-in..................	1.35
10-in..................	0.144	30-in..................	1.65
12-in..................	0.18	33-in..................	2.20
15-in..................	0.243	36-in..................	2.45

MISCELLANEOUS

Wood Preservatives—Special preservatives for lumber are sold at the following prices per gallon delivered to points in this country: Pentin, a flame proof preservative, 80c. per gal.: Creolin, a creosote, flame proof, 45c. per gal.; Maretin, a preservative for marine use, 60c. per gal.

Lighterage Limits—The free delivery or "Lighterage Limits" in New York City are as follows: In Manhattan, from a point opposite the Fort Lee ferry, south along the Hudson River around the Battery and north along the East and Harlem Rivers to the Jerome Ave. Bridge at 155th St. In New Jersey, south from Fort Lee ferry to Bayonne City, points on the north and east shores at Staten Island, between Bridge Creek (Arlington) and Clifton, both inclusive, and including Elm Park, Erastina and Shooters Island. In Brooklyn, from 69th St., Bay Ridge, north to Pot Cove, Astoria, Long Island City.

Rubber—Prices of rubber show little change, and the supply seems more than sufficient for present needs. There is no embargo, and rubber is coming into the country in good quantities. Prices are as follows, per pound delivered in New York: Up River Para fine, 71 to 72c.; Up River Para coarse, 54 to 55c.; Cauchaou ball 53 to 55c. Scrap rubber is slightly lower, automobile tires being quoted at 5c., bicycle tires at 3 to 3¼c.; solid tires, at 5c ; while airbrake hose is 2½ to 3c., and inner tube 16 to 17c.

Railroad Ties—Business is at a standstill and quotations are nominal. Prices are as follows for yellow pine ties 7x9 in. by 8 ft. 6 in., 76c.; 6x8 in. by 8 ft., 64c.

Explosives—Dynamite of the kind generally used by contractors is approximately 11 to 13c. per lb., f.o.b. factory, in ton lots. Blasting powder, classified as "soda" grade, is sold at $1.20@1.40 per keg of 25 lb. in lots of 10,000 lb.

Exploders, per hundred, are sold at the following prices: 4 ft., $3.60, 6 ft., $4.10, 8 ft., $4.60, 10 ft., $5.10; 12 ft., $5.60; 16 ft., $6.60; 20 ft., $7.60, 25 ft., $9.10, 30 ft., $12, 36 ft., $14.60.

Caps in lots of 10,000 are $7.08 per thousand.

Blasting machines for 10 holes are $12: 25 holes, $20, 50 holes, $40, 100 holes, $60.

RAILWAYS

West Virginia—[illegible] & Western R R—[illegible] Charleston [illegible] Engr

Mississippi—[illegible] Plans are [illegible] for the extension of its railway [illegible] is Gen. Mgr

Kentucky—[illegible] R R—This company is [illegible] Ky, which [illegible] W H [illegible], Louisville, is Ch Engr

Illinois—[illegible] R R—Plans are being prepared by this company for the construction of a railway from Golconda to [illegible], Ill. [illegible] St Louis Mo, is Ch Engr

Iowa—[illegible] Western R R—Plans are being prepared [illegible] of its railway from [illegible] Chicago Great Western [illegible] Iowa, is Gen Mgr

✦**Montana**—[illegible] Milwaukee & St Paul R R—This company has awarded the contract to the MONTANA POWER CO., Butte, Mont, for the completion of the electrification of its line from Three Forks [illegible] Deer Lodge, Mont

Northern Pacific Ry—This company has taken over the [illegible] R R, a [illegible] line from Armstead to [illegible] the line from [illegible] Twin Bridges W L Darling St Paul. [illegible] of the Northern Pacific

Arkansas—Arkansas & Saline River R R—Plans are being prepared by this company for the extension of its railway from [illegible] Ark. J H Allen [illegible] Ark, is Pres and Gen. Mgr

Fort Smith [illegible] & Eastern R R—Surveys have been made by this company for the extension of its railway from [illegible] Ark, about 21 miles. Henry Stroup, [illegible] Ark, is Pres and Gen Mgr

Texas—San [illegible] & Rio Grande Valley R R—Plans are being [illegible] by this company for the construction of a railway from [illegible] Tex, to [illegible] Tex, about 60 miles. S. A. [illegible] Tex, is Pres

Clinton & Oklahoma Western Ry—See item under Oklahoma

Texas—Texas New Mexico & Eastern R R—This company is being organized for the purpose of constructing a railway from San Antonio [illegible] Tex, about 172 miles Thomas Moore, [illegible] is Ch Engr

Oklahoma—A company is being organized to construct a railway from [illegible] Okla, about 20 miles. J. H. Morgan, [illegible] Okla, is interested

Clinton & Oklahoma Western Ry—Extensions from Clinton, Okla, to [illegible] Tex, and to El Reno, Okla, are contemplated by this company. Guy V. McClure, Clinton, Okla, is Ch Engr

Idaho—Oregon Short Line R R—The Commercial Club of Caldwell, Idaho, is urging this company to electrify its branch line from Caldwell to Wilder, about 11 miles. Carl Stradley, Salt Lake City, Utah, is Ch Engr

✦**Arizona**—Magma Copper Co—This company has awarded a contract to McARTHUR BROS. [illegible] St, New York N Y, for constructing a railway from Superior to Webster, Ariz, about [illegible] miles. Noted [illegible]

ELECTRIC RAILWAYS

South Weymouth, Mass.—The Bay State St Ry Co is contemplating plans for the construction of an electric railway from [illegible] to South Weymouth [illegible] Boston, is Vice Pres and Gen Mgr

New York, N. Y.—[illegible] According to press reports the [illegible] & Queens Traction Corporation [illegible] the construction of an extension of its line [illegible] Long Island City, is Secy, Gen Mgr and Pur Agt

Westfield, N. Y.—The [illegible] Westfield & Northwestern [illegible] has completed [illegible] for the construction of an electric railway from Westfield to the lake shore [illegible] is Gen. Mgr and Supt

Orange, N. J.—The City [illegible] plans to extend the [illegible] trolley line from the [illegible] to connect with the [illegible] of the [illegible] in Orange

Erie, Penn.—The [illegible] & Lake Erie Traction Co is preparing [illegible] about two miles of [illegible] in Erie. [illegible] is Gen Mgr

✦**Lancaster, Penn.**—The [illegible] & Lancaster [illegible] has awarded the contract for constructing [illegible] miles of [illegible] to [illegible] New York, N. Y. The new line will [illegible] & [illegible] and the Reading and Lancaster lines. Noted [illegible]

Middletown, Penn.—The [illegible] Co contemplates the extension of its electric railway from Middletown to [illegible] Harrisburg, is Pres and Gen Mgr

Titusville, Penn.—The Titusville [illegible] Traction Co contemplates [illegible] W. [illegible] is Mgr

Jacksonville, Fla.—The Commissioners of the [illegible] making preliminary arrangements for the construction of a railway [illegible] F. W. [illegible] is Ch Engr

Covington, Ky.—The South Covington & Cincinnati St. Ry. [illegible] for the extension of [illegible] Pres [illegible] Cincinnati, Ohio, is Gen Mgr

Evansville, Ind.—The Evansville & New Harmony Traction [illegible] to start work in the spring on the construction of an electric railway from [illegible] to New Harmony

Dwight, Ill.—[illegible] has been [illegible] by the [illegible] & [illegible] for the construction of an electric railway [illegible] to Dwight [illegible] is Gen Mgr and Pur Agt

Milwaukee, Wis.—The Milwaukee Electric Ry. & Light Co., has been [illegible] to consider plans for laying double tracks on its line on [illegible] Ave from Hartford and Edgewood Ave. Peter [illegible] is Mgr

Cedar Rapids, Iowa—The Iowa Ry. & Light Co. has secured the right-of-way and will soon start work on the construction of an electric railway to connect with the lines of the Waterloo Cedar Rapids & Northern Ry. R. S. Cook, Cedar Rapids, is Pur. Agt.

St. Paul, Minn.—The extension of its Dale and Forest St line [illegible] in St. Paul is contemplated by the St. Paul St. Ry. Co.

Garden City, Kan.—The Garden City Sugar Co. is preparing plans for the construction of an electric railway from its sugar beet plant to various points in Finney County.

St. Louis, Mo.—The United Ry. Co. of St. Louis is considering plans for the construction of a system of loops in the [illegible] section of the city. Robert McCulloch, St. Louis, is Pres., Gen. Mgr. and Pur. Agt.

Searcy, Ark.—The Searcy & Kensett Transportation Co. has been granted a franchise to construct and operate an electric railway from Searcy to Kensett, about four miles. H. E. Hill, Searcy, is interested.

Beaumont, Tex.—The Beaumont Traction Co. has been petitioned to consider plans for the extension of its line from Beaumont south to the refinery of the Magnolia Petroleum Co. G. W. Kellogg, Beaumont, is Mgr.

Huntsville, Utah—Surveys are being made by the Ogden Logan & Idaho Ry. Co. for the extension of its line from Idlerwood to Huntsville.

Tucson, Ariz.—The City Council has granted a franchise to the Tucson Rapid Transit Co. to extend several of its lines in Tucson. Frank E. Russell, Tucson, is Gen. Mgr.

San Francisco, Calif.—Tentative plans are being considered by the City Council for the construction of an electric railway from Keystone to the Hetch Hetchy Valley, about [illegible]0 miles. M. M. O'Shaughnessy is City Engr.

LIGHT, HEAT AND POWER

Poughkeepsie, N. Y.—The Central Hudson Gas & Electric Co. contemplates improvements and extensions to its plant at Poughkeepsie, at an estimated cost of $1[illegible],000. The plans include an 8000-kw. turbo-generator, an electric crane, construction of new substations and extension of transmission lines. F. M. Stark, Poughkeepsie, is Pur. Agt.

✦**Syracuse, N. Y.**—The Commissioners of Onondaga County have awarded the contract for power plant, heating and ventilating system at the County Tuberculosis Hospital, to the EDWARD JOY CO., Syracuse, at $76,179.

✦The Syracuse Lighting Co. has awarded the contract for the construction of a new generating station to the TAYLOR-HORNBY CONSTRUCTION CO., at about $[illegible]. The building will be 3[illegible]x68 ft., one story, steel frame.

Holmesburg, Penn.—It is reported that plans are being prepared for the installation of a new power plant at the Home for the Indigent, Holmesburg.

Johnstown, Penn.—The Dale Light, Heat & Power Co., Johnstown, contemplates building a power plant, estimated to cost $[illegible]0, at Dale, a suburb of Johnstown. C. F. Lancaster is Supt., Mgr. and Cont. Agt.

Pittsburgh, Penn.—Press reports state that bids are being received by George W. Gerwig, Secy. of the Bd. of Education, for electrical work at the McNaugher and Latimer Schools.

Hyattsville, Md.—(Official) The Mayor and City Council have appointed a special committee to investigate the feasibility of installing an electric light plant in connection with the present municipal water works plant. Two [illegible]-kva. units, [illegible] volt, 6[illegible] cycle will be required. J. C. Hawkins is a member of the Com.

Bay Minette, Ala.—(Official) See item under "Water Supply and Irrigation."

Bristol, Tenn.—The [illegible] Electric Co. has begun the construction of a second hydro-electric plant for the development of the water power of this region. The dam in question is across the middle fork of the Holston River near [illegible], Va., [illegible] miles east of Bristol. The machinery will not be installed before next spring, and will have a minimum of [illegible] hp. with a maximum of [illegible] hp.

Dresden, Tenn.—See item under "Water Supply and Irrigation."

Paducah, Ky.—The Kentucky Southwestern Electric Ry., Light & Power Co. is considering the construction of a power house, three substations, a repair shop, car houses [illegible] in connection with a railway from Paducah to Murray, a distance of [illegible] miles. H. C. Rhodes is [illegible] of the company.

✦**Alliance, Ohio**—The Building Commission of the new City Hall has awarded the contract for the heating and plumbing [illegible] in the building to [illegible] & [illegible], Alliance, at $[illegible]; the contract for the electric lighting was awarded to the [illegible] CONSTRUCTION CO., Alliance, at $[illegible].

Cleveland, Ohio—(Official)—Bids will be received until [illegible] by the Commissioner of Purchases and Supplies, City Hall, for general service pumps and equipment for the municipal electric light plant. F. W. [illegible], [illegible] East Third St., is Comr. of Light and Heat Dept.

✦**Anderson, Ind.**—The Board of Public Works has awarded the contract for furnishing the municipal electric light and power plant with a [illegible] and other equipment to the [illegible] & [illegible] Co., Pittsburgh, Penn., at $[illegible]. The lowest bid for furnishing a turbine generator was that of the Allis-Chalmers Co., Milwaukee, at $[illegible].

Tekonsha, Mich.—The City Council has granted a franchise to the [illegible] to install and operate an electric plant in Tekonsha.

Kankakee, Ill.—Bids will be received until Dec. 14, by the Board of Administration, Capitol Bldg., Springfield, Ill., for heating, electrical work and plumbing in a contagious disease building at the Kankakee State Hospital. James B. Dibelka, 29 South La Salle St., Chicago, is State Arch.

Lewistown, Ill.—Press reports state that the Lewistown Electric Co. will build a transmission line from its plant at this point four miles east into the country for the purpose of supplying electric current to the farmers along the line. C. J. King is Secy. and Supt. of the Lewistown Electric Co.

Belgium, Wis.—It is reported that the Milwaukee Northern Ry. Co., Cedarburg, Wis., plans to install a substation in Belgium to supply energy for lamps and motors in the surrounding territory. John St. John, Cedarburg, is Gen. Mgr. and Cont. Agt. for the Milwaukee Northern Co.

+Oelwein, Iowa—The Fayette Utilities Co., Oelwein, has awarded the contract for the construction of a power plant to the SCHMIDT BROS. CONSTRUCTION CO., 105 North Park St., Chicago, Ill.

+Aurora, Minn.—The Village Council has awarded the contract for the construction of a power house to the BOWBURKE CONTRACTING CO., St. Paul, Minn., at $13,661. The plant, with equipment, will cost about $27,000. Noted Nov. 5.

Canton, Kan.—It is reported that the municipal electric light plant was recently destroyed by fire at a loss of about $5000.

Kansas City, Kan.—The city will soon purchase, for its pumping station at Quindaro, a 5000-hp. feed water heater, a 500-hp. steam turbine driven boiler feed pump, a 20,000,000-gal. motor driven centrifugal pump and three 400-kw. transformers. W. M. Barclay is City Engr.

Pawnee Rock, Kan.—T. J. Stinson, Spearville, Kan., has purchased the electric-light plant at Pawnee Rock. He will reopen the plant, which has been closed down, and will install new engines and dynamos.

Wellington, Kan.—(Official)—Bids will be received until 2 p.m., Dec. 17, by the City Commissioners for engines, pumps, boilers, heater, switchboard and miscellaneous electric apparatus for the proposed new water works system and light plant in the city and substation at the Mayfield wells. Alternate bids will be accepted on steam turbines and cross compound corliss engines. The Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla., is Engr. in Charge.

Chamberlain, S. D.—The power house of the Chamberlain Gas Light & Power Co. was recently damaged by fire. It is reported that the plant will be rebuilt at once. Guy Kelley is Secy. and Mgr.

Michigan, N. D.—Preparations are being made for the installation of a municipal electric-light plant. Bonds have been voted for this purpose.

Hale, Mo.—The Citizens Light, Water & Power Co. contemplates building a new 16x60-ft. power house, and installing two boilers and a corliss engine. Fred Helbauer is Pres., Secy. and Treas.

Corpus Christi, Tex.—Henry M. Wallace, Pres. of the Corpus Christi Gas Co., plans to lay a natural gas pipe line from the White Point field, near Corpus Christi, to San Antonio, 150 miles. Gas will be supplied to a number of towns along the route. It is estimated that the project will cost about $1,500,000.

Groesbeck, Tex.—The Driscoll Pipe Line Co. has been incorporated in Limestone County, with a capital stock of $200,000, and plans to lay a natural gas pipe line from the Mexia fields to Corsicana and intermediate towns, and a second line from the same fields to Austin, about 150 miles. The incorporators are: Timothy J. Driscoll, Indianapolis, Ind., Lewis E. Willett and Percy A. Little, Buffalo, N. Y., Cornelius T. Herring, Amarillo, Tex.

Cushing, Okla.—The Cushing Electric Light & Power Co. plans to install a 500-kw. generating unit, including generator direct-connected to a corliss engine, boilers of return tubular type and some other equipment, at a total cost of about $30,000. H. Askin is Secy. and Mgr.

Santa Fé, N. M.—James A. French, State Engr., has approved the plans of John Borradelle and associates, for the establishment of a hydro-electric plant in White Rock Cañon, 15 miles from Santa Fé. A transmission line will be constructed from the plant to Santa Fé, Albuquerque, Las Vegas and Socorro.

Seattle, Wash.—The Board of Public Works has received the following bids for furnishing distributing transformers for the municipal electric-light system: Pittsburg Transformer Co., Pittsburgh, Penn., $28,434; Maloney Electric Co., $30,086; W. R. Hendry Co., Armour Bldg., Seattle, $29,127; General Electric Co., $29,137; Duncan Electric Mfg. Co., $36,853; Kuhlman Electric Co., $30,192; Allis-Chalmers Co., $29,808; Packard Electric Co., $29,779; Westinghouse Electric & Mfg. Co., $34,443.

Newport, Ore.—The Yaquina Electric Co. has increased its capital stock from $20,000 to $40,000 for the purpose of making additions and improvements in its system. The company is developing power sites in the vicinity of Yaquina, Ore. George Blanchard, Newport, is Mgr. and Cont. Agt.

Silverton, Ore.—The City Council is considering plans for the installation of an electric lighting system for the entire city. It is reported that bids will soon be asked for furnishing and installing the equipment. Bids will also be asked for supplying energy to operate the system for a period of years.

Placerville, Calif.—It is reported that the Standard Oil Co will build a $20,000 substation at Placerville.

BRIDGES

+Portland, Maine—The Commissioners of Cumberland County have awarded contracts for the construction of the bridge between Portland and South Portland to: The HOLBROOK, CABOT & ROLLINS CORPORATION, Boston, Mass., at $352,135, for foundation work, including piling; PHOENIX BRIDGE CO., Phoenixville, Penn., at $139,650, for the steel superstructure of the middle portion, including the draw; T. STUART & SONS CO., Newton, Mass., at $250,000, for the concrete superstructure of the remainder of the bridge. Noted Sept. 24, Oct. 1, Nov. 12 and 19.

Concord, N. H.—(Official)—It is expected that bids for the Pembroke Bridge over the Merrimack River will be received about Dec. 15. The bridge will be about 470 ft. long, four spans, two pony and two high trusses. W. B. Howe is City Engr. Noted Nov. 19.

+Charlotte, N. Y.—The Monroe County Building Commission and the Board of County Supervisors, Rochester, have awarded the contract for the construction of a Strauss double leaf bascule bridge over the Genesee River at Charlotte, to the PENN BRIDGE CO., Beaver Falls, Penn., at $231,940. List of bids noted Aug. 13.

Whitehall, N. Y.—The residents of Whitehall will ask the State Legislature for an appropriation of $25,000 for the purpose of repairing the South Bay Bridge, which is considered unsafe at present.

Perth Amboy, N. J.—Bids will be received until Dec. 7, by the Board of Chosen Freeholders of Middlesex County, New Brunswick, for the construction of pile and timber emergency rest piers for the Amboy Bridge over the Raritan River. Alvin B. Fox, Perth Amboy, is County Engr. Noted Nov. 12.

Bids for furnishing and placing 40-, 60- and 80-ft. piles for the Amboy Bridge were received from: General Contracting & Engineering Co., 29 Broadway, New York, N. Y., $8242; Henry H. Holmes, Jersey City, N. J., $9426, and Rhodes & Manvel, Elizabeth, N. J., $11,074.

+Pittsburgh, Penn.—The Commissioners of Allegheny County have awarded the contract for the construction of Bridge No. 15 over Pine Creek to the PENN BRIDGE CO., Beaver Falls, Penn., at $15,980.

+Princeton, W. Va.—The Commissioners of Mercer County have awarded the contract for the construction of three reinforced concrete bridges across the Bluestone River to the FARRIS BRIDGE CO., Pittsburgh, Penn., at $12,800 for the three. Noted Nov. 19.

Folkston, Ga.—Bids will be received until Dec. 15, by the Commissioners of Charlton County, for the construction of a bridge over the St. Mary's River between Charlton County and Nassau County, Florida.

Rome, Ga.—(Official)—Applications will be received by the Commissioners of Floyd County on Dec. 8, for the position of Consulting Bridge Engineer. The county will build three bridges, two of concrete, each about 300 ft. long, and one of steel, about 250 ft. long. All three will have 40-ft. roadways, and an 8-ft. sidewalk on each side of the roadway. J. G. Pollock is Chn. of the Comrs. Kieffer Lindsey is County Engr.

+Wetumpka, Ala.—The Yellow Pine Lumber Co. has awarded the contract for bridge construction in connection with building 10 miles of railway to J. M. GILLIS & SON, Brewton, Ala.

Pittsboro, Miss.—Bids will be received until Dec. 8, by the Highway Commissioners of Supervisors' District No. 1 of Calhoun County, for the construction of several bridges on the road from Pittsboro to the eastern boundary line of the district. A. A. Bruner, W. R. Byars and R. F. Provine are Highway Comrs.

Paducah, Ky.—See item under Light, Heat and Power.

Marietta, Ohio—(Official)—Bids will be received until 1 p.m., Dec. 16, by the Commissioners of Washington County, for the construction of the east abutment of the Elk Run Bridge, Lawrence Township. W. B. Alexander is County Audr.

Covington, Ind.—Plans are being prepared for rebuilding the bridge over the Wabash River at Covington, and it is expected that the contract will be awarded at the January meeting of the Commissioners of Fountain County. The west span, which was not damaged, will be left standing, and two new spans will be built at the east end, replacing the two which were entirely burned.

Richmond, Ind.—Press reports state that plans are almost completed for a new bridge over the Whitewater River, and that bids for its construction will soon be asked. Fred R. Charles is City Engr.

+Detroit, Mich.—The Common Council has awarded the contract for the construction of a concrete bridge over Connors Creek to THOMAS E. CURRIE, 20 McGraw Bldg., Detroit, at $5400.

Marquette, Mich.—Bids will be received until 2:30 p.m., Dec. 7, by Daniel S. Donovan, City Clk., for the construction of a 60-ft. girder bridge over the Carp River at Lake St.

Taylorville, Ill.—(Official)—Bids will be received until 9 a.m., Dec. 9, by C. A. Penington, County Supt. of Highways, Christian County, for the construction of two bridges; one, between Johnson and Taylor Townships, of three 90- and one 100-ft. span, requiring about 600 cu.yd. concrete and 19,830 lb. of reinforcing steel; estimated cost, $15,350. The other, in Johnson Township, will have three 85-ft., one 100- and one 70-ft. span, requiring 612 cu.yd. concrete and 11,630 lb. reinforcing steel; estimated cost, $17,000.

St. Paul, Minn.—It is reported that the City Council is considering plans for the construction of a new bridge over Marshall Ave. Oscar Claussen is City Engr.

+Independence, Kan.—(Official)—The Commissioners of Montgomery County have awarded the contract for repairing the McTaggart Bridge over the Verdigris River to the ROCHESTER BRIDGE CO., Rochester, Ind. Noted Nov. 19.

+Sioux Falls, S. D.—(Official)—The Commissioners of Minnehaha County have awarded the contract for all bridge work in the county during 1915 to the WESTERN BRIDGE & CONSTRUCTION CO., Omaha, Neb. Harry H. Howe is County Audr. Noted Nov. 12.

Chouteau, Mont.—(Official)—The Commissioners of Teton County will probably take no further action before next March in the matter of four new bridges to be built in the district, and for which plans are in preparation. E. C. Garrett is County Clk. Noted Nov. 19.

Dallas, Tex.—[illegible] Noted Oct. [illegible]

♦Houston, Tex.—(Official)—The Commissioners' Court of Harris County [illegible] THEIS, [illegible] H. [illegible] Noted Nov. 12.

♦Pawnee, Okla.—[illegible] The Commissioners of Pawnee County [illegible]

Boulder, Colo.—The City Council [illegible] City Engr.

Colorado Springs, Colo.—It is expected that the Atchison, Topeka & Santa Fe [illegible] C. F. W. [illegible] City Engr.

♦St. Thomas, Nev.—The Commissioners of Clark County, Las Vegas, have awarded the contract for the construction of a steel bridge over the Virgin River near St. Thomas to CAMPBELL & TURNER [illegible]

Seattle, Wash.—It is reported that the entire issue of $[illegible] in bonds for the construction of bridges over Lake Washington Canal [illegible] Noted [illegible] Aug. [illegible]

♦Snoqualmie, Wash.—The Commissioners of King County, Seattle, have awarded the contract for the construction of [illegible] to NETTLETON, BRUCE & [illegible] Noted [illegible]

Salem, Ore.—The Marion County Court has had plans prepared by Henry L. Bowlby, State Highway Engr., for the construction of a bridge over the Willamette River at this point. The costs for various plans range from $[illegible] to $[illegible]

Hanford, Calif.—The Board of Supervisors of Kings County is receiving bids for the construction of a bridge over Cross Creek [illegible] Hanford.

♦Modesto, Calif.—The Board of Supervisors of Stanislaus County has awarded a contract for the construction of a reinforced-concrete bridge and approach to L. M. SIMPSON at [illegible]

San Francisco, Calif.—The Board of Supervisors [illegible]

♦San Gabriel, Calif.—The City Trustees have awarded the contract for the construction of [illegible]

Sanger, Calif.—The Board of Supervisors of Fresno County [illegible] Kings River [illegible]

♦San Luis Obispo, Calif.—The Board of Supervisors of San Luis Obispo County has awarded the contract for the construction of a [illegible] bridge near Atascadero [illegible]

Quebec, Que.—[illegible]

Ottawa, Ont.—[illegible]

Vancouver, B. C.—[illegible]

WATER SUPPLY—IRRIGATION

♦♦Boston, Mass.—[illegible]

♦Boston, Mass.—[illegible]

Fitchburg, Mass.—[illegible]

Le Roy, N. Y.—J. R. Wells, Rochester, has been retained by the Board of Water Commissioners to make surveys for the construction of a new water system. The estimated cost is $[illegible]

New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until 2 p.m., Dec. 4, by William Williams, Municipal Bldg., for laying water mains and appurtenances in [illegible] and Park Ave. and in East [illegible] St. and East [illegible] St., Borough of Manhattan.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 2 p.m., Dec. 11, by William Williams, Comr. Water Supply, Gas and Electricity, for removing the present foundation and erecting a new foundation under the water [illegible] of No. 1 Worthington [illegible] Mg. triple expansion pumping engine at the Ridgewood North Side pumping station. For removing two boilers and their appurtenances from the [illegible] pumping station, transporting and reerecting one in the [illegible] pumping station and one in the Agawam pumping station with new stacks, piping and other appurtenances.

♦Troy, N. Y.—The contract for laying pipe has been awarded to FLOOD & VAN WERT, Hudson Falls, at $[illegible]. Noted Nov. [illegible]

♦Wappingers Falls, N. Y.—(Official)—Bids were received Nov. [illegible] by the Board of Trustees for constructing a water system as follows: Abner Harper, Inc., Newburgh, N. Y., $[illegible]; Christopher & Lockwood, Peekskill, N. Y., $[illegible]; Kellogg & [illegible] Co., Schenectady, N. Y., $[illegible]; Thompson & [illegible], Walden, N. Y., $[illegible]; Roth & Weston, Lawrence, N. Y., $[illegible]; Louis R. Harrison, [illegible] Broadway, New York, N. Y., $[illegible]; [illegible] Construction Corporation, Albany, N. Y., $[illegible]; [illegible], 115 East 127th St., New York, N. Y., $[illegible]; Samuel [illegible], Beacon, N. Y., $[illegible]; F. N. Lewis, [illegible] Manhattan Ave., New York, N. Y., $[illegible]; [illegible], 147 [illegible] St., New York, N. Y., $[illegible]; [illegible] Market St., Poughkeepsie, N. Y., $[illegible]; Peekskill Construction Co., 115 South St., Peekskill, N. Y., $[illegible]; H. K. [illegible], 170 Broadway, New York, N. Y., $[illegible]; Frank [illegible], [illegible] St., Paterson, N. J., $61,[illegible]; Young & [illegible], Produce Exchange Bldg., New York, N. Y., $61,438; [illegible] Construction Co., Luzerne, Penn., $61,[illegible]; James F. [illegible] Construction Co., [illegible] Cutler Bldg., Rochester, N. Y., $[illegible]; [illegible] & [illegible], [illegible] E. 138th St., New York, N. Y., $[illegible]; [illegible] & Hollenbeck, Harriman, N. Y., $[illegible]; William S. Mitchell, [illegible] Walton Ave., Bronx, N. Y., $[illegible]; Daly & Merritt, Port Chester, N. Y., $[illegible]; [illegible] Contracting Co., 12 South Broadway, Yonkers, N. Y., $[illegible]; Suburban Engineering Co., [illegible] West [illegible] St., New York, N. Y., $[illegible]; [illegible] & Von Cleave, [illegible] Park, N. J., $[illegible]; [illegible] Bldg., [illegible], N. Y., $[illegible]; Joseph L. [illegible], N. Y., $[illegible]; [illegible] Co., [illegible] St., Waterbury, Conn., $[illegible]; James J. [illegible], [illegible] St., Newark, N. J., $[illegible]; [illegible] Engineering & Contracting Co., Queens Plaza Court Bldg., Long Island City, N. Y., $[illegible]; [illegible] Burnett Ave., Syracuse, N. Y., $[illegible]; [illegible], Kingston, Penn., $[illegible]; H. J. Zevely, Morgantown, W. Va., $71,[illegible]; J. R. Pennell, [illegible] Bldg., Yonkers, N. Y., $[illegible]; [illegible] St., Hartford, Conn., $[illegible]; Joseph Johnson's Sons, [illegible] Broadway, W. New Brighton, N. Y., $[illegible]; Michael [illegible] Main St., [illegible], N. Y., $[illegible]; Hope Engineering & Supply Co., [illegible] Park Bldg., Pittsburgh, Penn., $[illegible]; Hanover Contracting Co., [illegible] West [illegible] St., New York, N. Y., $[illegible]; [illegible] & Phillips, Schenectady, N. Y., $[illegible], and L. M. [illegible] St., [illegible], $[illegible]; H. L. Sterling, [illegible] St., Newburgh, is Engr. Noted Nov. 12.

♦Asbury Park, N. J.—(Official)—The contract for laying a [illegible] pipe from the pumping station to Main and [illegible] Ave. has been awarded to PARTRIDGE & BURKE, [illegible], N. J.

Newark, N. J.—The Board of Freeholders has approved plans prepared by [illegible], Newark, for the construction of a new water system at the Overbrook Hospital.

Greencastle, Penn.—Bonds for $[illegible] have been voted by the [illegible], the proceeds of which will be used for making [illegible] to the water system.

♦New Holland, Penn.—The contract for laying water mains has been awarded by the New Holland Water Co. to J. [illegible]

♦Baltimore, Md.—Bids will be received until Dec. [illegible] by the Board of Awards, City Hall, for [illegible] Noted Nov. [illegible]

♦♦Baltimore, Md.—Bids were received Nov. [illegible] [illegible] Noted Nov. [illegible]

Lumberton, N. C.—The installation of a filtration plant at the [illegible] water system is contemplated by the [illegible] Supt. of Water Wks.

♦♦Columbus, Ga.—Contracts have been awarded for the [illegible] of a water system as follows: [illegible] to MORRIS [illegible], N. Y., at $[illegible]. Bids opened Nov. [illegible]. Noted Oct. [illegible]

Bay Minette, Ala.—(Official)—Bids will be received until 8:15 p.m., Dec. 15, by W. D. Stapleton, Mayor, and the Council for constructing a water system, and electric light plant. Edgar B. Kay is Engr. Noted Sept. 24.

+New Orleans, La.—The contract for installing water and sewer systems, boilers and pumps at the Louisiana Lepers' Home has been awarded to MONTAGNE BROS., Abbeville, La. Bids opened Nov. 10. Noted Oct. 29.

Dresden, Tenn.—The citizens on Nov. 21 voted in favor of issuing $27,000 in bonds, the proceeds of which will be used for the construction of a water system and electric light system. Noted Nov. 5.

Henderson, Ky.—The Board of Water Commissioners plans to improve the water system at an estimated cost of $100,000. Pollard & Ellms, Cincinnati, Ohio, are Engrs.

Sebree, Ky.—Plans have been prepared by William Barrows for the construction of a water system. Noted Nov. 19.

Cleveland, Ohio—Bids will be received until Dec. 8, for installing a filter and equipment at the filtration plant. Noted Nov. 5.

All bids received Oct. 21, for low lift centrifugal pumps, have been rejected. Charles F. Schultz, City Hall, is Comr., Div. of Water. Noted Oct. 8.

Cuyahoga Falls, Ohio—The city plans to install a 375,000-gal. centrifugal pump for the municipal water system. L. F. Cook is Supt.

East Palestine, Ohio—The village contemplates constructing a water system for the Hill district at an estimated cost of $40,000.

Lowellville, Ohio—(Official)—Bids will be received until Dec. 21, for the purchase of $33,000 in bonds the proceeds of which will be used for the construction of a water system. C. W. Baker is Clk. and William Wilson, Elks Bldg., Youngstown, is Engr. Noted May 28.

Pataskala, Ohio—An election will be held, Dec. 21, to vote on the question of issuing bonds for $25,000, the proceeds of which will be used for the installation of a water system. Noted Nov. 5.

Wooster, Ohio—The city plans to construct a new water system, estimated to cost $125,000. R. H. Hunter is Engr.

Zanesville, Ohio—Chester & Fleming, Consult. Engrs., Pittsburgh, Penn., are preparing plans for the construction of a filtration plant. J. G. Peterson is Pres. of the City Council. Noted Oct. 15.

Madison, Ind.—(Official)—The city contemplates drilling wells and installing an air lift pumping system for the water system. John W. Moore, 3342 North Illinois St., Indianapolis, is Consult. Engr.

Albion, Mich.—W. G. Clark, Engr., Toledo, Ohio, has been retained by the city to make an investigation for the extension of the municipal water system. Bonds have been voted. Noted Sept. 17.

Benton Harbor, Mich.—A special election will be held, Dec. 8, to vote on the question of issuing bonds for $60,000, the proceeds of which will be used for the construction of a water system. B. Spaulding is City Clk.

Detroit, Mich.—(Official)—Bids will be received by the Board of Water Commissioners until 2 p.m., Dec. 8, for water meters. H. A. Gilmartin is Secy, of Bd.

Lansing, Mich.—The city contemplates constructing a belt line of water mains, estimated to cost $50,000. W. F. Sullivan is Pres. of the Water Works and Electric Light Bd.

Muskegon Heights, Mich. — The city has sold $25,000 in bonds, the proceeds of which will be used for the extension of the water system. Noted Aug. 13.

Royal Oak, Mich.—The citizens on Nov. 10, voted in favor of issuing $27,500 in bonds, the proceeds of which will be used for the extension of the water mains and for the construction of a new pumping station.

Joliet, Ill.—The bid of the Newkirk & Powers Construction Co. for the construction of a reservoir has been rejected by the city. Noted Nov. 12.

St. Charles, Ill.—Bids will be received until 7 p.m., Dec. 7, by the Board of Local Improvements for constructing a pipe line in the following streets: East Fifth; North and West Seventh St. The Central Engineering Co., St. Charles, is Engr.

Sparta, Ill.—Press reports state that at a recent election the citizens voted to issue bonds, the proceeds of which will be used for the construction of a water system.

Sheboygan Falls, Wis.—At a recent election the citizens defeated the bond issue, the proceeds of which were to be used for the construction of a water system. Noted Nov. 12.

Taycheedah, Wis.—A water system will be installed at the Industrial School for Girls. W. G. Kirchoffer, Madison, is Engr.

Osawatomie, Kan.—An election will soon be held to vote on the question of issuing bonds for $10,000, the proceeds of which will be used for making extensions and remodeling the water system. Noted Sept. 10.

Wellington, Kan.—(Official)—See item under Light, Heat and Power.

Tecumseh, Neb.—The city plans to lay two miles of 6-in. wood pipe. W. R. Tasker is Supt.

Mott, N. D.—At a recent election the citizens voted to issue $16,000 in bonds, the proceeds of which will be used for the construction of a water system. Noted Nov. 19.

Edina, Mo.—Bonds for $20,000 have been voted by the citizens, the proceeds of which will be used for the installation of a water system.

Aspermont, Tex.—A municipal water system will be constructed at Aspermont. The estimated cost is $18,000.

Big Springs, Tex.—Plans are being prepared to lay 8000 ft. of 8-in. water mains and 17,000 ft. of 6-in. mains. Fire hydrants will also be installed. The estimated cost is $25,000.

Brady, Tex.—The citizens contemplate installing a municipal water system.

Corpus Christi, Tex.—(Official)—Bids will be received until 4 p.m., Dec. 29, by F. J. Mulligan, City Secy., for the construction of a water system. Noted Nov. 19.

Kiefer, Okla.—(Official)—Rollins & Co., 439 Midland Bldg., Kansas City, Mo., have been retained to prepare plans for the construction of a water system at Kiefer, at an estimated cost of $60,000.

Anacortes, Wash.—The City Council contemplates purchasing the Anacortes Water Co. and making improvements estimated to cost $65,000.

Tacoma, Wash.—The City Council plans to construct wooden water mains and install hydrants in 24th St. from Washington to Stevens St. W. C. Raleigh is City Engr.

Ashland, Ore.—Bonds will soon be issued, the proceeds of which will be used for the improvement of the water and light systems.

St. Johns, Ore.—The City Council contemplates purchasing the water system and making extensions to it.

Warrenton, Ore.—At a special election bonds for $150,000 were voted, the proceeds of which will be used for the construction of a municipal water system. Noted Aug. 13.

+Glendora, Calif.—The contract for installing a 120-hp. Snow Diesel engine for the water system has been awarded to H. R. WORTHINGTON CO., at $8700.

Red Bluff, Calif.—An election will be held Dec. 10, to vote on the question of issuing bonds for $85,000, the proceeds of which will be used for the installation of a municipal water system. Noted Oct. 1.

Susanville, Calif.—On Nov. 23, the citizens voted in favor of issuing bonds for $50,000, the proceeds of which will be used for the construction of a municipal water system. Noted Nov. 5.

Aylmer, Que.—The Provincial Government has authorized the Town Council to construct a filtration plant for the water system.

Mimico, Ont.—The Council has authorized the construction of water and sewer systems, estimated to cost $125,000. E. A. James is Engr.

Toronto, Ont.—(Official)—Bids will be received until noon. Dec. 8, by H. C. Hocken, Chn. Bd. of Control, for the following supplies: Brass and bronze castings, brass work for house services, c.-i. pipe, hydrants, lead pipe, special castings and stop valves.

SEWERS

+Boston, Mass.—The contract for replacing wooden sewers in several streets has been awarded to TIMOTHY J. O'CONNELL.

Valley Falls, R. I.—The installation of a sewer system is contemplated by the citizens. An election will be held, Dec. 14, to vote on the question.

Warren, R. I.—The Town Council has authorized the construction of a sewer system.

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 11 a.m., Dec. 10, by Maurice E. Connolly, Pres. of the Borough of Queens, for constructing a sewer in Forest Ave. from Myrtle Ave. to Halleck Ave., Second Ward in Beaufort Ave. from Briggs Ave. to Lefferts Ave., Fourth Ward; in Wilbur Ave. from William St. to Ely Ave., First Ward; in Birch St. Jamaica Ave. to Hillside Ave., Fourth Ward and for constructing receiving basins and appurtenances on Purvis St. and Thompson Ave., First Ward.; on Twelfth Ave. and Newtown Road, First Ward; on Woolsey Ave. and Seventh Ave.; Sixth Ave. and on Park Pl., First Ward and for reconstructing and repairing siphon and appurtenances under Broadway, Elmhurst, L. I. (known as Horse Brook Siphon), Second Ward.

★Wappingers Falls, N. Y.—(Official)—Bids were received, Nov. 18, for constructing a sewer system as follows: H. L. Armando, Boston, Mass. (informal), $37,513; Evergreen Construction Co., 244 Jackson Ave., Long Island City, N. Y., $67,328; Kellam & Shaffer Co., Schenectady, N. Y., $67,477; G. B. Coon Construction Co., 274 Union St., Luzerne, Penn., $68,796; Samuel Beskin, Beacon, N. Y., $69,051; Both & Weston, Laurence, N. Y., $70,695; Christopher & Lockwood, Peekskill, N. Y., $73,278; R. B. Kennedy, 302 Paul Bldg., Utica, N. Y., $73,673; Langan Construction Corporation, Albany, N. Y., $74,405; Canedella & Co., 68 School St., Milford, Mass., $74,942; James F. Tusco, 671 Broad St., Newark, N. J., $75,143; James McAvoy, 315 East 127th St., New York, N. Y., $75,975; Amanna & Sullivan, 24 East 19th St., New York, N. Y., $76,380; Daly & Merritt, Port Chester, N. Y., $77,349; Frank Puglia, 34 Cross St., Paterson, N. J., $78,058; John I. McDonald, 42 Market St., Poughkeepsie, N. Y., $78,775; H. W. Golden & Son, Inc., 756 Jacob St., Troy, N. Y., $79,032; Samuel Boun, 654 Burnett Ave., Syracuse, N. Y., $79,105; John W. Collins, 1533 Wright St., Flint, Mich., $79,127; J. F. Leary Construction Co., 224 Cutler Bldg., Rochester, N. Y., $79,665; Harrison & Burton Co., 220 Broadway, New York, N. Y., $80,133; D. M. Rosser, Kingston, Penn., $80,446; Joseph L. Sigretto & Co., Woodhaven, N. Y., $81,404; Gardner & Von Cleave, Asbury Park, N. J., $82,132; Berandino Silvester & Co., 19 Dartmouth St., Hartford, Conn., $83,180; Briggs & McLaughlin, 337 East 134th St., New York, N. Y., $83,584; Barbaru & D'Aurio Co., 90 Franklin St., Waterbury, Conn., $83,735; H. J. Zevely, Morgantown, W. Va., $85,349; Petrossi Bros., 39 Woodbridge St., Hartford, Conn., $90,117; Peekskill Construction Co., 415 South St., Peekskill, N. Y., $90,781; Green Contracting Co., 734 Vernon Ave., Long Island City, N. Y., $92,985; Suburban Engineering Co., 15 West 38th St., New York, N. Y., $93,511; J. B. Pennell & Co., Radford Bldg., Yonkers, N. Y., $94,003; Pioneer Contracting Co., New Rochelle, N. Y., $95,547; Michael Spino, 290 Main St., Beacon, N. Y., $96,237; Pratt, Reed & Phillips, Schenectady, N. Y., $97,652 and Joseph Johnson's Sons, 455 Broadway, W. New Brighton, N. Y., $101,065. H. L. Sterling, 56 Second St., Newburgh is Engr. Noted Nov. 12.

Gloucester, N. J.—[illegible]

♦Manasquan, N. J.—[illegible]

♦Newark, N. J.—[illegible] For details see advertisement under "Contracts To Be Let."

Oaklyn, N. J.—Plans are being prepared for the installation [illegible]

♦Paterson, N. J.—[illegible] For details see advertisement under "Contracts To Be Let."

[illegible] bids will be received by the Passaic Valley Sewerage Commissioners [illegible] for the construction of the [illegible] For details see advertisement under "Contracts To Be Let."

Perth Amboy, N. J.—The Board of Aldermen has authorized the [illegible] of a new sewer in [illegible] Ave. Wilbur La [illegible]

♦Allentown, Penn.—(Official)—Bids will be received until [illegible] a.m., Dec. [illegible], by Charles W. [illegible], Mayor, for constructing a storm water sewer in East [illegible] St. from the Lehigh River [illegible]. For details see advertisement under "Contracts To Be Let."

Middletown, Del.—The Town Council plans to issue bonds, the proceeds of which will be used for the construction of a sewer system and for the improvement of the streets.

Deland, Fla.—See item under "Streets and Roads."

Bay Minette, Ala.—(Official)—Bids will be received until [illegible] by W. [illegible], Mayor, and the Council, for constructing a sewer system. Noted Sept. 24.

New Orleans, La.—See item under "Water Supply and Sewers."

East Cleveland, Ohio.—(Official)—Bids will be received [illegible] for constructing [illegible] sewers. The estimated cost is [illegible]. [illegible] Leader Bldg., Cleveland, is City Engr.

Fostoria, Ohio.—(Official)—Bids will be received by E. K. [illegible] for improving the sewage disposal plant.

♦Hawenstine (North [illegible] post office), **Ohio.**—A contract for constructing [illegible] of sewer to the new sewage disposal plant has been awarded to JOHN F. CASEY, Pittsburgh, Penn., at [illegible].

♦East Chicago, Ind.—The contract for constructing sewers [illegible] has been awarded to THOMAS TAYLOR [illegible].

Indianapolis, Ind.—The Board of Public Works contemplates constructing a sewer in [illegible] St. from Pleasant Run [illegible]. The estimated cost is $22,[illegible].

♦Detroit, Mich.—The contract for constructing a sewer [illegible] has been awarded to [illegible] at $[illegible].

Averyville (Peoria post office), **Ill.**—(Official)—The Peoria [illegible] has prepared plans for a sewer system for the village of Averyville. [illegible]

Lockport, Ill.—[illegible]

St. Charles, Ill.—[illegible]

♦Ames, Iowa.—[illegible]

Afton, Ohio.—[illegible]

Tempe, Ariz.—[illegible]

Marshfield, Ore.—[illegible]

Tacoma, Wash.—[illegible]

♦Richmond, Calif.—[illegible]

Santa Monica, Calif.—[illegible]

Windsor, Ont.—See item under "Water Supply and Irrigation."

Niagara Falls, Ont.—[illegible]

Toronto, Ont.—[illegible]

[illegible]

(Official)—Bids will be received by H. C. H[illegible]ken, Chn. [illegible], Dec. [illegible], for reconstructing a part of [illegible] of the High Level Interceptor.

GARBAGE

Boston, Mass.—The following low bids were received by the Commissioner of Public Works, Nov. 16, for the removal of snow and ice for the winter season 1914-15: District 1, Joseph M. [illegible]; District 2, Joseph McGreevy, 31c.; [illegible] J. Jacobs Co., 34c.; District [illegible], Coleman [illegible]; District 6, J. C. Coleman & Sons Co., 31c. Noted Nov. 12.

Akron, Ohio.—(Official)—The proposed waste reduction plant has been voted down by the City Council. Noted Nov. 12.

Kalamazoo, Mich.—Local financiers have subscribed $[illegible], and a company will be incorporated to undertake the collection and disposal of garbage in Kalamazoo. The disposal plan includes the purchase of a [illegible]-acre tract of land for the establishment of a piggery. C. D. Wolcott, Grand Rapids, is interested.

Rock Island, Ill.—According to press reports the City Council contemplates the installation of a garbage incinerator.

Muscatine, Iowa.—The City Board of Health is considering plans for a garbage disposal plant. Charles Young, City Engr., is preparing a report on collection and disposal conditions.

Salt Lake City, Utah.—The City Commission has received a communication from S. Q. Cannon, City Engr., recommending the installation of a garbage incinerator, to cost about $12,[illegible].

San Francisco, Calif.—(Official)—The Board of Public Works passed a resolution, on Nov. 27, rejecting the Islais Creek incinerator and requesting that the Power Specialty Co. remove the plant and return all money paid to date.

Berlin, Ont.—The City Council will submit a by-law to the rate payers at the New Year's election, calling for a bond issue of $11,0[illegible] for erecting an incinerator and other improvements.

STREETS AND ROADS

Boston, Mass.—Bids will be received until Dec. [illegible], by the Public Works Department, for constructing a roadway in Westmoreland [illegible] and Dorchester. L. K. Rourke is Comn.

♦Buffalo, N. Y.—The contract for paving Harrison St. with brick has been awarded to the CONSTANTINE CONSTRUCTION CO., Buffalo, N. Y., at $[illegible].

♦New York, N. Y.—(Borough of Manhattan)—(Official)—Contracts have been awarded for repaving Ave. D, from Fifth to Eighth St., to the AZTEC ASPHALT CO., $20,614; Washington Pl., from Broadway to Washington Sq., to M. J. FITZGERALD, $[illegible]; and [illegible] St., from Audubon to Wadsworth Ave., to the UVALDE ASPHALT CO., $[illegible]. Noted Nov. [illegible] and [illegible].

(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Pres., Borough of Manhattan, Municipal Bldg., until [illegible] p.m., Dec. [illegible], for improving [illegible]th St., from Eighth to Tenth Ave.

(Borough of Queens)—(Official)—Bids will be received by Maurice E. Connolly, Pres. of the Borough, until 11 a.m., Dec. 1[illegible], for improving Liberty Ave., from Walker to [illegible] Ave.; [illegible] Turnpike, from New York Ave. to [illegible] Creek; and Hancock St., from [illegible] to [illegible] Ave.

(Borough of Richmond)—(Official)—Bids will be received by Charles J. McCormack, Pres. of the Borough, until noon, Dec. [illegible], for improving St. Mary's Ave., from New York to Tompkins Ave.; Third St., from Lafayette Ave. to its easterly [illegible].

Watertown, N. Y.—Bonds for $[illegible] have been sold, the proceeds of which will be used for highway improvements.

♦♦Camden, N. J.—Bids were received, Nov. 11, by the County Road Committee for constructing roads as follows: [illegible]

[illegible] JAMES MAGOWAN, Haddon Heights, $[illegible] [illegible]

[illegible] KELLEY McKELVEY CO., Camden [illegible]

Deal, N. J.—[illegible]

East Orange, N. J.—[illegible]

East Orange, N. J.—[illegible]

Jersey City, N. J.—[illegible]

Jersey City, N. J.—[illegible]

Paterson, N. J.—[illegible]

West Hoboken, N. J.—[illegible]

+Harrisburg, Penn.—Bids were received, Nov. 24, by the State Highway Commissioner for constructing 20,158 lin.ft. of brick block pavement in Butler, Summit, and Jefferson Townships, Butler County as follows: O'BRIEN BROS., Avoca, $85,702 (awarded contract), Rinehart Bros., East Liverpool, Ohio, $86,104; South Shore Construction Co., Erie, $87,426, R. H. Cunningham & Sons, Turtle Creek, $88,388, Duquesne Contracting Co., Pittsburgh, $92,959 and Pietro Paving & Construction Co., Morgantown, W. Va., $94,770. Noted Nov. 12.

+Sharon, Penn.—A contract for constructing a two-mile macadam road in Brookfield Township has been awarded to WILLIAM McINTYRE & SONS, at $11,000.

Cumberland, Md.—Bonds for $150,000 were sold Nov. 20, the proceeds of which will be used for paving.

Spencer, W. Va.—Bids will be received by A. B. Gainer, Mayor, until noon, Dec. 11, for paving a section of Market St.

Clinton, N. C.—Bids will be received by the County Commissioners until Dec. 14, for the sale of $25,000 in bonds for constructing roads.

Deland, Fla.—An election will be held, Jan. 13, to vote on the question of issuing $45,000 in bonds for paving the business streets and for constructing a storm water sewerage system.

Vernon, Ala.—An election will be held, Dec. 21, to vote on the question of issuing $75,000 in bonds for constructing roads. R. L. Bradley is Probate Judge.

Armory, Miss.—Bids will be received until Dec. 9, for improving several streets. The estimated cost is $25,000. G. E. Hauser, Aberdeen, is Engr.-in-Charge.

Thibodaux, La.—At an election held Nov. 17, the people of La Fourche Parish voted in favor of issuing $100,000 in bonds for improvements in Road District No. 1.

Columbus, Ohio—Bids will be received by George A. Borden, Dir. of Pub. Ser., until noon, Dec. 8, for improving Garfield, Miller, Sixth Ave., High, Hoster, Wall, Seventh St. and Kimball Pl.

Bids will be received by the Commissioners of Franklin County until, Dec. 11, for the sale of $48,000 in bonds for road improvements. John Scott is Clk. of the Comrs.

Columbus, Ohio—(Official)—Bids will be received by G. A. Borden, Dir. Pub. Ser., until noon, Dec. 8, for improving the following streets: Garfield, Miller, Sixth Ave., Kimball Pl. Ave., High, Hoster and Wall St. Paul B. Kemper is Clk. of Bd. Pub. Ser.

Kenton, Ohio—The City Council and County Commissioners will pave the public square with asphalt over the brick pavement. The estimated cost is $10,000.

Lima, Ohio—(Official)—Bids will be received by the Commissioners of Allen County until noon, Dec. 8, for constructing 22,000 sq.yd. of concrete roadway, from ½ mile west of Landeck on the Van Wirt County line and extending two miles eastward.

Frankfort, Ind.—(Official)—Bids will be received by the Board of Commissioners of Clinton County, until 2 p.m., Dec. 14, for improving several roads.

Hartford City, Ind.—Bonds for $60,000, $39,000 and $18,600 have been sold, the proceeds of which will be used to improve Monroe, Franklin and Frank St., respectively.

Lebanon, Ind.—(Official)—Bids will be received until 10 a.m., Dec. 7, by J. T. Frank Laughner, Treas., Boone County, for the sale of $57,600 in bonds for highway improvements.

Martinsville, Ind.—(Official)—Bids will be received until noon, Dec. 10, for the sale of $10,740 and $6600 in bonds for highway improvements.

Michigan City, Ind.—(Official)—Bids will be received by the Board of Public Works, until 11 a.m., Dec. 8, for improving Fir and East Eighth St. A. Spychalski is City Clk.

St. Joseph, Mich.—According to press reports, bids will be received by the County Clerk, until, Dec. 9, for constructing 32 miles of macadam. W. J. Cleary is County Highway Engr.

La Crosse, Wis.—Plans are being prepared by G. P. Brodish, City Engr., for macadamizing 17 blocks of West Ave. and 16th St. and paving three blocks of Fifth St. with brick.

+Grand Rapids, Minn.—A contract for constructing 25 miles of the Ardenhurst-Moose Park Rd. has been awarded to P. McDONNELL, Duluth, at $32,000.

St. Paul, Minn.—The City Council contemplates issuing $100,000 in bonds for public improvements. Included among these improvements is the paving of Jackson St., at an estimated cost of $65,000.

+Grand Island, Neb.—A contract for paving 8311 yd. has been awarded to the E. D. TYNER CONSTRUCTION CO., Kansas City, Mo. Noted Oct. 15.

+Kansas City, Mo.—Contracts have been awarded for paving Holmes St., from 22d to 23d St., with asphalt, to the CLEVELAND TRINIDAD PAVING CO., at $18,133, and Main St., from Ninth to 12th St., to A. JAICKS & CO., at $14,502.

Anderson, Tex.—The Richards Road District has retained Browne & Wilder, Engrs., Houston, Tex., to prepare plans for a system of gravel roads.

Bryan, Tex.—According to press reports, an election will soon be held to vote on the question of issuing $600,000 in bonds for road construction and improvements.

Corsicana, Tex.—Bids will be received by N. D. Johnson, County Audr., until 10.30 a.m., Dec. 10, for the sale of $75,000 in bonds for improvements in Road District No. 3.

+Temple, Tex.—The City Council has awarded the contract for the paving of about eight miles of streets to the LEVY & LEVY CO., Muskogee, Okla., and H. K. McCULLOM, Fort Worth. The cost will be about $280,000.

+Velasco, Tex.—A contract for constructing about 15 miles of hard surfaced gravel roads has been awarded to the OWENS CONSTRUCTION CO.

Port Orchard, Wash.—Bids will be received by the County Auditor until Dec. 7, for improving ten miles of road.

Prosser, Wash.—According to press reports bids will be received by the County Commissioners until Dec. 8, for improving Benton County Permanent Highway No. 4 (Kennewick Finley Rd.)

Portland, Ore.—Bids were received by the City Council for laying sidewalks on the east side as follows: Star Stand Co., $7871; Cochran-Nutting & Co., $8511; George Gundlach, $8343; O. M. Patton, $7996; Manning & Co., $8293; Gilbisch-Joplin Co., $8099.

Roseburg, Ore.—According to press reports bids will be received until Dec. 15, for constructing 11,000 ft. of road.

+Dunlap, Calif.—The Board of Supervisors of Fresno County has awarded a contract for the construction of the Dunlap cut-off to C. M. BAKER, at about $5000.

+East San Diego, Calif.—The contract for improving University Ave. has been awarded to the MORSE CONSTRUCTION CO., at $7592.

+Glendora, Calif.—WILLIAM G. WAGNER, Monrovia, Calif., has been awarded the contract at $5336 for improving Meda Ave.

+Los Angeles, Calif.—The contract for improving Painer Ave. has been awarded to FRED HOFFMAN.

Monrovia, Calif.—At a recent election the citizens voted in favor of issuing $15,000 in bonds for improving streets.

Sacramento, Calif.—(Official)—Bids will be received by the State Highway Commission, 515 Forum Bldg., until 2 p.m., Dec. 14, for the following road construction: Siskiyou County, from Hornbrook to Yreka, Sutter County from Yuba City to the northerly boundary. Los Angeles County from Section 17 to Liebre Mountain; Orange County from San Juan Capistrano to Galivan.

San Dimas, Calif.—The city contemplates macadamizing about ¾ mile of Cataract and Fifth St.

Quebec, Que.—Plans have been prepared by W. D. Baillarge, City Hall, Quebec, for paving St. Louis and St. Foye Rd. The estimated cost is $180,000.

Waterloo, Que.—Bids will be received some time in January by the Town Council for macadamizing about three miles of roads. The estimated cost is $27,000.

Kerrisdale, B. C.—Bids will be received by the City Council, until Dec. 7, for paving University Ave.

+Victoria, B. C.—A contract for laying 12,000 yd. of asphalt pavement has been awarded by the City Council to the CANADIAN MINERAL RUBBER CO., Victoria, at $1.05 per yd.

INDUSTRIAL WORKS

Boston, Mass.—McFarland & Colby, Archs., 46 Cornhill St., are preparing plans for the construction of the bakery for the Grocers Baking Co.

Clinton, Mass.—Plans are being prepared for an addition to the plant of the Clinton Wire Cloth Co.

+Hyannis, Mass.—The contract for the construction of a cold storage plant on the Cobb & Smith wharf has been awarded to J. W. BISHOP CO., Worcester, Mass.

Millbury, Mass.—The Metropolitan Ice Co. will construct an addition to its plant at Dorothy Pond, to cost $25,000.

+Providence, R. I.—The contract for the construction of the five-story brick and reinforced-concrete warehouse at Fountain, Clements and Worcester St., for N. Leroy Gardner, has been awarded to the TURNER CONSTRUCTION CO., New York.

+Groton, Conn.—The contract for the construction of a building for the New London Ship & Engine Co. has been awarded to H. R. DOUGLAS, INC.; steel work to the BERLIN CONSTRUCTION CO.

+New Haven, Conn.—The contract for the construction of a building at the plant of the Winchester Repeating Arms Co. has been awarded to the ABERTHAW CONSTRUCTION CO., 8 Beacon St., Boston, Mass. Noted Aug. 6.

+Stamford, Conn.—The general contract for the construction of the three-story warehouse on Jefferson St., for S. J. Slawson, has been awarded to the VUONA CONSTRUCTION CO., Bank Bldg., Providence, R. I.

+Buffalo, N. Y.—The contract for the construction of a four-story factory at West Mohawk St. and South Elmwood Ave., for the Robertson Cataract Electric Construction Co., has been awarded to the TURNER CONSTRUCTION CO., 311 Prudential Bldg., Buffalo.

+Ilion, N. Y.—The general contract for the construction of the buildings for the Remington Arms Co. has been awarded to JAMES STEWART & CO., 30 Church St. The estimated cost is $500,000. Noted July 30.

+New York, N. Y.—(Borough of Queens)—The steel contract for the two-story addition to the refinery of the National Sugar Refining Co., has been awarded to POST & McCORD, 101 Park Ave., New York. The general contract has been awarded to LEDDY & MOORE, 105 W. 40th St., New York.

Niagara Falls, N. Y.—A. M. Boff & Son, 1009 Garden Ave., manufacturers of metals, will construct an addition to their factory.

The Niagara Falls Linen Co. is having plans prepared by Walter McCulloh, Engr., Gluck Bldg., for an addition to its plant. The estimated cost is $200,000.

Rochester, N. Y.—Walker, Livingston & Brackett, Archs., E. & H. Bldg., have prepared plans for the construction of a five-story warehouse on Exchange Ave., for George C. Buell & Co. The estimated cost is $75,000.

Wildwood, N. J.—The Board of Trade of Wildwood plans to construct a factory in the western section of the town.

+Jeannette, Penn.—The contract for the construction of the warehouse for the American Window Glass Co. has been awarded to the BOLLINGER ANDREWS CONSTRUCTION CO.

Philadelphia, Penn.—The Roesch Packing Co. is having plans prepared for a four-story addition to its plant at Second and Poplar St.

Philadelphia, Penn.—Charles W. Denny, Arch., is preparing plans for the construction of a two-story, 75x100-ft. warehouse, to be built for Charles Devlin. The estimated cost is $20,000.

Asheville, N. C.—[illegible] Lockwood, [illegible] warehouse [illegible].

✦Birmingham, Ala.—The contract for the construction of a [illegible] has been awarded to [illegible].

Louisville, Ky.—[illegible] for the addition to the plant of the [illegible]. The estimated cost is [illegible].

Sebree, Ky.—The [illegible] Brick & Tile Co. [illegible] plant at Sebree. The estimated cost is [illegible].

Cleveland, Ohio.—The [illegible] Supply Co. [illegible] for the construction of a warehouse. Work [illegible].

Toledo, Ohio.—[illegible] plans the construction of two [illegible]. One will be two stories and basement [illegible] ft., and the other [illegible] ft.

✦Fort Wayne, Ind.—The contract for the construction of a [illegible] St. for the [illegible] Mfg. Co. has been awarded to [illegible] & [illegible]MANN. Estimated cost, [illegible].

Tell City, Ind.—The Tell City Furniture Co. plans the construction of a four-story [illegible] ft. brick addition to its plant.

Ecorse, Mich.—The [illegible] Co. plans the construction of [illegible] West Jefferson Ave. and Ecorse River. Estimated cost, [illegible].

Chicago, Ill.—The [illegible] Co., Louisville, Ky., has purchased a site at North [illegible] St. between Madison and Washington St. for the construction of a [illegible] warehouse.

Peoria, Ill.—Plans are being prepared by [illegible] & [illegible] for the construction of a warehouse at [illegible] and [illegible] St. for the Federal Warehouse Co., recently incorporated.

✦Cornell, Wis.—The contract for the construction of a [illegible] for the Cornell [illegible] Co. has been awarded to [illegible]-FLYNN CO., [illegible] Jackson St., St. Paul, Minn. [illegible] St. Paul, Minn., are Architects.

✦Marshfield, Wis.—The contract for the construction of a [illegible] has been awarded to the WEINFELD CONSTRUCTION CO. [illegible]

✦Milwaukee, Wis.—The contract for the construction of [illegible] at Sixth and Clark St. for [illegible] has been awarded to D. ROTHMAN. Estimated cost, [illegible]. Noted Sept. [illegible].

✦[illegible] for the construction of a [illegible] and basement [illegible] ft. [illegible]. The contract for the concrete foundation has been awarded to WILLIAM F. [illegible]. Noted Nov. 19.

Superior, Wis.—The [illegible] Co. will construct a [illegible] factory at [illegible].

Minnesota—The [illegible] Steel Co., [illegible], plans the construction of a [illegible] plant near the [illegible] Lake, Crow Wing County. [illegible] is representative of the company.

St. Paul, Minn.—The [illegible] Commission [illegible] at the Minnesota [illegible].

[illegible] plans the construction of a [illegible] at [illegible] University Ave. [illegible].

[illegible] plans the construction of a [illegible]. The estimated cost is [illegible].

Gainesville, Tex.—[illegible] at Gainesville. [illegible] is interested.

Spur, Tex.—[illegible] New York, N. Y., [illegible].

Portland, Ore.—[illegible] for the construction of a [illegible]. Estimated cost, [illegible].

Emeryville, Calif.—The [illegible] Co. [illegible] the plant at Emeryville, which was recently destroyed by fire. Estimated cost, [illegible].

Fresno, Calif.—[illegible] plans to [illegible] at Fresno [illegible] Los Angeles. [illegible]

San Pedro, Calif.—The Board of Harbor Commissioners is [illegible] for the construction of a [illegible] concrete [illegible] warehouse at the [illegible]. The estimated cost is [illegible].

✦Calgary, Alta.—The general contract for the construction of [illegible] has been awarded to [illegible]. Cost, [illegible].

FEDERAL GOVERNMENT WORK

✦Dredging—[illegible] Harbor. The following bids were received [illegible] for dredging in [illegible] Harbor: [illegible] New York, N. Y., [illegible]; [illegible] Dredging Co. [illegible]; [illegible] Packard Dredging Co., Providence, R. I., [illegible]; [illegible] Boston, Mass., [illegible]; [illegible] New York, N. Y., [illegible]; [illegible] Dredging Co., Norfolk, Va., [illegible]; [illegible] Mass., [illegible]. Noted Oct. [illegible].

✦Shipbuilding Cranes—Boston, Mass.—The contract for furnishing and [illegible] shipbuilding cranes at the Boston and Philadelphia Navy Yards has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the M[illegible] INTERSTATE CO., Bedford, Ohio, at $67,24[illegible]. Noted Nov. [illegible] and Nov. 12.

Dredging—Salem, Mass.—Bids will be received by Lieut. Col. W. E. Craighill, U. S. Engineer office, Boston, Mass., until [illegible] Dec. [illegible], for dredging in Salem Harbor.

Dredging, Etc.—Newport, R. I.—The following are the bids received for dredging and rock removal in Newport Harbor: Eastern Dredging Co., Boston, Mass., $84,79[illegible]; G. N. Harries, [illegible] St., Boston, Mass., $114,2[illegible]1; Charles W. Johnston, Lewes, Del., $117,78[illegible]; P. Sanford Ross, Inc., Jersey City, N. J., $1[illegible]; [illegible] Dredging Co., Norfolk, Va., $[illegible]; John H. [illegible], Boston, Mass., $67,181; Timothy J. Dady, New York, N. Y., $21[illegible]; R. G. Packard Co., Bayonne, N. J., $[illegible]; J. S. Packard Dredging Co., Providence, R. I., $[illegible]. Noted Oct. [illegible].

✦Purchasing Steamer—Newport, R. I.—(Official)—Bids will be received at the U. S. Engineer office, Newport, until 11 a.m., Jan. 2, 1915, for purchasing the steamer "Cora." For further information consult "Contracts To Be Let."

✦Repairs to Breakwater—Stonington, Conn.—Bids will be received by Maj. G. B. Pillsbury, U. S. Engineer office, New London, Conn., until 2 p.m., Jan. 15, for repairing breakwaters in Stonington Harbor.

Pier—New York, N. Y.—(Borough of Brooklyn)—Bids will be received by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., for building a timber and reinforced-concrete pier at the United States Navy Yard, New York, N. Y.

✦Dredging—New Jersey—Bids will be received by Col. Frederick V. Abbot, Army Bldg., Whitehall St., New York, N. Y., until noon, Dec. 8, for dredging in Passaic River, N. J.

✦Post Office—Carnegie, Penn.—The contract for constructing the U. S. post office at Carnegie has been awarded to the E. T. ABBOT CONSTRUCTION CO., 1133 Broadway, New York, N. Y. Noted Sept. 24 and Nov. 5.

✦Shipbuilding Cranes—Philadelphia, Penn.—See item under Boston, Mass.

✦Machinery—Anacostia, D. C.—Bids will be received by the Secretary of the Interior, Washington, D. C., until 2 p.m., Dec. 1[illegible], for furnishing machinery and apparatus required in remodeling the pumping plant of the Government Hospital for the Insane.

✦Building—Washington, D. C.—The contract has been awarded by the Commissioners of the District of Columbia for reconstructing the Western High School to RICHARDSON & BURGESS, Washington, D. C., at $48,877. Noted Nov. [illegible].

✦Building—Washington, D. C.—The contract for the construction of a foundation for a new high school at First and N St., Washington, has been awarded to P. F. GORMLEY CO., Washington, D. C., at $[illegible]. Noted Nov. 12 and Nov. [illegible].

✦Grading—Washington, D. C.—The contract for new roads and grading ground at the Hygienic Laboratory, Washington, D. C., has been awarded to CHARLES H. TOMPKINS, Washington, D. C., at $7800. Noted Nov. 1[illegible].

Repair Shops—Washington, D. C.—Bids will be received until 2 p.m., Dec. 16, by the Commissioners, District of Columbia, for constructing repair shops for the Water Department.

✦Excavating—Wilmington, Del.—The lowest bid received by Maj. E. N. Johnston, U. S. Engineer office, Wilmington, Nov. 1[illegible], for excavating Inland Waterway between Rehoboth Bay and Delaware Bay, Lewes Canal, Del., was that of the [illegible] Dredging Co., Mobile, Ala., at [illegible] per cu. yd. Noted Nov. [illegible].

✦Jetty Work—St. Petersburg, Fla.—Bids will be received by Maj. W. [illegible] Ladue, U. S. Engineer Office, Jacksonville, Fla., until noon, Dec. [illegible], for building stone jetty at entrance to St. Petersburg Harbor.

✦Post Office—Jellico, Tenn.—The contract for the construction of the post office at Jellico has been awarded to VOLNEY [illegible] TAYLOR, Huntington, W. Va. Noted Sept. [illegible] and Oct. [illegible].

✦Post Office—Shelbyville, Tenn.—The contract for the construction of a post office at Shelbyville has been awarded to [illegible], Greensboro, N. C., at $[illegible]. Noted Nov. [illegible].

✦Repairs to Post Office—Springfield, Ohio.—The contract for repairs to the U. S. post office, Springfield, Ohio, has been awarded to [illegible] CONTRACTING CO., Joliet, Ill., at $[illegible].

✦Post Office—[illegible], Ind.—Bids will be received by Oscar Wenderoth, Supervising Arch., Treasury Dept., Washington, D. C., until [illegible] Jan. [illegible], for constructing a post office at [illegible]. The building will be two stories and basement. For particulars see advertisement under "Contracts To Be Let."

Improving Post Office and Court House—Detroit, Mich.—The following bids were received by Oscar Wenderoth, Supervising Arch., Treasury Dept., Washington, for the construction of an extension to and remodeling the U. S. post office and court house, Detroit: [illegible] Co., Detroit, Mich., $[illegible]; [illegible] Co., New York, N. Y., $[illegible]; [illegible]; [illegible] Building & Construction Co., [illegible], $[illegible]. Noted Oct. [illegible].

✦Dredging—Chicago, Ill.—The contract for dredging in [illegible] has been awarded to the GREAT LAKES DREDGE & DOCK CO., Chicago, Ill., at $[illegible].

✦Post Office—[illegible]ville, Ill.—The contract for the construction of the U. S. post office at [illegible]ville has been awarded to WILLIAM O'NEILL & SON CO., Faribault, Minn., at $[illegible]. Noted Sept. [illegible] and Nov. 12.

Post Office—[illegible], Wis.—Bids were received as follows by Oscar Wenderoth, Supervising Arch., Treasury Dept., Washington, D. C., for the construction of a post office at [illegible]: [illegible]; [illegible] Construction Co., Chicago, Ill., $[illegible]; [illegible], Canton, Ohio, $[illegible]; [illegible] Construction Co., St. Paul, Minn.

(a) $50,000; (b) $50,000; McManus & Tarnoski, St. Paul, Minn., (a) $46,124; (b) $48,383; General Construction Co., Milwaukee, Wis., (a) $46,131; (b) $47,831 Noted Oct. 29.

✚**Repairs to Post Office**—Jefferson, Tex.—The contract for repairs to the U. S. post office, Jefferson, has been awarded to MOOS & RODGERS, Marshall, Tex., at $5490.

Post Office—El Reno, Okla.—Bids were received as follows by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post office at El Reno, (a) limestone, (b) sandstone, (c) marble: Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $70,413, (b) $70,913, (c) $83,413; Schafer & Kreipke, El Reno, Okla., (a) $66,784, (b) same, (c) $71,944; Dieter & Wenzel Construction Co., St. Louis, Mo., (a) $76,666, (c) $85,666; M. Yeager & Co., Danville, Ill., (a) $69,869, (b) $73,369, (c) $83,800; George A. Shaul, Seneca, Kan., (a) $69,289, (c) $83,824; J. L. Crouse, Greensboro, N. C., (a) $66,970, (b) $67,570, (c) $79,192; Nandenberg & Pauley, Wichita, Kan., (a) $75,207, (b) $75,557, (c) $86,211; George W. Stiles Construction Co., Chicago, Ill., (a) $63,876, (c) $80,120; J. H. Wiese, South Omaha, Neb., (a) $74,900, (b) $88,900; Latimer & Benning, Kansas City, Mo., (a) $74,953, (c) $89,453; W. D. Lovell, Minneapolis, Minn., (a) $87,400, (b) $100,400. Noted Oct. 22.

★**Bridge**—Tuba, Ariz.—Bids will be received by the Commissioner of Indian Affairs, Washington, D. C., until 2 p.m., Dec. 22, for constructing a steel highway bridge across the Moencopi Wash near Tuba Plans and specifications are on file at the office of "Engineering News," Tenth Ave at 36th St. For further information see advertisement under "Contracts To Be Let."

Cranes—Pearl Harbor, H. T.—Bids will be received by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Dec. 12, for furnishing three electric traveling shop cranes at the naval station, Pearl Harbor, Hawaii.

Miscellaneous Supplies—Panama—Bids will be received by Maj. F. C. Boggs, Gen. Pur. Officer, Panama Canal Comn., Washington, D. C., until 10:30 a.m., Dec. 14, for furnishing, by steamer, free of all charges, on dock at either Colon, Atlantic port, or Port of Ancon, Balboa, Canal Zone, Pacific Port, Isthmus of Panama, steel rolling doors, wire cables and attachments, galvanized sheet steel, rivets, bolts, washers, cable clips, turnbuckles, bronze bars, carpenter's squares, metallic tapes, manila rope, leather belting, flax packing, sandpaper, chamois skins, ship's felt, window glass, lye, metal polish, soap, lard oil, linseed oil, Japan drier, varnish, lampblack, engine-truck paint, chrome yellow, bristol board, paper and scrub brushes.

Miscellaneous Supplies—Panama—Bids will be received by Maj. F. C. Boggs, Gen. Pur. Officer, Panama Canal Comn., Washington, D. C., until 10:30 a.m., Dec. 7, for furnishing structural steel, soft-steel bars, steel angles and plates, checkered steel plates, bronze bushings, steel castings, iron castings, steel forgings, steel cable, boiler tubes, pipe fittings, brass clean-outs, brass hibbs, sheet copper, copper bars, brass grommets, wheelbarrows, corn brooms, life preservers, grindstones and yellow pine lumber. These supplies are to be delivered, free of all charges, on dock at either Colon, Atlantic port, or Port of Ancon, Balboa, Canal Zone, Pacific port, Isthmus of Panama.

Fuel Oil—Panama—Bids were received as follows on Nov. 23, by Maj. F. C. Boggs, Gen. Pur. Oficer, Panama Canal Comn., Washington, D. C., for furnishing 600,000 bbl. of fuel oil during the year 1915, under item (1), 450,000 bbl. delivered at Balboa, and item (2), 150,000 bbl. delivered at Cristobal: Anglo-Mexican Petroleum Products Co., 32 Broadway, New York, N. Y., bid A, in lots of 38,000-40,000 bbl., (1) $1.03, (2) 88c.; in lots of 58,000-60,000 bbl., (1) 98c., (2) 83c.; bid B, in lots of 38,000-40,000 bbl., (1) 88c., (2) 73c.; in lots of 58,000-60,000 bbl., (1) 83c., (2) 68c.; bid C, in lots of 38,000-40,000 bbl., (1) 98c., (2) 83c.; in lots of 58,000-60,000 bbl., (1) 93c., (2) 78c.; Associated Oil Co., San Francisco, Calif., (1) $1; Huasteca Petroleum Co., 32 Broadway, New York, N. Y., (2) 90c.; National Petroleum Co., Richmond, Va., (1) 91c., (2) 79c., or will deliver entire quantity at Cristobal at 79c.; Pierce Oil Co., St. Louis, Mo., (2) $1.20; Standard Oil Co., San Francisco, in lots of 30,000 bbl., (1) $1.03, (2) $1.25; in lots of 60,000 bbl., (1) 92c., (2) $1.05; in lots of 100,000 bbl., (1) 88c., (2) $1.05; Sun Co., Philadelphia, (1) $1.39, (2) $1.20; Texas Co., New York, N. Y., bid A, (1) $1.06, (2) 88c.; bid B, (1) $1.29, (2) $1.12; Union Oil Co. of California, San Francisco, (1) 98c., (2) $1.10; W. R. Grace & Co., San Francisco, (1) 98c., (2) $1.10; Gulf Refining Co., Pittsburgh, Penn., (1) $1.35, (2) $1.05. Noted Nov. 5.

MISCELLANEOUS

Motor Fire Apparatus—Boston, Mass.—James M. Curley, Mayor, has approved the recommendation of the Fire Commissioner, providing for the purchase of tractors for the three water towers. The estimated cost is $16,613.

Pier—New Bedford, Mass.—Bids will be received, until Dec. 12, by the State Harbor and Land Commissioner for the construction of a pier and a two-story steel shed at New Bedford. William I. Williams is Ch. Engr.

River Improvement—Quincy, Mass.—The City of Quincy, the Fore River Shipbuilding Co. and the State of Massachusetts plan to spend $100,000 in the improvement of Weymouth Fore River. Frank F. Crane is Comr. of Water-Front, Navigation and Waterways.

Elimination of Grade Crossings—Central Falls, R. I.—The City Council passed a resolution on Nov. 18, appropriating $350,000 to pay the city's share for the elimination of grade crossings between Central Falls and Pawtucket.

★**Barge Canal Work**—Albany, N. Y.—(Official)—Bids will be received by Duncan W. Peck, State Supt., Pub. Wks., until noon, Dec. 22, for the following work: Contract C-2, for the removal of buildings and clearing site at Seneca Falls, N. Y.; Terminal contract No. 13, for constructing a guard-lock, highway bridge and cut-off dam at Schuylerville. For details see advertisement under "Contracts to Be Let." Engineer's estimate, $61,664.

✚**Barge Canal Work**—Albany, N. Y.—Duncan W. Peck, State Supt., Pub. Wks., has awarded the following contracts: Contract G, for furnishing and erecting the lock gates, lock valves and buffer beams for Locks 2, 3 and 4, needle beam for the spillway in Dam 2, superstructure for the Taintor gates at Waterloo, guard gates at Locks 3 and 4 and over the old canal at Waterloo, and all incidental work, LUPFER & REMICK, Buffalo, at $110,115. Contract J, for constructing the substructure, superstructure and approaches of a highway bridge over the Cayuga and Seneca Canal at Fourth St., Watkins, and for constructing a section of a dockwall between the west abutment and the end of the Terminal dockwall, OSWEGO CONSTRUCTION CO., INC., Fulton, N. Y., at $52,939. Terminal Contract No. 29, for the construction of a harbor, dockwall and two breakwaters on Oneida Lake at Constantia, N. Y., BARRALLY & INGERSOLL, Rochester, N. Y., at $38,733.50. Noted Nov. 19 and 26.

✚**Creek Improvement**—Albany, N. Y.—(Official)—Duncan W. Peck, State Supt., Pub. Wks., has awarded the contract for the improvement of Ellicott Creek, Erie County, to FRANK L. COHEN, Buffalo, at $62,829. The only other bid received was that of the Great Lakes Dock & Dredge Co., at $99,461. Noted Nov. 19.

Fire Alarm System—New York, N. Y.—(Borough of Brooklyn)—The Bureau of Repairs and Supplies has awarded the contract for extending the fire alarm telegraph system in Brooklyn to KNIGHT & DeMICIO, INC., New York, at $11,442. J. R. Keefe is Ch. of Bureau.

Storage Packet—New York, N. Y.—(Borough of Bronx)—(Official)—Bids will be received until Dec. 9 by the President of the Borough of the Bronx, Municipal Bldg., Crotona Park and 177th St., for furnishing the labor and materials required for constructing a four-bin storage pocket, automatic grab on mast and gaff, automatic railway and hopper, at Fort Schuyler Rd. and Westchester Creek, Borough of the Bronx.

★**Subway Reconstruction**—New York, N. Y.—(Borough of Brooklyn)—(Official)—The following are the unofficial totals of the bids received by the Public Service Commission on Dec. 1, for the reconstruction of Section No. 9-C-1 of Route No. 9, a part of the Fourth Ave. Subway in Brooklyn: Samuel Beskin, Beacon, N. Y., $134,085; Ward & Tulley, Inc., $141,762; Thomas F. Shaughnessy, $154,144; Kaufman Contracting Co., $158,109; Thomas Crimmins Contracting Co., $168,000; Snare & Triest, $172,733; Norton & Gorman, $185,830; J. F. Cogan Co., $190,000; Degnon Contracting Co., $192,389. Noted Nov. 19.

✚**Steam Asphalt Rollers**—New York, N. Y. — Borough of Manhattan)—(Official)—The contract for five steam asphalt rollers has been awarded by Marcus M. Marks, Borough Pres., to the KELLY-SPRINGFIELD CO. Noted Nov. 5 and 19.

Pier Extension—New York, N. Y.—(Borough of Manhattan)—(Official)—The lowest bid received by R. A. C. Smith, Comr. of Docks, for furnishing the material and labor necessary for extending Pier 43, was that of the General Contracting & Engineering Co., 29 Broadway, New York., at $21,000. Noted Nov. 19.

✚**Dumping Board**—New York, N. Y.—(Borough of Manhattan)—(Official)—The contract for constructing portions of a dumping board at the foot of East 72d St. has been awarded by the Commissioner of Street Cleaning to HENRY A. ASSERSON, Brooklyn, at $16,456. Other bids were: Stillman, Delehanty, Ferris Co., $16,945; Simon Russek, Inc., $17,430; George B. Spearun, $17,776; Post & McCord, $19,595; A. W. King, $19,703; Otto Metz, $19,810; J. M. Knopp, $21,593. Noted Nov. 19.

Motor Tractors—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until Dec. 10, by the President of the Borough of Manhattan, Municipal Bldg., for six motor tractors.

★**Sanitary Work**—Rochester, N. Y.—(Official) — The State Hospital Commission has postponed indefinitely the sanitary work for which bids were advertised to be received on Dec. 4. The specifications are being revised.

Motor Fire Apparatus—Bristol, N. J.—Bristol Fire Co. No. 1 plans to purchase a motor-driven pumping engine.

Dock—Newark, N. J.—The city has sold $300,000 in bonds, the proceeds of which will be used for the construction of a dock in the Passaic River.

Excavation—Newark, N. J.—(Official)—Bids will be received until 4 p.m., Dec. 15, for excavating for the foundations of the McKinley School. R. D. Argue is Secy.

Bath House—Newark, N. J.—The lowest bid received by the Common Council for the construction of the East Side Bath House, was that of E. M. Waldron & Co., Newark, at $64,316. This bid was in excess of the amount available. Specifications will be revised and new bids called for. Noted Nov. 19.

Dock—Roosevelt, N. J.—The Borough Council plans to purchase suitable property and to construct a public dock. A special election has been called for Dec. 8 to secure the approval of residents.

Motor Fire Apparatus—Weehawken, N. J.—The West New York Borough Council plans to purchase a motor-driven fire truck and combined chemical engine and hose truck for its new fire department to be inaugurated early in 1915. The equipment is estimated to cost $15,000.

✚★**Creek Improvement**—York, Penn.—(Official)—The contract for excavating about 20,000 cu.yd. of earth for a channel in Codorus Creek has been awarded to SLACK & SLACK, Baltimore, Md., at $7870. Other bids were: Otto Paving Construction Co., $7950; Firor & Williams, $9455; Roy B. Wenner, $9890; Bruno Pizzimenti, $11,620; Whiting-Turner Construction Co., $12,020; S. W. Chiles, $13,515; R. E. Neumeyer, $14,955; T. L. Eyre, $16,893. George A. Warner is City Engr. Noted Nov. 12.

✚★**Pumping Station**—Charlotte, N. C.—The Lake Mattamuskeet Drainage District, Hyde County, has awarded the contract for the construction of the pumping plant for draining Lake Mattamuskeet, to T. C. THOMPSON & BROS., Charlotte, at $75,000. Noted Oct. 15.

Filling—Jacksonville, Fla.—Duval County Commissioners will receive bids until Dec. 23, for filling back of bulkhead at north end of the Ortega Bridge. J. H. Patterson is Chmn.

Drainage Bonds—Tallahassee, Fla.—The Board of Commissioners, Everglades Drainage District of Florida, will receive bids until Dec. 10, for the purchase of $1,500,000 drainage bonds. J. Stewart Lewis is Secy.

Shed Improvements—[illegible] The estimated cost is [illegible].

Trash Boxes—New [illegible] has [illegible] for the installation of [illegible] at street intersections. [illegible]

Stockyard Improvements—L[illegible], Ky.—The [illegible] contract for the construction of a [illegible] to the [illegible] CO., [illegible]. The estimated cost is [illegible]. [illegible] & Bro., [illegible], are Archs.

Comfort Station—[illegible] Ohio—The lowest bid received by the [illegible] for the construction of a comfort station [illegible] was that of E. H. Walker, at $10,[illegible].

Recreation Building—W[illegible] Ohio—The city of [illegible] is having plans prepared for the construction of a [illegible] building in W[illegible]. The estimated cost is [illegible]. [illegible] Bldg., Cleveland, is Arch. [illegible]

Park Improvements—Grand Rapids, Mich.—The city contemplates an expenditure of $[illegible] for improvements to [illegible] Park.

Terminal and Freight Yard—Chicago, Ill.—According to press reports the Baltimore & Ohio R.R. has begun negotiations which will result in the construction of elevated freight yards and terminal buildings south of 11th St., near Western Ave. The estimated cost is said to be about $1[illegible],000,000.

♦Police Alarm System—[illegible] Island, Ill.—(Official)—Bids will be received until Dec. 12 by the city for the installation of a police fire alarm system. See advertisement under "Contracts To Be Let."

Drain—Clarion, Iowa—Bids will be received until Dec. [illegible] by F. [illegible], County Audr., for the construction of Drain No. 9[illegible]. About 1[illegible] ft. of tile will be required. Bids will also be received at the same time for constructing lateral No. [illegible] of Drain No. 36, requiring 1[illegible] ft. of tile. Noted Nov. [illegible] and 19.

♦Ditch—Fort Dodge, Iowa—Contracts have been awarded for [illegible] to D. L. OLSON, Lanesboro, [illegible] PLYMOUTH CLAY PRODUCTS CO., Fort Dodge, at $[illegible] for tile.

♦Drainage—Nebraska City, Neb.—(Official)—Bids will soon be received for the improvement of Drainage District No. 1, [illegible] Counties. The work includes 1,6[illegible],800 cu. yd. of earth excavation, river clearing and small amount of levee work. Further information can be obtained from George H. Heinke, Nebraska City, who is Atty. for the District. See advertisement under "Contracts to Be Let."

Drainage—Omaha, Neb.—An issue of $300,000 in bonds has been voted and bids probably will be called for soon for the construction of about 33 miles of drainage ditches in Wash[illegible] Counties. The T[illegible] Engineering Co., Omaha, prepared the plans.

Drainage—[illegible] Mo.—(Official)—The Grand River Drainage District, [illegible] Counties has recently been [illegible]. The district comprises about [illegible] and will be [illegible] ditch. [illegible] D. K. Hall, [illegible]

Drainage—[illegible] Mo.—The [illegible] Drainage District [illegible] For [illegible]

Waterway—[illegible]

♦Jetty—[illegible]

♦Marine Repairs—[illegible]

♦Jetties, Pile Driving and Ditches—[illegible]

♦Embankment—[illegible]

♦Reinforced Concrete Wharf—[illegible]

River Improvement—[illegible]

Traveling Crane and Freight Handling Equipment—[illegible]

Drydock—Halifax, N. S.—Plans will soon be completed by the Dominion Government, Department of Public Works, for the construction of a 1[illegible]0x11[illegible]-ft. drydock. The estimated cost is $[illegible]. [illegible] C. Desrochers, Ottawa, is Secy.

Breakwater—St. John, N. B.—The Public Works Department, Ottawa, Ont., will not undertake the breakwater extensions for which bids were asked early in October. [illegible] C. Desrochers is Secy. Noted Sept. 3.

BUILDINGS

♦Boston, Mass.—(Official)—The contract for the additions to the [illegible] building at Harrison and Massachusetts Ave. has been awarded to M. F. McDONALD & SON, 9[illegible] Granite St., Boston, Mass. Noted Nov. 19.

Plans are being prepared by M. M. Kalman, Arch., for the six-story building to be constructed at [illegible]16 Hanover St., for D. De Stefano.

Brockton, Mass.—The Damocles Lodge of the Knights of Pythias will construct a temple at Brockton. The estimated cost is $6[illegible].

Concord, Mass.—The following bids were received by the Armory Commissioner for the construction of the armory at Concord: Fi[illegible] Construction Co., Boston, Mass., $41,9[illegible]; T. F. H[illegible], Marlboro, Mass., $42,74[illegible]; Whiton & Haynes Co., Boston, Mass., $44,[illegible]; J. F. Keating, Westboro, $44,7[illegible]; Wiley & Foss, Fitchburg, $45,491; R. L. Wilson Co., Concord, $48,198; Walter I. Mellen, Wrentham, $4[illegible],866; Marr Bros. & Stewart, Boston, $[illegible]; H. S. Sibley, Boston, $[illegible]1,798; Afted & McDuffee, Malden, $55,168; E. A. Peabody & Son, Lawrence, $[illegible].

Fall River, Mass.—Edward M. Corbett, Arch., is preparing plans for the construction of the four-story police station at Fall River.

Mattapan (Boston post office) **Mass.**—The lowest bid received by Richard A. Lynch, Supt. of Bldgs., for the construction of the police station, was submitted by John Bowen, $[illegible]3. Noted Nov. 19.

Needham, Mass.—Plans have been prepared by James H. Ritchie, Arch., Boston, Mass., for the library to be constructed at Highland Ave. and Rosemary St.

♦Northampton, Mass.—The contract for the construction of a three-story building for the Sherwin Estate has been awarded to A. C. WIGGLESWORTH, 19 Trinity Terrace. The Samuel Green Co. is Arch.

New Haven, Conn.—L. W. Robinson, Arch., has completed plans for the administration building to be built by the New Haven Hospital Association, and the building for the Yale Medical School. The estimated cost is $300,0[illegible].

Stamford, Conn.—Bids are being received by Henry C. Pelton, Arch., 8 West 28th St., New York, for the construction of a seven-story apartment hotel on South St., for the M[illegible] Realty Co. The estimated cost is $1[illegible]0,000. Noted Aug. 27.

♦♦Buffalo, N. Y.—The general contract for the construction of the two-story brick armory and stable on Delevan St., for the New York State Armory Commission, has been awarded to CHARLES EVERITT, [illegible] White Bldg. Noted Nov. [illegible].

New Rochelle, N. Y.—Frederick Stevens, Arch., [illegible] Park St., Boston, Mass., is preparing plans for a brick addition to the hospital [illegible] St., for the New Rochelle Hospital Association. The estimated cost is $[illegible].

New York, N. Y.—(Borough of Brooklyn)—Bids will be received until [illegible] p.m., Dec. 7, by C. B. J. Snyder, Supt. of School Bldgs., Park Ave. and 59th St., Borough of Manhattan, for general construction of additions and alterations to Public School 1[illegible], at [illegible] and [illegible] St.

New York, N. Y.—(Borough of Richmond)—Bids will be received until [illegible] Dec. [illegible], by Charles J. McCormack, Pres., Borough of Richmond, Borough Hall, St. George, New Brighton, for the general construction of a county court house at St. George, Borough of Richmond.

New York, N. Y.—(Borough of Manhattan)—Plans have been completed by Jackson & Rosencrans, Archs., [illegible], New York, for the construction of the Y. M. C. A. building to be constructed at East Third St. and the Bowery. The estimated cost is $[illegible].

Schroon Lake, N. Y.—W. E. Lawrence, Arch., 11[illegible] [illegible] St., Glens Falls, N. Y., is preparing plans for rebuilding the three-story hotel for James S. Emerson and [illegible] W. [illegible]. The estimated cost is $[illegible].

Troy, N. Y.—N. E. Clerk, Arch., Cannon Pl., Troy, is preparing plans for the [illegible] of a hospital and nurses home to be constructed by the [illegible] Hospital at [illegible]th St. and [illegible] Ave. The estimated cost is $[illegible].

Utica, N. Y.—The Knight Templars of New York State will [illegible] Masonic Home [illegible] at Utica. The estimated cost is $[illegible].

Elberon, N. J.—The Elberon Hotel recently destroyed by fire will be rebuilt. The estimated cost is $[illegible]. [illegible]

Newark, N. J.—The Board of Education is having tentative plans for the [illegible] School and the [illegible] School [illegible]. The estimated cost is $[illegible]. [illegible] F. [illegible], [illegible] St., is [illegible] Arch.

Newark, N. J.—The [illegible] Methodist Episcopal Church plans to construct a church at Mt. Prospect and [illegible] Ave. The estimated cost is $[illegible]. Rev. [illegible] M. West, [illegible] Clifton Ave., [illegible]

[illegible] to construct a brick building [illegible]

New Brunswick, N. J.—Alexander Merchant, Arch., [illegible] St., is preparing plans for constructing a two-story [illegible] at [illegible] and Delaware Ave. The estimated cost is $[illegible].

Gloucester City, N. J.—The Board of Education will [illegible] a school at [illegible] and [illegible]

Rochaway, N. J.—Bids will be received until Dec. 16, by the Board of Education, for the construction of a school. J. J. [illegible]

Roselle, N. J.—D. C. Newman Collins, Arch., 29 Broadway, New York, is preparing plans for the construction of a high school at Roselle. The estimated cost is $40,000.

West Hoboken, N. J.—The National Bank of North Hudson plans to construct a bank. The estimated cost is $40,000.

Waynesboro, Penn.—(Official)—Bids will be received until Dec. 16, by Harry H. Wehmeyer, 1004 W. Lehigh Ave., for the construction of a Y. M. C. A. building at Waynesboro. The estimated cost is $75,000. Noted incorrectly Nov. 12.

Atlanta, Ga.—A. Ten Eyck Brown, Arch., has prepared plans for the construction of the Fulton Theater on Houston St. The estimated cost is $100,000.

+Thomasville, Ga.—The contract awarded to the T. E. Amason Co. for the construction of the school on Malette Heights, has been rescinded and awarded to the GEORGE A. CLAYTON CO., 507 Gould Bldg., Atlanta, Ga., at $41,149. Noted Aug. 20.

Baton Rouge, La.—Favrot & Livaudais, Archs., 505 Title Guarantee Bldg., New Orleans, are preparing plans for the George Peabody Building at the Louisiana State University and Agricultural and Mechanical College.

New Orleans, La.—Lodge No. 30, B. P. O. E. will erect a building at New Orleans. The estimated cost is $100,000.

+Shreveport, La.—The contract for the construction of the three-story labor temple and office building at Shreveport, has been awarded to P. MARTINEAU. The estimated cost is $40,000. Clarence W. King, Shreveport, is Arch.

Vivian, La.—The Town Council has decided to construct a school. Plans are now being prepared. The estimated cost is $65,000.

Chattanooga, Tenn.—J. R. Baylor, Principal of the Baylor School, will construct buildings estimated to cost $70,000.

+Memphis, Tenn.—The contract for the construction of a temple at Poplar Ave. and Montgomery St., for the Congregation of the Children of Israel, has been awarded to JAMES ALEXANDER CONSTRUCTION CO., Memphis. The estimated cost is $100,000. Noted Nov. 5.

Covington, Ky.—Weber, Werner & Adkins, Archs., 1206 Mercantile Library Bldg., Cincinnati, Ohio, are preparing plans for constructing the two-story and basement school at Covington. The estimated cost is $150,000.

Louisville, Ky.—The Standard Club, Louisville, Ky., will rebuild its clubhouse recently destroyed by fire. The estimated cost is $75,000. Louis Hirsch is Pres.

Akron, Ohio— H. E. Shinmin, Arch., 2031 Euclid Ave., Cleveland, is preparing plans for the construction of an eight-story and basement, 124x127-ft. masonic temple. Estimated cost, $400,000. George Billows, 110 Beck Ave., Akron, is Chn. of Bldg. Com.

Cincinnati, Ohio—Bids will soon be received for the construction of a $2,500,000 court house and jail at Cincinnati. James Albert Green is Chn. of Court House Comn. Noted July 23 and Sept. 3.

Cleveland, Ohio—Plans are being prepared by Fulton & Taylor, Archs., 704 Permanent Bldg., Cleveland, for the construction of a four-story and basement, 90x175-ft. apartment house for the Euclid-Carnegie Co. Estimated cost, $100,000. John Thorman, 516 Citizens Bldg., Cleveland, is Pres.

Morron & Cross, Archs., 734 Garfield Bldg., are preparing plans for the construction of a three-story freight station for the Cleveland R.R. Co. Estimated cost, $250,000. H. J. Davis, Leader News Bldg., is Secy. of the company.

+The contract for the construction of a two-story and basement, 81x81-ft, and a two-story and basement, 80x408-ft. passenger and freight building, at Cleveland, for the Detroit & Cleveland Navigation Co., Detroit, Mich., has been awarded to GEORGE R. COOK, Ford Bldg., Detroit, Mich. Estimated cost, $100,000. Noted Nov. 12.

Plans have been prepared by W. R. McCormick, Arch., Board of Education Bldg., Cleveland, for the construction of a three-story and basement, 85x180-ft. school. The estimated cost is $200,000.

Plans have been prepared by Frank C. Warner, Arch., 767 Hippodrome Bldg., for the construction of an eight-story, 78x162-ft. and a five-story, 35x180-ft. railroad terminal for the Northern Ohio Traction & Light Co., Hamilton Bldg. Estimated cost, $200,000. Bids will be received in the spring.

The construction of an apartment building at Forest Hill and Superior Ave. is contemplated by Samuel Deckelbaum, 2350 East 39th St., Cleveland. Estimated cost, $60,000.

+Columbus, Ohio—The contract for the construction of the one-story, 36x122-ft. addition to the Hyper-Immune building at the State Serum Farm has been awarded to MOOR BROS., Builders' Exchange, Columbus. Harry C. Holbrook, Columbus, is Arch.

Columbus, Ind.—The construction of a $100,000 theater will begin in the spring for a company now being organized in Columbus. Barton & Olson, Indianapolis, are interested.

Greencastle, Ind.—Bids will be received about Jan. 15, 1915, by G. L. Grose, Pres. of DePauw University, for the construction of a $100,000 gymnasium. R. P. Daggett & Co., Archs., are preparing plans. Noted Oct. 8.

Detroit, Mich.—C. Howard Crane, Dime Bank Bldg., is preparing plans for the construction of an amusement hall and store building at Columbia and Woodward St., for the Colonial Garden Co. Estimated cost, $50,000.

+Grand Rapids, Mich.—The contract for the construction of a one-story and basement, 58x146-ft. building, for the St. Anthony's R. C. Church, has been awarded to SCHILDROTH & EDWARDS, 1314 Henrietta Ave., Grand Rapids. Estimated cost, $75,000. Noted Oct. 22.

Sturgis, Mich.—Plans have been prepared by Robinson & Campau, Archs., Grand Rapids, for the construction of a three-story reinforced-concrete fireproof school on Nottawa St. The estimated cost is $95,000.

+Bloomington, Ill.—The contract for the construction of a three-story high school has been awarded to J. L. SIMMONS, 423 West Madison St., Chicago. Estimated cost, $250,000.

Continued on page 348

CONTRACT PRICE

BARGE CANAL WORK, ALBANY, N. Y.

Contract No. 29

Bids were received Nov. 20 by Duncan W. Peck, State Supt. Pub. Wks., Albany, for Barge Canal Contract No. 29, constructing a harbor, dockwall and two breakwaters in Oneida Lake at Constantia, N. Y., and Contract J, constructing the substructure, superstructure and approaches of a highway bridge over the Cayuga and Seneca Canal at Fourth St., Watkins, N. Y. Bids were submitted by (A) Seneca Engineering Co., Montour Falls, N. Y.; (B) Low B. Cleveland, Watertown; (C) D. L. Taylor & Co., Medina; (D) Parker Beebe, Waterford; (E) Frank L. Cohen, Buffalo; (F) Drake & Dean Co., Inc., Buffalo; (G) Brooks & Julian, Rochester; (H) Lathrop, Shea & Henwood Co., Buffalo; (I) Chesley, Earl & Heimbach Co., Buffalo; (J) Barrally & Ingersoll, Rochester; (K) Walsh Construction Co., Davenport, Iowa; (L) John Kelly, Elmira; (M) Oswego Construction Co., Fulton; (N) Scott Bros., Rome; (O) Flood & Van Wirt Co., Hudson Falls; (P) James Stewart & Co., Inc., 50 Church St., New York; (Q) Eastover Construction Co., Inc., Utica. The item bids were as follows:

	J	P	Q
48,000 cu.yd. excavation	$0.40	$0.54	$0.49
24 M ft. b.m. sawed lumber	50.00	50.00	50.00
49,000 lin.ft. round timber (cribs)	0.16	0.20	0.20
230 cu.yd. second class concrete	8.00	8.00	9.50
1,230 cu.yd. stone filling	1.50	1.47	1.80
1,500 cu.yd. second-class rip-rap	4.50	4.50	2.50
1,170 lb. iron casting, plain	0.05	0.05	0.05
Extended totals	$38,733	$47,377	$42,7

CONTRACT J

	A	B	C	D	E	F	G	H
8850 cu.yd. excavation	$0.72	$0.63	$0.60	$0.75	$0.41	$0.68	$0.63	$0.65
90 cu.yd. lining	1.50	1.50	1.50	1.50	1.25	1.45	1.25	1.50
19 M ft. b.m. sawed lumber	50.00	50.00	50.00	50.00	45.00	50.00	40.00	55.00
6900 lin.ft. foundation piles	0.33	0.25	0.36	0.36	0.36	0.32	0.35	0.35
2580 cu.yd. second-class concrete	6.00	6.65	7.00	8.00	7.60	7.20	6.50	7.50
130 cu.yd. first-class reinforced concrete	12.00	11.80	12.00	12.00	12.00	12.00	10.00	12.00
6050 lb. c.i. pipe	0.03	0.02½	0.03	0.03	0.02½	0.03	0.02	0.03
331,000 lb. structural steel	0.04	0.038	0.039	0.04	0.03½	0.04	0.0385	0.04
23,700 lb. metal reinforcement	0.03	0.03	0.03	0.03½	0.03	0.03½	0.03	0.03½
2300 sq.ft. concrete sidewalks	0.14	0.20	0.25	0.25	0.25	0.24	0.15	0.20
580 lin.ft. concrete curb and gutter	0.50	0.70	1.00	1.00	1.00	0.95	0.60	1.00
1160 sq.yd. waterbound macadam H. O.	1.00	1.00	1.00	1.00	1.00	0.97	0.80	1.00
350 sq.yd. asphalt block pavement	2.00	2.00	2.00	2.00	2.00	2.10	2.00	2.00
725 lin.ft. wooden fence	0.27	0.25	0.25	0.25	0.25	0.30	0.25	0.25
285 lin.ft. w.i. pipe railing	1.25	1.10	1.25	1.50	1.25	1.30	1.25	1.25
175 lin.ft. lattice railing	1.75	1.50	1.75	2.00	1.75	1.75	1.75	2.00
150 cu.yd. stone filling for cribs	2.00	2.00	1.50	2.00	1.50	1.90	1.50	2.10
6 oil signal lamps	15.00	15.00	18.00	15.00	15.00	15.00	10.00	15.00
Maintaining highway traffic (lump sum)	100.00	100.00	120.00	100.00	50.00	100.00	25.00	100.00
Maintaining navigation (lump sum)	100.00	100.00	1.00	100.00	1.00	100.00	100.00	100.00
Cofferdams pumping, bailing and draining (lump sum)	4400.00	7000.00	4800.00	4800.00	4100.00	4000.00	4800.00	4800.00
Extended totals	$19,227	$51,590	$51,413	$56,021	$19,020	$52,126	$18,883	$53,746

	I	J	K	L	M	N	O
8850 cu.yd. excavation	$0.60	$0.60	$0.55	$0.70	$0.90	$0.65	$0.75
90 cu.yd. lining	1.25	1.50	1.25	1.50	1.50	1.50	1.50
19 M ft. b.m. sawed lumber	38.00	50.00	50.00	50.00	60.00	50.00	50.00
6900 lin.ft. foundation piles	0.25	0.30	0.26	0.30	0.36	0.30	0.36
2580 cu.yd. second-class concrete	7.20	6.50	6.53	6.50	7.40	7.25	8.00
130 cu.yd. first-class reinforced concrete	10.00	11.00	11.00	10.00	12.00	14.00	12.00
6050 lb. c.i. pipe	0.02½	0.02½	0.03	0.02	0.03	0.03	0.02½
331,000 lb. structural steel	0.0365	0.0415	0.04	0.0425	0.03	0.041	0.04
23,700 lb. metal reinforcement	0.02½	0.02½	0.02½	0.03	0.03	0.03½	0.03
2300 sq.ft. concrete sidewalks	0.18	0.20	0.22	0.15	0.25	0.25	0.20
580 lin.ft. concrete curb and gutter	0.80	1.00	0.80	0.75	1.00	1.00	0.75
1160 sq.yd. waterbound macadam H. O.	0.85	1.00	1.00	1.00	1.00	1.00	1.20
350 sq.yd. asphalt block pavement	1.75	2.00	2.00	2.00	2.00	2.00	2.20
725 lin.ft. wooden fence	0.18	0.25	0.25	0.25	0.25	0.25	0.25
285 lin.ft. w.i. pipe railing	1.00	1.25	1.25	1.00	1.25	1.50	1.25
175 lin.ft. lattice railing	1.50	1.75	1.75	1.75	1.75	1.85	1.75
150 cu.yd. stone filling for cribs	2.00	2.00	1.50	2.00	2.00	2.40	2.00
6 oil signal lamps	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Maintaining highway traffic (lump sum)	100.00	100.00	100.00	50.00	100.00	100.00	120.00
Maintaining navigation (lump sum)	100.00	100.00	100.00	50.00	100.00	100.00	1.00
Cofferdams pumping, bailing and draining (lump sum)	3750.00	3500.00	4000.00	4500.00	1.00	4800.00	4800.00
Extended totals	$18,065	$18,970	$18,204	$50,722	$17,640	$53,412	$55,729

Buildings (continued)

Chicago, Ill.—[illegible] has prepared [illegible] the [illegible] at [illegible] to be [illegible] the State Bldg. [illegible]

Danville, Ill.—The construction of a temple, to cost $1[illegible],000, is contemplated by the [illegible] Association. James P. [illegible], [illegible] of the Association.

Joliet, Ill.—The Paul Revere Lodge of the Knights of Pythias is [illegible] the construction of a [illegible] temple at Ottawa and [illegible] St. Estimated cost, $[illegible]

Kankakee, Ill.—Bids will be received until [illegible] p.m., Dec. 14, by the Board of Administration, Capitol Bldg., Springfield, for the [illegible] of a [illegible] building at the Kankakee State Hospital.

Quincy, Ill.—[illegible] and Main St., is preparing plans for the construction of the [illegible] School. The estimated cost is $[illegible] Noted Sept. 24.

Madison, Wis.—Bids will be received until 2:30 p.m., Dec. 1[illegible], by M. E. [illegible], Secy. of the University of Wisconsin, Administration Bldg., Madison, for the construction of [illegible] building at the university.

Davenport, Iowa.—The [illegible] of Davenport are contemplating the construction of a $[illegible] [illegible] at Fifth and [illegible] St.

St. Paul, Minn.—[illegible] & [illegible], Archts., 5[illegible] Shubert Bldg., are preparing plans for the [illegible] of the St. Paul [illegible] building on [illegible] and Minnesota St., for [illegible] [illegible] Estimated cost, $[illegible]

Red Lodge, Mont.—Plans are being prepared by C. M. [illegible], Archt., [illegible], for a two-story hotel, store and theater building for the Red Lodge Theater Co. The estimated cost is $[illegible]

Belleville, Mo.—Bids will soon be received by the Belleville [illegible] Board, for the construction of the Carnegie Library at [illegible] and Jackson St. Estimated cost, $15,-[illegible] Noted Oct. [illegible]

Jefferson City, Mo.—Plans have been prepared by Frank [illegible], Jefferson City, for the construction of a seven-story [illegible] building at Madison and High St., for the Central [illegible] Trust Co. Estimated cost, $1[illegible]

Logan, Utah.—Bids are being received by Cannon & Fetzer, Archts., [illegible], Salt Lake City, for the construction of a [illegible] chemistry building for the Utah Agricultural College. Estimated cost, $1[illegible]

Bisbee, Ariz.—Bids will soon be received for the construction of a [illegible] hospital. The estimated cost is $[illegible] [illegible] is City [illegible]

✦Republic, Wash.—[illegible] VAN [illegible]KEN, Coeur d'Alene, [illegible] has been awarded the contract for the construction of a [illegible] at Republic. Estimated cost, $[illegible] [illegible] Spokane, are Archts.

Portland, Ore.—Bids will be received about Jan. 15, 1915, by the [illegible] Banks [illegible] building. D. C. Lewis [illegible] [illegible] Noted July 30 and Sept. [illegible]

Bids will be received about Jan. 1, 191[illegible], by the Commissioners of Multnomah County for the construction of a [illegible] reinforced-concrete [illegible] hospital. [illegible] & Webber, [illegible] of Commerce Bldg., are Archts.

The [illegible] of [illegible] Hall recently [illegible] by fire with a loss of $[illegible], contemplates rebuilding the structure. Estimated cost, $[illegible] A. A. [illegible] is [illegible]

✦The contract for the construction of the Shattuck School has been awarded to BOYAJOHN-ARNOLD CO., Panama Bldg., Portland, at $[illegible]. The lowest bid for the heating and ventilating was that of the Alaska Plumbing Co., $[illegible]. Noted Nov. [illegible]

Fresno, Calif.—Schwartz, Hotchkin & Schwartz, Archts., are preparing plans for the construction of a two-story and basement, [illegible]-ft. building on Tulare and L St., for F. M. Fossaler [illegible] Estimated cost, $7[illegible],000.

Los Angeles, Calif.—Robert H. Orr, Archt., Van Nuys Bldg., has prepared plans for the construction of a 56x1[illegible]-ft. building on South Park Ave. and 42d St. for the South Park Christian Church.

Los Angeles, Calif.—Plans are being prepared by H. Allen Reeves, Chamber of Commerce Bldg., for the construction of a building for the Cienaga School District. Estimated cost, $6[illegible] Noted Nov. 19.

Oakland, Calif.—Plans have been prepared by J. J. Donovan, Security Bank Bldg., for the construction of a reinforced-concrete high school at Magnolia and [illegible] St. Estimated cost, $16[illegible]

✦San Bernardino, Calif.—Contracts for the construction of a group of [illegible] school buildings were awarded as follows: GEORGE C. CONDON, Citizen's National Bank Bldg., Los Angeles, to construct the administration and manual arts building, $[illegible]; CRESSMER MANUFACTURING CO., Riverside, for the [illegible], science and home economics buildings, $[illegible],991. The estimated cost of the group is $2[illegible] Norman F. Marsh, Broadway Central Bldg., Los Angeles, is Archt. Noted Oct. 1.

San Diego, Calif.—Eugene Hoffman, Archt., Spreckels Bldg., has prepared plans for the construction of an apartment hotel for the [illegible] Hotel Co., of San Diego. Estimated cost, $1[illegible] Eugene Hoffman is Pres. of the company.

✦San Francisco, Calif.—The contract for the construction of a two-story addition to the Ferry Bldg., for the Board of State Harbor Commissioners, has been awarded to the [illegible] CONSTRUCTION & ENGINEERING CO. The estimated cost is $3[illegible] Noted July 30.

Plans are being prepared for the construction of a building on the Embarcadero, between Mission and Howard St., for the Board of State Harbor Commissioners. Estimated cost, $[illegible]

Fort George, B. C.—The Fort George Hotel recently destroyed by fire will be rebuilt at an estimated cost of $1[illegible],000.

RECORD BIDDING ON CONSTRUCTION

Not within the memory of the older engineers and contractors has there been such keen bidding on all classes of construction work. In a recent piece of work at Wappingers Falls, N. Y., there were forty-two bidders for the water supply system and thirty-seven bidders for the sewers. A new storehouse is to be built at the Washington Navy Yard, and to date there have been 136 applications for plans, of which five are duplications, that is, where firms have a Washington and a New York office, each would apply for the same plan. Of the remaining 131, thirty-seven are obviously subcontractors who would not bid on the entire proposition. Sixteen sets of plans have been returned by bidders evidently not interested. For the Rock Creek bridge in Washington there were [illegible] bidders, and for the high school, 1[illegible] bidders. A new post office will be constructed at Morristown, N. J., and already over 60 applications are on file at the Treasury Department for the plans of this work.

Philadelphia Builders Fail.—Notice has been received that [illegible] & [illegible] has been unable to meet its bills. A preliminary examination reports the total liabilities of the firm as $[illegible] and the total assets $1[illegible]. One of the important buildings the company now has under construction is the [illegible] Building, 14[illegible] South Penn Square, which is being completed.

Contracts for Dual System of Rapid Transit

FOR OPERATION BY NEW YORK MUNICIPAL RAILWAY CORPORATION

[illegible] Route No. [illegible]

Section	Limits	Contractor	Contract Executed	Amount of Contract	Date of Engineering News
[illegible]	[illegible]	[illegible]	[illegible]	$1,[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Contracts for Dual System of Rapid Transit—Continued

FOR OPERATION BY INTERBOROUGH RAPID TRANSIT CO.

Seventh Ave.-Lexington Ave. Subway—Routes Nos. 5, 19 and 22, 43, 16, 4 and 38, 9 and 48					
*6	26th St. to 40th St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	$3,634,213.50	Nov. 3, 1910
* Work stopped on April 26, 1912, on account of change in routing of this branch.					
Lexington Avenue Branch—Route No. 5					
7	43d St. to 53d St.	Rapid Transit Subway Construction Co., 165 Broadway, New York		$1,915,164.00	June 25, 1914
8	53rd St. to 67th St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	$3,369,484.20	Nov. 3, 1910
9	67th St. to 79th St.	P. McGovern & Co., 1 Madison Ave., N. Y.	Feb. 13, 1912	1,961,997.00	Dec. 14, 1911
10	79th St. to 93rd St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	3,253,072.80	Nov. 3, 1910
11	93rd St. to 106th St.	Bradley Contracting Co., 1 Madison Ave., N. Y.	July 21, 1911	3,132,195.05	Nov. 3, 1910
12	106th St. to 118th St.	Oscar Daniels Co., Woolworth Bldg., N. Y.	Sept. 3, 1911	2,825,740.74	Nov. 3, 1910
13	118th St. to 129th St.	Bradley Contracting Co., 1 Madison Ave., N. Y. (Assigned to McMullen, Snare & Triest, Inc.)	Nov. 17, 1911	4,071,416.50	Nov. 3, 1911
14	129th St. to 135th St.	Arthur McMullen & Olaf Hoff, 149 Broadway, N. Y.	July 23, 1912	3,889,775.05	June 16, 1912
15	135th St. to 157th St.	Hagerty-Drummond Co., 48 Park Row, N. Y. (Assigned to Rogers & Hagerty)	Nov. 17, 1911	3,820,129.75	Nov. 3, 1910
Total				$26,323,811.09	
Southern Boulevard Branch—Routes Nos. 19 and 22 (In the Bronx)					
1	138th St. to 147th St.	John F. Stevens Construction Co., 55 Wall St., N. Y. (Assigned Oct. 23, 1913 to Richard Carvel Co., Inc., 401 West 59th St., N. Y.)	Oct. 22, 1912	$2,253,281.75	Sept. 26, 1912
1-A	147th St. to Bancroft St.	Rodgers & Hagerty, E. 152nd St. and Harlem River, N. Y.		2,253,159.25	Dec. 11, 1913
Total				$4,506,441.00	
Jerome Avenue Branch—Route No. 16—(In the Bronx)					
1	157th St. to 182nd St.	Oscar Daniels Co., Woolworth Bldg., N. Y.	Dec. 31, 1913	$1,077,978.00	Dec. 11, 1913
2	182nd St. to Woodlawn Road	Cooper & Evans, 220 Broadway, N. Y.		1,075,831.00	Feb. 19, 1914
Seventh Avenue-Lexington Ave.—Routes Nos. 4 and 38					
1	Battery Park to Greenwich and Vesey St.	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.		$2,120,000.00	April 30, 1914
1-A	Connection from 7th Ave. Subway to present subway	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.		$474,244.00	June 18, 1914
2	Vesey to Beach St.	Degnon Contracting Co., 30 East 42nd St., N. Y.	Mar. 1914	3,059,522.00	Dec. 11, 1913
3	Beach St. to Commerce St.	Degnon Contracting Co., 30 East 42nd St., N. Y.	Dec. 31, 1913	2,185,063.50	Nov. 20, 1913
4	Commerce St. to 16th St.	United States Realty & Improvement Co., 111 Broadway, N. Y.	Mar. 6, 1913	1,837,726.00	Mar. 12, 1914
5	16th St. to 30th St.	Canavan Bros., N. Y.	Dec. 31, 1913	2,401,306.75	Nov. 20, 1913
6	30th St. to 43rd St.	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.	Dec. 31, 1913	2,292,000.00	Jan. 8, 1914
6-A	43rd to 45th St. Times Sq.	Holbrook Cabot & Rollins Corp., 331 Madison Ave. N. Y.		421,566.00	May 28, 1914
Total				$14,790,428.25	
White Plains Road Line—Route No. 18—(In the Bronx)					
1	180th St. to Burke Ave.	Oscar Daniels Co., Woolworth Bldg., N. Y.	Mar. 16, 1914	914,400.00	Feb. 19, 1914
2	Burke Ave. to 241st St.	Alfred P. Roth, Broad St., N. Y.	Dec. 31, 1913	958,484.00	Dec. 4, 1913
†Woodside, Astoria and Corona Line—Routes Nos. 36 and 37—(In Queens)					
1	Queensboro Bridge Plaza	Snare & Triest, 143 Liberty St., N. Y.	Oct. 7, 1913	$884,859.00	Aug. 28, 1913
2	Astoria Line	Cooper & Evans, 220 Broadway, N. Y.	Mar. 11, 1913	860,743.50	Feb. 13, 1913
3	Corona Line	E. E. Smith Contracting Co., 101 Park Ave., N. Y.	Mar. 11, 1913	2,063,588.00	Feb. 13, 1913
Total				$3,809,190.50	
Steinway Tunnel Extension—Route No. 50—(In Queens)					
	Davis St. and Ely Ave., Van Alst Ave. to Queensboro Bridge	Degnon Contracting Co., 30 East 42nd St., N. Y.	Dec. 1, 1913	$557,857.50	
Route 48					
3	Clark Tunnel	*Booth & Finn Ltd., and O'Rourke Engineering & Contracting Co.		$6,469,916.00	June 4, 1919
Lutheran Cemetery and Myrtle Ave. Connection					
2		Phoenix Bridge Co., 49 William St., N. Y.		$707,661.00	
2		F. W. Burnham, 30 East 42nd St., N. Y.	Mar. 1914	143,225.00	
Reconstruction Steinway Tunnel-Route 26					
	42nd and Lexington Ave., under East River to Jackson and Alst Ave., L. I. City	Rapid Transit Subway Construction Co., 165 Broadway, N. Y.	Feb. 17, 1914	$383,911.00	Feb. 26, 1911
Connection with Brighton Beach Line—Route 12					
1	St. Felix St. and Ashland Pl. to Hanson Pl.	Cranford Co., 190 Montague St., Brooklyn		$2,195,296.00	June 25, 1914
1-A	In Flatbush Ave., between St. Marks Ave., Prospect Park Plaza	Cranford Co., 190 Montague St., Brooklyn		$2,225,519.25	April 9, 1914
1		Frederick L. Cranford, Inc., 177 Montague St., Brooklyn		1,571,363.00	Oct. 22, 1914
2		Smith, Hauser & MacIsaacs		2,254,670.00	Sept. 24, 1914

* Awarded two contracts jointly.
† Trackage rights also to New York Municipal Railway Corporation.

Favorable Balance of Trade—Enormous purchases by European interests and their inability to sell to us is resulting in a large and unusually favorable balance of trade. Figures just compiled by Secretary of Commerce Redfern estimate that there was an excess of exports in November of $63,188,000.

The value of sugar exports in October was $6,984,929, an increase of $6,872,111 over October, 1913. Wheat exports were heavily increased, and exports of oats, rye and canned beef, which in normal years are practically nothing, jumped in huge proportion. The value of wheat exports for October was $4,344,636, against $1,884,352 in the previous year. It is estimated that in the five months ended November 30 exports of wheat have been 140,000,000 bu., only 5,000,000 bu. less than the exports in the entire year previous ended June 30. Oats exported in October were valued at $1,492,876, against $8040 the previous year.

Cartridges exported from New York were valued at $1,229,117, nearly ten times the amount for the corresponding month last year. Firearms exports were more than double what they were in October, 1913.

The great demand that is being filled for Europe in this country for war munitions is illustrated in the $2,239,547 worth of automobile trucks exported, against $66,040 last year. New York is getting only a part of the exports of these materials, much going from Chicago and Detroit through Canada.

Three aëroplanes went out of New York during the month, against none last year, and 594 motorcycles were shipped, against 168 the year before. Exports of horses were 342, against 135, valued at $99,145, against $92,368 the previous year. A great part of the horse shipments are going from Gulf ports. Freight room here is reported to be scarce, a rate named yesterday being $65, against the normal $25 per horse. The value of drugs doubled, amounting to $632,588.

Some of the big increases in October exports to neutral countries close to Germany were those to Italy, the value being $5,108,214, against $3,258 643 the previous year; Denmark, $5,041,028, against $582,618; Norway, $2,526,416, against $571,717; Sweden, $2 915,119. Even Iceland figures in the export trade, taking $89,988, chiefly in wheat and oil, against $512 the previous year There were no direct exports to Germany and Austria.

That the stream is only beginning is evident from the resumption of cotton shipments, the further demands for wheat and numerous inquiries for manufactured goods. On Dec. 1 an inquiry was received for 2,000,000 yd. of cloth and an order booked for 500,000 pairs of shoes.

A New Enterprise—The old dry-goods store of Stern Bros. on West 23d St., New York, N. Y., will be remodeled and used as a public food market, to be known as the Cosmopolitan Garden. It will be on the order of the Convent Garden of London, and will contain more than 150 booths on the first and second floors, which will be leased. The estimated cost of the alterations is $300,000. Starrett & Van Vleck, New York, are the Archs.

Company Not to Retire—Rumors have been circulated to the effect that the Best Mfg. Co., Pittsburgh, Penn., intended retiring from the piping business. The company wishes to emphatically deny these rumors and assure the trade which has known the Best Mfg. Co. for over 30 years that it is now, and intends to continue, in the piping business.

Contracts to Be Let

Bids received until Dec. 22, 1914

Barge Canal Work

STATE OF NEW YORK

OFFICE OF SUPERINTENDENT OF PUBLIC WORKS.

Albany, November [illegible], 1914.

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Tuesday, December 22d, 1914, at which place and hour they will be publicly opened and read, for improving the Cayuga and Seneca canal pursuant to the provisions of Chapter [illegible] of the Laws of [illegible] and Chapter 147 of the Laws of [illegible] and of the amendments thereto, as follows:

[illegible] CONTRACT [illegible]

Cayuga and Seneca Canal—Section [illegible]

For the removal of buildings, etc., at Seneca Falls, N. Y.

Sheet [illegible].

And for the construction of Barge Canal terminals pursuant to the provisions of Chapter 746 of the Laws of 1911, and of the acts supplementary thereto, as follows:

[illegible] TERMINAL CONTRACT NO. 18.

For constructing a [illegible] bridge and cut-off wall at [illegible].

Contract [illegible], sheets 1 to 12, inclusive.

Plans [illegible] and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the [illegible] office, Builders' Exchange, Buffalo, N. Y.

[illegible] plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of preparing them.

[illegible] will be paid [illegible] of the work done at the [illegible] must be accompanied by [illegible] in the form of a draft or certified check [illegible] in the city of Albany [illegible]

[illegible]

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned the interests of the State will be promoted thereby.

DUNCAN W. PECK,
Superintendent of Public Works.

Bids received until Dec. 9, 1914.

Somers Point—Longport Boulevard

Atlantic City, N. J.

Sealed bids will be received by the Board of Chosen Freeholders of Atlantic County, N. J., at Twelve o'clock noon, December 9th, 1914, in Memorial Hall, Atlantic City, N. J., for the improvement of the Somers Point-Longport Boulevard, Atlantic County, N. J.

Said boulevard to be [illegible] miles long, graveled to the width of [illegible] feet. Contract will include furnishing in place [illegible] with concrete head walls, building small [illegible] timber pile bridges, and furnishing in place [illegible] timber bulkheads.

Plans and specifications may be seen at the office of the Engineer for Atlantic County at No. 636 Bartlett Building, Atlantic City, and copies may be had for a deposit of $[illegible] for each set of plans and specifications. Such deposit will be returned if plans and specifications are returned in good condition by noon, December [illegible], 1914.

Certified check to the amount of $[illegible] will be required of each bidder and a bond in the full amount of the contract will be required of the Contractor.

The right is reserved to reject any or all bids.

GEORGE B. JEFFRIES,
Chairman Road Committee.

A. H. [illegible],
Engineer for Atlantic County.

Bids received until Dec. 10, 1914.

Highway Work

OFFICE OF THE STATE COMMISSION OF HIGHWAYS

Albany, New York, Nov. [illegible], 1914.

Sealed proposals will be received by the undersigned at their office, No. [illegible] Lancaster Street, Albany, N. Y., at 1 o'clock p.m., Thursday, December 10th, 1914, for the improvement of highways in the following counties:

[illegible] county ([illegible]), Cayuga county ([illegible]), Columbia county ([illegible]), [illegible] ([illegible]), Jefferson ([illegible]), Madison ([illegible]), [illegible] ([illegible]), Orange ([illegible]), Oswego ([illegible]), [illegible] ([illegible]), [illegible] ([illegible]), [illegible] ([illegible]), Warren ([illegible]), Washington ([illegible]), Westchester ([illegible]).

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, New York, and also at the office of the [illegible] in whose division the road is to be constructed. [illegible]

[illegible]

The right is reserved to reject any or all bids.

JOHN N. CARLISLE, Commissioner.

R. K. FULLER, Secretary.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

Building Operations Drastically Curtailed

Country-wide reports show a severe reduction in contemplated construction. It is more noticeable this month than any time since the war began. In Philadelphia the returns were the smallest for any November since 1907. In Detroit operations fell below $1,000,000 for the first time in several years. In New York despite the unsatisfactory operations last year—the smallest since 1903—it is probable that 1914 will make a new low record since that year. In Hoboken, N. J.—perhaps more adversely affected by the war than any other American city—the contemplated buildings only amounted to $1650, and in August, $2727. Reports from Milwaukee state that much work is postponed until spring. The loss since the war began has been progressive except where influenced by local conditions in October—for a loss of 4% was reported in the combined return of 52 cities in August; 37% in 55 cities in September; 17% in 58 cities in October, and 29% in 52 cities last month.

In 19 Eastern cities there was a falling off of 33% in November, but for the 11 months the decrease was only 1%.

Cities in the Southern States have had to contend with the lack of funds due to the inability to sell cotton. In seven cities there was a falling off of 52% for the month and 15% for the 11 months.

The Middle West shows a decrease of 15% in 21 cities, but for the period January to December there has been a small gain.

Chicago is the conspicuous example of a large city where a gain is shown. In most of the large cities the falling off has been greater in proportion than in cities of less than half a million population. A comparison with the corresponding month in 1912 would be far more unfavorable, for a slump was well under way this time last year.

On the Pacific coast conditions are not so bad, according to the reports, a loss of 14% being shown in seven cities, but in October there was a loss of more than 20%.

The following table shows the contemplated building operations from plans filed during November. A comparison is made with the corresponding month last year. Figures are also given showing operations proposed in the 11 months of the two years mentioned.

EASTERN STATES

	Month of November 1914	Month of November 1913	First 11 Months of Year 1914	First 11 Months of Year 1913
Albany, N. Y.	$301,578	$277,855	$5,964,278	$8,817,405
Baltimore, Md.	321,950	612,796	11,316,696	8,569,019
Boston, Mass.			17,196,693	16,143,070
Bridgeport, Conn.	364,859	239,852	2,656,295	2,697,341
Buffalo, N. Y.	498,000	580,000	2,789,436	10,824,243
Elizabeth, N. J.	98,388	111,438	1,313,415	2,338,848
Hartford, Conn.	399,385	1,071,045	3,759,876	5,534,356
Hoboken, N. J.	1,650	21,198	767,327	415,140
Jersey City, N. J.	176,804	267,098	3,307,770	5,110,918
Newark, N. J.	373,427	549,371	9,165,777	13,132,145
New Haven, Conn.	315,755	214,475	3,884,872	3,392,931
New York, N. Y.				
Manhattan	1,505,800	3,424,500	44,656,965	58,196,035
Bronx	403,490	314,750	20,045,343	19,043,111
Brooklyn	1,423,840	2,052,575	36,976,690	27,762,716
Queens	1,316,220	1,332,892	17,500,145	15,921,826
Paterson, N. J.	46,961	81,030	1,475,106	1,368,789
Philadelphia, Penn.	1,240,530	2,026,565	33,929,470	38,688,425
Pittsburgh, Penn.	777,368	698,617	14,721,582	14,553,600
Reading, Penn.	20,350	58,650	1,139,175	845,500
Rochester, N. Y.	397,830	649,575	8,369,658	8,908,939
Scranton, Penn.	88,852	156,625	1,640,757	1,279,243
Springfield, Mass.	197,502	951,295	4,707,532	4,807,971
Syracuse, N. Y.	235,365	182,380	2,693,570	4,327,223
Totals	$10,716,814	$15,885,582	$252,978,748	$256,535,78
	Decrease 33%		Decrease 1%	

SOUTHERN STATES

	Month of November 1914	Month of November 1913	First 11 Months of Year 1914	First 11 Months of Year 1913
Atlanta, Ga	$228,104	$278,904	$4,482,628	$4,894,323
Chattanooga, Tenn.	28,258	38,610	1,047,137	998,150
Dallas, Tex.	133,850	876,615	5,133,585	8,2 7,630
Louisville, Ky.	139,900	184,910	4,201,415	3,896,360
Memphis, Tenn.	133,275	211,271	2,894,564	3,979,012
Richmond, Va.	130,638	281,399	3,070,843	2,962,081
Washington, D. C.	419,544	644,033	8,529,744	8,873,556
Totals	$1,213,569	$2,515,712	$29,359,916	$35,924,629
	Decrease 52%		Decrease 15%	

MIDDLE WEST

	Month of November 1914	Month of November 1913	First 11 Monshs of Year 1914	First 11 Monshs of Year 1913
Akron, Ohio	$171,585	$173,135	$3,597,580	$4,922,510
Chicago, Ill	6,513,150	6,490,700	77,048,060	83,234,577
Cincinnati, Ohio	336,210	457,050	8,576,113	7,954,937
Cleveland, Ohio	2,153,645	1,241,640	26,092,185	21,779,380
Columbus, Ohio	377,385	398,720	5,889,861	5,075,808
Denver, Colo.	134,410	155,129	3,136,948	3,727,977
Des Moines, Iowa	93,302	108,990	1,188,550	1,641,159
Detroit, Mich.	962,355	1,665,645	25,602,550	28,392,193
Duluth, Minn.	189,510	215,500	2,798,828	4,013,366
Evansville, Ind.	57,086	103,405	1,270,390	1,715,643
Grand Rapids, Mich.	171,425	275,384	3,496,169	4,017,395
Indianapolis, Ind	265,190	479,711	7,573,348	8,660,504
Kansas City, Kan.	50,435	62,703	1,039,138	1,074,144
Kansas City, Mo.	341,220	934,672	16,981,370	10,105,498
Milwaukee, Wis.	591,583	1,711,300	9,390,511	12,975,096
Minneapolis, Minn.	703,615	820,990	14,693,125	11,709,290
Omaha, Neb.	133,583	268,590	4,393,981	3,961,258
St. Louis, Mo.	650,029	1,083,643	12,188,618	14,579,779
St. Paul, Minn.	710,697	647,682	13,141,342	8,736,037
Salt Lake City, Utah	107,232	171,800	2,811,796	1,915,985
Toledo, Ohio	276,676	283,555	5,945,237	5,686,971
Totals	$15,124,173	$17,749,944	$246,855,700	$245,889,507
	Decrease 15%		Increase trifling	

PACIFIC COAST

	Month of November 1914	Month of November 1913	First 11 Months of Year 1914	First 11 Months of Year 1913
Oakland, Calif.	$281,769	414,226	3,552,828	8,041,222
Portland, Ore.	453,830	608,865	7,732,720	12,331,525
San Diego, Calif.	154,910	263,511	2,728,556	6,732,299
San Francisco, Calif.	988,587	1,142,986	27,459,669	19,079,925
Seattle, Wash.	229,615	387,790	11,357,435	8,771,380
Spokane, Wash.	55,880	77,610	965,347	3,364,583
Tacoma, Wash.	270,655	63,520	2,116,251	2,360,064
Totals	$2,435,246	$2,958,508	$55,912,801	$60,680,998
	Decrease 14%		Decrease 8%	

RELIEF WORK IN PITTSBURGH

The City Council, Pittsburgh, Penn., on Nov. 23, appropriated $80,000 to provide 40,000 days' work at $2 per day, work to be started immediately on two public improvements, the Woodland Avenue Extension and the River View Park Boulevard widening. All police stations in the city have been turned into relief stations, and clearing houses for the collection and distribution of foodstuffs and supplies. Pittsburgh has been more seriously hit by the present hard times than in the panic of 1907. The mills of the Steel Corporation are running about 35% of capacity, and the Jones & Laughlin Co., 24%. Car builders are practically out of work, and more than 2000 miners are unemployed and have been unemployed for several weeks. The police department, besides providing lodging for the homeless men, is furnishing hot coffee and bread at breakfast time each day. Instead of laying off men as is usual at this time of the year in the Park and Sewer Department, the city is adding to the number of employees. The County Commissioners at a meeting last week decided to continue county road work throughout the winter if possible, at least to not stop any job definitely but continue until work is made impossible by the severity of temperature.

The Koehring Machine Co., Milwaukee, Wis., has taken over the Dennis Traction Grader & Loader Co., and will proceed at once to manufacture and place the Dennis traction grader and loader on the market.

Engineering Sales Co., 114 Liberty St., New York, has recently been organized by Edwin H. Johnson and Richard B. Franken. The new company will represent a number of out of town manufacturers interested in sheet-metal work and general wrought-iron work.

CATALOG NOTICES

The Hitchcock Mfg. Co., Tarentum, Penn. Catalog. Turnouts, switches, frogs. Illustrated, 38 pp., 6x9 in.

The Continental Fibre Co., Newark, Del. Catalog. Vulcanized fibre, Bakelite-Dilecto, Continental-Bakelite. 46 pp., 5x8½ in.

The Neil & Smith Electric Tool Co., Cincinnati, O. Catalog No. 4. Portable electric drills, buffers, grinders, screwdrivers, etc. Illustrated, 56 pp., 6x9 in.

The Connersville Blower Co., Connersville, Ind. Catalog. Cycloidal pumps. Illustrated, 48 pp., 9x12 in.

The Watson-Stillman Co., Aldene, N. J. Booklet. Kromax leather packings. Illustrated, 16 pp., 3½x6 in.

RAILWAYS

Pennsylvania—New York, Pittsburgh & Chicago Air Line R.R.—[illegible] the central part of Pennsylvania. [illegible]

West Virginia—[illegible] Charleston to Pal[illegible] [illegible]

Norfolk & Western Ry.—This company [illegible] to carry [illegible] West Virginia [illegible] Fork and [illegible]

Texas—[illegible]—Press reports state that this road will be extended to [illegible] Tex.

New Brunswick—[illegible] R.R.—Surveys are [illegible] of extending its [illegible] about 65 miles.

ELECTRIC RAILWAYS

Milford, Mass.—The Milford & Uxbridge St. Ry. plans to extend its lines to [illegible]

Southbridge, Mass.—The [illegible] Consolidated Ry. Co. [illegible] plans for extending its Sand[illegible] line to Southbridge.

Lockport, N. Y.—The Niagara River & Eastern Ry. Co. has [illegible] to the Public Service Commission of New York for [illegible] an electric railroad between Niagara Falls and Lockport, where it is proposed to connect with the Buffalo, Lockport & Rochester Ry. Charles Hickey is Pres.

Philadelphia, Penn.—The Philadelphia & West Chester Traction Co. is [illegible] plans for constructing a line for East Lansdowne [illegible]. It will extend from the terminus at 69th St., then through private right-of-way to [illegible] Lane and Pembroke Ave., East Lansdowne, and then to Stewart Ave. and Lansdowne Ave., making the terminus at Lansdowne and Baltimore Ave., Lansdowne.

Frederick, Md.—The Hagerstown & Frederick Ry. plans to build an electric line to Williamsport, with the possibility of [illegible] from Williamsport and an extension across the [illegible] River into Berkeley County, W. Va.

Shreveport, La.—The Texas-Louisiana Traction Co. is having surveys made on the section of its line between Shreveport and Marshall. The contract for the construction of this line between Shreveport and Monroe has been awarded. This railway will run through Jefferson and Greenville and will connect with the [illegible] line from Dallas. Ultimately this line will connect Shreveport, La., and Jefferson and Longview, Tex., via Mansfield, Vivian, [illegible]hard, Oil City, Mooringsport, Greenville, Monroe and Marshall. A. H. Blevins, Jefferson, is Pres.

Middletown, Ky.—The Middletown & Chester Ry. plans to [illegible] its electric line between Middletown and Chester. Richard H. [illegible] and Gustaf B. [illegible] are interested. This railway will be an extension of the Shore Line Electric Ry. and a separate company has been organized to obtain the charter for this line, which will be known as the Middletown & Chester Ry.

Cleveland, Ohio—The Cleveland & Youngstown Ry. has been granted a franchise by the City Council of Cleveland to make certain grade changes.

Chicago, Ill.—The [illegible] Illinois Ry. & Power Co. will [illegible] start [illegible] its line between Herrin, West Frankfort, Johnston City and [illegible] in Illinois.

Coffeyville, Kan.—The [illegible] Traction Co. will consider [illegible] line from Coffeyville to Centralia.

Bryan, Tex.—The Bryan & Central Texas Interurban Ry. [illegible] plans to build a line from Bryan to Navasota, Tex.

Houston, Tex.—The Houston Electric Ry. Co. has been asked to consider plans for extending its [illegible] from [illegible] to [illegible]. A. T. Kurz is [illegible]

Port Arthur, Tex.—The Port Arthur Traction Co. has [illegible] the City Council for a franchise for the extension of its line from [illegible] to [illegible]

San Antonio, Tex.—The City Council [illegible] a franchise to the San Antonio Traction Co. to [illegible] West [illegible] St., from [illegible] to [illegible] St., also to [illegible]

Walla Walla, Wash.—[illegible]

Ukiah, Calif.—[illegible]

LIGHT, HEAT AND POWER

Burlington, Vt.—[illegible]

Torrington, Conn.—[illegible]

Winsted, Conn.—[illegible]

Albany, N. Y.—[illegible] Albany, for electric wiring for book stacks and reflectors for the New York State Education Building, Albany. Lewis F. Pilcher is State Arch. For further details, see advertisement under "Contracts To Be Let."

✦The Delaware & Hudson Co. has awarded the contract for the construction of a transformer station at Sheridan and Chapel St., Albany, to the HINKIN-CONKEY CONSTRUCTION CO., at approximately $16[illegible]. This new station will be used to transform the power from the Spier Falls plant for the local trolley lines.

South Orange, N. J.—The Board of Trustees has had estimates prepared by John J. Boyd, Engr., for constructing and operating a municipal electric light plant in conjunction with the water-works system. The estimates include: Power plant equipment, $1[illegible]; conduits and manholes, $[illegible]; cables and wires, $11,[illegible]; lamps, brackets, etc., $[illegible].

Freemansburg, Penn.—The Borough Council has granted a franchise to the Freemansburg Electric Light & Power Co. to supply electricity for light, heat and power in Freemansburg and vicinity. It has also awarded a contract to the company to light the streets of the borough for a period of five years. A. H. S. Cantlin is Pres. and Gen. Mgr. of the company.

Paoli, Penn.—The Pennsylvania R.R. is having plans prepared by William H. Cookman, Broad St. Station, Philadelphia, for the construction of a one-story brick and concrete power house at Paoli.

Clarksville, Va.—Bids will soon be received by J. W. Maxey, Town Clk., for the installation of a municipal power plant and lighting system. Bonds for $[illegible] have been voted for the purpose. George W. Rappleyea is Engr. Noted Aug. 27.

Huntington, W. Va.—The City Commission is considering the installation of a power station in the basement of the municipal building to furnish light for the city hall and fire station, and power for the fire-alarm and police-call systems. A. B. Maupin is City Engr.

Tarpon Springs, Fla.—It is reported that the Pinellas Electric Light & Power Co. has applied to the City Council for a franchise to furnish electric light and power.

Cleveland, Ohio—Bids will be received until noon, Dec. 1[illegible], by the Commissioner of Purchases and Supplies, Room 51[illegible], City Hall, for furnishing transformers for the electric-light department. F. W. Ballard is Comr. of Heat & Light Dept.

West Liberty, Ohio—The Public Utilities Commission has granted permission to the West Liberty Light & Power Co. to issue $10,000 in bonds, of which $7500 will be used to purchase the local electric light plant of C. A. Hartzler, and the remainder for improving and extending the system.

Jeffersonville, Ind.—The Indiana State Reformatory, Jeffersonville, is asking for an appropriation of $16,0[illegible] to be used for installing two additional boilers in the power plant of the institution. D. C. Peyton is Supt.

River Rouge, Mich.—Press reports state that the Detroit Gas Co. plans to build the first unit of a gas plant in River Rouge, to cost about $1,500,000. It is said that eventually the plant will cover about 80 acres of ground, and will represent an investment of between $7,000,000 and $8,000,000. V. L. Dewey, Detroit, is Pres. of the company.

Blackcreek, Wis.—At a recent election, the citizens voted in favor of issuing $7000 in bonds, to be used for the installation of a municipal electric light plant.

Manitowoc, Wis.—It is reported that the C. Reiss Coal Co., Manitowoc, has purchased the franchise of the West Side Electric Co., which furnishes electrical service to the west side of the city, and will establish a power plant on its docks.

Oshkosh, Wis.—The Board of Education has [illegible] Henry Auler to prepare plans for the new [illegible] plant to provide light, heat and power for the Central High School and annex, and the Beach Manual Training Institute. D. Witzel is City Clk.

Mondak, Mont.—A company has been organized for the purpose of establishing an electric light plant in Mondak. Ground has been broken for the construction of the power house.

St. Louis, Mo.—The [illegible] Gas Light Co. has taken out a permit for the construction of a power house, estimated to cost $[illegible]

✦**Tipton, Mo.**—The contract for the installation of the [illegible] to the [illegible] HEATING CO., Jefferson City, at about $[illegible]

Dallas, Tex.—The City Commission [illegible]

El Campo, Tex.—[illegible]

Yorktown, Tex.—[illegible]

Lebanon, Wash.—[illegible]

Riverside, Wash.—[illegible]

Seattle, Wash.—[illegible]

tional unit at the Cedar Falls power plant, to cost about $500,000. The plans provide for a third power water main from the new masonry dam and power plant at Cedar Falls, a new building and equipment to increase the capacity of the Cedar River system by 10,000 kw.

Helix, Ore.—A syndicate, headed by the Freuler & Dyer Engineering Co., Walla Walla, Wash., will establish an electric light plant in Helix. The initial unit will consist of a 22-hp. crude oil engine to drive a 20-hp. generator. The plant will be so constructed that additional units may be installed.

Santa Maria, Calif.—The Santa Maria Gas & Power Co. will extend its gas-distributing system from Arroyo Grande to San Luis Obispo, a distance of ten miles.

Newmarket, N. B.—An election will be held, Jan. 4, for the purpose of voting on the question of issuing $15,000 in bonds, to be used for the construction of a new substation.

Shawinigan Falls, Que.—The Shawinigan Water & Power Co., 607 Power Bldg., Montreal, Que., has had plans prepared for the construction of a transmission line extending from Shawinigan Falls to the city of Quebec. Julian C. Smith, Montreal, is Gen. Supt. and Ch. Engr.

Delaware, Ont.—The Village Council is considering the construction of a municipal electric power plant to supply energy for light, heat and power.

Dresden, Ont.—(Official)—No bids will be asked for the construction of the new municipal hydro-electric lighting system, as the work is being done by local forces. J. T. Bridgewater is Town Clk. Noted July 30 and Nov. 26.

Mount Brydges, Ont.—At an election on Nov. 23, the citizens passed a bylaw for securing electricity for general purposes from the Hydro-Electric Power Commission.

Shelburne, Ont.—The rate-payers have approved a bylaw providing for securing energy from the Hydro-Electric Power Commission of Ontario.

Toronto, Ont.—Bids will be received until Dec. 11, by the Toronto Board of Education, for power equipment for the new Central Technical School, including steam engines, generators, switchboard, steam-piping and electrical connections. The Canadian Domestic Engineering Co., Ltd., 47-51 King St., West, Toronto, is Engr. in Charge.

Regina, Sask.—It is reported that the City Council plans to purchase, early next year, a quantity of new equipment for the municipal power plant. E. W. Hull is Mgr. of the plant.

BRIDGES

Concord, N. H.—(Official)—Bids will be received until 5 p.m., Dec. 15, by W. B. Howe, City Engr., for the construction of a 470-ft. bridge over the Merrimack River. Noted Nov. 19 and Dec. 3.

Lawrence, Mass.—The Massachusetts Harbor and Lands Commission has approved the plans for the Central Bridge over the Merrimack River at Lawrence, and construction work will be started at once. The contract for this bridge was awarded last May to Ryan & Keon, Boston, at about $322,000. Noted May 7 and May 28.

Hartford, Conn.—Bids were received Nov. 30, by Charles J. Bennett, State Highway Comr., for bridge construction as follows: Old Lyme Township, removing an old bridge to new location, constructing wing walls, abutments and approaches and painting the bridge, Connecticut Good Roads & Construction Co., New Britain, $12,330; D. F. Toomey, South Norwalk, $7842; Daly & Merritt, Portchester, N. Y., $12,873; Jobson-Gifford Co., 30 East 42d St., New York, N. Y., $11,147; New England Contracting Co., Worcester, Mass., $10,678; B. D. Pierce, Jr., Co., Bridgeport, $12,017. Noted Nov. 19.

For the construction of a 30-ft. I-beam bridge in Stonington Township, bids were received from: Daly & Merritt, $7581; C. W. Blakeslee & Sons, New Haven, $5669; Edmund P. Wall, Torrington, $7608; William J. Mertz, Portchester, N. Y., $6060; Louis Longhi & Bro., Torrington, $5881; C. W. Tryon, Meriden, $6994; Kellogg & Gregory Co., Danbury, $6795; Connecticut Good Roads & Construction Co., $6929; B. D. Pierce, Jr., Co., $8121; O'Brien Construction Co., Grand Central Terminal, New York, N. Y., $6314.

Paterson, N. J.—The Board of Chosen Freeholders of Passaic County will build a new bridge over the Passaic River to Totowa, provided the city will construct the approaches. Colin R. Wise is City Engr.

Trenton, N. J.—The Pennsylvania R.R. has submitted plans to the City Engineer for new lift bridges to replace its present structures over the canal at Hamilton and Greenwood Aves. Frank Thompson is City Clk.

Mauch Chunk, Penn.—The Board of Commissioners of Carbon County is having plans prepared by William Tombler, County Engr., for the construction of a reinforced concrete bridge.

★Pittsburgh, Penn.—(Official)—Bids will be received until 10 a.m., Dec. 21, by the Department of Public Works for the construction of the steel superstructure of the Sylvan Ave. Bridge. Joseph G. Armstrong is Mayor. Robert Swan is Dir. Dept. of Pub. Wks.

+Pittsburgh, Penn.—(Official)—The Commissioners of Allegheny County have awarded the contract for the construction of Bridge No. 19, over Pine Creek, Shaler Township, to the PITT CONSTRUCTION CO., Fulton Bldg., Pittsburgh, at $18,100. Noted Nov. 26.

Bradentown, Fla.—(Official)—Bids will be received until 7 p.m., Dec. 11, by W. H. Tracy, Comr. of Public Works, for the construction of a Scherzer rolling lift bridge.

Jacksonville, Fla.—Bids will be received until Dec. 11, by the Committee on Public Works of the Board of Bond Trustees for the construction of a reinforced concrete bridge over Hogans Creek on Union St. The cost must not exceed $4000. S. C. Harrison, Jr., is Chn. of the Com.

Birmingham, Ala.—The Jefferson County Board of Revenue has instructed the Highway Engineer to locate a bridge over the Cahaba River on the proposed road from Irondale to Leeds. J. W. Gwin is Highway Engr.

Eufaula, Ala.—The Board of Revenue of Barbour County, Clayton, plans to build a reinforced concrete bridge over Barbour Creek on the National Highway, about two miles from Eufaula. The estimated cost is $6000, of which half will be paid by the county, and the other half by state aid.

★+Crowley, La.—(Official)—The Police Jury of Acadia Parish has awarded the contract for the construction of two steel bridges, with concrete abutments, timber and earth approaches, to C. S. JACKSON & CO., LTD., New Iberia, La., at $15,575. Other bidders were: Austin Bros., Dallas, Tex., $21,500; Blodgett Construction Co., Galveston, Tex., $19,912; Vincennes Bridge Co., Vincennes, Ind., $12,888, for bridge work only, no earthwork; Perry & Bownes, Mobile, Ala., $24,000; Emply Construction Co., Hattiesburg, Miss., $22,497. Noted Nov. 5.

Lake Charles, La.—The Police Jury of Calcasieu Parish has authorized an issue of $300,000 in bonds for the purpose of building a bridge over the Calcasieu River at this point, and repairing sections of the public highway. Plans are being prepared for a bridge to cost approximately $200,000. E. C. House is Clk. of the Police Jury. Noted Oct. 15.

New Orleans, La.—The Louisiana Motor League and the engineers of Orleans and St. Tammany Parishes are considering the construction of steel bridges, to cost about $65,000, across the Chef Menteur and Rigolets Bayou, as a part of the coastal highway from New Orleans to Pass Christian and other gulf coast resorts. An amendment has recently been passed, appropriating the money paid for automobile licenses to the state road fund for building and maintenance.

Knoxville, Tenn.—John W. Flenniken, Comr., has recommended to the Board of City Commissioners the construction of a reinforced concrete viaduct on Gay St. over the tracks of the Southern Ry. to replace the present steel and wood structure. If the bridge is built, the expense will be divided among the city, the Southern Ry. and the Knoxville Ry. & Light Co.; the tracks of the latter are on the bridge.

Akron, Ohio—C. P. Parker, Dir. of Pub. Ser., has approved plans for a bridge over Furnace St. to be built jointly by the Baltimore & Ohio R.R. Co. and the city. The estimated cost is $10,000. J. A. Gehres is City Engr.

Cincinnati, Ohio—(Official)—Preliminary plans have been submitted to the City Council for the proposed reinforced concrete ornamental bridge over Kemper Lane, at the Parker Ave. entrance to Eden Park. The bridge will have a span of about 180 ft., with a 40-ft. roadway and two 12½-ft. sidewalks. The estimated cost, including street improvements, is $165,000. It is hoped that an appropriation will be made, so that the work can be advertised next spring. F. S. Krug is Ch. Engr. of the Dept. of Pub. Ser., Frank L. Raschig is Prin. Asst. Engr. of the Div. of Structures. Noted Nov. 26.

Columbus, Ohio—(Official)—Bids will be received until noon, Dec. 26, by the Board of Commissioners of Franklin County for constructing the approaches to the Williams Bridge in Perry, Norwich and Franklin Townships. John Scott is Clk. of the Bd.

(Official)—The Commissioners of Franklin County have awarded contracts for bridge work under Engineer's Estimates 146 and 149, to H. E. BARTHMAN, Columbus, and W. O. JEWETT, Worthington, Ohio, respectively. Noted Nov. 12.

Fremont, Ohio—Revised plans have been prepared for the Tindall Bridge over the Sandusky River, Ballville Township, and bids for its construction will soon be asked. The bridge will be about 335 ft. long. William F. Schepflin is County Engr. Noted Aug. 27 and Oct. 1.

+Hamilton, Ohio—The Board of Commissioners of Butler County has awarded the contract for the construction of a reinforced concrete bridge over the Miami River at Woodsdale to A. J. YAWGER & CO., Indianapolis, Ind., at $84,460. List of bidders noted Aug. 13.

Toledo, Ohio—The Public Improvements Committee of the City Council is considering the construction of a creosoted block floor on the Fassett St. Bridge. The estimated cost of the work is approximately $35,000. Herbert McKechnie is City Engr.

Greensburg, Ind.—(Official)—Bids will be received until 1 p.m., Dec. 14, by the Board of Commissioners of Decatur County for the construction of three bridges in Sandcreek Township, and one each in Jackson, Marion and Saltcreek Townships. Linton W. Sands is County Audr.

+Lansing, Mich.—(Official)—The State Highway Commission has awarded the contract for a 130-ft. steel bridge over the Tittabawassee River, Jerome Township, Midland County, to the CENTRAL STATES BRIDGE CO., Indianapolis, Ind., at $2.60 per 100 lb. for the steel, f.o.b. Sanford, Mich., and $785 for erection and painting. Noted Nov. 12.

Alton, Ill.—(Official)—At a special election held Nov. 28, the bond issues of $55,000 for the construction of a viaduct over Seventh St., and $15,000 to build a fire station in Upper Alton were defeated. B. R. Kennedy is City Clk. Noted Nov. 19.

Danville, Ill.—(Official)—Bids will be received until 7:30 p.m. Dec. 15, by the City Council for the construction of a reinforced concrete bridge over the North Fork of the Vermillion River at Bridge St. The structure will be about 800 ft. long and 40 ft. wide. Bonds to the amount of $80,000 were voted at the November election for the building of this bridge. W. H. Martin is City Engr. Noted Sept. 24, Oct. 8, and Nov. 12.

+Jacksonville, Ill.—The Directors of Road District No. 6, Morgan County, have awarded the contract for the construction of a steel bridge with concrete foundations on the road leading to the County Home, to the ILLINOIS STEEL BRIDGE CO.

Appleton, Wis.—Press reports state that the Chicago & Northwestern Ry. , ans to build a new railway bridge over the Fox River at a point just east of the John St. Bridge. It is designed to take the place of the present bridge east of the Lawe St. Bridge. W. H. Finley, Chicago, Ill., is Ch. Engr

Madison, Wis.—The City Council has decided to build a new bridge over the [illegible]. E. E. Parker is City Engr.

Mauston, Wis.—[illegible]

Ottawa, Kan.—[illegible]

+Mitchell, S. D.—[illegible]

Kansas City, Mo.—[illegible]

Marion, Ark.—[illegible]

Dallas, Tex.—[illegible]

San Antonio, Tex.—[illegible]

Chandler, Okla.—[illegible]

Bellingham, Wash.—[illegible]

Seattle, Wash.—[illegible]

Eugene, Ore.—[illegible]

Fresno, Calif.—[illegible]

Modesto, Calif.—[illegible]

Sonora, Calif.—[illegible]

St. Johns, Que.—[illegible]

Hamilton, Ont.—[illegible]

Lac du Bonnet, Man.—[illegible]

Winnipeg, Man.—[illegible]

Victoria, B. C.—(Official)—No bids will be asked for the construction of the [illegible] Great Eastern Ry. a new bridge over the [illegible] River at Station [illegible]. The work is now under way, and is included in the general contracts for construction of the railway. [illegible], Welton Block, Vancouver, B. C., is Ch. Engr. of the Pacific Great Eastern Ry. Noted Nov. 26.

WATER SUPPLY—IRRIGATION

Keene, N. H.—(Official)—The city will install water meters [illegible]. Paul [illegible] is Supt.

+Fall River, Mass.—The contract for [illegible] has been awarded by the Watuppa Water Board to McNALLY CONSTRUCTION CO., Fall River [illegible].

Lynn, Mass.—[illegible]

+Hartford, Conn.—The contract for constructing the pumping [illegible] has been awarded to FRED T. LEY & CO., Springfield, Mass. [illegible] Board of Water Commissioners. Noted Nov. [illegible].

Ilion, N. Y.—[illegible]

New York, N. Y.—[illegible]

Port Washington, N. Y.—[illegible]

Victor, N. Y.—[illegible]

Wappingers Falls, N. Y.—[illegible]

Woodstown, N. J.—[illegible]

Atglen, Penn.—[illegible]

Gallitzin, Penn.—[illegible]

Kutztown, Penn.—[illegible]

Newtown, Penn.—[illegible]

New Wilmington, Penn.—[illegible]

Moundsville, W. Va.—[illegible]

Rutherfordton, N. C.—[illegible]

Charleston, S. C.—[illegible]

Florence, S. C.—[illegible]

Corinth, Miss.—[illegible]

Vivian, La.—[illegible]

Henton, Tenn.—[illegible]

Murfreesboro, Tenn.—[illegible]

Fulton, Ky.—[illegible]

Hickman, Ky.—[illegible]

Leitchfield, Ky.—[illegible]

Cleveland, Ohio.—[illegible]

[illegible]

Evansville, Ind.—(Official)—Bids will be received until 10 a.m., Dec. 24, by the Board of County Commissioners for installing an electric pumping system at the Vanderburg County Poor Farm. C. P. Beard is Audr.

Mishawaka, Ind.—Bids will be received until Dec. 14, by the Board of Works, for constructing a 4,000,000-gal, horizontal, corliss, cross-compound, opposed type, crank and flywheel pumping engine. A. R. Klein is Supt. of Water Wks.

Terre Haute, Ind.—The installation of a low-service pump is contemplated in 1915 by the Terre Haute Water-Works Co. Dow R. Gwinn is Pres. Noted May 28.

Ann Arbor, Mich.—The city plans to construct one mile of 16- and 20-in. water main and install a 3,000,000-gal. centrifugal pump and a filtration plant. George S. Vanawarker is Mgr.

+Leland, Ill.—The contract has been awarded to MONIE & DUNBAR, St. Louis, Mo., at $9664 for installing a water system. Noted Sept. 9.

Louisville, Ill.—The installation of a new pump at the municipal water-works is contemplated. H. S. Stanford is Supt.

Sparta, Ill.—The city has retained W. M. K. Brown, 300 Cahokia Bldg., East St. Louis, to prepare plans for the construction of a water system. Noted Dec. 3.

Baraboo, Wis.—The city plans to construct six subsurface wells and install two Deane power pumps, one Worthington duplex compound steam pump and motor driven centrifugal pumps. H. E. Fruich is City Engr. The estimated cost is $135,000.

Portage, Wis.—The installation of a new filtration plant and steam boilers is contemplated at the water-works. George E. James is Supt.

Burlington, Iowa—The citizens contemplate spending $10,000 for the water system.

Ottumwa, Iowa—Bids will be received until Dec. 18, by the Board of Water-Works Trustees, for constructing concrete dams. Horace A. Brown is Supt. of Water Wks.

Duluth, Minn.—Bids will be received by the Water and Light Department until 11 a.m., Dec. 12, for laying water and gas mains. C. S. Palmer is City Clk.

+Douglass, Kan.—The contract for constructing a water system has been awarded to O'NEIL CONSTRUCTION CO., Leavenworth, Kan., at $10,995. A. C. Moore, Joplin, Mo., is Engr. Noted Nov. 19.

Emporia, Kan.—The city contemplates laying a number of miles of pipe, installing a filtration plant and constructing three dams. W. J. Reynolds is Supt.

Wellington, Kan.—Bids will be received until Dec. 17, by the City Clerk, for equipment for the municipal water and light plant and substation at Mayfield Wells. The Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla., is the Engr. Noted Dec. 3.

Plainview, Neb.—The city plans to lay one mile of 4-in. water mains and install a 50,000-gal. pressure tank. O. A. Curtis is Supt. of Water Wks.

Spearfish, S. D.—The city contemplates installing water meters throughout the city. J. T. L. Henry is Supt. of Water Wks.

Billings, Mont.—The election proposed for Dec. 1 was rescinded and bids will be received, as before stated, on Dec. 29 for the purchase of $450,000 in bonds, the proceeds of which will be used for the construction of a water system. Noted Nov. 12.

Macon, Mo.—The city contemplates installing a filtration plant in 1915. C. F. Thudium is Supt. of Water Wks.

Ft. Worth, Tex.—The city contemplates installing a filtration and water softening plant at the municipal water works. F. J. Von Zuben is City Engr.

Sweetwater, Tex.—According to press reports bids are being received by the City Council for 35,000 ft. of 12-in. water main, 6900 ft. of 10-in., main, 1700 ft. of 8-in. main, 26,000 ft. of 6-in. main and 23,000 ft. of 4-in. c.-i. pipe.

McAlester, Okla.—The city has a plan whereby the water of Wild Horse Creek will be brought into the present reservoirs. F. S. Pitman is Supt. of Water Wks.

Hailey, Idaho—At a recent election the citizens voted in favor of issuing bonds for $35,000, the proceeds of which will be used for the purchase and improvement of the water system. Noted Sept. 10.

Ephrata, Wash.—The citizens contemplate issuing bonds for $19,000, the proceeds to be used for the construction of a water system.

Everett, Wash.—Burns & McDonnell, Kansas City, Mo., have been retained by the city to prepare plans for the improvement of the water systm.

Kirkland, Wash.—The city has won the condemnation case to secure the springs south of Kirkland for a water supply. Bids for the installation of a water system will soon be received. Noted June 18.

Seattle, Wash.—D. H. Traphagen, Artic Club, was low bidder, at $28,982, for laying water mains in 38th Ave., S. W. Noted Nov. 12.

+Tonasket, Wash.—The contract has been awarded to G. D. MACY, by the Bonaparte Land Co., Tonasket, for laying about 4000 ft. of water mains.

Ashland, Ore.—Bonds have been voted, the proceeds of which will be used for the improvement and extension of the water and light systems. Noted Dec. 3.

Oregon City, Ore.—Bids were opened Nov. 28, by the South Fork Water Commission for a gravity water system. The low bidders are as follows: Pacific Bridge Co., Portland, wood-pipe construction, $209,770; open reservoir, $34,224; lap-welded pipe, $338,117; covered reservoir, $78,775; P. E. McHugh, Tacoma, wood-pipe, $219,034; open reservoir, $47,871; lap welded pipe, no bid; covered reservoir, $92,817; Consolidated Contract Co., Portland, wood pipe construction, $221,100; open reservoir, $43,622; lap-welded pipe, none; covered reservoir, none; Boyajohn-Arnold Co., Panama Bldg., Portland, wood-pipe construction, $241,996; open reservoir, $42,550; lap-welded pipe, $407,471; covered reservoir, $77,298. Noted Nov. 26.

+Turner, Ore.—The contract has been awarded to DENNIS CONSTRUCTION CO., Portland, for the construction of a water system. Noted Apr. 30.

+Imperial, Calif.—The contract for constructing a wood flume across the New River has been awarded to MERCEREAU BRIDGE & CONSTRUCTION CO., Pacific Electric Bldg., Los Angeles, at $33,686. Noted Oct. 8.

+San Diego, Calif.—The contract for installing a filtration plant has been awarded to CALIFORNIA JEWELL FILTER PLANT CO., at $52,954. Noted Nov. 26.

Somis, Calif.—The Pleasant Valley Lemon Co. will construct a pipe line four miles long and an irrigation system, estimated to cost $100,000, and a cement distributing system, costing $50,000. A. C. Hardison is Dir. Engr.

Quebec, Que.—According to press reports the water system will be extended at an estimated cost of $120,000. T. A. Forrester is Engr.

Cochrane, Alta.—The citizens contemplate installing a water system in 1915. J. E. Laird is Secy.-Treas.

Cranbrook, B. C.—Bids will soon be received by the City Clerk, for valves and hydrants.

New Westminster, B. C.—Preliminary plans are under way for the construction of a reservoir, with a capacity of 5,000,000 gal., by day labor.

SEWERS

+Boston, Mass.—The contract for the reconstruction of old sewers in Beach, Kilby, Congress and Water St. has been awarded to W. BARRETT & CO., at $47,707. Other bids were: Merrimac Construction Co., $48,967; McCarthy & Walsh, $51,190; Charles R. Gow Co., $51,851; West Roxbury Trap Rock Co., $53,043; Antony Baruffaldi, $53,661; Coleman Bros., $56,402; Northern Construction Co., $56,701; William J. Barry, $58,850; George M. Bryne, $60,137; Hugh Nawn Contracting Co., $65,078; James Driscoll & Sons Co., Brookline, $65,847; Bruno & Pettiti, $66,102, Antony Cefalo, $67,287; M. Russo & Sons Co., $80,202. Noted Nov. 12.

Bids will be received until Dec. 11. by the Public Works Department for constructing sewers in Freeport St. and Melvinside Terrace, Dorchester District. L. K. Rourke is Comr.

Buffalo, N. Y.—The City Council has authorized the construction of 24-, 20-, 18- and 15-in. tile sewers in Woodside Ave. and Potters Rd. between Abbott Rd. and Niantic St., and in Heath and Angle St. Francis G. Ward is Dir. of Pub. Ser.

Fredonia, N. Y.—The Board of Village Trustees will build a sewage disposal plant at Temple St. and Canadaway Creek. Plans are being prepared by Frederick Wing, White Bldg., Buffalo.

Great Neck, N. Y.—Plans are being prepared by Watson Engineering Co., 38 West 32d St., New York, for the installation of a sewer system and sewage-disposal plant at Great Neck. The estimated cost is $150,000.

+Scarsdale, N. Y.—The contract for constructing the Morris Lane extension sewer has been awarded to FRANK GEORGE, White Plains, N. Y., at $5008.

★+Wappingers Falls, N. Y.—(Official)—The contract for constructing a sewer system has been awarded to SAMUEL BESKIN, Beacon, N. Y., at $69,051. List of bidders noted Dec. 3.

Bristol, N. J.—The State Board of Health has ordered the installation of a sewer system, including house connections.

Perth Amboy, N. J.—The Board of Aldermen plans to establish a public park in upper Smith St. The initial work in connection with the improvement will comprise 1000 ft. of storm sewer, estimated to cost $7000, a 3000-ft. driveway, estimated to cost $6000, and 3600 ft. of fencing.

Trenton, N. J.—The Board of City Commissioners has authorized the construction of Sewer No. 608 in Lyndale Ave. Frank Thompson is City Clk.

Bradford, Penn.—Plans are being prepared by B. A. Wise, City Engr. for constructing an Imhoff tank, a sewage pumping plant and intercepting sewers.

Erie, Penn.—William L. D'Olier, Philadelphia, Engr., has been retained, by Theodore Eichhorn, Supt. of Streets, to prepare plans for a sewage-disposal plant.

Oaklyn, Penn.—According to press reports bids will soon be received for constructing a sewer system at an estimated cost of $50,000.

Arlington, Md.—The County Commissioners of Baltimore County, Towson, are conferring with Ezra B. Whitman, Engr., 1319 Fidelity Bldg., Baltimore, in connection with the construction of a sewage disposal plant at Arlington.

Albany, Ga.—The citizens contemplate issuing bonds, the proceeds of which will be used for the installation of sewer and water systems and for street paving. H. A. Tarver is Mayor.

Pensacola, Fla.—The construction of storm sewers in Brue, Palafox and Romana St. is contemplated by the city. The estimated cost is $18,000. L. Earl Thornton is City Engr.

Gallatin, Tenn.—The city plans to construct a sewer system in the business district.

Ashtabula, Ohio—(Official)—Bids will be received by M. H. Turner, Dir. of Pub. Ser., until noon, Dec. 12, for constructing sewers in Jefferson and Thornton St.

★+Canton, Ohio—The contract for constructing the main sewer to the new sewage disposal plant has been awarded to JOHN F. CASEY, Oliver Bldg., Pittsburgh, Penn., at $169,000. Noted Nov. 5.

Cleveland, Ohio—Bids will be received by the Commissioner of Purchases and Supplies, Room 518, City Hall, until noon, Dec. 17, for constructing sewers in a number of streets. Robert Hoffman is City Engr.

Lodi, Ohio—[illegible] will be received by G. C. [illegible] Village [illegible] until [illegible] for the sale of [illegible] in bonds for [illegible] sewerage and a sewage disposal plant.

Steubenville, Ohio—Bids will be received by T. M. Kennedy, Clk. of the Bd. of Pub. Ser., until Dec. 21, for constructing a [illegible] vitrified pipe sewer in Lake Erie Ave. from South to [illegible] St.

West Indianapolis (Indianapolis post office), **Ind.**—According to press reports the Board of Public Works contemplates constructing a main sewer, at an estimated cost of $[illegible].

Lockport, Ill.—(Official)—Bids will be received by the Board of Local Improvements, about Jan. [illegible], for constructing [illegible] of [illegible] to [illegible]-in. pipe sewers. The estimated cost is $[illegible]. A. S. [illegible] Asst. Engr. of Joliet, Ill., is Engr.-in-Charge. Noted Dec. [illegible].

+**Appleton, Wis.**—A contract for constructing sewers in [illegible] and [illegible] Forest Ave. has been awarded to J. DITTMANN & CO., Appleton.

+**West Allis, Wis.**—A contract for constructing a sewer has been awarded to F. F. KAMINSKI, Watertown, Wis., at $[illegible].

+**Cedar Rapids, Iowa**—A contract for constructing sanitary sewers has been awarded to the CEDAR RAPIDS CONSTRUCTION CO.

Duluth, Minn.—Plans are being prepared by John Wilson, City Engr., for constructing a sanitary sewer system in New Duluth [illegible].

+**Lincoln, Neb.**—The contract for constructing the N St. sewer has been awarded to the H. J. CATHRO(?) CO., at $10,[illegible].

Fargo, N. D.—(Official)—Bids will be received by A. R. Watkins, City Audr., until 9:30 a.m., Dec. 16, for constructing a [illegible] lateral sewer in Second St. N. from Ninth to 12th Ave. N.

+**Fort Benton, Mont.**—A contract for constructing a municipal sewerage system has been awarded to D. H. KELLEY, Kalispell, Mont., at $[illegible]. Noted May 21 and Aug. 27.

+**Joplin, Mo.**—A contract for constructing sewers in three sewer districts has been awarded by the City Commissioner to V. F. K[illegible], at $[illegible].

Santa Anna, Tex.—The City Council contemplates constructing a sewage disposal plant.

Ogden, Utah—The City Commissioners contemplate an expenditure of $[illegible] to extend the sewer system.

+**Los Angeles, Calif.**—The contract for constructing a sewer in Figueroa St. between Florence and Slauson Ave., has been awarded to A. J. WULETICH, at $9900.

Richmond, Calif.—According to press reports bids will be received until [illegible], for constructing a sewer in the [illegible] District.

Visalia, Calif.—At the election held Nov. 17, the question of issuing $[illegible] in bonds for extending the sewer system was defeated. Noted Nov. [illegible].

+**Toronto, Ont.**—The York Township Council has awarded the contract for constructing sewers in Glenholme and Earnscliffe Ave., to J. C. SCOTT, Lambton Mills, Ont. Noted Dec. 3.

Vancouver, B. C.—Plans are in progress for the construction of [illegible] Drive trunk sewer, estimated to cost $[illegible], for Vancouver District Joint Sewerage and Drainage Board, [illegible] St. It has not been decided yet whether to let a contract or do the work by day labor.

GARBAGE

+**Boston, Mass.**—(Official)—The Commissioner of Public Works has awarded the following contracts for snow and ice removal: District 1, JOSEPH M. KILEY at 3[illegible] per cu. yd.; District 2, [illegible] 21[illegible]; Districts 3 and 4, C. J. [illegible]; District [illegible] COLEMAN [illegible] 3[illegible]; District 6, J. C. COLEMAN & SONS CO., [illegible]. Noted Nov. 12, Dec. 3.

North Bergen, N. J.—Bids will be received until 8 p.m. [illegible] by the Township Committee for the removal of all [illegible] garbage, [illegible] and other refuse for a period of one year. [illegible] is Township Clk.

Philadelphia, Penn.—The following contracts have been [illegible] for (a) cleaning of [illegible] for the year 1915, [illegible] collection and disposal of ashes and rubbish for the year [illegible] [illegible] KELLEY [illegible] EDWIN H. VARE [illegible] EDWIN H. VARE [illegible] THOMAS F. FLANIGAN [illegible] JOHNEY [illegible] [illegible]. Noted [illegible].

Dayton, Ohio—The City Commission has passed an [illegible] authorizing an issue of [illegible] in bonds for completing the [illegible]. Noted [illegible].

Detroit, Mich.—The Department of Public Works will [illegible] for [illegible] the [illegible]. [illegible] are the [illegible].

Fort Worth, Tex.—[illegible] New York, have been retained to investigate [illegible].

Berlin, Ont.—[illegible] for the council.

STREETS AND ROADS

+**Boston, Mass.**—The contract for [illegible] St. with [illegible] has been awarded [illegible] [illegible]. Noted Nov. [illegible].

Bids will be received until Dec. 11, by the Public Works Department, for bituminous macadam roadways in Herbert St., Dorchester District, and Saybrook St., Brighton District. L. K. Rourke is Comr.

Woonsocket, R. I.—(Official)—Bids will be received by the Committee on Streets and Roads until 8 p.m., Dec. 21, for improving Pond St. Frank H. Mills is City Engr.

Hartford, Conn.—Bids were received Nov. 30, by Charles J. Bennett, State Highway Comr., for state road work in the following townships:

Sherman Township, about 3896 lin.ft. native stone macadam on the Gaylordsville Rd., Olin T. Benedict, Pittsfield, Mass., $11,[illegible]; John de Michiel & Bro., Torrington, Conn., $12,104; Robert G. Miller Contracting Co., Hartford, Conn., $12,[illegible]; Kellogg & Gregory Co., Danbury, Conn., $10,19[illegible]; Marcello Contracting Co., Portsmouth, N. H., $10,181; Louis Longhi & Bro., Torrington, Conn., $12,380; H. Sanford Osborn, Redding Ridge, Conn., $11,31[illegible].

Winchester Township (Winsted post office), about 4615 lin.ft. (a) trap rock, (b) native stone, (c) macadam, on the Riverton Rd., Louis Longhi & Bro., Torrington, Conn., (a) $10,6[illegible], (b) $11,[illegible]; E. B. Alfred, New Hartford, Conn., (b) $10,93[illegible]; John de Michiel & Bro., Torrington, Conn., (a) $10,303, (b) $[illegible]; Marcello Contracting Co., Portsmouth, N. H., (a) $11,0[illegible], (b) $10,524.

Saybrook Township (Deep River post office), about 4170 lin.ft. (a) trap rock, (b) native stone, (c) gravel, A. Brazos & Sons, Middletown, Conn., (a) $14,292, (c) $12,269; A. Vito Construction Corporation, Thompson, Conn., (a) $11,674, (b) $14,308, (c) $11,796; Connecticut Good Roads & Construction Co., New Britain, Conn., (a) $12,981, (b) $13,812, (c) $10,[illegible]; Olin T. Benedict, Pittsfield, Mass., (a) $12,307, (b) $13,198, (c) $11,[illegible]; Frank Arrigoni & Bro., Middletown, Conn., (a) $14,[illegible], (b) $14,330, (c) $13,541; Leonardo Suzio, Meriden, Conn., (a) $11,987, (c) $10,490.

Lebanon Township, about 7300 lin.ft. native stone macadam on the Creamery Hill Rd., Frank A. Wilcox, Norwich, Conn., $16,8[illegible]; Olin T. Benedict, Pittsfield, Mass., $18,149; Robert G. Miller Contracting Co., Hartford, Conn., $19,[illegible]; Amos D. Bridge's Sons, Hazardville, Conn., $20,3[illegible]; A. Vito Construction Corporation, Thompson, Conn., $18,193; Ahern Construction Co., Willimantic, Conn., $22,7[illegible]; A. Brazos & Sons, Middletown, Conn., $19,965.

Stonington Township, about 21,920 lin.ft. (a) concrete with washed sand, (b) concrete with unwashed sand, (c) reinforcement, (d) bituminous native stone macadam, (e) gravel, (f) hassam block, A. D. Bridge's Sons, Inc., Hazardville, Conn., (d) $[illegible],675; the Connecticut Hassam Paving Co., New Haven, Conn., (c) $4185, (f) hassam with washed sand, $73,[illegible]39, with washed stone, $69,354, hassam reinforced with washed sand, $[illegible], with unwashed sand, $73,724; Kellogg & Gregory Co., Danbury, Conn., (d) $[illegible],666; C. W. Blakeslee & Sons, New Haven, Conn., (a) $78,[illegible], (b) $[illegible],419, (c) $[illegible], (d) $61,669, (e) $50,369; Charles W. Tryon, Meriden, Conn., (d) $[illegible],893; O'Brien Construction Co., Grand Central Terminal, New York, (a) $[illegible],349, (b) $81,351, (c) $10,462, (d) $[illegible], (e) $19,086; Daly & Merritt, Portchester, N. Y., (a) $74,701, (b) $73,[illegible], (c) $4185, (d) $69,9[illegible], (e) $57,103; A. Vito Construction Corporation, Thompson, Conn., (a) $66,[illegible], (b) $64,[illegible], (c) $4185, (d) $[illegible],156, (e) $38,839; Connecticut Good Roads & Construction Co., New Britain, Conn., (a) $74,876, (b) $71,191, (c) $3766, (d) $6[illegible], (e) $48,791; B. D. Pierce, Jr., Co., Bridgeport, Conn., (a) $77,[illegible], (b) $75,603, (c) $[illegible], (d) $61,1[illegible], (e) $11,[illegible]; Louis Longhi & Bro., Torrington, Conn., (a) $70,[illegible], (b) $68,[illegible], (c) $[illegible], (d) $56,002, (e) $[illegible]; William J. Mertz, Portchester, N. Y., (a) $69,056, (b) $6[illegible], (c) $1603.

[illegible] (East Hampton post office), about [illegible] lin.ft. of (a) trap rock, (b) gravel on the Middle Haddam Rd., Connecticut Good Roads & Construction Co., New Britain, Conn., (a) $13,712, (b) $11,385; Olin T. Benedict, Pittsfield, Mass., (a) $12,122, (b) $11,0[illegible]; John Arborio, 172 Congress Ave., New Haven, Conn., (a) $13,134, (b) $10,57[illegible]; A. Vito Construction Corporation, Thompson, Conn., (a) $13,719, (b) $10,[illegible]; Frank Arrigoni & Bro., Middletown, Conn., (a) $13,966, (b) $11,[illegible]; Leonardo Suzio, Meriden, Conn., (a) $11,6[illegible]; [illegible] Bros., Middletown, Conn., (a) $13,[illegible]; A. Brazos & Sons, Middletown, Conn., (a) $10,7[illegible], (b) $1[illegible].

Bridgewater Township, about 16,1[illegible] lin.ft. [illegible]-in. native stone macadam on the Southville Rd., John Arborio, 172 Congress Ave., New Haven, Conn., $[illegible]; Robert G. Miller Contracting Co., Hartford, Conn., $18,671; Louis Longhi & Bro., Torrington, Conn., $[illegible],937; H. Sanford Osborne, Redding Ridge, Conn., $[illegible]; Goodman & Trumbull Co., [illegible], Conn., $[illegible]; B. D. Pierce, Jr., Co., Bridgeport, Conn., $[illegible]; John de Michiel & Bro., Torrington, Conn., $[illegible]; A. Brazos & Sons, Middletown, Conn., $[illegible]; Kellogg & Gregory Co., Danbury, Conn., $[illegible]. Noted Nov. 19.

Buffalo, N. Y.—The City Council is having plans prepared for the paving of portions of Chippewa and Georgia St.

Buffalo, N. Y.—The City Council has authorized the repaving of [illegible] and North Division St.

New York, N. Y.—(Borough of Manhattan)—(Official)—The following bids were received Nov. 2[illegible], by Marcus M. Marks, for regulating and repaving Riverside Drive, Service St. from [illegible] to 16[illegible] St., and for paving and curbing the [illegible] street from [illegible] to 161st St.: Barber Asphalt Paving Co., $[illegible]; [illegible] Contracting Co., $[illegible] and Asphalt Construction Co., $[illegible]. Noted Nov. 2[illegible].

Yonkers, N. Y.—According to press reports plans are being prepared by Daniel F. [illegible], City Engr., for grading, paving and [illegible] a section of Yonkers Ave.

Cranbury, N. J.—The Board of Freeholders of Middlesex County is considering the construction of a new road from Cranbury, Middlesex County, to [illegible], Mercer County, reducing the present distance to Trenton by about six miles. The Mercer County Board of Freeholders is also interested.

Hightstown, N. J.—The Board of Freeholders of Mercer County will immediately improve the Windsor-Hightstown Rd. at a cost of about $[illegible].

Millville, N. J.—The State Road Commissioner, Trenton, N. J., approved plans for improving that section of road between Millville and the [illegible] farm at Leesburg, 10 miles. Estimated cost, $[illegible] per mile.

New Brunswick, N. J.—The Board of Freeholders of Middlesex County has approved plans for the improvement of the [illegible] section of the [illegible] road.

Perth Amboy, N. J.—See item under "Water Supply and Irrigation."

Weehawken, N. J.—The Board of Council of West New York plans to open and improve 10th, 11th and 15th St.

+Baltimore, Md.—Contracts have been awarded for constructing 7.84 miles of road from Greenridge to Washington County line, to I. G. ROBINSON, Hancock, at $65,758, and a road in Cecil County through Chesapeake City, to M. J. BEST, Philadelphia, Penn., at $10,179.

Baltimore, Md.—Bids will be received by the Paving Commission until Dec. 16 for paving Latrobe St. The work includes 760 sq.yd. of vitrified block paving, concrete filler with 6-in. concrete base, and 1160 sq.yd. vitrified block paving, concrete filler with 4-in. concrete base.

New Cumberland, W. Va.—(Official)—Bids will be received by the County Court until noon, Jan. 4, for improving roads in Butler District. C. E. Grafton is County Rd. Engr.

Aiken, S. C.—See item under "Federal Government Work."

St. Augustine, Fla.—All bids received Nov. 25, by L. Pomar, City Clk., for paving Cincinnati Ave. were rejected. New bids will be advertised.

+Centerville, Ala.—A contract for grading, draining and surfacing a section of the Centerville and Blocton Rd. has been awarded to O. P. HEAD, at $10,540. Noted Nov. 12.

Columbiana, Ala.—Bids will be received until Dec. 21, for grading and draining the road from Vandiver, Shelby County, to the Jefferson County line.

Vernon, Ala.—An election will be held, Dec. 21, to vote on the question of issuing $75,000 in bonds for constructing roads.

Louisville, Ky.—The Board of Park Commissioners will build a road from Greenwood Ave. to the state fair grounds, at a cost of $10,000.

Dayton, Ohio—(Official)—Bids will be received by Hugh E. Wall, City Accountant, until noon, Dec. 15, for the sale of $101,200 in bonds for paving in Herman, Virginia, Neal, Forest, Salem Ave., May and Bowen St., respectively.

The City Commission contemplates paving Main St. with wood block. The estimated cost is $102,300.

Anderson, Ind.—(Official)—Bids will be received by the Commissioners of Madison County until 10 a.m., Dec. 21, for constructing 12 gravel and 11 concrete roads. J. B. Benefiel is County Audr.

Newcastle, Ind.—(Official)—Bids will be received by Commissioners of Henry, Fayette and Rush Counties until 2 p.m., Dec. 28, for constructing a county line highway. P. H. Wolfard is Audr. of Henry County.

Detroit, Mich.—Plans are being prepared for resurfacing a number of streets with sheet asphalt. The estimated cost is $600,000.

Bloomington, Ill.—The Board of Local Improvements contemplates paving White Pl. Blvd. The estimated cost of the work is $15,184.

+Chicago Heights, Ill.—A contract for paving in District No. 2 has been awarded to the CHICAGO HEIGHTS COAL CO., Chicago Heights, at $52,804.

St. Paul, Minn.—Bids will be received by August Hohenstein, Purchasing Agt., until 10 a.m., Dec. 14, for improving Cook St. from Matilda to Western Ave.

Anderson, Tex.—Grimes County Road District No. 2 contemplates an expenditure of $50,000 for road construction. J. G. Browne, Navasota, Tex., is Engr.-in-Charge.

+Angleton, Tex.—A contract for constructing about 12 miles of hard-surface gravel roads has been awarded to the OWENS CONSTRUCTION CO.

Bryan, Tex.—At an election to be held Dec. 30, the citizens of Brazos County will vote on the question of issuing $600,000 in bonds for constructing roads. Noted Dec. 3.

Cuero, Tex.—According to press reports, an election will soon be held to vote on the question of issuing $60,000 in bonds for constructing roads.

Floresville, Tex.—An election will be held Dec. 15, to vote on the question of issuing $30,000 and $18,000 in bonds for constructing and improving roads in Lavernia and Sutherland Springs District, respectively.

+Houston, Tex.—The contract for paving West Alabama Ave. from Main to San Jacinto St. has been awarded to the TEXAS BITULITHIC CO., Dallas, Tex. Noted Nov. 19.

Paris, Tex.—An election will be held Dec. 29, to vote on the question of issuing $100,000 in bonds for street improvements.

Terrell, Tex.—The City Council contemplates paving a section of North Rockwall Ave.

Fallon, Nev.—At the general election the citizens voted in favor of issuing $50,000 in bonds for constructing roads.

Bellingham, Wash.—The City Council contemplates an expenditure of $75,000 to pave three miles of Lake St. with asphalt or macadam.

Everett, Wash.—At the general election the question of issuing $1,500,000 in bonds for constructing roads was defeated.

+Seattle, Wash.—The contract for constructing concrete walks on 29th St. has been awarded to the HARBOR PAVING CO., at $7196.

Astoria, Ore.—The County Commissioners contemplate an expenditure of $22,642 for constructing a road from Flavel toward Seaside.

+Burlingame, Calif.—The City Trustees have awarded a contract for the paving of streets in the Langville District to the FEDERAL CONSTRUCTION CO., Monadnock Bldg., San Francisco, Calif., at $33,950.

Castella, Calif.—The Trinity Asbestos Mining Co. is preparing to construct a road from Castella, Shasta County, to the asbestos mines in Trinity County, a distance of 20 miles. The road will cost $45,000.

Fullerton, Calif.—The City Council plans to pave Brea Rd. to the city limits. The citizens will vote on the question of issuing $35,000 in bonds for this purpose.

+Los Angeles, Calif.—Contracts have been awarded for improving Seventh and Eighth St., to the FAIRCHILD-GILMORE-WILTON CO., at $26,259 and $27,695, respectively.

Bids will be received by the Board of Supervisors until 2 p.m., Dec. 21, for grading and constructing oil macadam pavement in County Road District No. 1.

Ontario, Calif.—Bids will be received by R. O. Brackenridge, City Clk., until 5 p.m., Dec. 14, for grading and paving with concrete base and oiled surface, about six blocks of Euclid Ave. between G St. and the north city limits. The work includes about 350,000 sq.ft. concrete base with oiled surface, 150,000 sq.ft. grading and paving with macadam and oiled surface, 67,000 sq.ft. cementing cobble stone gutters and 56,000 sq.ft. concrete gutters.

+Pasadena, Calif.—A contract for paving 148,000 sq.ft. on East Orange Drive with 4-in. oil macadam has been awarded to J. C. KINSMAN, 372 North Fair Oaks Ave., at $10,212.

+Pomona, Calif.—A contract for paving nine miles of street has been awarded to GEORGE H. MAGILL, of Crandall Construction Co., Santa Ana, at approximately $150,000. Noted Nov. 19.

+Sacramento, Calif.—The State Highway Commission has awarded contracts for highway construction in Glenn County from Willows to southerly boundary to C. W. CROSS, Oakland, Calif., at $40,013, and in Solano County from Cordelia to Fairfield to P. H. HOAN, Oakland, Calif., at $40,357. Noted Oct. 29 and Nov. 26.

+San Francisco, Calif.—The contract for paving Corbett Ave. from Stanford Heights to Sloat Blvd. has been awarded to G. W. McGINN & CO.

+Santa Monica, Calif.—The contract for improving Colorado Ave. from Ocean Ave. to Fourth St. has been awarded to J. D. KEEN CONTRACTING CO., Dudley Bldg., at $28,827.

Vacaville, Calif.—An election will be held Dec. 15, to vote on the question of issuing $12,000 and $18,000 in bonds for street improvements.

Venice, Calif.—The City Council contemplates improving Redondo Drive, connecting Venice and Redondo.

Quebec, Que.—Plans have been prepared by W. D. Baillarge, City Hall, City Engr., for paving from St. Valies St. to city limits. The estimated cost is $27,000.

INDUSTRIAL WORKS

Fitchburg, Mass.—The Fitchburg Yarn Co. will erect a three-story brick and wood storehouse on Sheldon St.

+New Bedford, Mass.—The contract for the construction of the warehouse for Charles Richmond, 600 Pleasant St., has been awarded to the B. F. SMITH CONSTRUCTION CO., Pawtucket, R. I. The estimated cost is $12,000.

Providence, R. I.—O. E. Haskell, 51 Sackett St., Providence, will erect a public garage on Worthington St.

Warren, R. I.—Plans have been completed for a building to be erected for the Swiss Textile Co.

Bridgeport, Conn.—The Royal Equipment Co. plans to erect a three-story addition to its factory on Railroad Ave.

+New Haven, Conn.—The Winchester Repeating Arms Co. has awarded contracts for the construction of buildings at its plant, to the WESTINGHOUSE, CHUCH, KERR CO., New York, N. Y. Noted Dec. 3.

Buffalo, N. Y.—The Ross Food Co. is having plans prepared for a building at Buffalo. Alexander Ross, 915 Ellicott Square Bldg., is the Pres.

The Pierce Arrow Motor Car Co. has purchased a site at Elmwood Ave. and the New York Central R.R., upon which will be erected a plant for the manufacture of automobile trucks.

Falconer, N. Y.—The Ferncliff Worsted Co. will erect a building at its plant, to provide for additional machinery.

New York, N. Y.—(Borough of Manhattan)—Wortmann & Braun, Archs., 114 E. 28th St., are preparing plans for the warehouse and garage, to be erected at 107th St. and Columbus Ave., for the Chelsea Storage Warehouse Co. Louis Shram, 426 West 26th St., is Pres.

New York, N. Y.—(Borough of Queens)—Plans have been prepared by William Higginson, 13 Park Row, Manhattan, for the four-story reinforced concrete lithographing factory in Meadow St. Long Island City, for the Degnon Realty & Terminal Improvement Co., 30 East 42d St.

Revised plans are being prepared by Frank Braun, 585 Ninth Ave., Long Island City, for a one-story brick shop, 50x100 ft., at Ridge and Sherman St. Long Island City, for J. Kleine Steel & Iron Works, 82 Broadway.

Poughkeepsie, N. Y.—Smith Bros., cough drop manufacturer, will erect a factory on Church St. The estimated cost is $40,000.

+Harrison, N. J.—The general contract for the construction of the factory at Third and Sussex St., for the Calculagraph Co., of New Jersey, 9 Maiden Lane, Manhattan, has been awarded to SALMOND BROS. CO., 526 Elm St., Arlington, N. J. Noted Nov. 19.

+Millville, N. J.—The contract for the construction of the factory for the Caloris Co., has been awarded to H. H. HANKINS & BRO., Bridgeton, N. J.

Newark, N. J.—The Consolidated Cork Specialty Co. contemplates the erection of a two-story building, 100x150 ft., at 43 Barbara St. The estimated cost is $100,000.

The Mass & Waldstein Co. will erect a chemical plant on Ave. R near the Passaic River. The estimated cost is $50,000.

+New Brunswick, N. J.—The contract for the construction of the factory for the Endurance Tire & Rubber Co., has been awarded to the DAVID HENRY BLDG. Co. Noted Sept. 17.

Passaic, N. J.—Morris & David Levine, 111 Columbia St., Passaic, are receiving bids for the construction of a one-story brick storage and grain elevator at Monroe St. and Dayton Ave. The estimated cost is $10,000.

✦**Philadelphia, Penn.**—The contract for the construction [illegible] at Kensington Ave. and [illegible] St., for [illegible], has been awarded to HARRY [illegible], JR., [illegible] Ave. Noted [illegible].

✦The contract for the construction of the three-story ice-[illegible] at [illegible] St., for Joseph J. [illegible], has been awarded to [illegible] Wood St.

✦**Pittsburgh, Penn.**—The contract for remodeling the plan-[illegible] of the [illegible] J. K[illegible] Co. has been awarded to the WALKER [illegible] CO., at [illegible].

York, Penn.—J. A. [illegible], Arch., York, is preparing plans for the two-story [illegible] building for the [illegible]. The estimated cost is [illegible].

✦**Wilmington, Del.**—The contract for the construction of the [illegible] at [illegible] St. for W. W. [illegible], has been awarded to JOHN [illegible] & SON.

Wilmington, Del.—The [illegible] Mfg. Co. has had plans prepared for the erection of a factory at Wilmington. It will be two stories, [illegible] of brick and concrete.

Baltimore, Md.—The [illegible] Oil Corporation, New York, is planning the erection of an oil refinery on the Patapsco River, near Baltimore.

✦**Hagerstown, Md.**—The contract for the construction of a garage for [illegible] Sherley has been awarded to the PRICE CONSTRUCTION CO., [illegible] St., Baltimore, Md. It will be three stories, [illegible] ft.

✦**Clarksburg, W. Va.**—The contract for the construction of the plant for the [illegible] Co. has been awarded to the J. F. MOSS IRON WORKS, Wheeling, W. Va., at [illegible]. Noted Nov. 1[illegible].

Augusta, Ga.—The [illegible] Mine recently in-corporated, plans to construct buildings at Augusta.

New Orleans, La.—Thomas [illegible] Co. will erect a ware-house at Howard Ave. and Dryades St. The estimated cost is [illegible].

Akron, Ohio—Plans have been prepared by N. A. Mentz, Arch., for the construction of a two-story, [illegible]x160-ft. building at [illegible] Spicer St., for the Krouse Clay [illegible] Co.

The Miller [illegible] Co. plans the construction of a group of five buildings, estimated to cost [illegible]. The group includes a [illegible]-story building, power plant, two storage buildings and a two-story building.

Chillicothe, Ohio—Burrell Engineering & Construction Co., Archts. & Engrs., Detroit, Mich., is preparing plans for the construction of a [illegible] grain elevator for the Standard Cereal Co. Bids will be received in the spring.

✦**Cleveland, Ohio**—The contract for the construction of a six-story and basement, [illegible]-ft. factory for the Cleveland Worsted Mills Co. [illegible], has been awarded to the HUNKIN-CONKEY CONSTRUCTION CO., [illegible] Cuyahoga Bldg. Estimated cost, [illegible].

Plans have been prepared by Mechanics Marshall Co., Pittsburgh, Penn., for the construction of a one-story, [illegible] [illegible]-ft. addition to the Empire Rolling Mill Co., Bessemer Ave. and the Pennsylvania R.R. Estimated cost, [illegible].

Plans are being prepared by W. S. Lougee, Arch., Marshall Bldg., for the construction of a six-story warehouse at East [illegible] St. and Lakeside Ave., for the Union Paper & Twine Co., [illegible] St. Clair Ave., N. W.

The Cleveland officials of the Lake Shore & Michigan Southern and Cleveland, Cincinnati, Chicago & St. Paul Ry. are [illegible] the construction of a [illegible]-story railroad freight terminal warehouse at West [illegible] St. and [illegible] Ave. The estimated cost is [illegible]. A. A. Mudge, of Mudge & Reed, is interested.

Cuyahoga Falls, Ohio—[illegible], Arch., [illegible] Bldg., Youngstown, is preparing plans for the construction of a [illegible] for the Falls Hollow Staybolt Co. [illegible].

✦**Sandusky, Ohio**—[illegible]

Evansville, Ind.—[illegible] warehouse.

✦**Grand Rapids, Mich.**—[illegible]

Chicago, Ill.—[illegible]

Clearing, Ill.—[illegible]

Minneapolis, Minn.—[illegible]

✦**St. Paul, Minn.**—[illegible]

Stafford, Kan.—[illegible]

South Omaha, Neb.—[illegible]

Hamilton, Mont.—[illegible]

San Antonio, Tex.—[illegible]

✦**Seattle, Wash.**—[illegible]

Spokane, Wash.—The Non-Slip Sidewalk Door Co., recently incorporated with a capital of $60,000, plans to build a factory at Spokane.

Medford, Ore.—Edgar Hafer contemplates constructing a sawmill and box factory on Bear Creek. The plant will have a capacity of [illegible] ft. a day.

San Francisco, Calif.—The John Center Co. plans the construction of a two-story brick bakery at Bryant and Seventh St. The estimated cost is $18,000.

FEDERAL GOVERNMENT WORK

Post Office—Brattleboro, Vt.—Plans have been completed and bids will soon be called for by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., for the post office and Federal building at Brattleboro.

✦**Dredging**—New York, N. Y.—The following are the [illegible] received for dredging in Staten Island Sound, N. Y., and N. J.: P. Sanford Ross, Inc., (a) [illegible] measurement, per cu.yd., [illegible]; Morris & Cummings Dredging Co., (a) 19[illegible], (b) place measurement per cu.yd., 22[illegible]; Bowers Southern Dredging Co., (a) 1[illegible]; L. T. Gaylord, (b) 1[illegible]; Coastwise Dredging Co., (a) 1[illegible]; [illegible], (b) 23c.; R. G. Packard Co. [illegible]. Noted Nov. 1[illegible].

✦**Mechanical Equipment**—Syracuse, N. Y.—The contract for installing conduit and wiring, lighting fixtures, and making repairs to the heating system in the U. S. post office at Syracuse, has been awarded to BURNS BROS., Syracuse, N. Y., at $[illegible]. Noted [illegible] 2[illegible].

Post Office—Morristown, N. J.—Bids were received as follows by Oscar Wenderoth, Superv. Archt., Treasury Dept., Washington, D. C., for the construction of a post-office at Morristown: Wilbert R. Titus, Philadelphia, Penn., $[illegible]; Keeps Dry Construction Co., New York, $[illegible]; Altoria Realty & Construction Co., New York, $99,431; Charles McCaul Co., Philadelphia, $99,790; Henry L. Brown, Philadelphia, $1[illegible]; George R. Willis, New York, $103,709; Ossawana Building Co., New York, $103,97[illegible]; Limouse Bros., Weehawken, N. J., $[illegible]; John Lowry, Jr., New York, $1[illegible]7,345; William H. F[illegible] & Co., New York, $10[illegible]; Westchester Engineering Co., New York, $1[illegible]; Simon Rossek, Inc., New York, $[illegible]; Charles Gilpin, Philadelphia, $109,[illegible]; William H. [illegible], New York, $110,[illegible]; J. G. Galard & Co., New York, $111,[illegible]; Keele & Kelly, Inc., New York, $111,[illegible]; Andrew J. [illegible], New York, $111,[illegible]; William Werner, New York, $11[illegible]; R. C. Ballinger & Co., Philadelphia, $[illegible]; De Riso [illegible], Weehawken, N. J., $118,125; T. A. Clarke Co., New York, $11[illegible]; J. W. Hathor & Sons, Trenton, N. J., $12[illegible]; [illegible] Bros., Morristown, N. J., $122,1[illegible]; J. S. Rogers, Moorestown, $122,3[illegible]; Egan & Montague, Jersey City, N. J., $124,940. Noted Oct. 22.

✦**Dredging**—Philadelphia, Penn.—Bids will be received by Col. George A. Zinn, 815 Witherspoon Bldg., Philadelphia, until noon, Jan. 7, 1915, for dredging in Delaware River below Philadelphia.

Coal Handling Apparatus—Philadelphia, Penn.—The following bids were received for installing coal handling apparatus in the U. S. mint: F. L. Hoover & Sons, Philadelphia, Penn., $10,741; Specialty Engineering Co., Philadelphia, Penn., $11,610; Arthur G. McKee, Cleveland, Ohio, $1[illegible]; W. W. Lindsay & Co., Philadelphia, Penn., $1[illegible]; Link Belt Co., Philadelphia, Penn., $1[illegible]; Guarantee Construction Co., New York, N. Y., $16,12[illegible]; alternate for pneumatic system, $[illegible].

Repair Shops—Washington, D. C.—Bids will be received by the Commissioners of the District until [illegible] p.m., Dec. 16, for constructing repair shops for the water department on Bryant St. Oliver P. Newman, District Bldg., is one of the Comnrs.

✦**Motor Trucks**—Washington, D. C.—The contract for furnishing two motor trucks for the U. S. Army has been awarded to the DUPLEX POWER CO., Charlotte, Mich. Noted Nov. [illegible].

Grading—Arlington, Va.—Bids will be received by J. R. Houston, Depot Quartermaster, U. S. Army, Washington, D. C., until [illegible], Dec. 1[illegible], for leveling, paving and grading around the site of the Maine Memorial, Arlington National Cemetery, Virginia.

Post Office—[illegible]

Road—Aiken, S. C.—[illegible]

Repairing Vessel—Charleston, S. C.—[illegible]

✦**Dam, Building, Etc.**—[illegible]

Earthwork—New Orleans, La.—[illegible]

Levee Work—Memphis, Tenn.—[illegible]

(b) $19,674; C. C. Aderholt, Friars Point, Miss., (a) $61,200, (b) $18,900; Roach, Stansell, Lowrance Bros. & Co., Memphis, Tenn., (a) $54,040, (b) $19,830; Denison & Rodgers Bros., Memphis, (a) $72,112, (b) $24,225; S. M. Bush, Memphis, (a) $38,192, (b) $11,007; R. L. Leonard, Memphis, (a) $68,000, (b) $21,150; Bond, McMurray & Co., Beulah, Miss., (a) $81,100, (b) $24,930; Roper Bros., Memphis, (a) $56,000; B. M. Turner & Co., Memphis, (a) $84,164, (b) $23,196; Malachi Tansey, Arkansas City, Ark., (a) $45,500, (b) $22,275; Linnan Bros. & F. T. Constant, Alexandria, La., (a) $72,852, (b) $23,901; C. I. Anderson, Commerce Mo.; W. T. & E. M. Lowrance & Co., Memphis, (a) $69,060, (b) $19,725; H. H. Shackleford Co., Memphis, (b) $11,160; Oglesby & Co., Memphis, (a) $67,400. Noted Nov. 26.

+Steel Hull—Cincinnati, Ohio—The contract for constructing and delivering the steel hull for the dipper dredge "Carrollton," has been awarded to the AMERICAN BRIDGE CO., Cincinnati, at $8888. Noted Oct. 1 and Oct. 29.

Life Saving Station—Mackinac Island, Mich.—The following bids were received for constructing a life saving station and launchway on Mackinac Island: R. J. B. Newcombe, Manistee, Mich., $22,225; August Tiedemann, Ludington, Mich., $21,834; The Price Bros. Co., East Jordan, Mich., $19,500; Jacob C. Jensen, Racine, Wis., $19,300; Richard Collins, Alpena, Mich., $21,757; Sheboygan Mfg. Co., Sheboygan, Wis., $19,834; C. R. Jensen Co., Muskegon, Mich., $20,700. Noted Nov. 12.

Post Office—Robinson, Ill.—Bids were received as follows by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, for the construction of a post office at Robinson: (a) Limestone; (b) sandstone: A. W. Lane Co., Chicago, Ill., (a) $41,280; George W. Stiles Construction Co., (a) $42,898; James Devault & Co., Canton, Ohio, (a) $44,945; (b) $45,745; R. S. Moore, Lafayette, Ind., (a) $44,949; (b) $46,350; W. L. Holladay, Greensboro, N. C., (a) $45,582; (b) $46,582; Mayben & Fruechtel, Gadsden, Ala., (a) $45,879; (b) $47,232; Hiram Lloyd Building & Construction Co., St. Louis, Mo., (a) $45,934; Volney E. Taylor, Huntington, W. Va., (a) $47,875; (b) $49,500; Thomas W. Cissel, Wooster, Ohio, (a) $49,214; (b) $51,000; Wharton Building & Supply Co., St. Louis, Mo., (a) $53,970. Noted Nov. 5.

Metal Flumes—Powell, Wyo.—Bids will be received by the U. S. Reclamation Service, Powell, until 2 p.m., Dec. 10, for furnishing about 1214 lin.ft. of metal flumes of various diameters, from 2 ft. 6½ in. to 5 ft. 8¾ in. H. N. Savage is Superv. Engr.

Post Office—Bozeman, Mont.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 2, for constructing a two-story and basement stone and brick post office.

Cement—Denver, Colo.—Bids will be received at the office, U. S. Reclamation Service, Commonwealth Bldg., Denver, until 10 a.m., Dec. 18, for furnishing 140,000 bbl. of portland cement, f.o.b. cars at the works of bidder.

★Steel Rolling Crest—Grand Valley, Colo.—The following bids were received for furnishing one steel rolling crest for the Grand River Diversion Dam, Grand Valley Project, expressed in cents per lb. at the points named: Riter-Conley Mfg. Co., 2.55c., at Leetsdale, Penn.; Penn Bridge Co., Beaver Falls, Penn., 2.94c., at Beaver Falls; Steacy Schmidt Mfg. Co., York, Penn., 3.20c., at York; American Bridge Co., Baltimore, Md., 3.20c., at Ambridge, Penn.; Independent Bridge Co., Pittsburgh, 3.46c., at Pittsburgh; St. Paul Foundry Co., St. Paul, Minn., 3.55c., at St. Paul; Minneapolis Steel & Machinery Co., Minneapolis, Minn., 3.72c., at Minneapolis; Milwaukee Bridge Co., Milwaukee, Wis., 3.72c., at Milwaukee; Chicago Bridge & Iron Works, Chicago, Ill., 3.75c., at Chicago; Allis-Chalmers Mfg. Co., Milwaukee, Wis., 3.80c., at Milwaukee; Reumeli-Dawley Mfg. Co., St. Louis, Mo., 3.9c., at St. Louis; Pittsburgh-Des Moines Steel Co., Pittsburgh, Penn., 3.97c., at Pittsburgh; Kansas City Structural Steel Co., Kansas City, Mo., 4c., at Kansas City, Kan.; The McMyler Interstate Co., Bedford, Ohio, 4.76c., at Bedford; Treadwell Construction Co., Midland, Penn., 5.375c., at Midland; Whitehead & Kales Iron Works, Detroit, Mich., 5.80c., at Detroit; William Cramp & Sons, Philadelphia, Penn., 8.55c., at Philadelphia. Noted Oct. 22.

Power House—Seattle, Wash.—Bebb & Gould, Archs., Denny Bldg., have completed plans for a two-story reinforced-concrete power house to be built at the Narrows, Lake Washington Canal. Maj. J. B. Cavanaugh, Burke Bldg., Seattle, is in charge.

Miscellaneous—Panama—Bids will be received by Maj. F. C. Boggs, Gen. Pur. Officer of the Panama Canal, until Dec. 23, for furnishing cranes, car journal braces and crude carbolic acid.

MISCELLANEOUS

+Motor Fire Apparatus—Boston, Mass.—(Official)—John Grady, Fire Comr., has awarded the contract for furnishing the department with three two-wheel tractors for water towers to the AMERICAN & BRITISH MFG. CO., Providence, R. I., at $16,613. Noted Dec. 3.

Elimination of Grade Crossing—Winchester, Mass.—The Grade Crossing Commissioners, appointed by the Superior Court, have made a report recommending the elimination of the grade crossing over the Boston & Maine R.R. tracks at the main depot. Arthur B. Corthell, North Station, Boston, is Ch. Engr., Boston & Maine R.R.

Dredging—Newport, R. I.—The lowest bid received for the removal of 14,371 cu.yd. of earth and rock from Newport Harbor was that of the Coastwise Dredging Co., Norfolk, Va., at $3.89 per cu.yd.

+Quay Wall—Pawtucket, R. I.—(Official)—The following bids were received by the State Harbor Improvement Commission, Providence, for the construction of a quay wall: JOHN CASHMAN & SONS, Boston, $85,425 (awarded contract); Ray H Beattie, Inc., Fall River, $87,421; H. P. Converse, Boston, $90,362; T. A. Scott Co., Inc., New London, $123,745. William D. Bullock is Ch. Engr. Noted Oct. 22, Nov. 12, Nov. 19.

★Steel Furniture and Rugs—Albany, N. Y.—(Official)—Bids will be received until 2 p.m., Dec. 29, by the Trustees of Public Buildings, Capitol, Albany, for furnishing standard and steel furniture, also rugs, for the State Tax Commission. For details, see advertisement under "Contracts to Be Let."

Retaining Wall—Buffalo, N. Y.—Plans have been prepared, and a bond issue of $50,000 passed, for the construction of a retaining wall along the inner line of Black Rock Harbor, at Ferry St.

Motor Fire Apparatus—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until 10:30 a.m., Dec. 14, by Robert Adamson, Fire Comr., Municipal Bldg., for furnishing and delivering 20 motor-driven hose wagons.

Motor Tractors—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until 2 p.m., Dec. 14, by Marcus M. Marks, Borough Pres., for furnishing and delivering six motor tractors. Blank forms and specifications may be had at the office of the Commissioner of Public Works, Bureau of Highways, Room 2124, Municipal Bldg.

Broken Stone—New York, N. Y.—(Borough of Manhattan)—(Official)—Bids will be received until noon, Dec. 17, by R. A. C. Smith, Comr. Docks, for furnishing and delivering 1½-in. broken stone. For further information apply to the office of the department, Pier A, Battery Pl.

+Pier Extension—New York, N. Y.—(Borough of Manhattan)—(Official)—The Commissioner of Docks has awarded the contract for extending Pier 43, to the GENERAL CONTRACTING & ENGINEERING CO., 29 Broadway, New York, at $21,000. Noted Nov. 19, Dec. 3.

Comfort Station—Syracuse, N. Y.—James A. Randall, Arch., has prepared plans for the construction of a public comfort station in Veteran Park. They will be submitted to the Park Commission in the near future for approval.

Fire Station—Elizabeth, N. J.—The Saybrook Fire Co. No. 1 is having plans prepared for a fire station to be erected at Hollywood and Long Island Ave.

Market—Jersey City, N. J.—The Board of City Commissioners is having plans prepared for a 42x102-ft. corrugated iron market building, to be erected at Railroad Ave. and Barrow St. John T. Rowland is the Arch.

Bathhouse—Newark, N. J.—The city has rejected all bids for the construction of the East Side bathhouse. Specifications will be revised and bids again called for. Appropriation available, $91,000.

Market—Newark, N. J.—The Common Council soon will receive bids for the erection of buildings for the Center Market. The contract for this work, recently awarded to the Essex Construction Co., has been voided by the State Supreme Court.

Stadium—Philadelphia, Penn.—Plans for the construction of a stadium seating 100,000 people are being considered by a committee of business men together with officials of the University of Pennsylvania. The object is to build a stadium with adequate accommodations for the Army-Navy game. The estimated cost is about $500,000.

Elimination of Grade Crossings—Pittsburgh, Penn.—The Grade Crossing Committee, composed of B. E. Briggs, City Engr., Mayor Stern and Director Eichorn, has approved the estimate of the City Engineer for the city's share in the construction of subways at Parade, Peach, Sassafras and Cherry St. The entire cost will be $326,000, of whcih the city will pay $106,500 and the railroads the remainder.

Breakwater and Boat Houses—Baltimore, Md.—The city has appropriated $50,000 for the construction of a breakwater and boat houses at Fort McHenry Park. James H. Preston is Mayor. Noted Nov. 26.

Levee—Augusta, Ga.—The River and Canal Commission has instructed Nisbit Winfield, City Engr., to prepare plans for a levee to be constructed between East boundary and Charleston & West Carolina Ry.

Harbor Improvements and Municipal Docks—Miami, Fla.—The City Council has accepted the plans of Isham Randolph, Engr., Chicago, Ill., for a 1000-ft. dock, including railroad trackage. The estimated cost is $385,000. J. W. Watson is Mayor. Noted Sept. 24.

+Seawall—Safety Harbor, Fla. (Espiritu Santo Springs post office)—The Espiritu Santo Springs Co. has awarded the contract for the construction of 2500 ft. of seawall to the SOUTHERN CONCRETE & CONSTRUCTION CO., Clearwater, Fla. W. E. Sinclair is Gen. Mgr.

Vault Linings and Metal Furniture—West Palm Beach, Fla.—Bids will be received until Jan. 5, by R. H. Rousseau, Chn., Palm Beach County Commissioners, for furnishing vault linings, vault doors, metal and wood furniture for the new courthouse. George O. Butler is County Clk., West Palm Beach.

Drainage—Memphis, Tenn.—(Official)—Stein & Harbert, Indianola, Miss., and S. W. McClesky, Memphis, Tenn., have been retained by the commissioners as engineers for the Forked River Drainage District, Haywood and Crockett Counties, Tenn.

Pavilion—New Orleans, La.—The Commission Council has decided to erect a steel dome pavilion in the West End. An ordinance authorizing the retaining of a structural engineer has been passed.

Drainage—Humboldt, Tenn.—Oldfield & Brady, Engrs., Cairo, Ill., have completed preliminary work for a drainage system.

Elimination of Grade Crossing—Columbus, Ohio—(Official)—Plans were approved on Dec. 4 for the elimination of grade crossings on the line of the Norfolk & Western Ry. in the City of Columbus. The work calls for 700,000 cu.yd. of embankment and the erection of elevated structure over 10 streets. The estimated cost is $1,000,000. The city will pay 35% of the cost of double-track work. Grade crossings on the lines of the Baltimore & Southwestern, Hocking Valley, Toledo & Ohio Central and Little Miami Division have been eliminated at a cost of $1,000,000. J. E. Crawford is Ch. Engr., Norfolk & Western Ry. Henry Maetzel is City Engr.

Levee Work—Honey Creek, Ind.—An issue of Honey Creek levee bonds was recently sold for $17,000. This amount will be used to reconstruct levees for flood protection.

Dredging—Indianapolis, Ind.—The lowest bid received by the Board of Public Works for the removal of encroachments along the east bank of White River was that of Bernard Norton, at $11,126.

Drain—Coldwater, Mich.—Bids will be received until Dec. 15, by Eli Tift, County Drain Comr., Branch County, for the construction of a drain to be known as the Little Swan Creek

[illegible] Matteson, [illegible] County, and [illegible] St. Joseph County. [illegible] of the Commissioners.

Dock Reconstruction—[illegible] According to press reports plans are now being prepared by the [illegible] & Northwestern Ry. for general reconstruction of its [illegible] in this city.

Beach and Bathhouse—[illegible] Charles W. Kallal, City Arch., has completed plans and bids will be received shortly for the construction of the [illegible] Ave. public bathing beach and bathhouse. The estimated cost is [illegible].

✦**Ditch**—Forest City, Iowa—The contract for the construction of drainage ditch No. [illegible] has been awarded to ARTHUR McHASE [illegible], Iowa, at $16,[illegible]. C. K. Nelson is County Aud.

Ditch—[illegible]water, Minn.—Bids will be received until Dec. 19, by N. A. Nelson, County Audr., for the construction of Judicial ditch No. [illegible]. Estimated cost $17,[illegible]. H. E. Ridge, [illegible] is Engr.

Drainage—[illegible] Kan.—Property owners along the course of [illegible] Creek plan to form a drainage district to undertake flood prevention work.

✦**Cutoffs**—[illegible] Kan.—Drainage District No. 1 has awarded the contract for excavating 61,[illegible] cu. yd. of earth for the construction of cutoffs in the Delaware River, Straight Creek and [illegible] Creek to WM. D. BANCROFT & DOTY, Omaha, Neb., at $6,[illegible]. H. B. Walker, Manhattan, Kan., is Engr.

Drainage—[illegible] Neb.—(Official)—A communication from the [illegible] Engineering Co., Omaha, states that the proposed bond issue of $[illegible] for drainage work in Washington and Burt Counties was defeated at the recent election. Noted Dec. [illegible].

✦**Drainage**—Tecumseh, Neb.—(Official)—Bids will be received until 10 a.m., Jan. 11, by James Meek, Secy., Drainage District No. 1, Otoe and Johnson Counties, for the construction of new channels for the Little Nemaha, Spring Creek, south branch of the Little Nemaha, Wilson Creek, Walnut Creek, Muddy Creek and laterals A to H inclusive. The estimated yardage is 1,6[illegible] cu. yd.; also about 6750 squares of clearing river channel and 1,[illegible] cu. yd. of levee work. Plans and specifications for this work are on file at the office of Clyde W. [illegible] Co., [illegible] City National Bank Bldg., Omaha, Neb. For details see advertisement under "Contracts to Be Let." Noted Dec. [illegible].

Ditch and Flume—Missoula, Mont.—(Official)—A communication from S. H. Ketcham, Engr., 220 Higgins Ave., states that the construction of three miles of ditch and 1200 ft. of flume near Iron Mountain has been postponed because of inability to secure the right-of-way. Noted Oct. 22.

✦**Comfort Station**—Dallas, Tex.—The City Park Board and the Board of City Commissioners have awarded the contract for constructing comfort stations at Elm St. and Ervay St. to the TRINITY CONSTRUCTION CO., at $11,6[illegible].

✦**Drainage**—Houston, Tex.—Harris County Drainage District No. [illegible], [illegible] Anderson, Chm., has awarded the contract for the construction of 44 miles of drainage canals to the J. B. ARPIN [illegible] CO., [illegible] Bldg., Houston, at about $140,000. J. C. [illegible] is the Engr. Noted Nov. [illegible].

Drainage System—[illegible] Tex.—The taxpayers of this district have voted favorably on the proposed bond issue of $[illegible] for the construction of a drainage system.

Levee Work—Waxahachie, Tex.—Bids will be received until [illegible] by the Commissioner of Ellis County Drainage District No. [illegible] for the construction of new levees and repairing old one. Work consists of deepening [illegible], draining ditches and the removal of 16[illegible] cu. yd. of earth. Address bids to J. H. [illegible], Tex. [illegible] T. H. [illegible], Waxahachie.

Drain—North Yakima, Wash.—Drainage District No. 2 in the near future plans to deepen the existing drains and construct new ones in a district of [illegible] acres. The estimated cost of the project is $[illegible].

Train Sheds—Tacoma, Wash.—The Northern Pacific Ry. Co., [illegible] will soon receive bids for the erection of two concrete train sheds. The estimated cost is $[illegible].

Oil Fire Protection Equipment—Walla Walla, Wash.—The Standard Oil Co., San Francisco, plans to install [illegible] for fire protection at Walla. The estimated cost is $[illegible]. H. M. [illegible] Bldg., San Francisco, is Engr.

✦**Flume**—Los Angeles, Calif.—The contract for the construction of a timber flume across New River has been awarded to the [illegible] BRIDGE & CONSTRUCTION CO., Los Angeles, at $[illegible].

Pier—San Francisco, Calif.—The State Harbor Commission [illegible] for the construction of pier [illegible] at the foot of [illegible] St.

Trance—[illegible]

[illegible]

Crushed Stone and Screenings—[illegible]

[illegible]

Fire Docks—[illegible]

[illegible]

Market—[illegible]

[illegible]

BUILDINGS

[illegible]

Brattleboro, Vt.—[illegible]

Boston, Mass.—Thomas W. Lamb, Arch., 501 Fifth Ave., New York, is preparing plans for the theater to be erected on Massachusetts Ave. for the Colonial Amusement Co., Old South Bldg. The estimated cost is $120,000.

Salem, Mass.—A. Rosenstein, Arch., 218 Essex St., is preparing plans for a four-story, 55x10[illegible]-ft. store and loft building on Washington St., for Nathan Shribman. The estimated cost is $[illegible].

Springfield, Mass.—Plans are being prepared by Gardner & Gardner, Archs., for the construction of the dormitory for the Y. M. C. A. The estimated cost is $150,000.

✦**Waltham, Mass.**—The contract for the construction of the public library at Waltham has been awarded to HORTON & HEMENWAY, 683 Atlantic Ave. Noted Oct. 8.

Worcester, Mass.—Bids will be received for the construction of a gymnasium for the Polytechnic Institute. Hewitt & Brown, South Minneapolis, Minn., are the Archs. Noted Sept. 17.

✦**Providence, R. I.**—The contract for the construction of the wing of the Park Museum has been awarded to the O. D. PURRINGTON CO., at $37,600.

✦**New Haven, Conn.**—The masonry contract for the three-story addition to the Crittenden Home for Children has been awarded to the SPERRY & TREAT CO.; carpentry, the WILLIAM RITCHIE CO. C. F. Townsend, 129 Church St., New Haven, is the Arch.

✦**Long Beach, N. Y.**—The general contract for the construction of the clubhouse for the Lido Corporation has been awarded to the GEORGE A. FULLER CO., 111 Broadway, New York, N. Y. Noted Aug. 27.

New Hartford, N. Y.—Plans are being prepared by the Thomas P. Barnett Architectural Co., 923 Central National Bldg., St. Louis, Mo., for a three-story brick and stone hospital for St. Elizabeth Hospital. The estimated cost is $350,000.

New York, N. Y.—(Borough of Bronx)—Bids are being received by John J. Van Pelt, Arch., 381 Fourth Ave., for the four-story school at Marion Ave. and Fordham Road, for the Church of Our Lady of Mercy. The estimated cost is $100,000.

(Borough of Brooklyn)—Frank Helmle, Arch., 190 Montague St., is preparing plans for a nurses' home on Sixth St., for the Methodist Episcopal Hospital. The estimated cost is $100,000.

(Official)—The lowest bid received by C. B. J. Snyder, Supt. of School Bldgs., Park Ave. and 59th St., for additions and alterations to Public School 18, at Maujer and Leonard St., was submitted by Frymier & Hanna, at $102,271. Noted Nov. 26.

(Borough of Manhattan)—Plans are being prepared by T. Joseph Bartley, Arch., 15 Broad St., for the construction of a building at Fifth Ave. and 40th St., for Arnold Constable Co.

Plans have been completed by Louis Sheinert, Arch., 194 Bowery, for the construction of the nine-story loft building at 234 West 25th St. The estimated cost is $110,000.

(Borough of Manhattan)—Plans have been completed by Thomas W. Lamb, Arch., 501 Fifth Ave., for the construction of a 20-story theatre, store and office building at Broadway and 48th St. The estimated cost is $350,000.

The 137 East 72d St. Corporation, care of Van Wyck Thorne, 170 Broadway, contemplates the erection of an apartment hotel at 72d St. and Lexington Ave.

✦ (Official)—Bids were received Dec. 4, by the Board of Trustees, Bellevue Hospital, for making the alterations to the power house and ambulance station at the Harlem Hospital, as follows: William Werner, $44,887; Neptune B. Smyth, $52,891; Marble Arch Co., $56,900; William H. Egan, $[illegible]; Lincoln Steel Fleming Co., $42,810; Louis Wechsler, $48,911; Tower Mfg. Co., $39,[illegible]. Noted Nov. 26.

(Official)—Bids were received Dec. 4, by the Board of Trustees, Bellevue Hospital, for alterations to the main building of the Harlem Hospital, as follows: M. P. Lundin, $16,491; Andrews Bldg. Co., $[illegible]; J. M. Knopp, $[illegible],378; William H. Egan, $34,840; Marble Arch Co., $[illegible]; A. W. King, $[illegible]; Lincoln Steel Fleming Co., $44,871; Wells & Newton, $36,339. Noted Nov. 26.

Niagara Falls, N. Y.—The taxpayers of Niagara Falls will be asked to vote, on Dec. 15, for the proposed city hall, to cost $176,412.

✦**Yonkers, N. Y.**—The general contract for the construction of the Y. M. C. A. building at Riverdale Ave. and Hudson St. has been awarded to GEORGE T. KELLEY, 20 John St., Yonkers. Noted Nov. 26.

Jersey City, N. J.—The United States Theatre Co., Hoboken, will erect a theatre at Bergen Square. Frank O. [illegible] is Arch.

The Westminster Presbyterian Church plans to construct an addition to its edifice at Magnolia and [illegible] Aves.

✦**Passaic, N. J.**—The general contract for the construction of the three-story school on Watson Ave. has been awarded to the [illegible] HAFFER CONSTRUCTION CO., [illegible] West [illegible] St., New York; heating and ventilating, BEAVER ENGINEERING CO., [illegible] St., Newark, N. J.

Athens, Penn.—[illegible] & [illegible]ford, Archs., Elmira, N. Y., have completed plans for the construction of a school at Athens. The estimated cost is $[illegible].

Kennett Square, Penn.—Plans are being prepared by [illegible], Arch., [illegible] Arch St., Philadelphia, Penn., for the construction of the school at Kennett Square. The estimated cost is $[illegible].

Cumberland, Md.—The local lodge of Knights of Pythias will erect a building to cost $[illegible].

Richmond, Va.—Bids will be received until Dec. [illegible] by [illegible] for the school at [illegible] Ave.

Charleston, W. Va.—The lowest bid received by the Board of Education for the high school at Charleston was submitted by the [illegible] & [illegible] Co., Hamilton, Ohio, at $[illegible]. Noted Oct. [illegible].

Spartanburg, S. C.—Bids are being received by F. W. [illegible], [illegible] St., New York, for the construction of a building for the First National Bank. The estimated cost is $[illegible]. Noted July [illegible].

Deland, Fla.—Bids will be received until Dec. 15, by L. J. Cambron, for a hotel to be erected at Deland. The estimated cost is $40,000.

West Palm Beach, Fla.—Bids will be received until Jan. 5, by the Palm Beach County Comrs., for the courthouse to be erected at West Palm Beach. The estimated cost is $180,000. Noted Nov. 19.

Baton Rouge, La.—Bids will be received until Dec. 16, by Favrot & Livaudis, Archs., 305 Barrone St., New Orleans, for the three-story building at the Louisiana State University.

Nashville, Tenn.—Edward Dougherty, Arch., Candler Bldg., Atlanta, Ga., has prepared plans for the construction of a clubhouse at Belle Meade, for the Nashville Golf & Country Club. The estimated cost is $50,000.

Cincinnati, Ohio—Bids will be received until Feb. 16, 1915, by James A. Green, Chn. of Court House Comn., for the construction of the $2,500,000 court house and jail. Noted July 23, Sept. 3 and Dec. 3.

Cleveland, Ohio—Plans have been prepared by Nicola Petti, Arch., Williamson Bldg., for the construction of a theater and commercial building at Euclid and Lake Front Ave. for Jacob Babin. The estimated cost is $80,000. Noted Nov. 5.

Columbus, Ohio—Plans are being prepared by the City Engineering Department for the construction of a market house exposition hall for the City of Columbus. Estimated cost, $750,000. George J. Karb is Mayor.

Portsmouth, Ohio—Bids will be received until Dec. 18, by the Board of Education for the construction of the two-story and basement Garfield School. Estimated cost, $70,000. W. A. De Voss, 37 First National Bank Bldg., is Arch.

Ripley, Ohio—The Board of Education plans the construction of a ten-room school having an auditorium with a seating capacity of 600. Weber, Werner & Adkins, Cincinnati, are Archs.

Sidney, Ohio—The First National Exchange Bank plans the construction of a $40,000 one-story bank. The work will begin in the spring.

Detroit, Mich.—Plans are being prepared by Smith, Hinchman & Grylls, Archs., 710 Washington Arcade Bldg., for the construction of a one-story central market. Estimated cost, $50,000.

Highland Park, Mich.—Plans are being prepared by the School Board for the construction of a $75,000 school, at Oakland and Massachusetts Ave.

Jackson, Mich.—Nathan F. Simpson, Warden of Jackson Prison will petition the next legislature to appropriate $160,000 of which $80,000 will be expended for the construction of a cell house.

+Dixon, Ill.—The general contract for the construction of an administration building and dormitories at the epileptic colony, Dixon, for the State Board of Administration, has been awarded to W. M. ALLEN CO., Peoria, at $217,200.

The County Commissioners contemplate the construction of an almshouse estimated to cost $60,000. Morris Cook, Steward, Ill., is Chn. of Bldg. Com.

Bancroft, Iowa—The St. John's Catholic Church plans the construction of a $60,000 building, early in the spring.

+Fort Dodge, Iowa—The contract for the construction of the city hall has been awarded to J. B. EVANS, Mexico, Mo. Estimated cost, $80,000. Noted Nov. 12.

Iowa City, Iowa—The State Board of Education will petition the next legislature to appropriate $200,000 for a botany and geology building at the Iowa University; $100,000 for a Hall of Dentistry and $20,000 for a Detention Hospital.

Minneapolis, Minn.—Frank Nelson, Pres. of Minnesota College, plans the construction of a $60,000 college building and a $40,000 auditorium.

Kansas City, Kan.—Plans have been prepared by Rose & Peterson, Archs., Barker Bldg., for the construction of a two-story and basement addition to the Whittier School. The estimated cost is $80,000.

Grand Forks, N. D.—Bids will be received about Jan. 4, 1915, for the construction of a $40,000 church on Belmont Ave., for the St. Marys Parish.

Missoula, Mont.—Plans are being prepared by George Nelson, Arch., Butte, for the construction of a theater for the Montana Amusement Co. T. McDonald is local manager.

St. Joseph, Mo.—Bids will be received until, Dec. 20, for the construction of a five-story reinforced concrete hospital. Estimated cost, $150,000. Joseph Meir, Lincoln Bldg., is Arch.

St. Louis, Mo.—The Francis-Wyland Construction Co., Liggett Bldg., has purchased a site at Limit and Von Versen Ave., for the construction of an apartment house. Estimated cost, $125,000.

The Council of the St. Louis has introduced a bill appropriating $75,000 for the construction of a three-story detention house at 1226 Clark Ave.

El Paso, Tex.—Bids will be received until Dec. 21, by the Secretary of the Board of School Trustees for the construction of a $500,000 high school. Noted Sept. 17.

Salt Lake City, Utah.—The lowest bidder for the construction of the school at Tenth St. S., and Fifteenth St. E. was Alston & Hoggan at $85,104. Noted Nov. 5.

Okanogan, Wash.—Plans have been prepared by George H. Keith, Arch., for the construction of a three-story, reinforced concrete county courthouse and jail. Estimated cost, $50,000.

Olympia, Wash.—The Regents of the University of Washington will petition the next legislature to appropriate $300,000 for additional buildings at the university.

North Bend, Ore.—Bids will he received about Jan. 15, 1915, for the construction of an apartment house for Peter Loggie. Estimated cost, $60,000. Tourtellotte & Atkins, Portland, are Archs.

RAPID TRANSIT SYSTEM, NEW YORK, N. Y.

Section 9-C-1, Route 9

Reconstruction of Fourth Ave. Subway—Bids were received, Dec. 1, by the Public Service Commission for the construction of additional crossovers in Section No. 9-C-1 of Route No. 9, a part of the Fourth Ave. Subway in Brooklyn, from (A) Samuel Beskin, Beacon, N. Y.; (B) Ward & Tully, Inc., (C) Frawley-Kaufman Contracting Co., 51 Chambers St., New York, N. Y.; (D) T. F. Shaughnessy, Albany, N. Y.; (E) Thomas Crimmins Contracting Co., 444 East 69th St., New York; (F) Snare & Triest Co., Woolworth Bldg., New York; (G) Norton & Gorman Contracting Co.; (H) J. F. Cogan Co., Woolworth Bldg., New York; (I) Degnon Construction Co., 30 East 42d St., New York. The item bids were as follows:

	A	B	C	D	E	F	G	H	I
11,500 cu.yd. earth excavation above mean high water	$4.00	$4.00	$5.00	$4.60	$4.50	$5.60	$5.50	$6.00	$5.00
250 cu.yd. earth excavation below mean high water	5.00	4.00	5.00	6.00	5.00	7.00	6.50	6.00	9.00
1750 cu.yd. concrete masonry	8.00	9.00	10.00	10.00	15.00	11.00	12.00	10.00	12.00
220 cu.yd. concrete masonry outside water proofing	7.50	10.00	8.00	10.00	12.00	11.00	12.00	10.00	12.00
10 cu.yd. brick masonry	15.00	25.00	30.00	15.00	20.00	18.00	20.00	15.00	20.00
1300 cu.yd. removal of present masonry	13.00	10.00	15.00	15.00	10.00	15.00	15.00	15.00	25.00
Lump sum removal and restor. present masonry around T-beam	300.00	2000.00	500.00	100.00	1500.00	800.00	1000.00	1000.00	1000.00
10 cu.yd. hollow terra cotta or tile masonry	15.00	15.00	30.00	15.00	30.00	18.00	20.00	15.00	20.00
100 bbl. portland cement grout	2.50	2.00	3.00	3.00	3.00	4.00	3.50	3.00	2.00
100 sq.yd. resurfacing concrete masonry	0.50	1.00	1.00	2.50	0.50	1.50	0.50	1.00	1.00
250 cu.yd. broken stone and gravel	1.75	2.00	3.00	2.50	2.50	2.50	2.50	2.50	3.00
50 sq.yd. waterproofing, 1-ply	0.45	0.60	0.80	0.60	0.50	0.70	0.50	0.60	0.80
50 sq.yd. waterproofing, 2-ply	0.70	1.00	0.90	0.90	0.75	1.00	1.00	1.00	1.30
50 sq.yd. waterproofing, 3-ply	0.90	1.10	1.00	1.20	1.10	1.20	1.50	1.40	1.80
50 sq.yd. waterproofing, 4-ply	1.20	1.50	1.10	1.50	1.50	1.40	2.00	1.75	2.30
50 sq.yd. waterproofing, 5-ply	1.40	1.75	1.50	1.75	1.80	1.80	2.50	2.10	2.80
1000 sq.yd. waterproofing, 6-ply	1.60	2.00	2.00	2.00	2.25	2.00	3.00	2.50	3.00
50 sq.yd. waterproofing, dry ply	0.35	0.40	0.50	0.60	0.75	0.70	0.50	0.50	0.40
40 cu.yd. brick in asphalt mastic	27.00	25.00	30.00	30.00	27.50	30.00	35.00	35.00	30.00
33,100 duct ft. tunnel ducts	0.10	0.15	0.20	0.15	0.12	0.12	0.20	0.20	0.15
1400 duct ft. railroad ducts	0.50	0.15	0.20	0.25	0.15	0.25	0.20	0.20	0.20
150 cu.yd. removal of tunnel ducts	4.00	3.00	3.00	10.00	8.00	5.00	6.00	8.00	25.00
350 tons steel—riveted	68.00	75.00	70.00	100.00	90.00	74.00	98.00	100.00	90.00
50 tons removal of steel	20.00	50.00	1.00	20.00	12.00	20.00	20.00	50.00	25.00
34 each removal and resetting struts	50.60	8.00	3.00	30.00	80.00	30.00	20.00	100.00	25.00
2 each removal and resetting columns	10.00	100.00	100.00	50.00	45.00	50.00	45.00	500.00	50.00
70 tons steel—beams	58.00	75.00	60.00	60.00	90.00	70.00	76.50	90.00	90.00
5500 holes drilling in steel	0.25	0.50	0.30	0.40	0.75	0.40	0.60	0.25	0.50
6 tons steel rods and bars	35.00	70.00	50.00	65.00	60.00	70.00	62.50	80.00	80.00
1 ton miscellaneous castings	50.00	100.00	40.00	60.00	60.00	80.00	75.00	75.00	80.00
1000 lb. wire forms	0.10	0.10	0.10	0.10	0.15	0.12	0.10	0.30	0.10
320 sq.yd. street surface restored (sidewalk)	1.50	3.00	3.00	2.50	1.80	2.00	3.00	2.00	2.00
30 sq.yd. asphalt pavement restored	3.00	3.00	3.00	2.50	3.50	4.00	2.50	4.00	2.50
1300 sq.yd. granite block pavement restored	3.50	2.50	2.00	2.00	4.71	3.00	3.50	3.00	2.50
280 lin.ft. support electric railroad (trolley)	5.00	7.00	10.00	4.00	10.00	8.00	0.25	10.00	5.00
Underpinning present subway in Flat. Ave. Ext. (lump sum)	2500.00	5000.00	2000.00	100.00	500.00	9000.00	9760.00	5000.00	8500.00
600 lin.ft. 6" w.i. by-passing pipes	3.00	3.00	3.00	1.00	4.00	2.50	2.00	3.00	4.00
420 sq.ft. white glazed tile—straight	0.50	0.50	1.00	1.30	0.80	1.00	0.75	1.50	0.60
135 sq.ft. white glazed tile—curved	1.25	0.75	1.50	1.30	1.70	3.00	2.00	1.50	1.00
20 sq.yd. plastering on concrete arch surface	1.00	1.00	2.00	1.50	1.00	3.00	2.10	1.00	0.75
60 sq.yd. plastering on concrete flat surface	1.00	1.00	2.00	1.00	1.00	2.00	1.43	0.60	0.75
60 lin.ft. cement cove	0.16	0.25	0.25	0.40	0.08	0.50	0.25	0.50	0.25
220 sq.ft. cement floor finish	0.20	0.20	0.25	0.15	0.15	0.40	0.25	0.20	0.15
Cement finish on concrete									
410 sq.ft. brick and tile	0.20	0.20	0.25	0.15	0.05	0.20	0.05	0.30	0.10
12 each removing windows	2.50	10.00	10.00	3.00	3.00	5.00	3.50	5.00	5.00
11 each resetting windows	2.50	10.00	10.00	2.00	3.00	5.00	5.00	8.00	10.00
Per cent. additional expense due to railroad operation	10%				10%				
Extended totals	$133,947	$141,762	$153,184	$155,875	$168,118	$172,733	$185,831	$190,325	$192,389

Contracts to Be Let

Bids received until Dec. 22, 1914.

Barge Canal Work

STATE OF NEW YORK.

OFFICE OF SUPERINTENDENT OF PUBLIC WORKS.

Albany, November 2[illegible]th, 1914

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Tuesday, December 22nd, 1914, at which place and hour they will be publicly opened and read, for improving the Cayuga and Seneca canal pursuant to the provisions of Chapter 391 of the Laws of 1909, and Chapter 147 of the Laws of 1912 and of the amendments thereto, as follows:

1. CONTRACT C-2.

Cayuga and Seneca Canal—Section 1

For the removal of buildings, etc., at Seneca Falls, N. Y.

Sheet 1.

And for the construction of Barge Canal terminals pursuant to the provisions of Chapter 746 of the Laws of 1911, and of the acts supplementary thereto, as follows:

2. TERMINAL CONTRACT NO. 13

For constructing a guard-lock, highway bridge and cut-off dam at [illegible].

Contract plans, sheets 1 to 12, inclusive.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y.; at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y.; at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

On the terminal contract monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the city of Albany or New York issued by a national or state bank or trust company (in the case of terminal contract), in good credit within the State and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal except in the case of Contract C-2, which such deposit shall at least amount to $[illegible].

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

[illegible]

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned the interests of the State will be enhanced thereby.

DUNCAN W. PECK,
Superintendent of Public Works

Bids received until Dec. 29, 1914.

Section 17—Main Sewer

PASSAIC VALLEY SEWERAGE COMMISSIONERS

Paterson, N. J.

Notice is hereby given that the Passaic Valley Sewerage Commissioners have designated Tuesday, the twenty-ninth day of December, nineteen hundred and fourteen, at two o'clock in the afternoon, as the time when they will meet at their usual place of meeting, Essex Building, Clinton Street, Newark, New Jersey, to receive proposals, in writing, for the construction of the CENTRAL PORTION of SECTION 17 of the MAIN INTERCEPTING SEWER, in the City of Paterson, in the County of Passaic, in New Jersey.

Particulars that may enable Contractors to judge of the character of the work are given below:

APPROXIMATE QUANTITIES
Central Portion of Section 17

Item 1—Earth Excavation and Refilling, in trench, for 69-inch concrete sewer	[illegible]	linear feet
Item 2—Earth Excavation and Refilling, in trench, for 65-inch concrete sewer	[illegible]	linear feet
Item 3—Earth or Rock Excavation and Refilling, in tunnel, for 69-inch concrete sewer	390	linear feet
Item 4—Rock Excavation, in trench	11,[illegible]	cubic yards
Item 5—Concrete masonry, with Portland cement mortar, in place, in trench	[illegible]	cubic yards
Item 6—Concrete masonry, with Portland cement mortar, in place, in tunnel	[illegible]	cubic yards
Item 7—Brick masonry and appurtenant work, in manholes, with Portland cement mortar	13[illegible]	cubic yards
Item 8—Steel for Concrete Reinforcement in place	1,[illegible]	pounds
Item 9—[illegible] rap, in place	1,[illegible]	long tons

Drawings, form of contract and specifications, and blank form for proposal may be obtained at the Commissioners' office from William M. Brown, Chief Engineer.

The Commissioners reserve the right to reject any or all bids.

PASSAIC VALLEY SEWERAGE COMMISSIONERS.
JOHN [illegible], Clerk.
November 17, 1914.

Bids received until Dec. 14, 1914.

School Bond Issue

[illegible], Pa.

Sealed bids will be received by the Board of School Directors of [illegible] Township, [illegible] County, Pennsylvania, for a fully authorized school bond issue of seventeen thousand (17,000) dollars. The bonds are payable thirty years from their date, but the School District reserves the right to redeem them at the end of [illegible] years from their date. The rate of interest is [illegible]. All bids must be accompanied by a certified check drawn to the order of R. A. [illegible], School Treasurer, for [illegible] of the par value of the bonds for which bid is made. Bids will be opened in the High School at [illegible], December 14, 1914, at 7:30 p.m. Send all proposals to John M. [illegible], Secretary, [illegible], Pa. The board reserves the right to reject any or all bids.

JOHN M. [illegible], Secy.

Construction News

★Denotes work advertised in ENGINEERING NEWS.
+Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS

+New Jersey—Pennsylvania R.R.—This company has awarded a contract for grading and track work at Camden, N. J., to the JAMES McGRAW CO., Commercial Trust Bldg., Philadelphia, Penn.

+Pennsylvania—Philadelphia & Reading Ry.—A contract has been awarded by this company to C. P. BOWERS & CO., Reading, Penn., for grading and masonry work on a section of 1.84 miles from Nicetown Junction, Philadelphia, to Newtown Junction, Penn.

Virginia—Mill Creek Ry.—This company contemplates the construction of a railway from Wilderness, Va., to Williamsville, Va., about 18 miles. E. E. McCutcham, Staunton, Va., is Ch. Engr.

West Virginia—It is reported that the Horse Creek Land & Mining Co., which owns 12,000 acres of coal and timber lands in Lincoln County, W. Va., contemplates the construction of a ten-mile railway to develop its property. L. E. Poteet, Charleston, W. Va., is Gen. Mgr.

+Georgia—Southern Ry.—A contract has been awarded by this company to STEWART & JONES, Rock Hill, S. C., for work north of Gainesville, Ga., in connection with the reconstruction and double-tracking of the Charlotte-Atlanta line. The work includes the construction of 6½ miles of new line, four miles near Mount Airy, Ga., and 2½ miles near White Sulphur, Ga.

+Alabama—Ensign Yellow Pine Co.—According to press reports this company has awarded a contract to J. N. GILLIS & SONS, for the construction of a five-mile logging road out of Wetumpka, Ala.

Illinois—Palatine, Lake Zurich & Wauconda R.R.—An extension of its line from Wauconda, Ill., to Fox Lake, Ill., about ten miles, is contemplated by this company. C. H. Patten, Palatine, Ill., is Pres.

Wisconsin—Montana-Waumandee Ry.—This company has been incorporated to construct a 10- to 20-mile railway from Montana, Wis., Waumandee post office. F. D. Brandenburg, Minneapolis, Minn., is interested.

Idaho—American Falls & Rockland Valley R.R.—This company, recently incorporated, plans to start work in the spring on the construction of a railway from American Falls, Idaho, to Roy, Idaho, about 25 miles.

+Washington—Great Northern Ry.—This company has awarded a contract to COUGHREN & WOLDSON, Spokane, Wash., for repairing 38 miles of grade on the Bluestem-Columbia branch, near Davenport, Wash.

California—Diamond Match Co.—This company contemplates the extension of its logging road from Stirling City, Calif., north toward Butte Meadows, Calif.

ELECTRIC RAILWAYS

Boston, Mass.—The Boston Elevated Ry. Co. has been petitioned to consider plans for the construction of tracks on Pleasant St. from the subway to Washington St. Edward Mahler, Boston, is Pur. Agt.

Westport, Conn.—The Connecticut Co. is preparing plans for the extension of its line on Railroad Ave. to the station in Westport. J. K. Punderford, New Haven, is Vice-Pres. and Gen. Mgr.

Trenton, N. J.—Rights-of-way are being acquired for the construction of an electric railway line from Trenton to Washington's Crossing; a power plant for its operation is planned at Trenton. Horace G. Hough and Barton T. Fell are interested.

Corry, Penn.—The Corry & Columbus St. Ry. Co. is preparing plans for the construction of a 30-mile electric railway from Corry, Penn., to Mayville, N. Y. C. P. Northrop, Corry, is Pres. and Gen. Mgr.

Holmesburg (Philadelphia post office), **Penn.**—Peter E. Costello, Philadelphia, has applied for a franchise to construct and operate an elevated railway from Front and Arch St. to Rhawn St., Holmesburg.

★Pittsburgh, Penn.—(Official)—See item under "Miscellaneous," Track Laying and Paving.

Tarpon Springs, Fla.—James H. Murphy, St. Petersburg, has applied to the City Council for a franchise to construct and operate an electric railway in Tarpon Springs.

Cincinnati, Ohio—The Cincinnati Traction Co. is considering plans for the construction of a crosstown line north of the present route on McMillan St. T. Fitzgerald, Cincinnati, is Gen. Mgr.

Youngstown, Ohio—The Mahoning & Shenango Ry. & Light Co. has applied to the City Council for a franchise to extend its Mahoning Ave. line to Perkins Corners. G. J. A. Paul, Youngstown, is Mgr. Rys.

Paris, Ill.—The Central Illinois Traction Co. plans to construct an extension from Charleston to Paris next spring. W. V. Driscoll, Mattoon, is Supt.

Winthrop, Minn.—The Electric Short Line Ry. Co. is considering plans for the construction of an electric railway through Winthrop, north to Winsted and south, through Sleepy Eye to Jackson. DeKoven Hunter, Minneapolis, is Gen. Mgr.

Bonner Springs, Kan.—The Kansas City, Kaw Valley & Western Ry. Co. has completed financial arrangements and plans to start work about Jan. 1 on the construction of its proposed electric railway from Bonner Springs to Lawrence. W. R. Taylor, Bonner Springs, is Gen. Mgr. and Pur. Agt. Noted Aug. 13.

Madison, Neb.—The Niobrara, Sioux City & Omaha Ry. Co. has completed surveys for the extension of its line from Madison to Elgin, Neb. Charles W. Baker, Omaha, is interested. Noted July 17.

St. Louis, Mo.—The United Railways Co. has been petitioned to extend its Tower Grove line to the Gratiot and Lindenwood sections of the city. Robert McCulloch, St. Louis, is Pres., Gen. Mgr. and Pur. Agt.

Houston, Tex.—The Houston, Laporte & Bay Shore Ry. Co. is making preliminary arrangements for the construction of its proposed electric railway to connect Houston, Pasadena, Deepwater, Deer Park, San Jesenta City, Laporte, Seabrook, Webster, Friendswood and Pearland. Samuel F. George, Dayton, Ohio, is Pres. and Gen. Mgr. and John H. Stoner, Houston, Ch. Engr.

Benicia, Calif.—Preliminary arrangements are being made by the Benicia-Vallejo Electric Ry. Co. for the construction of its proposed line from Benicia to Vallejo, about seven miles. A. D. Bowen is Pres. Noted July 2 and Aug. 20.

San Francisco, Calif.—The lowest bid received by the Board of Public Works for the construction of the California St. branch of the municipal electric railway was that of F. Rolandi, San Francisco, at $101,309.

Guelph, Ont.—The Guelph Radial Ry. Co. has been granted permission by the Board of Railway Commissioners to construct a one-track line on Suffolk St. A. H. Goshi, Guelph, is Gen. Mgr., Supt. and Pur. Agt.

+Ottawa, Ont.—According to press reports, the Ottawa & St. Lawrence Electric Ry. Co. has awarded a contract to EASTMAN, KENNY & STEARNS, Russell, Ont., for grading about six miles of its proposed line from Russell to Metcalfe.

LIGHT, HEAT AND POWER

Manchester, N. H.—The Manchester Traction, Light & Power Co. has taken out a permit to build a one-story power house at Kelley's Falls. J. Brodie Smith is Vice-Pres. and Gen. Mgr. of the company.

Greensboro, Vt.—The Greensboro Electric Co. is receiving bids for the construction of a hydro-electric plant, including a concrete dam, 33x250 ft., a one-story concrete power house and a penstock, 600 ft. long. Noted Sept. 17 and Oct. 29.

+Boston, Mass.—The Infirmary Commission of the Public Works Department has awarded the contract for heating and ventilating systems at the Long Island Nurses' Home, and in ward buildings, to C. H. SANBORN, Boston, at $6976 and $9674.

Montague City, Mass.—The Amherst Power Co., controlled by the Cabot interests of Boston, will begin at once the construction of a 45,000-hp. hydro-electric plant at Montague City. Energy generated at this station will supply the transmission lines of the company in the Central Connecticut Valley, including new lines to connect the generating station with the system of the United Electric Light Co., Springfield, Mass. Fred L. Hunt, Greenfield, Mass., is Ch. Engr. of the Amherst Power Co.

West Newbury, Mass.—It is reported that the Board of Selectmen is considering the installation of a municipal electric light plant.

Bath, N. Y.—(Official)—Bids will be received until 6 p.m., Dec. 22, by the Village Trustees, for furnishing and installing engines, boilers, generators and piping for an electric lighting station. W. W. Babcock is Chn. of the Com. John W. Taggart is Village Clk.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received until 3 p.m., Dec. 21, by C. B. J. Snyder, Supt. of School Bldgs., Park Ave. and 59th St., Borough of Manhattan, for heating and ventilating apparatus and temperature regulation in new Public School 50, Driggs Ave. and South Third St., Borough of Brooklyn.

+Newark, N. J.—The Board of Education has awarded the contract for heating equipment for the 13th Ave. School to E. G. WOOLFOLK & CO., 153 West 31st St., New York, N. Y., at $14,777.

+Philadelphia, Penn.—The Philadelphia Electric Co. has awarded the contract for the concrete work in its new power house at 26th and Christian St. to the DREHMANN PAVING CO., Philadelphia, at about $150,000. John T. Windrim, Commonwealth Trust Bldg., Philadelphia, is Arch.

Reading, Penn.—The City Council will begin early in January to advertise for bids for lighting the city for a period of years, as the present five-year contract with the Metropolitan Electric Co. expires next April. Charles Marks is City Clk.

Baltimore, Md.—[illegible] will be received until [illegible] by the Board of Awards [illegible] for electrical equipment for the [illegible] station [illegible] Ernest [illegible] Pres. [illegible] of Awards. [illegible]

Logan, W. Va.—[illegible] The following contracts have been [illegible] in connection with the construction of the [illegible] for the [illegible] Light & Power Co.: Power-plant building [illegible] McNULTY, Huntington, W. Va.; [illegible] RIVERSIDE BRIDGE CO., Martins Ferry, Ohio; [illegible] GENERAL CONCRETE CONSTRUCTION CO., New York, N. Y.; general electrical equipment, GENERAL ELECTRIC CO., Schenectady, N. Y.; boilers and superheaters, [illegible] CO., [illegible] Del.; economizers, boiler feed and auxiliary pumps, H. R. WORTHINGTON, INC., Philadelphia, Penn.; stokers, DETROIT STOKER CO., Detroit, Mich.; coal-handling equipment, C. W. HUNT CO., New York, N. Y.; transmission wire, ALUMINUM CO. OF AMERICA, Pittsburgh, Penn. [illegible] for about 60 miles of transmission line, power-plant piping, traveling crane and miscellaneous equipment will be awarded shortly. Francis R. Weller, [illegible] Washington, D. C., is Engr.-in-Charge. Noted July 30, Sept. 17, Nov. 12 and 19.

Farmville, N. C.—The City of Farmville plans improvements to the municipal electric-light plant next year to include the installation of a new engine and generator. T. C. [illegible] is Mayor.

Florence, S. C.—The Carolina Electric Co., recently organized at Florence by D. T. McKeithen, Darlington, Pres.; J. W. [illegible], Darlington, Vice-Pres., and George E. Dargan, Secy. and Treas., has acquired and consolidated the following companies: The Florence Electric & Utility Co., Florence; the Marion Water & Electric Co., Marion, and the Darlington Water & Electric Co., Darlington. The company is capitalized at [illegible].

Westminster, S. C.—It is reported that D. R. Traxler, Greenville, S. C., will construct a hydro-electric plant about three miles from Westminster, to develop 1000 hp. for transmission to Westminster, Walhalla, nine miles away, and [illegible] 12 miles distant.

Carlisle, Ky.—It is reported that the Carlisle Electric Light & Power Co. plans to install a new lighting system and make other improvements to its property. Boon Ingles is Secy. and Mgr.

Scottsville, Ky.—The Scottsville Electric Light Plant has been taken over by J. W. Hood, who has purchased the lease, which has nine years yet to run, from Mays & Schlinker, Glasgow, Ky. No improvements of importance will be made, as the plant was newly equipped a year ago.

Sturgis, Ky.—It is reported that the West Kentucky Coal Co., whose power plant at Sturgis was recently burned at a loss of [illegible], has decided to rebuild the plant.

Bowling Green, Ohio—(Official)—See item under "Water Supply—Irrigation."

Butler, Ohio—The Hicksville Electric Light Co., Hicksville, [illegible], has purchased the municipal electric light plant of Butler for [illegible]. The new owners will operate the Butler system from the Hicksville station.

Cincinnati, Ohio—[illegible] & Co., Fifth St. and Central Av., [illegible] has leased a building at [illegible] St., which will be [illegible] for occupancy. The improvements proposed include additional [illegible] and an electric-light plant to cost about [illegible].

Columbus, Ohio—The City Council is again considering the question of issuing [illegible] in bonds for the purpose of making extensions and additions to the municipal electric lighting system. [illegible] T. Kerr is City Clk.

Kingston, Ohio—The Village Council has granted a 25-year franchise to [illegible] to construct and operate an electric light plant in Kingston.

Huntington, Ind.—The Board of Public Works has awarded the contract for [illegible] and power plant piping at the [illegible] and water-works plant to the W. A. [illegible] CO., Milwaukee, Wis., at [illegible]. Noted Nov. [illegible]

Foxlake, Wis.—The [illegible] Light & Power Co., a subsidiary of the [illegible] Light & Power Co., [illegible] is preparing to install an electric lighting system in Foxlake [illegible] year. [illegible]

[illegible], Iowa—[illegible]

Windom, Minn.—[illegible]

[illegible], Kan.—[illegible]

Thompson Falls—[illegible]

Joplin, Mo.—[illegible]

Paris, Tex.—The Texas Power & Light Co., Dallas, will build a new transmission line to [illegible] from the central power station which it is building at Paris. F. R. Slater, Dallas, is Gen. Supt. of the company.

La Junta, Colo.—The City Council is considering the establishment of a municipal electric light plant. It is said that the question of a bond issue of $7000 for this purpose will be submitted to the voters at the spring election.

Beaver, Utah—The Beaver River Power Co. contemplates the construction of an additional power plant on the Beaver River about five miles below the present plant, to supply the increased demand for electrical service by the various mining companies operating in Beaver, Millard, Sevier and Piute Counties. Several miles of transmission line will be required. A. L. Woodhouse, Richfield, Utah, is Mgr. of the company.

Elma, Wash.—L. H. Burnett, Aberdeen, Wash., has been granted a franchise to construct a gas-making plant and distributing system in Elma. It is reported that the plant will be in operation within a year.

North Yakima, Wash.—The Yakima Central Heating Co. will install an electric distributing system.

Spokane, Wash.—Plans for the construction of a hydro-electric plant on the Pend d'Oreille River, near this city, are being prepared by Hugh Lincoln Cooper, Consult. Engr., Spokane. It is reported that the plant will have a capacity of 35,000 hp. and will cost about $7,000,000.

Baker, Ore.—An election will soon be held to vote on the question of issuing $97,776 in bonds to be used for the construction of a municipal electric light plant and distribution system. If built, the plant will obtain its energy from streams in the water reserve belonging to the City of Baker. Preliminary surveys have been made by L. R. Stockman, Consult. Engr. Noted Nov. 5.

Gold Hill, Ore.—The City Council is considering the installation of an electric light plant. Bids submitted by the California-Oregon Power Co. and the Rogue River Public Service Corporation for constructing and operating the system have been taken under advisement.

Auburn, Calif.—The City Trustees are considering the construction of a municipal electric-light plant.

Los Angeles, Calif.—The City of Los Angeles has asked the State Railroad Commission to fix a price to be paid for the distribution system of the Southern California Edison Co. within the city limits of Los Angeles and certain adjoining territory. The city proposes to acquire these lines by condemnation, to be used for the distribution of the hydro-electric power to be developed in connection with its aqueduct. R. F. Del Valle is Pres. of Bd. of Pub. Ser. Comrs. E. F. Scattergood is Ch. Elec. Engr. for the city.

San Francisco, Calif.—The Board of Public Works has awarded a contract for the installation of heating equipment in the power plant at the Civic Center to DAVIS, ROGERS & CO., at $11,950, and a contract for an underground steam distributing system for the Civic Center to WHITTMAN, LYMAN & CO., at $23,964. Noted Oct. 15 and Nov. 19.

Fraserville, Que.—The City of Fraserville is receiving bids for new turbines to be installed in the municipal electric light plant. E. Talbot is Secy., Treas. and Mgr.

Quebec, Que.—It is reported that the city contemplates municipalizing the light and power service of the Dorchester Electric Co., at an approximate cost of $1,000,000.

Exeter, Ont.—T. H. Carling, Exeter, has been authorized by the Town Council to prepare plans for the installation of a new hydro-electric system for lighting and general power purposes.

BRIDGES

Fort Kent, Maine—Bids will be received until Dec. 31 by the State Highway Commission, Augusta, for the construction of a bridge over St. John's River between Fort Kent and St. Francis, N. B. The substructure, which will be of concrete on spruce piles, is estimated to cost $15,000, while the steel superstructure will cost about $11,[illegible]. Paul D. Sargent, Ch. Engr. of the State Highway Comn., is Engr. in Charge.

Hartford, Conn.—The State Highway Commission has awarded the contract for removing a bridge from [illegible] town to another in Old Lyme Township and constructing wing walls, abutments, etc., to D. F. TOOMEY, South Norfolk, at [illegible]. List of bidders noted Dec. 10.

Niagara Falls, N. Y.—Plans are being prepared by F. S. [illegible]hurst, Jr., City Engr., for a new bridge at Second and Canal St.

Jersey City, N. J.—Thomas J. Wasser, Engr. of Hudson County, has recommended to the Board of Chosen Freeholders the removal of the present Whipple truss deck bridge over the [illegible] R.R. at Summit Ave. and replacing it with a reinforced-concrete structure.

New Brunswick, N. J.—The Board of Chosen Freeholders of Middlesex County has instructed the County Engineer to prepare plans for a bridge of either lift or draw type, to be built at the [illegible] over the [illegible] River at this point.

Northfield, N. J.—(Official)—The Board of Chosen Freeholders of Atlantic County has awarded the contract for the [illegible] Creek, on the road from Northfield to [illegible] Landing, to [illegible] HALDEMAN, [illegible], N. J., at [illegible]. Other bidders were: I. W. [illegible], [illegible]; H. H. [illegible], [illegible]; [illegible], [illegible]; John F. Kable, [illegible], and [illegible] & [illegible]wood, [illegible]. Noted Nov. [illegible]

Somers Point, N. J.—(Official)—The Board of Chosen Freeholders of Atlantic County has awarded the contract for the construction of a bridge over Patcong Creek, near Somers Point, to the ATLANTIC CONSTRUCTION & SUPPLY CO., Atlantic City, at [illegible]. Other bidders were: John F. Kable, [illegible]; [illegible] Construction Co., [illegible]; Hassel, Mauer & [illegible], [illegible]; F. W. [illegible] Sr. Co., [illegible]; J. W. [illegible], [illegible]; Whitaker & [illegible]ehl, [illegible]; [illegible] & [illegible] Co., [illegible]; F. L. [illegible], [illegible]. A. H. Nelson, Atlantic City, is County Engr. Noted Nov. [illegible]

Leesport, Penn.—The citizens of Leesport have petitioned the Board of [illegible] of Berks County to build a new bridge over the Schuylkill River between the townships of

Leesport and West Leesport, replacing the present wood structure which is inadequate for the increased traffic at this point. The old bridge is 170 ft. long and 16 ft. wide. D. K. Hoch, Reading, is Controller of Berks County. Charles F. Sanders is County Engr.

Morgantown, W. Va.—(Official)—Bids will be received until 1:30 p.m., Dec. 28, by the County Court of Monongalia County, for the construction of the South Morgantown Bridge at Morgantown. It will be of reinforced concrete, 150-ft. span, 30-ft. roadway and 8-ft. walks. The estimated cost is $65,000. The Monongahela Engineering Co., Morgantown, is Engr.-in-Charge. Noted May 21.

Shelby, N. C.—The Shelby Northern Ry. Co., S. S. Royster, Pres., will build two bridges on its proposed 21-mile line from Shelby to Casar, N. C. Noted Nov. 26 under "Railways."

+Milton, Fla.—(Official)—The Board of Commissioners of Santa Rosa County has awarded the contract for the construction of two steel drawbridges, one over the Blackwater River at Milton, and the other over the Escambia River near Chumuckla Mineral Springs, to the VIRGINIA BRIDGE & IRON CO., Roanoke, Va., at $24,100. Other bidders were: Austin Bros., Dallas, Tex., $28,300; Southern Bridge Co., Birmingham, Ala., $25,995; Vincennes Bridge Co., Vincennes, Ind., $39,500. Noted Nov. 26.

Eufaula, Ala.—(Official)—Bids will be received until Dec. 29, by the Board of Revenue of Barbour County, Clayton, for the construction of a steel bridge with concrete floor and abutments, over Barbour Creek on the Clayton-Eufaula Rd. Plans on file with W. S. Keller, State Highway Engr., Montgomery, Ala. Noted Dec. 10.

Greenville, Miss.—(Official)—Bids will be received until Jan. 4, 1915, by the Board of Supervisors of Washington County for the construction of 18 steel bridges of from 32- to 70-ft. span, and for three wooden bridges. The Morgan Engineering Co., Goodwyn Institute Bldg., Memphis, Tenn., is Engr.-in-Charge. This work is a part of the development of the Bogue Phalia Drainage District. Noted Oct. 1 and 15.

+Gretna, La.—The Police Jury of Jefferson Parish has awarded the contract for repairing the bridge at East End, on Lake Ponchartrain, to C. M. HALE, Gretna.

Lake Charles, La.—(Official)—Bids will be received until 10 a.m., Jan. 5, by the Police Jury of Calcasieu Parish, for the construction of 66 reinforced-concrete bridges and culverts and a number of wooden bridges and culverts on Highways Nos. 5, 6, 7, 8, 14 and 16. E. C. House is Secy. of the Police Jury.

New Orleans, La.—Plans are being prepared for the construction of a bridge over Bayou St. John at City Park Ave. and a track loop on Metearie Ridge. The cost of these improvements will be shared by the New Orleans Ry. & Light Co., and the Orleans-Kenner Interurban Ry. M. S. Sloan is Gen. Mgr. of the New Orleans Ry. & Light Co.

Elyria, Ohio—The City Council and the Board of Commissioners of Lorain County are considering widening and repairing the East Bridge St. Bridge to accommodate the constantly increasing traffic. The county has about $16,000 available for the purpose, and if this amount is insufficient, the city and the street railway company will be required to make up the deficit. C. M. Theobald is City Engr.

South Bend, Ind.—The Board of Public Works has approved of plans submitted by the Grand Trunk Western Ry. for a new single-track railway bridge to replace the old one at South St. Peter St. William S. Moore is City Engr.

Washington, Ind.—The Commissioners of Daviess and Pike Counties have had plans prepared for the construction of a steel bridge across the White River at Harriman's ferry. The estimated cost is $17,250. Bids will be asked the first of the year, if the County Councils will make appropriations for the purpose. Lewis T. Gootee, Washington, County Surv. of Daviess County, is Engr.-in-Charge.

+Marquette, Mich.—(Official)—The City Council has awarded the contract for the construction of a 60-ft. bridge over the Carp River at Lake St. to the WORDEN-ALLEN CO., Milwaukee. Noted Dec. 3.

Lebanon, Ill.—(Official)—Bids will be received until 10 a.m., Dec. 28, at the office of C. E. Chamberlin, Lebanon, for the following bridge construction in St. Clair County: College Road No. 2 Bridge, O'Fallon Township, 70-ft. span, 16-ft. roadway, steel bridge, concrete abutments, estimated cost, $3350; White No. 2 Bridge, Shiloh Valley Township, 70-ft. span, 16-ft. roadway, steel and concrete, estimated cost, $2780; State Road No. 2 Bridge, O'Fallon Township, 70-ft. span, 18-ft. roadway, steel and concrete, estimated cost, $4075. David O. Thomas, Belleville, is Supt. of Highways for St. Clair County.

+Taylorville, Ill.—(Official)—The County Superintendent of Highways of Christian County has awarded the contract for the construction of a reinforced concrete bridge between Johnson and Taylor Townships to the EAST ST. LOUIS BRIDGE CO., East St. Louis, Ill., at $12,100; the contract for a bridge in Johnson Township was awarded to the CENTRAL STATES BRIDGE CO., Indianapolis, Ind., at $15,596. The Engineer's estimates for these two bridges were $15,350 and $17,000 respectively. Noted Dec. 3.

Columbus, Wis.—Bids will be received until Dec. 18, by the City Clerk for the construction of a 60-ft. plate-girder bridge with concrete abutment and floor.

+La Crosse, Wis.—The Board of Public Works has awarded the contract for repairing the Mississippi River Wagon Bridge, including steel girders, creosoted block pavement and construction of west approach, to the LACROSSE CONSTRUCTION CO., LaCrosse, at $13,940.

Washburn, Wis.—M. W. Torkelson, State Bridge Engr., Madison, Wis., is preparing plans for five plate-girder and I-beam bridges to be built in Bayfield County with state aid. Contracts will not be awarded before spring.

Bemidji, Minn.—See item under Miscellaneous; Metal Culverts.

Breckenridge, Minn.—(Official)—On account of changes in the plans for 10 county bridges, ranging in length from 20 to 26 ft., bids for which were received Dec. 5, the work will be readvertised at an early date P. E. Truax is County Audr. Noted Nov. 26.

Melrose, Minn.—(Official)—Bids will be received until 2 p.m., Dec. 22, by N. Thomey, Audr. of Stearns County, St. Cloud, Minn., for the construction of State Bridge No. 1605 on State Road No. 1. The bridge will be 120 ft. long with an 18-ft. roadway.

Winona, Minn.—Plans are being prepared by L. P. Wolff, Consult. Engr., Germania Life Bldg., St. Paul, Minn., for a new approach to the High Wagon Bridge over the Mississippi River. It will be about 1700 ft. long with an 18-ft. roadway and one 5-ft. sidewalk. The estimated cost is $82,000 for a steel structure, or $100,000 if of concrete.

Anthony, Kan.—Plans have been completed by Harris & Eastham, Engrs., Hutchinson, Kan., for the construction of reinforced-concrete bridges as follows: One of nine spans, 299 ft. long; one of four spans, 88 ft.; one of two spans, 45 ft., and two of one span each, 23 and 33 ft. long, respectively. D. B. Heacock, Attica, Kan., is Chn. Bd. of County Comrs.

Kansas City, Kan.—The Board of Commissioners of Wyandotte County has adopted plans for the new high-line bridge over the Kaw River at Central Ave., Kansas City, Kan. The center span will be 344 ft. long, with two end spans of 200 ft. each. Viaducts at each end will add 1500 ft. to the length of the structure. The channel piers will be of concrete. Plans will be submitted at once for the approval of the War Department and the Kaw Valley Drainage Board. R. L. McAlpine is County Engr. Noted Sept. 24 and Oct. 15.

Turner, Kan.—The Commissioners of Wyandotte County, Kansas City, Kan., have decided to repair the east approach of the Turner Bridge at a cost of about $10,000. The bridge and its west approach were rebuilt about a year ago, costing about $37,000. Noted Oct. 16 and Nov. 20, 1913.

Omaha, Neb.—The United States Supreme Court has confirmed the right of the city of Omaha to enforce the ordinance compelling the Missouri Pacific Ry. to place a viaduct over its tracks on West Dodge St. to accommodate street cars as well as other traffic. According to press reports, construction work will begin soon on a viaduct to cost about $80,000. J. R. Stephens, St. Louis, Mo., is Ch. Engr.

Billings, Mont.—Bids will be received until Dec. 28, by the Auditor of Yellowstone County for the purchase of one issue of $45,000 in bonds, and one of $32,000, the proceeds to be used for the construction of bridges over the Yellowstone River at Pompey's Pillar and across Duck Creek. H. E. Howell is Deputy County Clk. Noted Oct. 16 and 29, Nov. 19.

★Great Falls, Mont.—(Official)—See item under "Federal Government Work"—Bridge.

Kalispell, Mont.—The Commissioners of Flathead County are having plans prepared for the construction of a wood and steel bridge across the Swan River near Swan Lake, and a steel bridge over the Whitefish River about 12 miles from Kalispell. Bids will shortly be asked.

+Victoria, Tex.—The Commissioners Court of Victoria County has awarded the contract for the steel bridge over Coleto Creek to A. A. ALSBURY & CO., Houston, at about $9000. Noted Nov. 26.

Kamiah, Idaho—It is reported that the Northern Pacific Ry. will soon begin the construction of a steel railway bridge to replace the present wood structure, over the Clearwater River at this point. W. L. Darling, St. Paul, Minn., is Ch. Engr.

Ogden, Utah—See item under "Miscellaneous"; Culverts.

+Tacoma, Wash.—The Oregon-Washington R.R. & Navigation Co. has awarded the contract for the steelwork of its new bridge across the city waterway at 15th St. to GERRICK & GERRICK, Seattle, at approximately $30,000.

Chiloquin, Ore.—See item under "Federal Government Work"—Bridges.

San Francisco, Calif.—Jerome Newman, Engr. of the State Board of Harbor Commissioners, is preparing plans for a bridge across the Embarcadero for the use of pedestrians to and from the ferries. It will be of steel with an asphalt runway, 22 ft. high, 12 ft. wide, and will extend from the terminus of Market St. to the second floor of the ferry house. The estimated cost is $15,000.

Annapolis, N. S.—Bids will be received until Dec. 31, for the construction of bridges and culverts in the County of Annapolis. Plans on file at the office of the Road Commissioner, Halifax, N. S., O. S. Miller, Municipal Clk., Bridgetown, N. S., and H. R. McKay, Annapolis.

Toronto, Ont.—R. C. Harris, Comr. of Works, has been instructed to report on the feasibility of building a new bridge at St. Clair Ave. in Moore Park. H. C. Hocken is Chn. Bd. of Control.

★The Commissioner of Works and the Board of Control have recommended to the City Council the awarding of the contract for the construction of the Don Section of the Bloor St. Viaduct to Quinlan & Robertson, Montreal, Que., at $947,076. Bids were opened Oct. 5. Noted June 18 and July 30.

WATER SUPPLY—IRRIGATION

Brookline, Mass.—The citizens contemplate spending $200,000 for the improvement of the water system. A filtration plant is contemplated. Alexis H. French is City Engr.

Easthampton, Mass.—The city plans to meter all its taps, 1259, of which 659 are metered, by 1916, relay small pipe lines and connect dead ends. W. C. Tannant, Jr., is Supt. of Pub. Wks.

+Lynn, Mass.—The contract for supplying 1500 tons of c.-i. pipe for the water department has been awarded to the UNITED STATES CAST IRON PIPE & FOUNDRY CO., Philadelphia, Penn., at $19.13 per ton.

+New Bedford, Mass.—According to press reports the contract has been awarded to R. D. WOOD & CO., Philadelphia, Penn., at $23,000 for c.-i. pipe and specials.

New Britain, Conn.—(Official)—The city plans to complete the high-service system by constructing a 16-in. pipe to the stand pipe in 1915. P. J. Egan is Secy

Wallingford, Conn.—(Official)—The Water Commissioners plan to lay one mile of 6- to 8-in. pipe and construct a 4,000,000-gal. controlling reservoir in 1915 and 1916. William Allackenzie is Supt.

Binghamton, N. Y.—(Official).—The city plans to install a [illegible] system for [illegible] pressure at the water works. [illegible] of Water Wks.

Le Roy, N. Y.—Plans have been prepared by J. P. Wells, [illegible] for a [illegible] system. The estimated cost is $11,[illegible]. Noted [illegible].

✦New York, N. Y.—(Borough of Manhattan).—(Official).—The contract for laying water mains in Third, Madison and [illegible] and East [illegible] St. has been awarded to [illegible] ENGINEERING & CONSTRUCTION CO., at [illegible]. Noted Dec. 10.

[illegible] (Official).—Bids were received [illegible] W[illegible] Williams, Commr. of Water Supply, [illegible] for removing the present [illegible] and erecting a new [illegible] under the water [illegible] of No. 1 W[illegible] [illegible] expansion pumping engine at the Ridgewood North Side pumping station. For removing two boilers and their appurtenances from the M[illegible] pumping station, [illegible] and erecting one in the Woodhaven pumping station and one in the Agawam pumping station with new [illegible] and other appurtenances. Campbell & Seeley, at $[illegible], were low bidders for the work at Ridgewood North Side pumping station, and [illegible] Gersman, at $[illegible], was low bidder for work at the Woodhaven pumping station. Noted Dec. 3.

Saratoga Springs, N. Y.—At a recent election, the citizens voted against the question of issuing bonds, the proceeds of which would have been used for the installation of a filtration plant. Noted Nov. 26.

Sheridan, N. Y.—Bids are being received by the Board of Village Trustees for making additions to the water works pumping plant.

Syracuse, N. Y.—(Official).—The city plans to lay feed and distributing mains to supply a section which will be annexed Jan. 1. W. T. Wooley is City Engr.

Berlin, N. J.—Plans are being prepared by William H. Boardman, Fourth and Walnut St., Philadelphia, Penn., according to press reports, for the installation of a water system.

✦•Baltimore, Md.—(Official).—Bids were received Dec. 2, by the Board of Awards, for constructing a reinforced-concrete lining in the Gunpowder Tunnel, under Contract 37, as follows: C. R. CLARK & CO., Baltimore, at $67,416 (awarded contract); James F. Leary Construction Co., Rochester, N. Y., $[illegible]; [illegible] Contracting Co., New York, N. Y., $83,135; James Ferry & Sons, Baltimore, $[illegible]; Lock Joint Pipe Co., New York, N. Y., $92,161; Mason Hilton & Co., New York, N. Y., $[illegible], and H. K. Corbin Co., New York, $115,6[illegible]. Noted Nov. 19.

•Baltimore, Md.—(Official).—Bids will be received until 11 a.m., Dec. [illegible], by the Board of Awards for installing pumping machinery for the Upper Service Pumping Station, under Contract No. 3[illegible]. For details see advertisement under "Contracts To Be Let."

•Kensington, Md.—Bids will be received by the Mayor and Town Council until 8 p.m., Jan. 15 for the construction of a water system. For details see advertisement under "Contracts To Be Let." Noted July 9.

Norfolk, Va.—All bids received, Aug. 1, by the Water Department for water meters have been rejected. Noted July 2[illegible].

✦Stuart, Va.—The contract for constructing water and sewer systems has been awarded to SLUSS-BAKER CONSTRUCTION CO., [illegible], Va., at $13,380. J. N. Ambler, [illegible], N. [illegible], is Engr. Noted Nov. 26.

Lumberton, N. C.—The Council has decided not to install a [illegible] plant at the water-works now. [illegible] T. Page is Clk. Noted Dec. [illegible].

Marion, Ky.—An application has been made to the City Council by the [illegible] for the construction of a water system. [illegible] Moore is interested.

Bowling Green, Ohio.—(Official).—Bids will be received by [illegible], Secretary of the Bd. of Trustees of the Bowling Green State Normal College until noon, Jan. 9, for a [illegible] power building, stack, tunnel system, water [illegible] and [illegible], steam boilers and pumps.

Chardon, Ohio.—[illegible] Fenton, Cleveland, has been granted a franchise by the Council for the construction and operation of a water system.

Cleveland, Ohio.—(Official).—Bids were received Dec. 8, for [illegible], as follows: [illegible], $11,[illegible]; American Water Softener Co., Philadelphia, Penn., $[illegible]; Roberts Filter Mfg. Co., [illegible], Penn., $[illegible]; Norwood Engineering Co., [illegible], Mass., $[illegible]; Pittsburgh Filter Mfg. Co., Pittsburgh, Penn., $[illegible], and W[illegible] & [illegible], Chicago, Ill., $[illegible]. Noted Dec. [illegible].

Dayton, Ohio.—The [illegible] Cast Iron Pipe & Foundry Co. was low bidder for [illegible] water pipe and [illegible]. Noted Dec. [illegible].

East Palestine, Ohio.—[illegible]

Findlay, Ohio.—[illegible]

Kenmore, Ohio.—Bonds for [illegible], the proceeds of which will be used for the construction of a water system, have been sold. [illegible]

Plain City, Ohio.—(Official).—Bids will be received until [illegible]

✦Anderson, Ind.—The contract for [illegible] [illegible] at $[illegible].

✦Madison, Ind.—(Official).—The contract for drilling wells has been awarded to CHARLES KRAUSS & SONS, Indianapolis. The city also contemplates installing an air lift pumping system. J. W. Moore, 1342 North Illinois St., Indianapolis, is Consult. Engr. Noted Dec. 3.

South Bend, Ind.—(Official).—Bids will be received until 10 a.m., Dec. [illegible], by the Board of Public Works for c.-i. pipe and specials for [illegible]. C. M. Morris is Pres. of the Bd.

✦Muskegon Heights, Mich.—Contracts have been awarded by the City Council to AMERICAN CAST IRON PIPE CO., Kansas City, Mo., at $14,[illegible] for c.-i. water pipe and to J. B. CLOW & SONS, Chicago, Ill., for hydrants and valves.

Acen, Ill.—(Official).—Bids will be received until 8 p.m., Jan. 6 by the Board of Trustees for erecting an elevated tank and tower, pumping station, power pumping plant complete. Theodore F. Swan is Village Clk.

✦Chicago, Ill.—Bids were received Dec. 2 by the City of Chicago for constructing Sect. 1 of the Wilson Ave. water tunnel, as follows: Great Lakes Dredge & Dock Co., $[illegible]; Fitzsimons & Connell Co., $403,179; Nash-Dowdle Co., $[illegible],710, and Byrnes Bros. Dredge & Engineering Co., $[illegible],047, all of Chicago. Noted Nov. 19.

Lockport, Ill.—Bids will soon be received by the Board of Local Improvements for making extension to the water mains in Hamilton, State, Washington, Jefferson, Madison, Sixth, Seventh, Ninth, 11th, 12th, 13th, 14th and 15th St. The estimated cost is $29,000.

✦Neoga, Ill.—The contract for installing a water system has been awarded to W. G. HOY, Woodstock, Ill., at $[illegible]. Bids opened Dec. 4. Noted Nov. 26.

✦St. Charles, Ill.—(Official).—The contract for constructing a pipe line in a number of streets has been awarded to H. D. HALLETT, Aurora, Ill., at $[illegible]. Other bids were George A. Mallory & Co., $61[illegible]0, and Yale & Rengon, $6000. Bids opened Dec. 7. Noted Dec. 3.

West Allis, Wis.—Bonds for $10,000 have been sold by the Common Council, the proceeds of which will be used for the improvement of the water system. J. J. Mulhaney is Mayor. Noted Sept. 17.

Crawfordsville, Iowa.—An election will soon be held to vote on the question of issuing bonds, the proceeds of which will be used for the installation of a water system.

Two Harbors, Minn.—The City Clerk has been instructed by the Council to obtain from the State Board of Health plans for a new hypochlorite plant.

St. Paul, Minn.—(Official).—The Bureau of Water plans to construct a new reservoir with a capacity of 42,000,000 gal. and improve a natural reservoir having a capacity of [illegible],000,000 gal. in 1915. A pumping engine with a capacity of 1[illegible],000,000 gal. will also be installed, and from 15 to 20 miles of distributing mains laid. Steps will be taken to render the water supply free from alga. Garrett O. House is Gen. Supt. of Bureau of Water. Noted Sept. 24.

Geneseo, Kan.—The citizens contemplate installing a municipal water system.

Severance, Kan.—The installation of a water system is contemplated by the citizens.

Corsica, S. D.—Meters will be installed in the town by April, 1915. H. L. Nixon is Town Clk.

Hudson, Wyo.—Bonds have been voted by the citizens, the proceeds of which will be used for the construction of a municipal water system.

Harlowton, Mont.—Press reports state that Garharz-[illegible] Engineering Co., Great Falls, has prepared plans for the construction of a water system at Harlowton. Noted Aug. 13.

Heber Springs, Ark.—The construction of a water system is under consideration.

Texarkana, Ark.—According to press reports the Council has authorized the construction of a water system, estimated to cost $[illegible],000. Noted Nov. [illegible].

✦New Boston, Tex.—According to press reports, the contract for installing a water system has been awarded to E. L. DALTON, Dallas, at $[illegible]. Noted Aug. [illegible].

Texas City, Tex.—At an election held Dec. [illegible] the citizens defeated the bond issue for $[illegible], the proceeds of which was to be used for the purchase of the present water system or for the construction of an additional system. Noted Nov. 1[illegible].

Wilburton, Okla.—(Official).—Plans are being prepared for the improvement of the water system. Noted June 11.

Payette, Idaho.—Bonds for $[illegible] were voted by the citizens, the proceeds of which will be used for the installation of a filtration plant. Noted Nov. 1[illegible].

Price, Utah.—The citizens contemplate constructing a new water system. Albert [illegible] is Supt.

Ephrata, Wash.—The citizens voted in favor of issuing bonds for $1[illegible], the proceeds of which will be used for the construction of a water system. Noted Dec. 1[illegible].

Walla Walla, Wash.—The citizens voted at a recent election in favor of constructing a reservoir estimated to cost $[illegible]. Walter [illegible] is City Engr.

Bakersfield, Calif.—The Kern Valley Reclamation Co. is planning to construct storage reservoirs and distributing canals to irrigate [illegible] acres of land in Kern and Kings Counties. J. [illegible], Menlo Park, Calif., is a director. Noted Aug. [illegible].

Headley, Calif.—The City Trustees have rejected all bids for the installation of an [illegible] pumping plant and will call for new bids. Noted Nov. 1[illegible].

Brantford, Ont.—At the January election the question of issuing $[illegible] in bonds, the proceeds of which will be used for the completion of the water-works, will be voted upon by the citizens.

+Ottawa, Ont.—The contract has been awarded to CANADIAN ALLIS-CHALMERS CO., LTD., Montreal, Que., at $10,360 for four low lift pumps for the Lemieux Island pumping station. Noted Nov. 12.

Saskatoon, Sask.—Plans have been prepared for the construction of a 24-in. force water main under the South Saskatchewan River from 11th to Sixth St., Saskatoon. J. Johnson is City Engr.

SEWERS

Boston, Mass.—Bids will be received until Dec. 23, by the Public Works Department, for constructing sewers in Cypress Rd. and Baker St., West Roxbury, and for constructing Faneuil Valley Brook conduit in Faneuil and Oakland St., Brighton. L. K. Rourke is Comr.

New Haven, Conn.—Bids will be received until Dec. 18, by F. L. Ford, City Engr., for constructing sewers in portions of Fox and Hedge St.

Huntington, N. Y.—The Sewer Committee of the Town Board is in favor of the construction of the system proposed by the citizens. Stanton E. Sammis is Town Clk.

New York, N. Y.—(Borough of the Bronx)—(Official)—Bids will be received until 10:30 a.m., Dec. 23, by Douglas Mathewson, Pres. of the Borough, for the following sewer work: Constructing a sewer on the west side of Aqueduct Ave. (University Ave.) between West 176th and West 174th St.; constructing a sewer in Glover St. between Lyon Ave. and St. Raymond Ave.; rebuilding the portions of the sewer in East 149th (Burgay) St. between the East River and Eastern Blvd.; East 144th (St. Joseph) St. for about 200 ft. from East 149th (Burgay) St.; rebuilding the sewer in Third Ave. between East 138th and East 140th St.; constructing sewers in Westchester Ave. (north side) between Metcalf and Taylor Ave.; Westchester Ave. (south side) between Metcalf and St. Lawrence Ave.; Westchester Ave. (both sides) between Taylor and Theriot Ave.; Beach Ave. between Westchester and Randolph Ave., and constructing sewers in Watson Ave. between Theriot and Beach Ave., Beach Ave. between Watson and Westchester Ave.

+Syracuse, N. Y.—The contract for constructing a sewer in Elmwood Ave. has been awarded by the Board of Contract and Supply to JAMES SWIFT, at $5756.

★Newark, N. J.—(Official)—Bids will be received by the Passaic Valley Sewerage Commissioners until 2 p.m., Jan. 12, for constructing the northerly portion of Sect. 18 of the main intercepting sewer in Paterson. John S. Gibson is Clk. For details see advertisement under "Contracts to Be Let."

★Paterson, N. J.—(Official)—Bids will be received by the Passaic Valley Sewerage Commissioners until 2 p.m., Jan. 5, for constructing the central portion of Sect. 18 of the main intercepting sewer in Paterson. John S. Gibson is Clk. For details see advertisement under "Contracts to Be Let."

Trenton, N. J.—(Official)—Bids will be received by the Board of Commissioners until 2:30 p.m., Dec. 23, for constructing sewer 608 in Lyndale Ave. Frank Thompson is City Clk. Noted Dec. 10.

Erie, Penn.—(Official)—William L. D'Olier, Engr., Philadelphia, Penn., states that he has not been retained by the City of Erie to prepare plans for a sewage-disposal plant, as was stated in the issue of Dec. 10.

Parkesburg, Penn.—According to press reports, plans are being prepared by F. G. Shaw, Brennaman Bldg., Lancaster, for a sewer system and sewage-disposal plant. The estimated cost is $25,000. Noted Nov. 19.

Philadelphia, Penn.—According to press reports, $500,000 will be spent by the city to relocate sewers preparatory to constructing the central subway loop. A. Merritt Taylor, Dir. of Transit, is in charge.

Pittsburgh, Penn.—The expenditure of $1,000,000 is contemplated by the city for the construction of sewers in the West End.

Baltimore, Md.—(Official)—Contract No. 140 for the construction of sanitary sewers in Dist. 31-B has been readvertised and bids will be received by the Sewerage Commission until Dec. 23. Calvin W. Hendrick is Ch. Engr. Noted Nov. 19.

+★(Official)—Bids were received Dec. 2, by the Sewage Commission, for the following work:

Contract No. 138, Ostend St. trunk sewer—Boyle, Lehmuller Contracting Co., Baltimore, $28,025; RYAN & REILLY CO., Union Trust Bldg., Baltimore, $28,428 (awarded contract); M. J. Beach, Baltimore, $29,896; J. W. Heller, Newark, N. J., $29,974; Whiting Turner Construction Co., Baltimore, $31,468; W. H. H. Allen Construction Co., $32,154; D. D'Anfre Bros., Leominster, Mass., $32,721; P. A Rose & Co., Baltimore, $33,831; M. O'Herron & Son, Baltimore, $35,230; William McCarthy, Baltimore, $35,978; James Ferry & Sons, Baltimore, $39,601; Smith & Ruggles, Baltimore, $43,131; B. F. Sweeten & Son, Baltimore, $53,996.

Contract No. 139, District 44-B, lateral sewers—RYAN & REILLY CO., Baltimore, $120,866 (awarded contract); James Ferry & Sons, Baltimore, $121,754; Carozza Bros. & Co., Baltimore, $124,647; M. O'Herron & Son, Baltimore, $125,521; Gallagher, Beyel & Bryan, Baltimore, $126,089; William McCarthy, Baltimore, $130,405; Whiting Turner Construction Co., Baltimore, $135,617.

Contract No. 41, storm water sewer—RYAN & REILLY CO., Baltimore, $77,395 (awarded contract); M. O'Herron & Sons, Baltimore, $77,826; Slack & Slack Co., Baltimore, $78,003; William McCarthy, Baltimore, $82,632; James Ferry & Sons, Inc., Baltimore, $83,787; Whiting-Turner Construction Co., Baltimore, $86,133; John W. Heller, Newark, N. J., $88,933; B. F. Sweeten & Sons, Baltimore, $108,156.

Contract No. 126, Sect. 10, high level interceptor—M. O'Herron & Sons, Baltimore, $41,514; Ryan & Reilly Co., Baltimore, $43,892; Whiting-Turner Construction Co., Baltimore, $46,509; Middleton, Thompson Co., Baltimore, $47,963; W. H. H. Allen Construction Co., $48,782; James Ferry & Sons, Baltimore, $51,066; A. J. Carozza & Co., Baltimore, $59,304; Mason, Hilton & Co., New York, N. Y., $62,274. Noted Nov. 19.

★Kensington, Md.—(Official)—Bids will be received by the Mayor and Town Council until 8 p.m., Jan. 15, for the construction of a sewer system. For details see advertisement under "Contracts to Be Let." Noted May 7.

Martinsburg, W. Va.—An election will be held in January to vote on the question of issuing bonds, the proceeds of which will be used for the installation of a sewer system.

St. Augustine, Fla.—The City Council plans to construct a municipal sewer system. A. W. Corbett is Mayor.

+Columbus, Ohio—The contract for constructing the Shoemaker Ave. sewer from Cleveland Ave. to Sidney Alley has been awarded to I. O. JONES, at $5268. Noted Sept. 24.

+Fostoria, Ohio—The contract for improving the sewage-disposal plant has been awarded to J. H. JONES, at $19,000. Noted Dec. 3.

New Philadelphia, Ohio—The City Council has approved plans for sanitary and storm sewers in Beaver Ave.

Cadillac, Mich.—The City Commission is considering plans for improving the present system of sewage disposal. The City Engineer advises a trunk sewer, costing $16,000, and a new disposal plant at an estimated cost of $30,000. O. A. Carr is City Mgr.

+Grosse Point, Mich.—The contract for constructing a trunk sewer along East Jefferson Ave. has been awarded to WILLIAM SAGER, Saginaw, at $86,000. Noted Nov. 19.

Marion, Ill.—The City Council contemplates constructing a septic tank. The Aetna Engineering Bureau, 17 North La Salle St., Chicago, is Engr.

+St. Charles, Ill.—(Official)—The contract for constructing a sewer in East Fifth St. has been awarded to H. D. HALLETT, Aurora, Ill., at $5875. Other bids were George A. Mallory, $6150; Yale & Reagan, $6000. Noted Dec. 3.

Sheboygan, Wis.—Bids will be received some time in March for extending the sewer system on the northwest side, estimated to cost $17,771. C. U. Boley is City Engr. Noted Sept. 17.

Dubuque, Iowa—The City Council has instructed E. C. Blake, City Engr., to prepare plans for a system of sewers for the section west of Grandview Ave. and Delhi St.

Hutchinson, Kan.—The City Commission has ordered the construction of a sanitary sewer for the L. A. Bigger tract.

Portland, Ore.—Bids were received by the City Council, for the construction of a trunk sewer in East 82d St., as follows: Giebish & Joplin, $173,494; Consolidated Contract Co., $174,459; Elliott Contracting Co., $174,535; J. F. Shea, $175,269; James Kennedy, $177,924. Noted Oct. 22.

+Holtville, Calif.—The city has awarded contracts to McLEAN & WALSH, Los Angeles, $21,244, for lateral sewers, and to DOYLE BROS., San Diego, $11,546, for outfall sewers. Noted Oct. 29.

Hamilton, Ont.—An election will be held Jan. 1, to vote on the question of raising $305,000 for the construction of a system of overflow sewers in the central section of the city.

+Toronto, Ont.—The contract for constructing a sewer in Swanwick Ave. from Cockburn to Victoria Park Ave. has been awarded to the J. H. McKNIGHT CONSTRUCTION CO., at $4982.

GARBAGE

New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 11 a.m., Dec. 22, at the office of the President of the Borough of Queens, Fifth St. and Jackson Ave., Long Island City, for the general construction of the destructor plant at Ridgewood, Second Ward, Borough of Queens

Louisville, Ky.—The Board of Public Works is considering the establishment of a garbage incinerator. Owen R. White, Keller Bldg., Louisville, is preparing plans.

Dayton, Ohio—Bids will be received until Feb. 1, for the purchase of $55,000 in bonds, the proceeds of which will be used in constructing the proposed garbage disposal plant. Noted Oct. 22, Dec. 10.

Ishpeming, Mich.—(Official)—A communication from P. H. Devine, Supt. Pub. Wks., states that nothing will be done with the incinerator proposition before next summer. Noted Nov. 26.

Kalamazoo, Mich.—Clarence Miller, City Clk., will receive bids until Jan. 15, for the collection of garbage for a period of five years. Bond required, $10,000.

+Fort Worth, Tex.—The City Commission has awarded the contract for the disposal of the city's garbage to W. F. LOWRY, for a period of two years. The contractor will pay to the city the sum of $4212 per year for the privilege.

STREETS AND ROADS

Boston, Mass.—Bids will be received until Dec. 18, by the Public Works Department, for macadam roadway in Deering Rd., Dorchester District, and for grading Temple and Hillcrest St., West Roxbury District. L. K. Rourke is Comr.

+Woonsocket, R. I.—A contract for constructing about 20,000 lin.ft. of curbing has been awarded to BLANCHARD BROS., Linwood, Mass., at 50c. per lin.ft.

+Hartford, Conn.—Contracts for state road work, bids for which were received Nov. 30, have been awarded by the Connecticut Highway Commissioners as follows:

Bridgewater Township, a section of 4-in. macadam on the Southville Rd., to KELLOGG & GREGORY CO., Danbury, Conn., at $18,000.

Lebanon Township, a section of active stone macadam on the Creamery Hill Rd., to FRANK A. WILCOX, Norwich, Conn., for $10,229.

Saybrook Township (Deep River post office), a section of trap-rock macadam on the Winthrop Rd., to LEONARDO SUZIO, Meriden, Conn., for $8125. Noted Nov. 19 and Dec. 10.

★Albany, N. Y.—(Official)—Bids will be received by John N. Carlisle, State Highway Comr., 55 Lancaster St., until 1 p.m., Jan. 5, for improving highways in various countries. For particulars see advertisement under "Contracts to Be Let."

+Albany, N. Y.—Bids were received by the State Highway Commission, 55 Lancaster St., Dec. 10, for the construction of public highways, by State Aid, as follows:

Southern Blvd., Albany County, 1.59 miles: LANGAN CONSTRUCTION CORPORATION, Albany, $39,993 (awarded con-

[illegible]

Road No. [illegible] [illegible] Falls, [illegible] [illegible] [illegible] King [illegible] New York, [illegible] [illegible] Construction Co., West Hartford, Conn., [illegible] Lagan Construction Corporation, Albany, [illegible] [illegible] Corporation, New York, [illegible] [illegible] Sons, Inc., Housatonic, Conn., [illegible] SAMUEL ROSKIN, Beacon, [illegible] (awarded contract).

Road No. [illegible], King Ferry-[illegible] Ridge, Cayuga County, [illegible] miles. [illegible] H [illegible], Rochester, [illegible] Flood & Van Wirt Co., Hudson Falls, [illegible] Richard Hopkins, Troy, [illegible] [illegible] Fulton, [illegible] John H [illegible], Albany, [illegible] [illegible] Metzger & Baum Co., [illegible] [illegible] (All bids were rejected, low bid being informal.)

Road No. [illegible], [illegible] Corners-Stuyvesant Dock, Columbia County, [illegible] miles. [illegible] Bridges Sons, Inc., Hazardville, Conn., [illegible] John [illegible], New Haven, Conn., $14,[illegible] James [illegible] & Son, Mt. Vernon, [illegible] Hurst & Stevens, Lake Placid, [illegible] SAMUEL ROSKIN, Beacon, $14,[illegible] (awarded contract); John J. McDonald Contracting Co., Poughkeepsie, [illegible] [illegible] Kearney, Harlem, $16,199.

Road No. [illegible] A, Cowanda Village, Erie County, 0.[illegible] mile. Elmer H. Brown, Hempstead, L. I., $19,[illegible] Thomas Mahoney, Jamestown, [illegible] Austin W. [illegible], Buffalo, [illegible] Thomas Fitzgerald Co., Fredonia, $18,[illegible] JOHN L. McDONALD CONTRACTING CO., Poughkeepsie, $18,[illegible] (awarded contract); H. L. Armande & Co., Boston, Mass., [illegible]

Road No. [illegible], [illegible] Springs-Hamburg, Erie County, [illegible] miles. [illegible] Buffalo, [illegible] Albert L. [illegible], [illegible], [illegible] THOMAS F. SHAUGHNESSY, Albany, [illegible] (awarded contract); J. B. Harley, Inc., Fredonia, [illegible] Lake Shore Construction & Supply Co., Dunkirk, [illegible] [illegible] & Percival, Buffalo, [illegible] Constantine Construction Co., Buffalo, [illegible]

Road No. [illegible], Watertown City, Eastern Blvd., Jefferson County, [illegible] miles. STANLEY CONSTRUCTION CO., Buffalo, [illegible] (awarded contract); Louis B. Cleveland, Watertown, [illegible] [illegible] Bros. & Haley, Watertown, $36,09[illegible] Murray Construction Co., Troy, $34,862; Roger B. Kennedy, Utica, [illegible] W. J. Kennedy, Utica, $35,711.

Road No. [illegible], Chittenango Village, Seneca Turnpike, Madison County, [illegible] miles. Phelan & [illegible], Utica, $7186; CONDIT & [illegible], [illegible], [illegible] (awarded contract); [illegible] B. [illegible], Syracuse, [illegible] [illegible] & King, Sherburne, [illegible]

Road No. [illegible], [illegible] Ave., Spencerport, Monroe County, [illegible] miles. [illegible] Holler [illegible], Rochester, [illegible] [illegible]-Hicks Contracting Co., Rochester, $70,17[illegible] FRANK A. BROTSCH CO., Rochester, [illegible] (awarded contract); [illegible] H. [illegible], Rochester, [illegible] Louis H. Brotsch, Rochester, $73,461; [illegible] & Barnes, Rochester, $77,469; [illegible] Murray, Rochester, [illegible]

Roads Nos. 766 and 767, [illegible]-[illegible], Parts 1 and 2, Monroe County, [illegible] miles. [illegible], Williamsport, Penn., [illegible] Newport Construction Co., Herkimer, [illegible] James Anderson, Albany, $77,[illegible] [illegible] & [illegible], Rochester, [illegible] [illegible] & Sons, Inc., Middletown, Conn., [illegible] [illegible] Rochester, [illegible] [illegible]-Holler Co., Rochester, [illegible] All bids were rejected.

Road No. [illegible], [illegible]-West Point, Part 1, Orange County, [illegible] miles. Elmer H. Brown, Hempstead, L. I., [illegible] [illegible] & [illegible], Port Henry, [illegible] [illegible]-Parker Construction Co., [illegible], $11[illegible] James Anderson, [illegible] Lagan Construction Corporation, Albany, [illegible] James [illegible] & Sons, Inc., Mt. Vernon, [illegible] Award withheld.

Road No. [illegible] [illegible] County, [illegible] miles. Henry P. [illegible] Co., Buffalo, [illegible] James L. [illegible], [illegible] [illegible] H. Murray, Rochester, [illegible] [illegible] Contracting Co., Syracuse, [illegible] Frank E. Gore, New York, [illegible] HEMBDT & WASHINGTON, Monticello, [illegible] (awarded contract).

Road No. [illegible], [illegible], Part 1, Oswego County, [illegible] miles. [illegible] Construction Corporation, [illegible], [illegible] A. J. [illegible], Rochester, [illegible] [illegible] (awarded contract); [illegible] New York, [illegible] Frank E. Gore, New York, [illegible] [illegible] Construction Co., Buffalo, [illegible] [illegible] Bros., Watertown, [illegible]

Road No. [illegible], Syracuse City, [illegible] Ave., Onondaga County, [illegible] mile. Frank E. Gore, New York, [illegible] [illegible], Syracuse, [illegible] J. W. [illegible] Construction Co., [illegible], [illegible] [illegible] W. [illegible], Albany, [illegible] [illegible], Syracuse, [illegible] [illegible], Syracuse, [illegible] C. T. [illegible] CONSTRUCTION CO., Syracuse, [illegible] (awarded contract); [illegible] & [illegible], [illegible], [illegible] [illegible], Syracuse, [illegible] James [illegible] & Sons, Mt. Vernon, [illegible]

Road No. [illegible] [illegible]

Road No. [illegible] [illegible]

Road No. [illegible] [illegible]

Road No. [illegible] [illegible] Road, $14,[illegible] Hembdt & Washington, Monticello, $14,[illegible]

Road No. [illegible], Glens Falls City, Glen St., Warren County, [illegible] mile. [illegible] J. [illegible], Glens Falls, $48,34[illegible] H. W. ROBERTS & CO., Utica, $46,[illegible] (awarded contract); Murray Construction Co., Troy, $46,[illegible] Flood & Van Wirt, Hudson Falls, $47,159; W. L. Lawton, Glens Falls, $48,637; Gifford Construction Co., Jamaica, $47,[illegible]

Road No. [illegible], Whitehall Village, Canal and Broad St., Washington County, 1.[illegible] miles. Brooks & Julian, Rochester, $44,16[illegible] Murray Construction Co., Troy, $47,[illegible] John T. McDonald Contracting Co., Poughkeepsie, $47,0[illegible] John B. Dower, Ballston Spa, $47,[illegible] John P. Dugan & Co., Amsterdam, $46,[illegible] THOMAS F. SHAUGHNESSY, Albany, $45,916 (awarded contract).

Road No. [illegible], Crafts Corners-Vista, Westchester County, [illegible] miles. [illegible] Donovan, Kingston, $63,63[illegible] Samuel Roskin, Beacon, $62,19[illegible] James Garofano & Son, Inc., Mt. Vernon, $6[illegible] C. W. Tryone, Boyntonville, $61,[illegible] George B. [illegible], Mt. Kisco, $59,76[illegible] Frank E. Gore, New York, $6[illegible] White & Colligan, Purchase, $61,667. All bids were rejected, low bid being informal. Noted Nov. 26.

New York, N. Y.—(Borough of Brooklyn)—(Official)—Bids will be received by L. H. Pounds, Pres. of the Borough, until 11 a.m., Dec. 23, for the following: 25,000 grade 1 paving blocks, [illegible] bbl. of portland cement, 7[illegible] gal. kerosene oil, [illegible] tons limestone or other suitable inorganic dust, 2[illegible] gal. of residuum oil, 15,000 cu.yd. asphalt sand, 2000 cu.yd. paving gravel, 4000 cu.yd. binder stone, 300 cords of hard wood.

✦(Borough of Manhattan)—(Official)—The contract for regulating and grading Riverside Drive, Service St., from 1[illegible]th to 16[illegible]th St., and for paving and curbing the same street from 1[illegible]th to 161st St. has been awarded to the ASPHALT CONSTRUCTION CO., Madison Ave. and 127th St., at [illegible] Noted Nov. 26 and Dec. 1[illegible]

(Borough of Manhattan)—(Official)—Bids will be received by Marcus M. Marks, Pres. of the Borough, until 2 p.m., Dec. 21, for improving the market spaces under Manhattan Bridge from Division to Madison St.

(Borough of Manhattan)—(Official)—The contract for improving 30th St., from Eighth to Tenth Ave., has been awarded to the SICILIAN ASPHALT PAVING CO., 41 Park Row, at $15,392. Noted Dec. 3.

(Borough of Queens)—(Official)—Bids were received Dec. 10 by Maurice E. Connolly, Pres. of the Borough for improving Liberty Ave., from Walker to Ocean Ave., from Grimmer Construction, $5101, and Francis J. Ahearn, $57[illegible]; and Hancock St., from Payntar to Freeman Ave., J. F. Covalhozzo, $10,612. Noted Dec. 3.

Waterford, N. Y.—(Official)—Bids were received Dec. 7 by the Board of Trustees for brick paving as follows: John W. Flynn, Waterford, $4806; J. W. Davitt, Troy, $5[illegible]; J. P. Kelly, Cohoes, $[illegible]; George Holler, Glenns Falls, $4971.

✦**Atlantic City, N. J.**—The contract for paving sections of Aberdeen Pl., Sunset and Winchester Ave. has been awarded to the WARNER QUINLAN ASPHALT CO. at $10,[illegible]

✦✦**Hammonton, N. J.**—A contract for improving Wheat Rd. from the Cumberland County line to the intersection of Bellevue Ave. and White Horse Pike, Hammonton, has been awarded to [illegible]URK & BONHAM, Plainfield, N. J., at $67,519. Other bids were: Miller Engineering and Construction Co., $77,46[illegible] A. H. Lupton & Son, $79,522. Noted Nov. 26.

Irvington, N. J.—The Town Commission is considering the paving of Linden Ave. from West Clinton Ave. to Silkman Pl.

✦**Somers Point, N. J.**—(Official)—The date for receiving bids has been extended until noon, Dec. 30 for improving the Somers Point-Longport Blvd. A. H. Nelson, County Engr., is in charge. For particulars see advertisement under "Contracts To Be Let." Noted Nov. 26.

Trenton, N. J.—The Road Committee of the Board of Freeholders has notified the State Road Department of its intention to improve the following roads with estimated cost as noted: Trenton and Allentown Pike, $10,[illegible]; Pennington Rd., $[illegible]; [illegible]ville Rd., $3[illegible]; Edinburgh Rd., $[illegible]; road [illegible] Yardville to Crosswicks, $70[illegible]; Upper River Rd., $2[illegible]; [illegible]ville Rd., $[illegible]; road from Windsor to Hightstown, $[illegible]; road from Yardville to Allentown, $[illegible]; Pennington Rd. from Trenton to [illegible]ville, $927[illegible] and road from [illegible] to Marshall's Corner, $[illegible]

Trenton, N. J.—The New Jersey Harbor Commission has approved plans prepared by the Board of City Commissioners for the construction of an improved street to run from Factory St. to the proposed terminals along the Delaware River, to be known as Factory St.

West Hoboken, N. J.—(Official)—The Town Council plans to improve [illegible] St. from Palisade Ave. to Clinton Ave. by paving the roadway with a "[illegible]" pavement composed of stone, ocean sand, etc., also resetting curbs and relaying flag stone. A. L. [illegible] is Town Clk.

✦**Pittsburgh, Penn.**—(Official)—See item under "Miscellaneous: Track Laying and Paving."

✦**Moundsville, W. Va.**—A contract for improving a portion of [illegible] Rd., Washington District, has been awarded to the TORONTO FIRE CLAY CO., Toronto, Ohio.

Tavares, Fla.—Bonds for $[illegible] were sold Nov. [illegible], the proceeds of which will be used for construction [illegible] miles of [illegible] roads throughout Lake County.

✦**Birmingham, Ala.**—The Board of Commissioners Dec. [illegible] awarded the contract to J. L. MULLARKY [illegible], for paving [illegible] Ave. from [illegible] to [illegible] St. and [illegible]th St. from [illegible] Ave. to [illegible] and James [illegible], with asphaltic concrete, at an estimated cost of $[illegible] The work includes [illegible] sq.yd. asphaltic concrete on [illegible]-in. concrete base, [illegible] sq.yd. [illegible] concrete base, [illegible] lin.ft. granite curb, [illegible] sq.ft. [illegible] walk, [illegible] lin.ft. stone headers and [illegible]

Louisville, Ky.—The Board of Public Works will receive bids until Dec. [illegible] for improving [illegible] St. from [illegible]th to [illegible] St., with granite block [illegible], bituminous concrete [illegible] and brick gutters. Noted Nov. [illegible]

✦**Middlesboro, Ky.**—A contract for paving a number of streets has been awarded to the CALEY-[illegible] CONSTRUCTION CO., [illegible], Ky., at approximately $[illegible]

Cleveland, Ohio—Bids will be received by the office of the Commissioner of Purchases and Supplies, Room 513, City Hall, until noon, Dec. 23, for grading, draining and otherwise improving East Blvd., from Union Ave. to East 116th St.

Bids will be received by the Board of Trustees for Royalton Township, Town Hall, until 1 p.m., Dec. 26, for the sale of $13,581 in bonds for highway improvements.

Defiance, Ohio—Press reports state that $28,000 in bonds were sold, the proceeds of which will be used for improving roads.

Strongsville, Ohio—At a recent election the citizens voted in favor of issuing $50,000 in bonds for improving roads.

Indiana—(Official)—Bids will be received as follows for road improvements in Indiana:

Greencastle, until 2 p.m., Jan. 4, by the Commissioners of Putnam County, for constructing a macadam road in Franklin Township. C. L. Airhart is County Audr.

Williamsport, until 1 p.m., Jan. 4, by the Commissioners of Warren County, for constructing gravel roads in Steuben, Mound, Warren and one on line between Mound and Kent Townships. D. H. Moffitt is County Audr.

Valparaiso, until 10 a.m., Jan. 4, by the Commissioners of Porter County, for constructing a gravel road in Union Township. C. A. Bachley is County Audr.

Greenfield, until 10 a.m., Jan. 4, by the Commissioners of Hancock County, for constructing a road on line dividing Green and Center Townships. Lawrence Wood is County Audr.

Portland, until 10 a.m., Jan. 4, by the Commissioners of Jay County, for constructing a stone road in Wayne and Noble Townships. John Bonifas is County Audr.

Muncie, until 2 p.m., Jan. 12, by the Commissioners of Delaware County, for constructing a gravel road on Delaware-Henry County line. F. M. Williams is County Audr.

Franklin, until 2.30 p.m., Jan. 15, by the Commissioners of Johnson and Marion Counties, for constructing a county line road. H. L. Knox is County Audr.

Boonville, Ind.—The Board of County Commissioners has ordered an election to be held in Greer Township, Feb. 25, for the purpose of voting on the question of constructing seven miles of macadam roads, estimated to cost $27,000.

+Brownstown, Ind.—The contract for constructing a gravel road in Grassy Fork Township, Jackson County, has been awarded to McCAMMON & RICH, Brownstown, at $10,443. Noted Nov. 19.

+Indianapolis, Ind.—The contract for improving Finley St. from Shelby to Boyd St. has been awarded to J. HARRY ROBERTS.

Michigan City, Ind.—(Official)—No bids were received by the Board of Public Works, Dec. 8, for improving Fir and East Eighth St. A Spychayski is City Clk. Noted Dec. 3.

Cadillac, Mich.—Plans are being prepared for the construction of a drive around Cadillac Lake. O. E. Carr is City Mgr.

Muskegon, Mich.—The City Council has instructed Harry Beck, City Engr., to estimate the cost of resurfacing all brick-paved streets with asphalt.

+St. Joseph, Mich.—(Official)—Contracts for constructing 16¾ and 14 miles of county road have been awarded to the ZENIGH STONE CO., Kankakee, Ill., at $100,303, and the GOOD ROADS CONSTRUCTION & SUPPLY CO., Chicago, Ill., at $96,967, respectively. Noted Dec. 3.

Peoria, Ill.—The City Council contemplates resurfacing Moss Ave., from Elizabeth St. to Western Ave., with asphalt. Leonard Jefferies, City Engr., estimates the cost at $27,076.

Beloit, Wis.—Plans have been prepared by R. R. Caldwell, City Engr., for paving about 33 streets.

Kansas City, Kan.—According to press reports, bids will be received until Jan. 1 for constructing 17,000 sq.yd. of rock asphalt. W. Barclay is City Engr.

Edina, Mo.—Press reports state that bids will be received until Jan. 15 for 15,000 sq.yd. of brick paving. Tuttle & Pike, Shubert Theater Bldg., Kansas City, Kan., are Engrs.-in-Charge.

Austin, Tex.—The City Council is considering the improvement of Dam Blvd., at an estimated cost of $11,420 for macadam, or $32,000 for concrete pavement.

+Dallas, Tex.—The contract for paving Elm St. from Ervay to Harwood St. and St. Paul St. from Pacific to Elm St. has been awarded to the CULLOM-BAVOUSET CO., at $13,603. Other bids were: Texas Bitulithic Co., $14,214; Roach Manigan Paving Co., $14,081, and the Bert Hahn Construction Co., $14,253.

+Yoakum, Tex.—The City Council has awarded a contract for graveling several blocks of streets to WILLIAM A. BRUNET, Houston, at $7430.

Clarkston, Wash.—The City Council has instructed the City Engineer to prepare plans for the paving of Bridge St., from Second to 13th St.

+Seattle, Wash.—The contract for paving Stone Way has been awarded to the J. McHUGH PAVING & CONSTRUCTION CO., at $154,569.

Redwood City, Calif.—Bonds for $200,000 have been sold by the City Commissioners, the proceeds of which will be used for improving streets.

San Francisco, Calif.—The Board of Public Works plans to improve sections of Folsom and Lane St., Oakdale and Hudson Ave.

Santa Clara, Calif.—An election will be held Dec. 21, to vote on the question of issuing $30,000 in bonds for completing the state highway through Santa Clara.

+Stockton, Calif.—The City Council has awarded a contract for street paving to A. H. MUNSON & SON, Stockton, at $24,326.

Maisonneuve, Que.—Plans are being prepared by M. Desfresne, Engr. and Arch., Ontario St., Montreal, Que., for improving and paving Pius IX Blvd.

Waterloo, Que.—(Official)—No bids will be received by the Town Council for macadamizing three miles of roads, as the work will be done by the corporation. Noted Dec. 3.

North Vancouver, B. C.—A bylaw has been passed authorizing the expenditure of $75,000 for paving by the City Council. A. M. West is City Engr.

Saanichton, B. C.—The City Council contemplates extending and widening Shelburne St., at an estimated cost of $30,000.

INDUSTRIAL WORKS

Quincy, Mass.—The Fore River Shipbuilding Co. has received a permit for the construction of an 80x200-ft. concrete building. Estimated cost, $60,000.

Salem, Mass.—The Naumkeag Steam Cotton Co. has plans for the construction of a four-story 135x722-ft. spinning mill on Congress St.

Elmira, N. Y.—The A. P. Morrow Mfg. Co. plans the immediate construction of a $125,000 shop and the enlargement of its plant.

East Stroudsburg, Penn.—Samuel Scott and Charles Warman are planning the construction of a glass factory on Lackawanna Ave.

Lebanon, Penn.—Plans have been prepared for the construction of a 40x150-ft. brick addition at 15th and Cumberland St. for the Columbus Chain Co.

New Castle, Penn.—A. W. Leh, Engr. and Arch., has prepared plans for the factory and power plant to be constructed for the Bethlehem Steel Co.

Philadelphia, Penn.—Plans have been prepared by Savery, Sheetz & Savery for the construction of a two-story, 22x66-ft. addition, on Commonwealth Ave. and Mifflin St., for Crew, Levick & Co.

+Sharon, Penn.—The general contract for the construction of a factory and warehouse on Seuth Dock St., for Mott Robertson, has been awarded to A. WISHART & SONS CO. Estimated cost, $20,000.

Gainesville, Ga.—A company recently organized plans the construction of a hosiery mill, a 50x150-ft. main building, dye house, engine and boiler room, storage house, office building and a 100-hp. steam and electric power plant. Estimated cost, $20,000.

Birmingham, Ala.—Essig & Busenlehner have had plans completed for their bakery at 14th St. and Fourth Ave. The estimated cost is $20,000.

The Southern Sewer Pipe Co., whose plant was recently destroyed by fire with a loss of $125,000, plans to rebuild at Birmingham.

Mobile, Ala.—The Barker Cotton Mills, Prichard, Ala., contemplates the construction of a bleaching plant. The estimated cost is $30,000.

Chattanooga, Tenn.—The Enterprise Enamel Co., Martins Ferry, Ohio, has secured a site for the construction of a plant in Chattanooga. William Lipphardt & Sons are interested.

Louisville, Ky.—The Kentucky & Indiana Terminal R.R. Co. contemplates the construction of a foundry. John H Rightmeyer, Gen. Mgr., is in charge of the work.

Akron, Ohio—Henry Murphy, Arch., Doyle Bldg., has prepared plans for the construction of a four-story, fireproof storage building at 41-45 North High St., for the Union Storage Co. Estimated cost, $25,000.

I. S. Myers and associates have purchased a site for the construction of a five-story, 127x198-ft. garage on Forest St. Estimated cost, $100,000.

Cleveland, Ohio—Bids will soon be received by Ernest McGeorge, Arch., Leader News Bldg., for the general construction of the factory at Superior and Payne Ave., for the Hunt-Dorman Mfg. Co. The building will have 22,000 sq.ft. of floor space.

Coalburg, Ohio—Plans have been prepared by the Lake Shore & Michigan Southern Ry. for the construction of a $200,000 roundhouse and repair shop.

Hamilton, Ohio—The Andrews Asphalt Paving Co. has secured a permit for the construction of a 66x100-ft. warehouse along the Cincinnati, Hamilton & Dayton Ry.

Attica, Ind.—The Tishimingo Gravel & Cement Co. plans the construction of a $140,000 plant at Attica.

Elkhart, Ind.—Plans are being prepared for the rebuilding of the Western Adjusting Co., Ideal Steel Wheel Co. and the Sevison Electric Co., recently destroyed by fire. J. B. Fitch is Pres. of the Western Adjusting Co.

Kokomo, Ind.—John T. Neary, Supt., Kokomo Rubber Co., contemplates the construction of a $10,000 public garage on Main St.

Detroit, Mich.—The Fisher Body Co. plans the construction of a six-story, 80x112-ft. addition on Piquette Ave., to cost $40,000. An additional story will be added to the main structure.

Ecorse, Mich.—The Bowering Soap Co. plans the construction of a four-story plant. The estimated cost is $150,000.

Holland, Mich.—Plans are being prepared by R. C. Clark, Arch., Chicago, Ill., for the construction of a three-story and basement, 50x200-ft. tannery on Eighth St., for the Coppon & Bertsch Leather Co. Estimated cost, $45,000.

+East St. Louis, Ill.—The contract for the construction of the $167,000 roundhouse for the Southern Ry. Co. has been awarded to R. L. MURPHY CONSTRUCTION CO., Washington, D. C. Noted under Denverside (East St. Louis post office), Ill., Nov. 19.

Milwaukee, Wis.—The Waldheim Furniture Co. will build a 10-story, 80x135-ft. building on West Water St., estimated to cost $250,000. Plans are being prepared by H. C. Koch & Sons. Noted under "Buildings," Nov 5.

St. Paul, Minn.—The American Farm Products Co. plans the construction of a $250,000 warehouse, construction to begin in January.

Libby, Mont.—[illegible]

Fort Smith, Ark.—[illegible]

Austin, Tex.—[illegible]

Lewiston, Idaho.—[illegible]

Los Angeles, Calif.—[illegible]

San Francisco, Calif.—[illegible]

Vancouver, B. C.—[illegible]

Peel, N. B.—[illegible]

FEDERAL GOVERNMENT WORK

Storehouse—[illegible]

Dredging—[illegible]

Dredging, Etc.—[illegible]

Latchouses and Storehouse—[illegible]

Dredging—New York, N. Y.—The contract for dredging [illegible]

Mail-Handling Apparatus—New York, N. Y.—[illegible]

Dredging—New Jersey—[illegible]

Excavating—[illegible]

Repairing Vessel—[illegible]

Boilers, Etc.—[illegible]

Skylights—[illegible]

Bridge—[illegible]

Railroad Track Scale Testing Equipment—[illegible]

Oil Storage Tanks—[illegible]

[illegible] (7) $17,271. Western Pipe & Steel Co., [illegible] Market St., San Francisco, Calif. [illegible]

Storehouse—Washington, D. C.—Bids were received Dec. 12 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a storehouse at the Washington Navy Yard. The building will be either steel frame or reinforced-concrete [illegible], five stories high, [illegible] [illegible]

Building—Wilmington, N. C.—Bids will be received by [illegible] Treasury Dept., Washington, D. C., [illegible] for the construction of a [illegible] U. S. Marine Hospital, Wilming-[illegible]

✚**Post Office**—Fayetteville, Tenn.—The contract for the construction of the post office at Fayetteville has been awarded to R. P. FARNSWORTH & CO., Owensboro, Ky., at $37,300. Noted Oct. 8 and Nov. 26.

★**Metal Work**—Cleveland, Ohio—Bids will be received by the Lighthouse Inspector, Buffalo, N. Y., until 2 p.m., Dec. 30, for furnishing metal work for the fog-signal building at Cleveland.

★**Post Office**—Tiffin, Ohio—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., until 3 p.m., Feb. 8, for the construction of a two-story and basement stone post office at Tiffin.

✚**Life Saving Station**—Mackinac Island, Mich.—The contract for constructing a life saving station and launchway on Mackinac Island has been awarded to JACOB C. JENSEN, Racine, Wis., at $19,300.

✚**Post Office**—Canton, Ill.—The contract for the construction of the U. S. post office at Canton has been awarded to THOMAS W. CISSEL, Wooster, Ohio, at $59,600. Noted Oct. 8 and Nov. 19.

Post Office and Court House—McCook, Neb.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 26, for the construction of a three-story and basement stone post office and court house.

★**Bridge**—Great Falls, Mont.—Bids will be received by the U. S. Reclamation Service, Great Falls, until 2 p.m., Jan. 12, for erecting one highway and pipe bridge of two spans, each composed of three trusses 97½ ft. long, for the St. Mary Storage Unit Milk River Project, Mont.

★**Canal Construction**—Great Falls, Mont.—The following are the bids received for the construction of a portion of the Pishkun Reservoir Supply Canal: Bates & Rodgers Construction Co., 206 Lindell Block, Spokane, Wash., $39,939; Security Bridge Co., Billings, Mont., $43,936; McArthur Bros. Co., Chicago, Ill., $50,653; O'Connor & Helean, Great Falls, Mont., $59,305. Noted Nov. 5.

Paving—St. Ignatius, Mont.—The following bids were received by the U. S. Reclamation Service, for 1700 sq.yd. of 18-in. paving on South Pablo Dam, Flathead Project: Wilson Bros., Polson, Mont., $4590; A. L. Markhus, Polson, $6715; Municipal Construction Co., Helena, Mont., $6885.

Remodeling Building—St. Louis, Mo.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 19, for remodeling the Custom House at St. Louis.

★**Post Office**—Uvalde, Tex.—Bids will be received by Oscar Wenderoth, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p.m., Jan. 22, for the construction of a one-story and basement brick and stone post office at Uvalde.

★**Canal, Etc.**—Olathe and Delta, Colo.—Bids will be received at the office of the U. S. Reclamation Service, Montrose, Colo., until 4 p.m., Jan. 5, 1915, for the construction of the Lower Selig Extension Canal and laterals, Uncompahgre Valley Project, in the vicinity of Olathe and Delta, Colo. The work involves the excavation of about 117,300 cu.yd. of material in open cut.

✚**Canal Work**—Provo, Utah—Contracts for constructing sections of the High Line Canal have been awarded as follows: Division 1, MENDENHALL, STRAW & BIRD CONSTRUCTION CO., Springville, Utah, at $47,465; Division 2, RYDEOUT & ANDRUS, Provo, Utah, at $25,897; Division 3, McARTHUR BROS., 11 Pine St., New York, N. Y., at $37,078. Noted Oct. 8 and Nov. 26.

Bridges—Chiloquin, Ore.—The U. S. Indian Service, Dept. of the Interior, contemplates the construction of three steel or wooden bridges on the Klamath Indian Reservation. Surveys, plans and estimates for the work will be submitted by Harvey W. Hincks, Engr.-in-charge.

Dredging—Oakland, Calif.—Bids will be received by Lieut. Col. Thomas H. Rees, Custom House, San Francisco, until 11 a.m., Dec. 31, for dredging in Oakland Harbor.

✚**Naval Dry Dock**—Pearl Harbor, H. T.—The government has awarded a contract to the SAN FRANCISCO BRIDGE CO., at $1,261,350, for completing the dry dock at the Pearl Harbor Naval Station. The basin will be 1029 ft. long, 148 ft. wide and 35 ft. deep. The total cost is estimated at $4,442,115, exclusive of caissons, pumping plant, etc. C. W. Parks, Naval Engr., will supervise the construction.

MISCELLANEOUS

Dredging and Wharf Construction—New Bedford, Mass.—The following bids and alternates were received Dec. 11 by the State Harbor and Land Commissioners, Boston, for dredging and wharf construction: John R. Burke, $339,777, $361,217; William H. Ellis & Son Co., $347,910, $323,437; Woodbury & Leighton, $355,635, $383,760; Coleman Bros., $361,305, $354,946; John Cashman & Sons Co., $367,311, $353,453; T. A. Scott, New London, Conn., $368,005, $404,369; H. P. Converse & Co., $374,082, $409,619; Snare & Triest, New York, N. Y., $386,735 $387,242; E. W. Foley Construction Co., $392,209, $422,530; Hanscom Construction Co., $392,530, $419,910; Lawler Bros., $482,245, $473,184. William I. William is Comn. Engr.

✚**Motor Fire Apparatus**—New Haven, Conn.—The Board of Fire Commissioners has awarded the contract for furnishing the fire department with three pieces of apparatus, to the SEAGRAVE CO., Columbus, Ohio, at $21,700.

Dredging—New Haven, Conn.—Bids are being received by Frederick L. Ford, City Engr., for dredging a basin in the inner portion of the main harbor at the outlet of the East St. sewer.

Elevated Railway Stations—New York, N. Y.—(Borough of Brooklyn)—With the approval of the Public Service Commission, the New York Municipal Ry. Corporation has awarded contracts to the P. J. CARLIN CONSTRUCTION CO., for constructing the following stations on the Liberty Ave. elevated railroad extension: Hudson St., $41,500; Boyd Ave., $40,000; Rockaway Blvd., $44,500; Oxford Ave., $42,500; Greenwood Ave., $40,500; Lefferts Ave., $23,000.

Bulkheads and Filling—New York, N. Y.—(Borough of Queens)—(Official)—The lowest bid received by the President of the Borough of Queens for repairing the roadway and constructing pile and timber bulkheads in the Rockaway Turnpike, Fourth Ward, was that of the Public Works Contracting Co., 110 West 34th St., New York, at $11,255. Noted Dec. 3.

★**Subway**—New York, N. Y.—(Borough of Manhattan)—(Official)—The date for receiving bids for the construction of Section 4 of Routes Nos. 4 and 36, a part of the Broadway-Fourth Ave. Rapid Transit R.R. in the Borough of Manhattan has been extended by the Public Service Commission from Dec. 11 to Dec. 29. See advertisement under "Contracts to Be Let."

Fire-Protection—New York, N. Y.—(Boroughs of Manhattan and Richmond)—(Official)—Bids will be received until 2:30 p.m., Dec. 30, by John A. Kingsbury, Comr. Dept. Pub. Charities, Room 1091, Municipal Bldg., Borough of Manhattan, for installing fire-protection work in the groups of buildings under the jurisdiction of the Department of Public Charities on Randall's Island and in the New York City Farm Colony, Borough of Richmond.

Stable and Section House—New York, N. Y.—(Borough of Queens)—(Official)—Bids will be received until 11 a.m., Dec. 22, by the President of the Borough of Queens, Fifth St. and Jackson Ave., Long Island City, for the general construction of a stable and section house for the Bureau of Street Cleaning, at Flushing Ave., Ridgewood, Borough of Queens. The amount of security required is $30,000. Plans and specifications on file at the office of the Borough President.

Fire Station—Hoboken, N. J.—The following bids were received on Dec. 9, by the Common Council for constructing Fire Station, No. 3: Thomas J. Waters, New York, $41,800; L. J. Rice, New York, $37,900; Limouze Bros., Weehawkan, N. J., $38,987; William Flanagan, New York, $45,725; John Egan, Jersey City, $42,365; Bernard Vezetti, Hoboken, N. J., $45,477; A. J. Phelan, Jersey City, $43,388; De Riso Bros., Inc., Union Hill, N. J., $38,974; Dominico De Riso and Emil Arena, $47,500; Cona Construction Co., West Hoboken, N. J., $48,000; W. H. & E. W. Crane, New York, $42,916. Noted Nov. 26.

Bathhouse—Newark, N. J.—(Official)—Bids will be received until 1:30 p.m., Dec. 23, by the Commission on Public Buildings of the Common Council, for the construction of the proposed East Side bathhouse. James S. Pigott, Union Bldg., Newark, is Arch.

Dredging—Passaic, N. J.—The Passaic Board of Trade and the Paterson Chamber of Commerce are perfecting plans for dredging the Passaic River from Paterson to Newark.

★**Track Laying and Paving**—Pittsburgh, Penn.—(Official)—Bids will be received until 10 a.m., Dec. 21, at the office of the City Controller, Municipal Hall, Pittsburgh, for laying street railway tracks and paving the roadway and sidewalks on the North Side Point Bridge. For details see advertisement under "Contracts to Be Let."

✚**Cold Storage Plant Alterations**—Scranton, Penn.—The Lackawanna Cold Storage Co. has awarded the contract to WILLIAMS & RICHARDSON, Scranton, for making alterations and building additions to its plant. The estimated cost is $45,000. Edward Langley, Scranton, is Arch.

Barn—Charlestown, W. Va.—(Official)—Bids will be received until Feb. 1, by Marshall Burns, for constructing a 50x100-ft. frame barn with slate roof. Estimated cost $10,000.

Drainage—Concord, N. C.—Cabarrus County Drainage District No. 3 plans to issue bonds not to exceed $14,000 for the improvement of Coddle Creek. R. W. Fleming is Secy.

Pier—Fort Meyers, Fla.—The Lee County Investment Co. plans to construct a 500-ft. pier in Poinciana Park.

✚**Drainage**—Zellwood, Fla.—The Zellwood Florida Farms Co., A. E. Hartcom, Pres., 20 Nassau St., New York, N. Y., has awarded the contract for draining 20,000 acres in Lake and Orange Counties, to the FURST-CLARK CONSTRUCTION CO., Fidelity Bldg., Baltimore, Md.

Market Reconstruction—New Orleans, La.—Plans are being prepared and bids will be received soon for remodeling and rebuilding five of the city markets.

Dredging—Akron, Ohio—According to press reports, property owners in Summit, Wayne and Stark Counties are advocating a plan to dredge the Tuscarawus River for several miles through the three counties. The estimated cost is $100,000.

Motor Fire Apparatus—Canton, Ohio—The City Council will soon advertise for bids for furnishing the fire department with a triple combination motor truck.

Comfort Station—Cincinnati, Ohio—(Official)—Bids will be received until noon, Dec. 21, by Ernst Von Bargen, City Pur. Agt., for furnishing the material and labor for the erection of a comfort station opposite the Government Bldg.

Motor Truck, Ambulance—Cincinnati, Ohio—(Official)—Bids will be received by the Board of Hospital Commissioners until 3 p.m., Jan. 5, for furnishing one motor truck, one ambulance and a refrigerating apparatus for the Nurses Home.

Greenhouses—Columbus, Ohio—Bids will be received until, Jan. 5, by Carl E. Steeb, Secy., Bd. Trustees, Ohio State University, for the constrction of greenhouses. For specifications, address, Joseph H. Bradford, University Arch., Auditors Office, Columbus.

Recreation Building—Warrensville, Ohio—(Official)—J. Milton Dyer, Arch., Cuyahoga Bldg., Cleveland, writes that this building will probably be built by the city providing an appropriation can be secured next year. No plans have been prepared yet for this work. Noted Dec. 3.

✚**Retaining Wall**—Fort Wayne, Ind.—(Official)—The Board of Public Works has awarded the contract for constructing a reinforced concrete wall on the west side of St. Joseph Blvd. to the MOELLERING CONSTRUCTION CO., Fort Wayne. F. M. Randall is City Engr. Noted Nov. 26.

Dredging—Indianapolis, Ind.—The Board of Public Works has rejected all bids received for removing encroachments along the east side of White River. Noted Dec. 10.

Playground—Highland Park, Mich.—At a recent election $90,000 in bonds were voted for the purchase of additional playground space

Drainage—[illegible], [illegible]—The Jackson County Drainage [illegible] has been organized and plans [illegible] along the [illegible] River. N. F. [illegible] is Pres. [illegible] W. Allen, Jackson, is [illegible].

Motor Fire Apparatus—[illegible], Wis.—Next year's budget now before the City Council includes an item of $[illegible] for the purchase of motor apparatus for the police and fire departments.

Traction Engines—[illegible], [illegible]—The County Board of [illegible] will purchase two traction engines, four standard graders, [illegible] wagons, bridges and complete outfit for grading.

✚Ditches—[illegible], Minn.—Contracts for the construction of Judicial Ditches [illegible] and 21 have been awarded to the MINNESOTA DRAINAGE CO., [illegible], Minn., at $[illegible] and $[illegible], respectively. The contract for the construction of Ditch 22 was not awarded. The work will be readvertised. J. L. [illegible] is County Audr. Noted Nov. 19.

Metal Culverts—[illegible], Minn.—Bids will be received until [illegible], Dec. [illegible], by [illegible], Co. Audr. of Beltrami County, for [illegible] metal culverts for Judicial Ditch No. [illegible]. George W. Walker, Thief River Falls, Minn., is Engr.

Drainage—K[illegible], Mo.—Bids will be received until Dec. [illegible], by the [illegible] Drainage District, for deepening the [illegible] of drainage canal from 6 to 8 ft. William [illegible] is Pres.

Motor Fire Apparatus—San Antonio, Tex.—The City Council has [illegible] $[illegible] for the purchase of a combination hose and chemical motor engine and $[illegible] for a motor tractor.

Drainage Bonds—Seadrift, Tex.—The Seadrift Drainage District of [illegible] County has voted $[illegible] in bonds for the construction of a drainage system.

Dock Reconstruction—Seattle, Wash.—Bids are being received by the [illegible] Pacific Steamship Co. for constructing a dock to replace the one recently destroyed by fire. The estimated cost is $[illegible]. C. H. Nicholson is Mgr.

Reclamation—Tacoma, Wash.—The Hylebos Creek Diking District has retained as engineer Donald B. Roben, Tacoma. The proposed work will reclaim about [illegible] acres of salt grass marsh. W. [illegible] is Consult. Engr.

Drainage—North Yakima, Wash.—According to press reports the County Commissioners plan to enlarge Drainage District No. [illegible] so as to include South Nob Hill and the territory south of Wide Hollow Creek. The construction of additional canals and ditches is contemplated. The estimated cost is $[illegible].

Shipyard Reconstruction—Portland, Ore.—The Portland Shipyards Co., whose plant was recently destroyed by fire, will rebuild as soon as plans can be prepared. Charles M. Nelson is Pres.

Canal—Seaside, Ore.—According to press reports, J. E. Oates and a number of business men of this city are considering the construction of a 3½-mile canal from Seaside to Warrenton. The estimated cost is $50,000.

Reclamation—Bakersfield, Calif.—According to press reports the Kern Valley Reclamation Co. has been organized and will undertake to reclaim an extensive tract of land in the Lost Hills region. It is planned to construct a canal from this territory to Tulare Lake.

River Improvement and Bulkhead—Sacramento, Calif.—(Official.) A communication from P. M. Norboe, Asst. State Engr., states that the plan for improving the navigability of the Sacramento River near Crouch Landing has been postponed indefinitely. The construction of a pile and brush bulkhead at Collins Eddy will be undertaken in coöperation with the War Department. Noted Dec. 3.

BUILDINGS

Other items relative to Building Construction will be found under the following headings: "Industrial Works", "Federal Government Work" and "Miscellaneous."

Auburn, Maine—It is proposed that a new high school will be built. Plans are to be received Jan. 6. The cost will be about $100,000.

✚Amherst, Mass.—The contract for the construction of the new Agricultural Building at the Massachusetts Agricultural College has been awarded to the CASPER RANGER CONSTRUCTION CO., Appleton and Bond St., Holyoke, Mass. The building will be brick with concrete floors, three stories, 62x166 ft., with a wing 76x94 ft. The cost will be about $150,000. SHEA & DONNELLY, Lynn, Mass., have the sub-contract for the cut stone. James H. Ritchie, Boston, Mass., is the Arch.

Continued on Page 374

✚Sewer System—Wappingers Falls, N. Y.—Bids were received by the Board of Trustees, Nov. 18, for the construction of a sewer system according to plans prepared by H. L. Sterling, Engr., Newburgh. [illegible] (A) James McAvoy, New York, N. Y.; (A-1) Kellam & Shaffer, Schenectady, N. Y.; (B) [illegible] Wheeler & Co., Hartford, Conn.; (B-1) Suburban Engineering Co., New York, N. Y.; (C) Green Construction Co., Long Island City, N. Y.; (C-1) Pratt Reed & Phillips, Schenectady, N. Y.; (D) H. J. Zeel, Morgantown, W. Va.; (D-1) [illegible] & [illegible] Co., Waterbury, Conn.; (E) J. F. Leary Construction Co., Rochester, N. Y.; (E-1) J. L. Sgretto, Woodhaven, L. I.; (F) Frank [illegible], Paterson, N. J.; (F-1) Connolly & Co., [illegible], Mass.; (G) Samuel [illegible], Saratoga, N. Y.; (G-1) [illegible] & Weston, Lawrence, L. I.; (H) Joseph Johnson's Sons, [illegible], N. Y.; (H-1) Peekskill Construction Co., Peekskill, N. Y.; (I) John J. McDonald, Poughkeepsie, N. Y.; (J) Harrison & Burton, New York, N. Y.; (J-1) Michael Spino, Beacon, N. Y.; (K) Pioneer Construction Co., New Rochelle, N. Y.; (K-1) SAMUEL BESKIN, Beacon, N. Y. (awarded contract); (L) D. M. Rosser, Kingston, Penn.; (M) B. G. Coon Construction Co., Luzerne, Penn.; (M-1) J. W. Collins, Flint, Mich.; (N) R. B. Kennedy, Utica, N. Y.; (N-1) H. H. Golden & Son, Troy, N. Y.; (O) Daly & Merritt, Port Chester, N. Y.; (P) Evergreen Construction Co., Long Island City, N. Y.; (Q) Briggs & McLaughlin, New York, N. Y.; (R) Amabile & Sullivan, Bronx, N. Y.; (S) James J. Tusco, Newark, N. J.; (T) Langan Construction Corporation, Albany, N. Y.; (U) Petrossi Bros., Hartford, Conn.; (V) J. B. Pennell & Co., Yonkers, N. Y.; (W) Christopher & Lockwood, Peekskill, N. Y.; (X) Gallier & Van Cleave, Asbury Park, N. J. The item bids were as follows:

	A	A-1	B	B-1	C	C-1	D	D-1	E	E-1	F	F-1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$0.15	$0.10	$0.12	$0.10	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.68	0.75	0.75	[illegible]	0.45	0.50
[illegible]	[illegible]	0.48	[illegible]	0.71	[illegible]	[illegible]	[illegible]	0.75	[illegible]	0.66	0.75	[illegible]
[illegible]	[illegible]	0.82	0.7[illegible]	1.[illegible]	0.81	0.81	1.12	1.00	0.85	0.70	0.75	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.50	1.72	1.35	1.30	1.15	[illegible]	1.10	1.10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.50	[illegible]	1.84	1.40	1.35	1.22	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.01	1.60	[illegible]	1.45	[illegible]	2.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.66
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.60	0.64	[illegible]	0.60
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.60	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.10	1.00	1.00	0.92	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	G	G-1	H	H-1	I	J	J-1	K	K-1	L	M	M-1
Laying 8-in. pipe 4 ft. deep	$0.35	$0.40	$0.68	$0.48	$0.43	$0.34	$0.52	$0.55	$0.47	$0.36	$0.33	$0.48
Laying 8-in. pipe 4 to 6 ft. deep	0.34	0.45	0.73	0.48	0.48	0.51	0.69	0.75	0.55	0.48	0.39	0.52
Laying 8-in. pipe 6 to 8 ft. deep	0.45	0.50	0.98	0.61	0.61	0.59	0.79	1.05	0.65	0.60	0.56	0.65
Laying 8-in. pipe 8 to 10 ft. deep	0.68	0.70	1.40	0.89	0.82	0.92	1.25	1.30	0.84	0.76	0.74	0.70
Laying 8-in. pipe 10 to 12 ft. deep	1.05	0.90	1.60	1.28	1.13	1.11	1.55	1.60	0.95	0.98	0.90	0.85
Laying 8-in. pipe 12 to 14 ft. deep	1.90	1.20	1.90	1.97	1.30	2.05	2.00	1.85	0.98	1.50	1.30	0.95
Laying 8-in. pipe 14 to 16 ft. deep	2.25	1.80	2.70	3.90	1.63	2.36	2.59	2.20	1.19	1.70	1.70	1.32
Laying 8-in. pipe 16 to 18 ft. deep	2.40	2.50	3.10	5.50	2.11	2.67	3.27	2.40	1.53	2.50	2.10	1.45
Laying 8-in. pipe 18 to 20 ft. deep	2.60	3.00	3.75	7.57	2.30	3.92	3.78	2.80	1.65	2.80	2.70	1.75
Laying 10-in. pipe 4 to 6 ft. deep	0.55	0.55	0.94	0.65	0.56	0.57	0.74	0.85	0.63	0.54	0.51	0.56
Laying 10-in. pipe 6 to 8 ft. deep	0.60	0.65	1.05	0.80	0.69	0.65	0.99	1.20	0.69	0.66	0.63	0.82
Laying 10-in. pipe 8 to 10 ft. deep	0.75	0.80	1.30	1.10	0.90	0.95	1.24	1.45	0.90	0.85	0.70	0.85
Laying 10-in. pipe 10 to 12 ft. deep	1.05	1.00	1.60	1.40	1.20	1.17	2.00	1.75	0.97	1.05	1.10	1.08
Laying 10-in. pipe 12 to 14 ft. deep	1.40	1.30	1.98	2.20	1.38	2.11	2.25	2.10	1.08	1.55	1.40	1.18
Laying 10-in. pipe 14 to 16 ft. deep	1.75	1.90	2.78	4.26	1.71	2.42	2.85	2.50	1.26	1.75	1.80	1.38
Laying 10-in. pipe 16 to 18 ft. deep	2.15	2.60	3.20	6.00	2.19	2.73	3.26	2.70	1.68	2.55	2.30	1.52
Laying 10-in. pipe 18 to 20 ft. deep	2.50	3.10	3.85	8.17	2.38	3.98	4.05	3.00	1.87	2.90	3.20	1.62
Laying 15-in. pipe 4 to 6 ft. deep	0.80	0.95	1.12	0.95	0.77	0.75	1.65	1.00	0.81	0.80	0.63	0.80
Laying 15-in. pipe 6 to 8 ft. deep	0.95	1.05	1.30	1.10	0.88	0.87	1.25	1.35	0.91	1.15	0.75	1.00
Laying 15-in. pipe 8 to 10 ft. deep	1.05	1.20	1.54	1.36	1.13	1.10	2.19	1.25	1.14	1.30	0.90	1.40
Laying 15-in. pipe 10 to 12 ft. deep	1.30	1.40	2.25	1.78	1.46	1.39	2.35	2.10	1.20	1.50	1.20	1.65
Laying 15-in. pipe 12 to 14 ft. deep	1.60	1.70	2.70	2.75	1.65	2.45	2.95	2.40	1.38	2.00	1.58	2.15
Laying 15-in. pipe 14 to 16 ft. deep	2.10	2.30	3.10	5.00	2.03	2.67	3.29	2.75	1.50	2.20	2.00	2.65
Laying 15-in. pipe 16 to 18 ft. deep	2.30	3.00	3.80	7.00	2.53	2.85	3.65	3.10	1.98	3.00	2.60	3.15
Laying 15-in. pipe 18 to 20 ft. deep	2.70	3.50	4.50	9.00	2.78	4.00	4.75	3.50	2.46	3.30	3.60	3.65
Laying 15-in. pipe 20 to 22 ft. deep	3.10	4.50	4.99	12.00	3.03	4.05	6.09	4.50	2.70	3.50	4.60	4.25
Laying 18-in. pipe 6 to 8 ft. deep	1.30	1.55	1.50	1.40	1.20	1.32	2.00	1.60	1.37	1.35	1.04	1.42
Laying 18-in. pipe 8 to 10 ft. deep	1.65	1.70	1.65	1.75	1.45	1.55	2.19	2.10	1.57	1.55	1.20	1.67
Laying 18-in. pipe 10 to 12 ft. deep	2.10	1.90	1.97	2.20	1.60	1.84	2.59	2.35	1.63	1.75	1.55	1.82
Laying 18-in. pipe 12 to 14 ft. deep	2.30	2.20	2.78	3.10	2.01	2.72	3.00	2.65	2.19	2.25	1.90	2.15
Laying 18-in. pipe 14 to 16 ft. deep	2.40	2.80	3.35	5.67	2.39	3.50	3.85	3.10	2.29	2.50	2.20	2.65
Laying 18-in. pipe 16 to 18 ft. deep	2.25	3.50	4.10	7.78	2.58	3.84	4.25	3.40	2.34	3.25	2.80	3.15
Laying 20-in. pipe 6 to 8 ft. deep	1.50	2.05	1.90	1.70	1.35	1.50	2.50	1.85	1.47	1.50	1.20	1.50
Laying 20-in. pipe 8 to 10 ft. deep	1.75	2.20	2.15	2.20	1.60	1.68	2.50	2.35	1.62	1.20	1.45	2.00
Laying 20-in. pipe 10 to 12 ft. deep	2.00	2.40	2.40	2.80	1.75	1.97	2.75	2.95	1.79	1.90	1.90	2.25
Laying 20-in. pipe 12 to 14 ft. deep	2.30	2.70	3.20	4.00	2.16	2.85	3.50	3.50	2.35	2.40	2.30	2.50
Laying 20-in. pipe 14 to 16 ft. deep	2.70	3.30	4.30	6.10	2.54	3.80	4.00	4.10	2.42	2.65	2.80	3.00
500 lin.ft. deep sewer connections	0.30	0.50	2.10	0.60	0.23	0.65	0.50	0.25	0.25	0.80	0.50	0.50
3 M ft. b.m. lumber	33.00	30.00	35.00	50.00	55.00	25.00	55.00	50.00	30.00	40.00	35.00	40.00
14 tons c.i. pipe	32.00	30.00	27.00	45.00	50.00	25.00	49.00	30.00	30.00	32.00	42.00	40.00
10 cu.yd. extra concrete	6.00	10.00	8.00	10.00	14.00	10.00	8.50	10.00	10.00	7.00	7.00	7.00
63 manholes 6 ft. deep	50.00	30.00	40.00	27.50	70.00	30.00	39.00	40.00	35.00	40.00	30.00	35.00
52 manholes 6 to 8 ft. deep	55.00	40.00	45.00	40.00	80.00	40.00	55.00	50.00	40.00	50.00	33.00	45.00
141 lin.ft. manhole necks over 8 ft. deep	6.00	4.00	5.00	5.50	5.50	3.00	4.75	2.75	3.50	6.00	3.00	4.00
42 flush tanks	75.00	60.00	100.00	55.00	65.00	65.00	69.00	75.00	90.00	100.00	75.00	75.00
1000 lin.ft. 6-in. tile pipe	0.30	0.15	0.30	0.50	0.23	0.25	0.35	0.15	0.20	0.50	0.35	0.25
2000 cu.yd. rock	4.00	3.00	3.50	3.00	3.00	3.33	4.25	4.00	1.90	4.00	2.30	3.50
200 cu.yd. excavation, sewage treatment works	2.50	1.00	1.50	1.50	1.10	1.00	1.00	1.00	0.60	1.00	1.50	1.00
Disposal plant (lump sum)	$24,000	$18,000	$22,000	$18,750	$20,000	$20,562	$19,500	$17,665	$17,400	$20,640	$18,680	$23,500
Extended totals	$79,105	$70,695	$101,065	$90,782	$78,776	$80,133	$96,237	$95,548	$69,052	$80,446	$68,796	$79,127

	N	N-1	O	P	Q	R	S	T	U	V	W	X
Laying 8-in. pipe 4 ft. deep	$0.47	$0.36	$0.47	$0.55	$0.70	$0.36	$0.42	$0.40	$0.45	$0.57	$0.40	$0.58
Laying 8-in. pipe 4 to 6 ft. deep	0.48	0.44	0.60	0.60	0.75	0.41	0.47	0.44	0.60	0.63	0.59	0.63
Laying 8-in. pipe 6 to 8 ft. deep	0.60	0.63	0.65	0.67	0.80	0.50	0.52	0.57	0.70	0.78	0.63	0.75
Laying 8-in. pipe 8 to 10 ft. deep	0.75	1.01	0.93	0.82	0.85	0.58	0.62	0.78	0.85	0.98	0.78	0.88
Laying 8-in. pipe 10 to 12 ft. deep	1.15	1.25	1.15	1.05	0.90	0.75	0.77	1.09	1.25	1.27	1.00	0.98
Laying 8-in. pipe 12 to 14 ft. deep	1.25	1.63	1.50	1.35	1.00	0.85	0.89	1.26	1.50	1.83	1.33	1.12
Laying 8-in. pipe 14 to 16 ft. deep	1.38	1.81	1.54	1.48	1.10	1.42	1.10	1.58	2.00	2.41	1.81	1.48
Laying 8-in. pipe 16 to 18 ft. deep	1.90	2.56	1.86	1.81	1.20	1.71	1.50	2.07	2.50	3.32	1.99	1.63
Laying 8-in. pipe 18 to 20 ft. deep	2.10	3.11	2.25	2.00	1.30	1.92	2.50	2.26	3.20	4.38	2.08	1.83
Laying 10-in. pipe 4 to 6 ft. deep	0.71	0.55	0.70	0.65	0.60	0.35	0.50	0.53	0.65	0.71	0.58	0.79
Laying 10-in. pipe 6 to 8 ft. deep	0.85	0.68	0.75	0.75	0.85	0.67	0.60	0.65	0.75	0.86	0.62	0.89
Laying 10-in. pipe 8 to 10 ft. deep	0.90	1.20	0.95	0.99	0.90	0.75	0.72	0.86	0.95	1.06	0.87	1.21
Laying 10-in. pipe 10 to 12 ft. deep	1.20	1.53	1.20	1.20	0.95	0.96	0.87	1.17	1.20	1.35	1.09	1.33
Laying 10-in. pipe 12 to 14 ft. deep	1.30	1.75	1.21	1.35	1.00	1.40	1.00	1.34	1.60	1.91	1.42	1.63
Laying 10-in. pipe 14 to 16 ft. deep	1.50	1.95	1.54	1.55	1.20	1.80	1.25	1.67	1.90	2.50	1.90	1.71
Laying 10-in. pipe 16 to 18 ft. deep	1.95	2.63	1.90	1.85	1.25	2.40	1.75	2.15	2.25	3.42	2.08	1.98
Laying 10-in. pipe 18 to 20 ft. deep	2.50	3.08	2.30	2.20	1.35	3.00	3.00	2.34	3.00	4.48	2.17	2.22
Laying 15-in. pipe 4 to 6 ft. deep	1.20	0.83	0.95	0.85	0.90	0.97	0.72	0.73	0.95	1.00	0.81	1.31
Laying 15-in. pipe 6 to 8 ft. deep	1.30	0.90	1.00	1.00	0.95	1.08	0.77	0.84	1.25	1.21	0.85	1.33
Laying 15-in. pipe 8 to 10 ft. deep	1.40	1.42	1.40	1.25	1.00	1.28	0.87	1.09	1.40	1.39	1.10	1.71
Laying 15-in. pipe 10 to 12 ft. deep	1.60	2.25	1.65	1.55	1.10	1.56	1.10	1.42	1.70	1.75	1.30	1.89
Laying 15-in. pipe 12 to 14 ft. deep	2.50	2.50	1.90	1.85	1.20	2.10	1.30	1.61	2.10	2.21	1.65	2.26
Laying 15-in. pipe 14 to 16 ft. deep	2.50	2.75	2.00	2.10	1.25	2.40	1.50	1.99	2.25	3.62	2.13	2.43
Laying 15-in. pipe 16 to 18 ft. deep	2.75	3.10	2.05	2.25	1.30	3.30	2.15	2.49	3.00	4.55	2.31	2.61
Laying 15-in. pipe 18 to 20 ft. deep	2.75	3.65	2.25	2.45	1.40	4.20	3.50	2.74	3.50	5.61	2.40	2.84
Laying 15-in. pipe 20 to 22 ft. deep	2.75	4.15	2.40	2.75	1.50	5.10	5.00	2.99	5.50	6.61	2.60	3.08
Laying 18-in. pipe 6 to 8 ft. deep	1.40	1.29	1.10	1.85	1.10	1.25	1.15	1.16	1.40	1.49	1.01	1.73
Laying 18-in. pipe 8 to 10 ft. deep	1.90	1.81	1.15	2.00	1.20	1.45	1.30	1.41	1.60	1.76	1.32	2.11
Laying 18-in. pipe 10 to 12 ft. deep	2.10	2.06	1.75	2.30	1.25	1.72	1.75	1.56	2.25	2.20	1.50	2.29
Laying 18-in. pipe 12 to 14 ft. deep	2.60	2.41	2.00	2.50	1.30	2.00	2.20	1.94	2.40	2.79	1.87	2.65
Laying 18-in. pipe 14 to 16 ft. deep	2.75	2.59	2.25	2.70	1.40	2.60	2.50	2.36	2.75	4.27	2.35	2.83
Laying 18-in. pipe 16 to 18 ft. deep	3.20	3.69	2.50	3.00	1.50	3.50	3.00	2.54	3.00	5.26	2.53	3.06
Laying 20-in. pipe 6 to 8 ft. deep	1.55	1.60	1.50	2.10	1.30	1.62	1.50	1.31	1.85	1.67	1.31	1.96
Laying 20-in. pipe 8 to 10 ft. deep	1.70	2.18	1.60	2.40	1.40	1.75	1.67	1.56	2.25	1.94	1.56	2.40
Laying 20-in. pipe 10 to 12 ft. deep	2.10	2.43	1.90	2.70	1.50	2.00	2.00	1.71	2.60	2.38	1.75	2.52
Laying 20-in. pipe 12 to 14 ft. deep	2.70	2.78	2.20	3.00	1.60	2.40	2.50	2.12	3.00	2.97	2.10	2.88
Laying 20-in. pipe 14 to 16 ft. deep	3.30	3.50	2.50	3.25	1.70	3.00	3.00	2.50	3.50	4.45	2.69	3.12
500 lin.ft. deep sewer connections	0.35	0.22	0.40	0.60	0.80	2.00	0.75	0.19	2.00	0.20	1.00	0.18
3 M ft. b.m. lumber	30.00	42.00	50.00	40.00	30.00	15.00	50.00	48.00	15.00	40.00	35.06	35.00
14 tons c.i. pipe	40.00	35.00	35.00	35.00	30.00	25.00	50.00	45.00	100.00	35.00	40.00	25.00
10 cu.yd. extra concrete	9.00	15.00	7.00	8.00	7.00	7.00	10.00	12.00	15.00	7.00	10.00	8.00
63 manholes 6 ft. deep	36.00	45.00	37.00	32.00	50.00	33.00	17.00	65.00	38.00	40.00	40.00	50.00
52 manholes 6 to 8 ft. deep	38.00	52.00	40.00	38.00	55.00	38.00	50.00	75.00	40.00	45.00	50.00	60.00
141 lin.ft. manhole necks over 8 ft. deep	4.00	4.00	5.00	3.90	1.00	40.00	7.00	5.00	5.00	6.00	4.00	5.00
42 flush tanks	80.00	85.00	85.00	98.00	175.00	90.00	100.00	60.00	120.00	100.00	60.00	75.00
1000 lin.ft. 6-in. tile pipe	0.30	0.16	0.20	0.60	0.30	0.20	0.75	0.19	0.50	1.00	0.50	0.18
2000 cu.yd. rock	3.50	3.00	3.50	2.00	4.00	3.00	3.00	2.75	4.25	4.50	3.50	3.50
200 cu.yd. excavation, sewage treatment works	1.00	0.70	0.70	0.90	2.00	0.50	1.00	1.00	0.60	2.50	1.00	0.75
Disposal plant (lump sum)	$17,585	$17,700	$19,500	$10,000	$20,000	$20,000	$22,000	$19,000	$22,000	$20,000	$16,500	$18,275
Extended totals	$73,671	$79,032	$77,350	$67,329	$83,581	$76,381	$75,143	$74,105	$90,117	$94,004	$73,278	$82,133

Robbins & Myers Co., Springfield, Ohio, advises us that newspaper reports about the damage to its plant by fire were exaggerated. The electrical plant was not damaged, and there will be no interference in filling orders for motors, generators and fans. Arrangements have already been made with manufacturers in the vicinity for the use of their foundries until a new one can be built. The only delay which will be occasioned will be in transferring patterns from the present plant to the new foundries. Work was started Monday cleaning away the débris, and a modern foundry will be built. The loss was entirely covered by insurance.

The Pelton Water Wheel Co., San Francisco, Cal. Catalog. Turbine and tangential water wheels. Illustrated, 102 pp., 6x9 in.

A. O. Norton, Inc., 286 Congress St., Boston, Mass. Catalog No. 28. Ball-bearing jacks. Illustrated, 50 pp., 6x9 in.

The Holt Mfg. Co., Peoria, Ill. Bulletin T. E. 69. The "Baby Caterpillar" tractor. Illustrated, 24 pp., 7x10 in.

Independent Pneumatic Tool Co., Thor Building, Chicago, Ill. Circular. Thor electric drills. Illustrated.

BUILDINGS—Continued from page 372

Athol, Mass.—[illegible]

+Boston, Mass.—The contract for the construction of a [illegible] has been awarded to [illegible] Ave. It will [illegible]

+The contract for the construction of a Nurses' Home, [illegible] Infirmary [illegible]

Holyoke, Mass.—[illegible] Help [illegible]

Providence, R. I.—[illegible] has been [illegible]

+Providence, R. I.—The contract for [illegible] JOHN & FLYNN [illegible]

The City Council has appropriated [illegible] for the construction of [illegible] Mayor [illegible]

[illegible] will build a school on [illegible] The building will be of brick, stone and steel, five stories and basement. [illegible]

+Greenwich, Conn.—The contract for the construction of the [illegible] building has been awarded to JACOB ZIMMERMAN, [illegible] New York, N. Y. It will be [illegible]

New Haven, Conn.—Bids will be received about Feb. 1 for [illegible] to the building [illegible] Hospital Association. L. W. Robinson, [illegible] Church St., is a [illegible] Noted Dec. [illegible]

+Norwalk, Conn.—The contract for a two-story school on [illegible] Ave. has been awarded to H. W. MATHER, Norwalk. Noted Oct. 1.

Dunkirk, N. Y.—James L. Droken, Mgr. Droken Theater, [illegible] Ave. and will erect theater to cost about $[illegible]

New York, N. Y.—(Borough of Manhattan)—Plans are being drawn by Lewis F. Pilcher, State Arch., Albany, N. Y., for a three-story [illegible] hospital on Ward's Island. The New York State Hospital Commission will have charge of the work, [illegible]

+(Borough of Brooklyn)—Contract for additions and alterations to [illegible] has been awarded to FRYMIER & HANNA [illegible] Manhattan. Noted Dec. 3.

(Borough of Brooklyn)—The Maternity Hospital Society of [illegible] New York has been incorporated to secure funds and build a hospital in that section. Of the [illegible] has been subscribed. Dr. [illegible], 329 Stone Ave., East New York, is interested.

(Borough of Bronx)—Bids will be received about Jan. 15 for the four-story [illegible] hospital for the Bronx Hospital Association. Louis A. Abramson, 220 Fifth Ave., is Arch. Noted Oct. 1.

(Borough of Manhattan)—Bids were received [illegible] by the Board of Trustees of the Bellevue Hospital, for alterations to the main building of Harlem Hospital, as follows: [illegible]; Andrews Bldg. Co., $[illegible]; [illegible]; Wm. H. Egan, $[illegible]; Marble [illegible]; A. W. King, $[illegible]; Lincoln Steel, Fleming Co., $[illegible]

Rochester, N. Y.—The Knights of Pythias are considering building a $[illegible] temple. [illegible] has the matter in charge.

White Plains, N. Y.—A special committee has been appointed [illegible] Supervisors of Westchester County, to investigate [illegible] plans for a new courthouse. [illegible]

[illegible]

Belleville, N. J.—[illegible]

Camden, N. J.—The Board of Education [illegible]

Cliffside Park, [illegible] N. J.—The Board of Education [illegible]

Jersey City, N. J.—[illegible]

[illegible]

North Bergen, [illegible] N. J.—The Board of Education [illegible]

Summit, N. J.—The Board of Education is [illegible] for the construction of a new [illegible]

Carnegie, Penn.—[illegible]

Scranton, Penn.—[illegible]

Washington, D. C.—Harry Wardman, 1416 K St., has had plans prepared by F. B. White & Co., 1412 14th St., N. W., for four [illegible] to cost about $[illegible], three to be located at [illegible] and one at 18th and Swann St.

Richmond, Va.—The City has commissioned Carneal & Johnston, [illegible] Archs. for the municipal building. The plans call for a structure divided in three sections and calling for a library, auditorium, five courts, lecture rooms, etc. The cost will be over $[illegible]

Savannah, Ga.—Bids will be received by Robert M. Hicks until Dec. 12 for erecting the hotel on Congress St. Noted Sept. 17.

Clearwater, Fla.—The lowest bid submitted to the County Commissioners for erecting the court house, was that of the [illegible] Construction Co., [illegible], Fla., at $146,[illegible]

Louisville, Ky.—Four stories will be added to the Tyler Hotel and the front will have an addition of [illegible] ft. The present building is eight stories. N. Bower is Mgr. of the hotel.

Plans are being prepared by John Bacon Hutchings, [illegible], for a Y. W. C. A. building. It will cost $[illegible] and be located at Broadway and Second St.

+The contract for the Crescent Hill school has been awarded to GEORGE L. HOMMEL CO., at $[illegible]

Nashville, Tenn.—Press reports state that bids will be received about Feb. 1 for a new medical school and at Vanderbilt University. This will be known as the Carnegie Bldg., will be four stories and cost $[illegible]. Samuel Hannaford & Sons, [illegible] and Sixth St., are Archs.

+Cleveland, Ohio.—The contract for the construction of the eight-story and basement, [illegible]-ft. building for the [illegible] Co., has been awarded to METTLER-GLOYD & CO., [illegible] Ave. Estimated cost, $1[illegible],000. Noted Aug. 13 and Sept. 17.

Hammond, Ind.—Plans are being prepared by Max Turner, Arch., Citizens National Bank Bldg., Hammond, for the construction of a $[illegible] grade school on [illegible] Ave.

Detroit, Mich.—Bids will be received until 1 p.m., Jan. 4, 1915, by the Library Commission, Farmer and Gratiot St., for the excavation and foundation work for the New Main Library. Cass Gilbert, 11 East 24th St., New York, N. Y., is Arch.

Lapeer, Mich.—The Michigan Central R.R. and the Grand Trunk Ry. plan the construction of a [illegible]-ft. freight depot near the Grand Trunk passenger station.

Chicago, Ill.—Erich J. Patelski, Arch., 162 West Washington St., has prepared plans for the construction of a three-story brick store and apartment building, on [illegible] Ave., for R. Kennell, 919 North Fairfield Ave. Estimated cost, $40,000.

Superior, Wis.—Bids will be received about Jan. 1, by [illegible], Arch., 1900 Euclid Ave., Cleveland, Ohio, for the construction of an asylum for the Wisconsin [illegible]. Estimated cost, $[illegible],000. Noted July 16.

Des Moines, Iowa.—Fleming Bros., Inc., plans the construction of a twelve-story fireproof addition to the Fleming Bldg. The estimated cost is $160,000.

Duluth, Minn.—Plans are being prepared by Shutick & [illegible], Archs., for the construction of a four-story apartment at Superior St. and Tenth Ave., E., for the [illegible] Investment Co., of Philadelphia, Penn. Estimated cost, $[illegible]

Minot, N. D.—Olaf A. Olsen plans the construction of a five-story, [illegible]-ft. store and office building on [illegible] St. Estimated cost, $[illegible]

Kansas City, Mo.—The Pratt & Thompson Construction Co. will construct an eight-story building at Tenth and Wyandotte St. for Mrs. Anna M. Mason, [illegible] East Armour Blvd. Estimated cost, $[illegible]. S. R. Tarbet is Arch.

El Paso, Tex.—The County Commission of El Paso contemplates the construction of a $[illegible],000 courthouse and county building.

Prescott, Ariz.—W. H. Day, Interstate Secy., Y. M. C. A., Tucson, and G. C. [illegible], District Secy., Denver, Colo., are contemplating the construction of a $[illegible] Y. M. C. A. building at Prescott.

+Eugene, Ore.—Contracts for the construction of the [illegible] two-story and basement National Guard Armory have been awarded as follows: [illegible] VAN PATTEN, [illegible]; W. KIRK [illegible], Portland, wiring, $[illegible]; VALLEY HEATING & [illegible] CO., [illegible], heating, $[illegible]. Noted June 18.

Auburn, Calif.—[illegible]

Hawthorne, Calif.—W. C. Pennell, Arch., is preparing plans for the construction of a one-story and basement school. Estimated cost, $[illegible]

+Lindsay, Calif.—The contract for the construction of the [illegible] school has been awarded to [illegible] & JOHNSON, [illegible]. Estimated cost, $[illegible]. Noted [illegible]

+Los Angeles, Calif.—The contract for the construction of a [illegible] for the [illegible] has been awarded to the WILLIAM SIMPSON CONSTRUCTION CO. Estimated cost, $[illegible]

San Francisco, Calif.—Bids will soon be received by the [illegible] for the construction of a [illegible] Branch [illegible]

Visalia, Calif.—The [illegible] Building Association, recently [illegible] contemplates the construction of a [illegible] at Visalia.

Guelph, Ont.—The Board of Education contemplates the construction of an addition to the Collegiate Institute [illegible]. Estimated cost, $[illegible]. J. M. [illegible] is [illegible]

+Point Grey, B. C.—Contracts for the construction of the [illegible] have been awarded as follows: [illegible] KYDD [illegible], 1[illegible] Granville St. [illegible]

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

Railways Allowed Substantial Rate Increase

The Interstate Commerce Commission handed down the Rate Decision on Friday which allowed one hundred railway companies in the East to increase their rates on certain classes of freight. The advance, which will amount to 5% in some cases, will average 3½ to 4%, and mean an increase in the revenue of $30,000,000 to $35,000,000 per year. Decision was affirmed by a vote of 5 to 2, Commissioners Harlan and Clements dissenting.

This decision was the result of reopening the case after the war started. That the war had an influence on the decision is seen from the following extract of the opinion:

"Whatever the consequences of the war may prove to be we must recognize the fact exists; the fact that it is a calamity without precedent and the fact that by it the commerce of the world has been disarranged and thrown into confusion. Collectively they (war conditions) present a new situation."

By many it is argued that the increase in rates is not the important part of the decision, but the change in temper of the commissioners who are aiding the railways by their counsels. That the entire country has changed its opinion of the railway situation is evident from the decision and the referendum vote in Missouri repealing the "Full Crew Law."

Physical Valuation of Railways Criticized—When the valuation work was started Congress appropriated about a million and a half dollars for expenses. Beginning on an entirely new subject, it was to be expected that many mistakes would be made, but it was not contemplated that practically the whole of the first year's work would go to waste, says the "Journal of Commerce." While officials of the Commission would attempt to refute the statement that nothing tangible had been accomplished with the million and a half appropriated by Congress, here are many railroad experts who assert that the work done has proven of very little, if any, use. It is now learned that the Commission is contemplating asking Congress for an appropriation of three million dollars for the physical valuation work during the coming year. The Government, it is said, is not at present in any position to make large appropriations. The European war has reduced the customs revenues and the war revenue tax was placed upon the statute books for but one year.

A number of railroad experts question whether any direct good is to be accomplished by making a physicial valuation of the railroads of the United States. Theoretically it would be a good step inasmuch as the Interstate Commerce Commission might then have some comprehensive basis for making rates, and then it would be easy to establish the desirability of new security issues. But already the physical valuation work has raised a new crop of critics. The theory upon which the Commission is basing this work has been adversely discussed in many quarters. It was the subject of a special report and discussion by the National Association of Railway Commissioners, who convened here last month. The question was raised after obtaining the first cost value of railroad property. How is the Government to establish the present value of this property following many years of usage?

The Physical Valuation Board has provided for a "condition per cent." account, but even this has been criticized as an arbitrary matter and wholly impracticable. In the first place, it was asked, What is the meaning of "condition per cent." If the condition per cent. is fixed at 75 per cent., would it mean that one-quarter of the life of the ties had expired, or that three-quarters of them were as good as it was practicable to maintain them, or that one-quarter of them should be immediately replaced, or that the present value was 75 per cent. of the present cost of laying them, or that the average tie was about three-quarters as good as new. This same question might arise as to any class of property of the railroads.

The schedules of valuation advanced by the Commission might all be discussed just as adversely as the "condition per cent." mentioned herewith. Probably the most important of these items is that of abandoned property. The railroads might reasonably ask the Commission what is to be done with abandoned property. Even granting that it will be comparatively easy to estimate the value of abandoned property, the question still arises, What effect such property is to have on the rate basis? When the property is abandoned for the best interests of the road it appears to be reasonable to suppose that a road should not be compelled to lose on that account. If the reasonableness of rates is to be measured by the physical value of the property used in transportation, the abandoned property still on the hands of the roads should be estimated into this valuation. Furthermore, it was suggested to the Commission that "abandoned property" should be divided into two classes, namely, that property which has been abandoned and sold by the railroads and that property which is no longer used in the business of transportation, but which is still in the possession of the roads.

Higher Ocean Freight Rates

Rates for shipment on the seas have risen in a perpendicular way since the middle of October, and are now higher than before in years. As an example, foreign vessels have recently been chartered to take cotton to Scandinavian ports at a rate of $1 to $1.30 per 100 lb. The rate for grain from the Atlantic seaboard to Liverpool, which was 2¼d. last year, has risen to 7d. Flour, which was 14 cents then has advanced to 26 cents. The National City Bank has received a cable from its Buenos Aires branch, saying that ship owners can obtain very lucrative rates for sailing at that port from January to July, both for steam and sail tonnage. Those familiar with maritime matters predict that a rate of 10s. will be paid for grain shipment before the highest figures are reached. The causes are well known. For example, there are approximately 42,000,000 gross tons of shipping available by the maritime nations. This includes some coastwise trade and also more than 2,000,000 tons on the Great Lakes of the United States. There has been taken from this, since the war started, 3,500,000 gross tons of German and Austrian vessels, which has been inturned at neutral ports, in home waters, or captured. A quarter of a million tons have been lost by British ship owners to the Germans, and perhaps 350,000 tons, vessels of all nations, have been lost by mines. In addition, the British Government has commandeered 500 vessels, with a gross tonnage of 1,700,000, to transport troops from various parts of the world. This makes a total of nearly 6,000,000 tons, or approximately 15% of the world's tonnage available in ordinary times, but at present of no use as far as cargo-carrying trade is concerned. In addition to this, the element of time in making a voyage has a great deal to do with the matter. Vessels are held up for days and even works, in part owing to naval operations.

Navigation is impeded by the restricted use of the wireless, the lack of proper beacons; but more than all of this, there is the fact that a great deal more traffic has to be moved, particularly to Great Britain; where formerly ships were heavily laden on outbound voyages from London and British ports, now they go light, coming back with full cargoes. Considerable difficulty has also been experienced in securing coal at home ports and ordinary coaling stations. Then, too, the price of coal in the Southern Hemisphere and Mediterranean and Asiatic ports is very much higher than at any previous time.

The Steinway Tunnel, a tube extending from Long Island City under the East River to the Borough of Manhattan, New York, will be open for travel April 1, according to a recent statement by Theodore P. Shonts, Pres. of the Interborough, who said a temporary service will be started at that time. Trains from Jackson Ave., Long Island City, will run to a temporary station at 41st St. and Lexington Ave., Manhattan. The tunnel has been practically completed for several years, but never opened because of litigation.

The Bucyrus Co., South Milwaukee, Wis., has just received an order for a levee building machine from the United States Army Engineer's office for the Fourth District. This office is located at New Orleans. The machine cost approximately $44,000. It is reported that another machine of a similar design will be ordered for levee work in the spring.

RAILWAYS

North Carolina—[illegible] R.R.—This company [illegible] from [illegible] to Cape [illegible] N. C.

Georgia—[illegible] R.R.—This company will [illegible] Perry to Macon. [illegible] is Pres.

✚ Alabama—[illegible] & [illegible] R.R.—This company has awarded a contract to THOMAS [illegible] for the construction of a [illegible] from [illegible] Ala.

Louisiana—[illegible] R.R.—This company [illegible] to construct a line from Monroe [illegible] The capital stock is [illegible] and the company is controlled by [illegible]

Illinois—[illegible] R.R.—This company will make the following improvements [illegible] track work [illegible] Contracts have been awarded to the following: [illegible] WINSTON [illegible] WALSH CONSTRUCTION CO., Davenport, Iowa.

Chicago & Illinois [illegible] R.R.—Plans are being [illegible] of this company to connect with the Wabash R.R. [illegible] F. [illegible] 732 [illegible] Ave., Chicago, Ill., is Pres.

North Dakota—[illegible]—Surveys are being made by this company for an extension from [illegible] N. D. to [illegible] Forks [illegible]

Arkansas—[illegible] R.R.—This company [illegible] with the Rock Island R.R. [illegible] three miles north of [illegible] The estimated cost is [illegible]

Colorado—[illegible] R.R.—This company has made [illegible] the Colorado & [illegible] right-of-way [illegible]

Idaho—Oregon Short Line R.R.—The [illegible] of Caldwell, Idaho, are preparing to [illegible] the electrification of this company's [illegible] from Caldwell to [illegible] about 11 miles [illegible] is Chm. Noted Dec. 3.

California—[illegible] Los Angeles & Salt Lake R.R.—Press reports state that this company has applied to government for right-of-way through Angeles Forest Reserve for its proposed line from [illegible] to San [illegible] Surveys have been made. The line would be about [illegible] miles long and would cost about [illegible]

ELECTRIC RAILWAYS

Worcester, Mass.—The Worcester Consolidated St. Ry. Co. is considering plans for the extension of its [illegible] line to [illegible] H. C. Page, Worcester, is Gen. Mgr. Noted [illegible]

Providence, R. I.—The Rhode Island Co. has been petitioned to extend its North Main St. line to the state line in [illegible] A. E. Potter, Providence, is Pres. and Gen. Mgr.

Middletown, Conn.—The Middletown & [illegible] Ry. Co. is considering plans for the extension of its electric railway through [illegible] Higganum and Middletown. [illegible] is interested.

Torrington, Conn.—The Torrington Traction Co. is being organized to construct an electric interurban railway from Torrington to [illegible] are interested.

Batavia, N. Y.—The Batavia Traction Co. is preparing plans for a [illegible] line from Batavia to [illegible] Lake. The line will connect with the [illegible]

Depew, N. Y.—The Buffalo & Depew Ry. Co. is considering plans for the extension of its line [illegible] Depew to [illegible] about six miles. [illegible] is Pres.

Horizon, Fla.—Plans are being prepared by the [illegible] for the construction of about [illegible] miles of new track. [illegible] is Pres. and Gen. Mgr.

New Orleans, La.—The [illegible] Kenner Electric Ry. Co. will build [illegible] in New Orleans.

Somerset, Ky.—The [illegible] Co. recently [illegible] bonds for [illegible] the proceeds of which will be used for the extension of its electric railway from Somerset to [illegible] is Mgr.

Cleveland, Ohio—The [illegible] to extend its [illegible] George L. [illegible] Cleveland, is Gen. Mgr.

The [illegible] has been incorporated to construct an electric railway in Cleveland Heights. The incorporators are [illegible]

The Cleveland, [illegible] & [illegible] Ry. Co. has been incorporated to construct a [illegible] railway [illegible] from the lake front to [illegible] The incorporators are [illegible]

Adrian, Mich.—According to press reports [illegible] for the construction of an electric railway [illegible]

Detroit, Mich.—The [illegible] has been asked to consider plans for the extension of its tracks on the west [illegible] Detroit is Gen. Mgr.

Menominee, Mich.—The Menominee & Marinette Light & Traction Co. [illegible] Manager, [illegible] is Sec. and Gen. Mgr.

Muskegon, Mich.—The [illegible]-Michigan Ry. Co. has secured franchises, right-of-way and terminal properties for its proposed line between Muskegon and [illegible]

Alton, Ill.—The Alton & Eastern Electric Ry. Co. is making arrangements for the extension of the Alton St. line from Alton to the new hospital east of Alton. T. W. Gregory, East St. Louis, is Secy.

Amboy, Ill.—The Lee County Central Electric Ry. Co. [illegible] to build a [illegible]-mile line from Middleburg to Rochelle during 1915.

Cascade, Mo.—The Ozark Valley Ry. Co. has been incorporated to construct an electric railway from Cascade to Williamsville. The incorporators are [illegible] J. T. Long, Kansas City; James K. Cochran, Pana, Ill.; James H. Downes, Assumption, Ill., and G. A. Long, Kenner, Mo.

Argenta, Ark.—The City Council has granted a franchise to the Argenta Ry. to extend its line on Washington Ave. F. W. [illegible], Little Rock, is Vice-Pres. and Ch. Engr.

Calico Rock, Ark.—S. J. Johnson, Calico Rock, and associates are interested in the construction of an electric railway from Calico Rock to Hoxie.

Glendale, Calif.—The Glendale & Montrose Ry. Co. is preparing to award contracts for the construction of an electric railway from Glendale to Eagle Rock.

Los Angeles, Calif.—The City Council will offer for sale a [illegible]-year franchise to construct an electric railway on portions of Brooklyn, Wabash and Evergreen Ave.

Pasadena, Calif.—The Council has granted a franchise to the Pacific Electric Ry. Co. to double-track its line on North Lake Ave. from Colorado to Washington St. J. McMillan, Los Angeles, is Gen. Mgr.

San Francisco, Calif.—Plans are being prepared by M. M. O'Shaughnessy, City Engr., for the construction of the proposed municipal electric railway through Golden Gate Park to the Sunset District.

LIGHT, HEAT AND POWER

Buffalo, N. Y.—The lowest bids received by the Department of Public Works for the equipment of the power and lighting plant for the new Porter Ave. pumping station were those of McIntosh & Seymour, Auburn, N. Y., at [illegible] and [illegible] and McCarthy Bros. & Ford, Buffalo, [illegible] and [illegible]. Francis G. Ward is Comr. of Pub. Wks.

Poland, N. Y.—It is reported that the villages of Poland and Cold Brook are considering the construction of a joint electric-light plant to furnish light and power to both villages.

Newark, N. J.—The Public Service Electric Co. and Public Service Gas Co. have issued [illegible] and [illegible] respectively of capital stock in accordance with permission granted by the Board of Public Utility Commissioners for extensions and improvements to plants and systems.

The [illegible] & Waldstein Co., manufacturing chemists, plans to build a hollow-tile and reinforced-concrete power plant, to cost about [illegible] at its factory on [illegible] Ave.

West Monroe, La.—See item under "Water Supply—Irrigation."

Uniontown, Ky.—The Uniontown Light & Power Co. is reported to be considering plans for improvements and extensions to the local plant. P. A. McIntire is Secy. and Treas.

Cleveland, Ohio—Bids will be received until noon Dec. [illegible] by the Commissioner of Purchases and Supplies, 513 City Hall, for rubber-covered lead-encased cable for the [illegible] electric-lighting system. F. W. Ballard, 1443 East Third St., is [illegible] of Light and Heat Dept.

New Philadelphia, Ohio—Press reports state that the [illegible] Co. plans a number of improvements to its plant at New Philadelphia. C. H. Howell, Coshocton, Ohio, is Vice-Pres. and Mgr. of the company.

✚ Norwood, Ohio—The Board of Control has awarded contracts in connection with the rebuilding of the municipal electric-light plant to: The NAUGLE POLE & TILE CO., Chicago, for poles; the WESTERN ELECTRIC CO., wiring, insulators and cross-arms; the BEATTIE ELECTRIC CO., new leads for old generators. Noted July [illegible]

Youngstown, Ohio—The Public Utilities Commission has authorized the Mahoning Light & Power Co., recently organized, to issue [illegible] in bonds, the proceeds of which will be used to build a plant. The company was granted permission to purchase the plant of the Youngstown Heating Co. for [illegible]

✚ Indianapolis, Ind.—The Board of Park Commissioners has awarded the contract for lighting the parks, bridges and boulevards for a period of ten years to the MERCHANTS HEAT & LIGHT CO. The price based on the initial installment is [illegible] a year. At the expiration of the contract all equipment becomes the property of the city. Thomas A. [illegible] is City Clk.

Grantsburg, Wis.—A special election will soon be held to submit to the voters the question of granting a franchise to the Grantsburg Light & Power Co. for installing and operating an electric-light and power plant in Grantsburg.

Stillwater, Minn.—The City Council is considering the establishment of a municipal electric-light plant in Stillwater. The present contract with the [illegible] Power Co. for street lighting expires next April. [illegible] is City Clk.

Larned, Kan.—Bids will be received until Jan. 18 for the construction of a municipal electric-light plant in Larned. The equipment will include two motor-driven turbine pumps, one [illegible]-kw. and one [illegible]-kw. generating unit, direct-connected, and distributing system complete. Worley & Black, [illegible] Bldg., Kansas City, Mo., are Engrs.

Hecla, S. D.—It is reported that a company formed of local business men has been granted a franchise by the Town Board to construct and operate an electric-light plant in Hecla.

Flaxville, Mont.—According to press reports the Flaxville Commercial Club is promoting a plan for the establishment of an electric-light plant in the town.

Pine Bluff, Ark.—The City of Pine Bluff is considering the purchase of the electric-light plant and water works system. Improvements and extensions will be made if the transaction is completed. W. A. Lee is City Clk.

Marble Falls, Tex.—It is reported that the Colorado River Power Co., Marble Falls, plans to build transmission lines from its hydro-electric plant, now in course of construction, to Houston and neighboring cities and towns. Noted July 9.

Bedrock, Okla.—See item under "Water Supply-Irrigation."

Red Cliff, Colo.—It is reported that John Fleming, Red Cliff, is considering the establishment of an electric-light plant to serve the town, and will shortly apply for a franchise.

White Oaks, N. M.—The Wild Cat Mining Co. is building a new electric power plant to supplement the present one. A total of 1100 hp. will be available. The company will extend its transmission lines to the properties of the Parsons Mining Co. and the American Mining Co. Noted Sept. 10, under Carrizozo, N. M.

Montesano, Wash.—The Northwest Electric & Water Works Co. has had plans prepared for an electric-power plant to be ready for operation by spring. The plans call for a steam-power plant to be located on the water front.

+Seattle, Wash.—The Board of Public Works has awarded contracts for furnishing distributing transformers for the municipal electric-light plant to the FORT WAYNE ELECTRIC CO., Colman Bldg., Seattle, at $27,972 and the PITTSBURG TRANSFORMER CO., Pittsburgh, Penn., at $5000. Noted Dec. 3.

+Gold Hill, Ore.—The City Council has awarded the contract for lighting the city for a period of ten years to the CALIFORNIA-OREGON POWER CO. The system will consist of 183 cluster lights, 35 single lights on wooden standards and 16 lights on iron standards. Bids for its installation will be received until Jan. 4. B. G. Harding is City Recdr. Noted Dec. 17.

Pasadena, Calif.—It is reported that the City Trustees contemplate the installation of new equipment, costing about $46,000 in the municipal electric-light plant. C. W. Koiner is Gen. Mgr. and Ch. Engr. of the plant.

+Stockton, Calif.—The City of Stockton has awarded the contract for lighting the streets and boulevards of the city for a period of five years, beginning Dec. 15, to the WESTERN STATES GAS & ELECTRIC CO., of California. Some additions will be made to the system.

BRIDGES

Woonsocket, R. I.—The City Council has passed a resolution appropriating $75,600 to be used for straightening the lower end of Hamlet Ave. between Davison St. and Cumberland St., and replacing the two wooden bridges between those points with one reinforced concrete bridge over the Hamlet Trench and the Blackstone River. F. H. Mills is City Clk.

Oswego, N. Y.—At a special election held, Dec. 11, the taxpayers of the towns of Oswego and Volney voted in favor of building a reinforced concrete bridge over the Oswego River at Minetto, Oswego County. The bridge will be located at Benson Ave., about 1800 ft. south of the present structure at Mineto. The estimated cost is $91,414.

Paterson, N. J.—The Board of Chosen Freeholders of Passaic County has instructed Garwood Ferguson, County Engr., to prepare plans for a bridge across the Passaic River from the Pennington Park property to Westside Park. Alternative plans for a concrete arch bridge and a two-span steel bridge will be submitted to the Park Board for approval. It is said that either bridge will cost aproximately $45,000.

+Perth Amboy, N. J.—The Board of Chosen Freeholders of Middlesex County, New Brunswick, has awarded the contract for pile and timber rest piers under the draw span of the Amboy Bridge over the Raritan River, to the GENERAL CONTRACTING & ENGINEERING CO., 29 Broadway, New York, N. Y., at $4942. Other bidders were: Rhodes & Manvel, Elizabeth, N. J., $6500, and H. H. Holmes, Jersey City, $11,900. Noted Dec. 3.

Trenton, N. J.—The Pennsylvania R.R. has submitted a plan to the Board of City Commissioners to eliminate navigation on the waterway of the Delaware & Raritan Canal, and construct permanent bridges at the following street crossings: Hermitage Ave., Prospect, Willow, North Warren, West Hanover, North Broad and North Montgomery Sts.; estimated cost, $125,000.

+Nanticoke, Penn.—(Official)—The Dravo Contracting Co., Pittsburgh, general contractors for the construction of the bridge over the Susquehanna River between Nanticoke and West Nanticoke, has awarded a sub-contract for the concrete piles required for the structure to the RAYMOND CONCRETE PILE & FOUNDATION CO., 11 Pine St., New York, N. Y. D. A. Keefe, Athens, Penn., is Consult. Engr. Noted June 25 and July 23.

Norristown, Penn.—Press reports state that the Commissioners of Montgomery County are considering the construction of two new bridges in Frederick Township, one over Sciota Creek, on the road leading from Swamp Rd. to Little Rd., estimated cost, $2500, and the other over Goshenhoppen Creek on the road from Zieglerville to Spring Mount, estimated cost, $2000.

Allen, Md.—(Official)—Bids will be received until noon, Dec. 29, by the State Roads Commission, 601 Garrett Bldg., Baltimore, for the construction of a reinforced concrete bridge over the creek, between Wicomico and Somerset Counties, near Allen, Md. Contract No. 094-A. O. E. Weller is Chn., and William L. Marcy is Secy. of the State Roads Comn.

Baltimore, Md.—Bids will be received until Dec. 29, by the State Roads Commission, Garrett Bldg., for the construction of a draw rest pier for the Dover Bridge, Talbot and Caroline Counties.

Covington, Va.—(Official)—Bids will be received until noon, Jan. 4, by the Clerk of the Circuit Court of Alleghany County for the construction of a 100-ft. bridge over Dunlaps Creek, 5½ miles from Alleghany; superstructure to be either of steel or reinforced concrete with concrete substructure.

Gate City, Va.—(Official)—Bids will be received until 1 p.m., Jan. 5, by the Clerk of the Circuit Court of Scott County for the construction of a bridge over Big Moccasin Creek about 6½ miles from Gate City. It will be 87½ ft. long with a 12-ft. roadway.

Lynchburg, Va.—(Official)—Plans for the 1700-ft. viaduct over the James River, to be built jointly by the city, Amherst County, the Chesapeake & Ohio, the Norfolk & Western and the Southern Ry., are still in the preliminary stages. A special act of the Legislature authorizing its construction will be necessary, and nothing further will be done until this is passed. Noted July 16 and 30, Nov. 19.

Radford, Va.—The City Council is considering a bond issue of $12,500 to be used for the construction of a bridge over the New River.

Richmond, Va.—(Official)—Bids will be received until noon, Jan. 4, by the Clerk of the Circuit Court of Henrico County for a reinforced concrete bridge over the Chickahominy River between Hanover and Henrico Counties, about two miles from Glen Allen. The structure will have three spans of 31½ ft. each, with a 12-ft. roadway. The Childrey Co., Richmond, is Engr.-in-Charge.

Shelby, N. C.—(Official)—We are advised by S. S. Royster, Pres. of the Shelby Northern Ry. Co., that bids will probably be asked within the next 60 days for the construction of two bridges on the proposed railway from Shelby to Casar, N. C. Noted Dec. 17.

+Folkston, Ga.—(Official)—The Commissioners of Charlton County have awarded the contract for constructing a bridge over St. Mary's River between Charlton County, and Nassau County, Florida, to E. F. DEAN, Sr., Folkston. Noted Dec. 3.

Bradentown, Fla.—(Official)—All bids received, Dec. 11, by the Board of Public Works for the construction of a Scherzer rolling lift bridge were rejected. W. H. Tracy is Comr. of Pub. Wks. Noted Dec. 10.

Fort Lauderdale, Fla.—Bids will be received until Jan. 4, by Z. T. Merritt, Clk. of the Bd. of Comrs. of Dade County, for the construction of steel drawbridge with approaches and abutments over the New River at Fort Lauderdale. Noted July 23, Aug. 20, Oct. 22 and Nov. 19.

+Vicksburg, Miss.—(Official)—The Boards of Supervisors of Warren and Hinds Counties have awarded the contract for the construction of a 520-ft. bridge over the Big Black River at Holt's Ferry near the Alabama & Vicksburg Ry., to the VINCENNES BRIDGE CO., Vincennes, Ind., at $9708. Other bidders were: Virginia Bridge & Iron Co., $11,450; W. T. Young, $9772; A. M. Blodgett Construction Co., $11,186; Central States Bridge Co., $11,990; Midland Bridge Co., $14,456; Owens Construction Co., $17,778. Noted Oct. 29, Nov. 19 and 26.

Covington, Ind.—(Official)—Bids will be received until 1:30 p.m., Jan. 7, by the Board of Commissioners of Fountain County for the construction of a bridge over the Wabash River at Covington. It will consist of a steel superstructure with concrete abutments and piers. The estimated cost is $40,000. J. G. B. Short is County Engr. W. B. Gray is Audr. Noted Dec. 3.

+Greensburg, Ind.—(Official)—The Board of Commissioners of Decatur County has awarded contracts for bridge construction in the county to the BURK CONSTRUCTION CO., Newcastle, Ind., at $7180; CENTRAL STATES BRIDGE CO., Indianapolis, $945, and BARRINGER & CO., Greensburg, $3229. Noted Dec. 10.

+South Bend, Ind.—(Official)—The Grand Trunk Western Ry. has awarded the contract for the construction of a new railway bridge at South St. Peter St. to CHARLES GORDON. Noted Dec. 17.

+Keokuk, Iowa—Press reports state that the contract for rebuilding the Keokuk-Hamilton Bridge over the Mississippi River has been awarded to the STROBEL STEEL CONSTRUCTION CO., Chicago, Ill. The work will cost approximately $400,000. Ralph Modjeski, Chicago, is Consult. Engr. Noted Aug. 6, Sept. 3 and Nov. 19.

Garfield, Kan.—The Commissioners of Pawnee County, Larned, have passed a resolution appropriating $13,000 for the construction of a bridge over the Arkansas River at Garfield. The structure will be of reinforced concrete. Noted Oct. 22.

Yates Center, Kan.—(Official)—Bids will be received until noon, Jan. 4, by the County Clerk, of Woodson County for the construction of two steel I-beam bridges with concrete substructures and reinforced concrete floors; the Pierson Bridge, Eminence Township, and the Plum Creek Bridge, Owl Creek Township.

Geneva, Neb.—Bids will be received until noon, Jan. 12, by the Board of Commissioners of Fillmore County for bridge construction during 1915. Bert A. Lynn is County Clk.

Omaha, Neb.—Bids will be received until noon, Jan. 2, by the Board of Commissioners of Douglas County for all county bridge construction during 1915. Frank Dewey is County Clk.

+Aberdeen, S. D.—The Board of Commissioners of Brown County has awarded the contract for the construction of nine bridges in the county to the IOWA BRIDGE CO., Des Moines, Iowa, at $13,998.

Bastrop, Tex.—The Smithville Precinct of the Commissioners Court of Bastrop County has sold bonds for $50,000, the proceeds of which will be used to rebuild a bridge over the Colorado River destroyed by the flood of last December. Noted Jan. 15.

San Antonio, Tex.—The City Council is considering the construction of a reinforced-concrete bridge over the San Antonio River at Garden St. Hans Helland is City Engr.

+[illegible], Ohio [illegible]

Bellingham, Wash. [illegible]

Hoquiam, Wash. [illegible]

Spokane, Wash. [illegible]

Roseburg, Ore. [illegible]

[illegible], Calif. [illegible]

San Francisco, Calif. [illegible]

+London, Ont. [illegible]

+Toronto, Ont. [illegible]

+St. Catharines, Ont. [illegible]

WATER SUPPLY—IRRIGATION

+Thompsonville, Conn. [illegible]

Buffalo, N. Y. [illegible]

Hudson, N. Y. [illegible]

Mount Morris, N. Y. [illegible]

Rochester, N. Y. [illegible]

Watervliet, N. Y. [illegible]

Atlantic City, N. J. [illegible]

+East Orange, N. J. [illegible]

Lambertville, N. J. [illegible]

+Allendale, S. C. [illegible]

Charleston, S. C. [illegible]

Philadelphia, Miss. [illegible]

Plaquemine, La. [illegible]

Welsh, La. [illegible]

+West Monroe, La. [illegible]

Covington, Ky. [illegible]

[illegible] pipes in the rock at the bottom of the river [illegible] pipe at either end. Noted Nov. 1[illegible]

Cincinnati, Ohio [illegible]—Bids will be received until [illegible] by Philip Fosdick, Dir. of Pub. Serv., for [illegible]

[illegible] will [illegible] be received by Philip Fosdick, Dir. of Pub. Serv., [illegible] for the construction of th[illegible] water [illegible]. The estimated cost is [illegible]

Coshocton, Ohio. Plans have been prepared by Chester & Fleming, [illegible] Engrs., Union Bank Bldg., Pittsburgh, Penn., for the construction of a 10,000,000-gal. reservoir. Noted July 1[illegible]

+Dayton, Ohio. The contract for 5000 tons of c.-i. water [illegible] has been awarded by the City [illegible] to UNITED STATES CAST IRON PIPE & FOUNDRY CO., at $1[illegible]. Noted Dec. 17.

Napoleon, Ohio. The [illegible] has requested the State Board of Health to extend the time for the construction of a filtration plant. [illegible] is City Engr.

Shadyside, Ohio. An election will soon be held to vote on the question of [illegible] bonds for $1[illegible], the proceeds of which will be used for the construction of a water system.

Zanesville, Ohio. The State Board of Health has [illegible] the [illegible] the contract for the installation of a [illegible] plant is awarded by June 1, 1915, the [illegible] will [illegible] its approval. [illegible] W. Ho[illegible]king is City [illegible]. Noted [illegible]

Princeton, Ind. The Public Service Commission has ordered the installation of a filtration plant in Princeton [illegible]. The estimated cost is about $1[illegible]. Noted Nov. [illegible]

+Detroit, Mich. The contract for [illegible] tons of c.-i. pipe has been awarded to AMERICAN CAR & FOUNDRY CO., at $[illegible] per ton.

Menominee, Mich. [illegible]

+Cuba, Ill. The contract for installing a water system has been awarded to MONIE & DUNBAR, St. Louis, Mo., at $1[illegible]

Peoria Heights, Ill. The Board of Trustees has authorized the installation of a water system estimated to cost $[illegible]. Noted Apr. 16.

Lake Geneva, Wis. The installation of new pumps at the plant of the Geneva Water & Light Co. is contemplated. The estimated cost is $[illegible]. William O'Neill is Supt.

+Manitowoc, Wis. The contract for laying water mains [illegible] has been awarded to GRAY [illegible] & [illegible] Manitowoc.

New Richmond, Wis. Bonds for $1[illegible] have been sold by the [illegible] Council. Plans will be prepared for the construction of a water system.

Blairstown, Iowa. Plans have been prepared by [illegible], Kansas City, Mo., for the installation of a water system.

Iowa Falls, Iowa. The contract for constructing [illegible] ft. of water [illegible] and [illegible] ft. of sewers [illegible] will be received until Dec. [illegible] by [illegible], City Mgr., for this work. Noted Nov. 26.

+Hibbing, Minn. The contract for [illegible] ft. of [illegible]-in. extra strong lead pipe and five tons of pig lead pipe for the [illegible] water line construction has been awarded to CRANE & ORDWAY, Duluth, Minn.

Burrton, Kan. An election will soon be held at which the citizens will vote on the question of issuing bonds for $[illegible], the proceeds of which will be used for installation of a water system.

Haven, Kan. An election will soon be held to vote on the question of issuing bonds, the proceeds of which will be used for the construction of a water system.

Larned, Kan. [illegible]

Pretty Prairie, Kan. [illegible]

Pierce City, Mo. [illegible]

Corpus Christi, Tex. [illegible]

Magnolia Park [illegible], Tex. [illegible]

Uvalde, Tex. [illegible]

Bedrock, Okla. [illegible]

Vale, Okla. [illegible]

Albuquerque, N. M. [illegible]

Bailey, Idaho—(Official)—We have been advised that the citizens defeated the question of issuing bonds, the proceeds of which would have been used for the purchase and improvement of the water system. Noted Dec. 10.

Raymond, Wash.—The City Council contemplates purchasing the water system and making improvements and extensions.

+Seattle, Wash.—The contract for laying water mains in 38th Ave. S. W. has been awarded to D. H. TRAPHAGEN, Arctic Club, Seattle, at $26,864. Noted Dec. 10.

Warden, Wash.—Bids will be received, according to press reports, until Jan. 5 by the City Clerk, for constructing a water system.

+Oregon City, Ore.—(Official)—The contract for the construction of the South Fork water system has been by the Commission to OREGON ENGINEERING & CONSTRUCTION CO., Oregon City, at $315,000. List of bidders noted Dec. 10.

Warrenton, Ore.—Plans have been prepared by E. H. Green, Engr., Spokane, Wash., for the installation of a water system. The estimated cost is $150,00. Noted Dec. 3.

+Escondido, Calif.—Contracts have been awarded by the city to HOLLAND CONSTRUCTION CO., Ganger Bldg., San Diego, at $11,494 for constructing a concrete reservoir and to JOHN M. GARDINER CO., Byrne Bldg., Los Angeles, at $55,000 for laying 16 miles of pipe.

Lindsay, Calif.—An irrigation district is being organized, comprising about 24,000 acres, to be irrigated wth water from the Keweah and Tule Rivers. A dam will be constructed in the west end of the Kokohl Valley. G. V. Reed is the organizer.

Red Bluff, Calif.—(Official)—At the election held, Dec. 10, the citizens defeated the bond election for $85,000, the proceeds of which were to be used for the installation of a municipal water system. Noted Dec. 3.

Rio Vista, Calif.—The city contemplates metering all its taps. R. L. Uphan is Supt.

San Diego, Calif.—The La Mesa, Lemon Grove and Spring Valley Irrigation District has bought the Cuyamaca Water Co. in San Diego, and will construct a dam at a cost of $335,000.

Hull, Que.—The city plans to install an 8,000,000-gal. turbine pump and to extend the water mains. The estimated cost is $200,000. J. P. Albert Laforest is City Engr.

★Winnipeg, Man.—(Official)—Bids will be received until noon, Jan. 18, by S. H. Reynolds, Chn. of Comn., Greater Winnipeg Water Supply, for gravel pit excavation, screening, elevating and crushing machinery and for locomotives and cars.

Edmonton, Alta.—The construction of a new filtration plant is contemplated by the city. J. W. Turner is Supt.

Hollyburn, B. C.—Bids will be received until Dec. 28, by G. H. Peake, Municipal Clk., for installing a water system.

Kamloops, B. C.—The City Council plans to spend $75,000 for the extension of the water system and electric-power plant. M. J. Carment is City Clk.

Vancouver, B. C.—Bids will be received until Dec. 28 by G. H. Peeke, City Clk., for the construction of a water system for West Vancouver. The estimated cost is $150,000. Noted Dec. 1.

SEWERS

Boston, Mass.—Bids will be received until Dec. 28, by the Public Works Department, for building catch basins in South Boston and in Dorchester District, also for constructing sewers in Everton St. L. K. Rourke is Comr.

Reading, Mass.—According to press reports the Council plans to enter the Metropolitan Sewer District, of Boston, involving an expense of $224,000. Charles D. Smith, 1 Ashburton Pl., Boston, is Ch. Engr. of the Metropolitan Sewer Bd.

+Albany, N. Y.—The contract for constructing sewers has been awarded to KATTEUN & DeNALLO, 841 Albany St., Schenectady, at $9490.

Bethlehem, N. Y.—(Official)—The citizens plan to construct a sewer system, estimated to cost $13,000. Plans have been approved by the State Board of Health.

Camden, N. Y.—Plans are being prepared by Morrell Vrooman, Consult. Engr., Gloversville, N. Y., for the installation of a sewer system and sewage treatment works at Camden.

Hamburg, N. Y.—The citizens held a meeting to discuss the question of a new sewer system.

Mount Morris, N. Y.—At a recent election the citizens voted $69,000 in bonds, the proceeds of which will be used for the construction of a sewer system.

Ravena, N. Y.—Morrell Vrooman, Consult. Engr., Gloversville, is preparing plans for the construction of a sewer system and sewage treatment plant at Ravena.

Camden, N. J.—The City Council has adopted an ordinance providing for the installation of sewers in Louis, 26th St., and Harrison Ave.

★Dunellen, N. J.—(Official)—Bids were received, Dec. 7, by the Borough Council for constructing a sewage collecting system. The following are the low bidders: H. K. Corbin, 170 Broadway, N. Y., $82,601, Bruno Pizzamenti, Seneca Falls, N. Y., $84,115 and Di Napoli-Teriello Construction Co., Hackensack, N. J. William P. Deering is Borough Clk. Noted Nov. 12.

Jersey City, N. J.—The City Commission is considering the construction of three sewage disposal plants and several trunk sewers. Michael I. Fagan is City Clk.

Millburn, N. J.—See item under "Streets and Roads."

Summit, N. J.—On Dec. 15, Alexander Potter, Consult. Engr., 50 Church St., New York, N. Y., recommended the adoption of Plan B of the proposed sewage disposal plant. Estimated cost, $22,889. Three plans are under consideration.

Middletown, Del.—(Official)—Pugh & Hubbard, Engrs., Witherspoon Bldg., Philadelphia, Penn., have been retained to prepare plans for the construction of a sewer system and sewage disposal plant. Noted Dec. 3.

Laurel, Md.—Bonds for $80,000 have been sold by the City. The proceeds will be used for the installation of a sewer system and for extending the water system. Noted July 9.

Ocean City, Md.—(Official)—Pugh & Hubbard, Engrs., Witherspoon Bldg., Philadelphia, Penn., have prepared plans for the installation of a sewer system and sewage disposal plant for Ocean City. Work will start in the spring.

Hazlewood (Waynesville post office), **N. C.**—Bonds for $15,000 have been voted by the citizens, the proceeds of which will be used for the construction of sewer and water systems and an electric-light plant. The Mayor is in charge.

Arcadia, Fla.—The J. B. McCrary Co., Third National Bank Bldg., Atlanta, Ga., according to press reports, will make surveys and prepare plans for making extensions to the sewer system.

+Bradentown, Fla.—The contract for constructing 12,000 ft. of sanitary sewer and 1500 ft. of reinforced concrete and segment block storm sewer has been awarded to BRYAN & CO. and the SOUTH FLORIDA ENGINEERING & CONTRACTING CO., Bradentown.

Brewster, Ohio—Bids will be received by the Village Clerk, until Jan. 2, for the sale of $16,000 in bonds for constructing a sanitary sewer system.

Cleveland, Ohio—(Official)—Bids will be received by the Commissioner of Purchases and Supplies until noon, Dec. 31, for constructing a sewer in East 93d St., from Carr Ave. N. E. to Lake Erie.

Cleveland, Ohio—See item under "Streets and Roads."

Coshocton, Ohio—Plans are being prepared by Chester & Fleming, Union Bank Bldg., Pittsburgh, Penn., for the construction of the proposed sewage disposal plant.

Lorain, Ohio—(Official)—Bids will be received by the Director of Public Service until noon, Dec. 28, for constructing a sanitary sewer in East 35th St. from Clifton to Dallas Ave.

Detroit, Mich.—According to the Park Commissioner a sewage purifying plant will be installed with the $50,000 sewer system of Belle Isle.

Keota, Iowa—(Official)—Bids were received Dec. 9 by the Town Council for (a) sewage disposal plant, (b) pipe and specials, (c) five miles of sanitary sewers, as follows: Thomas Joyce, Kokomo, Ind., (a) $12,252, (b) $1265, (c) $26,013; Cedar Rapids Construction Co., Cedar Rapids, Iowa, (a) $9240, (b) $997, (c) $21,913; C. E. Hughes, Rockford, Ill., (b) $1362, (c) $15,996; J. W. Turner Improvement Co., Des Moines, Iowa, (a) $10,636, (b) $799, (c) $20,067; Western Construction Co., Iowa City, Iowa, (a) $10,729, (b) $1164, (c) $24,178; A. A. Dobson Co., Lincoln, Neb., (a) $11,045, (b) $1205, (c) $24,081; Inter-Mountain Bridge & Construction Co., Tecumseh, Neb., (a) $12,759, (b) $789, (c) $26,178; Alamo Engineering & Supply Co., Omaha, Neb., (a) $10,359, (b) $859, (c) $29,919; D. E. Keeler Co., Davenport, Iowa, (a) $10,071, (b) $1205, (c) $21,163; Birdsall-Griffith Construction Co., Racine, Wis., (a) $9849, (b) $844, (c) $20,687; M. Tschirigi & Sons, Cedar Rapids, Iowa, (a) $9871, (b) $911, (c) $22,293; Cady & Savonell, Sioux City, Iowa (a) $12,758, (b) $1094, (c) $24,780; M. McElligot, Evanston, Ill., $10,098, (b) $729, (c) $22,265; Black Hawk Construction Co., Waterloo, Iowa, (b) $791, (c) $24,183. Noted Nov. 26.

Cherryvale, Kan.—J. N. Sandefur, City Engr., is making surveys for the construction of a sewer system, estimated to cost $15,000.

+Lawton, Okla.—A contract for constructing a sewer along Gore Blvd. has been awarded to MAYFIELD & SHAW, Fort Bliss, Tex., at $27,000. Noted Oct. 15 and Nov. 26.

Seattle, Wash.—The following bids have been received for construction of sewers in Ell Ave. by Board of Public Works: L. Coluccio, 1642 Lane St., $20,879; L. R. Ellis, $21,806; Thomas Scalza, $22,070; V. Ramaglia, $22,385; Jahn Contracting Co., $22,861; Dicken, Rightmire & Petersen, $21,875; John Allemandi, $28,692.

All bids for the construction of sewers in Leary Ave. have been returned unopened by the Council. Changes in specifications will be made and new bids will be asked.

+The HARBOR PAVING CO., Aberdeen, at $31,262, received the contract for sewers in 37th Ave. S. and other streets.

Portland, Ore.—The City Commission has rejected all bids for the construction of the Willow St. extension of the East Stark St. trunk sewer and new bids will be invited soon. The work will cost about $175 000.

+Etna Mills, Calif.—A contract for constructing the sewer system and disposal works has been awarded to E. D. FRITTS at $15,658. Noted Nov. 12 and 26.

+Los Angeles, Calif.—H. H. KOCH and JOHN CHUTUK were awarded the contract at $7466 for sewer construction in Denker Ave. from Slauson Ave. to 57th St.

Newcastle, Calif.—An addition to the present sewer system will be made, bonds for the purpose having been voted.

South Pasadena, Calif.—This city, together with Pasadena, and Alhambra, will unite in the construction of a joint main line sewer from Pasadena sewer farm to an undetermined point near the Puente foothills.

Stockton, Calif.—Plans have been completed by C. E. Grunsky, San Francisco, for the proposed sewer system.

GARBAGE

+North Bergen, N. J.—The Township Committee, Dec. 17, awarded the contract to ANTONIO ROSILLA, North Bergen, at about $4000, for the removal of garbage for a period of one year.

Cleveland Heights, Ohio—Bids will be receivel until Dec. 28, by H. H. Canfield, Village Clk., Beckman Bldg., Cleveland, for the removal and disposal of garbage for the period beginning Jan. 1, 1915, to Jan. 1, 1917.

Norwood, Ohio—The city contemplates the construction of an incinerating plant in the spring. Walter G. Franz, Union Trust Bldg., Cincinnati, is Engr.

Sheboygan, Wis.—The [illegible] will [illegible] in the 1915 [illegible] an appropriation of [illegible] for the installation of a municipal [illegible] plant.

Fargo, N. D.—[illegible] City Engr, [illegible] that he wishes to [illegible] catalogs [illegible] on [illegible] of garbage disposal.

STREETS AND ROADS

Boston, Mass.—Bids will be received until Dec [illegible] by the Public Works Department for [illegible] roadway in Intervale St, [illegible] Street [illegible].

+The contract for [illegible] granite [illegible] roadway in [illegible] St from [illegible] to [illegible] St has been awarded to J [illegible] & SONS CO, at [illegible]. Other bids were A J & J H McDonald, [illegible] Street Contracting Co, [illegible] A De [illegible], [illegible] James Doherty, [illegible] John F [illegible], [illegible] John Kenny Co, [illegible] William J Doherty Co, [illegible]. Noted Dec 10.

Providence, R. I.—(Official)—Bids will be received until [illegible] p.m., Dec [illegible], for paving certain streets with bitulithic or asphalt pavement. [illegible] C [illegible] is City Clk.

Woonsocket, R. I.—[illegible]

+**Hartford, Conn.**—The State Highway Commissioner has awarded contracts for road work in Sherman Township, about [illegible] ft [illegible] to the [illegible] Rd, to the [illegible] CONSTRUCTION CO, [illegible]mouth, N H, at [illegible]; Winchester Township, about [illegible] ft macadam on the [illegible] Rd, to JOHN [illegible] MICHEL & BRO, Torrington, Conn, at [illegible]. Noted Nov [illegible] and Dec 1.

+**Yonkers, N. Y.**—The contract for regulating and grading [illegible] Ave from [illegible] Rd to [illegible]hard St has been awarded to THOMAS F [illegible], at [illegible].

Hackensack, N. J.—The Bergen County Board of Chosen Freeholders, Hackensack, Dec 11, authorized a bond issue of [illegible] for road improvements and bridge work.

Jersey City, N. J.—The Board of City Commissioners plans the improvement of Winfield Ave from the Boulevard to the Morris Canal.

(Official)—Bids will be received until 11 a.m., Dec 31, by the Board of Commissioners, for improving Sackett St from [illegible] Ave to [illegible] St, with old Belgian blocks. [illegible] is City Clk.

Millburn, N. J.—The cost of proposed road and storm sewer improvements in the [illegible] section of Millburn has been estimated at [illegible]. William Byrd, Minnisink Ridge Rd, Short Hills, N J, is interested.

+**Montclair, N. J.**—The Town Council, Dec 11, awarded the contract to the [illegible]STONE CONSTRUCTION CO, Montclair, for the extension of Highland Ave, north to the town line, at [illegible].

New Brunswick, N. J.—The Board of Freeholders has received the following bids for the improvement of the [illegible] Station Rd, North Brunswick Township: J L Lecompt, Lakewood, [illegible]; Frank [illegible], Trenton, [illegible]; and the [illegible] Contracting Co, [illegible], [illegible].

+**Perth Amboy, N. J.**—The Board of Aldermen has awarded a contract for the paving of New Brunswick Ave with vitrified brick to [illegible] & PFEIFFER, Perth Amboy.

Baltimore, Md.—Bids will be received by the State Road Commission [illegible] Garrett Bldg, until Dec 29, for constructing [illegible] miles of [illegible] concrete road along Annapolis [illegible], Anne Arundel County, and 0.61 mile of sheet asphalt on Cathedral St, Baltimore.

Sanford, N. C.—An election will be held Jan 16, for the purpose of voting on the question of issuing [illegible] in bonds.

Macon, Ga.—According to press reports, an election will be held some time in February to vote on the question of issuing [illegible] in bonds for paving.

Tampa, Fla.—Bids will be received by the Commissioners until Dec [illegible], for paving the Plant City [illegible] extension from [illegible] Creek to Plant City. [illegible] is [illegible]. Noted June 11 and July [illegible].

+**Birmingham, Ala.**—A contract for improving [illegible] has been awarded by the Jefferson County Commissioners to [illegible].

+**Aberdeen, Miss.**—[illegible] A contract has been awarded to [illegible], at [illegible] for street work, and [illegible], at [illegible] for [illegible] road work. Noted Dec [illegible].

Holly Springs, Miss.—At a recent election the citizens voted in favor of issuing [illegible] in bonds for paving or macadamizing [illegible] and the square. Noted Nov 26.

Meridian, Miss.—Bids will be received by the Board of Supervisors until Jan 4 for the sale of [illegible] in bonds for building good roads.

Port Allen, La.—Bids will be received by the [illegible] until Jan [illegible] for the sale of [illegible] in road [illegible].

Middlesboro, Ky.—An election will be held Feb [illegible] for the purpose of [illegible] to vote on the question of issuing [illegible] in bonds for constructing roads.

Greenup, Ky.—An election will be held Jan [illegible] for the purpose of [illegible] County to vote on the question of issuing [illegible] in bonds for road construction.

Cincinnati, Ohio—(Official)—Bids will be received by [illegible], until noon, Dec [illegible], for [illegible] Ave and [illegible] Ave [illegible].

(Official)—Bids will be received by [illegible] until [illegible], Dec [illegible], for paving [illegible] Ave from [illegible] to [illegible] Ave with brick.

Cleveland, Ohio—(Official)—Bids will be received by [illegible], Village of [illegible] Heights, until noon, Jan [illegible] for improving [illegible] Rd, [illegible] Rd, [illegible] Rd, [illegible] Rd, [illegible] Rd, [illegible] Rd, [illegible] Rd, Woodbury Rd, Huntington Rd, [illegible] Rd, Conway Rd, [illegible] Rd, Keswick Rd, Milton Rd, Beckett Rd, Ashwood Rd, Hampton Rd, [illegible] Rd, Warrington Rd and Ludlow Rd, by grading, paving, curbing, constructing sewers and laying water mains.

Coshocton, Ohio—According to press reports, bids will soon be received for paving [illegible] St from Walhonding bridge to the corporation limits.

East Youngstown, Ohio—(Official)—Bids will be received by C R [illegible]son, Village Clk, until noon, Jan 4, for paving a section of Wilson Ave.

Fremont, Ohio—Plans are being prepared by C A Hochenedel, City Engr, for paving Arch St. Bids will be advertised in the spring.

Galion, Ohio—(Official)—Bids will be received by Commissioners of Morrow and Crawford Counties until noon, Jan 13, for the construction of the Hershner Joint County Rd in Washington Township, Morrow County, and Polk Township, in Crawford County. C O Higgins is Audr of Morrow County.

Lima, Ohio—All bids received Dec 8, by H J Lawlor, Clk of Bd of County Comrs, for paving 22,000 sq yd, have been rejected. Contract has been readvertised and bids will be received Jan 2. Noted Dec 3.

Mt. Gilead, Ohio—C C Higgins, Audr of Morrow County, will receive bids until Jan 13 for the construction of a macadamized road in North Bloomfield Township and Sandusky Township, Richland County.

Sandusky, Ohio—Plans and estimates have been submitted by R L J Wager, City Engr, for the proposed paving of Fulton St from Water to Adams St, estimated to cost $14,000.

Troy, Ohio—(Official)—Bids will be received by the Board of County Commissioners until 10 a.m., Jan 4, for grading, concreting and macadamizing with asphalt binding the Dayton and Troy Spur and One Mile Assessment Pike. M T Staley is County Audr.

Indiana—Bids will be received as follows for road improvements in Indiana:

Wabash, until 2 p.m., Jan [illegible], by the Commissioners of Wabash County, for constructing two gravel roads in Liberty Township. D Showalter is Audr.

Monticello, until 10 a.m., Jan [illegible], by the Commissioners of White County, for constructing a road in Big Creek Township. A G Fisher is Audr.

New Albany, until 10 a.m., Jan 7, by the Commissioners of Floyd County, for constructing a gravel road in New Albany Township.

Evansville, Ind.—(Official)—Bids will be received by Carl Laurenstein, Treas of Vanderburgh County, until 10 a.m., Jan 2, for the sale of $20,000 in bonds for improving highways.

Muncie, Ind.—(Official)—Bids will be received by the Commissioners of Delaware County until 10 a.m., Jan 23, for constructing a gravel road on the Delaware-Henry County line. F M Williams is County Audr.

+**Rochester, Ind.**—A contract for constructing two gravel roads has been awarded by the County Commissioners to McTIERNAN BROS, Elwood, Ind, at $29,748. Noted Nov 19.

+**Williamsport, Ind.**—A contract for constructing a road in Pine Township has been awarded by the Board of County Commissioners to C E GANT, Colfax, Ind, at $6695. Noted Nov 19.

Kenosha, Wis.—(Official)—Bids will be received by the Street Assessment Committee, until 2 p.m., Jan 8, for improving Ridge St from Prairie Ave to Grand Ave.

Bonham, Tex.—Bids will be received by the Road Commissioners until Dec 28, for the construction of about 30 miles of roads.

Floresville, Tex.—At the election held Dec 15 the citizens of Lavernia and Sutherland Springs Districts voted in favor of issuing $[illegible] and $15,000 in bonds, respectively. Noted Dec 1.

Greenville, Tex.—(Official)—Bids will be received by the Board of Permanent Road Commissioners until Jan 2[illegible] for constructing a system of highways in Road District No. 1. Julian C Field, Division and Greenville, is Consulting Engr.

Las Cruces, N. M.—The Board of Road Commissioners will soon begin the work of improving the roads of this district for which purpose $[illegible],000 in bonds were issued.

+**Port Orchard, Wash.**—A contract for improving roads has been awarded by the Commissioners of Kitsap County to NELSON & SHOULE at approximately $10,000. Noted Oct 29 and Dec 3.

Bay City, Ore.—Bids will be received by L C McClure, City [illegible], until Feb 1, for improving a number of streets in the business district, estimated to cost $[illegible].

+**Pendleton, Ore.**—S [illegible] & CO has been awarded a contract by the Northern Pacific RR Co for 14,000 ft of concrete sidewalk, covering 14 city blocks.

+**Portland, Ore.**—The City Commission has awarded a contract for the paving of East [illegible]th St from Alberta St to Ainsworth Ave, to [illegible]KAR [illegible]ER, at $17,0[illegible].

+**Roseburg, Ore.**—A contract for constructing two miles of road through [illegible] Creek has been awarded to H J [illegible], at $[illegible]. Noted Dec 3.

Los Angeles, Calif.—According to press reports, bids will be received by the Board of Supervisors until Dec 2[illegible], for improving [illegible] and Olive St in Road District No 43. Estimated cost [illegible].

Ontario, Calif.—(Official)—Bids were received Dec 14 by [illegible], City Clk, for improving [illegible] Ave from [illegible] to the north city limits as follows: Highway Construction Co, [illegible], Calif, $[illegible]; H L Taylor, Los Angeles, Calif, $[illegible]; Southern California Construction Co, Ocean Park, Calif, $[illegible]; Johnson-Shea Co, Riverside, Calif, $[illegible]; [illegible], Los Angeles, Calif, $67,444; Hudson, Johnson Co, Los Angeles, Calif, $[illegible]; Bent & Pennebaker, Los Angeles, Calif, $[illegible]; Montgomery Co, Alhambra, Calif, $[illegible]; [illegible], Los Angeles, Calif, $[illegible]; H F Cov[illegible], [illegible], Calif, $[illegible]; E L Fleming, Pomona, Calif, $[illegible]; Andrew [illegible], Pasadena, Calif, $[illegible]. Noted Dec 10.

Porterville, Calif.—Press reports state that bids will be received about Jan. 1 for paving approximately 33 streets.

✚**San Diego, Calif.**—M. D. GOODBODY has been awarded the contract at $30,342 for grading Raynard Way, State St. and Goldfinch St. from Laurel to Sutter St.

INDUSTRIAL WORKS

✚**Boston, Mass.**—The contract for the construction of a five-story 50x100-ft. warehouse at Commonwealth Ave. and Roman Terrace, Brighton District, for W. Stanley Tripp, 95 Milk St., has been awarded to L. L. SELLEW, 136 Brighton Ave. Estimated cost, $40,000.

Bridgeport, Conn. — Plans have been prepared for the Standard Mfg. Co., Housatonic Ave., for the construction of a two-story and basement 50x90-ft. addition to its plant.

✚**Auburn, N. Y.**—The Auburn Woolen Co. has awarded the contract to the B. F. SMITH CONSTRUCTION CO., Pawtucket, R. I., for the construction of a five-story and basement 80x 120-ft. addition to its plant.

Rochester, N. Y.—The Pennsylvania Feldspar Co., Philadelphia, Penn., plans to rebuild its plant which was recently destroyed by fire, at Rochester, with a loss of $125,000.

Saratoga Springs, N. Y.—Bids are being received by C. G. Anthony, Consulting Engr., State Reservation Commission, for the construction of a spring water bottling plant for the State of New York.

Ligonier, Penn.—The Ligonier Valley R.R. has had plans prepared for the construction of a brick roundhouse 195x200 ft. The estimated cost is $125,000. B. C. Boyle is Master Mechanic.

Marcus Hook, Penn.—The Benzol Products Co., Philadelphia, Penn., plans the construction of a plant at Marcus Hook.

Monongahela, Penn.—The Universal Ice & Cold Storage Co., recently incorporated with a capital of $75,000, plans the construction of a reinforced-concrete ice plant, with a daily capacity of 25 tons; also a cold-storage plant.

✚**Philadelphia, Penn.**—The contract for the construction of a one-story, 61x188-ft. manufacturing and store building at 209-13 North 22d St., for Edward M. Harris, 48 North 23d St., has been awarded to EDWARD CUNNINGHAM, 50 North 23d St. Estimated cost, $12,000.

West Reading, Penn.—The Atlantic Refining Co. plans the construction of a plant, estimated to cost $150,000.

Baltimore, Md.—Plans are being prepared for the construction of a 135x215-ft. warehouse and factory at Bayard and Hamburg St., for the Baltimore Gas Appliance Mfg. Co.

Petersburg, Va.—Plans are being prepared for the construction of three buildings on Madison Ave., from Hamilton Ave. to Park St., for the Wayne Paint Co.

New Orleans, La.—Plans have been prepared by J. E. Otis and W. K. Keenan, Associate Archs., for the construction of a cold-storage and packing plant for the Cudahy Co., at Poydras and Howard St.

New Orleans, La.—The Board of Commissioners of the Port of New Orleans, Dec. 14, received the following bids for the construction of a cotton warehouse and terminal: Jefferson Construction Co., New Orleans, $1,323,444; Durolithic Co., Buffalo, N. Y., $1,399,900; James Stewart & Co., Inc., St. Louis, Mo., $1,466,000; John W. Ferguson Co., Paterson, N. J., $1,467,000; J. A. Zimmerman & Son, New York, N. Y., $1,499,000; Haglin Stahr Co., Minneapolis, Minn., $1,511,000; Gilsonite Construction Co., St. Louis, Mo., $1,518,530; MacArthur Bros. Co., New York, N. Y., $1,600,000; Ferro-Concrete Construction Co., Cincinnati, Ohio, $1,642,000; Wells Bros. Co., New Orleans, $1,659,-000; Selden Breck Co., St. Louis, Mo., $1,665,000; Hughes, O'Rourke Construction Co., Dallas, Tex., $1,733,266; Bates & Rogers Construction Co., Chicago, Ill., $1,749,700; H. P. Converse & Co., Boston, Mass., $1,765,000; Hunt Engineering Co., Kansas City, Mo., $1,795,000; Doullut & Williams, New Orleans, $1,801,000; George J. Glover, New Orleans, $1,818,816. Ford, Bacon & Davis, 921 Canal St., New Orleans, are Engrs. Noted Nov. 5.

Chattanooga, Tenn.—Plans are being prepared by W. H. Sears for the construction of a plant for William Lippinhardt Wheeling, W. Va. The plant will manufacture enameled sheet steel, iron products, gas stoves and railroad semaphores. Estimated cost, $100,000. Noted Dec. 17.

Lawrenceburg, Ky.—The Kentucky River Stone & Sand Co., Tyrone, has increased its capital stock to $45,000. The company plans the construction of an additional crushing unit, dust plant and machine shops.

Louisville, Ky.—The Reliance Textile & Dye Works, Covington, have plans for the construction of an addition, estimated to cost $25,000.

Columbus, Ohio—John Dewine contemplates constructing a $50,000 grain elevator on a site between the Cleveland, Cincinnati, Chicago & St. Louis Ry. and the Pennsylvania R.R., West Side.

✚**Toledo, Ohio**—(Official)—The contract for the construction of the pedestal concrete pile foundation for the State Hospital laundry has been awarded to the MacARTHUR CONCRETE PILE & FOUNDATION CO., 11 Pine St., New York, N. Y. Marriott, Allen & Hall, Columbus, are Archs.

Big Rapids, Mich.—The Board of Trade of Big Rapids is preparing to construct a two-story and basement, 42x150-ft. factory for the Falcon Mfg. Co.

✚**Detroit, Mich.**—The contract for the steel work on the one-story addition to factories Nos. 2, 3, 6 and 7 on Jefferson Ave. and Connors Creek Rd. for the Hudson Motor Car Co. has been awarded to McCLINTIC-MARSHALL CO.

Kalamazoo, Mich.—The Kalamazoo Vegetable Parchment Co. will construct a 70x327-ft. plant at Kalamazoo.

East St. Louis, Ill.—The Pioneer Box Co., manufacturers of wire-bound boxes, will construct a plant, estimated to cost $75,000.

✚**Manitowoc, Wis.**—The contract for the construction of a $20,000 warehouse for the Chicago & North Western Ry. has been awarded to KULK CO., Freeport, Ill.

✚**Lexington, Neb.**—The contract for the construction of a five-story fireproof reinforced concrete mill for the Lexington Mill & Elevator Co., has been awarded to the BURRELL ENGINEERING CO., Chicago, Ill. The estimated cost is $50,000.

Lincoln, Neb.—The Curtis, Towle & Paine Co. will construct a four-story factory, 60x100 ft., on Seventh and K St.

Hanford, Wash.—The Hanford Fruit Growers Association has purchased a site on the Columbia River for the construction of a warehouse and cold-storage plant.

North Yakima, Wash.—The American Hawaiian Fruit Canneries Co., 409 Hoge Bldg., Seattle, recently incorporated with a capital of $200,000, contemplates constructing by-product plants at North Yakima, Wenatchee and Vashon.

Los Angeles, Calif.—Plans are being prepared by Edward C. Thorne, Arch., Realty Board Bldg., for the construction of a two-story and basement 25x146-ft. factory on San Pedro St., for Wise & Downey, 705 East Seventh St.

Toronto, Ont.—Anderson MacBeth, Ltd., plans the construction of a $50,000 warehouse at King and John St.

FEDERAL GOVERNMENT WORK

Locomotive Crane—Boston, Mass.—Bids will be received by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a.m., Jan. 9, for furnishing one 15-ton locomotive crane to the Navy Yard, Boston.

★**Storehouse**—Fort Strong (Boston post office), **Mass.**—Bids will be received by Capt. H. T. Matthews, Constructing Quartermaster, Port Warren, until noon, Jan. 18, for the construction of a concrete storehouse at Fort Strong.

✚**Dredging**—New Haven, Conn.—The following are the bids received for dredging in New Haven Harbor: Atlantic, Gulf & Pacific Co., Park Row Bldg., New York, N. Y., $56,980; William Beard & Co., 21 State St., New York, N. Y., $78,750; R. G. Packard Co., East 28th St., Bayonne, N. J., $68,600; Timothy J. Dady, 350 Fulton St., New York, N. Y. (Borough of Brooklyn), $108,500; Taylor Dredging Co., Foot Communipaw Ave., Jersey City, $54,600; Metropolitan Dredging Co., 90 West St., New York, $52,080; American Dredging Co., Philadelphia, Penn., $62,300; Coastwise Dredging Co., Norfolk, Va., $54,530; Baystate Dredging Co., Ltd., 247 Atlantic Ave., Boston, Mass., $70,000; Eastern Dredging Co., 172 Condor St., East Boston, Mass., $82,833; Maritime Dredging Co., 80 Broad St., New York, $77,000; Morris & Cumings Dredging Co., 17 State St., New York, $52,080; John A. Seely, 30 Church St., New York, $63,000; P. Sanford Ross, Inc., Jersey City, N. J., $62,650; Furst-Clark Construction Co., Baltimore, Md., $75,250; John H. Gerrish, 101 Tremont St., Houston, $64,400. Noted Nov. 15.

Post Office—Glens Falls, N. Y.—Bids were received as follows for the construction of a post office at Glens Falls, (a) limestone, (b) sandstone: Charles McCaul Co., Philadelphia, Penn., (a) $64,539, (b) $64,939; Charles P. Boland Co., Troy, N. Y., (a) $73,452, (b) $73,700; Lewis P. Fluhrer Co., 220 West 42d St, New York, N. Y., (a) $65,719; Altoria Realty & Construction Co., 3 East 44th St., New York, N. Y., (a) $62,964, (b) $62,964; William H. Egan, 147 East 125th St., New York, N. Y., (a) $65,913, (b) $66,813; Benedetto-Clark & Nugent, Inc., 423 East 115th St., New York, (a) $72,971; Kelly & Kelley, Inc., Long Island City (Borough of Queens), New York, N. Y., (a) $70,600, (b) $71,000; John G. Unkefer & Co., Minerva, Ohio (a) $66,437, (b) $67,187; George B. Wills & Co., Inc, 101 Park Ave., New York, (a) $61,557, (b) $62,000; Westchester Engineering Co., White Plains, N. Y., (a) $66,-700, (b) $67,000. Noted Nov. 5.

Pier—New York, N. Y.—(Borough of Brooklyn)—Bids were received as follows, for the construction of a timber and reinforced concrete pier at the New York Navy Yard. The pier is to consist of a reinforced concrete deck, beams, girders and columns, supported on wooden piles and platforms—including paving, railroad and crane tracks, fresh water, salt water and air piping, electric ducts, telephone conduit, manholes, bollards and cleats. The general dimensions are: Length on center line, 677 ft., width, out to out of backing logs, 80 ft. (a) Pier complete, with wood block paving; (b) pier complete, with asphalt paving; (c) pier complete, under alternative plans and specifications. Snare & Triest Co., 233 Broadway, New York, (a) $148,730; (b) $144,980; (c) $149,400. C. R. Simpson, 170 Broadway, New York, (a) $179,352; (b) $176,352; (c) $175,940. Henry Steers, Inc., 17 Battery Place, New York, (a) $161,720; (b) $156,100; (c) $153,870. McHarg-Barton Co., 171 Madison Ave., New York, (a) $166,540; (b) $161,140; (c) $144,474. Noted Dec. 3.

Gasoline Cutter—Philadelphia, Penn.—All bids received by Col. George A. Zinn, Witherspoon Bldg., Philadelphia, for constructing and delivering a gasoline cutter, wooden hull and house, have been rejected. New bids will soon be requested.

✚**Storage Tanks**—Washington, D. C.—The contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of nine fuel oil storage tanks, 2,100,000 gal capacity, to be erected at Norfolk, Va.; Mare Island, Calif.; Puget Sound, Wash.; San Diego, Calif., and Melville, R. I., to the PITTSBURG-DES MOINES STEEL CO., Curry Bldg., Pittsburgh, Penn., at $120,136. Noted Dec. 17.

Building—Washington, D. C.—Bids were received as follows, by the Commissioners of the District of Columbia, for the construction of a repair shop for the Water Department, on Bryant St. near Second St., Washington, D. C.: Andrew Murray, $21,700; A. L. Smith & Co., $19,100; Melton Construction Co., $18,100; Westchester Engineering Co., White Plains, N. Y., $28,256; Skinker & Garrett, $20,753; A. M. Poynton, $21,-000; J. L. Marshall, $19,154; J. L. Robinson Construction Co., Baltimore, Md., $23,200; W. E. Mooney, $19,945; Charles A. Langley, $20,573; H. B. Davis, $21,400; Richardson & Burgess, $21,006; M. A. Weller, $19,149; Upton-Smoot Construction Co., $19,487. Above bidders are of Washington, D. C., unless otherwise specified.

Grading—Arlington, Va.—The following are the bids received for grading, paving and [illegible] Arlington National Cemetery [illegible]

Building—Arlington, Va.—The following bids were received for [illegible] Arlington National Cemetery [illegible]

♦Foundation—[illegible]

Post Office—[illegible]

♦Post Office—[illegible]

♦Reconstructing Pier—[illegible]

♦Improving Post Office and Court House—[illegible]

♦Post Office—[illegible]

♦Post Office—[illegible]

Post Office—[illegible]

Building—[illegible]

♦Post Office—Mandan, N. D.—The contract for the construction of a post office at Mandan has been awarded to GEORGE W. STILES CONSTRUCTION CO., [illegible] Bldg., Chicago, Ill., at $[illegible]. Noted Aug. [illegible] and Oct. [illegible]

★Canal Work—St. Ignatius, Mont.—The following are the bids received for earthwork and excavation in connection with the canal construction on the Flathead Project: [illegible] Charles Wilhite & Co., $[illegible]; [illegible] Temple & Strek[illegible], $[illegible]; T. H. [illegible], $[illegible]. Noted Nov. 12.

Post Office—[illegible], Tex.—The following bids were received for the construction of a post office at [illegible], Tex.: (a) limestone with stone facing; (b) limestone with brick facing; (c) sandstone with [illegible] facing; (d) sandstone with brick facing: [illegible] Shaul, Seneca, Kan., (a) $[illegible]; T. H. [illegible], Tex., (a) $[illegible], (c) $[illegible], (d) $[illegible]; J. G. [illegible] Knight, [illegible], Tex., (a) $[illegible], (c) $[illegible]; Schafer & Kr[illegible], (a) $[illegible], (c) $[illegible]. Noted Nov. [illegible]

♦Hull—Portland, Ore.—The contract for the construction of the wooden hull to be used as a [illegible] dredge has been awarded to the WILLAMETTE IRON & STEEL WORKS, Portland. Noted Oct. [illegible] and Nov. 19.

Post Office—[illegible], Tex.—Bids will be received until 3 p. m., Jan. [illegible], by Oscar Wenderoth, Superv. Archt., Treasury Dept., Washington, D. C., for the construction of a two-story and basement brick and terra cotta post office.

Buildings—Fort Kamehameha (Honolulu post office), H. T.—Bids will be received by the Constructing Quartermaster, Honolulu, until 11 a. m., Dec. [illegible], for constructing [illegible] frame buildings.

Locomotive Cranes—Pearl Harbor, H. T.—Bids will be received by H. R. Stanford, Chief, Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a. m., Jan. 23, for furnishing two [illegible]-ton locomotive cranes at the naval station, Pearl Harbor.

Cranes—Pearl Harbor, H. T.—The following are the bids received for furnishing three electric traveling shop cranes at the naval station, Pearl Harbor: (a) 3 cranes delivered; (b) deduct from (a) if cranes is of two-motor type; (c) cranes, complete: [illegible] Crane & Engine Co., [illegible], (a) $[illegible], (b) $[illegible]; Whiting Foundry Equipment Co., Harvey, Ill., (a) $[illegible], (b) $[illegible], (c) $12,800; Morgan Engineering Co., Alliance, Ohio, (a) [illegible]-ton, $[illegible], [illegible]-ton, $[illegible], three-ton, one-motor, $[illegible], (b) three-ton, two-motor, $[illegible]; Manning, Maxwell & Moore, New York, N. Y., (a) $11,[illegible], (b) $175, (c) $[illegible]; Pawling & Harnischfeger Co., Milwaukee, Wis., (c) $[illegible]; Niles-Bement-Pond Co., New York, N. Y., (a) $12,[illegible], (b) $175. Noted Dec. [illegible]

Miscellaneous Supplies—[illegible]—Bids will be received by Maj. F. C. Boggs, [illegible] Purchasing Officer, Panama Canal, Washington, D. C., until [illegible] a. m., Dec. [illegible], for furnishing by steamer, free of all charges, on dock at either Colon, Atlantic port, or Port of Ancon, Balboa, Canal Zone, [illegible] castings, wire, [illegible] copper, [illegible], white zinc, [illegible] white lead, [illegible] oil, blank books and paper.

MISCELLANEOUS

★♦Tunnel—Boston, Mass.—[illegible]—The following bids were received Dec. [illegible] by the Boston Transit Commission for the construction of Section [illegible] Tunnel: [illegible] Madison Ave., New York, $1[illegible] (award); [illegible] Boston, $[illegible]; [illegible] Construction Co., [illegible] St., Boston, $[illegible]; [illegible] St., New York, $[illegible]. Noted Nov. [illegible]

Grand Stands—[illegible]

Barge Canal Bonds—[illegible], N. Y.—[illegible]

Dock Walls—[illegible], N. Y.—[illegible]

Motor Fire Apparatus—[illegible], N. Y.—[illegible]

Motor Tractors—[illegible]

★♦Subway—New York, N. Y.—[illegible]

+Motor Fire Apparatus—Orange, N. J.—The City Commission, Dec. 14, awarded the contract for furnishing the fire department with motor fire apparatus, to the WHITE CO., Main St., East Orange, N. J., at $18,450.

+Excavation and Concrete Work—Point-no-Point, N. J.—The Public Service Electric Co. has awarded the contract for excavation and concrete work to the SNIDE & GRIFFITH CO., at $167,995.

Dock—Roosevelt, N. J.—At a special election the citizens voted a bond issue of $18,500 for the erection of a municipal dock on the site of the present Radley dock.

+Concrete Coal Bunkers—Chester and Tacony, Penn.—The Philadelphia Electric Co. has awarded contracts to the DREHMANN PAVING CO., at $10,000, for constructing reinforced-concrete coal bunkers at its plants in Tacony and Chester.

Skylights and Roofing for Piers—Philadelphia, Penn.—(Official)—Bids will be received until noon, Jan. 4, by George W. Norris, Dir., Dept. Wharves Docks and Ferries, 555 Bourse Bldg., Philadelphia, for installing skylights, roofing, erecting cargo doors and chutes at Piers 38 and 40, South Delaware River. For details see advertisement under "Contracts to Be Let."

Subway—Cumberland, Md.—Surveys have been completed and plans prepared for the construction of the Green St. subway for the elimination of the grade crossing at the Baltimore & Ohio Ry. tracks. The city and the railway company will share jointly in the cost, which is estimated at about $62,000. Noted Oct. 29.

Natatorium—Espiritu Santo Springs (Safety Harbor P. O.), Fla.—The Espiritu Santo Springs Co. plans to build a Turkish bathhouse and swimming pool estimated to cost $25,000. W. E. Sinclair is Gen. Mgr.

Docks—Jacksonville, Fla.—The Port Commissioners have ordered Frederick Bruce, City Engr., to prepare estimates for the construction of the proposed municipal docks.

Drainage—Pinellas Park, Fla.—(Official)—Bids will be received by the Supervisors of Pinellas Park Drainage District until Dec. 30 for constructing approximately one hundred miles of ditches, including 1¾ miles of channel, 100 ft. wide; 1½ miles of channel, 50 ft. wide; 2½ miles of channel, 30 ft. wide; all 3 ft. below low tide level. C. M. Dechant is Ch. Engr.

Steel Furniture—Tampa, Fla.—Bids will be received until Jan. 2, by D. B. McKay, Pres. Bd. Pub. Wks., for furnishing steel furniture for the city mill.

Seawall—West Palm Beach, Fla.—(Official)—Bids will be received until Jan. 5 by L. T. Lockwood, Pres. City Council, for the construction of a seawall. The work will include 1350 cu.yd. reinforced concrete, 73 tons of steel reinforcement, 99,000 cu.yd. fill and 2415 sq.yd. of sidewall. In October the city voted an issue of $100,000 in bonds to construct this wall. J. B. McCrary Co., Atlanta, Ga., are Engrs. Noted Oct. 8.

Arena—New Orleans, La.—The New Orleans Auditorium and Athletic Assn. has had plans prepared for the construction of an arena, 215 ft. in diameter. It will have a seating capacity of 10,000. W. R. Burk, New Orleans, is the Arch.

Steel Pipe for Drainage System—New Orleans, La.—The following bids were received on Dec. 1 by the Sewerage and Water Board Commission for furnishing riveted steel pipe for drainage system, including 75,000 lb. 12-in. riveted steel suction pipe, 65,000 lb., 12-in. discharge pipe and 7000 lb. 60-in. riveted-steel constant-duty discharge pipe: John H. Murphy, $9805; Chicago Bridge & Iron Works, $10,380; McAleenan Bros. Co., $13,680; Memphis Steel Construction Co., $13,949; Treadwell Construction Co., $14,600.

Levee Work—Memphis, Tenn.—The Mississippi River Commission, First and Second Districts, will receive bids until, Dec. 28, at Room 20, Custom House Bldg., Memphis, for 700,000 cu.yd. of levee work.

Stadium—Lexington, Ky.—The State University of Kentucky plans the construction of a stadium, estimated to cost about $25,000.

Drydock—Chicago, Ill.—According to press reports, the American Shipbuilding Co. will receive bids for the construction of a 750-ft. reinforced concrete drydock at its yards on the East Side in South Chicago. The estimated cost is $250,000.

★Drainage—Peoria, Ill.—Bids will be received until 9:30 a.m., Jan. 20, by J. H. Best, Secy., Fabius Drainage District, Illinois State Bank, Quincy, Ill., for the construction of levees, ditches and diversion channels. The work will involve about 2,000,000 cu.yd. of fill and excavation. Jacob A. Harmon, Peoria, Ill., is Ch Engr. For details see advertisement under "Contracts to Be Let."

Excavation—Marengo, Iowa—Bids will be received by Charles E. Zoff, County Audr., until noon, Dec. 30, for construction in Drainage District No. 3, which involves about 22,500 cu.yd. of excavation.

Ditch—Ada, Minn.—Bids will be received until Jan. 12 by the county auditor, Ada, for constructing Judicial Ditch No. 52, Norman and Polk Counties. The work will include 170,000 cu.yd. excavation; construction of 27 bridges; and erection of reinforced-concrete and corrugated iron culverts. The estimated cost of the excavation is $47,071; that of the bridges and culverts, $21,820.

Park-Bonds—Duluth, Minn.—(Officials)—Bids will be received until, Jan. 4, by F. J. Vass, Comr. of Finance for the purchase of $50,000 in bonds. The proceeds to be used in park improvements and the purchase of new park land. Noted Nov. 26.

Ditch—Duluth, Minn.—A meeting will be held on Jan 8 by the Board of County Commissioners for the report on County Ditch No. 2. This ditch will be 93 miles in length and will drain 80,000 acres. The estimated cost is $185,000. The work will include earth and rock excavation, road and bridge construction, and the laying of culverts. E. K. Coe is County Engr.

Ditches—International Falls, Minn.—The contracts for the construction of several ditches involving about 199 miles of excavation, will soon be awarded. The estimated cost is $547,000. E. W. Kibbey is Engr.-in-Charge.

Ditch—Marshall, Minn.—All bids received on Dec. 7 by the County Commissioners for the construction of County Ditch No. 13 have been rejected. E. S. Shepard is County Audr. Noted Nov. 5 and 19.

+The contract for constructing County Ditch No. 14 has been awarded to the TRACY TILE CO., Tracy, Minn., at $10,496.

Drainage—Wynne, Ark.—The lowest bid received by W. H. Newsom, Engr., Drainage District No. 2, Crittenden County, for 5,164,000 cu.yd. of floating dredge work, was that of Wills & Sons, Paragould, at $430,000. Noted Nov. 26.

Drain—Houston, Tex.—Bids will be received until 10 a.m., Dec. 28, by H. L. Washburn, County Audr., Harris County, for the construction of the Adlong drain. Plans on file at the office of the County Engineer.

Dredging—Port Arthur, Tex.—The West India Molasses Co. plans to dredge a 60-ft. slip near its plant for docking facilities.

+Concentrating Tables—Globe, Ariz.—The Inspiration Copper Co. has awarded a contract to the DEISTER MACHINE CO., Fort Wayne, Ind., at $150,000, for installing all the concentrating tables at its mill.

Dikes—Kelso, Wash.—The bond issue of $60,000 has been disposed of; plans have been prepared; and bids will soon be received for the construction of the proposed dikes.

+Trestle—Port Angeles, Wash.—The contract for constructing the pile trestle on Front, Valley and Cherry Sts., has been awarded to P. J. WOOD, at $31,000. Charles J. Filion, Port Angeles, is the Engr.

Wharf—Seattle, Wash.—The Standard Oil Co. has filed plans with the Port of Seattle Commission for a reinforced-concrete wharf to be constructed in the East Waterway. The estimated cost is about $250,000.

Bulkhead—Seattle, Wash.—City Engineer A. H. Dimock has completed plans for the construction of a 1190-ft. gravity bulkhead along the western front of Railroad Ave., between Madison and Washington St. Bids will be received shortly after the first of January. The estimated cost is about $450,000. A. L. Valentine is Chn., Bd. Pub. Wks.

+Dock—Seattle, Wash.—The Grand Trunk Pacific Ry. Co. has awarded the contract for the construction of its dock to NETTLETON, BRUCE & ESCHBACH, Seattle, at $75,000. Noted Nov. 26.

Dredging—Long Beach, Calif.—Bids will be received soon by the Board of Public Works for dredging the entrance to Long Beach harbor, to an average depth of 18 ft. at low tide. The estimated cost is about $20,000. Noted Oct. 22.

Fire Equipment Bonds—Los Angeles, Calif.—The Fire Commission contemplates a bond issue of $1,000,000 for the complete equipment of the fire department.

+Carbarn—San Francisco, Calif.—The Works Board has awarded the contract for the construction of the municipal railway carbarn on 17th St. to the CLINTON FIREPROOFING CO., at $195,500.

+Elevators—Montreal, Que.—The Department of Public Works, Ottawa, has awarded the contract for installing two passenger and six freight elevators in the Examining Warehouse, to the OTIS-FENSOM ELEVATOR CO., Toronto, Ont.

+Elevators—Ottawa, Ont.—The Department of Public Works has awarded the contract for furnishing and installing three passenger elevators and one freight elevator in the Langevin Bldg., to the GENERAL SUPPLY CO. OF CANADA, LTD.

Steel Work—Toronto, Ont.—Bids will be received by Armand Malo, St. Jerome St., Toronto, for furnishing the steel necessary for the construction of a three-story, 25x100-ft. stable. The estimated cost of the building is $20,000. S. Comber, 1215 Green Ave., is Arch.

+Breakwater—St. John, N. B.—The contract for the extension of the breakwater from West St. John to Partridge Island has been awarded to the MARITIME DREDGING & CONSTRUCTION CO. by the Department of Public Works at Ottawa.

Locomotives and Cars—Winnipeg, Man.—(Official)—See item under "Water Supply—Irrigation."

Bathhouse—Vancouver, B. C.—The Vancouver Salt Water Baths, English Bay, has had plans prepared for the erection of a 60x150-ft. bathhouse. The estimated cost is $75,000. Emil Guenther, Northwest Trust Bldg., Vancouver, is Arch.

BUILDINGS

Boston, Mass.—Plans are being prepared by Harrison H Atwood, Arch., 61 Alban St., for a $300,000 school on Fremont St.

Montpelier, Vt.—According to press reports, the Board of Trade has appointed a committee to investigate a site for a $40,000 theater. H. T. Caton, Claremont, N. H., is interested

+Cranston, R. I.—The contract for constructing additions to the State Insane Hospital has been awarded to W. L. MELLEN, 393 Main St., Worcester, Mass., Estimated cost, $275,000. Martin & Hall, 806 Union Trust Bldg., are the Archs.

Providence, R. I.—Bids will be received until January, 1915 for the construction of a two-story school on Laurel Hill Ave Estimated cost, $80,000. Charles V How, Turks Head Bldg is the Arch.

Providence, R. I.—Bids will soon be received by the Board of Contract for the construction of a $55,000 police station.

New York, N. Y.—(Borough of Bronx)—The construction of a five-story apartment on Vermilyea Ave., between Isham and 211th St., is contemplated by the Aldus Construction Co., Inc., to cost $100,000 Jacob S Kahn, 600 West 181st St., is interested.

(Borough of Queens)—Plans are being prepared by Edward Hahn, Bridge Plaza, for the construction of a five-story, 50x82-ft building on Jamaica Ave, between Eighth and Ninth Ave. for the Reliable Building Co., 1401 Second Ave. Estimated cost, $50,000.

(Borough of Queens)—Preliminary plans are being prepared by Frank Braun, 585 Ninth Ave., Astoria, L. I., for the con-

[illegible] of a five-story, [illegible]-ft. building for A. [illegible], [illegible] North Ave. Estimated cost, $[illegible].

Arlington, N. J.—[illegible], Kearney, plans to construct [illegible] four-story buildings on Kearney Ave. and [illegible] St. Estimated cost, $[illegible].

Newark, N. J.—Bids are being received by the [illegible] Council for [illegible] additions and alterations for the hospital on [illegible] St. Estimated cost, $[illegible]. H. A. & J. J. King, [illegible] Bldg., Newark, are Archs.

Ridgewood, N. J.—The Board of Education contemplates [illegible] a $[illegible] High School on [illegible] Ave. H. S. [illegible] is Pres. of Bd.

Trenton, N. J.—Bids will soon be received by the Board of Education for the construction of the Junior High School on [illegible] Ave., to cost $[illegible].

Woodstown, N. J.—Plans are being prepared by A. W. [illegible] for the construction of a high school, [illegible] ft. Estimated cost, $[illegible].

Greensburg, Penn.—Bids will be received about Feb. 1 for the construction of a [illegible]-story and basement bank building for the Westmoreland National Bank. Estimated cost, $[illegible]. [illegible] Barber Co., [illegible] Bldg., [illegible], is Arch. Noted Sept. 21.

✦**Harrisburg, Penn.**—According to press reports the Penn [illegible] R.R. has awarded a contract to the BROWN-KING CONSTRUCTION CO., Philadelphia, for constructing freight stations in the [illegible] section of the city.

Philadelphia, Penn.—Preliminary arrangements are being made for the construction of a two-story, [illegible]-ft. synagogue for the [illegible] congregation. Estimated cost, $[illegible].

Philadelphia, Penn.—Plans have been prepared for the construction of a four-story [illegible] apartment at 12th St. and [illegible] Lane, for Charles [illegible]. Estimated cost, $[illegible].

Pottsville, Penn.—Plans are being prepared by F. X. Reilly, Arch., Pottsville, for altering and erecting additions to a school at Pottsville. Estimated cost, $[illegible].

Scranton, Penn.—The Directors of the Scranton Life Insurance Co. are having plans prepared for the construction of a 12-story fireproof building to cost $[illegible].

Towanda, Penn.—[illegible] & [illegible], Archs., Elmira, N. Y., are preparing plans for a two-story and basement high school, to be constructed at a cost of $[illegible].

Baltimore, Md.—Bids will be received by Israel Silberstein, [illegible] Equitable Bldg., Baltimore, until Jan. 1[illegible], for the construction of [illegible] apartment at [illegible] Ave. and Park Front Terrace. Estimated cost, $[illegible]. [illegible] Russell is Arch.

Richmond, Va.—Bids will be received until Jan. 4 by the Board of [illegible] Commissioners for the construction of a [illegible], [illegible] ft., at [illegible] and Marshall St. Estimated cost, $[illegible]. [illegible] & Johnston, Chamber of Commerce, are Archs.

Roanoke, Va.—All bids received for the construction of a building at [illegible] Ave. and Franklin Rd. for Christ Episcopal Church have been rejected. The plans will be revised by Frederick W. [illegible], Arch., Minneapolis, Minn., and C. H. [illegible], Arch., Roanoke. Estimated cost, $[illegible]. New bids will be asked.

✦**Charleston, W. Va.**—The contract for the high school to be constructed at Charleston has been awarded to the [illegible] BUILDING CO., [illegible] Johnston Bldg., Cincinnati, Ohio, at $[illegible]. Noted Dec. 10.

Asheville, N. C.—Plans are being prepared by W. H. Lord, Arch., [illegible] Church St., for additions to be made to the Mission Hospital, to cost $[illegible].

Tampa, Fla.—Plans have been prepared by F. G. Kennard for the construction of an [illegible]-story hotel on Lafayette St. for [illegible], [illegible] Bldg., Tampa, and others. Estimated cost, $[illegible].

✦**Montevallo, Ala.**—The contract for the construction of a [illegible]-story [illegible] building for the Alabama Girls' [illegible] School has been awarded to [illegible] LAMARKE, [illegible], at $[illegible]. Noted [illegible].

Vivian, La.—Bids will be received by Edward F. Neil, [illegible], until Jan. [illegible], for the construction of a public school at Vivian. Estimated cost, $[illegible]. Noted Dec. [illegible].

Chattanooga, Tenn.—The First Methodist Church contemplates [illegible] a $[illegible] building at Chattanooga. J. W. [illegible] is Pastor.

Louisville, Ky.—[illegible], Arch., [illegible], is preparing plans for the construction of a [illegible] [illegible] building.

Cleveland, Ohio.—Plans are being prepared by [illegible], Arch., for the construction of a [illegible] bank building for the [illegible] Banking & Trust Co., [illegible] Ave. [illegible] is Vice Pres.

Cleveland Heights ([illegible] post office), **Ohio.**—Plans have been prepared for the construction of an apartment house at [illegible] Heights Blvd. and [illegible] Rd., for the [illegible] Investment Co. [illegible]. Estimated cost, $[illegible].

East Liverpool, Ohio.—Bids will be received until [illegible] for the construction of the [illegible] House on West Fifth St.

Fremont, Ohio.—The Commissioners of Sandusky County contemplate the construction of a Court House, estimated to cost $[illegible].

Hamilton, Ohio.—The city plans the construction of a [illegible] and city hall. [illegible] is Mayor.

Marble, Ohio.—Bids will be received until Jan. [illegible] for the construction of a school. [illegible] & [illegible], [illegible], are Archs.

Wilmington, Ohio.—Plans have been prepared by [illegible] & [illegible], Archs., Cincinnati, for the construction of a hotel, to cost about $[illegible].

Youngstown, Ohio.—Plans are being prepared by Frank [illegible], Arch., [illegible] Bldg., for the construction of a [illegible] telephone exchange building for the [illegible] Telephone Co.

Zanesville, Ohio.—The City Council, of Zanesville, plans the construction of city hall and market, to cost about $52,000.

Chicago, Ill.—Plans are being prepared by Frederick Koenning, Arch., 3[illegible] North Dearborn St., for the construction of a three-story and basement 107x120-ft. apartment house on 7[illegible]th Pl. and Oglesby Ave. for Smith Hoyll, [illegible] North Dearborn St. Estimated cost, $65,[illegible].

Chicago, Ill.—L. M. Mitchell, Arch., 9 South La Salle St., is preparing plans for the construction of three apartments at [illegible]-27 St. Lawrence Ave. for Johnston Bros., 109 North Dearborn St. Estimated cost, $120,000.

Plans are being prepared by John E. Stone, Arch., 8 South Dearborn St., for the construction of a three-story brick apartment at [illegible] Woodlawn Ave. Estimated cost, $40,000.

A permit for the construction of a three-story brick apartment at [illegible] East 7[illegible]th Pl. has been granted to Mrs. E. Hashel, [illegible] Oglesby Ave. The estimated cost is $75,000. Thomas Bishop is Arch.

(Continued on page 387)

CONTRACT PRICE

QUAY WALL, PAWTUCKET, R. I.

✦Bids were received Nov. 24, by the State Harbor Improvement Commission, for the construction of a quay wall at Pawtucket from (A) JOHN CASHMAN & SONS, Boston (awarded contract), (B) John Cashman & Sons, Boston (alternate bid), (C) Roy H. Beattie, Inc., Fall River, (D) H. P. Converse Co., Boston, (E) T. A. Scott Co., Inc., New London, Conn. The item bids were as follows:

	A	B	C	D	E
1[illegible],000 cu. yd. excavation, earth	$0.17	$0.4[illegible]	$0.70	$0.6[illegible]	$0.7[illegible]
[illegible] cu. yd. excavation, rock	[illegible]	[illegible]	5.50	[illegible]	1[illegible]
4780 cu. yd. granite wall	6.90	7.2[illegible]	6.30	[illegible]	11.00
690 lin. ft. granite coping	9.70	8.70	10.[illegible]	11.3[illegible]	12.[illegible]
15 lin. ft. granite coping	7.00	7.00	6.00	[illegible]	12.00
600 lin. ft. wooden fendering	9.[illegible]	5.[illegible]	[illegible]	7.00	9.[illegible]
11,0[illegible] lb. cast iron	0.04	0.04	0.04	0.04	0.04[illegible]
Extended totals	$[illegible]	$80,748	$87,[illegible]	$[illegible]	$123,7[illegible]

SEWER, PORTLAND, ORE.

Bids were received by the City Council for the construction of a trunk sewer in East 82d St. from (A) Giebish & Joplin, (B) Consolidated Contract Co., (C) Elliott Contracting Co., (D) J. F. Shea, (E) James Kennedy. The item bids were as follows:

Vitrified clay pipe—	A	B	C	D	E
24[illegible] lin. ft. 24-in.	$2.00	$[illegible]	$2.00	$2.00	$1.[illegible]
[illegible] lin. ft. [illegible]	1.70	1.6[illegible]	1.[illegible]	1.60	1.6[illegible]
[illegible] lin. ft. [illegible]	1.40	1.30	1.30	1.[illegible]	1.[illegible]
[illegible] lin. ft. [illegible]	1.20	1.20	1.[illegible]	1.10	1.1[illegible]
[illegible] lin. ft. 16-in.	1.00	1.10	0.90	0.[illegible]	0.[illegible]
[illegible] lin. ft. 1[illegible]-in.	0.75	1.00	0.7[illegible]	0.[illegible]	0.[illegible]
[illegible] lin. ft. 1[illegible]-in.	0.60	0.60	0.[illegible]	[illegible]	0.[illegible]
[illegible] lin. ft. 1[illegible]-in.	0.[illegible]0	0.[illegible]0	0.[illegible]	0.40	0.4[illegible]
[illegible] lin. ft. 8-in.	0.[illegible]	0.3[illegible]	0.3[illegible]	0.30	0.[illegible]
[illegible] lin. ft. 6-in.	0.2[illegible]	0.[illegible]	[illegible]	0.2[illegible]	0.[illegible]
Reinforced-concrete pipe—					
[illegible] lin. ft. 6[illegible]-in.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] lin. ft. [illegible], Class A	[illegible]	6.00	[illegible]	6.9[illegible]	[illegible]
[illegible] lin. ft. [illegible], Class B	4.[illegible]	[illegible]	4.[illegible]	[illegible]	[illegible]
16[illegible] lin. ft. [illegible]	[illegible]	3.[illegible]	3.2[illegible]	[illegible]	3.6[illegible]
43 lin. ft. [illegible], Class A	3.[illegible]0	[illegible].60	3.10	3.[illegible]	3.[illegible]
[illegible] lin. ft. [illegible], Class [illegible]	[illegible]	2.00	[illegible]	2.0[illegible]	[illegible]
16[illegible] lin. ft. [illegible]-in.	[illegible]30	[illegible]	1.90	2.1[illegible]	[illegible]
[illegible] cu. yd. earth excavation	[illegible]	0.[illegible]	0.7[illegible]	0.70	0.[illegible]
Extended totals	$1[illegible]	$1[illegible]	$17[illegible]	$17[illegible]	$177,[illegible]

WATER SYSTEM, WAPPINGERS FALLS, N. Y.

✦Bids were received by the Board of Trustees Nov. 1[illegible] for the construction of a water system according to plans prepared by H. L. Sterling, Engr., Newburgh, from (A) [illegible], Hartford, Conn.; (A-1) Michael Spino, [illegible], N. Y.; (B) [illegible], Morgantown, W. Va.; (B-1) [illegible] & [illegible], [illegible], N. Y.; (C) Daly & Merritt, Port Chester, N. Y.; (C-1) [illegible] Corbin, New York, N. Y.; (D) J. F. [illegible], Newark, N. J.; (D-1) [illegible] & [illegible], Harriman, N. Y.; (E) [illegible] Contracting Co., New York, N. Y.; (E-1) [illegible], [illegible], Penn.; (F) [illegible] & D'Aurio Co., [illegible]; (F-1) [illegible] Construction Corporation, Albany, N. Y.; (G) Joseph [illegible] & Sons, [illegible] Broadway, [illegible], N. Y.; (G-1) [illegible] Engineering & Contracting Co., [illegible], N. Y.; (H) Joseph [illegible]; (H-1) J. R. [illegible], Yonkers, N. Y.; (I) [illegible], N. Y.; (I-1) Thompson & [illegible], [illegible], N. Y.; (J) [illegible]; (K) [illegible] Construction Co., N. Y.; (K-1) O'Rourke Contracting Co., [illegible], N. Y.; (L) [illegible] & [illegible] Co., Schenectady, N. Y.; (M) J. F. [illegible] & Co., Rochester, N. Y.; (M-1) Harrison & Burton Co., New York, N. Y.; (N) [illegible], N. Y.; (N-1) [illegible] & [illegible], New York, N. Y.; (O) [illegible] Construction Co., [illegible], Penn.; (O-1) Abner M. Harper, Newburgh, N. Y.; (P) [illegible] & [illegible], Schenectady, N. Y.; (P-1) F. A. [illegible], New York, N. Y.; (Q) Frank [illegible], Paterson, N. J.; (Q-1) [illegible], [illegible], Mass.; (R) Burns & [illegible], New York, N. Y.; (R-1) William [illegible] Mitchell, [illegible], N. Y.; (S) [illegible] & [illegible], Inc., New York, N. Y.; (S-1) J. J. McDonald, [illegible], N. Y.; (T) Gardner & Van [illegible], Asbury Park, N. J.; (T-1) [illegible] M. [illegible], New York, N. Y.; (U) CHRIS [illegible] & [illegible], Peekskill, N. Y. (awarded contract); (V) [illegible] Engineering & Supply Co., Pittsburgh, Penn.; (W) [illegible] Engineering Co., New York, N. Y. The item bids were as follows:

	A	A-1	B	B-1	C	C-1	D	D-1	E	E-1	F	F-1	G	G-1	H	H-1	I	J	J-1	K	K-1
42,840 lin.ft. trenching, Class A	$0.23	$0.25	$0.22	$0.16	$0.19	$0.18	$0.32	$0 19	$0.18	$0 20	$0.22	$1.25	$0.20	$0.01	$0 30	$0.24	$1.95	$0.23	$0.18	$0.20	$2.41
50 lin.ft. trenching, Class B	0.38	1.00	4.00	5.00	1.00	2.00	0.50	0.75	0.50	2.00	0.25	0.45	10.00	3.00	1.18	1.50	2.00	8.00	2.00	3.00	1.00
1000 cu.yd excavation, Class C	4.00	3.49	2.50	3.00	3.50	3.00	3.00	1.50	2.60	4.00	3.75	2.50	3.50	3.50	3.54	3.50	4.00	3.35	2.00	3.00	2.90
662 tons c.i. pipe	28.00	30 00	30.00	25.00	24.00	22.00	25.00	27.50	23.50	25.00	28.65	23.25	25.50	28.00	25.60	24.25	25.50	23.00	25.00	21.50	23.50
15 tons special iron castings	60.00	40.00	66.00	60.00	60.00	60.00	50.00	70.00	60.00	57.00	70.26	58.00	67.50	60.00	60.25	51.50	60.00	55.00	65.00	50.00	55.00
1 ton straight flanged pipe	50.00	38.00	40.00	40.00	80.00	50.00	50.00	50.00	40.60	50.00	42.35	38.00	50.60	60.00	60.23	31.50	70.00	40.00	80.00	40.00	40.00
8 ton valve boxes	65.00	60.00	70.00	55.00	60.00	55.00	50.00	60.00	55.00	60.00	52.05	73.00	65.00	60.00	54.30	37.70	48.00	55.00	65.00	52.00	60.00
38 4-in. valves	8.00	9.75	11.00	12.00	9.00	7.50	7.00	10.00	6.75	6.50	9.25	8.25	10.00	10.00	7.46	10.50	8.50	10.00	7.00	6.00	6.25
43 6-in. valves	12.50	14.25	18.00	17.00	14.00	12.00	10.00	15.00	11.00	9.75	14.70	11.50	15.00	15.00	11.00	15.17	13.00	13.00	12.00	9.00	9.05
5 8-in. valves	18.00	23.00	26.00	25.00	18.00	16.50	15.00	25.00	18.00	15.00	21.25	18.00	20.00	25 00	16.55	21.97	18 00	20.00	18.00	14.00	14.50
3 10-in. valves	26.00	34.00	40.00	35.00	30.00	23.50	25.00	35.00	25.00	23.00	29.50	28.00	30.00	40.00	25.30	30.00	27.00	30.00	25.00	22.00	25 00
300 ⅝-in. corrugated cocks	4.00	1.00	2.50	2.00	1.00	2.50	1.00	1.00	2.00	1.35	1.08	1.25	4 50	2 00	2.36	2.85	6.50	4.50	1.50	1.00	2.50
10 ¾-in. corrugated cocks	4.25	1.50	2.75	3.00	2.00	2.50	1.20	1.50	2.00	1.50	1.49	1.50	6.50	4.00	2.36	2.90	8.50	6.00	1.70	2.00	2.50
10 1-in. corrugated cocks	4 40	2.15	3.00	5.00	3.00	3.00	1.50	2.00	3.00	2.00	3 10	2 00	10.00	5.00	2.36	3.00	12.00	7.00	1.70	4.00	3.00
40 hydrants, 2-nozzle	36 00	30.00	35.00	28.00	27.50	25.00	25.00	30.00	25.00	30.00	27.50	29.00	38 00	30.00	37.20	37.50	27.00	27.00	26.00	23.00	40.00
24 hydrants, 3-nozzle	50.00	42.00	40.00	40.00	45.00	50.00	40.00	35.00	30.00	45.00	32.03	41.90	50.00	50.00	57.25	51.50	20.50	35.00	30.00	26.00	55.00
15,415 lin.ft. 4-in. pipe	0 13	0.14	0.12	0.08	0.10	0.06	0.10	0.08	0.08	0.12	0.14	0.95	0.15	0.40	0.07	0.19	0.75	0.19	0.10	0.08	0.95
21,035 lin.ft. 6-in. pipe	0.15	0.16	0.15	0.11	0.12	0.09	0.13	0.12	0.10	0.15	0.17	0.11	0.20	0.41	0.12	0.21	0.95	0.24	0.12	0.10	0.12
2080 lin.ft. 8-in. pipe	0.20	0.20	0.18	0.14	0.19	0.12	0.15	0.15	0.13	0.22	0.22	1.35	0 25	0.42	0.20	0.27	0.16	0.25	0.15	0.15	0.16
4310 lin.ft. 10-in. pipe	0 25	0.24	0.20	0.17	0.55	0.17	0.17	0.22	0.16	0 25	0.32	0.17	0.30	0.43	0.22	0.30	2.35	0.30	0.18	0.20	0.26
26,000 cu.yd. excavation, reservoir	0.60	0.89	0 65	0.40	0.60	0.60	0.52	0.48	1.50	0.75	0.55	0.70	0.75	0.50	0.59	0.75	0.77	0.50	0.45	0.60	0.61
650 lin.ft. gutter	0.50	0.50	0.90	0.80	0.45	0.65	0.60	0.70	0.75	1.00	0.98	0.25	1.00	0 50	0.71	0.25	0.70	0.60	0.60	0.50	0.75
970 cu.yd. division wall	10.00	8.00	8.00	6.00	7.00	8.00	7.00	6.25	7.50	8.00	5.98	4.90	9.50	6.50	5.00	7.00	7.00	7.00	4.50	8.00	5.50
3700 sq.ft. core wall	0.40	0.15	0.16	0.07	0.20	0.10	0.50	1.00	0.25	0.20	0.18	0.09	0.60	0 40	0 17	0.15	0.10	0.20	0.12	0 20	0.15
1 manhole	75.00	175.00	100.00	50.00	90.00	45.00	100.00	50.00	50.00	100.00	75.00	75.00	65.00	59.00	59 00	150.00	60.00	40.00	40.00	60.00	100.00
11 cu.yd. concrete overflow	10.00	8.00	8.00	8.00	10.00	15.00	8.00	10.00	8.00	10.00	9.57	12.00	9.00	10.00	8.26	7.00	10.00	9.00	5.00	15.00	8.50
3324 sq.yd. gravel floor	1 00	0.60	0.40	0.35	0.25	0.33	0.75	0.50	0.50	0.40	0.42	0.33	0.45	0.40	0 40	0.50	0.50	0.35	0.15	0.35	0.45
Rock	4.00	5.00	2.50	3.00	3.50	3.50	3.00	1.50	5.00	4.00	2.25	3.00	3.00	7.50	1 77	3.00	5.00	2.00	3.00	3.00	3.50
Extended totals	$76,081	$79,984	$71,779	$55,083	$63,114	$60,315	$68,169	$62,629	$84,422	$70,863	$67,634	$57,863	$78,058	$68,541	$67,056	$74,014	$69,652	$66,676	$53,773	$60,136	$64,044

	L	M	M-1	N	N-1	O	O-1	P	P-1	Q	Q-1	R	R-1	S	S-1	T	T-1	U	V	W
42,840 lin.ft. trenching, Class A	$0.12	$0 29	$0.20	$0.18	$0.20	$0.21	$0.11	$0.30	$0.15	$0.15	$0.52	$0 16	$0.16	$0.17	$0.13	$0.20	$0.09	$0 20	$0.43	$0.225
50 lin.ft. trenching, Class B	0.50	0.29	3.00	1.00	1.00	0.80	1.00	1.50	1 00	1 00	0.80	1.50	5.03	4.00	0.50	1.00	0.001	0.80	2.82	3.50
1000 cu.yd. excavation, Class C	2.50	4.50	3.00	1.90	2.50	2 30	3.00	4.50	3.00	2.00	4.50	2.50	2.75	3.00	3 00	3.50	0.001	2.00	2 75	3.50
662 tons c.i. pipe	24.15	23.90	24.00	25.75	23.00	23.25	22.00	28.00	23.00	25.00	24.50	23.42	26.24	25.75	23.50	25 10	21.50	23.00	22.50	23.00
15 tons special iron castings	64.72	52.00	55.00	70.00	53.00	64.00	60.00	63.00	55.00	55.00	53.50	55.00	65.00	60.35	60.00	58.68	50.00	50.00	57.00	56.00
1 ton straight flanged pipe	26.83	35.00	60.00	50.00	38.00	60.00	40.00	100.00	50.00	45.00	38.50	55.00	50.00	44.75	40.00	28.50	35.00	35.00	31.20	45.00
8-ton valve boxes	45.00	34.40	40.00	70.00	53.00	50.00	60.00	80.00	50.00	55 00	53.50	54.00	62.50	61.00	75.00	66.82	50.00	50.00	52.50	51.50
38 4-in. valves	10.17	5.75	7.50	7.00	15.00	6.75	7.00	12.00	7.00	9.00	6.72	7.00	8 00	11.50	8.35	8.34	8.50	10.00	9.70	8.25
43 6-in. valves	14.88	9.80	11.50	10.00	20.00	11.00	10.50	20.00	10.50	14.00	9.78	10.00	11.25	15.25	11.53	13.40	12.00	13.50	15.00	14.00
5 8-in. valves	20.62	16.25	17.00	16.00	25.00	16.00	16.00	30.00	15.00	21.00	15 00	14 00	17.00	23.00	18.65	19.55	17.00	18.00	21.00	20.00
3 10-in valves	29.24	23.50	25.00	25.00	33.00	23.50	23.00	40.00	25.00	30.00	22.25	22.00	25.00	38.00	28.00	28.24	27.00	27.00	29.00	30.00
300 ⅝-in. corrugated cocks	1.50	0.90	1.50	2.50	2.50	1.80	0.60	1.50	2.50	1.00	2.00	1.00	2.50	1.38	1 25	1.40	0.25	1.35	1 00	4.40
10 ¾-in. corrugated cocks	2.00	1.25	1.75	2.50	2.50	2.00	1.50	2.50	2.75	1.50	2.50	1.40	2 75	1.85	1.50	1.66	0 25	1.55	1.10	4.75
10 1-in. corrugated cocks	2.00	1.60	2.00	2.50	3.00	2.20	2.50	3.00	3.00	1 75	3.00	3.50	4.00	4.00	2.00	2.50	0.25	1.75	2.50	6.50
40 hydrants, 2-nozzle	27.82	22.50	26.50	30.00	41.00	27.50	24.00	35.00	25.75	30.00	27.00	28.00	32.00	33.35	29.80	35.00	29.00	29.00	30.50	30.00
24 hydrants, 3-nozzle	44.60	27.00	43.50	42.00	54.00	29.50	30.00	50.00	40.00	46.00	40.00	34.00	46.00	52.60	42.00	37.00	41.00	41.00	35.75	50.00
15,415 lin.ft. 4-in pipe	0.11	0.10	0.10	0.10	0.10	0.08	0.16	0.08	0.10	0.12	0.45	0.10	0.08	0.14	0.10	0.06	0.42	0.11	0.075	0.11
21,035 lin.ft. 6-in. pipe	0.12	0.12	0 12	0.13	0.16	0.09	0.18	0.10	0.12	0.15	0.50	0.15	0.095	0.17	0 11	0.08	0.42	0.15	0.085	0.13
2080 lin.ft. 8-in. pipe	1.35	0.15	0.14	0.16	0.20	0.12	0.20	0.12	0.14	0.22	0.70	0.17	0.11	0.19	0.14	0.115	0.42	0.20	0.11	0.15
4310 lin.ft. 10-in. pipe	1.65	0.20	0.17	0.20	0.20	0.15	0.22	0.14	0.15	0.25	0.80	0.20	0.125	0.23	0.17	0.145	0.42	0.25	0.145	0.19
26,000 cu.yd. excavation, reservoir	0.43	0.44	0.38	0.45	0.60	0.63	0.49	1.10	0.47	0.60	0.65	0.60	0.57	0.45	0.725	0.75	0.33	0.35	0.80	0.60
650 lin.ft. gutter	0.65	0.66	0.80	0.60	6.00	0.60	0.30	0.35	0.54	0.45	0.75	1.00	0.64	0.69	0.25	0.90	0.97	1.00	1.40	0.68
970 cu.yd. division wall	7.00	7.50	5.95	5.00	2.00	7.00	3.50	8.00	9.00	6.00	8.50	5.15	8.43	7.35	5.00	7.10	4.00	4.53	9.00	7.35
3700 sq.ft. core wall	0.12	0.08	0.15	0.75	0.15	0.30	0.15	0.20	2.25	0.25	0.45	0.20	0.27	0.12	0.095	0.10	0.80	0.10	1.70	0.16
1 manhole	75.00	60.00	50.00	50.00	100.00	150.00	50.00	150.00	100.00	40.00	25.00	75.00	95.00	57.00	50.00	73.00	60.00	64.00	200.00	80.00
11 cu.yd. concrete overflow	9.00	7.50	8.00	8.00	7.00	7.00	10.00	12.00	9.00	7.00	16.00	10.00	7.00	7.50	12.00	7.25	4.00	6.00	10.00	8.00
3324 cu.yd. gravel floor	0.15	0.30	0.25	0 25	0.35	0.40	0.10	0.40	0.47	0.50	0.35	0.50	0.38	0.33	0.35	0.25	0.50	0.20	0.42	0.35
Rock	2.95	4.50	3.00	1.00	3.00	2.50	3.00	3.50	1.50	4.00	2.00	3.00	3.50	3.00	3.00	3.00	1.50	1.50	2.75	3.50
Extended totals	$53,632	$62,308	$55,127	$58,382	$62,516	$61,998	$51,507	$85,468	$58,540	$61,068	$98,838	$59,207	$62,737	$61,437	$59,730	$65,800	$58,323	$52,386	$84,224	$65,484

PIER, NEW BEDFORD, MASS.

[illegible] (F) T. A. Scott Co., Inc. (G) H. P. Converse & Co. (H) [illegible] (I) [illegible] Contracting Co. [illegible] (K) Lawler Bros. [illegible]

ALTERNATE CONSTRUCTION

	A	B	C	D	E	F	G	H	I	J	K
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SOLID FILL CONSTRUCTION

	A	B	C	D	E	F	G	H	I	J	K
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CATALOG NOTICES

[illegible]

BUILDINGS

(Continued from page 384)

East St. Louis, Ill.—The Maher Commission Co., East St. Louis, has purchased a site at Sixth St. and Missouri Ave., for the construction of an office building. Construction will begin in the spring.

Galesburg, Ill.—Veritas Lodge No. 478 and the First Scandinavian Lodge No. 446, I. O. O. F. will construct a four-story building, estimated to cost, $70,000.

Ottawa, Ill.—Plans have been prepared by Jason F. Richardson, Jr., Arch., for the construction of three fireproof buildings. The group will be known as the Illinois Valley General Hospital. The estimated cost is $75,000.

Springfield, Ill.—The Illinois Centennial Commission will petition the next legislature to appropriate $1,000,000 for the construction of a state building. Hugh S. Magill, Jr., Springfield, is Chn. of Comn.

Madison, Wis.—Bids will be received until 2:30 p.m., Jan. 18, by M. E. McCaffrey, Secy., University of Wisconsin, Administration Bldg., for constructing the superstructure of the addition to the Soils Bldg.

St. Paul, Minn.—The St. Paul Union Depot Co., are having plans prepared for the construction of the $15,000,000 St. Paul Union Depot. E. Pennington, Minneapolis, is Pres.

The St. Paul Athletic Club is planning to construct a $500,000 club house.

+Parsons, Kan.—The contract for the construction of a three-story office building for the Missouri, Kansas & Texas Ry. has been awarded to the WIMMER CONTRACTING CO., St. Louis, Mo. Estimated cost, $50,000.

Kansas City, Mo.—Plans are being prepared for the construction of an addition, as a home for nurses for the German Hospital Association. Estimated cost, $60,000.

Oakland, Mo.—The Ursuline Sisters are planning the construction of a $125,000 seminary for young women, on a site recently purchased.

Temple, Tex.—Bids will soon be received by the Board of Directors of the Atcheson, Topeka & Santa Fé Ry. Employees Hospital, for the construction of a $50,000 addition, at Temple. Noted Aug. 6.

Denver, Colo.—The citizens of Denver are projecting a movement to raise $1,000,000 for the construction of a granite castle and development of the 640 acres of land on Mount Falcon, 15 miles west of Denver. The castle is to be the summer home for the use of the President of the United States. It will be built and presented to the nation by the citizens of the 22 states west of the Mississippi River.

Tacoma, Wash.—The Fry Bruhn Co., 1120 C. St. plans to expend $50,000 on improvements to its building.

Portland, Ore.—Bids will be received about Jan. 1, by McNaughton & Raymond, Archs., for the construction of the five-story, 100x200-ft. Blake-McFall Bldg., on East Ankeny between East Second and East Third St. Estimated cost, $90,000.

Portland, Ore.—Frye & Co., Seattle, Wash., contemplates the construction of a four-story, 50x100-ft. building on Third and Yamhill St. The estimated cost is $75,000.

Portland, Ore.—The School Board contemplates constructing the first unit of the Franklin High School at East 52d and Division St. Estimated cost, $100,000.

F. A. Naramore, Arch., is preparing plans for the construction of the $40,000 Kennedy School on Jessup St.

Salem, Ore.—The State Fair Board will petition the next legislature to agree to the expenditure of $123,638 for the construction of a 159x270-ft., livestock exhibition building.

Los Angeles, Calif.—Plans have been prepared for the construction of a 100x195-ft. building on Central Ave. and Fourth St. for Wells, Fargo & Co. Estimated cost, $100,000.

The Owensmouth Union High School District voted $100,000 in bonds for the construction of a high school.

FILTRATION PLANT, CLEVELAND, OHIO

Bids were received Dec. 8 by the city for the construction of a filtration plant at the Division Pumping Station, from (A) M. L. Bayard, Philadelphia, Penn.; (B) American Water Softener Co., Philadelphia, Penn.; (C) Roberts Filter Mfg. Co., Darby, Penn.; (D) Norwood Engineering Co., Florence, Mass.; (E) Pittsburgh Filter Mfg. Co., Pittsburgh, Penn.; (F) William A. Pope, Chicago, Ill. The item bids were as follows:

	A	B	C	D	E	F
Filter strainer systems (lump sum)	$53,000.00	$50,441.00	$56,738.00	$54,600 00	$55,639 00	$65,992 00
Filter rate controllers (lump sum)	35,000 00	36,916.00	33,084.00	34,200.00	35,295 00	39,325 00
Sample pumps and piping (lump sum)	900.00	1325.00	1229 00	1500 00	1103 00	2640.00
Sand piping and equipment (lump sum)	4000.00	3983.00	3234 00	6500 00	4018 00	6740 00
Water level indicators and recorders (lump sum)	1000.00	1450.00	1101 00	1052 00	1171.00	830.00
Laboratory equipment (lump sum)	1700 00	1834 00	2652.00	2546 00	2226.00	2710 00
Sterilizing apparatus and piping (lump sum)	3600.00	4440.00	3810.00	3878.00	4273 00	4250.00
Automatic scales (lump sum)	6900 00	7312 00	7531.00	6035 00	6464 00	6100.00
Scale supports, platforms, spouts and gates (lump sum)	3300 00	2728 00	3437.00	2700 00	2658 00	5570.00
Lime slaking apparatus (lump sum)	3600 00	3690.00	3780.00	3600 00	4400 00	5090.00
Coagulant dissolving tanks (lump sum)	300 00	474.00	493.00	760 00	631.66	1240.00
Chemical pumps and stirrers (lump sum)	2400 00	1564 00	1701 00	2600 00	2250 00	3500 00
Coagulant feed device (lump sum)	1800.00	500 00	1089 00	1210 00	1089 00	1950.00
Lime and coagulant piping (lump sum)	6000 00	8891 00	5462.00	5900 00	6530 00	9940.00
Solution tank gages and alarms (lump sum)	700.00	759 00	838 00	848.00	946 00	866.00
Recording thermometers (lump sum)	300.00	304 00	328 00	385 00	345 00	480.00
Blower and ducts (lump sum)	800.00	1204 00	889 00	1093 00	859 00	1300.00
Water heaters (lump sum)	1200.00	1529 00	1589 00	1596 00	1631 00	2370.00
Hot water tanks and piping (lump sum)	700 00	607 00	722 00	767 00	704 00	960.00
Sludge car (lump sum)	100 00	54 00	69 00	50 00	78 00	102.00
Coagulant feed indicators and wiring (lump sum)	300 00	408 00	408 00	420 00	400 00	420 00
Coagulant disintegrators (lump sum)	1100.00	1320 00	1130 00	1340 00	1516 00	1540 00
Constant head tank (lump sum)	200.00	216 00	282 00	176.00	175 00	336.00
Sump pumps (lump sum)	700 00	890 00	781 00	973 00	865 00	1070 00
Switch boards, conduits and wiring (lump sum)	1500 00	1023 00	1122 00	956 00	1031 00	1528 00
Miscellaneous piping (lump sum)	800.00	609 00	630 00	1440 00	1016 00	3781 00
Baffles (lump sum)	900 00	858 00	1405 00	1090 00	1300 00	1462 00
Excavation and backfilling	400 00	300 00	360 00	300 00	240 00	800.00
Setting venturi meter recorders (lump sum)	300.00	309 00	310 00	342 00	365 00	1490.00
Totals	$133,500	$135,938	$136,204	$138,857	$139,218	$174,402

WATER TUNNEL LINING, BALTIMORE, MD.

Bids were received Dec. 2 for the construction of a concrete lining in the tunnel of the Gunpowder Water Supply Improvement District, from (A) C. B Clark & Co., Baltimore; (B) James F. Leary Construction Co., Rochester, N. Y.; (C) Stobaugh Contracting Co., New York, N. Y.; (D) James Ferry & Sons, Baltimore; (E) Lock Joint Pipe Co., New York, N. Y.; (F) F. K. Corbin Co., New York, N. Y.; (G) Mason-Hilton & Co., New York, N. Y. The item bids were as follows:

	A	B	C	D	E	F	G
285 cu.yd. excavation for vault and steel sections	$4 00	$6 00	$5 00	$6 50	$6.00	$5.00	$3 00
22½ tons furnishing and placing steel bends, etc.	130 00	200 00	170 00	220 00		240.00	110 00
Placing 60-in. valve	50 00	200 00	300 00	700 00	200 00	800.00	75 00
325 cu.yd. 1:2:4 concrete in vault and around pipe	7 75	10 00	10.00	9 50	10 00	11.00	10 00
24 cu.ft. furnishing and placing 3-in. vault drain	1 20	1 15	1 50	0 50	1 00	1 00	1 00
3387 lb. furnishing and placing reinforcing steel, etc	0 03	0 08	0 05	0 10	0 05	0 04	0 05
1502 sq ft gunite lining in steel specials	0 50	0 30	0 40	0 50	0.12	1 00	0 60
1502 sq.ft. bitumastic lining steel specials	0 15	0 30	0 20	0 20	0.11	0 15	0 10
150 lin.ft. furnishing and placing 1-in. pipe for subdrain	0 90	0 30	1 30	0 50			1 50
20 lin.ft. furnishing and placing 1½-in. pipe for subdrain	1 20	0 35	1 40	0 65			2 00
100 lin.ft. furnishing and placing 3-in. pipe for subdrain	1 90	0 60	1 60	1 00			3 00
50 lin.ft. furnishing and placing 4-in. pipe for subdrain	2 40	0 85	2 00	1 50			4 00
50 lin.ft. furnishing and placing 6-in. pipe for subdrain	3 00	1 10	2 20	1 80			6 00
200 lin.ft. furnishing and placing 2-in. pipe subdrain	0 40	0 55	1 50	0 90			2 50
500 lin ft. furnishing and placing 8-in. pipe subdrain	2 00	1 80	3 00	2 50			7 00
100 lin.ft furnishing and placing 10-in. pipe subdrain	2 50	2 70	3 75	3 00			8 60
390 lin.ft. furnishing and placing 12-in. pipe subdrain	3 10	4 00	5 50	3 80			11 00
520 lin.ft. furnishing and placing 16-in. pipe subdrain	1 90	5 60	7 00	1 50			17 00
Furnishing and placing 8-in. x 8-in. x 3-in. to 4-in. c.i. tees	18 00	16 00	22 00	6 50			25 00
Furnishing and placing 10-in. x 10-in. x 4-in. to 6-in. c.i. tees	25 00	24 00	30 00	9 50			30 00
Furnishing and placing 12-in. x 12-in. x 4-in. to 6-in. c.i. tees	31 00	30 00	38 00	12 00			40 00
Furnishing and placing 16-in. x 16-in. x 4-in. to 6-in. c.i. tees	15 00	45 00	68 00	25 00			60 00
Furnishing and placing 1-8-in. and 1-12-in. valve	75 00	80 00	200 00	65 00			250 00
1730 lin.ft. (A) alternate drainage system				2 00	0 10	0 50	3 50
60 lin.ft. lining shafts	31 00	50 00	100 00	50 00	60 00	10 00	40 00
2000 lin.ft. reinforced concrete lining	26.00	29.00	29 00	31 50			32 00
2000 lin.ft. (A) alternate reinforced pipe					39 00	50 00	
335 sq.yd. repairing roadway (macadam)	0.50	1 00	1 25	2 00	2 00	1 00	1 26
500 hr. reimbursement for delays	1.00	1.00	1.00	1 00	1.00	1 00	1 00
Extended totals	$67,417	$98,400	$83,135	$90,134	$115,685	$92,462	$93,767

PART OF PISHKUN RESERVOIR SUPPLY CANAL

Sun River Project, Montana

Bids were received by the U. S. Reclamation Service, Dec. [illegible], at Great Falls, Mont., for [illegible] the Pishkun Reservoir Supply Canal, Sun River Project, from Station [illegible] to Station [illegible], from (A) [illegible] Construction Co., Spokane, Wash.; (B) [illegible] Co., [illegible], Mont.; (C) McArthur Bros. Co., [illegible] South La Salle St., Chicago, Ill.; (D) [illegible] & [illegible], Great Falls, Mont. The item bids were as follows:

	A	B	C	D
[illegible] cu.yd. excavation, Class 1	[illegible]	[illegible]	[illegible]	[illegible]
11,[illegible] cu.yd. excavation, Class 2	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] cu.yd. excavation, Class 3	[illegible]	1.25	2.50	1.00
1[illegible] sta. cu.yd. overhaul	[illegible]	[illegible]	[illegible]	[illegible]
1[illegible] cu.yd. concrete in conduit, spillway, etc.	[illegible]	[illegible]	13.00	12.00
[illegible] cu.yd. concrete in bridge piers	[illegible]	[illegible]	[illegible]	11.00
[illegible] lb. placing reinforcing steel	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] lin.ft. placing line in [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] ft. b.m. erecting lumber in structures	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] cu.yd. riprap, timber, etc.	[illegible]	1.[illegible]	[illegible]	1.[illegible]
[illegible] sq.yd. dry paving	[illegible]	[illegible]	2.[illegible]	1.[illegible]
Estimated totals	[illegible]	$1[illegible],[illegible]	$[illegible],[illegible]	$[illegible]

"Engineering News" Representative in South America

The high altitudes and lack of oxygen at some of the mines in South America have long been noted as being a stumbling block to American engineers. The representative of "Engineering News," Duncan [illegible], who went to South America as a trade scout in September, was overcome, notwithstanding he has had considerable experience in high altitudes. His letter, mailed from Lima, Peru, the last of October, describes his troubles, which should be read with care by those American engineers who contemplate going to that part of the world.

I arrived here Sunday morning from Cerro de Pasco. I would have written sooner, but was not in such physical condition that my brain could work right.

Before going to Cerro de Pasco I was warned to beware of "El Soroche," a sickness caused by a sudden change to high altitudes in the Andes. I took all the known precautions to avoid it, took two days to make the trip, and dieted, etc., but I got it, and I am frank to say it has all other sicknesses that I have experienced [illegible] off the boards. The only persons exempt from it are [illegible] and those who have weak lungs. Not being in that class I got an especially strong attack.

I have lived [illegible] at altitudes of [illegible] ft. above sea level, and thought I would have no trouble.

I am informed, however, that in the Andes, at similar altitudes, that the percentage of oxygen in the air is much less than in other parts of the world and [illegible] for El Soroche.

[illegible] it consists of a [illegible] cough with each full breath one takes, [illegible] "la grippe," all the nerves of the body [illegible], the pulse rises to 120 and stays there day and night. Sleep is out of the question, and one sits up in bed to lessen the [illegible]. Sudden chills and fevers chase each other in and out of your body. There is no cure for it; it either wears off or continues and then one must return immediately to a lower altitude or death results.

At the end of the fourth day, the [illegible] told me I would have to return immediately to Lima, [illegible] to be responsible for the result. [illegible] of the Cerro de Pasco [illegible] as a result of [illegible]. So I came back.

RAILWAY PROSPECTS APPEAR BRIGHTER

E. J. Spence, director of traffic, who has returned from a month's inspection trip over the Southern Pacific lines in Louisiana, Texas, New Mexico, Arizona, California and Nevada, is quoted as follows:

"In Louisiana a good rice crop has been harvested and warehouses are filled with sugar. Texas produced a large cotton crop, but the European war has so curtailed the market and reduced the price that the business of the State has been unfavorably affected. In New Mexico, Arizona and Nevada the mining industry has been crippled by the war, so that some of the mines have been closed down, while others are turning out about [illegible] of their usual output. The most serious effect of these conditions is reflected in the diminished purchases of all classes of merchandise by merchants and consumers and a remarkable decrease in railroad travel. Although California has produced bountiful crops there has been comparatively little new construction or new projects of any character and an enormous shrinkage in travel, especially local travel, which is chiefly attributable to the wave of economy throughout the country that has been inspired by the prevalent feeling of uncertainty about the future of business. The earnings of the transcontinental lines have been further affected by the competition of the Panama Canal, which, of course, has not created new business but has transferred tonnage from the railroads.

"I am of the opinion that decreases in earnings have reached the limit and that after the beginning of the New Year we shall experience a gradual improvement, but this will largely depend upon the attitude of the Government.

"There are two methods by which the railroads can be assisted. First, by being allowed to advance their rates where competitive conditions will permit them to do so; and secondly, by being permitted to make necessary rates to retain their traffic against unregulated competition of steamship lines, without being required to reduce rates on other traffic that is not subject to the same competition, so long as other rates are no more than just and reasonable.

"The Interstate Commerce Commission in finally authorizing increases in rates of the Eastern lines, has responded to an unmistakable public sentiment, but during a long period of suspension the railroads have been deprived of the revenue of which they should have enjoyed the benefit from the date their tariffs were originally filed to become effective. This emphasizes a serious injustice in the provision of existing law which authorizes the Interstate Commerce Commission, upon its own initiative, to suspend any advanced rates that may be filed by the carriers. This responsibility is met by suspending practically all advanced rates, so that even though the increased rates are justified and eventually approved the carriers are usually deprived of the revenue that should accrue to them during the period of suspension. While the President has hesitated to exercise any influence over the findings of the Commission, it is within his power to send a recommendation to Congress to repeal that provision of the law which empowers the Commission to suspend advanced rates. Under existing practice the railroads are considered guilty of extortion until they prove their innocence and may suffer starvation while awaiting the sustenance to which they are eventually found to be entitled.

"My suggestion affords adequate protection to all interests. First, it relieves the members of the Interstate Commerce Commission of the responsibility of authorizing increases in rates, which they are reluctant to assume, and, by permitting the railroads to assume the initiative in rate making, leaves the Commission unprejudiced in future hearings upon complaints of any of the rates involved. Secondly, the power of the Commission to award reparation will assure the merchants the benefit of the former rates from the date they were advanced whenever the Commission, upon complaint, finds that the increases are unreasonable and orders the former rates restored. Finally, it contemplates a simple measure of justice to the railroads in giving them the immediate benefit of the revenue accruing from advanced rates to which they are entitled, without any prejudice to the interests of the shippers."

DORCHESTER TUNNEL, BOSTON, MASS.

Section 1

[illegible] (A) [illegible] Contracting Co., [illegible] New York, N. Y.; (B) [illegible]; (C) James J. [illegible]; (D) [illegible] Contracting Co., [illegible]; (E) [illegible] Co., Inc., 17 Battery Pl., New York, N. Y.; (F) Coleman Bros., Boston; (G) Hugh Nawn Contracting Co., 12 [illegible] St., Roxbury; (H) Holbrook, Cabot & Rollins Corporation, 6 Beacon St., Boston; (I) Bruno & Petitti, 18 Tremont St., Boston; (J) McGOVERN & CO., 1 Madison Ave., New York, N. Y. (awarded contract). The item bids were as follows:

	A	B	C	D	E	F	G	H	I	J
[illegible] cu.yd. earth excavation (tunnel plant removed)	[illegible]	[illegible]	[illegible]	[illegible]	$4.[illegible]	[illegible]	$[illegible]	[illegible]	$4.00	[illegible]
[illegible] cu.yd. earth excavation (tunnel without shield)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8.00	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12.50
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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Other work [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	70,000.00	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.30	0.50	[illegible]
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Furnishing and installing equipment at plant [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	75,000.00	[illegible]
Estimated totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$2,1[illegible],750	$2,080,795	$2,[illegible],150	$1,9[illegible]

Construction News

★Denotes work advertised in ENGINEERING NEWS.
✚Denotes contract awarded. The names of bidders awarded contracts are set in CAPITALS.

RAILWAYS

Alabama—Tennessee & Alabama R. R.—See item under Tennessee.

Tennessee—Tennessee & Alabama R.R.—Surveys are being made by this company for the construction of its proposed railway from Fayetteville, Tenn., to Huntsville, Ala., about 34 miles. J. E. Hurd, Fayetteville, Tenn., is Ch. Engr.

✚**Kentucky**—Louisville & Nashville R.R.—According to press reports this company has awarded a contract to LANGHORNE & LANGHORNE, Richmond, Va., for constructing a five-mile branch from Typo, Ky., to the property of the Haley Coal Co.

Edwin W. Gearhart and J. A. Helm, Scranton, Penn., who recently purchased coal and timber lands in Clay County, Ky., plan the constructior of a railway from Barbourville to Manchester, Ky.

Ohio—Pennsylvania Lines West of Pittsburgh—This company, it is reported, bought the Dayton, Lebanon & Cincinnati R.R., which runs between Dayton, Ohio, and Lebanon, Ohio, for $1,000,000.

Missouri—Rolla, Ozark & Southern Ry.—This company has secured the right-of-way and is making preliminary arrangements to construct its proposed railway from Rollo to Anutt, Mo., about 18 miles. J. E. Walker, Rollo, Mo., is Secy. and Gen. Mgr. Noted July 2.

Arkansas—Cairo-Truman & Southern Ry.—This company contemplates the construction of a 20-mile extension to its line from its present terminus to Earl, Ark. L. M. Preston, St. Louis, Mo., is Gen. Mgr.

Washington—The Farmers' Union Grain Agency contemplates the organization of a company for the construction of a 20-mile railway in Washington. R. O. Earnheart, Wallula, Wash., is interested.

California—Southern Pacific Co.—According to press reports plans are being considered by this company for the extension of its Mojave and Bakersfield branch from Cameron to Mojave, Calif., and from Tehachapi to Treves. W. Hood, San Francisco, Calif., is Ch. Engr.

Stockton, Terminal & Eastern R.R.—Plans are being prepared by this company for the extension of its line from Bellota to Jenny Lind, Calif., about ten miles. J. E. Adams, Stockton, Calif., is Vice-Pres. and Gen. Mgr.

Northwestern Pacific R.R.—Surveys are being made by this company for the construction of a branch line from Healdsburg to Christine, Calif., about 61 miles. J. W. Williams, San Francisco, Calif., is Ch. Engr. Const.

ELECTRIC RAILWAYS

New Haven, Conn.—The Connecticut Co. is considering plans for the extension of its lines on East St. from Water to State St. F. P. Harlan, New Haven, is Mgr.

Willimantic, Conn.—The Willimantic & Manchester St. Ry. Co. has been incorporated to construct an electric railway to connect Willimantic, Hop River, Andover, Bolton and Manchester, about 18 miles. T. J. Spellacy, Hartford, Conn., is interested.

Ilion, N. Y.—The Business Men's Association is agitating the construction of an electric railway in Ilion.

Monticello, N. Y.—The Monticello & Middletown Ry. Co. is being organized to construct an electric railway from Monticello to Middletown. Blake A. Mapledoram, Monticello, is interested.

Saratoga Springs, N. Y.—The Hudson Valley Ry. Co. contemplates constructing the connection of its Troy-Saratoga and Saratoga-Warrensburg lines in Saratoga Springs. A. E. Reynolds, Glens Falls, is Gen. Mgr.

✚**Point Pleasant, N. J.**—The Trenton, Lakewood & Seacoast Ry. Co. has awarded the contract for the construction of an electric railway from Trenton to Point Pleasant, about 30 miles, to the VANDERGRIFT ENGINEERING CO.

Marietta, Penn.—The citizens of Marietta and Maytown contemplate the construction of an electric railway to connect the two towns.

Washington, D. C.—Preliminary arrangements are being made by the Washington Ry. & Electric Co. for double-tracking its line on 14th St. from F St. to Pennsylvania Ave., and on Water St. from 14th St. eastward. R. W. Crowell, Washington, is Pur. Agt.

Safety Harbor, Fla.—According to press reports, plans are being prepared for the construction of an electric railway at Safety Harbor.

Birmingham, Ala.—The Birmingham Ry., Light & Power Co. is preparing to construct about two miles of new track in Birmingham. J. P. H. de Windt, Birmingham, is Gen. Mgr.

Newport, Tenn.—The Carolina, Greenville & Northern R.R. Co. has been incorporated to construct an electric railway from Kingsport to Newport. H. S. Reed, Los Angeles, Calif., is Pres., and James L. Callahan and Kirby Thomas, New York, N. Y., are Vice-Presidents.

Alliance, Ohio—The Stark Electric Ry. Co. plans to extend its line from Alliance to Marlborough, about seven miles. F. I. Mowry, Alliance, is Gen. Mgr. and Pur. Agt.

Chillicothe, Ohio—According to press reports, a company is being organized to construct an electric railway from Chillicothe, Ohio, to Peoria, Ill. E. F. Hunter, E. A. Mitchell, E. V. Mattice and John F. Lynch are interested.

Columbus, Ohio—The citizens have petitioned the Columbus Ry., Power & Light Co. to construct a line to connect its 11th and Chittenden Ave. lines. E. K. Stewart, Columbus, is Vice-Pres. and Gen. Mgr.

Ironton, Ohio—The Portsmouth St. Ry. & Light Co. is preparing plans for the construction of an electric railway from Ironton to Sciotoville, about 22 miles. R. D. York, Portsmouth, is Vice-Pres. and Gen. Mgr.

Dixon, Ill.—Plans are being prepared by the Sterling, Dixon & Eastern Electric Ry. Co. for the extension of its lines in Dixon. A. W. Cournyer, Dixon, is Supt.

Peoria, Ill.—See item under Chillicothe, Ohio.

Phœnix, Ariz.—Plans are being considered by the Phœnix Ry. Co. for the construction of a $1\frac{1}{2}$-mile extension to its line on South First Ave. Samuel H. Mitchell, Phœnix, is Gen. Mgr. and Pur. Agt.

Pasadena, Calif.—The City Council has granted a franchise to the Pacific Electric Ry. Co. to construct a double-track line on North Lake Ave., in Pasadena. J McMillan, Los Angeles, is Gen. Mgr.

Ukiah, Calif.—Preliminary arrangements are being made for the construction of the proposed electric railway to connect Ukiah, Cold Creek, Upperlake and Potter Valley. E. L. Cunningham, P. Connolly and T. J. Weldon are interested. Noted Dec. 10.

LIGHT, HEAT AND POWER

Pawtucket, R. I.—It is reported that bids will soon be asked for plumbing and heating apparatus in the new Abbott St. and Newport Ave. Schools. R. C. Monahan is Arch.

✚**Hartford, Conn.**—The P. J. Carlin Construction Co., general contractors for the reconstruction of the station of the New York, New Haven & Hartford R.R., has awarded a subcontract for heating and ventilating equipment to the MILNER-BILL CO., Springfield, Mass.

Albany, N. Y.—The United Traction Co. will spend about $55,000 for machinery and for copper and underground cable for its new transformer station to be built at Sheridan Ave. and Chapel St. James F. Hamilton, Albany, is Gen. Mgr. of the company.

Newton, N. J.—The Board of Public Utility Commissioners has authorized the Newton Gas & Electric Co. to make some improvements in its gas and steam plants. George P. Matthews, Newton, is Secy. of the Newton Gas & Electric Co.

Kutztown, Penn.—The Borough Council has decided to build a new municipal electric plant, costing about $23,000, to supply electricity for municipal and commercial purposes. Bonds for the construction of a new plant were voted last November. The present plant will be used until the new one is completed. F. A. Moyer is Chn. of the Electric Light Com. Noted Nov. 19.

Laurelton, Penn.—It is reported that the Borough Council is considering the construction of a power house to cost about $6000.

Monaca, Penn.—The City Council, according to press reports, is considering the establishment of a municipal electric-light plant, in which case, it will purchase the distributing systems of the Monaca Electre Co. and the Beaver County Light Co., which now supply electricity to the town.

✚**Bay Minette, Ala.**—The City Council has awarded the contract for the construction of a municipal electric-light plant to J. W. GURLEY, Mobile, Ala., at approximately $32,500. The plant will include a three-phase 60-cycle 2300-volt generator, a two-panel switchboard exciter and about two miles of pole line. Edgar B. Kay, Tuscaloosa, Ala., is Engr.-in-Charge. Noted Aug. 20.

Canal Dover, Ohio—Fred Warther, Ch. Engr. of the municipal power plant, has recommended to the City Council the installation of an additional 350-hp. gas engine and generator, to cost about $20,000. If the new unit is installed, an addition to the present power station will be necessary. O. Salmond is Dir. of Pub. Ser.

East Liverpool, Ohio—It is reported that plans have been prepared for a municipal electric-light plant estimated to cost $60,000. J. C. Kelly is City Engr.

✚**Lowellville, Ohio**—The Ohio Iron & Steel Co. has awarded the contract for new boiler equipment for its furnace plant to the BABCOCK & WILCOX CO., 85 Liberty St., New York, N. Y., at $50,000.

Detroit, Mich.—It is reported that the City Council has authorized the City Controller to issue bonds for $350,000, the proceeds of which will be used for improving and extending the municipal lighting system. George Engle is City Controller.

Tipton, Iowa—At a recent election the citizens voted in favor of municipalizing the electric-light and power plant, now controlled by the Tipton Light & Heating Co.

Gaylord, Kan.—The city is reported to be contemplating the establishment of a municipal electric-light plant to cost about $7000.

Cameron, Mo.—[illegible] Kansas City, Mo. [illegible] electric light system [illegible] Cameron [illegible] installation of some new machinery [illegible] is City Clk.

La Junta, Colo.—[illegible] F. T. [illegible] City Engr. that the bond issue [illegible] at the spring election, the proceeds of which will be used for the construction of a municipal electric-light plant [illegible] Noted [illegible]

Tucson, Ariz.—It is reported that the City Council plans the construction of a new street-lighting system [illegible] Engr.

Ridgefield, Wash.—The [illegible] Mill Co. has been granted a franchise to furnish electric light for the city and surrounding country [illegible]

[illegible] (Durango) Mexico.—It is reported that the [illegible] Consolidated Mining & Milling Co. will install an [illegible] plant at its mines at this point. Pumps will also be installed for taking the water from the workings of the mines.

BRIDGES

Fort Kent, Maine.—(Official.) We are advised by Paul D. Sargent, Ch. Engr. of the State Highway Commission, Augusta, that on account of the Canadian authorities changing their [illegible] and owing to the fact that the appropriation from the State of Maine [illegible] it is improbable that the bridge over St. John River between Fort Kent and St. Francis, N. B., will be built at present. Bids for the construction of this bridge were advertised for Dec. 21. Noted Dec. 17.

Niagara Falls, N. Y.—(A correction.) We are advised by F. [illegible] Jr., City Engr., that no plans are being prepared for the construction of a bridge at Second and Canal St.

Wallkill, N. Y.—[illegible] The [illegible] Engineering Co., [illegible] New York, N. Y., has been engaged to prepare plans for the construction of a new bridge at Wallkill. It will be about [illegible] ft. long, [illegible] ft. wide and the estimated cost is [illegible]

New Brunswick, N. J.—It is reported that the Board of Chosen Freeholders of Middlesex County is negotiating with the [illegible] R.R. for the construction of a new draw span in the Albany St. bridge over the Raritan River. Alvin B. Fox, [illegible] is County Engr.

✦Trenton, N. J.—The Pennsylvania R.R. has awarded the contract for the construction of substructures and approaches of new bridges at [illegible] and Hamilton Ave. to the [illegible] KING CONSTRUCTION CO., Philadelphia, Penn., at about [illegible] Noted Dec. 17.

The Board of Chosen Freeholders has directed the County Engineer to prepare plans at once for the new bridge over [illegible] Creek at [illegible] Ave. It is hoped to advertise for bids [illegible] that construction work may be started as soon as weather conditions in the spring permit. Theodore [illegible] is County Engr. Noted Sept. 17.

✦Nanticoke, Penn.—(A correction.) The contract for the [illegible] required for the new bridge between Nanticoke and West Nanticoke was awarded to the MACARTHUR CONCRETE PILE & FOUNDATION CO., [illegible] New York, N. Y., instead of to the Raymond Concrete Pile Co., as erroneously noted in the issue of Dec. 24.

Wilkes-Barre, Penn.—A [illegible] at the request of the Board of Commissioners of [illegible] County, has approved [illegible] a bridge over the [illegible] River at West Market St. as a memorial to the citizens of the county who fought in the Civil War. A soldiers and sailors monument was originally planned, but the jury claims that no suitable site is available. F. [illegible] is County Controller.

Spartanburg, S. C.—The Southern Ry. is [illegible] for the construction of a new [illegible] North Church St. to replace the present wooden structure at this point. [illegible] Ch. Engr. in charge for the Southern Ry.

✦Delaware, Ohio.—It is reported that the Commissioners of [illegible] County have awarded the contract for the construction of a [illegible] bridge over the [illegible] River to [illegible] It will be a [illegible] steel structure. Noted Dec. 17 and [illegible]

Hamilton, Ohio.—It is reported that [illegible] County Engr. of Butler County, has [illegible] for the proposed [illegible] bridge over the Great Miami River [illegible] The estimated cost of the structure is [illegible] It is hoped that bids may be asked about Mar. 1.

Indianapolis, Ind.—The Board of Public Works and the Board of Park Commissioners are preparing [illegible] plans for a new bridge over Fall Creek at [illegible] to replace the present [illegible] structure. The new bridge will be [illegible] ft. longer than the present one. The estimated cost is [illegible] It is hoped to build the bridge next [illegible] City Engr.

Plymouth, Ind.—The City Council and the Board of Commissioners of Marshall County are considering the construction of a [illegible] bridge over the Yellow River [illegible] The estimated cost of the structure is [illegible]

La Salle, Ill.—[illegible]

✦Columbus, Wis.—[illegible] The City Council has awarded the contract for the construction of the [illegible] bridge [illegible] Noted Dec. 17.

Breckenridge, Minn.—[illegible] Bids will be received until Jan. [illegible] by [illegible] County, for the construction of [illegible] bridges [illegible] ranging from [illegible] ft. long [illegible]

Mankato, Minn.—The City Council is considering plans for the construction of a concrete bridge over the Minnesota River at Main St. to replace the present bridge which is said to be inadequate for increasing traffic. The proposed bridge is estimated to cost about [illegible] F. W. Bates is City Clk.

Anthony, Kan.—(Official.) Bids will be received until Jan. 11 by the Board of Commissioners of Harper County for the construction of five reinforced-concrete bridges, ranging from [illegible] ft. in length. D. E. Hancock, Attica, Kan., is Chn. Bd. of Commrs. Harris & Eastham, Hutchinson, Kan., are Engrs.-in-Charge. Noted Dec. 17.

Ottawa, Kan.—The Board of Commissioners has rejected for the second time all bids received for the construction of a bridge over the Marais des Cygnes River near Richter, none exceeding the appropriation of $5000. There were eight bids ranging from [illegible] to [illegible]. Noted Nov. 12 and Dec. 10.

Salina, Kan.—Advertisements asking bids until Dec. 15 for the construction of a concrete bridge over the Smoky Hill River at Iron Ave., Salina, were withdrawn by the Board of Commissioners of Saline County, and it is reported that new bids will be received about Feb. 1. Wilmarth & Zerbe, Salina, are Engrs. in Charge. Noted Aug. 27, Nov. 12 and 26.

Turner, Kan.—(Official.) Bids will be received until noon, Jan. [illegible] by Frank M. Holcomb, Clk. of Wyandotte County, Kansas City, Kan., for building a concrete approach to the Turner Bridge. The Engineer's estimate is [illegible] R. [illegible] McAlpin is County Engr. Noted Dec. 17.

York, Neb.—Bids will be received until noon, Jan. 12, by H. F. [illegible] Clk. of York County, for bridge construction during 191[illegible] About 15 bridges will be built, ranging in length from [illegible] ft.

✦Oklahoma, Okla.—(Official.)—The Commissioners of Oklahoma County have awarded the contract for the construction of two steel bridges to the OREGONIA BRIDGE CO., Lebanon, Ohio, and Oklahoma, Okla., at [illegible] Noted Nov. 26.

✦Boise, Idaho.—The State Highway Commission has awarded the contract for the construction of 11 reinforced-concrete culverts and bridges on the Idaho-Pacific Highway, to LONG & BLODGETT, Gooding, Idaho.

✦Logan, Utah.—The Commissioners of Cache County will, on Jan. 2, award contracts to L. J. ROSS for three county bridges as follows: [illegible] Bridge, 125 ft. long, at [illegible] of [illegible] ft. over Muddy Creek near Lewiston, [illegible], and [illegible]-ft. bridge over the railway creek at Millville, $375[illegible]

Tucson, Ariz.—The city plans to build a new reinforced-concrete bridge across the Santa Cruz River at Congress St. to cost about $35,000. The bridge will be about 13[illegible] ft. long with a 26-ft. roadway and two 7-ft. sidewalks. J. M. Rutherford is City Engr. Noted Nov. 26.

Sacramento, Calif.—Bids will be received until Jan. [illegible] by the Board of Supervisors of Sacramento County, for the construction of a bridge on the Folsom-Orangevale Rd. Estimated cost, $6300. E. F. Pfund is Clk., Bd. of Suprvs.

Santa Barbara, Calif.—It is reported that the Board of Supervisors of Santa Barbara County will soon call a special election to vote on the question of issuing $5[illegible] in bonds to be used for the construction of new bridges in the county.

Hamilton, Ont.—(A correction.) We are advised by the Canada Cement Co., Ltd., Montreal, Que., that it is not preparing plans for a concrete bridge in connection with the Toronto-Hamilton Highway, as this company does no business other than the manufacture of cement. Noted Dec. 1[illegible]

Ottawa, Ont.—(Official.)—Bids will be received until Jan. [illegible] by the City Council for the construction of the substructure of the Pretoria Ave. Bridge. F. C. Askwith, City Engr., will have charge of the work. [illegible] McL. Hunter is Roadway Engr. Noted Oct. [illegible] and Nov. [illegible]

✦[illegible] & [illegible], Montreal, general contractors for the construction of the [illegible] Viaduct, have awarded a subcontract for 12,500 tons of structural steel to the HAMILTON BRIDGE WORKS CO., Hamilton, at about [illegible] Noted Dec. 1[illegible] and [illegible]

Winnipeg, Man.—(Official.) Plans have been prepared by [illegible] Bridge Engr. of the City of Winnipeg, for the construction of four bridges across the [illegible] River. Each bridge will be about [illegible] ft. long with a [illegible]-ft. roadway, two [illegible] sidewalks and double street-car tracks. The estimated total cost is [illegible] It is expected that bids will be asked as soon as the funds for their construction have been voted. [illegible] Noted Nov. 1[illegible]

✦Santo Domingo, Dominican Republic.—Bids were received [illegible] by the Director General of Public Works for the construction of a steel highway bridge over the Ozama River at Santo Domingo City, from [illegible] Santo Domingo City, [illegible]; [illegible] & Co., Santo Domingo City, [illegible]; [illegible] New York, N. Y., [illegible]; [illegible] Santo Domingo City, [illegible]; [illegible] New York, N. Y., [illegible]; [illegible] New York, N. Y., [illegible] Noted [illegible]

WATER SUPPLY—IRRIGATION

Boston, Mass.—Bids will be received until Jan. 6 by the Supply Department for [illegible] water pipe and [illegible] Frank [illegible] is Supt. of Supply Dept.

Albion, N. Y.—[illegible] The F. F. Wittmer Engineering Co., [illegible] has prepared plans for either the [illegible] of [illegible] filters for the purification of water from a creek or from wells. Bonds have been voted for this work. Noted Aug. [illegible]

[illegible], N. Y.—(Official.) The citizens have voted [illegible] the proceeds of which will be used for the purchase of the private water company. Plans have been prepared by J. F. Wittmer Engineering Co., [illegible] N. Y., and approved by the State Board of Health for the construction of a gravity [illegible] and for the extension of the distribution system. Pipe for this work has already been purchased.

✦New York, N. Y.—(Borough of Brooklyn.) (Official.)—Contracts for removing the present foundation and erecting a new foundation under the water main of No. 1 Worthington

20 Mg triple expansion pumping engine at the Ridgewood North Side pumping station, for removing two boilers and their appurtenances from the Milburn pumping station, transporting and reërecting one in the Woodhaven pumping station and one in the Agawam pumping station with new stacks, piping and other appurtenances, have been awarded to CAMPBELL & SMILEY, at $3092, for work at the Ridgewood North Side pumping station and to RUDOLPH GERSMAN, at $3462, for work at the Woodhaven pumping station. Noted Dec. 3 and Dec. 17.

✚**Camden, N. J.**—The contract for c.-i. pipe, specials and fire hydrants has been awarded to R. D. WOOD & CO., Philadelphia, Penn.

Freehold, N. J.—The Board of Public Utility Commissioners has granted the Monmouth County Water Co. permission to issue bonds for $81,000, the proceeds of which will be used for the improvement of the water system.

Jersey City, N. J.—(Official)—Bids will be received until 2 p.m., Jan. 7, by the Board of Commissioners for c.-i. pipe. M. I. Fagan is City Clk.

Newark, N. J.—Bonds for $200,000 have been sold the proceeds of which will be used for making extensions to the watershed. Tyler Parmly is City Controller.

West Orange, N. J.—According to press reports Alexander Potter, Consult. Engr., 50 Church St., New York, N. Y., is preparing plans for the construction of a 24-in. water main in West Orange, to the Thomas A. Edison works Carl Fentz is Chn. of the Water Comn. Noted Aug. 20.

Ford City, Penn.—Bids will be received until Jan. 4, by D. O. Crouch, Borough Secy. for an 18-in. low lift centrifugal pump.

✚**Baltimore, Md.**—The contract for constructing a pumping station near the Pimlico entrance to Druid Hill Park has been awarded to D. M. ANDREW CO., Baltimore, at $15,500.

Tarpon Springs, Fla.—All bids received for materials for making extensions to the water and sewer systems have been rejected. The contract will be readvertised soon. J. B. McCrary Co., 1408 Third National Bank Bldg., Atlanta, Ga., is Engr.

✚**Bay Minette, Ala.**—The contract has been awarded to J. W. GURLEY, Mobile, at $32,000 for constructing a water system, sewer system and electric-light plant. Bids were opened Dec. 15. Noted Dec. 3.

✚**Nashville, Tenn.**—The contract has been awarded to T. T. CURTIS & SONS, Nashville, at $4184 for laying about 15,000 ft. of water mains.

Sebree, Ky.—Bids will be received until Jan. 4, by the City Clerk for the purchase of $14,000 in bonds, the proceeds of which will be used for the construction of a water system. Noted Dec. 3 and Nov. 19.

Akron, Ohio—An election will probably be held to vote on the question of issuing $500,000 in bonds, the proceeds of which will be used for the completion of the water system.

✚**Cleveland, Ohio**—The contract has been awarded to W. L. BAYARD, Philadelphia, Penn., at $133,500, for installing a filter and equipment at the filtration plant. Bids opened Dec. 8. Noted Dec. 17.

Cleveland, Ohio—(Official)—Bids were received, Dec. 18, by the Commissioner of Purchases and Supplies for fire hydrants and sluice gates as follows: Pittsburgh Valve Foundry & Construction Co., Pittsburgh, Penn., $3900; Coffin Valve Co., Neponset, Mass., $4256; Bruce Macbeth Engine Co., Cleveland, Ohio, $4264; Coldwell-Wilcox Co., Newburgh, N. Y., $4500; Cleveland Machine & Mfg. Co., Cleveland, Ohio, $5000 and Roe Stephens Mfg. Co., Detroit, Mich., $5000. Noted Dec. 10.

Findlay, Ohio—(Official)—We have been advised that the Illinois Pipe Line Co. does not intend to build a pipe line from Columbia to Van Wert County. Noted Dec. 17.

Lima, Ohio—At the next meeting of the City Council, Carl Bryson, City Engr., will present plans for the construction of an upper reservoir and for drilling wells. The estimated cost is $70,000. Noted Sept. 24.

Lorain, Ohio—Bonds for $103,151 will be issued by the Council, the proceeds of which will be used for the improvement of the water system. Noted Aug. 6.

New Boston, Ohio—(Official)—Bids will be received until noon, Jan. 11, by the Village Council for completing the water system. Thomas D. O'Neal is Clk.

Shaker Heights (Cleveland post office), **Ohio**—Bids will be received until noon, Jan. 19, by Carl A. Palmer, Village Clk., First National Bank Bldg., Cleveland, Ohio, for laying 6-in. water mains. B. W. Willard, 804 Marshall Bldg., Cleveland, is Village Engr.

South Newburgh (Newburgh post office), **Ohio**—Bids will be received until Jan. 30, by H. H. Bohning, Clk., for the purchase of $31,000 in bonds, the proceeds of which will be used for the installation of a water system.

Benton Harbor, Mich.—Bonds for $60,000 were voted by the citizens at a recent election. The proceeds will be used for the improvement and extension of the water system. B. Spaulding is City Clk. oted Dec. 3.

Anna, Ill.—According to press reports bids will be received in January for making extensions to the water system. E. S. Alden is Pres. of the Bd. of Local Improvt.

Clinton, Ill.—At a recent election the citizens defeated the question of issuing $8000 in bonds, the proceeds of which would have been used for the repair of the water system.

✚**Hinsdale, Ill.**—The contract has been awarded to KENNICOTT CO., Chicago Heights, Ill., at $18,054, for installing a water softening plant at the water works. Bids opened Nov. 16. Noted Oct. 29.

Buffalo Center, Iowa—The citizens contemplate issuing bonds, the proceeds of which will be used for the extension of the water system and for the construction of an electric-light plant. C. H. Galagan is City Clk.

✚**Council Bluffs, Iowa**—According to press reports the contract has been awarded to CAST IRON PIPE CO., Kansas City, Mo., for 16,600 ft. of c.-i. pipe.

Crawfordsville, Iowa—Press reports state that bids will be received in February for the construction of a water system estimated to cost $10,000.

✚**Ottumwa, Iowa**—(Official)—Bids were received, Dec. 18, by the Board of Water Works Trustees, for constructing concrete dams as follows: J. W. TURNER IMPROVEMENT CO., Des Moines, at $50,880 (awarded contract); W. B. Saunders, Minneapolis, Minn., $52,605; A. J. Martin & Co., Augusta, Ga., $53,640; Hannan, Hickey Bros. Construction Co., St. Louis, Mo., $54,000; Middleton & Ludlow, Kansas City, Mo., $57,953; and Inter-Mountain Bridge & Construction Co., Tecumseh, Neb., $62,500. Horace A. Brown is Supt. of Water Wks. Noted Dec. 10.

Salem, Iowa—At a recent election the citizens defeated the bond issue, the proceeds of which would have been used for the construction of a water system.

Fort Scott, Kan.—Plans have been submitted to the State Board of Health for the construction of a mechanical filtration plant. The estimated cost is $30,000. Noted Oct. 29.

Springfield, Mo.—According to press reports the Springfield Water Co. will make improvements costing $100,000. H. B. McDaniel is Treas. and Mgr.

Wilburton, Okla.—(Official)—The Benham Engineering Co., Oklahoma City, Okla., has been retained by the City Council to prepare plans and to supervise the improvement of the water and sewer systems. Noted Dec. 17.

Twin Falls, Idaho—The Public Utilities Commission has been petitioned by Twin Falls to approve of the construction of a water system at Twin Falls. Noted Aug. 6.

Escalante, Utah—The citizens plan to install a water system at an estimated cost of $45,000.

Salt Lake City, Utah—Sylvester Q. Cannon, City Engr., according to press reports, will award contracts the first of the year for work in connection with the water system, estimated to cost $153,000.

Huntington Beach, Calif.—The Huntington Beach Water Co. plans to install additional pumping machinery.

Seattle, Wash.—The Council contemplates replacing the 36-in. and 42-in. water main in 12th Ave. N., from Volunteer Park to Denny Way with steel pipe.

✚**Orillia, Ont.**—The contract has been awarded to INTERNATIONAL FILTER CO., Chicago, Ill., at $14,465 for the installation of a filtration plant.

✚**Saskatoon, Sask.**—(Official) — The contract has been awarded to A. G. SANGSTER, at $36,051 for laying a 24-in. pipe under the South Saskatchewan River. J. Jonsson is Assistant Engr. Noted Dec. 17.

SEWERS

East Rochester, N. Y.—A special election will be held, Jan. 2, to vote on the question of issuing $41,700 in bonds, the proceeds of which will be used for constructing a sewer in Main St., and for paving and curbing.

Lyons, N. Y.—(Official)—Plans have been prepared by J. F. Wittmer, Dun Bldg., Buffalo, and approved by the State Department of Health, for the construction of Imhoff tanks and contact beds for the sewer system. Bonds for this work were voted in June. Noted July 2.

Yorkville, N. Y.—The construction of sewers in Myers Ave., Cooper Ave., Erie St. and Tabor Pl. is contemplated by the Board of Trustees.

✚★**Dunellen, N. J.**—(Official)—The contract has been awarded to H. K. CORBIN, 170 Broadway, New York, N. Y., at $82,604 for constructing a sewage collecting system. Noted Dec. 24.

✚**Edgewater, N. J.**—The contract for constructing sewer outlet No. 12 has been awarded to JOHN J. McGARRY, at $16,063.

Jersey City, N. J.—See item under "Streets and Roads."

✚★**Newark, N. J.**—(Official)—The contract will be awarded to CENEDELLA CO., Milford, Mass., at $160,741 for constructing Section 14 of the Main Intercepting Sewer in Passaic. Bids opened Dec. 22. Noted Dec. 3.

★**North Plainfield, N. J.**—(Official)—Bids were received, Dec 8, by the Borough of North Plainfield for a sewage collecting system and outfall sewer as follows: Contract No. 1, Harrison & Burton Co., New York, N. Y., $72,598; John C. Schrade Inc., Brooklyn, N. Y., $72,772; H. C. Brooks Co., Martinsburg, W. Va., $77,322; Frank Puglia, Paterson, N. J., $78,102; D. Donnegan Co. & F. N. Lewis, Brooklyn, N. Y., $78,788; Cantrell Construction Co., Philadelphia, Penn., $84,314; Peekskill Construction Co., Peekskill, N. Y., $85,924; Cauldwell-Wingate Co. & Atlantic Construction & Supply Co., New York, N. Y., $86,899; Burke & Bonham Inc., Plainfield, N. J., (irregular), $87,073; Joseph L. Sigretto & Co., Woodhaven, N. Y., $87,393; Kelly-McFeeley Co., Camden, N. J., $92,308; Bruno Pizzimenti, Seneca Falls, N. Y. (irregular), $93,042; Fusco Contracting Co., Newark, N. J., $93,148; Schneider Stelle & Co., New Brunswick, N. J., $94,314; Joseph Johnson's Sons, West New Brighton, N. Y. (irregular), $95,934; Weldon Contract Co., Rahway, N. J., $98,300. Canedella, Orange, N. J., $111,792.

Collecting system, Contract No. 2: A. D. Ambrosio & Co., Hartford, Conn. (irregular), $63,878; Frank Puglia, Paterson, N. J., $70,817; Harrison-Burton Co., New York, N. Y., $74,342; Schneider-Stelle & Co., New Brunswick, N. J., $275,730; DiNapoli & Toriello Contracting Co., Hackensack, N. J., $75,926; Martin & Miller, Elizabeth, N. J., $77,214; Cauldwell-Wingate Co., and Atlantic Contracting & Supply Co., Association, New York, N. Y., $83,064; Joseph L. Sogretto & Co., Woodhaven, N. Y., $84,300; Weldon Contracting Co., Rahway, N. J., $88,996; Joseph Johnson's Sons, West New Brighton, N. Y., $91,062; Briggs & McLoughlin Contracting Co., New York, N. Y., $96,713; Kelley McFeeley Co., Camden, N. J., $98,282; Burke & Bonham Inc., Plainfield, N. J., $99,738. Noted Nov. 19.

Allentown, Penn.—Bids were received, Dec. 15, for constructing storm water sewers in East Maple St., as follows: Frank Cannon, Allentown, $15,906; S. W. Chiles, South Bethlehem, $15,968; Middletown Thompson Co., Baltimore, Md., $19,820 and R. S. Rathbun, Allentown, $20,079, were the low bidders Noted Dec. 3.

Moorefield, W. Va.—The citizens at a recent election voted in favor of issuing bonds for [illegible], the proceeds of which will be used for the installation of a sewer system.

Starke, Fla.—[illegible] for the construction of a sewer system.

Tarpon Springs, Fla.—See item under "Water Supply and Irrigation."

West Palm Beach, Fla.—Bids will be received [illegible] by [illegible], Clerk of the City Council, for building [illegible] to the sewer system. Noted Nov. 12.

Bay Minette, Ala.—See item under "Water Supply—Irrigation."

Bowling Green, Ky.—The Southern Asphalt & Construction Co., Birmingham, Ala., has been [illegible] by the City Council [illegible] for the construction of a sewer system [illegible].

Piqua, Ohio.—Bids will be received by Albert [illegible], Dir. of Pub. [illegible], until Jan. 7 for constructing a storm sewer in [illegible] St. from [illegible] to Washington Ave.

Sandusky, Ohio.—Bonds for $[illegible] have been sold, the proceeds of which will be used for constructing sewers.

Bloomington, Ind.—[illegible]—Bids will be received until [illegible] Jan. [illegible] by the Common Council for constructing a sewer in [illegible] St. [illegible] is City C[illegible].

♦Indianapolis, Ind.—The contract for [illegible] a main sewer in [illegible] St., from [illegible] to [illegible] Drive, has been awarded to the AMERICAN CONSTRUCTION CO., at $[illegible]. Noted Dec. [illegible].

Superior, Wis.—Press reports state that the City Commission has decided to construct a storm sewer estimated to cost [illegible].

Bettendorf, Iowa.—According to plans prepared by A. M. [illegible], City Engr., the construction of the west end sewer system will cost $[illegible]. The system will be [illegible] ft. in length and of [illegible], 12- and [illegible]-in. vitrified pipe.

♦Keota, Iowa.—The Town Council has awarded contracts for constructing a sewage-disposal plant, pipe and specials to the [illegible] CONSTRUCTION CO., and five miles of sanitary sewers to [illegible] HUGHES, Rockford, Ill., at $1[illegible],998. Noted Nov. 26 and Dec. 24.

Hibbing, Minn.—[illegible]—Plans have been prepared and submitted by Burns & McDonnell, Kansas City, Mo., Engrs., for the construction of storm water and sanitary sewers in the Alice addition, estimated to cost $[illegible] and $[illegible], respectively.

Wilburton, Okla.—[illegible]—See item under "Water Supply—Irrigation."

Texarkana, Tex.—The City Council contemplates installing a storm sewer system.

Pueblo, Colo.—The City Council contemplates an expenditure of $[illegible] for constructing a storm sewer.

♦Salt Lake City, Utah.—A contract for constructing sewer extension No. [illegible] has been awarded to W. M. GIBSON, Grand Junction, Colo., at $[illegible].

♦Seattle, Wash.—The contract for constructing a concrete sewer in [illegible] Ave. [illegible] has been awarded to the [illegible], Hope Bldg., at $[illegible].

Reedley, Calif.—The State Board of Health has ordered the City Council to build a sewage disposal plant.

Lindsay, Ont.—Press reports state that the Town Council is having plans prepared for a sanitary sewer and [illegible] in [illegible] St., estimated to cost $[illegible]. A. J. [illegible] is Engr. and Town Clerk.

Ottawa, Ont.—According to press reports the City Council contemplates constructing a [illegible] sewer in [illegible].

Ottawa, Ont.—Press reports state that an election will be held Jan. [illegible] to vote on the question of issuing $[illegible] in bonds for the [illegible] sewer.

GARBAGE

New York, N. Y.—[illegible] of Queens—[illegible]

North Bergen—[illegible], N. J.—[illegible]

Jacksonville, Fla.—Bids will be received by the [illegible]

Lansing, Mich.—Bids will be received until Jan. [illegible]

♦Hibbing, Minn.—[illegible]

San Antonio, Tex.—According to press reports the city has [illegible]

Ottawa, Ont.—[illegible]

STREETS AND ROADS

♦Boston, Mass.—The contract for [illegible]

♦Hartford, Conn.—The contract for the construction of a section of trap rock macadam on the East Hartford Rd., bids for which were received Nov. 30, has been awarded by the State Highway Commission to LEONARDO SUZIO, Meriden, Conn., at $[illegible]. Noted Nov. 19 and Dec. 1[illegible].

Buffalo, N. Y.—The City Council has ordered Beatrice and [illegible] St. to be paved with asphalt, at an estimated cost of $[illegible] and $[illegible], respectively.

♦Buffalo, N. Y.—The contract for repaving Breckenridge St. from [illegible] to Elmwood Ave. has been awarded to the GERMAN BRICK ASPHALT CO., at $13,8[illegible].

Port Dickinson, N. Y.—Bids will soon be received by the Board of Trustees for the sale of $3[illegible] in bonds for paving Chenango St.

Freehold, N. J.—Bids will be received by the Board of Freeholders until Jan. 4 for improving a section of Norwood Ave., Borough of Deal and Allenhurst, with asphalt. G. D. Cooper, Red Bank, is County Engr.

Jersey City, N. J.—The Board of City Commissioners has instructed Charles Van Keuren, City Engr., to prepare plans for improvements in the Marion and West End sections as follows: Cutting through of Van Winkle Ave. to Summit Ave., with formation of a 90-ft. improved thoroughfare, cutting through of Bevan St., Frazer Pl. and other short streets running between West Newark Ave. and Van Winkle Ave. All to be paved, curbed and sewers constructed therein.

Newark, N. J.—Revised plans for the improvement of Washington St. at its intersection with Market St., and for extending Frelinghuysen Ave., have been completed. Estimated cost, exclusive of property to be bought, about $1[illegible].

♦Princeton, N. J.—The Common Council has awarded a contract to the HASTINGS PAVEMENT CO., New York, for the installation of asphalt block paving on 6-in. concrete foundation on Mercer St., in the park section.

Union, N. J.—The lowest bid received by the Board of Council for repaving Palisade Ave. was submitted by the Clinton Contracting Co., at $31,760. Sebastian Maulbeck is Town Surv.

Vineland, N. J.—According to press reports the question of issuing $100,000 in bonds for paving Landis Ave. was defeated at the general election.

West Hoboken, N. J.—The Town Council has approved plans for the improvement of Barclay St., from Palisade to Clinton Ave., and authorized the advertising of bids. John J. Rowe, West New York, is Engr. Noted Dec. 17.

West Reading, Penn.—A special election will be held Jan. 12 to vote on the question of issuing $2[illegible],000 in bonds for street improvements.

Bland, Va.—The citizens of Seddon Magisterial District, Bland County, will vote Feb. 16, on the question of issuing $[illegible],000 in bonds for road and bridge improvements.

Quaker Gap, N. C.—The citizens will vote Jan. 19 on the question of issuing $[illegible],000 in bonds for building roads.

Southport, N. C.—Bonds for $[illegible],000 have been sold, the proceeds of which will be used for improving roads.

Aiken, S. C.—See item under Federal Government Work, [illegible] Aiken, S. C. Noted Dec. 1[illegible].

Birmingham, Ala.—The Board of Commissioners voted in favor of [illegible] and constructing concrete walks on [illegible], 19th St. and Fifth Pl., estimated to cost $11,900.

Alexandria, La.—According to press reports, bids will be received by the City Secretary until Jan. 4 for improving a section of Third St.

Ama, La.—All bids for the extensive road building work in St. Charles Parish were rejected because of technicalities. New bids will be asked for to be opened late in January. The proposed roads are to be of gravel construction.

Hahnville, La.—The following bids were received for the Police Jury for constructing gravel roads in Road District No. [illegible], St. Charles County: [illegible] & Lambert Bros., $11,[illegible]; St. Charles Construction Co., $[illegible]; and Boyd & Bradshaw, [illegible], Miss., $[illegible]. Noted Jan. [illegible].

Lake Charles, La.—See item under "Miscellaneous," Drainage.

Manchester, Tenn.—According to press reports at the election held Dec. [illegible] the question of issuing $[illegible] in bonds for constructing roads was defeated. Noted Nov. 1[illegible].

Louisville, Ky.—The Board of Public Works will receive bids until Jan. [illegible] for the construction of Hill St. from [illegible] to [illegible] with bituminous concrete, estimated to cost $[illegible].

Pineville, Ky.—Press reports state that the citizens of said county will vote Feb. [illegible] on the question of issuing $[illegible] in bonds for constructing roads and bridges. W. [illegible] is County Clk.

Cincinnati, Ohio.—[illegible]—Bids will be received by [illegible] until noon, Jan. 4, for improving a section of [illegible] Av.

St. Marys, Ohio.—The Board of Sinking Fund Trustees has authorized the sale of $[illegible] bonds for the improvement of [illegible] St.

New Albany, Ind.—Bids will be received by the Board of Public Works until Jan. [illegible] for paving [illegible] St. from Main to [illegible] St. with [illegible].

♦Vincennes, Ind.—The contract for improving Fourth St. has been awarded to the [illegible] CONSTRUCTION CO., [illegible], at $[illegible].

♦Port Huron, Mich.—A contract for constructing a state [illegible] highway has been awarded by the Commissioners of St. Clair County to the PORT HURON [illegible] CO., Port Huron, at $[illegible]. Noted Nov. [illegible].

Aitkin, Minn.—Bids will be received by [illegible], County Aud., until [illegible] Jan. [illegible] for constructing [illegible] miles of county road between [illegible] Lake townsite and Hill City.

Anthony, Kan.—[illegible]—Bids will be received by the Commissioners of Harper County until Jan. 11 for constructing [illegible] culverts. Harris & [illegible], Hutchinson, Kan., are Engrs.

Junction City, Kan.—Press reports state that bids will be received until Jan. 5, by the Board of County Commissioners, for paving approximately 5000 sq.yd. of roadway, 16 ft. wide, with concrete. W. V. Bucks is County Engr.

Minot, N. D.—Bids will be received by H. E. Wheeler, Clk. of the Park Bd., until 4 p.m., Jan. 5, for graveling Park Rd. in Riverside Park.

Anderson, Tex.—The citizens of District No. 4, Grimes County, will vote Jan. 2, on the question of issuing $60,000 in bonds for constructing macadam, gravel and paved roads. Noted Dec. 10.

Cuero, Tex.—(Official)—We have been advised that the citizens do not intend voting on a bond issue. Noted Dec. 10.

+Marshall, Tex.—The contract for paving West Rusk St. from Adkins to Bishop St. with asphalt macadam has been awarded to the BERT HAHN CONSTRUCTION, Dallas.

Sulphur Springs, Tex.—Bids will be received by the City Secretary until Jan. 19 for approximately 35,000 sq.yd. of paving, 20,000 sq.yd. concrete curb and 12,000 cu.yd. earth excavation. A. D. Stivers is City Engr.

Fallon, Nev.—In the issue of Dec. 10 we stated that at the general election the question of issuing $50,000 in bonds carried, but have since learned that it was defeated. Noted Dec. 10.

North Yakima, Wash.—City Council has instructed N. A. Gillman, City Engr., to prepare plans for paving First Ave. with brick, laid on concrete base. Work will be ordered early in the year.

+Port Angeles, Wash.—A contract for road improvements in Improvement District No. 24 has been awarded to P. J. WOODS at $31,596.

+Spokane, Wash.—The contract for paving South Market St. has been awarded to the SPOKANE BITUMINOUS CO., at $4200.

Portland, Ore.—The lowest bid received by the City Council for the grading and construction of sidewalks in 62d St., from Powell Valley Rd. to Foster Rd., was submitted by Bodman & Burge at $5873.

Bakersfield, Calif.—Bids will be received until 10 a.m., Jan. 9, for constructing 11½ miles of the Bakersfield-Taft Rd. I. R. Miller is Clk. of the Supvrs. of Kern County.

Calexico, Calif.—This city will pave Imperial Ave. from a point between Sixth and Seventh St. to the railroad right-of-way; Second St. and First St., between the Southern Pacific tracks and Heffernan St., Heffernan to Third, and thence west to the depot, and Paulin and Rockwood, between First and Third St.

+Compton, Calif.—C. SCHEERER, 512 Stimson Bldg., Los Angeles, has been awarded the contract at about $19,000 for improving portions of Oleander and Almond St.

+Los Angeles, Calif.—F. W. WHITTIER has been awarded the contract, at $10,830, for improving Marguerite St., from its easterly terminus to Avenue 33.

Sacramento, Calif.—(Official)—Bids were received Dec. 14, by the State Highway Commissioners, for constructing roads in the following counties: (a) Siskiyou County, (b) Otter County, (c) Los Angeles County (work to be done in 450 days), (d) Los Angeles County (250 days), (e) Los Angeles County (150 days), (f) Orange County—Blanchard-Brown Co., San Francisco, (a) $128,316; Palmer & McBryde, San Francisco, (a) $154,265, (e) $485,373; James Fitzpatrick, Sacramento, (a) $126,330; Berry Mackie & Co., San Francisco, (a) $90,653; Smith & Brice, Eureka, (a) $105,715, (d) $405,389, (e) $414,914; E. T. Johnson, Portland, Ore., (a) $90,522, (b) $54,472; F. Rolandi, San Francisco, (a) $116,001; Taylor & Berliner, Los Angeles, (b) $49,791; Chico Construction Co., Chico, (b) $49,582; P. L. Burr, San Francisco, (b) $53,455; Tieslau Bros., San Francisco, (b) $56,696; L. F. Gerdetz, San Francisco, (b) $59,461; C. H. & A. W. Garrill, San Francisco, (b) $42,381; Bates, Borland & Ayer, Oakland, (b) $51,887; Whitlock & Gorrill, San Francisco, (b) $48,917; Forest City Paving & Construction Co., San Francisco, (b) $48,674; H. A. Taylor, Los Angeles, (c) $391,822; F. A. Keasal, San Francisco, (c) $34,500; Chadwick & Sykes, Inc., San Francisco, (c) $498,708; Lynn S. Atkinson, Los Angeles, (c) $630,810; Lee Moor Contracting Co., Los Angeles, (c) $256,246, (d) $268,946, (e) $281,646; A. C. McLean Construction Co., San Francisco, (c) $315,895, (d) $328,595, (e) $343,155; Twohey Bros. Co., San Francisco, (c) $300,897, (d) $304,071, (e) $326,296; Mahoney Bros., San Francisco, (c) $308,565, (d) $314,915, (e) $333,965; Richard Rothwell & A. H. McCray, Los Angeles, (c) $520,507; Warren A. Bechtel, Alton, Calif., (d) $553,01; Charles Daley & Co. and Hans Pederson, Seattle, Wash., (d) $367,597; Callahan & Hedrick, El Centro, (f) $45,344; the M. A. Co., Inc., Los Angeles, (f) $35,831; Modern Construction Co., Inc., (f) $40,763. Noted Dec. 3.

Salinas, Calif.—Press reports state that bids will be received by T. P. Joy, County Clk., until Jan. 5, for the sale of $570,000 in bonds for constructing roads.

San Diego, Calif.—Bids will be received by the Board of Supervisors until 2:30 p.m. of Jan. 6, for constructing about 2½ miles of paved highway to extend from a point near Laes at Tia Juana to Snell's Corner. It will have a 20-ft. center of bitulithic macadam and 8 ft. sides of oiled granite. J. T. Butler is County Clk.

+San Francisco, Calif.—The Board of Public Works has awarded a contract for the paving of a 30-ft. strip on Sloat Blvd., to BLANCHARD & BROWN, at .169c. per sq. ft. The total cost of the work will be $58,400.

Santa Ana, Calif.—Bids will be received by the Board of Supervisors until 2 p.m., Jan. 6, for the construction of about 2¼ miles of Sec. 2, Anaheim-Olive Rd. The work comprises 6330 cu.yd. excavation, 11,516 lin.ft. sloping roadbed, 14 cu.yd. concrete, 2560 cu.yd. concrete in pavement and 870 lb. reinforcing steel. S. H. Finley is Chief Engr.

Vacaville, Calif.—At the election held Dec. 14, the citizens voted in favor of issuing $30,000 in bonds for street improvements. Noted Dec. 10.

Willows, Calif.—According to press reports the City Trustees will soon receive bids for paving five blocks.

INDUSTRIAL WORKS

Worcester, Mass.—The Mills Woven Cartridge Belt Co. plans the construction of a three-story, 50x120-ft. addition. Estimated cost, $25,000.

Buffalo, N. Y.—The Atlas Works of the Standard Oil Co. will construct a one-story, 55x147-ft. steel storehouse addition on Elk St. and the Buffalo Creek R.R. H. P. Chamberlain is manager.

Syracuse, N. Y.—Bids are being received by Taber & Baxter, Archs., for the construction of a two-story and basement, 35x80-ft. addition to the Sheet Metal Works, 921 North State St., for the H. E. Hessler Co., 521 North Salina St. Estimated cost, $20,000.

Watertown, N. Y.—The Gould Automobile Co. will build a two-story and basement, 50x150-ft. garage. William Gould, 223 King St., is Pres.

+Newcastle, Del.—The contract for the construction of the first group of buildings for the Bethlehem Steel Co. has been awarded to WILLIAM STEEL & SONS CO., Philadelphia, Penn. Estimated cost, $100,000. Noted Nov. 12.

Baltimore, Md.—Plans are being prepared by Haskell & Barnes, 301 North Charles St., for the construction of an 18x60-ft. factory on Paca and Mulberry St. Estimated cost, $14,000.

+Norfolk, Va.—The contract for the construction of a two-story, 50x215-ft. building for the Davis Bakery, has been awarded to W. H. SAUNDERS, Norfolk. Estimated cost, $20,000.

Richmond, Va.—The Spence-Nunnamaker Co. plans the construction of a three-story fireproof brick warehouse on 17th St. Estimated cost, $16,000.

Roanoke, Va.—The Hammond Printing & Lithographing Works plans the construction of a four-story reinforced-concrete shop. The estimated cost is $40,000.

Columbia, S. C.—The Columbia, Newberry & Laurens R.R. plans the rebuilding of its roundhouse and repair shops, recently destroyed by fire with a loss of $15,000.

Jacksonville, Fla.—The Atlantic Coast Line R.R. will construct export terminals to be one-story, 127x267 ft. and cost $27,000. E. B. Pleasants is Ch. Engr.

Newellton, La.—Oscar Jones, Chrisman, Ill., and others, are planning the construction at Newellton of a 50,000-bu. grain elevator.

+New Orleans, La.—The Board of Commissioners of the Port of New Orleans awarded the contract for the construction of cotton warehouses and a terminal to the JEFFERSON CONSTRUCTION CO., New Orleans, at $1,323,444. Noted Nov. 5 and Dec. 24.

Memphis, Tenn.—The Illinois Central R.R. plans the construction of an icing plant in Nonconnah Yards. The estimated cost is $165,000.

Cleveland, Ohio—J. B. Davis & Co., Archs., 207 Arcade Bldg., are preparing plans for the construction of a 50x400-ft. addition to the Union Rolling Mills Co. at Aetna Rd. and Penn. R.R.

Detroit, Mich.—Plans are being prepared by H. S. Angell, 722 Free Press Bldg., for the construction of a two-story, 30x100-ft. factory for Gordon-Pagel Co., 461 Chene St. Estimated cost, $40,000.

Monroe, Mich.—The Van Block Motor Co. contemplates constructing a two-story factory addition, estimated to cost $10,000.

+Chicago, Ill.—The contract for the construction of a four-story and basement, 90x109-ft. factory, at 2341-43 Wabansia Ave., for the Burkland Knitting Works, 538 South Dearborn St., has been awarded to the WIEBOLDT CONSTRUCTION CO., 1534 West Van Buren St.

The Hardstone Brick & Tile Co. plans the construction of a four-story, 75x300-ft. factory and a two-story, 25x75-ft. office building, on 66th St., and 59th Ave. Estimated cost, $50,000.

Ashland, Wis.—The Ashland Cigar & Tobacco Co. contemplates constructing a 74x140-ft. factory and warehouse.

+Laporte City, Iowa—The contract for the construction of a glove factory for the United Glove Co., has been awarded to O. W. ARMAGAST. Estimated cost, $10,816.

Brainerd, Minn.—John Zeta contemplates constructing a factory; estimated cost, $100,000.

Minneapolis, Minn.—Plans are being prepared by Long, Lamoreaux & Long, Archs., 830 Hennepin Ave., for the construction of a three-story, 97x112-ft. warehouse on Third St. and 11th Ave., for S. R. Sykes .

F. D. Knoblauch plans the construction of a one-story and basement, 50x150-ft. garage, at 1112 Harmon Pl. Estimated cost, $20,000.

St. Paul, Minn.—Plans have been prepared and are being considered by G. S. Loftus, 2401 Grand Ave., Sales Mgr. for the St. Paul Grain Exchange, for the construction of a $200,000 terminal grain elevator

The Citizens Fuel Co., 8 West Fourth St., plans the construction of an ice plant on St. Anthony Hill. Estimated cost, $100,000.

Great Falls, Mont.—The Amalgamated Copper Co. plans the construction of an oil refinery, estimated to cost $1,000,000. J. D. Ryan is Pres.

Galveston, Tex.—Plans are being prepared for the construction of the superstructure of the 1,000,000-bu. concrete fireproof grain elevator for the Southern Pacific Terminal Co., a subsidiary of the Southern Pacific Co. A. McDonald, Supt. of Bridges & Bldgs., will supervise the foundation work. The grain elevator was recently damaged by fire with a loss of $1,000,000.

+Nacogdoches, Tex.—The contract for the construction of a feed mill, grain elevator and warehouse for the Nacogdoches Elevator Co. has been awarded to PARRISH BROS. Estimated cost, $20,000.

Trinity, Tex.—[illegible]

Cushing, Okla.—[illegible]

Sapulpa, Okla.—[illegible]

Woodward, Okla.—[illegible]

Vale, Okla.—[illegible]

Seattle, Wash.—[illegible]

Portland, Ore.—[illegible]

Alameda, Calif.—[illegible] of Webster St. [illegible]

San Francisco, Calif.—The Western [illegible] W. H. [illegible] California St. [illegible]

San Francisco, Calif.—[illegible]

FEDERAL GOVERNMENT WORK

Storehouse—[illegible] H. [illegible] Wright [illegible] New London, Conn. [illegible]

Dredging—New York, N. Y.—Bids will be received by [illegible] River Channel, New York.

Repairs to Post Office—Niagara Falls, N. Y.—Bids will [illegible]

Dredging—New Jersey.—The contract for dredging in [illegible] JOHN [illegible] N. Y. Noted Dec. [illegible]

Building—Washington, D. C.—The contract for the [illegible] CONSTRUCTION CO. [illegible] Noted Dec. [illegible]

Road—[illegible]

Marble—[illegible]

Post Office—[illegible]

Lock and Dam—[illegible]

Post Office—[illegible]

Post Office—[illegible]

Piers—[illegible]

[illegible] cu. yd. of excavation and backfilling and is situated [illegible] Blackfeet Indian Reservation, about 15 miles northwest of Browning. H. N. Savage is Superv. Engr.

Building Supplies—Fort Reno (El Reno post office), Okla.—Bids will be received by Capt. W. S. Valentine, Fort Reno, until [illegible] Jan. 18, for furnishing lumber and hardware required for constructing the riding hall.

Sewer System—Lawton, Okla.—The Secretary of the Department of [illegible] has awarded the contract for constructing a [illegible] water sewer system for the north addition to MAYFIELD & SHAW, Fort Bliss, Tex., at $27,3[illegible] Noted Oct. [illegible] and Nov. 19.

Structures—Glendale, Ariz.—The contract for constructing structures on the [illegible] Canal, Salt River Project, has been awarded to MARTIN & GILLIS, Phoenix, Ariz., at $[illegible] Noted July 16 and Sept. 24.

Repairs to Vessel—Seattle, Wash.—Bids will be received by [illegible] until [illegible] Jan. 1[illegible] for making repairs to the hull, boiler and machinery of the S. S. Patterson.

MISCELLANEOUS

Elimination of Grade Crossing—South Framingham, Mass.—Plans for the elimination of grade crossings are being prepared by Jas. Spofford & Thorndike, Engrs., 308 Boylston St., Boston.

Barge Canal Work—Albany, N. Y.—The lowest bid received by [illegible] W. [illegible], State Supt. Pub. Wks., for contract C-[illegible] clearing the site at Seneca Falls, was that of the [illegible] Wrecking Co., Hoboken, N. J., at $2675, this amount to be paid to the state. The following bids were received on the same date for contract No. 13 for constructing a guard lock, [illegible] wall, bridge and cut-off dam at Schuylerville: Lou R. [illegible], Watertown, $[illegible]; The Johnson-Gifford Co., New York, $[illegible]; [illegible] Bros., Elmira, $76,264; Farrally & Ingersoll, [illegible], $[illegible]; Parker & Beebe, Waterford, $51,[illegible]; Flood & Van Wirt Co., Hudson Falls, $53,963; Leary & [illegible] Co., [illegible], $[illegible]; Eastover Construction Co., Inc., Utica, $[illegible]; Callahan & Prescott, Inc., Albany, $[illegible]2,366; George Haller, Albany, $[illegible]311; Champlain Engineering & Construction Corporation, Saratoga, $50,731; W. F. Shields, Albany, $[illegible]; Scott Bros., [illegible], $51,[illegible]03; Chesley, Earl & Heimbach, [illegible] Buffalo, $[illegible]; Holler & Shepard, Rochester, $[illegible]; [illegible] & [illegible], [illegible], $[illegible]; Walsh Construction Co., Davenport, Iowa, $56,2[illegible]3. Noted Dec. 3.

Police Signal System—Buffalo, N. Y.—Bids will be received until Jan. [illegible] by Frank J. Tanner, Clk. of Police Commissioners, for furnishing and installing police patrol signal flashlight system in three precincts.

Stable and Section House—New York, N. Y.—Borough of Queens.—All bids received on Dec. 23 for the construction of a stable and section house in connection with the [illegible] plant at [illegible] have been rejected due to the supply of specifications and blank forms being exhausted before all the bidders could be furnished with them. The work will be readvertised in the near future. Noted Dec. 17.

Riprap—New York, N. Y.—(Borough of Manhattan)—[illegible]—Bids will be received until Jan. [illegible] by R. A. C. Smith, Comr. Docks and Ferries, for furnishing, delivering and placing about 10,000 cu. yd. of riprap. Security required $[illegible]

Elevated Railway Work—Belvidere, N. J.—[illegible] the Pennsylvania R.R. [illegible] to elevate its tracks from [illegible] to a point near Prospect St.

Motor Fire Apparatus—[illegible] Heights, N. J.—Bids will be received until [illegible] by [illegible] for furnishing and delivering [illegible] combination hose and chemical wagon, [illegible] tractor attached to steam fire engine, [illegible] tractor for fire engine and [illegible] triple combination [illegible] chemical and hose wagon.

Motor Police Patrols—[illegible] City, N. J.—[illegible]—Bids will be received until [illegible] Jan. [illegible] the Board of Commissioners [illegible] automobile patrol wagons. [illegible]

Crib Work—[illegible] N. J.—The City Commissioners will [illegible] for bids for cribbing along the ocean front repairing the recent storm damage. The work is estimated to cost about $[illegible] J. Wesley [illegible] is City Engr.

Broken Stone—Mount Holly, N. J.—Bids will be received [illegible] the Board of Chosen Freeholders for furnishing [illegible] stone to the county for the year 1915 [illegible]

Dock Bonds—Newark, N. J.—The city, Dec. 21, sold $[illegible] worth of dock bonds. [illegible] is City Controller.

Lock—[illegible] N. J.—The [illegible] Land & Power Co. has [illegible] by the city for the construction of a lock through the present [illegible] dam.

Bulkhead and Boardwalk—[illegible] N. J.—The city is [illegible] that portion of the bulkhead and boardwalk [illegible] by the recent storm. The estimated cost is $[illegible]

Breakwater and Boathouses—Baltimore, Md.—H. Kent Mc[illegible] Supt. [illegible] is preparing tentative plans for the proposed [illegible] improvements at Fort McHenry. These include the construction of a breakwater around the park [illegible] along the entire [illegible] Harbor Bd. will be in charge of the [illegible] Noted Nov. 18 and Dec. 1[illegible]

Drainage—[illegible] N. C.—[illegible] County Drainage District No. [illegible] has awarded the contract for constructing [illegible] to THOMSON & M[illegible], [illegible] N. C., at $[illegible] Noted Dec. [illegible]

Drainage—[illegible] N. C.—The Commissioners of [illegible] Drainage District have awarded [illegible] Creek and [illegible] Creek to MARK T. [illegible] at $[illegible] and $[illegible], respectively. J. M. Miller, [illegible] Noted Nov. [illegible]

Dock and Harbor Improvements—Miami, Fla.—The United States government engineers in charge of the South Atlantic [illegible]

coast, have approved the plans of Isham Randolph for the municipal dock and harbor work. This plan is known as Randolph Plan No. 5. Noted Sept. 24, Dec. 10.

Drain—Parish, Fla.—The Manatee County Commissioners has authorized the construction of the Gamble Drain. It will drain about 20,000 acres of land and is estimated to cost $90,000.

Drainage—Gonzales, La.—The Commissioners of the New River Drainage District have approved the plans of Daney & Waddill, Engrs., and will receive bids until Feb. 4, for the construction of the proposed drainage system, requiring about 2,000,000 cu.yd. of excavation.

Drainage—Lake Charles, La.—The North American Land & Timber Co. has purchased 7240 acres in this parish. A drainage system will be constructed and roads built. When the improvements are completed, the property will be sold for farmsteads.

Canal—New Orleans, La.—The Dock Board has instructed its engineers to prepare plans and specifications for the construction of a commercial canal from the Mississippi to Lake Pontchartrain. It will be ten miles in length.

+Arena—New Orleans, La.—The New Orleans Auditorium & Athletic Association has awarded the contract for the construction of a 215-ft. diameter arena to A. RUPVICH, at $30,000. W. R. Burk, 840 Gravier St., is Arch. Noted Dec. 24.

+Ditch—Greenville, Ky.—According to press reports the Board of Drainage Commissioners has awarded the contract for constructing a 3½-mile ditch, requiring 55,000 cu.yd. of excavation, to EWING & BROKENBROUGH, Lafayette, Ind., at 11.15c. per cu.yd.

Ditch—Bucyrus, Ohio—L. P. Michaelis, County Surv., will let contracts about Feb. 1 for the construction of Trustee Ditch, estimated cost, $1560; and the Mud Run Ditch, requiring 150,000 cu.yd. of excavation, estimated to cost $56,000.

Shelter House and Comfort Station—Cleveland, Ohio—Plans and specifications are being prepared by Frank D. Skeel, Arch., Vickers Bldg., Cleveland, for a shelter house, comfort station and store house to be constructed by the City of Cleveland under the viaduct at Euclid Ave. and 55th St. The buildings will be constructed of reinforced concrete.

Mausoleum and Crematory—Cleveland, Ohio—The Cleveland Cemetery Association, 860 Leader News Bldg., has purchased a 100-acre site on North Ridge Rd. for a cemetery. A granite and marble mausoleum and a crematory will be constructed in the spring at an estimated cost of $175,000. H. F. Whedon is Pres.

Fire Hydrants—Cleveland, Ohio—(Official)—The following bids were received Dec. 18 by the Department of Public Utilities Division of Water for furnishing 1000 4-in., and 100 6-in. fire hydrants: R. D. Woods & Co., 400 Chestnut St., Philadelphia, Penn., at $25,545; The Kennedy Valve Mfg. Co., Elmira, N. Y., $26,384; Roe Stephens Mfg. Co., Detroit, Mich., $27,200.

Retaining Wall—Tiffin, Ohio—According to press reports the City Council has voted that the City Solicitor be instructed to advertise for bids for the construction of a retaining wall on the east side of the river. The total cost of the work is estimated at $150,000. The present plans call for its construction by sections as the funds are available.

Ore Dock Repairs—Ashland, Wis.—According to local press reports the Minneapolis, St. Paul & Sault Ste. Marie Ry. plans to spend $25,000 in making repairs to its ore docks at Ashland.

Grandstand—Madison, Wis.—C. R. Van Hise, Pres., University of Wisconsin, has recommended to the Board of Regents that a grandstand be erected having a seating capacity of 10,000. The estimated cost is $53,500.

+Grading—Milwaukee, Wis.—The County Commissioners have awarded the contract for leveling the grounds at the House of Correction, Grantville, to EDWARD RADTKE, Milwaukee, at 15.5c. per cu.yd.

Physical Training Building—Oshkosh, Wis.—Bids will be received until Jan. 1, by William Kittle, Secy., State Bd. of Normal Regents, Madison, for the construction of a three-story, 44x146-ft. physical training building at the State Normal School. The estimated cost is $100,000. Van Ryn & De Gelleke, Archs., 725 Caswell Bldg., Milwaukee, prepared the plans.

Ditch—Stillwater, Minn.—All bids received on Dec. 19 for the construction of Judicial Ditch No. 4 have been rejected, being higher than the engineer's estimate. N. A. Nelson, County Audr., will advertise for new bids. H. R. Ridge is Engr. Noted Dec. 10.

Motor Fire Apparatus—Sioux Falls, S. D.—The Seagrave Co., Columbus, Ohio, and James Boyd & Bros., Inc., Philadelphia, both at $10,000, were the low bidders for furnishing the city with a 75-ft. automobile fire truck.

Drainage—Wynne, Ark.—All bids received Dec. 7, by W. H. Newsom, Engr., Drainage District No. 2, Crittenden County, have been rejected. The lowest bid received was $430,000. New bids will be asked for shortly. Noted Nov. 26, Dec. 24.

+Grading—Dallas, Tex.—The Dallas Baseball Club has awarded the contract for grading its new baseball park to the CULLUM-BAVOUSETTE CO., Dallas.

River Diversion—Rocky Ford, Colo.—The County Commissioners plan to divert the Arkansas River at a point west of the Ordway road bridge. The plan, as it now stands, calls for the excavation of a straightaway channel, eliminating the former elbow.

Filling—Aberdeen, Wash.—Press reports state that citizens of North Aberdeen have voted to fill the city's tide flats at an estimated cost of $65,000.

+Metal Flume—North Yakima, Wash.—The Union Gap Irrigation District has awarded the contract to the VALLEY CONSTRUCTION CO. for installing three miles of metal flume, replacing a woden flume.

+Filling—Tacoma, Wash.—The Union Pacific R.R. has awarded the contract for filling in the abandoned tunnel at 25th St. and Jefferson Ave to GRANT, SMITH & CO., at $50,000.

Waterway—Tacoma, Wash.—At the election held on Dec. 12, the citizens voted in favor of the plans for the construction of the Hylebos Creek Waterway, 2½ miles in length from deep water to Julia's Gulch. The estimated cost is $350,000. Noted July 9, Oct. 8, Nov. 19, Dec. 17.

+Motor Fire Apparatus—Portland, Ore.—The Council has awarded the following contracts for furnishing the city with motor fire apparatus: For one auto-service truck, SEAGRAVE FIRE APPARATUS CO., Columbus, Ohio, at $6468; for one combination chemical and hose wagon, WHITE AUTOMOBILE CO., Cleveland, at $5900.

+Elevators—Portland, Ore.—The Meier & Frank department store has awarded a contract to the OTIS ELEVATOR CO., at $200,000, for the installation of ten passenger and three service elevators.

Dredging—Longbeach, Calif.—The lowest bid received for dredging Longbeach harbor to an average depth of 18 ft., was that of the Los Angeles Dredging Co., at $24,000, lump sum, or 24c. per cu.yd. The next lowest bid was that of the Standard American Dredging Co., at $27,000, or 38.5 per cu.yd. Noted Oct. 22, Dec. 24.

+Oil Pumping Stations—San Francisco, Calif.—The Valley Pipe Line Co. has awarded a contract for the construction of 11 pumping stations along its line from Coalinga to Martinez. to the COLUMBIA STEEL WORKS, Pittsburg, Calif.

Fire Alarm System—Welland, Ont.—Bids soon will be received for the installation of a complete automatic fire alarm system. Clarence W. Webber is interested.

Crushing Machinery and Locomotives—Winnipeg, Man.—(Official)—Bids will be received until noon. Jan. 18, by S. H. Reynolds, Chn. of Comrs., 901 Boyd Bldg., for furnishing gravel-pit excavation, screening, elevating and crushing machinery; also for locomotives and cars for pit and railway service.

Wharf Extension—New Westminister, B. C.—The Canadian Pacific R.R., it is reported, will soon make an appropriation for the extension of its wharf out to the harbor line.

BUILDINGS

New London, Conn.—Bids are being received by Dudley St. Clair Donnelly for the construction of a three-story brick Y. M. C. A. building. Estimated cost, $100,000. G. S. Palmer, F. W. Mercer, and E. D. Steele are members of the building committee.

Dunkirk, N. Y.—Plans are being prepared for a theater on Central Ave. Estimated cost $50,000. James L. Drohen is Mgr.

Mohawk, N. Y.—Bids will be received until Jan. 30, by Walter Frank, Arch., Clarendon Bldg., Utica, N. Y., for constructing a two-story and basement 70x100-ft. school. Estimated cost, $40,000.

New York, N. Y.—(Borough of Brooklyn)—Plans are being prepared by Shampan & Shampan, 772 Broadway, Brooklyn, for the construction of an apartment house at South Second and Berry St. Estimated cost, $48,000.

New York, N. Y.—(Borough of Brooklyn)—Preliminary arrangements are being made for the construction of a temple 100x100 ft. on Lincoln Pl. and Rochester Ave., for the Petach Tikvah congregation. Estimated cost, $100,000. Edward M. Adelsohn is Arch. W. B. Roth 1133 Eastern Parkway, is Pres. of the congregation.

+New York, N. Y.—(Borough of Brooklyn)—The contract for the construction of a five-story nurses home on Sixth St., for the Methodist Episcopal Hospital has been awarded to THE WILLIAM KENNEDY CONSTRUCTION CO., 215 Montague St., Brooklyn, N. Y. Estimated cost, $150,000. Noted Dec. 10.

(Borough of Bronx)—The Board of Supervisors of Westchester County appointed a committee to select a site for a county jail to cost $400,000. E. P. Barrett is Chn. of Bd.

(Borough of Queens)—Low bids for the construction of the nurses' home and two ward buildings at the Long Island almhouse have been received as follows: Manus J. Fish, general contract, $131,130; C. H. Sanborn, heating, $16,650; Carlisle Connor Co., electrical work, $10,900.

(Borough of Richmond)—Plans have been completed by Harry W. Pelcher, Naitonal Bank Bldg., Port Richmond, for the construction of a five-story 45x125-ft. hotel at Jay and De Kalb St., New Brighton. Estimated cost, $55,000.

+(Borough of Richmond)—Chas. J. McCormack, has awarded a contract to JOHN H. PARKER CO., 315 Fourth Ave., for the construction of a four-story, 150x150-ft. court house in De Kalb, Wall, Stuyvesant, Jay and Hamilton St. Estimated cost, $237,985. Carrere & Hastings, 225 Fifth Ave. are Archs. Noted Nov. 26.

+Olean, N. Y.—The contract for the construction of a one-story and basement 65x178-ft., church has been awarded to WILLIAM STOKES & SONS. Estimated cost, $100,000. E. N. Uhlrich, 19 Euclid Bldg., Cleveland, Ohio, is Arch.

Watertown, N. Y.—The Board of Education contemplates constructing a $65,000 school on Arsenal St. Frank S. Tisdale is Pres. of Bd.

Glen Ridge, N. J.—The Board of Education contemplates constructing an addition to the high school to cost $60,000.

Jersey City, N. J.—Bids will be received until Jan. 1, by the Fairmont Amusement Co., Spangarn Bldg. for the construction of a one-story and three-story 67x99-ft., 72x153-ft. theater. Estimated cost $100,000. Walter Hanken, 28 Delview Ave., Trenton, N. J. is Arch.

+Newark, N. J.—The Public Service Ry. Co. has awarded a contract to the HEDDEN CONSTRUCTION CO., 763 Broad St., for the construction of a railway terminal at Park Pl. Estimated cost, $1,980,000.

Plans have been prepared by Guilbert & Betille, Archs., and approved by the Board of Education for the construction of the McKinley School. Estimated cost, $102,000.

Princeton, N. J.—The Trustees of Princeton University contemplate constructing a $500,000 building to be used as a dining hall.

Ridgefield Park, N. J.—Bids will be received by the John J. Hearn Construction Co., 69 West 46th St., New York, N. Y., for the construction of a building for the St. Francis R. C. Church. Estimated cost, $100,000. F. J. Schwartz, Paterson, N. J., is Arch.

Carbondale, Penn.—Plans are being prepared for the construction of a two-story high school to cost $100,000. E. H. Davis, Connell Bldg., Scranton, is Arch.

New Castle, Penn.—Plans are being prepared for the construction of a three-story 60x100-ft. Masonic Temple. Estimated cost, $45,000. A. L. Thayer, Witherspoon Bldg., Philadelphia, Penn., is Arch.

Scranton, Penn.—Bids will be received by the Young Men's Hebrew Assoc. for constructing a three-story, 60x125-ft. building to cost $50,000. Albert J. Ward, Scranton, Penn. is Arch. Noted Dec. 17.

+Waynesboro, Penn.—The contract for the construction of the Y. M. C. A. building has been awarded to A. R. WARNER, Waynesboro, at $50,699.

Wilmington, Del.—Plans are being prepared by Wallace E. Hance, Arch., for the construction of the Avenue Theater. Estimated cost, $50,000. Mrs. Lulu C. Baldt, Philadelphia, is interested.

Norfolk, Va.—Plans have been prepared by Rossell Edward Mitchell and F. Nelson Wilcox, Dickson Bldg., for the construction of an 11-story, 87x120-ft. apartment house at Dundaff St. and Fairfax Ave. for the Plaza Realty Corporation, Virginia National Bank Bldg. Estimated cost, $275,000.

Richmond, Va.—Bids will be received until Jan. 4 by the Police Commissioners for the construction of a station house, 60x40 ft., to be located at Smith and Marshall St. Estimated cost, $45,000. Carneal & Johnston are Archs.

Parkersburg, W. Va.—Plans have been prepared by Dennison, Hirons & Darbeyshire, Archs., 475 Fifth Ave., New York, N. Y., for the construction of a building for the Second National Bank. Estimated cost, $50,000.

Savannah, Ga.—H. W. Witcover is preparing plans for the construction of an auditorium to cost $200,000.

+Monroe, La.—(Official)—The contract for the construction of a temple for the Congregation of Bnai Israel has been awarded to FRANK MASLING, Monroe. Noted Nov. 26.

Nashville, Tenn.—Bids will be received by Frank H. Simpson, until Jan. 30, for the construction of a four-story building for the college of medicine at Vanderbilt University. Estimated cost, $300,000. Samuel Hannaford & Sons, Cincinnati, Ohio, are Archs.

Louisville, Ky.—Ward & Glossop, Archs., Paul Jones Bldg., are preparing plans for the construction of a two-story building at Fifth and Jefferson St. Estimated cost, $400,000. Arthur E. Mueller is interested.

Cleveland, Ohio—The Al Koran Shrine Temple Co. will construct for the Cleveland Shriners a group of buildings on Euclid Ave. and East 46th St. The estimated cost is $3,000,000.

Hamilton, Ohio—The city of Hamilton will issue $200,000 in bonds for the construction of a city hall.

Grand Rapids, Mich.—Bids will be received about Jan. 1 for the construction of a one-story building for the First Methodist Church. Estimated cost, $160,000. Noted Nov. 12.

Chippewa Falls, Wis.—Raeuber & Mehmer, Archs., 826 South Eighth St., Manitowoc, have been selected by the Board of County Supervisors to prepare plans for the construction of a two-story brick and stone addition to the Chippewa County Court House. Estimated cost $50,000.

Cudahy, Wis.—Bids are being received by the Board of Education for the construction of a three-story and basement 122x133-ft. school. Estimated cost, $50,000. Robert A. Messmer & Bros., Majestic Bldg., Milwaukee, are Archs.

+Madison, Wis.—Contracts for the construction of the north wing of the capitol building have been awarded as follows: NORTHWESTERN MARBLE & TILE CO., Minneapolis, Minn., stone and marble, $133,870; McNULTY BROS., Chicago, Ill., masonry, $97,200; RIESEN & RIESEN, University Bldg., Milwaukee, carpentry, $36,473; DECORATOR STAINED GLASS CO., Madison, lead glass, $2210; FLOUR CITY ORNAMENTAL IRON WORKS CO., Minneapolis, Minn., ornamental iron, $36,350; MUELLER CO., Milwaukee, heating and ventilating, $61,400; C. J. FOX, Milwaukee, plumbing, $17,900; PAUL F. HARLOFF CO., Madison, electrical work, $23,700. Noted Dec. 25, 1913, Jan. 8 and Feb. 19, 1914.

+The contract for the construction of the physics building for the University of Wisconsin has been awarded to the WISCONSIN CONSTRUCTION CO. Estimated cost, $180,775. Noted Dec. 3.

+Marinette, Wis.—Contracts for the construction of the $125,000 high school have been awarded to BAILEY MARSH & CO., Minneapolis, Minn., general contract; GENERAL HEATING & VENTILATING CO., Milwaukee, heating and ventilating. Noted Aug. 27 and Oct. 8.

Milwaukee, Wis.—Plans have been prepared by A. C. Eschweiler, Arch., 141 Wisconsin St., for the construction of a $200,000 Main exchange building and a $45,000 Mitchell exchange building for the Wisconsin Telephone Co., 185 Fifth St.

Montello, Wis.—The Board of County Commissioners will submit at the April election a proposal to appropriate $40,000 for the court house and jail at Montello. William Guderjahn is County Clk.

Oshkosh, Wis.—See item under "Miscellaneous." Physical Training Building.

Oshkosh, Wis.—Bids will soon be received by the Secretary of the Board of Education for the construction of the three-story and basement, 78x144-ft. high school. Estimated cost, $165,000. Noted Oct. 22.

Union Grove, Wis.—Bids will soon be received by M. J. Tappins, Secy. of the Home for Feeble-Minded and Epileptics, Capitol Bldg., Madison, for the construction of the first unit of a group of buildings to cost $250,000. It includes a power plant, laundry, dormitory, shop and school. Noted Oct. 29.

Duluth, Minn.—Bids will be received about Feb. 1 for the construction of the Lincoln High School. F. G. German, American Exchange Bldg., is Arch.

Plans are being prepared by Kelly & Williams, Archs., 402 First National Bank Bldg., for the construction of an $110,000 armory, on London Rd. and 13th Ave. East.

Excelsior, Minn.—Plans are being prepared by Clifford T. McElroy and Leroy Kenport, Archs., 514 Essex Bldg., Minneapolis, for the construction of a $45,000 high school.

Glenwood, Minn.—Alban & Lockhart, Archs., Endicott Bldg., St. Paul, are preparing plans for the construction of a two-story and basement 73x116-ft. high school. Estimated cost, $50,000.

Hibbing, Minn.—The city of Hibbing plans the construction of a $75,000 court house. The architect has not been selected. D. D. Haley is City Recdr.

Minneapolis, Minn.—The Anderson & Nelson Construction Co. plans the construction of an 80x100-ft. apartment house at 821 First Ave. South. Estimated cost, $50,000.

Plans are being prepared by C. E. Bell, Arch., Security Bank Bldg., for the construction of a 12-story 50x88-ft. hotel on Second St. and Hennepin Ave. for the Union City Mission.

Bids will be received until 2 p.m., Jan. 7, by the State Board of Control, State Capitol Bldg., St. Paul, for the construction of the $200,000 Biology Building for the University of Minnesota. C. H. Johnston, 715 Capital Bank Bldg., St. Paul, is Arch. Noted Oct. 22.

St. Paul, Minn.—Plans are being prepared by A. H. Stem, Arch., 608 Endicott Bldg., for the construction of a ten-story building at Fourth and Cedar St. for the St. Paul Athletic Club. Estimated cost, $500,000. Noted Nov. 27, 1913, Sept. 3 and Dec. 24, 1914.

Atchison, Kan.—Bids will be received until Jan. 15 for the construction of the two-story Martin School. The estimated cost is $50,000. Sayler & Seddon, 606 Gumbel Bldg., are Archs.

Kansas City, Kan.—The Board of Administration will petition the next legislature to appropriate $250,000 for the construction of a six-story main hospital, a two-story free dispensary, and a one-story power house and laundry for the Bell Memorial Hospital and School of Medicine. Estimated cost, $500,000.

Havre, Mont.—Plans have been prepared by Frank Bossuat for the construction of a three-story court house, surmounted by a dome. Estimated cost, $125,000.

Kansas City, Mo.—The Security Realty Co. plans the construction of an eight-story hotel at Ninth, Main and Delaware St. Estimated cost, $200,000. McKechnie & Trask are Archs.

St. Louis, Mo.—Plans are being prepared by A. Meyer, Arch., 705 Olive St., for the construction of a one-story and basement building at Fair and Margarretta Ave., for the Independent Evangelical Protestant Church. Estimated cost, $45,000.

+St. Louis, Mo.—The contract for the construction of a nine story building on Fourth and Washington St. for the Missouri Athletic Association has been awarded to JAMES H. BRIGHT CONTRACTING & BUILDING CO. Estimated cost, $118,985. Noted July 30 and Aug. 27.

Helena, Ark.—Plans are being prepared by the building committee of the Temple Betz Eljel for the construction of a $50,000 building.

+Canyon, Tex.—(Official)—The contract for the construction of a three-story and basement State Normal School has been awarded to the GROSS CONSTRUCTION CO., Waco. George A. Endress, Austin, is Arch.

San Antonio, Tex.—Plans have been prepared by Chapman & Murphy, Archs., for the remodeling and construction of two additional stories to the building at 213-17 St. Mary's St., for Jourdan Campbell.

Oklahoma City, Okla.—(Official)—The contract for the construction of the 143x424-ft. state capitol for the State of Oklahoma will be awarded about Jan. 15. The estimated cost is $1,500,000. Noted Apr. 23 and Nov. 26.

Okanogan, Wash.—(Official)—Bids will be received until Jan. 6 for the construction of a three-story, 55x82-ft. court house for Okanogan County. George H. Keith is Arch. Noted Dec 10.

Spokane, Wash.—Bids will soon be received by the County Commissioners of Spokane County for the construction of a $40,000 tuberculosis sanitarium. A. Rigg is Arch.

El Centro, Calif.—The city of El Centro contemplates constructing a $40,000 city hall on State St. A. W. Swanson is Mayor.

+Fresno, Calif.—The Board of Education has awarded contracts for the construction of the Webster School on Carl and Augusta St. to JAMES L. DALY, at $52,700; and the Longfellow School to the EVANS CONTRACTING CO., at $85,250.

+San Francisco, Calif.—The contract for the construction of fire-proof partitions in the Fine Arts Building for the Panama-Pacific International Exposition Co. has been awarded to STRETHLOW, FREESE & PETERSON. Estimated cost, $60,070.

+The contract for the construction of the exhibition building on the Panama-Pacific International Exposition grounds for the Southern Pacific Co. has been awarded to the DUNNAVANT-HOUGHTON-VAN SANT CO., INC. Estimated cost, $56,500.

Weyburn, Sask.—Plans are being prepared for the construction of a $125,000 court house and registry office at Weyburn.

Old Hickory is the new name of an old wagon. This name will be applied to the dump wagons made by the Kentucky Wagon Mfg. Co., Louisville, Ky. Their former trade name was "Kentucky."

The Weber Chimney Co. announces that the New York office has been changed from 95 Liberty St. to 30 Church St., Hudson Terminal. This office will be in charge of Halbert T. Hill, Inc.